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THE PROVENTRICULAR FLANGES IN MOSQUITO LARVAE[1] [2]

A. Glenn Richards, Sandra H. Seilheimer[3]

ABSTRACT: Examination of stained thin sections by transmission electron microscopy showed that mature larvae of species in 9 different genera of mosquitoes have 1, 2, or more circumferential flanges around the proventriculus. Differences could supply taxonomically useful characters. Similar flanges have been recorded for some chironomid larvae, and flanges with serrated edges in black fly larvae.

DESCRIPTORS: Mosquito larva, *Simulium* larva, proventriculus, cuticle.

The proventriculus of late instar larvae of *Aedes triseriatus* and *Aedes aegypti* are surrounded by two circumferential flanges as described in detail by Romoser and Venard (1967) and Richards and Richards (1971, 1976). This structure is illustrated in cut-away surface view in Figure 1 and in longitudinal section in Figure 2. Since the situation described for larvae of *Anopheles plumbeus* by Wigglesworth (1930) seemed somewhat different, a survey of available mosquito larvae was made using thin sections and transmission electron microscopy.

The larvae were fixed in cold buffered glutaraldehyde followed by O_SO_4, embedded in an epoxy resin, sectioned, stained with uranyl acetate and lead citrate, and examined in a Philips 300 EM.

Fourth instar larvae of culicine mosquitoes fall into two groups: those which like *Aedes* have two flanges on a swollen ring (Figs. 1-6), and those which have only one flange (Figs. 7-8). It is to be noted that one of the species of *Culiseta* has two flanges (Fig. 3) whereas the other has only one (Fig. 7), but these two species are in different subgenera. Two genera are not illustrated: *Coquillettidia ("Mansonia") perturbans* is very close to Figure 7, and *Orthopodomyia signifera* is also similar to Figure 7 but flat as Figure 8 is.

The single specimen of *Uranotaenia sapphirina* showed no swollen ring (Fig. 6). This is probably the true condition since the underlying epidermis seems to be in a quiescent rather than a

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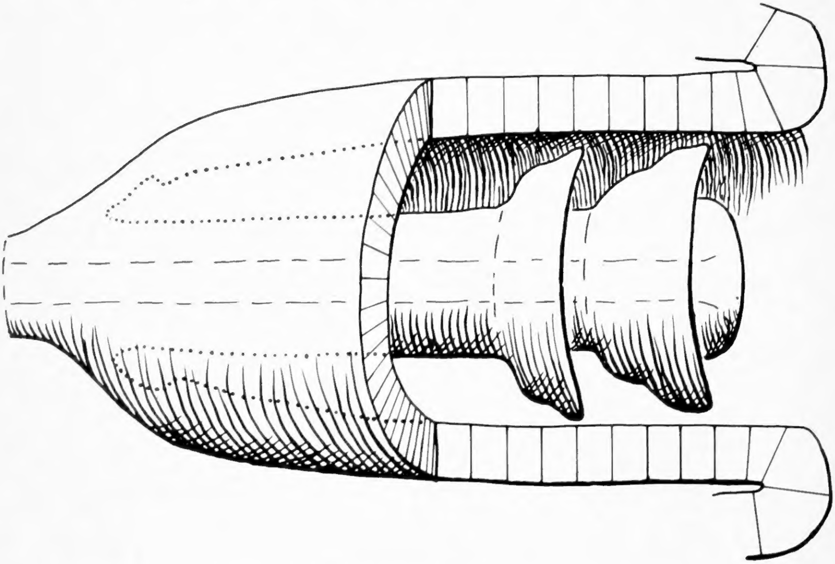


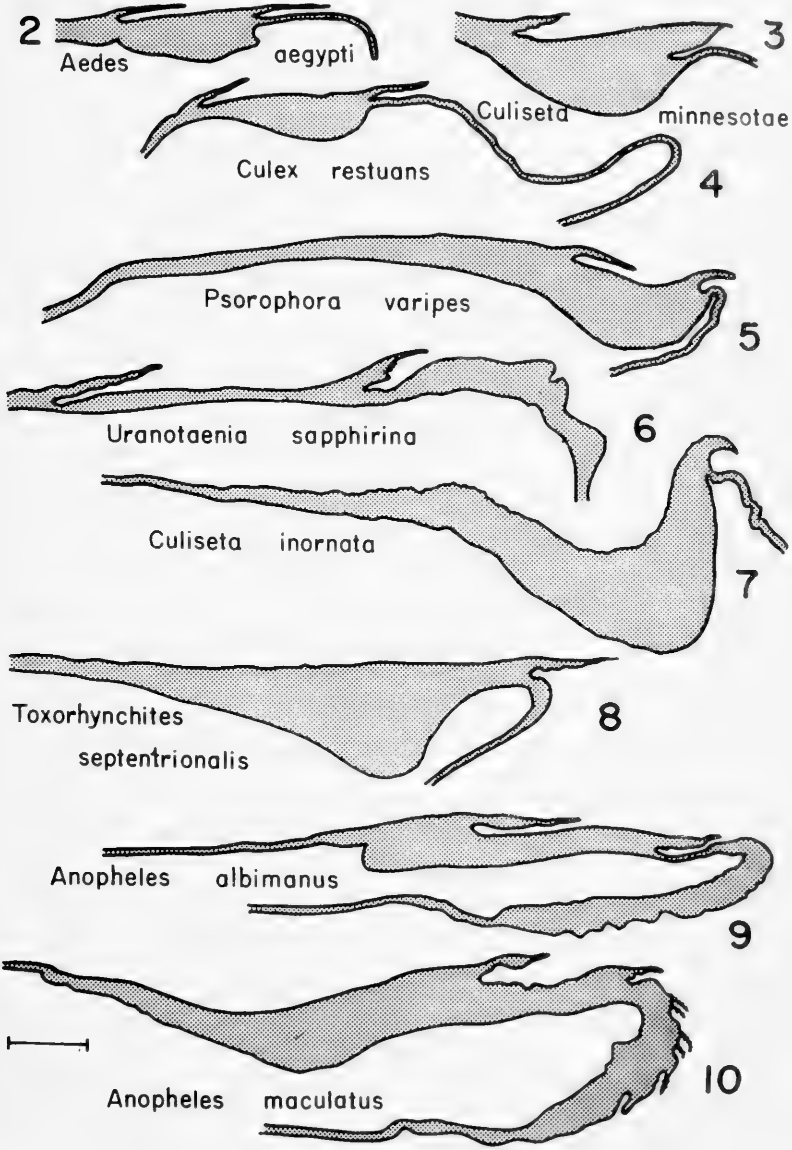
Fig. 1. Diagrammatic hemisectional view of the anterior end of the midgut of a fourth instar larva of *Aedes aegypti* with the flanged proventriculus protruding into it. Head to left. (After Richards & Richards, 1976).

secretory phase. But it is not certain that this larva, although large, was in the fourth instar.

The situation in larvae of anopheline mosquitoes is more variable and in some species more complex.

Within the genus *Anopheles* there are various subdivisions. A half dozen subgenera are recognized, the three largest being *Nyssorhynchus, Cellia* and *Anopheles.* Of the species treated, *A. albimanus* (Caribbean region) belongs to the subgenus *Nyssorhynchus, A. maculatus* (Malaya) and *A. balabacensis* (Philippines) to *Cellia,* and *A. freeborni* (western U.S.A.), *A. quadrimaculatus* (eastern U.S.A.) and *A. plumbeus* (Europe) to the subgenus *Anopheles.*

Fourth instar larvae of all of the species of *Anopheles* differ from culicines in having not only a swollen ring at the level of the flanges but also a swollen cuticle extending on around the end of the proventriculus and a corresponding distance up the esophagus (compare Figs. 9 & 10 with 4 & 5). But there are differences in the flanges: in *A. albimanus* (Fig. 9) and *A. balabacensis* there are two circumferential flanges equivalent to those seen in many culicines; in *A. maculatus* (Fig. 10) there are two major circumferential

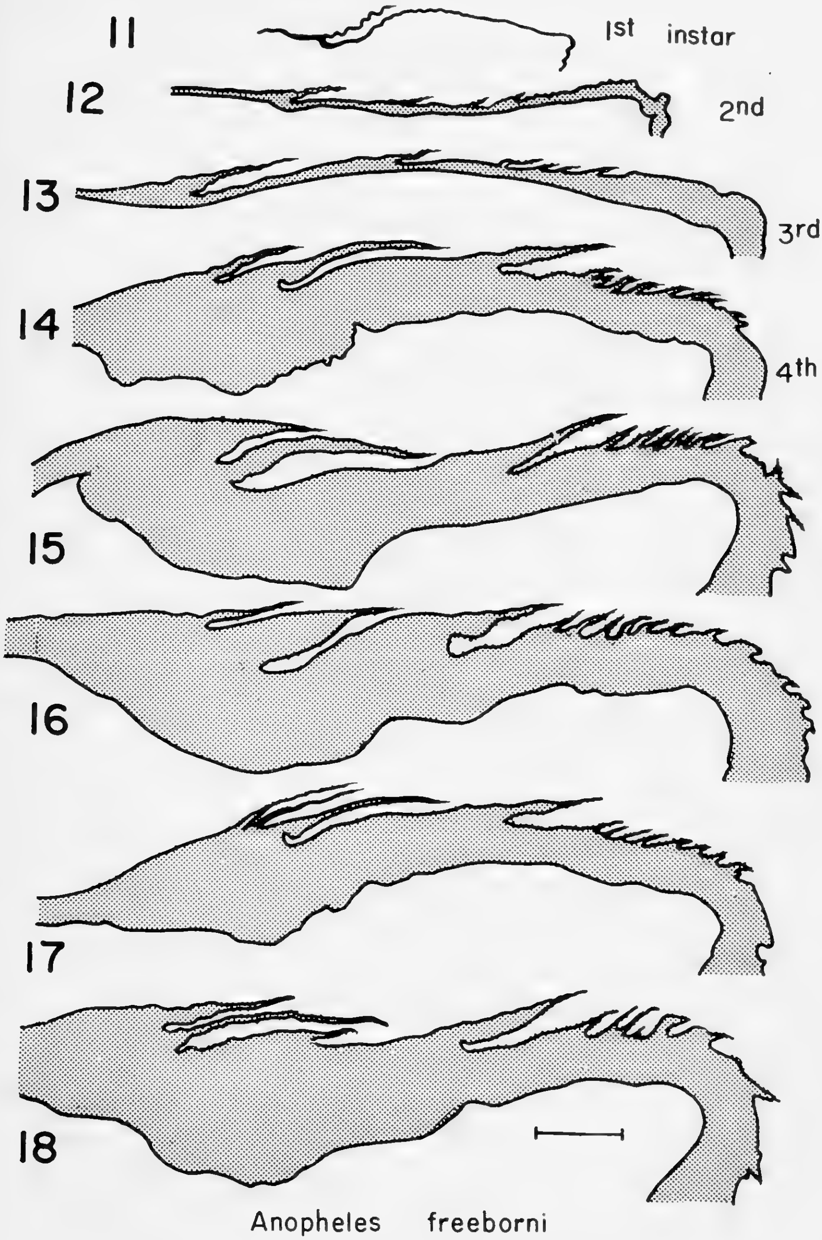


Figs. 2-10. Tracings of the flanges and cuticular thickenings as seen in longitudinal sections of the proventriculus of fourth instar larvae of the indicated mosquitoes. All at the same magnification (bar = 10 μm) except Fig. 8 which is at 1/3 this magnification.

flanges plus a half dozen minor wrinkles at the tip of the proventriculus; but in *A. freeborni* (Figs. 14-18) and *A. quadrimaculatus* (presumably also *A. plumbeus*) there are 3 or 4 major circumferential flanges plus up to a dozen minor ones in the area between the major flanges and the tip of the proventriculus. Serial sections show that the major flanges mostly extend all the way around the proventriculus although sometimes one does not, but the minor flanges commonly extend only part of the way. For documentation of this statement, we examined 21 successive longitudinal sections from one larva of *A. freeborni*. These sections averaged 0.08 μm thick and therefore represent a distance of more than 1.5 μm. The first and twenty-first sections (and all intervening ones) were essentially the same (Figs. 15-16). From another larva we examined every twentieth section for a distance of 320 sections (ca 25 μm). All of these showed 4 major flanges, seemingly continuous but of fluctuating size, plus 6-8 smaller ones (Figs. 17-18). Clearly one is dealing with flanges rather than spicules (Fig. 19).

For most of the species a single larva or only a few larvae were examined. But for *Anopheles freeborni* we examined sections from 5 fourth instar larvae, for *A. quadrimaculatus* from 4, and for *Aedes aegypti* from hundreds of larvae during various studies. In *A. aegypti* there is only slight variation from section to section and from specimen to specimen (Richards and Richards, 1976). Their general similarity to *A. aegypti* suggests that the same will be true for most culicines. But in the two species of *Anopheles* there is both considerable individual variation (Figs. 14 vs 15-16 vs 17-18) and a smaller amount of circumferential variation.

The development of flanges has been worked out in detail for *Aedes aegypti* (Richards and Richards, 1976). Rings of several dozen cells cooperate to produce circumferential cytoplasmic flanges which, when the new cuticle is secreted, become solid cuticular flanges. Sections from single pharate individuals of *Anopheles albimanus, Culiseta minnesotae* and the chironomid *Psectrocladius* sp. indicate that this is the general method for flange formation. But the fully-formed condition can be different in different instars. In *A. aegypti* the first instar and most of the second instar larvae have no flanges, but most third instar larvae have 2 flanges and the fourth instar ones always have 2 flanges on a swollen ring. In *Anopheles albimanus* the first and second instars



Figs. 11-18. Tracings of the flanges and cuticular thickenings as seen in longitudinal sections of the proventriculus of larvae of *Anopheles freeborni.* We examined sections from 2 first instar, 2 second instar, 3 third instar, and 5 fourth instar larvae. Fig. 14 is from one specimen (= Fig. 19); Figs. 15-16 are from a set of serial sections from another specimen and are ca 1.5 μm apart; and Figs. 17-18 are from another set of serial sections and are ca 15 μm apart. All figures at the same magnification (bar = 10 μm).

each have a single delicate flange, the third instar has 2 flanges, and the fourth instar has 2 flanges on a swollen ring. In *Anopheles freeborni* the first instar has a single delicate flange (Fig. 11), the second instar has 3 or 4 flanges but there is no distinction between major and minor ones (Fig. 12), the third instar has 2 or 3 major and 4 or 3 minor ones (Fig. 13), and the fourth instar has 3 or 4 major flanges plus 6-10 minor ones on a considerably swollen cuticle (Figs. 14-18).

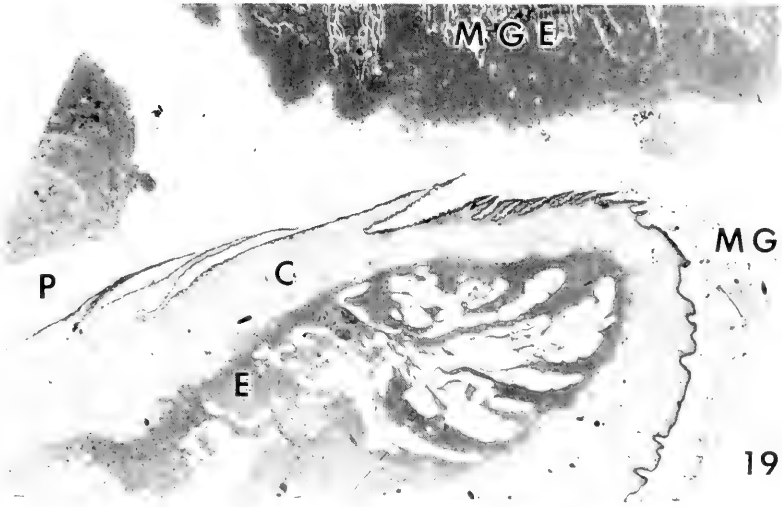
Sections of last instar larvae of a *Simulium* sp. (probably *venustum*) showed what at first looked like minute spicules as described by Puri (1925). Closer inspection, especially of cross sections of the proventriculus, revealed that these are really incomplete circumferential flanges with serrated tips (Fig. 20). Actually, this is little different from the old drawing by Puri except that he saw only the serrated tips without being able to resolve clearly the overlapping flanges.

Discussion

Clearly, circumferential flanges of cuticle around the larval proventriculus are to be found in a number of families of nematocerous Diptera, as first recorded by Vignon (1901). The larger ones of these seem to be continuous around the entire circumference; smaller ones may be continuous or extend only part way around. When such incomplete smaller flanges are present there are numerous ones with the result that flanges extend all the way around the proventriculus even though no single one does.

In mosquito larvae the flanges are formed around cytoplasmic projections which form a nearly uniform albeit somewhat ruffled collar (Fig. 1. Richards and Richards, 1976). In a black fly larva the cytoplasmic projections must have a serrated margin because they produce flanges with serrated edges (Puri, 1925, and Fig. 20). This is consistent with the fact that at the asterisk in Figure 20 there are cross sections of 4 cytoplasmic fingers with spacings similar to that of the serrated edge of the flange [the presence of microvilli at the cell-cuticle interface indicates that this specimen is still secreting cuticle].

In a mycetophilid larva Holmgren (1907) reported "minute spicules" on the cuticle of the proventriculus. Re-examination by electron microscopy is needed to see if they, like the spicules of



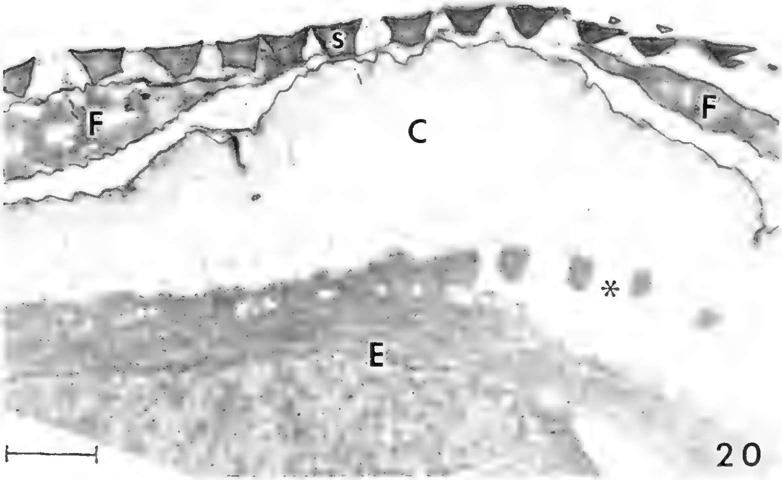


Fig. 19. Actual transmission electron microscopy picture of a longitudinal section of the proventriculus of a fourth instar larva of *Anopheles freeborni* (Fig. 14 was traced from this picture). The peritrophic membrane which lies against the flanges has been masked with "liquid paper" to permit the flanges to be seen clearly. Same magnification as Fig. 20.

Fig. 20. Cross section of proventriculus of a larva of *Simulium* sp. (probably *venustum*) showing overlapping flanges with serrated tips. A ring of serrated tips (S) are outside the more basal flanges (F) which are in turn separate from the general cuticle (C). Bar = 10 μm.

Abbreviations: C = cuticle of proventriculus; E = epidermis of proventriculus; F = circumferential cuticular flanges; MG = lumen of midgut; MGE = epithelium of midgut; P = pouch formed by proventriculus protruding into midgut; S = spicule of serrated tip of a flange.

Puri (1925) and Wigglesworth (1930), are to be re-interpreted.

It has been suggested that these flanges may function either in helping propel the peritrophic membrane posteriorly or in keeping food and bacteria out of the pouch where the PM is formed or both (Richards and Richards, 1971, 1976). Figure 21 is consistent with the second suggestion; a fortuitous dilatation at the level of the proventriculus shows the numerous bacteria and food particles in the lumen of the gut extending up to the first flange, and a few getting beyond the first flange but not beyond the second flange. Whatever the function, the possible use of these details as taxonomic characters is obvious. But, unfortunately, despite the size of these flanges it is difficult to work with them by light microscopy because the flanges and peritrophic membrane are usually squeezed together between proventriculus and midgut epithelium. Only occasional specimens have the parts so separated that the details can be seen in sections prepared for light microscopy. Whole mounts would show little when examined by light microscopy, and would show only half the features if examined by scanning electron microscopy. Thin sections prepared for transmission electron microscopy are really needed – and these require specially processed material and much work.

ACKNOWLEDGEMENTS

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Thanks are also due for financial support from the Parasitology and Medical Entomology Branch of the National Institutes of Health (Grant No. AI 09559).

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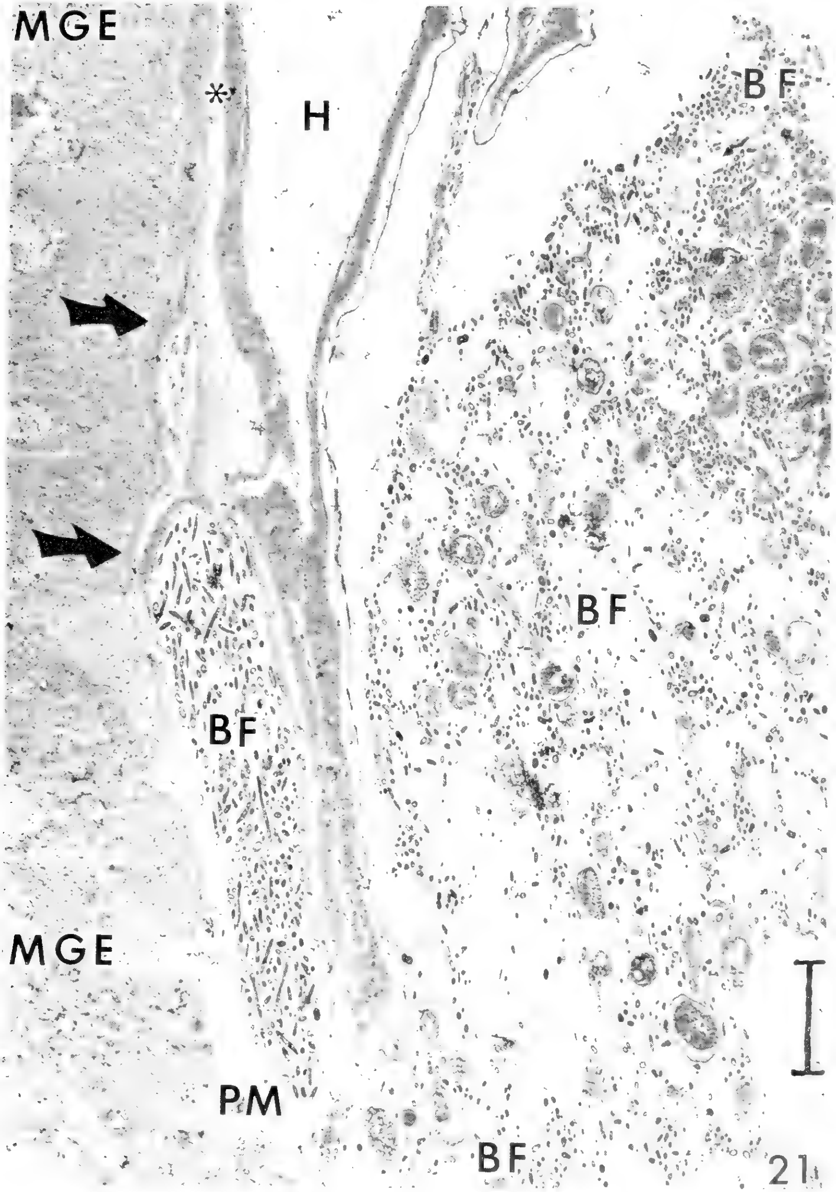

Fig. 21. Longitudinal section of a fourth instar larva of *Aedes aegypti* showing part of one side of the proventricular region. Head end of larva beyond top of picture. A dilatation shows that bacteria and food particles (BF) are mostly blocked from the pouch where peritrophic membrane is formed (*) by the first flange (lower arrow) and entirely by the second flange (upper arrow). Bar = 10 μm.

H = hemocoel within proventriculus; MGE = midgut epithelium; PM = fully formed peritrophic membrane.

AN AQUATIC SPITTLE BUG (HOMOPTERA: CERCOPIDAE) FROM A *HELICONIA* FLOWER BRACT IN SOUTHERN COSTA RICA[1,2]

Durland Fish[3]

ABSTRACT: An immature aquatic spittle bug was found inhabiting a water-filled flower bract of an unidentified wild plantain *Heliconia* sp. in southern Costa Rica. An enclosed ventral air tube used by terrestrial forms to aerate spittle enables this aquatic form to remain completely submerged in water with only the posterior tip of the abdomen reaching the surface for gas exchange. Cryptic coloration suggests that it may be an obligate inhabitant of water-filled *Heliconia* flower bracts.

DESCRIPTORS: Aquatic spittlebug, *Heliconia,* phytotelma

While surveying aquatic insects inhabiting the water-filled flower bracts of wild plantain, *Heliconia* sp., at the Las Cruces Botanical Garden near San Vito de Java in southern Costa Rica, I found a large immature spittle bug. The insect was completely submerged in the estimated 50 ml of rain water contained in the bract with only the posterior extremity of its abdomen reaching the water surface (Fig. 1). When the insect was removed from the bract and kept in a pan of water ranging in depth from 0 to 2 cm for several days, it remained submerged in the same manner as observed while in the flower bract.

The specimen measured 18 mm in length and 6 mm in width at the thorax. The abdomen and thoracic sclerites were bordered in red as were the distal ends of each leg and antennal segment. With the exceptions of dark wing pads (indicating a late nymphal instar) the remainder of the cuticle was a faint yellowish orange color and almost transparent. (Fig. 2).

Unfortunately my departure from Las Cruces prevented efforts to rear the specimen to maturity. Consequently it was preserved in alcohol precluding an identification in the absence of keys to the immature Ceropidae, and has been deposited in the Florida State Collection of Arthropods.[4]

The large colorful bracts of many *Heliconia* species effectively impound rain water providing the developing flowers with an aquatic medium (Fig. 3). Typically, 15 to 20 flowers were developed in sequence within each bract.

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Each flower lasts but one day and senescent flowers decompose in the bract water (Stiles, 1975). Skutch (1933) states that the floral structures of *Heliconia* resemble those of truly aquatic plants and suggests that the aquatic micro-habitat provided by the bracts may protect the flowers from destructive insects. However, a variety of aquatic organisms have been found inhabiting *Heliconia* flower bracts. Seifort (1974, 1975) reported 6 species of aquatic insects (Coleoptera: 2 sp.; Diptera: 4 sp.) regularly inhabiting *Heliconia* inflorescences in the Osa Peninsula of Costa Rica. He observed that some species fed on decaying flower parts while others attacked the living

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Figure 1. Aquatic cercopid submerged in the water of a *Heliconia* flower bract.

Figure 2. Aquatic cercopid removed from the flower bract is seen here submerged in a petri dish of water.

Figure 3. Inflorescence of the unidentified *Heliconia* in which the aquatic cercopid was found.

flowers. In addition, Maguire *et al.* (1968) reported 2 other dipterous species as well as copepods, ostracods, and protozoa living in the bracts of *Heliconia* in Puerto Rico.

The cercopid here reported presumably feeds on the vascular tissue of the thick flower bracts since it has typical homopteran mouthparts. Many situations in the tropics could conceivably provide suitable habitat for an aquatic homopteran considering the abundance of plant-contained· ponds (phytotelmata) such as bromeliads, leaf axils of certain Araceae, and flower bracts of *Heliconia.* However, this insect may be restricted to *Heliconia* as its red markings are suggestive of cryptic coloration: Most *Heliconia* flower bracts are bright red, an adaption to hummingbird pollination (Stiles, 1975).

Kershaw (1914) described the respiratory system of immature Cercopidae. The pleural sclerites are extended ventrally over the sternal sclerites enclosing them to form an air tube the length of the abdomen. This abdominal air tube is open at the posterior end allowing gas exchange with the lateral spiracles on each abdominal segment. It is by means of this specialized air tube that terrestrial immature spittle bugs aerate anal secretions to produce large amounts of the familiar spittle (Gahan, 1918).

The respiratory modifications of the insect found in *Heliconia* bracts were essentially the same as those described by Kershaw (1914) for terrestrial forms. Thus, immature spittle bugs appear to be pre-adapted to plant associated aquatic habitats as an alternative to a terrestrial existence enveloped in protective anal secretions. Respiration through a posterior air tube in contact with the water surface is a recognized adaptation to an aquatic environment found also in immature mosquitoes and water scorpions. The discovery of an aquatic form in the order Homoptera is an addition to the 10 insect orders that Usinger (1971) recognized as having aquatic forms.

These observations were conducted while participating in the Organization for Tropical Studies Course 75-2. Financial support was provided by a fellowship from the University of Florida Division of Biological Sciences.

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INSECTS ASSOCIATED WITH FLOWERING BLOODROOT, *SANGUINARIA CANADENSIS* L., AT FANSHAWE LAKE, ONTARIO[1]

W. W. Judd[2]

ABSTRACT: Insects in Hemiptera, Coleoptera, Diptera and Hymenoptera were collected from flowering bloodroot, *Sanguinaria canadensis* L., at Fanshawe Lake, Ontario in April, 1975. The most prevalent pollinators (83%) were bees in Andrenidae, Halictidae, and Apidae.

DESCRIPTORS: Hemiptera, Coleoptera, Diptera, Hymenoptera, Fanshawe Lake, Ontario, Bloodroot flowers.

Fanshawe Lake is an artificial lake, a few miles northeast of London, produced by the building of Fanshawe Dam on the North Branch of the Thames River in London and West Nissouri Townships, Middlesex County, Ontario, Canada (Fig. 1). In an earlier account (Judd, 1961) the association of insects and other invertebrates with flowering skunk cabbage, *Symplocarpus foetidus* (L.) Nutt., on the north shore of the Lake was described. In April, 1975 a study was made of the insects found at flowers of bloodroot, *Sanguinaria canadensis* L.

At its north end Fanshawe Lake is bordered by an abrupt clay cliff rising to a crest 900 feet above sea level. Along this crest are deciduous woods. In openings in these woods grows the bloodroot. Insects were collected from the flowers on April 30, 1975, a day of clear skies with a light southerly breeze. The temperature at 9:30 a.m. was 10°C and rose to its maximum for the day of 21°C by 1.00 p.m. At 10.00 a.m. all the flowers of bloodroot were still closed. At 10.30 a.m. they began to open, when the first insect, a bee, was collected from a flower. By 11.00 a.m. all flowers were open to the sun with their petals extended horizontally. From 10.30 a.m. to 2.00 p.m. insects were collected from the flowers by netting, by use of an aspirator or by clapping them between the lid and jar of a cyanide jar.

The insects were pinned and labelled and sent to the Biosystematics Research Institute, Agriculture Canada, Ottawa where they were identified by the following taxonomists: D. E. Bright (Curculionidae), J. M. Campbell (Oedemeridae), Bruce Cooper (Calliphoridae), G. Gibson (Andrenidae, Apidae, Halictidae, Tenthredinidae), L. A. Kelton (Miridae), W. R. M. Mason

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(Pompilidae), J. F. McAlpine (Milichiidae), J. McNamara (Coccinellidae), J. R. Vockeroth (Muscidae, Syrphidae). All specimens are deposited in the collection of the Department of Zoology, University of Western Ontario except the sawfly, *Dolerus* sp., kept in the National Collection, Ottawa.

ACCOUNT OF INSECTS COLLECTED

Hemiptera

Miridae

Lygus lineolaris (Beauv.) - 2 bugs. This insect hibernates and appears on flowers in spring, e.g. on dandelions (Judd, 1971) and wild carrot (Judd, 1970).

Coleoptera

Oedemeridae

Asclera ruficollis Say - 2 bettles. Adults of this species visit flowers where they feed on nectar and pollen (Arnett, 1968). It is common on willow catkins in early spring and is found on other spring-blooming flowers (Dillon and Dillon, 1961).

Coccinellidae

Coleomegilla maculata lengi Timb. - 2 beetles. This is a common polyphagous species (Hodek, 1973) that occurs on plants in spring, e. g. dandelions (Judd, 1971) and wild carrot (Judd, 1970).

Curculionidae

Hypera postica (Gyll.) - 1 weevil. This weevil (*Phytonomus posticus* Gyll.) occurs on various plants, specially *Medicago,* alfalfa (Titus, 1911).

Diptera

Milichiidae

Madiza glabra Fallen - 1 fly. This species occurs across Canada from British Columbia to Nova Scotia (Stone *et al*., 1965).

Syrphidae

Helophilus fasciatus Walk. - 1 ♂
Syrphus torvus O.S. - 1 ♀
Sphaerophoria sp. - 1 ♀
Eristalis dimidiata Wied. - 1 ♂

Flies of this family are habitual visitors at flowers (Stone *et al*., 1965). *E. dimidiata* was found on skunk cabbage at Fanshawe Lake (Judd, 1961).

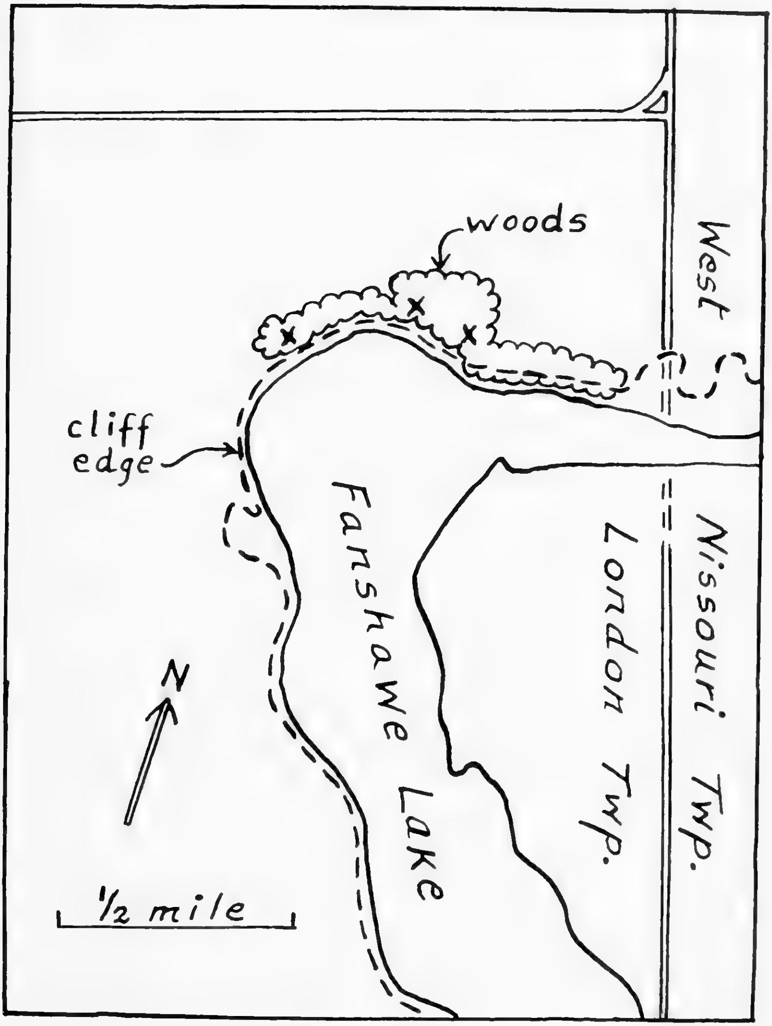

Fig. 1 – Map of Fanshawe Lake, Ontario showing location of bloodroot flowers (X)

Calliphoridae

Pollenia rudis (Fab.) - 1 fly. The cluster fly is a common visitor at flowers, e.g. boneset (Judd, 1969) and wild carrot (Judd, 1970).

Muscidae

Musca autumnalis Deg. - 2 ♂♂. The facefly hibernates and occurs on flowers in spring, e.g. marsh marigold (Judd, 1964), boneset (Judd, 1969) and wild carrot (Judd, 1970).

Orthellia caesarion (Mg.) - 1 ♀. This fly is common over much of North America (Stone *et al.*, 1965). It was found previously at London in 1953, mainly in swampy areas (Judd, 1956).

Hymenoptera

Tenthredinidae

Dolerus sp. - 1 sawfly. G. Gibson, in identifying the specimen, expressed the opinion that it represents a new species. The genus includes sawflies that feed on grasses and sedges (Muesebeck *et al.,* 1951).

Pompilidae

Priocnemis cornica Say - 1 wasp. This wasp occurs in eastern Canada and preys on small spiders (Muesebeck *et al.*, 1951).

Andrenidae

Andrena (Bythandrena) carlini carlini Cockerell - 9 bees. This bee has been found previously in the vicinity of London on flowers of leatherleaf (Judd, 1966a) and blueberry (Judd, 1966b).

Andrena miserabilis bipunctata Cresson - 16 bees. This bee has been found previously in the vicinity of London on flowering marsh marigold (Judd, 1964).

Andrena sp. - 43 bees.

Halictidae

Lasioglossum (Dialicuts) sp. - 10 bees.
Lasioglossum (Evylaeus) sp. - 3 bees.

Apidae

Nomada sp. - 6 bees.

Ceratina sp. - 2 bees.

Apis mellifera L. - 4 bees. Honeybees were found at Fanshawe Lake on flowers of skunk cabbage (Judd, 1961).

Of the 111 insects collected from the flowers 93 (83%) were bees (Andrenidae, Halictidae, Apidae). They were moving actively among the flowers and were well dusted with pollen and thus were the main pollinators of the bloodroot.

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DISTRIBUTION OF THE FAMILY PERLIDAE IN WEST VIRGINIA (PLECOPTERA)[1]

B. Douglas Steele[2], Donald C. Tarter[3]

ABSTRACT: The distribution of the stonefly family Perlidae in West Virginia was studied from September 1973 to June 1974. Fourteen species were found in the state of which nine were new records. Significant increases in North American distribution were found for *Acroneuria perplexa* and *Perlesta frisoni*.

DESCRIPTORS: Stoneflies, taxonomy, distribution, family Perlidae, state and county records

This paper represents the first concentrated study dealing with Perlidae of West Virginia. Since the nymphs of these insects are aquatic and increase their ranges slowly, these records represent definite inhabitants of West Virginia and not a specimen that has strayed into the study area and not established itself.

A review of the literature reveals many studies dealing with the Plecoptera of the United States, Canada, and other countries. Very few of these studies have records of West Virginia perlid species (Needham and Claassen, 1925; Ricker, 1949). Records from other eastern states include Walker (1947), Berner (1948), Harden and Mickel (1952), Gaufin (1956), McCaskill and Prins (1968), Hitchcock (1974) and Surdick (1974). Recent investigations by Burrows (1971), Steele (1974), Hissom (1975), Tarter et al. (1975), Farmer and Tarter (1976), Tarter (1976) and Tarter et al. (1976) have added much information on Plecoptera of the state. The records listed in this paper are a compilation of various literature records, West Virginia Department of Natural Resources and the United States Department of Interior Surveys, unpublished museum records, and personal collecting efforts.

The state may be divided into seven major river systems (Janssen, 1944).

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These systems are:

- I. Ohio River
- II. Monongahela River
- III. Potomac River
- IV. Little Kanawha River
- V. Kanawha River
- VI. Guyandot River
- VII. Big Sandy River

and were described by Farmer and Tarter (1976).

This paper brings the total number of distributional records of Perlidae in West Virginia to fourteen species. The classification scheme used by the authors follows that of Illies (1966) and Zwick (1973). The list of Perlidae species follows.

Subfamily Perlinae

Genus *Paragnetina* Klapalek

1) *P. media* (Walker)

Distribution: Braxton Co., Little Kanawha River. Fayette Co., Meadow River. Mingo Co., Laurel Fork. Monroe Co., Wolf Creek. Pendleton Co., Seneca Creek; White's Run. Pocahontas Co., Williams River. Randolph Co., Gandy Creek; Red Creek. Tucker Co., Blackwater River; Otter Creek; Shaver's Fork. Wayne Co., Twelvepole Creek. Webster Co.,Cranberry River; Elk River; Williams River.

2) *P. immarginata* (Say)

Distribution: Clay Co., Elk River. Hardy Co., Lost River. Mineral Co., New Creek; Patterson Creek. Nicholas Co., Cherry River. Pendleton Co., Brush Creek; Potomac River; White's Run. Pocahontas Co., Williams River. Preston Co., Wolf Creek. Randolph Co., Gandy Creek; Shaver's Fork. Tucker Co., Blackwater River; Otter Creek; Shaver's Fork. Webster Co., Cranberry River; Elk River; Williams River.

Genus *Phasganophora* Klapalek

3) *P. capitata* (Pictet)

Distribution: Braxton Co., Little Kanawha River. Clay Co., Elk River. Greenbrier Co., Greenbrier River. Mercer Co., East River. Monroe Co., Dry Fork. Nicholas Co., Cherry River. Pocahontas Co., Elk River; Day Run; Greenbrier River. Preston Co., Wolf Creek. Randolph Co., Gandy Creek. Summers Co.

Genus *Neoperla* Needham

4) *N. clymene* (Newman)

Distribution: Berkeley Co., Back Creek. Brooke Co., Buffalo Creek. Cabell Co., Mud River. Fayette Co., New River. Greenbrier Co., Greenbrier River. Hardy Co., Lost River. Mason Co., Eighteen Mile Creek. Mercer Co., Bluestone River. Mineral Co., Patterson Creek. Monongalia Co., White's Run. Monroe Co., Indian Creek; Salt Sulfur Springs; Wolf Creek. Pendleton Co., Brush Creek. Wayne Co., Twelvepole Creek.

Subfamily Acroneuriinae

Genus *Acroneuria* Pictet

5) *A. abnormis* (Newman)

Distribution: Berkeley Co., Back Creek. Boone Co., Hopkin Fork. Braxton Co., Little Kanawha River. Clay Co., Elk River. Fayette Co., Mann's Creek; New River. Grant Co., Jordan Run. Greenbrier Co., Greenbrier River. Hampshire Co., Cacapon River. Jackson Co., Mill Creek. Lincoln Co., Mud River. Logan Co., Copperas Mine Fork. Marion Co., Prickett's Creek. Mineral Co., New Creek. Mingo Co., Laurel Fork. Monongalia Co., White Day Creek. Morgan Co., Sleep Creek. Pendleton Co., Brush Creek; North Fork; Seneca Creek; White's Run. Pocahontas Co., Day Run; Greenbrier River; Laurel Creek; Tea Creek; Williams River. Preston Co., Cheat River; Wolf Creek. Randolph Co., Gandy Creek; Shaver's Fork; Tygart River. Summers Co. Tucker Co., Blackwater River; Shaver's Fork. Upshur Co., Buckhannon River. Wayne Co., Camp Creek. Webster Co., Williams River. Wyoming Co., Huff Creek.

6) *A. carolinensis* (Banks)

Distribution: Barbour Co., Middle Fork River. Boone Co., Skin Creek. Braxton Co., Little Kanawha River. Clay Co., Elk River. Fayette Co., Bracken Creek; Buffalo Creek; Dempsey Branch; Dowdy Creek; Falls Creek; Gauley River; Hendrick's Run; Kenney Creek; Laurel Creek; Pack's Branch; Rich Creek; Twentymile Creek. Greenbrier Co., Cherry River. Hampshire Co., Little Cacapon River. Hancock Co., Hardin Creek. Lewis Co., Little Kanawha River. Logan Co., Copperas Mine Fork; Island Creek. Mercer Co., Bluestone River. Mingo Co., Laurel Fork. Monongalia Co., White Day Creek. Morgan Co., Sleep Creek. Nicholas Co., Cherry River. Pendleton Co., White's Run. Pocahontas Co., Day Run; Elk River; Greenbrier River; Hill Creek; Island Creek Run; Williams River. Preston Co., Wolf Creek. Randolph Co., Gandy Creek; Shaver's Fork. Wayne Co., Camp Creek. Webster Co., Williams River. Wetzel Co., Arches Run. Wyoming Co., Huff Creek.

7) *A. evoluta* Klapalek

Distribution: Pocahontas Co., Greenbrier River. Summers Co., Indian Creek.

8) *A. internata* (Walker)

Distribution: Berkeley Co., Back Creek. Braxton Co., Little Kanawha River. Fayette Co. Greenbrier Co., Greenbrier River. Mineral Co., Patterson Creek. Monongalia Co., White Day Creek. Morgan Co., Sleep Creek. Pocahontas Co., Greenbrier River. Preston Co., Cheat River; Big Sandy Creek. Randolph Co., Tygart Valley River. Summers Co., Greenbrier River; New River. Webster Co., Elk River; Williams River.

9) *A. lycorias* (Newman)

Distribution: Barbour Co., Middle Fork River. Berkeley Co., Back Creek. Boone Co., Pond Fork. Braxton Co., Little Kanawha River. Grant Co., Greenbrier River; Cherry River. Lewis Co., Little Kanawha River. Lincoln Co., Fall Creek; Guyandot River; Mud River. Monongalia Co., Dent Run; White Day Creek. Monroe Co., Wolf Creek. Pocahontas Co., Preston Co., Big Sandy Creek; Cheat River. Randolph Co., Gandy Creek; Shaver's Fork. Ritchie Co., North Fork Hughes River. Roane Co., Little Kanawha River. Wayne Co., Twelvepole Creek. Webster Co., Williams River. Wood Co., North Fork River. Wyoming Co., Huff Creek.

10) *A. perplexa* Frison

Distribution: Barbour Co., Middle Fork River. Brooke Co., Buffalo Creek. Doddridge Co., Arnold's Creek. Gilmer Co., Steer Run. Jackson Co. Lincoln Co. Marion Co., Prickett's Creek. Mason Co., Sixteen Mile Creek. Mingo Co., Laurel Fork. Monongalia Co., White's Run. Pleasants Co., French Creek. Pocahontas Co., Greenbrier River. Summers Co., Greenbrier River. Upshur Co., Little Kanawha River. Wayne Co., Mill Creek. Wirt Co., Tucker Creek.

Genus *Eccoptera* Klapalek

11) *E. xanthenes* (Newman)

Distribution: Berkeley Co., Back Creek. Jackson Co., Cow Creek. Lincoln Co., Laurel Creek; Mud River; Straight Creek. Logan Co., Copperas Mine Fork; Trace Fork. Monongalia Co., White's Run. Mingo Co., Nicholas Co. Pocahontas Co., Greenbrier River. Ritchie Co., Jug Handle Run. Roane Co., Pocatalico River. Wayne Co., Camp Creek.

Genus *Perlesta* Banks

12) *P. placida* (Hagen)

Distribution: Braxton Co., Little Kanawha River. Clay Co., Elk River. Greenbrier Co. Hampshire Co., Cacapon River, Jackson Co., Mill Creek. Jefferson Co., Shenandoah River. Monongalia Co., White Day Creek. Pendleton Co., Brush Creek. Pleasants Co. Pocahontas Co., Cumming's Creek. Preston Co. Putnam Co. Randolph Co., Leading Creek. Tyler Co. Wayne Co., Twelvepole Creek. Wirt Co.

13) *P. frisoni* Banks

Distribution: Boone Co., Pond Fork. Cabell Co., Fourpole Creek. Clay Co., Elk River. Doddridge Co., Arnold's Creek. Fayette Co., Oppossum Creek; Rich Creek. Greenbrier Co., North Fork Cherry River. Jackson Co., Mill Creek. Lincoln Co., Bear Creek; Buffalo Creek; Green Shoal Branch; Trace Fork. Logan Co., Trace Fork. Mason Co., Rock Fork. Pendleton Co., Seneca Creek. Pleasants Co. Pocahontas Co., Tea Creek. Putnam Co., Heizer Creek. Randolph Co., Gandy Creek; Shaver's Fork. Tyler Co. Wayne Co., Camp Creek. Webster Co., Laurel Run; Williams River. Wirt Co. Wood Co.

Genus *Perlinella* Banks

14) *P. drymo* (Newman)

Distribution: Cabell Co., Fourpole Creek. Greenbrier Co., Cherry River. Putnam Co. Tucker Co.

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ODONATA FROM HOT BROOK, SOUTH DAKOTA WITH NOTES ON THEIR DISTRIBUTION PATTERNS[1]

A. V. Provonsha, W. P. McCafferty[2]

ABSTRACT: Ten species of Odonata are reported for the first time from Hot Brook, South Dakota, four of which are new published state records. The warm spring environment can account for the disjunct range extension of several species. North American biogeography of each species is briefly discussed.

DESCRIPTORS: Odonata, South Dakota, warm springs, new records, species ranges.

The aquatic insects of Hot Brook were sampled as part of an extensive study of the aquatic insect fauna of the Black Hills area of South Dakota. Hot Brook (figs. 1-4) is located in Hot Brook Canyon at the outskirts of Hot Springs, Fall River County, in far western South Dakota. It is a small stream about 12 miles long which is fed by a number of continuous warm springs over much of its length. On June 12, 1975, when collections were made, the water temperature ranged from 19-26°C, varying with respect to the spring inlets. This was greatly contrasted by the many cold streams encountered in the area which had temperatures averaging 12°C at the same time. The warm water environment and red bluffed canyon provided a unique collecting opportunity and yielded many very atypical species for the region.

The Odonata of South Dakota, in general, are poorly known (Montgomery, 1967). Of ten Odonata species sampled at Hot Brook, four are new state records and all are reported for the first time from Fall River County. Because of the unique environment of Hot Brook, many of the species are regarded as isolated, disjunct populations of biogeographic interest.

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Suborder Anisoptera

Family Libellulidae

Libellula saturata Ulmer. 2 ♂♂, 7 larvae. NEW STATE RECORD.

This species is common throughout Mexico and the southwestern United States. The northern limits of its general range appear to be southern California, Nevada, Utah, Colorado, Nebraska, and Missouri. It has been reported from isolated warm springs in Idaho, Montana, and Wyoming by Needham and Westfall (1955) and from Wyoming by Bick and Hornuff (1972) (fig. 1). The occurrence of *L. saturata* at Hot Brook is not surprising in light of these previous records at other warm springs in the northern latitudes. It is however a considerable eastern extension of the known warm springs distribution.

Suborder Zygoptera

Family Calopterygidae

Hetaerina americana (Fabricius). 1 ♂, 1 larva. NEW STATE RECORD.

H. americana has an extensive range over most of the United States with the exception of the far northwestern States. South Dakota seems to be near the northern limits of its range, but it is not restricted to warm water environments. This species has been known previously from the state by Westfall (personal communication, 1970) but has not been published as such.

Family Coenagrionidae

Argia alberta Kennedy. 1 ♂. NEW COUNTY RECORD.

This species was first reported from South Dakota by Bick and Hornuff (1972). It occurs throughout the intermountain area of the western United States, South Dakota being at the northeastern limit of its known range. Although it is frequently found at warm streams, it is by no means restricted to this type of habitat. Since no larvae were encountered, it cannot be determined if the single specimen had emerged from Hot Brook or if it had migrated from some other nearby cold stream.

Argia immunda Hagen. 4 ♂♂. NEW STATE RECORD.

In addition to the specimens collected during this present study, *A. immunda* was collected from Hot Brook in 1961, by G. F. Edmunds and

W. L. Peters (Gloyd, personal communication, 1975). A state record for this species, however, has not appeared previously in published form, although Westfall (personal communication, 1970) had known of the Edmunds' material. *A. immunda* is widely distributed throughout Mexico and the southwestern United States, Oklahoma being the northern limit of its normal range (Fig. 2). Hot Brook is a widely disjunct northern record for this species, being far removed from its next closest known locality in southern Oklahoma.

Argia vivida Hagen. 4 ♂♂, 3 ♀♀, 12 larvae. NEW COUNTY RECORD.

A. vivida was first reported from South Dakota by Kormondy (1957). Its main distribution is west of the Rocky Mountains (fig.3). Like *L. saturata*, it has been taken at a number of warm springs in the northern latitudes, including Alberta (Walker, 1953), Idaho and Montana (Westfall, personal communication 1970), and Wyoming (Bick and Hornuff, 1972). The Black Hills region of South Dakota is the farthest east that we have seen verified records of *A. vivida*. As pointed out by Gloyd (1958), all other previous reportings of this species east of the Rocky Mountains are probably of its close relative *Argia plana* Calvert, which has been reported from the southeastern portion of South Dakota by Bick and Hornuff (1972).

Enallagma anna Williamson. 2 ♂♂, 1 ♀. NEW COUNTY RECORD.

This species was first reported from South Dakota by Kormondy (1957). Its distribution is strictly western, with South Dakota being at the eastern limit of its range. It is not known as being restricted to warm water environments.

Enallagma praevarum Selys. 1 ♂. NEW STATE RECORD.

This close relative of *E. anna*, is found throughout Mexico and the southwestern United States. This is evidently the first time these two species have been taken at the same locality. Even though Hot Brook is far north of its normal range (fig. 4), its presence was not totally unexpected because of recent collections of this species in Wyoming (Bick and Hornuff, 1972) and Montana (Bick and Hornuff, 1974).

Amphiagrion sp. 1 ♂. NEW COUNTY RECORD.

Amphiagrion abbriveatum was reported from South Dakota by Kormondy (1957). However, our specimen more closely resembles a yet undescribed species of *Amphiagrion* (*A*. sp. of L, K. Gloyd, MS) which is known from other localities in the central United States. It is possible that Kormondy's record is also assignable to this yet undescribed species.

Ischnura perparva Selys. 3 ♂♂. NEW COUNTY RECORD.

This species is very common throughout the western United States, and is adpated to a broad range of habitats (Provonsha, 1975). It was first reported from South Dakota by Kormondy (1957), which remains near the eastern boundry of its known distribution.

Ischnura verticalis (Say). 1 ♂. NEW COUNTY RECORD.

Interestingly, this was the only species of Odonata taken at Hot Brook which has an eastern North American distribution. It was first reported for South Dakota by Kormondy (1957). At that time, it was the furthest west that it had been taken. However, it has recently been collected in Wyoming (Bick and Hornuff, 1972), and Montana (Bick and Hornuff, 1974). This species evidently develops in a wide variety of water temperatures throughout its range.

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We wish to thank Mr. Brad Heath, Purdue University for his assistance during the Black Hills sampling. We would also like to acknowledge Mrs. L. K. Gloyd, Ann Arbor, Michigan and Dr. B. E. Montgomery for their advice.

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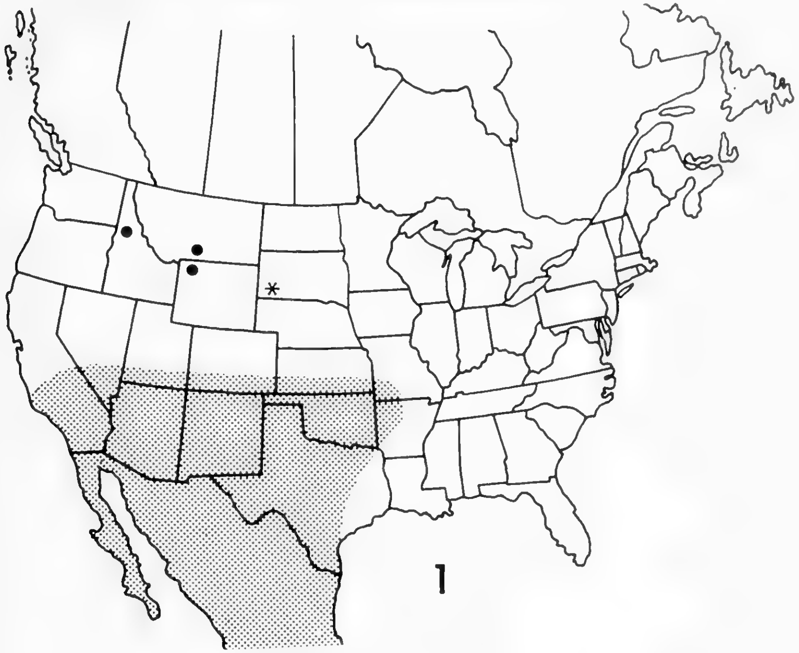

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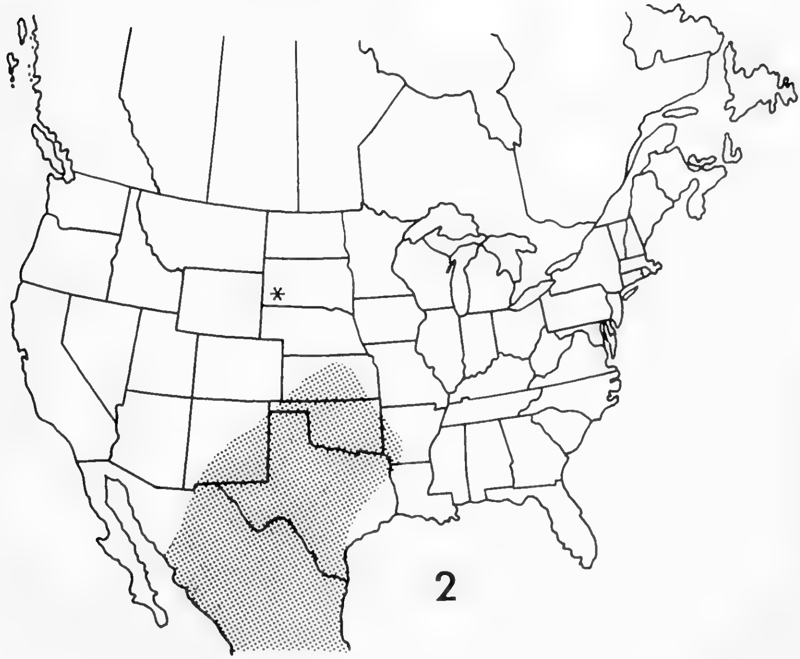

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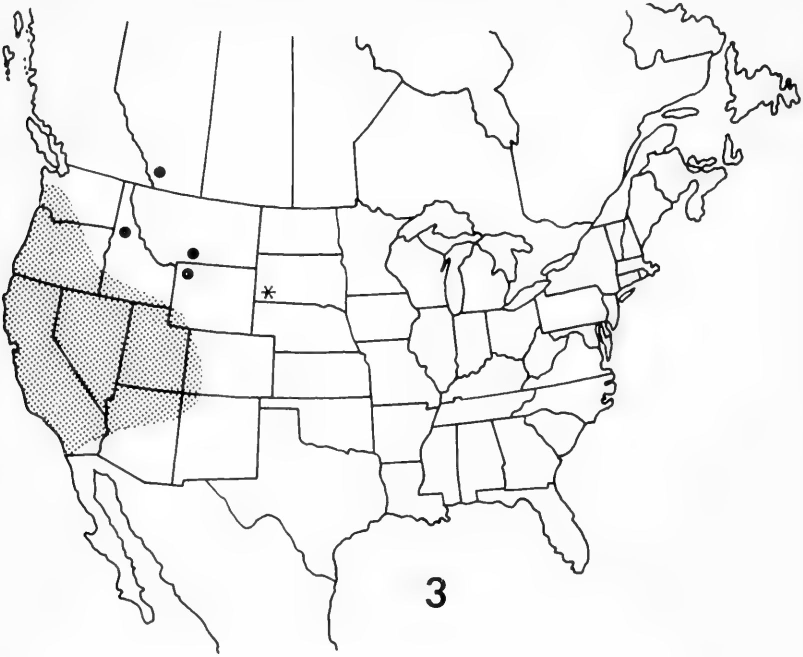
Figures 1-2, distribution maps. Fig. 1, *Libellula saturata* Ulmer. Fig. 2, *Argia immunda* Hagen.



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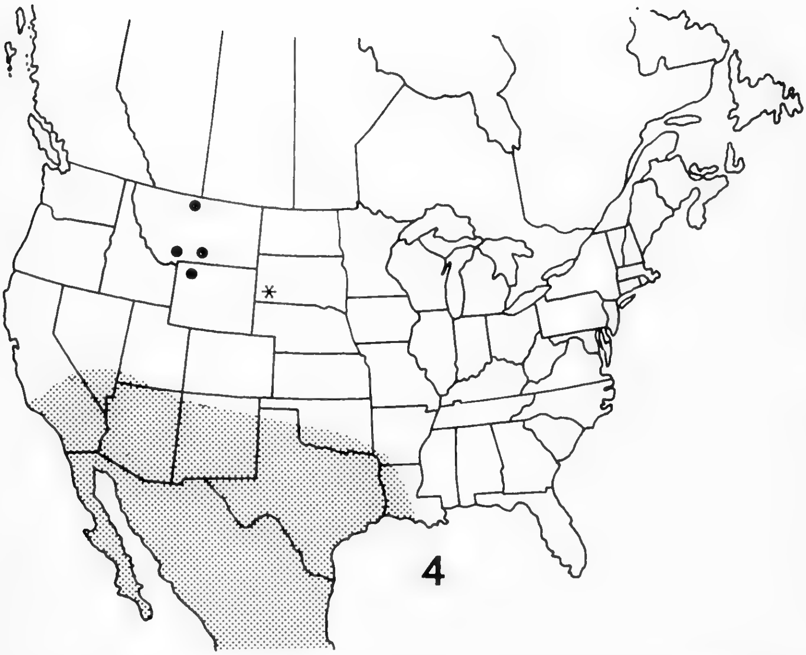

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Figures 3-4, distribution maps, Fig. 3, *Argia vivida* Hagen. Fig. 4, *Enallagma praevarum* Selys.

NEW WORLD LIMNICHINAE II: *CEPHALOBYRRHINUS* PIC (COLEOPTERA: LIMNICHIDAE)[1]

David P. Wooldridge[2]

ABSTRACT: The genus *Cephalobyrrhinus* Pic is removed from the subfamily Cephalobyrrhinae where it had been placed in error and transferred to the Limnichinae. A supplementary description is given for the genus and its type species and one new species *C. impressopunctatus* is described from Bolivia.

DESCRIPTORS: Limnichidae; *Cephalobyrrhinus;* generic description, new species, key.

The genus *Cephalobyrrhinus* was described from Costa Rica by Maurice Pic in 1923 with a very short diagnosis. From that time until this study, the only mention of the genus was in part 2 of the Blackwelder catalog (1944). Probably because of the similarity in names, Blackwelder placed the genus in the subfamily Cephalobyrrhinae. This subfamily was created by Champion (1925) to contain *Cephalobyrrhus* Pic (1923) and it differs from other subfamilies in having the eyes widely separated on the vertex and the hypomera without transverse ridges.

In my recent key to the New World genera of the Limnichidae (Wooldridge, 1975) I left *Cephalobyrrhinus* in the subfamily Cephalobyrrhinae because I had not seen the type nor any specimens that I recognized as belonging to the genus. Pic had stated in his description that *Cephalobyrrhinus* should be placed near *Eulimnichus* Casey, which is in the subfamily Limnichinae. But, few of the South American limnichids described by Pic, and none of the *Eulimnichus,* were given correct generic placement so his statement had to remain suspect.

A recent examination of the holotype of *Cephalobyrrhinus curticornis* Pic, the type of the genus, leaves no doubt that the genus is a member of the Limnichinae. The eyes are widely separated on the head, invisible from above, hypomeral ridges are present, and the ventral surfaces are grooved for the reception of the legs. It is a member of the Limnichini because the surface of the pronotum is not excavated to receive the antennal club.

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Cephalobyrrhus, an Old World genus, is the genus described in the first part of couplet 3 of my key to the New World genera of Limnichidae (Wooldridge, 1975). *Cephalobyrrhinus* runs to couplet 12 which can be modified as follows:

12 (7) Pronotum with a distinct semicircular series of punctures extending laterally from each side of midpoint, curving toward base 13

Pronotum plain or with a row of tuberculate punctures 12A

12A (12) Pronotum plain, without distinct series of punctures. 14

Pronotum with a nearly straight row of tuberculate punctures on disk extending about halfway toward lateral margins . . *Cephalobyrrhinus* Pic 1923

A supplementary description of the genus and its type species is given here in an effort to clarify the taxonomic situation. In addition, one new species is described from South America.

Genus *Cephalobyrrhinus* Pic

Cephalobyrrhinus Pic 1923, p. 6.

Pic's brief description consisted of the following:

Head strongly carinate laterally; anterior subarcuate; antennae short, apices widely dilated; thorax carinate at sides, anterior angles prominent; elytra carinate-marginate at sides.

Supplementary Description

Length 2.1-2.5 mm; width 1.4-1.6 mm. Elongate oval, very convex. Head finely, evenly and sparsely punctate, each puncture bearing a long golden hair, punctures closer and coarser on clypeus; eyes vertical and flattened, a wide flat to slightly concave space between the eyes and the marginal carina at the sides of the vertex; frons with a deep, perforate pit along the margin on each side behind the concealed antennal insertions (Fig. 1); basal two antennal segments cylindrical and about equal, segments 3 to 10 flattened and symmetrically widened, with tufts of bristles at the sides, segment 11 flattened, ovate and bristly (Fig. 2). Pronotum evenly convex, punctation and pubescence about like head, except for a transverse line of slightly tuberculate punctures just in front of the midline on the discal third. Elytral background punctation and pubescence about like head, but with several longitudinal rows of broad shallow punctures; margins strongly carinate. All ventral surfaces except legs finely, evenly punctate and pubescent. Prosternal process broadly convex, not at all grooved (Fig. 3). Last abdominal segment slightly notched at apex.

Key to the Species of *Cephalobyrrhinus*

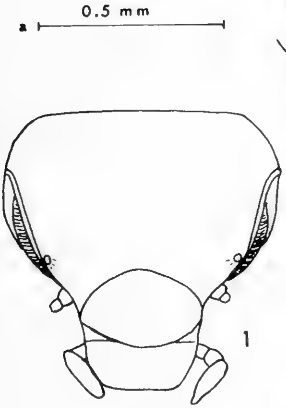
Coarse rows of puncture absent or indistinct on elytral disk near scutellum; pronotal series of tuberculate punctures forming an irregular broad row; Central America . . . . *curticornis* Pic

Coarse rows of punctures very broad and distinct on elytral disk near scutellum; pronotal series of tuberculate punctures forming a nearly straight narrow row; Bolivia . . . . *impressopunctatus* new species

Cephalobyrrhinus curticornis Pic

Cephalobyrrhinus curticornis Pic 1923, p. 6. Type locality: Costa Rica. Holotype located in National Museum of Natural History, Paris.

Length: 2.4 mm. Width 1.5 mm. Elongate oval, convex. Head dark mahogany brown; punctation fine and distant, surface polished, except near clypeus more coarsely punctate and alutaceous. Pronotum dark mahogany brown to nearly black on disk;



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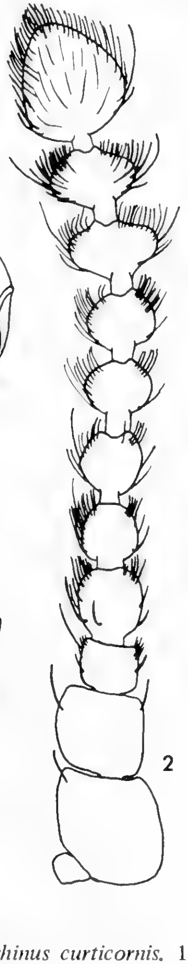

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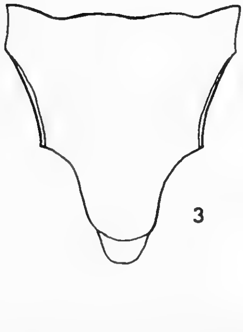

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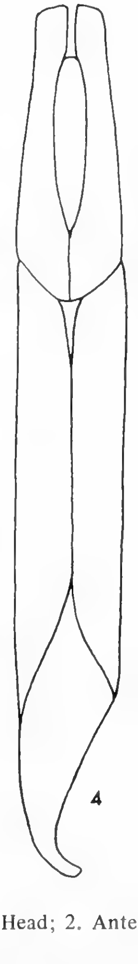

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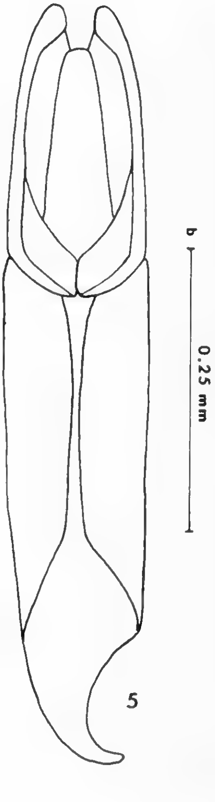

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Figures 1-4. *Cephalobyrrhinus curticornis.* 1. Head; 2. Antenna; 3. Prosternum; 4. Aedeagus, dorsal view.

Figure 5. *Cephalobyrrhinus impressopunctatus* aedeagus, dorsal view.

Figures 1 and 3 to scale a; 2, 4 and 5 to scale b.

punctation fine and scattered, except for a very irregular transverse row of tuberculate punctures on center one-third of disk about one-third of distance to hind margin; background punctation coarser in front of median row. Elytra black shading to very dark mahogany brown at sides; punctation fine and scattered, except for seven longitudinal rows of deep, widely spaced, broad punctures on each elytron; rows one and two, counted from the suture, distinct only in apical one-half; no deep punctures near the scutellum; background faintly alutaceous. Venter red-brown to mahogany; surfaces shining, except hind coxal plates and abdomen finely alutaceous. Sexes externally indistinguishable. Aedeagus as in Fig. 4.

Specimens examined: 30. **Costa Rica:** Hamburg Farm, Reventazon Riv., August, September. **Nicaragua:** Musawas, Waspuc Riv., October. **Panama: Canal Zone:** Barro Colorado Is., March, July. Camp Pina, June. Paraiso, January.

Cephalobyrrhinus impressopunctatus Wooldridge, new species

Holotype: Male. Bolivia: Rurrenabaque, Rio Beni, Oct. W.M. Mann, Mulford Bio. Expl. 1921-22. USNM Type #73400. Length 2.2 mm. Width 1.5 mm. Elongate oval, convex. Head black, punctation fine and distant, surface polished; clypeus with slightly coarser punctation and alutaceous. Pronotum black, punctation fine and scattered, except for the median tuberculate punctures which form a narrow, slightly irregular, single row across center one-third of disk, about one-third of distance to hind margin. Elytra black; punctation fine and scattered except for seven complete longitudinal rows of deep, broad, widely spaced punctures and two abbreviated rows of similar punctures on each elytron, the two short rows beside and ending just behind the scutellum, the first complete row beginning about one-fourth the distance toward the humeral angle, running diagonally toward the suture, then parallel to it to apex; background slightly alutaceous. Venter dark red-brown; surfaces shining except hind coxal plates and abdomen noticeably alutaceous. Aedeagus with tips of parameres rounded and slightly inwardly directed; penis spatulate, slightly U-shaped, evenly tapered to a broadly rounded tip; basal piece about as long as parameres (Fig. 5).

Female: Unknown.

Paratypes: 2. **Bolivia:** 1♂, same data as holotype. 1 ♂, Ivon. Beni, Feb. W.M. Mann, Mulford Bio Expl. 1921-22.

ACKNOWLEDGEMENTS

I am indebted to the following individuals and museums for the loan of material used in this study. Mme. A. Bons, National Museum of Natural History, Paris; Dr. David Kavanaugh and Mr. Hugh B. Leech, California Academy of Sciences, San Francisco; Dr. John Lawrence and Mrs. Janice Scott, Harvard Museum of Comparative Zoology; Dr. Milton W. Sanderson and Dr. Warren U. Brigham, Illinois Natural History Survey,' Urbana; and Dr. Paul J. Spangler, National Museum of Natural History (USNM), Washington, D.C.

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DESCRIPTION OF THE ADULT MALE OF *ALLONARCYS COMSTOCKI* (SMITH) (PLECOPTERA: PTERONARCIDAE)[1,2]

C. H. Nelson[3], D. C. Tarter[4], M. L. Little[4]

ABSTRACT: The adult male of *Allonarcys comstocki* (Smith) is described and figured for the first time. The adult specimen was reared from a last instar nymph collected in Seneca Creek, Pendleton County, West Virginia. Characters serving to distinguish the male of this species from that of closely related *A. proteus* are discussed. A key to all the described males of the genus *Allonarcys* is presented.

DESCRIPTORS: Plecoptera; Pteronarcidae; *Allonarcys comstocki* (Smith); adult male described.

Allonarcys comstocki was described from the adult female by Smith in 1917 and the nymph of this species was identified by Ricker in 1952. The apparently elusive male imago has remained undescribed for nearly sixty years, even though *A. comstocki* has a range across northeastern North America (Ricker, 1952; Nelson and Hanson, 1971; Zwick, 1973; Tarter, et al, 1975). Hence, it is indeed fortunate that an adult male specimen of this species reared from a last instar nymph (fig. 1) at the biological sciences laboratories of Marshall University has become available for examination. The last instar nymph was collected on 21 February 1976 from Seneca Creek approximately one-half mile above the mouth of White's Run (altitude: 658.2m), Pendleton County, West Virginia. The nymph was then transferred to a small container of aged tap water and placed within an incubator at a temperature of 12.8°C with a twelve hour photoperiod. The adult male emerged sometime on the dates of 13 – 15 March 1976. The nymphal exuviae and adult specimen are deposited in the C. H. Nelson collection. Unless otherwise indicated, the morphological terms used in this present work are those introduced by Nelson and Hanson (1971) in their study of the family Pteronarcidae.

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[2] Published with the aid of funds from the University of Tennessee, Chattanooga

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Male imago:

Length to tip of abdomen 27mm, to tip of wings 33mm. General body color, in alcohol, dark brown with large yellow-whitish colored membranous areas on each of the three thoracic sterna and orange-yellowish ecdysial cleavage line mesally dividing pronotum.

Mesal anterior half of ninth tergite elevated to form an anteriorly projecting process with broadly rounded frontal margin (figs. 2, 3). Mesal posterior half of ninth tergite covered with many peg-like setae. Ninth sternite characterized by posteriorly produced rounded subgenital plate (fig. 3). In ventral view, ninth mesal sternal area elevated to form a longitudinal "plateau" (fig. 4, pl) narrowing posteriorly from its greatest width anteriorly. Median hemitergal lobes (fig. 2, mhl) of tenth tergite narrowly rounded at apical margins and covered apically with peg-like setae for slightly over half their length. Posterior hemitergal lobes (fig. 2, phl) are narrow, difficult to discern, and covered with long, thin setae for most of their length. Inner part (figs. 5, 6, ip) of supra-anal process approximately 3/4 length of dorsal section (fig. 5, ds) of free part. Trough-shaped process (fig. 5, 6, tp) of dorsal section of supra-anal process well demarked, projecting anteriorly from frontal sclerotized surface. Subanal lobes lightly sclerotized and in lateral view somewhat boot-shaped in appearance (fig. 2). Cerci slightly more than 1/2 length of abdomen; approximately 27 segments.

Nelson and Hanson (1971) relying upon female genitalic structures, noted that *A. comstocki* was very likely the sister species of *A. proteus* (Newman). Further support for this contention is obtained from the observation that the male genitalic structures of *A. comstocki* very closely resemble those of *A. proteus.* Indeed, owing to this close structural similarity males of *A. comstocki* could be easily confused with those of *A. proteus* and this may in part explain the past difficulty encountered by students of Plecoptera in finding males of the former species. Nonetheless, the male of *A. comstocki* exhibits the following features by which it can be readily distinguished from that of *A. proteus*: (1) median process of ninth tergite is less pronounced with frontal margin entire; (2) median hemitergal lobes are narrowly rounded at their apical margins; (3) inner part of supra-anal process in less elongate only 3/4 length of dorsal section and (4) trough-shaped process is somewhat larger and more pronounced.

In order to further facilitate recognition of the adult male of *A. comstocki* a key to the described males of the species within *Allonarcys* is presented.

Key to the Described Males of *Allonarcys*

1. Apical spatula present on dorsal section of supra-anal process; ninth tergite mesally divided by longitudinal membranous band (East Asian) .2

Apical spatula absent from dorsal section of supra-anal process; ninth tergite entirely sclerotized (Eastern North America) 3

2. Spatula long, approximately 1/2 length of dorsal section of supra-anal process; posterior border of median hemitergal lobes nearly straight . . . . *A. reticulata* (Burmeister)

   Spatula short, approximately 1/4 length of dorsal section of supra-anal process; posterior border of median hemitergal lobes arcuate . . . . . . *A. sachalina* (Kalpalek)

3. Mesal anterior half of ninth tergite lacking anteriorly projecting process; inner part of supra-anal process short, approximately 1/2 length of dorsal section 4

   Mesal anterior half of ninth tergite elevated forming anteriorly projecting process; inner part of supra-anal process long, greater than 2/3 length of dorsal section 5

4. Protuberances present on trough-shaped process of supra-anal process; cowl with fork-like structure present; setae on anterior lateral "arms" of cowl distinct and numerous . . . . *A. biloba* (Newman)

   Protuberances absent from trough-shaped process of supra-anal process; cowl lacking fork-like structure; setae on anterior lateral "arms" of cowl indistinct and sparse . . . . *A. scotti* (Ricker)

5. Frontal border of ninth tergal process emarginate; apical margin of median hemitergal lobes broadly rounded; inner part of supra-anal process approximately equal in length to dorsal section . . . . *A. proteus* (Newman)

   Frontal border of ninth tergal process entire; apical margin of median hemitergal lobes narrowly rounded; inner part of supra-annal process nearly 3/4 length of dorsal section . . . . *A. comstocki* (Smith)

ACKNOWLEDGEMENT

The authors would like to thank Dr. Richard E. Garth for his critical reading of this manuscript.

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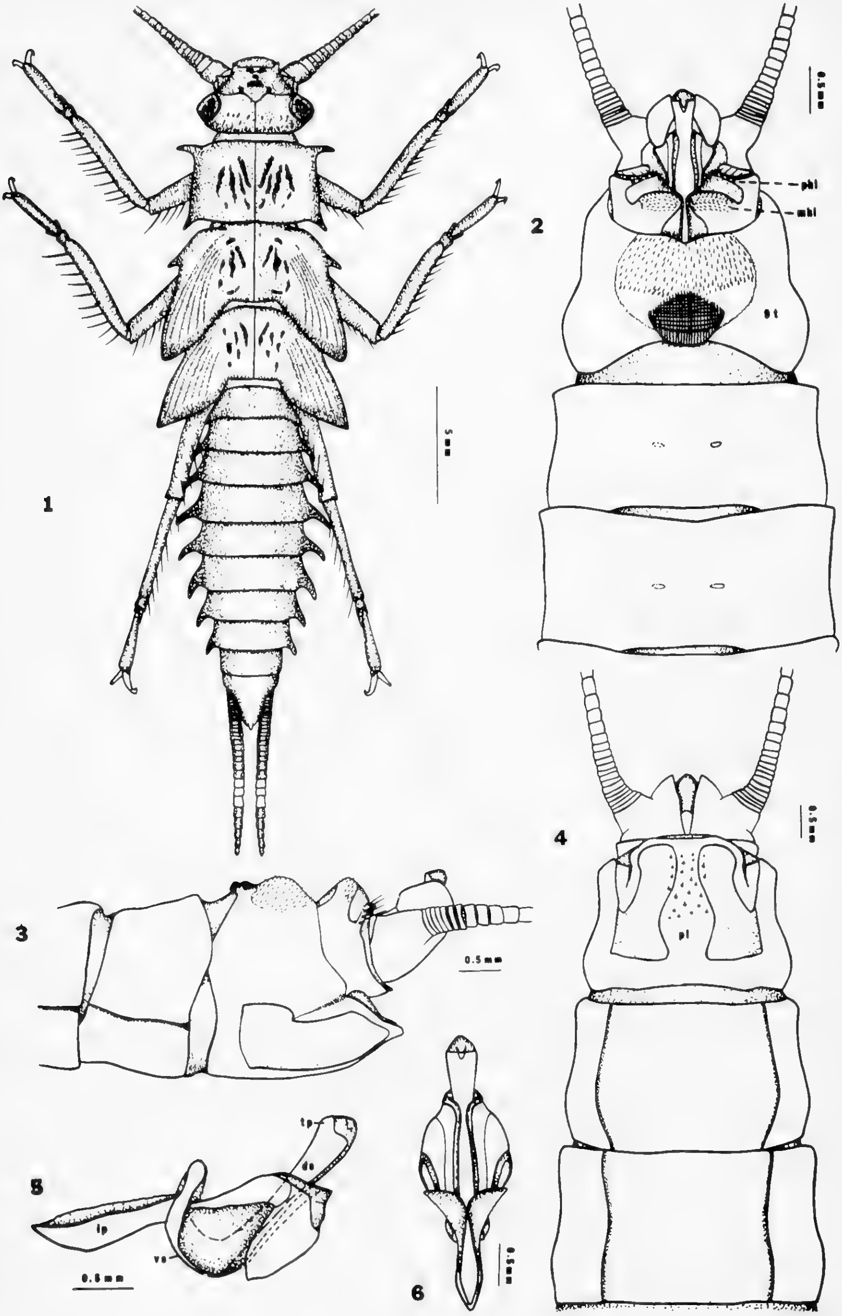

Figs. 1-6. *Allonarcys comstocki* (Smith). Fig. 1. Last instar nymph, dorsal view. Fig. 2. Male terminalia, dorsal view (mhl = median hemitergal lobes, ph1 = posterior hemitergal lobes). Fig. 3. Male terminalia, lateral view. Fig. 4. Male terminalia, ventral view (pl = plateau). Fig. 5. Supra-anal process, lateral view (ip = inner part, vs = ventral section, ds = dorsal section, tp = trough-shaped process). Fig. 6. Supra-anal process, anterior view.

A NEW SUBGENUS *ELEVANOSA*, AND NEW SPECIES OF *GYPONA* (HOMOPTERA:CICADELLIDAE)[1]

Dwight M. DeLong[2]

ABSTRACT: A new subgenus, *Elevanosa*, and a new species, *Gypona (E.) vertara* n.sp., from Argentina are described.

DESCRIPTORS: *Gypona* leafhopper, *Elevanosa vertara*, Homoptera, Cicadellidae.

A study of South American specimens of Gyponinae has revealed two specimens with head and genital structures that are quite different from related species of *Gypona*. In general form and coloration *E. vertara* resembles species of *Curtara* but the type of crown margin and the male genital structures are more like *Gypona*. It is placed as a new subgenus of *Gypona*.

Subgenus *Elevanosa*, n. sub.

Crown as in *Gypona* with a distinct margin, but margin indented at about middle each side forming a central median lobe which is slightly upturned at apex. Ocelli about equidistant between proximal eye and median line a little closer anterior than posterior margins. Male aedeagus without parameres but with a median ventral process extending ventrally. Pygofer with an unsclerotized ventrocaudal lobe and a heavily sclerotized dorsocaudal process.

Type species: *Gypona E. vertara* n.sp.

Gypona (Elevanosa) vertara n.sp.

(Figs. 1-6)

Length of male 9.5 mm, female unknown. Crown almost twice as broad between eyes at base as median length, with a distinct margin which is indented about half the distance between eye and apex each side forming an apical, slightly produced lobe. Color pale yellowish brown with a fine black line on margin of crown.

Male genitalia with plates almost four times as long as median width, apex bluntly angled. Style with basal half of blade short and broad, abruptly narrowed at two thirds its length, producing a narrow apical portion which is bent dorsally and pointed at apex. Aedeagus bearing a pair of short proximal lateral processes each side of apex extending laterobasally. The aedeagal shaft bears a slender ventral process extending ventrally which is one-third length of shaft. Pygofer with an unsclerotized lobe extending caudally on basal half and a heavily sclerotized blunt rounded dorsal projection extending ventrocaudally.

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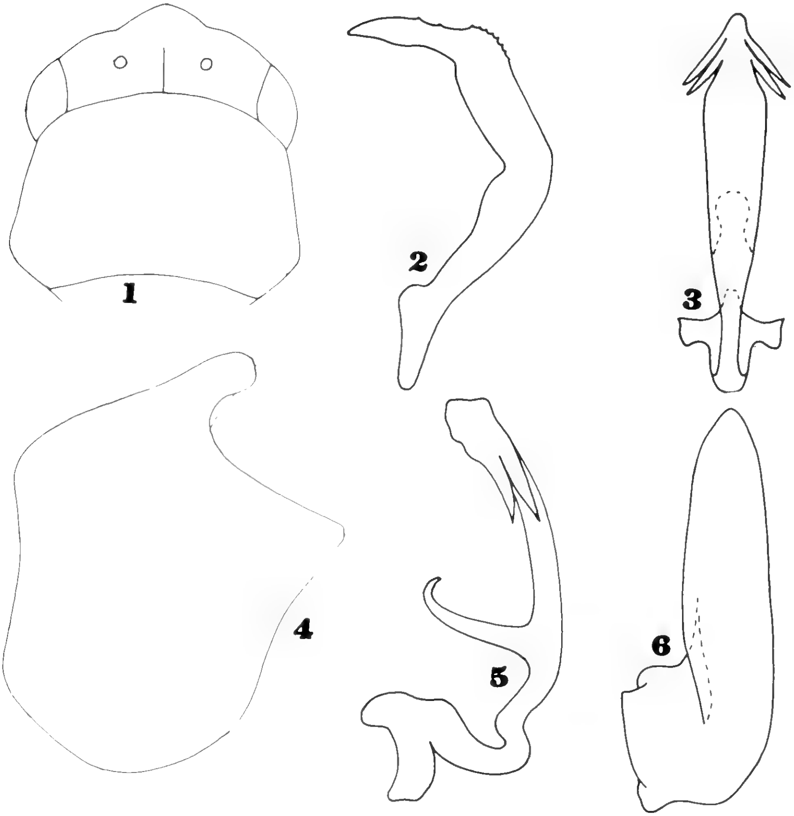
[1] Accepted for publication: June 12, 1976

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

Holotype male Argentine: La Rioja Prov., Patquia, K.J. Hayward, B. M. 1933-333. Paratype 1 ♂ Argentine: 1932-33, K. J. Hayward 1933-187. Both types in the British Museum of Natural History.



Figs 1-6 Gypona (E) vertara n.sp. 1-dorsal view, head & thorax; 2-style, lateral view; 3-aedeagus, ventral view; 4-pygofer, lateral view; 5-aedeagus, lateral view; 6-plate, ventral view.

A *NEOCLYTUS* NEW TO THE UNITED STATES (COLEOPTERA: CERAMBYCIDAE)[1]

Gary V. Manley[2], J. Victor French[3]

ABSTRACT: The Mexican *Neoclytus augusti* (Chevrolat) is reported from the United States for the first time. The species emerged from citrus wood collected in the Lower Rio Grande Valley of Texas.

DESCRIPTORS: Coleoptera, Cerambycidae, *Neoclytus augusti*; new United States record.

***Neoclytus augusti* (Chevrolat)**
Figure 1.

Clytus Augusti Chevr. 1835 Col du Mexique, fasc. 4, Ceramb. 4; Lap & Gory, Mon. Clyt. p. 30, t. 7.

Clytus Dubius Chevr. 1835. Col du Mexique, fasc. 4, Ceramb. 5 (Var. o)

Clytus (Rhopalomerus) Augusti Chevr. 1860. Ann. Soc. Ent. Fr. p. 495.

Neoclytus Augusti (Chevr.) Bates, 1885, Biologia Centrali-Americana, Coleoptera, Vol. 5, p. 45 and 301.

Description – Body is elongate, slender, and tapering; integument reddish-brown; pronotum clothed with pale yellowish pubescence, which partially obscures the surface, basal margin of the pronotum with a narrow pale yellow band; elytra densely clothed with reddish-brown recumbent pubescence, marked with three areas of heavy pale yellow appressed pubescence as follows: the first – a wide transverse band covering basal 1/5, posteriorly slanting obliquely towards suture giving the band the appearance of a half circle, the second – a narrow transverse band forming an oblique "M" shaped mark at middle, and the third – a transverse band at apical 1/4 broadly tapering anteriorly toward suture of elytra, broadest at middle. Head is densely, coarsely punctate, front flat, moderately clothed with pale yellow pubescence, a sharply defined narrow longitudinal groove from middle of vertex to clypeus, antenna inserted in elevated regions on front of head; pronotum wide, subcylindrical, sides rounded, disk with a median longitudinal row of transverse carina, also a short transverse carina at basal 1/3 on either side of middle, dorsal surface densely, coarsely punctate. Abdomen sparsely pubescent except for heavy white pubescent transverse bands along posterior margin of the first and second abdominal segments.

Type Locality – Mexico, Vera Cruz, Tlacotalpam.

Range – Lower Rio Grande Valley of Texas, Hidalgo County.

Previous from Guatemala and Mexico. In Mexico the species is known from Vera Cruz and Tres Marias Islands (Bates 1885) and the Mexican states of Oaxaca and San

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[1] Accepted for publication: July 3, 1976

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ENT. NEWS, 88: 1 & 2: 39 - 40, January & February 1977

Luis Potosi (E. Gorton Linsley, personal communication). The present records extend the range considerably north of previous known localities since the state of San Luis Potosi, Mexico represents the previous most northern record.

Flight Period – Two adults, emerged August 24 and September 4.

Host Plants – Citrus spp.

This species keys to *N. acuminatus,* Linsley (1964).

ACKNOWLEDGEMENT

We thank Dr. E. Gorton Linsley, University of California, Berkeley, California, for identifying this species.

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Figure 1. *Neoclytus augusti* (Chevrolat)

THE MIMETIDAE OF ST. HELENA ISLAND (ARACHNIDA: ARANEAE)[1]

John D. Unzicker[2]

ABSTRACT: The spider family Mimetidae is reported for the first time from St. Helena Island in the southern Atlantic Ocean. The family is represented on the island by a single species, *Ero aphana* (Walckenaer) which has an old world distribution.

DESCRIPTORS: spiders, Araneae, Mimetidae, Ero aphana, distribution, St.Helena Island.

St. Helena Island is located in the southern Atlantic Ocean approximately 1,932 km. west of Angola on the western coast of Africa at approximately 15°56'S 5°42'W. It is a mountainous island of volcanic origin which is 16.9 km long and 10.4 km wide. The highest point on the island is Mt. Achtaeon at 8.81 km.

The spider family Mimetidae is represented on the island of St. Helena by a single species, *Ero aphana* (Walckenaer). Observations by Hentz (1875), Gerhardt (1926), Bristowe (1941), Archer (1941), Czajka (1963), Kaston (1965), Cutler (1972) and Lowrie, Icenogle and Thompson (1972) indicate that mimetids feed on other spiders (eg. Agelenidae Araneidae, Dictynidae, Linyphiidae, Philodromidae, Tetragnathidae, Theraphosidae, Theridiidae and other Mimetidae). Cutler (1972) and Lawler (1972) have observed *Mimetus eutypus* Chamberlin & Ivie and *Mimetus puritanus* Chamberlin also feeding on insects. Mimetids are typically found in ground debris, vegetation and the webs of other spiders. The members of this family are distinguished from other spiders by the presence of a promarginal row of long, slightly curved spines on the tibae and metatarsi of legs I and II. Shorter curved spines between the long spines are graduated, short at the proximal end to long at the distal end. The genus *Ero* is characterized by having the height of the clypeus hardly, if at all, narrower than the length of the MOA, and leg I not more than one and one-third times as long as leg IV.

Heretofore the family Mimetidae has not been recorded from St. Helena. The genus *Ero* is world wide in distribution but *E. aphana* (Walckenaer) has an Old World distribution (North Africa, Europe and Russia) and thus the Mimetid fauna of St. Helena

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[1] Accepted for publication: July 23, 1976

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ENT. NEWS, 88: 1 & 2: 41 - 42, January & February 1977

appears to be Old World in origin.

Ero aphana (Walckenaer), 1802

Aranea aphana Walckenaer, 1802, p. 206 (n. sp.).
Ero aphana: Simon, E., 1881, p. 33; 1882, p. 361; 1884, p. 330; 1898, p. 2; 1932, p. 774, 778.

Records: S.W. Thompson's Wood, elev. 1700-1800 ft., November 23, 1965, collectors: P. Bailewsky, P. Benoit and N. Leleup, 1♂ and 1 juvenile (Coll. No. 129.109); High central ridge, Mt. Actaeon, elev. 8.53-8.86 km., December 11, 1965, collectors: P. Basilewsky, P. Benoit and N. Leleup, 1♂ (Coll. No. 129.326); High central ridge, Cabbage Tree road, elev. 8.21 km., March, 1967, collectors: J. Decelle, N. and J. Leleup, 2♂, 2♀ and 2 juveniles (Colls. No. 133.283, 133.286 and 133.305); High central ridge, elev. 8.53 km., Cabbage Tree, February 6, 1967, collectors: J. Decelle, N. and J. Leleup, rotten log, 1♂ and 2♀ (Colls. No. 133.379 and 133.384); High central ridge, elev. 7.55-8.53 km., January 22-31, 1967, collectors: J. Decelle, N. and J. Leleup, 1♀ and 1 juvenile (Coll. No. 133.370); High peak, elev. 7.87-8.53 km. March, 1967, collectors: J. Decelle, N. and J. Leleup, 1♂ (Coll. No. 133.333); Valley near St. Diana's Peak, February 9, 15, 1967, collectors: J. Decelle, N. and J. Leleup, 1 juvenile (Coll. No. 133.448).

The specimens listed above are deposited in the Musee Royal de l' Afrique Centrale, Tervuren, Belgium. The author would like to thank Dr. P.L.G. Benoit for making the specimens available for study.

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PRIMARY TYPE SPECIMENS IN THE SOUTH DAKOTA STATE UNIVERSITY INSECT COLLECTION[1,2]

Edward U. Balsbaugh, Jr.[3]

ABSTRACT: Specimen data and references to their original descriptions are provided for 16 species of insects for which primary types (holotypes, syntypes) and allotypes are deposited in the South Dakota State University Insect Collection. Insect orders for these types include: Orthoptera, Coleoptera, Diptera and Hymenoptera.

DESCRIPTORS: Primary Types, South Dakota State University, Holotypes, Allotypes, Syntypes, Orthoptera, Coleoptera, Diptera, Hymenoptera

One of the obligations of institutions housing type material in collections in their care is to make those specimens freely available for study by other scientists. The insect collection of South Dakota State University contains several type specimens, including primary types for 16 species and numerous secondary types. This paper identifies those specimens in our care.

H.C. Severin, former Head of the Entomology-Zoology Department at South Dakota State College, indicated his intent to present type specimens in the S.D.S.C. collection to the U.S. National Museum (Osborn, 1930). However, in 1970, when I requested a check of the records of the U.S.N.M., the Secretary of the Smithsonian Institution (U.S.N.M.) indicated that only a single hymenopteran type was received from Prof. Severin. Evidently the bulk of the types was never sent. A search of the S.D.S.U. collection, which includes more than one million specimens, revealed the following primary types.

ORTHOPTERA

Acrididae

Melanoplus algidus Scudder 1899. Proc. Davenport Acad. Nat. Sci. 7: 195, 199-201, pl 9 fig. 6. 2 Syntypes: ♂♂ "Mary's Peak, Benton Co., Or. Sept. 16, 1897". "Type 15474".

Melanoplus debilis Scudder 1899. Proc. Davenport Acad. Nat. Sci. 7: 196, 201-202, pl 9 fig. 7. 2 Syntypes: ♂ "Siskiyou, Or. Sept. 6, 1897". "Type 15487". ♀ "Ashland, Or. Sept. 7, 1897".

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Melanoplus decoratus Morse 1904. Psyche 11: 12. 2 Syntypes: ♀♀ "Murphy, N.C. July 25, 1903". "Type 15516".

Melanoplus devius Morse 1904. Psyche 11: 12. 2 Syntypes: ♂ "Wytheville, Va. Sept. 5, 1903". ♀ "Wytheville, Va. Sept. 4, 1903". "Type 15505".

Melanoplus divergens Morse 1904. Psyche 11: 8. "Type 15509". ♀ "Balsam, N.C. Aug. 19, 1903 Jones' Peak".

Melanoplus islandicus sylvestris Morse. 1904. Psyche 11: 10. 2 Syntypes: ♂ & ♀ "Blowing Rock, N.C. July 19, 1903". "Type 15513".

Melanoplus nanus Scudder 1899. Proc. Davenport Acad. Nat. Sci. 7: 160, 161, pl 7, fig. 3. 2 Syntypes: ♂ "Berkeley, Calif. Aug. 21, 1897". ♀ "Baden, Calif. Aug. 24, 1897". "A.P. Morse Coll." "Type 15484".

Melanoplus phoetaliotiformis Scudder 1899. Proc. Davenport Acad. Nat. Sci. 7: 175, 179, pl 7, fig. 9. [=*Phoetaliotes nebrascensis* (Thomas)]. Syntypes: ♂ "Gazelle, Calif. Sept. 5, 1897". "Type 15481". ♀ Collection data same as first syntype.

Melanoplus validus Scudder 1899. Proc. Davenport Acad. Nat. Sci. 7: 195, 197, pl 9 figs. 4,5. 4 Syntypes: ♂ "Roseburg, Or. Sept. 10, 1897". "A.P. Morse Coll.". ♂ & ♀ "Glendale, Or. Sept. 9, 1897". ♂ "Drain, Or. Sept. 11, 1897". "A.P. Morse Coll.". "Type 15475".

Melanoplus varicus Scudder 1899. Proc. Davenport Acad. Nat. Sci. 7: 160, 161 pl 7, fig. 3. 2 Syntypes: ♂ "Tehachapi, Calif. Aug. 2, 1897". "A.P. Morse". ♀ "Tehachapi, Calif. Aug. 9, 1897". "A.P. Morse". "Type 15478".

COLEOPTERA

Melyridae

Collops bridgeri Tanner 1936. Proc. Utah Acad. Sci. 13: 153. Allotype: "Placid Lake, Mont. Aug. 8, 1947. H.C. Severin, Coll."

Chrysomelidae

Myochrous movallus Johnson 1931. Canadian Entomol. 43: 148. 2 Syntypes of 5 mentioned in the original description. "Elk Point, S.D. June 24, 1926. G.I. Gilbertson Collector".

Pachybrachis othonus sioux Balsbaugh 1973. Ann. Entomol. Soc. America 66: 254. Holotype: ♂ "Cottonwood, S.D. June 1, 1955 H.C. Severin Coll.". Allotype: ♀. Collection data same as for holotype.

Paria pratensis Balsbaugh 1970. Ann. Entomol. Soc. America 63: 457. Holotype: ♂ "Volga, South Dakota".

DIPTERA

Tachinidae

Grisdalemyia setosa Reinhard 1937. Brooklyn Entomol. Soc. Bull. 32: 72-74. Holotype. ♂ "Winner, S.D. July 4, 1924". "H".

HYMENOPTERA

Megachilidae

Megachile dakotensis Mitchell 1926. Psyche 33: 164. Holotype: ♂ "Hot Springs, S.D. July 10, 1924". Allotype: ♀ "Ft. Pierre, S.D. Aug. 11, 1924".

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REDESCRIPTION OF *VAEJOVIS GLOBOSUS* BORELLI (SCORPIONIDA, VAEJOVIDAE)[1]

Oscar F. Francke[2]

ABSTRACT· *Vaejovis globosus* Borelli (1915), from Durango, México, is redescribed in order to clarify the taxonomic status of this poorly known species. *Vaejovis gilvus* Williams (1968), from Coahuila, México, is found to be a junior synonym of *V. globosus*. This species apparently occurs throughout the Chihuahuan desert of North America, and its presence in the U.S. is reported for the first time.

DESCRIPTORS: Scorpionida, scorpion, Vaejovidae, *Vaejovis globosus*, redescription, synonymy, North America, Chihuahuan desert.

The scorpion *Vaejovis globosus* Borelli (1915) is one of many poorly known species in the North American fauna. Originally described on the basis of a single adult female from Dinamita, Durango, México, it has remained virtually unknown ever since and no additional specimens have been reported in the taxonomic literature. Hoffmann (1931), in an extensive monograph on Mexican scorpions, lists *V. globosus* among the species not seen by him and gives but a brief diagnosis based on Borelli's original description. Stahnke (1974) does not include *V. globosus* in the list of species recognized by him.

In late 1974 I tentatively identified some specimens from Texas as being either *V. globosus* or a very closely related taxon. A recent study of the holotype of *V. globosus*, as well as numerous other specimens, have enabled me to ascertain that this is a valid species apparently widely distributed in the Chihuahuan desert. The following redescription is aimed at increasing our knowledge of this taxon, and to contribute to our understanding of the North American Vaejovids and their phylogeny.

Vaejovis globosus Borelli

Vaejovis globosus Borelli 1915:4-5 (HOLOTYPE ♀: México, Durango, Dinamita).
Vejovis globosus: Hoffmann 1931:402. Hoffmann 1938:318.
Vaejovis globosus: Díaz Nájera 1975:6, 22.
Vejovis gilvus Williams 1968:2-6 (HOLOTYPE ♂: México, Coahuila, 13 km. SW Cuatro Cienegas de Carranza). NEW SYNONYMY.
Vejovis gilvus: Soleglad 1973:359. Stahnke 1974:135.
Vaejovis gilvus: Díaz Nájera 1975:6, 20.

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DIAGNOSIS – Small to medium-sized scorpion, adults range from 30-45 mm. in total length. Carapace campaniform, anterior margin straight; interocular triangle in females smooth and lustrous, in males coarsely granulose. Tergite VII pentacarinate; sternite VII bicarinate, ventral submedian keels obsolete. Pectinal tooth count 10-14 in females, 13-18 in males. Metasoma: ventral submedian carinae progressively stronger distally, vestigial and smooth on I, moderate and subgranose on IV; ventral lateral carinae weak to moderate, serrate; lateral supramedian and dorsal lateral carinae moderate, finely serrate. Telson globose in females, length/width ratio 2.05-2.25; elongate in males, length/width ratio 2.30-2.70. Pedipalps orthobothriotaxic (type C); chela acarinate, fingers without distal whitish cap and with dentate margins entire, fixed finger as long as underhand.

HOLOTYPE – Adult female (measurements in Table 1).

Prosoma. Carapace flavus with diffuse fuscosity delimiting interocular triangle, and along posterior margin. Median and lateral eyes piceous; three pairs of lateral eyes, gradually decreasing in size posteriorly. Campaniform: anterior margin essentially straight; lateral margins sinuous, with shallow emarginations at level of median eyes and posterior lateral furrows; posterior margin straight. Anterior median furrow shallow, broad. Median ocular prominence moderately raised above carapacial surface, longitudinally feebly concave between median eyes; median eyes located at anterior two-fifths of carapace length, separated by slightly more than their own diameter. Posterior median furrow present at distal submargin, short, deep, narrow. Posterior marginal furrow vestigial. Posterior lateral furrows strongly arcuate, moderately deep and wide. Texture: interocular triangle lustrous, smooth; other areas shagreened, with moderate to dense small and medium granules. Venter flavus to ochroleucus, sparsely setate. Sternum subpentagonal, sides moderately divergent distally, and slightly wider than long.

Mesosoma. Tergites flavus; I-VI with distinct submedian fuscosity extending laterally along anterior margin, VII vestigially infuscate. Texture: medially lustrous, smooth on I-III, vestigially to weakly carinate on IV-VII; submedially and laterally shagreened to densely granose, VII with submedian and lateral carinae moderately strong and granulose. Genital operculi flavus, one and one-half times wider than long, posteriorly conspicuously lobed submedially; median longitudinal membranous connection present on basal four-fifths, but appearing shorter due to posterior submedian lobes on genital operculi. Pectines ochroleucus: basal piece one and one-half times wider than long, deeply notched anteromedially; lamellae moderately setate; fulcra subtriangular, setate; pectinal tooth count 12-13, each tooth about two times longer than wide. Sternites flavus: III-VI lustrous, smooth, with stigmata six to seven times longer than wide; VII bicarinate with submedian keels obsolete, lateral keels weak, smooth to subcrenate.

Metasoma. Flavus, moderately to sparsely setate. Ventral submedian carinae: on I-II vestigial to obsolete, smooth, parallel; on III weak, smooth, parallel; on IV weak to moderate, basally smooth and distally subgranose, parallel. Ventral lateral carinae: on I-II weak to moderate, feebly serrate; on III-IV moderate, serrate. Lateral inframedian carinae: on I moderate, complete, serrate; on II present on distal one-third, weak, serrate; on III present on distal one-fifth, weak, subgranose; on IV obsolete. Lateral supramedian carinae moderately strong, on I-III serrate, on IV serrato-granose. Dorsal lateral carinae strong, serrato-crenate.

Segment V: ventral median keel moderate, serrate; ventral lateral carinae strong, serrate; lateral median carinae present on basal one-third to one-half, subserrate to smooth; dorsal lateral carinae weak, feebly crenate. Anal arc subcircular: anal subterminal keel weak, granulose; anal terminal keel weak to vestigial, minutely granulose. Intercarinae on I-V smooth, lustrous.

Telson dorsally with small whitish patch at base of aculeus, reminiscent of "androvestigium" of Bothriuridae and *Hadrurus* spp. Vesicle globose, slightly wider than segment V, lustrous, smooth, moderately to sparsely setate. Subaculear tubercle vestigial. Aculeus ferrugineous, moderately curved.

Chelicera. Flavus, teeth ferrugineous. Fixed finger dorsally with three teeth: bicuspid basal, single median and distal; ventrally smooth, rounded. Movable finger dorsally with five teeth: small basal, moderate median, two small subdistals, moderate distal not closely apposed to ventral counterpart; ventrally with distinct, sharp, entire edge extending distally to single ventral distal tooth. Movable fingers lacking serrulae.

Pedipalp. Femur flavus. Dorsal internal keel strong, granose. Dorsal external keel moderately strong, subserrate. Ventral internal keel strong, granose. Ventral external keel obsolete. External keel present on distal one-half, weak to vestigial, subcrenate. Ventral, external, and dorsal faces smooth, lustrous. Internal face shagreened, with few large granules medially. Orthobothriotaxia "C" (Vachon, 1974).

Tibia flavus. Dorsal internal keel weak to vestigial, sparsely granulose; basal tubercle weak. Dorsal median carina strong, granose. Dorsal external keel weak, smooth to subgranose. External keel obsolete. Ventral external keel weak, smooth. Ventral median keel obsolete. Ventral internal keel moderate, subgranose to granulose. Intercarinae smooth, lustrous. Orthobothriotaxia "C" (Vachon, 1974), with standard pattern of genus.

Chela flavus. fingers ferrugineous. Manus subelliptical in cross-section; all carinae obsolete, their presence subtly suggested by flat to feebly convex "intercarinal" spaces. Fingers distinctly shorter than carapace and metasomal segment V, with inner margins very shallowly arcuate; dentate margins granulose, with six and seven inner accesory granules on fixed and movable fingers respectively. Finger tips lacking unsclerotized (?) whitish caps. Dentate margins of fingers meet only along distal one-fourth when fingers closed. Orthobothriotaxia "C", with two internal tricobothria on basal three-tenths of fixed finger.

Legs. Flavus, with femora and patella vestigially shagreened. Tarsal armature and morphology standard for genus.

Condition. Holotype in moderate condition. The metasoma is precariously attached at basal articulation. Right legs I-II missing tarsomere II, leg IV tarsomere dangling loosely. Ungues damaged on all legs but left II. Most setae and trichobothria broken off basally.

MALE – Differs from female as indicated below (measurements in Table 1).

Prosoma. Carapace coarsely granulose, including interocular triangle.

Mesosoma. Tergites shagreened, lateral submargins coarsely granulose. Genital operculi without median longitudinal membranous connection, genital papillae present. Pectines longer with more middle lamellae and teeth per comb, each tooth about three times longer than wide. Sternites smooth, not lustrous.

Metasoma. Intercarinae smooth, not lustrous. Vesicle more elongate, considerably narrower than segment V; vestigially rugose, not lustrous.

TYPE DEPOSITORIES – Holotype of *Vaejovis globosus* Borelli in the collection of the Museo ed Istituto de Zoologia Sistematica, Universita di Torino, Italy (Sc. # 507). Primary types of *Vaejovis gilvus* Williams in the collection of the California Academy of Sciences, San Francisco.

DISTRIBUTION – In addition to the holotype of *V. globosus,* the following specimens have been examined: MÉXICO, *Coahuila;* 16 mi SW of Cuatro Cienegas de Carranza (west point of Laguna Grande dunes, 775 m), 9 August 1968 (S.C. Williams, M. Bentzien, J. Bigelow, and W.L. Minckley; 1 ♂ and 1 ♀ identified as *Vejovis gilvus* Williams by Dr. S.C. Williams); 4.5 mi NNE of Cuatro Cienegas de Carranza (Rio Cañon, 800 m), 11 August 1973 (L.R. Erickson and M.E. Soleglad; 11 ♂♂ and 7 ♀♀). *Zacatecas;* 45 mi NE Zacatecas, 8 August 1973 (L.R. Erickson and M.E. Soleglad; 9 ♂♂, 8 ♀♀, and 8 second instars). UNITED STATES, *Texas;* Brewster Co., Big Bend National Park, Rio Grande Village, 21 June 1970 (7 ♂♂, 17 ♀♀); 16 June 1974 (1 ♂, 3 ♀♀); 17 June 1974 (3 ♂♂, 1 ♀) (M.A. Cazier, L. Draper, and O.F. Francke).

INTRASPECIFIC VARIATION – The holotype and the adult specimens from Rio Grande Village, Texas, show the same coloration pattern (see holotype's redescription); on immatures it is occasionally more pronounced, and fuscous markings may appear on metasomal segments IV-V. Adult females from the Texas population range from 40-45 mm in total length; and the metasomal segments bear conspicuous reddish setae, 1.0-1.5 mm long, on the carinae and telson. Adult males range from 35-40 mm in total length: the metasonal segments ventrally and laterally bear short, stout reddish setae 0.25-0.40 mm long; dorsally and on the telson the setae are small, whitish, and very inconspicuous. Immatures show the setal pattern described for females, but with the setae proportionately shorter.

The specimens from the Cuatro Cienegas basin in Coahuila show a reduction in the extent and intensity of the fuscous markings, although the pattern remains unchanged. Those from Laguna Grande dunes do not differ in size or in the sexually dimorphic setation pattern from the Texas population. The Rio Cañon population in the Cuatro Cienegas basin shows considerable differences from the Texas population as follows: adult females range from 30-35 mm in total length, adult males range from 28-33 mm in total length; there is no sexual dimorphism in the metasomal setation pattern (neotenic condition ?), both sexes bearing reddish setae 0.8-1.2 mm long which are conspicuously present both along the dorsal carinae and on the telson.

The population from the state of Zacatecas resembles the Texas population in that the setation pattern reflects sexual dimorphism, but differs in size and color. Adult females range from 35-40 mm in total length, and males are only slightly smaller. On all specimens the carapace and tergites are densely infuscate, the latter having only a narrow median and two narrow lateral flavus bands. The metasoma is nigrocarinate, and the distal segments show diffuse intercarinal fuscosity. The femora and tibiae of the pedipalps and legs show moderately dense, variegated fuscosity.

The different populations of *V. globosus* do not differ significantly in pectinal tooth counts (Table 2), or in telson morphometrics (Table 3). Adult females have an extremely swollen telson, slightly over twice longer than wide, and it is to this "globose" structure that the species owes its name.

INTERSPECIFIC COMPARISONS – *Vaejovis globosus* appears to be most closely related to *Vaejovis coahuilae* Williams, with which it is known to be sympatric in the northern one-half of its geographic range, and the separation of these two species is often complicated by the unusual degree of variability observed among the different populations of *V. globosus. Vaejovis coahuilae* occurs in Coahuila, México, and in Texas and New Mexico in the U.S.; adults range from 35-50 mm in total length, have a moderately to densely infuscate opisthosoma and a nigrocarinate metasoma, and both sexes have a moderately setate metasoma. Thus, *V. coahuilae* resembles very closely the Zacatecas population of *V. globosus* in coloration pattern, and the Rio Cañon,. Cuatro Cienegas basin, population in the absence of sexual dimorphism in metasomal setation. In general, *V. coahuilae* can be recognized by its more elongate telson (Table 3); its higher pectinal tooth count, in females ranging from 13-18 teeth per comb (mode is 15 for 299 specimens), and in males from 16-22 (mode is 19 for 161 specimens); finally, adult males have a slightly more swollen pedipalp chela, and the dentate margin of the fixed finger is feebly to moderately emarginate basally.

Vaejovis globosus differs from *Vaejovis spinigerus* (Wood), a common species in Arizona and western New Mexico, in that the latter is a larger species (adults often exceeding 60 mm in total length), has a granulose vesicle and a higher pectinal tooth count, in females ranging from 16-22 teeth per comb, and in males from 22-27 teeth.

In the original description Borelli related *V. globosus* to *Vaejovis bilineatus* Pocock, a species reported from Texas and Aguascalientes, México. *V. bilineatus* can be recognized by its extensive fuscous markings, which reach their highest density on the pedipalp chela and distal segments of the metasoma; by having sternite VII acarinate, and metasomal segments I-IV with the ventral submedian keels obsolete and the ventral lateral keels smooth.

In the description of *V. gilvus,* Williams related this taxon to *Vaejovis confusus* Stahnke which occurs in Arizona. *V. confusus* can be readily separated by its granulose vesicle; its proportionately longer pedipalp fingers, which are approximately one and one-half times the length of the underhand (approximately equal in length in *V. globosus*); and by having metasomal segment I about as long as wide (distinctly wider than long in *V. globosus*).

ACKNOWLEDGEMENTS

I am extremely grateful to Dr. Orsetta Elter, Museo ed Istituto di Zoologia Sistematica, Universita de Torino, Italy, for enabling me to study the holotype of *V. globosus.* Similarly, my gratitude goes to Dr. Stanley C. Williams, San Francisco State University and California Academy of Sciences, San Francisco, for supplying the specimens from Laguna Grande dunes, Cuatro Cienegas basin, Coahuila; and to Mr. Michael E. Soleglad, San Diego, for the loan of the specimens from Zacatecas, and Rio Cañon, Cuatro Cienegas basin, Coahuila, as well as for his comments on the manuscript. I was partially supported by an Arizona State University Graduate College Fellowship during the course of this investigation.

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	HOLOTYPE female	MALE (Texas)
Total length	41.95	38.30
Carapace length	5.50	4.70
Anterior width	3.20	2.70
Width at median eyes	4.00	3.40
Posterior width	5.20	4.30
Mesosoma length	11.70	10.00
Metasoma length	24.75	23.60
I length/width/depth	2.50/3.05/2.50	2.50/2.80/2.20
II length/width/depth	2.95/3.00/2.50	3.00/2.80/2.20
III length/width/depth	3.10/2.95/2.50	3.20/2.75/2.20
IV length/width/depth	4.00/2.95/2.50	4.10/2.70/2.20
V length/width/depth	6.00/2.95/2.45	5.60/2.60/2.10
Telson length	6.20	5.20
Vesicle length/width/depth	4.20/3.00/2.50	3.50/1.90/1.60
Aculeus length	2.00	1.70
Pedipalp length	14.50	13.30
Femur length/width/depth	3.60/1.45/1.30	3.40/1.30/1.10
Tibia length/width/depth	4.10/1.80/1.80	3.80/1.50/1.40
Chela length/width/depth	6.80/2.40/2.15	6.10/2.00/1.80
Movable finger length	4.00	3.50
Fixed finger length	3.00	2.55
Chelicera length	2.70	2.10
Chela length/width	1.75/1.40	1.40/1.10
Movable finger length	1.75	1.30
Fixed finger length	1.00	0.75
Pectinal tooth count	12-13	16-16
Middle lamellae count	9-10	13-13

Table 1. Measurements (in millimeters) of *Vaejovis globosus* Borelli.

	FEMALES					MALES					
Number of teeth	10	11	12	13	14	13	14	15	16	17	18
MÉXICO:											
Durango (holotype)	–	–	1	1	–	–	–	–	–	–	–
Zacatecas	–	–	7	9	–	–	–	2	11	5	–
Coahuila: Rio Cañon	1	2	10	1	–	1	1	13	5	–	–
Laguna Grande dunes	–	–	2	–	–	–	–	–	1	1	–
UNITED STATES											
Texas, Brewster Co.	–	–	8	26	6	–	–	1	9	11	1

Table 2 – Variability in pectinal tooth counts observed in the different populations of *Vaejovis globosus* Borelli. The pectinal combs in scorpions are paired appendages, often asymmetrical in the number of teeth born on each side; thus, there are twice as many observations on pectinal tooth counts as the actual number of specimens examined.

	FEMALES				MALES			
	n	$\bar{x}$	high	low	n	$\bar{x}$	high	low
V. globosus								
MÉXICO								
Durango (holotype)	1	2.07	2.07	2.07	–	–	–	–
Zacatecas	4	2.16	2.20	2.10	4	2.56	2.65	2.50
Coahuila: Rio Cañon	4	2.12	2.20	2.05	9	2.44	2.60	2.30
Laguna Grande dunes	2	2.12	2.15	2.10	2	2.62	2.68	2.55
UNITED STATES								
Texas, Brewster Co.	7	2.17	2.25	2.05	7	2.64	2.70	2.50
V. coahuilae								
Texas, Brewster Co.	20	2.38	2.50	2.25	20	2.76	3.00	2.60

Table 3 – Variability in the telson length/width ratio observed between adults of the different geographical populations of *Vaejovis globosus* Borelli, and its close relative *Vaejovis coahuilae* Williams.

The Entomologist's Record

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

RECORD OF NEW NATURAL PARASITES OF SORGHUM SHOOTFLY *ATHERIGONA VARIA SOCCATA*, ROND. (DIPTERA: ANTHOMYIIDAE) IN INDIA

P.R. Shivpuje (Parbhani)

During studies on percentage parasitism at Sorghum Research Station, Parbhani, two new natural parasites have been recorded on sorghum shootfly *Atherigona varia soccata*, Rond. These are identified as *Ganaspis* sp. and *Odonteucoila* sp. (Hymenoptera: Eucoilidae). Their parasitism in the month of October was 2 & 4% respectively. These parasites are recorded for the first time in India.

Very little work has been done on biotic agents and host parasite relationships of shootfly. Kundhu et al. (1971) recorded parasites *Aprostocetus* sp. (Hymenoptera: Eulophidae) and *Callitula bipartitus* sp. nov., (Hymenoptera: Pteromalidae) on shootfly from Udaipur, Rajasthan state. Raodeo et al. (1972) recorded *Tetrastichus nyemitavus*, Rohwer and *Tetrastichus* sp. on shootfly from Maharashtra state.

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NEW RECORD OF *TROPIDISHIA XANTHOSTOMA* SCUDDER (ORTHOPTERA: GRYLLACRIDIDAE)[1]

Brent L. Prothero[2]

ABSTRACT: A new Oregon record for *Tropidishia xanthostoma* Scudder is Lane County. Inland occurrence exceeding 80 miles from the Pacific coast may be considered as east of the Pacific Slope.

DESCRIPTORS: *Tropidishia xanthostoma,* Gryllacrididae, Oregon, Pacific Slope.

Tropidishia xanthostoma Scudder is a comparatively rare cavernicole restricted to moist habitats on the Pacific coast of North America. Locality records, of interest to zoogeographical investigation, are scarce. This note offers a new occurrence record.

During August, 1975, a female pre-adult instar was collected in Lane County, Oregon, by Dr. N.H. Anderson. The collection constitutes a new county record extending inland distribution south. The cricket was collected on the underside of a log angled into Mack Creek in the Andrews Forest approximately eleven miles northeast of Blue River at an elevation of about 2500 feet.

On November 1, 1975, I located a new population of *T. xanthostoma,* numbering approximately 135 members, five miles north of one previously described (Prothero 1975) near Mill City in Marion County, Oregon. The new population is located on Henline Creek in an abandoned mine at an elevation of about 1800 feet.

Inland distribution of *T. xanthostoma* has been reported only in Oregon (Fulton 1928) between 80 and 94 miles from the coast. As other specified locations extend a maximum of approximately 26 miles inland to Mary's Peak, Benton County, Oregon, and occur most frequently on the Pacific coast, inland distribution may be considered as outside of the Pacific Slope range. Previously recorded localities include: Vancouver Island and Stanley Park, Vancouver, British Columbia (Buckell 1922); Victoria and Nanaimo, British Columbia (Buckell 1930); Hoquiam, Washington, and Los Angeles County, California (Caudell 1916); Crescent City, California (Scudder 1862); Benton, Lincoln, and Linn Counties, Oregon, and Mendocino, California (Fulton 1928); and Marion County, Oregon (Prothero 1975).

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NON-CAVERNICOLOUS PSEUDOSCORPIONS FROM WEST VIRGINIA[1]

Michael P. Sweeney, Ralph W. Taylor, and Clement L. Counts, III[2]

ABSTRACT - Three species of non-cavernicolous pseudoscorpions, *Apochthonius moestus, Chthonius tetrachelatus,* and, *Neobisium carolinense*, are reported for the first time from West Virginia.

Previous reports of pseudoscorpions from West Virginia have been confined to the cavernicolous species. Hoff (1958) reported only one species, *Kleptochthonius (Chamberlinochthonius) henroti* (Vachon), as occurring within the state. Muchmore (1965) reported *K. (C.) henroti, K. orpheus* Muchmore, and *K. proserpinae* Muchmore, from eastern West Virginia caves, as well as *Apochthonius paucispinosus* Muchmore (Muchmore, 1967). Muchmore (1973) further reported *Chitrella cavicola* (Packard), *C. regina* (Malcolm and Chamberlin), and *K. (C.) hetricki* Muchmore (1974) in West Virginia. The present note reports three species of non-cavernicolous pseudoscorpions from West Virginia.

Chthonius tetrachelatus (Preyssler) was collected from within the empty shells of the terrestrial gastropods *Mesodon thyroidus* (Say) and *Triodopsis albolabris* (Say) from Lesage, Cabell County; Nitro, Kanawha County; Hurricane, Putnam County; and Lavalette, Wayne County. *Apochthonius moestus* (Banks) was also collected, under similar circumstances, from Milton, Cabell County. *Neobisium carolinense* (Banks) was taken from a spider web in woodland near White Run of Seneca Creek, Randolph County, by Dr. Donald C. Tarter. This occurrence may have been due to the pseudoscorpions arrival in the web by phoretic means, however, *N. carolinense* has never been reported in a phoretic situation (Muchmore, 1971).

C. tetrachelatus has been reported from every state adjacent to West Virginia (Hoff, 1958) and *A. moestus* has been found in every surrounding state but Ohio (Hoff, 1958). *N. carolinense* has been found in Kentucky, Pennsylvania, and Virginia (Hoff, 1958). Thus, the presence of these species in West Virginia is not surprising. However, this note represents the first report of non-cavernicolous pseudoscorpions in West Virginia.

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FURTHER STUDIES ON THE NORTH AMERICAN SPECIES OF *PRISTOCERA* (HYMENOPTERA: BETHYLIDAE)[1]

Howard E. Evans[2,3]

ABSTRACT: *Pristocera parkeri* is described from males from Missouri, with additional specimens from Arkansas, Louisiana, and Texas. *P. dreisbachi* is described from males from Veracruz, Mexico. Notes and range extensions are presented for five other species of this genus.

DESCRIPTORS: Bethylidae, *Pristocera:* new species, distribution.

This is a supplement to my revision of *Pristocera* of North America, published in 1963. At that time I recognized 19 species, collectively ranging from northern United States to Panama. In 1964 I added two more species, and in 1967 presented several new distribution records. Material examined since that date includes two additional species as well as several range extensions. As pointed out in 1964, all American species are properly assigned to the subgenus *Acrepyris.*

In 1963 I reviewed what is known regarding the biology of species of *Pristocera,* commenting that "there is a good possibility that all species. . . will be found to attack elaterid larvae". Recently an important paper has appeared on the biology of *P. rufa* Kieffer (Baker, 1976). This species attacks the larvae of a curculionid which infests the wood of cacao trees in Papua New Guinea. Baker's paper provides more detail than has previously been available on members of this genus.

Pristocera parkeri new species

Holotype. – ♂, MISSOURI: Columbia, 20 July 1967 (Malaise trap, 7 am – 4 pm, F.D. Parker) (U.S. National Museum).

Description. – Length 8 mm; fore wing 5 mm. Black, wings lightly tinged with yellowish brown. Mandibles 5-dentate (essentially as in the following species, Fig. 6). Clypeus weakly emarginate. First four antennal segments in a ratio of 14:3:10:8, segment three 2.4 X as long as wide, segment eleven 3.4 X as long as wide; pubescence erect, setulae of segment eleven one third as long as width of segment. Eyes with very sparse but moderately long setae. Head with large, contiguous punctures, space between punctures reduced to a reticulum. Width of front 1.56 X height of eye; width of ocellar

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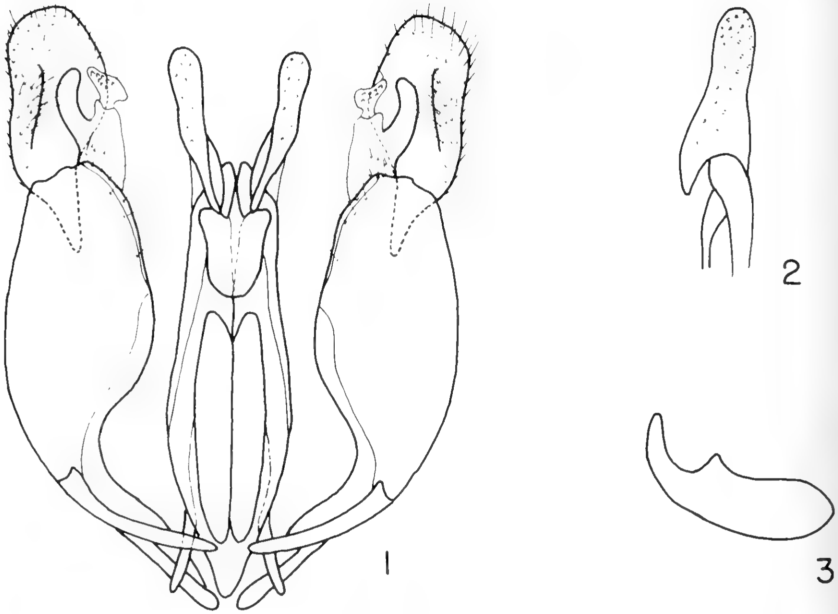

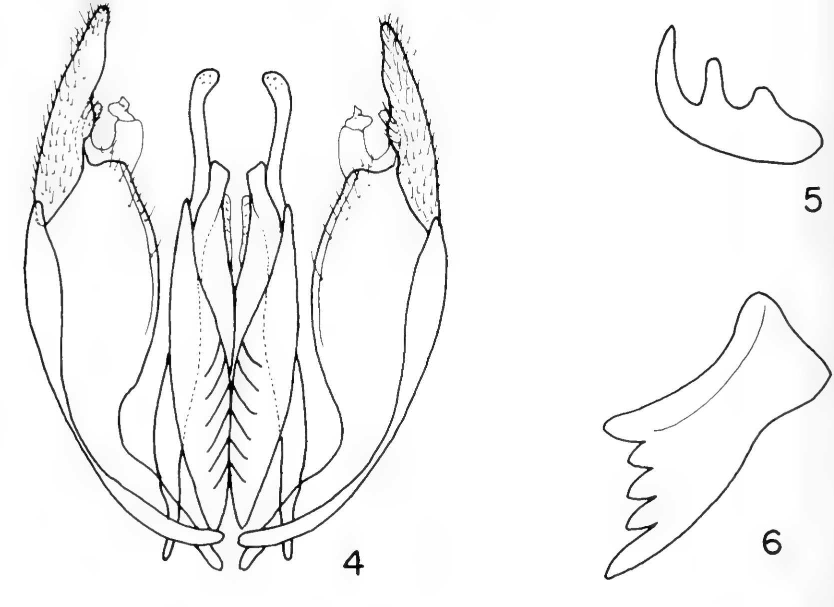

Figs. 1-3. *Pristocera parkeri* new species. Fig. 1, genitalia, ventral aspect. Fig. 2, apex of aedeagus, lateral view. Fig. 3, hind tarsal claw.

Figs. 4-6. *Pristocera dreisbachi* new species. Fig. 4, genitalia, ventral aspect. Fig. 5, hind tarsal claw. Fig. 6, mandible.

triangle 0.8 X ocello-ocular line. Pronotum with irregular transverse rugae (less pronounced than in *armifera*) between which are large, transverse punctures; posterior margin not depressed or preceded by a groove or ridge. Mesoscutum with punctures similar to head but slightly more widely spaced. Propodeum with basal triangle coarsely reticulate, not strongly set off from postero-lateral portions, which are transversely reticulate. Mesopleura with coarse punctures separated by narrow, polished ridges, much like head. Claws dentate (Fig. 3). Wing venation as in *armifera*. Subgenital plate truncate. Genitalia with parameres short and blunt; aedeagus complex, terminating in two long, widely separated processes which are somewhat produced ventrad at base (Figs. 1, 2).

Paratypes. – MISSOURI: 2♂♂, same data as type except 22 Sept., 15 Oct. 1967; ARKANSAS: 1 ♂, Conway Co., 3 July 1959 (on alfalfa); LOUISIANA: 1 ♂, 7 mi. S DeRidder, 13 June 1956 (G.R. Ferguson); TEXAS: 1 ♂, Matagorda, 5 May 1953 (R.H. Beamer, on *Monarda pectinata*) (U.S. Nat. Mus., Univ. Calif. Davis, Univ. Arkansas, Univ. Kansas).

Variation. – The specimens from Louisiana and Texas have the wings nearly hyaline, only very weakly tinged with brown at the radial vein. There are no noteworthy differences in size, sculpturing, or standard measurements, and the genitalia are consistent with those of the type.

Remarks. – This species runs reasonably well to *armifera* Say in my 1963 key, except that the eyes have a few moderately long hairs, the flagellar pubescence is slightly shorter, and the aedeagus of very different form. The female is unknown, as in most species of this genus.

Pristocera dreisbachi new species

Holotype. – ♂, MEXICO: Veracruz, 28 July to 11 Aug. 1956 (R. & K. Dreisbach) (Michigan State University).

Description. – Length 7 mm; fore wing 4.5 mm. Black, except antennae, legs, and abdomen very dark brown; wings subhyaline. Mandibles 5-dentate (Fig. 6). Clypeus broadly truncate. First four antennal segments in a ratio of 11:3:8:7, segment three 2.2 X as long as wide, segment eleven 2.6 X as long as wide; pubescence suberect, setulae of segment eleven 0.3 X as long as width of segment. Eyes with only sparse, minute setae. Head with large, subcontiguous punctures, space between them reduced to narrow, flat-topped, shining ridges, center of front longitudinally grooved. Width of front 1.30 X eye height; width of ocellar triangle 0.95 X ocello-ocular line. Pronotum with irregular transverse rugae between which there are a few large, transverse punctures; posterior margin depressed, the depression preceded by a low but rather broad, transverse elevation. Mesoscutum polished, with small punctures which are separated by 1.0 – 1.5 X their own diameters. Propodeum shining, basal triangle and posterior margin of dorsum with very coarse reticulations, sides of dorsum with weak, arching striae. Mesopleura with coarse punctures which are separated by narrow, flat-topped ridges. Claws trifid, middle tooth truncate, subparallel to but shorter than outer ray (Fig. 5). Wing venation as in *armifera*. Subgenital plate very weakly emarginate. Parameres tapering, subacute; aedeagus complex, ventral valves acuminate, middle valves truncate, apical lobes slender and widely separated, slightly curved (Fig. 4).

Paratype. – 1 ♂, same data as type (U.S. Nat. Mus.).

Remarks. – This species runs reasonably well to *bridwelli* Evans in my 1963 key. It differs in having the pronotum less strongly transversely elevated and in having trifid claws. In the genitalia, the parameres are more tapered and the ventral and middle valves of the aedeagus differently shaped. I would, however, regard *bridwelli* and *dreisbachi* as closely related species.

Pristocera cockerelli Evans

This species can now be recorded from BAJA CALIFORNIA SUR: 1 ♂, Comondu, 22 July 1938 (Michelbacher & Ross) (Calif. Acad. Sci.). In this widely distributed species, color of the mandibles, antennal bases, and legs varies from castaneous to black, but there is little variation in the distinctive structural features.

Pristocera atra Klug

The late R.R. Dreisbach collected 3 ♂♂ of this species in VERACRUZ: 28 July 1956 (Michigan State Univ.). This is the first record of this species from Mexico.

Pristocera hyalina Brues

The range of this species can now be extended to include ARKANSAS: 1 ♂, Union Co., April, and 1 ♂, Sevier Co., April (Univ. Arkansas).

Pristocera varidens (Cameron)

This species is widely distributed in Mexico and can now be recorded from SINALOA: 3 ♂♂, 15 mi. W El Palmito, 5000 feet, 8 Aug. 1964 (W. Mason) (Canad. Nat. Coll.).

Pristocera rugifrons (Cameron)

I have recently studied an additional series of 5 ♂♂ from EL SALVADOR: Quezaltepeque & vicinity, June-Aug. 1961-63 (M. Irwin) (Calif. Acad. Sci. & Univ. Calif. Davis). One of these males has the abdomen entirely red, as I reported from this locality in 1967.

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OBSERVATIONS ON *CRYPTURGUS ALEUTACEUS* SCHWARTZ (COLEOPTERA: SCOLYTIDAE), AN ASSOCIATE OF THE SOUTHERN PINE BEETLE[1]

M.W. MacGown[2] and T.E. Nebeker[2]

ABSTRACT: *Crypturgus aleutaceus* Schwartz is recorded as an associate of the southern pine beetle in Mississippi for the first time. SEM photographs are presented to distinguish this minute bark beetle taxonomically and to point out some unusual features of the antennal morphology.

Crypturgus aleutaceus Schwartz (Figs. 1-4) was reared in the fall of 1975 from the bark of shortleaf pine (*Pinus echinata* Mill.) collected at the Homochitto National Forest in southern Mississippi. Craighead (1950) suggested that the beetles utilized burrows and ventilation holes of other, larger species, i.e., *Dendroctonus, Ips, Polygraphus* and *Monochamus* to gain entry to the tree; the specimens discussed herein could only have been associated with *Dendroctonus frontalis* Zimm. Occasionally up to 40 specimens of the species in addition to the southern pine beetle and other associates were reared from 66 cm^2 of bark.

The range of the species was previously known to extend from New Jersey to Florida. Blatchley and Leng (1916) recorded the species from *Pinus palustris* Mill. in Florida and from *P. virginana* Mill. in Washington, D.C. This report and that of Stein (1975) extend this west to Texas. Blackman (1922) did not previously list this species in his summary of the bark beetles of Mississippi, and it was absent from his comprehensive bark beetle collection at Mississippi State University.

Payne et al. (1973) presented SEM photographs of the antennae of several species of *Dendroctonus, Ips, Pseudohylesinus, Scolytus* and *Trypodendron* (Coleoptera: Scolytidae), all of which differ considerably from the antennae *C. aleutaceus* (Figs. 3 and 4).

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[1] Accepted for publication: August 5, 1976

[2] Graduate Research Assistant and Assistant Professor, respectively, Department of Entomology, Mississippi Agricultural and Forestry Experiment Station, Mississippi State University, Mississippi State, Mississippi 39762. Scientific Contribution no. 3376.

While the keys of Blatchley and Leng (1916), and others call for a two-segmented funicle, only one segment is present according to our observations (Fig. 2, arrow; Fig. 3, fu). The club is relatively large, quadrangular, without sutures, but with a lateral and apical recessed area which contains numerous sensory organs. Sensilla chaetica are sparsely scattered over the surface of the club. Both short and long basiconica are present in the recessed area (Fig. 4, b_1, b_2). Along with these are found several large, lobe like organs, apparently sensilla basiconica (Fig. 4, b_3) which were not described in Payne et al. (1973).

ACKNOWLEDGEMENTS

We thank Dr. D.M. Anderson, U.S. Department of Agriculture Systematic Entomology Laboratory, for identifying the species and providing helpful information about its range and literature.

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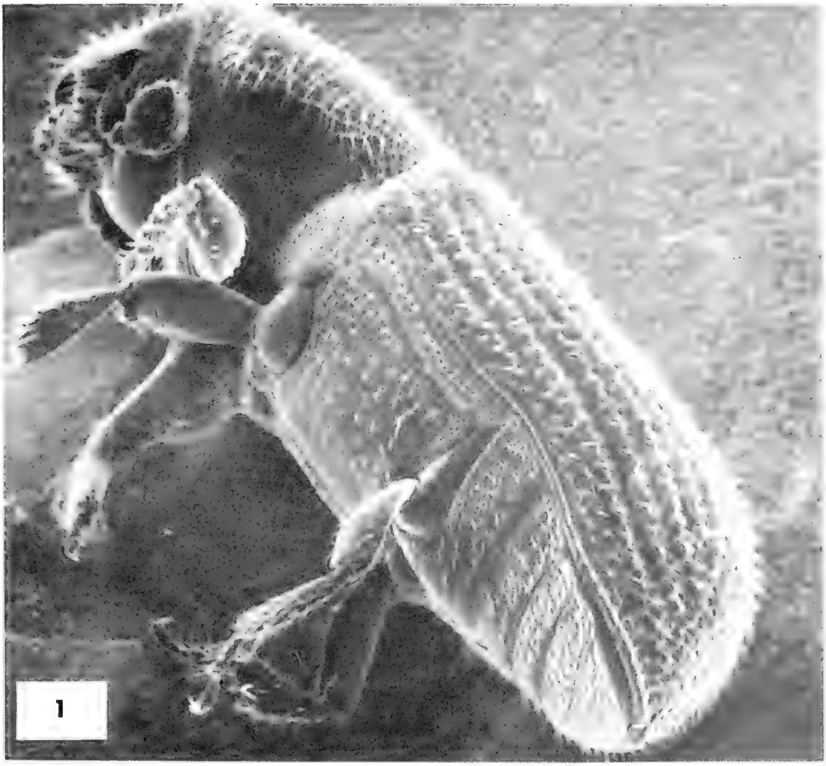

Figs. 1-4. Crypturgus aleutaceus Schwarz.

Fig. 1. Whole mount, X170.

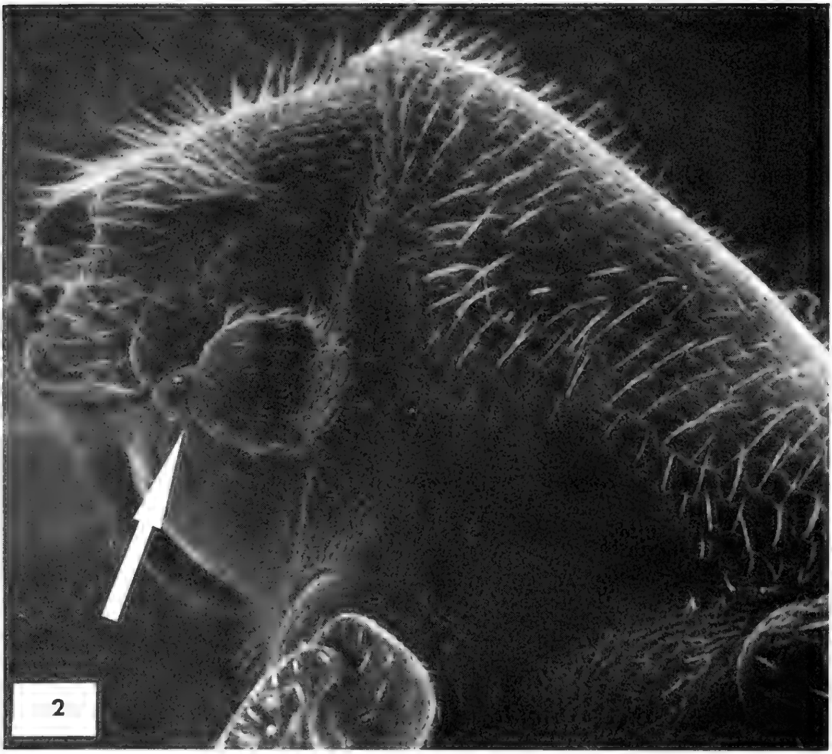

Fig. 2. Head, Thorax in side view, X440 (arrow indicates funicle, the diagnostic character).

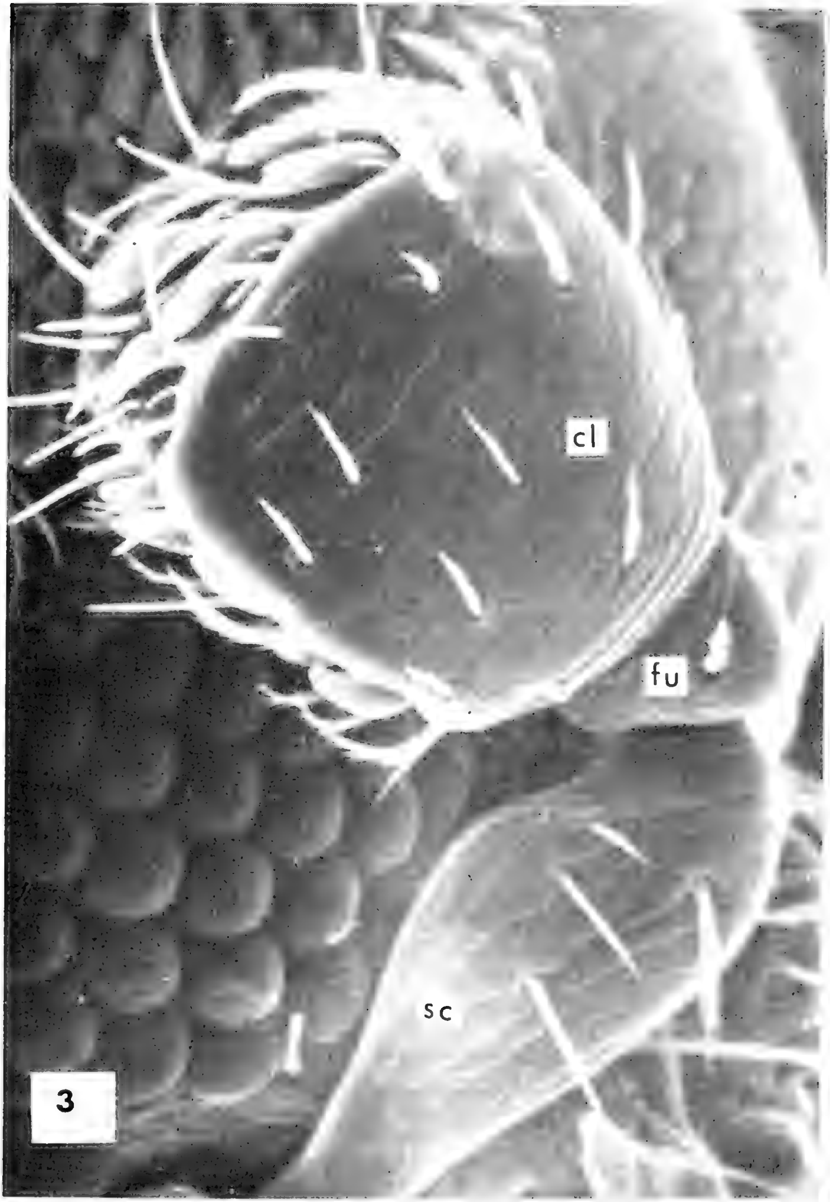

Fig. 3. Antenna, X1400 (sc = scape, fu = funicle, cl = club).

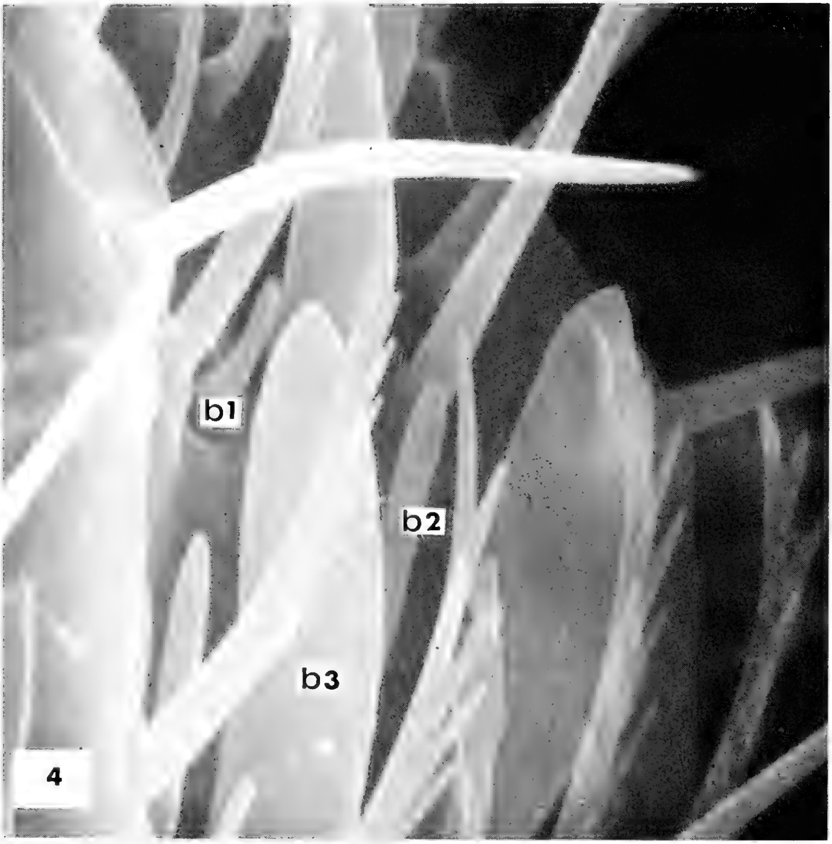

Fig. 4. Apex of antennal club, X7000 (b_1 = short basiconica, b_2 = long basiconica, b_3 = large, lobe-like basiconica).

NOTES ON THE DISTRIBUTION AND MORPHOLOGY OF THE WATER STRIDER *METROBATES ALACRIS* DRAKE (HEMIPTERA: GERRIDAE)[1]

Paul D. Kittle[2]

ABSTRACT: *Metrobates alacris* Drake, previously known only from Louisiana, was collected in Hempstead County, Arkansas, and Jefferson County, Texas. Two taxonomically valuable characters, a mesosternal spur and hairs on the pygophore, are described.

DESCRIPTORS: *Metrobates alacris*, Hemiptera, Gerridae, water strider, Arkansas, Texas, distribution, morphology.

Drake (1955) described *Metrobates alacris* from Tallulah, Louisiana, and based his description on five specimens collected on July 17, 1930, by H.B. Mills. Gonsoulin (1974) reported this species from Allen, Beauregard, and Vernon parishes, Louisiana. This paper presents two new locality records and figures two previously undescribed morphological characters.

Two male and eight female *M. alacris* were collected on July 29, 1975, from Bois d'Arc Creek, seven miles southwest of Spring Hill, Hempstead County, Arkansas. Bois d'Arc Creek is a small stream with a mud and sand substrate and relatively fast flow. Other water striders found at this site include *Gerris canaliculatus, G. nebularis, Rheumatobates hungerfordi, R. palosi, R. tenuipes,* and *Trepobates subnitidus.* On June 16, 1976, 23 male, 16 female and 38 late instar nymphs of *M. alacris* were taken from Pine Island Bayou two and one-half miles south of Sour Lake, Jefferson County, Texas. Pine Island Bayou is a large stream with a mud substrate and slow flow. *G. canaliculatus, R. hungerfordi, R. palosi, R. tenuipes,* and *T. subnitidus* were also collected at this locality. All specimens collected at both sites were apterous. The present known distribution of *M. alacris* is shown in Figure 1.

Male *M. alacris* have a single median mesosternal spur (Fig. 2) and moderately long hairs on the lateral margins of the pygophore (Fig. 3). Neither of these characters were mentioned in the original description (Drake, 1955); however, Dr. Richard C. Froeschner (pers. comm.) examined the male holotype and single male paratype of *M. alacris* in the Drake Collection, U.S. National Museum, and found that both specimens have these characters. The mesosternal spur was imbedded in adhesive and was not visible until the specimens were soaked off the points on which they had been mounted.

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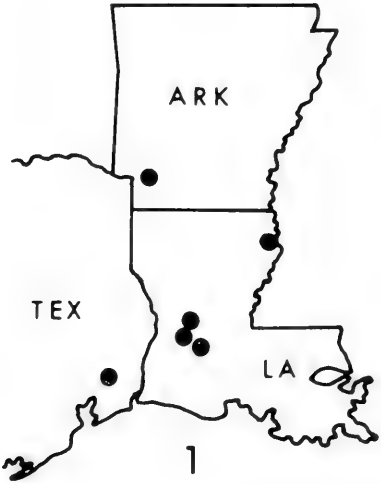

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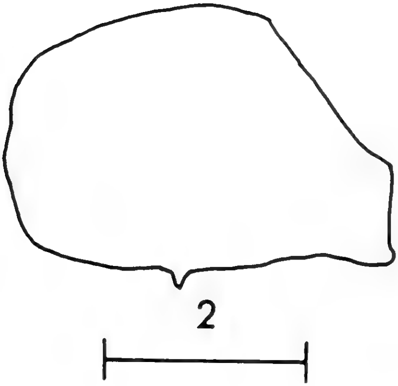

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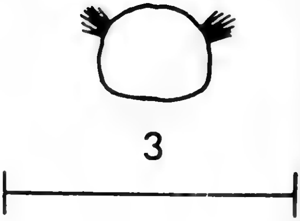

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Figure 1. Distribution of *M. alacris.*

Figure 2. Mesothorax of male *M. alacris,* left lateral view.

Figure 3. Pygophore of *M. alacris,* ventral view.

SEASONAL EMERGENCE PATTERNS OF FISHFLIES EAST OF THE ROCKY MOUNTAINS (MEGALOPTERA: CORYDALIDAE)[1]

D.C. Tarter[2], W.D. Watkins[3], M.L. Little[2], D.L. Ashley[2]

ABSTRACT: Emergence patterns of seven species of fishflies are presented after the examination of 2944 adults from 38 states east of the Rocky Mountains. *Chauliodes pectinicornis* and *C. rastricornis* emerge with regional variations from February to November and January to December, respectively. *Nigronia serricornis* emerges from March to November, while *N. fasciatus* emerges from April to July. The emergence period for *Neohermes concolor* extends from April to August. *Neohermes angusticollis* and *N. matheri* emerge from April to June and May to June, respectively.

DESCRIPTORS: Emergence period, Fishfly, Megaloptera, Corydalidae

Many authors, including Tarter et al. (1976a, b), Caldwell (1976), Watkins et al. (1975), Tarter et al. (1975), Peterson (1974), Tarter and Watkins (1974), Neunzig (1966), Flint (1965), Hazard (1960), Parfin (1952), and Davis (1903), have reported taxonomical, distributional, and ecological information on fishflies in eastern North America.

The subfamily Chauliodinae contains three eastern genera of fishflies: *Chauliodes, Neohermes,* and *Nigronia.* Generally, the larvae of the lentic species, *C. pectinicornis* (Linnaeus), and *C. rastricornis* Rambur, are found in logs in marshes, lakes, swamps, oxbows, and ponds. The larvae of *Nigronia serricornis* (Say) are inhabitants of rocky streams with high to intermediate gradient, whereas the larvae of *N. fasciatus* (Walker) are found under rocks in small, woodland brooks. The larvae of *Neohermes concolor* (Davis), *N. angusticollis* (Hagen), and *N. matheri* Flint are unknown.

The primary objective of this investigation was to report the seasonal emergence patterns of fishflies east of the Rocky Mountains.

Emergence Patterns

Seasonal emergence patterns of seven species of fishflies are noted after the examination of 2944 adults from 38 states east of the Rocky Mountains. Due to the lack of environmental information, no attempt was made to assess the role of temperature and photoperiod on the emergence patterns of fishflies.

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Based on the examination of 868 adults from 33 states, emergence of *Chauliodes pectinicornis* occurs between 30 February (Louisiana) and 11 November (Maryland) (Table 1).

The adults of *C. rastricornis* emerge from some region east of the Rocky Mountains throughout the year. The emergence period, based on the examination of 862 adults from 36 states, extends from 10 January (Florida) to 28 December (Florida) (Table 2).

The emergence period of *Nigronia fasciatus,* based on a limited sample of 194 adults from 18 states, ranges from 15 April (Florida) to 7 July (Pennsylvania) (Table 3). Tarter et al. (1975) reported that *N. fasciatus* from Cabell County, West Virginia, emerged 16 May to 25 May: peak emergence occurred on 20 May.

Based on the examination of 740 adults from 29 states, the emergence period of *N. serricornis* extends from 25 March (Pennsylvania) to 25 November (New York) (Table 4).

The emergence period of *Neohermes concolor,* following the examination of 239 adults from 21 states, ranges from 21 April (Pennsylvania) to 19 August (New York) (Table 5). In Kentucky (Boyd County), 13 collections of adults showed that peak emergence occurred on 3 July (emergence period, 12 June-16 July) (Tarter et al., 1976a). Flint (1965) reported that adults were collected from Massachusetts, Virginia, Missouri, and the District of Columbia in July, May-July, June, and June, respectively.

Neohermes angusticollis has been reported from Georgia and South Carolina (Flint, 1965 and Tarter et al., 1976b). The emergence periods extend from 4 June-19June (13 adults) and 14 May-27 June (10 adults), Georgia and South Carolina, respectively.

Neohermes matheri is known only from Mississippi (Flint, 1965). Emergence, based on 18 adults, occurs from 24 May to 20 June.

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Table 1. Seasonal emergence of *Chauliodes pectinicornis* east of the Rocky Mountains. Number of adults are enclosed in parentheses.

	F	M	A	M	J	J	A	S	O	N
Northcentral Region										
Illinois (10)					6	—	29			
Indiana (11)					17	—	—	8		
Kansas (1)					DATE NOT RECORDED					
Kentucky (5)					13	—	24			
Michigan (59)				?	—	—	—	8		
Missouri (1)						-?-				
Nebraska (1)					-10-					
Ohio (14)					9	—	—	5		
Wisconsin (15)				19	—	—	—	1		
Eastern Region										
Connecticut (61)				?	—	—	—	23		
Dist. Columbia (8)				26	—	—	3			
Delaware (3)					21	26				
Maine (12)				19	—	—	6			
Maryland (53)				29	—	—	—	—	—	11
Massachusetts (11)				3	—	—	6			
New Hampshire (17)					11	—	30			
New Jersey (62)				23	—	—	—	21		
New York (89)				25	—	—	—	—	—	9
Pennsylvania (84)					18	—	22			
Rhode Island (28)						17	—	2		
Vermont (22)					29	—	1			
Virginia (46)				22	—	—	—	—	2	
West Virginia (20)				22	—	—	—	9		
Southeastern Region										
Alabama (2)				22	—	—	—	18		
Arkansas (2)				20	—	—	28			
Florida (29)			9	—	—	—	—	6		
Georgia (40)		16	—	—	—	—	—	—	?	
Louisiana (8)	30	—	—	—	—	—	—	14		
Mississippi (22)					24	—	—	19		
North Carolina (70)			14	—	—	—	—	25		
South Carolina (52)		26	—	—	—	—	—	4		
Tennessee (9)			18	—	—	—	21			
Southwestern Region										
Texas (1)									-2-	
	F	M	A	M	J	J	A	S	O	N

Table 2. Seasonal emergence of *Chauliodes rastricornis* east of the Rocky Mountains. Number of adults are enclosed in parentheses.

	J	F	M	A	M	J	J	A	S	O	N	D
Northcentral Region												
Illinois (95)			19	—	—	—	—	30				
Indiana (19)					15	—	—	17				
Iowa (2)						8	15					
Kansas (7)				30	—	29						
Kentucky (1)					-13-							
Michigan (69)			2	—	—	—	—	11				
Minnesota (80)					19	—	30					
Missouri (12)				30	—	—	—	28				
Nebraska (5)						13	—	—	—	26		
Ohio (31)					13	—	—	5				
South Dakota (1)						DATE NOT RECORDED						
Wisconsin (85)						2	—	25				
Eastern Region												
Connecticut (12)					9	—	22					
Delaware (1)						-13-						
Maine (1)						-27-						
Maryland (3)					5	—	7					
Massachusetts (12)						17	14					
New Hampshire (1)						-24-						
New Jersey (6)				21	—	5						
New York (46)				16	—	—	—	19				
Pennsylvania (9)					13	—	23					
Rhode Island (6)					20	—	20					
Vermont (3)						18	24					
Virginia (17)				28	—	—	—	12				
West Virginia (2)						-2-						
Southeastern Region												
Alabama (2)								-19-				
Arkansas (7)			31	—	—	—	—	8				
Florida (165)	10	—	—	—	—	—	—	—	—	—	—	28
Georgia (26)			4	—	—	—	—	—	14			
Louisiana (68)	25	—	—	—	—	—	—	—	—	—	?	
Mississippi (10)			30	—	—	—	—	—	18			
North Carolina (14)				4	—	1						
South Carolina (16)			15	—	—	—	—	27				
Tennessee (4)				?	—	—	—	16				
Southwestern Region												
Oklahoma (4)						1	—	29				
Texas (20)			19	—	—	—	—	—	—	5		
	J	F	M	A	M	J	J	A	S	O	N	D

Table 3. Seasonal emergence of *Nigronia fasciatus* east of the Rocky Mountains. Number of adults are enclosed in parentheses.

	April	May	June	July
Northcentral Region				
Illinois (14)		16 —	— ?	
Indiana (5)		10 —	— 8	
Kentucky (1)		-31-		
Missouri (1)			-22-	
Ohio (31)		21 —	— 11	
Eastern Region				
Delaware (1)		-31-		
Maryland (5)		-29-		
New Hampshire (1)			-21-	
New Jersey (1)			-14-	
New York (1)			-25-	
Pennsylvania (33)			4 —	— 7
Virginia (5)		20 — 30		
West Virginia (31)		16 —	— 10	
Southeastern Region				
Florida (1)	-15-			
Georgia (22)	20 —	—	— 22	
North Carolina (8)		14 —	— 22	
South Carolina (26)	18 —	—	—	— 2
Tennessee (7)		21 —	— 19	
	April	May	June	July

Table 4. Seasonal emergence of *Nigronia serricornis* east of the Rocky Mountains. Number of adults are enclosed in parentheses.

	M	A	M	J	J	A	S	O	N
Northcentral Region									
Illinois (3)				2	13				
Indiana (28)			13	21					
Kansas (1)					-18-				
Kentucky (8)			11	12					
Michigan (68)		18				24			
Minnesota (16)				7		31			
Missouri (21)			28			6			
Ohio (86)			1		26				
Wisconsin (42)				7			9		
Eastern Region									
Connecticut (75)			21					1	
Delaware (1)				DATE NOT RECORDED					
Dist. Columbia (7)			27	1					
Maine (13)				13	28				
Maryland (23)			15		11				
Massachusetts (8)				5	15				
New Hampshire (21)				5		12			
New Jersey (9)				6—30					
New York (90)		30							25
Pennsylvania (74)	25					5			
Rhode Island (1)				-5-					
Vermont (5)				7	1				
Virginia (52)			14		8				
West Virginia (21)			11		4				
Southeastern Region									
Arkansas (4)				5				15	
Florida (7)		-2-							
Georgia (16)		26		30					
Louisiana (3)		22	6						
North Carolina (9)			1	8					
South Carolina (8)		17				19			
Tennessee (20)		4			14				
	M	A	M	J	J	A	S	O	N

Table 5. Seasonal emergence of *Neohermes concolor* east of the Rocky Mountains. Number of adults are enclosed in parentheses.

	Apr	May	Jun	Jul	Aug
Northcentral Region					
Illinois (4)			20 —	— 8	
Indiana (23)			1 —	— 24	
Kentucky (72)		25 —	—	— 31	
Missouri (4)				2 — 28	
Ohio (25)		1 —	—	— 18	
Eastern Region					
Delaware (2)				? — ?	
Maryland (4)			18 —	— 17	
Massachusetts (1)		DATE NOT RECORDED			
New Jersey (2)				1 — 29	
New York (20)			30 —	—	— 19
Pennsylvania (31)	21 —	—	—	— 29	
Vermont (2)				? — ?	
Virginia (9)			2 —	—	— 10
West Virginia (8)			8 —	— 3	
Dist. Columbia (1)				-1-	
Southeastern Region					
Arkansas (2)			8 —	— 13	
Georgia (1)			-10-		
Mississippi (8)			13 — 16		
North Carolina (11)		26 —	— 18		
Tennessee (5)		18 —	— 24		
Southwestern Region					
Oklahoma (1)			-12-		
	Apr	May	Jun	Jul	Aug

ESTIMATING GRAPE PHYLLOXERA (HOMOPTERA: PHYLLOXERIDAE) GALL NUMBERS ON SINGLE GRAPE LEAVES[1, 2]

G.L. Jubb, Jr.[3]

ABSTRACT: Linear regression and correlation analyses showed that the number of grape phylloxera *Daktulosphaira vitifoliae* (Fitch) leaf galls on single leaves of *Vitis riparia* Michx. could be estimated by counting galls on one half the leaf, using the midrib as a dividing line, and multiplying that value by a factor of 2.

Experiments evaluating chemical sprays or measuring incidence of foliage damage caused by leaf form (gallicola) of grape phylloxera, *Daktulosphaira vitifoliae* (Fitch), = *Phylloxera vitifoliae* (Fitch), require a time-consuming counting of galls on the ventral sides of leaves. The number of galls produced by phylloxera on grape leaves may range from as few as 1 gall/leaf to >300 galls/leaf, depending on grape variety and time of infestation. When the number of phylloxera galls per leaf is as low as <20 galls/leaf, counts can be made quickly. However, as the number of galls increase, considerably more time is required to make counts.

This report summarizes observations on numbers of grape phylloxera leaf galls on wild grapevines, *Vitis riparia* Michx, and describes a simple method for estimating the total gall numbers on single grape leaves.

Methods

Leaves infested with >20 phylloxera galls per leaf were collected during August from wild *V. riparia* vines growing in the vicinity of North East, Pa. Sample leaves were fully expanded and were selected at random from heights of 1.5-2.1 m above the ground on vines located near commercial wine grape vineyards. In the laboratory, the number of galls on each half of the leaf were recorded. Counts were made on the ventral surface using the midrib as the dividing line between halves. A total of 29,700 galls was counted on 330 leaves.

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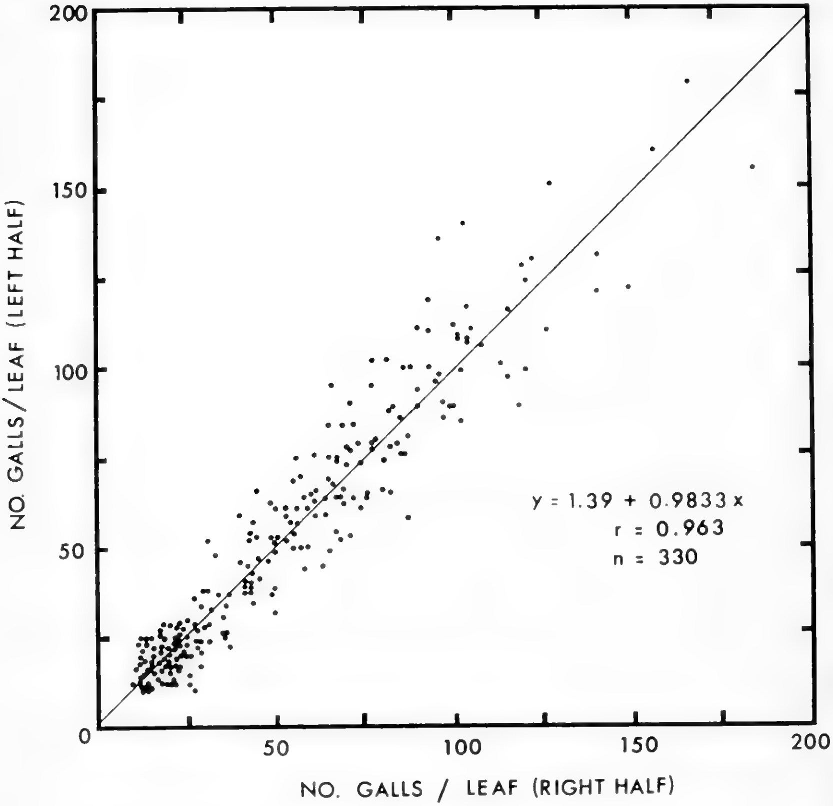

Figure 1. Relationship between number of grape phylloxera galls on ventral right half of *V. riparia* leaf and ventral left half of leaf.

Linear regression and correlation analyses were used to determine the relationship between the number of galls counted on the right and left halves and between the actual number of galls per leaf and the estimated number of galls per leaf.

Results and Discussion

A correlation coefficient of 0.963 indicated a very close relation between the numbers of galls on each half of the leaves (Fig. 1). The number of galls on the right half of the leaves averaged 43.1 (SD = ± 34.6, range = 10-184),

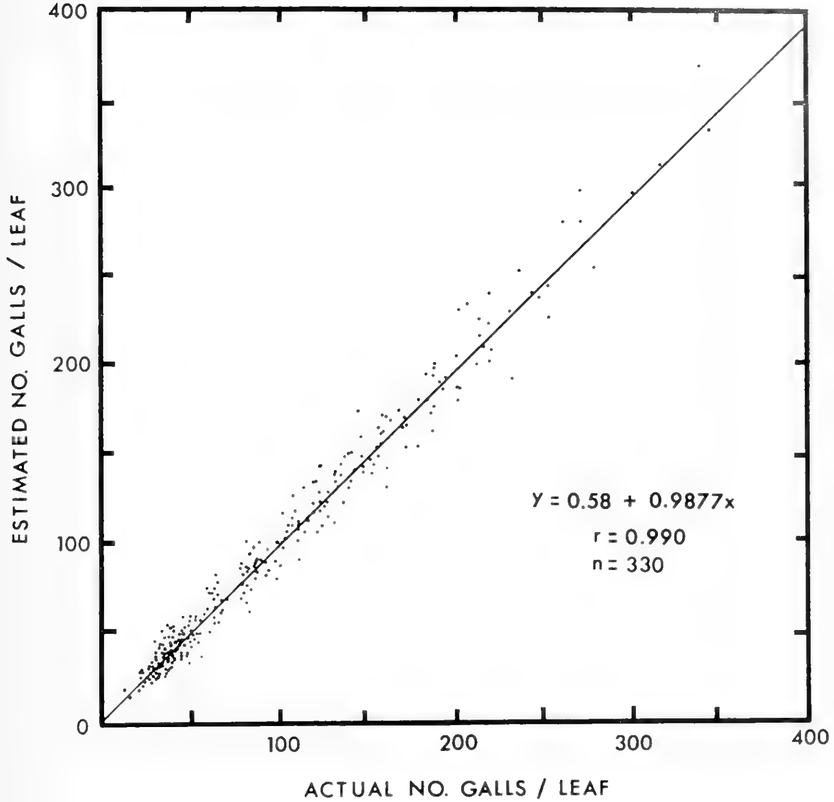

Figure 2. Relationship between actual number of grape phylloxera leaf galls and estimated number of leaf galls.

while the average number on the left half was 43.8 (SD = ± 35.4, range = 10-179). Standard error of the estimate was 9.6 galls/leaf.

This result indicated that the total number of galls per leaf could be estimated by doubling the number of galls counted on one half of the leaf.

A correlation coefficient of 0.990 indicated a strong relation between actual and estimated counts determined by multiplying a right-half gall count by a factor of 2 (Fig. 2). Actual mean number of galls per leaf counted was 90.0 (SD = ± 66.5, range = 21-345). Estimated mean number galls per leaf was 89.5 (SD = ± 66.4, range = 20-348). Standard error of the estimate was 9.4 galls/leaf.

Stevenson (1970) used several methods for evaluating foliage infestations of grape phylloxera and proposed a gall index rating, calculated from the formula, Σ (No. leaves in class x mid-class value)/Total number of leaves examined. Leaf classes were designated according to the number of galls present, 0, 1-5, 6-15, 16-35, 36-75, 76-150, and >150 galls/leaf. Use of this gall index can be facilitated by estimating the total number of galls on single leaves by counting galls on half of each leaf and multiplying that value by 2. In this way, the time may be reduced for counting leaf galls.

Dispersal of grape phylloxera gallicolae over shoots has not been studied in detail, although newly-hatched gallicolae are known to move from galls on older leaves to younger leaves at the shoot tip. Infestation of young leaves occurs in the growing shoot tip before leaves become fully expanded. Apparently phylloxera gallicolae disperse uniformly over both halves of the expanding blade of the young leaf. This uniform distribution of gallicolae and the resulting galls support the method of estimating leaf gall numbers described herein.

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SOME PARASITES OF LEPIDOPTERA LARVAE RECENTLY COLLECTED IN DELAWARE[1] [2] [3]

Kenneth F. Raffa[4]

ABSTRACT: The larval parasites of some Lepidoptera present in Delaware were surveyed and tabulated. Twenty-six parasitic species, including one new record, and 36 host-parasite relationships were obtained. Fourteen of these relationships are additions to the Thompson Host-Parasite Catalogue.

Parasites of Lepidoptera larvae in Delaware were collected from April to October, 1975 in conjunction with an attempt to find an alternate host for two gypsy moth parasites (Raffa 1976). Larvae collected in the field were reared to the adult stage in cardboard ice cream cups with transparent lids under artificial light simulating natural day length. Emerging adult parasites were collected and identified by the USDA ARS Insect Identification and Beneficial Insect Introduction Institute. Lepidopterans and parasites which had not transformed to the adult stage by 15 September were transferred to an outdoor insectary for overwintering.

The families and species of parasites, their numbers, hosts and host numbers collected are shown in Table 1. The species names of tentative identifications are given in parentheses. Of the 36 parasite-host relationships reported here, 14 are additions to Thompson's Host-Parasite Catalogue (1957).

A single specimen of *Chaetophlepsis,* tentatively identified as *C. nasellensis* Rein, may represent a new record or a new species, as *C. nasellensis* has been reported only from the state of Washington (Stone et al 1965). *Lespesia aletiae* (Riley) was recovered from

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three species of defoliators in soybean fields, *Epargyreus clarus* (Clemens), *Diacrisia virginica* (F.), and *Estigmene acrea* (Drury). Among the Braconids, the genus *Apanteles* was predominant (Table 1), having been recovered from 11 host species.

ACKNOWLEDGEMENT

I gratefully acknowledge the identification of these parasitoids by C.W. Sabrosky, R.W. Carlson, and P.M. Marsh of the USDA ARS Insect Identification Institute under Lloyd Knutson. Without their assistance this project would not have been possible. I would also like to thank George W. Angalet of the USDA ARS Beneficial Insects Research Laboratory for his cooperation in this project.

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Table 1. Parasites recovered from Lepidoptera larvae in Delaware, 1975.

Family	Species	No. Parasites Recovered	Host	No. Hosts Collected
Tachinidae				
	Chaetophlepsis sp. (*nasellensis* Rein)	1	*Paraphia unipunctata*[a] Haworth	18
	Blondelia sp. (*paradexoides* Townsend)	1	*Epimecis virginaria*[a] Cramer	7
	Actia sp. (*interrupta* Curran)	1	Tortricidae	1
	Parachaeta fusca Townsend	1	*Isia isabella*	25
	Lespesia aletiae (Riley)	3	*Epargyreus clarus* (Clemens)	10
		2	*Diacrisia virginica* (F.)[a]	30
		5	*Estigmene acrea* (Drury)[a]	20

Table 1. (Continued)

Family	Species	No. Parasites Recovered	Host	No. Hosts Collected
		1	*Paraphia pustularia* Hubner[a]	5
	Lespesia archippivora (Riley)	2	*Danaus plexippus*	8
	Nemorilla pyste (Walker)	5	*Yponomeuta multipunctella*[a] Clemens	36
Braconidae	*Protomicroplitis foacetosa* (Weed)	1	*Zale* sp.[a]	2
	Blacus sp.	1	*Isia isabella*[a] (J.E. Smith)	25
	Agathis annulipes (Cresson)	1	Tortricidae	3
	Apanteles diacrisiae Gahan	116[b]	*Diacrisia virginica* (F.)	30
	Apanteles hyphantriae Riley	8	*Hyphantria cunea* (Drury)	125
		1	*Estigmene acrea*[a] (Drury)	20
	Apanteles paleacritae Riley	1	*Zale* sp.	2
	Apanteles sp. (*pyralidis* Muesebeck)	20[c]	*Diacrisia virginica* (F.)	30
	Apanteles sp.	1	*Hyphantria cunea* (Drury)	125
		5	*Polia* sp.	6
		8[d]	*Lithophane unimoda* (Lintner)	14
		1	*Paraphia unipunctata*[a] Haworth	18
		1	*Paraphia pustularia* Hubner[a]	5
		1	Geometridae	1

Table 1. (Continued)

Family	Species	No. Parasites Recovered	Host	No. Hosts Collected
		1	Geometridae	1
		17[c]	*Loxostege* sp.	20
	Microplitis sp.	1	*Acronycta americana* Harris	3
		3	*Polia latex* (Guenee)[a]	3
Icheumonidae	*Diradops bethunei* (Cr.)	1	unknown	1
	Metopius sp.	1	unknown	1
	Triclistus sp.	1	Tortricidae	1
	Sinophorus sp.	2	*Hyphantria cunea* (Drury)[a]	125
	Casinaria sp.	1	Geometridae	1
	Campoletis flavicincta	1	*Spodoptera frugiperda*[a] (J.E. Smith)	1
	Hyposoter fugitivus (Say)	2	*Malacosoma americanum* (Fabricius) (F.)	50
		4	*Euchaetias egle* Drury	50
	Hyposoter pilosulus (Prov.)	5	*Hyphantria cunea* (Drury)	125
	Mesochorus sp.	1	Arctiidae	1
Eulophidae	*Euplectrus catocalae* Howard	7[f]	unknown	1

a. Host-parasite relationship not listed in Thompson (1957).

b. Three individual larvae issued 72, 27, and 17 parasites respectively.

c. A single larva issued 20 parasites.

d. A single larva issued 8 parasites.

e. 3 larva issued, 8, 4, and 5 parasites respectively.

f. A single larva issued 7 parasites.

RECURRENCE OF *ATTA* COLONIES AT A CANAL ZONE SITE (HYMENOPTERA: FORMICIDAE)[1]

Neal A. Weber[2]

ABSTRACT: Incipient colonies of the common leaf-cutting and fungus-growing ant, *Atta colombica tonsipes* Santschi, have been taken repeatedly under and beside the same *Terminalia* tree in the Panama Canal Zone. In a square of 15.24 meters on a side 70 colonies were mapped in 1971, 118 in 1973 and in 1976 eight of many similar colonies were removed for study. One of the 1971 survived in the laboratory five years. The living weights of six queens averaged 172.1 mg; soldiers of 10 mm length weighed 26.85 to 35.32 mg; workers of 1.5 to 9 mm weighed 0.53 to 20.98 mg. Three colonies developed maximum gardens in their first year from 20 to 2100 estimated milliliters. One 1971 colony used a monthly minimum of 2 to 35 g fresh leaves in 1971, 23 to 155 g in 1972, 32 to 640 g in 1973 and 25 to 58 g in 1974 with yearly totals of 85 to 2515 g. Corresponding monthly garden sizes were 2.5-300 ml (1971), 220-1000 ml (1972), 200-4100 ml (1973) and 250-1600 ml (1974).

DESCRIPTORS: Formicidae, fungus-growing, leaf-cutting, garden growth rate, living ant weight, repeated nesting.

The common *Atta* of the Panama Canal is *Atta colombica tonsipes* Santschi (Weber 1969, 1972a), distributed across the Isthmus. A site under and beside a *Terminalia muricata* tree (Combretaceae) was mapped with the assistance of Jean Weber on 5 August 1971 for new colonies from a probable May or June nuptial flight. In a square of 15.24 m on a side (50 ft) the location of 70 independent colonies was shown on a map (Weber, 1972b), not including an estimated 10-15% being missed. Fourteen were removed to my U.S. laboratory of which one remains alive in Florida in August 1976.

The tree was revisited on 21 August 1973 and a similar square outlined by Peter Weber. The census revealed 118 young nests of two or three months of age of which six were collected. They were in the same stage of development as in 1971, having fungus gardens of an estimated 30-65 ml at depths in the soil of 5-8 cm. Noteworthy was the absence of any colonies originating in 1971, which in 1973 would have had multiple crater nests of several meters in diameter and with well-developed trails many meters in length. The area is one sprayed with insecticides.

The exact site was examined 12 July 1976 with a party consisting of C. Jerry Wallace, Carl Hiner, Claire and David Ehrlinger and Burton Weiss, for living colonies to take to the Cincinnati Zoo and Drexel University (Weiss).

Eight young colonies of ages comparable to those of 1971 and 1973 were removed. Others were doubtless present in long grass. However, there was one much larger colony that may have dated from one seen here in 1973 or possibly from a later nuptial flight. It was nearly 2 m in diameter and had trails of many meters leading off the site.

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Weights in Life of the Ants

The queen. Four from the 1971 colonies weighed 148.8, 149.4, 182.6 and 192.3 mg., respectively; two from 1973 were 151.0 and 208.5 mg. The average of the 6 was 172.1 mg.

The workers. The soldier sub-caste in mature colonies in nature weigh 60-80 mg; smaller ones of 10 mm length in a 1½ year colony weighed 26.85-35.32 mg. Workers of 7-9 mm weighed 8.03-20.98, those of 4-6 mm were 3.05-7.69 mg and the smallest of 1.5-3 mm weighed 0.53-2.22 mg.

Growth of the Colonies and Their Gardens

Growth in the Swarthmore laboratory of the colonies and their gardens was measured as in Weber 1976 a and b, but for shorter periods. The fresh green leaves used as substrate were the same. Three colonies of similar age taken a few km from the *Terminalia* tree in 1966 had the following growth of gardens in estimated milliliters for their first full year:

Col. A. 120-650 ml; Col. B. 20-800 ml; Col. C. 20-2100 ml.

This great disparity in growth was duplicated by colonies of other *Atta* species. A *tonsipes* garden of 1650 ml weighed 177 g with ants, the latter probably weighing less than 20 g and consisting of about 8000 individuals.

One colony of the *Terminalia* site of 1971 showed the following monthly growth of gardens:

Substrate use in grams			Total for year	Garden Size Estimated in Milliliters	
Year	Minimum	Maximum		Minimum	Maximum
1971	2	35	85	2.5	300
1972	23	155	841	220	1000
1973	32	640	2515	200	4100
1974	25	58	177	250	1600
1975	Not measured		–	500	1500

The garden size fluctuated in January-July 1976 from 330 to 1020 ml.

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BIOLOGY AND HABITATS OF THE LYNX SPIDER *OXYOPES SCALARIS* HENTZ (ARANEAE: OXYOPIDAE)[1]

Bruce Cutler,[2] Daniel T. Jennings,[3] Marjorie J. Moody[4]

ABSTRACT: *Oxyopes scalaris* Hentz is found most frequently on woody vegetation. Color and pattern vary considerably between local populations, and these morphs are interfertile. Mating is very brief, lasting only a few seconds. The egg sac is securely fastened to foliage and is guarded by the female. Prey is rapidly captured, prey being grasped by the first two pairs of legs. The spiders rest at night suspended from foliage by a thread. Adults are found from late spring to summer. Females construct egg sacs in early to midsummer, and the immatures overwinter.

Oxyopes scalaris Hentz is one of the most widespread species of nearctic spiders. While it is most abundant in and west of the Rocky Mountains, it is found in most of the eastern states, the Mexican Plateau, and sporadically through Canada (Brady 1964). For a number of years we have accumulated data on certain aspects of the biology and habitats of the species from different areas of the United States: Cutler in east-central Minnesota; Jennings in northern Arizona, New Mexico, south-central Nebraska, and western Wisconsin; and Moody in southern California. This paper summarizes our observations on habitat associations, seasonal occurrence, feeding behavior, mating behavior, color variations and egg-sac construction of *O. scalaris.*

In Minnesota, *O. scalaris* has been collected chiefly on *Pinus* spp. (once on *Juniperus horizontalis* in a stand of *Pinus*). Southwestern collections of *O. scalaris* are also from *Pinus*, especially *P. edulis* and *P. ponderosa*, but this spider also occurs on other woody plants. In California, this spider is found in a diverse habitat range, including grasses, forbs, and shrubs.

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Cutler collected *O. scalaris* in Idaho while beating *Sarcobatus*, a xerophytic shrub. Brady (1974) reported that *O. scalaris* is very common on sagebrush (*Artemisia* spp.) and similar shrubs throughout the West. With the exception of collections from *Lepidium montanum*, specimens of *O. scalaris* were absent in sweep-net collections from 43 species of grasses and forbs in New Mexico (Jennings 1971). There is a trend for the species to be collected from woody vegetation, usually conifers, in north-central and northeastern states, and in mountainous parts of the West.

Table 1 is a composite of our observations and literature references to previous habitat associations of *O. scalaris*.

Ecological investigations have shown that particular species of foliage-hunting vagrant spiders, such as *O. scalaris*, are often significantly more abundant on one vegetation type than on another. This phenomenon is especially well known for thomisids and salticids (Cutler unpublished) and it will probably be observed in other foliage-searching vagrant spiders, such as the Anyphaenidae and Clubionidae.

Predation and Feeding

Under laboratory conditions prey is captured by a short stalk, followed by a pounce onto the prey. The prey is grasped by the spiny first two pairs of legs, in basket fashion, and forced toward the chelicerae. Prey items are not macerated, unless very small (ca. 1/10 the size of the spider), and carcasses are thereby recognizable. Prey capture takes only a few milliseconds. Vision seems to be the chief cue to capture, although tactile stimuli also may play a role. Prey taken under laboratory conditions included representatives of Araneae (Clubionidae, Oxyopidae, Salticidae, Thomisidae, and Theridiidae) and Insecta (Diptera, Homoptera, and Lepidoptera). Jennings and Pase (1975) found females guarding egg sacs and eating scolytid beetles on ponderosa pine foliage in Arizona. A female was observed feeding on a phalangid on ponderosa pine foliage in Nebraska.

Cannibalism can occur with both juveniles and adults, and is the rule if two or more individuals are confined together in the laboratory. A mature female *O. scalaris* was collected in New Mexico feeding on a penultimate male.

Mating Behavior

The mating behavior of *O. scalaris* has been observed many times in the laboratory by Moody. The male approaches the female, tapping the substratum with his outstretched first pair of legs. If receptive, the female assumes a cataleptic pose, with her legs curled inward for the brief instant of copulation. The spiders assume mating position II of Gerhardt. Copulation is so brief as to cast doubt that mating has actually occurred, but spiderlings emerge from sacs made by previously virgin females that had mated in this fashion. Sometimes the female emerges from catalepsis before copulation is complete, in which case the male loses a leg to the female. Second copulations are infrequent.

Gerhardt (1927, 1933) describes a similar mating behavior in *O. ramosus* (Mart. & Goez) and *O. heterophthalmus* Latr. The extreme rapidity of mating, allowing only one insertion of the embolus for about 20 seconds (Gerhardt 1933), probably accounts for the belief that it is difficult to get *Oxyopes* to mate under laboratory conditions.

Egg Sac

The egg sac of *O. scalaris* is characteristically a white flattened or lenticular disc, 7-10 mm in diameter, firmly attached to the substrate. The eggs are non-agglutinated and approximately 0.8 mm in diameter. Outlines of the eggs are impressed on the outer layers of silk and are clearly visible through the sac. This silk is tough and difficult to tear apart. The sparseness of egg sacs in collections is readily accounted for, since they adhere to foliage and are not dislodged by beating or sweeping. Sacs made in vials tend to be flatter than field-collected material and lack guy threads, possibly because of the nature of the substrate.

Jennings collected *O. scalaris* egg sacs from *Pinus ponderosa* foliage in the field. They had a maze of guy threads almost obscuring the shape of the sac. Cutler provided one female with a *P. banksiana* branch inserted in moist sand in a gallon jar. The female constructed an egg sac similar to field-collected sacs.

The female crouches over the sac in a characteristic position with legs slightly outstretched (fig. 1). She defends the sac and captures prey that comes near. Two sacs are customarily made under laboratory conditions.

The number of eggs and postembryonic stadia confined to sacs, based on 8 sacs collected by Jennings in Arizona and New Mexico, averaged 71, range 56-88. One second egg sac constructed in the laboratory had 26 eggs. Three sacs from *Pinus banksiana* in Wisconsin averaged 87 eggs and postembryonic stadia, range 82-94. Brady (1964) reports that a single egg case from Arizona contained 45 embryos.

Nielsen (1932) described and illustrated the sac of *O. ramosus,* and Jerrard (1972) illustrated the sac of *O. heterophthalmus.* Both are similar to the sac of *O. scalaris,* which supports Brady's (1964) contention that the three species are related. The egg sac of *O. salticus* Hentz, the only other nearctic *Oxyopes* whose egg sac has been described, is different: roughly spherical and half the size of the *O. scalaris* sac (Brady 1964).

Out of the 7 sacs (4 California, 3 Minnesota) for which data were recorded, an average of 21 days (range 19-26 days) elapsed from time of completed sac to time of emergence of spiderlings under laboratory conditions. Upon emergence, the young remain close to the sac and molt within 1-3 days before dispersing. After molting, they wander and become somewhat cannibalistic if not provided with ample food.

Parasitoids

In August, 1974, Jennings collected a female *O. scalaris* guarding an egg sac on ponderosa pine foliage near Hastings, Nebraska. The female and sac were preserved in ethanol and later opened and examined in the laboratory. The sac contained 3 uneclosed eggs (probably nonviable), 1 unemerged spiderling (enclosed within a membrane), 1 spiderling, and 55 parasitoids or hyperparasitoids (fig. 2). These parasites were all in the pupal stage, hence they could only be tentatively identified as Pteromalidae.

Fig. 1. Female *Oxyopes scalaris* guarding egg sac.

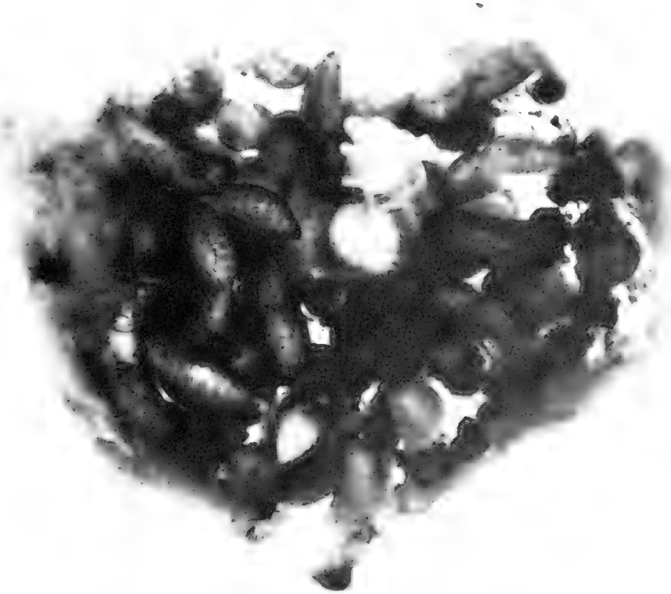

Fig. 2. *Oxyopes scalaris* egg sac with spiderling and parasitoids.

Color Variation

O. scalaris is extremely variable in color and pattern, perhaps accounting in part for seven synonyms, the best known being *O. rufipes* Banks. The basic patterns (Brady 1964, figs. 87-90) remain the same, but can be masked by increased scale and seta density. Pale gray individuals are characteristic in the western chaparral and intermountain deserts and plains, while dark brown (almost black) individuals are found in the Pacific Northwest and New England. These differences are most easily noted in live specimens.

Populations within a few kilometers may differ markedly in coloration. Moody observed this phenomenon in California, and Cutler observed it in northwestern Wisconsin and east-central Minnesota. A characteristic pattern from Minnesota and Wisconsin is: dorsum of opisthosoma with few white setae, overall dark brown, russet marks on each side of the anterior third of opisthosoma, more rarely in the cardiac region. Freshly molted Minnesota laboratory specimens have some gray pilosity, but most field-collected specimens lacked this pile. Juveniles tend to retain more of these gray scales than adults, based on field-collected material.

Moody has done extensive breeding tests with *O. scalaris* in southern California that ranged in color from white and reddish orange to blackish brown. The parent spiders mated readily in the laboratory and produced viable offspring, but she was unable to rear the juveniles to maturity. There appears to be no biological or physical barrier to gene flow between the different color morphs.

Rest

One of the peculiarities of *Oxyopes* species, including *O. scalaris,* is that they rest at night suspended from a dragline attached to the underside of a leaf. Lowrie (1971) suggested this habit may account for the greater abundance of *Oxyopes* in night sweep samples than in day sweep samples: the spiders are simply more readily dislodged while resting. Thus, although diurnally active, *Oxyopes* appear most abundantly in night sweep-net samplings.

Seasonal Cycle

In Minnesota there is a definite cycle in the appearance of the instars. For two years small numbers of spiders were consistently taken on a monthly basis (May-October) in a stand of planted *Pinus banksiana* in southwestern Anoka County. Size estimates indicated there are approximately six instars after young leave the egg sac, the last being the mature spider (table 2). Catches were small, and there was no attempt to be quantitative in sampling. All samples were collected in the period between 1100 and 1400 hours. Spiders reach maturity in early summer, but by August no adults were collected. In captivity, however, females have survived until December. Early to half-grown immatures overwinter to mature the following spring. Mature males were taken only in June in Minnesota and Wisconsin. Both Bristowe (1958) and Nielsen (1932) state that *O. heterophthalmus* Latr. has this same general life history cycle in England and Denmark, respectively.

Data from specimens collected in Wisconsin indicate the seasonal cycle there is probably the same as in Minnesota. In Arizona and New Mexico the pattern is roughly the same as in the upper Midwest, but mature individuals appear earlier in New Mexico (table 2).

A more extensive study was done by Whitcomb et al. (1966) with *Peucetia viridans* (Hentz), the large southern green lynx spider. In Arkansas, this species has a seasonal cycle similar to *O. scalaris,* except that it is delayed about a month. Mature specimens of *P. viridans* are found in July, and only very early instars are found in April. *O. scalaris* from the southeastern United States may show a different seasonal cycle than we observed in the Midwest and Southwest.

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Table 1. Habitat associations of *Oxyopes scalaris* Hentz.

Associations	Localities	References or Sources[1]
Coniferous Trees		
Abies concolor	New Mexico	(Matlack and Toliver)
Juniperus sp.	Kansas	Heinrichs and Thompson, 1968
Juniperus horizontalis	Minnesota	(Cutler)
Juniperus monosperma	New Mexico	(Jennings)
Juniperus scopulorum	New Mexico	(Jennings)
Juniperus virginiana	Missouri	Dowdy, 1951
Pinus sp.	Connecticut	Kaston, 1948
Pinus banksiana	Michigan	Allen, Knight, and Foltz, 1970
	Minnesota	(Cutler)
	Wisconsin	(Jennings) (Cutler) (Jennings and Stary)
	Manitoba	(DeBoo)
Pinus echinata and *Pinus taeda*[2]	Arkansas	Peck, Warren, and Brown, 1971
Pinus edulis	New Mexico	(Jennings) (Toliver) (Benton and Jennings)
Pinus ponderosa	Arizona	(Jennings) Jennings and Pase, III, 1975 (Coffman)
	California	Dahlsten, 1961
	Nebraska	(Jennings)
	North Dakota	(Tagestad)
	South Dakota	(Tagestad)
Pinus resinosa	Michigan	(Peterson)
	Minnesota	(Cutler)
	Wisconsin	(Jennings and Stary)
Pinus strobus	Minnesota	(Cutler)
Pinus virginiana	Maryland	Howden and Vogt, 1951
Pseudotsuga menziesii	British Columbia	Turnbull, 1956
Tsuga canadensis	New York	(Cutler)
Deciduous Trees and Shrubs		
Artemisia sp.	Utah	Fautin, 1946
	Western North America	Brady, 1964 and Gertsch, 1949
Artemisia tridentata	New Mexico	(Jennings)
Baccharis pilularis	Utah	Tilden, 1951
Berberis fremontii	Arizona	(Jennings)
Berberis haematocarpa	New Mexico	(Jennings)
Ceanothus sp.	California	(Moody)
Chilopsis linearis	New Mexico	(Pierce)
Chrysothamnus sp.	New Mexico	(Jennings)
Cowania mexicana	Arizona	(Jennings)

Table 1. (continued)

Associations	Localities	References or Sources[1]
Fallugia paradoxa	New Mexico	(Jennings)
Pyrus malus	New Jersey	Specht and Dondale, 1960
Quercus grisea	New Mexico	(Jennings and Toliver)
	New Mexico	(Jennings, Toliver and Matlack)
Ribes sp.	New Mexico	(Jennings)
Sarcobatus sp.	Idaho	(Cutler)
	Utah	Fautin, 1946
Tamarix pentandra	New Mexico	(Jennings)
Tetradymia sp.	Utah	Fautin, 1946
Undet. shrubs and trees	California	(Moody)
Herbaceous Vegetation		
Andropogon virginicus	North Carolina	Barnes and Barnes, 1955
Asclepias kansana	Kansas	Fitch, 1963
Lathyrus odoratus	New Mexico	(Jennings)
Lepidium montanum	New Mexico	(Jennings)
Pisum sativum	New Mexico	(Jennings)
Undet. grasses	California	(Moody)
Undet. herbaceous vegt. in deciduous woodland	Missouri	(Cutler and Jennings)
Undet. roadside vegt.	California	(Moody)
Parasitic Plants		
Arceuthobium americanum Host: *Pinus contorta*	Colorado	(Penfield)
Arceuthobium vaginatum Host: *Pinus ponderosa*	Colorado	(Penfield)
Other Habitats		
In house	New Mexico	(Campbell)
Pitfall trap (in *Artemisia* community)	Wyoming	(Schmid)
Disturbed *Agropyron-Poa*, forbs and shrubs	Utah	Hayward, 1945
No clear distinction between field and forest	North Carolina	Berry, 1970
On automobile	New Mexico	(Matlack)
On outside walls of house	New Mexico	(Matlack)
Under car hood	New Mexico	(Benton and Toliver)
On garden wall	New Mexico	(Matlack)

[1] Previously unpublished records in parentheses.

[2] Collections not separated by tree species.

Table 2. Seasonal occurrence of *Oxyopes scalaris.*

State	Life stage	Specimens collected per month						
		Apr.	May	June	July	Aug.	Sept.	Oct.
Minnesota Anoka Co.	juv.		(6)	(6)	(2)	(6)	(5)	(16)
	males			(4)				
	penult. females			(1)		(3)		
	females			(4)	(1)			
Wisconsin	juv.		(2)	(11)	(6)			
	males			(4)				
	females			(5)	(9)	(2)		
Arizona	juv.	(1)	(5)	(3)	(6)	(1)		
	penult. males	(1)						
	males			(8)	(2)			
	penult. females	(1)						
	females			(12)	(7)	(1)		
New Mexico	juv.		(10)	(17)		(13)	(29)	(2)
	penult. males		(2)	(7)				
	males		(6)	(11)				
	penult. females		(1)					
	females		(8)	(16)	(1)	(3)		

NEW RECORD FOR A NON-CAVERNICOLOUS PSEUDOSCORPION IN WEST VIRGINIA[1]

Stephen J. Sweeney, Susan L. Stryker, Michael P. Sweeney,
Ralph W. Taylor, Clement L. Counts, III[2]

Hoff and Bolsterli (1956) estimated the number of species of pseudoscorpionida resident to each of the states in the Mississippi River drainage to be 25. However, they noted that an average of only 10 – 15 species had been reported per state thus far. West Virginia is unique in that, prior to the report of Sweeney, et al. (1977), only 6 cavernicolous species had been reported from the state. Sweeney, et al. (1977) reported *Apochthonius moestus* (Banks), *Chthonius tetrachelatus* (Preyssler), and *Neobisium carolinense* (Banks) from the southwestern counties of West Virginia. The present note reports *Dactylochelifer copiosus* Hoff for the first time in West Virginia.

Females of *D. copiosus* were collected in August 1976 at Glenwood, Mason County, West Virginia, in the flood plain of the Ohio River. All specimens were collected from under rocks. These specimens were examined by Dr. William B. Muchmore at the University of Rochester who confirmed the species diagnosis.

D. copiosus has been previously reported in Kentucky by Hoff (1958). Hence, its presence in West Virginia is not that remarkable. However, extensive collections in the southern end of the state have not revealed its presence in those mountainous areas. Collections in the southern end of the Ohio River Valley, south of Mason County, have also been devoid of this species. More collections will be necessary to determine the extent of its range in West Virginia.

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Sweeney, Michael P., Ralph W. Taylor, and Clement L. Counts, III. 1977. Noncavernicolous pseudoscorpions from West Virginia. Ent. News (In Press).

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THE CHROMOSOMES OF TWO SPECIES OF NORTH AMERICAN TETTIGONIIDS (ORTHOPTERA – TETTIGONIOIDEA)[1], [2]

Alejo Mesa[3,4] and Amilton Ferreira[4]

ABSTRACT: *Dichopetala brevihastata* (Phaneropteridae) has the karyotype 2n (♂) = 23, including a "giant" pair of autosomes. This chromosome number has not previously been observed in the family. *Eremopedes ephippiata* (Tettigoniidae) has the karyotype 2n (♂) = 31, the modal number for the family. Both species have an XO (♂) – XX (♀) sex-determining mechanism.

DESCRIPTORS: *Dichopetala brevihastata*: karyotype; records. *Eremopedes ephippiata*: karyotype; records. Tettigonioidea: karyotypes, survey of.

The species of the superfamily Tettigonioidea are common insects, and the group is represented in the recent fauna by about 1120 genera and over 7000 species. The literature on the cytology of the tettigonioids is, however, very limited, and deals with only about 1.5% of the species. The pioneer works on the subject are those of McClung (1902, 1905, 1914, 1917), Woolsey (1915), Winiwarter (1931), Ohmachi (1935), Hareyama (1932), Asana (1941), Asana et al. (1938), Matthey (1948), and Piza (1950, 1953, 1958). More recently a few additional papers have been published, by Henderson (1961), Dave (1965), White et al. (1967), and Ferreira (1969, 1973, 1976a, b).

The data thus far obtained show that this group of insects is characterized by a wide range of variation in the chromosome number. This situation agrees with the taxonomists' concept of the Tettigonioidea being an ancient and very diversified group. The great majority of the studied species have males with an XO (♂) sex mechanism, the X being either acrocentric or metacentric and always heteropycnotic during the first prophase, its size being rather variable among the species. Thus far six species are known to have changed their primitive XO (♂) – XX (♀) sex mechanism to a more complex one (Dave, 1965; White et al., 1967; Ferreira, 1969, 1976a). In the present paper we deal with the chromosomes of two species belonging to different genera of which no members have hitherto been cytologically examined.

Material and Methods. The specimens studied were collected at the following localities in Cochise Co., Arizona, U.S.A. by A. Mesa and T.J. and

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J. Cohn, and have been deposited in the Museum of Zoology of the University of Michigan.

Phaneropteridae

Dichopetala brevihastata **Morse.**

4 ♂♂, Bisbee Jct., 4 mi. S. of Warren, alt. 4,700 ft., 22 Aug., 1973 (Cohn-Mesa Field No. 23; Slide Nos. 4951-3).

Tettigoniidae: Decticinae

Eremopedes ephippiata **(Scudder)**

1 ♂, Don Luis, 0.3 mi. W. of Naco Road Jct., alt. 5,020 ft., 22 Aug., 1973 (Cohn-Mesa Field No. 21; Slide No. 4954).

2 ♂♂, Huachuca Mts., road summit above Carr Canyon, 7.8 road mi. SW. of Fletcher's at jct. with Hwy. 92, alt. 7,400 ft., 22-23 Aug., 1973 (Cohn-Mesa Field No. 25; Slide Nos. 4955-6).

All the testes were fixed in a mixture of 100% ethyl alcohol and acetic acid (3:1). The squash preparations of the chromosomes were stained with acetic orcein (2%), and the photographs taken with a Zeiss photomicroscope.

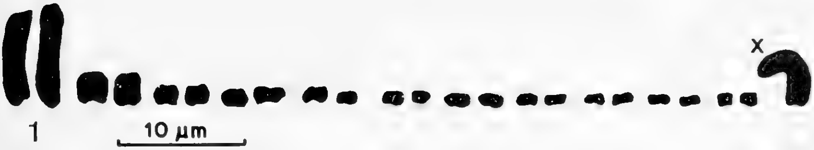
Results

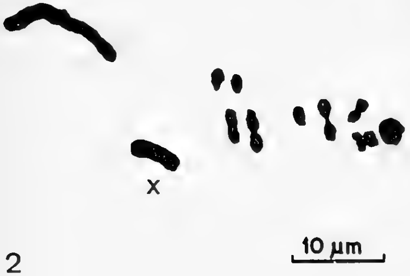
Dichopetala brevihastata. The chromosome number of this species is 2n (♂) = 23 and the sex mechanism is of the XO (♂) – XX (♀) type. All the chromosomes are acrocentric. The autosomes are organized into one huge pair, another medium-sized one, and nine pairs of small chromosomes (figs. 1 and 2). The giant bivalent, which contains nearly one-half ($\cong$ 7/15) of the autosomal chromatin, shows only one or two chiasmata and always has a delayed segregation during the first anaphase (fig.3). The medium-sized bivalent also shows one or two chiasmata, while the remaining pairs have only one chiasma per bivalent.

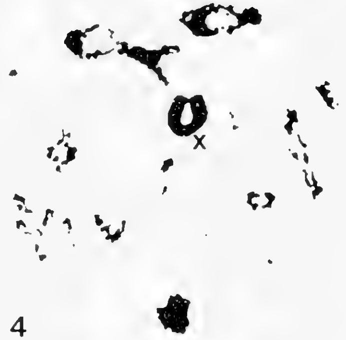
Eremopedes ephippiata. This species has 2n (♂) = 31 acrocentric chromosomes and a sex mechanism of the XO (♂) – XX (♀) type. During the first prophase fifteen bivalents besides the unpaired X are seen (fig. 4). The fifteen autosome pairs show a gradual decrease in size from largest to smallest, making their grouping difficult (fig. 5). The largest pairs have two or three chiasmata, while the remainder have a single chiasma which may be interstitial or terminal. No asynchronized movement of the chromosomes to the pole was observed. The sex chromosome is the largest of the set, and is always heteropycnotic during first prophase.

Discussion

Among the tettigoniids the widest range in chromosome number is found in the family Phaneropteridae, in which the lowest and highest numbers as yet known are 2n (♂) = 16 and 2n (♂) = 39 (Ferreira, 1973, 1976a, b). Species with 2n (♂) = 33, 31, 29, 27, 25, 21 and 16 have been reported by several







Dichopetala brevihastata. Fig. 1. Spermatogonial metaphase, with chromosome pairs arranged according to size.

Fig. 2. First metaphase.

Fig. 3. First anaphase.

Eremopedes ephippiata. Fig. 4. Diplotene.

Fig. 5. First metaphase.

authors. According to Ferreira (1967a,b) the commonest karyotype among phaneropterids is 2n (♂) = 31, with all the chromosomes acrocentric. The usual sex mechanism is of the XO (♂) – XX (♀) type. Five species of the family are known to have a more complex sex system (Dave, 1965; White et al., 1967; Ferreira, 1969, 1973, 1976a). Many chromosomal rearrangements must have occurred during the evolution of the family to account for the present karyotypic diversity (Ferreira, 1976b).

Dichopetala brevihastata is the first phaneropterid with 2n (♂) = 23 acrocentric chromosomes to be reported. The oddity of chromosome size-grouping observed in it is due to the occurrence of a "giant" chromosome pair. A series of translocations and inversions concentrated nearly half of the autosomal chromatin in a single chromosome. The presence of such a "giant" chromosome is unusual in the family, but a similar situation was found by Ferreira (1969) in the Australian *Tinzeda albosignata,* which has a "derived" karyotype with 2n (♂) = 25 acrocentric chromosomes and shows a sharp bimodality of chromosome size. In both it and *D. brevihastata* the asynchronized behavior of the "giant" autosomes during anaphase is a consequence of the sharp difference in size among the autosomes.

The subfamily Decticinae is, together with the Tettigoniinae and Saginae, the most primitive among the living tettigoniids with developed wings (Sharov, 1968). The karyotype found in *Eremopedes ephippiata,* with 2n (♂) = 31 acrocentric chromosomes, is the one commonest among the Decticinae, which exhibit a remarkably constant chromosome set among their species (Mohr, 1916; Buchner, 1909; Winiwarter, 1931; Hareyama, 1932; Ohmachi, 1935; Henderson, 1961; White, 1941). There are, however, some notable exceptions in *Atlanticus pachymerus* (White, 1941), *Lanciana albidicornis* (Ferreira, 1969) and *Anabrus simplex* (McClung, 1902, 1905, 1914). In the first two of these 2n (♂) = 25 occurs; in *A. pachymerus* the X chromosome and four autosomes are submetacentric, while in *L. albidicornis* all the chromosomes are acrocentric. In *Anabrus simplex* McClung found 2n (♂) = 33 and a sex mechanism of the XO (♂) – XX (♀) type. On the basis of McClung's description and drawings, however, White et al. (1967) suggested that *Anabrus simplex* has a neo-XY (♂) sex system, making the further study of its karyotype desirable.

ACKNOWLEDGEMENTS

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NEW STATE RECORD OF THE ALDERFLY *SIALIS CONCAVA* BANKS FROM THE CRANBERRY GLADES IN WEST VIRGINIA (MEGALOPTERA: SIALIDAE)[1]

D.C. Tarter[2], W.D. Watkins[3], M.L. Little[2], and D.L. Ashley[3]

ABSTRACT: The alderfly *Sialis concava* Banks is collected for the first time for West Virginia.

DESCRIPTORS: Alderfly, Megaloptera, *Sialis concava,* State Record

Sialis concava Banks is reported for the first time in West Virginia. At 1500 hrs on 12 June 1976, one male was captured while touring the boardwalk in Cranberry Glades. The Glades is an area of approximately 750 acres in mountainous Pocahontas County, at an elevation of 3375 ft, of unique biological interest (Darlington, 1943). It is at the headwaters of Cranberry River, which flows through the bog. Cranberry Glades is a refugium where northern plant and animal life has survived in the Southern Appalachians. This climate is responsible for the success of *S. concava,* normally a northern alderfly.

Prior to this state record, four alderflies have been reported for West Virginia: (1) *S. velata* Ross (Jefferson County) (Ross, 1937), (2) *S. joppa* Ross (Pendleton County) (Tarter, 1973), (3) *S. aequalis* Banks (Wayne County) (Tarter and Woodrum, 1973), and (4) *S. itasca* Ross (Wayne County) (Tarter et al., 1976).

The genus *Sialis* contains 23 Nearctic species (Ross, 1937; Townsend, 1939; and Flint, 1964). Banks (1897) described the holotype male of *S. concava* from Ithaca, New York. The female is unknown. *Sialis concava* has been recorded from Maryland (1♂), New York–Ithaca: 29 May 1913, 1♂, and Ontario–Power Glen: 25 June 1926, 1♂ (Ross, 1937).

A special word of appreciation to Dr. Oliver S. Flint, Jr., United States National Museum, Washington, D.C., for confirmation of the alderfly.

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(Continued on inside of back cover)

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OBSERVATIONS ON THE MORPHOLOGY AND BEHAVIOR OF THE ENICOCEPHALIDAE (HEMIPTERA)

Gene Kritsky

ABSTRACT: The morphology of the Enicocephalidae is examined and related to its behavioral implications. Sexual dimorphism and enicocephalid swarming behavior are also discussed.

DESCRIPTORS: Behavior, Enicocephalidae, morphology, sexual dimorphism, swarming.

The Enicocephalidae are small predaceous hemipterans which live in a protected habitat (i.e. under bark or in leaf litter). They are called enicocephalids or "unique-headed bugs" because the constriction behind the eyes gives the head a two-lobed appearance (Fig. 1).

Enicocephalids possess a four-segmented rostrum, four-segmented antenna, and two large ocelli on the posterior lobe of the head (Fig. 2).

They have grasping forelegs (Fig. 3), but not raptorial forelegs as for example in the Phymatinae, which have the tibia closing on the femur for grasping. The foreleg has a one-segmented tarsus with at most two large claws and four fluted spines depending on the genus. Similar spines are to be found on the apex of the tibia. The tarsal claws oppose these spines. The cleaning comb (Fig. 4) on the side of the tibia closest the body consists of long spines which are used to clean the long hairs on the antenna and the rostrum.

The middle and hind legs are also equipped with two tarsal claws and sometimes tibial spurs. There is a cleaning comb on both sides of each leg.

I have seen individuals start their cleaning ritual by using the comb on the foreleg to clean the antennae and then the rostrum. They will use the middle leg's comb to clean the forelegs, followed

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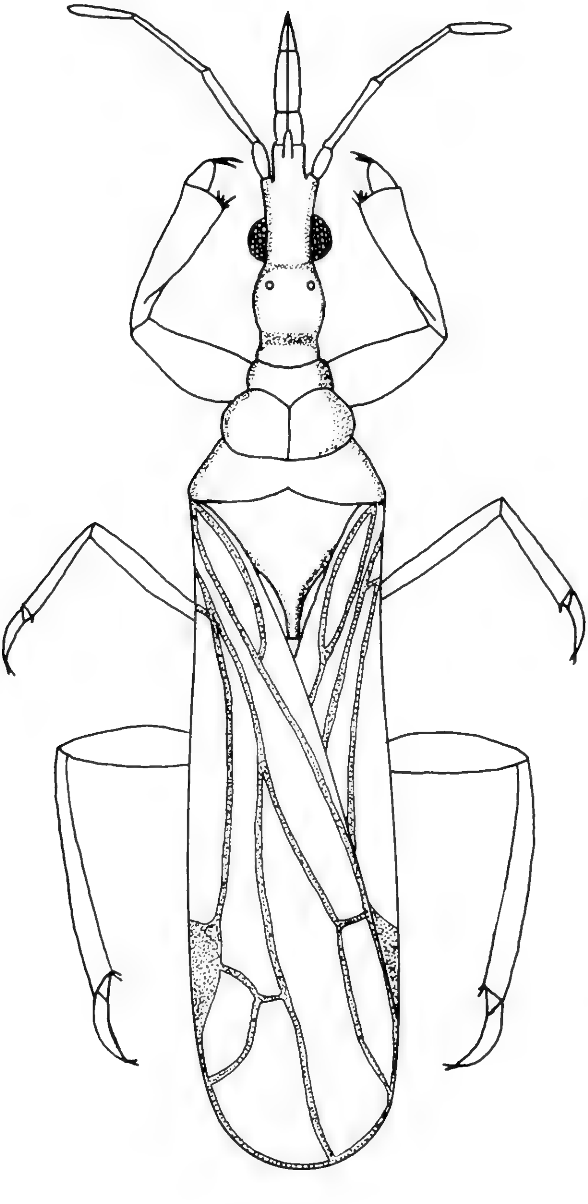


Figure 1. *Systelloderes biceps.*

Figure 2. *Systelloderes biceps* head, 90X.

by cleaning the middle legs with the hind leg's comb. The task is completed by the two hind legs cleaning each other. Because the foreleg is cleaned by the middle leg, it only needs a comb on the side of the foreleg closest to the body. However, the middle and hind legs need combs on both sides of the leg to clean all sides of the legs, this explains why there is only one comb on the inside of the foreleg, and two on the middle and hind legs.

The most observable aspect of Enicocephalidae behavior outside their protected environment is their tendency to form mating swarms. Since Emile Blanchard first recorded a swarm in 1852, there have been numerous published accounts of such events. The most recent published account was of a swarm of an undescribed species of *Systelloderes* in Costa Rica seen by Toby Schuh (1970).

The swarms are generally described as resembling a swarm of chironomids (Knab 1908; Johannsen 1909; Schuh 1970). The individuals hover between 1-4 meters off the ground and all align themselves up in the same direction with the wind. Swarms consist predominantly of males. Schuh (1970) reported 434 males and 7 females. In 1950, Dr. H.B. Mills collected 303 males and 7 females

Figure 3. *Systelloderes biceps* foreleg, 150X.

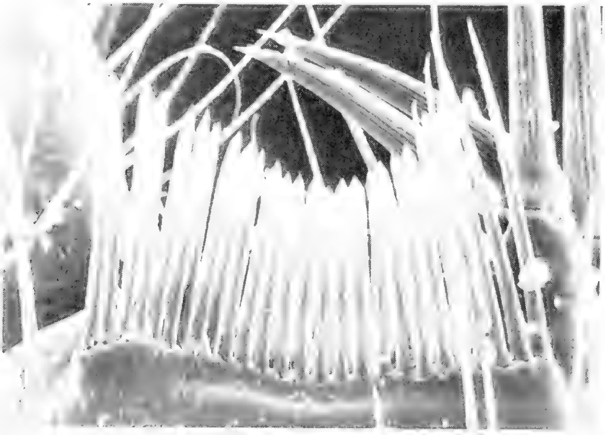
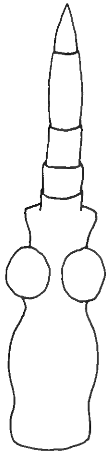


Figure 4. *Systelloderes biceps* cleaning comb, 1025X.

Figure 5. *Systelloderes biceps* male head. Figure 6. *S. biceps* female head. Figure 7. *S. biceps* male foreleg. Figure 8. *S. biceps* female foreleg. Figure 9. *S. biceps* male pronotum. Figure 10. *S. biceps* female pronotum.



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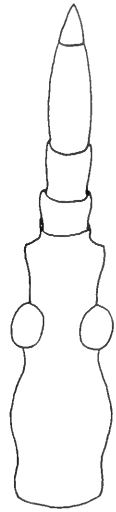

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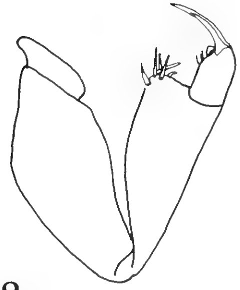

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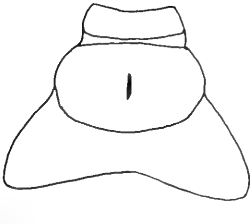

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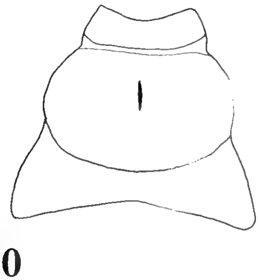

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of *S. biceps* in a swarm in Champaign, Illinois, and in 1954 Drs. E.S. Ross and E.I. Schillinger collected 90 males and 3 females of *S. longiceps* from a swarm in Peru. Similar mating swarms are known in the Diptera, Ephemeroptera, Trichoptera, and Hymenoptera (Downes 1969).

Mating swarms have adaptive advantages in that they aid the dispersal of the species as well as promote better genetic exchange. It should be noted that there is one enicocephalid genus, *Phthirocoris,* which is totally apterous and obviously doesn't swarm.

There is evidence that enicocephalid swarms are like the Diptera swarms, being station swarms. Knab (1908) writes that the swarms were "dancing in sunlight in an open space," and Ross and Schillinger (personal communication) report the swarms occurring in a "sunlit glade".

The enicocephalids are sexually dimorphic. In all species so far examined, the male has larger eyes than the female (Figs. 5 and 6).

Downes (1969), in his paper on Diptera swarming, points out that the larger male eye is used for finding the station and for spotting another individual in the swarm. The enlargement of the ventral portion of the male enicocephalid eye suggests that the male spots a station marker that is below him. The enlargement of the ocular area also suggests that the male approaches the female from the top. The actual approach of enicocephalids is unknown but the male does position himself directly on top of the female during copulation in flight (Schuh 1970).

The male also has a more slender foreleg than the female, as seen in figs. 7 and 8. A third dimorphic feature is the greater size of the middle lobe of the pronotum of the female as shown in figs. 9 and 10.

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A KEY TO THE SPECIES OF THE GENUS *CENTRUROIDES* MARX (SCORPIONIDA: BUTHIDAE)[1]

Herbert L. Stahnke[2], Michele Calos[3]

ABSTRACT: This is not a revisionary study A key to the species of the genus *Centruroides*, as presently recognized, is presented for the non-systematist. Diagnostic characteristics of the genus are given, followed by a list of 37 species and a key for their determination. A list of subspecies of *Centruroides* is given followed by synonymies of the *Centruroides* species and additional species placed in the old genus *Centrurus*. The discussion points up the need for a revisionary study because of the creation of artifical species due to over-weighting the color characteristics and failure to recognize adequate diagnostic features.

DESCRIPTORS: *Centruroides* key; *Centruroides* diagnosis; Scorpionida; Buthidae; *Centruroides* species synonymy.

The growing interest in the genus *Centruroides* by disciplines other than systematics has suggested the need for a key to the presently recognized species. This paper is not intended as a revisionary study of the genus, but simply the offering of a key constructed some time ago for personal use. The nomenclature and measurement methods employed follow the suggestions made by Stahnke (1970). Subspecies are not included in the key but are listed later.

Scorpions included in the key are those members of the family Buthidae characterized as follows:

Tibial spurs lacking; interior and exterior pedal spurs well developed, the latter frequently with a small basal thorn and machrochaete; interior margin of fixed cheliceral finger bears one large tooth, while that of the movable finger bears two large teeth; mesosomal terga mono- or tri-keeled; subaculear protrusion obsolete to strongly developed, sometimes spinoid; male cauda not broader distad but distinctly longer than that of female, often extremely so; dorsal furrow of caudal segment V shallow or absent; sternite III of basilary area smooth, or at most weakly granular, and sometimes lightly furrowed; trichobothrium D2 more distad than D3; pedipalp tarsus cutting edge bearing from seven to nine oblique rows of denticles (sometimes plus a short apical row of three to five denticles), these rows flanked externally and internally by large, dentate, lateral granules; between the lateral granules are one to four granules that are much smaller and referred to as *supernumerary* granules. These accessory granules, as a rule, do not appear

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until about the fourth instar, and therefore juveniles of the larger species, like *C. gracilis,* might be mistaken for an *Isometrus* species if just this characteristic is used to identify the genus, as is frequently done.

The genus *Centruroides* is apparently entirely an American taxon with its center of distribution in Mexico. It is found from the central United States to Central America, and in the West Indies. A few species have invaded South America as far as Argentina and Chile.

Species Included in the Key

Centruroides aguayoi Moreno, 1939; *C. argentinus* Werner, 1939; *C. bertholdi* (Thorell), 1876; *C. bicolor* (Pocock), 1898; *C. chisosarius* Gertsch, 1939; *C. dammanni* Stahnke, 1970; *C. danieli* (Prado and Rios-Patiño), 1939; *C. dasypus* C. de Mello-Leitão and J. de Araújo Feio, 1950; *C. elegans* (Thorell), 1876; *C. exilicauda* (Wood), 1863; *C. flavopictus* (Pocock), 1898; *C. fulvipes* (Pocock), 1898; *C. gracilis* (Latreille), 1804; *C. hasethi* Pocock, 1902; *C. hentzi* (Banks), 1900; *C. infamatus* (C.L. Koch), 1845; *C. insulanus* (Thorell), 1876; *C. keysi* Muma, 1967; *C. limbatus* (Pocock), 1898; *C. limpidus* (Karsch), 1879; *C. margaritatus* (Gervais), 1841; *C. nigrescens* (Pocock), 1898; *C. nigrimanus* (Pocock), 1898; *C. nigrovariatus* (Pocock), 1898; *C. nitidus* (Thorell), 1876; *C. noxius* Hoffmann, 1932; *C. ochraceus* (Pocock), 1898; *C. pallidiceps* Pocock, 1902; *C. pantheriensis* Stahnke, 1956; *C. rubricauda* (Pocock), 1898; *C. sculpturatus* Ewing, 1928; *C. subgranosus* (Kraepelin), 1898; *C. suffusus* Pocock, 1902; *C. testaceous* (Geer), 1778; *C. thorelli* (Kraepelin), 1891; *C. vittatus* (Say), 1821; *C. zweifeli* Gertsch, 1957.

Key to the Species

1a With seven medial oblique rows of denticles on the cutting edge of the pedipalp tarsus. Pecten teeth: Male, 24, female 22 . . . . *dasypus*
Distribution: Andahuaylas, Peru.

1b With eight medial oblique rows of denticles on the cutting edge of the pedipalp tarsus (often plus a short apical row of three to five granules), or six rows plus a coalesced row and a short apical row 9

1c With nine medial oblique rows of denticles on the cutting edge of the pedipalp tarsus (often plus a short apical row of three to five granules), or seven rows plus a coalesced row and a short apical row 2

2a(1c) Color uniformly yellowish. Only female known: Pecten teeth 25; all keels of manus distinctly granular; about 60 mm long; ratio of caudal segment V length to carapace length 1.10; carapace taper 0.38 mm/mm length; ratio pedipalp tibia length to manus width 3.64 . . . . *argentinus*
Distribution: Campos Santo, Salto Province, Argentina

2b(1c) Uniformly blackish or bicolor without distinct, dark, broad longitudinal bands 3

3a(2b) Subaculear tooth close to base of aculeus, its point inclined toward aculeus 4

3b(2b) Subaculear tooth away from base of aculeus, its point inclined outward 6

4a(3a) Adult animal of uniform blackish color with only tibia fingers, and the ends of leg tarsi and pedipalp tarsi lighter. Pecten teeth: Males 29-33, females 27-31 . . . . *nigrescens*
Distribution: Southern part of Guerrero, Mexico and mainly in the coastal region along the Pacific. It may extend along the coastal regions of Oaxaca.

4b(3a) Color not uniformly black; tergite VII may be lighter than other tergites; legs, pedipalp femur, and at times the patella, yellowish to reddish. 5

5a(4b) Pedipalp patella of a light yellowish color similar to femur, but much lighter than manus. Pecten teeth: Males 33-38, females 29-35. . . . . *nigrimanus*
Distribution: Oaxaca, Mexico; Honduras.

5b(4b) Pedipalp patella much darker than femur, but same color as manus; tergite VII paler than others. Pecten teeth: (only female known) 28-29 . . . . *fulvipes*
Distribution: Xautipa, Guerrero, Mexico.

6a(3b) Color of trunk, legs, chela, and metasoma yellow; edges of terga, pedipalp tibia fingers and tarsi, and the end of metasoma black. Pecten teeth: Males 23-25, females 22-23 . . . . *limbatus*
Distribution: Sirirea in Talamanca, Costa Rica; Chanquinole, Panama; Quezaltenango, Guatemala.

6b(3b) At least the carapace and terga (except tergite VII in *bicolor*) blackish or deep brown 7

7a(6b) Tergite VII yellow; pedipalp manus much darker than patella. Pecten teeth: Males 28-29, females 26-28. . . . . *bicolor*
Distribution: Costa Rica; Panama.

8a(7b) Granules on metasoma keels few in number and remote from each other. Pecten teeth: Males 21-23, females 20-21. . . . . *rubricauda*
Distribution: Costa Rica.

8b(7b) Granules on metasoma keels numerous and close. Pecten teeth: Males 26-36, females 24-30 . . . . *gracilis*
Distribution: Mexico to northern South America: Antilles; Cuba; Jamaica; Santa Cruz de Tenerife; Florida, United States.

9a(1b) Tegites of adults with two broad, dark, longitudinal bands 10

9b(1b) Primarily yellow, but tergites with one narrow, median, very dark, longitudinal band. Pecten teeth: (Only female known) 16-18 . . . . *aguayoi*
Distribution: Cuba.

9c(1b) Tergites of adults without two dark, longitudinal bands; may be uniformly colored or variegated bicolor 22

10a(9a) Pedipalp tibia finger and tarsus approximately same color as manus 11

10b(9a) At least basal half of pedipalp tibia finger and tarsus dark brown to blackish 20

11a(10a) Posterior margin of tergites I-VI yellowish, but pretergites with an intense black spot. Pecten teeth: Males 22-26, females 20-25 . . . . *elegans*
Distribution: Jalisco, Guerrero, Nayarit, and Tres Marias Islands, Mexico.

11b(10a) Posterior margin of tergites I-VI dark colored; may consist of only a transverse row of dark granules 12

12a(11b) Pedipalp, legs, and ventral cauda spotted with brown; these markings may be very faint 13

12b(11b) Not as above 16

13a(12a) Large, strongly developed subaculear tooth; median longitudinal row of coarse granules on ventral surface of telson vesicle 14

13b(12a) Weakly developed subaculear tooth 15

14a(13a) Female carapace longer than caudal segment III (ratio over 1.14); ratio of pecten length to width at level of first tooth; Males under 5.20, females under 4.40; ratio of male caudal segment V length to width over 4.25. Pecten teeth: males 16-21, females 16-21 . . . . *hentzi* and *keysi*
(Discussion p. 120)
Distribution: Florida, United States.

14b(13a) Female carapace shorter than, or equal to, the length of cauadal segment III (ratio about 0.96-1.00); ratio of pecten length to width at level of first tooth: Males over 5.75, females over 4.75; ratio of male caudal segment V length to width under 3.80. Pecten teeth: Males 18-20, females 13-18. . . . . *thorelli*
Distribution: Cuba; central Mexico to Central America.

15a(13b) Tergite I-VI with an intense black spot on pretergite, and another larger, but more diffuse, spot on posterior border; the two dorsal black longitudinal bands begin as a transverse black line on posterior border of carapace. Pecten teeth: Males 21-26, females 17-23 . . . . *limpidus*
Distribution: Central Guerrero, Morelos, southern Puebla, and along western coast, Mexico.

15b(13b) Dark spot on only posterior portion of tergites; spots may be small and very faint. Female basal piece with central hole. Pecten teeth: Males 19-23, females 17-22 . . . . *nigrovariatus*
Distribution: Oaxaca, Mexico.

15c(13b) Dark pigment variegated, extending over entire tergite and lightly on pretergite; dark pigment often quite faint in adults, but readily recognized in young. Carapace of juveniles with four well defined, longitudinal, dark lines which become greatly reduced or almost obsolete in adults. Female basal piece

with central hole. Pecten teeth: Males 19-23, females 18-21. . . . . . *pallidiceps*
Distribution: Sinaloa and parts of Sonora, Mexico.

16a(12b) Distinct, well defined black interocular triangle with apex extending just posteriad of ocular tubercle; black pigment extends to posterior margin of carapace as two tapered bands which form two black transverse lines on posterior margin. Female basal piece with central hole. Pecten teeth: Males 24-27, females 22-26 . . . . *vittatus*
Distribution: South, central and western United States, and adjacent Mexican states.

16b(12b) Interocular triangle not as above 17

17a(16b) Entire carapace invaded by dark spots alternating with symmetrically placed light areas; dark pigment on tergites primarily along posterior half; may consist of dark, coarse granules. Female basal piece with central, narrow, elongated, central depression. Pecten teeth: males 27-28, females 24-26 . . . . *chisosarius*
Distribution: Chisos Basin, Big Bend National Park, Texas, United States.

17b(16b) Carapace light colored laterally and sometimes in area of posterior median furrow; otherwise entire posterior median portion of carapace darker, sometimes in a slightly diffuse manner. 18

17c(16b) Carapace light colored except for blackish pigment circling median eyes, sometimes extending diffusely along anterior median keels and spreading lightly throughout interocular triangle; carapace also with two elongate, transverse, dark spots along posterior margin, sometimes extending anteriorly along the crests of median posterior keels and then fanning out laterally as they advance half the length of carapace 19

18a(17b) Cauda of adult male at least 8.25 times longer than carapace; caudal segment V of adult male about four times longer than wide; male caudal segment II longer than carapace (ratio about 0.86); ratio of male telson vesicle length to aculeus length over 1.78. Female basal piece with central hole. Pecten teeth: males 21-26, females 20-23 . . . . *suffusus*
Distribution: Central portion of state of Durango, Mexico.

18b(17b) Cauda of adult male not over 7.5 times longer than carapace; caudal segment V of adult male not over 3.5 times longer than wide; male caudal segment II about same length as carapace (ratio 0.98-1.00); ratio of male telson vesicle length to aculeus length under 1.60. Female basal piece lacks central hole. Pecten teeth; males 23-25, females 21-22 . . . . *infamatus*
Distribution: Michoacan, Jalisco, Zacatecas, Durango and Veracruz, Mexico.

19a(17c) Cauda ventrally infuscate. Ratio of pedipalp tibia length to manus width: Males under 2.50, females under 2.60; ratio telson vesicle length to aculeus length: Males under 1.55, females under 1.16. Male telson ovate to tear-drop shaped. Female basal piece with shallow, broad, gradually sloping central depression; not sharp, pit-like at deepest point. Pecten teeth: Males 18-26, females 17-24. Bicolor phase . . . . *exilicauda*
Distribution: Baja California, Mexico.

19b(17c) Cauda ventrally not infuscate. Ratio of pedipalp tibia length to manus width: Males over 2.80, females over 3.00; ratio of telson vesicle length to aculeus length: Males over 1.80, females over 1.20. Male telson vesicle subcylindrical. Basal piece of female lacks central hole or depression. Pecten teeth: Males 22-29, females 19-26. Bicolor phase . . . . *sculpturatus*
Distribution: Arizona, western New Mexico, and eastern California, United States; northern Mexico.

20a(10b) Superior keels of pedipalp manus distinctly granular. Ratio of caudal segment I length to width: Males under 1.70, females under 1.30; ratio of pedipalp manus width to patella width: Males about 1.12, females 1.03-1.13. Female basal piece with transversely elongated, central depression. Pecten teeth: Males 20-22, females 17-20. . . . . *insulanus*
Distribution: Jamaica; Choco; Brazil.

20b(10b) Pedipalp manus superior keels agranular. Ratio of caudal segment I length to width: Males over 1.87, females over 1.40. 21

21a(20b) Inferior lateral keels of cauda bearing large serrate granules (in adult males sometimes not distinctly serrate), eg, segment IV of female bears about 20 granules. Ratio of caudal segment IV length to width: Males under 2.80, females under 1.95; ratio of pedipalp manus width to patella width: Males and females over 1.35. All segments of cauda about the same basic color. Pecten teeth: Males 18-24, females 19-20 . . . . *nitidus*
Distribution: Puerto Rico; Haiti; Brazil.

21b(20b) Inferior lateral keels of cauda bearing small, subserrate granules (in adult males somewhat confluent), eg. segment IV of female bears about 30 granules. Ratio of caudal segment IV length to width: Males over 3.80, females over 2.10; ratio of pedipalp manus width to patella width, male and female under 1.35. Segments I and II of cauda lighter in color than other segments. Pecten teeth: Males 21-25, females 20-24 . . . .*dammanni*
Distribution: St. John, Virgin Islands.

22a(9c) Pedipalp tibia finger and tarsus, at least at the base, dark brown or blackish, with the manus a lighter color. 23

22b(9c) Pedipalp tibia finger and tarsus not darker than manus, but may be lighter than manus 25

23a(22a) Carapace (except median ocular tubercle and possibly crests of posterior median keels) and tergites a uniform color 24

23b(22a) Carapace and tergites more or less variegated in color. Ratio of caudal segment I length to width: Males under 1.80, females under 1.35. Frequently a fine, light, longitudinal line persists on median keels of tergites of adults; such a line found only on juveniles of other species. Pecten teeth: Males 19-22, females 16-20 . . . .*flavopictus*
Distribution: Veracruz and Chipas, Mexico.

24a(23a) All keels of sternite VII smooth. Subaculear tooth large and sharp. Pecten teeth: Males 27-28; females 26-28 . . . . *ochraceus*
Distribution: Yucatan and Campeche, Mexico

24b(23a) Only median keels of sternite VII smooth, seldom slightly granular. Subaculear tubercle minute. Keels obsolete on caudal segment V. Ratio of caudal segment I length to width: Males over 2.00, females over 1.70. Pecten teeth: Males 23-24, females 20-22 . . . . *testaceous*
Distribution: Montserrat; Haiti.

25a(22b) Fifth caudal segment of a darker color than rest of cauda 26

25b(25a) Fifth caudal segment essentially of same color as other segments, never darkened 27

26a(25a) Fifth caudal segment in adults only slightly darker than other segments, sharply contrasting in juveniles; diffuse dark ring circles median eyes. Male telson vesicle without rounded, lateral, terminal expansions. Pecten teeth: Males 27-30, females 22-26 . . . . *pantheriensis*
Distribution: Big Bend National Park, Texas, United States.

26b(25a) Fifth caudal segment much darker than rest of cauda. Male telson vesicle with rounded, lateral, terminal expansions on both sides; small to moderate sized subaculear tooth. Granular keels of tergite VII and cauda black, contrasting sharply with intercarinal spaces. Portions of pedipalps generally densely covered with yellow setae. Adults large, 10 cm long or greater. Pecten teeth: Males 26-34, females 23-32 . . . . *margaritatus*
Distribution: Cuba; northern Mexico to northern South America.

26c(25a) Fifth caudal segment and lower portion of vesicle darker than other segments; granular keels of tergite VII and cauda almost same color as pedipalps. Pedipalp tarsus with large basal lobe. Strongly developed subaculear tooth which is not near base of aculeus. Ratio of total cauda length to carapace length about 8.00. Pecten teeth: Males 28-29, females 20 . . . . *danieli*
Distribution: Colombia (Andes).

27a(25b) Subaculear tubercle strongly developed and spinoid. Legs and cauda not infuscate; tergites I-VI blackish, but with a narrow, light colored, lateral band on each side. Adults small, about 4-5 cm long. Pecten teeth: Males 17-21, females 15-19 . . . . *noxius*
Distribution: Nayarit and southern Sinaloa, Mexico.

27b(25a) Subaculear tubercle obsolete to moderate sized. No narrow, light colored, lateral bands on each side 28

28a(27b) Subaculear tubercle of adults obsolete but well developed and spinoid on juveniles. Aculeus and vesicle of telson approximately equal in length. Posterior edge of carapace and all tergites dark brown or black and studded with a transverse row of dark, coarse granules. Superior keels of pedipalp manus well developed and strongly granular. Adults small, about 3-4 cm long. Pecten teeth: Males 17-21, females 15-19 . . . . *zweifeli*
Distribution: San Martin Island, Baja California, Mexico.

28b(27b) Combination of characters not as above 29

29a(28b) Subaculear tubercle moderately developed and spinoid. Telson vesicle of male

subcylindrical, nearly three times as long as wide. Lateral keels of tergites obsolete, traceable only as a pair of serially arranged granules. Female cauda about 5.5 times as long as carapace, which is about as long as caudal segment IV. Pecten teeth: Males 24-25, females 22-23 . . . . *subgranosus*
Distribution: Central America

29b(28b) Subaculear tubercle obsolete to small and spinoid. Male telson vesicle not subcylindrical. Tergites with lateral keels at least on anterior half of tergites V and VI. 30

30a(29b) Entire supercillary crests of median eyes smooth except for a few granules at extremities. Telson vesicle of male ovate, about twice as long as wide. Pecten teeth: Males 22-26, females 21-23 . . . . *bertholdi*
Distribution: Central Jalisco, Mexico.

30b(29b) Entire supercillary crests covered with granules 31

31a(30b) Ratio of caudal segment V length to width: Males under 3.10, females under 2.40; ratio of caudal segment IV length to width: Males under 2.70, females under 2.10. Pecten teeth: Males 23-29, females 21-27 . . . . *hasethi*
Distribution: Curaçao (West Indies).

31b(30b) Ratio of caudal segment V length to width: Males over 3.80, females over 2.60; ratio of caudal segment IV length to width: Males over 3.70, females over 2.25 32

32a(31b) Ventral cauda not infuscate. Adult male telson vesicle subcylindrical. Ratio of male vesicle length to aculeus length over 1.80; ratio of pedipalp tibia length to manus length: Males over 2.85, females over 2.70. Pecten teeth: Males 22-29, females 19-26. Concolorous phase . . . . *sculpturatus*
Distribution: Arizona, western New Mexico, and eastern California, United States; northern Mexico.

32b(31b) Ventral cauda may be infuscate. Adult male telson vesicle ovate to tear-drop in shape. Ratio of male vesicle length to aculeus length under 1.65; ratio of pedipalp tibia length to manus length: Males under 2.45, females under 2.55. Pecten teeth: Males 18-26, females 17-24 . . . . *exilicauda*
Distribution: Baja California, Mexico.

List of Subspecies

Centruroides elegans elegans (Thorell), 1876; *C. e. guanensis* (Franganillo), 1931; *C. e. insularis* Pocock, 1902; *C. e. meisei* Hoffmann, 1939.

Centruroides flavopictus chamulaensis Hoffmann, 1932; *C. f. flavopictus* (Pocock), 1898; *C. f. meridionalis* Hoffmann, 1932.

Centruroides gracilis gracilis (Latreille), 1804; *C. g. johannis* Moreno, 1939; *C. g. nigrescens* (Franganillo), 1934 (not of Pocock, 1898); *C. g. pectinatissimus* Moreno, 1939; *C. g. ruber* Franganillo, 1936.

Centruroides hasethi arubensis (Bakker), 1963; *C. h. hasethi* Pocock, 1902.

Centruroides infamatus infamatus (C.L. Koch), 1845; *C. i. ornatus* Pocock, 1902.

Centruroides insulanus barbudensis (Pocock), 1898; *C. i. insulanus* (Thorell), 1876.

Centruroides limpidus limpidus (Karsch), 1879; *C. l. tecomanus* Hoffmann, 1932.

Centruroides margaritatus chiapanensis Hoffmann, 1932; *C. m. margaritatus* (Gervais), 1841; *C. m. morenoi* Mell-Leitao; *C. m. septentrionalis* Hoffmann, 1932; *C. m. tapachulaensis* Hoffmann, 1932.

Centruroides nigrovariatus baergi Hoffmann, 1932; *C. n. nigrovariatus* (Pocock), 1898.

Centruroides suffusus chiaravigili Borelli, 1915; *C. s. suffusus* Pocock, 1902.

Centruroides testaceous exsul (Meise), 1933; *C. t. testaceous* (Geer), 1778.

Centruroides thorelli cubensis Moreno, 1940; *C. t. thorelli* (Kraepelin), 1891.

Synonyms of Species of *Centruroides*

C. biaculeatus; Androctonus biaculeatus Lucas, 1835= *C. gracilis*
C. californicus; Scorpio (Atreus) californicus Girard, 1853=? *C. exilicauda.*
C. carinatus; Tityus carinatus C.L. Koch, 1845= *C. margaritatus.*
C. congerer; Tityus congerer C.L. Koch, 1845= *C. gracilis.*
C. degeeri; Scorpio (Atreus) degeeri Gervais, 1844= *C. gracilis.*
C. denticulatus; Tityus denticulatus C.L. Koch, 1845=? *C. gracilis.*
C. ducalis; Tityus ducalis C.L. Koch, 1845= *C. margaritatus.*
C. edwardsi; Scorpio (Atreus) edwardsi Gervais, 1844= *C. margaritatus.*
C. gambiensis; Centrurus gambiensis Karsch, 1879= *C. margaritatus.*
C. gertschi; Centruroides gertschi Stahnke, 1940= *C. sculpturatus.*
C. granosus; Centrurus granosus Thorell, 1877= *C. margaritatus.*
C. griseus; Scorpio griseus Fabricus, 1793=? *C. testaceous.*
C. heterurus; Centrurus heterurus Karsch, 1879= *C. gracilis.*
C. macrurus; Tityus macrurus C.L. Koch, 1845= *C. margaritatus.*
C. mulatinus; Tityus mulatinus C.L. Koch, 1845= *C. gracilis.*
C. nebulosus; Tityus nebulosis C.L. Koch, 1845= *C. gracilis.*
C. nigrifrons; Scorpio (Atreus) nigrifrons Berthold, 1846 = *C. gracilis.*
C. olivaceus; Centrurus olivaceus Thorell, 1877=? *C. vittatus.*
C. republicanus; Centrurus republicanus Karsch, 1879= *C. nitidus.*
C. sayi; Scorpio (Atreus) sayi Girard, 1853= *C. gracilis.*
C. serenus; Tityus serenus C.L. Koch, 1845=? *C. testaceous.*
C. subviridus; Centruroides subviridus Franganillo, 1929= *C. gracilis.*
C. tenuis; Centrurus tenuis Thorell, 1877= *C. nitidus.*

Synonymy of Other *Centrurus* Species

C. agamemnon (C.L. Koch), Kraepelin, 1899 = *Rhopalurus agamemnon.*
C. americanus (Herbst), Peters, 1861 = *Isometrus maculatus.*
C. barythener Penther, 1913 = *Rhopalurus rochai.*
C. galbineus C.L. Koch, 1838 = *Heterometrus longimanus* (Scorpionidae).
C. hemprichii (Gervais), Kraepelin, 1891 = *Rhopalurus junceus.*
C. junceus (Herbst), Kraepelin, 1899 = *Rhopalurus junceus.*
C. koesteri Kraepelin, 1911 = *Rhopalurus testaceus.*
C. laticauda (Thorell), Kraepelin, 1891 = *Rhopalurus laticauda.*
C. phaiodactylus Wood, 1863 = *Anuroctonus phaiodacylus* (Vejovidae).
C. princeps Karsch, 1879 = *Rhopalurus princeps.*
C. stenochirus Penther, 1913 = *Rhopalurus stenochirus.*
C. trilineatus Peters, 1861 = *Buthotus trilineatus.*

Discussion

In previous taxonomic considerations of the genus *Centruroides*, color and color patterns have been weighted too heavily in the determination of species. As a result, artificial species have been created. This was illustrated by Stahnke's (1971) study of *C. gertschi* Stahnke and *C. sculpturatus* Ewing in which it was conclusively shown that *C. gertschi* was merely a color phase of *C. sculpturatus.* In a recent study of a series of litters taken from females of a mixed color pattern population (unpublished data), we observed a similar situation in *C. exilicauda* (Wood). Hoffmann's (1932) key to the species of this genus illustrates this overemphasis on color pattern. His first dichotomy, "unstriped species" vs. "striped species", thus, according to present evidence, automatically created artificial species. Present evidence (unpublished data) indicates that it is highly probable that *C. vittatus* (Say), *C. chisosarius* Gertsch and *C. pantheriensis* Stahnke are merely different color phases of the same species. Other observations of a similar nature make it appear highly probable that this condition exists throughout the genus.

A study of three litters (unpublished data) of *C. hentzi* (Banks) revealed that some females had a central hole in the pecten basal piece while others of the same litter did not. In addition, the color patterns in each litter were also variable. This suggests the *C. hentzi* and *C. keysi* Muma may be conspecific and consequently were placed together in the key.

A serious study of speciation within the genus is needed so that the species taxa may be more correctly known This is important to other disciplines interested in the genus from the standpoint of giving greater validity to their results. Since the lethal scorpions of the United States and Mexico are Centruroides an improvement in our systematics of the genus would be of considerable importance to the field of medicine.

LITERATURE CITED

Hoffmann, C.C. 1932. Los Scorpiones de Mexico. Segunda Parte; Buthidae. An. Inst. Biol. Univ. Mexico 2:244-361.

Stahnke, H.L. 1970. Scorpion nomenclature and mensuration. Entomol. News 81:297-316.

Stahnke, H.L. 1971. Some observations of the genus *Centruroides* Marx (Buthidae, Scorpionida) and *C. sculpturatus* Ewing. Entomol. News 82:281-307.

NEW NORTH AMERICAN BOMBYLIIDAE (DIPTERA) WITH NOTES ON SOME DESCRIBED SPECIES[1]

Neal L. Evenhuis[2]

ABSTRACT: Five new species of the family Bombyliidae: *Parabombylius aureus, P. loriae, Caenotus thompsonii, Bombylius anthophoroides,* and *B. breviabdominalis,* and one new subspecies, *Poecilanthrax moffitti pallidifrons,* are described. The distribution of *Bombylius mohavensis* Evenhuis is extended to include Idaho and Utah. A new synonym of *B. mohavensis, B. abdominalis* Johnson and Johnson, is listed, and the authorship of *Bombylius lassenensis* Johnson and Johnson is clarified.

DESCRIPTORS: Diptera; Bombyliidae; *Parabombylius aureus,* n. sp.; *Parabombylius loriae,* n. sp.; *Caenotus thompsonii,* n. sp.; *Bombylius anthophoroides,* n. sp.; *Bombylius breviabdominalis,* n. sp.; *Poecilanthrax moffitti pallidifrons,* n. ssp.; *Bombylius abdominalis,* n. syn.; *Bombylius lassenensis* Painter.

The following descriptions of new taxa and the notes on other species are presented here primarily to facilitate future publications on Bombyliidae and to allow the return of borrowed specimens. In addition to specimens from my own collection (NLE), material examined in this study was borrowed from the California Academy of Sciences (CAS), California State Polytechnic University, Pomona (CPU), California Department of Food and Agriculture (CDFA), and the University of California, Riverside (UCR). All primary types are deposited in the California Academy of Sciences.

Parabombylius aureus, n. sp.

Male. Length 5mm. Head black; frons with two golden tomentose stripes on midline from eyes to bases of antennae; silver patch of tomentum lateral to antennal bases; face and oral margin black pilose; occiput with bushy yellow pile; ocellar tubercle with long black hair; antennae black, segment I with long black hair, segment II with black hair shorter than length of second segment, segment III with sparse hairs on dorsal edge, style bare. Scutum and scutellum shining black, dense yellow pilose; pleura brown, bare for the most part, hypo- and pteropleura with tufts of long yellow pile, sternopleuron with small tuft of short black hair; halter brown. Wing slightly tinted with yellow-brown basally, color extending to alula; alular fringe yellow pilose; rest of wing hyaline. Legs black; coxae and bases of femora black pilose; long black spines on venter of femora and tibiae; shorter spines on venter of tarsi. Abdomen shining black, yellow pilose; segments II and III with black pile laterally; yellow tomentose spots middorsally on segments III-V; apex of abdomen with mixed yellow and black hair. Genitalia not dissected.

Female. Unknown.

Holotype male from 65km. S. Tuxtla Gutierrez, Chiapas, Mexico, XI-12-1974 (D.E. and J.A. Breedlove) (CAS).

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This species is closest in appearance to *Parabombylius loriae,* n. sp. and is separated from it by the yellow pile on thorax and abdomen, the conspicuous stripes of golden tomentum on the frons, and the hyaline wings.

Parabombylius loriae, n. sp.

Male. Length 7mm. Head black, black pilose; gula with long thin grey to brown hair; occiput grey-black, orange pilose above, black below; antennae black, segment I long black pilose, segment II with black hair shorter than length of second segment, segment III bare except for sparse black hairs on dorsal edge; style segment I black, bare, remaining segments brown. Scutum and scutellum black, orange-yellow pilose anteriorly, black pilose dorsally and posteriorly; small spot of orange tomentum middorsally on scutum anterior to scutellum; scutellum with mixed black and orange sparse hair; pleura brown, sparse black pile on hypo- ptero-, and sternopleura; halter blackish-brown. Wing tinted brown basally, infuscation extending along entire length of R_1; alula tinted brown, fringed with yellow pile; axillary cell and rest of wing faint smoky brown. Legs black basally, brown apically; coxae black pilose; femora black pilose ventrally, bare dorsally; tibiae and tarsi with black spines. Abdomen black; black pilose dorsally and laterally on segments I-IV; segments V-VII whity pilose laterally, black dorsally; apex of abdomen with few long black hairs; venter sparse black pilose on all segments. Genitalia with basistylus linear-ovate; dististylus short, broad, tapering to apex; tip of aedeagus reflexed downward slightly; epiphallus curved upward smoothly; epandrium subquadrate with slight anterior and posterior processes.

Female. Hardly distinguishable from male except for the following: Orange tomentum above antennal bases; black pile on head restricted to oral margin and ocellar tubercle; scutum and scutellum with mat of orange tomentum; abdominal segment I with small tufts of yellow hair lateral to scutellum.

Holotype male, allotype female from Lagunas de Montebello Nat'l. Park, Chiapas, Mexico, X-19-1974 (D.E. and J.A. Breedlove) (CAS).

Paratypes. MEXICO. Chiapas. 2♂, 3♀ collected with the types: 1♀ Rio Cintalpa, X-5-1972 (D.E. Breedlove) (CAS).

In Painter's (1926) key to species, *Parabombylius loriae* keys to *P. dolorosus* (Will.) but is separated easily by the absence of white stripes on the thorax and absence of white scales on the abdomen. The thoracic pile of *dolorosus* is black whereas *loriae* has orange and black pile intermixed.

Caenotus thompsonii, n. sp.

Male. Head black; short black pile on frons; oral margin bare; gula grey, dense white pilose; occiput with black hair below, yellow above; ocellar tubercle with black hair; black bristles on upper occiput behind eye margin; antennae black, segments I and II with short black hair, segment III bare; style black, bare. Dorsum of thorax brown with scattered gold tomentum overlaid by sparse black hair; scutellum darker brown, bordered posteriorly by intermixed yellow and black hair; pleura grey, white pilose; halter stem brown, knob grey-black. Wing tinted light yellow at extreme base; alula fringed with white pile; rest of wing hyaline with five posterior cells. Legs black; white pile and scales on coxae and femora; knees brown scaled; tibiae and tarsi bare except for black spines. Abdomen black; appressed white pile on all segments; apex of abdomen brown with white hair. Genitalia with basistylus subovate; dististylus short, broad, bluntly rounded at apex; tip of aedeagus extremely recurved ventrally; neck of epiphallus thin, straight to tip of aedeagus; epandrium subtriangular; cerci large.

Female. Unknown.

Holotype male and two **paratype** males from San Dimas Exp. Forest, L.A. Co., California, V-24-1976 (D. Force) (CPU).

These species keys to *Caenotus inornatus* Cole in Melander's (1950) key and can be separated by the black legs, black-brown genitalia, and by its distribution.

Poecilanthrax moffitti pallidifrons, n. subsp.

Male. Frons and face pale yellow, short yellow pilose, sparse black hair above antennal bases; vertex black, black pilose; tip or oral margin with yellow hair; antennal segments I and II orange, segment I with black hair dorsally, yellow hair elsewhere, segment II with black hair, segment III black, bare; occiput black with short pale yellow to white tomentum. Scutum and humeral callus black, yellow to yellow-orange pile overlaying short yellow tomentum on notum; pleura pale grey, pale yellow to white pilose on lower pleura, upper pleura yellow to yellow-orange pilose; halter stem orange-yellow, knob white; scutellum red, yellow tomentum and bristles apically, black tomentum basally. Wing tinted dark brown except as following: vein bordering fourth posterior and discal cells, spot in second basal, marginal, apical portion of first submarginal, all of second submarginal, middle of second, third, and fourth posterior, and apical one-half of dical cells; second basal cell tan; axillary cell tinted dark brown; alula fringed with orange hair. Fore coxa orange, grey ventrally; mid and hind coxae orange, all white to pale yellow pilose; femora orange, yellow scales and pile basally, black scales apically; fore tibia orange, black at apex; mid and hind tibiae orange; tarsi orange. Abdomen dark grey, yellow tomentose; lateral red spots on segments II and III; medially expanded black tomentose spot on segment II not quite reaching lateral margin, reduced on succeeding segments, absent on segments VI and VII; yellow pile posteriorly and laterally on all segments, a few black hairs posteriorly on segments IV-VII; apex of abdomen yellow pilose; venter of abdomen red, grey on posterior portion of all segments except II and III, pile yellow to white. Genitalia with aedeagus relatively small, short, and curving from base to apex; tip in dorsal view broadly rounded; aedeagus from tip to gonopore angle slightly more than twice the length from gonopore angle to gonopore tip.

Female. Hardly distinguishable from the male except for the lighter infuscations in wings, axillary cell lightly infuscated, if at all; body size generally larger than male; abdominal tomentose spots more reduced, absent on segments V-VII.

Holotype male from 8mi. W. Simmler, San Luis Obispo Co., California, IX-7-1974 (N. Evenhuis) (NLE); **allotype** female from Tehachapi Summit, Kern Co., California, X-5-1970 (T. Plichta) (NLE).

Paratypes: California, Kern Co.: 1♀, 1mi. W. Tehachapi, Hwy. 58, X-5-1970 (T. Plichta) (NLE). San Bernardino Co.: 5♂, Cajon Jct., X-10-57, IX-20-58 (J.C. Hall, R.H. Painter) (UCR); 1♂, Lone Pine Cyn., IX-20-58 (J.C. Hall) (UCR). San Luis Obispo Co.: 1♀, 8mi. W. Simmler, IX-7-74 (N. Evenhuis) (NLE); 1♂, 14mi. W. Simmler, X-20-71 (N. Evenhuis) (NLE); 1♂, 15mi. W. Simmler, IX-8-73 (N. Evenhuis) (NLE).

This subspecies can be separated from *moffiti moffiti* Painter and Hall by the orange fore coxae, grey pleura, and the absence of black hair at the tip of the oral margin.

Bombylius anthophoroides, n. sp.

Male. Frons brown, white pilose; tufts of silver tomentum lateral to antennal bases; gena, oral margin light tan, while pilose; gula white, white pilose; ocellar tubercle grey with brown and black hair intermixed; occiput white, white pilose; antennal segments black, segments I and II with white hair and scales, segment III linear lanceolate, white scales basally; style brown, bare. Scutum and scutellum grey-brown, pale yellow to white pilose; pleural stripe absent; macrochaetae white to yellow; halter yellow. Wing infuscated brown basally, color extends to apex of costal, second basal, and anal cells; alula grey with fringe of white pile. Legs orange; coxae white pilose; femora with white hair and scales basally becoming sparse apically; tibiae and tarsi with spines; claws brown. Abdominal ground color and pile of tergites I-III concolorous with thorax; tergites IV-VII dense white tomentose overlaid by dense white pile; sternites brown, dense pale yellow to white pilose; black hair on posterior margins of all sternites. Genitalia with basistylus linear-ovate, weakly pronounced anterior claw-like process; dististylus long, thin, toothed near apical hook; tip of aedeagus extremely long, thin, tapering sharply to almost a point; epiphallus with prominant dorsal bulb-like process; epandrium subquadrate, anterior process moderately pronounced, posterior process spatulate.

Female. Similar to the male except as follows: ocellar tubercle black, black hair; vertex and frons black, white pilose; occiput with pale yellow pile; prescutum with one middorsal and two lateral spots of brown hair; pleura darker grey than male; legs orange-yellow; halter stem brown, knob yellow; wing hyaline; abdomen dull grey-black; segment I pale yellow pilose; tergites II-VII with dorsal crossbands of white pile, white recumbent tomentum, and black bristles (in that order); venter white pilose on segments I and II; segments III-VII mixed white, black and gold pilose.

Holotype male, allotype female from 14mi. W. Simmler, San Luis Obispo Co., California X-20-71 (N. Evenhuis) (NLE).

Paratypes: California: 10♂♀, topotypic, collected with the types. Contra Costa Co.: 1♀, nr. Oakley, IX-26-37 (E.C. VanDyke) (CAS). Fresno Co.: 6♂♀, 5 mi. S. J1 on Int. 5, IX-29-73 (N. Evenhuis) (NLE). Los Angeles Co.: 1♂, Agoura, X-4-75 (N. Evenhuis) (NLE); 1♂, Diamond Bar Hills, IX-12-74 (N. Evenhuis) (NLE). Santa Barbara Co.: 1♂, 2mi. S. Solvang, IX-10-74 (N. Evenhuis) (NLE). Santa Clara Co.: 1♀, Morgan Hill, IX-28-58 (K.W. Brown) (UCR). Ventura Co.: 5♂, 2 mi. N. Gorman, IX-11-74, IX-14-76 (N. Evenhuis, L.L. Lepere) (NLE).

Numerous specimens were examined of this species from the following counties in California: Contra Costa, Fresno, Kern, Los Angeles, Merced, Riverside, San Joaquin, San Luis Obispo, Santa Barbara, Santa Clara, Stanislaus, and Ventura. All specimens collected were found either feeding or near the labiate plant *Trichostema lanceolatum* whose distribution coincides with that of *B. anthophoroides.*

Bombylius anthophoroides is closest in appearance to *B. montanus* Johnson and Johnson and can be separated from that species by the scales of the third antennal segment, the spatulate process of the epandrium, and the temporal distribution; *anthophoroides* occurring in the months of September and October as opposed to the early summer months for *montanus.*

Bombylius breviabdominalis, n. sp.

Male. Frons light brown, black hair near ocellar tubercle, tufts of silver tomentum lateral to antennal bases; face and gena light brown, black pilose; oral margin white pilose; occiput and gula light tan, white tomentose; ocellar tubercle grey with black hair; antennal segments I and II brown, brown and black hair intermixed, segment III black, bare, linear-lanceolate; style with segment I black, segment II brown. Scutum and scutellum brown-green, white pilose, patch of brown to black hair middorsally on mesoscutum directly behind head; few brown hairs intermixed with white hair in front of wing base and on humeral callus; post-alar callus black, black pilose; pleura brown, pale yellow pilose; scutellum with short yellow hair and longer sparse black hair; halter stem brown, knob black to tan. Wing tinted brown basally, color extending along entire length of R_1 and barely reaching anterior crossvein; spots on anterior and posterior crossveins, in middle of first posterior, distal end of anal, bases of second and third posterior cells, basally on R_4, and distally on R_{2+3}. Legs yellow-orange, fore and mid coxae white pilose, hind coxa white and golden pilose; femora white pilose basally, white and golden scales along entire length; tibiae and tarsi with spines; claws black. Abdomen dull grey-black, silvery-white hair on all segments; lateral tufts of intermixed black, brown, and golden hair on segments I, III, and IV; white sinuous hair on succeeding segments. Genitalia with basistylus sublanceolate, constricted on dorsal edge; dististylus tapering apically, apical beak-like process reflexed downward; tip of aedeagus prominantly projecting dorsally; neck of epiphallus straight, twice as long as aedeagus tip; epandrium subquadrate, posterior process squared, anterior process pointed.

Female. Similar to male with the following exceptions: abdominal dorsum with golden tomentum; black hair on posterior margins of segments II-VII; white hair restricted to lateral margins of segments IV-VII, distributed sparsely on dorsum, when present.

Holotype male, allotype female from 1mi. W. Crestline, San Bernardino Co., California, V-26-66 (J.C. Hall) (UCR).

Paratypes: California: 3♂♀, topotypic, collected wih the types (J.C. Hall). Kern Co.: 1♀, (no other label) (UCR). Los Angeles Co.: 1♂, Lodi Cyn., 2.2mi, NE San Dimas, V-28-75 (N. Evenhuis) (NLE). Riverside Co.: 1♀, The Gavilan, V-17-51 (R.C. Bechtel) (UCR); 1♂, Deep Cyn., V-22-73 (A. Tabet) (UCR); 5♂♀, Riverside, IV-26-26, V-11-69, V-19-69, V-25-69, VI-17-69, VII-5-69 (J.C. Hall, F. Andrews, P.H. Timberlake, W.A. Hunt) (UCR). San Bernardino Co.: 1♂, Angeles Oaks, VI-17-74 (J.C. and E.M. Hall) (UCR); 2♂♀, 1mi. N. Cajon Jct., VI-24-58 (J.C. Hall) (UCR). San Diego Co.: 1♂, La Mesa, IV-16-53 (F.X. Williams) (UCR); 1♀, 6mi. NW Mt. Laguna, VI-28-62 (J.F. Lawrence) (UCR); 1♂, Warner Hot Springs, VI-12-58 (H.R. Moffitt) (UCR). Ventura Co.: 3♂♀, Ojai, VI-1-62, IV-26-69 (W.E. Simonds, M. Wasbauer) (CDFA).

This species is separated from its closest apparent relative, *B. albicapillus diegoensis* Painter, both geographically and chronologically, as well as morphologically. *B. breviabdominalis* occurs at relatively high altitudes during the summer months whereas *diegoensis* occurs at lower elevations during the spring months. Males of *breviabdominalis* can be separated from *diegoensis* by the presence of dense white hair on abdominal tergites IV-VII, black hair wanting. Females can be separated by the entirely orange femora in *breviabdominalis*; in *diegoensis* the femora are black basally and orange apically.

Bombylius mohavensis Evenhuis

Bombylius mohavensis Evenhuis, 1975: 472.
Bombylius abdominalis Johnson and Johnson 1975: 414, new synonym.

Since the original description new material has been examined. This new material extends its present distribution from the Mojave Desert into Utah and Idaho. Material examined: numerous specimens from the following states and counties: California (Kern and San Bernardino), Idaho (Oneida), Utah (Salt Lake).

Bombylius lassenensis Painter

Bombylius lassenensis Painter in Painter and Painter, 1965: 409.
Bombylius lassenensis Johnson and Johnson, 1975: 416.
Bombylius pallescens Johnson and Maughan, 1953: 20, (preoccupied, Hesse, 1938).

Painter and Painter, in the Catalog of the Diptera of America North of Mexico (p. 409) changed *Bombylius pallescens* Johnson and Maughan (preoccupied, Hesse, 1938) to *Bombylius lassenensis.* Painter and Painter credited the name change to Johnson and Johnson, but these latter authors did not publish the change until 1975. As a consequence, *lassenensis* is to be credited to R.H. Painter (cf.: Painter and Painter, 1965:408) and not Johnson and Johnson as cited.

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HERETOFORE UNDESCRIBED FEMALES OF TWO NEARCTIC SPECIES OF *PARYDRA* (DIPTERA: EPHYDRIDAE)[1] [2]

Philip J. Clausen[3]

ABSTRACT: The females of *Parydra (Chaetoapnaea) pedalis* Clausen and *Parydra (Chaetoapnaea) spinosa* Clausen are described, illustrated, allotypes designated, and modifications to an existing key are provided. Both species were previously known only from the males. A slight modification to the description of the males of *P. spinosa* is included.

DESCRIPTORS: Diptera, Ephydridae, *Parydra, pedalis* and *spinosa*, females described, allotypes designated.

At the completion of our revision of the nearctic species of the tribe Parydrini (Clausen and Cook, 1971), four new species of *Parydra* were described only from males as the females were then unknown. Of these four species, I now have seen females of two *(Parydra pedalis* and *spinosa),* and I offer this paper as a supplement to the above revision.

Parydra (Chaetoapnaea) pedalis Clausen

Diagnosis: As in Clausen and Cook, 1971, except female abdomen with sternite 5 subtriangular; sternites 5 through 8 subequal in width to other sternites; sternite 8 consisting only of a large median sclerite without a deep posterior notch, blunt to convex anteriorly, much smaller than sternite 7; ventral receptacle slender with rounded cap, internal fold not constricted near top, cap about 2/3 length of receptacle.

Description: MALE. – As in Clausen and Cook, 1971.

FEMALE. – Total body length 3.06 to 3.30 mm; shining black with coppery, golden, and greyish pruinosity. **Head** shining black with coppery pruinosity except where mentioned; length 0.75 to 0.85 mm; ocellar triangle raised; 3 round ocelli; ocellar setae large, divergent; interocellar and postocellar setae small, divergent; 2 large pairs of orbital setae; eyes red, oval; vertex with coppery pruinosity above, becoming golden below; 1 large pair of convergent, inner vertical setae; 1 large pair of divergent, exterior vertical

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setae; postorbitals and occipitals small; gena black with golden pruinosity. Face shining black with golden pruinosity, straight to concave when viewed in profile; facial depressions long, from antennal base to first parafacial seta; 1 large pair and 5 smaller pairs of parafacial setae. Clypeus with coppery pruinosity; mouthparts with greyish pruinosity. Antennae dark, brown to black with coppery pruinosity; arista brown, slightly plumose.

Thorax shining black with golden to coppery pruinosity; greyish spot at intrascutal suture; faint greyish stripes laterally along dorsocentral setal rows, between acrostichal and dorsocentral setal rows, and medially between acrostichal setal rows; stripes all more apparent anteriorly and posteriorly; scutum length 0.92 to 1.05 mm; many long acrostichal setae; many long dorsocentral setae with 2 pairs being larger than others, 1 pair at intracentral suture and 1 pair farther posterior; 1 long pair of prescutellar setae; humeral and posthumeral setae long and fine; presuturals long and fine, 1 larger pair; 2 large pairs of notopleurals, posterior pair larger; 1 large pair of posterior intraalar setae; pleura shining black with golden pruinosity above, becoming greyish below; 1 large pair of mesopleural setae; sternum with greyish pruinosity; katepisternal spine absent. Scutellum shining black with golden pruinosity, length 0.34 to 0.41 mm, apical process small and pointed, apical tubercules small, lateral tubercules absent, apical and lateral scutellar setae large. **Legs** all black or dark brown except reddish tarsi, covered with greyish pruinosity; prothoracic tibiae with long yellow setae at apex, mesothoracic tibiae each with a spur and 3 black anterior setae at apex; apex of metathoracic tibiae with 3 or 4 black anterior setae and a yellow posterior comb. **Wing** clear, slightly darkened around crossveins; no white spots; R_{2+3} sometimes with appendage near apex; veins dark brown to black; length from humeral crossvein 2.58 to 2.99 mm; width 1.16 to 1.26 mm; distance from h to R_1 0.75 to 0.88 mm; R_1 to R_{2+3} 1.16 to 1.33 mm; R_{2+3} to R_{4+5} 0.71 to 0.82 mm; R_{4+5} to M_{1+2} 0.37 to 0.44 mm; length R_{4+5} 1.53 to 1.84 mm; length M_{1+2} 0.82 to 0.92 mm; costal section from R_1 to R_{2+3} 1.5 to 1.7 times distance from R_{2+3} to R_{4+5}; halteres light brown to yellowish.

Abdomen as in Figure 1. Ventral receptacle as in Figure 2.

Distribution. Northwestern U.S. and southwestern Canada.

Specimens examined. 12 specimens (7 ♂♂ and 5 ♀♀). This species was originally described from the holotype ♂ and 3♂ paratypes from British Columbia and the state of Washington (see original description for exact localities). I have now examined 3 ♂♂ and 5 ♀♀ from California, Siskiyou County, Mount Shasta, McBride Spring, 7 km NE Mount Shasta City, 28-VII-1974, Paul H. Arnaud, Jr., and one female of this series I am herein designating as the allotype. The allotype ♀, 2 ♂♂ and 3 ♀♀ are to be deposited in the collection of the Califoria Academy of Sciences, and the remaining ♂ and ♀ are to be retained in the author's collection.

Parydra (Chaetoapnaea) spinosa Clausen

Diagnosis. As in Clausen and Cook, 1971 except female abdomen with sternites 5 through 8 much wider than other sternites; sternite 8 consisting only of a large median sclerite without a deep posterior notch, blunt to convex anteriorly, subequal to smaller than 7, smaller than 6.

Description. MALE. – As in Clausen and Cook, 1971 except wings with cells dimpled, wings appear wrinkled.

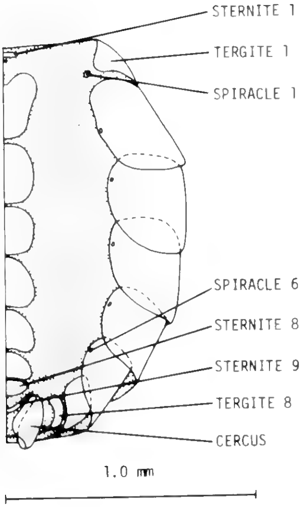
FEMALE. Total body length 3.33 to 3.37 mm; shining black with coppery, golden and greyish pruinosity. **Head** shining black with coppery pruinosity except where specified; length 0.82 to 0.85 mm; ocellar triangle raised; 3 round ocelli; ocellar setae large, divergent; interocellar and postocellar setae small, divergent; 2 large pairs of orbital setae; eyes red, oval; vertex with coppery pruinosity above, becoming golden or greyish below; 1 large pair of convergent, inner vertical setae; 1 large pair of divergent, exterior vertical setae; postorbitals and occipitals small; gena black with golden pruinosity. Face shining black with coppery pruinosity, straight to concave when viewed in profile; facial depressions long, from antennal base to first parafacial seta, covered with greyish pruinosity; 1 large pair and 4 or 5 smaller pairs of parafacial setae. Clypeus with coppery or golden pruinosity; mouthparts with greyish pruinosity. Antennae dark, brown to black with greyish pruinosity on segments 1 and 2, coppery on segment 3; arista black, slightly plumose.

Thorax shining black with coppery pruinosity; greyish spot at intrascutal suture; greyish stripes laterally along dorsocentral setal rows, and between acrostichal and dorsocentral setal rows; scutum length 0.92 mm; many long acrostichal setae; many long dorsocentral setae with 1 longer pair at intrascutal suture; 1 long pair of prescutellar setae; humeral and posthumeral setae long and fine; presuturals long and fine, 1 larger pair; 2 large pairs of notopleurals, posterior pair larger; 1 large pair of posterior intraalar setae; pleura shining black with coppery or golden pruinosity above, becoming greyish below; 1 large pair of mesopleural setae; sternum with greyish pruinosity; katepisternal spine absent. Scutellum shining black with coppery pruinosity, except with white to greyish central spot; length 0.51 mm; apical process rather large and rounded; apical and lateral tubercules absent; apical and lateral scutellar setae large. **Legs** with coxae and all but apex of femurs black; trochanters, apex of femurs, tibiae, and tarsi reddish; covered with greyish pruinosity; prothoracic tibiae with long yellow setae at apex; mesothoracic tibiae each with a spur and 3 black anterior setae at apex; matathoracic tibiae with an anterior cluster of black setae and a yellow posterior comb at apex. **Wing** clouded, darkened areas at crossveins bounded by white spots, appearing purplish; one such spot posterior to medial crossvein; R_{2+3} with appendage near apex; veins brown; cells dimpled, wings appear wrinkled; length from humeral crossvein 2.45 to 2.52 mm; width 1.12 to 1.16 mm; distance from h to R_1 0.71 to 0.75 mm; R_1 to R_{2+3} 1.12 to 1.16 mm; R_{2+3} to R_{4+5} 0.65 to 0.68 mm; R_{4+5} to M_{1+2} 0.34 mm; length of R_{4+5} 1.43 to 1.60 mm; length of M_{1+2} 0.65 to 0.68 mm; costal section from R_1 to R_{2+3} 1.7 times distance from R_{2+3} to R_{4+5}; halteres yellow.

Abdomen as in Figure 3. Ventral receptacle as in Figure 4.

Distribution. Far western U.S.

Specimens examined. 9 specimens (7 ♂♂ and 2 ♀♀). This species was described from the holotype ♂ and 4 ♂ paratypes from California, Washington, and Idaho (exact localities in original description). I have since examined 1 ♂ from Oregon caves, Josephine County, Oregon, 27 June 1972, Wayne N. Mathis; and 1 ♂ and 2 ♀♀ from Mill Valley, Marin County, California 17. VIII. 1967, P.H. Arnaud, Jr. I am herein designating 1 ♀ as the allotype which will be deposited in the collection of the California Academy of Sciences, and the remaining ♂ and ♀ from Marin County, California are to be retained in the author's collection.



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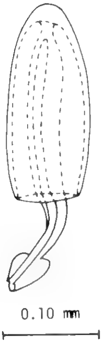

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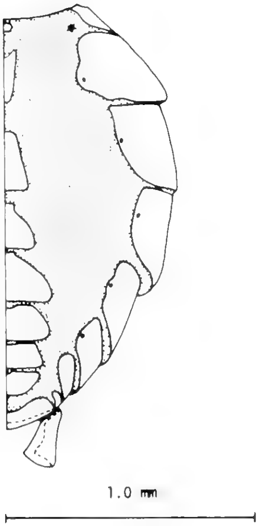

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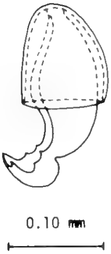

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Figures 1 and 3 – Female abdomens – Fig. 1 – *Parydra pedalis;* Fig. 3 – *Parydra spinosa.*

Figures 2 and 4 – Ventral receptacles – Fig. 2 – *Parydra pedalis;* Fig. 4 – *Parydra spinosa.*

Key

The females of both species will key to couplet 50 in Clausen and Cook, 1971. The remainder of the key, with previous figure references omitted, should then read as follows:

50. Sternites 5 through 8, or 6 through 8 much wider than other sternites 51

Sternites 5 through 8 subequal in width to other sternites 52

51. Sternites 5 through 8 much wider than other sternites (Fig. 3), ventral receptacle as in Fig. 4 . . . . *spinosa* Clausen

Sternites 6 through 8 much wider than other sternites. . . . . . . *succurva* Clausen

52. Costal section of wing from R_1 to R_{2+3} 1.7 or less times distance from R_{2+3} to R_{4+5} 53

Costal section of wing from R_1 to R_{2+3} 1.9 or more times distance from R_{2+3} to R_{4+5} . . . . *hamata* Clausen

53. Sternite 5 round to oval, ventral receptacle usually with top of cap narrow and appearing somewhat pointed, R_{2+3} usually appendiculate near tip . . . . *appendiculata* Loew

Sternite 5 not round or oval, subtriangular, with or without an anterior notch, or round with an anterior projection; ventral receptacle with top of cap rounded, not narrow and appearing somewhat pointed; R_{2+3} with or without appendiculate tip 54

54. Ventral receptacle with internal fold of cap not constricted near top, cap about 2/3 length of receptacle. 55

Ventral receptacle with internal fold of cap constricted near top, cap about 3/4 length of receptacle 56

55. Ventral receptacle broad, sternites 7 and 8 subequal in size . . . . . *borealis* Clausen

Ventral receptacle slender (Fig. 2), sternite 8 much smaller than 7 (Fig. 1) . . . . *pedalis* Clausen

56. Metatibiae each with one very large spine on anteroventral apex which extends far beyond apex of tibia . . . . *parasocia* Clausen

Metatibiae each with several small spines on anteroventral apex which extend at most only slightly beyond apex of tibia . . . . *socia* (Cresson)

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For providing the specimens which made this paper possible, I would like to thank Dr. Paul H. Arnaud, Jr. of the California Academy of Sciences.

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A PRELIMINARY LIST OF THE COLLEMBOLA OF KENTUCKY[1] [2]

Jack S. Lesshafft, Jr.[3]

ABSTRACT: This first published list of the Collembola of Kentucky records 89 species representing 34 genera. Seventy-two species are reported from the state for the first time. Sources of records are: (1) specimens collected from various parts of the state by the author; (2) specimens from the University of Louisville; and (3) specimens from the University of Kentucky. County records are included, and cave specimens are noted.

DESCRIPTORS: Collembola, Kentucky, springtails, taxonomic lists.

Collembola have received little attention in the United States, especially in the Appalachian region. Christiansen (1960a, 1960b, 1964) has reported extensively on Kentucky cave Collembola of the genera *Sinella, Pseudosinella,* and *Tomocerus.* Christiansen (1958) also lists several surface springtails of the family Entomobryidae; other than these species, little is known of the epigeic springtails of Kentucky.

Specimens were collected by the author from various areas around the state from February 1975 to August 1976, by means of hand collecting, Berlese funnel, and a "small cannister apparatus" (Macfayden, 1961). In addition, the collections of the Universities of Louisville and Kentucky were identified.

One area of major interest, in regards to the collembolan fauna, was Bernheim Forest (Bullitt Co.), where I worked on an insect survey team conducting a study of forest collembolan populations.

The list of species which follows is arranged according to Gisin (1960). Species previously recorded from the state are preceded by Δ and the reference is given. Species known to occur in Bernheim Forest are preceded by *. County records are given and cave specimens are identified as such.

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ARTHROPLEONA
PODUROIDEA
PODURIDAE
PODURINAE

Podura aquatica L. – Jefferson, Oldham

HYPOGASTURINAE

Hypogastrura armata (Nicolet) – Fayette
**Hypogastrura denticulata* (Bagnall) – Bullitt, Jefferson
Hypogastrura macrospinata Maynard – Morgan
Hypogastrura matura (Folsom) – Wolfe
Hypogastrura tullbergi Schaffer – Fayette, Jefferson, Wolfe

NEANURINAE

**Odontella* sp. – Bullitt
**Pseudachorutes rugatus* Wray – Bullitt, Shelby
**Anurida pygmaea* (Borner) – Bullitt
**Neanura barberi* (Handshin) – Bullitt
Neanura muscorum (Templeton) – Carroll, Menifee
**Neanura* sp. – Bullitt
Micranurida sp. – Morgan

ONYCHIURIDAE

**Onychiurus fimetarius* L. – Anderson, Bullitt, Jefferson
Onychiurus pseudarmatus Folsom – Bullitt, Morgan
**Onychiurus ramosus* Folsom – Bullitt
**Onychiurus similis* Folsom – Bullitt, Jefferson, Owen, Powell, Shelby
**Onychiurus subtenuis* Folsom – Anderson, Bullitt, Fayette, Henry, Jefferson, Menifee, Owen, Shelby, Spencer, Wolfe
**Tullbergia* sp. (in desc. Christiansen-Bellinger) – Bullitt, Morgan

ENTOMOBRYOIDEA
ISOTOMIDAE
ISOTOMINAE

**Tetracanthella ethelae* Wray – Anderson, Bullitt, Jefferson
**Folsomia nivalis* (Packard) – Bullitt, Jefferson
**Folsomia duodecimoculata* Ford – Bullitt, Shelby
**Folsomia macroseta* Ford – Bullitt
Folsomia candida Willem – Jefferson
**Folsomia prima* Mills – Bullitt
**Folsomia stella* Christiansen – Bullitt, Owen
**Isotoma tarspinata* MacGillvray – Bullitt, Carter, Jefferson
Isotoma subaequalis Folsom – Jefferson, Oldham
**Isotoma carpenteri* Borner – Bullitt, Menifee, Morgan, Wolfe
**Isotoma japonica* Yossi – Bullitt, Jefferson
Isotoma sp. (in desc. Christiansen-Bellinger) – Carter (cave)
Isotoma viridis Bourlet – Carroll, Jefferson, Oldham, Shelby
**Isotomiella minor* (Schaffer) – Bullitt
Degamea tenuis (Folsom) – Fayette
Isotomurus sp. (in desc. Christiansen-Bellinger) – Jefferson
Isotomurus palustris (Muller) – Jefferson

ENTOMOBRYIDAE
TOMECERINAE

Δ **Tomocerus bidentatus* Folsom – Adair (cave), Allen (cave), Barren (cave), Carter (cave), Edmonson (cave), Hart (cave), Powell (cave), Polaski (cave), Warren (cave), (Christiansen, 1964).
Bullitt, Carter, Jefferson, Menifee, Metcalfe (cave), Morgan, Powell, Russell, Shelby, Spencer, Wolfe

Tomocerus celsus Christiansen – Jefferson, Wolfe

Δ*Tomocerus dubius* Christiansen – Edmonson (cave), Johnson (cave), Barren (cave), (Christiansen, 1964).
Menifee

**Tomocerus flavescens* (Tullberg) – Bullitt, Carter, Carroll, Fayette, Jefferson, Lawrence, Menifee, Oldham, Powell, Shelby, Wolfe

Δ*Tomocerus elongatus* Maynard – Carter (cave), Edmonson (cave), Elliot (cave), Hardin (cave), Hart (cave), (Christiansen, 1964).
Jefferson, Oldham, Owen, Powell, Russell, Wolfe

Δ*Tomocerus lamelliferus* (Mills) - Edmonson (cave), (Christiansen, 1964)

Δ*Tomocerus missus* (Mills) – Livingston (cave), (Christiansen, 1964)

Tomocerus vulgaris Tullberg – Oldham, Powell

ENTOMOBRYINAE

Entomobrya assuta Folsom – Jefferson

Entomobrya atrocincta Schott – Jefferson

Entomobrya bicolor Guthrie – Jefferson

Entomobrya decemfasciata (Packard) – Carter, Jefferson

**Entomobrya multifasciata* Tullberg – Bullitt, Jefferson, Oldham

Δ **Entomobrya nivalis* L. – Crailhope (Christiansen, 1958). Bullitt, Jefferson, Oldham

Δ*Entomobrya quadrilineata* Bueker – Crailhope (Christiansen, 1958).

Entomobrya sauteri (Borner) – Jefferson

Entomobryoides purpurascens (Packard) – Anderson, Shelby, Fayette

Entomobryoides dissimilis (Moniez) – Powell, Spencer

**Pseudosinella alba* (Packard) – Bullitt

Δ*Pseudosinella argentea* Folsom – Kentucky (cave), (Christiansen, 1960b)

Pseudosinella cavernorum (Moniez) – Jefferson

Pseudosinella collina Wray – Menifee

Δ*Pseudosinella boneti* Christiansen – Pulaski (cave), (Christiansen, 1960b)

Δ*Pseudosinella doudecimpunctata* Denis – Jackson (cave), (Christiansen, 1960b)

Pseudosinella espana Christiansen – Metcalfe (cave)

Δ*Pseudosinella hirsuta* (Delamare) – South-central Kentucky (cave), (Christiansen, 1960b)

Pseudosinella petterseni Borner – Wolfe, Metcalfe (cave)

Δ **Pseudosinella sexoculata* Schott – Fayette (cave), (Christiansen, 1960b) Bullitt, Carter, Jefferson, Oldham

**Pseudosinella violenta* (Folsom) – Anderson, Bullitt, Carroll, Jefferson, Lawrence, Meade, Owen

Δ*Sinella avita* Christiansen – Crittenden (cave), Livingston (cave) (Christiansen, 1960a)

Δ **Sinella barri* Christiansen – Kentucky (cave) (Christiansen, 1960a)
Bullitt

Δ*Sinella cavernorum* (Packard) - Kentucky (cave) (Christiansen, 1960a)

Δ*Sinella krekeleri* Christiansen – Jackson (cave) (Christiansen, 1960a)

Δ*Sinella basidens* Bonet – Fayette (cave) (Christiansen, 1960a)

Lepidocyrtus alleganyensis Maynard – Oldham

**Lepidocyrtus cinereus* Folsom – Bullitt
**Lepidocyrtus cyaneus* Tullberg – Bullitt, Carter, Jefferson, Morgan, Powell
**Lepidocyrtus helenae* Snider – Anderson, Bullitt, Jefferson, Morgan, Oldham
Lepidocyrtus unifasciatus James – Menifee, Powell
Lepidocyrtus violaceus Fourcroy – Jefferson
Orchesella ainsliei Folson – Jefferson
Orchesella cincta (L.) – Powell, Wolfe
**Orchesella sp.* – Bullitt, Fayette

SYMPHYPLEONA
SMINTHURIDAE
NEELINAE

**Megalothorax minimus* Willem – Bullit

SMINTHURIDINAE

**Sminthurides* spp.
**Sminthurinus* spp.
Katiannina macgillivrayi (Banks) – Menifee

SMINTHURINAE

**Sminthurus* spp.
Neosminthurus spp.
Neosminthurus clavatus Mills – Menifee, Oldham
Pararrhopalites spp.

DICYRTOMINAE

Dicyrtoma ochreoa Wray – Jefferson, Powell
Dicyrtoma purpurata Maynard – Carter, Morgan, Wolfe
Dicyrtoma quadrangularis Mills – Carter
Ptenothrix marmorata Packard – Jefferson, Menifee, Nelson
Ptenothrix pineolae Wray – Jefferson, Oldham
Ptenothrix unicolor Harvey – Jefferson, Nelson

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I would like to thank Dr. K. Christiansen for aiding in the identification of numerous specimens; Bernheim Forest for their help and consideration; Drs. C.W. Covell and P. Freytag of the Universities of Louisville and Kentucky for lending numerous specimens; and Mr. Doug Barnett who collected and mounted most of the Univ. of Kentucky specimens.

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PLACEMENT OF *ANISOTOMA FENDERI* HATCH (COLEOPTERA: LEIODIDAE: AGATHIDIINI)[1]

Quentin D. Wheeler[2]

ABSTRACT: *Anisotoma fenderi* Hatch is transferred to *Agathidium* **(new combination)** and the name *Agathidium hatchi* Wheeler **(new name)** is proposed to resolve resultant homonymy.

DESCRIPTORS: *Anisotoma fenderi* Hatch; *Agathidium hatchi* Wheeler; New Combination; New Name; New Synonymy; distribution.

During my revision of the genus *Anisotoma* Panzer, the unique female type of *Anisotoma fenderi* Hatch (Hatch, 1957:32) was examined, and found to belong to the genus *Agathidium* Panzer. Because the name *fenderi* is previously occupied in *Agathidium* (Hatch, 1957:36), it is necessary to propose a new name to resolve homonymy.

Agathidium hatchi Wheeler, **new name** and **new combination.**

Anisotoma fenderi Hatch, 1957:32, **new synonymy.**

Agathidium hatchi is strongly contractile, and has a large head with highly developed postocular tempora (fig. 2); both apotypic states of *Agathidium.* Structure of the antennae is, to my knowledge, unique in the genus being gradually clavate, without an abrupt club (fig. 1). While this condition is not typical of *Agathidium,* it is equally unusual for *Anisotoma* as suggested by Hatch. While *hatchi* could belong to the sub-genus *Cyphoceble* (Hlisnikovsky, 1964:13), the precise relationship to other American species is not clear. A revision of the genus, underway by the author, will hopefully settle the placement of *hatchi.*

In addition to the type from Ocean Park (Oregon) I have seen a specimen, also female, from near Newberg (Oregon) taken at black light.

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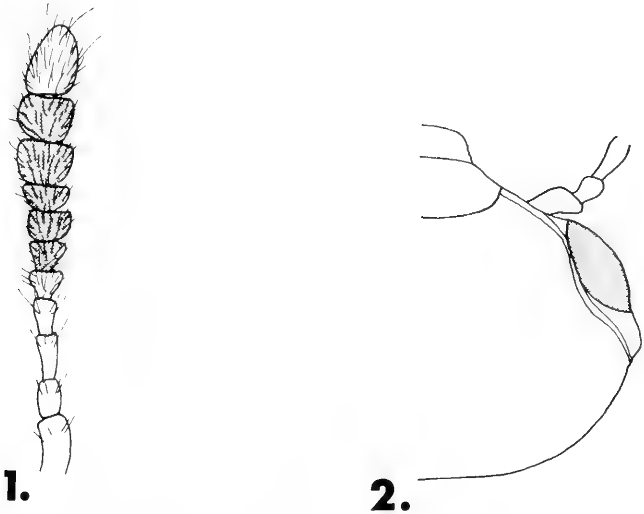

Figs. *Agathidium hatchi* Wheeler; 1.: Antenna; 2.: Head, dorsal view.

ACKNOWLEDGEMENTS

I would like to thank Dr. Sievert Rohwer (Burke Museum, University of Washington) for a loan of the type specimen; Mr. Richard L. Westcott (Oregon Department of Agriculture, Plant Division) for a loan of several Leiodidae; and Dr. Charles A. Triplehorn (Ohio State University, Department of Entomology) for his advice on the nomenclatural problems and for reading this paper prior to publication.

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PREDATION OF HACKBERRY PSYLLID GALLS BY FOX SQUIRREL[1]

Raymond W. Neck[2]

ABSTRACT: Hackberry trees have long been known to supply food in the form of fruit for fox squirrels. Observations reported herein add hackberry psyllid galls as a source of nutrition for these animals and add an additional predator which could affect the population dynamics of hackberry gall insects.

DESCRIPTORS: hackberry gall insects, *Pachypsylla celtidis-mamma*, . *Pachpsylla venusta,* fox squirrel, *Sciurus niger,* nutrition.

Fox squirrels (Sciuridae: *Sciurus niger limitus* Baird) feed on a great variety of plant materials (Martin, et al., 1951). Fruits of numerous shrubs and trees are favored, although succulent buds are a major part of their winter diet.

Fox squirrels are quite common in wooded areas of residential Austin, Travis County, Texas. Fall foods consist of fruit of pecan, various oaks and cedar elm. Spring foods appear to be largely fruit of Texas sugarberry (Ulmaceae: *Celtis laevigata* Willd.) in addition to stored foods, although insects and green shoots are also eaten. Hackberry fruit has been reported previously as a minor food for fox squirrels in Michigan (Allen, 1943).

On 25 May 1970, I observed an adult fox squirrel feeding in the upper branches of a Texas sugarberry tree. Occasionally it would drop a small branch which it had broken from the tree to facilitate feeding. Examination of these branches revealed fruit which had been partially eaten. Much of the fleshy pulp had been removed, leaving the stony seed. In addition, galls of the hackberry nipple gall psyllid, Psyllidae: *Pachypsylla celtidis- mamma* (Riley), were partially eaten. The base of the gall where it merges with normal leaf tissue remained intact.

Woodpeckers, "mice" and gray squirrels have been reported to open galls in search of gall insects (Davis, 1931, and references therein). The fox squirrel described in this article was probably simply feeding on succulent gall tissue as *P. celtidis-mamma* is a very small insect. Adults including wings are three to

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[1] Accepted for publication: November 5, 1976

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four millimeters in length (Tuthill, 1943). The amount of gall material in an individual gall is very small, but the galls are abundant (up to ten per leaf). Actually, one gall may contain nearly as much edible plant material as one fruit, because most of the gall is plant tissue with only a relatively small sinus for the gall insects (see fig. 193 in Felt, 1940).

Gray squirrels have been observed feeding on bark of water oak during a time of food shortage following Hurricane Camille (Gunter & Eleutrius, 1971). No known food shortage occurred at the time of observation of hackberry leaf galls by a fox squirrel. Significantly, this fox squirrel did not feed on galls of the hackberry petiole gall psyllid, *Pachypsylla venusta* (Osten-Sacken). Galls of this insect are comparatively large but are very hard, being woody in texture and, presumably, of inferior nutritive value.

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A MODIFIED SWEEP NET FOR QUANTITATIVE SAMPLING[1]

J.T. Regensburg[2]

ABSTRACT: A sweep net having small detachable bags is described.

DESCRIPTORS: Insect net, sweep net, quantitative sampling.

When taking a large number of samples with a sweep net additional time is usually sacrificed transferring an intact sample out of the net bag. The Ward's Natural History Establishment[3] has manufactured a "Drosophila net" which is a funnel-shaped aerial insect net designed to hold a replacable vial in the end. Although this system works well, it is restricted to smaller specimens. The use of hook and loop material enables a modified net to be constructed having small detachable bags to hold separate samples (Figs. 1, 2) with no restriction as to specimen size. Hook and loop material was originally designed for the clothing industry as a substitute for zippers. The material comes in strips of two types: one strip consists of many minute nylon loops, the other is made up of minute hooks. The two strips when pressed together form a fairly strong bond which with sudden force can be pulled apart and which will withstand extensive use without replacement. I have used Velcro™[4] with great success. It can be purchased at most sewing stores.

A funnel-shaped net bag about 30 cm in length can be used, the small end having an opening about 12 cm in diameter. The larger end is attached to the net ring. The perimeter of the smaller hole is hemmed and a band of loop material 3 cm wide is sewn firmly around the outside edge. It is important that the band be at least 3 cm wide to facilitate addition of the smaller bags in the field. A number of small bags of desired length may then be constructed with openings the size of the outside diameter of this hole in the end of the net bag attached to the net ring. A strip of the hook material about 1 cm wide is sewn around the inside edge of each small bag. If the strip of hook material is too wide the bags will be more difficult to remove. If a

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[1] Accepted for publication: November 23, 1976

[2] Miami University Insect Collection, Department of Zoology, Miami University, Oxford, Ohio 45056

[3] Ward's Biology, Earth Science, and Chemistry Catalog for 1976-77. No. 767, p. 396.

[4] Talon Division of Textron, American Velcro Inc, Manchester, New Hampshire.

reasonably strong nylon material is used the small bag may be ripped off quickly after sampling with no damage. It can then be closed with a rubber band or wire (twist-ties), labeled, and placed in a killing jar before sorting. A different bag can readily be added for another sample. It is suggested that the sample bag be placed in the killing jar as soon as possible to reduce the damage done by spiders collected with the sample.

I have used this method successfully in 650 field hours to collect small acalyptrate Diptera and other orders along shorelines. When counting net sweeps the result is a quantitative sample with specimens in excellent condition.

Figure 1. Sweep net with a replacable sample bag attached. The net ring is about 30 cm in diameter.

Figure 2. A close-up of the Velcro^{TM} bond partially ripped. The sample bag with the hook material is the lower.

ACKNOWLEDGEMENTS

I would like to acknowledge a useful critique of the manuscript by Dr. D.L. Deonier and Mr. B.A. Steinly. Saralene Regensburg aided in constructing the net bags.

A SIMPLE METHOD FOR MAKING FINE DISSECTING NEEDLES[1]

R.A. Galbreath, N.H. Galbreath[2]

ABSTRACT: A simple method is described for making robust and very sharp dissecting needles by electrolytically etching tungsten wire to a fine point.

DESCRIPTORS: dissecting needles, electrolytic sharpening.

This note is to draw the attention of entomologists to a simple method for making robust and very sharp needles for dissection and other fine work. The method is based on that used to make electrophysiological micro-electrodes by electrolytically etching a fine wire (Hubel, 1957; Levick, 1972). Little skill is needed to consistently produce very sharp needles by the procedure described here and none of the dimensions or voltages quoted are critical.

Tungsten wire is used because of its toughness – it can be sharpened to tip dimensions of a few micrometers and still stand up to long use. We obtain 0.25 mm diameter tungsten wire from suppliers of electron microscope materials and cut it into 2 cm lengths with wire-cutters (which soon lose their edge from such hard use). We insert these lengths into hypodermic needles which provide a convenient base during etching and for subsequently mounting the finished needle on a handle. The needles are crimped to hold the wire firmly.

The tungsten is etched by dipping it and a carbon electrode (obtained from a small dry cell battery) into 10% sodium hydroxide solution and applying 12 volts A.C. between them. The tungsten wire is clamped so that about 2 mm dips into the solution and when the current is switched on, the tungsten is etched away through the meniscus around the wire. As etching progresses this meniscus recedes and a sharp conical tip is produced automatically. However, if this process is allowed to

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[1] Accepted for publication: December 31, 1976

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continue until the meniscus finally drops away from the wire, the result is a rather blunt tip. If the current is switched off just before this stage a very fine conical tip remains. This is achieved by monitoring the current flowing through the wire (which decreases from an initial level of about 500 mA) and switching it off when it drops below 30 mA. We have designed a circuit to do this electronically, but it can be done manually by connecting an A.C. current meter in series with the tungsten wire and switching the current off as soon as it begins to fall below 50 mA (this higher terminating current is to allow for the slower reaction time).

If the wire is dipped into the solution and 12 volts D.C. is used instead of A.C. (with the tungsten positive), a different process occurs which can also be used to advantage. After a few seconds the current falls because of polarisation, and electropolishing of the wire occurs; any prominences are preferentially etched away leaving a very smooth and highly polished surface. This may be done before the etching procedure described above to give the wire a preliminary clean and polish, or after it, which leaves the tip not quite as sharp as before but much smoother and therefore less likely to snag or bend in use. The actual procedure used depends on whether sharpness or durability is more important. The finished needles are washed under running water before mounting on a suitable handle. When it becomes necessary to re-sharpen them, the etching procedure is simply repeated.

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A METHOD FOR CONVERTING DRY MOUNTS OF MIDGES (DIPTERA: NEMATOCERA) INTO SLIDE MOUNTS[1]

M.W. Boesel[2]

ABSTRACT: Insects such as midges, preserved dry and glued to points or to insect pins, may be converted into permanent slide mounts by first soaking in relaxing fluid followed by a passage through a series of alcohols and beechwood creosote and mounting in diaphane. Air may be removed from specimens by the application of heat. The method may be used also for immatures or adults which have dried out.

DESCRIPTORS: Ceratopogonidae, Chironomidae, Diptera, midges, mounting, Nematocera, preservation, technique.

Fragile insects such as midges are particularly difficult to preserve indefinitely. The necessity for detailed study of genitalia presents a special problem. Preservation in fluid makes possible the examination of specimens from all angles, but such specimens inevitably suffer damage and loss of parts as a result of direct manipulation. Furthermore, color and certain surface and wing features are likely to be lost. On the other hand, the study of genitalia on dry specimens is particularly difficult. Ideally specimens of a given species when collected should be processed in 2 ways: (1) glued to points on pins and kept in the dry state and (2) placed in vials containing fluid, later to be mounted on slides. Dry mounts and slide mounts are not subject to direct manipulation and are therefore likely to have a longer life than specimens in fluid. Thus the advantages of developing a simple method for converting dry mounts into slide mounts are obvious. Although to date tested only on Chironomidae and Ceratopogonidae, the basic procedure detailed here should have rather wide application.

The method which follows is applicable particularly to insects such as midges mounted on points with white shellac, cellulose nitrate, cellulose acetate, clear nail polish, or various commercial glues. As indicated below, it may be used with slight modification for specimens mounted on minuten nadeln. Certain chemicals,

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[1] Accepted for publication: January 15, 1977

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including xylene, formalin, and potassium hydroxide, destroy features such as body color of adults and eyespots of larvae and are deliberately avoided.

Details of the Method

Step 1. Submerge the specimen in a fluid having the following ingredients: 45 parts 95% ethyl alcohol, 5 parts benzene, 15 parts ethyl acetate, and 35 parts distilled water. This is similar to Barber's fluid (Borror and DeLong 1971) and will subsequently be referred to as relaxing fluid. Pointed specimens may be slipped to the top of the pin and then submerged by angling the pin from a standard insect pin holder. The relaxing fluid may be contained in a small stender dish. If the specimen in the fluid is released, proceed to step 4; otherwise allow to soak about an hour and then proceed to step 2.

Step 2. Without removing the specimen from the dish, change the fluid by alternately pipetting off fluid and adding ethyl acetate. Specimens lightly attached are quickly released. Heavily glued insects may remain attached. In the latter case, after about an hour, use a fine dissecting needle and, by applying the needle to the soft glue rather than to the specimen, tease off the specimen in the fluid. Do not try to remove glue from the specimen. Glue tends to separate in step 8 and may then be removed before applying the cover slip.

Step 3. By alternately pipetting off ethyl acetate and adding relaxing fluid, change the fluid back to relaxing fluid. Allow to soak at least 10 minutes.

Step 4. Examine the specimen under a dissecting scope. If air bubbles are present, proceed to step 5; if absent, to step 6. All specimens that float should be subjected to step 5.

Step 5. Cover the dish containing the specimen loosely with a glass plate. Using an infrared lamp, apply heat to the fluid until the specimen moves in the fluid. Generally a lamp held about 4 or 5 inches above the dish provides enough heat to eliminate air bubbles in about 5 minutes. Remove the lamp if the specimen moves violently. Examination of the insect after the medium has cooled should determine whether all objectionable air has been eliminated.

Step 6. Using the same means as in step 2, change the fluid in the dish to 95% ethyl alcohol. After about 5 minutes, change to absolute alcohol. Allow to soak at least 10 minutes.

Step 7. Pipette off as much alcohol as possible without causing the specimen to lose the support of the fluid. Then add beechwood creosote. Allow to soak overnight.

Step 8. Mount the specimen on a glass slide in diaphane. Details of the mounting process have been published previously (Boesel and Vaughn 1951) and need not be repeated here.

Discussion

The procedure described here is particularly useful in managing dry specimens for which genitalia mounts are desired. The genitalia should be removed only after the specimen has been placed in diaphane on the slide. Loss of genitalia then is virtually impossible.

In the case of dry specimens impaled on minuten nadeln, steps 2 and 3 should of course be omitted. After soaking in relaxing fluid the insect is readily pushed off the point.

Prolongation of the period of submergence in relaxing fluid, ethyl acetate, or creosote has no appreciable bleaching effect on specimens. In general, time allotted in the directions to the various soaking periods may be considerably shortened, particularly for smaller specimens. For example, specimens allowed to remain in creosote only until they sink are presentable. Some sink in 15 minutes or less.

Specimens mounted on celluloid points must be treated with caution for the point will soften and collapse in step 1. Should the celluloid tend to enclose the specimen it should not be disturbed for it will be removed in step 2.

The method is applicable for the recovery of adults or immatures which have been preserved in fluid but have dried out. In that case, steps 2 and 3 should be omitted.

ACKNOWLEDGEMENTS

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A NEW SPECIES OF *ACTINOPTERA* RONDANI TOGETHER WITH DISTRIBUTIONAL RECORDS OF OTHER FRUIT FLIES (DIPTERA: TEPHRITIDAE) FROM INDIA[1]

V.C. Kapoor[2], Jasjit S. Grewal[2]

ABSTRACT: A new species of fruit fly, *Actinoptera carignaniensis* is described. Distributions in India for the fruit flies – *Trupanea amoena* (Frauenfeld),*Pliomelaena zonogastra* (Bezzi), *Dioxyna sororcula* (Wiedemann), *Platensina acrostacta* (Wiedemann) and *Scedella spiloptera* (Bezzi) are provided.

DESCRIPTORS: *Actinoptera carignaniensis* sp. nov., other tephritines, India.

During a recent survey of the fruit fly fauna of the Simla Hills (Himachal Pradesh) an interesting new species of the genus *Actinoptera* Rondani was collected. 25 species of this genus are distributed in Africa and Europe and 12 (including the new one) in the Orient. In India, only two species have been known prior to the present new one. This new description is followed by a listing of the various fruit flies of the subfamily Tephritinae now recorded from various parts of India.

Actinoptera carignaniensis, sp. nov.

(Figs. 1-3)

Male: Small; brownish-yellow. Head (fig. 1) brownish-yellow, broader than long; frons broader, brown, yellow on eye margins; face and antennae yellowish-brown; arista short, pubescent. 2nd antennal segment a little less than half as long as the 3rd and with a black median bristle; 3rd about 2/3rd as wide as long and with a point anteriorly; one pair of upper orbitals and two pairs of lower orbitals; ocellar bristles thin and long, little shorter than outer verticals; outer verticals less than one half the inner verticals; all bristles brownish-yellow except yellow occipitals. Thorax dark grey with blue dust and yellowish-brown bristles; anterior dorso-central bristles just behind the suture. Scutellum with two long bristles. Halters pale. Abdomen (fig. 3) triangular in outline, with blue dust and a number of obliquely placed yellow bristles. Legs brownish-yellow, femora with black tinges posteriorly. Wings much longer than the body, hyaline basally, apically one half dark brown with hyaline spots (fig. 2); costal spine single; stigma short, dark brown; cell r_1 with 2 hyaline spots, the basal one more than twice as long as the apical one; cell r_3 broken with 4 hyaline spots, the long basal ones a little beyond r-m, the anterior apical spot oval, enclosing a small portion of apex of R2+3, about 1/3rd of the posterior apical triangular spot; cell r_5 with 2 large hyaline spots, the basal one a little beyond the base of the 2nd hyaline apot of cell r_3, the apical spot about twice as long as the basal one, irregular in shape, indicating its origin from 3 hyaline spots; cell 2 m_2 with 3 hyaline spots, apical one smallest and basal one largest; cell 1 m_2 broken into 2 large hyaline areas by a light but distinct band; a light brown coloured band starting from the stigma to the hinder margin of the wing but broken in between R_{4+5} and M_{1+2}; cross

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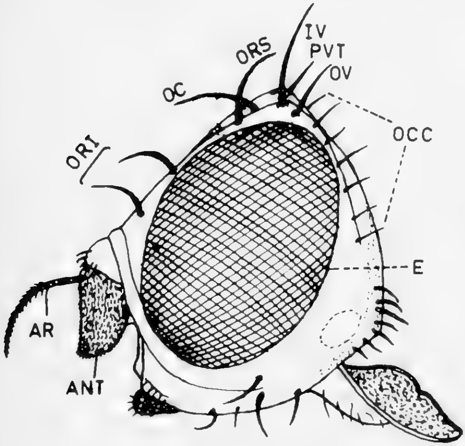
vein r-m and posterior cross veins with little infuscations; r-m situated at about apical one-fourth of the discal cell (cell Im_2); cubital cell with a very short point; Cu_2 + 1A ending much before the wing margin. Length: Body-2.00 mm; Wings-2.75 mm.
Female: Unknown.



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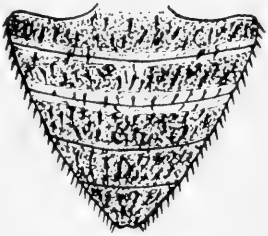

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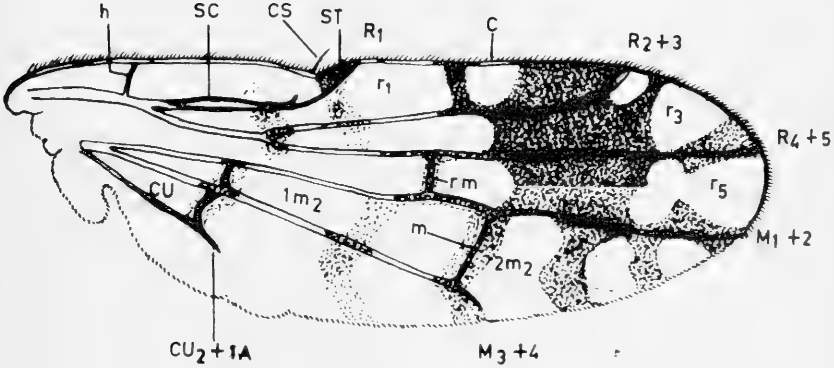

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Actinoptera carignaniensis, nsp.

ANT-Antennae; AR-Arista; C-Costal vein; CS-costal spine; Cu-cubital cell; E-eye; Cu_2 + 1A-2nd cubital vein plus 1st anal vein; h-humeral cross-vein; IV-inner vertical bristles; m-medial cross-vein; M 1+2, M_{3+4}-medial veins; m_2 and m_4-2nd and 4th medial cells; Oc-occellar bristles; Occ-occipital bristles; ORI-Inferior orbital (or lower orbital) bristles; ORS-superior orbital (or upper orbital) bristles; OV-outer vertical bristles; PVT-postvertical bristles; R_1, R_{2+3}, R_{4+5}-Radial veins; r_1, r_3, r_5-radial cells 1, 3 and 5; r-m - radial-medial cross-vein; Sc-subcostal vein; ST-Stigma.

Collection examined: Holotype male, Carignano (Simla, Himachal Pradesh), 18.1X.1976.Coll. J.S. Grewal.

This species is very peculiar in body size and colouration. The wings are narrow and longer than the body. It is very closely related to *Actinoptera tryapaneoides* Shiraki (1968. Smiths. Inst. U.S.N.M. Bull. 263: 88-90) described from Iriomote Islands. The new species can be separated from it by the characters of hyaline spots of the wing, thoracic markings and abdomen without posterior bristles.

Trupanea amoena (Frauenfeld)

Trypeta amoena Frauenfeld, 1865, Akad. Wiss. Wein, 22: 542.
Trupanea amoena (Frauenfeld) Bezzi, 1913, Mem. Indian Mus. 3: 164
Collection examined: 1 female, on wing, Punjab Agricultural University Orchard, Ludhiana, 26.VIII.1976. Coll. J.S. Grewal; 1 male, on wing, R.B.S. College Field, Agra, 15.X.1976.Coll. M.L. Agarwal.

Pliomelaena zonogastra (Bezzi)

Tephritis zonogastra Bezzi 1913, Mem. Indian Mus. 3: 164.
Pliomelaena zonogastra (Bezzi) Hardy, 1974, Pac. Ins. Monog. 32: 242.
Collection examined: 1 female, on maize crop, Bangalore, 18.VI.1973. Coll K.D. Ghorpade; 1 male, on wing, Mashobra (Simla), 17.IX.1976. Coll. Ramesh Chander., 1 male, on wing, Taj Garden (Agra), 13.X.1976. Coll. M.L. Agarwal.

Dioxyna sororcula (Wiedemann)

Trypeta sororcula Wiedemann, 1830, Aussereur. Zueifl. Ins. 2: 509.
Dioxyna sororcula (Wiedemann) Frey, 1944, Comm. Biol. Soc. Fenn. 2: 62.
Collection examined: 4 males and 6 females on wing, Solan (Himachal Pradesh) 7.IX.1976.Coll. M.L. Agarwal.

Platensina acrostacta (Wiedemann)

Trypeta acrostacta (Wiedemann), 1824, Anal. Ent. p. 54.
Ensina guttata Macquart, 1843, Mem. Soc. Lille, 1842: 387.
Tephrostola acrostacta (Wiedemann) Bezzi, 1913, Mem. Ind. Mus. 3: 153.
Platensina acrostacta (Wiedemann) Munro, 1938, Rec. Ind. Mus. 40: 36. This is widely distributed in India, Pakistan and Sri Lanka.
Collection examined: 1 male, on maize crop. Bangalore, 18.VI.1973. Coll. K.D. Ghorpade; 2 females, same data, 3.II.1973 ad 13.IV.1973.

Scedella spiloptera (Bezzi)

Tephritis spiloptera Bezzi 1913, Mem. Indian Mus. 3: 165.
Scedella spiloptera Hardy 1973, Pac. Ins. Monog. 31: 322.
Collection examined: 1 male, on wing, Bichpuri, Agra, 15.X.1976. Coll. M.L. Agarwal.

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NEW RECORDS OF SOME TROMBICULID AND SARCOPTID MITES AND THEIR HOSTS FROM INDIA[1]

Parshotam Singh Sandhu, V.C. Kapoor[2]

ABSTRACT: *Myobia musculi* (Shrank), *Radfordia* sp., *Listrophoridia* sp. and the subfamily Labidocarpinae form new records for India. *Cheyletus* sp. and *Gahrliepia (Schongastiella) gammonsi* are recorded for the first time from the hosts *Tatera indica* and *Mus booduga,* respectively.

DESCRIPTORS: Acarine ectoparasites, rats and mice, India.

During a survey of the acarine ectoparasites of rats and mice in Punjab, 2460 acarines including 52 ixodid ticks (10 nymphs and 42 larvae) and 2408 mites were collected from 330 rats and mice. Of these acarines, some mites, in addition to their new hosts, also form new records from India infesting rats and mice which are being reported in this paper.

Suborder I. TROMBIDIFORMES

Family 1. CHEYLETIDAE

Cheyletus sp

Collection Data:[3] 4 F[4], ex. *Tatera indica,* 8.V.1975

So far this genus *Cheyletus* has been recorded from India as *Cheyletus fortis* Oudemans infesting bark of unidentified tree and stored potatoes from Tamil Nadu and West Bengal (Cherian, 1931; Ghai, 1964 and Gupta, 1970) and as *Cheyletus malacensis* Oudemans infesting stored fish and prawns and feeding on the mite *Lardoglyphus konoi* (Sasa and Asanuma) (found on dry fish in South India by Hughes, 1961) (Pillai, 1957 and Hughes, 1961).

So, *Tatera indica* forms new host record for this genus which may be due to the contamination.

Family 2. MYOBIIDAE

1. *Myobia musculi* (Shrank)

Collection Data: 1F, ex. *Mus booduga,* 28.IV.1975

A single female specimen of *Myobia musculi* (Shrank) was collected from Punjab infesting *Mus booduga.*

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[3] All collections were made in Ludhiana

[4] F stands for female and L for larva

2. *Radfordia* sp

Collection Data: 1F, ex. *Rattus rattus,* 26.III.1975; 1F, ex. *Mus booduga,* 30.IV.1975; 1F, ex. *Tatera indica,* 1.V.1975; 1F, ex. *R. rattus,* 26.VI.1975; 2F, ex. *R. rattus,* 8.VIII.1975.

It is interesting to note that this genus has not previously been known from this country.

Family 3. TROMBICULIDAE

Subfamily Gahrliepiinae

Gahrliepia (Schoengastiella) gammonsi Traub and Evans

Collection Data: 1L, ex. *Mus booduga,* 3.V.1975; 1L, ex. *Mus booduga,* 16.V.1975.

This species has already been reported from Assam parasitizing a short tailed shrew (*Anourosorex squamipes assamensis,* Anderson) (Traub and Evans, 1953). Here it has been collected from its new host, *Mus booduga.*

Order II. SARCOPTIFORMES

Family LISTROPHORIDAE

Subfamily 1. LABIDOCARPINAE

Collection Data: 2F, ex. *Millardia meltada,* 17.X.1974; 3F, ex. *M. meltada,* 22.III.1975; 2F, ex. *Mus booduga,* 23.IV.1975; 3F, ex. *M. meltada,* 31.VII.1975.

The specimens could not be identified further. The subfamily itself is a first record from India.

Subfamily 2. LISTROPHORINAE

Listrophoridia sp

Collection Data: 1F, ex. *Millardia meltada,* 21.IX.1974; 2F, ex. *M. meltada,* 17.X.1974; 1F, ex. *M. meltada;* 22.III.1975; 4F, ex. *Mus booduga,* 23.IV.1975; 1F, ex. *M. meltada,* 18.VII.1975; 1F, ex. *M. meltada,* 28.IX.1975.

This is recorded for the first time from India.

ACKNOWLEDGEMENTS

The authors are grateful to Dr. S.S. Guraya, Prof. & Head, Department of Zoology, Punjab Agricultural University, Ludhiana for the facilities provided.

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PTIOLINA EDETA (WALKER) (DIPTERA: RHAGIONIDAE), A REDESCRIPTION AND NEW SYNONYMY[1]

Donald W. Webb[2]

ABSTRACT: *Ptiolina* edeta (Walker) is redescribed, with *Atherix vidua* Walker and *Ptiolina grisea* Curran designated as new synonyms.

DESCRIPTORS: Diptera: Rhagionidae; *Ptiolina edeta* (Walker), redescribed: *Atherix vidua* and *Ptiolina grisea* new synonyms.

Walker (1849) originally described *Ptiolina edeta* in the genus *Spania* based on a single male collected at St. Martin's Falls, Albany River, Hudson's Bay. Williston (1908) reexamined the type and found it to be a true *Ptiolina.* In his publication, Walker (1849) also described *Atherix vidua* from five males and one female collected at the same locality as the holotype of *P. edeta.* I have examined the types of these species and find them to be identical, and as first reviser, I select *P. edeta* as being the valid name. After examining the type series of *A. vidua,* a lectotype specimen was designated.

Hardy and McGuire (1947) revised the Nearctic *Ptiolina* but did not examine the types of *P. edeta* or *A. vidua.* In their revision (Hardy and McGuire 1947) the types of *P. edeta* and *A. vidua* will key out to *P. grisea* Curran. My examination of Curran's type indicated that *P. grisea* is also a synonym of *P. edeta.*

Because Walker's original description of *P. edeta* was very general and included several inconsistencies, I am redescribing this species based on the various type-specimens, in addition to other available material.

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[1] Accepted for publication: December 6, 1976

[2] Illinois Natural History Survey, Urbana, Illinois 61801

Ptiolina edeta (Walker)

Spania edeta Walker, 1849:489.
Ptiolina edeta: Williston, 1908:387.
Atherix vidua Walker, 1849:1153. New Synonomy.
Ptiolina grisea Curran, 1931:251. New Synonomy.

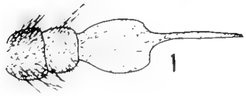
Male. – Length 3.39-3.64 mm. (excluding antennae).

Eyes pale to dark reddish brown, contiguous medially, bare, facets in ventral third smaller than in dorsal two-thirds. Ocelli hyaline to amber, large, on broad dark reddish brown to black subtriangular ocellar tubercle with pale greyish pruinosity, bearing numerous, erect, black, anteriorly directed setae. Antennae (5:4:12) three segmented with distinct apical style (Fig. 1), dark reddish brown with light greyish pruinosity; basal segment globular, 1.6 times wider than long, with numerous erect, elongate, dark reddish brown setae on dorsal and ventral surfaces; second segment subrectangular, 2.0 times wider than long, slightly shorter than basal segment, with numerous, erect, elongate, dark reddish brown setae on dorsal and ventral surfaces, setae on dorsal surface longer than on ventral surface, occasionally scattered setae on lateral surface; third segment subrectangular, flattened laterally, apical angle almost square, 1.2 times longer than wide, 1.3 times combined length of first two segments, lacking erect, elongate setae; style elongate, pointed apically, occasionally expanded medially, situated apically on third antennal segment, 7.0 times longer than wide, 1.2 times longer than third antennal segment. Maxillary palps (9:16) dark reddish brown, with faint greyish pruinosity, bearing numerous erect, elongate, black setae; basal segment cylindrical, 2.1 times longer than wide; apical segment distinctly clavate, 2.3 times longer than wide, 1.8 times longer than basal segment. Labial palps dark reddish brown, pruinose, bare except for several short, erect, whitish setae at apicies. Labrum short, tapered, reddish brown, glossy. Gena dark reddish brown, pruinose, with numerous erect, elongate, reddish brown facial setae. Frons and clypeus dark reddish brown, bare. Occipital setae short, erect, reddish brown to black.

Thorax dark reddish brown to black, often covered with greyish pruinosity. Vittae indistinct. Humerus dark reddish brown to black, slightly paler than rest of thorax, lacking erect, elongate setae. Stenopleuron dark reddish brown, lightly pruinose with erect, elongate, black setae on ventral half. Mesopleuron, pteropleuron, hypopleuron, and metapleuron dark reddish brown, lightly pruinose, lacing erect, elongate setae. Halteres reddish to dark reddish brown, capitulum darker, bare except for several small erect, setae on posterior margin. Scutellum black with numerous erect, elongate, black setae.

Wing length 3.20-3.52 mm., width 1.09-1.28 mm., 2.7 times larger than wide.

Figures 1-9: *Ptiolina edeta,* 1) antenna, lateral view. 2) male terminalia, dorsal view. (BB) basistylar bridge. (AA) aedeagal apodeme. (PV) penis valve. (E) endophallus. 3) male terminalia, ventral view. (PV) penis valve. 4) female abdomen, lateral view. (Sp) spermatheca. (Ce) cerci. 5) female terminalia, dorsal view. 6) female terminalia, ventral view. 7) female reproductive structures, dorsal view. (Sp) spermatheca. (SpD) spermathecal duct. (F) furca. 8) furca, lateral view. Dotted outline indicated general position of genital chamber.



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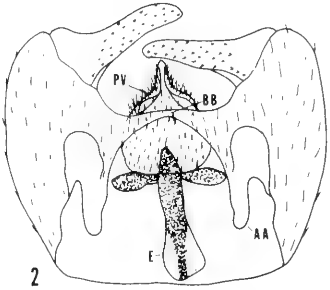

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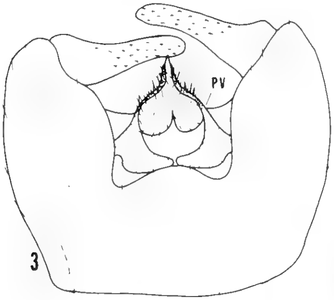

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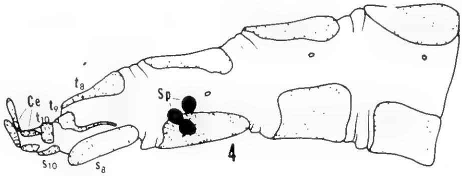

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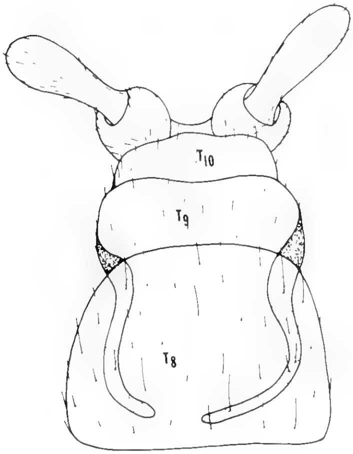

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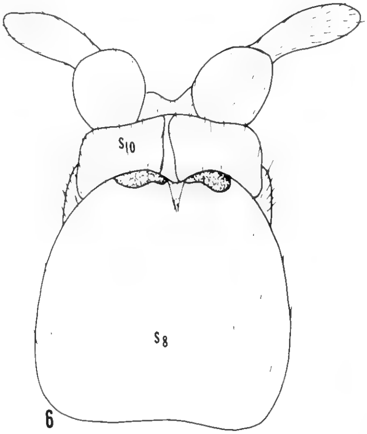

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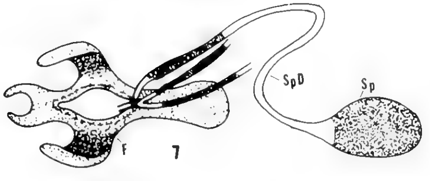

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8

Membranes (Fig. 2), pale yellow, stigma moderately darker. Humeral crossvein distinct. Costa circumambient, thicker along anterior margin. Sc ending in C distad to middle of discal cell. R_1 ends in C above or slightly before R_{4+5}. R_{2+3} ends beyond fork of R_{4+5}. R_{4+5} forks before or slightly distal to apex of discal cell. R_5 ends before apex of wing. R-M attached to basal third of discal cell. M_1 and M_2 joined separately or at junction with discal cell. Cell M_3 widely separated apically. Anal cell closed near wing margin, leaving short petiole. Anal angle and alula broadly rounded. Squama large with narrow fringe of short pale brown setae.

Legs reddish to dark reddish brown, concolor, with faint greyish pruinosity. Tibial spurs 0:2:1. Fore femur may or may not be swollen. Femora and tibiae with numerous erect, elongate, black setae. Fourth tarsal segment shorter than fifth. Empodium pale yellow, pulvilliform, distinct. Tarsal claws simple.

Abdomen and terminalia reddish to dark reddish brown, lightly pruinose, although occasionally glossy, bearing numerous erect, elongate, black setae. Tergite 10 subrectangular, 1.5 times wider than long, posterior margin sinuate. Cerci large, broadly conical, separated basally. Basistyle (Figs. 3, 4) broad, separated ventrally, dorsally fused by narrow basistylar bridge (BB), with two narrow aedeagal apodemes (AA) projecting anteriorly but not reaching anterior margin of basistyle. Dististyle short, curved, tapered apically, covered with numerous short, coarse, basally directed spines. Aedeagus composed of two sinuate penis valves (PV) (Fig. 4) and an endophallus (E). The penis valves project and taper to an acute point posteriorly, bearing numerous fine, apical spines; basally they expand and attach laterally to basistyle, then converge medially but are not fused. In ventral view they are covered medially by a thin membrane bearing numerous elongate spines. The heavily sclerotized endophallus (E) lies medially in dorsal view (Fig. 3), tapered apically with middle third narrowed. Aedeagus in dorsal view enclosed in thin transparent membrane bearing numerous short and elongate spines.

Female. – Length 4.5 mm.

Eyes dark reddish brown, pilose, facets of equal size, widely separated medially. Ocelli hyaline, ocellar tubercle dark reddish brown, raised, with numerous erect, elongate, anteriorly directed, black setae. Antennae (4:4:13) dark reddish brown; basal segment subrectangular, 1.5 times wider than long, with erect, elongate brown setae only on ventral surface; second segment equal in length to basal segment, 1.7 times wider than long, with circle of short, erect, brown setae around apical margin; third segment flattened laterally, 1.4 times longer than wide, 1.6 times combined length of first two segments, erect, elongate setae absent, apex angulate; style situated apically on third antennal segment, cylindrical, tapered apically to acute point, 9.5 times longer than wide, 1.5 times length of third antennal segment. Maxillary and labial palps as in male. Frons reddish brown with numerous, scattered, short, erect, brown setae. Clypeus reddish brown with greyish pruinosity, bearing several scattered elongate brown setae. Gena reddish brown with whitish grey pruinosity, bare anteriorly, with numerous white facial setae posteriorly. Occipital setae numerous, erect, brown.

Thorax dark reddish brown with scattered grey pruinosity. Humerus pale reddish brown, lacking erect setae. Remainder of thorax as in male.

Wing length 4.10 mm, width 1.47 mm., 2.8 times longer than wide. Membranes hyaline, with stigma pale brown. R_5 ending at apex of wing. R_{4+5} forked above apex of discal cell. M_1 and M_2 joined separately to discal cell. Remainder of wing as in male.

Legs dark reddish brown, concolor. Fore femora swollen. All femora and hind tibia with erect, elongate, brown setae. Fourth tarsal segment shorter than fifth.

Abdomen (Fig. 5) dark reddish brown. Eighth tergite (Fig. 6) broad, wider than long, broadly rounded apically. Tergite nine with apical half broad, wider than long, apical margin truncate to slightly emarginate; basal half narrow, sigmoidally curved, arising from the anterolateral corners, converging medially beneath tergite eight. Tergite 10 broad, wider than long, slightly convex posteriorly. Cerci with large, globose basal segment and elongate, clavate apical segment. Sternite eight (Fig. 7) very broad, apex broadly rounded with moderate emargination, each broad lobe formed by emargination has darkened apex due to apicies being curved under sternite. Sternite nine greatly modified and invaginated dorsal to sternite eight to form an internal furca (Fig. 8); furca almost twice as long as wide, emarginate apically to form two narrow convergent lobes, median section broad with oval concavity over which lies genital chamber, with two broad, upturned, wing-shaped extensions laterally, basal third of furca swollen anteriorly. In lateral view (Fig. 9) furca flattened dorsoventrally. Sternite 10 subrectangular, wider than long, separated medially into two distinct sections. Internally three dark brown circular spermatheca (Fig. 8) located in seventh abdominal segment. From each spermatheca leads a thin transparent spermathecal duct to genital chamber located dorsally over median area of furca. Spermathecal ducts united shortly before entering genital chamber and show darkened rings surrounding ducts over posterior third of their length.

Distribution – Alaska: Muir Inlet, Sitka, 13-VI-1899, 1♂ (USNM); Fern Mine, 29-VII-1956, W.C.F., 3♂♂ 1♀ (USNM). New Hampshire: Mt. Washington, Mrs. Slosson, 3♂♂ 1♀ (USNM, AMNH); White Mountains, Morrison, 2♀♀ (USNM). Ontario: St. Martin's Falls, Albany River, Hudson's Bay, 5♂♂, 1♀ (BM).

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The Entomologist's Library

This section contains titles of books, monographs, and articles received by the editor that may be of special interest to entomologists and biologists. A brief statement of contents and items of interest are noted. Brief analytical reviews may be submitted for possible publication. All correspondence for this section should be addressed to the editor.

BOOK REVIEWS

ADVANCES IN INSECT PHYSIOLOGY – Vol. 11. Edited by J.E. Treherne, M.J. Berridge and V.B. Wigglesworth. Academic Press, New York, 1975. 432 pp. $31.00.

This volume includes rather thorough reviews in four areas of insect physiology. In "Regulatory Mechanisms in Insect Feeding," L. Barton Browne discusses regulatory changes in components of feeding behavior, long-term regulation of intake, and other factors which affect feeding behavior. Although almost 200 papers are listed with this review, about 15% of them were authored by three well-known insect physiologists – L. Barton Browne, V.G. Dethier, and A. Gelperin. These workers have contributed a wealth of literature on various aspects of feeding by Diptera.

In "The Cytophysiology of Insect Blood," A. Clive Crossley presents a very well-written review on various aspects of the morphology and physiology of insect blood cells. Mention is made of Gregoire and his co-workers who have studied blood clotting in 1600 Arthropods and who have published extensively on their results. Although the phase-contrast microscope was used by this group of researchers many others have used electron microscopy in insect blood cell studies. Eighteen electron micrographs are included in this section. Had glossy paper been used, the micrographs would have been much sharper and of greater value to the reader.

William H. Telfer's review "Development and Physiology of the Oöcyte-Nurse Cell Syncytium" summarizes ". . . the literature on the development and function of the oöcyte-nurse cel complex, . . ." Telfer informs the reader that this topic is one of the oldest subjects in the field of cell biology. Representatives of many orders of insects have been studied and reported on in this section. Several very good diagrams and some fair electron micrographs scattered throughout this review help to make it a little less difficult to understand. Some information on RNA and DNA in insects is included.

In "Major Patterns of Gene Activity During Development in Holometabolous Insects," John A. Thomson attempts to present a broad overview of the ". . . patterns of gene activity seen in insect development." Although most of the studies referred to are concerned with Diptera, Thomson also referred to some studies on Lepidoptera, Coleoptera, and Hymenoptera. Thomson discusses size and organization of the genome, patterns of gene activity in replication and transcription, translation of the larval gene set, translation of the imaginal gene set, and endocrine influences on fat body structure and function.

Although few readers of Entomological News may have need for such a technical volume on insect physiology, this reviewer can not help but be impressed by the tremendous amount of research effort being expended on this subject by highly trained workers. It is an excellent volume for reference purposes.

Paul P. Shubeck
Montclair State College

PESTICIDES IN THE ENVIRONMENT, Vol. 2, edited by Robert White-Stevens. Marcel Dekker, Inc., New York and Basel. 1976. 480 pp. $37.50.

The title of the text "Pesticides in the Environment" implies that the reader will garner an understanding of the use of and ultimate fate of commonly used pesticides and their impact on man's environment. In this light the text has serious shortcomings. It is more closely a text that is useful as a reference on the historical development of fungicides and nematocides, a synopsis of major diseases of important crop plants and a specialized section dealing with insecticides and control of animal ectoparasites. The reader will find useful listings of widely used fungicidal, nematocidal and insecticidal chemicals with occasional sentences or paragraphs admonishing one to be familiar with restrictions on their particular use. Missing is any substantive statements on the various classes of chemicals as to what is known about the fate of the chemicals that are so widely used in the environment. The reader does not learn whether or not there is scientific confidence that in using the stated materials we have a base of data on which to substantiate their continued use without environmental damage. It is not enough to simply state that a pesticide lable represents the concentrated distillation of several million dollars and many thousands of man-hours of highly sophisticated technical work. This begs the issue of whether or not we know that once used as prescribed, the chemicals have no subsequent deleterious affects in the environment. It is in this important consideration that the text is of no value.

Dr. D.F. Crossan, Chairman
Department of Plant Science, University of Delaware

CLASSIFICATION OF THE ACRIDOMORPHID INSECTS. by V.M. Dirsh. 1975, 171 pages, 74 figures. E.W. Classey publisher, Park Road, Faringdon, Oxon. England. £ 9.60

Not much more can be said about this book that hasn't already been said in at least three reviews with which this author is familiar. Basically, this book is a reclassification of grasshoppers (in the broadest sense). It is a culmination of the author's lifetime work in the taxonomy of these insects. As a result, with few exceptions, the treatment at the subfamily and generic level is knowledgeable, clear, and accurate. However, the remarks in the first five pages have overshadowed, to a large extent, what has been proposed in the succeeding 165, and has raised the hackles of many an otherwise inocuous acridologist. It seems likely that Dr. Dirsh had no idea that his introduction would cause such a stir.

What Dr. Dirsh has done is to propose a reclassification of the orthopteriod insects at the highest levels. He has expanded on his 1973 classification which was based largely on the structure of concealed genitalia. In his present book, he recognizes 10 orders of what had previously been considered the Orthoptera. These are: Tettigonioidea, Gryllacridoidea, Grylloidea, Gryllotalpoidea, Cylindrochetoidea, Tridactyloidea, Rhipipterygoidea, Tetrigoidea, Eumastacoidea, Acridomorphoidea. Some reviewers have been concerned with the atypical usage in the endings of these orders. This is a semantic issue which, in the final analysis, really is of little consequence. The concept is what should be considered.

In proposing the reclassification, one expects criticism. For classification is a matter of opinion (of course, the more valid opinions are based on the better evidence), because the true lineage of these groups will never be known with certainty. Dr. Dirsh's approach exemplifies the most extreme case of splittling. As an example, the pygmy mole crickets are divided into separate orders. Until relatively recently, these diminutive crickets were classified in two families. Now they are either the Tridactyloidea or the Rhipipterygoidea. Similarly, the division of the eumastacids from the other grasshoppers at the ordinal level is not warranted.

What will happen is that this will stimulate, as it already seems to be doing, a wave of interest resulting in a balancing of the classification to one which will be accepted by the majority of orthopterists. This was in evidence at the XV Congress of Entomology in Washington, D.C. where a symposium on the higher classification of the Orthoptera caused the emergence of many "closet classificationists" who generally concluded that the present classification had been split too much.

In rendering a classification, I feel that authors should be aware that the "popular concept" of the insects is important too. An entomologist recognizes an acridid as a grasshopper and finds it useful to be able to call 90% of the standard grasshoppers acridids. However, if a dozen or so subfamilies contained therein are raised to familial status, his concept is gone, and he is left with rather muddled views about what a grasshopper really is. In the final analysis, it really matters little to specialists whether a subfamily remains as such or is elevated. The use of tribes or subgenera can handle this. It does matter at the "popular concept" level, however.

A word of criticism. There is some inconsistency in treatment of genera. On page 90 with reference to the Spathosterninae, Dirsh states "Besides the type genus, five more genera of this subfamily are known." On page 92 he lists the 7 genera of the Leptacrinae. It would have been very helpful if he had listed all the genera included in each of his subfamilies. There are also a few problems with distribution and character states. In addition, there are minor errors like the one on page 44 in the legend of figure 15 which refers the reader to "Grant, 1960." This should have either read Grant and Rentz, 1967 (as it is in the bibliography) or perhaps, Rehn and Grant, 1961. But these omissions are exceptional and the author is to be complemented on the clarity of written word and the excellent reproduction, placement, and labelling of the illustrations.

Acridology, and orthopterology, is a greatly expanding field. Hundreds of new genera have been described in the past 25 years. These discoveries reflect a dynamic classification, probably more so than in most other groups of insects. As a result, new schemes are presented from time to time. Dr. Dirsh has suggested a classification and probably within five years an acceptable compromise will be adopted which will at least be reflected in more than two texts.

D.C. Rentz, California Academy of Sciences, San Francisco.

BOOKS RECEIVED AND BRIEFLY NOTED

THE MAYFLIES OF NORTH AND CENTRAL AMERICA. G.F. Edmunds, jr., S.L. Jensen & L. Berner. Univ. of Minnesota Press. 1976. 330 pp. $28.50.

This book provides modern, useful and well illustrated keys to both adults and nymphs. Data on habitats, behavior and life history are given for each genus. Characteristics of nymphs and adults are given for families, subfamilies and genera, with brief accounts for extralimital families. A discussion of methods of collecting and preserving specimens precedes the main portion of the text. The book is well illustrated with drawings, photographs and a map.

LEGION OF NIGHT: THE UNDERWING MOTHS. T.D. Sargent. Univ. of Massachusetts Press. 1976. 222 pp. 8 pl. $15.00

This book presents a complete survey of all species of the genus *Catocala* found in eastern North America, and is designed for both amateur naturalists and professional biologists. Included also is a summary of current biological information on *Catocala* and reports on some recent investigations being conducted on these moths.

BUTTERFLY MAGIC. K.B. Sandved & M.G. Emsley. Penguin Books. 1976. 128 pp. 76 pl. $4.95.

This 8 1/4 x 10 1/2 paperback book is primarily a series of very beautiful colored photographs of butterflies and enlargements of butterfly wings, with explanatory notes for each plate.

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Wanted: ENTOMOLOGICAL NEWS, Volume 57 (1946). Roderick R. Irwin, 24 East 99th Place, Chicago, Illinois 60628.

For sale: The 1973 republication of America's first book on entomology–the 1806 edition of F.V. Melsheimer's A CATALOGUE OF INSECTS OF PENNSYLVANIA. Also included is a 17 page biographical sketch and cover protrait of Frederich Valentine Melsheimer, 86 p. Price $4.00. Entomological Society of Pennsylvania, 106 Patterson, University Park, PA 16802.

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(Continued on inside of back cover)

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TWO NEW GENERA OF ENICOCEPHALIDAE (HEMIPTERA)[1]

Gene Kritsky[2]

ABSTRACT: Two new genera of Enicocephalidae, one from the subfamily Aenictopechinae and one from the subfamily Enicocephalinae, are described.

DESCRIPTORS: Hemiptera; Enicocephalidae; *Tornocrusus*, n. gen.; *Brevidorsus*, n. gen.

The last reviews of the Enicocephalidae genera of the Western Hemisphere were by R. Jeannel (1942) and R.L. Usinger (1945). Since then four new Western Hemisphere genera have been discovered, *Alienates* (Barber, 1953), *Boreostolus* (Wygodzinsky and Stys 1970), and two which are described herein.

SUBFAMILY AENICTOPECHINAE

Members of this subfamily do not have the pronotum divided into two or three lobes, and do possess well developed genitalia.

Genus *Tornocrusus*, new genus

Medium sized enicocephalids, adults 4-4.5 mm (fig. 1).

Head with slight postocular impression, eyes moderate in size but not closely approximated on ventral side of head. Ocelli placed close together, not greatly elevated (fig. 2).

Pronotum simple, smooth dorsal surface.

Scutellum distinctly notched at the posterior end (fig. 3).

Foreleg stout (fig. 4), tarsus with two claws of unequal length and two spines, a hook-shaped spine closely adpressed to tarsus; other spine conical and erect (fig. 5). Apical end of tibia with six spines; inner group with two plate-like spines and one conical spine, outer group with three conical spines inserted at same level (fig. 6).

Middle and hind tarsi two-segmented (figs. 7 & 8).

Forewings with basal cell present and discal cell closed (fig. 9).

Parameres without hooks. Phallus sclerotized and erect (fig. 10).

Female more stout than male, with smaller eyes and thicker fore femora and tibia (fig. 12).

Type-speces: *Tornocrusus stysi*, new species.

This genus can be distinguished from other genera of this subfamily that occur in the Western Hemisphere by its notched scutellum and by the spination of the foreleg. *Gamostolus* has four spines on the fore tarsus and *Boreostolus* has the outer most spine on the fore tibia proximad to the adjacent spines.

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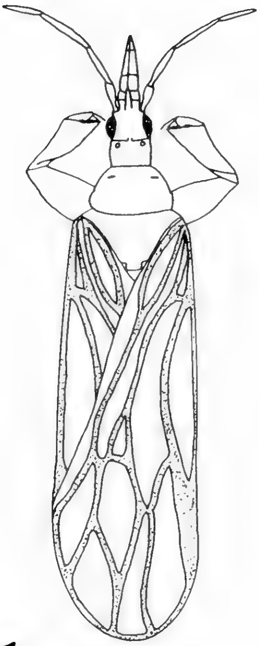

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Fig. 1. *Tornocrusus stysi* male

Tornocrusus stysi, new species

Length 4.25 mm, moderately clothed with short setae. Entire body a deep rich brown.

Head 1.28 mm long (fig. 2); posterior lobe 0.30 mm long, 0.46 mm wide. Constriction behind eyes distinct. Length of antenna segments I, 0.30 mm; II, 0.52 mm; III, 0.61mm; IV, 0.43 mm.

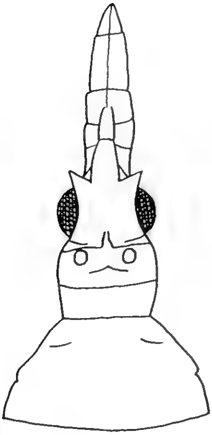
Pronotum without markings; 0.51 mm long, 0.97 mm wide at posterior edge, 0.43 mm wide at anterior edge.

Foreleg spination as in generic description; length of ventral edge to width ratio of femur 1.53; tibia with ratio of length along ventral edge to distal end width 2.28.

Forewing venation as in fig. 9.

Male genitalia as in fig. 10; parameres large triangular with small lobe near base but without hooks (fig. 11).

Holotype: male, Costa Rica, Alajuela Chomogo area, 1620 meters; 10° 18' W, 84° 47' N; June 13, 1973; (Erwin and Hevel Central American Expedition 1973). In the United States National Museum.



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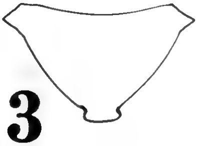

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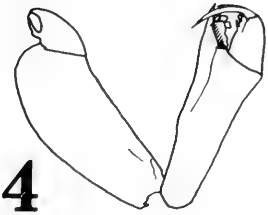

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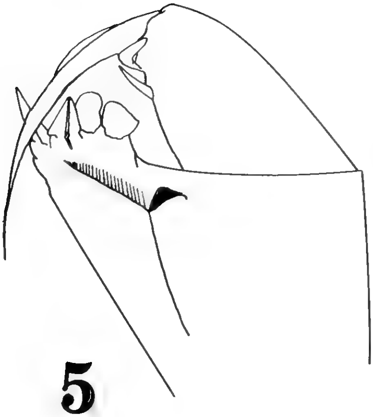

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Fig. 2. *Tornocrusus stysi* male head
3. *T. stysi* scutellum
4. *T. stysi* foreleg
5. *T. stysi* fore tarsus
6. *T. stysi* fore tibia spination

SUBFAMILY ENICOCEPHALINAE

The subfamily Enicocephalinae is characterized by having a three lobed pronotum, male genitalia without separate parameres and females without valvulae.

Genus *Brevidorsus*, new genus

Small enicocephalid, 2.75 mm long.

Head with posterior lobe compressed against anterior lobe; rostrum reduced (fig. 13). Eyes large; ocelli large, placed far apart. Antennae longer than head and pronotum combined.

Pronotum three lobed; posterior lobe very narrow (fig. 13).

Scutellum pentagonal shaped (fig. 14).

Foreleg slender (fig. 15); tarsus with two claws of unequal length and no spines. Distal end of tibia with six conical spines, four clustered together, two spines placed proximad other spines (fig. 16).

Middle and hind tarsi two-segmented with two conical spines present on distal end of tibia (fig. 17).

Forewing with reduced venation; basal cell open; discal cell, $R_{1 \& 2}$, A_2 and outer end of Cu absent (fig. 18).

Male genitalia reduced, posterior apophysis of pygophore opening below lateral and medial sclerites (fig. 19).

Female unknown.

Type-species: *Brevidorsus arizonensis,* new species

This genus can be easily distinguished from the other genera in the subfamily by the shape of the posterior lobe of the head, narrow third lobe of the pronotum and by the reduced forewing venation.

Brevidorsus arizonensis, new species

Length 2.75 mm. Body clothed with short setae, head and thorax light brown, abdomen much lighter, hemelytra transparent.

Head 0.79 mm long; posterior lobe 0.15 mm long, 0.29 mm wide. Anterior lobe with slight ridge directed to posterior lobe. Length of antennal segments I, 0.12 mm; II, 0.34 mm; III, 0.36 mm; IV, 0.26 mm.

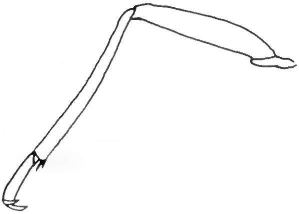
Pronotum length 0.36 mm, anterior lobe width 0.22 mm, posterior lobe length 0.42 mm.

Foreleg spination as in generic description (fig. 15). Length of ventral edge of femur to width ratio 2.47, tibia length-width ratio 3.00.

Forewing venation as in generic description (fig. 18).

Male genitalia as in fig. 19.

Holotype: male and 11 paratypes, U.S.A., Arizona, Pinal County, Boyce Thompson Arboretum near Superior; July-September, 1948; (light trap), (H. Gloyd). In the Illinois Natural History Survey Collection.



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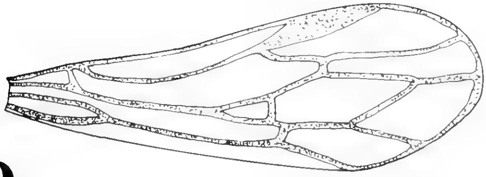

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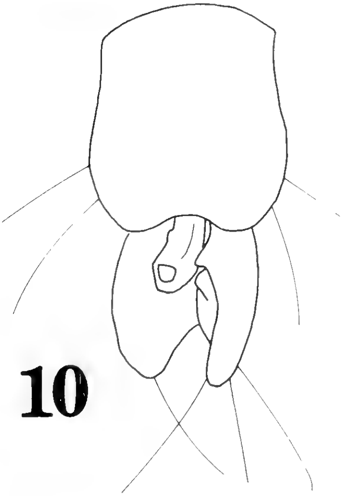

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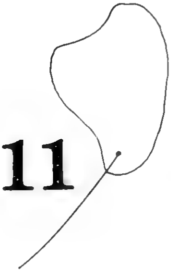

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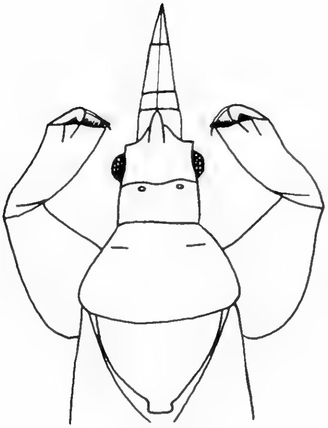
Fig. 7. *Tornocrusus stysi* hindleg
8. *T. stysi* hind tarsus
9. *T. stysi* forewing
10. *T. stysi* male genitalia
11. *T. stysi* paramere



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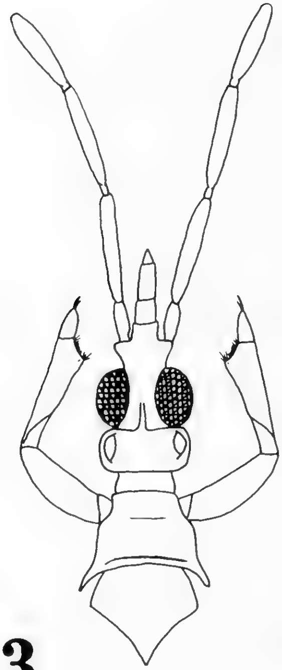

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Fig. 12. *Tornocrusus stysi* female
13. *Brevidorsus arizonensis* male

DISCUSSION

The genus *Tornocrusus* occurs geographically between *Gamostolus,* known from Tierra del Fuego, and *Boreostolus,* known from northwest U.S.A. and eastern U.S.S.R. *Tornocrusus* also exhibits morphological characters which are transitional between these genera. For example, it has only two spines on the fore tarsus, the *Boreostolus* condition; and *Tornocrusus* has the *Gamostolus* arrangement of spines on the fore tibia.

Brevidorsus appears to be transitional to the subfamilies Enicocephalinae and Alienatinae. *Brevidorsus* has large eyes, a small rostrum, and no spines on the fore tarsus all characteristic of the Alienatinae. Moreover, the narrow third lobe of the pronotum and reduced venation of the forewings approach the Alienatinae condition.

In order to facilitate generic identification a key is provided to the enicocephalid genera of the Western Hemisphere.

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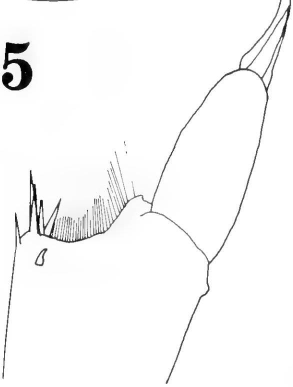

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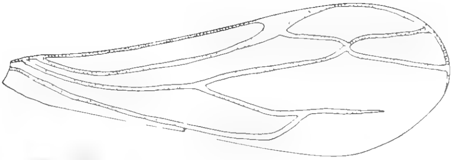

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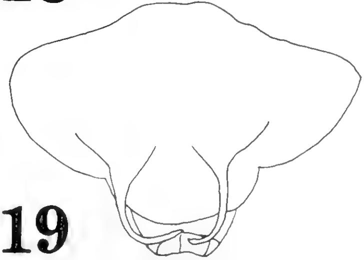

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Fig. 14. *Brevidorsus arizonensis* scutellum
15. *B. arizonensis* foreleg
16. *B. arizonensis* fore tarsus
17. *B. arizonensis* hindleg
18. *B. arizonensis* forewing
19. *B. arizonensis* male genitalia

KEY TO THE GENERA OF ENICOCEPHALIDAE OF THE WESTERN HEMISPHERE

1. Pronotum entire, not divided into two or three distinct lobes (subfamily Aenictopechinae) 2
   Pronotum divided into two or three distinct lobes 4

2. Male parameres with hooks, outer apical spine of the fore tibia arising below the inner two spines . . . . *Boreostolus*
   Male parameres without hooks, outer apical spines of the fore tibia arising at the same level 3

3. Scutellum triangular in outline, fore tarsus with four spines . . . . *Gamostolus*
   Scutellum notched (fig. 3), not simply triangular; fore tarsus with two spines (fig. 5) . . . . *Tornocrusus*

4. Pronotum divided into two distinct lobes, wing venation reduced at most four veins present (subfamily Alienatinae) . . . . *Alienates*
   Pronotum divided into three distinct lobes (subfamily Enicocephalinae) 5

5. Fore tarsus with one large claw, scutellum ending in a knob . . . . . . *Enicocephalus*
   Fore tarsus with two claws, scutellum without knob 6

6. Posterior lobe of pronotum very narrow (fig. 13); scutellum pentagonal-shaped . . . . *Brevidorsus*
   Not as above 7

7. Middle lobe of pronotum with a deep medial impression forming two lateral lobes, each trisected by a Y shaped impression . . . . *Oncylocotis*
   Middle lobe of the pronotum not as above 8

8. Posterior edge of pronotum straight, wing venation with basal cell closed and discal cell present . . . . *Hymenocoris*
   Posterior edge of the pronotum not straight, wing venation with basal cell open and discal cell absent . . . . *Systelloderes*

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ELEVATION OF THE SEEDBUG *EREMOCORIS BOREALIS* (DALLAS) FROM SYNONYMY WITH *EREMOCORIS FERUS* (SAY) (HEMIPTERA: LYGAEIDAE)[1]

Merrill H. Sweet

ABSTRACT: A neotype is selected for *Eremocoris ferus* (Say) and *Eremocoris borealis* (Dallas) is raised from synonymy. These sibling species show behavioral and reproductive isolation in mating trials. The courtship behavior of *E. borealis* is described. *E. borealis* has a more northern distribution; *E. ferus*, a more southern distribution. In the zone of sympatry in southern New England the species exhibit ecological displacement in which *borealis* is restricted to cool hemlock forests, *ferus* to warmer deciduous forest. The species are morphologically distinguished. A key to the species of *Eremocoris* of North America east of the 100° meridian is given.

DESCRIPTORS: Hemiptera, *Eremocoris,* reproduction, ecology, behavior, sibling species, seedbugs.

Eremocoris is a moderately large genus of seedbugs of which 17 species and 5 "varieties" are Palearctic and 11 species are Nearctic (Slater 1964). In terms of the world fauna the genus has never been monographed and badly needs revisional study. Many new taxa are present in the western Nearctic fauna and a suspiciously large gap exists in records of *Eremocoris* from the eastern Palearctic. Nevertheless, due to the studies of Barber (1928) the fauna of eastern North America on the alpha taxonomy level is comparatively well known, and at present consists of one widespread species, *E. ferus* (Say) and two southeastern species, *E. setosis* Blatchley and *E. depressus* Barber.

Eremocoris seedbugs are common insects in eastern North America (Sweet 1964). Their apparent rarity, such as indicated by the few records given in the Slater catalogue (1964), is merely a function of the collecting habits and specializations of entomologists since the insects live on the ground under litter where, in the sense of Janzen (1971) they prey on fallen seeds, especially those of coniferous trees. I found other species of the genus in the western United States to be similarly abundant under various coniferous trees. From the standpoint of reproductive ecology and forestry the significance of these insects must be severely underestimated since the bugs not only feed on seeds after they have fallen, but do so in an inconspicuous manner through drilling a nearly invisible hole into seeds, rather than in the easily detected destructive manner of small rodents.

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My study (1964) of *Eremocoris ferus* in New England suggested that actually two closely related sibling or better, cryptic species were present. Such hemipterists as Barber (1928) Blatchley, (1926) Torre-Bueno (1946), Van Duzee (1921), and Walley (1934) who had occasion to collect and study *Eremocoris* taxonomically did not distinguish these two common species.

Since names are already available for each of the species I prefer here only to differentiate the species since appropriate redescriptions ought to be made in the context of a world revision with complete series of all the available species in the genus. A key to the species of eastern North America is given. As it will be probably some time before a generic revision will be undertaken, and as both species are abundant and of some ecologic and probable economic importance, I give evidence here for the following taxonomic actions: 1) to raise *Eremocoris borealis* (Dallas, 1852) from synonymy with *E. ferus* (Say); and 2) to designate a neotype for *Eremocoris ferus* (Say, 1831).

The materials and methods used in the present study are described in Sweet (1964). Since seedbugs can be cultured and studied easily in the laboratory, reproductive as well as ecological and morphological criteria could be utilized which is unusual in taxonomic studies.

Results and Discussion

Reproductive isolation – The initial realization that two species were present came through laboratory studies. When measuring the prereproductive periods of *E. ferus* I noted that on several occasions normal courtship behavior, copulation, egg deposition or development did not occur (Sweet, 1964). Reexamination of the data showed that this occurred when males from hemlock-birch forests of northern New England were placed with austral New England virgin females reared in the laboratory. I could later reinvestigate these findings. An *E. borealis* sample was collected under a gray birch-jack pine association in Sparta, Wisconsin and the *E. ferus* sample was collected under *Thuja* in east central Texas at College Station. No courtship behavior was seen in paired and multiple mating trials using both virgin and mated females. The specimens used were sexually active as shown by the eliciting of normal courting behavior in *ferus* males introduced to the virgin *ferus* females. Similarly, the *E. borealis* males were placed with *E. borealis* females and went readily into the courtship behavior which was similar to that described for *E. ferus* (Sweet, 1964), except that the motions were slower and males less responsive to the females. The courtship behavior of *E. borealis* is as follows: On contact with the female the male rose slightly up on his legs and touched the female with antennae. The male would bend his antennae and stiffly hold the terminal three antennal segments at right angles level to his body. The antennae were vibrated in rapid bursts as the male jerkily advanced toward and upon the female. This behavior was observed repeatedly since many such advances were made before copulation would occur. In the presence of an *E. ferus* female the *borealis* male extended the antennae as previously but did not respond further. *E. ferus* male behaved similarly toward an *E. borealis* female. This lack of courtship response by the males of *Eremocoris* to females of another species is in marked contrast to *Ligyrocoris* seedbugs (Sweet, 1963, Sweet, unpublished) in which males of 6 species each indiscriminately responded to the females of all the other species, and the isolating mechanism evidently was the female's escape response.

Because one of the females in the New England study did lay 65 eggs of which 23 developed and hatched but died as early instars, three virgin receptive *ferus* females and four *borealis* males were left together in a culture dish for two months during which the three virgin *ferus* females laid a total of but 11 infertile eggs. In contrast, in control cultures of *E. borealis* from Wisconsin and New Hampshire, and of *E. ferus* from Texas and Connecticut, a female normally laid hundreds of fertile eggs which hatched and were reared easily to the adult stage. Because of the logistics of my residence in Texas, the cross matings could not be further replicated and virgin *E. borealis* females were not available to mate with *E. ferus* males for the reverse cross. Nevertheless, from my experience of rearing and mating lygaeid bugs, this was strong evidence in conjunction with the ecological and morphological evidence that *E. borealis* Dallas is a distinct species from *E. ferus* Say, and is not a subspecies or an ecophenotype.

Habitat ecology.–The presence of two species made explicable my field studies in New England which showed *E. ferus* in the sense as previously understood, to have an unusually broad ecological amplitude ranging from cool wet alpine habitats on Mt. Washington, New Hampshire, to relatively dry warm *Myrica-Rhus* coastal scrub along Long Island Sound in Connecticut. Moreover, the specimens of *Eremocoris* from the cooler northern areas of New England were much more heat sensitive and more difficult to transport to the laboratory than those from warmer, more southern areas of New England. Such a variation was not seen in other cool-adapted rhyparochromines studied. The northern set of *Eremocoris* populations *(E. borealis)*, was usually found in association with the lygaeid seedbugs *Scolopostethus diffidens* Horvath, *Antillocoris minutus* (Bergroth), *Plinthisus americanus* (Van Duzee) and sometimes *Scolopostethus thomsoni* Reuter in ground litter of cool Canadian Transitional Zone coniferous forests dominated by spruce (*Picea rubens* Sarg.) or hemlock (*Tsuga canadensis* (L.) Carr) and usually mixed with birches (*Betula papyrifera* Marsh, *B. lutea* Michx., *B. populifolia* Marsh) (Sweet 1964).

The more austral set of populations *(E. ferus)*, was present in a larger variety of Carolinian Zone forest and shrub biotopes in southern New England but not in the relictual hemlock or spruce forests present. The insect was most common in open red maple-oak forests beneath the undershrubs *Vaccinium* spp. and *Viburnum* spp. where it occurred in association with the seedbugs *Ozophora picturata* Uhler, *Scolopostethus atlanticus* Horvath, *Drymus unus* (Say), and *Antillocoris minutus* (Bergroth). The southern *E. ferus* was also found in similar habitats along forest margins of eastern Texas and into central Texas under juniper breaks in sheltered locations along the edge of the Edwards Plateau. *E. ferus* fed on a broader range of host seeds (Sweet, 1964), but the propensity toward conifer seeds so marked among species of *Eremocoris* was still evident since the insects, despite being often present in deciduous woodlands, were frequently found feeding on the fallen seeds of *Juniperus* spp. and *Thuja occidentalis* L. Since both species would feed readily in the laboratory on the same variety of seeds, host preferences *per se* probably may play at most a subsidiary role in habitat selection.

Morphology.–A consequent morphological reexamination of the specimens of the two species thus recognized on reproductive and ecological evidence showed that they can be easily distinguished despite their close resemblance. In the northern species the hind tibia appears nearly nude, with the very short hairs being shorter than the length of the small moveable spurs present on the inner surface of the hind tibia (Fig. 1); the hairs on the body are also relatively more sparse and shorter, and on the abdominal venter the hairs are relatively long only on the terminal two sterna; the labium reaches, at most, the metasternum. In contrast the southern species has the hind tibia densely investitured with long erect hairs (Fig. 2) which are much longer than

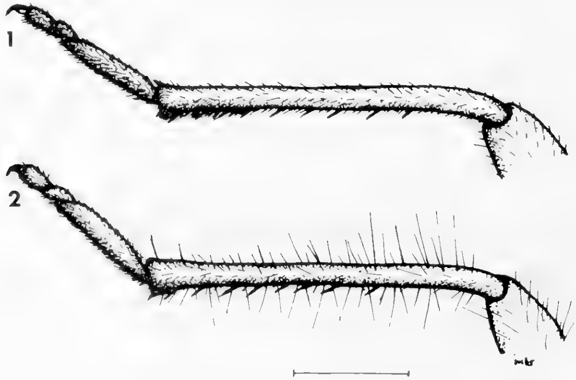

Fig. 1-2. Hind tibia showing investiture. Fig. 1.–*E. borealis* (Dallas), Fig. 2.–*E. ferus* (Say). Scale line equals 0.5mm.

the moveable spurs; the body hairs are relatively denser and longer and long hairs evenly cover nearly all of the abdominal venter; the labium reaches the abdomen. The tibial pilosity is the most reliable character. Increasingly toward the north and northwest a subbrachypterous form is present in *E. borealis,* which corresponds to the comparative habitat permanence of climax spruce taiga forest. Such wing polymorphisms are characteristic of many ground-living seedbugs of permanent habitats.

Eremocoris ferus (Say)

Since Thomas Say's specimens are no longer extant a neotype designation is required for *E. ferus.* Say (1831) collected in the area between Virginia and Indiana and studied collections from expeditions to the southern United States. It is very probable that Say had the southern population before him when he described *ferus.* I therefore hereby designate a neotype (USNM Type No. 73953) to fix the name *Eremocoris ferus* (Say) for the southern population. The type-specimen bears the data: Nelson Co., Va., June 30, 1924 (W. Robinson). A neotype designation is especially important in this case because of the mixed concept of *E. ferus* documented here. Moreover Say's description does not exactly agree with the concept of *E. ferus* as used by all subsequent authors. Say's description mentioned piceous hemelytra and the hemelytra of *E. ferus,* while relatively dark, are clearly bicolored. However, it surely would serve no meaningful purpose to change such a long accepted name for the common *Eremocoris* of the eastern United States. The present neotype designation would promote nomenclatural stability by fixing the name *Eremocoris ferus* (Say) for the eastern species discussed herein.

E. ferus (Say), as thus here understood has a Carolinian and Austroriparian Zone distribution extending from the Gulf of Mexico in the eastern United States north to lowland locations in New England with the northern records being from Boston, Massachusetts, Clarmont, New Hampshire, Storrs, Connecticut, and southern New York. The specimens so far seen from Illinois, Iowa and Indiana are all referable to *E. ferus* and appear to mark the northern limit of the distribution of the species in the midwest. I have seen no *E. ferus* from west of the 100° meridian. However, small relictual populations occur in sheltered cedarbreak habitats along the Balcones Escarpment of the Edwards Plateau of Texas and may extend west of the meridian.

Eremocoris borealis (Dallas)

E. borealis (Dallas, 1852) had been placed in synonymy with *E. ferus* (Say) by Uhler (1871). I was able to examine at the British Museum the lectotype selected by Scudder (1967) of *Rhyparochromus borealis* Dallas, 1852 which Scudder listed as a synonym of *E. ferus* (Say). The type-locality is Hudson's Bay which while it had a broader meaning before 1852 than at present, is still a northern location. The type-specimen was not in perfect condition, but it shows the requisite characters noted earlier and is clearly conspecific with the northern population of *Eremocoris* documented previously as distinct from *E. ferus.* I therefore raise *Eremocoris borealis* (Dallas, 1852: List Hem. B.M. 2: 565) (NEW STATUS) from synonymy with *Eremocoris ferus* (Say, 1831; Des. Het. Hem. N. Amer. p. 333).

Specimens which are attributable to *E. borealis* occur in the Canadian Zone from Anchorage, Alaska, Hudson's Bay (the type-locality), to Newfoundland and Labrador, and south in the east at high elevations along the Appalachians with specimens at hand from summits of Mt. LeConte, Tennessee (M.D. Leonard, X-10-26) and Black Mountain, N. Carolina. The southermost records available in the midwest are from Sparta, Wisconsin and Alger Co., Michigan (R.&K. Dreisbach). However, in the west, the species extends south through British Columbia and Alberta to Montana and Oregon. The specimens seen so far from Colorado, Wyoming, New Mexico and Arizona are neither *E. borealis* nor *E. ferus.*

It is clear from the study of specimens in various collections determined by H.G. Barber, the leading specialist on the Lygaeidae during the first half of this century, that Barber's concept of *Eremocoris ferus* in the western North America represents a complex of closely related species which includes *Eremocoris borealis, E. dimidiatus* Van Duzee, *E. obscurus* Van Duzee, and *E. canadensis* Walley, as well as several undescribed species, all of which I have studied. These western species, it may be noted, show parallel variations in the pilosity of the tibia, which led Barber to disregard this obvious difference between the northern and southern species of the eastern *"E. ferus"*. In any case the western *Eremocoris* should be studied only in conjunction with the fauna of the eastern Palearctic. Indeed, Horvath (1883) noted the similarity of the Siberian *E. angusticollis* Jakovlev, 1881 to *E. ferus. E. angusticollis* could very well be a synonym of *E. borealis,* given the far northern taiga distribution of the cool-adapted *E. borealis.*

Sympatry – In the eastern part of its distribution, E. borealis narrowly overlaps the northern limits of the range of *E. ferus.* In the zone of sympatry in southern New England, *E. borealis* was found in cooler hemlock forest ravines; *E. ferus* in warmer deciduous edge habitats; the two were never found together in the same biotope. However, each species, *borealis* to the north, *ferus* to the south, were each found in a greater diversity of biotopes outside of than within the zone of sympatry. This suggests that within the zone of sympatry habitat displacement occurs: the northern species has the competitive advantage in cooler habitats; the southern species in warmer habitats.

In the zone of sympatry I could discern no morphological evidence in the specimens available of any intergradation or hybridization between the two species: the specimens formed distinctly separate series. Conversely, I saw no evidence of character displacement in the sense of Brown and Wilson (1956) in the color, size, pilosity, and labial length of specimens of the two species within the zone of sympatry.

The lack of character displacement may be interpreted as a result of the ecological displacement in the zone of sympatry. Since the two species were not found together in the same biotope, there may have been no direct competitive interactions to provide the selective pressures to create morphological character displacement, although ecophysiological character displacement may have occurred.

No one of the lines of evidence so far discussed would by itself demonstrate that two species are present. However, taken together, the reproductive, behavioral, ecological, morphological and distributional evidence, strongly supports the species distinction of *E. borealis* Dallas from *E. ferus* Say.

Key to the Species of Eremocoris of North America East of the 100°th Meridian

1. Entire body and legs densely pilose with long erect hairs; hemelytra dark brown; fore femora armed beneath with two major spurs . . . . *E. setosis* Blatchley

   At least femora, often hemelytra with at most short inconspicuous hairs; hemelytra at least in part pale; fore femora armed beneath with one major spur 2

2. Corium uniformly shining pale brown; nearly nude above; body strongly flattened in appearance, length of antennal segment 2 and length of anterior lobe of pronotum much greater than thickness of abdomen . . . . *E. depressus* Barber

   Corium dull bicolored, anteriorly paler; at least scutellum pilose; body not flattened in appearance, length of antennal segment two and length of anterior lobe of pronotum less or equal to thickness of abdomen 3

3. Tibia pilose with hairs much longer than moveable spines (fig. 2) abdomen evenly pilose; labium attains abdomen . . . . *E. ferus* Say

   Tibia sparsely pilose, hairs shorter than moveable spines (fig. 1), abdomen with long hairs only on posterior two segments; labium attains thoracic metasternum . . . . *E. borealis* Dallas

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NEARCTIC *GLYPTA* PARASITES (HYMENOPTERA: ICHNEUMONIDAE) OF CONIFER FEEDING OLETHREUTIDAE (LEPIDOPTERA)[1]

G.S. Walley, J.R. Barron[2]

ABSTRACT: The Nearctic species of *Glypta* Gravenhorst which parasitize larvae of Olethreutidae that feed in cones or shoots of conifers are described. These are *Glypta evetriae* Cushman and three new species: *zozanae, eucosmae,* and *rhyacioniae.* The cephalic structures of the last instar of *eucosmae* larvae are described and illustrated.

Four Nearctic species of *Glypta* Gravenhorst, parasites of several species of Lepidoptera of the family Olethreutidae, whose larvae feed in the cones or shoots of conifers, were studied and are described. These include *Glypta evetriae* Cushman and three new species. *G. evetriae* occurs in the western Nearctic where it parasitizes the larvae of *Barbara colfaxiana* Kearfott which feed in the cones of *Pseudotsuga menziesii* (Mirb.) Franco. The three other species all attack olethreutid larvae that bore in the shoots of *Pinus* species. One of the latter, which closely resembles *evetriae,* is known, as yet only from lower elevations of the Sierra region of central California where it has been reared from *Rhyacionia zozana* (Kearfott), a borer in shoots of *Pinus ponderosa* Lawson. The other two species occur in the eastern Nearctic where one is a parasite of the Nantucket pine tip moth, *R. frustrana* (Comstock); the other parasitizes *Eucosma gloriola* Heinrich and *E. cocana* Kearfott. Both species of *Eucosma* are borers in shoots of *Pinus* species. The two eastern species of *Glypta* resemble each other very closely and differ more widely from the two western species which in turn are similar.

Key to Species

1. Temple rather long and not, or only weakly, receding (Figs. 1, 2); face as wide as, or a little wider than, length of eye. Western Nearctic 2

Temple rather short and strongly receding (Figs. 3, 4); face slightly narrower than length of eye. Eastern Nearctic 3

2. Temple not or only very slightly receding (Fig. 1); propodeum with median longitudinal carinae absent or very weak and usually incomplete . . . . *evetriae* Cush.

Temple weakly receding (Fig. 2), propodeum with distinct, complete, median longitudinal carinae . . . . *zozanae* n. sp.

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3. Occipital carina extending to base of mandible; ovipositor sheath about as long as propodeum and abdomen combined; first abdominal tergite in female slightly wider (1.04-1.31) than long . . . . *eucosmae* n. sp.

Occipital carina intersecting oral carina close to base of mandible (distance from point of intersection to base of mandible about equal to diameter of terminal segment of maxillary palpus); ovipositor sheath about as long as thorax and abdomen combined; first abdominal tergite of female slightly narrower (0.83-0.97) than long . . . . *rhyacioniae* n. sp.

Glypta evetriae Cushman

Glypta evetriae Cushman, 1917. Proc. U.S. natn. Mus. 53: 469. Types, 5 females, 4 males, reared from *Evetria taxifoliella* Busck in cones of *Pseudotsuga menziesii*, at Ashland, Oregon, USNM.

Glypta evetriae; Viereck, 1925. Ann. Rpt. ent. Soc. Ont. 55: 102.

Female – Length: front wing 5.3 - 6.0 mm, ovipositor sheath 5.2 - 5.5 mm. Face 1.08 - 1.20 as wide as length of eye. Occipital carina narrowly incomplete above, extending below to base of mandible, not sinuate opposite lower part of eye. Temple very broad, broadly rounded and not receding except in posterior 0.35 (Fig. 1). Gena in front view very strongly rounded. Ocellocular space slightly greater than diameter of lateral ocellus. Malar space about 0.55 basal width of mandible. Apical margin of clypeus weakly convex, without median notch. Antennal flagellum with about 34 articles. Face and base of clypeus with dense, rather fine punctures. Frons with very dense, rather coarse punctures; region above antennal sockets with a few short, transverse wrinkles.

Thorax moderately stout; epomia short; notaulus very weak, ending a little before middle of mesoscutum. Propodeum with distinct, but often rather weak, apical transverse carina; median longitudinal carinae absent or weak and usually incomplete; costulae and lateral longitudinal carinae absent; posterior declivity of propodeum evenly, densely punctate.

Abdomen moderately stout; tergites with coarse, dense and often confluent punctures; first tergite moderately convex in profile, 1.00 - 1.06 as wide at apex as long; second tergite 1.49-1.55 as wide as long; tergites 2 to 4 with strong, oblique impressions; tergites 5 and 6 strongly retracted. Ovipositor sheath about as long as thorax and abdomen combined.

General colour of body black. Clypeus usually black, but sometimes dull yellowish or brownish except at base. Mandibles black. Palpi mostly pale brownish with labial palpus and first and second segments of maxillary palpus blackish. Legs colored as in *eucosmae.*

Male – Closely resembling female in structure and colour. Differs in structure in having flagellum with 2 or 3 additional articles, abdominal tergites more elongate with tergites 5 and 6 only slightly retracted, and hind tarsus usually blackish except for a very narrow whitish annulus at base of first segment.

Specimens Examined. CANADA, British Columbia (10 males, 17 females), Agassiz, May 5, 1922, R. Glendenning; Cowichan, reared from *Barbara colfaxiana,* May 13, 1935, May 5-15, 1958, Apr. 26, 1951, Mar. 7-11, 1951, D. Radcliffe; Cowichan Lake, Mar. 17, 1958, Mar. 22, 1952; Crofton, reared from *B. colfaxiana,* June 13, 1952; Franklin River, reared from *B. colfaxiana;* Oyster Bay, reared from *B. colfaxiana,* June 13, 1952; Oyster River, Vancouver Is., reared from cones of *Abies grandis,* G.R. Hopping; Pigoot Creek, reared from *B. colfaxiana coloradensis,* June 5, 1953. **UNITED STATES,** Montana, Missoula; Oregon (4 males, 5 females), Ashland, reared from *Evetria taxifoliella* in cones of *Pseudotsuga menziesii.*

Distribution. (Fig. 7).

Glypta zozanae n. sp.

Holotype female – Length: front wing 5.8 mm; ovipositor sheath 5.5 mm. Face 1.0

as wide as length of eye. Occipital carina narrowly incomplete above, extending below to base of mandible, weakly sinuate opposite lower part of eye. Temple broad, very broadly rounded, weakly receding (Fig. 2). Gena in front view rather strongly rounded. Ocellocular space slightly greater than diamter of lateral ocellus. Malar space 0.60 basal width of mandible. Antennal flagellum with 36 articles.

Propodeum with distinct apical transverse and median longitudinal carinae.

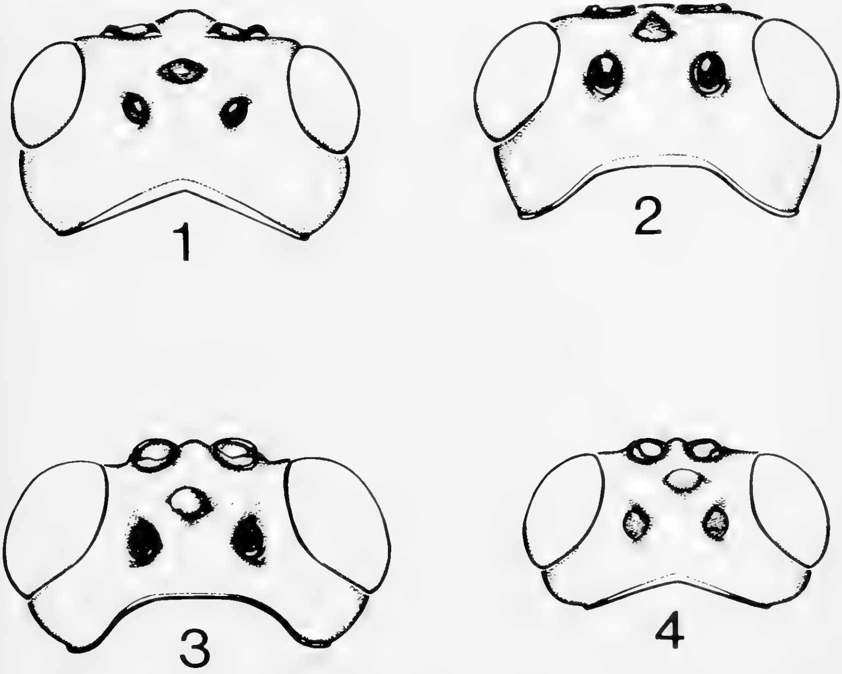
Abdomen as in *evetriae.*

Colour as in *evetriae.*

Male – Closely resembles female in structure and colour. Differs in structure mainly in its slightly narrower face, slightly shorter malar space and distinctly more elongate abdominal tergites. The middle trochanters are paler.

This species agrees with *evetriae* in structure and colour, except for a few minor differences as noted in the key and description above. The two species also differ somewhat in their biology and distribution. *Glypta evetriae* is a parasite of larvae that feed in cones of *Pseudotsuga* in some parts of California (Kean, 1958, U.S. Dept. Agr. Tech. Bull. 1169, p. 89), in Montana, Oregon, and southwestern British Columbia. *Glypta zozanae* attacks a borer in the shoots of *Pinus ponderosa* Laws, and as yet has only been found in two localities in the Sierras of California.

TYPES. HOLOTYPE, female, 15 mi SE Groveland, Cal., reared from *Rhyacionia zozana* on *Pinus ponderosa,* autumn 1963, emerged Apr. 1, 1964, R.E. Stevens, USNM.



Figs. 1-4. Dorsal aspect of head, females, 1, *evetriae,* 2, *zozanae,* 3, *eucosmae,* 4, *rhyacioniae.*

PARATYPES, UNITED STATES, California (2 males, 1 female), same data as holotype, also Placerville, reared from *R. zozana* on *P. ponderosa,* coll. Jan.-Apr., emerged June 11, 1964 and May 11, 1964, R.E. Stevens. Paratypes, USNM.

DISTRIBUTION. (Fig. 7).

Glypta eucosmae n. sp.

Glypta n. sp. Drooz, 1960. J. econ. Ent. 53: 248.
Glypta sp. Butcher, 1949. Ms. Thesis, Univ. Minnesota.
Glypta sp. DeBoo, Sippell, and Wong, 1971. Can. Ent. 103: 1483.

Holotype female – Length: front wing 5.5 mm; ovipositor sheath 5.2 mm. Face 0.85 as wide as length of eye. Occipital carina narrowly incomplete above, extending below to base of mandible, weakly sinuate opposite lower part of eye. Temple rather narrow, very broadly rounded, strongly receding (Fig. 3). Ocellocular space slightly greater than diameter of lateral ocellus. Malar space 0.55 basal width of mandible. Apical margin of clypeus weakly convex, without median notch. Antennal flagellum with 36 articles. Face and base of clypeus with dense, rather fine punctures. Space between and immediately above antennal sockets with a pair of short, weak, divergent carinae. Frons with very dense, rather coarse punctures; region above antennal sockets with a few short, transverse wrinkles.

Thorax moderately stout; epomia short; notaulus very weak, ending a little before middle of mesoscutum. Pronotum, mesothorax and propodeum moderately to densely punctate; intervals between punctures, and speculum, polished; posterior declivity of propodeum punctate-rugose. Propodeum with strong, regular, median longitudinal and apical transverse carinae; costulae rather weak and somewhat irregular. Hind wing with nervellus slightly inclivous, intercepted at posterior 0.3.

Abdomen stout; tergites with coarse, dense, and in part more or less confluent punctures; first tergite moderately convex in profile, 1.07 as wide at apex as long; second tergite 1.72 as wide as long (Fig. 5); tergites 2 to 4 with strong, oblique impressions; tergites 5 and 6 strongly retracted. Ovipositor sheath about as long as propodeum and abdomen combined.

General colour of body black. Clypeus except at base, mandible at middle and scutellum at apex dull reddish-brown. Antenna blackish with apex of pedicel yellowish-brown, flagellum brownish-black, paler beneath, especially toward base. Palpi yellowish, tinged with brownish. Tegula and elongate, triangular spot on hind corner of pronotum whitish. Legs fulvous with markings as follows: front leg with most of coxa, trochanters, apex of femur, upper side of tibia, and four basal segments of tarsus whitish; middle leg with trochanters, apex of femur, upper side of tibia and four basal segments of tarsus, except at their apices, whitish; hind leg with basal trochanter whitish in part, distal trochanter entirely whitish, femur narrowly infuscate at apex, tibia whitish with a faint, narrow, sub-basal, fuscous annulus that is interrupted on upper side and beneath is joined by a fuscous stripe to a broader, apical, blackish annulus, tarsus blackish with basal 0.6 of basal segment and bases of segments 2 to 4 successively more narrowly whitish.

Male – Closely resembling female in structure and colour. Differs in structure mainly in its slightly narrower face, slightly shorter malar space, slightly more elongate abdominal tergites 2 to 4 and less strongly retracted apical tergites. Middle coxa mostly whitish and trochanters usually entirely whitish.

Larva – Cephalic structure of final instar (Fig. 6) moderately sclerotized. Epistoma very lightly sclerotized, incomplete, produced dorsally little beyond superior mandibular process. Superior mandibular process well sclerotized, almost as broad at apex as at base, the sides only slightly convergent towards subtruncate apex. Pleurostoma lightly sclerotized, not well defined. Inferior mandibular process with pointed posterior and anterior strut, posterior slightly longer than anterior. Hypostoma lightly sclerotized, almost straight, without dorsal extension at lateral end. Hypostomal spur large, nearly twice as long as wide at base. Stipital sclerite relatively long, about same width as hypostoma at middle. Labial sclerite rounded, incomplete ventrally, lateral arm slightly enlarged to form a dorsal flange, length to width ratio 1:1, broadest at middle. Prelabial sclerite very lightly sclerotized, not attached to labial sclerite dorsally, attached to labial sclerite ventrally but indistinct. Maxillary and labial palpi small, each with one large and one small sensillum, each with diameter slightly larger than width of lateral arms of labial sclerite. Silk press large, prominent, and heavily sclerotized, with two small sensilla beneath external opening of press. Mandibles relatively small, each with blade slightly curved, without teeth, length of blade slightly less than half overall length of mandible, junction of blade and body of mandible continuous, without interruption or angulation. Antennal sockets lightly sclerotized, each with narrow, lightly sclerotized outer rim, with three small sensilla apparent. Spiracle with three reticulations on atrium, with stalk of four or five annulations and closing apparatus, the latter distant from atrium. Integument densely covered with small cone-shaped protuberances, with a few short setae.

There are differences in the degree and extent of infuscation of adults, some appearing paler, with black replaced by piceous, by ferrugineous, and fulvous by whitish. Differences between *eucosmae* and *rhyacioniae* are as given in the key and in remarks under *rhyacioniae* and are illustrated in Fig. 5.

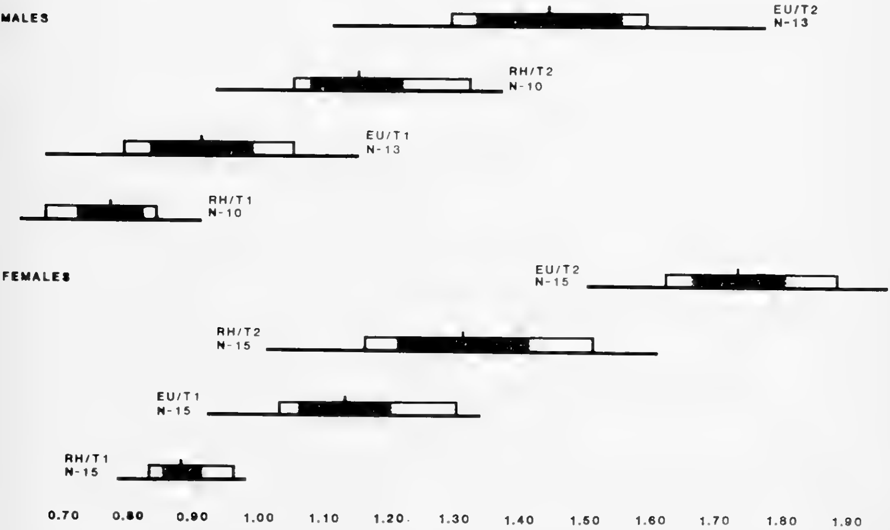


Fig. 5. Variation in length to width ratio of abdominal tergites T1 and T2 of combined population samples of *eucosmae* (EU) and *rhyacioniae* (RH). Samples show range (open bar), mean, standard deviation (closed bar) and 99% confidence limits.

The last instar cephalic structures of species of *Glypta* previously described and figured are *fumiferanae* (Viereck) (Brown, 1947), *haesitator* Gravenhorst (Cameron, 1938), *murinanae* Bauer (Short, 1970), *parvicaudata* Bridgman (Beirne, 1941), and *Glypta* sp. (Short, 1959). The hypostoma of *eucosmae* larvae is only slightly curved as in *fumiferanae, murinanae,* and *parvicaudata,* but is somewhat longer. The hypostoma of *haesitator* and Short's *Glypta* sp. is strongly curved. The hypostomal spur of *eucosmae* is similar to the described species except that of Short's *Glypta* sp. which is smaller. The labial sclerite is rounded, a characteristic of the genus, but is incomplete as in *fumiferanae, parvicaudata,* and Short's *Glypta* sp.; that of *haesitator* and *murinanae* is complete. The silk press is large and well sclerotized as in the other species and the mandibles are characteristic and without teeth.

TYPES. HOLOTYPE, adult female, Galt, Ontario, reared from *Eucosma gloriola,* emerged Mar. 9, 1966, CNC (No. 15213). **PARATYPES, CANADA,** Ontario (52 males, 63 females), reared from *E. gloriola,* emerged late Feb. to late June, Chatsworth, Galt, Hudson, Ignace, Midhurst, Paisley, Simcoe, Thessalon, Valora, Webwood; Manitoba (22 males, 29 females), Sandilands Forestry Reserve, Woodridge. **UNITED STATES,** Connecticut (1 male, 2 females), Stamford, reared from *E. gloriola,* May, 1932, E.P. Felt, Hym. lot No. 7979, *ex* White pine shoot moth, July 8, 1931, *ex* tips of *Pinus strobus,* July 10, 1930, em June 1, 1931; Georgia (8 males, 4 females), Clarke Co., *ex Eucosma cocana* Kft., May 4-14, 1969, B.H. Ebel, Hopk. 47546; Pennsylvania (15 males, 36 females), Knauers, *ex E. gloriola* on Scots pine, Nov.-Jan., 1958, 1959. Specimens from Canada reared in laboratory. Paratypes, USNM, Tow. coll., CNC (No. 15213).

DISTRIBUTION. (Fig. 7).

Glypta rhyacioniae n. sp.

Glypta varipes; Cushman, 1927. J. Agr. Res. 34: 618.

Glypta varipes; Yates, 1967. Key to Nearctic parasites of the genus *Rhyacionia* with species annotations. SE Forest Exp. Stn., Asheville, N.C., U.S. Dep. Agr., Forest Service, p. 73.

Holotype female – Length: front wing 4.7 mm.; ovipositor sheath 6.3 mm. Face 0.8 as wide as length of eye. Occipital carina narrowly incomplete above, joining oral carina below at a point close to base of mandible, very weakly sinuate opposite lower part of eye. Temple narrow, moderately rounded, strongly receding (Fig. 4). Ocellocular space slightly greater than diameter of lateral ocellus. Malar space 0.52 basal width of mandible. Apical margin of clypeus weakly convex, without median notch. Antennal flagellum with 36 articles. Sculpture of face and frons as in *eucosmae* except that carinae between antennal sockets are indistinct.

Thorax and propodeum a little more slender, otherwise as in *eucosmae.*

Abdomen rather slender; first tergite 0.90 as wide at apex as long; second tergite 1.33 as wide as long (Fig. 5). Ovipositor sheath about as long as thorax and abdomen combined. Abdomen otherwise as in *eucosmae.*

Colour essentially as in *eucosmae.*

Male – Closely resembles female in structure and colour. Differs in structure mainly in its slightly narrower face, slightly shorter malar space, slightly more elongate abdominal tergites 2 to 4 and less strongly retracted apical tergites. The middle coxae are paler, usually mostly whitish.

Colour varies as described under *eucosmae.* Length to width ratios of abdominal tergites 1 and 2 (Fig. 5) between population samples of *eucosmae* and *rhyacioniae* are significantly different.

TYPES. HOLOTYPE, female, Nantucket, Mass., reared from *Rhyacionia frustrana* Comst., emerged Mar. 15, 1926, I.W. Bailey, USNM. **PARATYPES, UNITED STATES,** Massachusetts (10 males, 14 females). Nantucket, reared from *R. frustrana,* Mar. 12-25, 1926, I.W. Bailey, reared from *R. frustrana* on *Pinus rigida,* June 10, 1927, L.G. Baumhofer, reared from *R. frustrana* on *P. resinosa,* June 19, 1927, L.G. Baumhofer, reared from *R. frustrana,* May 27, 1926, Nantucket Island, reared from Nantucket pine tip moth, May 15, 1932, E.P. Felt, Hym. lot No. 7979; Sharon Hts., reared from *R. frustrana* on *Pinus rigida,* Apr. 28 - May 6, 1915, C. Heinrich, reared from *R. frustrana* on *P. mughus,* Apr. 30, 1915; New York (2 males), Croton Falls, "host in red pine", Aug. 7, 1933, *leg.* Purdeys. Paratypes, USNM and CNC (No. 15214).

DISTRIBUTION. (Fig. 7).

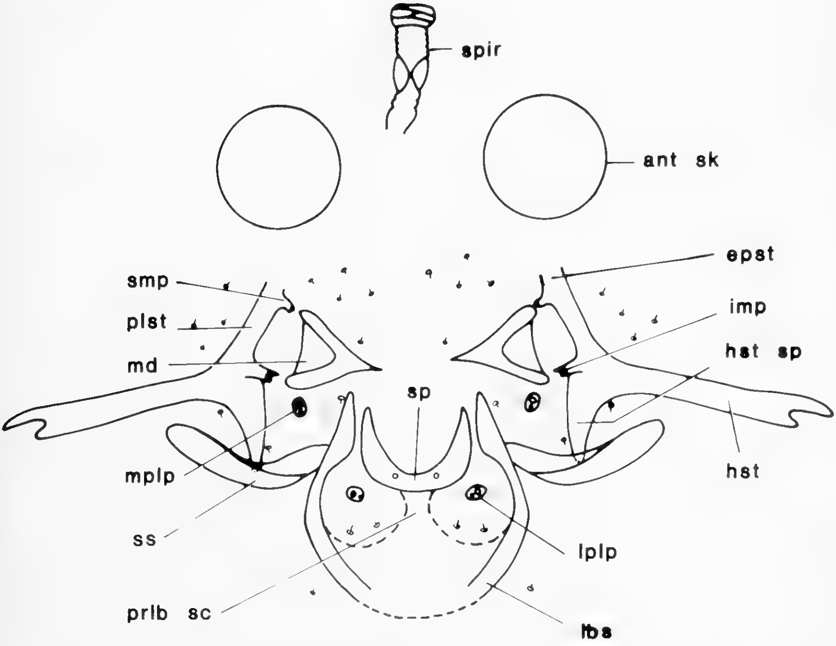


Fig. 6. Cephalic structures of final instar of *eucosmae;* ant sk, antennal socket; epst, epistoma; hst, hypostoma; hst sp, hypostomal spur; imp, inferior mandibular process; lbs, labial sclerite; lplp, labial palp; md, mandible; mplp, maxillary palp; plst, pleurostoma; prlb sc, prelabial sclerite; smp, superior mandibular process; sp, silk press; spir, spiracle; ss, stipital sclerite.

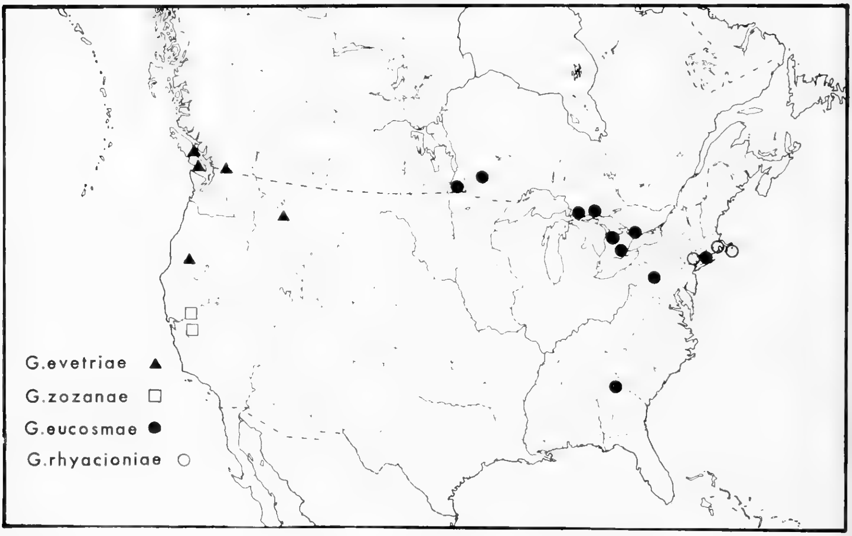


Fig. 7. Distribution of specimens of *evetriae, zozanae, eucosmae, rhyacioniae.*

ACKNOWLEDGEMENTS

For assistance in this study the authors are indebted to Miss Luella Walkley, Washington, for specimens and information, especially concerning the identity of the species *G. eucosmae* and *G. rhyacioniae,* described herein. We are also grateful to the following for supplying additional specimens and information: R.W. Carlson, United States National Museum, Washington; R.F. DeBoo, Department of the Environment, Winnipeg, Manitoba; D. Evans, Department of the Environment, Victoria, British Columbia; and H.O. Yates III, Forestry Sciences Laboratory, Athens, Georgia. Dissections, drawings, and assistance in interpretation of head capsules of larvae by H.E. Bisdee, Biosystematics Research Institute, Ottawa, is gratefully acknowledged. We are also grateful to Sharon Bolte, formerly of this Institute, for the drawings of adult heads.

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THE ECOLOGY OF HONEY CREEK, OKLAHOMA: THE DOWNSTREAM DRIFT OF THREE SPECIES OF AQUATIC DRYOPOID BEETLES (COLEOPTERA: DRYOPOIDEA)[1]

William K. Reisen[2]

ABSTRACT: Daily adult and larval *Lutrochus luteus* LeConte drift was highest during May and June 1973, while larval benthic densities were maximal during late summer, 1972. Drifting *Dubiraphia vittata* (Melsh.) and *Microcylloepus pusillus* LeConte adults were most prevalent during spring and summer, 1973. Diel adult drift rates for all three species were characteristically nocturnal with a significant pre-midnight peak of activity, while *L. luteus* larvae were most active during the midnight hours.

DESCRIPTORS: drift, benthos, dryopoid beetles

Practically all information on the ecology of midwestern, aquatic dryopoid beetles has been presented as a series of qualitative observations by Brown and associates (Sanderson and Brown, 1956; Brown and Shoemake, 1964b; Brown, 1966; Brown and Murvosh, 1970). This group of beetles typically inhabit unpolluted, fast moving streams where they are found attached to, or beneath, stones and allochthonous detritus. Several genera such as *Lutrochus* (Limnichidae), and *Dubiraphia* and *Microcylloepus* (Elmidae) are frequently associated with travertine streams throughout their distribution and have been reported from Honey Creek, Oklahoma (Sanderson and Brown, 1956; Brown, 1956, 1960; Brown and Shoemake, 1964a; Reisen 1975a). Although the downstream drifting behavior of many stream insects is well understood (Waters, 1972; Hynes, 1972, Bournaud and Thibault, 1973), no quantitative observations have been reported on the diel or temporal drifting patterns of these genera of dryopoid beetles with the possible exception of Bishop and Hynes (1969) who listed *Dubiraphia* as a minor component of the autochthonous drift comprising 0.1% of the total.

During a study on the population ecology of simuliids at Honey Creek, Oklahoma, (Reisen, 1974, 1975b, 1977), dryopoid larvae and adults were routinely encountered in both benthic and drift samples. The purpose of the present report is to describe the temporal and diel patterns of those collections.

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[1] Accepted for publication: March 17, 1977

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Methods and Materials

Selected aspects of the ecology of Honey Creek including temporal patterns in physico-chemical conditions and periphyton abundance have been studied by Hornuff (1957) and Reisen (1974, 1975a and 1976b). All collections presented in the present report were made within the zone of travertine deposition between Bridal Veil and Turner Falls coinciding with those stations described by Reisen (1974, 1976b, 1977).

The drift sampling apparatus, collection procedures, sampling schedule, specimen sorting methodology and statistical analyses were the same as those used by Reisen (1974, 1976a, 1977). *Lutrochus luteus* Le Conte larvae were also frequently recovered from weekly bottom samples taken at 6 permanent stations situated at different riffles within the zone of travertine deposition (Reisen, 1976b). Single "best estimate" collections were made at each station with a modified Surber sampler (bottom area = 39.0 cm^2) averaged over the 6 stations, and expressed as the mean number of larvae per cm^2 of bottom area.

Results and Discussion

L. luteus larvae were recovered throughout the year in both benthic and drift samples with peak abundances observed during the warmer months of the year (Fig. 1 and 2a). Benthic densities on the riffles were highest during the late summer and early fall of 1972 when stream discharge was exceedingly low due to an extended rainless period. Larvae were frequently taken among *Simulium* populations in fast moving riffles practically devoid of periphyton (Reisen, 1977). Larval benthic density was negatively correlated with increases in stream discharge ($r = -0.399, P < 0.05$). However, larval downstream drift was maximized during the late spring of 1973 when rains were frequent, and the discharge was greater. These data would suggest that *L. luteus* larvae were susceptible to being washed away by increased discharge. In the study area, travertine deposition converted the normally 3-dimensional riffle habitat into a 2-dimensional space, reducing the fauna to those forms able to tolerate constant exposure to the current (e.g., Simuliidae, Hydropsychidae), or able to burrow into the substrate (e.g., Chironomidae). Drifting larvae probably consisted of individuals leaving protected microhabitats in search of food that were passively swept away by the current. Larval and adult drift were not correlated with larval benthic density ($r = -0.024$, $r = -0.115$, $P > 0.05$). Perhaps if benthic samples had been taken in more preferred microhabitats, a significant positive correlation may have been realized. Larval drift was correlated with periphyton abundance being highest during May and June, 1973 ($r = 0.605, P > 0.01$).

L. luteus apparently overwinters in the larval stage as adults were not

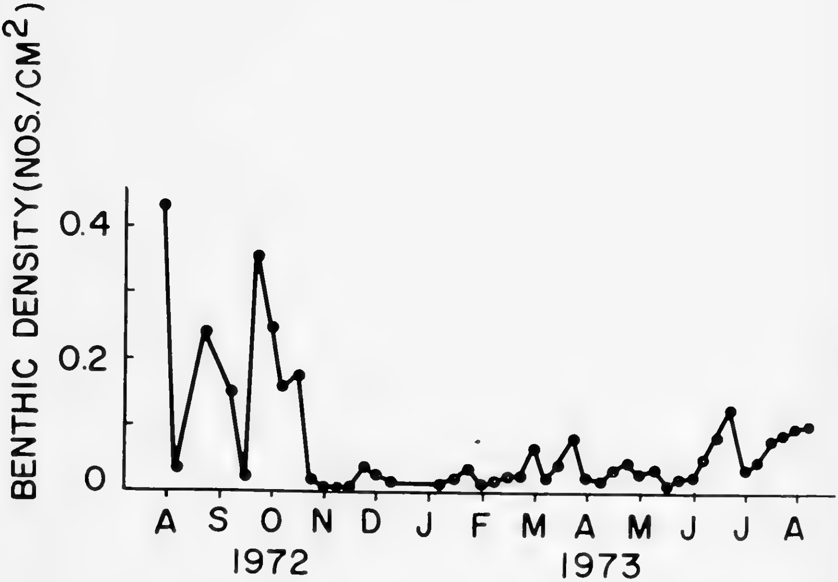
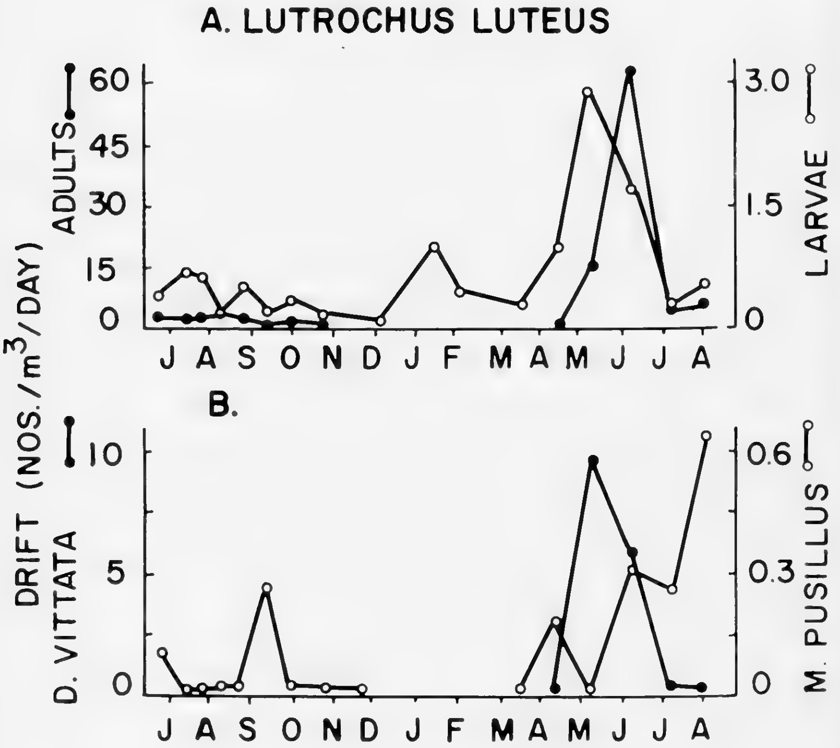


Figure 1. Weekly changes in the mean benthic density of *Lutrochus luteus* larvae collected at 6 riffles between Bridal Veil and Turner Falls.

collected from October through April (Fig. 2a). As the terrestrial pupae were not sampled during the present study, it was not ascertained if the winter was also spent as diapausing pupae. Peak adult drift occurred about 1 month after peak larval drift suggesting a single generation per year at Honey Creek (Fig. 2a). Adult drift rates were positively correlated with algal abundance ($r = 0.518$, $P < 0.05$) and rainfall ($r = 0.678$, $P < 0.01$), and presumably were a function of the effect of these factors on larval survivorship. Adults were encrusted with travertine to varying degrees suggesting the drifting population consisted of both newly emerged (unencrusted) and older (heavily encrusted) individuals. Locomotion by the heavily encrusted individuals was probably restricted to crawling, and drifting may provide a valuable downstream dispersion mechanism. In agreement with Brown and Murvosh (1970) adults were usually observed to be flying upstream presumably exemplifying Müller's recolonization cycle (Müller, 1954).

Dubiraphia vittata (Melsh) and *Microcylloepus pusillus* Le Conte adults were most prevalent in the drift during the spring and summer of 1973 (Fig. 2b). *Dubiraphia* larvae were rarely encountered during this investigation and presumably remained hidden within the dense *Myriophyllum* beds which abounded in most pools in Honey Creek (Reisen, 1975a). Adults were also infrequently collected among the *Myriophyllum* but were abundant in drift samples (Fig. 2b). *M. pusillus* larvae and adults were occasionally encountered in benthic samples, but not frequently enough to describe seasonal abundance patterns. Larvae were rare in drift samples. Drifting *M. pusillus* adults were most abundant during the summer of 1973 (Fig. 2b) and were positively correlated with increasing rainfall ($r = 0.669, P < 0.01$). It would appear from the adult drift rate that there were possibly two adult emergences per year, one in early summer and a second in late summer or fall. Variations in environmental conditions in 1972 and 1973 (Reisen, 1976b), may have altered the magnitude and timing of these emergences.

The diel drift patterns of the adult dryopoids was characteristically


A. LUTROCHUS LUTEUS

B.

Figure 2. Temporal changes in the mean daily drift rate of A. *Lutrochus luteus* larvae and adults, and B. *Dubiraphia vittata* and *Microcylloepus pusillus* adults collected at 2 stations from 8 July 1972 through 15 August 1973.

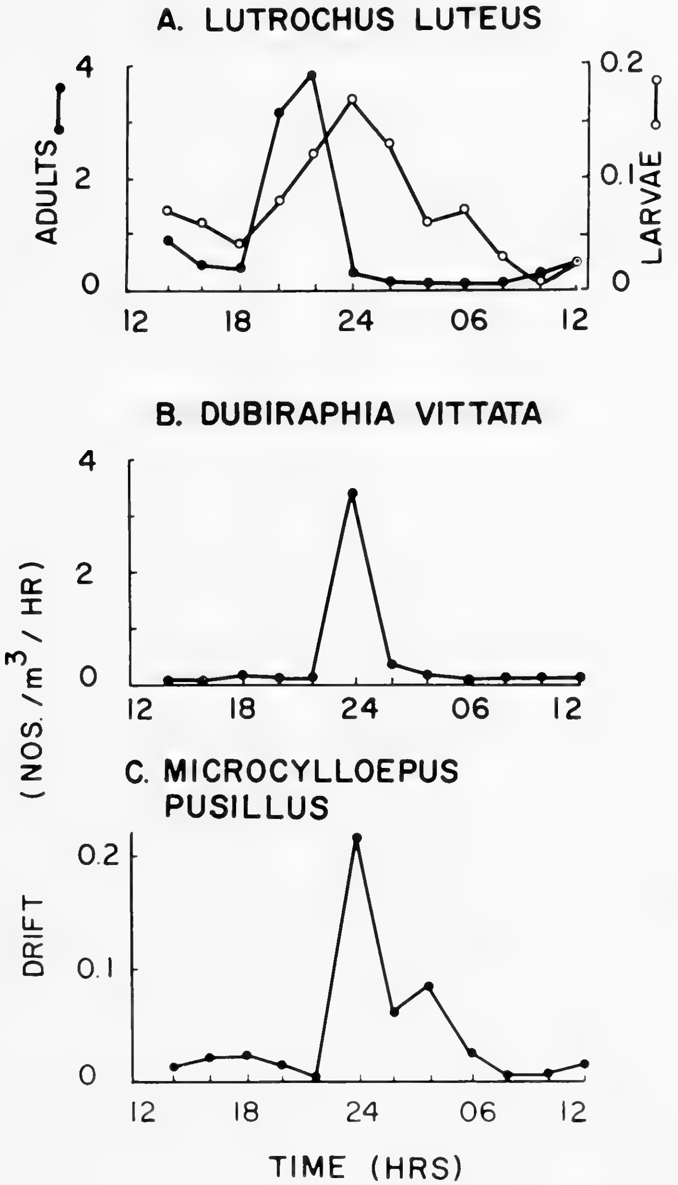


Figure 3. Diel changes in the mean hourly drift rate averaged over 2 stations and successive 24 hour studies during peak abundance: A. *Lutrochus luteus* adults (n = 9) and larvae (n = 11). B. *Dubiraphia vittata* adults (n = 4), and C. *Microcylloepus pusillus* adults (n = 2), where n = number of 24 hour studies included.

nocturnal with a significant ($P < 0.05$) bigeminous (pre-midnight) peak (Fig. 3) (Bournaud and Thibault, 1973), agreeing with the reported drift patterns of other dryopoid genera (e.g., *Helmis (=Elmis),* Elliott and Minshall, 1968, and Elliott, 1967; *Optioservus, Cleptelmis,* and *Lara,* Brusven, 1970; and *Elmis,* Müller, 1970). Most drift occurred between 2200 and 2400 hours for *D. vittata* and *M. pusillus,* and between 1800 and 2200 for *L. luteus.* Since sunset during the months of greatest drift (Fig. 2) was never later than 1949 hours central standard time, it seemed improbable that *D. vittata* and *M. pusillus* drift were directly entrained changes in illumination during dusk. Conversely, adult *L. luteus* were apparently stimulated by the light-off stimulus with increased drift rates observed just after dusk. Increased drift was presumably related to increased adult activity, perhaps the entering of the adults into the water in search of food. *L. luteus* larval drift gradually increased with the onset of darkness and was maximal between 2000 and 0200 hours. Increases in larval drift were presumably related to periods of increased periphyton grazing, predisposing the larvae to being washed away by the current.

ACKNOWLEDGEMENTS

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FIRST RECORD OF A CHIRONOMID LARVA LIVING PHORETICALLY ON AN AQUATIC HEMIPTERAN (NAUCORIDAE)[1]

Selwyn S. Roback[2]

Recently in the course of re-examining some Neotropical Naucoridae, a chironomid larva was found in its tube between the meso – and meta-thoracic coxae of *Cryphocricos peruvianus* De Carlo (Fig. 1). The chironomid larva, in the opinion of Dr. O. Saether, who kindly examined the specimen, is probably a *Eukiefferiella* sp. The relationship between the chironomid and the hemipteran is undoubtedly phoretic as there does not appear to be any nutritive relationship between the two. Steffan (1967) in his survey of ectosymbiosis in aquatic insects, does not list either *Eukiefferiella* or any aquatic Hemiptera as being involved in a phoretic association. This appears to be the first such instance for both, though I am sure more cases will appear when additional larger Neotropical aquatic Hemiptera are critically examined.

Steffan, A.W. 1967. Ectosymbiosis in aquatic insects. Chapter 4 in Henry, S.M., Symbiosis. Academic Press, New York and London: 207-289.

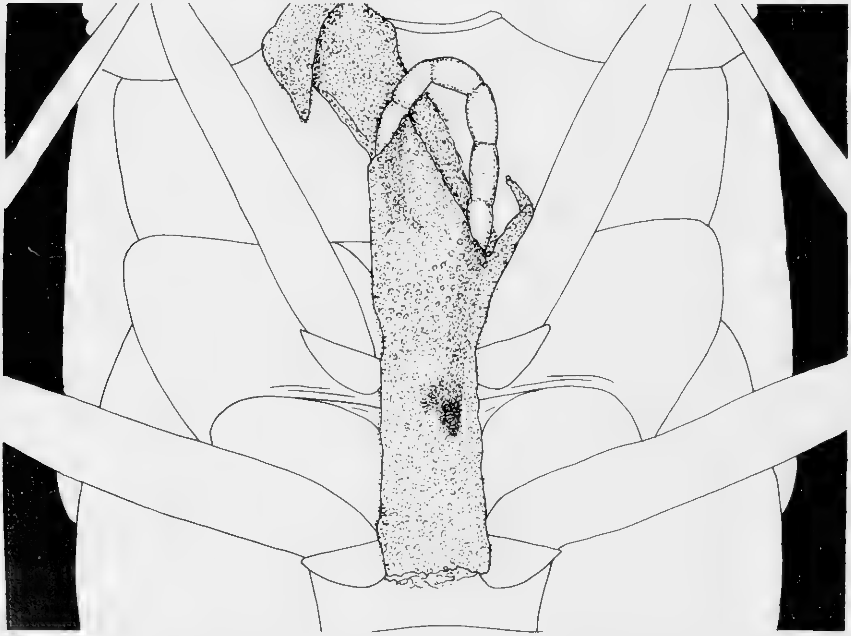

Fig. 1 *Eukiefferiella* larva in tube between meso- and methathoracic coxae of *Cryphocricos peruvianus* De Carlo.

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[1] Accepted for publication: March 22, 1977

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THE OCCURRENCE OF PESTIFEROUS *VESPULA* SPP. IN NORTHERN DELAWARE (HYMENOPTERA: VESPIDAE)[1,2]

W.D. Lord[3]

ABSTRACT: Yellowjacket wasps in the genus *Vespula* are often prominent pests in public parks, recreation areas and around homes in Delaware. *Vespula maculifrons* Buysson was the most abundant of the 7 species collected in a survey of such habitats in northern Delaware and Maryland. It composed 90-100% of the samples from parks and recreation areas and 84% of those from around residences.

DESCRIPTORS: *Vespula maculifrons, Vespula germanica,* residential and recreational areas, Delaware, yellowjackets

The pestiferous habits of wasps in the genus *Vespula* have led to increased investigations into their biological and ecological characteristics in recent years (Spradberry, 1973; Akre, 1975; MacDonald, 1973, 1974, 1975). However, little has been published concerning species occurring in the northeastern United States. Preiss (1968) conducted an investigation of the habitat parameters of *Vespula maculifrons* Buysson in an urban Delaware woodlot, and Eickwort (pers. comm.) has completed a recent study on the distribution of *Vespula germanica* Fabricius in New York State. This note reports the results of a survey conducted during 1976 in northern Delaware and northeastern Maryland to determine the relative abundance of *Vespula* spp. in public parks, recreation areas and around residences. These are areas where contact with man results in the wasps' pestiferous behavior.

Methods

Weekly sweep net collections were made around garbage cans and picnic tables in six public parks during July, August and September 1976 (Table 1). Extensive areas were repeatedly sampled in each location to secure representative samples of wasps present.

Responses to an Extension Service press release requesting locations of ground nests of yellowjackets plus the usual inquiries made to Extension

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[3] Department of Entomology and Applied Ecology, University of Delaware, Newark, DE 19711.

personnel in the Department of Entomology and Applied Ecology served as a source for the residential survey. The residential survey was limited to a 13 km (8 mile) radius of Newark, Delaware. The residential nest survey concerns only ground nesting species.

Species identifications are based on the taxonomic keys of Miller (1961) and Menke and Snelling (1975).

Results and Discussion

Seven species of *Vespula* wasps were collected. *Vespula maculifrons,* a subterranean nester, was the dominant species. In 5 of the 6 recreational areas examined *V. maculifrons* comprised 90-100% of the populations sampled (Table 1). *Vespula germanica,* a recently established immigrant from Europe (Menke and Snelling 1975), initially appeared as the dominant species in Carpenter Park. Subsequent collections, however, revealed a decrease in the *V. germanica* population with an increase in the occurrence of *V. maculifrons.* Carpenter Park is the only collection site located on the Piedmont. The other areas sampled are on the Coastal Plain. Examination of the overall species composition of the sample areas clearly illustrates the abundance of *V. maculifrons* in park and recreational areas in Delaware.

Of the 32 subterranean nests examined in residential areas during the 1976 survey, 27 (84%) were of *V. maculifrons.* The remaining 5 (16%) were of *V. squamosa* Drury. *Vespula maculifrons,* therefore, may also be considered a major pestiferous species for homeowners in northern Delaware.

In addition to the subterranean nests I also found nests of *V. maculifrons, V. squamosa,* and *V. germanica* within the walls and attics of several homes in the survey area. *Vespula germanica* was the most abundant species in these sites.

The presence of several species of wasps in habitats closely associated with human activity results in numerous unpleasant encounters. The identification of the dominant species present in these situations is an important aspect of the management, control, and avoidance of these insects.

ACKNOWLEDGEMENTS

Thanks are due to Dr. R.R. Roth for his direction of the research and critical review of the manuscript, to Mindy Hetrick and Thomas Norton for their aid in the collection of samples, and Dr. R.W. Rust for his many helpful insights. Thanks also to Dr. H.V. Cornell and Dr. L.P. Kelsey for their reviews of the manuscript. Dr. G.C. Eickwort kindly provided his manuscript concerning *V. germanica.* Financial support came from the McIntire-Stennis Cooperative Forestry Research Program and the Delaware Agricultural Experiment Station.

Table 1. Occurrence of *Vespula* spp. in parks and recreation areas expressed as percent of total collection per day per park

		Percent Occurrence				
Location	**Species**	**31 July**	**6 August**	**13 August**	**20 August**	**2 September**
Rittenhouse Park, Newark, DE	*V. maculifrons*	100	100	100	100	100
Lums Pond State Park 14 km S of Newark, DE	*V. maculifrons*	100	100	100	100	100
Blackbird State Forest Blackbird, DE	*V. maculifrons*	100	100	100	100	100
Killen Pond State Park 5 km SE of Felton, DE	*V. maculifrons*	100	86	93	91	88
	V. squamosa	0	14	7	5	12
	V. maculata	0	0	0	4	0
Walter S. Carpenter State Park 6.5 km N of Newark, DE	*V. maculifrons*	15	54	74	57	97
	V. squamosa	19	27	10	29	0
	V. germanica	44	5	7	14	3
	V. vidua	7	3	7	0	0
	V. arenaria	15	11	0	0	0
	V. maculata	0	0	2	0	0
Elk Neck State Park 13 km S of North East, MD	*V. maculifrons*	75	90	100	100	100
	V. squamosa	12	0	0	0	0
	V. vulgaris	12	0	0	0	0
	V. arenaria	0	10	0	0	0

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BOOK RECEIVED AND BRIEFLY NOTED

A REVISION OF NORTH AMERICAN BEES OF THE SUBGENUS CNEMIDANDRENA (HYMENOPTERA: ANDRENIDAE). Barry J. Donovan. University of California Press. 1977. 107 pgs., incl. figs. and maps. $4.75.

This systematic revision of the New World *Cnemidandrena* validates 26 North American species. Included also is a brief discussion of the relationships of some of the New World representatives with those of the Old World.

MAXILLARY PALPAL MUSCLES OF CAVE CRICKET *KEMPIOLA SHANKARI* SINHA & AGARWAL (ORTHOPTERA: PHALANGOPSIDAE)[1]

K.M. Sinha[2]

ABSTRACT: Depressor muscle of fourth and fifth maxillary palpal segments of *Kempiola shankari* is described.

Maxillary muscles of orthoptera have been studied by various workers such as Albrescht (1953), Crampton (1916), Du Porte (1920), Hsu (1931), Misra (1945), Rakshpal (1954), Snodgrass (1928) and Thakare (1961). All of these deal with the description of epigean forms. Richard (1955) studied the muscles of the cave-orthopteran *Macropathus filifer* but did not study the maxillary palpal muscles. However, the number and arrangement of the maxillary muscles of *K. shankari* agree with the description given by Thakare (1961) for *G. bimaculatus.* A characteristic difference has been observed in the insertion of the fourth depressor muscle and in the origin of the fifth depressor muscle.

The fourth depressor is a long slender muscle arising from the inner lateral side of the third maxillary segment. Passing across the segment, it forms a thin apodeme (1F) at the base of the fourth maxillary segment. This apodeme, in addition to being inserted into the base of the fourth segment, crosses the third segment. The depressor of the fifth segment (2), a long slender muscle arising from this apodeme and passing across the whole length of the fourth maxillary segment, is inserted on the inner lateral angle of the base of the fifth maxillary segment. The contraction of this muscle pulls down both the fourth and the fifth maxillary segment at the same time.

In *Gryllus assimilis,* Du Porte (1920) states that within each of the first three segments of the palps, there is both an extensor and a flexor muscle of the palpal segment. In *G. bimaculatus,* Thakare (1961) states there is a single depressor muscle for each of the fourth and the fifth maxillary segments. *K. shankari* also possesses a single depressor muscle for each of the segments, but both depressor muscles are connected with each other by a characteristic apodeme which has not previously been described in any other orthopteran.

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[1] Accepted for publication: April 14, 1977

[2] Department of Zoology. Govt. College, Ambikapur M.P. (India)

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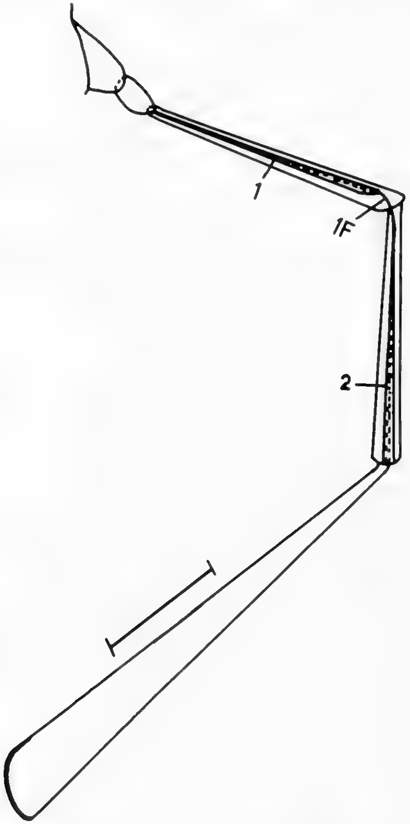

Fig: Maxillary palp showing fourth depressor muscle (1), Fifth depressor muscle (2) and characteristic apodeme (1F). (magnification given is 1 mm.).

NEW SYNONYMY, NEW COMBINATIONS, A LECTOTYPE DESIGNATION, AND A TYPE-SPECIES DESIGNATION IN NEOTROPICAL TYLODINA (COLEOPTERA: CURCULIONIDAE)[1]

Wayne E. Clark[2]

ABSTRACT: *Cryptotelus* Marshall, 1939 (replacement name for *Cryptacrus* Kirsch, 1869, not Mayr, 1864), is newly placed in synonymy with *Oxytenopterus* Berg, 1898 (replacement name for *Oxypterus* Faust, 1896, not Rafinesque, 1814); *O. torvidus* (Faust, 1896) is designated type-species of *Oxytenopterus* Berg. *Cryptacrus clotho* Kirsch, 1869, and *C. fulvonotatus* Fiedler, 1936, are transferred to *Oxytenopterus,* as *O. clotho* (Kirsch), and *O. fulvonotatus* (Fiedler), and a lectotype is designated for *O. fulvonotatus. Oxytenopterus fasciculosus* (Champion, 1905) is newly placed in synonymy with *O. clotho* (Kirsch, 1869). *Euxenus posticus* Faust, 1896, is confirmed as type-species of *Faustinus* Berg, 1898 (replacement name for *Euxenus* Faust, 1896, not LeConte, 1876), and *Cryptacrus hystrix* Fiedler, 1954, is transferred to *Faustinus,* as *F. hystrix* (Fiedler).

Nine Neotropical members of the cryptorhynchine subtribe Tylodina were assigned to the genus *Cryptotelus* Marshall, 1939 (as *Cryptacrus* Kirsch, 1869, not Mayr, 1864) by Fiedler (1936, 1952, 1954). I recently examined the types of all of these (through the courtesy of R.T. Thompson, British Museum (Natural History), London, T. Nyholm, Naturhistoriska Riksmuseet, Stockholm, and R. Krause, Staatliches Museum für Tierkunde, Dresden), and have concluded that *Cryptotelus,* as defined by Fiedler, is polyphyletic. Six of Fiedler's *Cryptotelus, C. atropos* (Boheman), *C. camelus* (Fiedler), *C. lachesis* (Fiedler), *C. leucomelas* (Boheman), *C. semialbus* (Fiedler), and *C. variegatus* (Fiedler), all Brazilian species, will receive further consideration in a revision of the genus *Phymatophosus* Faust, currently in preparation. These have the eyes separated from each other in front by a distance equal to or greater than the width of the rostrum at the base, a visible scutellum, and unarmed femora, which are channeled beneath to receive the tibiae when the legs are folded. The remaining 3, *C. clotho* (Kirsch) from Colombia, *C. fulvonotatus* (Fiedler) from Brazil, and the Peruvian *C. hystrix* (Fiedler), are distinguished by having the eyes separated from each other in front by a distance less than the width of the rostrum at the base, and although these may have armed or unarmed femora, they do not have the femora channeled beneath. The generic

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placement of these 3 species is the subject of the present communique. Two of the 3 belong to the genus *Oxytenopterus* Berg; the 3rd belongs to *Faustinus* Berg.

Genus *Oxytenopterus* Berg

Oxytenopterus Berg, 1898:18 (replacement name for *Oxypterus* Faust, 1896:36, not Rafinesque, 1814:13); type-species, by PRESENT DESIGNATION, *Oxypterus torvidus* Faust, 1896:40.

Cryptotelus Marshall, 1939:583 (replacement name for *Cryptacrus* Kirsch, 1869:198, not Mayr, 1864:904); type-species, by original designation for *Cryptacrus, Cryptacrus clotho* Kirsch, 1869:199. NEW SYNONYMY.

Oxytenopterus clotho (Kirsch), New Combination

Cryptacrus clotho Kirsch, 1869:199.
Oxytenopterus fasciculosus Champion, 1905:491. NEW SYNONYMY.

The holotype of *Cryptacrus clotho* Kirsch (in the Staatliches Museum für Tierkunde, Dresden) is labelled "Bogota Kirsch" "Typus" and "Cryptacrus clotho Kirsch". I consider the species which it represents to be conspecific with that represented by specimens in the collection of the U.S. National Museum of Natural History, Washington, identified as *Oxytenopterus fasciculosus* (Champion). The syntypes of *O. fasciculosus* (15 specimens were originally included) have not been examined, but the USNM specimens appear, upon comparison with Champion's (1905:491-492, tab. 24, figs. 5, 5a) original description, to be correctly identified. The conspecificity of the type-species of *Cryptotelus* with one of the species assigned to *Oxytenopterus* necessitates the generic synonymy proposed above.

Oxytenopterus fulvonotatus (Fiedler), New Combination

Cryptacrus fulvonotatus Fiedler, 1936:129.

The LECTOTYPE (HERE DESIGNATED) of *O. fulvonotatus* (Fiedler) is a male, deposited in the British Museum (Natural History), labelled "Type" "10160" "Fry Rio Jano" "Fry Coll 1905. 100" and "Cryptacrus fulvonotatus sp. n. Fiedler. Typus o". I consider *O. fulvonotatus* to be congeneric with *O. clotho* (Kirsch), as did Fiedler (1936). Both species have toothed femora, but the scutellum is visible only in *O. clotho*.

Genus *Faustinus* Berg

Faustinus Berg, 1898:18 (replacement name for *Euxenus* Faust, 1896:47, not LeConte, 1876:409); type-species, by subsequent designation for *Euxenus* (Champion, 1905:494), *Euxenus posticus* Faust, 1896:47.

Champion's (1905:494) reference to *F. posticus* (Faust), one of the species included originally in *Euxenus* Faust (1896:47), as the "type" of *Euxenus*. This reference satisfies the conditions of Article 69 (a) (iii), International Code of Zoological Nomenclature, for subsequent designation of type-species of genera. Buchanan (1935:125) cited Champion's reference as justification for recognition of *E. posticus* as type-species of *Faustinus* Berg.

Faustinus hystrix (Fiedler), New Combination

Cryptacrus hystrix Fiedler, 1954:4.

The holotype of *F. hystrix* (deposited in the Staatliches Museum für Tierkunde, Dresden) is labelled "Peru 15620" "Typus" and "Cryptacrus hystrix". In my opinion, the species which it represents is not congeneric with that represented by the type of *O. clotho* (Kirsch), type-species of *Cryptotelus.* It does, however, share the following combination of characters with members of the genus *Faustinus* Berg: scutellum not visible, eyes narrowly separated from each other in front by distance less than width of rostrum at the base and femora unarmed, not channeled beneath (I have seen identified specimens of *F. apicalis* (Faust), *F. cubae* (Boheman), *F. ovatipennis* (Champion), *F. rhombifer* (Champion), and *F. subparallelus* (Champion), in the U.S. National Museum Collection; I have not seen the type-species of *Faustinus, F. posticus* (Faust)).

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MAYFLIES, OR EPHEMEROPTERA, OF WEST VIRGINIA WITH EMPHASIS ON THE NYMPHAL STAGE[1]

Gerald M. Faulkner[2], Donald C. Tarter[3]

ABSTRACT: This investigation represents the first detailed study of the Ephemeroptera of West Virginia. Twelve families are represented including 24 genera and 106 species. Sixty-nine state records and 508 county records were ascertained.

DESCRIPTORS: Mayflies, Ephemeroptera, Taxonomy, Distribution, State and County Records

The study of mayflies in West Virginia has been neglected. Prior to this investigation, 37 species have been recorded for this state (Needham et al., 1935; Burks, 1953; Berner, 1956; Maxwell and Benson, 1963; McDiffett, 1964; Wilburn, 1964; Olson, 1971; Burrows, 1971; Tarter, 1972; Menendez, 1974; and Lewis, 1974). Statewide distribution patterns of mayflies were presented by Faulkner (1974).

Following this investigation, the state list of mayflies now comprises 106 species. Sixty-nine state records and 508 county records were noted. County records are given after each species and the asterisk denotes a state record.

Family Siphlonuridae

Ameletus lineatus Traver: Mingo, Wayne (Tarter, 1972)
A. ludens Needham: Marion (Needham et al., 1935), Randolph (Menendez, 1974), Tucker (Menendez, 1974)
Siphlonurus marshalli Traver*: Putnam
Isonychia albomanicata Needham*: Hardy (CU) (Adults and Nymphs)
I. sadleri Traver*: Randolph (1 Male)

Family Baetidae

Baetis cingulatus McDunnough*: Mercer (USDI), Wetzel
B. flavistriga McDunnough*: Putnam
B. frondalis McDunnough*: Jackson
B. intercalaris McDunnough*: Fayette, Jackson, Kanawha, Nicholas (USDI), Summers (USDI), Wyoming (USDI)
B. levitans McDunnough*: Lincoln
B. phoebus McDunnough*: Mercer
B. phyllis Burks*: Kanawha, Logan (USDI)
B. propinquus (Walsh)*: Hardy (USNM)

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B. rusticans McDunnough*: Fayette, Jackson, Kanawha, Mercer, Monroe, Nicholas (DNR), Putnam, Webster (DNR)
B. vagans McDunnough*: Marginal counties only: Logan, Mercer, Randolph, Tyler
Callibaetis fluctuans (Walsh)*: Cabell
Centroptilum rivulare Traver*: Summers (DNR)
Cloeon vicinum (Hagen): No county record, Male (Burks, 1953)
Pseudocloeon carolina Banks*: Berkeley (USNM)
P. cingulatum McDunnough*: Pocahontas
P. dubium (Walsh)*: Calhoun, Fayette, Lewis (USDI), Mason, Pleasants, Pocahontas (DNR), Putnam, Webster (DNR), Wirt
P. myrsum Burks*: Nicholas (USDI), Pocahontas (DNR), Putnam, Randolph (USDI), Tucker (USDI), Webster (DNR)
P. parvulum McDunnough*: Marginal counties only: Jefferson, Mercer (USDI), Tucker (USDI), Wayne
P. punctiventris (McDunnough): Calhoun, Jackson, Marion (USDI), McDowell (USDI), Tyler, Wayne (Tarter, 1972)

Family Heptageniidae

Epeorus dispar (Traver)*: Kanawha, Pendleton
E. fragilis (Morgan): Preston (Adult) (Maxwell and Benson, 1963)
E. humeralis (Morgan)*: Randolph (2 males)
E. pluralis (Banks): Preston (Adult) (Maxwell and Benson, 1963)
E. rubidus (Traver)*: Berkeley (USNM) (Adult)
Heptagenia aphrodite McDunnough: Fayette, Marion (Needham et al., 1935), Mercer (USDI), Pendleton (Needham et al., 1935)
H. diabasia Burks*: Braxton, Fayette, Kanawha, Lincoln, Logan, Randolph, Wyoming (USDI)
H. flavescens Walsh*: Fayette, Logan, Pocahontas (DNR), Tucker (USDI)
H. hebe McDunnough*: Hardy (CU) (Adult)
H. julia Traver*: Grant (CU) (Adult)
H. juno McDunnough*: Boone, Lincoln, Mason, Putnam, Tucker
H. lucidipennis (Clemens)*: Putnam
H. maculipennis Walsh*: Berkeley, Nicholas, Pocahontas (USDI), Webster (DNR)
H. marginalis Banks: Grant (CU), Marion (Needham et al., 1935), Pendleton, Pocahontas (Needham et al., 1935), Raleigh (CU)
H. perfida McDunnough*: Pleasants, Putnam, Tyler, Wirt, Wood
Stenonema bipunctatum (McDunnough)*: Mercer
S. carolina (Banks): Hardy (Lewis, 1974; 1 male, 3 females), Jackson, Nicholas, Webster
S. femoratum (Say)*: Calhoun (USDI), Kanawha (USDI), Lewis (USDI), Putnam
S. gildersleevi Traver*: Mercer
S. integrum (McDunnough)*: Cabell (USDI), Grant (CU), Kanawha (USDI), Nicholas (DNR), Pocahontas (CU)
S. interpunctatum (Say): Marginal counties only: Hampshire, Hancock, Mercer, Wayne, (Grant; Lewis, 1974)
S. ithaca (Clemens and Leonard): Monroe, Nicholas, Pendleton (Needham et al., 1935), Randolph (USDI)
S. pudicum (Hagen): Preston (Wilburn, 1964), (Adult)
S. pulchellum (Walsh)*: Fayette, Mercer, Nicholas
S. rubromaculatum (Clemens)*: Marginal counties only: Hancock, Mason, Mercer, Randolph

S. rubrum (McDunnough)*: Marginal counties only: Berkeley, Lincoln, Monroe, Tucker
S. tripunctatum (Banks): Marginal counties only: Marshall, McDowell (USDI), Monongalia (USDI), Wayne (Tarter, 1972)
S. vicarium (Walker) Marginal counties only: Berkeley, Hancock, Mercer, Wayne, (Randolph; Lewis, 1974)

Family Leptophlebiidae

Habrophlebia vibrans Needham: Pocahontas (Burrows, 1971)
Leptophlebia cupida (Say)*: Wayne
Paraleptophlebia adoptiva (McDunnough)*: Mercer, Nicholas, Pocahontas (DNR), Randolph (DNR), Summers, Webster
P. debilis (Walker): Preston (Wilburn, 1964), Randolph (2 males)
P. guttata (McDunnough): Grant (CU), Hardy (Needham et al., 1935), Pendleton (Needham et al., 1935), Pocahontas (Needham et al., 1935), Preston (Wilburn, 1964)
P. mollis (Eaton)*: Marginal counties only: Fayette, Logan, Pendleton, Wetzel
P. ontario (McDunnough)*: Mercer, Pleasants, Pocahontas (DNR), Randolph, Tyler, Webster (DNR), Wirt, Wood
P. praepedita (Eaton)*: Mercer, Randolph
P. volitans (McDunnough)*: No county record (CU)

Family Ephemerellidae

Ephemerella aestiva McDunnough*: Logan, Pleasants, Pocahontas, Raleigh, Randolph (DNR), Tyler, Wirt, Wood
E. allegheniensis Traver: Mineral (Needham et al., 1935)
E. argo Burks*: Logan, Mingo
E. bicolor Clemens*: Clay
E. catawba Traver*: Kanawha
E. cornuta Morgan: Marginal counties only: Fayette, Logan, Pendleton, Preston (Wilburn, 1964)
E. cornutella McDunnough: Monongalia (McDiffett, 1964), Pendleton, Randolph (USDI), Tucker (USDI), Webster (DNR)
E. coxalis McDunnough*: Cabell, Putnam
E. deficiens Morgan: Marginal counties only: Mercer, Mingo, Preston, Hardy (Needham et al., 1935)
E. dorothea Needham: Marginal counties only: Hardy (Needham et al., 1935), Logan, Mercer, Randolph (USDI)
E. excrucians Walsh*: Randolph (USDI)
E. frisoni McDunnough*: Pocahontas, Tucker
E. funeralis McDunnough*: Marginal counties only: Cabell, Grant, Mingo, Pendleton
E. invaria (Walker): Monongalia (McDiffett, 1964), Nicholas
E. lata Morgan*: Pocahontas (USDI), Randolph (DNR), Webster (DNR)
E. minimella McDunnough*: Marginal counties only: Brooke, Lincoln, Pendleton, Summers
E. needhami McDunnough*: Hancock, Pocahontas (USDI), Putnam, Randolph (USDI), Ritchie (USDI), Webster (DNR)
E. rotunda Morgan*: Marginal counties only: Lewis, Monroe, Pendleton, Putnam
E. serrata Morgan: Hardy (Needham et al., 1935)
E. serratoides McDunnough: Boone, Grant (CU), Hardy (Needham et al., 1935), Mineral (Needham et al., 1935), Pendleton, Randolph, Summers (CU)

E. simplex McDunnough*: Barbour (USDI), Randolph (USDI)
E. subvaria McDunnough*: Pocahontas (DNR), Randolph (DNR), Webster
E. temporalis McDunnough*: Putnam, Randolph, Tucker, Wayne
E. walkeri Eaton*: Randolph (USDI), Tucker (USDI)

Family Tricorythidae

Tricorythodes explicatus Eaton*: Hardy (CU) (Adult)
T. stygiatus McDunnough*: Hardy (CU) (Adult)

Family Caenidae

Caenis amica Hagen: No county record (Burks, 1953) (Adult)
C. diminuta Walker*: Jackson (CU) (Adult)
C. hilaris (Say)* (Adults): Hardy (CU), Mingo (CU), Pocahontas (CU)
C. jocosa McDunnough*: Randolph (6 males)

Family Neoephemeridae

Neoephemera purpurea (Traver): Mineral (Berner, 1956)

Family Baetiscidae

Baetisca bajkovi Neave: Marginal counties only: Lewis, Lincoln (USDI), Pleasants, Wayne (Olson, 1971)
B. callosa Traver: Marginal counties only: Berkeley (USDI), Greenbrier, Preston (Needham et al., 1935)
B. carolina Traver: Monongalia (Needham et al., 1935)

Family Potamanthidae

Potamanthus distinctus Traver: Grant (Needham et al., 1935), Mingo (Needham et al., 1935) (Adult)
P. neglectus Traver*: No county record (CU) (Adult)

Family Ephemeridae

Ephemera guttulata Pictet: Marginal counties only: Berkeley, Mingo, Preston (USDI), Wayne (Tarter, 1972)
E. simulans Walker*: Brooke, Greenbrier, Logan, Randolph, Webster
E. triplex Needham (All Adult Records): Fayette (CU), Hardy (Needham et al., 1935), Marion (Needham et al., 1935), Monongalia (CU), Pocahontas (Needham et al., 1935)
E. varia Eaton: Marginal counties only: Hampshire (CM), Hancock, Lincoln, Monroe, (Randolph; Needham et al., 1935)
Hexagenia atrocaudata McDunnough: Grant (Needham et al., 1935), Mercer (Needham et al., 1935), Pendleton (Needham et al., 1935), Pocahontas (CU)
H. limbata (Serville): Fayette (USDI), Jackson (Needham et al., 1935), Kanawha (USDI), Lewis (USDI), Randolph, Tucker, Wayne
H. munda Eaton*: Wayne (1 male, 2 females)
Litobrancha recurvata (Morgan): Grant (Needham et al., 1935), Mineral (CU), Nicholas, Pocahontas

Family Polymitarcidae

Ephoron leukon Williamson*: Marginal counties only: Cabell (USDI), Lewis (USDI), Mineral (CU), Monroe (USDI)

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SPIDERS FROM MILKWEED, *ASCLEPIAS SYRIACA* L., AT DUNNVILLE, ONTARIO[1]

W.W. Judd[2]

ABSTRACT: On July 18, 19, 20, 1976 fifty spiders, including *Dictyna foliacea, Enoplognatha ovata, Theridula emertoni, Araneus cornutus, Philodroma cespitum* and *Phidippus clarus* were collected from milkweed, *Asclepias syriaca,* at Dunnville, Ontario, the type and location of the shelters and webs on the plants being noted.

DESCRIPTORS: Araneida, Dictynidae, Theridiidae, Araneidae, Thomisidae, Salticidae, Milkweed, Ontario.

On July 18, 19, 20, 1976, collections were made of spiders from plants of common milkweed, *Asclepias syriaca* L., in the southwest corner of Ward 1 (formerly Dunn Township) of Dunnville, Haldimand County, Ontario. The three days were warm, partly cloudy and with light southwest winds. The plants examined were between the edge of the pavement and the fence line of fields along roads. Several thousand plants were examined during the three days and when a spider was found on a plant it was sucked up with an aspirator or captured by clapping the flower or leaf on which it rested between the lid and jar of a cyanide jar. Fifty spiders were collected, 23 on July 18, 18 on July 19 and 9 on July 20. Each specimen was assigned a serial number from 1 to 50 and was preserved in fluid in a vial. Insect prey captured in a spider's web was assigned the same number as the spider. The spiders were identified by Dr. Robin Leech, Research Secretariat, Alberta Environment, Edmonton, Alberta. All specimens are deposited in the collection of the Department of Zoology, University of Western Ontario except seven noted as "kept" by Dr. Leech.

Spiders Collected:

Dictynidae

Dictyna foliacea (Hentz) – 10 females (1 kept)

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Theridiidae

Enoplognatha ovata (Clerck) – 2 females (1 kept)
Theridula emertoni Levi – 3 females (1 kept)
Theridula sp. – 17 immatures (4 males, 3 females, 10 of undetermined sex)

Araneidae

Araneus (Nuctenea) cornutus Clerck – 2 males (1 immature), 2 females (1 kept)

Thomisidae

Philodromus cespitum (Walckenaer) – 11 females (2 kept)

Salticidae

Phidippus clarus Keyserling – 1 male (kept), 2 females (1 kept)

Account of Collections

Dictyna foliacea (Hentz) – These were found on light webs spun across the width of leaves, eight across the upper surface of the leaf and two across the lower surface. Trapped on three of the webs on July 19 were 4, 12 and 1 small midges of the family Chironomidae. *D. foliacea* was the spider most commonly found on milkweed leaves at London, Ontario by Judd (1969) with a variety of small insects trapped on the webs. It was also found by Judd (1965b) on flowering heads of ox-eye daisy at London and Dunnville.

Enoplognatha ovata (Clerck) – These spiders had formed tubular shelters, one by tying two upper leaves of a plant along their length and the other by rolling a leaf inward along its length. In the former case the web held a dead beetle of the Family Lampyridae. *E. ovata* was found also in the drier regions of the Byron Bog at London by Judd (1965a).

Theridula emertoni Levi – These spiders formed light webs on the lower surface of leaves, one of them causing a slight bowing of the tip of the leaf toward the lower surface. Two webs each held a spherical egg case 3 mm. in diameter. Spiders of the genus *Theridula* are regularly found on bushes (Comstock, 1940), *T. emertoni* being reported from bushes and hemlock trees (Kaston and Kaston, 1953).

Theridula sp. – Seventeen spiders of this genus were not identified to species, owing to their immature condition; Dr. Leech expressed the opinion that they were probably *T. emertoni.* They were all on light webs spun across the width of the lower surface of leaves.

Araneus (Nuctenea) cornutus Clerck – These four spiders were in tubular shelters at the tip of the plant. In one the shelter was composed of the three small leaves at the tip of the plant, rolled around one another, and in the three others the shelter was formed by binding two leaves at the tip of the plant, face to face, with silk. *A. cornutus* regularly inhabits rank herbage (Bristowe, 1958) and stays in a retreat during the day (Kaston and Kaston, 1953).

Philodromus cespitum (Walckenaer) – These spiders formed tubular shelters, most of them by tying two or three leaves at the tip of the plant lengthwise, face to face, others by rolling the edge of a leaf toward the lower surface of the leaf and others by rolling the tip of a leaf toward its lower surface. Three shelters included egg cases attached to the web in the shelter. *P. cespitum* was also found on milkweed leaves at London by Judd (1969).

Phidippus clarus Keyserling – These spiders formed shelters in leaves, two by rolling a leaf along its length and the other by tying two leaves together along their length. *P. clarus* was found also by Judd (1965a) on bushes in the Byron Bog at London.

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NEW RECORD OF NEOTROPICAL KATYDID *CELIDOPHYLLA ALBIMACULA* (ORTHOPTERA: TETTIGONIIDAE) AND PARASITISM, FROM COSTA RICA[1]

Allen M. Young[2]

ABSTRACT: A live female specimen of neotropical katydid *Celidophylla albimacula* Saussere and Pictet was found in old secondary forest in northeastern Costa Rica. The find represents the second specimen of this species known to science, and the first female specimen. The female was weak, being parasitized by an unidentified species of Sarcophagidae.

Although the species richness of Orthoptera is high in the wet forests of tropical America, very little is known about the biology of individual species, including interactions with parasites. Some members of the Tettigoniidae are so scarce that only a few specimens of certain genera are known. A good example is *Celidophylla albimacula* Saussure and Pictet, a large leaf-like katydid of which, prior to the present discovery, only one specimen (male) had been collected (I.J. Cantrall, pers. comm.). The species was described by Saussere and Pictet in Godman and Salvin (1898) from a single male from Chontales, Nicaragua. The purpose of this note is to report (1) the discovery of the first known female of this katydid, and (2) the first record of this katydid being parasitized by a sarcophagid fly.

While censusing cicadas in an old secondary forest (dominated by *Goethalsia meiantha* trees – Tiliaceae) near Finca La Tirimbina, La Virgen, Heredia Province, Costa Rica, in the Premontane Tropical Wet Forest life zone (Holdridge, 1967), a weak but alive female *C. albimacula* (73 mm body length; 98 mm long including wing covers) was discovered in leaf litter on 12 August 1972 (10:00 A.M.). When discovered, the katydid appeared fresh, and there were no signs of attack by ants, suggesting that it had just fallen from the canopy. Several species of predaceous ants forage in the litter here. It was collected and placed in a clear plastic bag; the following morning several small dipterous larvae (second instars, about 50 in number) were noted crawling over the katydid (Fig. 1). The larvae were exiting from the katydid's body in the thoracic region, apparently disturbed at being removed from the forest habitat. A sample of the larvae, preserved in 70% ethanol, was identified as

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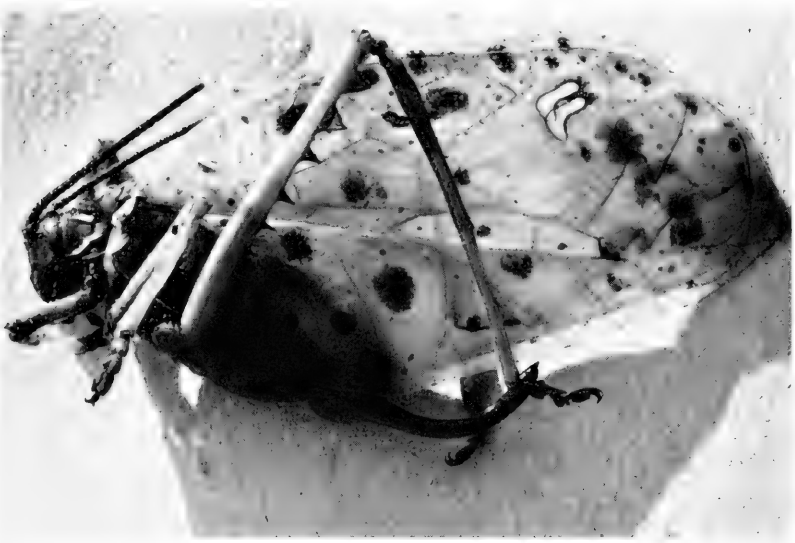

Figure 1. The only known female specimen of the neotropical katydid *Celidophylla albimacula,* showing second instar sarcophagid larvae on the thorax and wing covers.

Sarcophagidae, unknown genus. As very little is known about the systematics and biology of Neotropical Sarcophagidae, including the taxonomy of immature stages, (Souza Lopes, 1969), it is not possible to identify the sarcophagid further at this point. It is known, however, that some sarcophagids often parasitize Orthoptera (Souza Lopes, 1969). Owing to the fact that the katydid was alive when discovered, appendages intact and the larvae already second instars, it is very unlikely that they were scavengers. The mechanical disturbance of taking the infected katydid from the forest floor probably caused the larvae to exit before maturity. Unfortunately the remaining larvae did not develop to maturity so no adult flies were obtained. It is likely that the katydid was originally infected in the canopy of the forest, falling to the floor when weakened. Although nothing is known about the habits of *C. albimacula,* its appearance (brown-blotched bright green leaf-like wings) suggests that it is a canopy-dwelling species. As katydids in general can be specialized feeders (e.g., Gangwere, 1961) and the local tree species richness of tropical wet forests is high (e.g., Pires, Dobzhansky, and Black, 1953), it may not be unusual that *C. albimacula* is considered an extremely rare species, not withstanding the canopy-dwelling habit making it difficult to observe. Despite repeated searches of the same area of forest floor over three successive years (continued cicada censuses), no other individuals of *C. albimacula* have been found.

ACKNOWLEDGEMENTS

This research was supported by National Science Foundation Grant GB-33060, with field support from Dr. J. Robert Hunter. John H. Thomason assisted in the field. Dr. Irving J. Cantrall, Museum of Zoology, University of Michigan identified the katydid and with Dr. T.H. Hubbell, provided useful data. The cooperation of Drs. George Steyskal, Ray Gagne, and Curtis Sabrowsky (U.S. National Museum) with identification of the parasite is appreciated. The specimen of *C. albimacula* is deposited in the Orthoptera collection at the Museum of Zoology, University of Michigan.

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INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE ANNOUNCEMENT

The required six months' notice is given of the possible use of plenary powers by the International Commission on Zoological Nomenclature in connection with the following names listed by case number: (see Bull. Zool. Nom. 33, parts 3 & 4, 31 March 1977).

Z.N.(S.) 2157 *Goniurellia* Hendel, 1927 (Insecta, Diptera, TEPHRITIDAE): designation of type-species.

Z.N.(S.) 2170 *Pieris castoria* Reakirt, 1867 (Insecta, LEPIDOPTERA): proposed suppression.

Z.N.(S.) 2173 *Culex loewi* Giebel, 1862 (Insecta, Diptera, CULICIDAE): request for suppression so as to conserve *Toxorhynchites brevipalpis* Theobald, 1901.

Comments should be sent in duplicate (if possible within 6 months of the date of publication of this notice), citing case number to:

R.V. Melville, The Secretary, International Commission on Zoological Nomenclature,
c/o British Museum (Natural History), Cromwell Road, LONDON, SW7 5BD, England.

Those received early enough will be published in the Bulletin of Zoological Nomenclature.

The following Opinions have been published recently by the International Commission on Zoological Nomenclature

Opinion No. 1066 (Bull. zool. Nom. 33 (3 & 4) page 155) *Lyda alternans* Costa, 1859 under plenary powers given precedence over *Lyda inanis* Klug, 1808 (Insecta: Coleoptera).

Opinion No. 1073 (Bull. zool. Nom. 33 (3 & 4) page 172). Under plenary powers family name RIODINIDAE Grote, 1895 (Lepidoptera) to have precedence as from 1827 and ERYCINIDAE Swainson 1827 ruled invalid and placed on Official Index of Rejected and Invalid Family-Group Names in Zoology.

Opinion No. 1075 (Bull. zool. Nom. 33 (3 & 4) page 176) *Striglina* Guenee given precedence under plenary powers over *Daristane* Walker, 1859 (Lepidoptera, THYRIDIDAE).

The Commission cannot supply separates of Opinions.

CADDISFLIES IN GENUS *RHYACOPHILA* IN WEST VIRGINIA (TRICHOPTERA: RHYACOPHILIDAE)[1]

James S. Applin[2], Donald C. Tarter[3]

ABSTRACT: State and county records are presented for 13 species of the family Rhyacophilidae for West Virginia. Nine are previously unpublished species records for the state.

DESCRIPTORS: Larval caddisfly, Trichoptera, *Rhyacophila*, State and County Records

Until the present time, only four *Rhyacophila* species have been recorded from West Virginia: *R. fuscula, R. torva, R. minora,* and *R. nigrita* (Ross, 1944 and Roback, 1975). As part of the overall investigation of aquatic insects in West Virginia, a total of 603 collection sites were visited of which 49 were found to have larval *Rhyacophila* populations. Nine state records are reported. Flint (1962) described the larvae of the genus *Rhyacophila* in eastern North America.

Family Rhyacophilidae

New state records are marked with an asterisk.

1. *R. fuscula* (Walker)

Distribution: Fayette Co., Sewell Creek, 2 larvae, 26-VIII-73; Laurel Creek, 1 larva, 19-VII-73; Keeney's Creek, 1 larva, 8-IX-73; Manns Creek, 1 larva, 8-IX-73. Greenbrier Co., South Fork of Cherry River, 1 larva, 26-V-70. Lewis Co., Cherry Fork, 1 larva, 10-VII-75. Nicholas Co., Twentymile Creek, 1 larva, 16-IX-72; Cherry River, 2 larvae, 11-II-72; Panther Creek. Pendleton Co., Seneca Creek, 30-IV-74 (Ross, 1944); Smoke Hole. Pocahontas Co., Tea Creek, 4 larvae, 10-VII-75; Hills Creek, 1 larva, 8-VII-75. Randolph Co., Tygart Valley River. Tucker Co., Lead Mine Run; Engine Run in Blackwater Falls State Park (Roback, 1975). Webster Co., Left Fork of Holly River.

2. *R. vuphipes* Milne*

Distribution: Hampshire Co., Cacapon River (United States National Museum), 13-V-63.

3. *R. torva* Hagen

Distribution: Fayette Co., Short Creek, 1 larva, 18-VII-73. Tucker Co., Engine Run in Blackwater Falls State Park (Roback, 1975).

4. *R. lobifera* Betten*

Distribution: Jackson Co., Left Fork of Pocatalico River, 3 larvae, 24-II-73.

5. *R. glaberrima* Ulmer*

Distribution: Randolph Co., Laurel Fork River, 1 larva, 26-IV-74.

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R. minora group

6. *R. minora* Banks

Distribution: Hardy Co., Trout Run, 8 larvae, 6-VII-74. Pendleton Co., Spruce Knob (United States National Museum), 16-V-63. Randolph Co., Otter Creek, 14-VIII-69; Grants Branch near Spruce Knob Lake (United States National Museum), 17-V-63. Tucker Co., Engine Run in Blackwater Falls State Park (Roback, 1975).

7. *R. melita* Ross*

Distribution: Randolph Co., Gandy Creek (United States National Museum), 17-V-63.

R. invaria group

8. *R. vibox* Milne*

Distribution: Cabell Co., Fourpole Creek. Logan Co., Trace Fork, 1 larva, 17-II-73. Randolph Co., Glady Fork, 2 larvae, 26-IV-74. Wayne Co., Miller Fork, 1 larva, 29-I-74.

9. *R. invaria* (Walker)*

Distribution: Pocahontas Co., Tea Creek, 3 larvae, 30-VII-70. Randolph Co., Shavers Fork, 1 larvae, 21-X-70; Laurel Fork Run, 1 larva, 26-IV-74.

10. *R. nigrita* Banks

Distribution: Grant Co., North Branch Potomac River (Roback, 1975). Pendleton Co., Big Run, 6 larvae, 9-XII-70. Pocahontas Co., Williams River, 3 larvae, 11-VIII-71. Randolph Co., Shavers Fork, 1 larva, 21-X-70; Otter Creek, 1 larva, 14-VIII-69. Webster Co., Williams River, 1 larva, 10-VIII-71.

11. *R.* species 2 of Flint*

Distribution: Pocahontas Co., Shavers Fork below Bannock bridge, 1 larva, 21-X-70. Randolph Co., Shavers Fork at Spruce, 1 larva, 21-X-70.

R. carolina group

12. *R. ledra* Ross*

Distribution: Wayne Co., Beech Fork of Twelvepole Creek, 1 larva, 29-I-74.

13. *R. carolina* Banks*

Distribution: Fayette Co., Hendricks Creek, 1 larva, 19-VIII-73. Hardy Co., Trout Run, 2 larvae, 6-VII-74. Kanawha Co., Ash Branch, 1 larva, 21-VII-73. Tucker Co., Blackwater River, 3 larvae, 13-VII-72.

ACKNOWLEDGEMENT

A special thanks to Dr. Oliver S. Flint, Jr., Curator of Neuropteroids, United States National Museum, for suggestions on the manuscript and help in identifications of the caddisflies.

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THE OCCURRENCE OF *ARCHILESTES GRANDIS* RAMBUR (ZYGOPTERA: LESTIDAE) IN VIRGINIA[1]

James H. Kennedy[2]

ABSTRACT: The occurrence of *Archilestes grandis* Rambur in Virginia is documented. One specimen was captured two years prior to the previous first known record of *A. grandis* east of the Appalachian mountains.

DESCRIPTORS: Odonata, Zygoptera, *Archilestes Grandis* Rambur, Distribution, Virginia.

Previous lists of Virginia damselfly fauna have been published by Calvert (1890), Williamson (1903), Byers (1951), Gloyd (1951) and Donnelly (1961). None of these reports document the occurrence of *Archilestes grandis* in Virginia. *Archilestes grandis* is generally thought to occur in areas west of the Allegheny Mountain range (Smith and Pritchard 1955; Gloyd and Wright 1959), although it has been documented east of the range in Maryland and North Carolina (Donnelly 1961; Wray 1967). Donnelly (1961) reported the first known record of *A. grandis* east of the Appalachians as being taken at College Park, Maryland on 10 Oct. 1949.

While studying the Zygoptera in the Virginia Polytechnic Institute and State University Entomology collection several specimens of *A. grandis* that had been misidentified as *Lestes* spp. were found providing a new state record. One of these specimens, a female collected from Charlottesville, Virginia 14 Oct. 1947, precedes the earliest known record of *A. grandis* east of the Appalachians by at least 2 years. Additional records from Virginia include: MONTGOMERY CO., V.P.I. and S.U. campus 1♂, 1♀, Oct 1969 and 1♂, 13 Sept 1976; Price Mountain 1♂, 1♀, 8 Aug. 1971. FAIRFAX CO., Falls Church 1♂, 1♀, 20 Aug 1966. All material is deposited in the Department of Entomology collection at V.P.I. & S.U. except for the Fairfax Co. material which is in the U.S. National Museum.

ACKNOWLEDGEMENTS

I thank Dr. M. Kosztarab for permission to work with the Zygoptera in the V.P.I. & S.U. Department of Entomology collection and Dr. M.J. Westfall, Jr. for verification of the *A. grandis* specimens.

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[1] Accepted for publication: March 7, 1977

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BOOK REVIEW

THE ORTHOPTEROIDEA OF EUROPE. Part 3. by Kurt Harz and Alfred Kaltenbach. W. Junk, b. v., publishers. The Hague, Netherlands. 1976. 434 pages. $61.81

This third volume co-authored with Dr. A. Kaltenbach of Vienna completes the trio of books on the Orthoptera of Europe. It is a milestone in the published information on this order. Volume 3 actually covers more than strictly the Orthoptera. It deals with the Phasmatoptera, Dermaptera, Mantodea, Blattoptera, and Isoptera. This final volume contains chapters American readers might expect to find in an opening volume in the series. Among them are a key to Orthopteriod orders, and an extensive literature section. An Addenda is provided noting recent species descriptions, errata, and other information published since the completion of the first two volumes.

This third volume follows much the same format of the first two. Basically, it is written in German with generic diagnoses, keys, and epilogue with English translation. There is a chapter by M. Samways on the habitats and song of the five species of *Platycleis* (sensu strictu) which is meant to aid in the identification of these shield-backed tettigoniids.

The bibliography for the three volumes is particularly impressive. References for the Saginae (a small group of large, striking tettigoniids) and the Mantodea are separate from the others, reflecting Dr. Kaltenbach's contribution to this project. The epilogue contains comments on the authors' species concept and a very brief section on the preparation of specimens.

The hundreds of line drawings which accompany the keys and text should be very useful in the identification of species. The chief criticism of the third volume is as it was with the first two, the excessive price. It appears that this will restrict the use of these books and discourage those for whom they were originally intended, students of Orthoptera. The combined cost for the entire set is $210.48

D.C.F. Rentz, Division of Entomology, CSIRO, Canberra.

The Entomologist's Record

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

NEW RECORDS FOR TRICHOPTERA IN NORTH DAKOTA[1]

S.C. Harris, R.B. Carlson[2]

ABSTRACT: The known ranges of *Cheumatopsyche pasella* Ross and *Hydropsyche piatrix* Ross are extended westward to include North Dakota.

DESCRIPTORS: Hydropsychidae, State records, North Dakota.

Cheumatopsyche pasella Ross is primarily northeastern in distribution, extending as far south as Georgia and as far west as Wisconsin (Miller, 1965). *C. pasella* was collected in Richland and Ransom Counties, North Dakota during an investigation of small sandhill streams. A series of 54 adults, 12 males and 42 females, were collected in light traps in June and July, 1974.

Ross (1944) gives the distribution of *Hydropsyche piatrix* Ross as Missouri and Arkansas. Two females of this species were collected in light traps placed on the banks of a small stream in Richland County, North Dakota. The specimens were collected on June 5 and 9, 1974.

The assistance of Dr. Andrew Nimmo, Department of Entomology, University of Alberta, in identifying the specimens, is gratefully acknowledged.

LITERATURE CITED

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Ross, H.H. 1944. The caddisflies, or Trichoptera, of Illinois. Ill. Nat. Hist. Surv. Bull. 23: 1-326.

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The Entomologist's Record

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

NEW RECORDS OF HETEROCERIDAE FROM NORTH DAKOTA[1]

S.C. Harris, R.B. Carlson[2]

ABSTRACT: Records of the heterocerids *Lanternarius mollinus* (Kiesenwetter), *Lanternarius parrotus* Pacheco, *Lapsus tristes* (Mannerheim), and *Centuriatus auromicans* (Kiesenwetter) are reported for the first time from North Dakota.

DESCRIPTORS: Heteroceridae, State records, North Dakota.

Pacheco (1963) reported the Heteroceridae, *Lanternarius mollinus* (Kiesenwetter), *Lanternarius parrotus* Pacheco, *Lapsus tristes* (Mannerheim), and *Centuriatus auromicans* (Kiesenwetter), occurred in the northern, mid-western United States and southern Canada. These species have all been reported from Manitoba and from most of the states surrounding North Dakota. Though Heteroceridae are often collected in North Dakota, no species records have been published.

Adults of these four species were collected along the banks of small streams flowing through the sandhills of southeastern North Dakota. The specimens were hand-collected after water was splashed on the stream bank. The water floods the burrows of the beetles forcing them to run or fly.

Three specimens of *L. mollinus* (1 male; 2 female), nine specimens of *L. parrotus* (3 male; 6 female), and four specimens of *L. tristes* (1 male; 3 female) were collected in Richland County, North Dakota, in July, 1975. Though the beetles occurred in all wooded sections of the stream channel, these three species were most commonly observed and collected in the banks of a beaver pond.

Three males of *C. auromicans* were collected in July, 1976, in Ransom County, North Dakota. This species occurred in the banks of a stream impoundment.

The assistance of Dr. Francisco Pacheco, CIANO, Ciudad Obregón, Sonora, Mexico, in identifying the specimens is gratefully acknowledged.

LITERATURE CITED

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MESSAGE TO MEMBERS, SUBSCRIBERS AND AUTHORS

The American Entomological Society operates on funds from membership dues, subscriptions and sales of publications, and income from endowments. In this latter connection the Society is most fortunate, for without these funds its publications program, library acquisitions and other operations would be drastically reduced.

In spite of these funds, however, because of constantly increasing costs, the Society is facing deficits in several of its operations. For example, the ENTOMOLOGICAL NEWS account is several thousands of dollars in the red. This is largely due to the fact the Society currently must pay $37.00 for each printed page, but has asked authors to meet only $20.00 of these costs in page charges, and in the case of amateurs and retired scientists without institutional support only $5.00. Thus the Society has been underwriting ENT. NEWS in amounts from $17.00 to $32.00 for each page. Regrettably the Society can no longer afford this amount of expenditure, and must take action to recover a greater portion of its publication costs.

To bring income more in line with expenditures, at a meeting of the (executive) Council of the Society on April 28, 1977, the following changes were decided upon to become effective January 1, 1978:

Membership dues			**Subscriptions**	
			Regular	**Non-members**
Student	$4.00	Transactions	$8.00	$18.00
Regular	$7.00	Ent. News	$8.00	$18.00

Page charges on papers published after Jan. 1, 1978

	Regular	**Amateurs & unfunded retired scientists**
Transactions	$25.00/pg.	Negotiable, but minimum of $7.00/pg.
Ent. News	$25.00/pg.	Negotiable, but minimum of $7.00/pg.

Leaders of the Society welcome any suggestions for improvements in its operation. Especially welcome are suggestions for more adequate funding. The Society earnestly solicits the interest of anyone who may be in a position to contribute to its future publications program, thereby helping insure continued dissemination of valuable information resulting from entomological research.

H. P. B.

MEMOIRS OF THE AMERICAN ENTOMOLOGICAL SOCIETY

An irregular serial of monographic papers by students of authority in their respective subjects.

1. The Cresson Types of Hymenoptera. Ezra T. Cresson. 1916. $6.00.
3. A Venational Study of the Suborder Zygoptera (Odonata), with Keys for the Identification of Genera. Philip A. Munz. 1919. $2.00.
4. The Blattidae of Panama. Morgan Hebard. 1920. $3.00.
5. The Types of Hymenoptera in the Academy of Natural Sciences of Philadelphia other than those of Ezra T. Cresson. Ezra T. Cresson. 192. $2.00.
8. The Eumastacinae of Southern Mexico and Central America. James A.G. Rehn and John W.R. Rehn. 1934. $2.50.
9. The Generic Names of the Sphecoid Wasps and their type species. V.S.L. Pate. 1937. $2.50.
10. A Revision of the North American species belonging to the genus Pegomyia. H.C. Huckett. 1941. $3.00.
11. Catalogue and reclassification of the Nearctic Ichneumonidae. Henry K. Townes, Jr. 1944. $15.00.
14. Classification of the Blattaria as Indicated by their Wings (Orthoptera). John W. H. Rehn. 1951. $5.00.
15. The Neotropical Species of the "Subgenus Aeschna" sensu Selysii 1883 (Odonata). Philip P. Calvert. 1956. $10.00.
16. A Taxonomic Study of the North American Licinini with Notes on the Old World Species of the Genus Diplocheila Brulle (Coleoptera). George E. Ball. 1959. $10.00.
17. A Taxonomic Study of the Milliped Family Spirobolidae (Diplopoda: Spirobolida). William T. Keeton. 1960. $5.50.
18. The Genus Bucculatrix in America North of Mexico (Microlepidoptera). Annette F. Braun. 1963. $8.50.
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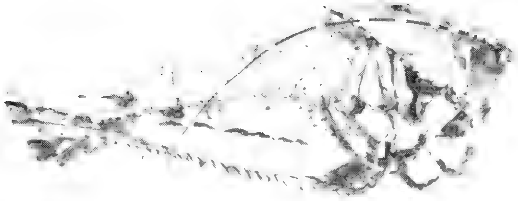

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Figures 4, 5. Holotype male *Neduba extincta* Rentz, new species. Fig. 4, lateral view; Fig. 5, dorsal view.

FERAL HOUSE CRICKETS *ACHETA DOMESTICUS* (L.) (ORTHOPTERA:GRYLLIDAE) IN SOUTHERN CALIF.[1]

David B. Weissman,[2] D.C.F. Rentz[3]

ABSTRACT: Feral house crickets (*Acheta domesticus* (L.) have been discovered in southern California. The crickets have apparently become established as escapes from pet shops and bait stores. The crickets sing almost always at night and live in situations associated with man.

Acheta domesticus (Linnaeus) is a species generally considered native to Europe, but according to Ghouri (1961) may have originated from northern Africa or southwest Asia. It is cosmopolitan, distributed by man, and has been reported in the eastern United States by Blatchley (1920) and Alexander (1957). We are aware of no reports of the species west of the Rocky Mountains although individuals are sold in pet stores and bait shops across the country. Surprisingly, the species lacks survival in peninsular Florida (Walker, personal communication). Our investigations into the California field crickets (Rentz and Weissman, 1978; Weissman and Rentz, 1978) revealed numerous, apparently feral, populations of *A. domesticus* in Orange County, California.

All feral house crickets captured have been macropterous, although Blatchley (1920) reports "micropterous" feral specimens in his study, and numerous "micropterous" adults can be found in pet store stocks. As Walker (1972, 1977) notes, such micropterous individuals probably represent crickets that have shed their metathoracic wings, possibly secondary to a poor protein food source. Autecological information below pertains to feral individuals only.

Recognition characters. – *A. domesticus* is distinguished from *Gryllus* species by its straw brown overall coloration; and head with an irregular, dark, transverse bar extending between the eyes near their dorsal border. There may be several smaller,

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lighter bars on either side of this large bar. The genitalic complex is equally distinctive (Randell, 1964). The number of teeth per millimeter in the file of the male stridulatory ridge of *A. domesticus* exceeds that seen in all western *Gryllus* species (Weissman and Rentz, unpublished). Over 50% of males have more than 200 teeth in the file (maximum 225).

Western geographical distribution. – We have found feral *A. domesticus* in the cities of Tustin, Santa Ana, Orange, and Crystal Cove (a linear distance of some 30 km), Orange County, California. The species is undoubtedly more widely distributed.

Song. – In the field house crickets sing almost exclusively at night. An isolated individual may be heard on overcast days, especially late in the year. The chirp rate is slow, usually 2-3 pulses per chirp (see figure 1).

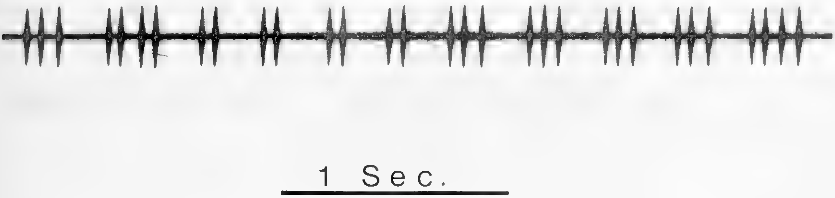

Figure 1. Calling song of house cricket, *Acheta domesticus.* Feral male at 20°C.

Seasonal occurrence. – Singing males first appear in mid to late spring disappearing by late fall. It is not known if there is more than one generation per year in the field, although crickets kept in stores can have continuous generations with proper resources thus indicating the absence of any obligatory dormancy period.

Habitat. – Feral house crickets occur in a variety of habitats, but always are associated with human structures. Individuals occupy cracks in buildings and the ground or are found under vegetation around buildings, cultivated areas, and railroad stations. The population at Crystal Cove was found under boards and ice plant (*Mesembryanthemum* sp.) around houses on the sandy beach front.

Discussion

Unlike the situation with most *Gryllus* species, *A. domesticus* is not always sympatric with other field crickets, further emphasizing its cosmopolitan nature. We do find an occasional *Gryllus* cricket, from any of a number of species, within *Acheta* populations.

Macropterous crickets may fly, but all our efforts to elicit flight in feral house crickets have failed.

Measurements (in mm)

Males

Locality	Length Body	Number Teeth	Length File	Teeth per millimeter
Tustin				
mean ± S.D.	17.7±1.3	204.3±15.3	3.1±0.2	65.9±6.8
n= 15				
range	14.5-19.7	176-225	2.9-3.7	53.2-75.5

Females

	Length Body	Length Ovipositor
Tustin		
range	16.5-19.0	12.2-12.3
m=2		
Crystal Cove		
range	15.5-17.0	9.5-11.5
n=2		

ACKNOWLEDGEMENTS

We would like to thank Dr. Werner Loher, Univ. of Calif., Berkeley, for kindly providing the oscillogram of the calling song of the cricket. We also thank Dr. T.J. Walker for reading an earlier draft and generously offering many helpful suggestions, including the sharing of an unpublished manuscript.

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Note added in proof: additional field work in 1977 has uncovered feral populations of *A. domesticus* in Calexco, Imperial Co., Calif. and across the border in Mexicali, Baja Calif. Norte.

THE GENUS *ACINOPTERUS* (HOMOPTERA: CICADELLIDAE) IN MEXICO AND THE NEOTROPICAL REGION[1]

Rauno E. Linnavuori,[2] Dwight M. DeLong[3]

ABSTRACT: New records of the genus *Acinopterus* Van Duzee are listed from Mexico and Central America. Two species, *A. perdicoenis* n. sp. and *A. igualanum* n. sp. are described as new, and a new name is proposed for *A. reticulatus* Beam. and Lawson.

DESCRIPTORS: Neotropical, *Acinopterus*, species (Homoptera: Cicadellidae)

The main range of the genus *Acinopterus* V.D. lies in North America where 25 species are known, most of them occurring in the arid and semiarid southwestern parts of the U.S. The Nearctic species were revised by Beamer and Lawson (1938), Beamer (1944) and Knull (1944). Three species of the genus are recorded from the Neotropical Region (Linnavuori 1959:58-60). Two of these are North American (A. acuminatus V.D., known only from Cuba, *A. angulatus* Laws. widespread) and only one, *A. gentilis* (Berg) is purely Neotropical.

The following article is based on a large number of specimens of the genus from Mexico, Central and South America in the DeLong collection at Ohio State University. Two new species are being described from Mexico and *A. inornatus* (Bak.) is recorded for the first time from that country.

Acinopterus angulatus **Laws.**
Cicada reticulata Fabricius 1794; 44, nom preoccupied
Acinopterus reticulatus Linnavuori 1959: 59
Acinopterus angulatus Lawson 1922: 119.

Material studied: Mexico: numerous examples from the following localities: Acapulco, Guerrero, 10.X.1939, DeLong & Plummer; Baja California Sur. 2 mim NW of Triumfe, 1900 ft.
DeLong, Caldwell & Plummer; Cuernavaca, Morelos, 6.IV.1932, C.C. Plummer; El Dorado, 23.XII.1928; Hasienda Fresno, Coaquila, A. Dampf; Jalapa Rd., Vera, 13.X.1942, Shaw, DeLong, Hershberger; Jiutepec, Morelos, 6.IX.1939, DeLong, Plummer; Mexico City, Toluca Road, 26.IX.1954; Fortin, Vera., 11.X.1954. Shaw, DeLong, Elliott, Hershberger; Mexcala, Gro. 10.II.1945, Balock, DeLong, Hershberger, Elliott; Monterey 1.XI.1938, J.S. Caldwell; Necaxa, Pue. 26.X.1945, Stone, DeLong, Hershberger, Elliott; Palomas, 12.X.1931; Plancha, Piedra, 28.X.1925; Rio Tuxpan, Mich., 29.X.1945, Plummer, DeLong, Hershberger, Elliott; Tamazunchale, 20.IX.1945, DeLong, Hershberger, Elliott; Taxco, Gro., 10.XI.1945, Balock, DeLong, Hershberger,

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Elliott; Tierra Colorado, Gro., 5.X.1945; Valles, S.L.P., 25.IX.1945, DeLong. Good, Caldwell; Vejuco, Gro., 3.IX.1930; Yaqui Valley, Sonora, 16.VIII.1927; Zimipan Hdq., 31.X.1945. DeLong, Hershberger, Elliott. Panama: Las Cumbres, IV.VIII.1973, 4 spec. Henk Wolda; Braizl: Surumu, Roraima, 2 spec. IX.1966, M. Alvarenga, F.M. Oliveira. Argentina: Urundel, Salta, 1 spec. 31.I.1950, R. Golbach. Very common in Mexico and the West Indies, apparently local in South America.

***A. pulchellus* Laws.**

Recorded from Keno Bay in Mexico (Beamer & Lawson 1938: 479). Otherwise known from SW USA.

***A. fuscifrons* Laws.**

Material studied: Mexico: Canon de El Adra, 2 exx, 4.XI.1945, DeLong, Hershberger, Elliott; Finca Belem, Chia., 1 ex, 23.VI.1935; Jalapa Road, Vera, 1 ex, 13.X.1942, Shaw, DeLong, Hershberger; Mont Grande, Chia., 1 ex, 23.III.1931, J. Parra; Tamazunchale S.L.P., 8 exx, 2.XI.1945, DeLong, Hershberger, Elliott; Valles S.L.P., 4 exx, 25.X.1941, DeLong, Good, Caldwell, Plummer. Range: SW USA and Mexico.

***A. acuminatus* V.Dz.**

A common Nearctic species. Recorded from Cuba (Linnavuori 1959: 58-59). Other records from the Neotropical Region undoubtedly refer to *A. angulatus.*

***A. inornatus* (Bak.)**

Material studied: Mexico: numerous exx from the following localities: Baja California Sur, 2 mi NW El Triumfo, 1900 ft, 10.X.1968 and 7.5 mi W El Triumfo, 1600 ft, 11.X.1968, E.L. Sleeper, F.J. Moore; Balsas, Gro., 11.XII.1929, A. Dampf; Hacienda Fresno, Coahuila, 2.VI.1931, A. Dampf; Hermosillo, Son., 23.III.1927; N of Monterey, 22.IX.1941, DeLong, Good, Caldwell, Plummer; Navajoa, Son., 28.III.1929, A. Dampf; Rodriguez N Leon, 5.VI.1930, A. Dampf; Valles S.L.P., 3.XI.1945, DeLong, Hershberger, Elliott. Common in SW USA, not previously recorded from Mexico.

***A. plenus* Beam. & Laws.**

Aedeagus in Figs. 4-6 and 10.

Material studied: Mexico: Acapulco, Guerrero, 1 ex, 10.IX.1939, DeLong & Plummer; Acapulco Road, 1 ex, 22.XI.1938, J.S. Caldwell; Cocula, Gra., 1 ex, 17.XII.1936; Cuernavaca, Mor., 4 exx, 25.IX.1945, Plummer, DeLong, Hershberger, Elliott; Iguala, Guerrero, 2 exx, 11.IX.1939, DeLong; Tasquillo, Hgo., 3 exx, 29.X.1941, DeLong, Caldwell, Plummer. Originally described from Cuernavaca. Also known from SW USA.

***A. peridicoensis* sp. n.**

Length ♂ 5.25-6.0 mm, ♀ 6.5-6.75 mm. Yellow-brown, often with greenish tinge. Frontoclypeus with faint brown lateral arcs. Crown and pronotum immaculate. Eyes brown. Scutellum with basal triangles and two median stripes faintly embrowned. Elytra yellow-brown, commissural margin of clavus, subapical area of corium and costal margin with milky patches, middle of costal margin dark brown; veins whitish, ± bordered with dark brown. Dorsum of abdomen and ventral surface of thorax ± infumed. Venter greenish. Legs green or olivaceous.

Resembling *A. plenus* in general habitus but body more elongate. Head 0.9 x as broad as pronotum, roundedly bluntly angulate, 1.41-1.5 x as long at middle as laterally, 2.0-2.2 x as broad as long (crown in *A. plenus* shorter and broader, 1.36-1.5 x as long at middle as laterally, 2.3-2.46 x as broad as long), with distinct depression along

Figs. 1-3. *Acinopterus pedricoensis* sp.n.: 1 aedeagus in lateral, 2 in ventral aspect; 3 basal appendage of same, broad aspect.

postfrontal suture. Elytra long and acuminate apically as in *A. plenus*; claval veins united with each other with 1-2 cross veins, several cross veins between lower claval vein and claval suture.

Aedeagus in Figs. 1-3. Shaft in lateral aspect broad and nearly straight; basal appendages very large, wing-like, with apical margins irregularly trilobate, margins finely serrate. Other genitalia of the usual type. 7th sternite (♀) broadly parabolic with a slight apical notch.

Mexico, Baja California Sur, 2.5 mi SE of Valle Perdico, 2000 ft, 1 ♂, type and 6 paratypes, 15.X.1968, E.L. Sleeper, F.J. Moore.

Near *A. plenus* but readily distinguished by the very broad basal processes of the aedeagus.

***A. igualanus* sp.n.**

Length ♂ 6.5 mm. Yellow-brown. Frontoclypeus with indistinct and short brown lateral arcs. Crown and pronotum immaculate. Eyes reddish brown. Basal triangles and two median bands on scutellum faintly embrowned. Coloring of elytra as in the preceding species but pattern a little less variegated. Under surface of thorax embrowned. Legs yellow-brown.

Resembling *A. plenus* but head narrower, 0.85 x as broad as pronotum. Crown longer, 1.6 x as long at middle as laterally, 2.1 x as broad as long. Elytra as in *A. plenus*; claval veins united with each other with a cross vein, several cross veins between lower claval vein and claval suture.

Aedeagus in Figs. 7-9. Shaft in lateral aspect broad, distinctly recurved dorsad; two pairs of short basal processes, the ventral pair claw-like, the dorsal processes expanding apicad and minutely dentate; basal part of aedeagus in ventral aspect rather narrow. Other genitalia of the usual type.

Mexico, Iguala, Guerrero, 1 ♂, type, 1.IX.1939. DeLong.

Of the *plenus* group. Readily distinguished from the other species by the four basal processes of the aedeagus.

***A. lawsoni* nom. n.**

Acinopterus reticulatus Beamer & Lawson 1938: 482-483 nec Fabricius 1794: 44.

Originally described from Keno Bay, Mexico. Also known from SW USA.

***A. gentilis* (Berg)**

Redescribed by Linnavuori (1959: 60).

Material studied: Brazil: Amazonas, Santarem, 4 exx, II.1943, L. Beery. Argentina: Rinconada, Tucuman, 1 ex, IV.1947, Ares; Urundel, Salta, 2 exx, 31.I.1950, R. Golbach. Previously known only from Argentina.

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NEW SPECIES OF MELITTOPHILOUS *PSEUDOCYPHODERUS* FROM COSTA RICA AND REMARKS ON TAXONOMY (COLLEMBOLA: CYPHODERIDAE)[1]

José A. Mari Mutt[2]

ABSTRACT: *Pseudocyphoderus melittophilous* n. sp. is described based on specimens collected in a nest of the stingless bee *Trigona (Partamona) testacea* in Costa Rica. A discussion is included on the possible morphological adaptations of this species to life in stingless bee nests. Remarks are made on the taxonomic status of *Pseudocyphoderus* Imms and *Delamareus* Mitra. The species *Pseudocyphoderus machadoi* Delamare Deboutteville 1958 is transferred to *Delamareus*.

DESCRIPTORS: *Pseudocyphoderus melittophilous* n. sp., Costa Rica, stingless bees, *Delamareus machadoi new combination.*

Members of the family Cyphoderidae are well known myrmecophiles and termitophiles; the whole family being restricted to ant and termite nests but for several species which are commonly collected in leaf litter. Delamare Deboutteville (1948) revised the taxonomy of the family and discussed the ecology and ethology of its species.

To the present day only two springtails (both cyphoderids) have been recorded from nests of stingless bees (tribe Meloponini, family Apidae). These are *Paracyphoderus dimorphus* (Silvestri) 1911, described from nests of *Trigona (Partamona) cupira* in Mexico and *Cyphoderus* sp., near *similis* Folsom 1927 reported by Salt (1929) from Colombia.

Through the kindness of Dr. Eric Smith, Mr. Hank Dybas, and the Field Museum of Natural History, Chicago, Illinois, I have studied a collection of cyphoderids from a nest of *Trigona (Partamona) testacea* in Costa Rica. The specimens belong to a new species which is described below.

The holotype and nine paratypes are deposited in the Field Museum. Two paratypes are in the Illinois Natural History Survey and one paratype is in the author's collection.

Pseudocyphoderus melittophilous new species

Length excluding antennae and furcula up to 3.2 mm. Body coloration cream white,

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[1] Accepted for publication: August, 1977

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devoid of dark pigment. Habitus as in figures 1 & 5. Body flattened dorsoventrally, lepismiform from a dorsal aspect (Fig. 5). Mesothorax over twice as long as metathorax, notched at anterior corners, dorsolaterally surpassing posterior
three abdominal segments (Abd. 1-3) small, Abd. 4 about 10 times longer than Abd. 3. Scales present throughout head, body and appendages with exception of last antennal segment (Ant. 4) and apical ½ of Ant. 3.

Dorsal head and body chaetotaxy as in figure 5, essentially achaetotic. Antennae relatively long, segments slender, not thicker at the middle as in many cyphoderids. Attachment of antennae, labrum and opening of mouth cone ventral in position on head. Prelabral setae four, smooth. Labral chaetotaxy of formula 5,5,4, all setae smooth. Mandibles with well developed apical teeth and molar plate (Fig. 4), right mandible with 5 teeth, left mandible with 4. Maxilla with well developed teeth and fringed lamellae (Fig. 2). Chaetotaxy of labial base as in figure 8.

Coxae (Fig. 11) very large, those of each pair of legs basally very close to each other and ventral in position on the body. Trochanters large, those of metathoracic legs of adult specimens with an outer open cup like depression (Figs. 1 & 11). This depression, of unknown function, and so far unique among the Collembola, is thickly lined with scales and its borders are more sclerotized than the adjoining cuticle. Distribution of smooth (finely striated) setae on tibiotarsi as in figure 11. Aside from these setae, many ciliated setae are present upon this segment. Morphology of claws as in figure 3. Note the large basal tooth upon the base of the unguis. Tenent hair large, finelly ciliated.

Chaetotaxy of anterior and posterior faces of collophore as in figures 7 & 10. Aside from these setae numerous scales are present. Corpus of tenaculum with a pair of setae arranged in a longitudinal medial line. Rami four toothed.

Manubrium twice as long as dentes. Distribution of macrochaetae on the dorsal distal portion of manubrium and dental chaetotaxy as in figure 6. Mucro absent (Figs. 6 & 12), but see under discussion of this species.

Dorsal head and body cuticle composed of quadrangular granules (Fig. 9).

Diagnosis: The new species differs from the other three members of the genus in possessing very well developed mouthparts, a cup like depression on the metathoracic trochanters of adult specimens, and in the shape of the body, particularly the mesothorax.

It differs from *Delamareus immsi* and *D. machadoi* in the structure of the unguis and in the presence of long mucrones in these species.

From *Paracyphoderus dimorphus* the new species may be separated by the presence of a well developed mucro in *dimorphus,* absence of sexual dimorphism in the new species, and in the structure of the mucro and tenent hair.

Discussion: Under the species description I state that the mucro is absent. I say this with some reservation. From a dorsal aspect (Fig. 6) the apex of the dens appears to have a short projection which could readily be taken for a short mucro. From a lateral aspect, however, the picture is more complicated (Fig. 12). The projection turns out to be the apex of the distal portion of the

Pseudocyphoderus melittophilous

Fig. 1. Habitus, lateral aspect; 2. Apex of maxilla; 3. Claw structure of metathoracic leg; 4. Apex of mandible; 5. Habitus, dorsal aspect, showing distribution of macrochaetae (circles) and lasiotrichia; 6. Chaetotaxy of apical portion of manubrium and dentes, scale striations omitted. Left dens shows only inner and outer rows of scales, right dens shows only the middle dorsal row of scales and macrochaetae.

dens, which is clearly separated from the rest of the segment by a conspicuous indentation.

It may be purported that the area distal to this indentation is the mucro. I know of no cyphoderid Collembola with scales or setae upon the mucro; is this the first? Is the indentation a secondary development of the dens and in no way related to the mucro-dens suture? I prefer the latter alternative but the true answer may very well lie elsewhere.

Material Examined: Costa Rica, Provincia Limon, Reventazon, Finca Hamburg, Jan. 21, 1938, in nest No. 33 of *Trigona (Partamona) testacea* Klug, Ferdinand Nevermann, col. Field Museum of Natural History, A. Bierig collection, acc. no. Z-13812. *Holotype* and 13 paratypes.

Morphological Adaptation and Life Habits of *Pseudocyphoderus melittophilous*—A Hypothesis

Salt (1929) and Wilson (1972) have pointed out (and exemplified) that several arthropod symbionts of stingless bees have heavily sclerotized dorsal surfaces, dorsoventrally flattened bodies, and "turtle shaped" bodies. The appendages of these species can be tightly pressed against the body or hidden under it. These morphological characteristics, it is said, are adaptive by protecting the host from the attacks and pursuits of the bees.

Pseudocyphoderus melittophilous n. sp. exhibit a series of morphological characteristics, the origin of some of which I feel could be explained by assuming their development as adaptations to life in stingless bee nests.

The dorsal cuticle of the new species is well sclerotized and composed of quadrangular granules (Fig. 9). It is also covered by a heavy coat of scales. The mesothorax is greatly enlarged, anteriorly it is notched and protects the posterior lateral portion of the head. Both meso and metathorax are expanded lateroventrally, protecting the pleuron and appendages. The coxae are placed ventrally on the body, those of each pair are very close together, in a way reminiscent of blattids. The legs are not long and can probably be hidden under the wide body. The cup like depression on the metathoracic trochanters of adults (Figs. 1 & 11) may be a further adaptation to the peculiar life habits but the adaptive significance of this feature is at present only open to speculation.

It is of interest to note here that *Paracyphoderus dimorphus,* one of the other two springtails recorded from nests of stingless bees, possesses a greatly expanded mesothorax somewhat similar to that of *Pseudocyphoderus melittophilous* n. sp. (see Silvestri 1911: 68, Fig. 1).


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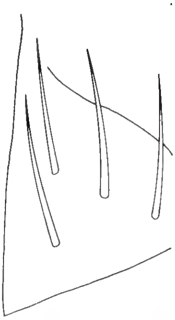
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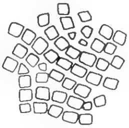
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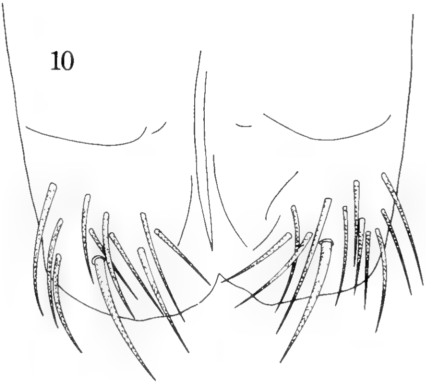
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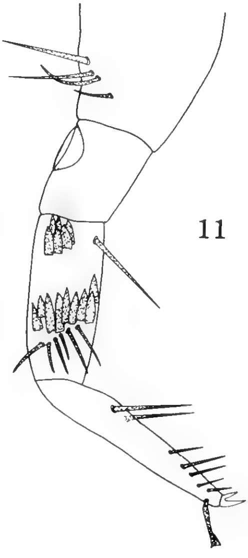
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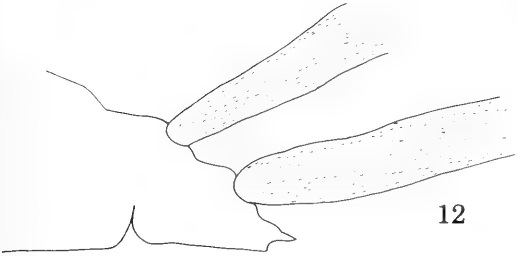
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Fig. 7. Chaetotaxy of anterior face of collophore; 8. Chaetotaxy of labial base; 9. Dorsal mesothoracic epicuticle showing quadrangular granules, redrawn from a scanning electron micrograph; 10. Chaetotaxy of posterior face of collophore; 11. Metathoracic leg; 12. Lateral view of apex of dens.

Remarks on the Taxonomic Status of *Pseudocyphoderus* Imms and *Delamareus* Mitra

Mitra (1977) erected the genus *Delamareus* for the Indian species *D. immsi.* The genus was to be separated from its closest relative, *Pseudocyphoderus,* by its unique ungual structure, the presence of well developed mandibles with conspicuous teeth and a large molar plate in *Delamareus,* and by the presence of a long mucro in the latter genus.

It appears, however, that Mitra overlooked Delamare Deboutteville's (1958) description of *Pseudocyphoderus machadoi* from Angola. That species, contrary to the other members of the genus, possesses well developed mandibles and a long mucro not unlike that of *Delamareus immsi.* Although the unguis of the latter species is definitely unique among the Collembola, it appears to me that the unguis of *Pseudocyphoderus machadoi* shares a few similarities with that of *D. immsi* (see Mitra 1977: Fig. 3 and Delamare Deboutteville 1958: 67, Fig. 2). Aside from the ungual structure, *Pseudocyphoderus* and *Delamareus* are seemingly equivalent.

The taxonomic status of these two genera can be resolved in one of two ways. *Delamareus* can be synonymyzed to *Pseudocyphoderus* or *P. machadoi* transferred to *Delamareus.* I have decided on practical grounds for the latter option and propose the following combination: *Delamareus machadoi* (Delamare Deboutteville) 1958 *new combination. Pseudocyphoderus* and *Delamareus* may now be differentiated on account of the structure of both unguis and mucro, and *Pseudocyphoderus* is again restricted to species with a very short mucro.

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POSITION OF *"LEUCTRA" DIVISA* HITCHCOCK WITHIN THE FAMILY LEUCTRIDAE (PLECOPTERA)[1] [2]

Charles H. Nelson[3]

ABSTRACT: The holotype male of *"Leuctra" divisa* Hitchcock is redescribed and refigured. Examination of the holotype indicates that the proper taxonomic assignment of this species is to a group of closely related species within the genus *Paraleuctra* which includes *P. sara, P. forcipata, P. vershina, P. purcellana, P. orientalis, P. zapekinae,* and *P. cercia.* Characters serving to distinguish *P. divisa* from the other species within this group are discussed. A preliminary analysis of the phyletic relationships of all the certain species belonging to this genus is depicted in the form of a computer-generated minimum spanning tree.

DESCRIPTORS: Plecoptera; Leuctridae; *Paraleuctra; "Leuctra" divisa* Hitchcock; holotype male redescribed.

"Leuctra" divisa was described by Hitchcock (1958) from a single adult male specimen. Unfortunately, in his description Hitchcock concentrated on genitalic structures and omitted detailed mention of prothoracic sternal and wing venational characteristics, two anatomical criteria which had been used by previous workers (Hanson, 1941; Ricker, 1943) in assigning species to their proper taxonomic group within the Leuctridae. Nonetheless, Hitchcock noted that *"L." divisa* was clearly distinct and that it could possibly be a representative of a new and undescribed subgenus in addition to those already recognized within the genus *Leuctra* (s.l.). Subsequently Illies (1966) elevated the subgenera within *Leuctra* (s.l.) to generic status, but retained Hitchcock's species within *Leuctra* (s.s.). However, Ricker and Ross (1969) and Nelson and Hanson (1973) in their respective studies on leuctrid phylogeny treated *"L." divisa* as not belonging to *Leuctra* (s.s.) but as a representative of its own separate group. Yet neither set of authors undertook any formal nomenclatural changes and, as recently noted by Zwick (1977), the precise placement of this species within the Leuctridae still remained unclear. In view of the uncertain placement of *"L." divisa* and its possible importance in clarifying the phylogeny of the Leuctridae, an examination of the holotype was carried out. This examination has revealed that while this species has

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been incorrectly assigned to *Leuctra* (s.s.) there is, on the other hand, no basis currently for erecting a new genus within the Leuctridae for its inclusion.

Paraleuctra divisa (Hitchcock), New Combination

Adult Male. – Body length and coloration as described by Hitchcock (1958).

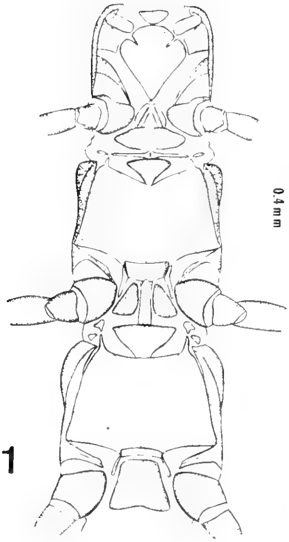
Prothoracic basisternum anteriorly partially fused to presternum and posteriorly fused to furcasternum (Fig. 1.).

Rs and M of forewing originate from separate points on R (Fig. 2). On hindwing Rs and M originate from separate points on arculus; M_{3+4} arises from M; m - cu crossvein distal to position of r - m crossvein and anal veins number three.

Pregenital abdominal tergites all entirely sclerotized dorsally. Ninth sternite with moderately produced vesicle (Fig. 5) arising from antero-medial sternal region. Subgenital plate posteriorly produced and emarginate. Tenth tergite with meso-posterior border produced posteriorly (Fig. 4). Tergite divided meso-dorsally for all of its longitudinal distance by narrow membranous strip. Tenth sternite incomplete ventrally (Fig. 5). Epiproct (Fig. 4) moderate in size and in lateral view (Fig. 3) curved, narrowing gradually from its base to a point apically. Epiproct situated underneath and anterior to the meso-posterior margin of tenth tergite. "Lateral bars" (Fig. 4) articulate with epiproct at their posterior extremities. Outer-lobes of paraproct (Fig. 3, 5) modified into elongate, narrow belt-like "suspensory bars" (Ricker and Ross, 1969). Each outer-lobe articulates at its basal extremity with the cercus. When viewed laterally each outer-lobe distally is somewhat club-shaped and covered on its antero-lateral surface with many small protuberances. Attachment bulb of paraproct (Zwick, 1973) small, half sclerotized and half membranous (Fig. 3, 5). Cercus of each side (Figs. 4, 5) broadest basally and narrowing to a bluntly pointed apex. Cercus, lacking spines and protuberances, apically bearing a small "rounded" sclerite, very likely representing remainder of second cercal segment.

Material Examined. – Holotype Male, Woodacre, Marin Co., California, IV-14-1956. S.W. Hitchcock. California Academy of Science, Type #9998.

Paraleuctra divisa shares with the other members of the genus the following combinations of features; (1) prothoracic presternum partially fused to basisternum, (2) prothoracic furcasternum fused to basisternum, (3) m-cu crossvein of hindwing distal to r-m crossvein, (4) outer-lobes of paraproct elongate, narrow "suspensory bars", and (5) mesobasal margin of each cercus expanded into a narrow, elongate belt-like extension. Within *Paraleuctra* this species is apparently closely related to a group of species in which the males are characterized by; (1) relatively short length of the distal region of the outer lobes of the paraproct, less than twice the length of the mesolongitudinal distance of the ninth sternite, and (2) absence of a distinctly expanded apical area of the distal region of the outer lobes. In addition to *P. divisa* members of this group include: *P. sara* (Claassen), *P. forcipata* (Frison), *P. purcellana* (Neave), *P. vershina* Gaufin and Ricker - North America; *P. orientalis* (Chu) - China; *P. cercia* (Okomato) - Japan; *P. zapikinae* Zhiltozova - USSR.



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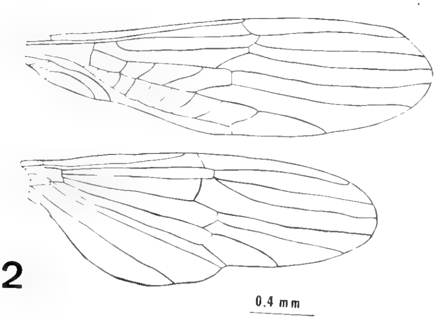

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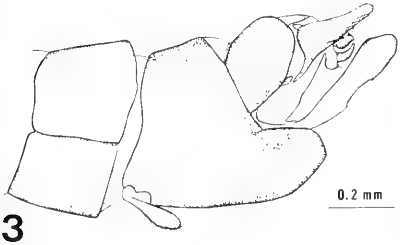

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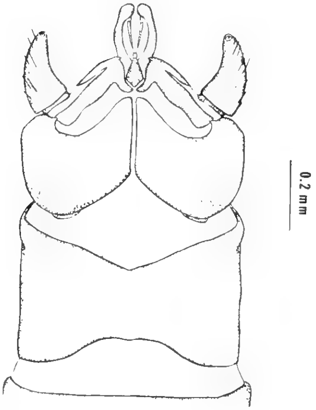

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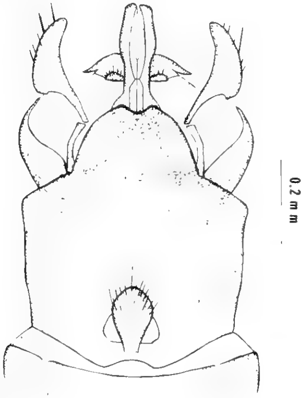

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Figs. 1-5. *Paraleuctra divisa* (Hitchcock). Fig. 1. Thoracic sterna. Fig. 2. Wings. Fig. 3. Male terminalia, lateral view. Fig. 4. Male terminalia, dorsal view. Fig. 5. Male terminalia, ventral view. Fig. 6. Minimum spanning tree for the species of *Paraleuctra*. Length of internodes proportional to phenetic distance.

A preliminary estimate of the phyletic relationships between all the certain species within *Paraleuctra* can be carried out utilizing the procedure for constructing a minimum spanning tree described by Farris (1970). Characteristics of the cerci and paraproct which have been chiefly relied upon in past studies for distinguishing between species in this group are employed in this present study and are arranged in a data matrix (Table 1). Unfortunately, specimens representing all the species in this group were not available for examination. Nonetheless, a data matrix based on characteristics of the cerci and paraproct could be obtained from existing descriptions and figures for these species. The resultant minimum spanning tree (Fig. 6) indicates that *P. divisa* has its closest phenetic affinity (*sensu* Farris, 1967) with *P. purcellana*, although the latter species is also phenetically equidistant from *P. sara* and *P. cercia*. It is interesting to note that three clusters of phenetically closely related species pairs can be discerned each with one member from North America and one from Asia: *P. sara - P. cercia; P. forcipata - P. orientalis; P. vershina - P. zapikinae.* A consistency index of 0.63 indicates a moderate correlation between the tree and the data. The homoplasious evolutionary transitions are found to occur in characters 3 through 7. Obviously these provisional results must be viewed with caution as they could be substantially altered when characters, other than just those of the cerci and paraproct, are obtained and analyzed.

Finally, while it has been possible to place *"Leuctra" divisa* within *Paraleuctra*, four other species, three described by Okamoto (1922) and one described by Kawai (1967), remain problematical regarding their inclusion within this genus. Okamoto's descriptions and figures of *Leuctra forficularis* (given uncertain species status by Illies, 1966) and *Rhopalopsole okomatoa* suggest, as noted by Zhiltzova (1975) and Zwick (1977) for the latter species, placement within *Paraleuctra*. On the other hand Okamoto's descriptions and figures of *Paraleuctra nipponica*, which Zhiltzova (1975) considered a species of *Rhopalopsole*, indicate that a more appropriate placement for this species might be within the genus *Perlomyia* (*sensu* Zwick, 1977). Lastly, the description and figure provided by Kawai for the female holotype of *Paraleuctra elongata* suggest that this species is possibly a member of *Rhopalopsole* (*sensu* Zwick, 1977). Resolution of the placement of these species as well as a detailed understanding of relationships of the species within *Paraleuctra* must await a thorough examination of all the considered species.

Descriptions of characters. – Fifteen characters were selected to undertake the preliminary analysis of the phyletics of *P. divisa* and closely related species. All the characters are two-state and are coded as follows: (1) Remainder of second cercal segment: present = 0; absent = 1. (2) Two arms arising from basal cercal area: absent = 0; present = 1. (3) Upper arm with projection of posterior surface: absent = 0; present = 1. (4) Upper arm with two or more tooth-like projections at apex: absent = 0; present = 1. (5) Length of lower arm compared to length of upper arm: 2/3 length or less = 0; nearly equal in length = 1. (6) Lower arm with projection on mesal surface: absent = 0; present = 1. (7) Lower arm apical margin: rounded = 0; truncated = 1. (8) Basal area with distinct posterior margin between upper and lower arms: absent = 0; present = 1. (9) Basal area with small projection on posterior surface near base of upper arm: absent = 0; present =1. (10) Basal area dorsoventral distance compared to anteroposterior distance: nearly equal in length = 0; approximately 1/2 length = 1. (11) Length of distal region of outer lobes of paraproct: less than twice the length of the mesolongitudinal distance of ninth sternite = 0; greater than twice the length of the mesolongitudinal distance of ninth sternite = 1. (12) Apical area of distal region of outer lobes: not distinctly expanded = 0; distinctly expanded = 1. (13) Apical area of distal region of outer lobes: not distinctly lobed = 0; distinctly lobed = 1. (14) Size of upper lobe of apical area compared to size of lower lobe: nearly equal = 0; approximately twice the size - 1. (15) Upper lobe with small coiled filament: absent = 0; present = 1.

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Table 1. Data Matrix consisting of the character states for the species of *Paraleuctra.*

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
P. sara	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0
P. forcipata	1	1	0	0	1	1	0	1	1	0	0	0	0	0	0
P. vershina	1	1	1	0	1	0	0	0	0	1	0	0	0	0	0
P. purcellana	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0
P. orientalis	1	1	0	0	0	1	0	1	1	0	0	0	0	0	0
P. zapekinae	1	1	1	1	1	0	0	0	0	1	0	0	0	0	0
P. cercia	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0
P. divisa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P. occidentalis	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0
P. jewetti	1	1	0	0	0	0	1	0	0	0	1	1	1	1	0
P. rickeri	1	1	0	0	0	0	1	0	0	0	1	1	0	0	0
P. gracilis	1	1	0	0	1	0	0	0	0	0	1	1	1	1	1

A NEW AND APPARENTLY EXTINCT KATYDID FROM ANTIOCH SAND DUNES (ORTHOPTERA: TETTIGONIIDAE)[1]

D.C.F. Rentz[2]

ABSTRACT: A new species of shield-backed katydid is described from the Antioch San Dunes, Antioch California which formerly occupied a considerable acreage along the Sacramento-San Joaquin Rivers but which is now a small highly disturbed parcel which may soon be completely destroyed. The holotype male is the only specimen known of the species which is now believed to be extinct.

Systematic and ecological studies in recent years on the western Decticinae have yielded some interesting records (see Rentz and Birchim, 1968; Rentz, 1972; Rentz, 1973) but none as peculiar as the species described in this paper. The male specimen reported here is apparently the sole existing representative (living or dead) of a species which was restricted to the narrow band of sand dunes in Antioch, California. The dunes now are largely destroyed either due to building construction or various other forms of habitat disturbance. The katydid is particularly distinctive for the genus *Neduba* and is of zoogeographical interest because of the proximity of the type locality (Mt. Diablo) of the widespread and abundant *Neduba (Neduba) diabolica* (Scudder).

The Antioch Sand Dunes are unique aeolian deposits and were once situated on the south shore of the confluence of the Sacramento and San Joaquin Rivers. This narrow band of sand, believed to be late Pleistocene in age, occupied several miles of shoreline. Now, industry, development, and sand removal have reduced the dunes to a few acres near the Pacific Gas and Electric tower on Wilbur Ave. The encroachment of introduced plants and the retardation of the free "waxing and waning" of sand have severely affected the area. And for some reason, no new sands are being deposited. The grazing of penned horses, tillage of soil, and severe dry summer of 1976 with concurrent brush fire probably have sounded the death knell for the Antioch Dunes.

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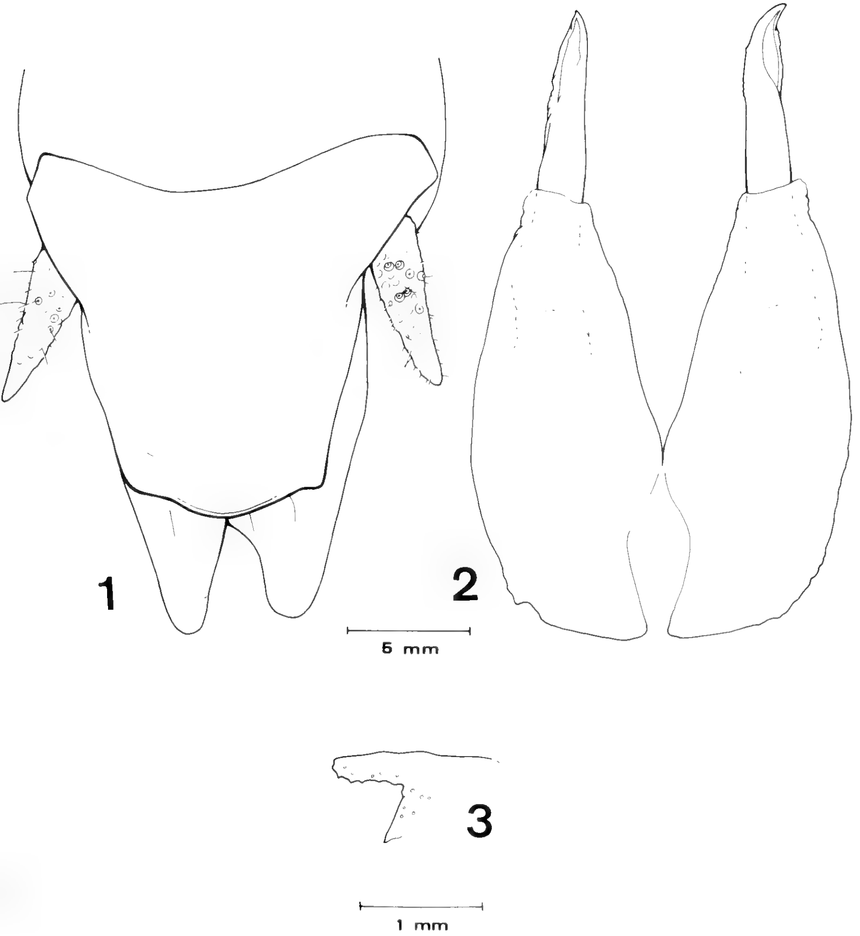
The Antioch Sand Dunes have received widespread recognition because of their unique geographic location and because northern taxa of typically desert species are known from there. It is also the type locality for many insects including another endemic decticine, *Idiostatus middlekauffi* Rentz. This species (see Rentz, 1973) was periodically common at the present dune site, at least in the late 1960's. The dunes and their unique insect fauna were popularized during the 1950's when Life Magazine devoted an article with a full color skematic drawing of the dunes and some of its inhabitants, including *Idiostatus middleakauffi.* This has been reprinted along with a photograph of the original dune site in the Time-Life Nature Library book on North America (see Farb, 1964).

The author made repeated trips to the Antioch Dunes during the 1960's both at night and during the day at different times of the year and has never encountered a *Neduba* species. It seems unlikely that this species exists elsewhere.

Neduba (Neduba) extincta Rentz, New Species

(Figures 1-5)

Species description. – HOLOTYPE MALE. Antioch, Contra-Costa County, California, 1 July 1937.
Sciences, number 12,987. Size large for genus, from robust. HEAD well seated in pronotum; fastigium of vertex with feeble sulcus, frons flat; eye ovo-elliptical, shallow. Pronotum not greatly produced distad as in other species, covering only about half of first abdominal tergite; apex of tegmen slightly protruding from beneath pronotum; anterior margin of pronotum straight, posterior margin obtuse, lateral carinae convergent proximad; lateral lobes of pronotum with borders evenly obtuse, posterior portion declivent; median carina barely perceptible; anterior fifth of disc cut by a single sulcus, obsolete mesad; dorsal surface of disc smooth but not glabrous; prosternum bearing a pair of widely separate aciculate processes; mesosternum produced laterally forming a pair of quadrate processes; metasternum similarly formed but processes lower. APPENDAGES: fore tibia armed on dorsal surface with 0 and 1 spine on anterior margin positioned in distal quarter, posterior margin with 2 spines, one positioned over auditory foramen, the other at apex; ventral surface bearing 6, 7 spines on both margins; middle tibia armed dorsally with 3 spines on anterior margin, all positioned in proximal third, posterior margin with 4 spines, the 4th spine positioned at apex, ventral surface bearing 7 spines on both margins; hind tibia armed dorsally with a large number of close-set spines of equal lengths, apex without spurs, ventral surface with several widely spaced spines, apex with a pair of spurs, the inner of which is much the longer. Plantula elongate, two-thirds the length of metatarsus. All femora unspined ventrally; fore femur armed on dorsal surface with 5 spines, 4 positioned in proximal quarter, the other subapically; middle tibia armed with 4 and 5 spines dorsally, one positioned subapically; dorsal surface of hind femur armed with a large number of spines all positioned on surface proximad to narrow distal portion. Genicular lobe of fore femur armed only on



Figures 1-3. Terminalia of holotype male *Neduba extincta* Rentz, new species. Fig. 1, dorsal view apex of abdomen; Fig. 2, titillator; Fig. 3, ventral sclerite.

anterior lobe with a single spine; middle femur armed similarly but on both lobes; hind femur armed only on internal lobe. ABDOMEN: dorsal surface with trace of median carina, apex with tenth tergite, cerci, and pseudocerci as (figs. 1, 5); subgenital plate without styles, apex very narrow, cut by an abrupt but shallow V-shaped incision. Titillator (figs. 2, 3), ventral sclerite feebly serrate. COLORATION: overall general coloration pale (not really shown in figs. 4-5) straw brown; head with mottling ventrad of eye; antenna dark with highly contrasting light and dark annuli; pronotum concolorous straw brown except apical rim which is alternately marked similar to antenna (fig. 5). Fore and middle femur with subapical dark annulus; fore and middle tibiae with two annuli, less extensively defined; hind femur with mottled areas dorsally (fig. 5), outer pagina with a narrow longitudinal stripe.

Measurements. – (in mm) Length body, 28.0; Length pronotum, 9.9; width pronotum, 6.6; Length hind femur, 21.8.

Derivation of name. – This species is named with reference to its probable status.

Discussion

Neduba extincta Rentz, new species is a member of the subgenus *Neduba* as indicated by the quadrate tenth tergite and distinctive titillators with parallel arms. It is very distinct from other species in the subgenus in the shape of the pronotum, its large size, and very pale coloration. The armature of the legs is also unique. Topotypic *N. (N.) diabolica* from Mt. Diablo, not far from the Antioch Dunes, have a pair of apical spines on the dorsal surface of the fore tibia rather than the single spical spine on the posterior margin. *N. (N.) extincta* is the sole known member of the subgenus lacking styles on the male subgenital plate.

The author has searched collections in the San Francisco Bay Area likely to have material from the Antioch Dunes for additional specimens but none have been located.

ACKNOWLEDGEMENTS

The author would like to thank the National Science Foundation which provided funds through grant GB 31044 used in this study.

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Figures 4, 5. Holotype male *Neduba extincta* Rentz, new species. Fig. 4, lateral view; Fig. 5, dorsal view.

FERAL HOUSE CRICKETS *ACHETA DOMESTICUS* (L.) (ORTHOPTERA:GRYLLIDAE) IN SOUTHERN CALIF.[1]

David B. Weissman,[2] D.C.F. Rentz[3]

ABSTRACT: Feral house crickets (*Acheta domesticus* (L.) have been discovered in southern California. The crickets have apparently become established as escapes from pet shops and bait stores. The crickets sing almost always at night and live in situations associated with man.

Acheta domesticus (Linnaeus) is a species generally considered native to Europe, but according to Ghouri (1961) may have originated from northern Africa or southwest Asia. It is cosmopolitan, distributed by man, and has been reported in the eastern United States by Blatchley (1920) and Alexander (1957). We are aware of no reports of the species west of the Rocky Mountains although individuals are sold in pet stores and bait shops across the country. Surprisingly, the species lacks survival in peninsular Florida (Walker, personal communication). Our investigations into the California field crickets (Rentz and Weissman, 1978; Weissman and Rentz, 1978) revealed numerous, apparently feral, populations of *A. domesticus* in Orange County, California.

All feral house crickets captured have been macropterous, although Blatchley (1920) reports "micropterous" feral specimens in his study, and numerous "micropterous" adults can be found in pet store stocks. As Walker (1972, 1977) notes, such micropterous individuals probably represent crickets that have shed their metathoracic wings, possibly secondary to a poor protein food source. Autecological information below pertains to feral individuals only.

Recognition characters. – *A. domesticus* is distinguished from *Gryllus* species by its straw brown overall coloration; and head with an irregular, dark, transverse bar extending between the eyes near their dorsal border. There may be several smaller,

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lighter bars on either side of this large bar. The genitalic complex is equally distinctive (Randell, 1964). The number of teeth per millimeter in the file of the male stridulatory ridge of *A. domesticus* exceeds that seen in all western *Gryllus* species (Weissman and Rentz, unpublished). Over 50% of males have more than 200 teeth in the file (maximum 225).

Western geographical distribution. – We have found feral *A. domesticus* in the cities of Tustin, Santa Ana, Orange, and Crystal Cove (a linear distance of some 30 km), Orange County, California. The species is undoubtedly more widely distributed.

Song. – In the field house crickets sing almost exclusively at night. An isolated individual may be heard on overcast days, especially late in the year. The chirp rate is slow, usually 2-3 pulses per chirp (see figure 1).

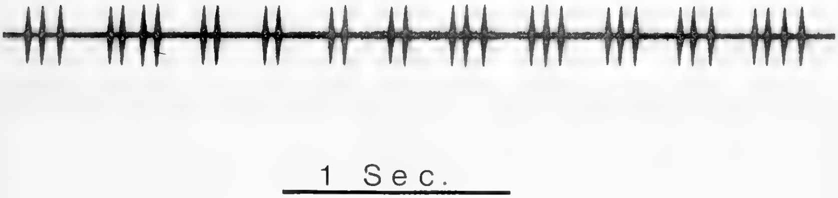

Figure 1. Calling song of house cricket, *Acheta domesticus.* Feral male at 20°C.

Seasonal occurrence. – Singing males first appear in mid to late spring disappearing by late fall. It is not known if there is more than one generation per year in the field, although crickets kept in stores can have continuous generations with proper resources thus indicating the absence of any obligatory dormancy period.

Habitat. – Feral house crickets occur in a variety of habitats, but always are associated with human structures. Individuals occupy cracks in buildings and the ground or are found under vegetation around buildings, cultivated areas, and railroad stations. The population at Crystal Cove was found under boards and ice plant (*Mesembryanthemum* sp.) around houses on the sandy beach front.

Discussion

Unlike the situation with most *Gryllus* species, *A. domesticus* is not always sympatric with other field crickets, further emphasizing its cosmopolitan nature. We do find an occasional *Gryllus* cricket, from any of a number of species, within *Acheta* populations.

Macropterous crickets may fly, but all our efforts to elicit flight in feral house crickets have failed.

Measurements (in mm)

Males

Locality	Length Body	Number Teeth	Length File	Teeth per millimeter
Tustin				
mean ± S.D.	17.7±1.3	204.3±15.3	3.1±0.2	65.9±6.8
n= 15				
range	14.5-19.7	176-225	2.9-3.7	53.2-75.5

Females

	Length Body	Length Ovipositor
Tustin		
range	16.5-19.0	12.2-12.3
m=2		
Crystal Cove		
range	15.5-17.0	9.5-11.5
n=2		

ACKNOWLEDGEMENTS

We would like to thank Dr. Werner Loher, Univ. of Calif., Berkeley, for kindly providing the oscillogram of the calling song of the cricket. We also thank Dr. T.J. Walker for reading an earlier draft and generously offering many helpful suggestions, including the sharing of an unpublished manuscript.

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Note added in proof: additional field work in 1977 has uncovered feral populations of *A. domesticus* in Calexco, Imperial Co., Calif. and across the border in Mexicali, Baja Calif. Norte.

THE GENUS *ACINOPTERUS* (HOMOPTERA: CICADELLIDAE) IN MEXICO AND THE NEOTROPICAL REGION[1]

Rauno E. Linnavuori,[2] Dwight M. DeLong[3]

ABSTRACT: New records of the genus *Acinopterus* Van Duzee are listed from Mexico and Central America. Two species, *A. perdicoenis* n. sp. and *A. igualanum* n. sp. are described as new, and a new name is proposed for *A. reticulatus* Beam. and Lawson.

DESCRIPTORS: Neotropical, *Acinopterus,* species (Homoptera: Cicadellidae)

The main range of the genus *Acinopterus* V.D. lies in North America where 25 species are known, most of them occurring in the arid and semiarid southwestern parts of the U.S. The Nearctic species were revised by Beamer and Lawson (1938), Beamer (1944) and Knull (1944). Three species of the genus are recorded from the Neotropical Region (Linnavuori 1959:58-60). Two of these are North American (A. acuminatus V.D., known only from Cuba, *A. angulatus* Laws. widespread) and only one, *A. gentilis* (Berg) is purely Neotropical.

The following article is based on a large number of specimens of the genus from Mexico, Central and South America in the DeLong collection at Ohio State University. Two new species are being described from Mexico and *A. inornatus* (Bak.) is recorded for the first time from that country.

Acinopterus angulatus **Laws.**
Cicada reticulata Fabricius 1794; 44, nom preoccupied
Acinopterus reticulatus Linnavuori 1959: 59
Acinopterus angulatus Lawson 1922: 119.

Material studied: Mexico: numerous examples from the following localities: Acapulco, Guerrero, 10.X.1939, DeLong & Plummer; Baja California Sur. 2 mim NW of Triumfe, 1900 ft.
DeLong, Caldwell & Plummer; Cuernavaca, Morelos, 6.IV.1932, C.C. Plummer; El Dorado, 23.XII.1928; Hasienda Fresno, Coaquila, A. Dampf; Jalapa Rd., Vera, 13.X.1942, Shaw, DeLong, Hershberger; Jiutepec, Morelos, 6.IX.1939, DeLong, Plummer; Mexico City, Toluca Road, 26.IX.1954; Fortin, Vera., 11.X.1954. Shaw, DeLong, Elliott, Hershberger; Mexcala, Gro. 10.II.1945, Balock, DeLong, Hershberger, Elliott; Monterey 1.XI.1938, J.S. Caldwell; Necaxa, Pue. 26.X.1945, Stone, DeLong, Hershberger, Elliott; Palomas, 12.X.1931; Plancha, Piedra, 28.X.1925; Rio Tuxpan, Mich., 29.X.1945, Plummer, DeLong, Hershberger, Elliott; Tamazunchale, 20.IX.1945, DeLong, Hershberger, Elliott; Taxco, Gro., 10.XI.1945, Balock, DeLong, Hershberger,

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Elliott; Tierra Colorado, Gro., 5.X.1945; Valles, S.L.P., 25.IX.1945, DeLong. Good, Caldwell; Vejuco, Gro., 3.IX.1930; Yaqui Valley, Sonora, 16.VIII.1927; Zimipan Hdq., 31.X.1945. DeLong, Hershberger, Elliott. Panama: Las Cumbres, IV.VIII.1973, 4 spec. Henk Wolda; Braizl: Surumu, Roraima, 2 spec. IX.1966, M. Alvarenga, F.M. Oliveira. Argentina: Urundel, Salta, 1 spec. 31.I.1950, R. Golbach. Very common in Mexico and the West Indies, apparently local in South America.

A. pulchellus **Laws.**

Recorded from Keno Bay in Mexico (Beamer & Lawson 1938: 479). Otherwise known from SW USA.

A. fuscifrons **Laws.**

Material studied: Mexico: Canon de El Adra, 2 exx, 4.XI.1945, DeLong, Hershberger, Elliott; Finca Belem, Chia., 1 ex, 23.VI.1935; Jalapa Road, Vera, 1 ex, 13.X.1942, Shaw, DeLong, Hershberger; Mont Grande, Chia., 1 ex, 23.III.1931, J. Parra; Tamazunchale S.L.P., 8 exx, 2.XI.1945, DeLong, Hershberger, Elliott; Valles S.L.P., 4 exx, 25.X.1941, DeLong, Good, Caldwell, Plummer. Range: SW USA and Mexico.

A. acuminatus **V.Dz.**

A common Nearctic species. Recorded from Cuba (Linnavuori 1959: 58-59). Other records from the Neotropical Region undoubtedly refer to *A. angulatus.*

A. inornatus **(Bak.)**

Material studied: Mexico: numerous exx from the following localities: Baja California Sur, 2 mi NW El Triumfo, 1900 ft, 10.X.1968 and 7.5 mi W El Triumfo, 1600 ft, 11.X.1968, E.L. Sleeper, F.J. Moore; Balsas, Gro., 11.XII.1929, A. Dampf; Hacienda Fresno, Coahuila, 2.VI.1931, A. Dampf; Hermosillo, Son., 23.III.1927; N of Monterey, 22.IX.1941, DeLong, Good, Caldwell, Plummer; Navajoa, Son., 28.III.1929, A. Dampf; Rodriguez N Leon, 5.VI.1930, A. Dampf; Valles S.L.P., 3.XI.1945, DeLong, Hershberger, Elliott. Common in SW USA, not previously recorded from Mexico.

A. plenus **Beam. & Laws.**

Aedeagus in Figs. 4-6 and 10.

Material studied: Mexico: Acapulco, Guerrero, 1 ex, 10.IX.1939, DeLong & Plummer; Acapulco Road, 1 ex, 22.XI.1938, J.S. Caldwell; Cocula, Gra., 1 ex, 17.XII.1936; Cuernavaca, Mor., 4 exx, 25.IX.1945, Plummer, DeLong, Hershberger, Elliott; Iguala, Guerrero, 2 exx, 11.IX.1939, DeLong; Tasquillo, Hgo., 3 exx, 29.X.1941, DeLong, Caldwell, Plummer. Originally described from Cuernavaca. Also known from SW USA.

A. peridicoensis **sp. n.**

Length ♂ 5.25-6.0 mm, ♀ 6.5-6.75 mm. Yellow-brown, often with greenish tinge. Frontoclypeus with faint brown lateral arcs. Crown and pronotum immaculate. Eyes brown. Scutellum with basal triangles and two median stripes faintly embrowned. Elytra yellow-brown, commissural margin of clavus, subapical area of corium and costal margin with milky patches, middle of costal margin dark brown; veins whitish, ± bordered with dark brown. Dorsum of abdomen and ventral surface of thorax ± infumed. Venter greenish. Legs green or olivaceous.

Resembling *A. plenus* in general habitus but body more elongate. Head 0.9 x as broad as pronotum, roundedly bluntly angulate, 1.41-1.5 x as long at middle as laterally, 2.0-2.2 x as broad as long (crown in *A. plenus* shorter and broader, 1.36-1.5 x as long at middle as laterally, 2.3-2.46 x as broad as long), with distinct depression along

Figs. 1-3. *Acinopterus pedricoensis* sp.n.: 1 aedeagus in lateral, 2 in ventral aspect; 3 basal appendage of same, broad aspect.

postfrontal suture. Elytra long and acuminate apically as in *A. plenus*; claval veins united with each other with 1-2 cross veins, several cross veins between lower claval vein and claval suture.

Aedeagus in Figs. 1-3. Shaft in lateral aspect broad and nearly straight; basal appendages very large, wing-like, with apical margins irregularly trilobate, margins finely serrate. Other genitalia of the usual type. 7th sternite (♀) broadly parabolic with a slight apical notch.

Mexico, Baja California Sur, 2.5 mi SE of Valle Perdico, 2000 ft, 1 ♂, type and 6 paratypes, 15.X.1968, E.L. Sleeper, F.J. Moore.

Near *A. plenus* but readily distinguished by the very broad basal processes of the aedeagus.

***A. igualanus* sp.n.**

Length ♂ 6.5 mm. Yellow-brown. Frontoclypeus with indistinct and short brown lateral arcs. Crown and pronotum immaculate. Eyes reddish brown. Basal triangles and two median bands on scutellum faintly embrowned. Coloring of elytra as in the preceding species but pattern a little less variegated. Under surface of thorax embrowned. Legs yellow-brown.

Resembling *A. plenus* but head narrower, 0.85 x as broad as pronotum. Crown longer, 1.6 x as long at middle as laterally, 2.1 x as broad as long. Elytra as in *A. plenus*; claval veins united with each other with a cross vein, several cross veins between lower claval vein and claval suture.

Aedeagus in Figs. 7-9. Shaft in lateral aspect broad, distinctly recurved dorsad; two pairs of short basal processes, the ventral pair claw-like, the dorsal processes expanding apicad and minutely dentate; basal part of aedeagus in ventral aspect rather narrow. Other genitalia of the usual type.

Mexico, Iguala, Guerrero, 1 ♂, type, 1.IX.1939. DeLong.

Of the *plenus* group. Readily distinguished from the other species by the four basal processes of the aedeagus.

***A. lawsoni* nom. n.**

Acinopterus reticulatus Beamer & Lawson 1938: 482-483 nec Fabricius 1794: 44.

Originally described from Keno Bay, Mexico. Also known from SW USA.

***A. gentilis* (Berg)**

Redescribed by Linnavuori (1959: 60).

Material studied: Brazil: Amazonas, Santarem, 4 exx, II.1943, L. Beery. Argentina: Rinconada, Tucuman, 1 ex, IV.1947, Ares; Urundel, Salta, 2 exx, 31.I.1950, R. Golbach. Previously known only from Argentina.

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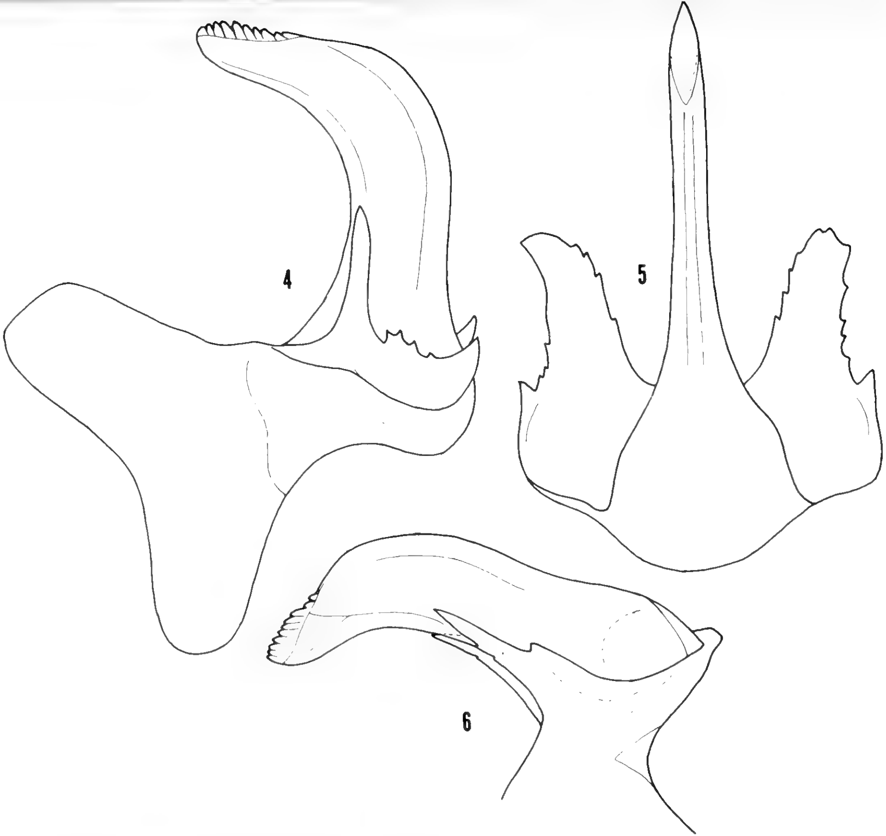
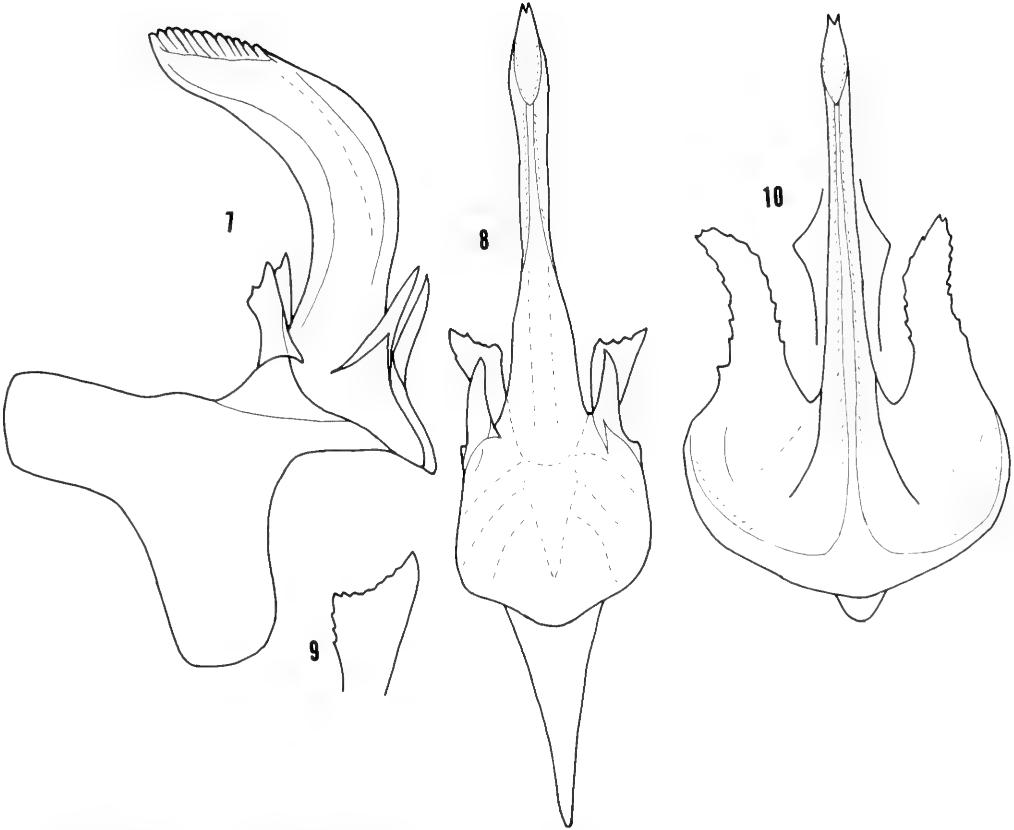


Figs. 4-6. *Acinopterus plenus* Beam. & Laws.: 4 aedeagus in lateral, 5 in ventral aspect; 6 same (of another ex) from side.



Figs. 7-10. *Acinopterus igualanus* sp.n.: 7 aedeagus in lateral, 8 in ventral aspect; 9 dorso-basal appendage of same, broad aspect. - *A. plenus* Beam. & Laws. (same ex as in

RECORDS OF ECTOPARASITES FROM BRAZILIAN MAMMALS[1],[2]

John O. Whitaker, Jr., Russell E. Mumford[3]

ABSTRACT: 31 species of ectoparasites were collected from Brazilian mammal hosts. Of these, 19 were taken from bats, 8 from rodents, 2 from horses and 2 from tapir.

DESCRIPTORS: Mammalian ectoparasites, Brazil, Diptera (Streblidae), Hemiptera (Polyctenidae), Mallophaga, Acarina.

There are few data on ectoparasites of mammals of Brazil. The present paper presents information on ectoparasites collected from mammals, particularly bats, in Brazil by Mumford. Unless otherwise stated, specimens were obtained at or near Vicosa, Minas Gerais, during 1973.

Materials and Methods

Parasites were taken mainly from wild mammals trapped or caught in mist nets; specimens were also obtained from domestic horses and a confined tapir. Parasites were preserved in ethyl alcohol and identified by Whitaker. Help in identifications was freely given for several taxa, as follows: Laelapidae and ticks, Nixon A. Wilson (University of Northern Iowa); Streblidae, Rupert L. Wenzel (Field Museum of Natural History); Nycteribiidae, B.V. Peterson (Biosystematics Research Institute, Canada); lice, K.C. Emerson (Arlington, Virginia); macronyssid mites, JoAnn M. Tenorio (Bernice P. Bishop Museum, Hawaii).

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Results and Discussion

Listed below by host are the various parasites found. The number of each host species examined is shown in parentheses.

Order Chiroptera:

Noctilio leporinus (1). Collected in the Parque Estadual do Rio Doce, near Coronel Fabriciano, Minas Gerais, in July 1970, this bat was host to two species of streblid flies. Thirteen individuals each of *Noctiliostrebla aitkeni* and *Paradyschiria fusca* were removed from this animal. It and other bats of the same species taken at this locality were heavily infested with streblids. *Noctiliostrebla aitkeni* was described from *Noctilio leporinus* from Manzanilla, Trinidad, but has been taken in Venezuela, B.W.I., Suriname, Peru, and in Brazil at Pará (Wenzel, 1970). *Paradyschiria fusca* was described from *N. leporinus* from Colombia, but has also been found in Venezuela, Trinidad, Suriname, French Guiana, and in Brazil at Pará (Wenzel, 1970).

Phyllostomus hastatus (1). A single streblid fly *(Strebla consocius)* was found on this specimen. This streblid was described from *P. hastatus* from Trinidad and was previously taken from Columbia, Venezuela, Suriname and Peru (Wenzel, 1970). This appears to be the first record for Brazil.

Anoura caudifera (3). Two new species of streblid flies of the genera *Trichobius* and *Anastrebla* were found. They are being described by R.L. Wenzel. In addition, an individual of the macronyssid mite *Parichoronyssus sclerus* is represented in our collections. *Parichoronyssus sclerus* previously was known only from *Glossophaga soricina* from Panama and from *Phyllostomus* sp. from Costa Rica (Radovsky, 1967).

Anoura geoffroyi (4). The 22 streblids taken from this species included 4 *Anastrebla modestini* and 17 *Exastinion clovisi. Anastrebla modestini* was originally described from *A. geoffroyi* from Panama and has since been taken from Mexico, Guatemala, El Salvador, Venezuela and Trinidad. *Exastinion clovisi* was originally described from Sao Paulo, Ipiranga, Brazil, from *A. geoffroyi.* Its range extends from Mexico to Brazil and Ecuador (Wenzel, 1970).

Sturnira lilium (7). Nine specimens of the streblid *Megistopoda proxima* and 3 individuals of a streblid *(Aspidoptera)* being described as a new species by Wenzel were found. *Megistopoda proxima* was originally described from Argentina from an unidentified bat, and is known from Mexico and through much of South America on *Sturnira lilium.* In Brazil it is known from Pará and Santa Catarina (Wenzel, 1970).

Vampyrops lineatus (2). One unidentified streblid of the genus *Paratrichobius* was taken from this bat. Flies in the *Paratrichobius longicrus* complex have been previously reported from Panama and Venezuela from *Vampyrops vittatus* (Wenzel, 1970).

Artibeus lituratus (1). This species was host to 2 *Paratrichobius longicrus* and one example of an unidentified species of *Paratrichobius,* both streblid flies. *Paratrichobius longicrus* is known from Mexico to Brazil and Peru from *Artibeus jamaicensis.* This is the first report of its occurrence on *A. lituratus.* In Brazil it is known from Guanabara, Rio de Janeiro, Quinto da Boa Vista, the type locality.

Myotis nigricans (1). This bat was host to 3 unidentified mites.

Myotis riparius (2). Two nycteribiid flies of the genus *Basilia* from this species are being described as new by B.V. Peterson. They are similar to *B. hugh-scotti.* Two small macronyssid protonymphs from *M. riparius* are an unidentified species of *Steatonyssus. Basilia hugh-scotti* is known from Rio Grande do Sul in southern Brazil (B.V. Peterson, pers. comm.), whereas *B. ferrisi, B. juquiensis* and *B. ortizi* have been taken on this host in Venezuela (Guimãraes, 1972).

Myotis ruber (2). Our material includes 7 unidentified macronyssid protonymphs in poor condition from this relatively rare bat.

Histotus velatus (2). Three unidentified ticks of the genus *Ornithodorus* and 22 macronyssid protonymphs of the genus *Steatonyssus* were taken from this bat.

Molossus molossus (2). A polyctenid hemipteran of the genus *Hesperoctenes* (possibly *H. fumarius*) was represented by 7 specimens. The other parasite found was an unidentified macronyssid protonymph. *Hesperoctenes fumarius* was originally described from *Molossus fumarius* from Jamaica, but in South America it has been recorded from Colombia, Bolivia and Venezuela (Ueshima, 1972).

Order Rodentia:

Oryzomys nigripes (2). One laelapid mite *(Gigantolaelaps wolffsohni)* was removed from each rat examined. *Gigantolaelaps wolffsohni* is known from Venezuela, Chile and Panama from several host species (Tipton *et. al.,* 1966; Oudemans, 1910; Furman, 1972).

Akodon arviculoides (2). These 2 mice yielded 3 laelapid mites *(Gigantolaelaps wolffsohni).*

Holochilus brasiliensis (1). This rat was host to 2 laelapid mites *(Gigantolaelaps mattogrossensis),* a mite found on the same host in Venezuela (Furman, 1972).

Coendou sp. (1). Charles O. Handley, Jr., is working on the taxonomy of the prehensile-tailed porcupines. He has not seen our specimen but has studied color slides of it. Among the biting lice (Mallophaga) removed from this specimen, a male and 2 female *Eutrichophilus cordiceps* and a male and female *Eutrichophilus cerocolabes* have been identified. Some additional unidentified juveniles and females of the same genus were also present.

Order Perissodactyla:

Equus caballus (2). A total of 78 ticks *(Anocenter nitens)* was removed from 2 horses. Most of the ticks were inside the ears, where they were present by the hundreds on both animals. This species is known as the tropical horse tick (Jones *et al.,* 1972).

Tapirus terrestris (1). An uncaged tapir, in a fenced zoo in Belem, Pará, was host to many ticks. We obtained 11 specimens of *Amblyomma cajennense* from this tame animal in August 1973. The species has been taken on this host in Venezuela, but occurs from Texas to Argentina (Jones *et al.,* 1972).

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SEXUAL DIMORPHISM IN PTERONOTUM OF CAVE-CRICKET *KEMPIOLA SHANKARI* SINHA & AGRAWAL (ORTHOPTERA: PHALANGOPSIDAE.)[1]

K.M. Sinha[2]

Skeletomuscular mechanism of the thorax of epigean orthoptera has been studied by various workers such as Du Porte (1920), Hsu (1931), Maki (1938), Misra (1946), Rakshpal (1954), Snodgrass (1927), & Thakare (1959). However, Richard (1955) studied the morphology and anatomy of the cave-orthoptera *Macropathus filifer*. Both the sexes of *M. filifer* are apterous. In *K. shankari* the male possess a pair of elytra on the mesothorax. Thus, differences in the pteronotum of the two sexes of *K. shankari* have been observed.

MESONOTUM of *K. shankari*

Female (fig. 1; T 2) A small single segmental plate connected with the pronotum through a large inter-segmental membrane and is not divisible into prescutum, scutum and scutellum. This is followed by metanotum (T 3). Mesonotum is broader than long and slightly convex on the dorsal side.

Male (fig. 2; T 2) Mesonotum is more compact and complicated than mesonotum of female because of its articulation with elytra. It consists of a single segmental plate, connected with the pronotum through a large anterior inter-segmental membrane. A pair of intersegmental sclerites (In. 1), the pretergites, lie transversely in the intersegmental membrane between pronotum and mesonotum.

Mesonotum of male is clearly divisible into four areas, viz., prescutum, scutum, scutellum and post-scutellum.

Prescutum (PSCT) constitutes the anterior rim of mesonotum. A prescutal suture (PSCTS) separates it from the rest of mesonotum.

Scutum (SCT) lies behind the prescutum. Its posterior boundary is marked by a suture (SS). This suture approaches the prescutal suture (PSCTS) antero-medially; this distinguishes right and left portions of scutum. The lateral margins of scutum give rise to anterior (ANP) and posterior (PNP) wing-notal processes for articulation of anterior axillary sclerites. Strong cuticular projections (VSR) are present on the two lateral margins of scutum.

Scutellum (SCL) is a triangular area which lies behind the scutum and is separated from it by a suture (SS).

Post-scutellum (PSCL) follows the scutellum and is a narrow posterior rim of mesonotum. This is more sclerotized and is slightly folded beneath.

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METANOTUM of *K. shankari*

Female (fig. 1; T 3) The single, large plate is not divisible into scutum and scutellum. Since the female is apterous, metanothum has no special modifications.

Male (fig. 2; T 3) This is also a single, large plate but it is divisible into scutum (MSCT) and scutellum (MSCTL) and has two large inter-segmental sclerites (IN.2) lying transversely in intersegmental membrane between meso- and metanotum. Posterior portion of metanotum is produced into large sinuate flap-like membranous structure (MF). No articular processes are developed on lateral margins. Metanotum of male possess two pairs of round median and antero-lateral cuticular projections (MP and LP) which bears sensillae setae (to be published).

Ewer (1954) has not observed any special difference in the tergum of the pterothorax of a macropterous and brachypterous form of a grassphopper, *Zonocerous elegans*. The differences in the pteronotum of *K. shankari* are due only to a pair of elytra. The sensory setae present on cuticular swellings of the metanotum are concerned with the movement of elytra.

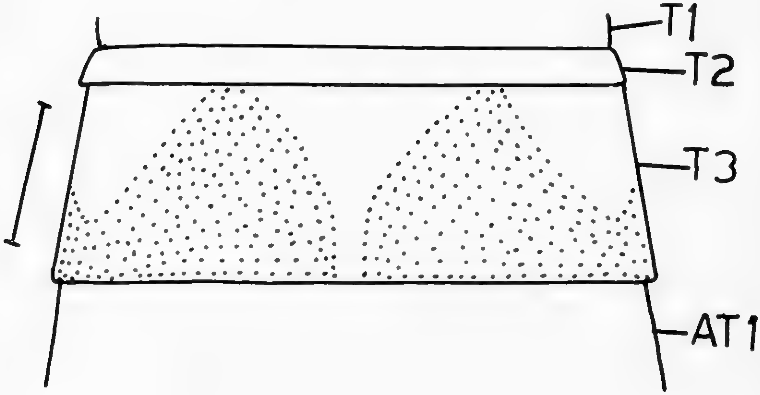

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Fig. 1. Meso- and metanotum of female.

Abbreviations used: AT 1– First abdominal tergum; ANP– Anterior notal process; IN.1– First inter segmental sclerite; IN.2– Second inter segmental sclerite; LP– Lateral cuticular projection; MF– Flap like membranous structure; MSCT– Scutum of metanotum; MP– Median cuticular projection; MSCTL– Scutellum of Metanotum; PNP– Posterior notal process; PSCL– Post scutellum; PSCT– Prescutum; PSCTS– Prescutellar suture; SS– Scutellar suture; SCL– Scutellum; SCT– Scutum; T 1– Pronotum; T 2– Mesontoum; T 3– Metanatum; VSR– Cuticular projection.

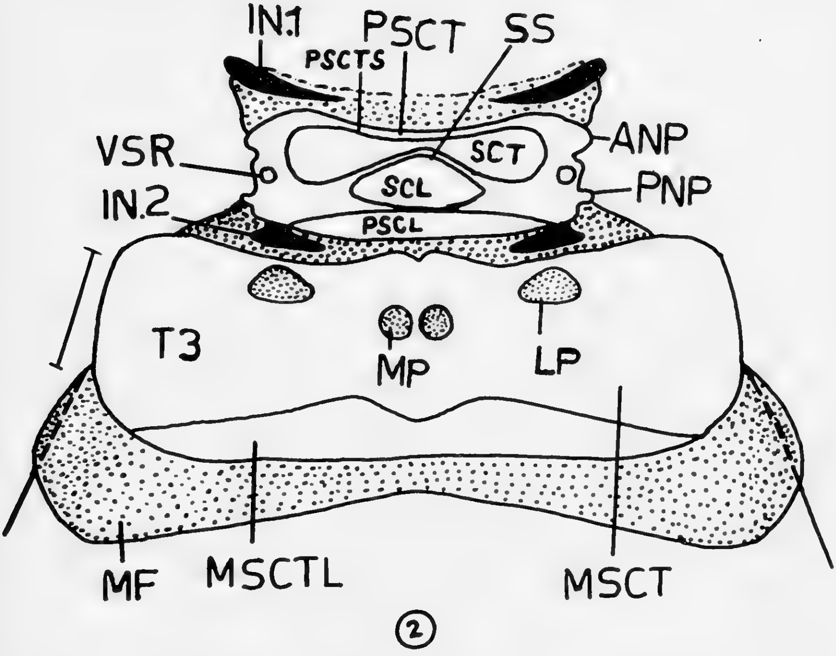

Fig. 2. Meso- and metanotum of male. (Magnification given in both figures is 1 mm.)

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NEW RECORDS OF THREE FRUIT FLIES (DIPTERA: TEPHRITIDAE) FROM INDIA[1]

V.C. Kapoor[2], J.S. Grewal[3], M.L. Agarwal[3]

ABSTRACT: *Themara maculipennis* (Westwood), *Xanthorrachis annandalei* Bezzi and *Rhabdochaeta bakeri* Bezzi are recorded for the first time from India.

During a study of the fruit fly specimens in the National Pusa Collection, Indian Agricultural Research Institute, New Delhi, three identified fruit fly species, *Themara maculipennis* (Westwood), *Xanthorrachis annandalei* Bezzi and *Rhabdochaeta bakeri* Bezzi were found. The presence of these fruit flies provide new records from India. Even the genus *Themara* is recorded for the first time from India. The collection data of these fruit flies are given below.

Themara maculipennis (Westwood)

Achias maculipennis Westwood, 1848, Cab. Orient. Ent., p. 38.
Themara ampla Walker, 1857, J. Proc. Linn. Soc. Lond. 1:33.
1 ♂, on pin, labelled 'Coorg, Polibetta, 16.XI.'15, Fletcher.
It was earlier recorded from Singapore, Borneo and Sumatra.

Xanthorrachis annandalei Bezzi

Xanthorrachis annandalei Bezzi, 1913, Mem. Indian Mus. 3:138. Type locality: Dawna Hills, Lower Burma.
1 ♀, on pin, labelled 'Canthanthod Wynad, D24/917, 18.XI.'17, V.R. Rao.
It was earlier recorded from Burma only.

Rhabdochaeta bakeri Bezzi

Rhabdochaeta bakeri Bezzi, 1913, Philipp. J. Sci. (D) 8:328. Type locality: Los Bǒnos, Laguna, Philippine Islands.
8 ♀, on pins, from *Blumesia balsemifera*, Pusa, Bihar, 6.IV.'08, AH, Cage No. 679.
It is an Oriental species and recorded here for the first time from India.

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PARVAMIMA BICOLOR RUCKES (HEMIPTERA: PENTATOMIDAE), A DESCRIPTION OF THE MALE[1]

H. Dodge Engleman[2]

ABSTRACT: The male of *Parvamima bicolor* Ruckes is described with figures of the male genitalia.

DESCRIPTORS: Hemiptera, Pentatomidae, Discocephalinae, *Parvamima,* male genitalia

Ruckes described the Discocephaline genus, *Parvamima,* and its single species, *P. bicolor,* from a single female specimen from Panama. Although in general appearance there is no sexual dimorphism and the male can be identified from Ruckes' description and illustration, the male exhibits some interesting sexual characteristics. These are of importance systematically should additional species of the genus be discovered and for determination of inter-genetic relationships.

Parvamima bicolor Ruckes

Parvamima bicolor Ruckes 1960:7

General appearance. Overall length male 9mm, female 9.5mm, greatest width male 5.5mm, female 6mm. Shape ovate, slightly convex above and below, head and anterior pronotum declivous. Head and anterior two-thirds of pronotum light tan, remaining upperparts tan, castaneous on transhumeral pronotum and disc of scutellum. Dorsal surface punctured castaneous. Venter tan, punctures finer than above.

Head. Juga meet in front of tylus, margin entire, very slightly sinuate before eyes. Antennae as long as head and thorax, each segment longer than preceding segment, IV twice as long as II. Rostrum not attaining metacoxae.

Thorax. Pronotal margins entire, obscure denticle at anterior lateral angle. Mesosternum mildly carinate, metasternum elevated, pentagonal. Ostiole with somewhat sigmoid tapering canal reaching two-thirds distance across metapleuron. Evaporatorium rugulose and poorly defined. Legs straminous, sparsely punctate, tibiae planosulcate, brown blotch on outer surface of distal hind femur.

Abdomen. Tergites dark castaneous. Apical margin of seventh tergite in male deeply notched on either side of wide median tergal process, divergent spines from lateral apical angles of process longer than twice their width. Connexivum narrowly exposed, castaneous, each segment centrally draped with a tan spot. Anterior ventral abdominal tubercle touching metasternum. Spiracles fuscous. Irregular blotch on central basal portion of sixth sternite in females lacking or obscur in males.

Genitalia, Male. Pygofer with truncate lateral apical lobes twice as long as wide, supinated distally, long setae at apex and inferior margin. Superior ridge arcuate over proctiger. Inferior ridge produced apically and superiorly in the form of vertical calloused labia diverging and attenuating ventrally, densely setose. Parameres large and foliate, exceeding apex of pygofer. From dorsal view medial aspect twice as long as wide,

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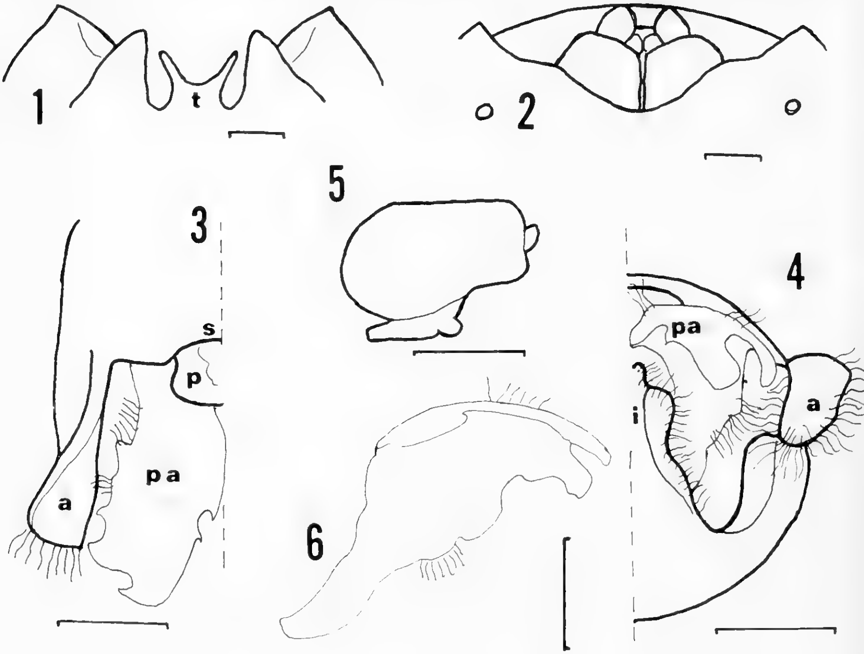

Figures 1-6. 1) Apical margin of seventh tergite in male. 2) Female genital plates, ventral view. 3) Left side genital capsule, dorsal view. 4) Right side genital capsule, caudal view. 5) Theca, lateral view. 6) Right paramere, medial view. Legend: a, lateral apical lobe; i, inferior ridge; p, proctiger; pa, paramere; s, superior ridge; t, tergal process. All scale lines indicate .5 mm.

decurved apically. Lateral aspect perpendicular to medial, broad, eroded, and terminating in decurved internally rotated hooked lobe which is separated form medial aspect of paramer by a deep notch. Theca heavily sclerotized, shaped like a short-muzzled old-fashioned cannon, small knobular processes anterolaterally on base and laterally on apex of barrel.

Voucher specimen. Male. Panama, Cerro Campana, 800M, 8°40'N x 79°56'W, 25·VIII·1975, col: D. Engleman. Deposited in the American Museum of Natural History.

Specimens examined. Eight males, two females, all from Cerro Campana or Canal Zone, Panama. One specimen taken at lights on Barro Colorado Island, the others obtained by beating or sweeping dense low vegetation along forest roads.

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SEXUAL DIMORPHISM IN *CALLASOBRUCHUS CHINENSIS* (L.) (BRUCHIDAE COLEOPTERA)[1]

G.S. Shukla, Sanjaya Kumar Pandey[2]

This paper deals with sexual dimorphism in *Callasobruchus-chinensis* (L.) in a laboratory culture. A number of specimens were examined to find sexual differences in the various organ structures in both male and female.

There is a marked difference in the structure of antennae in males and females. These differences are listed below.

Male

1. Apical segment of antenna is elongated and oblong in shape.
2. Antennal segments are deeply serrated.
3. Serration becomes more prominent from fourth segment onward.
4. Antennae move in right and left directions.
5. Antennae are curved inside, i.e. towards each other.
6. No movement is recorded on a touch stimulus i.e. negatively thigmotrophic (exhibits death feigning).

Female

1. Apical segment is somewhat bluntly rounded or ovate.
2. Antennal segments not deeply serrated.
3. Serration becomes prominent from fifth segment onward.
4. Antennae exhibit a forward and backward motion.
5. Antennae are straight in their morphological feature.
6. Movement is recorded during a touch stimulus given to the specimens i.e. positively thigmotrophic. (death feigning negative)

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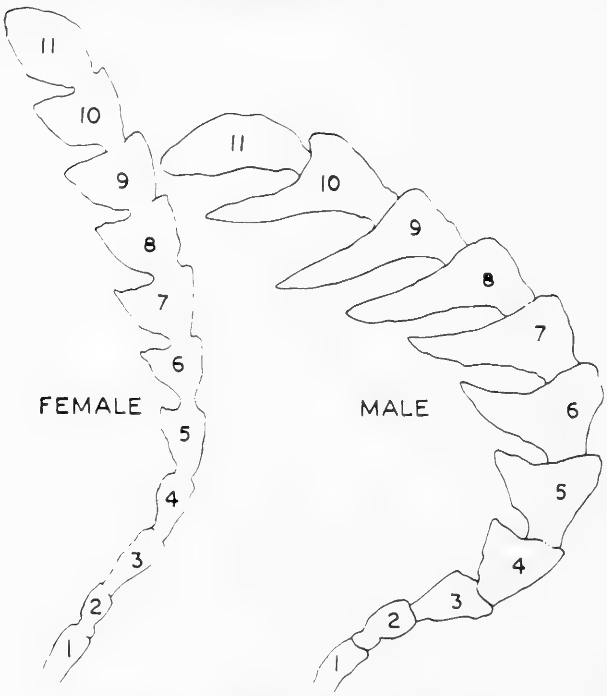

DIAGRAM SHOWING ANTENNA OF *Callasobruchus chinensis*

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BLOMIA GRACILIPES (= CHORTOGLYPHUS GRACILIPES): REDESCRIPTION & STATUS (ACARINA: GLYCYPHAGIDAE)[1]

A. Fain[2], K. Hyland[3], T. Tadkowski[4]

ABSTRACT: *Chortoglyphus gracilipes* Banks, 1917 is transferred from *Chortoglyphus* to *Blomia* Oudemans, 1928 and redescribed.

DESCRIPTORS: Glycyphagidae, Chortoglyphidae, *Blomia gracilipes* comb. nov., hypopial nymphs, follicular mites, house-dust mites.

Fain and Spicka (1977) have established that mites previously placed in the subfamily Aplodontopinae Fain, 1969 of the family Glycyphagidae should now be placed in the family Chortoglyphidae Berlese, 1897, because of the similarity of the adults of *Aplodontopus* Fain, 1967 with those of *Chortoglyphus* Berlese, 1884. *Aplodontopus* has been described from hypopial nymphs associated with the hair follicles on the tails of North American rodents whose adults live in nesting materials. Tadkowski and Hyland (1974) succeeded in rearing adults of *A. sciuricola* Hyland and Fain, 1968. *Chortoglyphus* has been found associated with floor dust of barns, mills, stables, granaries and houses. The genus *Chortoglyphus* presently contains two species, the cosmopolitan *C. arcuatus* (Troupeau, 1879) and *C. gracilipes* Banks, 1917, known only from North America.

Upon examining the types of *Chortoglyphus gracilipes* we were surprised to find that they were of another genus, namely *Blomia* Oudemans, 1928. We were able to examine these types from the U.S. National Museum of Natural History through the courtesy of Dr. E.W. Baker. The slide contains two female specimens along with a cheyletid mite and two psocids. The specimens were mounted in balsam and are in relatively poor condition. No attempt was made to remount them so there are certain characters which are difficult to verify.

Redescription of *Blomia gracilipes*

(Banks, 1917) nov. comb. (= *Chortoglyphus gracilipes*) (fig. 1-3)

The typical slide contains two female specimens. They measure 300 μ x 172 μ (specimen in ventral view) and 285 μ x 154 μ (specimen in ventro-lateral view) respectively (gnathosoma included). We designate as lectotype the specimen in ventral view. *Dorsum:* The cuticle is typically glycyphagid in that there are numerous spinelet-like projections arising from the surface. Most of the dorsal setae are long and barbed and the *v i* and *v e* setae are also long and barbed, and are situated close together as in the genus *Blomia.* There is a long and narrow copulatory tube at posterior

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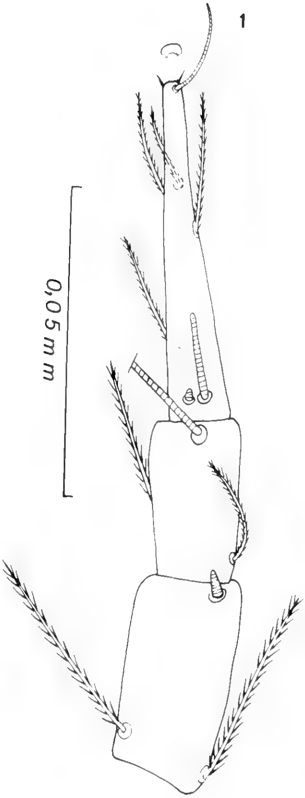

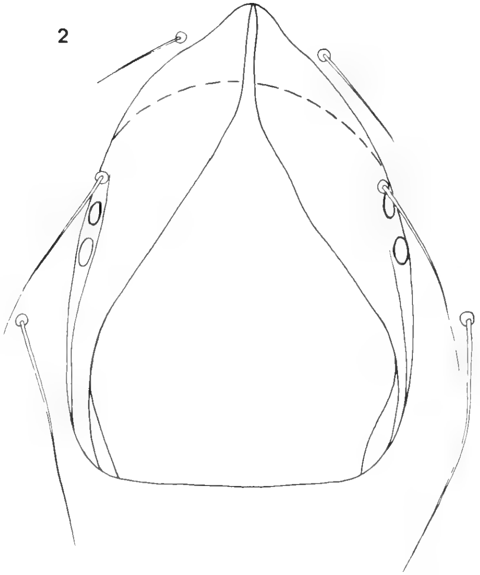

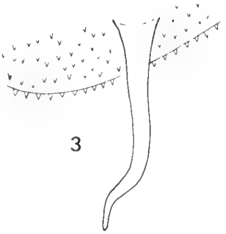

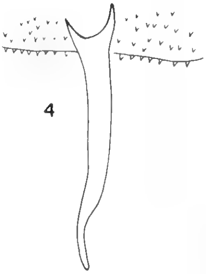

Fig. 1-3. *Blomia gracilipes* (Banks). Lectotype (female). 1. Genu, tibia, and tarsus I dorsally. 2. Vulva. 3. Copulatory tube.

Fig. 4. *Blomia tropicalis* Van Bronswijk et al. Paratype female: copulatory tube.

extremity of body. This tube is 39 μ long and distinctly longer than the genu I (34 μ). It is slightly bent in the larger specimen and strongly curved in the other specimen. The tube is distinctly pointed apically (fig. 3). Banks describes it at follows: "At tip of body is a prominent down-curved spine". *Venter:* Genital region very large, vulva in an inverted Y with a large posterior lip (fig. 2). The legs are long. Tarsi I to IV very narrow; their lengths are 63 μ - 62 μ - 72 μ and 75 μ. Chelicerae 87 μ long. Setae of legs as in other species of *Blomia. Solenidia:* Leg I: *ω1 14-15 μ* long, narrow and cylindrical; ω2 very short (1.5 μ long). The solenidia ω1 and ω2 are inserted at the same distance from the base of the tarsus (fig. 1). *Sigma* longer than the tarsus; *phi* is 3.8 μ long and conical.

Habitat: Lectotype and one female syntype from Tampa, Florida, 5 August 1913, in tobacco infested with the cigarette beetle (Runner).

Systematic Position of *Blomia gracilipes*

Van Bronswijk et al. (1973 a,b) have reviewed the genus *Blomia* and recognize six species. *B. gracilipes* belongs to the group which possesses a long copulatory tube and has the solenidia ω1 and ω2 of tarsus I situated at the same distance from base of tarsus. These characters are shared by *B. kulagini* Zachvatkin, 1936 and *B. tropicalis* Van Bronswijk et al., 1973.

B. gracilipes lacks the pair of cuticular projections ("wrats" of Van Bronswijk et al.) on the posterior region of opisthosoma but this character might not be visible owing to the poor condition of the specimens. With this exception it appears extremely close to *B. kulagini.* Unfortunately the type of *B. kulagini,* along with others of Zachvatkin, has been lost so it is impossible to decide if it should fall into synonymy with *B. gracilipes.*

Van Bronswijk et al. have chosen what they believe to be specimens representative of *B. kulagini* from Japan but they have noted several differences between the original description and their material. We think therefore that the identity of the true *kulagini* could be ascertained only after examination of new specimens collected from the typical locality (wheat stored in Moscow granaries).

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INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE ANNOUNCEMENT A.N. (S.) 103

The required six months' notice is given of the possible use of plenary powers by the International Commission on Zoological Nomenclature in connection with the following names listed by case number: (see *Bull. Zool. Nom.* 34, part 2, 31st August, 1977).

400 *Trombidium akamushi* Brumpt, 1910 (Acarina): proposed validation.

2115 *Glyphipterix* Hubner, [1825] (Lepidoptera, GLYPHIPTERYGIDAE): proposed designation of a type-species.

2130 *Stethaspis* Hope, 1837 (Coleoptera): proposed designation of a type-species.

2186 PIERIDAE Duponchel, [1835]: proposal to give precedence over COLIADINAE Swainson, 1827 (Lepidoptera).

2193 *Campylosteira* Fieber, 1844 (Hemiptera): designation of type-species.

2194 *Baeocera* Erichson, 1845 (Coleoptera): designation of type-species.

2204 *bjerkandrella, Tinea,* Thunberg, 1784, and *cardui, Phalaena (Noctua)* Hubner, 1790 (Lepidoptera): proposed conservation.

2201 MORPHIDAE Boisduval, 1836 (Lepidoptera): request for revision of the Official List.

Comments should be sent in duplicate (if possible within six months of the date of publication of this notice), citing case number to:

R.V. Melville, The Secretary, International Commission on Zoological Nomenclature,
c/o British Museum (Natural History), Cromell Road, LONDON, SW7 5BD,
England.

Those received early enough will be published in the Bulletin of Zoological Nomenclature.

The following opinions have been published recently by the International Commission on Zoological Nomenclature (see Bulletin Zoological Nomenclature Volume 34, part 1).

1083 (p.30) *Pisaurina* Simon, 1898 (Arachnids, Araneae) conserved under the plenary powers.

1087 (p.40) *Pamphilius viriditibialis* Takeuchi, 1930 designated under the plenary powers as type of species of *Onycholyda* Takeuchi, 1938 (Insecta, Hymenoptera).

1091 (p.50) *Geloius decorsei* Bolivar, 1905 (Insecta, Orthoptera) designation of a neotype.

1092 (p.53) *Dicyrtoma* Bourlet, 1842 and *Dicyrtomina* Borner, 1903 (Insecta, Collembola): designation of type-species under the plenary powers.

The Commission cannot supply separates of Opinions.

THYSANOPTERA TYPES IN COLLECTION OF ILLINOIS NATURAL HISTORY SURVEY[1]

Charles Gerdes[2]

ABSTRACT: More than 500 taxonomic types of Thysanoptera in the collection of the Illinois Natural History Survey, Urbana, have been listed by families, together with literature citations to the original descriptions.

DESCRIPTORS: Thysanoptera, thrips, types, taxonomic list.

The International Code of Zoological Nomenclature (ICZN) states that every institution should publish lists of types in its possession (Recommendation 72D). The following taxonomic list of thrips was compiled from microscope slides that were in the collection of the Illinois Natural History Survey and were labelled with one of the following terms: holotype, type, lectotype, cotype, paratype, allotype, or the equivalent in other languages. No other type designations of taxonomic importance were found on any slides. According to the ICZN the type terms that are necessary or recommended to designate species for taxonomic purposes are holotype, syntype, paratype, lectotype, paralectotype, and neotype (Articles 73-75). The term "type" on a label may be equivalent to "holotype" (ICZN: Article 73). The term "cotype" should be avoided since it may be used for either "syntype" or "paratype" (ICZN: Glossary). The term "allotype" is not in the ICZN but would fall under the definition of a paratype (Recommendation 73D and Glossary). Since changes have occurred in the valid scientific names of some species that are represented by these types, only the names that were given originally to these types were listed. The five families were listed alphabetically. After each scientific name the types in the collection were given, then the literature citation to the original description of the types. The last published list of types in the Illinois Natural History Survey collection was by Frison (1927), but his list included only ten species of thrips.

Aeolothripidae

Aeolothrips aureus, 1 ♀ paratype, Moulton (1931).
Aeolothrips brunneipictus, 1 ♀ paratype, Bailey (1951).
Aeolothrips distinctus, 2 ♀ paratypes, 1 ♂ paratype, Bhatti (1971).
Aeolothrips hesperus, 1 ♀ paratype, Bailey (1951).
Aeolothrips metacrucifer, 1 ♀ paratype, Bailey (1951).
Aeolothrips terrestris, 1 ♀ paratype, Bailey (1951).
Allelothrips ananthakrishnani, ♀ holotype, Stannard (1961).
Dactuliothrips xerophilus, 1 ♀ paratype, Bailey (1937).

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[2] Illinois Natural History Survey, Urbana, Illinois 61801

Melanthrips affluens, 4 ♀ paratypes, 1 ♂ paratype, Ananthakrishnan (1966).
Melanthrips arabs, 1 ♀ paratype, Priesner (1936a).
Melanthrips baileyi, 1 ♀ paratype, Ananthakrishnan (1965).

Heterothripidae

Heterothrips arisaemae, 1 ♀ paratype, Hood (1908).
Heterothrips bolivianus, ♀ holotype, ♂ allotype, 2 ♀ paratypes, Stannard (1972).
Heterothrips eversi, ♀ holotype, ♂ allotype, 6 ♀ paratypes, 1 ♂ paratype, Stannard (1958a).
Heterothrips julius, ♀ holotype, Stannard (1972).
Heterothrips prosopidis, 1 ♀ paratype, Crawford (1943b).
Heterothrips quercicola, 2 ♀ paratypes, Crawford (1942a).
Oligothrips oreios, 1 ♀ paratype, Moulton (1933).
Scutothrips incaensis, ♀ holotype, Stannard (1972).

Merothripidae

Merothrips plaumanni, 2 ♀ paratypes, Crawford (1942b).

Phlaeothripidae

Acanthothrips itzanus, ♂ holotype, ♀ allotype, Stannard (1957b).
Adelothrips acutus, ♀ holotype, 3 ♀ paratypes, Stannard (1956c).
Adelothrips bicolor, ♀ holotype, Stannard (1956c).
Adelothrips caribbeicus, ♀ holotype, 1 ♀ paratype, Stannard (1956c).
Adelothrips grandis, ♀ holotype, Stannard (1956c).
Adelothrips hammockensis, ♀ holotype, ♂ allotype, Stannard (1956c).
Adelothrips sporophagus, ♀ holotype, Stannard (1956c).
Adraneothrips apalus, ♀ holotype, ♂ allotype, 1 ♀ paratype, 2 ♂ paratypes, Stannard (1965).
Adraneothrips ephippium, ♀ holotype, Stannard (1956b).
Adraneothrips faustus, ♂ holotype, Stannard (1956b).
Adraneothrips hoffi, ♀ holotype, ♂ allotype, 15 ♀ paratypes, 7 ♂ paratypes, Stannard (1956b).
Adraneothrips vacuus, ♀ holotype, ♂ allotype, 5 ♀ paratypes, 4 ♂ paratypes, Stannard (1956b).
Agrothrips tantillus, ♀ holotype, ♂ allotype, 8 ♀ paratypes, 2 ♂ paratypes, Stannard (1958b).
Allidothrips tricolor, 1 ♂ paratype, zur Strassen (1968).
Allothrips acaciae, 1 ♀ paratype, Faure (1945).
Allothrips megacephalus, 1 ♀ paratype, Hood (1908).
Allothrips megacephalus stannardi, 1 ♀ paratype, 1 ♂ paratype, Mound (1972).
Allothrips watsoni acuta, ♀ holotype, ♂ allotype, 30 ♀ paratypes, Stannard (1955b).
Allothrips watsoni biminiana, ♀ holotype, 2 ♀ paratypes, Stannard (1955b).
Amphibolothrips brevitubus, ♀ holotype, ♂ allotype, 2 ♀ paratypes, Stannard (1957b).
Amphibolothrips caenosa, ♀ holotype, Stannard (1952b).
Ananthakrishnaniella tarai, ♀ holotype, Stannard (1970).
Antillothrips graminatus, ♀ holotype, 3 ♀ paratypes, Stannard (1957b).
Apterygothrips carolinae, 2 ♀ paratypes, 1 ♂ paratype, Faure (1959).
Apterygothrips longiceps, 3 ♀ paratypes, zur Strassen (1966a).
Atractothrips mockfordi, ♀ holotype, Stannard (1974).
Baenothrips chilensis, ♀ holotype, ♂ allotype, 3 ♀ paratypes, Stannard (1970).
Bolothrips lativerticis, 1 larval paratype, Post (1961).

Bolothrips similis, 1 ♀ paratype, Hartwig (1948).
Bolothrips subulatus, 1 ♀ paratype, Hartwig (1948).
Bolothrips varius, 2 ♀ paratypes, Hartwig (1948).
Cartomothrips browni, ♀ holotype, 2 ♀ paratypes, Stannard (1962).
Cartomothrips manukae, 6 ♀ paratypes, Stannard (1962).
Cercothrips modestus, 1 ♀ paratype, Priesner (1937a).
Chamaeothrips decoratus, ♀ holotype, Stannard (1955c).
Crotonothrips gallarum, 1 ♀ paratype, 1 ♂ paratype, Ananthakrishnan (1967).
Diphyothrips morainensis, ♀ holotype, 1 ♀ paratype, Stannard (1963).
Elatea stannardi, 2 ♀ paratypes, 1 ♂ paratype, Faure (1957).
Erkosothrips interior, ♀ holotype, ♂ allotype, 12 ♀ paratypes, 6 ♂ paratypes, Stannard (1955c).
Eschatothrips whitcombi, ♂ holotype, Stannard (1955c).
Eurythrips constrictus, ♀ holotype, Stannard (1958c).
Eurythrips reticulotubus, ♀ holotype, ♂ allotype, 2 ♀ paratypes, 2 ♂ paratypes, Stannard (1953b).
Eurythrips setiger, ♀ holotype, 6 ♀ paratypes, Stannard (1958c).
Gnophothrips piniphilus, 2 ♀ paratypes, 1 ♂ paratype, Crawford (1938a).
Gynaikothrips insulsus, 1 ♂ paratype, Priesner (1939).
Gynaikothrips priesneri, 1 ♀ paratype, 1 ♂ paratype, Faure (1964).
Gynaikothrips victor, ♀ and ♂ paratypes on one slide, Priesner (1939).
Haplothrips atriplicis, 1 ♀ paratype, Priesner (1936b).
Haplothrips jasionis, 1 ♀ paratype, 1 ♂ paratype, Priesner (1950).
Haplothrips omani, 1 ♀ paratype, Crawford (1947b).
Haplothrips sonorensis, ♀ holotype, Stannard (1956b).
Haplothrips subterraneus, 2 ♀ paratypes, Crawford (1938a).
Haplothrips sventenii, 1 ♀ paratype, 1 ♂ paratype, zur Strassen (1966b).
Hoplandrothrips bredoi, 1 ♀ paratype, Priesner (1937b).
Hoplandrothrips irretius, 1 ♀ paratype, 1 ♂ paratype, Kono (1964).
Hoplandrothrips lateralis, ♀ holotype, ♂ allotype, 5 ♀ paratypes, Stannard (1963).
Hoplothrips fieldsi, 1 ♀ paratype, 2 ♂ paratypes, Crawford (1939b).
Hoplothrips myceticola, 1 ♀ paratype, Crawford (1939b).
Hoplothrips pallicornis, 1 ♀ paratype, Crawford (1939a).
Idolothrips flavipes, 1 ♂ paratype, Hood (1908).
Illinothrips rossi, ♀ holotype, ♂ allotype, 8 ♀ paratypes, 3 ♂ paratypes, Stannard (1954b).
Lissothrips muscorum, 1 ♀ paratype, Hood (1908).
Machadonia crassisetis, 2 ♀ paratypes, Bournier (1965).
Megalothrips schuhi, 3 ♀ paratypes, Crawford (1947a).
Megeugynothrips efflatouni, 1 ♀ paratype, 1 ♂ paratype, Priesner (1929).
Neoheegeria ballotae, 2 ♀ paratypes, Priesner (1951).
Neothrips corticis, 1 ♂ paratype, Hood (1908).
Nesothrips schaferi, ♀ holotype, ♂ allotype, Thomasson and Post (1966).
Orthothrips bilineatus, ♀ holotype, ♂ allotype, 1 ♀ paratype, 1 ♂ paratype, Stannard (1955c).
Orthothrips boneti, ♀ holotype, ♂ allotype, 1 ♂ paratype, Stannard (1955c).
Orthothrips dubius, ♀ holotype, Stannard (1955c).
Phaeothrips mimicus, 1 ♀ paratype, Ananthakrishnan (1969).
Phthirothrips pediculus, 1 ♀ paratype, Priesner (1933).
Plectrothrips antennatus, 1 ♂ paratype, Hood (1908).
Plectrothrips bruneri, 1 ♀ paratype, Watson (1933).
Pnigmothrips medanensis, 2 ♀ paratypes, Priesner (1953).
Preeriella angolensis, 1 ♀ paratype, 1 ♂ paratype, Bournier (1965).
Pueblothrips minuta, ♂ holotype, ♀ allotype, 4 ♂ paratypes, Stannard (1950).

Saucrothrips scitulus, 1 ♀ paratype, Ananthakrishnan (1967).
Sericothrips desmodianus, ♀ holotype, Stannard (1968).
Talitha cincta, 1 ♀ paratype, 1 ♂ paratype, Faure (1958a).
Terthrothrips magnicauda, 1 ♀ paratype, Stannard (1955a).
Thorybothrips graminis, 1 ♂ cotype, Priesner (1924).
Transithrips murphyi, ♀ holotype, Stannard (1970).
Trichothrips americanus, 1 ♀ paratype, 1 ♂ paratype, Hood (1908).
Trichothrips angusticeps, 1 ♀ paratype, Hood (1908).
Trichothrips buffae, 1 ♀ paratype, Hood (1908).
Trichothrips longitubus, 1 ♀ paratype, Hood (1908).
Trisclerothrips hurricaneus, ♀ holotype, Stannard (1953b).
Tropothrips nigripes, ♀ holotype, ♂ allotype, 1 ♀ paratype, Stannard (1954a).
Tropothrips richardsi, ♀ holotype, 1 ♀ paratype, Stannard (1954a).

Thripidae

Anaphothrips figuratus, 1 ♀ paratype, 1 ♂ paratype, zur Strassen (1968).
Anaphothrips mohelensis, 6 ♀ paratypes, Pelikan (1949).
Anaphothrips sandersoni, ♀ holotype, 41 ♀ paratypes, Stannard (1957a).
Apollothrips bhattii, ♀ holotype, ♂ allotype, 1 ♀ paratype, 1 ♂ paratype, Wilson (1972).
Arachisothrips boneti, ♂ holotype, Stannard (1952a).
Arachisothrips millsi, ♀ holotype, Stannard (1952a).
Ascirtothrips varius, 5 ♀ paratypes, 1 ♂ paratype, Bhatti (1967).
Asprothrips raui, 1 ♀ paratype, Crawford (1938b).
Astrothrips parvilimbus, ♀ holotype, Stannard and Mitri (1962).
Astrothrips stannardi, 12 ♀ paratypes, 4 ♂ paratypes, Bhatti (1967).
Bregmatothrips sonorensis, ♀ holotype, ♂ allotype, 2 ♀ paratypes, 2 ♂ paratypes, Stannard (1956a).
Chilothrips occidentalis, ♀ holotype, ♂ allotype, 1 ♀ paratype, Stannard (1973).
Chilothrips rotrameli, ♀ holotype, Stannard (1973).
Chirothrips alexanderae, ♀ holotype, 1 ♀ paratype, Stannard (1959).
Chirothrips medius, 1 ♀ paratype, zur Strassen (1965).
Chirothrips praeocularis, 1 ♀ paratype, Andre (1941).
Chirothrips tuttlei, 1 ♀ paratype, 1 ♂ paratype, zur Strassen (1967).
Chloethrips faurei, 1 ♀ paratype, 1 ♂ paratype, Bhatti (1962).
Collembolothrips atlanticus, 2 ♀ paratypes, zur Strassen (1965).
Dendrothripiella stannardi, 1 ♀ paratype, Ananthakrishnan (1957).
Diarthrothrips lantana, 4 ♀ paratypes, 1 ♂ paratype, Bhatti (1967).
Frankliniella hemerocallis, 1 ♀ paratype, 1 ♂ paratype, Crawford (1948b).
Halmathrips beckeri, ♀ holotype, 3 ♀ paratypes, Stannard (1953a).
Halmathrips debilis, ♀ holotype, Stannard (1953a).
Halmathrips tricinctus, ♀ holotype, 2 ♀ paratypes, Stannard (1953a).
Helionothrips minutus, ♂ holotype, Wilson (1975).
Heliothrips apicalis, 1 ♀ type, 1 ♀ paratype, Bondar (1931).
Homothrips geyeri, 1 ♂ paratype, Faure (1942).
Hoodothrips neivai, ♀ lectotype, Bondar (1931).
Isochaetothrips gardeniae, 2 ♀ paratypes, Crawford (1945).
Isoneurothrips obscuratus, 1 ♀ paratype, Crawford (1941a).
Kurtomathrips unicolor, 1 ♀ paratype, Bailey (1961).
Mesostenothrips kraussi, 1 ♀ paratype, Stannard and Mitri (1962).
Othinanaphothrips spilleri, 1 ♀ paratype, Crawford (1943c).
Oxythrips illitus, 1 ♀ paratype, zur Strassen (1968).
Oxythrips nickelae, 1 ♀ paratype, zur Strassen (1968).

Plesiothrips andropogoni, ♀ holotype, 14 ♀ paratypes, Watts (1934).
Plesiothrips andropogoni watsoni, 4 ♀ paratypes, Watts (1934).
Plesiothrips ayarsi, ♀ holotype, 12 ♀ paratypes, Stannard (1957a).
Prosopothrips chilensis, ♀ holotype, 5 ♀ paratypes, Wilson (1975).
Psectrothrips beckeri, ♀ holotype, ♂ allotype, 5 ♀ paratypes, 10 ♂ paratypes, Stannard (1951a).
Pseudothrips beckhami, 2 ♀ paratypes, 1 ♂ paratype, Beshear and Howell (1976).
Scirtothrips aurantii, 2 ♀ paratypes, 1 ♂ paratype, Faure (1929).
Scirtothrips fulleri, 2 ♀ paratypes, Faure (1929).
Scirtothrips kenyensis, 1 ♀ paratype, Mound (1968).
Sericothrips andrei, 1 ♀ paratype, Crawford (1943a).
Sericothrips formosus, 2 ♀ paratypes, Faure (1958b).
Sericothrips lepidus, 1 ♀ paratype, 1 ♂ paratype, Faure (1958b).
Sericothrips minutus, 2 ♀ paratypes, Bhatti (1967).
Sericothrips pulchellus, 1 ♀ paratype, Hood (1908).
Sericothrips raniae, 1 ♀ paratype, 1 ♂ paratype, Bhatti (1967).
Sericothrips sidae, 1 ♀ paratype, Crawford (1944).
Sericothrips signifer, 1 ♀ paratype, Priesner (1932).
Sericothrips smithi, ♀ holotype, 4 ♀ paratypes, Stannard (1951b).
Sericothrips walteri, 1 ♀ paratype, Crawford (1938a).
Taeniothrips betulae, 1 ♀ paratype, Crawford (1939b).
Taeniothrips kraussi, 1 ♀ paratype, Crawford (1948a).
Taeniothrips walteri, 2 ♀ paratypes, Crawford (1941c).
Thrips asparagi, 2 ♀ paratypes, zur Strassen (1968).
Thrips brunneus, 2 ♀ paratypes, Ananthakrishnan and Jagadish (1968).
Thrips kodaikanalensis, 2 ♀ paratypes, Ananthakrishnan and Jagadish (1966).
Thrips latis, 1 ♀ paratype, Bhatti (1967).
Thrips sylvanus, ♀ holotype, ♂ allotype, 5 ♀ paratypes, 1 ♂ paratype, Stannard (1957a).
Thrips walteri, 1 ♀ paratype, Crawford (1938a).
Toxothrips ricinus, 3 ♀ paratypes, Bhatti (1967).
Uzelothrips scabrosus, 1 ♂ paratype, Hood (1952).
Zonothrips osmundae, 1 ♀ paratype, 1 ♂ paratype, Crawford (1941b).
Zonothrips smutsi, 2 ♀ paratypes, Faure (1957).

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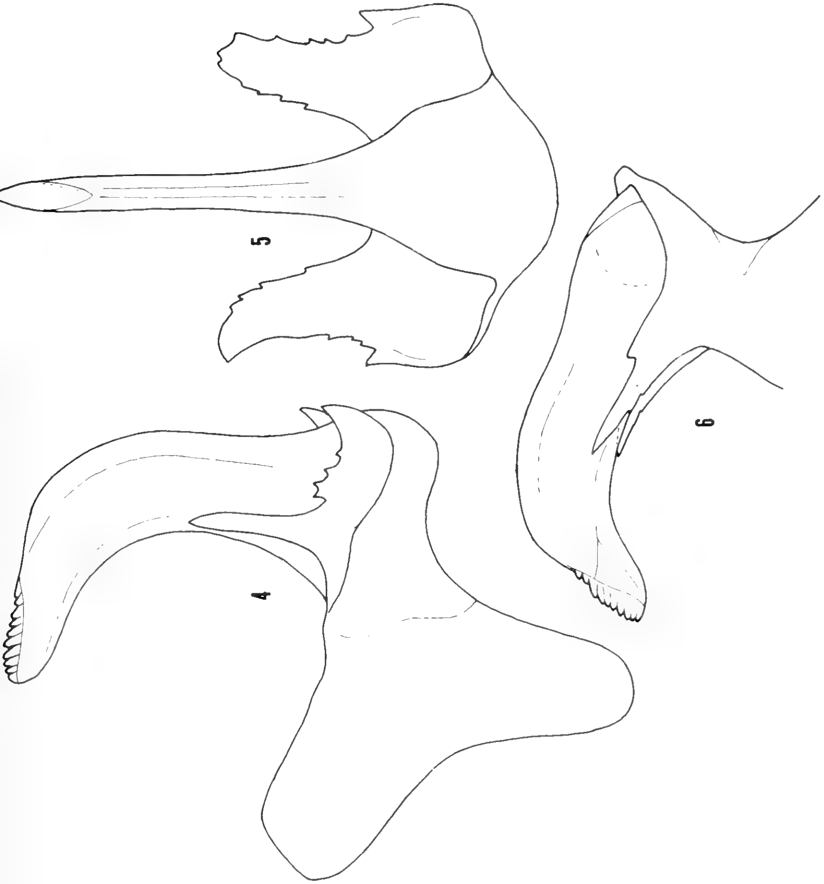
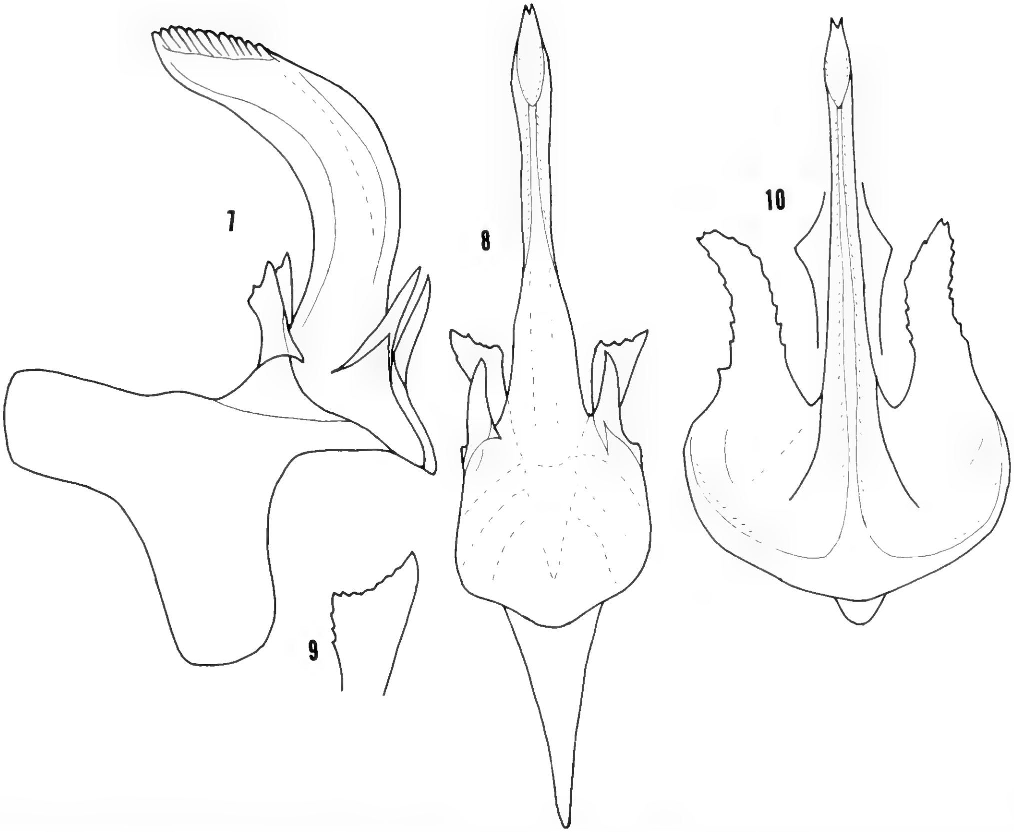


Figs. 4-6. *Acinopterus plenus* Beam. & Laws.: 4 aedeagus in lateral, 5 in ventral aspect; 6 same (of another ex) from side.



Figs. 7-10. *Acinopterus igualanus* sp.n.: 7 aedeagus in lateral, 8 in ventral aspect; 9

RECORDS OF ECTOPARASITES FROM BRAZILIAN MAMMALS[1], [2]

John O. Whitaker, Jr., Russell E. Mumford[3]

ABSTRACT: 31 species of ectoparasites were collected from Brazilian mammal hosts. Of these, 19 were taken from bats, 8 from rodents, 2 from horses and 2 from tapir.

DESCRIPTORS: Mammalian ectoparasites, Brazil, Diptera (Streblidae), Hemiptera (Polyctenidae), Mallophaga, Acarina.

There are few data on ectoparasites of mammals of Brazil. The present paper presents information on ectoparasites collected from mammals, particularly bats, in Brazil by Mumford. Unless otherwise stated, specimens were obtained at or near Vicosa, Minas Gerais, during 1973.

Materials and Methods

Parasites were taken mainly from wild mammals trapped or caught in mist nets; specimens were also obtained from domestic horses and a confined tapir. Parasites were preserved in ethyl alcohol and identified by Whitaker. Help in identifications was freely given for several taxa, as follows: Laelapidae and ticks, Nixon A. Wilson (University of Northern Iowa); Streblidae, Rupert L. Wenzel (Field Museum of Natural History); Nycteribiidae, B.V. Peterson (Biosystematics Research Institute, Canada); lice, K.C. Emerson (Arlington, Virginia); macronyssid mites, JoAnn M. Tenorio (Bernice P. Bishop Museum, Hawaii).

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Results and Discussion

Listed below by host are the various parasites found. The number of each host species examined is shown in parentheses.

Order Chiroptera:

Noctilio leporinus (1). Collected in the Parque Estadual do Rio Doce, near Coronel Fabriciano, Minas Gerais, in July 1970, this bat was host to two species of streblid flies. Thirteen individuals each of *Noctiliostrebla aitkeni* and *Paradyschiria fusca* were removed from this animal. It and other bats of the same species taken at this locality were heavily infested with streblids. *Noctiliostrebla aitkeni* was described from *Noctilio leporinus* from Manzanilla, Trinidad, but has been taken in Venezuela, B.W.I., Suriname, Peru, and in Brazil at Pará (Wenzel, 1970). *Paradyschiria fusca* was described from *N. leporinus* from Colombia, but has also been found in Venezuela, Trinidad, Suriname, French Guiana, and in Brazil at Pará (Wenzel, 1970).

Phyllostomus hastatus (1). A single streblid fly *(Strebla consocius)* was found on this specimen. This streblid was described from *P. hastatus* from Trinidad and was previously taken from Columbia, Venezuela, Suriname and Peru (Wenzel, 1970). This appears to be the first record for Brazil.

Anoura caudifera (3). Two new species of streblid flies of the genera *Trichobius* and *Anastrebla* were found. They are being described by R.L. Wenzel. In addition, an individual of the macronyssid mite *Parichoronyssus sclerus* is represented in our collections. *Parichoronyssus sclerus* previously was known only from *Glossophaga soricina* from Panama and from *Phyllostomus* sp. from Costa Rica (Radovsky, 1967).

Anoura geoffroyi (4). The 22 streblids taken from this species included 4 *Anastrebla modestini* and 17 *Exastinion clovisi. Anastrebla modestini* was originally described from *A. geoffroyi* from Panama and has since been taken from Mexico, Guatemala, El Salvador, Venezuela and Trinidad. *Exastinion clovisi* was originally described from Sao Paulo, Ipiranga, Brazil, from *A. geoffroyi.* Its range extends from Mexico to Brazil and Ecuador (Wenzel, 1970).

Sturnira lilium (7). Nine specimens of the streblid *Megistopoda proxima* and 3 individuals of a streblid *(Aspidoptera)* being described as a new species by Wenzel were found. *Megistopoda proxima* was originally described from Argentina from an unidentified bat, and is known from Mexico and through much of South America on *Sturnira lilium.* In Brazil it is known from Pará and Santa Catarina (Wenzel, 1970).

Vampyrops lineatus (2). One unidentified streblid of the genus *Paratrichobius* was taken from this bat. Flies in the *Paratrichobius longicrus* complex have been previously reported from Panama and Venezuela from *Vampyrops vittatus* (Wenzel, 1970).

Artibeus lituratus (1). This species was host to 2 *Paratrichobius longicrus* and one example of an unidentified species of *Paratrichobius,* both streblid flies. *Paratrichobius longicrus* is known from Mexico to Brazil and Peru from *Artibeus jamaicensis.* This is the first report of its occurrence on *A. lituratus.* In Brazil it is known from Guanabara, Rio de Janeiro, Quinto da Boa Vista, the type locality.

Myotis nigricans (1). This bat was host to 3 unidentified mites.

Myotis riparius (2). Two nycteribiid flies of the genus *Basilia* from this species are being described as new by B.V. Peterson. They are similar to *B. hugh-scotti.* Two small macronyssid protonymphs from *M. riparius* are an unidentified species of *Steatonyssus. Basilia hugh-scotti* is known from Rio Grande do Sul in southern Brazil (B.V. Peterson, pers. comm.), whereas *B. ferrisi, B. juquiensis* and *B. ortizi* have been taken on this host in Venezuela (Guimãraes, 1972).

Myotis ruber (2). Our material includes 7 unidentified macronyssid protonymphs in poor condition from this relatively rare bat.

Histotus velatus (2). Three unidentified ticks of the genus *Ornithodorus* and 22 macronyssid protonymphs of the genus *Steatonyssus* were taken from this bat.

Molossus molossus (2). A polyctenid hemipteran of the genus *Hesperoctenes* (possibly *H. fumarius*) was represented by 7 specimens. The other parasite found was an unidentified macronyssid protonymph. *Hesperoctenes fumarius* was originally described from *Molossus fumarius* from Jamaica, but in South America it has been recorded from Colombia, Bolivia and Venezuela (Ueshima, 1972).

Order Rodentia:

Oryzomys nigripes (2). One laelapid mite *(Gigantolaelaps wolffsohni)* was removed from each rat examined. *Gigantolaelaps wolffsohni* is known from Venezuela, Chile and Panama from several host species (Tipton *et. al.,* 1966; Oudemans, 1910; Furman, 1972).

Akodon arviculoides (2). These 2 mice yielded 3 laelapid mites *(Gigantolaelaps wolffsohni).*

Holochilus brasiliensis (1). This rat was host to 2 laelapid mites *(Gigantolaelaps mattogrossensis),* a mite found on the same host in Venezuela (Furman, 1972).

Coendou sp. (1). Charles O. Handley, Jr., is working on the taxonomy of the prehensile-tailed porcupines. He has not seen our specimen but has studied color slides of it. Among the biting lice (Mallophaga) removed from this specimen, a male and 2 female *Eutrichophilus cordiceps* and a male and female *Eutrichophilus cerocolabes* have been identified. Some additional unidentified juveniles and females of the same genus were also present.

Order Perissodactyla:

Equus caballus (2). A total of 78 ticks *(Anocenter nitens)* was removed from 2 horses. Most of the ticks were inside the ears, where they were present by the hundreds on both animals. This species is known as the tropical horse tick (Jones *et al.,* 1972).

Tapirus terrestris (1). An uncaged tapir, in a fenced zoo in Belem, Parã, was host to many ticks. We obtained 11 specimens of *Amblyomma cajennense* from this tame animal in August 1973. The species has been taken on this host in Venezuela, but occurs from Texas to Argentina (Jones *et al.,* 1972).

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SEXUAL DIMORPHISM IN PTERONOTUM OF CAVE-CRICKET *KEMPIOLA SHANKARI* SINHA & AGRAWAL (ORTHOPTERA: PHALANGOPSIDAE.)[1]

K.M. Sinha[2]

Skeletomuscular mechanism of the thorax of epigean orthoptera has been studied by various workers such as Du Porte (1920), Hsu (1931), Maki (1938), Misra (1946), Rakshpal (1954), Snodgrass (1927), & Thakare (1959). However, Richard (1955) studied the morphology and anatomy of the cave-orthoptera *Macropathus filifer*. Both the sexes of *M. filifer* are apterous. In *K. shankari* the male possess a pair of elytra on the mesothorax. Thus, differences in the pteronotum of the two sexes of *K. shankari* have been observed.

MESONOTUM of *K. shankari*

Female (fig. 1; T 2) A small single segmental plate connected with the pronotum through a large inter-segmental membrane and is not divisible into prescutum, scutum and scutellum. This is followed by metanotum (T 3). Mesonotum is broader than long and slightly convex on the dorsal side.

Male (fig. 2; T 2) Mesonotum is more compact and complicated than mesonotum of female because of its articulation with elytra. It consists of a single segmental plate, connected with the pronotum through a large anterior inter-segmental membrane. A pair of intersegmental sclerites (In. 1), the pretergites, lie transversely in the intersegmental membrane between pronotum and mesonotum.

Mesonotum of male is clearly divisible into four areas, viz., prescutum, scutum, scutellum and post-scutellum.

Prescutum (PSCT) constitutes the anterior rim of mesonotum. A prescutal suture (PSCTS) separates it from the rest of mesonotum.

Scutum (SCT) lies behind the prescutum. Its posterior boundary is marked by a suture (SS). This suture approaches the prescutal suture (PSCTS) antero-medially; this distinguishes right and left portions of scutum. The lateral margins of scutum give rise to anterior (ANP) and posterior (PNP) wing-notal processes for articulation of anterior axillary sclerites. Strong cuticular projections (VSR) are present on the two lateral margins of scutum.

Scutellum (SCL) is a triangular area which lies behind the scutum and is separated from it by a suture (SS).

Post-scutellum (PSCL) follows the scutellum and is a narrow posterior rim of mesonotum. This is more sclerotized and is slightly folded beneath.

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METANOTUM of *K. shankari*

Female (fig. 1; T 3) The single, large plate is not divisible into scutum and scutellum. Since the female is apterous, metanothum has no special modifications.

Male (fig. 2; T 3) This is also a single, large plate but it is divisible into scutum (MSCT) and scutellum (MSCTL) and has two large inter-segmental sclerites (IN.2) lying transversely in intersegmental membrane between meso- and metanotum. Posterior portion of metanotum is produced into large sinuate flap-like membranous structure (MF). No articular processes are developed on lateral margins. Metanotum of male possess two pairs of round median and antero-lateral cuticular projections (MP and LP) which bears sensillae setae (to be published).

Ewer (1954) has not observed any special difference in the tergum of the pterothorax of a macropterous and brachypterous form of a grassphopper, *Zonocerous elegans*. The differences in the pteronotum of *K. shankari* are due only to a pair of elytra. The sensory setae present on cuticular swellings of the metanotum are concerned with the movement of elytra.

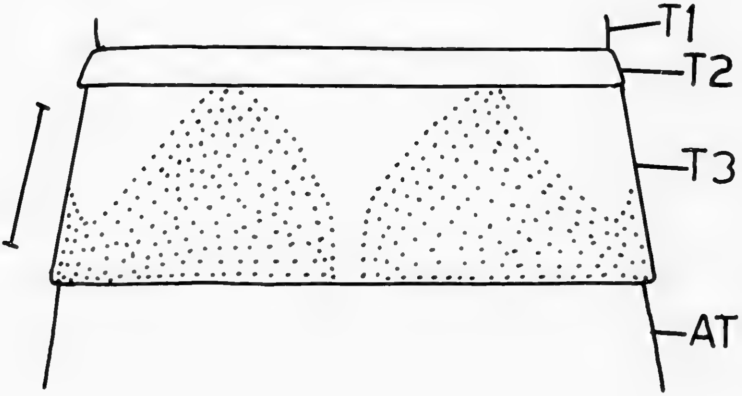

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Fig. 1. Meso- and metanotum of female.

Abbreviations used: AT 1– First abdominal tergum; ANP– Anterior notal process; IN.1– First inter segmental sclerite; IN.2– Second inter segmental sclerite; LP– Lateral cuticular projection; MF– Flap like membranous structure; MSCT– Scutum of metanotum; MP– Median cuticular projection; MSCTL– Scutellum of Metanotum; PNP– Posterior notal process; PSCL– Post scutellum; PSCT– Prescutum; PSCTS– Prescutellar suture; SS– Scutellar suture; SCL– Scutellum; SCT– Scutum; T 1– Pronotum; T 2– Mesontoum; T 3– Metanatum; VSR– Cuticular projection.

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Book wanted: Blatchley, W.S., Heteroptera or True Bugs of 1926, Nature Publ. Co., 1970 Univ. Microfilms.

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NOTES ON SEPARATION AND IDENTIFICATION OF NORTH AMERICAN RIFFLE BEETLES (COLEOPTERA: DRYOPOIDEA: ELMIDAE)[1]

Harley P. Brown[2], David S. White[3]

ABSTRACT: Practical aids are provided for the sorting and identification of North American elmids which have proven to be difficult for the average person working with benthic or drift samples. Both larvae and adults are discussed and figured. Included are: *Gonielmis, Promoresia elegans, P. tardella, Dubiraphia quadrinotata, Optioservus immunis, O. trivittatus, O. fastiditus, O. ovalis, O. castanipennis, O. quadrimaculatus, O. seriatus, O. divergens, Heterlimnius corpulentus, H. koebelei, Ampumixis, Cleptelmis, Zaitzevia, Atractelmis,* and *Rhizelmis.* Distribution maps for *Atractelmis, Gonielmis, Promoresia elegans, P. tardella,* and *Rhizelmis* are presented. For *Atractelmis, Dubiraphia, Gonielmis, Heterlimnius, Optioservus, Promoresia,* and *Rhizelmis* a table lists associated elmid genera in descending order of frequency.

DESCRIPTORS: Riffle beetles, Elmidae, Dryopoidea, *Ampumixis, Atractelmis, Cleptelmis, Dubiraphia quadrinotata, Gonielmis, Heterlimnius, Optioservus, Promoresia, Rhizelmis, Zaitzevia,* identification aids, distribution maps.

Riffle beetles often occur in considerable numbers in both benthic and drift samples from flowing streams. With access to such keys as those of Leech and Chandler (1956), Leech and Sanderson (1959), and Brown (1976), most North American elmids can be classified with relative ease, at least to genus. (Specific identification is more difficult, since it may require extraction and mounting of male genitalia.) However, certain groups continue to pose problems, as attested by the frequency of incorrect listings in such things as environmental assessment reports. This paper is intended to assist those who have the task of sorting and identifying either adult or larval elmids–especially in the Appalachian and western mountain regions, which provide the greatest difficulties. Workers in the central states have a relatively easy job of it.

In the eastern states, the major problems involve *Promoresia* and *Optioservus,* with *Gonielmis* and *Dubiraphia* adding to the confusion.

Gonielmis enters the picture primarily because Sinclair (1964), in his otherwise very useful paper, mistook *Promoresia elegans* (Fig. 3) for *Gonielmis dietrichi* (Fig. 2). The sources of this error are quite understandable. For two species presumably not closely related, they are remarkably similar, both as larvae and as adults. The adults have big feet and claws,

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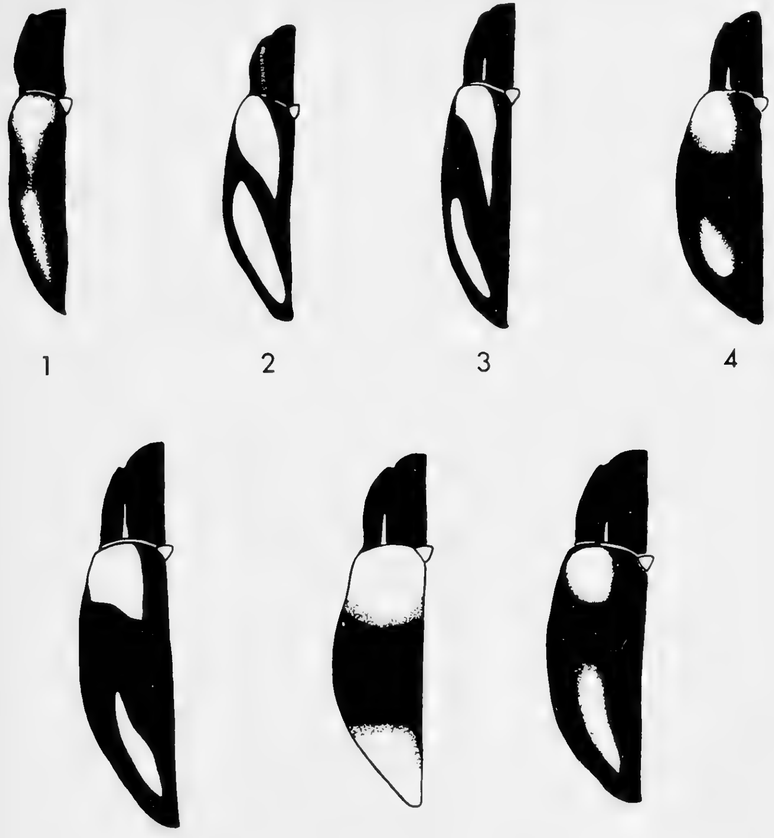
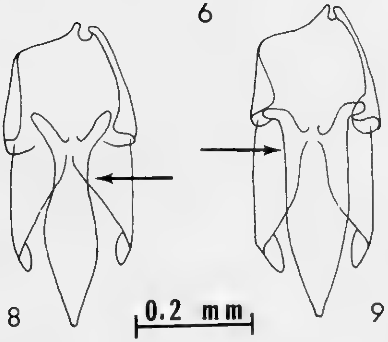
conspicuously oblique elytral markings (Figs. 2, 3), and are comparable in size. The larvae exhibit noticeable mid-dorsal humps on the abdominal segments and elongate dark markings on the thoracic segments (Fig. 10). Sanderson (1953-54), when he created the two genera, noted that . . ."*Gonielmis* appears to be unique among North American elmid larvae by having two longitudinal dark marks on each thoracic tergite." This may have been the clincher in Sinclair's identification of the larvae, though Sanderson had also mentioned that the larva of *Promoresia elegans* was unknown to him. One could hardly have anticipated that it would turn out to be so amazingly like that of *Gonielmis dietrichi.* Conveniently for the biologist, the two are unlikely to occur together. *Gonielmis* seems confined to the coastal lowlands bordering the Gulf of Mexico (Fig. 16), whereas *Promoresia elegans* is typically found in montane and foothill streams of the Appalachian and related mountains from northern Alabama and Georgia up into eastern Canada (Fig. 16). Adults of *Promoresia* differ from those of *Gonielmis* in possessing sublateral pronotal carinae and very dark legs. Larvae of *Promoresia* have the meso- and metapleuron each composed of but a single piece (Fig. 12), whereas these pleura in larvae of *Gonielmis* are composed of two parts: a long, slender anterior piece and a posterior piece twice as wide (Fig. 13). In small larvae and in those which are heavily encrusted, the pleurites may be very difficult to observe. The last abdominal segment is proportionately longer in the larva of *Gonielmis,* being conspicuously more than twice as long as it is high (Fig. 15); that of *Promoresia* is shorter and heavier, being only about twice as long as it is high (Figs. 10, 11).

Dubiraphia adults resemble those of *Gonielmis* and *Promoresia* in having large feet and claws, associated with the habit of clinging to roots and other submerged vegetation. They may also occur in the same streams as either of the two. *Dubiraphia* (Fig. 1) is readily distinguished, however, by its body shape and longitudinal rather than oblique elytral markings. The thorax is as wide as the abdomen, which is rather slender and parallel-sided. In most species the light-colored elytral markings form a conspicuous stripe or vitta, and the over-all body coloration may be quite light. Larvae of *Dubiraphia* are even more distinctive, with pleura on the first 8 abdominal segments and an extremely long, slender last (9th) abdominal segment. The larva of *Promoresia tardella* was described as that of *Dubiraphia quadrinotata* by West (1929) because such larvae taken at Ithaca, New York were reared by E.A. Richmond and the resulting adults were misidentified (by J.G. Needham?) as those of *Dubiraphia quadrinotata.* Conversely, we have encountered specimens of *D. quadrinotata* misidentified as *Promoresia.* As may be seen by comparing Figs. 1 and 4, the general body contours are quite different, and *Dubiraphia* lacks any trace of sublateral carinae on the pronotum.

The major difficulties in working with eastern montane streams involve *Optioservus* and *Promoresia,* which frequently occur together. Although there is a great range in size (Table 1), particularly in *P. tardella,* it is our opinion



Figs. 1-7. Dorsal aspect of adults, left half. (Not to scale.) 1, *Dubiraphia quadrinotata;* 2, *Gonielmis dietrichi;* 3, *Promoresia elegans;* 4, *Promoresia tardella;* 5, *Atractelmis wawona;* 6, *Heterlimnius corpulentus;* 7, *Optioservus ovalis.*



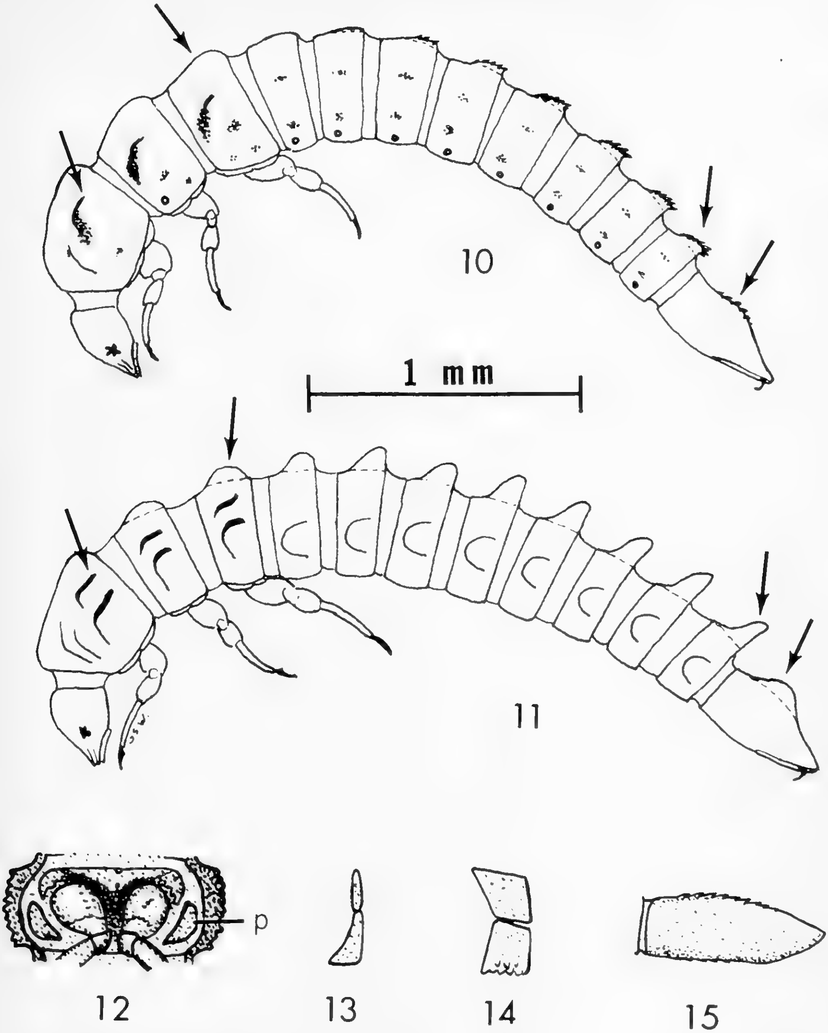
Figs. 8, 9. Male genitalia, dorsal aspect. 8, *Promoresia elegans;* 9, *Promoresia tardella.*

that there are only two species of *Promoresia* represented among the hundreds of specimens we have examined (Figs. 16, 17). Within a given stream, *P. tardella* typically occurs in the headwaters, overlapping with and being replaced by *P. elegans* in the lower reaches of the stream. The adults are readily separable on the basis of elytral maculation or contour (Figs. 3, 4). In case of doubt, the male genitalia may be examined. The penis of *P. elegans* has a distinct basal constriction (Fig. 8), while that of *P. tardella* is quite broad (Fig. 9).

For the most part, the larvae are also distinguishable on the basis of either coloration or contour (Figs. 10, 11). In the larva of *P. tardella* (Fig. 11; also described and figured by West, 1929, as larval type 8), the mid-dorsal humps are often so exaggerated as to render the larva almost pectinate in profile. They are reminiscent of the back of a *Stegosaurus.* The humps on abdominal segments 6-8 are commonly taller than long. Furthermore, each segment bears a dorso-lateral or sublateral bulge. In larvae of *P. elegans,* the humps are much more moderate in height. This is the opposite of what is stated in Brown's key (1972 or 1976, p. 63). Unless the cuticle is darkly tanned, the markings are more conspicuous in larvae of *P. elegans* than in *P. tardella:* the thoracic segments bear what appear to be elongate dark marks and each of at least the first 5 abdominal segments typically has both a supra-spiracular spot and a dorso-lateral spot. These markings are apparently not the products of pigmentation, but of subcuticular attachment of muscles. It is our impression that markings are less distinct in specimens preserved in formalin than in alcoholic material.

A forthcoming revision of the Nearctic species of *Optioservus* (White, in press) will greatly facilitate identification of this group. None of the three new species need concern us here, but White's relegation of *O. ampliatus* to synonymy with *O. ovalis,* of *O. cryophilus* to synonymy with *O. immunis,* of *O. pecosensis* to synonymy with *O. divergens,* of *O. ozarkensis* to synonymy with *O. sandersoni,* and his resurrection and characterization of *O. castanipennis* will simplify the matter appreciably. In the eastern states, body size and elytral maculation may be sufficient for differentiation of species, especially if geographic distribution is also taken into account. Thus, throughout the Appalachian and adjoining regions, any immaculate specimen may reasonably be presumed to be *O. immunis,* any with a mid-dorsal vitta to be *O. trivittatus,* and all others south of New York to be *O. ovalis* (Fig. 7). In Canada and the bordering states, *O. fastiditus* resembles *O. ovalis* but is larger (e.g., elytral length ca 2-2.25 mm as compared with ca 1.6-1.9 mm).

The oblique maculae of *Promoresia elegans* (Fig. 3) set it apart from all species of *Optioservus,* but *P. tardella* (Fig. 4) is easily and often mistaken for *Optioservus ovalis* (Fig. 7). The two commonly occur together, though *P. tardella* is typically nearer the headwaters and in submerged moss or roots, whereas *O. ovalis* is generally farther downstream and in coarse sand or gravel.



Figs. 10-15. Distinguishing larval features. 10, *Promoresia elegans,* lateral aspect, showing no significant humps on anterior segments and very moderate dorsal humps posteriorly; also lateral and dorsolateral markings. 11, *Promoresia tardella,* lateral aspect, showing prominent dorsal humps and lateral bulges. 12, *Promoresia elegans,* ventral aspect of mesothorax, showing single pleurite (p) which ranges in shape from somewhat crescentic to triangular. 13, *Gonielmis dietrichi,* ventral aspect of left mesopleuron, showing two pleurities, of which the posterior one is subcrescentic to subtriangular. 14, *Heterlimnius koebelei,* ventral aspect of left mesopleuron, showing two rectangular pleurites. 15, *Gonielmis dietrichi,* lateral aspect of ninth abdominal segment, showing the length to be well over twice the height; the basal half of the ventral margin is also straight, rather than convex.

The character most widely used in keys to distinguish the genera is the nature of the posterior margin of the pronotum, which is smooth in *Promoresia* and finely toothed or crenate in *Optioservus.* To those familiar with the beetles, however, the slimmer body and larger legs and claws of *Promoresia* reveal its identity; it is also smaller (ca 1.7-2.4 x 0.8-1.2 mm, as compared with ca 2.4-2.6 x 1.2-1.4 mm). Another very useful character for easy separation is leg color–very dark in *Promoresia,* relatively light in *Optioservus.* The mid-dorsal humps on the abdominal segments readily distinguish the larvae of *Promoresia* from those of *Optioservus.* As yet we have no key separating the larvae of the various species of *Optioservus.*

In the western mountains, *Optioservus* and *Heterlimnius* are the chief trouble-makers, as larvae and as adults. Both genera are common and widespread, often occurring in the same stream–though usually separated altitudinally. In the Rocky Mountains, *Heterlimnius corpulentus* is frequently the only elmid found at higher elevations, while *Optioservus* may abound further downstream. As a rule, adults of the two genera are rather easily separated by persons familiar with them, despite the difficulty in pinning down key characters. We know of no good, clear-cut character by which the genera may be distinguished. As Sanderson stated (1953-54), he would not have created the genera *Optioservus* and *Promoresia,* extracting them from *Heterlimnius,* except for the differences in larval structure. Then how does one identify *Heterlimnius* adults? Perhaps it is best done at the specific level. The coloration of *Heterlimnius* is quite variable, even in a single locality, ranging from immaculate to such conspicuous banding as shown in Fig. 6. If banded, it is readily recognized, for no species of *Optioservus* exhibits transverse markings of this sort. If immaculate, body contour can serve to distinguish *Heterlimnius* from *Optioservus divergens,* the only widespread western immaculate species of *Optioservus.* In profile, *Heterlimnius* is noticeably hump-backed. It is usually larger and proportionately plumper *(H.corpulentus* is ca 1.25-1.45 mm wide, *O. divergens* ca 1-1.1 mm wide). If one feels the need for reassurance, he may count the antennal segments (10 in *H. corpulentus* vs. 11 in *O. divergens*). Unfortunately, *Heterlimnius koebelei,* the type species for the genus, has 11 antennal segments, so this is not a usable generic character.

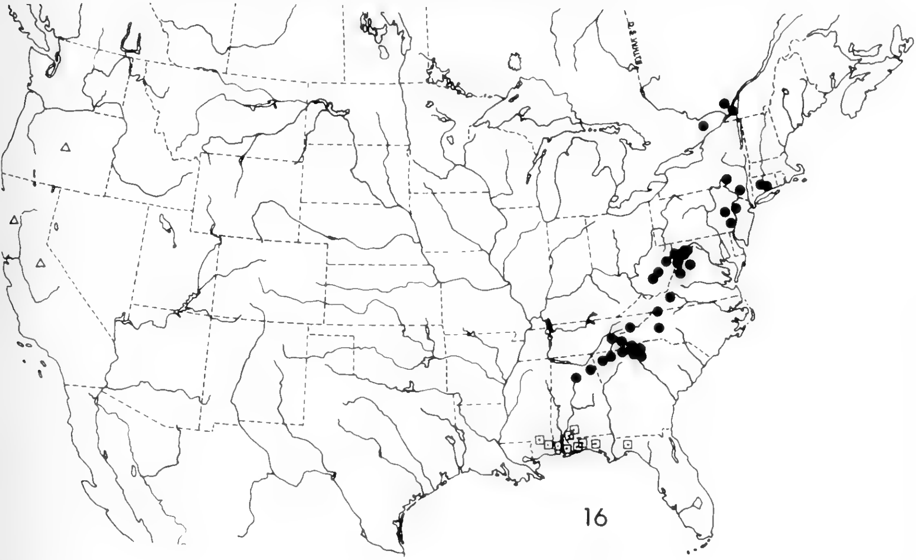
Larvae of *Heterlimnius* differ from those of *Optioservus* in having the pleura of the mesothoracic and metathoracic segments divided into 2 rectangular pieces (Fig. 14) instead of single, rather triangular pieces (much like Fig. 12). In well-sclerotized specimens this is not too difficult to see, but in tiny or teneral larvae, these features are often impossible to observe. Patterns of coloration (e.g., spots in *Heterlimnius* larvae) may provide local means of separating the larvae.

The western species of *Optioservus* provide more headaches for those who need specific determinations than do the eastern species. This will be true even after the appearance of White's forthcoming revision of the genus, primarily because there are 3 widespread and common species whose elytral color patterns and general aspects overlap: *O. castanipennis, O. quadrimaculatus,* and *O. seriatus.* Fortunately for the taxonomist, they do not often occur together in the same stream. Furthermore, knowledge of their known distribution may be of assistance. *O. castanipennis* is essentially a resident of the Rocky Mountains, occurring from eastern Arizona and New Mexico northward through Utah, Colorado, eastern Idaho, Wyoming, western Montana, and the Black Hills of western South Dakota. *O. quadrimaculatus* is a bit more northerly and westerly, ranging from central California and Nevada, southern Utah and Colorado northwestward through Oregon, Idaho, Wyoming, eastern Washington and western Montana into British Columbia and Alberta. *O. seriatus* is abundant in northern California and much of Oregon, but has also been reported from scattered localities in Colorado, Wyoming, Idaho, western Montana, and western Washington. Though all 3 of these species bear on each elytron a rounded humeral spot and a somewhat elongate subapical spot ranging in color from bright yellow to brick red, there is considerable variation among individuals. Typically, the spots are relatively small in *O. seriatus,* the humeral spot usually not extending medially beyond the third stria, whereas the spots are distinctly larger in *O. quadrimaculatus,* the humeral spot usually extending medially to the second stria. *O. castanipennis* is most variable of the three: the humeral spot ranges from small and very faint to large and bright, and the subapical spot may be large and even connected with the humeral spot, small and inconspicuous, or entirely absent. Aside, perhaps, from male genitalia, the best character for separating *O. seriatus* from *O. quadrimaculatus* is body contour: the sides of the elytra are typically subparallel in *O. seriatus* and hardly wider than the prothorax, but rounded and distinctly broader than the prothorax in *O. quadrimaculatus.* Though most populations of *seriatus* are distinguishable from *quadrimaculatus,* there are some specimens that seem to be intermediates. We would appreciate the opportunity to examine these.

Since most of us who have been identifying elmids in recent years have followed Collier (1969) in assuming that *O. castanipennis* (Fall, 1925) was synonymous with *O. divergens,* and since the vast majority of specimens of *O. castanipennis* are perceptibly maculate, most such specimens have been incorrectly diagnosed as either *O. quadrimaculatus* or *O. seriatus.* In correcting these errors, or in identifying new material, geographic distribution can provide a useful clue, as indicated above. The presence of reduced or absent subapical spots on the elytra of any individuals from a given locality will immediately suggest *O. castanipennis.* Members of this species are also somewhat larger than those of *O. quadrimaculatus* or *O. seriatus.* Any specimen resembling *O. seriatus* but occurring east of the coastal states should be considered suspect; it is probably *O. castanipennis.* Approximate maximal measurements for *O. seriatus* are as follows: pronotal length 0.53 mm, pronotal width 0.81 mm, elytral length 1.72 mm, maximum width across elytra 0.97 mm. *O. castanipennis* may also resemble *O. quadrimaculatus,* with which it exhibits a considerable overlap of geographic range. Again, size may be a helpful adjunct in identification. Approximate maximal measurements for *O. quadrimaculatus* are: pronotal length 0.66 mm, pronotal width 0.84 mm, elytral length 1.8 mm, greatest width 1.2 mm. Only females would approach these dimensions.

Prior to White's revision of the genus, we had the problem of distinguishing between two presumptive species of immaculate western *Optioservus: divergens* and *pecosensis.* Fortunately for all who faced the task, White has concluded that *pecosensis* is but a synonym, so the common, uniformly dark specimens of *Optioservus* ranging from the Mexican border up into Alberta and British Columbia can be identified as *O. divergens* with relative assurance. Minor exceptions are a small species resembling *O. immunis* in the mountains of central California, an isolated species in western Kansas, and some individuals of *O. castanipennis* with such faint elytral spots that they may be overlooked.

Occasionally, specimens of *Ampumixis* or *Cleptelmis* may be mistaken for *Heterlimnius,* since they are rather plump and their elytral coloration may resemble that of *Heterlimnius.* In fact, the elytral markings of *Ampumixis* are surprisingly like those of *Heterlimnius,* varying from immaculate to beautifully banded with red across the base and with or without a broad red apical spot. However, both *Ampumixis* and *Cleptelmis* have the elytral epipleuron uninterrupted by the sort of tooth which arises from the lateral margin of the fourth abdominal sternite in *Heterlimnius* to clasp the elytron, and both have characteristic pronotal configurations, such as the basally forked sublateral carina of *Cleptelmis.* They are also usually smaller than the *Heterlimnius* in whose company they may be found. These features will also serve to separate *Cleptelmis* from *Optioservus,* with which it may be found and which it may resemble in size and coloration. Specimens of *C. ornata* often look very much like *O. quadrimaculatus* or O. seriatus in color pattern, but the body is proportionately broader than even *O. quadrimaculatus.* The larvae of *Ampumixis* are distinctive among northwestern elmids in possessing mid-dorsal abdominal humps quite like those of *Promoresia* and *Gonielmis.* Being long and hemi-cylindrical in shape, the larva of *Cleptelmis* is unlikely to be confused with any other except that of *Zaitzevia* with which it often occurs). The easiest way to separate the two, though not mentioned in keys, is by the shape of the ninth (last) abdominal segment. In *Cleptelmis* it is smoothly rounded above, whereas in *Zaitzevia* it bears a distinct mid-dorsal carina.



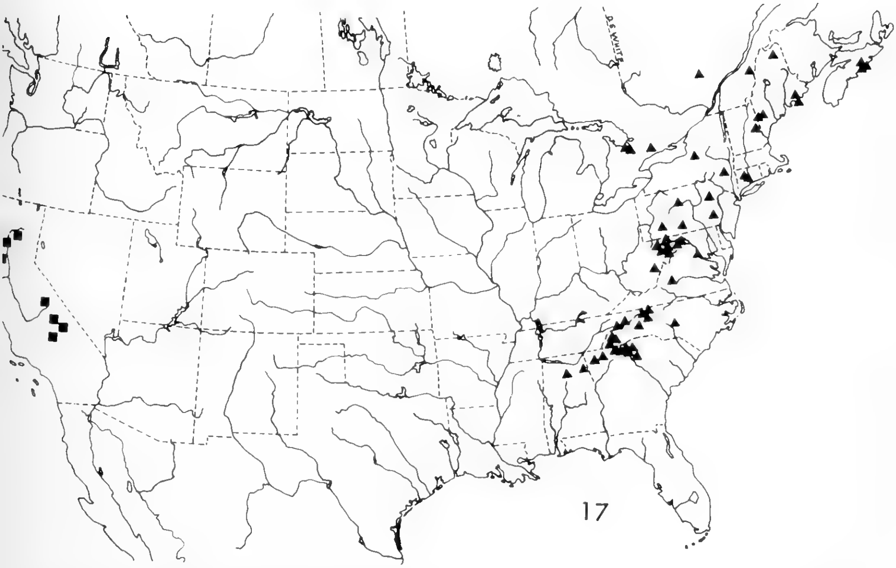


Fig. 16. Map showing distribution of specimens examined. *Atractelmis wawona,* hollow triangles; *Gonielmis dietrichi,* squares with a dot; *Promoresia elegans,* solid circles.

Fig. 17. Map showing distribution of specimens examined. *Promoresia tardella,* solid triangles; *Rhizelmis nigra,* solid squares.

Two remaining genera from far western mountains merit mention, not because they are likely trouble-makers, but because they may be overlooked among common forms they superficially resemble. *Atractelmis* (Fig. 5) differs from the *Optioservus* with which it occurs in having a more angular humeral spot and a very elongate subapical spot, as well as in having a saddle-like basal transverse depression across the pronotum. The larva of *Atractelmis* is unknown, but may be expected to exhibit the following features: anterior coxal cavities open behind (i.e., no posterior prothoracic sternum); postpleurite of prosternum consisting of 1 part (i.e., propleuron of 2 parts); meso- and metapleura each of 2 parts; abdomen with pleura on at least segments 1-6, probably also on segment 7, and possibly also on segment 8. So far as we know, *Atractelmis* has been taken only from two streams in California and one in central Oregon (Fig. 16), being represented by a total of only 5 specimens. It is quite likely that other specimens may have been collected and are tucked away in vials of *Optioservus.*

The other rarity is *Rhizelmis,* which looks enough like *Optioservus divergens* or immaculate specimens of *Heterlimnius corpulentus* to be mistaken for one of these common species. The resemblance to *Optioservus* is rather superficial, since the latter is noticeably more slender and has a rather uniformly convex pronotal disk. In general aspect, *Rhizelmis* is very much like *Heterlimnius,* and some specimens have a humeral spot quite like that of *Heterlimnius.* But whereas *Heterlimnius* has a slight mid-dorsal pronotal sulcus, *Rhizelmis* has a fine longitudinal carina in the corresponding position. In *Rhizelmis,* the sublateral pronotal carina is all but obscured by coarse punctures, and mesial to the base of the sublateral carina on each side is a depression; in fact, the entire basal portion of the pronotum is somewhat depressed; on each side of the median carina there is a small, button-like protuberance. In *Rhizelmis,* the maxillary palp is 3-segmented; the antenna is longer than the fore tibia and with each segment distinctly longer than wide. In *Heterlimnius corpulentus,* the maxillary palp is 4-segmented, the antenna shorter than the fore tibia and with several segments about as wide as long. The larva of *Rhizelmis* is totally unlike that of *Optioservus* or *Heterlimnius,* being long and slender with subparallel sides, hemicylindrical in cross section, and with pleura on abdominal segments 1-8. Aside from the few specimens (mostly larvae) reported by Chandler (1954) from Colusa, Shasta, and Inyo Counties in California, we are aware only of those collected by Brown from Fresno, Kern, Madera, and Tehama Counties, all in California (Fig. 17). It is likely that both adults and larvae have been taken by others in California and perhaps Oregon without coming to our attention, but the chances are very good that the adults are classified as *Heterlimnius,* rather than *Rhizelmis.* We should appreciate being informed of any records of either *Atractelmis* or *Rhizelmis.*

Since, as among other organisms, a riffle beetle may often be known by the company it keeps, it may be of help to list the consocies of the genera we have discussed. Table 2 presents such a list, in descending order of frequency, based upon collections deposited in the Stovall Museum of Science and History (University of Oklahoma). All genera listed are elmids, although other associated organisms might serve equally well, e.g., psephenid and dryopid beetles, trichopterans, mayflies, or stoneflies. An example will illustrate how the list was compiled: of 66 collections of *Optioservus* made east of the great plains in which at least one additional genus of elmid was taken, 53 included *Stenelmis,* 22 included *Oulimnius,* 17 *Promoresia,* 17 *Macronychus,* 16 *Microcylloepus,* and 11 *Dubiraphia.* The sequence, of course, is biased by the localities in which the collections were made. In the Ozarks, for example, there would be no *Oulimnius* or *Promoresia.* Regional lists of consocies would be more useful, but inappropriate for such a note as this. However, since an indiscriminate lumping of eastern and western material renders the data for *Dubiraphia* and *Optioservus* almost worthless, we have subdivided these two.

ACKNOWLEDGEMENTS

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Table 1.
Measurements of *Promoresia*

Species	Pronotal length	Pronotal width	Elytral length	Elytral width	Total length	Maximum width
elegans	0.5-0.7 mm	0.6-0.9 mm	1.6-2.1 mm	0.9-1.2 mm	2.1-2.8 mm	0.9-1.2 mm
tardella*	0.4-0.6 mm	0.5-0.9 mm	1.3-2.1 mm	0.8-1.2 mm	1.7-2.7 mm	0.8-1.2 mm

(*Note: by far the largest specimen of *tardella* was a paratype of *"Limnius subarcticus"* taken July 26, 1929 at Bradore Bay, Quebec by W.J. Brown, now in the Illinois Natural History Survey collection; in Brown's description, however, total length was given as 2.3-2.4 mm. Although the smallest specimens were from South Carolina and West Virginia, there appears to be no north-south relationship as to size. Instead, size differences may be related to time of cohort production.)

Table 2.
List of associated genera in descending order of frequency and abundance

	Atractelmis	**Dubiraphia**				**Gonielmis**	**Heterlimnius**
Typical habitat	Rather fast water in rocky streams	Usually on submerged vegetation of some sort: roots, stems, bark; occasionally on rocks or pebbles encrusted with algae				Submerged roots, etc. in clear cool streams	Rocky montane streams at high elevations
Geographic region covered	California (Mariposa Co.) Oregon (Crook Co.)	Eastern states	Great Basin states	Southwestern (Oklahoma, Texas)	Oregon	Lowland streams near the Gulf of Mexico	West of the great plains

Table 2. (Continued)

Associated genera of Elmidae	*Optioservus* *Zaitzevia* *Cleptelmis* *Heterlimnius* *Narpus* *Dubiraphia* *Microcylloepus*	*Stenelmis* *Macronychus* *Microcylloepus* *Optioservus* *Ancyronyx* *Promoresia* *Oulimnius* *Gonielmis*	*Optioservus* *Microcylloepus* *Stenelmis*	*Stenelmis* *Microcylloepus* *Macronychus* *Hexacylloepus* *Heterelmis* *Ancyronyx* *Neoelmis* *Elsianus* *Phanocerus*	*Optioservus* *Microcylloepus* *Heterlimnius* *Zaitzevia* *Cleptelmis* *Atractelmis*	*Stenelmis* *Ancyronyx* *Macronychus* *Microcylloepus* *Dubiraphia* *Oulimnius*	*Optioservus* *Zaitzevia* *Lara* *Narpus* *Ordobrevia* *Cleptelmis* *Microcylloepus* *Ampumixis* *Rhizelmis*

	Optioservus		**Promoresia**	**Rhizelmis**
Typical habitat	Gravel or coarse sand in fast, shallow water		On roots or moss in fast mountain streams	On roots or moss in fast mountain streams
Geographic region covered	East of the great plains	West of the great plains	Alabama and Georgia north to Maine	Central California (Kern, Fresno, Madera and Tehama Counties)
Associated genera of Elmidae	*Stenelmis* *Oulimnius* *Promoresia* *Macronychus* *Microcylloepus* *Dubiraphia*	*Narpus* *Zaitzevia* *Cleptelmis* *Ordobrevia* *Heterlimnius* *Microcylloepus* *Ampumixis* *Dubiraphia* *Heterelmis* *Rhizelmis* *Atractelmis*	*Oulimnius* *Optioservus* *Stenelmis* *Microcylloepus* *Macronychus* *Ancyronyx* *Dubiraphia*	*Optioservus* *Narpus* *Zaitzevia* *Ampumixis* *Lara* *Cleptelmis* *Heterlimnius* *Ordobrevia*

MATING SWARMS OF A SOUTH AMERICAN *ACROPYGIA* (HYMENOPTERA: FORMICIDAE)[1]

William G. Eberhard[2]

ABSTRACT: Observations of swarming behavior of the South American ant *Acropygia* sp. suggest it is more strongly outbreeding and more widely dispersing than *A. paramaribensis.* Both predominantly male and predominantly female swarms occur, and each female carries a coccid as she flies.

DESCRIPTORS: mating swarms, ants, symbiosis, outbreeding, dispersal, behavior

Ants of the myrmecine genus *Acropygia* live in subterranean colonies, collecting honeydew from coccids which live on plant roots, and have been described as pests of coffee (Bunzli 1935). Each female reproductive carries a coccid in her mouthparts as she leaves the maternal nest on her nuptial flight (Bunzli 1935, Brown 1945 and pers. comm.). This note describes some of the details of the events associated with the mating flight of a South American species of *Acropygia.* Dr. W. Brown very kindly identified the ants, which cannot be put to species at the present time; specimens have been deposited in the Museum of Comparative Zoology, Cambridge, Mass. 02138.

More than 100 swarms of reproductives were observed in and near Cali, Colombia in a zone described by Espinal and Montenegro (1962) as dry tropical forest. They occurred on sunny afternoons between about 17:00 and 18:00; typically there had been a rain in the morning or the evening before which broke a dry spell. The swarms seemed to be most common early in the rainy season, but occurred at other times also. They usually formed over lawns or other grassy areas, and generally hovered 1-15 feet above some sort of discontinuity such as a rock, a piece of paper, a person, etc. One swarm of males which was over a piece of paper consistently responded to my shaking the paper by abruptly rising several feet and then slowly drifting back down.

As shown in Table 1, swarms were usually either predominantly male or predominantly female. The flight patterns of individuals within a swarm were relatively constant. Females in female swarms flew mostly horizontally, making a quick pass through the swarm and then flying slowly back through it. Males in male swarms flew in more "dancing" patterns, with each individual making more or less figure-8 patterns from side to side. Although the ants tended to stay in swarms, appreciable numbers of both sexes were

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seen "wandering" alone in the general area of other swarms, and the swarms themselves sometimes dissolved more or less abruptly.

Pairs formed continuously in both male and female swarms, and fell to the ground below. Many were unisexual (two males or two females, depending on the sex predominating in the swarm), and quickly separated to rejoin the swarm. Bisexual pairs also fell, with the male holding onto but not copulating with the female. If the male maintained contact with her on the ground, the female remained more or less still, but she soon flew off if he lost contact. If the male succeeded in locking genetalia, the couple remained relatively quiet for about five minutes on the grass before separating. On two different occasions I was able to see that when pairs separated under male swarms, the male flew up to rejoin the swarm while the female flew off in a long, low arc, disappearing from sight 5-10 m away. In four cases in which I broke a pair apart prematurely, the female flew off in the same way.

On one occasion, reproductives were seen emerging from a nest(s) in a lawn of the grass *Paspalum* sp. (identified by L.S. Espinal) over which there were two male swarms. The reproductives, all females with coccids in their mandibles, came from many dispersed small holes. There were 1-10 workers around each hole. Each female climbed to the tip of a grass blade, and then took off. They all flew more or less straight up, and went very high and out of sight "despite" the presence of male swarms nearby. I estimated that more than 100 females flew up every minute from the 5 x 3m patch of lawn I was watching. Several *Ectatoma ruidum* (Ponerinae) were seen in the grass with female *Acropygia* in their mouthparts.

One afternoon, using flight pattern, ant size, and the presence or absence of coccids to distinguish male swarms from female swarms, I counted the swarms in a pasture (which included some brush and small trees) more than 200m long and 100m wide at its widest point. I noted 89 female swarms, 4 male swarms, and 2 swarms with appreciable numbers of both sexes. Although the swarms in the large field were scattered, all the swarms with males were in the same small sector. On another occasion I found 11 male swarms and 0 female swarms in an area about 200m away.

Males are apparently very short-lived. After netting a group of 108 males at about 17:30, I laid the closed net on my desk in front of an open window. When I returned to count the ants four hours later, the other insects which had also been captured – several acalyptrate flies, hemipterans, etc. – were all lively and flew off when I opened the net; but the ants were all very feeble, none being able to fly, and 58 were immobile and apparently already dead.

Discussion

The descriptions of swarming behavior in *A. paramaribensis* (Bunzli 1935) and *A.* sp. probably *acutiventris* (Brown 1945, pers. comm.) offer several points of comparison. The two species are similar to the one of this study in the following characteristics: females carry coccids (the "aphids" reported by Brown were coccids – pers. comm. W. Brown); swarming occurs during the day and is associated with previous rain; (at least for *A. paramaribensis*) many small holes are opened for the exit of the reproductives; and the flight patterns of male and female *A.* sp. prob. *acutiventris* are apparently similar.

They both differ from the species of this study in that they couple in flight rather than on the ground. In addition, *A. paramaribensis* differs in the following ways: swarms are much larger, consisting of up to millions of individuals; one sample showed a swarm to be composed of similar numbers of males and females; emerging females fly from the ground directly into swarms overhead; and the females, after landing following mating, seek shelter underground (apparently often within the maternal colony) rather than flying off.

It is surprising to find such marked differences in behavior of congeneric species. The species of this study is evidently more strongly outbreeding and more widely dispersing than *A. paramaribensis.*

Table 1. Composition of swarms of *Acropygia* sp. reproductives (close to the entirety of each swarm was collected with repeated passes of an insect net).

Date	Number of males	Number of females
17V172	2	44
17V172	1	17
22V73	0	108
26V73	3	263 (plus 1 worker)
6VIII73	1	7
6VIII73	19	3
15X174 (4 swarms collected into same net)	108 (total)	0

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AN ANNOTATED LIST OF ELMIDS, DRYOPIDS AND PSEPHENIDS FROM PENNSYLVANIA (COLEOPTERA)[1]

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ABSTRACT: The distribution of aquatic beetles in the families Elmidae, Dryopidae and Psephenidae in Pennsylvania was studied. Collection records are presented from Lake Erie, Ohio, Susquehanna, Potomac, and Delaware River Basins which drain the majority of the state. Thirty-two species were collected of which thirteen represent new state records.

DESCRIPTORS: Elmidae, Psephenidae, Dryopidae, Distribution.

A comprehensive study of the elmid, dryopid and psephenid fauna of Pennsylvania is lacking; however, Sanderson (1938), Musgrave (1935), Collier (1969) and Brown and Murvosh (1974) recorded the following species from Pennsylvania: *Stenelmis crenata, S. lateralis, S. bicarinata, S. mera, S. musgravei, S. markeli, Helichus basalis, Optioservus ampliatus, O. trivittatus, O. immunis, O. ovalis* and *Psephenus herricki.* Brown (1972) described the general distribution of all North American dryopoids but gave little annotated information concerning collection sites. In addition to the species listed above, Brown (1975) added the genera *Ancyronyx, Dubiraphia, Macronychus, Microcylloepus, Oulimnius, Promoresia, Ectopria,* and *Dicranopselaphus* to Pennsylvania's fauna. This study was undertaken to examine the distribution of the Elmidae, Dryopidae, and Psephenidae in Pennsylvania.

Shaw and Busch (1970) described the Lake Erie Basin and the Ohio, Susquehanna, Delaware, Potomac and Genesee River Basins as the six major drainage systems in Pennsylvania. Records presented here represent collections taken in the first five basins which drain the vast majority of the state. The Genesee River Basin drains only a portion of Potter County before flowing north into New York. Techniques used to collect beetles during this study included Surber sampling, kick sampling, artificial substrate sampling, and hand-picking beetles from rocks. Two personal collections and the Pennsylvania State University collection were also studied. The distribution of these aquatic beetles will be reported as follows:

1. beetle species taken in field collections will be indicated by a county

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and stream designation;

2. new state records will be denoted by an asterisk after the name; and
3. the river basins will be designated in the collection data by the following Roman numeral and letter key according to Shaw and Busch (1970):

I. **Delaware River Basin**
  - C. Delaware River from Lackawaxen River to the Lehigh River
  - D. Lehigh River
  - E. Delaware River from Lehigh River to the Schuylkill River
  - F. Schuylkill River
  - G. Delaware River from Schuylkill River to the Maryland border

II. **Susquehanna River Basin**
  - K. Susquehanna River from Lackawanna River to the West Branch Susquehanna River
  - L. West Branch Susquehanna River
  - M. Susquehanna River from West Branch Susquehanna River to the Juniata River
  - N. Juniata River
  - O. Susquehanna River from Juniata River to the Maryland border

III. **Ohio River**
  - P. Allegheny River to the New York border
  - Q. Allegheny River from the New York border to the Clarion River
  - W. Ohio River to the Ohio-West Virginia borders

IV. **Lake Erie Basin**
  - X. Lake Erie

V. **Genesee River Basin**

VI. **Potomac River Basin**
  - Z. Potomac River

A new species of *Stenelmis* collected during this study will be described at a later date.

RECORDS OF PENNSYLVANIA ELMIDAE:

County	**Drainage Basin**	**Collection Site**
	Ancyronyx variegata (Germar)	
Columbia	II-M	Briar Creek
Crawford	III-Q	Mill Run, French Creek, Woodcock Creek
Erie	IV-X	Conneauttee Creek
Huntingdon	II-N	Trough Creek State Park (Penn. State University collection)
Lancaster	II-O	Conestoga Creek
Montgomery	I-F	Schuylkill River
York	II-O	Codorus Creek

County	**Drainage Basin**	**Site**
	*Dubiraphia bivittata (LeConte)**	
Crawford	III-Q	Sugar Creek
Cumberland	II-O	Conodoquinet Creek
	*Dubiraphia minima Hilsenhoff**	
Crawford	III-Q	Woodcock Creek, French Creek
Dauphin	II-O	Swatara Creek
Lebanon	II-O	Swatara Creek
Northumberland	II-M	West Branch Susquehanna River
	Dubiraphia quadrinotata (Say)*	
Crawford	III-Q	Mill Run, Woodcock Creek, French Creek
Erie	IV-X	Mill Creek, Seven Mile Creek
Lancaster	II-O	Conestoga Creek
Venango	III-Q	Sugar Creek
	Dubiraphia vittata (Melsheimer)*	
Crawford	III-Q	French Creek, Woodcock Creek, Little Sugar Creek, Mill Run
Cumberland	II-O	Conodoquinet Creek
Dauphin	II-O	Swatara Creek
Erie	III-Q	Hare Creek
	IV-X	Mill Creek
Lancaster	II-O	Conestoga Creek
Lawrence	III-W	North Fork Little Beaver Creek
Mifflin	II-N	Juniata River
	Macronychus glabratus Say	
Bedford	II-N	Raystown Branch
Berks	I-F	Tulpehocken Creek
Columbia	II-M	Briar Creek
Crawford	III-Q	French Creek, Woodcock Creek
Cumberland	II-O	Conodoquinet Creek, Yellow Breeches Creek
Erie	III-Q	French Creek
	IV-X	Crooked Creek
Juniata	II-N	Tuscarora Creek
Lancaster	II-O	Conestoga Creek, Pequea Creek
Lawrence	III-W	Slippery Rock Creek, North Fork Little Beaver Creek
Lebanon	II-O	Swatara Creek
Perry	II-O	Sherman Creek
Venango	III-Q	Lake Creek, Allegheny River
York	II-O	Conewago Creek, Yellow Breeches Creek
	Microcylloepus pusillus (LeConte)	
Crawford	III-Q	French Creek, Woodcock Creek
Cumberland	II-O	Conodoquinet Creek
Dauphin	II-M	Wisconisco Creek

County	Drainage Basin	Site
Huntingdon	II-N	Aughwick Creek
Juniata	II-N	Tuscarora Creek
Lancaster	II-O	Conestoga Creek
Perry	II-O	Sherman Creek
Snyder	II-M	Middle Creek
York	II-O	Muddy Creek, West Branch Conewago Creek
	Optioservus ampliatus (Fall)	
Adams	II-O	Conewago Creek
Bedford	II-N	Raystown Branch, Bobs Creek
Blair	II-N	Halter Creek
Centre	II-M	Elk Run Tributary
Clearfield	II-L	Gazzam Run, Watts Creek, Cambell Run
Crawford	III-Q	Mill Run, Little Sugar Creek, French Creek, Shirley Run
Elk	III-Q	West Branch of Clarion River
Erie	IV-X	Seven Mile Creek, Eight Mile Creek, Trout Run, Elk Creek
	III-Q	Beaver Run
Huntingdon	II-N	Aughwick Creek
Lawrence	III-W	Big Run
Mercer	III-W	Little Shenango River
Mifflin	II-N	Jacks Creek
Potter	II-L	Pine Creek
	Optioservus fastiditus (Le Conte)*	
Centre	II-M	Elk Run Tributary
Erie	IV-X	Conneauttee Creek
Potter	III-P	Allegheny River
	Optioservus ovalis (LeConte)	
Blair	II-N	Frankstown Branch, Halter Creek
Bucks	I-E	Lahaska Creek
Centre	II-N	Logan Branch of Spring Creek
	II-M	Elk Run Tributary
Crawford	III-Q	Woodcock Creek, Little Sugar Creek, Shirley Run, French Creek
Cumberland	II-O	Yellow Breeches Creek
Elk	III-Q	West Branch of the Clarion River
Erie	IV-X	Walnut Creek, Mill Creek, Twelve Mile Creek, Elk Creek, Raccoon Creek, Little Conneauttee Creek, Seven Mile Creek, Eight Mile Creek, Hare Creek, Beaver Run, Trout Run
Huntingdon	II-N	Spruce Creek
Lawrence	III-W	Big Run
Mercer	III-W	Little Shenango River
Mifflin	II-N	Jacks Creek, Kishacoquillas Creek
Northampton	I-D	Monocacy Creek

County	Drainage Basin	Site
Perry	II-O	Sherman Creek
Venango	III-Q	Sugar Creek
York	II-O	West Branch of Codorus Creek
	Optioservus trivittatus (Brown)	
Adams	II-O	Conewago Creek
Bedford	II-N	Raystown Branch, Dunning Creek, Yellow Creek
Berks	I-F	Tulpehocken Creek
Blair	II-N	Little Juniata River, Burgoon Run
Cameron	II-L	Sinnemahoning Creek
Centre	II-M	Elk Run Tributary
Clearfield	II-L	Chest Creek, Little Clearfield Creek, Gazzam Run
Columbia	II-M	Briar Creek
Crawford	III-Q	Little Sugar Creek, Sugar Creek, Muddy Creek, Woodcock Creek, French Creek
Cumberland	II-O	Yellow Breeches Creek, Big Spring Creek, Middle Spring Creek, Mountain Creek, Conodoquinet Creek
Dauphin	II-M	Powell Creek, Wisconisco Creek
	II-O	Manada Creek
Elk	III-Q	West Branch of the Clarion River
Erie	IV-X	Crooked Creek, Raccoon Creek, Walnut Creek
	III-Q	South Branch of French Creek, Hare Creek, Beaver Run
Forest	III-Q	Tionesta Creek
Huntingdon	II-N	Juniata River, Frankstown Branch, Aughwick Creek, Standing Stone Creek
Juniata	II-N	Juniata River, Manhantango Creek, Lost Creek, Tuscarora Creek
Lancaster	II-O	Chickies Creek, Conestoga Creek
Lebanon	II-N	Swatara Creek
	II-O	Little Swatara Creek
McKean	III-P	Potato Creek
Mercer	III-W	Little Shenango River
Mifflin	II-N	Juniata River, Jacks Creek, Kishacoquillas Creek
Montgomery	I-F	East Branch Perkiomen Creek, Perkiomen Creek
Montour	II-K	Susquehanna River
Northampton	I-D	Lehigh River
Northumberland	I-F	Mahanoy Creek
Perry	II-N	Juniata River, Cocolamus Creek
	II-O	Sherman Creek
Snyder	II-M	Middle Creek, Penns Creek
Union	II-M	Penns Creek
Venango	III-Q	Sugar Creek, Stewart Run
York	II-O	Little Conewago Creek, South Branch of Codorus Creek

County	Drainage Basin	Site
	Oulimnius latiusculus (LeConte)	
Crawford	III-Q	Woodcock Creek
Erie	IV-X	Six Mile Creek, Little Conneauttee Creek
McKean	III-Q	Chappel Fork
Perry	II-O	Sherman Creek
York	II-O	Muddy Creek
	Promoresia elegans (LeConte)*	
Cumberland	II-O	Conodoquinet Creek
Juniata	II-N	Lost Creek, Tuscarora Creek
Perry	II-O	Sherman Creek
Snyder	II-M	Middle Creek
Union	II-M	Penns Creek
York	II-O	Muddy Creek
	Promoresia tardella (Fall)*	
Adams	II-O	Conewago Creek
Snyder	II-M	Middle Creek
Venango	III-Q	Stewart Run
	Stenelmis bicarinata LeConte	
Montour	II-K	Susquehanna River
Northumberland	II-M	Susquehanna River
	Stenelmis concinna Sanderson*	
Adams	II-O or VI-Z	Penn. State University collection
Northumberland	II-M	West Branch of the Susquehanna River
Schuylkill	I-F or II-M	Penn. State University Collection
	Stenelmis crenata (Say)	
Adams	II-O	Conewago Creek, South Branch of the Conewago Creek
Bedford	II-N	Raystown Branch, Dunning Creek, Bobs Run, Yellow Creek
Berks	I-F	Cacoosing Creek, Tulpehocken Creek, Willow Creek
Blair	II-N	Frankstown Branch, Plum Creek
Bucks	I-E	Lahaska Creek
Centre	II-M	Sinking Creek
Chester	I-G	Taylor Run
Columbia	II-M	Briar Creek
Crawford	III-Q	French Creek, Woodcock Creek, Mill Run, Sugar Creek
Cumberland	II-O	Conodoquinet Creek, Yellow Breeches Creek, Susquehanna River
Dauphin	II-M	Powells Creek, Wisconisco Creek,
	II-O	Swatara Creek, Beaver Creek, Paxton Creek, Manada Creek

County	Drainage Basin	Site
Elk	III-Q	Clarion River
Erie	IV-X	Walnut Creek, Elk Creek, Mill Creek, Trout Run, Crooked Creek, Raccoon Creek, LeBeouf Creek, Four Mile Creek, Little Conneauttee Creek, Seven Mile Creek
	III-Q	French Creek, South Branch of French Creek, Hare Creek
Forest	III-Q	Tionesta Creek
Huntingdon	II-O	Juniata River, Little Juniata River, Spruce Creek
Juniata	II-N	Juniata River
	II-M	Manhantango Creek, Tuscarora Creek
Lancaster	II-O	Mill Creek, Conoy Creek, Conestoga Creek, Swarr Run, Octoraro Creek, Pequea Creek, Cocalico Creek, Chickies Creek, Little Conestoga Creek
Lawrence	III-W	North Fork Little Beaver Creek, Big Run
Lebanon	II-N	Swatara Creek
	II-O	Little Swatara Creek
McKean	III-P	Potato Creek, Kinzua Creek
Mercer	III-W	Black Run, Little Shenango River
Mifflin	II-N	Juniata River, Jacks Creek, Kishacoquillas Creek
Montour	II-K	Susquehanna River, Chillisquaque Creek
Northumberland	II-M	Buddys Run
	I-F	Mahanoy Creek
Perry	II-O	Sherman Creek, Juniata River
Snyder	II-M	Middle Creek, Penns Creek
Venango	III-Q	Sugar Creek, Lake Creek
Warren	III-Q	Brokenstraw Creek
York	II-O	West Branch Codorus Creek, Oil Creek, Codorus Creek

Stenelmis markeli Motschulsky

Adams	II-O or VI-Z	Penn. State University collection
Centre	II-L or II-M	Penn. State University collection
Crawford	III-Q	French Creek
Cumberland	II-O	Conodoquinet Creek
Dauphin	II-O	Susquehanna River
Mifflin	II-N	Juniata River
Perry	II-N	Juniata River
Schuylkill	I-F or II-M	Penn. State University collection

Stenelmis mera Sanderson

Adams	II-O or VI-Z	Penn. State University collection
Bedford	II-N	Raystown Branch
Crawford	III-Q	French Creek
Cumberland	II-O	Conodoquinet Creek
Dauphin	II-M or II-N	(Light trap)
Erie	IV-X	Seven Mile Creek, Elk Creek, Six Mile Creek
	III-Q	Hare Creek

County	Drainage Basin	Site
Juniata	II-N	Juniata River
Lancaster	II-O	Susquehanna River, Conestoga Creek
Mifflin	II-N	Juniata River, Jacks Creek
Montour	II-K	Susquehanna River
Northumberland	II-M	East Mahantango Creek
Perry	II-O	Juniata River, Sherman Creek
Venango	III-Q	Sugar Creek
York	II-O	Penn. State University collection
	Stenelmis musgravei Sanderson	
Adams	II-O or VI-Z	Penn. Sate University collection
Blair	II-N	Penn. State University collection
	Stenelmis quadrimaculata (Horn)	
Erie	IV-X	Penn. State University collection
	Stenelmis sandersoni Musgrave*	
Lancaster	II-O	Octoraro Creek
Perry	II-O	Sherman Creek
	Stenelmis vittipennis Zimmerman*	
Dauphin	II-M or II-N	(Light trap)
	Stenelmis sp. n*	
Bedford	II-N	Raystown Branch, Dunning Creek, Bobs Creek
Blair	II-N	Plum Creek
Centre	II-M	Penns Creek, Sinking Creek
Clearfield	II-L	Little Clearfield Creek, Gazzam Run
Columbia	II-M	Briar Creek
Crawford	III-Q	French Creek, Mill Run, Woodcock Creek
Cumberland	II-O	Yellow Breeches Creek, Conodoquinet Creek
Erie	IV-X	Walnut Creek
Forest	III-Q	Tionesta Creek
Huntingdon	II-N	Juniata River, Frankstown Branch, Aughwick Creek
Juniata	II-O	Juniata River, Mahantango Creek, Lost Creek
Lancaster	II-O	Mill Creek, Conoy Creek, Conestoga Creek, Octoraro Creek, Cocalico Creek, Chickies Creek, Little Connestaga Creek, Swarr Run, Pequea Creek
Lawrence	III-W	North Fork of Little Beaver Creek, Big Run, Hickory Creek
Lebanon	II-O	Little Swatara Creek
Mifflin	II-N	Juniata River, Jacks Creek, Kishacoquillas Creek
Montour	II-K	Susquehanna River
Perry	II-N	Juniata River, Cocolamus Creek
Snyder	II-M	Middle Creek

County	Drainage Basin	Site
Venango	III-Q	French Creek, Allegheny River, Oil Creek
Warren	III-Q	Brokenstraw Creek
York	II-O	Little Conewago, Conewago Creek, Oil Creek, Codorus Creek

RECORDS OF PENNSYLVANIA DRYOPIDAE:

Helichus basalis LeConte

Crawford	III-Q	Mill Run, French Creek, Woodcock Creek
Erie	IV-X	Raccoon Creek

Helichus fastigiatus (Say)*

Erie	IV-X	Raccoon Creek
	III-Q	French Creek

Helichus lithophilus (Germar)*

Blair	II-N	Penn. Sate University collection
Crawford	III-Q	Woodcock Creek, French Creek
Cumberland	II-O	Yellow Breeches Creek
Erie	III-Q	French Creek
Franklin	II-O	Penn. State University collection
Lawrence	III-Q	North Fork of the Little Beaver Creek
Montour	II-K	Susquehanna River

RECORDS OF PENNSYLVANIA PSEPHENIDAE:

Ectopria nervosa (Melsheimer)

Crawford	III-Q	Woodcock Creek
Elk	III-Q	West Branch of the Clarion River
Erie	IV-X	Crooked Creek, Elk Creek

Psephenus herricki (DeKay)

Bedford	II-N	Raystown Branch, Yellow Creek
Cameron	II-L	First Fork of Sinnemahoning Creek, Driftwood Branch of the Sinnemahoning Creek
Crawford	III-Q	Shirley Run, Woodcock Creek, French Creek, Muddy Creek
Erie	IV-X	Seven Mile Creek, Crooked Creek, Twelve Mile Creek, Raccoon Creek, Walnut Creek, Four Mile Creek, Elk Creek, Mill Creek, Little Conneauttee Creek, Sixteen Mile Creek, Six Mile Creek, Eight Mile Creek, Trout Run, Conneauttee Creek
	III-Q	Hare Creek
Forest	III-Q	Allegheny River
Huntingdon	II-N	Aughwick Creek, Standing Stone Creek
Juniata	II-N	Tuscarora Creek

County	Drainage Basin	Site
Mercer	III-W	Little Shenango River
Northampton	I-C or I-D	Penn. State University collection
Perry	II-N	Cocolamus Creek
Potter	II-L	Pine Creek
Snyder	II-M	Middle Creek
Venango	III-Q	Oil Creek
Warren	III-Q	Brokenstraw Creek

Dr. David S. White is currently revising the genus *Optioservus* and has indicated *O. ampliatus* is probably a synonym of *O. ovalis* (personal communication).

By including previously published records with this study, Pennsylvania's elmid, dryopid and psephenid fauna now numbers thirty-two species. Thirteen species in the genera *Dubiraphia, Optioservus, Promoresia, Stenelmis* and *Helichus* are reported from the state for the first time.

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NEW SPECIES OF CONEHEAD FROM FLORIDA EVERGLADES (ORTHOPTERA: TETTIGONIIDAE: *NEOCONOCEPHALUS)*[1]

T.J. Walker[2], J.J. Whitesell[3]

ABSTRACT: *Neoconocephalus pahayokee* n.sp. resembles *N. lyristes* (Rehn and Hebard) but has a longer cone. *N. lyristes* occurs on the upper Atlantic Coast and in the Midwest and is univoltine. *N. pahayokee* occurs in the Florida Everglades and is bivoltine.

DESCRIPTORS: *Neoconocephalus,* Copiphorinae, Tettigoniidae, disjunct distribution, voltinism

Rehn and Hebard (1915), in the most recent revision of U.S. *Neoconocephalus,* recognized 11 species. Two others have since been added (Walker, Whitesell, and Alexander 1973; Walker and Whitesell 1978). Here we recognize yet another, a previously undescribed species that has been confused with *N. lyristes* (Rehn and Hebard), which in turn has been confused with *N. nebrascensis* (Bruner). The significant history of this compound confusion involves only four publications, discussed in the following four paragraphs.

Rehn and Hebard (1905) described *lyristes* from a single male that they believed had been collected at Chokoloskee, Florida, on the western edge of the Everglades.

Rehn and Hebard (1915) reported numerous additional specimens of *lyristes* from the upper Atlantic Coast (Long Island to southern New Jersey) and none from elsewhere. They noted that the dealer from whom they had purchased the original specimen of *lyristes* had proved "unreliable" and concluded (p. 384) that the type locality of *lyristes* "is extremely questionable, the type having been taken very possibly in the vicinity of New York City and incorrectly labelled."

Blatchley (1920) restored the probable type locality of *lyristes* to south Florida by means of a specimen from Palm Beach. This specimen resembled the type and New Jersey specimens but had (p. 519) "a slightly longer and more slender fastigium." Since Blatchley could not distinguish specimens of *lyristes* from these of the midwestern species *N. nebrascensis* (Bruner), he

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concluded that *lyristes* was but an eastern and southern subspecies of *nebrascensis.*

Thomas (1933) distinguished *lyristes* from *nebrascensis* by habitat, song, and morphology, and reported both in Ohio.

Subsequent authors have confirmed that *lyristes* is distinct from *nebrascensis* (e.g. Alexander, Pace, and Otte 1972), but none has dealt further with the type locality of *lyristes* or with the relationship between the south Florida and the northern U.S. populations of *lyristes*-like coneheads.

Methods

Each month from Sept. 1969 through March 1972, one or both of us traveled to south Florida to obtain specimens, tape recordings, and listening records of crickets and katydids–except Oct. and Dec. 1969, Feb. 1970, and Feb. 1972. We examined specimens of coneheads in the following collections: Florida State Collection of Arthropods, Gainesville (FSCA), University of Michigan Museum of Zoology, Ann Arbor (UMMZ), Academy of Natural Sciences of Philadelphia, and United States National Museum of Natural History, Washington.

Tape recordings were analyzed with an audiospectrograph. Stridulatory areas were removed, glued file-side-up near the end of the left tegmen and examined with a microscope.

Results

Because of morphological and ecological differences, we conclude that south Florida *"lyristes"* is specifically distinct from the upper Atlantic Coast *lyristes* and Midwestern *lyristes*. Because of the similarity of the latter two, we conclude they are conspecific. Morphologically the holotype of *lyristes* belongs to the upper Atlantic Coast populations. We propose that the type locality be fixed as New York City, agreeing with Rehn and Hebard's (1915) contention that the holotype may have come from that vicinity. The northern populations are thus appropriately called *N. lyristes,* and the south Florida populations belong to a species here described as *pahayokee* (the Seminole Indian name for everglades).

Neoconocephalus pahayokee, n.sp.

Everglades Conehead

Diagnosis. Compared with its closest relative, *lyristes,* this species is larger and has a longer cone (Table 1). It is bivoltine and occurs only in subtropical Florida.

Holotype. Male, Florida, Broward Co., jct. U.S. 27 and S.R. 820, 14 Sept. 1968, J.J. Whitesell.

Green except for brown tarsi and hind tibiae, pale yellow lines at lateral edges of pronotal disc and of cone, and black beneath cone. Cone as in Fig. 4 and 5; side of pronotum as in Fig. 9. Specimen is deposited in Academy of Natural Sciences of Philadelphia.

Allotype. Female, same site and deposition as holotype, 15 June 1969, J.J. Whitesell. Similar to holotype except cone slightly curved upward. Ovipositor slightly curved downward.

Measurements (mm). Total length, tip of cone to tip of tegmina, holotype, 59 (range for 31 male paratypes, 54-60), allotype, 67 (female paratype, 65); length of cone, measured as in Fig. 4, 3.6 (3.0-3.5), 4.3 (4.2); medial length of pronotum, 8.5 (7.5-8.4), 7.7 (7.5); length of tegmina, 46 (41-46), 52 (51); length of hind femur, 26 (21-26), 27 (27); length of ovipositor, 32 (29).

Paratypes: 31 ♂ (20 green; 11 brown) 1 ♀ (green); specimens in FSCA unless otherwise indicated. Florida. Broward Co., Fort Lauderdale, 4 Sep. 1925, T.H. Hubbell, 1 ♂ (UMMZ); Fla. Hwy 84, 6.5 mi e. of Andytown, 25 May 1968, TJW, D.L. Mays, JJW, 2 ♂; U.S. Hwy 27 and Fla. Hwy 820, 10 Sep 1969, TJW, JJW, 3 ♂; 10 Oct 1969, JJW, 5 ♂. Dade Co., Everglades Nat. Pk., Fla. Hwy 27, 20 June 1964, TJW, R.E. Love, K.J. Stone, 2 ♂; 21 June 1964, TJW, REL, 3 ♂; 20 mi w. ject. 41, 27, 31 May 1964, Alexander and Hull, 1 ♂, taped RDA 64(23)3, RDA 64(240) (UMMZ); Miami, 23 Apr. 1938, J.W. Cadbury, 1 ♀; 3 mi s. Frog City, Fla. Hwy 27, 23 May 1970, JJW, 7 ♂; 12 July 1970, JJW, 2 ♂; Homestead, 10 Oct. 1970, 1 ♂; jct. U.S. 41, Fla. 27, 23 Apr. 1971, JJW, 1 ♂; 22 Oct. 1971, JJW, 1 ♂. Charlotte Co., 9 May 1957, R.D. Alexander, 2 ♂ (UMMZ).

Geographical distribution. The general distributions of *pahayokee, lyristes,* and *nebrascensis* are shown in Fig. 1. Specific localities for *pahayokee,* other than the ones listed above, are Monroe Co., Fla. Hwy. 94 (TJW listening record), Martin Co., Jonathan Dickinson State Park (Univ. Fla. Tape 188-3), and Palm Beach Co., U.S. Hwy 441 (UFT 188-4). Blatchley's (1920, p. 519) record of a female *"lyristes"* from Palm Beach is also this species.

The Atlantic Coast – Midwest disjunction evident in *lyristes* distribution occurs in other animals and is thought to reflect a migration route via the Hudson and Mohawk Valleys that opened for grass-inhabiting species during a postglacial warm period (Thomas 1933), Gene flow between the two areas now occupied by *lyristes* must be nearly nil, but specimens from the two areas are sometimes indistinguishable.

Habitat and seasonal cycle. The principal habitat of *pahayokee* is the sawgrass (*Cladium jamaicense* Crantz) that dominates the Florida Everglades. Nearly all specimens were collected by homing on their songs. Some were on tall sawgrass emergent from at least two feet of water; others were on new growth in recently burned, still-dry areas. Occasionally males were heard away from sawgrass – e.g. beneath a streetlight in Homestead and 10 m up a

Caribbean pine in Joanthan Dickinson State Park.

N. pahayokee is apparently bivoltine with a spring generation of adults peaking in May-June and a fall generation in Sept.-Oct. The earliest and latest records for the spring generation are 23 Apr. and 12 July; for the fall generation, 4 Sep. and 22 Oct. Since we made monthly field trips to south Florida for more than two years, the lack of records of adults during winter and mid summer is noteworthy and not an artifact of sporadic sampling. *N. lyristes* is univoltine with adults occurring from early August until mid October.

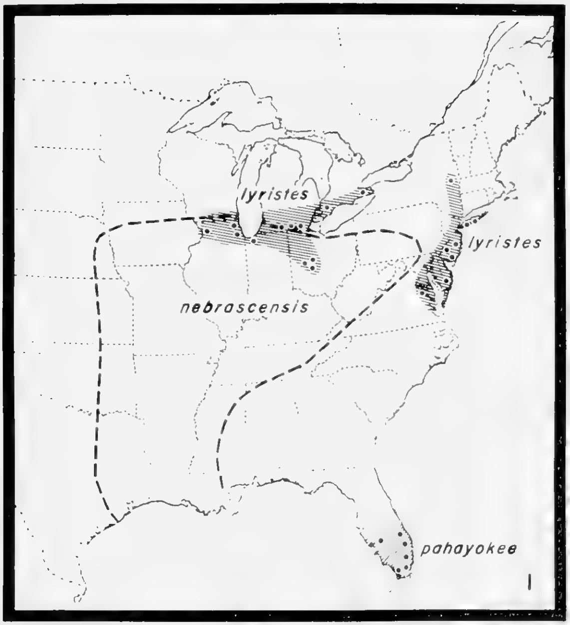
Brown-green color dimorphism in *pahayokee* differed in the two generations. Of 22 males captured or seen in the spring generation, 19 were green and 3 were brown; of 18 in the fall, 6 were green and 12 were brown. The spring generation had a significantly higher proportion of the green morph than did the fall generation (chi square; $P < 0.001$). Brown-green/dimorphism may be maintained by apostatic selection (Allen and Clark 1968). The differences in proportion of brown and green between generations may be triggered by photoperiod (Dolling 1973, Whitesell 1974) and result in the more cryptic form being prevalent each generation – the green form when the grass is young and green and the brown form when the grass is old and browning.

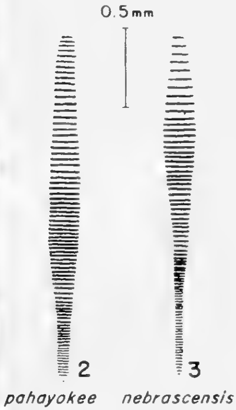
Song. The calling songs of *pahayokee* and *lyristes* are high-pitched, smooth, continuous buzzes. Those of *pahayokee* average aboue 155 pulses per second at 23°C with a dominant frequency of 10-11 kHz (n=9). Alexander (1956) found the song of an Ohio specimen of *lyristes* at 23°C to be 130 per second and 7.5 kHz. No tape recordings of eastern *lyristes* were available for analysis.

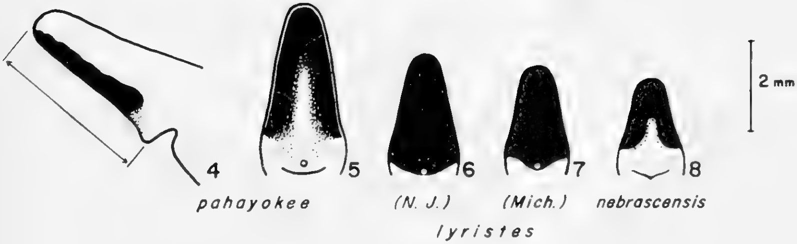
Morphology. Measurements of *pahayokee* and *lyristes* are summarized in Table 1. The shortest cone among males of *pahayokee* (n=32) was 3.0 mm; the longest among males of *lyristes* (n=15, N.J.) was 2.8 mm. Corresponding values for females (n=2 and 3) were 4.2 and 3.3 mm.

N. pahayokee (Fig. 9) and *lyristes* are similar in the shape and depth of the tegminal sinus of the pronotum but different from *nebrascensis* (Fig. 10).

The stridulatory files of *pahayokee* (n=3), *lyristes* (n=2, N.J.) and *nebrascensis* (n=5, Ind., Miss., Tenn., Pa.) cannot be distinguished by number of teeth or length: 84-92 teeth in 2.22-2.34 mm; 85 and 89 teeth in 2.28 and 2.34 mm; 81-89 teeth in 2.10-2.26 mm respectively. However, the spacing of the first 10-15 teeth at the lateral end of the stridulatory file is conspicuously wider than of subsequent teeth in *nebrascensis* (Fig. 3) but not in *pahayokee* (Fig. 2) or *lyristes.*







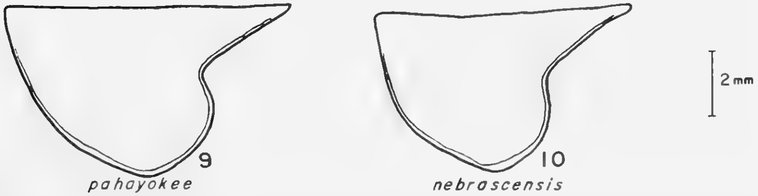


Fig. 1. Distribution of three species of *Neoconocephalus.* Shaded areas represent predicted general distribution and dots represent county records for *N. lyristes* and *N. pahayokee.* Dashed line encloses all records for *N. nebrascensis.* Fig. 2-3. Ventral views of stridulatory files of males (lateral ends above, mesal ends below). Fig. 4-8. Cones. Fig. 4. Method of measuring length, lateral view. Fig. 5-8. Ventral views. Fig. 9-10. Left lateral views of pronotums. Fig. 4, 5, 9. Holotype of *N. pahayokee.*

Table 1. Lengths in mm of selected structures of *N. pahayokee* and *lyristes.*

Species (locality)	n	Cone $\bar{x} \pm SD$	Tegmen $\bar{x} \pm SD$	Hind Femur $\bar{x} \pm SD$	Ovipositor range
pahayokee (Florida)					
males	10	3.2 ± 0.2	44 ± 2	25 ± 1	
females	2	4.2	52	27	29-32
lyristes (Upper Atlantic Coast)					
holotype (N.Y.?)	1	2.5	40	21	
males (N.J.)	10	2.5 ± 0.3	41 ± 3	22 ± 1	
females (N.J.)	3	3.3	47	24	26-29
lyristes (Ind. Mich.)					
males	10	2.1 ± 0.3	36 ± 2	20 ± 1	

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NEW SPECIES AND NEW SUBGENUS OF *BOMBYLIUS* (DIPTERA: BOMBYLIIDAE)[1]

Neal L. Evenhuis[2]

ABSTRACT: Two new species, *Bombylius curtirhynchus* and *B. painteri,* and two new subspecies, *Bombylius albicapillus washingtoniensis* and *B. lancifer xanthothrix,* are described and illustrated. In addition, a new subgenus, *Bombylius (Zephyrectes)* is described to include *Bombylius anthophoroides* Evenhuis and *B. montanus* Johnson and Johnson.

DESCRIPTORS: Diptera; Bombyliidae; *Bombylius curtirhynchus,* n. sp.; *Bombylius painteri,* n. sp.; *Bombylius albicapillus washingtoniensis,* n. ssp.; *Bombylius lancifer xanthothrix,* n. ssp.; *Bombylius (Zephyrectes),* n. subg.; *Bombylius (Zephyrectes) anthophoroides* Evenhuis, n. comb.; *Bombylius (Zephyrectes) montanus* Johnson and Johnson, n. comb.

Upon examination of numerous specimens of *Bombylius anthophoroides* Evenhuis and *B. montanus* Johnson and Johnson and comparing them with other species of *Bombylius,* it was found that these two represent a separate group of species with shared characters that warrant at least subgeneric, if not generic, status. A description of the new subgenus follows below. Also, at this time, I have taken the opportunity to describe two species and two subspecies of *Bombylius* new to science. These descriptions are presented here to facilitate forthcoming publications of western U.S. Bombyliidae.

Zephyrectes, new subgenus

Male. Length 10mm. Frons grey to brown, predominantly white pilose, some black hair may be present; genae, face, and oral margin light tan, white pilose; argentous tufts of recumbent pile lateral to antennal bases; gula white to grey, white pilose; occiput grey to tan, white pilose; antennal segments black, white hair and scales on segments I and II, segment III bare. Scutum and scutellum grey-brown, pale yellow pilose; pleura grey, white pilose; halter yellow. Legs orange, white hair and scales basally on coxae and femora. Wing tinted brown basally, rest of wing hyaline; squama grey to brown, fringe white. Abdomen grey-brown, white pile on basal tergites becoming denser on segments IV-VII; sternites brown, white pilose; black hair on posterior margin of apical sternites. Genitalia (Fig. 1) with basistylus three times as long as wide in lateral view, tapering apically; dististylus long, thin, with short apical hook; neck of epiphallus extremely long, thin, tapering sharply to tip of aedeagus; epiphallus with prominent bulb-like process dorsally; epandrium subquadrate, with prominent, darkly sclerotized posterior process.

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Female. Similar to male except frons and vertex grey to black, wing hyaline throughout, abdominal tergites pale yellow pilose with definite crossbands of black hair and white to pale yellow tomentum.

Genotype, Bombylius montanus Johnson and Johnson.

Species of *Bombylius (Zephyrectes)* are closest in appearance to the Palearctic *B. cruciatus* Fabricius and its relatives, and can be separated from these and other species of *Bombylius* sensu stricto by the tan to yellowish face, frons, and genae, the white scales on the second and sometimes third segments of the antennae, the predominant white pile on all parts of the body, being most dense on abdominal segments IV-VII of the male, the prominent posterior process of the epandrium, the conspicuous bulb-like process on the dorsal edge of the epiphallus, and the long neck of the epiphallus leading to the tip of the aedeagus.

In addition to the above characters, dissections of *anthophoroides* and *montanus* show yet another shared character which strongly suggests possible generic status for these species. Cross-sectioning of the thorax reveals the number of muscle bundles in the dorsal longitudinal flight muscle to be from 10-12 in both *anthophoroides* and *montanus.* When cross-sectioning numerous other species of *Bombylius,* it is found that the number of muscle bundles range only from 4-5. Tiegs (1955) implies that the increasing number of muscle bundles correspond to the increasing strength of flight of that insect. My studies confirm this and also show that the number of muscle bundles appears to be fairly consistent within species of a genus (e.g., *Mythicomyia* – 3; *Anthrax* – 7-8; *Poecilanthrax* – 5-6). Because of this latter fact, and noting that species of *Zephyrectes* consistently have more than twice the number of muscle bundles than species of *Bombylius* sensu stricto strongly suggests that *Zephyrectes* could be separate genus. I hesitate to raise *Zephyrectes* to generic status, though, until more studies are done on species of *Bombylius* from other zoogeographical areas and compared with *Zephyrectes* so as to clarify its position within the subfamily Bombyliinae and its relation to *Bombylius* sensu stricto.

Bombylius (Zephyrectes) anthophoroides Evenhuis

Bombylius anthophoroides Evenhuis, 1977: 124.

Material of this species was examined from Riverside, San Luis Obispo, and Ventura Counties, California. Cross-sectioning of the thorax show the number of muscle bundles in the dorsal longitudinal flight muscle to be 11-12.

Bombylius (Zephyrectes) montanus Johnson and Johnson

Bombylius montanus Johnson and Johnson, 1975: 413.

The original description records specimens of this species from Idaho and Utah. Since then, specimens of this species have been collected from the following counties in California: Kern, Lassen, Los Angeles, Orange, and Riverside. Cross-sectioning of the thorax show the number of muscle bundles of the dorsal longitudinal flight muscle to be 10-12.

Bombylius curtirhynchus, n. sp.

Male. Length 6mm. Frons black, and gula light brown; face and oral margin pale yellow to white pilose; gena silver recumbent tomentose above and lateral to antennal bases; face, oral margin, gena with black hair; gula white pilose; ocellar tubercle black with black hair; occiput cretaceous, white pilose, pale yellow pile laterally as continuation of pleural stripe of throax; antennae black, segments I and II with black hair, segment III bare; style with segment I black, segment II brown. Scutum and scutellum dull black, pale yellow to white pilose on scutum; tufts of black hair anteriorly on scutum behind occiput and laterally above wings; short black hair intermixed with pale yellow pile on notal disc; pleura grey-black, pale yellow pilose; pleural stripe with black hair; scutellum with intermixed pale yellow and white recumbent pile, long black hair on posterior margin; halter stem brown, knob yellow. Legs brown; coxae and femora white pilose basally, femora with white scales; claws black. Wing (Fig. 3) infuscated brown basally, extending to end of R_2+_3; basal halves of anal and axillary cells infuscated; spots present on anterior and posterior crossveins, base of R_4, junction of M_1 and R_5, and bases of first and second posterior cells; squama brown, fringe yellow. Abdomen black, pale yellow pilose; lateral tufts of black hair on tergites II-IV, white hair laterally on tergites V-VII; black hair on posterior margins of tergites II-VII; middorsal stripe of white tomentum on tergites II-VII; sternites brown, white pilose on posterior margins of sternites. Genitalia (Fig. 2) with basistylus linear-ovate; dististylus short, tapering sharply toward apex; aeadeagus with rounded beak-like process; epiphallus with long tapering neck; epandrium rhomboid with weak posterior process; anterior process moderately pronounced.

Female. Similar to male except frons and vertex light brown, vertex with sparse golden tomentum and black hair; oral margin with mixed black and white pile, sparser than in males; thorax with reduced middorsal stripe; golden tomentose on scutum.

Holotype male and **allotype** female from Devore, San Bernardino Co., Calif., III-30-75 (N. Evenhuis), both in California Academy of Sciences.

Paratypes. California. Los Angeles Co.: 1♂, Cal Poly Pomona Campus, III-20-73 (N. Evenhuis). Riverside Co.: 3♀, Univ. Calif. Riverside Campus, in hills, IV-3-75 (N. Evenhuis); 1♂, Hwy. 74, 11.5 mi. S. Palm Desert, Deep Cyn., III-21-75 (N. Evenhuis). San Benito Co.: 2♀, Pinnacles Nat. Mon., III-27-64 (W. Turner). San Bernardino Co.: 12♂♀, Devore, III-24-75, III-30-75, IV-3-75, IV-12-75 (N. Evenhuis). Shasta Co.: 1♀, Redding, IV-5-66 (B.A. Freeman).

Numerous specimens were examined from the following counties in California: Calaveras, Kern, Lake, Los Angeles, Monterey, Napa, Riverside, San Benito, San Bernardino, Shasta, Solano, Sonoma, Tulare.

This species is separated from its congeners by its short proboscis (less than 3mm), the spotting and infuscation of the wing, the prominent middorsal stripe of the abdomen extending onto the thorax, and the genitalic characters.

Bombylius painteri, n. sp.

Female. Length 10mm. Head black; frons white tomentose above and lateral to antennal bases; vertex short recumbent golden pilose; face black pilose; oral margin white pilose, antennae black, segment I mixed black and white pilose, segments II and III bare; stylar segments brown; occiput pale yellow pilose; gula grey, white pilose. Scutum and scutellum black, pale yellow to yellow pilose, sparse black hair intermixed on scutum; tuft of black hair middorsally on anterior portion of mesoscutum; pleura black, yellow pilose above, white pilose below; pleural stripe of thorax with a few black hairs; scutellum with long black hair on posterior margin; halter stem orange, knob brown. Coxae black, intermixed white and black pilose; femora black basally, orange-yellow apically, with white scales, fine black hair ventrally; tibiae and tarsi orange with white scales. Wing (Fig. 4) infuscated light brown at extreme base; spots present on anterior and posterior crossveins; squama brown, pale yellow fringe. Abdominal tergites black, pale yellow pile overlying shorter recumbent pale yellow hair; sparse black hair on posterior margins; sternites brown, white pilose.

Male. Unknown.

Holotype female and **paratype** female from 30mi. NW Laredo, Webb Co., Texas, III-4-72 (M.W. McFadden), both at Washington State University.

This species is closest in appearance to *Bombylius duncani* Painter and can be separated from it by the tuft of black hair anteriorly on the mesoscutum, the light infuscation of the wing and the absence of strong black tufts of hair laterally on the abdominal tergites.

Bombylius albicapillus washingtoniensis, n. ssp.

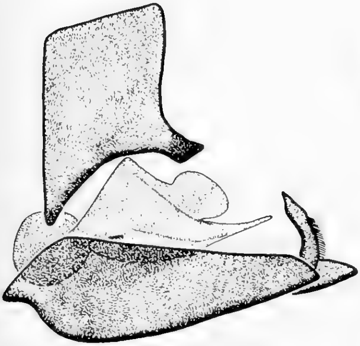
Female. Length 12mm. Frons and vertex brown; frons white pilose, a few erect black hairs along eye margin; vertex with sparse short black pile; face grey-black, black pilose, yellow recumbent pile lateral to antennal bases; occiput and gula grey; occiput dense pale yellow pilose; gula with white hair; oral margin brown, white pilose; antennae grey-black, segments I and II with pile as long as segment I, segment III bare; stylar segments brown. Scutum and scutellum black, pale yellow pilose with longer pale yellow pile on posterior margin of scutellum; pleura grey above, tan-grey below, pale yellow pilose; pleural stripe of thorax with few black hairs restricted to pteropleurn, otherwise dense yellow pilose; middorsal stripe of short white tomentum anterior to scutellum; halter stem orange, knob yellow. Coxae and base of femora grey-black; white pilose on coxa and basally on femora; femora orange-yellow with white scales; tibiae and tarsi orange yellow. Wing (Fig. 5) infuscated brown basally, extending almost to end of R_2+_3 and r-m crossvein; axillary cell infuscated; spots present on anterior and posterior crossveins, distal end of discal cell, base of second posterior cell, distal end of R_2+_3, base of R_4, and apex of first posterior cell; squama brown, fringe pale yellow. Abdominal tergites dull black, dense yellow pilose with sparse black hairs on posterior margin of tergites II-VII; sternites brown, white pilose.

Male. Unknown.

Holotype female from Pullman, Washington, V-23-69 (R.W. Dawson), at Washington State University.

Paratypes. Washington. 1♀, topotypic, collected with the type; 1♀, 10mi. W. Chenalis, VII-61 (C.A. Johansen).

This subspecies can be separated from the nominate subspecies by the white pile of the oral margin, the lack of dense tufts of black hair laterally on abdominal tergites II-IV, and the generally lighter pile of the thorax and abdomen.



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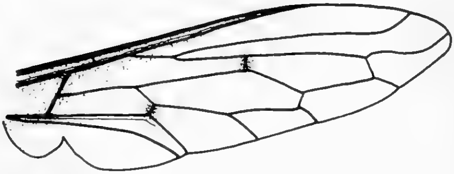

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Fig. 1. *Bombylius (Zephyrectes)anthophoroides;* male genitalia, lateral view.

Figs. 2-3. *Bombylius curtirhynchus,* new species. Fig. 2. Male genitalia, lateral view. Fig. 3. Right wing of male paratype.

Fig. 4. *Bombylius painteri,* new species; right wing of female holotype.

Fig. 5. *Bombylius albicapillus washingtoniensis,* new subspecies; right wing of female holotype.

Bombylius lancifer xanthothrix, n. ssp.

Male. Length 10-12mm. Frons brown, rest of head black; black pile on frons, face, genae, vertex, oral margin, and ocellar tubercle; occiput with yellow pile; gula grey-black, white pilose; antennae black, black hair on segments I and II, segment III and stylar segments bare. Thorax black, dense yellow pilose throughout; pleural stripe absent; halter yellow. Coxae grey, yellow pilose; femora orange, black ventrally, white pilose; tibiae and tarsi orange to brown. Wing infuscated light brown basally, extending to r-m crossvein; rest of wing hyaline; squama brown, fringe yellow. Abdomen black; tergites yellow pilose, sparse black hairs present on posterior margins; sternites white pilose on all segments. Genitalia not dissected.

Female. Hardly distinguishable from male except for dichoptism and sparse golden hairs mixed with black hairs on frons.

Holotype male and **allotype** female from Fields' Spr. St. Park., Asotin Co., Wash., VI-6-7-71 (M. Wiebers, D.N. Ferro), both at Washington State University.

Paratype male from 6mi. N. Moscow, Latah Co., Idaho, IV-21-71 (M. Mehary).

Specimens of *xanthothrix* can easily be separated from the nominate subspecies and its congeners by the striking yellow pile of the body and the absence of black crossbands on the abdominal tergites that are so conspicuous in *lancifer lancifer.*

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THE INTERNATIONAL CODE OF ZOOLOGICAL NOMENCLATURE

The draft third edition of the International Code of Zoological Nomenclature is now available for comment by zoologists. Copies may be obtained (price £2.50 surface mail, £4.00 air mail) from the Publications Officer, International Trust for Zoological Nomenclature, c/o British Museum (Natural History), Cromwell Road, London SW7 5 BD, U.K. Comments should be sent as soon as possible, and in any case before 30 November 1978, to the Secretary, International Commission on Zoological Nomenclature, at the above address.

A paper explaining the major changes proposed by the Commission's Editorial Committee to the existing Code has been published in the *Bulletin of Zoological Nomenclature,* vol. 34, part 3. Copies may be obtained (price 50p) from the same address as copies of the draft Code.

NEW TROGLOBITE SCORPION OF GENUS *DIPLOCENTRUS* (SCORPIONIDA: DIPLOCENTRIDAE)[1]

Oscar F. Francke[2]

ABSTRACT: *Diplocentrus cueva,* a new species of troglobitic scorpion from Cueva Desapareciendo, near Acatlan, Estado de Oaxaca, Mexico, is described and illustrated. Regressive evolution in troglobitic scorpions of the genus *Diplocentrus* is briefly discussed.

DESCRIPTORS: *Diplocentrus cueva,* new species, scorpion, troglobite, cave, speleobiology, regressive evolution.

Recently I revised the scorpions of the genus *Diplocentrus* Peters, from the state of Oaxaca, Mexico (Francke, 1977 a). In that contribution eight species and one subspecies were recognized, and I postulated that with this species diversity the state of Oaxaca might represent the center of distribution (Darlington, 1957) of the genus *Diplocentrus.* The new species described below tends to further support this by increasing the diversity (in terms of species numbers) known from that area.

In this contribution I describe the sixth, and largest troglobitic scorpion known, and the third one belonging to the family Diplocentridae. The description is followed by some remarks on regressive evolution in cave-dwelling scorpions.

Diplocentrus cueva, new species

Figures 1-12

Type data.–Holotype, adult male, from Cueva Desapareciendo, 2 km W. Acatlan, Oaxaca, Mexico, 5 January 1976 (A. Grubbs). Permanently deposited in the collection of the American Museum of Natural History, New York.

Etymology.–Specific name based on the Spanish word for cave.

Distribution.–Known only from the type locality.

Diagnosis.–Troglobite, adult male 80.4 mm long. Ochreous to testaceous throughout. Carapace subpentagonal with deep anteromedian notch; median eyes and ocular tubercle reduced. Tergite VII vestigially tetracarinate, sternite VII vestigially bicarinate. Pectinal tooth count 14-15. Metasoma attenuated, segment IV longer than carapace; strongly compressed dorsoventrally. Cheliceral fixed finger shorter than chela width; movable finger shorter than chela length, with superior distal tine closely apposed to inferior distal tine. Pedipalp: orthobothriotaxia "C"; femur wider than deep; chela moderately to strongly carinate, fixed finger shallowly arcuate. Legs attenuated, femur IV longer than

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carapace; tarsomere II spine formula 4/5:5/5:5/6:5/6.

Description.–Based on male (female unknown), measurements of holotype in Table 1.

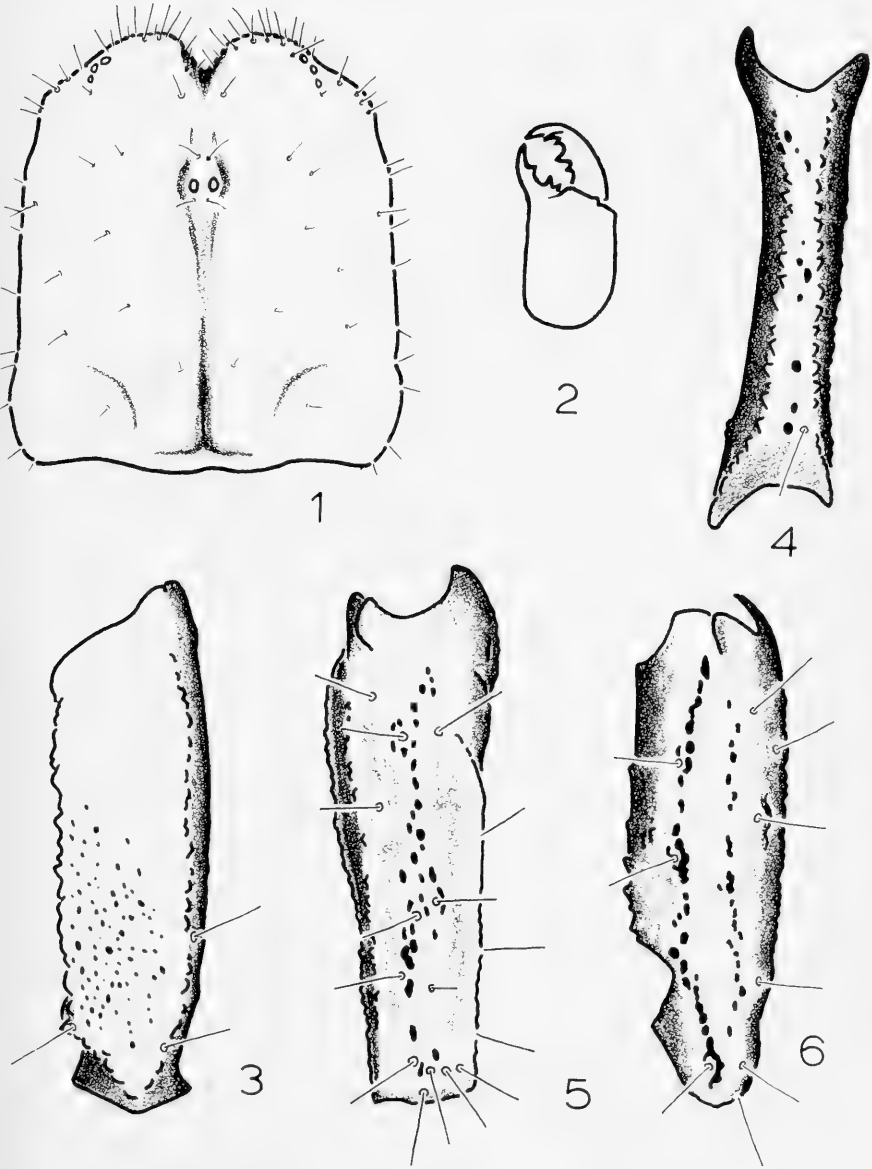
Prosoma. Carapace rather flattened dorsoventrally, accounting for its unusual shape (Fig. 1): testaceous, shagreened, anterior margin moderately setate, lateral margins sparsely setate, posterior margin bare; longer than wide, subpentagonal with deep anteromedian notch; posteromedian, posteromarginal, and posterolateral furrows moderate to deep; three pairs of lateral eyes, subequal in size; median eyes slightly larger than lateral eyes, located at anterior 0.35 of carapace length, ocular tubercle small. Venter: gnathobase I brunneous, gnathobase II and leg coxae ochreous fuscescent; smooth, lustrous, moderately setate. Sternum: ochreous fuscescent; moderately setate; pentagonal, 1.2 times longer than wide, with posteromedian furrow very deep.

Mesosoma. Tergites: testaceous, shagreened, bare; VII vestigially tetracarinate with submedian and lateral keels represented by sparse small granules on distal one-half. Genital operculum: ochreous, moderately setate; genital papillae present. Pectines: basal piece brunneous, moderately setate, two times wider than long with moderately deep anteromedian notch; marginal lamellae, middle lamellae, and fulcra ochreous, moderately setate; teeth with shaft ochreous and sensory area leucous, four times longer than wide with sensory area covering distal 75% of ventral aspect. Sternites III-VI: brunneous, smooth, lustrous, discs sparsely setate, lateral and posterior margins moderately setate; stigmata about three times longer than wide. Sternite VII: brunneous; submedian carinae obsolete, lateral carinae vestigial and smooth; median and submedian intercarinae lustrous, lateral intercarinae shagreened.

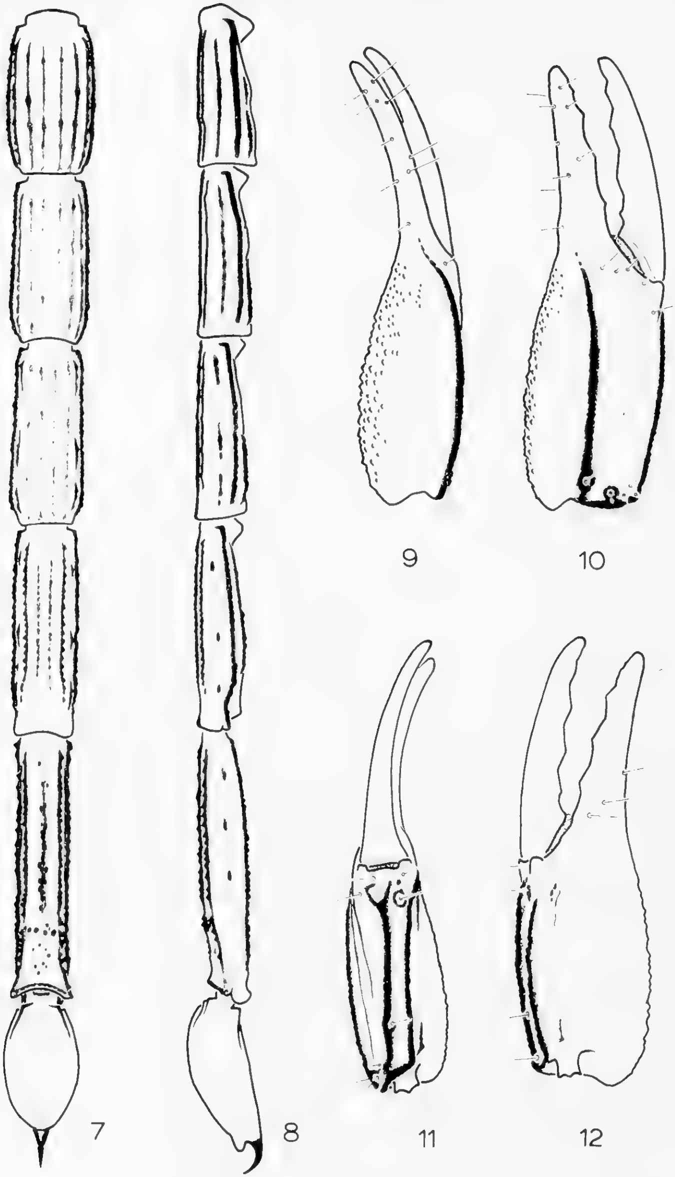
Metasoma. Preanal segments very elongate, compressed dorsoventrally (Figs. 7 and 8): brunneous to testaceous; segments I-IV sparsely setate, V and telson moderately setate. Dorsal submedian carinae absent. Dorsal lateral carinae: on I present on distal one-third, weak, granulose; II-III present on distal one-half, weak, granulose; IV present on distal one-half, moderate, granulose. Lateral supramedian carinae on I-IV moderately strong, granulose. Lateral inframedian carinae: on I complete, weak to moderate, granulose; II complete, weak, granulose; III present on proximal one-fourth and on distal one-half, weak, vestigially granulose; IV vestigial to obsolete. Ventral lateral carinae: on I weak, vestigially granulose; II weak to vestigial, sparsely granulose; III weak, sparsely to moderately granulose; IV weak to moderate, densely granulose. Ventral submedian carinae: on I-II vestigial to obsolete, smooth; III vestigial, sparsely granulose; IV weak to vestigial, moderately granulose. Segment V: dorsal lateral carinae moderately strong, densely granulose; lateral median carinae obsolete to vestigial; ventral lateral, ventral median, and ventral transverse carinae moderately strong, moderately granulose; anal subterminal keel moderate and granulose, anal terminal keel vestigial to obsolete and smooth. Metasomal intercarinae flat (including dorsals), smooth, lustrous. Telson: smooth, lustrous; subaculear tubercle well developed; aculeus short, moderately and evenly arcuate.

Chelicera. Chela ochreous, fingers brunneous; standard generic dentition (Fig. 2); fixed finger shorter than chela width; movable finger shorter than chela length, distal superior tine closely apposed to distal inferior tine.

Pedipalp. Testaceous, orthobothriotaxia "C". Femur (Figs. 3 and 4): quadrate in cross-section, two times wider than deep; dorsal internal and ventral internal carinae strong, granulose; dorsal external carina strong basally and moderate to weak distally, granulose; external median keel weak to moderate, vestigially granulose; ventral external keel weak to moderate, granulose; femoral faces shagreened to minutely granulose, sparsely setate. Tibia (Figs. 5 and 6): dorsal internal carina represented by three to five strong granules basally, obsolete distally; dorsal median carina moderate to strong,



Figures 1-6.—Holotype male of *Diplocentrus cueva*, a new species of troglobite scorpion from Oaxaca, Mexico: 1, dorsal aspect of carapace; 2, dorsal aspect of chelicera; 3, dorsal aspect of pedipalp femur; 4, internal aspect of pedipalp femur; 5, external aspect of pedipalp tibia; 6, dorsal aspect of pedipalp tibia.



Figures 7-12.–Holotype male of *Diplocentrus cueva,* new species of troglobite scorpion from Oaxaca, Mexico: 7, ventral aspect of metasoma; 8, lateral aspect of metasoma; 9, dorsal aspect of pedipalp chela; 10, external aspect of pedipalp chela; 11, ventral aspect of pedipalp chela; 12, internal aspect of pedipalp chela.

coarsely granulose; dorsal external carina weak, granulose; external median carina moderately strong, subgranulose; ventral external carina moderate to strong, subgranulose; ventral median carina vestigial, minutely granulose; ventral internal carina strong, coarsely granulose; tibial faces shagreened to densely and minutely granulose, bare to sparsely setate. Chela (Figs. 9-12): dorsal margin carinate, densely granulose; digital keel very strong, subgranose; dorsal secondary keel obsolete; external keel vestigial, smooth; ventral external keel obsolete basally, vestigial and smooth distally; ventral median and ventral internal carinae strong, subgranose to granulose; internal carinae obsolete; chelal faces vestigially reticulate, dorsal face bare, external and ventral faces sparsely setate, internal face moderately to densely setate. Fingers: shallowly arcuate, moderately to densely setate; dentate margins broadly subserrate, when closed leaving a narrow gap between them.

Legs. Attenuated; ochreous fuscescent, smooth, sparsely setate. Prolateral pedal spurs moderately developed on all legs. Tarsomere II spines 4/5 4/5:5/5 5/5:5/6 5/6:5/6 5/*.

Table 1.—Measurements (in millimeters) of *Diplocentrus cueva*, new species from Cueva Desapareciendo, Estado de Oaxaca, Mexico.

	HOLOTYPE MALE
Total length	80.40
Carapace Length	8.80
Anterior width/median width/posterior width	4.00/7.00/7.80
Mesosoma length	21.40
Metasoma length	50.20
Segment I length/width/depth	6.60/3.80/2.50
Segment II length/width/depth	7.30/3.40/2.40
Segment III length/width/depth	7.90/3.10/2.30
Segment IV length/width/depth	8.90/2.80/2.30
Segment V length/width/depth	11.50/2.30/2.30
Telson length/aculeus length	8.00/1.50
Vesicle length/width/depth	6.50/3.40/2.60
Pedipalp length	39.90
Femur length/width/depth	10.60/3.00/1.50
Tibia length/width/depth	9.00/3.00/2.50
Chela length/width/depth	20.30/6.10/3.80
Movable finger length/fixed finger length	10.70/8.40
Chelicera length	3.80
Chela length/width	2.60/1.90
Movable finger length/fixed finger length	2.10/1.20
Legs	
Femur I length/II length/III length/IV length	6.00/7.10/8.60/10.00
Tibia I length/II length/III length/IV length	5.50/6.20/7.50/8.30
Protarsus I length/II length/III length/IV length	3.60/4.00/4.40/4.70
Mesotarsus I length/II length/III length/IV length	3.60/4.00/4.50/5.00
Metatarsus I length/II length/III length/IV length	2.10/2.10/2.35/2.50

Comparisons.—*Diplocentrus cueva* can easily be separated from all described species in the genus by the unusual shape of the carapace, the attenuation and dorsoventral flattening of the metasoma, and the attenuation of the legs. It appears to be most closely related to *Diplocentrus mexicanus* Peters, also from the state of Oaxaca, as indicated by similarities in cheliceral morphometrics, pedipalp femora proportions, presence of a ventral median carina on the pedipalp tibiae, and in morphology and carination of the pedipalp chelae. The two species differ, in addition to the unique characters of *D. cueva* given above, in size, color, tarsomere II spine counts, carinal development on the metasoma, texture of the sclerites, and numerous other less significant characters.

Discussion

Cave-inhabiting organisms are usually classified into three discrete categories, based on their degree of dependence to (or independence from) the cave environment, as follows: (1) troglobites, or obligatory cave-dwellers found exclusively in caves; (2) troglophiles, or cave-lovers capable of completing their life-cycle in caves but also found in favorable habitats outside caves; (3) trogloxenes, or cave-guests unable to complete their life-cycle in the confines of a cave. Troglobitic scorpions have been found only in North America, and represent two of the four families present on this continent. The family Buthidae has some trogloxene species, and the family Vaejovidae has both trogloxenes and troglophiles, but neither family has any known troglobites. The family Chactidae has three eyeless troglobitic species belonging to the genus *Typhlochactas* Mitchell from Mexico (Mitchell, 1968, 1971). Finally, the family Diplocentridae has three eyed troglobitic species belonging to the genus *Diplocentrus*, two from the Yucatan Peninsula in Mexico (Francke, 1977 b), and the species described above from Oaxaca.

Table 2.–Extent of development of troglobitic facies in the three species of cave-dwelling *Diplocentrus*, based on comparisons to their respective epigean relatives.

	D. anophthalmus	*D. mitchelli*	*D. cueva*
Appendage attenuation	conspicuous	conspicuous	conspicuous
Metasomal carinae	reduced	reduced	reduced
Pedipalpal carinae	absent	absent	slightly reduced
Tarsomere II spination	reduced	equal ?	slightly reduced
Pigmentation	absent	vestigial	slightly reduced
Lateral eyes	vestigial	reduced	equal
Medial eyes	absent	vestigial	reduced

Regressive evolution is usually manifest in most troglobites, and often culminates with total loss of visual organs and pigmentation. The three troglobitic scorpions of the genus *Typhlochactas* lack both eyes and pigment, but so does the only other species in the genus, a montane-forest litter inhabitant (Mitchell and Peck, in press). Thus it is quite possible, as suggested by Mitchell and Peck (loc. cit), that the ancestor of the troglobitic species was already "pre-adapted," to some extent, to cave existence, accounting for the extreme regressive facies shown by all three troglobitic *Typhlochactas* spp.

The troglobitic diplocentrids have not yet reached such an advanced stage of cave-adaptedness. *Diplocentrus anophthalmus* Francke lacks pigment and median eyes, but still retains vestigial lateral eyes; *Diplocentrus mitchelli* Francke lacks pigment except for the visual organs, and still retains vestigial median and lateral eyes; and *D. cueva* has both pigment and eyes, although the median eyes are somewhat reduced in size. Evolutionarily, each of the three species is believed to be more closely related to epigean members of the genus than they are to each other. The respective epigean relatives, however, show no evidence of "pre-adaptation" to cave existence, and the three troglobites probably represent separate invasions of the cave environment. The cave-dwelling *Diplocentrus* show different degrees of cave adaptedness (Table 2), enabling us to understand for the first time in scorpions the steps of regressive evolution experienced by cave-dwellers. *D. cueva* displays the initial stages of regressive evolution, *D. mitchelli* the intermediate stages, and *D. anophthalmus* approaches the final stages but has yet to reach the condition of total eyelessness.

ACKNOWLEDGEMENTS

I am very grateful to Dr. Willis J. Gertsch, who originally received the type specimen of *D. cueva* for examination, for allowing me to study and describe the species. Thanks are also due to Dr. Robert W. Mitchell for allowing me to examine specimens of *Typhlochactas,* and for providing a copy of a manuscript in press. Finally, Dr. William R. Elliott and Mr. Frederick W. Wagner read the manuscript and made helpful suggestions.

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PARTHENOGENESIS IN THE MAYFLY *STENACRON INTERPUNCTATUM FRONTALE* (BURKS) (EPHEMEROPTERA: HEPTAGENIIDAE)[1]

Terry M. Mingo[2]

ABSTRACT: Development of unfertilized eggs of *Stenacron interpunctatum frontale* (Burks) is reported. Observed level of parthenogenetic egg development was 15.9% with hatching in 9.13%.

DESCRIPTORS: *Stenacron interpunctatum frontale* (Burks), parthenogenesis, mayfly, Heptageniidae, Ephemeroptera, reproduction.

The occurrence of parthenogenesis among mayflies has been confirmed for nine North American species. These include *Ameletus ludens* Needham (Clemens, 1922); *Ephoron album* (Say) (Britt, 1962); *Stenomena interpunctatum* (Say), *Stenonema pulchellam* (Walsh), *Stenonema vicarium* (Walker) (Huff and McCafferty, 1974); *Baetisca rogersi* Berner (Pescador and Peters, 1974); *Stenonema femoratum* (Say) (McCafferty and Huff, 1974); *Hexagenia rigida* McDunnough (Friesen and Flannagen, 1976) and *Cloeon triangulifer* McDunnough (Gibbs, 1977).

Additional North American species have been implicated as being potentially parthenogenetic on the basis of sex ratios observed in field collections. These species have been discussed by McCafferty and Huff (1974); however, experimental confirmations of parthenogenesis have yet to be demonstrated for them. European species showing parthenogenesis have been discussed by Degrange (1960).

The potential for parthenogenesis in *Stenonema interpunctatum* (Say) was first demonstrated by Huff and McCafferty (1974) when eclosion was produced from a single egg following a 32 day period of incubation. The total number of eggs incubated was not specified nor were further data reported for *S. interpunctatum.* The purpose of this paper is to report additional observations of parthenogenesis for this species[3].

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[3] The genus *Stenonema* has been divided into two genera by Jensen (1974). The *tripunctatum* and *vicarium* species groups remain in *Stenonema* while the *interpunctatum* group now constitutes the genus *Stenacron.*

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Methods and Materials

A series of nymphs of *Stenacron interpunctatum frontale* (Burks) was collected from Logan Brook at Route 158, approximately two miles east of Sherman Mills, Aroostook County, Maine, on August 3, 1976. The nymphs were transported in aerated gallon jars to the laboratory where cultures were maintained in an environmental chamber at a temperature of 72° ± 4°F and a light-dark photoperiod of 16:8 hours.

As darkened wing pads became evident, each nymph was transferred to an individual plastic "ice cream" cup and further isolated in a cheese cloth covered rearing cage. A humidifier was used to maintain moisture at or above 60% saturation. Reared adults and associated stages were preserved in 70% ethanol.

Observations on parthenogenesis began on August 8 with the emergence of a solitary female subimago. The imaginal molt occurred the following day and after a period of isolation (24 hours), attempts were made to induce oviposition behavior by placing the imago in contact with a water surface. These efforts were unsuccessful and the imago was placed in a Petri dish containing a thin layer of distilled water in the event that oviposition might occur.

At the end of the next 48 hour period, oviposition had not occurred and the moribund imago was dissected. Recovered eggs were placed in a Petri dish containing distilled water and incubated in the environmental chamber.

Results

Observations on development are summarized in Table 1. Of 819 eggs recovered from the unmated imago, 89 hatched. An additional 66 eggs showed evidence of embryonic development but failed to hatch. The percentage of eggs that showed embryonic development was 15.9% and those hatching was 9.13%.

Table 1. Development of parthenogenetic eggs of *S. i. frontale.*

Development of Eggs	Number of Eggs Incubated	% of Total
no embryonic development	819	84.08
development without eclosion	66	6.77
development with eclosion	89	9.13
total	974	99.98

Observations of nymphal eclosion are presented in Figure 1. Hatching was first observed after 17 days of incubation and continued for 47 days. The greatest number of eclosions occurred on day 17 when 20 eggs hatched. Hatching declined thereafter until the final eclosion of a single nymph on day 47. Observations were terminated after 64 days without additional eclosion.

During the period of observation, a short series of adults was reared. Thirteen were female and five were male giving a sex ratio of 2.6♀ to 1.0♂.

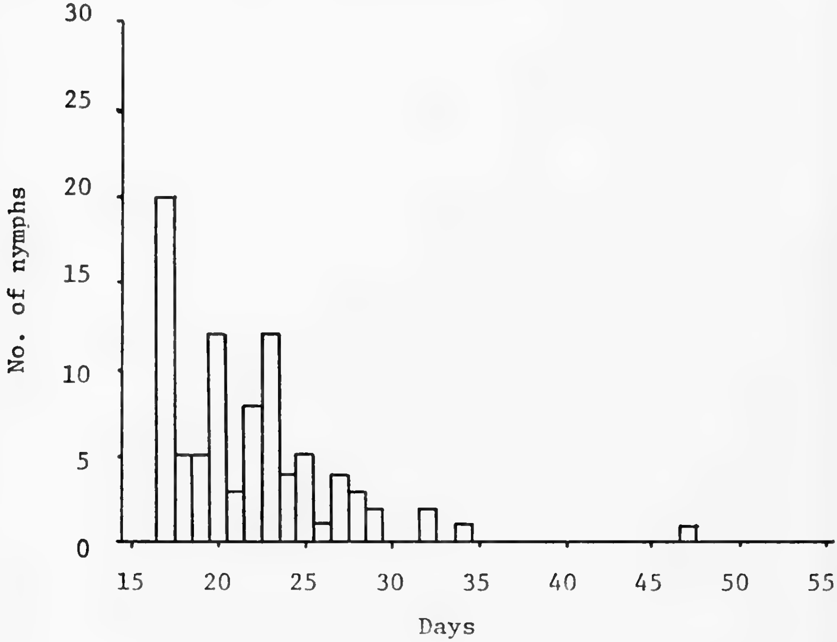

Figure 1. Days to eclosion of first instars of *S. i. frontale.*

Discussion

Obligatory parthenogenesis has been demonstrated for only a few species of mayflies (Clemens, 1922; Gibbs, 1977). These species typically exhibit very high levels of parthenogenesis and males are either extremely rare or unknown.

Faculative parthenogenesis is the more common form of parthenogenesis observed among mayflies and is found in species which normally reproduce sexually. Observed levels of parthenogenesis are typically low and arise from a small proportion of naturally occurring diploid eggs which have failed to undergo meiosis (McCafferty and Huff, 1974). This type of parthenogenesis is expressed under natural conditions when a female is unable to locate a mate; thus the occurrence could be accurately referred to as occassional or accidental parthenogenesis.

In order for parthenogenesis to evolve, two conditions must be satisfied. The female must be able to lay eggs without mating, and a high proportion of those eggs must hatch (Soumalainen, 1962). It has been clearly shown that the potential for parthenogenesis does exist in *S.i. frontale,* however it is not known if this potential is realized under natural conditions.

Several authors (Gibbs, 1977; McCafferty and Huff, 1974; Degrange, 1960) have observed that females of various species would readily oviposit when placed in contact with a water surface. Degrange (1960) also observed that some species could not be induced to oviposit by this method and concluded that some particular pre-oviposition activity such as a flight period was essential. It was further suggested that the muscular activity associated with flight promoted the passage of eggs through the oviducts and permitted their expulsion.

Dissection of several reared female imagos revealed that eggs had not entered the oviducts. Since the small size of the rearing cages severely hampered flight activity, an extended period of flight may be required for oviposition to occur in *S.i. frontale.* This might also explain the failure of the imago to oviposit when placed in contact with the water surface.

The advantages associated with obligatory parthenogenesis have been briefly reviewed by Gibbs (1977). Tjonneland (1970) and Gibbs (1977) also discussed the potential effects of obligatory parthenogenesis upon flight activity and emergence patterns.

The advantages of faculative parthenogenesis do not appear to have been investigated for mayflies. Faculative parthenogenesis may function as a means of continuing a genetic line in the event that a mate cannot be located, however, it would seem that reported levels of parthenogenesis (normally less than 10%) are too low to be of significance in the population dynamics of the species. McCafferty and Huff (1974) have suggested that the low levels they observed may represent a rudimentary type of parthenogenesis. Soumalainen (1960) has suggested that low levels may represent a transitional stage between sexual reproduction and thelytokous (female producing) parthenogenesis.

Due to the presence of males and presumably sexual reproduction, it is concluded that parthenogenesis in *S.i. frontale* is faculative and deuterotokous (producing both sexes). However, the actual type of parthenogenesis can only be verified by rearing successive generations in order to determine the sex ratio of the resulting nymphs. Until this is accomplished, it is possible that parthenogenesis as observed in *S.i. frontale* is thelytokous and that males are produced only through normal sexual reproduction. Similarly the mode of parthenogenesis, whether apomictic (ameiotic) or automictic (meiotic), can only be determined through cyto-genetic investigations.

ACKNOWLEDGEMENTS

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A NEW SPECIES OF *STATHMOPODA* FROM COLOMBIA (LEPIDOPTERA: STATHMOPODIDAE)[1]

J.F. Gates Clarke[2]

ABSTRACT: The new species *Stathmopoda filicula* is described from Colombia.

DESCRIPTORS: Microlepidoptera, moth, *Stathmopoda filicula,* Stathmopodidae, Colombia.

This species is described to provide a name so that the notes on the life history of this moth may be published by William G. Eberhard of Cali, Colombia in the following paper.

Stathmopoda filicula, new species

Figures 1-3

Alar expanse 7-7.5 mm.

Labial palpus buff. Antenna fuscous except outer fourth grayish buff; scape buff. Head gray with metallic luster. Thorax grayish fuscous with metallic luster. Forewing ground color fuscous, the whole wing with metallic luster; at basal fourth a broad, brassy fascia and in tornal area an ill-defined brassy blotch; cilia grayish fuscous. Hindwing grayish fuscous with brassy luster; cilia grayish fuscous. Foreleg buff with blackish-fuscous spot at end of femur and tibia; midleg straw yellow with blackish-fuscous spot at end of femur and tibia. Hindleg straw yellow with blackish -fuscous spot at distal end of femur and blackish-fuscous annulus at distal end of tibia; tarsal segments blackish fuscous. Abdomen grayish foscous dorsally, buff ventrally. ventrally.

Male genitalia slide USNM 24236. Harpe simple; sacculus narrowly and slightly thickened; cucullus broadly rounded. Gnathos stout, triangular, pointed. Uncus broad basally, slender distally and slightly hooked. Vinculum triangular. Tegumen curved dorsally, rather deep dorso-ventrally. Anellus a simple sclerotized plate. Aedeagus nearly straight, very stout; cornuti absent.

Female genitalia slide USNM 24237. Ostium transverse, broad, slitlike. Antrum not differentiated. Inception of ductus seminallis anterior, from bursa copulatrix. Ductus bursae membranous except for a sclerotized band anteriorly at junction with bursa copulatrix. Bursa copulatrix membranous; appendix bursae membranous. Signum an elongate scobinate plate with narrow, heavily sclerotized, longitudinal, median ridge.

Holotype male Colombia: 12 km. E. of Buenaventura, William G. Eberhard. USNM 75253. Paratype ♂ and ♀, same data.

There are no closely related species described from South America,

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Stathmopoda filicula, new species: Fig. 1. lateral aspect of male genitalia with aedeagus removed; Fig. 2. lateral aspect of aedeagus.

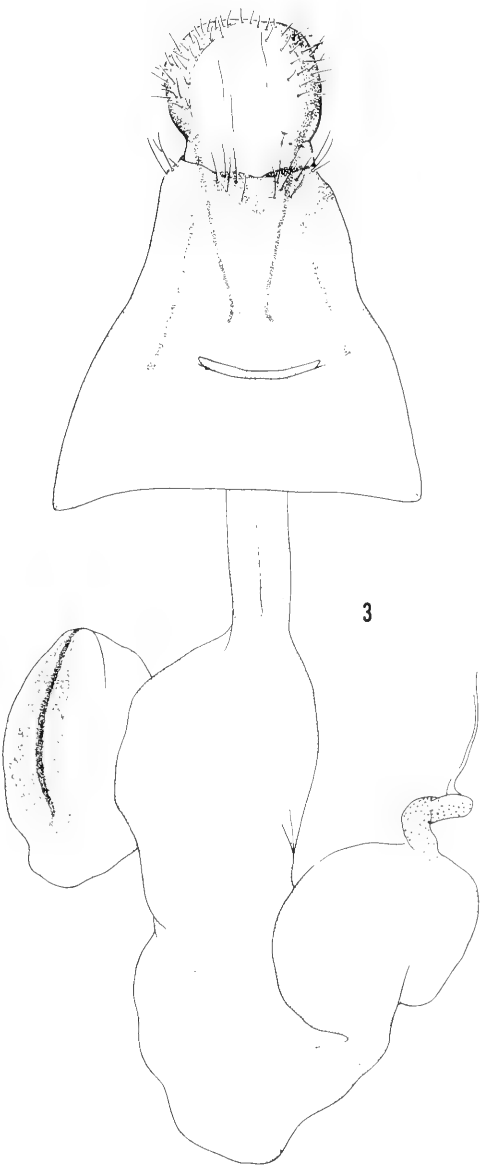

Fig. 3. ventral view of female genitalia.

but *filicula* is similar in superficial appearance to the North American *Schreckenstenia erythriella* (Clemens). The former can be distinguished immediately from the latter by its yellow legs and the brassy fascia of forewing.

ACKNOWLEDGEMENT

The drawings for this publication were made by Mr. Michael L. Druckenbrod, Smithsonian staff Illustrator.

NATURAL HISTORY OF IMMATURE STAGES OF MICROLEPIDOPTERAN *STATHMOPODA FILICULA* CLARKE[1]

William G. Eberhard[2]

ABSTRACT: A partial life history of *Stathmopoda filicula* Clarke is described.

DESCRIPTORS: Microlepidoptera, Stathmopodidae, *Stathmopoda filicula* Clarke, partial life history described.

On August 9th, 1975, larvae of *Stathmopoda filicula* Clarke were found on a frond of an unidentified fern growing on a roadbank in a cleared area about 12 km. east of Buenaventura, Colombia. This zone, on the coastal plain west of the Andes, is classified by Espinal and Montenegro (1963) as pluvial tropical forest. The larvae were most common near the central part of the leaf where the spores were darker and more mature. Each larva was living between the underside of the leaf and a sheet of white silk in which were included many empty sporangia. At one edge of each sheet was a hole in the leaf (probably chewed by the larva – one larva in captivity chewed a new hole, apparently discarding the pieces of leaf). When larvae were disturbed, they retreated through these holes onto the other (top) side of the leaf where there was a short flap made of silk and empty sporangia covering the hole. The larva usually retreated only part way through the hole, and the flap more or less covered its body; the flap was usually not large enough, however, to cover its entire body.

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Larvae were kept in captivity on pieces of the fern leaf, and several activities were observed:

1). Spinning – the head was held more or less level and swung from side to side. I could not distinguish any pattern in the movement other than that in several cases larvae seemed to try to work a sporangium into the sheet.

2). Feeding – the larva went to the edge of the sheet to a clump of sporangia and pulled a single sporangium back under the sheet. It then began chewing it, and in some cases I could watch through its semi-transparent head as the black spores entered its digestive tract one by one. The spores themselves were apparently not chewed, only the sporangium. Even small larvae were capable of breaking open sporangia.

3). Defecation – the posterior end of the body was just beyond the edge of the sheet (often just after the larva made a turn of 180°) and a black, apparently dry, and more or less round pellet released. This behavior seems designed to insure that feces are completely discarded, and none were found incorporated in fresh sheets in nature. In captivity, however, where the leaves were often oriented so that the larvae were on the top surfaces, feces were incorporated into the sheets.

4). Metamorphosis – larvae ready to pupate constructed chambers of dense white silk, and then change color from creamy white to bright pink-red and appeared to swell somewhat. The first individual changed to a pupa (white color) six days after making its chamber, and the first adult emerged 17 days after the first pupation. These individuals were kept at temperatures somewhat lower than those of their natural habitat, and the developmental times may be overestimates of natural times.

LITERATURE CITED

Espinal, L.S. and E. Montenegro. 1963. Formaciones Vegetales de Colombia. Republica Colombia, Insto. Geogra. "Augustin Codazzi", Bogota.

A NEW SPECIES OF WESTERN *CULICOIDES* OF THE *STONEI* GROUP (DIPTERA: CERATOPOGONIDAE)[1]

Robert H. Jones[2], Willis W. Wirth[3]

ABSTRACT: A new species of *Culicoides* in the *Stonei* group, *Culicoides owyheensis* n.sp., is described from Idaho, USA.

DESCRIPTORS: Diptera, Ceratopogonidae, *Culicoides owyheensis,* sheep, bluetongue.

A severe outbreak of bluetongue disease occurred in a flock of sheep in Idaho in 1973 (Jones et al, in manuscript). The primary vector of bluetongue virus appeared to be *Culicoides variipennis* (Coquillett). However, another species of *Culicoides* was common in light trap collections and was also collected biting inside the ears of sheep prostrate with bluetongue disease. This paper provides a name for this second species attacking sheep.

The second species is described here as a new species in the *Stonei* group of *Culicoides* as reviewed by Wirth and Blanton (1971). A revised key is given for the four species now included in the *Stonei* group.

Stonei group

The characters for this group are as given by Wirth and Blanton (1971) except for the following characters for females: eyes widely separated, with transverse transocular suture Y-shaped; third palpal segment swollen, with very shallow sensory pit with irregular opening; mesonotal disc usually concolorous, at most with three indistinct, longitudinal, darker lines; and spermathecae subequal, ovoid, usually with a distinct neck that is broadened basally.

The characters and measurements of five populations (1 paratypic *mortivallis* California, 1 paratypic *werneri* Arizona, 1 *owyheensis* n.sp., and 2 *stonei* Texas) clearly showed that *C. owyheensis* was closest to *C. mortivallis* when antennal sensoriae were used as the primary character for species separation (Wirth and Blanton, 1971). These data further showed that the

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Idaho population *(C. owyheensis* n.sp.) must be named as a new species but that a complete revision of the *Stonei* group should be undertaken. *Culicoides owyheensis* n.sp. was the largest fly studied, the length of antennal segment 11 was intermediate and yet the ratio of 1.6 was the largest value obtained for antennal segments (9 + 10)/11, and the third palpal segment was relatively short (2.0 largest ratio for lengths: third palpal segment /11).

Except for size, no characters were found that would distinguish the males of these species.

The authors are aware that the *Culicoides Stonei* group consists of species that are difficult to distinguish. They are committed to the further collection of material and to an extensive revision of the *Stonei* group.

Key to females of the *Stonei* group of *Culicoides*

1\. Antennal sensoriae present on segments 3-14 . . . . *stonei* James

Antennal sensoriae present on segments 3, 7-14; 3, 9-14; or 3, 10-14 2

2\. Antennal sensoriae present on segments 3, 9-14 or 3, 10-14 . . . . *werneri* Wirth & Blanton

Antennal sensoriae present on segments 3, 7-14 3

3.[a] Ratio 1.4 for antennal segments (9 + 10)/11; 1.8 for third palpal segment /11; 3.7 for proboscis /11; and mean wing length 0.9 mm . . . . *mortivallis* Wirth & Blanton

Ratio 1.6 for antennal segments (9 + 10)/11; 2.0 for third palpal segment /11; 4.2 for proboscis /11; and mean wing length 1.1 mm . . . . *owyheensis* n.sp.

Culicoides owyheenis n.sp.

Female: Wing length 1.1 mm (1.0-1.2; n=27). Antennal sensoriae on segments 3, 7-14 (69%, with 0% on 3-14; n=39), not multiple. Ratio of lengths of structures divided by antennal segment 11: antennal segments 9 + 10, 12, 13, 14, and 15 are 1.6, 1.0, 1.1, 1.4, and 1.7 (1.4-1.7, 1.0-1.1, 1.0-1.3, 1.2-1.5, and 1.4-1.9; n=24, 22, 22, 22, and 22); third palpal segment 2.0 (1.7-2.2; n=17); and proboscis 4.2 (3.7-4.6; n=24). Antennal ratio [AR (11-15)/(3-10)] 1.0 (1.0-1.1; n=21). Third palpal segment swollen with very shallow pit having irregular opening; palpal ratio (PR) of third segment length/width 2.2 (1.8-2.4; n=13). Ratio of head length to proboscis (H/P) 1.2 (1.1-1.3; n=27); this ratio for P/H of most authors 0.8 (0.77-0.93; n=27). Mandible with 11-13 teeth.

Brown species (pinned material; ♀♀ n=24) that is variously yellowed: from mesonotal disc and scutellum concolorous brown with three indistinct darker longitudinal lines on disc to usually mesonotal disc brown with humeral corners, anterior margin of mesonotum, and scutellum yellow; caudal margin of dorsal aspect of abdominal segments variously yellowed; and halters bright yellow, posteriorly whitened.

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[a] These ratios and measurements were taken from a comparison that included representative populations of all four species. For the populations measured the values were the smallest or close to the smallest for *mortivallis* and the largest for *owyheensis.*

Type Locality: USA, Idaho, Owyhee Co., near Bruneau, collectors ARS (USDA: R.H. Jones and H.W. Potter, Jr.). Types are deposited in U.S. National Museum. Holotype female (USNM Type No. 75302, slide), 26-27 VIII 1973, light trap. Allotype male, slide), same. Paratypes: Slides 26 ♀♀ and 2 ♂♂, 26-27 VIII 1973, light trap. Pinned 6 ♀♀, 23-24 VIII 1973, light trap; 12 ♀♀ and 3 ♂♂, 26-27 VIII 1973, light trap; and 6 ♀♀, 27 VIII 1973, from inside ear prostrate sheep. Alcohol 47 ♀♀ and 9 ♂♂, 26-27 VIII 1973, light trap.

LITERATURE CITED

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IMPORTANT NOTICE

Attention is called to an important change in the page charges policy of the American Entomological Society. With great reluctance, this new policy was adopted at a meeting of the executive Council of the Society on January 19, 1978 and is dictated by financial necessity. It applies to both TRANSACTIONS and ENTOMOLOGICAL NEWS and will become effective with all papers received for publication after April 1, 1978. This new policy follows:

"A charge of $25.00 is made for each published page of an article, plus costs of all illustrations. Papers may be published ahead of their regularly scheduled time at a cost of $30.00 per page.

"Unemployed and retired amateur and scientist members of the American Entomological Society who are without institutional support or are not subsidized by grants and who are without funds for publishing may apply for financial assistance at the time their manuscript is submitted. Such application must include an explanation of the author's status (unemployed or retired). Page charges for these individuals are negotiable, with a minimum of $7.00 per page."

At first glance this may not seem different from the present policy but the key new words are 'unemployed' and 'members'.

IDENTITY OF *GERRIS* (HEMIPTERA: HETEROPTERA) SPECIES FROM PLEISTOCENE ASPHALT DEPOSITS AT McKITTRICK, CALIFORNIA[1]

Diane M. Calabrese[2]

The late Dr. W.D. Pierce of the Los Angeles County Museum (LACM) studied the Pleistocene fossil insects from the asphalt deposits at McKittrick and LaBrea, California. He found "a species of *Gerris*" at McKittrick (Pierce 1947). He speculated that the site at which the *Gerris* fragments were found was covered by standing water during a considerable period of the year because most insect remains are of aquatic and semi-aquatic insect families (Pierce 1947).

Dr. E.C. Wilson and LACM kindly arranged a loan of the *Gerris* fragments Pierce had deposited there. No legs or antennae are among the fragments. The fragments consist of: 1 head, 5 pronota, 2 thoraces, 5 thoraces each with 1 or 2 abdominal segments attached, (3 of these include wing fragments and indicate that the specimens were long winged), and 1 thorax + complete abdomen including external female genitalia. The fragments were taken from a depth of 4 feet at Site 4 of the McKittrick location (LACM collection label).

It is unfortunate that the only external genital segments in the lot of fragments belong to a female. The connexival spines are curved strongly dorsad. The fragment would seem to belong on the basis of locality and form either to *Gerris incognitus* Drake and Hottes or *Gerris gillettei* Lethierry and Severin (Drake and Harris 1934), species difficult to separate on the basis of females alone (Drake and Harris 1928). Callahan (1974) has observed behavioral differences between these two extant species. She also demonstrated that *G. gillettei* females are pale ventrally, while those of *G. incognitus* are dark. The abdominal fragment at hand is dark and would seem to represent *G. incognitus* Drake and Hottes. Regrettably, one cannot extrapolate from this bit of information and conclude that by association all fragments

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represent *G. incognitus* for the two species in question often overlap (Callahan 1974).

ACKNOWLEDGEMENT

Scott E. Miller of the Santa Barbara Museum of Natural History suggested that I might find the Pierce material at LACM.

LITERATURE CITED

Callahan, J.R. 1974. Observations on *Gerris incognitus* and *Gerris gillettei* (Heteroptera: Gerridae). Proc. Entomol. Soc. Washington 76: 15-21.

Drake, C.J. and H.M. Harris. 1928. Concerning some North American water-striders with descriptions of three new species. Ohio J. Sci. 28: 269-276.

Drake, C.J. and H.M. Harris. 1934. The Gerrinae of the Western Hemisphere. Ann. Carnegie Museum 23: 179-240.

Pierce, W.D. 1947. Fossil arthropods of California. Bull. So. Calif. Acad. Sci. 46: 136-143.

INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

c/o British Museum (Natural History)
Cromwell Road, London, SW7 5 BD.

The following Opinions (listed by number) have been published recently by the International Commission on Zoological Nomenclature (see Bulletin Zoological Nomenclature Volume 34, part 3, November, 1977).

Opinion No. 1093 (p.143) *Apis rotundata* Fabricius, 1787 (Insecta: Hymenoptera): designation under the plenary powers of a neotype.

Opinion No. 1094 (p.147) Refusal of request to correct the following on the Official List of Family-Group Names in Zoology:–
No. 61 GYROPIDAE Kellog, 1896 (Insecta: Mallophaga)
No. 139 PYRALIDAE Latreille, 1809 (Insecta: Lepidoptera)
No. 199 EPISEMIDAE Guenee, 1852 (Insecta: Lepidoptera)
No. 324 TRINOTONIDAE Eichler, 1941 (Insecta: Mellophaga)

Opinion No. 1096 (p.155) *Psednura longicornis,* Sjostedt, 1920 (Insecta: Orthoptera): designation under plenary powers.

Opinion No. 1099 (p.164) *Drosophila mercatorum* Patterson & Wheeler, 1942 (Insecta, Diptera) conservation of;
Drosophila carinata Grimshaw, 1901, suppression of.

The Commission cannot supply separates of Opinions.

NEW NEOTROPICAL *CALYOZINA*, WITH KEY TO SPECIES (HYMENOPTERA: BETHYLIDAE)[1]

Howard E. Evans[2] [3]

ABSTRACT: *Calyozina azurea* is described from a male from Minas Gerais, Brazil, and a key is presented to the four known neotropical species of this genus.

DESCRIPTORS: Bethylidae, *Calyozina:* new species, key to species.

There are several species of neotropical Bethylidae, related to *Epyris,* in which the males have serrate antennae. These species have been assigned to the genus *Calyozina* Enderlein (Evans, 1964) although they are structurally diverse and in fact may merely be males of diverse, specialized lineages within the large genus *Epyris.* Until females have been associated with these males, it seems best to retain them in *Calyozina.* The four species are each known from a single male, but because of the striking appearance of these wasps a brief review of the species seems desirable.

Key to Neotropical Species (Males)

1. Antennae strongly pectinate, the processes on the middle segments about 3 X as long as the segments proper; mandibles with 4 or 5 teeth; pronotum smoothly rounded at anterior angles 2

   Antennae weakly pectinate, processes at most about as long as the segments proper; mandibles with two teeth; anterior angles of pronotum prominent or with conical processes 3

2. Claws with a short, erect tooth; legs bright rufotestaceous beyond coxae; mandibles rufotestaceous; thoracic dorsum alutaceous, somewhat duller than front (Oaxaca, Mexico) . . . . *mexicana* Evans, 1965

   Claws trifid, middle tooth blunt, basal tooth short; femora black; mandibles black on basal half; thoracic dorsum shining, very weakly alutaceous (Minas Gerais, Brazil) . . . . *azurea* new species

3. Antennae rather stout and with the middle segments only weakly produced; scutellar pits oblique, elongate, connected by a thin, shallow groove; pronotum merely somewhat prominent anterolaterally (Santarem, Brazil) . . . *amazonica* Evans, 1964

   Antennae more slender and with the processes of the middle segments nearly as long as the segments proper; scutellar pits subcircular, not distinctly connected; pronotum

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[3] Research supported by the National Science Foundation, grant DEB75-17142.

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with conical processes anterolaterally (Canal Zone, Panama)
. . . . *neotropica* Evans, 1964

Calyozina azurea, new species

Holotype. – ♂, BRAZIL: Pedra Azul, Minas Gerais, Nov. 1972 (Seabra & Oliveira) (Canad. Nat. Coll., Ottawa).

Description. – Length 7.0 mm; fore wing 4.4 mm. Black, head and thorax (but not propodeum) with dark bluish reflections; apical abdominal segment and genitalia rufous; mandibles black basally, rufous on apical half; scape black, flagellum rufotestaceous; coxae and femora black, tibiae and tarsi dull rufous; wings subhyaline, with dark setulae, veins yellowish brown. Mandibles with a large apical tooth, a slightly smaller second tooth, and 3 very small teeth basad of this (only 2 on one side in this specimen). Clypeus very short, broadly subangulate. Head broad, maximum width 1.2 X median length; front broad, minimum width 1.55 X eye height; vertex broadly rounded off a short distance above eye tops. Ocelli in a broad triangle, width of ocellar triangle slightly exceeding ocello-ocular line. Antennae segments 3-12 each bearing a slender, hairy apical process, these processes longest on the middle segments (5-10) where they are about 3 X as long as the segments proper; apical segment somewhat clavate. Front polished, very weakly alutaceous but with strong punctures which are separated by 2-3 X their own diameters. Thoracic dorsum also polished, weakly alutaceous, punctate; pronotum with smooth contours, not produced anterolaterally; notauli broad, separated by only a thin line posteriorly; scutellar pits subcircular, separated by about their own diameters, connected by a thin groove basally. Propodeal disc about as long as wide, with 3 strong discal carinae between which it is transversely striate; side-pieces with longitudinal ridges, some of which are more or less continuous with similar ridges on the mesopleura which define two concentric ellipses. Middle and hind tibiae spinose; claws trifid, middle tooth blunt.

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Evans, H.E. 1964. A synopsis of the American Bethylidae (Hymenoptera, Aculeata). Bull. Mus. Comp. Zool. Harvard, 132: 1-222.

Evans, H.E. 1965. Further studies on neotropical Epyrini (Hymenoptera, Bethylidae). Psyche, 72: 265-278.

AUSTRALASIAN SPECIES OF GENUS *LEIODES* LATREILLE (COLEOPTERA: LEIODIDAE: LEIODINAE)[1]

Quentin D. Wheeler[2]

ABSTRACT: Species described by Lea and Olliff as *Anisotoma* from Australia and Tasmania are transferred to *Leiodes* Latreille as follows: *Leiodes tasmaniae* (Olliff) comb. n., *L. ammophila* (Lea) comb. n., *L. bicoloriclava* (Lea) comb. n., *L. myrmecophila* (Lea) comb. n., *L. micropunctata* (Lea) comb. n., and *L. wiburdi* (Lea) comb. n.

Hatch (1929) corrected the misuse of the generic name *Anisotoma* Illiger for the genus *Leiodes* Latreille (see Horn, 1880), synonymizing the former with the latter. Species described by Lea (1911, 1912) and Olliff (1889) from Australia and Tasmania, however, were listed as *Anisotoma* Panzer by Hatch (1929).

This error came to my attention during revision of the North and Middle American species of *Anisotoma* Panzer (Wheeler, 1977). Removal of these species from the genus *Anisotoma* is harmonious with my views on the phylogeny and zoogeography of the leiodid beetles. For example, *Leiodes* Latreille is closely related to *Hydnobius* Schmidt and is, therefore, among the most pleisiotypic of leiodid genera (Crowson, 1967), and *Anisotoma* is among the more apotypic genera (Wheeler, 1977). It is hypothesized that the more pleisiotypic genera might occur in the Australian region, while the more apotypic genera would not. Recognition of the following species as *Leiodes* Latreille is in agreement with this notion.

I hereby propose the following placement of the species described by Lea (1911, 1912) and Olliff (1889):

Leiodes tasmaniae (Olliff), **New Combination**	Tasmania
Leiodes ammophila (Lea), **New Combination**	Tasmania
Leiodes bicoloriclava (Lea), **New Combination**	Tasmania
Leiodes myrmecophila (Lea), **New Combination**	Tasmania
Leiodes micropunctata (Lea), **New Combination**	New South Wales
Leiodes wiburdi (Lea), **New Combination**	New South Wales

I have not examined speciemens of the above species. The proposed changes are based on citation of *Anisotoma* Illiger (not *Anisotoma* Panzer) by Olliff, and descriptions made by both Olliff and Lea.

This paper should clarify the placement of these Australasian species, and emend their misplacement by Hatch.

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ENT. NEWS, 89: 1 & 2: 63 - 64, January & February 1978

ACKNOWLEDGMENT

I would like to thank Dr. Charles A. Triplehorn, Department of Entomology, Ohio State University, for his comments on the preparation of this paper.

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Wheeler, Q.D. 1977. A Revision of the Genus *Anisotoma* Panzer (Coleoptera: Leiodidae: Agathidiini) of North and Central America. Unpublished M.S. Thesis, the Ohio State University, Columbus. i-xv, 167 p., 138 figs.

INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE ANNOUNCEMENT

A.N.(S.) 10

The required six months' notice is given of the possible use of plenary powers by the International Commission on Zoological Nomenclature in connection with the following names listed by case number: (see *Bull. Zool. Nom.* 34, part 3, 9 November, 1977).

2199 *Pangonia conica* Bigot, 1857: designation as type-species of *Mycteromyia* Philippi, 1865 (Insecta, Diptera, TABANIDAE).

2209 *Attelabus* Linnaeus, 1758 (Insecta, Coleoptera): request for confirmation of designation of type-species.

Comments should be sent in duplicate (if possible within six months of the date of publication of this notice in *Bull. Zool. Nom.* 34, part 3), citing case number to

R.V. Melville The Secretary, International Commission on Zoological Nomenclature,
c/o British Museum (Natural History), Cromwell Road LONDON, SW7, 5BD, England.

Those received early enough will be published in the Bulletin of Zoological Nomenclature.

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 both a short informative abstract (not a descriptive abstract) of not over 150 words and a list of 3-10 key words or descriptors. 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. Authors can be very helpful by indicating, in pencil in the margin of the manuscript, approximate desired locations within the text of accompanying figures, tables and other illustrations.

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

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

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THE NORTH AMERICAN AND CARIBBEAN SPECIES OF *SYSTELLODERES* (HEMIPTERA: ENICOCEPHALIDAE)[1]

Gene Kritsky[2]

ABSTRACT: The species of *Systelloderes* from North America and the Caribbean are described. Four new species, illustrations of the species, and a key are included.

DESCRIPTORS: Enicocephalidae, *Systelloderes,* Hemiptera.

Systelloderes is a genus of Enicocephalidae that occurs in the Ethiopian, Oriental, Australian, Nearctic, and Neotropical regions. Jeannel (1942) included six species in his key of the *Systelloderes,* but the number has since greatly increased. Twenty *Systelloderes* species are now known from Africa (Villiers 1969) and two species from New Zealand (Woodward 1956). This work will provide descriptions of the twelve *Systelloderes* species from North America and the Caribbean of which four species are new.

Systelloderes is easily separated from the other Enicocephalidae genera by its forewing venation, having an open discal cell and no basal cell; a simple pronotum, and its convex or elongated posterior lobe of the head. For a key to the Enicocephalidae genera of the Western Hemisphere refer to Kritsky (1977).

Genus *Systelloderes* Blanchard (1852)

Type-species by original designation.–*Systelloderes moschatus* Blanchard

Small to large enicocephalids 2-11 mm.

Head with deep postocular impression. Posterior lobe usually without transverse impression. Rostrum moderate to long.

Pronotum distinctly divided into three lobes. Intermediate lobe smooth without deep inverted T-shaped culcus and Y shaped impressions on each side.

Scutellum triangular.

Foreleg with two claws and four spines on the tarsus (fig. 1). Apical end of tibia with 7 spines. Two possible arrangements, seven spines with innermost spines pear-shaped (fig. 1), seven spines with innermost spines with one pear-shaped and one elongated conical spine (fig. 2). Variations are seen in other regions.

Forewings with discal cell absent and basal cell open.

Male genitalia without distinct parameres, posterior apophysis of pygophore opening below anus.

Female usually stouter than male. Eyes usually smaller, middle lobe of pronotum larger, and forelegs more robust. Genitalia reduced to opening below anus.

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[1] Accepted for publication: September 19, 1977

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Key to the North American and Caribbean species of *Systelloderes*

1\. Tibia without a large curved spine (fig. 1) 2

Tibia with a large curved spine (fig. 2) 3

2\. Large enicocephalids, adults larger than 5.00 mm, posterior lobe of female head with parallel sides, posterior lobe of male head more rounded, body dark chocolate brown color (figs. 3 & 4) . . . . *longiceps*

Smaller than 5.00 mm, posterior lobe of female head with rounded sides, posterior lobe of male head with rounded sides, body brown to light brown (figs. 5 & 6) . . . . *angustatus*

3\. Posterior lobe of head pear-shaped 4

Posterior lobe of head round or with parallel sides 5

4\. Middle lobe of pronotum divided into two lobes by a longitudinal sulcus, small encicocephalid 2.25-2.50 mm (fig. 7) . . . . *nitidus*

Middle lobe of pronotum with slight longitudinal impression, more robust, 2.75-3.00 mm (fig. 8) . . . . *inusitutus*

5\. Ocelli very large 6

Ocelli moderate or small size 7

6\. Ocelli laterally directed, posterior lobe of head large and very round (fig. 9) . . . . *lateralus*

Ocelli directed upward, posterior lobe length greater than width (fig. 10). . *dorsalus*

7\. Posterior lobe of male head wider than anterior lobe giving head a globular appearance; female head with rounded posterior lobe (figs. 11 & 12) . . . . . *doriai*

Not as above 8

8\. Posterior lobe of head as wide as anterior lobe, (fig. 13) . . . . *culicus*

Posterior lobe of head not as wide as anterior lobe 9

9\. Large enicicephalid, adults, 5.00 mm, dorsal surface of pronotum very flat, posterior lobe of pronotum as wide as intermediate lobe (fig. 14) . . . . . . *grandes*

Not as above 10

10\. Posterior lobe of head with almost parallel sides, female with posterior lobe of pronotum much wider than intermediate lobe (fig. 15) . . . . *jamaicensis*

Posterior lobe of head more rounded, female's posterior lobe of pronotum not much wider than intermediate lobe 11

11\. Male with large intermediate lobe of pronotum and robust forelegs, female with posterior lobe of head longer than wide (figs. 16 & 17) . . . . *crassatus*

Male with small intermediate lobe of pronotum and female with slender forelegs, posterior lobe of head not longer than wide (fig. 18 & 19) . . . . *biceps*

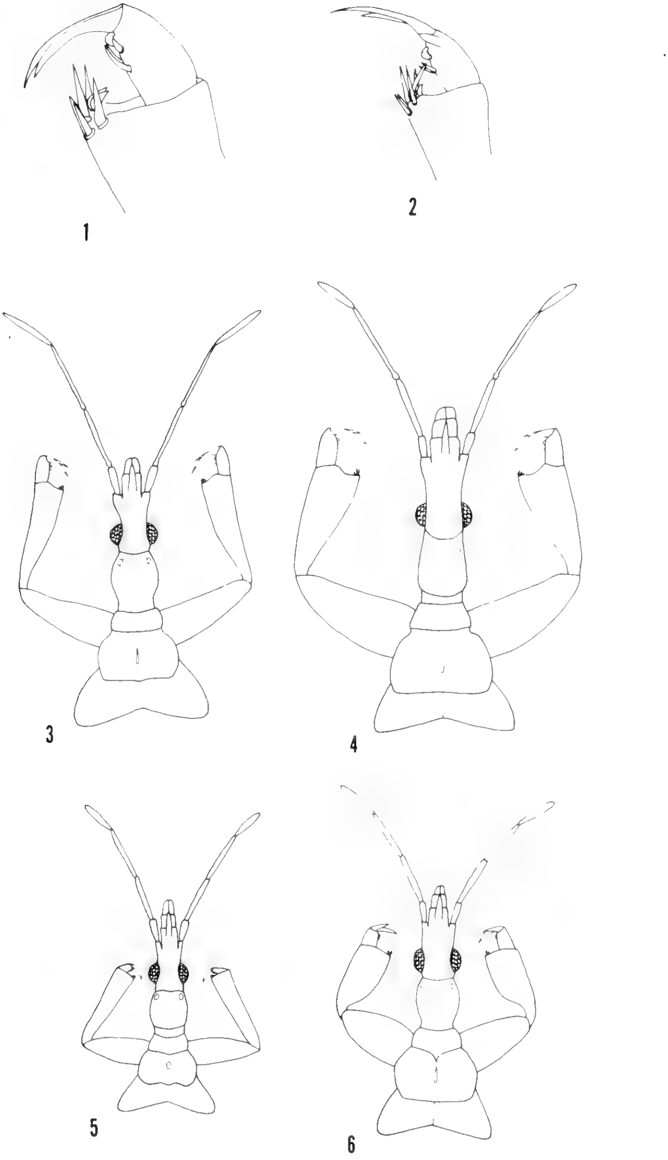


Figure 1. *Systelloderes angustatus* foreleg spination. 2. *S. biceps* foreleg spination. 3. *S. longiceps* male. 4. *S. longiceps* female. 5. *S. angustatus* male. 6. *S. angustatus* female.

Systelloderes longiceps Jeannel (1943) (figs. 3 & 4)

Type-locality. – Callaga, Peru.

Male length 5.00-6.00 mm. Sparcely clothed with long setae. Body a bronze color, wings smokey.

Head 1.21 mm long. Posterior lobe of head longer than wide. Ocelli of moderate size, placed far apart. Length of antennal segments I, 0.17 mm; II, 0.31 mm; III, 0.42 mm; IV, 0.31 mm.

Pronotum smooth, intermediate lobe with deep median impression. Posterior margin emarginate.

Male foreleg; femur length to width ratio 3.81, tibia length to width ratio 3.60. Female foreleg stout; femur length to width ratio 2.40, tibia length to width ratio 2.86. Spination as in fig. 1.

This species has been collected in Costa Rica.

Systelloderes angustatus (Champion) (1898) (figs. 5 & 6)

Type-locality. – Volcan de Fuego, Guatemala.

Male length 4.00 mm. Sparcely covered with long setae. Body shiny brown, wings smokey.

Head 1.12 mm long. Posterior lobe longer than broad. Ocelli of moderate size and placed far apart. Length of antennal segments I, 0.13 mm; II, 0.27 mm; III, 0.34 mm; IV, 0.27 mm.

Intermediate lobe of pronotum with slight pit depression located medially.

Male foreleg slender; femur length to width ratio 3.11, tibia length to width ratio 3.25. Female foreleg stout; femur length to width ratio 2.69, tibia length to width ratio 2.60. Spination as in fig. 1.

Systelloderes nitidus (Usinger) (1932) (fig. 7)

Type-locality. – Puerto Castilla, Honduras.

Female length 2.25-2.50 mm. Sparcely clothed with short setae. Body light amber color, wings hyaline.

Head 0.74 mm long. Posterior lobe pear-shaped. Ocelli small, placed far apart. Length of antennal segments I, 0.06 mm; II, 0.19 mm; III, 0.19 mm; IV, 0.19 mm.

Intermediate lobe of pronotum with diverging median impression. Anterior lobe collar-like.

Forelegs stout; femur length to width ratio 2.50, tibia length to width ratio 2.70. Spination as in fig. 2.

Systelloderes inusitatus (Drake and Harris) (1927) (fig. 8).

Type-locality. – Woodville, Mississippi.

Length 2.75- 3.00 mm. Sparcely clothed with short setae. Body brown; rostrum, legs, antenna lighter brown; wings hyaline.

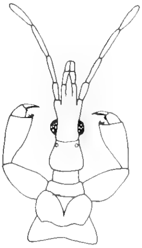
Head 0.61 mm long. Posterior lobe of head pear-shaped, slightly broader than long. Ocelli of moderate size, placed far apart. Length of antennal segments I, 0.11 mm; II, 0.13 mm, III, 0.15 mm; IV, 0.19 mm.

Intermediate lobe of pronotum with median impression not extending to posterior margin.

Male foreleg slender; femur length to width ratio 3.18, tibia length to width ratio 3.66. Female foreleg slender; femur length to width ratio 3.00, tibia length to width ratio 3.20. Spination as in fig. 2.

Systelloderes lateralus, new species (fig. 9).

Male length 3.25 mm. Sparcely clothed with long setae. Head, pronotum, scutellum



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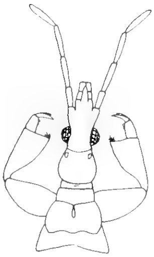

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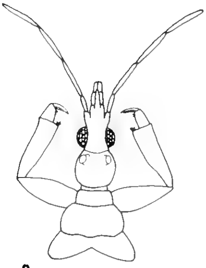

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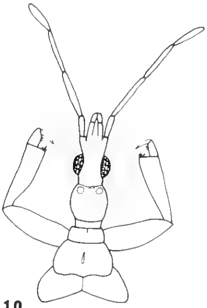

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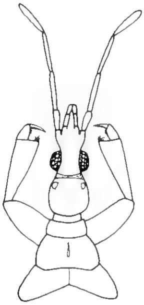

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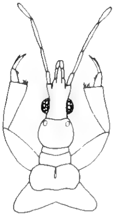

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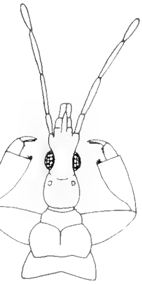

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Figure 7. *Systelloderes nitidus* female. 8. *S. inusitatus* female. 9. *S. lateralus* male. 10. *S. dorsalus* male. 11. *S. culicus* male. 12. *S. doriai* male. 13. *S. doria* female.

light brown; rostrum, antenna, legs and abdomen yellow; base of ocellus red; wings hyaline.

Head 0.80 mm long. Posterior lobe very round. Ocelli very large and diverging. Length of antennal segments I, 0.13 mm; II, 0.25 mm; III, 0.27 mm; IV, 0.23 mm.

Pronotum smooth. Intermediate lobe with slight intermediate impression. Posterior margin emarginate.

Forelegs slender; femur length to width ratio 3.00, tibia length to width ratio 3.16. Spination as in fig. 62.

Holotype: male, 2 paratypes; U.S.A., Virginia, Arlington; June 1, 1944 (collected by R.I. Sailer). The type is in the United States National Museum.

Systelloderes dorsalus, new species (fig. 10)

Male length 4.00 mm. Sparcely covered with long setae. Body a rich brown color, wings opaque brown.

Head 0.87 mm long. Posterior lobe generally round, longer than broad. Ocelli large directed upward. Length of antennal segments I, 0.13 mm; II, 0.27 mm; III, 0.29 mm; IV, 0.23 mm.

Anterior lobe of pronotum with slight transverse impression. Intermediate lobe with median pit. Posterior lobe with transverse impression.

Forelegs slender; femur length to width ratio 3.57, tibia length to width ratio 3.11. Spination as in fig. 2.

Holotype: male; Jamaica, Hardwar Gap, March 10, 1970 (collected by Wirth and Farr at stream margin). The type is in the United States National Museum.

Systelloderes doriai Villiers (1968) (figs. 11 & 12)

Type-locality. – San Jose, Costa Rica.

Male Length 3.25 mm. Sparcely clothed with long setae. Body brown; rostrum and antenna lighter brown; wings hyaline.

Head 0.85 mm long. Posterior lobe of male round. Ocelli of moderate size placed far apart. Posterior lobe of female with more parallel sides. Ocelli as in male. Length of antennal segments I, 0.13 mm; II, 0.19 mm; III, 0.23 mm; IV, 0.25 mm.

Intermediate lobe of pronotum with slight impression.

Male foreleg more slender than female. Male femur length to width ratio 2.90, tibia length to width ratio 3.00. Female femur length to width ratio 1.93, tibia length to width ratio 2.33. Spincation as in fig. 2.

Systelloderes culicus (Uhler) (1892) (fig. 13)

Type-locality. – Great Salt Lake, Utah.

Male length 3.50 mm. Moderately clothed with long setae. Head dark brown; remainder of body light brown; wings hyaline.

Head 0.81 mm long. Posterior lobe round. Ocelli of moderate size and placed far apart. Length of antennal segments I, 0.13 mm; II, 0.21 mm; III, 0.25 mm; IV, 0.23 mm.

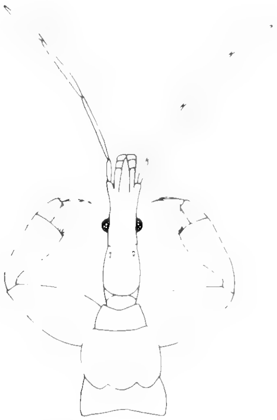
Intermediate lobe of pronotum with slight median impression. Posterior margin emarginate.

Forelegs slender; femur length to width ratio 3.00, tibia length to width ratio 3.14. Spination as in fig. 2.

Systelloderes grandes, new species (fig. 14)

Female length 5.00 mm. Sparcely clothed with short setae. Body yellow brown color.

Head 1.27 mm long. Posterior lobe elongate, sides almost parallel. Ocelli small, placed close together. Length of antennal segments I, 0.17 mm; II, 0.36 mm; III, 0.40 mm; IV, 0.36 mm.



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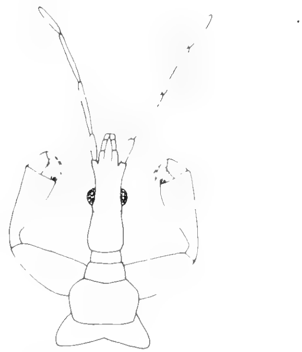

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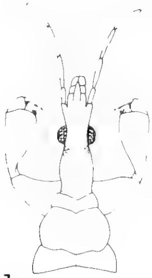

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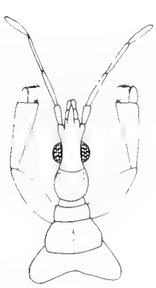

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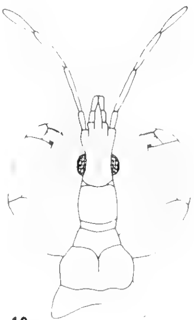

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Figure 14. *Systelloderes grandes* female. 15. *S. jamaicensis* female. 16. *S. crassatus* male. 17. *S. crassatus* female. 18. *S. biceps* male. 19. *S. biceps* female.

Pronotum with flat dorsal surface. Intermediate lobe as wide as posterior lobe.

Forelegs very stout; femur length to width ratio 2.40, tibia length to width ratio 1.84. Spination as in fig. 2.

Holotype: female; U.S.A.; Oregon, Jackson Co.; 14 miles S. Rush; May 19, 1962 (collected by J. Schuh under rocks along stream). Type is deposited in the California Academy of Science Insect Collection.

Systelloderes jamaicensis, new species (fig. 77)

Female length 4.00 mm. Sparcely clothed with short setae. Body brown, wings hyaline.

Head 1.23 mm long. Posterior lobe with sides almost parallel, length not greater than width. Ocelli small placed far apart. Length of antennal segments I, 0.13 mm; II, 0.34 mm; III, 0.34 mm; IV, 27 mm.

Pronotum smooth. Intermediate lobe with slight median suture.

Forelegs stout; femur length to width ratio 2.66, tibia length to width ratio 2.18. Spination as in fig. 62.

Holotype: female; Jamaica; Portland Trail; Caledonia Peak; May 26, 1956 (collected by C. Hoff). The type is deposited in the United States National Museum.

Systelloderes crassatus (Usinger) (1932) (figs. 16 & 17)

Type-locality. – Palm Springs, California.

Male length 3.50 mm. Moderately clothed with long setae. Head brown, remainder of body lighter brown.

Head length 0.91 mm. Posterior lobe of head of male round. Ocelli moderately directed laterally. Female posterior lobe more elongate, eyes smaller, ocelli smaller lateraly directed. Length of antennal segments I, 0.11 mm; II, 0.17 mm; III, 0.23 mm; IV, 0.27 mm.

Anterior margin of pronotum emarginate. Intermediate lobe of male large, but smaller than female, with slight median impression.

Forelegs stout. Male femur length to width ratio 2.33, tibia length to width ratio 2.37. Female femur length to width ratio 2.00, tibia length to width ratio 2.00. Spination as in fig. 2.

Systelloderes biceps (Say) (1832) (figs. 18 & 19)

Systelloderes terrenus (Drake and Harris) (1927), new synonym.

Type-locality. – Pennsylvania, U.S.A.

Male length 3.5-4.00 mm. Moderately clothed with long setae. Head dark brown; rostrum, antennae, legs, pronotum light brown; wings hyaline.

Head 0.91 mm. Posterior lobe of male round, with moderate sized ocelli placed far apart. Length of antennal segments I, 0.13 mm; II, 0.27 mm; III, 0.25 mm; IV, 0.23 mm.

Intermediate lobe of pronotum with slight median impression. Posterior lobe with slight transverse impression and slightly emarginate.

Male foreleg slender; femur length to width ratio 3.16, tibia length to width ratio 3.36. Female foreleg stout; femur length to width ratio 2.25, tibia length to width ratio 2.16. Spination as in fig. 2.

INCERTE SEDIS

The following two species are doubtful or I was unable to obtain material for study.

1. *Systelloderes iowensis* (Drake and Harris) (1927)
2. *Systelloderes tennis* Jeannel 1942.

DISCUSSION

The Caribbean species, *dorsulus* and *jamaicensis*, are the first species to be described from the said region. Barber (1939) reports a *Systelloderes* from Puerto Rico but was unable to describe it oweing to it's poor condition.

The foreleg spination of *longiceps* and *angustatus* (fig. 1) is very similar to the spination of the *Systelloderes* species which occur in the Neotropical region. The other *Systelloderes* species described have the spination shown in fig. 2. This might possibly indicate that there was a single migration into the Nearctic and Caribbean which subsequently speciated.

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A NEW SPECIES OF *HYMENOCORIS* FROM MEXICO (HEMIPTERA: ENICOCEPHALIDAE)[1]

Gene Kritsky[2]

ABSTRACT: A new species of *Hymenocoris* Uhler from Mexico is described and compared with the previously known species *Hymenocoris formicina.*

DESCRIPTORS: Enicocephalidae, Hemiptera, *Hymenocoris, Hymenocoris hintoni* n. sp., and *Hymenocoris formicina* Uhler.

Hymenocoris, first described by Uhler in 1892, has been known by a single species occurring in California. Herein is described a second species of *Hymenocoris* collected in Vera Cruz, Mexico.

Genus *Hymenocoris* Uhler (1892)

Type-species by original designation.– *Hymenocoris formicinia* (1892).

Long and slender enicocephalid, 5.5 – 6.5 mm. (fig. 1).

Head long and slender. Postocular impression deep, posterior lobe with large diverging ocelli. Rostrum long; eyes and ocelli large; and antennae longer than head and pronotum.

Pronotum distinctly divided into three lobes. Dorsal surface smooth with a slight transverse sulcus in intermediate lobe. Posterior margin of posterior lobe straight not emarginate.

Scutellum triangular.

Forelegs slender; tarsus with two claws and four spines, a hook-shaped spine and three curved spines. Apical end of tibia with seven spines grouped close together. Innermost spines small pear-shaped (fig. 2).

Forewing with complete venation (fig. 3).

Male genitalia without distinct parameres, posterior apophysis of pygophore opening below the anus.

Hymenocoris hintoni, new species (fig. 1).

Male length 6.5 mm. Sparsely clothed with long setae. Head, pronotum, scutellum, and thorax dark brown color; rostrum, antennae, abdomen, and legs light brown; wings hyaline; eyes and bases of ocelli red.

Head 1.64 mm long, width across eyes 0.42 mm. Posterior lobe 0.42 mm long and 0.30 mm wide. Posterior lobe with straight anterior margin and transverse impression. Ocelli large and placed on diverging lobes (fig. 4). Length of antennal segments I, 0.26 mm; II, 1.06 mm; III, 0.92 mm; IV, 0.74 mm (fig. 5).

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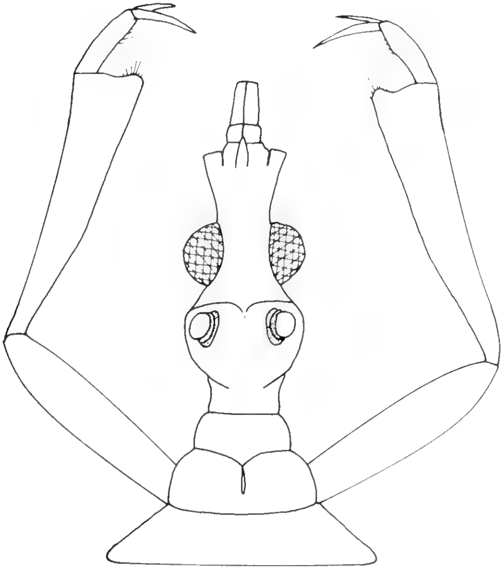

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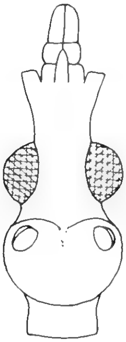

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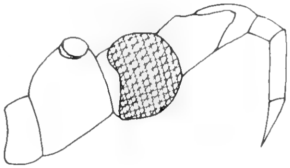

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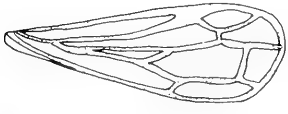

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Figure 1. *Hymenocoris hintoni.* **2.** *H. hintoni* foreleg spination. **3.** *H. hintoni* forewing. **4.** lateral view of *H. hintoni* head. **5.** *H. hintoni* antenna. **6.** *H. formicina* head.

Pronotum as in generic description. Length of pronotum 0.66 mm, width of anterior lobe 0.30 mm, width of posterior margin of posterior lobe 0.98 mm.

Forelegs slender; femur length to width ratio 4.81, tibia length to width ratio 4.38. Spination of tibia and tarsus as in fig. 2.

Forewing as in fig. 3.

Holotype: male, 7 paratypes; Mexico: Vera Cruz, Fortin de las Flores; collected December 23, 1963 by C.A. Toschi and M.J. Tauber. The type and paratypes are deposited in the California Academy of Science insect collection.

Discussion

H. hintoni is close to *H. formicina* shown in fig. 6. The following key will suffice to separate the two species.

1. Anterior margin of posterior lobe of head rounded and arising close to the eyes (fig. 6) . . . . *formicina*
   Anterior margin of posterior lobe of head not rounded and not arising close to the eyes (fig. 1) . . . . *hintoni*

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FOUR ECTOPARASITES FROM SOUTH DAKOTA[1]

Nixon Wilson[2]

ABSTRACT: Data is given for *Orchopeas howardii* (Baker), *Oeciacus vicarius* Horvath, *Argas cooleyi* Kohls & Hoogstraal, and *Ornithodoros concanensis* Cooley & Kohls collected in South Dakota. Each species is discussed in relation to its distribution in the northern Great Plains.

DESCRIPTORS: Ectoparasites, Siphonaptera, Hemiptera, Acari, South Dakota.

Two collections of four species of ectoparasites were made recently when passing through South Dakota. Their host relationships were not unusual; however, the distribution of three species was extended in the northern Great Plains, into South Dakota. The fourth species may have been collected previously from the southwestern part of the state. All specimens are in my collection.

INSECTA

Siphonaptera: Ceratophyllidae

Orchopeas howardii (Baker).–Two female fleas were found on a road kill fox squirrel, *Sciurus niger* Linnaeus, picked up on Interstate 90, 6 km south and west of Salem, McCook County, on 2 June 1977.

This is a common flea of the fox squirrel and gray squirrel, *S. carolinensis* Gmelin, in eastern North America and would be expected wherever they occur. It is not unusual to find it on other mammals which share the aboreal habitat with these squirrels (i.e. *Didelphis, Tamiasciurus, Glaucomys, Procyon*). The ranges of both squirrels extend into the Great Plains and the above record is an extension northward in the region.

Hemiptera: Cimicidae

Oeciacus vicarius Horvath.–Four males, 13 females, and four nymphs were collected from two partially completed nests of cliff swallows, *Petrochelidon pyrrhonota* (Vieillot), in a cement culvert, 13 km east and 6 km north of Wanblee, Washabaugh Co. (Pine Ridge Indian Reservation), on 26 May 1977.

The swallow bug is primarily a parasite of cliff swallows with large numbers usually found around active nests. It also has been reported from the nests of barn swallows, *Hirundo rustica* Linnaeus, and a nest of the

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white-throated swift, *Aeronautes saxatalis* (Woodhouse) (Usinger, 1966). Usinger (1966) indicates numerous collection localities in North America on a distribution map. One appears to be from southwestern South Dakota, and he mentions material from nearby Cedar Co., Nebraska taken from the bridge over the Missouri River at Yankton.

ACARI

Metastigmata: Argasidae

Argas cooleyi Kohls & Hoogstraal.–One male, three females, seven nymphs, two larvae, and one larval skin were collected from the same nests as the swallow bugs.

It is primarily a parasite of cliff swallows with single records from the barred owl, *Strix varia* Barton, and nest of the California condor, *Gymnogyps californianus* (Shaw) (Kohls & Hoogstraal, 1960). The distribution is extended some 430 km east northeast from Casper, Natrona Co., Wyoming. Other localities slightly more distant are Myers, Treasure Co., Montana and Fort Collins, Larimer Co., Colorado. This eastern extension in the northern Great Plains is equal to that of the two previous easternmost localities in Texas (see Howell and Chapman, 1976).

Ornithodoros concanensis Cooley & Kohls.–One nymph and one larva also were collected from the same nests as the swallow bugs.

It has been collected from bat infested caves and crevices, cliff swallow nests, and three species of falconiform birds (Kohls et al., 1965). Cook (1972) has shown that *O. concanensis* is capable of feeding on both cliff swallows and bats in its natural environment, the selection of hosts depending on seasonal availability. In the same situation *A. cooleyi* fed only on cliff swallows. Nearby localities in the northern Great Plains are Myers, Montana, Sheridan, Sheridan Co. and Chugwater, Platte Co., Wyoming, Hereford, Weld Co., Colorado, and Osborne, Osborne Co., Kansas. The closest of these is Chugwater, approximately 350 km to the southwest. Osborne and several localities in Texas extend slightly farther east.

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OCCURRENCE OF *CLOEON COGNATUM* STEPHENS IN THE UNITED STATES (EPHEMEROPTERA, BAETIDAE)[1]

R. Wills Flowers[2]

ABSTRACT: The presence of the European mayfly *Cloeon cognatum* Stephens in the United States is reported. Characters distinguishing this species from other North American *Cloeon* are given.

DESCRIPTORS: Ephemeroptera; Baetidae; *Cloeon cognatum; C. dipterum.*

Recently a collection of interesting *Cloeon,* collected in two small ponds near Pottstown, Pennsylvania, by William S. Ettinger, was sent to the Laboratory of Aquatic Entomology for identification. The specimens, adults and associated nymphs, were tentatively identified as *Cloeon dipterum* (L.) which is common and widely distributed in Europe but has been reported only twice from the United States. Specimens have been collected from Illinois in 1939 (Burks 1953) and Ohio in 1960 (Traver 1962). Sowa (1975) showed that *C. dipterum* of various authors includes three sympatric species: *Cloeon dipterum* (L.), *Cloeon cognatum* Stephens and *Cloeon inscriptum* Bengtsson. Much of the European data on *"C. dipterum"* reported over the years in fact applies to one or more of these species.

A series of the Pennsylvania *Cloeon,* including nymphs and adults, was sent to Dr. Sowa for identification. They were identified as *C. cognatum* which also occurs in continental Europe and the British Isles. This species differs from *C. dipterum* and *C. inscriptum* chiefly in color patterns of adult and nymph and also in minor morphological characters. Sowa's paper should be consulted for details. Adult male *C. cognatum* can be distinguished from other North American *Cloeon* by the following combination of characters: abdominal segments 2-6 with extensive dark reddish-brown maculae on tergites and sternites; caudal filaments white with dark red-brown annulation on articulations. The only other Nearctic *Cloeon* likely to be confused with *C. cognatum* are *C. mendax* (Walsh), *C. ingens* McDunnough and *C. implicatum* McDunnough, all of which lack the dark annulations on the caudal filaments. The nymph of *C. cognatum* differs from that of *C. ingens* in lacking a ventral lobe on the seventh gill and from *C. mendax* by its larger body size. The nymphs of American *Cloeon* are poorly known and further

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differentiation of *C. cognatum* nymphs is impossible at this time.

Comparison of Burks' and Traver's descriptions of Illinois and Ohio "*C. dipterum*" with Sowa's descriptions indicates that these specimens should also be placed in *C. cognatum*. Traver found that the Ohio forms corresponded with Eaton's (1885) Variation I of *C. dipterum*, which has been synonomyzed with *C. cognatum* by Sowa. In spite of the scarcity of reports, *C. cognatum* may be widely distributed from the mid-Atlantic to the midwestern states.

ACKNOWLEDGMENTS

The author wishes to thank William S. Ettinger for his donation of specimens, Dr. Ryszard Sowa for identifying the specimens and Michael D. Hubbard for his help in preparing this report. This research was financed by a grant (P.L. 89-106) from the Cooperative State Research Service, United States Department of Agriculture, to Florida A&M University.

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"DISAPPEARANCES" OF EGGS AND LARVAE OF *HELICONIUS* BUTTERFLIES (NYMPHALIDAE: HELICONIINAE) IN NORTHEASTERN COSTA RICA[1]

Allen M. Young[2]

ABSTRACT: Disappearances of eggs and young larvae of the butterflies *Heliconius cydno* and *H. hecale* on *Passiflora vitifolia* vines were estimated on two occasions at one locality in northeastern Costa Rica. During the first sampling period (January-February, 1977) *H. hecale* was more abundant than *H. cydno* and the opposite was the case in the second sampling period (August 1977). A total of 20 immatures (both species) were sampled the first time and 47 were sampled the second time. In both sampling periods, about 70% of the immatures of each species had disappeared either as eggs or by the third instar larva, suggesting substantial mortality (predation) on immatures. The data support the prediction of Gilbert (1975) that eggs and larva of *Heliconius* experience high levels of mortality.

Although much is known about the evolutionary biology and ecology of *Heliconius* butterflies (Lepidoptera: Nymphalidae: Heliconiinae) in Central and South America (e.g., Benson et al., 1975; Gilbert, 1975), one aspect that warrants further study is the impact of predators and parasitoids on their immature stages in the wild. Gilbert (1975) predicts that the eggs and larvae of *Heliconius* species suffer severe mortality from ants, and Gilbert and Ehrlich (1973) showed that over 90% of eggs in a *H. ethilla* population in Trinidad were killed by parasitoids. Other than the latter study, there are few published data on mortality of *Heliconius* eggs and larvae. This paper summarizes some preliminary data on "disappearances" of eggs and young larvae for *H. cydno galanthus* (Bates) and *H. hecale* (Fabricius) at one locality in northeastern Costa Rica. While the data are by no means conclusive, they offer tentative, indirect support for Gilbert's prediction of high egg and larval mortality.

Methods

This research was conducted at "Finca La Tigre", a mixed primary, secondary, and cultivated region near La Virgen (220 m elev.), Heredia Province, Costa Rica during two periods, January-February and August 1977. This locality is Premontane Tropical Wet Forest life zone (Holdridge, 1967). Here, both *H. cydno* and *H. hecale* (Fig. 1) lay eggs on *Passiflora vitifolia*

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(Passifloraceae), an abundant vine in secondary forest habitats. Searches for eggs and young larvae were made on small vines generally free of dense adjacent vegetation. In some instances, oviposition was observed while in others the eggs were discovered. While this procedure introduced a bias into sampling, bias is already large owing to small total sample size; but vines in dense growth are more difficult to census accurately. While in the wild eggs of the two species are difficult to distinguish, the larvae are readily distinguishable (Young, 1972; 1973). Once an egg or larva was discovered, the vine was

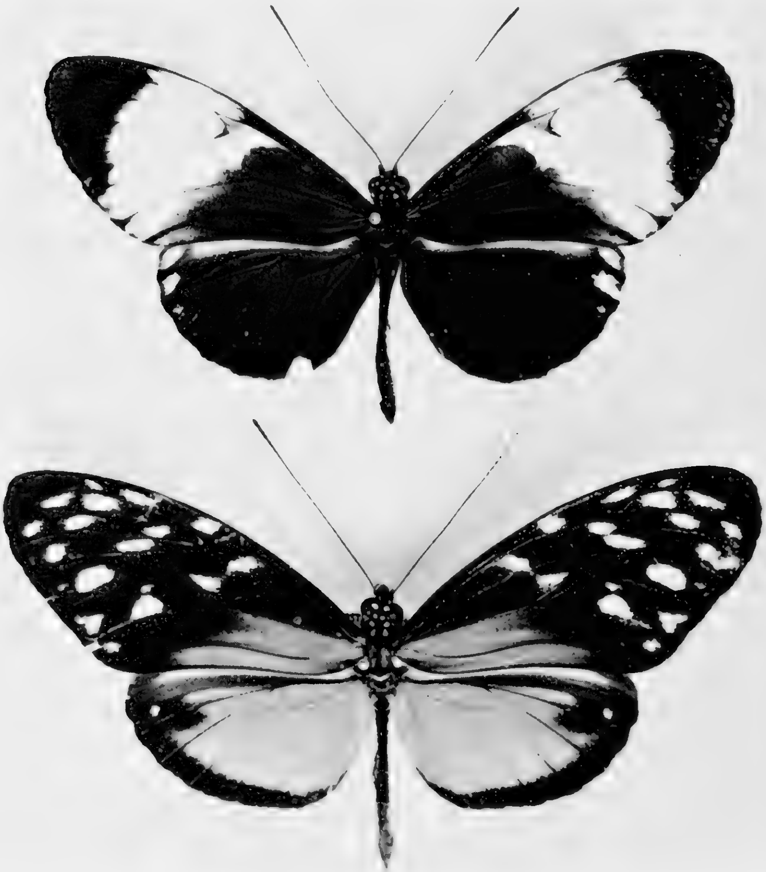

Fig. 1. *Heliconius cydno galanthus* (Bates) and *H. hecale* (Fabricius) from Finca La Tigre, La Virgen, Heredia Province, Costa Rica.

revisited to check for survival. Absence of an egg or larva was recorded as a "disappearance" and used as an indirect measure of mortality. In the August 1977 observations, less detailed records were kept, and disappearances of eggs and larvae were noted only on a single date within 10 days of the discovery of the first egg. Late third instar larvae and older ones were excluded from the data since the census intervals were long and these individuals could have reached maturity, leaving the food plant to pupate, rather than disappearing for other reasons. In rechecking eggs and larvae during February, each vine was also checked for new eggs.

Results

Twelve vines of *P. vitifolia* (Fig. 2) were censuses 16 times for *Heliconius* disappearances between January 13 and February 21, 1977. Sixteen eggs and four larvae were discovered and rechecked; of the eggs, only four (vine site A

Fig. 2. A young vine of *Passiflora vitifolia,* a larval food plant of *H. cydno* and *H. hecale* in northeastern Costa Rica.

– Table 1) were *H. cydno.* Thirty vines were censused once on August 23 following the discovery of eggs and larvae on several earlier dates (Aug. 13-17). The data for January-February are summarized in Table 1. For the August sample, thirty five eggs and 12 larvae were observed; only ten eggs and 3 larvae were *H. hecate,* the reverse of the earlier census. Eggs of *H. cydno* were sometimes found on leaf buds, and those of *H. hecale* on coiled tendrils (Fig. 3). Adjacent plants and debris did not have eggs. The vine sites were spread out over a very large area, with several hundred meters being the closest distance between two sites. An additional 10 vines examined during February did not have eggs or larvae.

For the January-February sample, of the twenty insects observed, only five (all *H. hecale*) lasted to the third instar, spending 5 to 14 days on the food plant. Most disappearances occurred before the third instar, but only seven eggs disappeared (Table 1). Thus, the disappearance rate for eggs and larvae of *H. hecale* was about 69%. For the August sample, of the 47 insects observed, only twelve (2 *H. hecale* and 10 *H. cydno*) were present on the food plants by the census date. The disappearance rate for *H. hecale* was about 77% (10/13 individuals) and for *H. cydno* it was about 70% (24/34 individuals).

In the January-February study period, on one occasion, a female of *H. cydno* deposited three eggs in quick succession (3 min.) on a food plant; of two eggs deposited on the same vine by *H. hecale,* in one case the eggs were deposited by one female, while in the second two females might have been involved (Table 1).

There were only two instances (*H. hecale*) of new eggs being discovered on a vine following the initial discovery of an egg or larvae during February, but only one of these occurred over a short interval of a few days (Feb. 3-7, Table 1).

Discussion

Assuming disappearance of an egg or larva from a vine results from a predator or parasitoid, and that my samples are sufficient, mortality of *H. hecale* and *H. cydno* on *P. vitifolia* is high. These species feed on other *Passiflora* at this locality (in prep.). Although the samples of individual species are limited, it is interesting that *H. hecale* was most abundant during the first sampling period (January-February) while *H. cydno* was found to be more abundant in August at the same locality. In addition, many more fresh adults of *H. cydno* were seen flying at Finca La Tigre in August than during the earlier sampling period.

Heliconius eggs and young larvae may be in the appropriate size range for many predatory ants attracted to *P. vitifolia.* Since some eggs or larvae disappeared quickly (within a few days), such predation may be operative. It

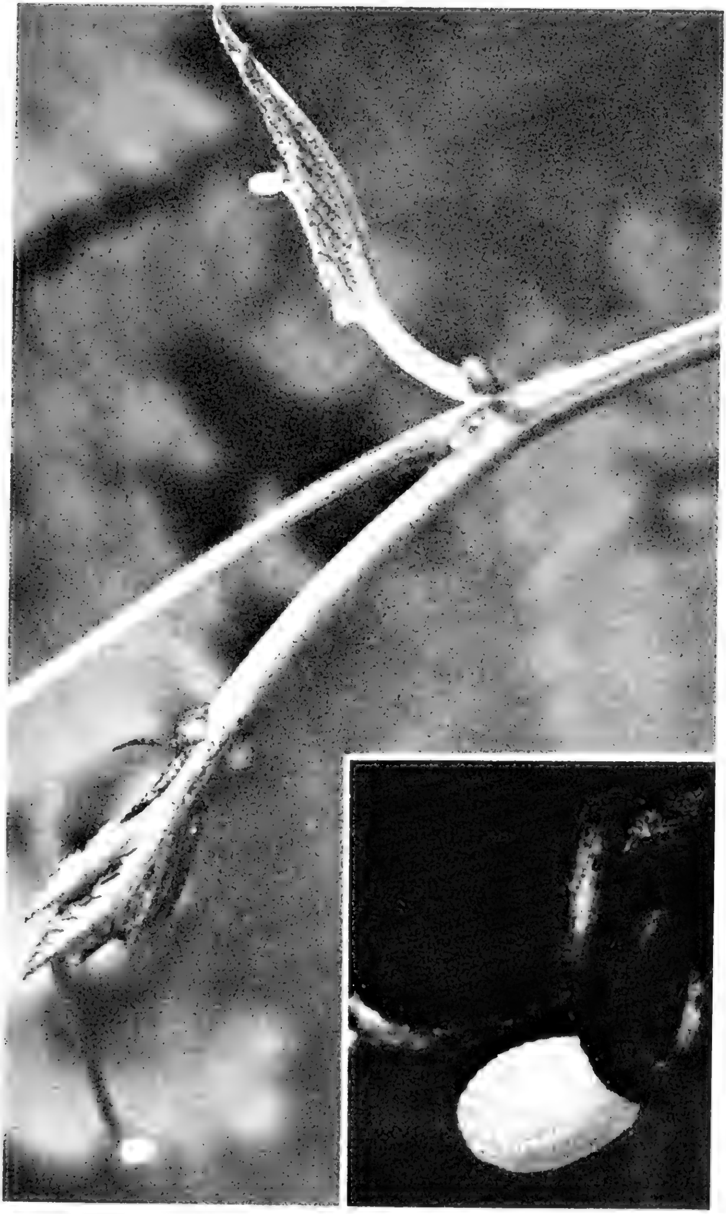

Fig. 3. Eggs (2) of *H. cydno* on young leaf and tendril (background to the left); insert: egg of *H. hecale* on mature tendril. Vine is *P. vitifolia* in both cases.

Table 1. Census history of *Heliconius* eggs and larvae in the wild, Finca La Tigre, La Virgen, Heredia Prov., Costa Rica, January-February 1977.

	Discovery Date	Vine Site	No. Eggs Per Vine	No. Larvae	Ovip. Obs?	Survival Dates and Condition					
(1)	1/13/77	A	3	0	Yes (one adult)	1/14-3 eggs	1/18-egg; 1st instar	1/19-same	1/31-gone		
(2)	1/31/77	A (same vine as #1)	1	0	No	2/2-1st instar	2/4-same	2/6-2nd instar	2/8-3rd instar	2/10-gone	
(3)	1/14/77	B	2	0	No	1/31-gone					
(4)	2/1/77	C	0	1-2nd instar (9mm)	–	2/2-same (10mm)	2/3-3rd instar (13mm)	2/6-gone			
(5)	2/3/77	D	1	0	No	2/6-same	2/7-same	2/8-same	2/14-gone		
(6)	2/7/77	D	1	0	No	2/8-same	2/14-gone				
(7)	2/14/77	C	0	1-1st instar	–	2/17-gone					
(8)	2/3/77	E	2	0	No	2/6-1 gone	2/7-both gone				
(9)	2/7/77	F	2	0	Yes (one adult)	2/8-same	2/14-one dead 1st instar; one 1st instar (6mm)	2/15-2nd instar (7mm)	2/16-2nd instar (9mm)	2/19-3rd instar (16mm)	2/20-3rd instar (21mm)
(10)	2/8/77	G	2	0	Yes (2 adults)	2/16-3rd instars 2-(15mm)	2/19-gone				
(11)	2/15/77	H	2	0	No	2/20-3rd instars (14mm)	2/21-gone				
(12)		I	0	2 (3rd instars	–	2/19-gone					

is unlikely that disappearances of larvae were due to their leaving the food plant (e.g., migration) since no major defoliation occurred and feeding took place at the terminal leaves.

The breadth of larval food plants of *H. hecale* and *H. cydno* at Finca La Tigre have not been determined, although Gilbert (1975) mentions that usually a *Heliconius* species has one local primary food plant. If *P. vitifolia* is the primary larval food plant of *H. hecale* and *H. cydno,* considerable mortality on eggs and larvae may take place. From studies on reproductive biology and longevity of *Heliconius* (Ehrlich and Gilbert, 1973; Gilbert, 1972), it is predicted (Gilbert, 1975) that larval survivorship is generally low and counterbalanced by a long reproductive life mitigated through pollen-feeding. At Finca La Tigre, both species of *Heliconius* have large white pollen loads (pers. obs.). As the spatial properties of *Heliconius* populations are determined primarily by the distribution of adult resources (Gilbert, 1975), the extent to which certain individuals of *P. vitifolia* will be used as oviposition sites depends on their locations. In the present study, the vines used were near patches of blooming cucubits (*Anguria* sp.) and these inflorescences were visited by *H. hecale* and *H. cydno* (pers. obs.). Vines consistently without eggs or larvae during the study periods were not close to blooming cucubits. The tendency for *H. hecale* and perhaps *H. cydno* to oviposit more than once on the same vine may be related to the proximity of the vine these inflorescences and the availability of other passifloraceous vines.

ACKNOWLEDGMENTS

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ADULT *ODOIPORUS LONGICOLLIS* (COLEOPTERA: CURCULIONIDAE) FEED ON OWN LARVAE[1]

A.K. Tripathi and M.L. Chaturvedi[2]

The banana pseudostem borer, *Odoiporus longicollis* (Oliv.) was reported by Shukla and Kumar (1969) from Uttar Pradesh, India. Shukla and Kumar (1970) and Dutt and Maiti (1972) studied its biology and bionomics. During certain experiments it was found that, when adults and larvae were kept together, larvae were eaten by adults, even while their natural food was present. Some times two to four adults attack together on a single larva and feed upon this.

To confirm this, five adults and ten larvae (of mixed sex and age group) were kept in a petri dish with sufficient pieces of banana pseudostem. The petri dish was covered by a wire mesh, which was covered with black cloth. After 24 hrs. only four larvae remained. It was observed that generally the adults start to feed on a larva from its posterior side but dislike the head region. It was also noticed that the adults prefer the lower instar larvae in comparison to higher instars. In another set of experiments, where the natural food was not kept with the larvae and adults, the rate of feeding on the larvae by adults was found slightly increased. In these experiments, five adults fed on 6-8 larvae in 24 hrs. Apparently light plays a role in the feeding activity of this insect as it was observed that the adults prefer to feed in the dark.

These observations confirm the cannibalistic nature of *O. longicollis,* which may be helpful in limiting the natural population of this pest.

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NUMBERS OF GENERA AND SPECIES OF CURCULIONIDAE (COLEOPTERA)[1] [2]

Charles W. O'Brien[3], Guillermo J. Wibmer[3]

ABSTRACT: In 1971 the weevil family Curculionidae had 4237 genera and 44883 species recognized as valid. The numbers of genera and species are herein recorded by subfamily according to the biogeographic region in which they were described and totalled by region and for the world.

DESCRIPTORS: Curculionidae, weevils, list of subfamilies, numbers of genera, numbers of species.

The beetle family Curculionidae (the "weevils" or "snout beetles") is currently the largest family of animals in the world. In 1971 there were 4237 genera and 44883 species recognized as valid. In this paper we are treating the Curculionidae in the broad sense *(sensu lato)* and have included in our counts the various primitive weevil groups sometimes separated as families, *e.g.* Apioninae, Rhynchitinae, Pterocolinae, etc., but have not included Anthribidae, Brentidae, Proterrhinidae and Scolytidae.

Our data are based on counts which we made from the Coleopterorum Catalogus (volumes 27 through 30) and the Zoological Record (1864 through 1971). We have recorded the species and the genera from the biogeographic region in which they were described, though many are present in more than a single region. Hence the total number of species or genera known to be in a region may be greater than the totals in our table (*e.g.* there are currently 402 genera in the Nearctic region, but only 239 were described from there) but we wished to avoid counting the same genus or species twice. All synonyms have been deleted and all revalidations added.

In an attempt to be as consistent as possible in placing the genera and species in the proper biogeographic region, we were forced to make certain rules for deciding placement based on the limitations of the data available. For example, all genera or species described from China and Japan have been placed in the Oriental region because the exact localities are not listed in our 2 sources. So although species or genera from the northern reaches of these

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Table 1. Numbers of genera and species of Curculionidae listed by subfamily according to biogeographic region and totalled for the world.

Subfamily	Nearctic		Neotropical		Palearctic		Oriental		Ethiopian		Australian		World	
	Gen	Sp	Gen	Sp	Gen	Sp	Gen	Sp	Gen	Sp	Gen	Sp	Gen	Sp
Acicnemidinae				—	—	9	3	193	—	—	—	2	3	204
Allocoryninae		1	1	3	—	—	—	—	—	—	—	—	1	4
Alophinae	5	25	—	—	7	59	—	7	—	1	—	—	12	92
Amalactinae	1	1	2	5	—	—	—	2	1	7	2	15	6	30
Amycterinae		—	—	—	—	—	—	—	—	—	41	451	41	451
Anthonominae	12	134	12	225	8	76	17	77	13	73	6	20	68	605
Antliarrhininae	—	—	—	—	—	—	—	—	4	14	—	—	4	14
Apioninae[1]	2	133	3	382	1	514	4	119	11	557	6	85	27	1793*
Apoderinae	-	—	—	1	1	6	9	246	7	180	—	—	17	433
Archolabinae	—	—	—	—	—	—	—	—	1	1	—	—	1	1
Aterpinae	—	—	3	22	—	—	2	3	—	—	10	68	15	93
Attelabinae	1	9	13	167	1	11	7	140	7	51	1	19	30	397
Baridinae	51	509	411	2968	9	196	61	319	11	195	4	47	547	4234
Belinae	—	—	4	13	—	—	—	5	—	1	8	122	12	141
Brachycerinae	—	—	—	—	—	30	—	1	13	490	—	—	13	521
Brachyderinae[2]	15	114	107	899	84	1272	69	1028	96	996	13	55	384	4365*
Byrsopinae		—	2	2	—	2	—	—	2	36	—	—	4	40
Camarotinae		—	1	42	—	—	—	—	—	—	—		1	42
Ceratopinae	—	—	5	32	—	—	2	2	1	8	—	—	8	42
Ceutorrhynchinae	11	137	5	64	40	657	5	123	11	58	—	2	72	1041
Cholinae	—	1	28	278	—	—	—	—	1	1	—	—	29	280
Cioninae		—			4	46	—	23	1	26	—	—	5	95
Cleoninae	—	111	1	101	16	711	1	175	2	332	3	13	23	1445*
Cossoninae	13	79	37	326	21	117	92	475	86	435	52	233	301	1666*
Cryptopharynginae	—	—	—	—	—	—	—	—	1	3	—	—	1	3
Cryptorrhynchinae	19	175	163	3487	12	188	161	1089	69	493	243	1366	667	6800*
Curculioninae	—	24	—	2	1	35	6	292	4	102	—	10	11	465
Cylindrorrhininae[3]	2	81	19	256	—	—	—	—	—	—	11	29	32	366
Diabathrariinae		—	-	—		—	1	1	3	20	6	42	10	63
Dinomorphinae	—	—	2	4	—	—	—	—	—	—	—	—	2	4
Ectemnorrhininae	—	—	1	1	—	—	6	10	—	—	—	3	7	14
Eremninae	—	4	1	1	13	70	53	267	16	117	6	290	89	749
Erirrhininae[4]	17	192	46	210	60	429	19	121	32	218	77	747	251	1917
Euderinae	—	—	—	—	—	—	—	—	4	7	—	—	4	7
Gonipterinae	—	—	—	1	—	—	—	—	—	—	8	131	8	132
Gymnetrinae[5]	—	1	—	1	6	166	1	367	1	190	—	1	8	726
Haplonychinae	—	—	—	—	—	—	—	—	—	—	5	99	5	99

								Sp	Gen	Sp	Gen	Sp	Gen	Sp
Hipporrhininae	—	—	—	—	—	—	—	—	6	188	—	—	6	188
Hylobiinae	7	30	42	701	28	183	33	249	36	182	10	64	156	1409
Hyperinae	—	7	7	36	11	289	3	36	5	13	4	11	31*	393*
Laemosaccinae	—	1	1	55	—	—	1	8	—	—	—	70	2	134
Leptopiinae	23	145	75	513	3	46	7	222	9	45	33	363	150	1334
Magdalinae	1	27	8	19	1	53	1	7	—	—	1	6	12	112
Mesoptiliinae	—	—	1	1	—	—	—	—	—	—	—	—	1	1
Nanophyinae	—	5	—	1	2	78	1	77	5	100	—	5	8	266
Nerthopinae	—	—	2	3	—	—	1	2	8	10	—	—	11	15
Omophorinae	—	—	—	—	—	—	2	3	2	24	—	4	4	31
Otidocephalinae	—	32	7	161	—	—	1	4	—	4	—	—	8	201
Otiorrhynchinae	37	94	33	411	84	2082	125	1050	132	1033	41	323	452	4997*
Oxycoryninae	—	—	4	12	—	—	1	12	2	3	—	—	7	27
Petalochilinae[6]	—	—	10	31	—	—	—	—	—	—	—	—	10	31
Phrynixinae	—	—	—	—	—	—	—	—	—	—	28	113	28	113
Pissodinae	—	32	5	9	1	13	3	10	3	9	5	14	17	87
Prionomerinae[7]	—	6	6	119	—	—	10	41	1	2	1	1	18	169
Pterocolinae	1	1	1	5	—	—	—	—	—	—	—	—	2	6
Pyropinae	—	—	3	8	—	—	—	—	—	—	—	—	3	8
Raymondionyminae	1	4	—	—	3	38	—	—	1	1	—	—	5	43
Rhadinosominae	—	—	—	—	—	—	—	—	1	1	4	12	5	13
Rhynchaeninae	—	18	2	4	3	80	4	39	2	28	—	9	11	178
Rhynchitinae	1	49	8	146	14	118	15	599	7	94	3	71	48	1077
Rhynchophorinae[8]	7	80	21	272	3	11	69	539	54	235	2	10	156	1148*
Rhyparosominae	—	1	1	1	2	5	—	1	5	19	12	108	20	135
Rhytirrhininae	—	—	1	4	16	171	—	1	10	69	6	33	33	278
Somatodinae	—	—	—	—	—	—	—	—	2	8	2	2	4	10
Tachygoninae	—	8	2	70	—	—	2	14	—	—	—	—	4	92
Tanyrrhynchinae	—	—	—	—	2	10	2	4	27	94	7	13	38	121
Thecesterninae	1	7	**	**	1	3	—	—	—	—	1	1	3	11
Trigonocolinae	—	—	—	—	—	—	2	17	1	34	—	—	3	51
Tychiinae	8	58	3	57	9	448	6	34	2	100	4	50	32	747
Ulomascinae	—	—	1	1	—	—	—	—	3	14	—	—	4	15
Xiphaspidinae	—	—	—	—	—	—	—	—	1	1	—	—	1	1
Zygopinae[9]	3	52	55	822	4	20	65	520	63	581	5	33	195	2028
Subfam. unknown	—	—	4	7	9	11	6	5	10	12	—	—	30*	39*
Total	239	2388	1170	12962	480	8253	879	8579	796	7516	671	5166	4237*	44883*

Footnotes 1-9: [1] includes Ithycerinae; [2] includes Tanymecinae; [3] includes the synonym, Epipedinae; [4] includes Eugnominae; [5] includes Mecyslobinae; [6] includes the synonym, Juanorhininae; [7] includes Piazorhininae; [8] includes Campyloscelinae and Phaenomerinae; [9] includes Menemachinae.

Footnote *: These totals include species or genera that could not be placed by biogeographic region.

Footnote **: One genus and two species, not included in the Coleopterorum Catalogus, were omitted here and should be added to totals as well.

two countries perhaps can be better placed in the Palearctic region we treated all such as Oriental. Also all from Mexico were included in the Neotropical region, though much of the northern desert and mountain areas of Mexico are clearly Nearctic. In spite of these and a few other such necessities the bulk of the data fit well within the usual limits of the biogeographic regions.

We have recorded the data by subfamilies primarily following the classification in the Coleopterorum Catalogus. This relatively conservative classification fits reasonably our own concepts of the subfamilies and those used by most current weevil specialists. We have indicated a few exceptions to this in footnotes to the table.

A NEW U.S. RECORD FOR *GLENANTHE INTERIOR* CHILLCOTT (DIPTERA: EPHYDRIDAE)[1]

J.T. Regensburg[2]

ABSTRACT: *Glenanthe interior* Chillcott has previously been reported only from Manitoba, Canada. This paper reports its presence in the United States and notes some differences from other North American species.

DESCRIPTORS: Diptera; Ephydridae; *Glenanthe*.

A survey of the ephydrid fauna of southern Ohio was conducted during 1974 and 1975. One species was collected which has not been previously reported in the United States.

Glenanthe interior Chillcott was first collected in southern Manitoba (Chillcott, 1964). The type-locality, the Bald Head Hills, is a region of active sand dunes in a spruce-covered area representing the shores of Pleistocene Lake Agassiz. The holotype and several other specimens were swept from *Petalostemum* sp. (prairie clover) on the sand dunes, June 21, 1958.

A single female was taken at Hueston Woods State Park, Butler Co., Ohio (39°33.4'N, 84°43.9'W) July 2, 1975. The habitat was a fairly stable sedge meadow within a seepage area below Acton Lake dam.

Wirth (1965) lists two species of *Glenanthe* Haliday for North America (*G. interior* being described after publication of the catalog). The geographic range of these two is apparently limited to coastal regions. *G. fascipennis* Sturtevant and Wheeler has been reported from Texas (Sturtevant and Wheeler, 1954). Probably the most common North American species, *G. litorea* Cresson has been collected from Alaska to Central America, and from New Brunswick to Florida (Cresson, 1925, 1942; Sturtevant and Wheeler, 1954; Wirth, 1965).

G. interior differs from *G. fascipennis* in the following morphological characters (Chillcott, 1964):

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1) Distinct brown pleura with a pale gray transverse vitta just below the middle of the mesopleuron;
2) Distinct brown spots at the bases of most bristles;
3) Usually a complete spurious crossvein between veins R_{2+3} and R_{4+5};
4) Strong proclinate orbitals;
5) A different pattern in placement of the wing markings.

Unmarked wings constitutes the most conspicuous intrageneric character for *G. litorea.*

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NOTES ON NORTH AMERICAN CERAMBYCIDAE (COLEOPTERA)[1]

F.T. Hovore[2], R.L. Penrose[3], E.F. Giesbert[4]

ABSTRACT: New distributional, bionomic or host plant data is presented for species in the following genera: *Callipogonius, Eburia, Elaphidion, Hypexilis, Mecas, Megacyllene, Nesostizocera, Obrium, Piezocera, Ataxia* and *Lochmaeocles.* Characters for the separation of *Elaphidion cryptum* Linsley and *E. irroratum* (Linnaeus) are enumerated. *Xeranoplium gracile* Linsley is placed as a junior synonym of *X. tricallosum* (Knull). *Heterops dimidiata* (Chevrolat) and *Eupogonius annulicornis* Fisher are recorded from North America for the first time. Corrigenda to a previous paper are given.

DESCRIPTORS: Cerambycidae, ecology, taxonomy, host plants, distribution, larvae, Arizona, Texas, Florida.

In an earlier paper, Hovore and Giesbert (1976) presented new ecological and distributional information for 63 species of Cerambycidae from western North America. The following brief accounts, based primarily upon the authors' recent field observations and collections in southern Arizona, southern Texas and the Florida Keys, are supplemental to that paper.

Specimens accumulated during these investigations are in the collections of the authors unless otherwise indicated. Miscellaneous corrigenda to our 1976 paper follow the species accounts.

Callipogonius cornutus (Linsley)

Linsley and Martin (1933) recorded this cryptically-colored lamiine as "beaten from dead *Salix*", and later, Linsley (1935), in his revision of the Pogonocherini, stated that *Salix* was the host, based upon the collection of numerous adults from dead and dying willow branches. We have confirmed *Salix* as the larval host by rearing numerous specimens from dead willow branches collected in the Sabal Palm Grove Sanctuary near Brownsville, Cameron County, Texas. Larvae tunnel parallel with the grain in the heartwood of small to medium-sized (20 – 40 mm dia.) branches. Pupation occurs in an oval cell beneath the bark or in the sapwood. Most individuals apparently require only one year to complete development, although adults continued to emerge in decreasing numbers for three years following branch

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collection. *Ataxia crypta* (Say), *Lochmaeocles c. cornuticeps* (Schaeffer) and the Buprestid *Dicerca lurida* (Fabricius) also emerged from the dead willow branches.

Eburia stigmatica Chevrolat and *Eburia mutica* LeConte

Linsley and Martin (1933) and Vogt (1949) collected adults of these species from beneath loose bark of *Salix, Acacia* and *Celtis* in southern Texas. F.T. Hovore and E.F. Giesbert collected adults and pupae of both species from pupal cells in the sound, dry heartwood of dead *Celtis* near Brownsville.

Elaphidion cryptum Linsley and *Elaphidion irroratum* (Linnaeus)

Elaphidion cryptum, described in 1963 from 5 females collected on Palmetto Key, Monroe County, Florida, was encountered in large numbers on Key Largo in April. Adults were collected at night from blossoms on freshly cut, down-hanging branches of wild tamarind (*Lysiloma bahamense* Benth.). A few specimens of both sexes were also attracted to mercury vapor and ultraviolet lights. *Elaphidion irroratum,* with which *cryptum* is frequently confused in collections, was also taken at light and on the *Lysiloma* blossoms.

Males of *E. cryptum* differ obviously from both sexes of *irroratum* by their more narrow, tapering form, bispinose 3rd and 4th antennal segments, absence of pale pubescence on the sides of the pronotum on the apical one-fourth, and feebly impressed, closely punctate prosternum. Males of both species are also easily separated by the much shorter antennae in *cryptum,* surpassing the elytral apices by little more than one segment. Sexual differences within *cryptum* include the narrower form of the male, with the fifth abdominal tergite distinctly emarginate (subtruncate in female) and the pronotal sides finely rugulose (coarsely, closely punctate in female).

Eupogonius annulicornis Fisher and *Heterops dimidiata* (Chevrolat)

Single specimens of both these longhorns were collected at mercury vapor light on Key Largo in May, 1975, by E.F. Giesbert. R.H. Turnbow Jr., (pers. comm.) beat two specimens of *E. annulicornis* and three of *H. dimidiata* from foliage of gumbo limbo (*Bursera simarubra* (L.) Sarg.) in May, 1977. A single specimen of *H. dimidiata* from Key Largo (Weems coll.) is also present in the Knull Collection, Field Museum of Natural History, Chicago. In addition to representing the first North American records for both species, *H. dimidiatus* is the first known North American member of the tribe Heteropsini.

Zayas (1975) records *H. dimidiata* as being active diurnally and feeding upon "la pulpa de las semillas de Anga (*Penthecolobius dulce*)." No biological information is presented for *E. annulicornis* by either Zayas or Fisher (1926). Multiple collections of both species would suggest that the West Indian *Heterops* and rare Cuban *Eupogonius* are established in the Florida Keys.

***Hypexilis pallida* Horn**

Linsley (1962) recorded this species only as having been collected at light in southern Texas. Several specimens were beaten from *Salix* near Brownsville, and F.T. Hovore beat a single female from Cedar Elm (Ulmus crassifolia Nutt.) at Bentsen-Rio Grande Valley State Park, Hidalgo County. It has also been taken at light in Green Gulch and Chisos Basin, Big Bend National Park, Brewster County. A single specimen in the California Insect Survey Collection, UC Berkeley, is from: Mexico, Nuevo Leon, 15 mi W Linares, VIII-27-1969, J. Haddock, J. Doyen collectors.

***Mecas linsleyi* Knull**

Originally described in 1975 from specimens collected on "Mexican devilweed" (*Aster spinosus* Benth.) at Bentsen-Rio Grande Valley State Park, this species' distribution is now known to include the southern Gulf-coast region of Texas. Numerous adults were beaten from *A. spinosus* in the Woodland-Spiny aster and Spiny aster-Longtom plant communities of Welder Wildlife Refuge, San Patricio County (May, 1977), and from scattered small stands of *Aster* at Anzalduas Park, Hidalgo County (May, 1976).

***Mecas (Dylobolus) rotundicollis* (Thomson)**

Chemsak and Linsley (1973) recorded *M. rotundicollis* as having been collected from flowers of *Guardiola* and *Eysenhardtia* in Mexico. Over 75 specimens of this attractive Lampyrid-mimicking longhorn were collected in May, 1977, from stems and foliage of Frostweed (*Verbescina microptera* D.C.) growing along the margins of a Bunchgrass-Annual forb plant community at Welder Wildlife Refuge. Another longhorn, *Hemierana marginata* (Fabricius) was also common on the Frostweed at this locality.

***Megacyllene robusta* Linsley and Chemsak**

This large clytine is extremely rare in collections, and nothing has heretofore been published concerning its habits. Recently, a group of entomology students from California State University, San Jose, and A.E. Lewis collected a few specimens from *Haplopappus* blossoms and stems and foliage of mesquite (*Prosopis glandulosa* Torr.), 2 mi S Willcox, Cochise County, Arizona. Subsequently, in early October 1976 and 1977, F.T. Hovore and E.F. Giesbert collected large series of adults and observed the habits of this species on mesquite along the northern margin of Willcox Dry Lake.

Females of *M. robusta* oviposit in bark crevices near the bases of smaller trees (10 – 15 cm dia.) or on large lateral branches of older trees. Larvae feed beneath the bark, excavating broad, meandering galleries packed with fine, grainy frass and fecula. The pupal cell is constructed in the sapwood or heartwood, and is plugged with coarse shredded frass which is occasionally visible externally. Fresh emergence holes are conspicuous in October; holes from previous years are evident as oval rings of scar tissue.

Megacyllene antennata (White), *Oncideres rhodosticta* Bates and the Buprestid *Chrysobothris octocola* LeConte were also present on the mesquite trees.

Nesostizocera floridana (Linsley)

Linsley (1949) described and later (1963) recharacterized this species from two females labelled "Marco, Florida" (Marco Island, Collier County). A.E. Lewis and the authors took series of both sexes at lights in April and May on Sanibel Island, Lee County. R.L. Penrose and F.T. Hovore observed adults of *N. floridana* walking, mating and ovipositing at night on dead limbs of Florida privet (*Forestiera segregata* var. *segregata* (Jacq.) Klug & Urban) in a thicket at the south end of the island. Numerous adults have subsequently been reared from this host.

Larvae mine extensively in the cambium and inner bark surface, packing their galleries with fine, grainy fecula and light, shredded frass. The simple, elongate pupal cell is constructed parallel with the grain in the heartwood; the exit hole is plugged to the inner bark surface with a wad of shredded frass. Adults emerged from infested wood for two seasons.

Males of *N. floridana* differ from females by their more slender, tapering form and longer antennae, surpassing the elytral apices by 3½ segments.

Obrium mozinnae Linell

This diminutive orange and black Texan species was originally described (1896) from a pair of specimens beaten from *Mozinna* (=Jathropa) *spatulata.* Linsley and Martin (1933) took it at light and by beating *Acacia*; Vogt (1949) beat it from the flowers and foliage of Brasil (*Condalia obovata* Hook.). The authors beat and reared *O. mozinnae* from tepehuaje (*Leucaena pulverulenta* (Schlect.) Benth.) branches which had been girdled and killed by *Oncideres pustulata* LeConte. A single specimen in the UC Berkeley Collection from Brownsville (H.S. Barber coll.) is labelled "ex. Huisache" (= *Acacia farnesiana* (L.) Willd.).

Piezocera serraticollis Linell

Numerous specimens of this apparently rare species were beaten from dead and dying spiny hackberry (*Celtis spinosa* Spreng., var. *pallida* Torr.) in the Sabal Palm Grove Sanctuary, May 1977. Occasional individuals were also collected from decadent branches of Texas ebony (*Pithecellobium flexicaule* (Benth.) Coulter), sugar hackberry (*C. laevigata* Willd.) and blossoms of tepehuaje.

Wickham (1898) recorded this species as inhabiting "thickets" in the lower Rio Grande Valley; Townsend (1902) took a single specimen by "beating in palmetto jungle at Santo Tomas, June 16th." Neither Linsley (1963), nor Martins (1976) list any host associations for *P. serraticollis.*

***Xeranoplium gracile* Linsley 57-16 = *Xeranoplium tricallosum* (Knull) 38-140**, New synonymy.

Study of a long series of specimens from a number of localities in southern Arizona shows that the single character cited by Linsley (1962) for separation of these two taxa–the number of discal pronotal callosities (4 in *gracile,* 2 in *tricallosum*)–is evenly transitional between the two extremes, depending solely upon the degree of development of the basal pair of protuberances. By this synonymy, *X. tricallosum* becomes the type species of the genus.

Corrigenda

The following changes should be noted to a previous paper (Hovore and Giesbert, 1976) on western Cerambycidae: p. 350, *Stenodontes arizonicus* (Casey): information given for this species refers in part to an undescribed species of *Stenodontes* (Subg. *Mallodon*) which breeds in living oak trees. *S. arizonicus* apparently utilizes dead wood. Host records of *"Condalia"* for *Chrotoma dunniana* Casey (p. 354) and *Anelaphus inflaticollis* Chemsak (p. 355) were based upon mis-identifications of boxthorn (*Lycium* spp.). *Parevander xanthomelas* (Guerin) and *Mannophorus laetus* LeConte were taken on flowers of *Viguiera stenoloba* Blake, not *Verbescina encilioides.*

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ERRATUM

In the paper "A New and Apparently Extinct Katydid from Antioch Sand Dunes (Orthoptera: Tettigoniidae)" by D.C.F. Rentz in Entomological News 88: 9 & 10: 241-245, November & December, 1977, due to a printing error, there was an omission from the second line of the species description on page 242. That line should have read "fornia, 1 July 1937. E.S. Ross collector. Holotype deposited in California Academy of". This line was intact on the proof submitted to and approved by the author but most of it was lost at the printer before final negatives were made. Both the printer and the editor apologize for this error. New reprints are being furnished gratis to the author, and anyone wishing a complete and correct reprint of this paper should write to D.C.F. Rentz, Curator of Orthoptera, Australian National Insect Collection, Division of Entomology, Commonwealth Scientific and Industrial Organization (CSIRO) P.O. Box 1700, Canberra City, A.C.T. 2601, Australia.

HOMONYMY NOTES IN THE BOMBYLIIDAE (DIPTERA). I.[1]

Neal L. Evenhuis[2]

ABSTRACT: The following new names for the genus *Bombylius* are proposed: *Bombylius basipennis,* n.n.; *Bombylius cirrhopus,* n.n.; *Bombylius efflatounbeyi,* n.n.; *Bombylius fascipennis,* n.n.; *Bombylius luteolus,* n.n.; *Bombylius maculipennis timondavidi,* n.n.; *Bombylius major notialis,* n.n.; *Bombylius medius varipennis,* n.n.; *Bombylius minor thapsinoides,* n.n.; *Bombylius walkeri,* n.n.

DESCRIPTORS: Diptera; Bombyliidae; *Bombylius*; homonyms.

In preparing a checklist of the world Bombyliidae, it was found that many of the names now in use are preoccupied and need to be changed. The following list is the first in a series of articles dealing with these name changes.

Until the status of *Spogostylum* Macquart and *Argyromoeba* Schiner are clarified with relation to *Anthrax* Scopoli in the Old World fauna, they are left here as separate genera. If either one or both are eventually synonymized under *Anthrax,* as they are in the New World (Marston, 1970), then name changes must be proposed for the homonyms that would result.

Bombylius cirrhopus, new name for *Bombylius fulvipes* Bigot, 1892: 362. Preoccupied by *Bombylius fulvipes* Villers, 1789: 609.

Bombylius efflatounbeyi, new name for *Bombylius minisculus* Efflatoun, 1945: 346. Preoccupied by *Bombylius minisculus* Hesse, 1938: 266.

Bombylius fascipennis, new name for *Bombylius pulchellus* Loew, 1863: 300. Preoccupied by *Bombylius pulchellus* Eversmann, 1834: 423.

Bombylius luteolus, new name for *Bombylius flavescens* Palm, 1875: 413. Preoccupied by *Bombylius flavescens* Philippi, 1865: 650.

Bombylius maculipennis timondavidi, new name for *Bombylius maculipennis melanopus* Timon-David, 1952: 144. Preoccupied by *Bombylius melanopus* Bezzi, 1924: 53.

Bombylius major notialis, new name for *Bombylius major australis* Loew, 1855: 14. Preoccupied by *Bombylius australis* Guérin-Méneville, 1838: 294.

Bombylius medius varipennis, new name for *Bombylius medius pictipennis* Loew, 1855: 12. Preoccupied by *Bombylius pictipennis* Macquart, 1849: 118.

Bombylius minor thapsinoides, new name for *Bombylius minor ochraceus* Paramonov, 1926: 59. Preoccupied by *Bombylius ochraceus* Bigot, 1892: 364.

Bombylius walkeri, new name for *Bombylius nanus* Walker, 1849: 278. Preoccupied by *Bombylius nanus* Meigen, 1838: 67.

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HOMONYMY NOTES IN THE BOMBYLIIDAE (DIPTERA). II.[1]

Neal L. Evenhuis[2]

ABSTRACT: The following new names are proposed in the family Bombyliidae: *Cytherea lyncharribalzagai,* n. n.; *Cytherea deserticola pallidifrons,* n.n.; *Exoprosopa dispar paramonovi,* n. n.; *Exoprosopa transcaspica,* n. n.; *Exoprosopa walkeri,* n. n.; *Geron colei,* n.n.; *Lomatia belzebul paramonovi,* n.n.; *Lomatia orientalis,* n.n.; *Usia glauca,* n.n.

DESCRIPTORS: Diptera, Bombyliidae; *Cytherea; Exoprosopa; Geron; Lomatia; Usia;* new names.

The following is the second list of name changes for preoccupied names in the family Bombyliidae.

Cytherea lyncharribalzagai, new name for *Cytherea cinerea* (Lynch Arribalzaga), 1878: 273 (as *Mulio*). Preoccupied by *Cytherea cinerea* Fabricius, 1805: 116.

Cytherea deserticola pallidifrons, new name for *Cytherea deserticola albifrons* Paramonov, 1930: 34. Preoccupied by *Cytherea albifrons* (Loew) 1873: 168 (as *Mulio*).

Exoprosopa dispar paramonovi, new name for *Exoprosopa dispar interrupta* Paramonov, 1928: 226. Preoccupied by *Exoprosopa interrupta* (Wiedemann), 1828: 273 (as *Anthrax*).

Exoprosopa transcaspica, new name for *Exoprosopa hyalipennis* Paramonov, 1928: 55. Preoccupied by *Exoprosopa hyalipennis* Cole, 1923: 290.

Exoprosopa walkeri, new name for *Exoprosopa antica* Walker 1871: 261. Preoccupied by *Exoprosopa antica* (Walker) 1852: 183 (as *Anthrax*).

Geron colei, new name for *Geron insularis* Cole, 1923: 313. Preoccupied by *Geron insularis* (Bigot), 1857: 332 (as *Bombylius*).

Lomatia belzebul paramonovi, new name for *Lomatia belzebul loewi* Paramonov, 1931: 142. Preoccupied by *Lomatia loewi* Bezzi, 1912: 614.

Lomatia orientalis, new name for *Lomatia brunnipennis* (Wulp), 1868: 110 (as *Comptosia*). Preoccupied by *Lomatia brunnipennis* (Macquart), 1840: 70 (as *Anthrax*). Though Bowden (1975) leaves *brunnipennis* Wulp in *Comptosia,* the original description and accompanying illustration of the wing identify it as a true *Lomatia.*

Usia glauca, new name for *Usia grisea* (Paramonov), 1947: 218 (as *Parageron*). Preoccupied by *Usia grisea* Efflatoun, 1945: 214. Since *Parageron* has been reduced to subgeneric status by Hull (1973), *grisea* Paramonov becomes a homonym of *grisea* Efflatoun and the name change above is necessary.

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NEW SYNONYMY IN EPHYDRIDAE (DIPTERA)[1]

Wayne N. Mathis[2]

ABSTRACT: The identity of *Coenia flavipes* Macquart is clarified. The species is transferred to *Ephydra* where it becomes the senior synonym of *E. helwanensis* Steyskal. Macquart's original locality data from South America are questioned and it is suggested that the syntypes were collected in the Old World.

While revising the Neotropical species of the tribe Ephydrini, I discovered the new synonymy and new combination indicated below. Because the changes do not affect my study of Neotropical Ephydrini and thus will not be included (see discussion) and because other workers have studies in progress for which the name changes would be useful, I am presenting the results now. Label data accompanying each syntype specimen are cited in full. A slash indicates a label change; clarifying or interpretive comments are inserted parenthetically.

Ephydra flavipes (Macquart), New Combination

Coenia flavipes Macquart, 1843: 412.
Ephydra helwanensis Steyskal, 1968: 110. Wirth, 1975: 32 (key, synonymy, and figures of male genitalia). **New Synonymy**

Through the kindness of Dr. Loic Matile, National Museum d'Histoire Naturelle, Paris, I was able to study Macquart's syntype series (2♂♂, 1♀) of *C. flavipes.* One of the males is here designated as lectotype and is labelled as follows: "2125. 33(1833). (Handwritten on a white, round label that is green colored on the underside)/**Lectotype** Coenia flavipes Macquart, by W.N. Mathis (red)." The male paralectotype is labelled: "1933. 33(1833). (handwritten on a white, round label that is green colored on the underside)/Coenia flavipes (handwritten)/**Paralectotype** Coenia flavipes Macquart, by W.N. Mathis (red)." The female paralectotype is labelled: "2123. 33(1833). (handwritten on a white, round label that is green colored on the underside)/**Paralectotype** Coenia flavipes Macquart, by W.N. Mathis (red)." The lectotype and both paralectotypes are in the National Museum d'Histoire Naturelle, Paris. All three specimens are double-mounted; the lectotype and female paralectotype are somewhat moldy; and the male paralectotype lacks its head. The abdomens of both males have been removed and dissected; the

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structures are in attached microvials. The total length of the lectotype before its abdomen was removed was 3.92 mm.

Wirth (1975:35) reported that *E. flavipes* (as *E. helwanensis*) is "...the commonest and most widespread of the brine flies occurring around the Mediterranean." The species also occurs eastward into Pakistan and the Aldabra Atoll and westward to the Canary Islands. This distribution does not coincide at all with that cited in the original description by Macquart (1843:275), who stated that the syntype specimens were collected in either Brazil or Chile (by Charles Gaudichard-Beaupré).

According to Papavero (1971), Gaudichard made three expeditions to South America, in 1817, 1831, and 1836 respectively. Because the syntype specimens were accessioned in 1833, it is likely that they were collected during the second voyage, which returned to France in May of 1833. However, unlike the first and third voyages, of which there are recorded port stops at Old World localities, the available itinerary of the second voyage (Urban, 1908) lists only South American ports.

Because the known distribution of the species is limited to the Old World, I am of the opinion that the "Du Bresil ou du Chili" locality record of Macquart is in error. Either the specimens were mislabelled or like the first and third voyages, supply stops were made at Old World ports such as the Canary Islands, where the fly is known to occur.

For further information on the identity, biology, and distribution of *E. flavipes*, refer to Wirth's recent revision of Old World *Ephydra* (1975).

I am grateful to Dr. Matile for loaning the syntypes and for interpreting the label data, to Dr. F.C. Thompson for hand carrying the specimens from Paris, and to Dr. W.W. Wirth for his critique of this paper.

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NEW RECORDS OF *ATISSA* IN OHIO (DIPTERA: EPHYDRIDAE)[1]

B.A. Steinly[2]

ABSTRACT: County records are presented for *Atissa litoralis* (Cole) and *Atissa pygmaea* (Haliday) for Ohio. These species were collected in saline and freshwater habitats. *Atissa pygmaea* is a previously unpublished record for Ohio.

DESCRIPTORS: Diptera; Ephydridae; *Atissa.*

Atissa litoralis (Cole) and *Atissa pygmaea* (Haliday) were earlier considered to be "sea beach-forms" in the eastern United States (Sturtevant and Wheeler, 1954). *A. litoralis,* "a scarce western species" (Cresson, 1942) was reported from Iowa (Deonier, 1965) and Ohio (Scheiring and Foote, 1970). *A. litoralis* puparia were collected at Rittman, Wayne County, Ohio around highly saline pools (Scheiring and Foote, 1973). *A. pygmaea* specimens were examined by Sturtevant and Wheeler (1954) from several states west of the Mississippi River including Missouri, Arkansas, Arizona, California, Texas, Oklahoma, Nebraska, New Mexico, and Nevada. Deonier (1965) collected *A. pygmaea* in Iowa in the sand-shore habitat. *A. pygmaea* was reported from numerous coastal states east of the Mississippi River including New Hampshire, Massachusetts, Alabama, Louisiana, New Jersey, and Mississippi (Sturtevant and Wheeler, 1954). Wirth (1965) listed the geographic range of *A. pygmaea*: Ireland; Alaska to Wyoming south to California and Florida; Central and South America; Europe.

Morphological separation of the species is based upon the number of rows of mesonotal setae and the number of setulae on the scutellum. *A. litoralis* has six rows of mesonotal setae between the interalars and a distinctly setulose scutellum as compared with four rows of mesonotal setae between the interalars and few setulae on the scutellum for *A. pygmaea* (Sturtevant and Wheeler, 1954). Deonier (1964) and Regensburg (1976) separated these species in the following way: *A. litoralis* with frons very oblique in profile, much shorter than the median face height; antenna dark brown; anteroclinate fronto-orbital well developed contrasted to *A. pygmaea* with frons, in profile, nearly horizontal or sloping anteroventrad at about 30°, its length subequal to the median face height; antenna yellow; anteroclinate fronto-orbital pale and reduced.

A recently concluded survey of the ephydrid fauna of northern Ohio

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confirmed the presence of *A. litoralis* at Rittman, Wayne County. Additional populations were discovered in Lorain and Van Wert Counties. Intensive collecting established that *A. litoralis* occurs in freshwater habitats in these counties. These new records substantiate a wider habitat and county distribution for the species in northern Ohio.

Adults of *A. pygmaea* were collected during the survey at Rittman, Wayne County and Beaver Creek, Lorain County. Specimens were collected with a modified aerial net (Regensburg, 1977) along the shores of salt pools and freshwater habitats respectively. This new state record for *A. pygmaea* constitutes a significant extension of the inland range within the eastern United States.

Family Ephydridae

1. *Atissa litoralis* (Cole)
   Distribution: Lorain Co., Beaver Creek, 23 adults, VIII-22-1977. Lorain Co., Beaver Creek, 48 adults, VIII-24-1977. Lorain Co., Beaver Creek, 8 adults, VI-29-1977. Lorain Co., Beaver Creek, 10 adults, VI-30-1977. Lorain Co., Vermillion River, 1 adult, IX-22-1976. Van Wert Co., Little Auglaize River, 1 adult, VIII-18-1976.
2. *Atissa pygmaea* (Haliday)
   Distribution: Wayne Co., Rittman Salt Pools, 4 adults, VI-30-1977. Lorain Co., Beaver Creek, 4 adults, VIII-22-1977. Lorain Co., Beaver Creek, 6 adults, VIII-24-1977.

ACKNOWLEDGEMENTS

I wish to thank Mr. Richard E. Winkler, Office Manager of the Rittman Plant of Morton Salt Company for permission to collect at the salt pools. Acknowledgement is made to Dr. D.L. Deonier for his useful critique of the manuscript.

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FOUR NEW SPECIES OF *HECALAPONA* (HOMOPTERA: CICADELLIDAE) FROM BRAZIL AND PERU[1]

Dwight M. DeLong[2]

ABSTRACT: Four new species of *Hecalapona, H. parela* n.sp., *H. virella* n. sp., *H. delara* n.sp. and *H. denella* n.sp. are described from Brazil and Peru.

DESCRIPTORS: New Brazil and Peru *Hecalapona* (Homoptera: Cicadellidae)

The genus *Hecalapona* was described by DeLong and Freytag (1975) who treated 39 species including *Gypona vittulata* Stal. DeLong (1975) described three species from Panama. Four new species from Brazil and Peru are described at this time.

Hecalapona parela n.sp.

(Figs. 1-5)

Length of male 7mm., female unknown. Crown more than three-fourths as long as basal width between eyes. Ocelli distinctly nearer anterior than posterior margins of crown. Color dull yellow, tinted with orange.

Male genitalia with plates four times as long as median width, apex rounded. Style with apical half more slender and curved dorsally. Aedeagal shaft blunt at apex, a slender process arising at base and contiguous with shaft on ventral margin to near apex, bends latero-ventrally subapically; protruding portion about one-third length of shaft. Pygofer narrowed and bluntly rounded at apex.

Holotype male Viscosa Brazil, December 1929 in DeLong collection.

Hecalapona virella n.sp.

(Figs. 6-10)

Length of male 6.5mm., female unknown. Crown strongly produced three-fourth as long at middle as basal width between eyes. Color greenish yellow, a small black spot at middle length of pronotum behind each eye, and a black spot at end of middle claval vein on commissure.

Male genitalia with plates more than three times as long as median width, apices rounded. Style with blade gradually narrowed to slender ventrally recurved apex, tip extending basad. Aedeagal shaft appearing slender in lateral view slightly broadened medially, apex curved dorsally, with a pair of short subapical spine-like processes at two-thirds length of shaft. Pygofer narrowed apically, roundly, bluntly pointed at apex;

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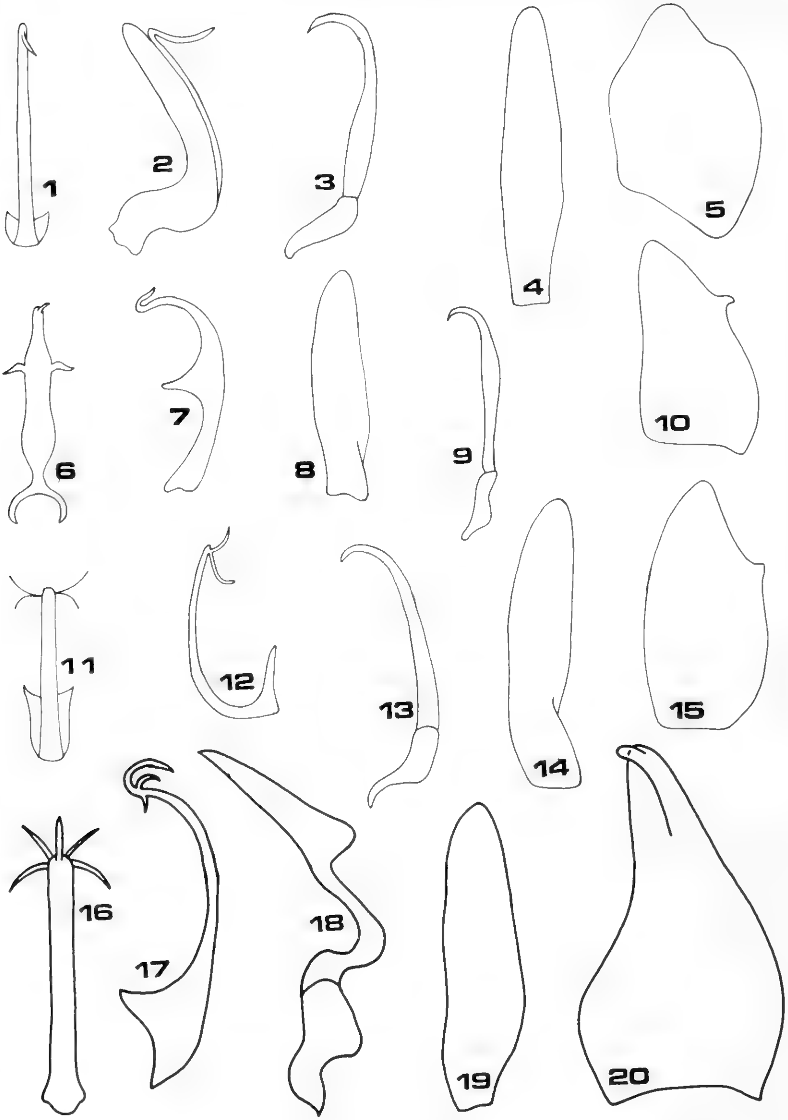
[1] Accepted for publication: November 12, 1977

[2] Department of Entomology, The Ohio State University



Figures 1-5 *H. parela* n.sp. 1 – aedeagus ventrally, 2 – aedeagus laterally, 3 – style laterally, 4 – plate ventrally, 5 – pygofer laterally. **Figs. 6-10** *H. virella* n.sp. 6 – aedeagus ventrally, 7 – aedeagus laterally, 8 – plate ventrally, 9 – style laterally, 10 – pygofer laterally. **Figs. 11-15** *H. delara* n.sp. 11 – aedeagus ventrally, 12 – aedeagus laterally, 13 – style laterally, 14 – plate ventrally, 15 – pygofer laterally. **Figs. 16-20** *H. denella* n.sp. 16 – aedeagus ventrally, 17 – aedeagus laterally, 18 – style laterally, 19 – plate ventrally, 20 – pygofer laterally.

ventral margin with a short blunt tubercle at two-thirds length of pygofer.

Holotype male Vicosa Brazil Dec. 1, 1929. E. Hambleton coll. Paratypes 5 ♂ same as holotype; 1 ♂ same except 10-14-29, 2 ♂ same except 10-18-29: 1 ♂ same except 9-17-29; 1 ♂ same except Dec. 1929.

Hecalapona delara n. sp.

(Figs. 11-15)

Length of male 6.5mm., female unknown. Crown strongly roundedly produced, more than half as long as basal width between eyes. Ocelli closer anterior than posterior margin. Color dull yellow, a black spot at one half length of pronotum behind each eye.

Male genitalia with plates about four times as long as median width, apices rounded. Style with apex broadly curved dorsally. Aedeagal shaft blunt apically with a pair of subapical bifid processes. The processes are almost apical, extend laterally, and the apical portion is slightly longer than the ventral portion, curving caudad. The ventral branch curves basad. Pygofer with a slight blunt tubercle on ventral margin at two-thirds its length beyond which the apical portion is narrowed, apex bluntly pointed.

Holotype male Viscosa Brazil, December 13, 1929 in the DeLong collection.

Hecalapona denella n.sp.

(Figs. 16-20)

Length of male 8.5mm., female unknown. Crown produced, rounded, not quite as long at middle as basal width between eyes. Ocelli about equidistant between anterior and posterior margins. Color dull to golden yellow.

Male genitalia more than three times as long as median width. Style with blade recurved then narrowed before the apical half which is abruptly broadened then gradually narrowed to a bluntly pointed apex. Aedeagus with five apical processes, a median process which curves caudad then basad, a pair of straight processes extending from apex caudolaterally and a slightly subapical pair which are a little longer, extending laterally and curving basad. Pygofer with apical portion narrowed, apex narrow, blunt, rounded. A narrow process arising at three-fourth length of pygofer, on ventral portion, extends slightly beyond apex dorsally and is narrow and rounded at apex.

Holotype male Lorata, Ucayali R. Yarina Cocha, Peru, XII-23-1953, Peter Hocking, in the Chicago Field Museum Collection.

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DeLong, Dwight M. 1976. Three new species of *Hecalapona* (Homoptera: Cicadellidae) from Panama. Jour. Kans. Ent. Soc. 49: 364-366.

Stal, C. 1854. Nya Hemiptera Ofr. Svenska. Vet. Akad. Forh. 11: 231-255.

PROCEEDINGS OF A.E.S. MEMBERSHIP MEETINGS

The October 1977 meeting was held Thursday, 13 October, in the Entomology Department at the University of Delaware, Newark. The meeting began at 7:45 p.m. with 8 members and 8 visitors present.

President Boyd introduced Millard (Bill) Davis a natural historian and writer. Bill's newest book is *The Near Woods*. R.W. Rust, Recording Secretary, presented a synoptic review of the Council's activities since the last membership meeting. These included the status of a possible new agreement with the Academy of Natural Sciences of Philadelphia, the change of membership meetings to the 2nd Thursday of October, November, February, March and April, changes in membership dues and subscription rates and the publishing of the membership meeting proceedings.

Insect Notes – Charles Mason, Corresponding Secretary, reported finding a large concentration of *Hermisia lucians* (Stratiomyidae) larvae in his compost pile. 100-200 individuals were collected from a small section ($.25m^2$) of the heap. Howard Boyd reported that late season tiger beetle collecting in the New Jersey Pine Barrens had produced 2 species, *Cicindela repanda* and *C. tranquebarica.* Bill Davis observed that yellowjackets, *Vespula* species, visited only empty wine and beer bottles at a mixed glass recycling center in central New Jersey. Wayne Lord observed a skunk, *Mephitis mephitis,* dig up and eat the contents of a *Vespula maculifrons* nest.

Meeting Presentation – Dr. Paul P. Shubeck from Montclair State College, N.J., presented an illustrated talk on Ecological Studies of Carrion Beetles (Coleoptera: Silphidae) and Methods of Trapping Them. Dr. Shubeck discussed his research with the seasonal distribution and movement patterns of the seven most common carrion beetles found in central New Jersey. These are *Silpha americana, S. noveboracensis, S. inaequalis, Necrodes surinamensis, Nicrophorus orbicollis, N. tomentosus* and *N. pustulatus.* He also reported on an 8 month study of all carrion visiting beetles which included species in the families Silphidae, Leptodiridae, Staphylinidae, Histeridae, Nitidulidae and Scarabaeidae. His presentation was followed by a lengthy discussion period. Coffee and donuts were provided by the Department of Entomology and Applied Ecology, University of Delaware. Meeting adjourned 9:30 p.m.

The November membership meeting was held Thursday, 10 November 1977 in the Entomology Department at the University of Delaware. The meeting began at 8:00 p.m., President Boyd presiding, with 8 members and 2 visitors present.

William Day, Chairperson of the Nominating Committee, presented the slate of candidates for the 1978 election: President – H.P. Boyd, Vice President – D. Otte, Treasurer – J. Freese, Recording Secretary – R.W. Rust, Corresponding Secretary – C.E. Mason.

Meeting Presentation – C. Mason introduced the evening's speaker Dr. Landis Doner, Eastern Regional Research Center, Agricultural Research Service, U.S.D.A. Dr. Doner spoke on "Determination of Type of Plant Sources (C_3 vs. C_4) by Examination of Honey." Dr. Doner presented an interesting talk on the process of how the honeybee converts nectar to honey and the complex nature of honey as compared to other simple sugars. He also explained the problems of detecting adulterated honey or the production of fake honeys with corn syrup and invert syrup and how the identification of the nectar source by measuring the isotope ratios of ^{13}C to ^{12}C or C_3 vs. C_4 plants can provide a 99.9% validity test. He pointed out the use of the C_3 vs. C_4 test for other plant sugar products, maple syrup, vanilla, etc. Coffee and donuts were served following the meeting. Meeting adjourned 9:05 p.m.

Richard W. Rust, Recording Secretary

TWO NEW SPECIES OF *SALINAMEXUS* FROM WESTERN NORTH AMERICA (COLEOPTERA: STAPHYLINIDAE)[1]

Ian Moore[2]

The three known species of *Salinamexus* Moore & Legner are intertidal insects from the shores of the northeastern Pacific Ocean. The first species was recently discovered in the Gulf of California (Moore & Legner 1977). One of the present species is also from the Gulf of California and the other from the coast of Washington. These three species may be easily distinguished among themselves by the following key:

Key to the species of *Salinamexus*

1. Tenth antennal segment longer than wide . . . . *browni* Moore & Legner
   Tenth antennal segment not longer than wide 2
2. Eyes shorter than tempora . . . . *giulianii,* new species.
   Eyes about as long as tempora . . . . *densus,* new species.

Salinamexus giulianii, new species

Color largely piceous with the appendages and mouth parts dark ferrugineous.

Head quadrate, as wide as long. Surface rather coarsely and densely reticulate with fine sparse pubescence. Disc concave. Eyes not prominent, occupying about one-third of the side of the head. Apex arcuate, tempora almost straight to the rounded basal angles, base broadly emarginate. Antennae longer than head and pronotum, moderately incrassate; first and second segments each about twice as long as wide with second segment slightly smaller than first; third segment a little more than half as long as second; fourth segment shorter than third, about as long as wide; fifth through tenth segments progressively larger with the tenth about as long as wide; eleventh segment as wide as tenth, almost twice as long as wide, rather abruptly narrowed before the narrowly rounded apex.

Thorax. Pronotum quadrate; about as long as wide, a little narrower than head; widest near apical angles; apex gently arcuate, apical angles narrowly rounded, sides straight and converging to narrowly rounded basal angles, base about four-fifths as wide as apex, slightly emarginate; surface slightly concave; sculpture and pubescence as on head. Elytra con-jointly wider than long, humeral angles broadly rounded, sides nearly straight, slightly diverging to acute outer apical angles, apex straight to the narrowly rounded obtuse inner apical angles, sculpture and pubescence as on head and pronotum.

Abdomen parallel; fourth and fifth tergites longer than the preceding; sculpture similar to that of elytra but not as strong; pubescence fine and sparse.

Length 2.2 mm.

Holotype: male with aedeagus extruded, Washington, Callum County, two miles north of LaPush, 17 October, 1974, Derham Giuliani collector.

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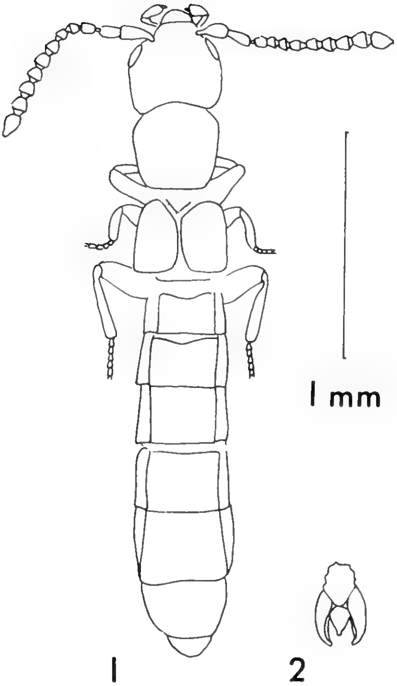
[1] Accepted for publication: January 9, 1978

[2] Division of Biological Control, University of California, Riverside, California 92502



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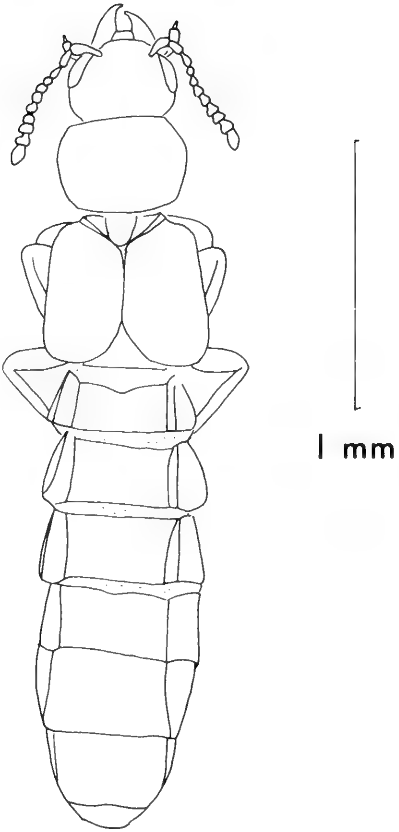

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Fig. 1. Dorsal aspect of *Salinamexus giulianii,* new species.

Fig. 2. Aedeagus of *Salinamexus giulianii,* new species.

Fig. 3. Dorsal aspect of *Salinamexus densus,* new species.

Paratypes: three males with aedeagus extruded and sixteen of undetermined sex with the same data as the holotype. External sexual differences have not been observed. There is no noticeable variation in color or size. According to Mr. Guiliani the specimens were very numerous and were very actively running about on a rock surface a few inches above the water during a high tide, in the sun. The rock was a large outcrop rising out of the sand.

Disposition of types. The holotype will be deposited on permanent loan at the California Academy of Sciences in San Francisco. The paratypes are at present in the collection of the University of California at Riverside.

Notes. This species is easily distinguished from *S. browni* Moore and Legner by its shorter antennae, the penultimate segments of which are not longer than wide and by its shorter elytra. It is known from *S. densus* by the shorter elytra and smaller eyes. It is named for its collector, Derham Giuliani.

Salinamexus densus, new species

Color largely piceous with the appendages and mouthparts dark ferrugineous.

Head ovoid, about one-fourth wider than long, surface evenly convex. Eyes not prominent, occupying a little more than half the side of head. Tempora evenly rounded. Surface very densely finely reticulate. Pubescence fine and sparse. Antennae moderately incrassate; shorter than the head and pronotum; first segment about twice as long as wide; second about two-thirds as long as first and a little narrower; third a little shorter and narrower than second; fourth half as long as second, about as wide as long; fifth through tenth hardly increasing in length but progressively wider until tenth is distinctly transverse; eleventh twice as long as tenth, pointed at apex.

Thorax. Pronotum quadrate, almost one-half wider than long, apex straight, anterior angles narrowly rounded, sides arcuate anteriorly, thence slightly sinuate to the very narrowly rounded obtuse basal angles, base broadly arcuate. Sculpture and pubescence as on head. Elytra conjointly one-sixth longer than wide, about twice as long as pronotum, humeral angles broadly rounded, sides slightly arcuate and diverging to the narrowly rounded outer apical angles, apex gently arcuate into the very broadly rounded inner apical angles. Sculpture and pubescence as on foreparts.

Abdomen slightly widened to fifth segment which is longer than the preceding four. Surface shining and finely reticulate. Pubescence very sparse and fine.

Length 3.0 mm.

Holotype: sex unknown, Mexico, Sonora, 15 miles southeast of Guaymas, 24 April, 1974, on beach, Derham Giuliani collector. According to Mr. Giuliani, "The location was at the north end of a rocky cliff where the beach begins running north. The tide was coming in so I could look only at the high tide level under rocks and dead fish that were on the sand or on smooth rock surfaces partly covered with sand. The staph, along with some histerids and dermestids had to be picked up in this way."

Notes. This species is easily known by its short antennae with the penultimate segment transverse, its large eyes and long elytra.

The mesosternal process is long and acute extending more than half the distance between the coxae. The middle tibiae are furnished with somewhat stouter setae than the front and posterior tibiae. The elytra are dehiscent. These three characters are not as in *S. browni* and *S. giulianii*. However, this species otherwise closely resembles the other two in most respects so it seems best to include it here rather than create a new genus for it.

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THE AMERICAN ENTOMOLOGICAL SOCIETY

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SCANNING ELECTRON MICROSCOPY OF ULTRAVIOLET-REFLECTIVE PRUINOSITY IN SPECIES OF *OCHTHERA* (DIPTERA: EPHYDRIDAE)[1]

B.A. Steinly,[2] D.L. Deonier,[3] J.T. Regensburg[4]

ABSTRACT: The micro-structural characteristics of the ultraviolet-reflective pruinosity on *Ochthera* were studied with a Coates and Welter Model 106 field emission scanning electron microscope. Micrographs of pruinosity having the greatest ultraviolet reflectance on *Ochthera mantis* (De Geer) and *O. lauta* Wheeler showed it to be composed of flattened units somewhat concave in cross-section and abruptly deflected apically. Nonreflective or minimally reflective pruinosity in both species was shown to be composed of appressed subuliform units or, as on dark areas of the abdomen, short, decumbent, setuloid units.

The scanning electron microscopy of cuticular surfaces of acalyptrate Diptera has been largely neglected. Bauchhenss and Renner (1977) investigated the pulvillus of *Calliphora erythrocephala* (Diptera: Calliphoridae) and Slifer and Sekhon (1964) the fine structure of the sense organs on the antennal flagellum of *Sarcophaga argyrostoma* (Diptera: Sarcophagidae).

The present study was initiated to provide more information on pruinosity of acalyptrates and to determine the micro-structural characteristics of ultraviolet-reflective pruinosity on *Ochthera* (Diptera: Ephydridae). When photographed through a Wratten filter, the golden pruinose face and silvery pruinose front coxae of *O. mantis* were shown to reflect relatively much more ultraviolet radiation than other body regions (Deonier, 1975). These data along with observed semaphoring with the large raptorial front legs and experimental disruption of mating in sexual pairs by obliteration of reflective fore-coxal pruinosity were interpreted as evidence for a signalling function of the reflectance.

Materials and Methods

The 12 specimens of *Ochthera mantis* examined were collected at Ravenel L., Highlands, Macon Co., North Carolina; a tributary of Four-mile Cr., Preble Co., Ohio; and near Oxford, Butler Co., Ohio. The 4 specimens of *O. lauta* were collected in Kansas at Sappa L., Decatur Co. and the Kansas R. near

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[1] Accepted for publication: February 9, 1978

[2] [3] [4] Department of Zoology, Miami University, Oxford, OH 45056

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Eudora, Douglas Co. and in Iowa near Fraser Dam on the Des Moines R., Boone Co. Both species were determined by using the keys and descriptions in Clausen (1977).

The specimens were mounted with double adhesive tape on standard aluminum studs and dried under incandescent light for 4 hours immediately prior to examination. The scanning electron microscope used was a Coates and Welter Model 106 field emission type having a maximum magnification of 90,000 X (photographic) or 180,000 X (visual) and a resolution of 60Å. Micrographs were made on Kodak 120 film (ASA 400) at f:5.6 with an emission current of 18 amperes and an accelerating voltage of 50. Ultraviolet reflectance was photographed on Kodak Tri-X Pan (ASA 400) at f:8, 0.8 sec. through a Kodak Wratten Ultraviolet Filter No. 18A (filter window range 3,000-4,000 Å) fitted to a 55 mm F:3.5 Micro Nikkor Auto lens on a Nikkormat camera.

Results

Scanning electron micrographs of pruinosity on adults of *Ochthera mantis* and *O. lauta* having the greatest reflectance of ultraviolet radiation showed it to be composed of flattened units somewhat concave in cross-section and abruptly deflected apically. The face of *O. mantis* (Fig. 1) is golden pruinose with paired ventrally diverging paramedial ridges. At low magnification, the pruinosity had a beaded-mat texture (Fig. 3) which at higher magnification was resolved into dense, apically deflected semierect lanceolate units (Fig. 4). This deflection of the apices (Fig. 7) occurred so regularly in all specimens that it was not likely an artifact. These broad, thin units (Fig. 6) had slightly upturned edges and averaged 0.40 um wide (range 0.35-0.48) and 1.90 um long (range 1.10-3.26). They occurred on both the median and lateral areas of the face and were sharply demarcated from units of the parafacialia, which were typically long, ensiform units (Fig. 4, 5) averaging 0.30 um wide (range 0.20-0.37) and 2.70 um long (range 2.25-2.49). The pruinosity units of face and parafacialia differed markedly in specific density and orientation. The long axes of the facial units were oriented dorsoventrally whereas those of the parafacial units were variably oriented (Fig. 3, 4, 5). The specific densities of the facial and parafacial units averaged respectively 100 per 100 um^2 (range 89-108) and 200 per 100 um^2 (range 180-212).

The face of *O. lauta* (Fig. 2) is moderately gibbose centrally with a pair of median silvery or golden-pruinose stripes separated by a slightly rugulose, shining black stripe and bordered laterally by paired, diagonally rugulose, ventrally diverging, shining black lines. Lateral to these lines are 7-9 shining black, shallow transverse depressions surrounded by silvery or golden pruinosity so as to give a definite barred impression to the face. The

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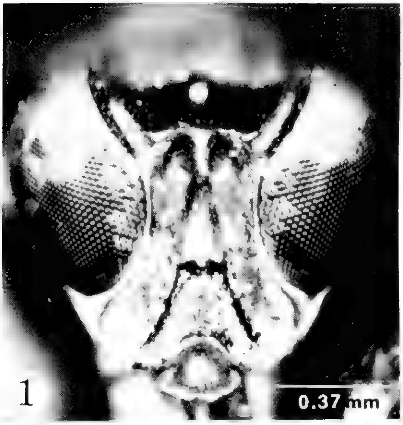

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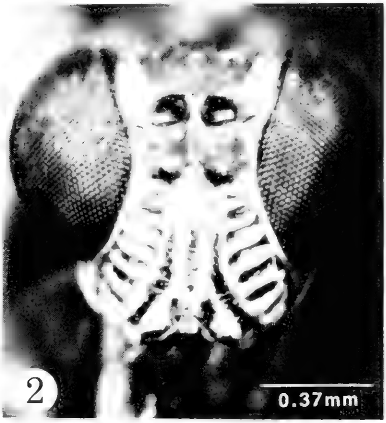

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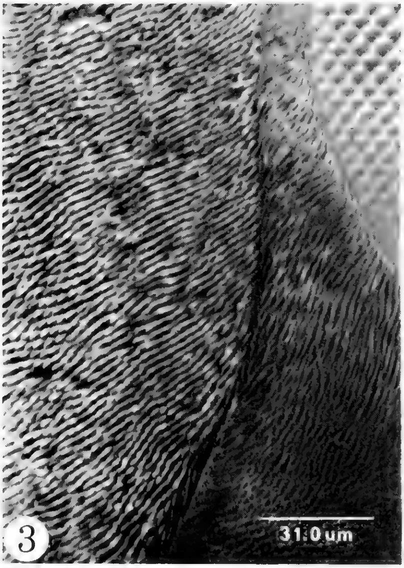

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Fig. 1. *O. mantis*: head, anterior view. Fig. 2. *O. lauta*: head, anterior view. Fig. 3. *O. mantis*: head, suture between face and parafaciale, anterior view. Fig. 4. *O. mantis*: head, suture between face (lower) and parafaciale (upper), anterolateral view.

transverse depressions (Fig. 9, 10) are bare except for the paired inner and outer facial setae. The pruinosity surrounding the depressions consisted of flattened, decumbent arcuate units (Fig. 10, 11). These units which also occur on the parafacialia and genae averaged 1.60 um wide (range 1.11-2.20) and 23.10 um long (range 14.00-28.40). They were directed medioventrad (Fig. 9, 10) and averaged 6 per 100 um^2 with a range of 4.79-7.10 per 100 um^2 (Fig. 10, 11).

Examination of the anterior coxal surfaces of *O. mantis* (Fig. 13) showed that the highly reflective silvery pruinosity consisted of both semierect, broad, thin lanceolate units (Fig. 8) and numerous semierect, striated, linear-lanceolate units (Fig. 14). The lanceolate units were slightly narrower and less attenuated apically than those on the face. Also, the entire unit tended to be gradually decumbent (Fig. 8) as opposed to the abrupt deflection of the apex in the facial unit. Density differences between anterior and lateral coxal surfaces were not sharply delineated. In *O. lauta,* anterior coxal surfaces were covered primarily with semierect flattened, linear-lanceolate units having projecting, non-deflected apices. The only sharp demarcation in density was associated with the proximal end of the anterior coxal surface (Fig. 12). Measurement of units in these zones showed noticeable size differences. The linear-lanceolate units in the sparse zone averaged 1.40 um wide (range 0.73-1.44) and 13.10 um long (range 9.10-17.30) as compared to the appressed setuloid units of the dense zone which averaged 0.70 um wide (range 0.45-0.73) and 15.40 um long (range 10.00-16.50). The average specific density of the dense zone was about twice that of the sparse zone.

The pleura of both species had reflective pruinosity of the semierect linear-lanceolate type with abruptly deflected apices. This pleural pruinosity was noticeably denser in *O. lauta.*

Nonreflective surfaces of both species had appressed subuliform units (Fig. 15) or, as on dark areas of the abdomen, short, decumbent, setuloid units (Fig. 16). The latter averaged 0.60 um in diameter (range 0.12-1.10) and 17.50 um in length (range 12.50-26.10). The femora had comparable nonreflective units as did the lateral (outer) surfaces of the fore-coxae where they were arranged in clusters of 3 within rows (Fig. 15).

Discussion

The results indicate that the pruinosity with maximal ultraviolet reflectance is composed of flattened units with slightly upturned edges whereas pruinosity with minimal ultraviolet reflectance is composed of round units. Apparently, the abruptly deflected apices in combination with the broad,

Fig. 5. *O. mantis*: head, lanceolate facial pruinosity (left) and linear-lanceolate parafacial pruinosity (right), anterolateral view. Fig. 6. *O. mantis*: head, lanceolate facial pruinosity, anterior view. Fig. 7. *O. mantis*: head, lanceolate facial pruinosity showing apical deflection, lateral view. Fig. 8. *O. mantis*: front coxa, anterior surface, anterolateral view.

Fig. 9. *O. lauta*: head, transverse facial depressions, anterolateral view. Fig. 10. *O. lauta*: head, transverse facial depressions, anterolateral view. Fig. 11. *O. lauta*: head, facial pruinosity around transverse depression, anterior view. Fig. 12. *O. lauta*: front coxa, anterobasal surface, anterior view.

Fig. 13. *O. mantis*: front coxa, anterior surface, anterior view. Fig. 14. *O. mantis*: front coxa, anterior surface pruinosity, anterolateral view. Fig. 15. *O. mantis*: front coxa, lateral surface, anterolateral view. Fig. 16. *O. lauta*: abdomen, dorsum, dorsolateral view.

slightly parabolic exposed shafts of the units effect the maximum reflectance possible from hairlike pruinosity units. The analogy to certain highly reflective lepidopteran scales is reinforced by the greater specific density of highly reflective pruinosity compared to dark or minimally reflective pruinosity.

All of the nonsocketed units of both types of pruinosity appear to be identical to microcuticular processes in Trichoptera to which Slifer and Sekhon (1971) applied the term microtrichia. However, we wish to point out that the term microtrichia (singular: microtrichion) has been defined as minute, nonsocketed, hairlike processes on the membrane of wings, e.g. in Diptera, Mecoptera, and Trichoptera (Chapman, 1971; Imms, 1957; Torre-Bueno, 1937; and others). A precise morphological term is needed for these pruinosity units and other nonsocketed microcuticular processes and, if the term microtrichia cannot, without confusion, be extended to include them, we propose that the term nanotrichia be used for them.

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TWO NEW SPECIES OF *PTILODACTYLA* (COLEOPTERA: PTILODACTYLIDAE)[1] [2]

Victor Johnson, Paul H. Freytag[3]

ABSTRACT: Two species of *Ptilodactyla* from Eastern North America are described. Both species, *carinata* n. sp. and *acuta* n. sp., are closely related to *serricollis* (Say) in that the male genital structures are similar. All three species are illustrated and compared.

Since Chapin (1927) studied the North American species of *Ptilodactyla,* it has been considered there are but four species in this genus north of the border with Mexico. We have reviewed the species of this genus and found all four species plus the two species described in this paper which have probably been included under the name *serricollis* as just variations of the male genitalia. These two species are described at this time and compared with *serricollis.*

Ptilodactyla serricollis (Say)

(Figures 1-2, and 7)

Ptilinus serricollis Say 1823, p. 186. Type – lost.
Ptilodactyla serricollis Horn 1880, p. 90; Chapin 1927, p. 242; Spilman 1961, p. 105.

This species is well described by Chapin (1927). The following clarifications can be added:

Tarsal claws of prolegs of male with inner portions of unguis about half length of claw, nearly truncate at apex (Fig. 7).

Median lobe of male penis strongly but asymetrically widened just before apex (Figs. 1 and 2). Lateral lobes nearly as long as median lobe, setiform.

Material examined: 24♂, 30♀, Lexington, Kentucky, from June 4-Sept. 3, 1969-71, Victor Johnson, at light; 10♂, 1♀, Pike Co., Kentucky, June 15, 1972, Victor Johnson, at light; 1♂, Hot Springs, Arkansas, June 10, 1971, Victor Johnson, at light; 7♂, Savannah, Georgia, from July 20-Sept. 11, 1971, Victor Johnson, at light. All in the University of Kentucky Collection.

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Ptilodactyla carinata n. sp.

(Figures 3-4, and 8)

Closely related to *serricollis* in all aspects except male tarsal claws and the apex of the median lobe of the penis.

Tarsal claws of prolegs of male with inner portions of unguis about half length of claw, median margin notched (Fig. 8).

Male genitalia similar to that of *serricollis,* except median lobe with apex smaller; widened symmetrically near apex (Figs. 3 and 4). Lateral lobes nearly same length as median lobe, setiform.

Note: This species is quite similar to *serricollis* in both size, shape, and color. The male genital structures and tarsal claws are quite different and will easily distinguish it from *serricollis.*

Holotype male and allotype female: Lexington, Kentucky, June 10, 1970, Victor Johnson, blacklight. Paratypes: three males, Lexington, Kentucky, one, June 25, 1969, one, June 28, 1969, one, Sept. 3, 1972, Victor Johnson, blacklight. Holotype and allotype deposited in the U.S. National Museum. Paratypes in the University of Kentucky Collection.

Other material examined: Two males, Fayette Co., Kentucky, June 24, 1970, Chris Sperka; 2♂, 2♀, Hot Springs, Arkansas, June 10, 1971, Victor Johnson, light trap; 2♂, 1♀, Carter Co., Kentucky, June 28, 1976, Victor Johnson, sweeping; 7♂, Savannah, Georgia, from June 18-Sept. 4, 1971-1972, Victor Johnson, blacklight. All in the University of Kentucky Collection.

Ptilodactyla acuta n. sp.

(Figures 5-6, and 9)

Closely related to *serricollis* in all aspects except male tarsal claws and the apex of the median lobe of the penis.

Tarsal claws of prolegs of male with inner portions of unguis about two-thirds length of claw, median margin deeply notched, with apex somewhat truncate (Fig. 9).

Male genitalia similar to that of *serricollis,* except median lobe much smaller in diameter, nearly same size to apex, only slightly widened before apex (Figs. 6 and 6). Lateral lobes nearly same length as median lobe, setiform.

Note: This species is quite similar to *serricollis* in size and color. The male genital structures are distinct and easily distinguished. The tarsal claw is similar to that of *equilobata,* but the male genitalia will easily distinguish it from that species.

Holotype male and allotype female: Savannah, Georgia, October 10, 1971, Victor Johnson, blacklight. Paratypes: 25♂, 25♀, same data as holotype. Holotype, allotype and 10 paratypes deposited in the U.S. National Museum. Other paratypes in the University of Kentucky Collection.

Other material examined: More than 200 specimens from the type locality collected from May 28-Oct. 18, 1971-1972. All in the University of Kentucky Collection.

We also have records of *angustata* from Lexington, Kentucky in June, Savannah, Georgia from June to September, and Abingdon, Virginia in July.

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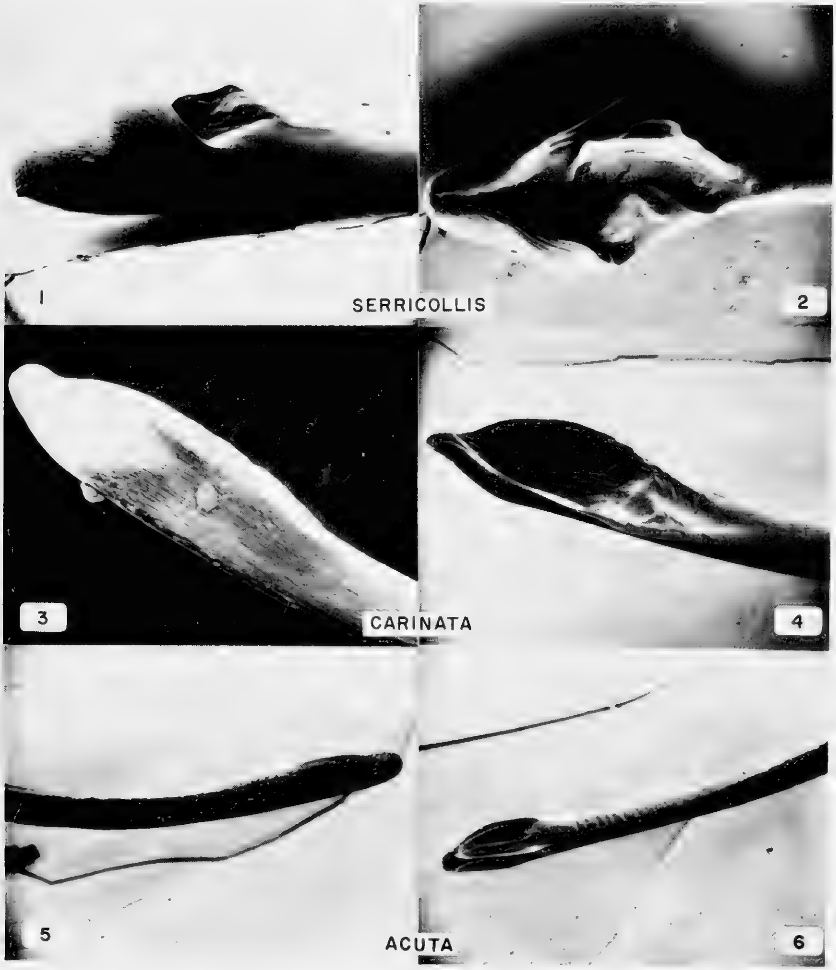

Figs. 1-6. SEM photographs of apical end of median lobe of male penis. 1. *Ptilodactyla serricollis* (Say), lateral view. 2. *P. serricollis* (Say), dorsal view. 3. *P. carinata* n. sp., lateral view. 4. *P. carinata* n. sp., dorsal view. 5. *P. acuta* n. sp., lateral view. 6. *P. acuta* n. sp. dorsal view. All to same scale (240x).

Figs. 7-9. SEM photographs of prothoracic tarsal claw of male. 7. *Ptilodactyla serricollis* (Say), 8. *P. carinata* n. sp. 9. *P. acuta* n. sp. All approximately to same scale (240x).

ANOTHER PREVIOUSLY UNDESCRIBED FEMALE OF A NEARCTIC SPECIES OF *PARYDRA* (DIPTERA: EPHYDRIDAE)[1] [2]

Philip J. Clausen[3]

ABSTRACT: The female of *Parydra (Chaetoapnaea) acuta* Clausen is described, illustrated, and an allotype designated. Also, the description of the male is modified and changes in existing keys for both males and females are made.

When the revision of the nearctic species of the tribe Parydrini (Clausen and Cook, 1971) was completed, four species of the genus *Parydra* were known solely from males. Later in Clausen (1977), this number was reduced to two species. Now, with the discoveries of the females of *Parydra acuta,* the females of only a single species remain to be described. Consequently, this paper should be considered as a supplement to Clausen and Cook (1971) and Clausen (1977).

In my original description of the males of *Parydra acuta,* I have only recently discovered an error in the calculation of the ratios of the costal section of the wing. Also, *Parydra acuta* was described from just two male specimens, and I since have seen five more. Therefore, with the error and discovery of more males, I am herein modifying the description of the males, describing the females, and correcting the existing keys for both.

Parydra (Chaetoapnaea) acuta Clausen

Diagnosis: Costal section of wing from R_1 to R_{2+3} 1.3 to 1.7 times the distance from R_{2+3} to R_{4+5}. **Male** with anterior ventral areas of tergites 3, 4 and 5 rounded or somewhat angled; gonites long, narrow and pointed, but not hooked at apex; aedeagus gradually tapering to a pointed apex. **Female** abdomen with sternites 6 through 8 much wider than other sternites; sternites 6, 7 and 8 all subequal in length.

Description: MALE. – As in Clausen and Cook, 1971, except **wing** with distance from h to R_1 0.48 to 0.58 mm; R_{2+3} to R_{4+5} 0.51 to 0.61 mm; and costal section from R_1 to R_{2+3} 1.3 to 1.6 times distance from R_{2+3} to R_{4+5}.

FEMALE. – Total body length 2.38 to 2.72 mm; shining black with golden, coppery and greyish pruinosity. **Head** shining black with coppery pruinosity except where stated;

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length 0.65 to 0.71 mm; ocellar triangle raised; 3 round ocelli; ocellar setae large, divergent; interocellar and postocellar setae small, divergent; 2 large pairs of orbital setae; eyes red, oval; vertex with coppery pruinosity above, becoming golden below; 1 large pair of convergent, inner vertical setae; 1 large pair of divergent, exterior vertical setae; postorbitals and occipitals small; gena black with golden pruinosity, ground color with metallic blue or green reflections. Face shining black with golden to greyish pruinosity, ground color with metallic blue reflections; straight to concave when viewed in profile; facial depressions long, from antennal base to first parafacial seta; 1 large pair and 2 to 4 smaller pairs of parafacial setae. Clypeus with golden pruinosity; mouthparts with greyish pruinosity. Antennae dark brown to black with coppery pruinosity; arista black, plumose.

Thorax shining black with golden to coppery pruinosity; faint greyish stripes between dorsocentral and acrostichal setal rows; greyish to white spot at intrascutal suture; scutum length 0.71 to 0.78 mm; many long acrostichal setae; many long dorsocentral setae, with 1 pair larger at intrascutal suture; 1 long pair of prescutellar setae; humeral and posthumeral setae long and fine; presuturals long and fine, 1 pair longer; 2 large pairs of notopleurals, posterior pair larger; 1 large pair of posterior intraalar setae; pleura shining black with golden pruinosity above, becoming greyish below; 1 large pair of mesopleural setae; sternum with greyish pruinosity; katepisternal spine absent. Scutellum shining black with coppery pruinosity; length 0.31 to 0.37 mm; apical process small, pointed; apical and lateral tubercules absent; apical and lateral scutellar setae large. **Legs** black except trochanters and tarsi dark brown; legs with greyish pruinosity; prothoracic tibiae with long yellow setae at apex; mesothoracic tibiae each without a spur but with 1 or 2 large anterior setae at apex; apex of metathoracic tibiae with anterior cluster of brown setae and a brown, posterior comb. **Wing** clouded; darkened areas around crossveins bounded by white areas, sometimes appearing purplish; one white spot posterior to medial crossvein; no spot near middle of M_{1+2}; veins brown; length from humeral crossvein 2.11 to 2.18 mm; width 0.95 to 1.05 mm; distance from h to R_1 0.54 to 0.61 mm; R_1 to R_{2+3} 0.95 to 1.02 mm; R_{2+3} to R_{4+5} 0.58 to 0.65 mm; R_{4+5} to M_{1+2} 0.27 to 0.34 mm; length of R_{4+5} 1.29 to 1.36 mm; length of M_{1+2} 0.61 to 0.68 mm; costal section from R_1 to R_{2+3} 1.5 to 1.7 times distance from R_{2+3} to R_{4+5}; halteres brownish yellow.

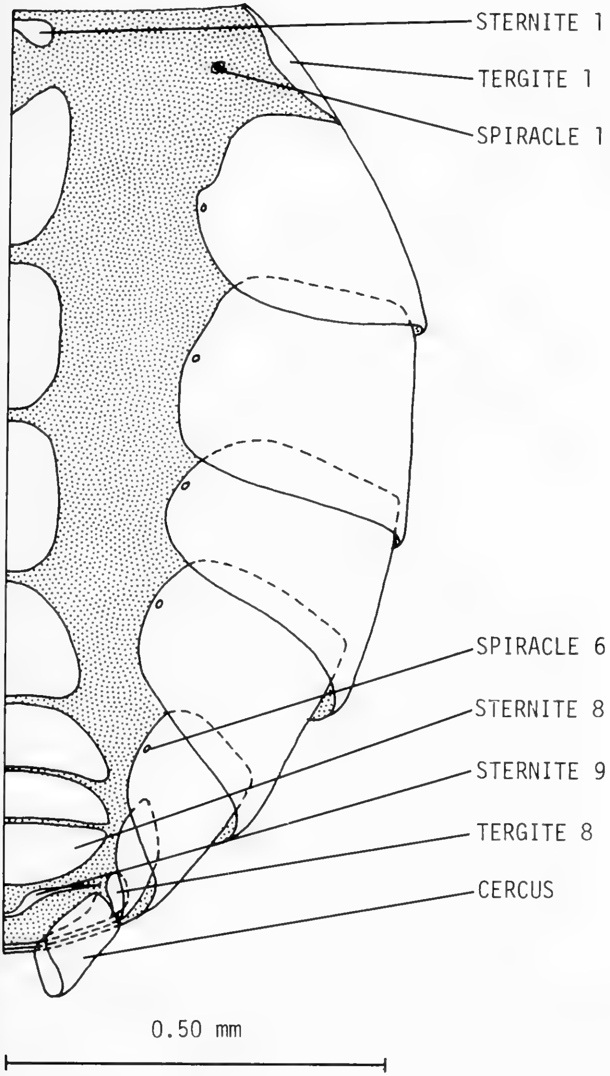
Abdomen as in Figure 1; shining black with golden pruinosity; setae rather long. Ventral receptacle as in Figure 2.

Distribution. Western Washington, near Mt. Rainier.

Specimens examined. 11 specimens (7♂♂ and 4♀♀). This species was described from the holotype and 1♂ paratype from Mt. Rainier, Washington (exact data in original description). Now, I have seen 5 more males and 4 females with the following data: 1♂, Washington, Pierce Co. Mt. Rainier N.P., West End Rd. nr. Payallup Riv., 3500 ft., VII-12-1977, R.S. Zack; 1♂, Washington, Pierce Co., Mt. Rainier N.P., Comet Falls Tr., above Christine Falls, 4500 ft., 13-VIII-77, W.J. Turner; and 3♂♂ and 4♀♀ Washington, Pierce Co., Mt. Rainier N.P., above Christine Falls, 3700 ft., VIII-(11-13)-1977, R.S. Zack, and one female of this series I am herein designating as the allotype. The allotype ♀ and the 5♂♂ and 2♀♀ will be deposited in the collection of Washington State University, and 1♀ will be retained in the author's collection.

Key

The males of *Parydra acuta* cannot be keyed out using my original key (Clausen and Cook, 1971). In my original description of this species, the



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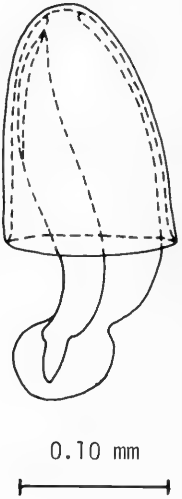

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Parydra acuta. Fig. 1 - Female Abdomen, Fig. 2 - Ventral receptacle.

costal section of the wing from R_1 to R_{2+3} was listed as being 0.6 to 0.8 times the distance from R_{2+3} to R_{4+5}, and this is an error. It should be 1.3 to 1.6 for males. Therefore all *acuta* males will key past couplet 30 to couplet 34, and then couplet 34 should be modified as follows:

34A. Aedeagus knife or sheath-like when viewed in profile (Fig. 95; Clausen and Cook, 1971); male abdomen as in Fig. 28 (Clausen and Cook, 1971) . . . . . *copis* Clausen

Aedeagus not as above, more slender, and pointed at apex 34B

34B. Aedeagus gradually tapering to a pointed apex (Fig. 90; Clausen and Cook, 1971); male abdomen as in Fig. 24 (Clausen and Cook, 1971) . . . . *acuta* Clausen

Aedeagus gouge-like when viewed in profile (Figs. 96 and 97; Clausen and Cook, 1971) . . . . *halteralis* (Cresson) 35

The females of *Parydra acuta* will key to couplet 50 in Clausen and Cook (1971) and then to couplet 51 in Clausen (1977). Now, couplet 51 (Clausen, 1977) should be modified as follows:

51A Sternites 5 through 8 much wider than other sternites (Fig. 3; Clausen, 1977); ventral receptacle as in Fig. 4 (Clausen, 1977) . . . . *spinosa* Clausen

Sternites 6 through 8 much wider than other sternites 51B

51B Sternite 6 longer than 7, and 7 longer than 8 (Fig. 70; Clausen and Cook, 1971); ventral receptacle as in Fig. 138 (Clausen and Cook, 1971) . . . . *succurva* Clausen

Sternites 6, 7 and 8 all subequal in length (Fig. 1); ventral receptacle as in Fig. 2 . . . . *acuta* Clausen

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I would like to thank Mr. Richard S. Zack of Washington State University for allowing me to use the specimens so necessary to this study.

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PREDATION OF ANTS BY MOUNTAIN QUAIL IN NEVADA (HYMENOPTERA: FORMICIDAE)[1] [2]

William H. Clark[3], Keith I. Giezentanner[4]

ABSTRACT: Four mountain quail, *Oreortyx pictus* (Douglas) were collected in northwestern Nevada in October 1972. Three of the quail were found to have fed upon worker ants; each contained a different species. *Formica subpolita* Mayr, *F. neogagates* Emery and *Camponotus* sp. were prey of the mountain quail. Ants formed a significant portion of the diet of these quail.

Ants form a frequent and significant portion of the food of a variety of wildlife. An example of this importance was given by Knowlton, Roberts and Wood (1946) who found that of 108 bird species examined in Utah, 70 species had recognizable ants in their stomachs. Since the ant species in such accounts are seldom listed we present the following.

On 1 October 1972, four Mountain Quail, *Oreortyx pictus* (Douglas) were collected on Dogskin Mountain, T24N, R19E, S35, Latitude 39°55' N, Longitude 119°49' W, Washoe County, Nevada, at an elevation of 2073 m (6800'). Examination of the crops of these birds revealed that three of the four had consumed worker ants.

Table 1 lists the occurrence of ants and plant fragments found in the crops of the Mountain Quail. Quail #1 ingested 18 individuals of *Formica subpolita* Mayr; Quail #2, 21 individuals of *F. neogagates* Emery; Quail #3, 1 individual of *Camponotus* sp. (minor worker); and Quail #4, no ants. In the three quail containing ants, only one species of ant was found per bird. It appears that the quail fed near ant concentrations such as nests or foraging concentrations. Once such a concentration was found by the quail it was evidently exploited. All of the Mountain Quail had ingested unidentifiable fragments of vegetation.

The ant species involved are known to inhabit mountain regions (Creighton, 1950; Wheeler and Wheeler, 1973). La Rivers (1968) has reported the ants from Nevada. It is possible that these, as well as other mountain

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inhabiting ants, form a significant portion of the diet of *Oreortyx pictus*. Larrison, Tucker and Jollie (1967) state that the Mountain Quail diet in Idaho consists mainly of plant material with a small amount of animal food. Martin, Zim and Nelson (1961) report that animal food is minor in the Mountain Quail diet but that it consists chiefly of ants.

Voucher specimens of the ants are in the collection of Clark as follows: WHC #419 *Formica subpolita*; WHC #420 *Formica neogagates*; and WHC #421 *Camponotus* sp.

Table 1. Food items of four Mountain Quail, *Oreortyx pictus*, in Washoe County, Nevada, 1 October 1972.

FOOD ITEMS INJESTED

Quail No.	*Formica subpolita*	*F. neogagates*	*Camponotus*	vegetation
1	18	0	0	present
2	0	21	0	present
3	0	0	1	present
4	0	0	0	present

Ants injested were all workers.

ACKNOWLEDGMENT

The authors thank Drs. G.C. and J.N. Wheeler for making the ant determinations.

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DASYMUTILLA OCCIDENTALIS: A LONG-LIVED APOSEMATIC WASP (HYMENOPTERA: MUTILLIDAE)[1]

Justin O. Schmidt[2] [3]

ABSTRACT: Adult females of *D. occidentalis comanche* survived approximately 500 days in the laboratory. This longevity indicates that the species is capable of overwintering in the adult stage and that by doing so some females can take advantage of two full reproductive seasons. The long adult lifespan is probably also an adaptation of survival value against predators.

The female of *Dasymutilla occidentalis* (Linneaus), a large, conspicuous red-on-black mutillid wasp, is frequently cited as a classical example of an aposematically colored insect. Like many aposematic animals, this species also possesses effective defenses against predation (Schmidt and Blum, 1977). Aposematic insects tend to be long-lived; cryptic insects are generally short-lived (Edmunds, 1974). The paucity of published reports pertaining to the adult longevity of *D. occidentalis*, or, for that matter, any other species of mutillid wasp precipitated this study.

Five adult female *D. occidentalis* subspecies *comanche* (Blake) were captured June 17, 1976 in Colorado County, Texas. From this time onward they were maintained at room temperature in sand bottomed cages and provided freshly wet cotton and honey approximately once every three days. When given the opportunity they would completely bury themselves for periods of weeks in soft dirt (small potted plants were added to the cages for a time). All wasps appeared in excellent health throughout the period of captivity until several weeks before death, at which time general loss of movement of the prothoracic legs was noted. All five individuals lived through that summer, the next winter and spring, and the entire following summer. The captive survival times ranged from 445 to 550 days with an average of 497 days (S.E. = 18.3 days), or about 1 year and 4.5 months. These times represent a minimum adult lifetime: the times between pupal eclosion and capture are not known. One specimen of the other subspecies, *D. occidentalis occidentalis*, captured July 10, 1975 in Clarke County, Georgia and likewise

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maintained, survived 511 days.

Although the conditions in this study are artificial, the results nevertheless indicate that the wasps are capable of living to the close of a second season. The artificial feeding conditions were possibly a detriment to survival: the only food source was honey, a product rich in carbohydrate and poor in amino acids or proteins. In nature mutillid wasps are reported feeding upon exudates of plants (Linsley and Cazier, 1963) and host species (Brothers, 1972) as well as honeydew and other sweet secretions (*cf.* Brothers, 1972), food sources which together may well be more nourishing than honey alone.

It is generally believed that mutillid wasps overwinter in the pupal or prepupal stages (Mickel, 1928); however this is not always true. Potts and Smith (1944) found overwintering adult *D. aureola* subspecies *pacifica* (Cresson) and Evans and Miller (1969) reported that *D. nigripes* (Fabricius) can overwinter in the adult stage in Michigan. Possibly other species including *D. occidentalis* also overwinter as adults. Longevity, including overwintering, for *D. occidentalis* would have two advantages: two reproductive seasons would be possible rather than just one, and a maximum time per individual wasp for reinforcing the learned avoidance behavior of potential predators would be realized – both would be adaptations selectively advantageous to individuals of a species with moderately low population levels and low reproductive potentials.

ACKNOWLEDGEMENT

I thank Drs. Clarence E. Mickel and David A. Evans for criticisms of the manuscript.

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A NEW SPECIES OF *PSEUDOGONATOPUS* FROM KENTUCKY (HYMENOPTERA: DRYINIDAE)[1] [2]

Paul H. Freytag[3]

ABSTRACT: The species *Pseudogonatopus similis* n. sp. is described, illustrated and compared with its closest relative *P. stenocrani* Perkins (=*stenocrani dubiosus* Perkins and *iowensis* Fenton). *P. similis* has been reared continuously in the laboratory for one year on delphacids of the genus *Delphacodes.* Thelytokus reproduction occurs in this species and the females vary greatly in size with the total length varying from one to four mm. Approximately 30 days are needed to complete a life cycle from egg to adult.

Two species of *Pseudogonatopus* have been reared in Kentucky from delphacids of the genus *Delphacodes.* Both species are very closely related and look much alike. Since one is a new species, it is necessary to describe both and give differences which will separate them.

Pseudogonatopus stenocrani Perkins

(Fig. 1)

Pseudogonatopus stenocrani Perkins 1905, p. 38; Kieffer 1907, p. 17. (Type female – Ohio, BPBM).

Pseudogonatopus stenocrani stenocrani Kieffer 1914, p. 81; Muesebeck et al. 1951, p. 1036.

Pseudogonatopus stenocrani var *dubiosus* Perkins 1905, p. 39; Kieffer 1907, p. 17. (Type female – Ohio, BPBM) NEW SYNONYM.

Pseudogonatopus stenocrani dubiosus Kieffer 1914, p. 82; Muesebeck et al. 1951, p. 1036.

Pseudogonatopus iowensis Fenton 1924, p. 190; Muesebeck et al. 1951, p. 1036. (Type female – Ames, Iowa, USNM) NEW SYNONYM.

This species was first described by Perkins (1905) from three female specimens from Ohio which had the tenth segment of the antenna white. The variety *dubiosus* was described at the same time on one female which differed only by not having the tenth segment of the antenna white. Fenton (1924) described *iowensis* from a single female specimen from Ames, Iowa which had the tenth segment of the antenna pale yellow. Upon examination of these five

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type specimens, one additional female specimen from Michigan and four other females from Lexington, Kentucky, it was found that they represent but a single species. This species can now be characterized as follows:

Length of female: Quite variable, usually 2-4 mm.

Color: Generally brown to dark brown. Pterothorax, propodeum and lateral parts of prothorax black. Antennae mostly brown, tenth segment light yellow to white, basal segments light yellowish-brown. Face yellowish-brown.

Head with vertex slightly convex, surface finely punctate. Prothorax anteriorly constricted, finely punctate, saddle-shaped. Propodeum with posterior surface transversely rugose. Chela (Fig. 1) with fifth tarsal segment with a slightly enlarged apical end with a brush of lamellae, basal arm with two rows of lamellae. Claw with a single row of lamellae, usually 6-8, with a single seta at end of row near apex, apex with a subapical tooth.

Type: Holotype female from Ohio, Koebele, no. 5851 in the Bernice P. Bishop Museum. Reared from a nymph of *Stenocranus dorsalis.*

Notes: This species has been reported as reared from either *Liburnia lutulenta* (now called *Delphacodes lutulenta*) or *Stenocranus dorsalis.* No males are known. This species is probably widely distributed throughout much of the eastern part of the United States. However, at present, it is only known from Iowa, Kentucky, Michigan and Ohio.

Specimens seen other than the types are as follows: Kentucky-Lexington, one female, July 14, 1975, P.H. Freytag (died July 15); two females, July 23, 1975, P.H. Freytag (both died July 24); and one female July 19, 1976, P.H. Freytag (died July 25) all in the University of Kentucky collection. Michigan-Midland County, one female, July 15, 1958, R.R. Dreisbach, in the Michigan State University Collection.

1

2

Fig. 1. *Pseudogonatopus stenocrani Perkins, chela of female. Fig. 2. Pseudogonatopus similis* n. sp. chela of female.

Pseudogonatopus similis n. sp.

(Figs. 2-6)

A species very closely related to *stenocrani* but differing by having the thorax entirely brown and the fifth tarsal segment not greatly expanded at apex.

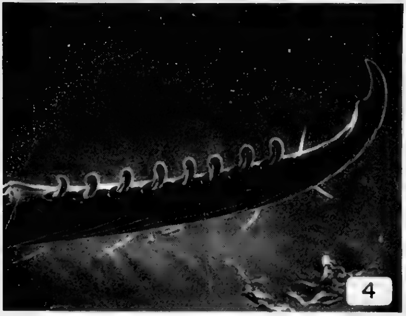
Length of female: Quite variable, from 1-4 mm.

Color: Generally light brown to brown. Antennae brown with the tenth segment usually white. Face and basal segments of antennal light yellowish-brown.

Head with vertex slightly convex, surface finely punctate. Prothorax with a slight anterior constriction, finely punctate, saddle-shaped. Propodeum with the posterior surface finely rugulose. Chela (Figs. 2-6) with fifth tarsal segment slightly enlarged at apex, lamellae in two rows along arm extending to a small grouping on the apical end. Claw with one row of lamellae, usually 7-9, with a single seta at end of row near apex, apex with a subapical tooth.


3


5


4


6

Fig. 3. *Pseudogonatopus similis* n. sp., claw of chela, ventral view, SEM photograph (500x). Fig. 4. *Pseudogonatopus similis* n. sp., claw of chela, lateral view, SEM photograph (500x). Fig. 5. *Pseudogonatopus similis* n. sp., apex of 5th tarsal segment, ventral view, SEM photograph (500x). Fig. 6. *Pseudogonatopus similis* n. sp., apex of 5th tarsal segment, lateral view, SEM photograph (500x).

Types: Holotype female, Lexington, Kentucky, June 7, 1976, P.H. Freytag (died June 27). Paratypes, 17 females, Lexington, Kentucky, June or July 1976, P.H. Freytag. All paratypes are offspring of the holotype, or the F_2 generation, reared in the laboratory on *Delphacodes lutulenta* (Van Duzee). The holotype and 10 paratypes are deposited in the U.S. National Museum collection. The remaining paratypes are deposited in the University of Kentucky collection.

Notes: This species has been continuously reared in the laboratory for more than a year. The data on the F_2 generation is given in Table 1. More than a thousand females have been reared without a single male specimen. Rearing conditions were usually maintained at 32°C and a 16-hour day. However, during the severe winter weather during January and February 1977 the temperature dipped to as low as 3°C for short periods. This change seemed to have little effect on this species except to lengthen the time for the life cycle. At normal rearing temperatures the life cycle from egg to adult takes approximately 30 days.

TABLE I

Data on F_2 Generation

Date Egg Layed	Number Parasitized	Approx. Date of Pupation	Adult Eclosed	Adult Died	
June 8	1	June 17	July 8	July 23	Paratype
June 8	1	June 17	July 8	July 26	Paratype
June 10	3	June 18	July 11	July 26	All Paratypes
June 14	1	June 22	July 14	July 26	Lost
June 14	2	June 23	died in cocoon		
June 15	1	June 23	July 14	July 26	Lost
June 15	2	died as larvae			
June 16	1	June 25	July 16	July 21	Paratype
June 16	1	June 25	July 19		Lost
June 16	1	June 25	died in cocoon		
June 17	1	June 25	July 19		Lost
June 17	2	died as larvae			
June 18	1	June 28	July 19	July 22	Paratype
June 21	1	June 28	July 20	Aug. 2	Paratype
June 21	1	June 28	July 24	July 26	Paratype
June 21	1	June 28	died in cocoon		
June 22	1	June 30	July 19	July 19	Paratype
June 22	1	June 30	July 25	July 26	Paratype
June 22	4	June 30	died in cocoon		
June 22	2	died as larvae			
June 23	3	July 2	July 25	July 26	All Paratypes
June 23	1	July 2	July 25		Lost
June 24	1	July 3	July 26	July 26	Paratype
June 24	2	July 3	July 26		Both Paratypes
June 24	3	July 3	died in cocoon		
June 25	1	July 6	died in cocoon		
June 26	1	July 6	July 27		Lost
TOTAL	**41 parasitized**		**23 ♀ produced**		

ACKNOWLEDGMENTS

I wish to thank Dr. Arnold S. Menke, U.S. National Museum, Washington, D.C. and Dr. Gordon M. Nishida, Bernice P. Bishop Museum, Honolulu, Hawaii for the loan of the type material. Also, Dr. Roland C. Fischer, Michigan State University, East Lansing, Michigan for the loan of their unidentified material, and Dr. James P. Kramer for the determination of the delphacid.

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NEW NAME FOR *BRUNDINIA* ROBACK NEC *BRUNDINIA* TOTTENHAM[1]

Selwyn S. Roback[2]

It has recently been brought to my attention that *Brundinia* Roback 1978, p. 168 (Diptera) is a junior homonym of *Brundinia* Tottenham 1949, p. 78 (Coleoptera). Accordingly I should like to propose *Brundiniella* as a replacement name for *Brundinia* Roback nec Tottenham.

Roback, S.S. 1978. The immature chironomids of the Eastern United State III. Tanypodinae-Anatopyniini, Marcropelopiini, and Natarsiini. Proc. Acad. Nat. Sci. Phila. 129: 151-202

Tottenham, C.E. 1949. New generic names in Staphylinidae (Coleoptera). Proc. Roy. Ent. Soc. Lond. (B) 18: 78.

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[2] Academy of Natural Sciences of Philadelphia

The Entomologist's Record

To encourage the publication of concise and useful new distribution records, corrections or previously published erroneous records, misidentifications, short field notes, and current news items about entomologists, amateur and professional, entomology departments and museums, prompt publication is offered in this department.

NEW TRICHOPTERA RECORDS FROM NORTH DAKOTA[1]

S.C. Harris, R.W. Katayama, R.B. Carlson[2]

ABSTRACT: The known ranges of *Limnephilus canadensis* Banks, *Limnephilus janus* Ross (Limnephilidae: Trichoptera), and *Ptilostomis angustipennis* (Hagen) (Phryganeidae: Trichoptera) are extended to include North Dakota.

Limephilus canadensis Banks and *Limnephilus janus* Ross were collected in Pembina County, North Dakota, from window-pane traps situated in shelterbelts adjacent to a slough. One male of each species was collected in late July, 1975. Both species have been reported from three midwestern areas: Alberta, Saskatchewan, and Minnesota. In addition, *L. canadensis* is known to occur in Maine and *L. janus* in Colorado (Nimmo, 1971).

Ptilostomis augustipennis (Hagen) has an eastern distribution extending as far west as Michigan (Ross, 1944). Three males of this species were collected in Pembina County, North Dakota in July, 1974 from window-pane traps situated in shelterbelts adjacent to a slough.

The authors with to acknowledge the assistance of Dr. G.B. Wiggins, Royal Ontario Museum, in verifying the identification of *L. janus.*

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Nimmo, A. 1971. The adult Rhyacophilidae and Limnephilidae (Trichoptera) of Alberta and eastern British Columbia and their post-glacial origin. Quaest. Entomol. 7: 3-234.

Ross, H.H. 1944. The caddis flies, or Trichoptera, of Illinois. Ill. Nat. Hist. Surv. Bull. 23: 1-326.

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[1] Accepted for publication: February 23, 1978

[2] Department of Entomology, North Dakota State University, Fargo, North Dakota 58102

ENT. NEWS, 89, 5 & 6: 142, May & June 1978

THE PAUL CURTIS WILBUR ODONATA LIBRARY AND A BIOGRAPHICAL NOTE[1]

Paul H. Arnaud, Jr.[2]

Paul Curtis Wilbur

Mr. Paul Curtis Wilbur of San Jose, California has presented his library of Odonata to the Libraries of the Department of Entomology, California Academy of Sciences and the Department of Biology, San Jose State University. The California Academy of Sciences was given those items which were new to its holdings, or those that would add bound copies, while all other books and separates were donated to San Jose State University, in recollection of pleasant contacts with the late Dr. Carl D. Duncan. Thirteen books and 162 separates were accessioned to the Academy Library, including a copy of Henrici Buchecker's "Systema entomologiae sistens insectorum classes, genera, species, Pars I. Odonata (Fabric.) europ." – "Munchen (Munic), im Selbstverlag des Verfassers, Findlingsstrasse 3 1/7", published in 1876 with its 44 plates (in this copy plates 5 to 42 are handnumbered, and two plates – 22 and 26 – have duplicate numbers with black and white

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[1] Accepted for publication: February 15, 1978

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plates) most of which are hand colored. A set of the "Collections Zoologiques du Baron Edm. de Selys Longchamps", Fascicules 9 through 20, nine bound books and 42 separates were accessioned by San Jose State University.

Mr. Wilbur, a Chemical Engineer by profession and an Odonatologist by avocation, was born in Los Angeles on March 19, 1902. He attended Leland Stanford Junior University, receiving an A.B. degree in 1924 and a Ch. E. in 1925. He has received 17 U.S. Patents for canning machines and food processes. From 1943–1954 he was Director of Research, Food Machinery and Chemical Corporation and Vice President and Director of Research from 1954–1967. At present he is Director of Citizens Savings and Loan Association and of the Beard Land and Investment Company.

His interest in Odonatology was kindled in 1925 while on a family vacation at Lake Tahoe, as a sister had loaned him a book on entomology from a course she had taken on the subject. He learned and collected the different insect orders at this time and decided to specialize in the Odonata. In his early employment he was associated with George S. Bohart (father of the entomologists, Drs. Richard M. Bohart and George E. Bohart – at that time students) whose experience in collecting Lepidoptera reinforced Wilbur's interest in entomology. In his employment he travelled extensively in the western and central United States, which permitted the collection of Odonata in these areas. Mr. Wilbur reports that he has found the study of Odonata a very great addition to his life. Unfortunately, his collection was destroyed by an accident in 1959. In 1945 he published the article "The collection of eggs of *Aeschna multicolor* (Hagen)" in Entomological News, volume 56, pages 48-49. His continuing interest in Odonata includes their plastic embedding and methods of preservation of the color in such mounted specimens.

COLLECTION TRANSFER

John H. Robinson recently has donated his Coleoptera collection of over 14,000 specimens to Robert R. Murray, Dep't. of Entomology, Texas A & M University. Over 8000 of these specimens are spread among 27 genera and 472 species of Cicindelidae. The remainder are mainly Carabidae, Scarabeidae, Cerambycidae and Buprestidae. A more detailed history of this worldwide collection and included taxa will be published in a forthcoming issue of the journal CICINDELA.

ADDITIONAL SPIDERS (ARANEAE) OF DELAWARE[1] [2]

J.D. Culin[3] [4]

ABSTRACT: Extensive surveying of the spider fauna of soybean fields in northern Delaware has yielded 26 species not previously listed for the state. This brings the total to 225 species in 27 families.

During 1976, I conducted a survey of the spider fauna occurring in soybean fields on the University of Delaware Experimental Farm in Newark, New Castle Co., Delaware (Culin, 1978). Twenty-six species of spiders not previously reported in Delaware (Uetz, 1976; Parker 1965) were found. This represents nearly a 13 percent increase in the number of species previously reported (199 to 225 spp). The 5 species of Erigonidae (=Micryphantidae) are the first of this family to be identified from the state. The new species are presented along with their month(s) of occurrence. These dates of occurrence should be interpreted with caution due to the transitory nature of the habitat surveyed.

List of Species

Labidognatha

Family Theridiidae
Theridion albidum Banks (June to August)
Theridion australe Banks (July and August)
Theridion cheimates Gertsch and Archer (August)
Theridion neshamini Levi (July and August)
Theridion rabuni Chamberlin and Ivie (July and August)
Theridula emertoni Levi (July to October)

Family Linyphiidae
Agyneta fabra (Keyserling) (August)
Florinda coccinea (Hentz) (July to September)

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[2] Published as Miscellaneous Paper No. 811 with the approval of the Director of the Delaware Agricultural Experiment Station. Publication No. 464 of the Department of Entomology and Applied Ecology, University of Delaware.

[3] Department of Entomology and Applied Ecology, University of Delaware, Newark, Delaware, 19711

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ENT. NEWS, 89, 5 & 6: 145-146, May & June 1978

Frontinella pyramitela (Walckenaer) (August to October)
Meioneta barrowsi Chamberlin and Ivie (May to November)

Family Erigonidae
Ceraticelus similis (Banks) (June to August)
Erigone autumnalis Emerton (May to August)
Erigone blaesa Crosby and Bishop (May to October)
Grammonota inornata Emerton (July to November)
Islandiana flaveola (Banks) (June to August)

Family Araneidae
Araneus juniperi (Emerton) (July and August)
Gea heptagon (Hentz) (July and August)

Family Tetragnathidae
Mimognatha foxi (McCook) (May to August)

Family Lycosidae
Arctosa funera (Hentz) (May to November)

Family Clubionidae
Clubiona abboti Koch (July and August)
Clubiona catawba Gertsch (July and August)
Clubiona johnsoni Gertsch (July and August)
Clubiona saltitans Emerton (July and August)

Family Philodromidae
Philodromus cespitum (Walckenaer) (September)
Philodromus rufus vibrans Dondale (July and August)

Family Salticidae
Pellenes hoyi (Peckham and Peckham)[1] (August)

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[1] collected during preliminary surveys in the same location in 1975.

LITERATURE CITED

Culin, J.D. 1978. Spiders in soybean fields: Community structure, temporal distribution of the dominant species, and colonization of the crop. M.S. thesis, University of Delaware, Newark, Delaware.

Parker, T.A. 1965. The spiders of Delaware. B.S. degree with distinction thesis, University of Delaware, Newark, Delaware.

Uetz, G.W. 1976. A preliminary list of the spiders (Aranea) of Delaware. Ent. News, 87: 203-210.

ACKNOWLEDGEMENTS

I would like to thank Dr. C.D. Dondale for kindly verifying and identifying specimens and Dr. R.W. Rust for support.

BOOK REVIEW

GRASSHOPPERS AND LOCUSTS. Vol. 2. 'Behaviour, Ecology, Biogeography, Population Dynamics' by Sir Boris Uvarov, Centre for Overseas Pest Research, London. 613 pp. 1977. U.K.£16.00, US $40,00.

Sir Boris Uvarov is considered the Founder of Modern Acridology and was affectionately known as the "grasshopper pope" among his colleagues. He was an adept taxonomist and ecologist as well, and is perhaps best known for his investigation into the population dynamics of the migratory locust *Schistocerca gregaria* (Forskal) which led to the establishment of the Anti-Locust Research Centre, now a part of the Centre for Overseas Pest Research.

Volume 1, published in 1966, covered anatomy, physiology, development, phase polymorphism, and taxonomy. Volume 2 completes the set and refines and updates some of the discussions such as those dealing with phase development of locusts found in the first volume. Volume 2 was in draft form at the time of Sir Boris' death in 1970 but it has been completed and made current by several members of the COPR staff. Their inclusions are indicated in the text by a different type-face thus preserving Uvarov's ideas and words. Volume 2 is a virtual compendium of all research world-wide on acridology. It is readable and fascinating. The text is liberally illustrated with useful charts, tables and photographs. There are chapters dealing with the behaviour of grasshoppers providing a great many references to which the reader can proceed for further information. A chapter on flight precedes three chapters dealing with current ideas on gregarious behaviour among grasshoppers. There are following chapters dealing with mating oviposition, life-style, population movement, ecology, and population dynamics. The book concludes with a chapter on current and future problems of acridology. A 55 page bibliography at the end of the book will prove most useful in tracing literature which the author states was appearing at the rate of one paper per day to 1969. In the words of the author "It is clear that the problem of ecological regulation of acridoid populations must be studied by acridologists in collaboration with botanists, pedologists, agronomists and zootechnicians, whose direct participation is essential in experimental field studies of the effects of different systems of land utilization not only on acridoids but also on the general economy of the region." The two volumes compiled by Sir Boris Uvarov will go a long way in forming a strong basis for anyone wishing to pursue these objectives.

D.C.F. Rentz, CSIRO, Division of Entomology, P.O. Box 1700,
CANBERRA CITY, A.C.T. 2601.

BOOKS RECEIVED AND BRIEFLY NOTED

INSECT LIFE. Michael Tweedie. Collins, London, 1977. 192 pp. $8.95.

Although intended to offer the beginner a modern introduction to British insect life, this small volume in the Collins Countryside Series deserves a space on every entomologist's bookshelf. Five chapters cover such basic subjects as anatomy, physiology, how they live, brief descriptive classification down to orders and insect relationships with man. Very interestingly written and well illustrated, this book should help develop a better understanding and appreciation for insects and their way of life.

IMMS' GENERAL TEXTBOOK OF ENTOMOLOGY, 10th Edition, O.W.

Richards and R.G. Davies. Chapman and Hall, London, 1977. Distributed in U.S. by Halsted Press, Div. of John Wiley & Sons, N.Y.

Vol. 1: Structure, Physiology and Development. 418 pp. Cloth $35.00, paperback $13.50.

Vol. 2: Classification and Biology. 1354 pp. Cloth $60.00.

Announcement of this long awaited revision of this standard reference text covering all aspects of entomology is welcome news. The entire text has been extensively rewritten and revised, reflecting the broader scope of entomology today. In volume 1, structure and physiology are treated in a series of major organ-system chapters incorporating the results of much recent research. In a second part of this volume, a full account is given of the embryonic and post embryonic development of insects emphasizing up to date interpretations of growth and metamorphosis.

Volume 2 covers both biology and classification in each of the orders. For each order of insects, a full account is given of their external and internal anatomy, biology, metamorphosis and general classification, as well as indications of their probable phylogeny and evolutionary relationships.

It is unfortunate that the cloth editions of these volumes are priced so high that they are almost out of reach for most individuals. It is to be hoped that, if students are to avail themselves of this fine reference, the publishers will see fit to also issue Vol. 2 in a paperback edition.

MEDICAL ASPECTS OF THE IMPORTED FIRE ANT. Robert B. Rhoades. University Presses of Florida. Gainesville, Florida, 1977. 75 pp. $4.75.

The red fire ant, *Solenopsis invicta* Buren was imported into the Mobile, Alabama area from South America sometime between 1933 and 1941. It has been extremely successful in establishing itself and now occupies major areas throughout our southern and southeastern states. This book begins with a review of some of the fascinating aspects of ant behavior and physiology. Detailed information is provided on the senses and communication of ants and the fire ant in particular. The author, a medical doctor, presents facts on the nature and effects of fire ant venom and case reports of allergic reactions and their treatment. The increasing human population in states infested by fire ants points up the need for effective measures to control the fire ant population without harm to the total environment.

ARTIFICIAL DIETS FOR INSECTS, MITES AND SPIDERS. Pritam Singh. IFI/Plenum, New York, 1977. 593 pp.

The aim of this book is to give complete but concise coverage of existing knowledge of insect dietetics. It is a complete survey of artificial diets for rearing insects.

Two more volumes, Nos. 13 & 14, in Junk's Series Entomologica have been published recently. These are:

THE WORLD OESTRIDAE (DIPTERA), MAMMALS AND CONTINENTAL DRIFT. N. Papavero, W. Junk, 1977, 238 pp.

In this work, the author deals only with the Cavicolae (Oestridae) in attempting to find answers to the following questions: What is the most probable suprageneric classification of the Oestridae? How is the present geographical distribution of the family explained? How is the absence of oestrids on certain continents explained? Why do oestrids parasitize only a relatively small fraction of living terrestrial mammals? Is there any correlation between the phylogeny of the Oestridae and that of their hosts? Are there any relationships between the zoogeography of the Oestridae and their mammal hosts? and what is the evolutionary history of the Oestridae? Contents are divided into three parts: A. History, folklore and biology, B. Systematics and phylogeny of the Oestridae and C. Characteristics of the hosts of Oestridae.

THE LEPIDOPTERA OF NORFOLK ISLAND, THEIR BIOGEOGRAPHY AND ECOLOGY. J.D. Holloway, W. Junk, 1977, 280 pp.

Norfolk Island, one of the smaller and more isolated islands in the south Pacific, consists of volcanic basalt and tuff, covered with forests. With the help of local people, the author has conducted an extensive moth sampling program using ultra violet light traps. To date, over 100,000 specimens have been tabulated. Numerical analysis of these provides an interesting picture of the local distribution of the species, arrivals of vagrant and partly vagrant species, seasonal patterns and response to climate conditions. The survey also provides valuable information on parameters of environmental diversity and island colonization and it leads to the conclusion that moth sampling may provide for the terrestrial environment the same sort of indication of changes, natural and man induced, that sampling of plankton and benthic communities provides in the study of marine environment.

WATER BALANCE IN LAND ARTHROPODS. Eric B. Edney. Springer-Verlag, New York, 1977. 282 pp. $34.40.

This book reviews the various means for gain and loss of water by land arthropods, the internal and external factors that determine the rate and extent of such water movements and the means of control. It is Vol. 9 in a series of zoophysiology and ecology.

CARABID BEETLES IN THEIR ENVIRONMENTS. D.S. Farner, Coord. Ed., Editors: W.S. Hoar, B. Hoelldobler, H. Langer, M. Lindauer. Springer-Verlag, New York, 1977. 369 pp. $44.20.

The subtitle of this volume (Vol. 10 in a series on Zoophysiology and Ecology), A Study on Habitat Selection by Adaptations in Physiology and Behavior, aptly describes the intent of this work which is threefold. First, it is a summary of knowledge relating to the ecology of the Carabidae. Second, using this major family of Coleoptera, the authors attempt to explain why organisms live where they do, through physiological and behavioral rather than morphological differences. A third objective is to show the extent to which research on carabids can contribute to the ecological, ethological and evolutionary research.

PROCEEDINGS OF A.E.S. MEMBERSHIP MEETINGS

An important meeting of the executive Council of the Society was held at the Academy of Natural Sciences in Philadelphia on January 19, 1978. The Society now has a new office secretary, Mrs. Mildred Morgan. After ten years of service as editor of TRANSACTIONS, Dr. Selwyn S. Roback is resigning this position effective the end of 1978. He will continue to edit MEMOIRS. The Society is very appreciative of the fine work that Sam Roback has performed during his tenure and expresses its thanks to him for this service.

The Society has mailed, to all members who subscribe to both the TRANSACTIONS and ENT. NEWS, a questionaire to evaluate our three publications. Results of this study will be reported at a future meeting. A new page charge policy was adopted and was printed on page 58, Vol. 89, #1 & 2, Jan. & Feb., 1978 issue of ENT. NEWS. Decisions were made to solicit estimates from additional printing houses for printing all three publications and to reduce the number of copies printed in efforts to reduce publication costs.

Financially, the Society is facing an extremely tight cash flow situation. Efforts will be doubled to secure payment of all funds due the Society so that we can meet our publishing committments.

The Society's long standing relationship with the Academy of Natural Sciences, including the Academy's management of the Society's library, is currently under review by both parties.

The February meeting of the Society took place on the snowy night of February 9 at the Academy of Natural Sciences. This was the annual meeting. Elections were held and the following will serve as officers of the Society for 1978: President, Howard P. Boyd; Vice President, Daniel Otte; Recording Secretary, Richard Rust; Corresponding Secretary, Charles Mason; Treasurer, Jesse Freese. Committees were appointed as follows: Publications and Editorial, Daniel Otte, Chr., Charles Mason, Sam Roback; Library, Sam Roback, Chr.; Finance, William Day and Murray Cooper, Co-Chairmen; Hospitality, Wayne Lord, Chr. The program for the evening was on the Ecology and Distribution of the Tiger Beetles of New Jersey by Howard Boyd. It was illustrated with slides, distribution maps and habitat photos of all New Jersey species.

The March membership meeting was held Thursday, March 9, 1978 in the Entomology Department at the University of Delaware. Eleven members and 14 guests were present. H. Boyd reported that the Council had approved a page charge increase of $25.00 per page for all Society journals. Only retired and unemployed members of the Society may request reduced page charges.

L.P. Kelsey submitted and read proposed changes in the Society By-laws. The proposed changes are Chapter III, articles 2, 7 and 10; Chapter IV, article 3; Chapter V, articles 1 and 5; Chapter VII, articles 2 and 7; Chapter IX, article 2; Chapter X, article 2.

The evening speaker was Philip E. Marucci, Cranberry and Blueberry Research Center, Rutgers University, Chatsworth, NJ who spoke on "Economic Insects of Cranberries and Blueberries and their Control". Mr. Marucci presented a well illustrated lecture on some 25 years of research he has conducted on cranberry and blueberry pests and the development of integrated pest management programs for certain pests. Coffee and donuts were served following the meeting.

The April membership meeting was held Thursday April 13, 1978 in the Entomology Department at the University of Delaware. Five members and 16 visitors were present.

R.W. Rust, Recording Secretary, reported that membership meetings will be held on the 1st Thursday of the month beginning in October 1978 and that Daniel Otte will become the new editor of the TRANSACTIONS in January 1979.

L.P. Kelsey presented the following changes to Society By-laws which were approved by the membership (new or changed wording is in italics). The complete revised By-laws are available to members upon request.

Chapter III. Article 2. Any person interested in entomology is eligible for resident membership and shall be subject to annual dues *of the Society.*

Resident members making an annual contribution of fifty dollars ($50) shall be designated as Patrons.

Any Resident member making three (3) consecutive Patron member contributions (= $150) shall automatically become a Resident member for life and shall be exempt from further dues.

Article 7. Application for Resident membership shall be made in writing. Each application shall include relevant information on the applicant's background, and shall also include at least one endorsement by a member of the Society in good standing. *Such endorsement shall be tantamount to election to membership.*

Article 10. All annual dues shall be payable in advance to the treasurer *as of January 1* of each year. The Council may exempt any member from a whole or part of his annual dues.

Chapter IV. Article 2. *The officers shall be elected bi-annually at the first stated meeting in alternate years to serve a two year term.*

Vacancies in the offices may be filled by election at any stated Society Meeting.

Chapter V. Article 1. The Council for any *biannium* shall consist of the officers of the Society, the *three previous* Presidents, and any Past President of the Society who shall express his desire to serve as a member of the Council.

Article 5. At a meeting to be held at least sixty days prior to the *bi-annual election meeting* of the Society, the President shall appoint a Nominating Committee, with approval of the Council, consisting of three members whose duties shall be to nominate the officers for the ensuing two years. These names shall be submitted at the last stated meeting of the Society in the calendar year prior to the election meeting. After the Nominating Committee shall have presented its nominations, the presiding Officer or the Recording Secretary shall call for additional nominations from the floor.

Chapter VII. Article 2. The principal of all funds shall be kept invested in the corporate name of the Society, *hereinafter termed the Custodial Account,* and only the income of such funds shall be used for the purpose of the Society.

Chapter X. Article 2. Stated meetings of the Society shall be held at such times as may be fixed at the *bi-annual* meeting; but if any meeting cannot be held on the date specified, the President may select the next available nearby date.

R.W. Rust introduced the evening's speaker, Dr. Howard "Buck" Cornell, School of Life and Health Sciences, Section of Ecology, University of Delaware. Dr. Cornell spoke on "Richness Patterns in Host-Herbivore Systems". Dr. Cornell related his research on oak-cynipid gall-interactions to other studies on host-parasite or host-herbivore relationships. He developed both the similarities and the differences between his research and that of others. Coffee and donuts were served during and following the meeting.

INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE ANNOUNCEMENT

A.N.(S.) 105

The required six months' notice is given of the possible use of plenary powers by the International Commission on Zoological Nomenclature in connection with the following names listed by case number: (see *Bull. Zool. Nom.* 34, part 4, 28 February, 1978).

1237 CARABIDAE (Coleoptera), proposals concerning the names of four Linnean species.

Comments should be sent in duplicate (if possible within six months of the date of publication of this notice in *Bull. Zool. Nom.* 34, part 4), citing case number to:

R.V. Melville, The Secretary, International Commission on Zoological Nomenclature, c/o British Museum (Natural History), Cromwell Road, LONDON, SW7 5BD, England.

Those received early enough will be published in the Bulletin of Zoological Nomenclature.

The following Opinions (listed by number) have been published recently by the International Commission on Zoological Nomenclature (see *Bulletin Zoological Nomenclature* Volume 34, part 4, 28 February, 1978).

Opinion No.	
1100 (p.203)	Designation of *Musca frit* Linnaeus, 1758, as type-species of *Oscinella* Becker, 1909 (Diptera CHLOROPIDAE).
1103 (p.218)	Suppression of nine specific names in the family TETRIGIDAE (Insecta, Orthoptera).
1105 (p.234)	Designation of a type-species for *Lonomia* Walker, 1855 (Insecta, Lepidoptera).
1106 (p.237)	Conservation of the generic name *Rhopalum* Stephens, 1829 (Insecta, Hymenoptera).

The Commission cannot supply separates of Opinions.

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. Authors can be very helpful by indicating, in pencil in the margin of the manuscript, approximate desired locations within the text of accompanying figures, tables and other illustrations.

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

Books for review and book publication announcements should be sent to the editor, Howard P. Boyd. For address, see under "manuscripts" above. Literature notices, books received and short reviews will be published in The Entomologist's Library on books dealing with systematics, morphology, 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.

Study notices, want items and for sale notices are published in The Entomologist's Market Place.

Page charges: A chage of $25.00 is made for each published page of an article, plus costs of all illustrations. Papers may be published ahead of their regularly scheduled time at a cost of $30.00 per page.

Unemployed and retired amateur and scientist members of the American Entomological Society who are without institutional support or are not subsidized by grants and who are without funds for publishing may apply for financial assistance **at the time their manuscript is submitted.** Such application must include an explanation of the author's status (unemployed or retired). Page charges for these individuals are negotiable, with a minimum of $7.00 per page.

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EDITOR'S NOTE

Effective with this issue, the use of key or descriptor words in connection with papers published in ENTOMOLOGICAL NEWS is being discontinued.

The Entomologist's Market Place

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.

Exchange: Coleoptera of all families from Arizona. Ask for list and send yours. Rudolph Lenczy, 126 Los Robles, Green Walley, Arizona, 85614.

Book wanted: Blatchley, W.S., Heteroptera or True Bugs of 1926, Nature Publ. Co., 1970 Univ. Microfilms.

BOOKS SEARCHED FOR: Also scientific books, subject histories, and important biographies purchased. Make inquiries and offers to: Significant Books, P.O. Box 40306 Cincinnati, OH 45240.

FREE: Moore and Legner, Catalogue of the Staphylinidae of America North of Mexico; Bibliography for same, keys to the genera of same. Ian Moore, Dep't. Biological Control, University of California, Riverside 92521

INSECT PINS – standard black, $8.50 per thousand. Clair Armin, 191 W. Palm Ave., Reedley, Calif., 93654

"NORTH DAKOTA ANTS UPDATED", a supplement to "The Ants of North Dakota" by George C. Wheeler and Jeanette Wheeler. Price $1.00 postpaid; FREE with a copy of "The Ants of North Dakota" at $4.00. University Bookstore, Grand Forks, North Dakota, 58202.

For sale: Large varieties of Malaysian entomological specimens such as butterflies, beetles and other mounted insects in plastic frame at reasonable prices. Contact: R.B.B.C., 5-D Ampat Tin Limited, 7th Mile, Batu Caves, Kuala Lumpur, Selangor, West Malaysia.

Wanted: Corbet, Longfield and Moore: Dragonflies, and Tillyard: The Biology of Dragonflies. Write stating condition and price to John E. Holzbach, 229 Maywood Drive, Youngstown, Ohio 44512

Wanted: Any records of *Nicrophorus americanus* collected since 1960 will be appreciated by Dr. Paul P. Shubeck, Biology Dep't., Montclair State College, Upper Montclair, N.J. 07043

Wanted: Adults and testes of any *Sphingonotus* grasshoppers (especially with blue wings) for study. Details for testes preparations, please write Dr. D.C.F. Rentz, CSIRO Division of Entomology, PO Box 1700, A.C.T. 2601, Australia.

Wanted: North and Central American *Araeoschizus* (Tenebrionidae) for revisional study. Charles S. Papp, Div. of Plant Industry, Dep't. of Food & Agriculture, Sacramento, CA 95814

VOL. 89 SEPTEMBER & OCTOBER NOS. 7 & 8

ENTOMOLOGICAL NEWS

THE AMERICAN ENTOMOLOGICAL SOCIETY

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Publications and Editorial Committee: D. Otte, *Chr.*, C. Mason, S. Roback and Howard P. Boyd, *Editor.*

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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., Tabernacle Twp., RD7, 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. Two double-spaced, typed copies of each manuscript are needed on 8½x11 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 systematics, morphology, ecology, behavior and similar aspects of insect life and related terrestrial arthropods are appropriate for submission to ENTOMOLOGICAL NEWS. When submitting papers, all authors are requested to (1) provide the names of two qualified individuals who have critically reviewed the manuscript *before* it is submitted and (2) submit the names and addresses of two qualified authorities in the subject field to whom the manuscript can be referred by the editor for final review. Titles should be carefully composed to reflect the true contents of the article, and be kept

(Continued on inside of back cover)

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BRACHYNEMURUS NEBULOSUS (NEUROPTERA: MYRMELEONTIDAE): A POSSIBLE BATESIAN MIMIC OF FLORIDA MUTILLID WASPS (HYMENOPTERA: MUTILLIDAE)[1]

Vincent Brach[2]

ABSTRACT: Larval *Brachynemurus nebulosus* (Neuroptera: Myrmeleontidae) from Florida exhibit a bold color pattern of orange-red, white and black which resembles that of three sympatric species of mutillid wasps (Mutillidae). When uncovered, *B. nebulosus* larvae run over the substrate in zig-zag dashes, further increasing their resemblance to mutillid wasps. It is suggested that the atypical coloration and behavior of *B. nebulosus* larvae may constitute a generalized Batesian mimicry of at least three of the common species of *Dasymutilla* of the region.

Mutillid wasps, or "velvet ants", are common and conspicuous inhabitants of open, sandy areas throughout the United States. Most display prominent aposematic patterns of red, orange, or yellow and black which often include whitish rings at the tip of the abdomen. This bold coloration and the rapid, zig-zag locomotion characteristic of the wingless females serves as a fair warning to would-be predators of the heavily armored bodies and formidable stings of these insects, the effect of the latter having been likened to a strong electric shock.

While collecting mutillid wasps at the Archbold Biological Station, Highlands Co., Florida, during the spring and summer of 1976, a visiting graduate student collected two specimens of larval antlions which bore a striking behavioral and morphological resemblance to mutillid wasps when viewed from above (Fig. 1). One of these larvae was reared and the imago identified as *Brachynemurus nebulosus* (Oliv.). The color of the head, thorax and anterior abdomen of these larvae in life is bright reddish-orange, while the latter half of the abdomen is boldly marked in black and white. In alcohol, the reddish-orange fades somewhat, but is still quite different from the dull brown and gray color of all other known larvae of *Brachynemurus* (Stange, 1970).

The behavior of the two *B. nebulosus* larvae was unusual in that the larvae would frequently run in abrupt dashes on top of the sand, rather than spending all of their time beneath it as do all other known *Brachynemurus* larvae. If buried *B. nebulosus* larvae were suddenly unearthed, they would often begin to run instead of lying motionless in the manner of cryptically-colored myrmeleontid larvae. This atypical behavior increases the resemblance of *B. nebulosus* larvae to mutillid wasps; indeed, both of the larval

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[1] Accepted for publication: June 26, 1978

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antlions collected were momentarily confused with mutillids when they first appeared. However, at the end of a run, the larvae would stop suddenly and rapidly dig themselves into the sand, completely hiding themselves in about one second. This maneuver might be expected to confuse a predator which had not yet recovered from the initial surprise of the sudden appearance of a "velvet ant". In the laboratory, the larvae of *B. nebulosus* ambushed prey in the manner common to the majority of antlion larvae which do not dig pits by lying in wait, mandibles spread, just beneath the surface of the sand. Prey items were seized as they walked over the mandibles and were dragged backwards until buried.

The abdominal patterns of the three commonest species of mutillid wasps found at the Archbold Station are shown in Fig. 2. *Dasymutilla vesta sappho* (Fox) (Fig. 2, c), which is approximately the size of the last-instar larva of *B. nebulosus*, is the commonest species. The posterior abdomen of this wasp bears conspicuous bands of white hairs set off by dark markings above and below, while the anterior portion of the abdomen, the thorax and the head are a dull reddish-orange. The next most common species, *D. p. pyrrhus* (Fox) (Fig. 2, b), is very brightly colored with shining orange-red hairs on its anterior portions, but the tip of the abdomen bears a conspicuous black region with rings of white fringing hairs around the bases of the last two tergites. *Dasymutilla occidentalis* L. (Fig. 2, c), the largest and least commonly encountered species, lacks white in its color pattern but is brightly marked in shining orange and black bands.

Dasymutilla vesta sappho approaches *B. nebulosus* larvae most closely in size and general appearance, but the reddish-orange coloration of the *B. nebulosus* larvae is more like that of *D. p. pyrrhus*. It is likely that the pattern displayed by *B. nebulosus* is a generalized rather than a specific attempt to simulate the overall mutillid wasp appearance, and that all of the common mutillid wasps of the area may serve as models to a greater or lesser extent. It has been demonstrated that for avian predators, the matching of mimic and model in a Batesian system may lack precision to the degree that the model is punishing (Alcock, 1970; Duncan and Sheppard, 1965). Recently, Terhune (1977) analyzed the components of the visual stimulus used by scrub jays (*Aphelocoma coerulescens*) to discriminate a Batesian model, and found that although color alone was most frequently used to discriminate a model from its mimics, jays also recognized the model on the basis of color and pattern, color and size, or all three components. Coincidentally, the scrub jay is an abundant insect predator at the Archbold Station. This jay frequently forages on the ground, and probably becomes acquainted with the painful stings of mutillid wasps at an early age. Although insufficient *B. nebulosus* larvae were available to perform definitive tests, it is possible that the brightly-colored larvae of *B. nebulosus* gain a measure of protection from scrub jays and

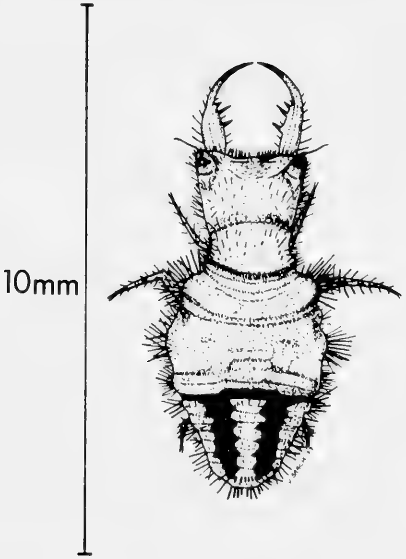

Fig. 1. *Brachynemurus nebulosus* (Oliv.), last-stage larva, dorsal view. The white regions are limited to the posterior abdomen; the color above this is uniformly orange-red.

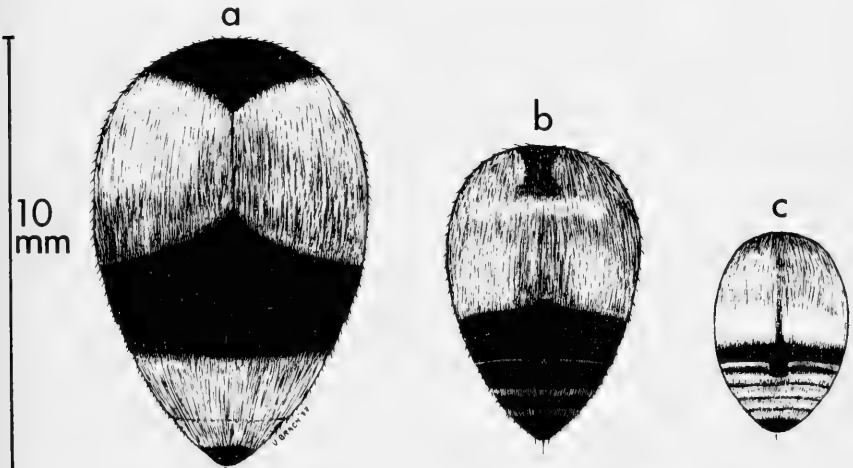

Fig. 2. Abdomens of the three common species of mutillid wasps (females) found at the Archbold Station, Highlands Co., Florida. a) *Dasymutilla occidentalis* L.; b) *D. p. pyrrhus* (Fox); c) *D. vesta sappho* (Fox). The latter two species have bands of white hairs fringing the posterior abdomen; otherwise, the abdominal colors are red or orange and black.

other visual predators by their generalized resemblance, both in appearance and behavior, to several of the mutillid wasps of the region.

ACKNOWLEDGEMENTS

I thank Mitch Masters for the collection of the two specimens of *Brachynemurus nebulosus.* Oliver S. Flint confirmed the determination of the reared adult of *B. nebulosus*, now on deposit at the United States National Museum of Natural History. The mutillid wasps were identified by comparison with material in the Archbold Biological Station collection which was determined by Karl V. Krombein.

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SURVEY OF HEMIPTERA COLLECTED ON COMMON MILKWEED, *ASCLEPIAS SYRIACA*, AT ONE SITE IN OHIO.[1]

Patrick J. Dailey[2], Robert C. Graves[2], Jon L. Herring[3]

ABSTRACT: Hemiptera frequenting 337 plants of common milkweed, *Asclepias syriaca* were surveyed by daily collecting for a period of 90 consecutive days. Forty-six species are listed, some of which are probably new Ohio records. Five species were considered to be significantly abundant (more than 50 individuals collected): *Lygaeus kalmii, Lygus lineolaris, Plagiognathus politus, Adelphocoris lineolatus,* and *Cosmopepla bimaculata.* Only *L. kalmii* (1,173 individuals collected) and *Oncopeltus fasciatus*, which was relatively scarce, are host specific.

The common milkweed, *Asclepias syriaca* L. (Asclepiadaceae), is a herbaceous perennial which is widely distributed in eastern United States, and is frequent along roads and in fields. It occurs in large stands or as solitary plants. *A. syriaca* is unusual in that it can reproduce vegetatively and as a result is a highly successful colonist (Wilbur, 1976). The pinkish flowers are borne on large umbels, and the numerous, wind-borne seeds develop in large pods.

Certain species of milkweed-specific Hemiptera such as *Lygaeus kalmii* and *Oncopeltus fasciatus* are readily maintained in the laboratory and have been extensively studied (e.g., Caldwell 1974, Dingle 1968, Feir 1974, Kelton 1975, Ralph 1977, Rothschild 1973).

The only major previous attempt to survey milkweed insects in the United States was that of Weiss and Dickerson (1921). These authors listed 8 species of Hemiptera collected from *A. syriaca* in scattered localities in New Jersey, with no attempt at daily collecting, and no information on numbers of individuals present. The present study lists 45 species of Hemiptera from a single site in Bowling Green, Ohio with numerical data obtained by daily collecting during a 90-day period (Table 1). The daily abundance of 4 common species is shown in Figure 1.

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ENT. NEWS, 89: 7 & 8: 157 - 162, September & October 1978

MATERIALS AND METHODS

The study site, a railroad right-of-way located in Bowling Green, Wood County, Ohio, was chosen because it was neither sprayed nor mowed during the entire season. Within this area (18.29 x 99.4 m.) 337 milkweed plants were investigated. Most plants were randomly distributed throughout the study area, but there were several clumps of 5-15 plants. Flowering began June 15 and continued into early September.

Hemiptera were hand-picked or aspirated from each of these 337 plants daily for 90 consecutive days (June 9-September 6, 1976). In addition four late-season collections were made (Sept. 12, 18, 25, and Oct. 4). Collecting was done between noon and 6:00 PM. Specimens were preserved in 85% ethanol to be sorted, counted and determined as time permitted.

All insects were removed from the plants each day. Therefore those collected the following day were individuals which had moved onto the milkweed plants during the preceding 24-hour period (the only exceptions to this would be the first collection, June 9, and the four late-season collections).

RESULTS AND DISCUSSION

The 45 species of Hemiptera collected on *A. syriaca* are listed in Table 1. Five of these species were each represented by 50 or more individuals and are considered "abundant" *(Lygus lineolaris, Plagiognathus politus, Adelphocoris lineolatus, Lygaeus kalmii,* and *Cosmopepla bimaculata*). All of these species were present throughout the collecting period except for *P. politus* which was not collected from July 17 to August 12.

Adults of *Lygaeus kalmii*, the most abundant species of Hemiptera, overwinter, and emerge from hibernacula near milkweed patches in the spring (Caldwell 1974). Nymphs and adults feed on the juices of green milkweed plants during the growing season (Simanton and Andre 1936). Nymphs

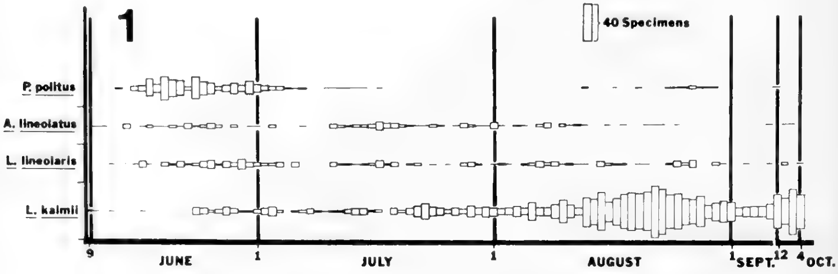

Figure 1. Graph illustrating the number of individuals of the most common species of Hemiptera collected each day from *Asclepias syriaca* plants.

were collected early in the season, most commonly at the base of plants, and seldom near the apex. If disturbed, they quickly dispersed into the gravel bed along the railroad tracks. Although 152 nymphs of various stadia were collected throughout the entire period, they represented only 13% of the total, which would indicate that a large percentage of nymphs were not on the *A. syriaca* plants when collections were made. The population in this area is the eastern subspecies, *L. k. angustomarginatus* Parshley (Slater and Knop 1969).

Another host-specific species, *Oncopeltus fasciatus* was rare at the collecting site in 1976, although in the summer of 1977 an aggregation of nymphs was observed at the study site on 2 milkweed plants (10-20 nymphs per plant). Aggregations of adults were seen in October 1978 at New Rochester, and at Portage, both in Wood County, Ohio.

The tarnished plant bug, *Lygus lineolaris,* is the most common mirid in the eastern United States, frequents many plant species (Knight 1941), and is one of the most widely distributed species in North America where it is found in all agricultural regions at both low and relatively high altitudes (Kelton 1975). Adults overwinter beneath leaves and in mullein rosettes (Watson 1928). Individuals of *L. lineolaris* were most commonly observed in the folded apical leaves where they were apparently feeding.

Adelphocoris lineolatus, the alfalfa plant bug, was also common, frequently on the apical portion of the plants, from which they take flight quickly when disturbed. According to Knight (1941), this species seems to prefer legumes, but may also feed on flower buds and newly formed seeds.

Plagiognathus politus feeds on various weeds, especially ragweed (*Ambrosia* spp.) and goldenrod *(Solidago* spp.), and has been successfully reared on apple *(Pyrus malus)*, where the nymphs fed on tender foliage (Watson 1928, Knight 1941).

The last of the "abundant" hemipteran species, *Cosmopepla bimaculata,* is a general feeder and has been recorded from all geographical areas in Ohio between April 27 and October 19 (Furth 1974). Detailed host and biological data for this species are given in Esselbaugh (1948).

Many of the other species listed in Table 1 are considered to be only temporary visitors to *Asclepias syriaca,* and in some instances, these are associated with other plant species. *Podisus maculiventris, Phymata fasciata, Sinea diadema,* and *Nabis* spp. are all predaceous on other insects and their occurrence on milkweed is incidental to their search for prey. Individuals of *Phymata fasciata* often lie in wait for prey in the flower heads and have been observed to capture flies and small Hymenoptera which visit the flowers.

Of the 45 species collected, 19 were mirids, 7 were lygaeids, and 4 were pentatomids. These three families included all of the most common species; no species in any other families were represented by more than 15 individuals during the entire collecting period.

Table 1. **Hemiptera collected on *Asclepias syriaca* in Bowling Green, Ohio**

	Total Individuals Collected	Dates Collected
ANTHOCORIDAE		
Orius insidiosus (Say)	11	20-VI to 23-VIII
MIRIDAE		
Neurocolpus nubilus (Say)	14	17-VI to 10-VIII
Leptopterna dolobrata (Linné)	2	12-VI to 22-VI
Lygus lineolaris (Palisot de Beauvois)	204	12-VI to 4-X*
Reuteroscopus ornatus (Reuter)	30	19-VI to 6-IX
Trigonotylus sp.	2	10-VIII to 14-VIII
Ilnacora sp.	2	26-VI
Criocoris saliens (Reuter)	1	13-VI
Plagiognathus albatus Van Duzee	1	16-VI
Plagiognathus politus Uhler	248	13-VI to 12-IX*
Plagiognathus sp.	1	14-VI
Hyaliodes vitripennis (Say)	1	4-VIII
Chlamydatus sp.	2	6-VII to 12-VII
Ceratocapsus sp.	1	2-VIII
Amblytylus nasutus (Kirschbaum)	12	10-VI to 17-VI
Capsus ater (Linné)	1	18-VI
Taedia scrupeus (Say)	1	10-VIII
Poecilocapsus lineatus (Fabricius)	2	10-VI to 24-VI
Adelphocoris rapidus (Say)	1	28-VII
Adelphocoris lineolatus (Goeze)	137	10-VI to 25-IX*
NABIDAE		
Nabis subcoleoptratus (Kirby)	6	9-VI to 3-VII
Nabis roseipennis Reuter	1	23-VI
Nabis americoferus Carayon	8	23-VI to 10-VIII
REDUVIIDAE		
Sinea diadema (Fabricius)	17	11-VI to 18-IX
PHYMATIDAE		
Phymata fasciata (Gray)	11	19-VI to 25-IX
PIESMATIDAE		
Piesma cinereum (Say)	2	13-VI to 14-VI
LYGAEIDAE		
Lygaeus kalmii Stål	1,173	9-VI to 4-X*
Oncopeltus fasciatus (Dallas)	4	15-VII to 27-VIII
Phlegyas abbreviatus (Uhler)	10	25-VI to 27-VII
Ortholomus scolopax (Say)	6	9-VIII to 2-IX
Pachybrachius bilobatus (Say)	6	9-VIII to 6-IX

Nysius ericae (Schilling)	1	2-VII
Blissus leucopterus (Say)	1	25-VII
BERYTIDAE		
Jalysus spinosus (Say)	4	25-VII to 18-IX
Berytinus minor (Herrich-Schäffer)	1	13-VII
RHOPALIDAE		
Leptocoris trivittatus (Say)	9	18-VII to 4-X
Stictopleurus crassicornis (Linné)	1	18-IX
Harmostes reflexulus (Say)	1	4-VIII
ALYDIDAE		
Alydus eurinus (Say)	2	20-VI to 18-IX
PENTATOMIDAE		
Cosmopepla bimaculata (Thomas)	79	17-VI to 4-X
Euschistus variolarius (Palisot de Beauvois)	11	26-VI to 4-X
Euschistus tristigmus (Say)	1	24-VII
Podisus maculiventris (Say)	11	15-VI to 18-IX
Unidentified nymphs	19	20-VI to 12-IX
CYDNIDAE		
Sehirus cinctus (Palisot de Beauvois)	15	22-VI to 27-VII
TINGIDAE		
Corythucha marmorata (Uhler)	2	17-VI to 18-VI

*Collecting data represented graphically in Fig. 1.

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ADDENDUM

The Coleoptera portion of this survey is scheduled for publication in December, 1978 as follows:

Dailey, P.J., R.C. Graves and J.M. Kingsolver. 1978. Survey of Coleoptera collected on the common milkweed, *Asclepias syriaca* at one site in Ohio. Coleopt. Bull. 32 (in press).

INSECTS FEEDING AT EXTRAFLORAL NECTARIES OF *IPOMOEA CARNEA* (CONVOLVULACEAE)[1]

Kathleen H. Keeler[2]

ABSTRACT: A list of insects observed feeding at extrafloral nectaries of *Ipomoea carnea* (Convolvulaceae), a shrubby morning glory in Guanacaste, Costa Rica, is given. Insects of more than 40 families and 77 genera were observed. Relative abundance and month observed are indicated.

Extrafloral nectaries are nectar-producing glands on a plant outside of the flower. Existing ecological evidence suggests that extrafloral nectaries function in a facultative ant-plant mutualism that is part of the plant's anti-herbivore defenses (Janzen 1966, 1967; Elias and Gelband, 1975; Bentley 1976, 1977ab; Keeler, 1977; Tilman, in press). By predation on small insects, scavenging, and excluding other insects from the area of the nectary, ants have been shown to reduce damage to the plant.

In addition to species involved in defense of the extrafloral nectaries, however, many other species feed on the extrafloral nectar. The relationship of most nectar-feeders to the plant is in general unknown. Some are herbivores of the plant, obtaining additional food (Lukefahr et al., 1965, 1966). Some are predatory insects supplementing their diets. Some may "parasitize" the mutualism, taking nectar but having no further interaction with the plant.

In this paper, the species observed at the extrafloral nectaries of *Ipomoea carnea* are reported. Such lists have not been published previously but it is considered likely that future work on the impact of extrafloral nectary bearing plants on populations of either desirable or undesirable species to agriculture may be assisted by this information (*e.g.* Lukefahr *et. al.,* 1965, 1966). This information likewise should be useful to future studies of the role of extrafloral nectaries in the biology of plants.

Methods and Site – Extrafloral nectary visitors to *Ipomoea carnea* Jacq., a woody tropical morning glory, were systematically observed and collected. *I. carnea* has two types of extrafloral nectaries, two at the distal end of the petiole and 5 in a ring around the pedicel. Since at the site studied the leaves are lost during the dry season when the plant is in flower, the two types of extrafloral nectaries were rarely present and functional at the same time. Chemical constituents of the two types of nectaries were slightly different but no difference was observed in the insects visiting the two, other than

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those due to seasonal appearance of the insects. For more information on *I. carnea* see Keeler 1975a, 1977.

The population of *I. carnea* studied was about a kilometer east of the Organization for Tropical Studies Palo Verde field station in Guanacaste, Costa Rica. This is tropical dry forest life zone of Holdredge (1967). The actual study site was very low-lying, tending to flood during the rainy season. The site was grazed by cattle, which do not eat *I. carnea* (pers. obs.; O'Donell, 1952; MacBride, 1959).

Insects visiting the extrafloral nectaries of *I. carnea* were surveyed on October 30-31, November 19-20, 1973 (rainy season) and January 7-8, and 10-11, 1974 (dry season). Insects present on the nectaries of a branch when approached were recorded. Two branches per plant were surveyed when possible. Insects were also netted or captured in alcohol for identification. Collections and additional observations were made from May 1973-late Jan. 1974.

The specimens are in the California Insect Survey, the University of California, Berkeley, #190000-190784, or in a few cases, in the possession of the individual who identified them. A list of the persons who identified the specimens is given at the end of Table 1.

Results and Discussion – Insects observed are listed in Table 1. I collected 478 extrafloral nectary feeders for identification and observed 3941. Results are presented as relative abundance because the number actually seen is of little comparative value. (Numbers are reported in Keeler, 1975b). The extrafloral nectary feeders included members of 40 insect families, at least 77 genera and 100 species. Note that in only six genera were more than two species observed: *Camponotus* (4 spp), *Pseudomyrmex* (4 spp.), *Solenopsis* (3), *Polistes* (3), *Trigona* (3), and *Calopteron* (3). All but *Calopteron* are hymenoptera, and the first three are ants (Formicidae).

Diptera and other small, fast moving insects are greatly underrepresented as they were difficult both to observe and to catch. Other systematic biases are not apparent. Noctural visitors are not represented.

Table 1. Insects feeding at extrafloral nectaries of Ipomoea carnea (Convolvulaceae) at Palo Verde (Guanacaste, Costa Rica).

	Abundance	Month	Role
COLEOPTERA			
Brentidae			
Taphroderus rectus Sharp	R	N	
Cantharidae			
Chauliognathus sp.	R	Jl	P
Cerambycidae			
Lissonotus flavocinctus Dupont	C	D, *Ja*	

	Abundance	Month	Role
Stenygra histrio Serv.	R	N	
Chrysomelidae			
Halicinae sp.	C	Jl-Ja	H
Diabrotica tripunctata Fabr.	R	N	
Diabrotica sp. 2	R	N	
many 5mm., dark	C	O-Ja	
Coccinellidae			
Cycloneda sanguinea L.	C	O-Ja	
Epilachna sp. 1	R	Jl	
Epilachna sp. 2	C	N-Ja	
Brachycantha sp.	R	Jl, O	
Elateridae			
Aeolus sp.	VC	O, *N*, Ja	H
Chalcolepidius sp.	R	Ja	
Lampyridae			
Apidosoma sp. 1	C	Jl-D	P
Apidosoma sp. 2	C	Jl-D	P
sp. 3	R	Jl-N	
sp. 4	R	Jl-N	
Lycidae			
Calopteron recticulatum Fabr.	R	Jl-N	
Calopteron sp. ns. *affine* Lucas	R	Jl-N	
Calopteron sp. 3	R	Jl-N	
Calopteron spp.	R	Jl-N	
Ostomatidae			
Temnochila sp. 1	R	O	P
Tenebrionidae			
Epitragus sp. 1	R	N-Ja	H, S
Epitragus sp. 2	R	N-Ja	H, S
Epitragopsis sp.	R	N-Ja	H, S
HEMIPTERA			
Lygaeidae			
Lygaeus pallidocinctus Stal	R	Ja	
Pentatomidae			
Podisus sp.	R	Jl-Ja	
Misc.		Jl-Ja	
Hypselonotus sp.	C	O-*Ja*	
LEPIDOPTERA			
Riodinidae	R	Jl	
NEUROPTERA			
Chrysophidae			
larvae	C	*Jl*-Ja	P
Mantispidae			
Climaciella sp.	R	Ja	P
DIPTERA			
Otitidae			
Euxesta annonae (Fabr.)	R	Jl	
sp. 2	R	Jl	

	Abundance	Month	Role
Platystomatidae			
Amphicnephes stellatus Wulp.	R	Jl	
Sciomyzidae			
Protodictya hondurana Steyskal	R	O	
Tabanidae			
Chrysops variegata Fab	R	O	
Tabanus dorsiger Wiedemann subsp. *modestus*	R	N	
Tabanus sp. 2	R	Jl	
Lepiselaga crassipes Fabr.	C	Jl-Ja	
Dolichopodidae	R	Jl	
Muscidae			
2 genera, 2 spp.	C	Jl-Ja	
Sarcophagidae			
sp. 1	C	Jl-Ja	
sp. 2	R	Jl	
sp. 3	R	Jl	
sp. 4	R	Jl	
other		Jl-Ja	
Stratiomyidae	R	N	
Sepsidae	R	O	
Tachinidae	R	Jl	
"Biblionidae"	R	Jl	
"Drosophilidae"	R	N	
HYMENOPTERA			
Apoidea			
Apidae			
Apis mellifera L.	R	Ja	N
Meliponidae			
Trigona capitata Smith	R	Jl-Ja	N
Trigona sp. 2	R	Jl-Ja	N
Trigona sp. 3	R	Jl-Ja	N
Brachygastra sp.	C	Jl-Ja	
Vespoidae			
Mutillidae	R	Jl	
Polibiidae			
Polybia occidentalis (Olivier)	C	Jl-Ja	
Polistidae			
Polistes canadensis (L.)	C	N-Ja	
P. instabilis Saussure	C	O-Ja	
P. major Beauvois	R	Ja	
Synoeca surinama (Fabr.)	R	Ja	
Stelopolybia sulfureofasciata (Ducks)	R	N	
Sphecoidea			
Sphecidae	R	N	
Philanthidae	R	O	
Psaminocharidae	R	N	
Chalicidoidea			
Chalcidae	R	Jl	P

	Abundance	Month	Role
Formicoidea			
Formicidae - Formicinae			
Paratrechina sp. near *Mexicana* (Forel)	R	O	
Camponotus brettesi Forel	VC	O-F	
C. abdominalis (Fabr.)	R	Jl-D	
C. substitutus Emery	R	Jl-D	
C. rectangularis Emery	C	Mr, Je, O-Ja	
Formicidae - Dolichoderinae			
Hypoclinae lutosa (F. Smith)	R	Ja	
"Iridomyrmex" pruinosum (Roger)	VC	O, N	
"I". humilis (Mayr)	R	Ja	
other		Ja	
Formicidae - Myrmicinae			
Crematogaster ampla Forel	C	all	S
Monomorium ebinium Forel	VC	O-Ja	S
Paracryptocerus umbraculatus (Fabr.)	R	O	S
P. minutus (Fabr.)	C	O, N, Ja	S
Pheidole pubiventris Mayr	R	O	
P. pugnax Dalla Torre	VC	O, N	
Solenopsis geminata (Fabr.)	VC	My, O, N	P, S
S. littoralis Creighton	C	Je, O	
Solenopsis sp. 3	R	O	
other		Je	
Formicidae - Pseudomyrmicinae			
Pseudomyrmex belti Emery	R	O-Ja	
P. gracilis (Fabr.)	C	O-Ja	S
P. nigropilosa Emery	R	N, Ja	S
Pseudomyrmex sp. 5	C	O-Ja	S
Formicidae - Ponerinae			
Ectatomma ruidum Roger	R	Je, N	P
E. tuberculatum (Olivier)	R	O, Ja	P
Odontomachus bauri Emery	C	O, N	P
other		Ja	

R – Rare 1-10
C – Common 10-100
VC – Very Common $>$100
Months: Ja = Jan., Je = June, Jl = July

P = predacious
S = scavenging
H = herbivorous
N = nectar feeder

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Brentidae – Leslie K. Johnson, Univ. of Iowa, Iowa City, IA.

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INSECTS ASSOCIATED WITH A COLONY OF APHIDS, *BRACHYCAUDUS CARDUI* L., ON SCOTCH THISTLE, *ONOPORDUM ACANTHIUM* L., AT DUNNVILLE, ONTARIO[1]

W.W. Judd[2]

ABSTRACT: From July 4 to 14, 1976, insects associated with a colony of the aphid, *Brachycaudus cardui,* on thistle, *Onopordum acanthium,* at Dunnville, Ontario, were collected. They were in Coleoptera (4 families), Diptera (9 families) and Hymenoptera (4 families), including insects known as feeders on honeydew, predators and parasites of aphids and wasps that use aphids to provision their nests.

In an account of the butterflies of Dunn Township, Ontario (Judd, 1963) it was pointed out that the Scotch Thistle, *Onopordum acanthium* L., grows in the township and is visited by butterflies. In the summer of 1976 a plant of this species was found infested with a colony of aphids in the south end of Lot 1, Concession IV of Dunn Township, Haldimand County on the north shore of Lake Erie. Dunn Township has recently been incorporated into the Town of Dunnville. The plant was growing in a ditch. Pressed flowers and leaves are included in the writer's herbarium (No. 805, August 9, 1976).

During June of 1976 a colony of aphids was seen to be developing along the stem of the upper part of the plant and through the first two weeks of July other insects were actively visiting the colony. The aphid, *Brachycaudus cardui* L., originally placed in the genus *Aphis* by Linnaeus, has been included, over the years, in other genera, e.g. *Anuraphis, Prunaphis* (Easthop and Ris Lambers, 1976). It has been reported by Patch (1938) as using several species in various families as food including thistles in the genus *Cirsium* and *Onopordum acanthium* L.

From July 4 to 14, 1976, insects visiting the colony were collected by using an aspirator or an insect net or by clapping between the lid and jar of a cyanide jar. They were identified by the following staff members of the Biosystematics Research Institute, Canada Agriculture, Ottawa: J.M. Campbell *(Bryoporus),* B. Cooper (Calliphoridae), M. Ivanochko (Ichneumonidae, Formicidae), C.C. Loan *(Diplazon),* W.R. Mason (Braconidae), L. Masner (Sphecidae), J.F. McAlpine (Anthomyiidae, Muscidae, Otididae, Tephritidae), J. McNamara (Coleoptera), B.V. Peterson (Chloropidae), W.R. Richards *(Brachycaudus cardui),* J.R. Vockeroth (Ceratopogonidae, Dolichopodidae, Scatophagidae, Syrphidae). All specimens are deposited in the collection of the Department of Zoology, University of Western Ontario except one, *Bracon tenuiceps,* kept in the National Collection, Ottawa.

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Aphids produce the sweet-tasting exudate "honeydew" from the digestive tract. It has frequently been observed that other insects are attracted to this material and use it as food and that the aphids themselves are preyed upon and parasitized by other insects. These features of aphid biology have been summarized by Dixon (1973).

ACCOUNT OF INSECTS COLLECTED

Coleoptera

Cantharidae

Podabrus rugulosus Lec. – 15 beetles, July 5 – 14.
Podabrus tomentosus Say – 6 beetles, July 4 – 6.

Beetles of the genus *Podabrus* were previously found in Dunn Township feeding in galls of *Phylloxera caryaecollis* Fitch (Judd, 1966) and on flowers of dogwood (Judd, 1975).

Lampyridae

Pyropyga decipiens Har. – 11 beetles, July 4 – 7.

Dillon and Dillon (1961) point out that beetles of this family are predaceous in both adult and larval stages, feeding on other insects.

Staphylinidae

Bryoporus sp. – 1 beetle, July 5. Blatchley (1910) includes two species in this genus, one known to occur beneath bark and rubbish.

Coccinellidae

Coccinella transversoguttata richardsoni Brown – 17 beetles, July 4 – 13.
Coccinella novemnotata Hbst. – 1 beetle, July 4.
Coccinella undecimpunctata L. – 1 beetle, July 11.
Adalia bipunctata L. – 1 beetle, July 4.
Hippodamia convergens Guer. – 16 beetles, July 4 – 13.
Hippodamia tredecimpunctata tibialis (Say) – 1 beetle, July 4.
Brachyacantha ursina F. – 11 beetles, July 4 – 13.

Lady beetles are among the most important predators on aphids (Dixon, 1973). Hodek (1973) points out that 85 percent of the prey of beetles in Coccinellinae are aphids. Of the seven species found at the colony of *B. cardui,* two were found previously at wild carrot in Dunn Township (Judd, 1970), one on dogwood (Judd, 1975) and one, *Hippodamia convergens,* was the commonest beetle in drift on the beach of Lake Erie (Judd, 1974). Four of the species are predators of aphids on peach trees in the Niagara Peninsula between Lake Erie and Lake Ontario (Putnam, 1964).

Diptera

Ceratopogonidae

Forcipomyia sp. – 1 fly, July 4. Some species in this family prey on small insects

(Curran, 1934).

Dolichopodidae

Condylostylus sp. – 1 female, July 4. Adults in this family are predaceous, feeding on smaller insects (Curran, 1934).

Syrphidae

Sphaerophoria sp. – 1 female, July 7. Larvae of several species of hover flies are predators of aphids (Curran, 1934; Dixon, 1973). The subfamily Syrphinae, which includes *Sphaerophoria,* shares with coccinellid beetles the role of the most important predators of plant lice (Stone *et al*., 1965).

Otitidae

Herina canadensis (Johnson) – 1 fly, July 5. Most insects in this family are saprophagic, while a few feed on living plant tissue (Stone *et al*., 1965).

Tephritidae

Orellia ruficauda (Fab.) – 1 fly, July 8. This fly is widely distributed in North America (Stone *et al*., 1965).

Chloropidae

Oscinella sp. – 1 fly, July 4. Flies of this genus have been reported from dogwood in Dunn Township (Judd, 1975).

Anthomyiidae

Scatophaga stercoraria (L.) – 1 female, July 7.
Hylemya platura (Meigen) – 9 males, 1 female, July 4 – 14.
Hylemya fugax (Meigen) – 1 male, July 4.
Hylemya sp. – 10 females, July 4 – 14.
Egle sp. – 1 male, July 14.

Larvae of this family for the most part feed in plant tissue and organic waste (Stone *et al*., 1965). It is likely that they were at the colony of aphids as feeders on honeydew.

Calliphoridae

Bufolucilia silvarum (Mg.) – 3 flies, July 4 – 8.
Lucilia illustris (Mg.) – 1 fly, July 4.

These flies have been recorded in Dunn Township on milkweed (Judd, 1968), wild carrot (Judd, 1970) and dogwood (Judd, 1975). They are habitual visitors at flowers and were probably attracted to the honeydew produced by the aphids on thistle.

Muscidae

Musca domestica L. – 1 fly, July 4. The house fly habitually feeds on sugary fluids and thus was probably attracted to the honeydew produced by the aphids.

Hymenoptera

Braconidae

Bracon tenuiceps (Muesebeck) – 1 wasp, July 4. This wasp is parasitic on a weevil (Muesebeck *et al.*, 1951).

Ichneumonidae

Pycnocryptus director (Thbg.) – 3 wasps, July 4. Most of the wasps in the tribe Mesostenini, to which *P. director* belongs, are parasitic on pupae or larvae concealed in tunnels or leaf rolls (Muesebeck *et al.*, 1951).

Cratichneumon ritus Heinrich – 1 wasp, July 4. *C. ritus* has been recorded from Ontario by Heinrich (1961) who reports that known hosts for wasps in *Crathichneumon* are caterpillars of moths.

Diplazon laetatorius Fabr. – 14 wasps, July 4 – 14. This wasp is parasitic on larvae of Syrphidae (Muesebeck *et al.*, 1951). The wasps found at the colony of aphids were thus doubtless parasitizing syrphid larvae predaceous on the aphids.

Formicidae

Formica glacialis Uhler – 23 ants, July 4 – 7. This ant is widely distributed in North America (Muesebeck *et al.*, 1951). During the two-week period when the aphid colony was observed, the worker ants were the most common insects clustering about the aphids. The food of ants in the genus *Formica* is largely honeydew (Muesebeck *et al.*, 1951).

Sphecidae

Pemphredon inornatus Say – 3 wasps, July 4 – 7.
Passaloecus singularis Dahlbom – 3 wasps, July 4.
Passaloecus sp. – 1 wasp, July 4.

Wasps in these two genera nest in burrows and provision them with aphids (Muesebeck *et al.*, 1951). The wasps at the aphid colony were thus doubtless gathering prey to provision their nests.

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A POSSIBLE OVER-WINTERING AGGREGATION OF *HOPLOTHRIPS KARNYI* (HOOD) (THYSANOPTERA: PHLAEOTHRIPIDAE) ON *LENZITES BETULINA* (FR.) FR. (APHYLLOPHORALES: POLYPORACEAE)[1]

Stephen W. Bullington[2]

ABSTRACT: An aggregation of *Hoplothrips karnyi* (Hood) (Thysanoptera: Phlaeothripidae) is recorded from the bracket fungus *Lenzites betulina* (Fr.) Fr. (Aphyllophorales: Polyporaceae). The number of adult males, macropterous females, micropterous females, and larvae in the aggregation are recorded. The date of capture suggests the aggregation was over-wintering.

Fourteen adult males, two macropterous females, 59 micropterous females and nine larvae of the thrips, *Hoplothrips karnyi* (Hood) were collected on 11 Dec. 1976 by S. W. Bullington from between two conks of the bracket fungus, *Lenzites betulina* (Fr.) Fr. The conks were located on the exposed xylem at one end of a black locust, *Robinia pseudoacacia* L., log that had fallen near an intermittent stream along Route 685, near the Radford Army Ammunition Plant, Montgomery Co., VA (37° 07' N, 80° 33' W). The thrips were clustered in a tight mass, several individuals deep between the two conks. Although the air temperature was only 29° C (at 3 PM, EST), the thrips were active enough to attempt to disperse when distrubed. After the thrips were collected with an alcohol-moistened camel's hair brush, the fungus was placed in a plastic bag. When examined later under a stereomicroscope, neither the fungus nor the bag contained thrips' eggs, prepupae, or pupae. The thrips were not observed feeding on the fungus.

The date of capture suggests the aggregation was over-wintering.

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BIONOMICS OF *ACROMYRMEX LUNDI PUBESCENS* (EMERY) IN PARAGUAY (HYMENOPTERA: FORMICIDAE)[1]

Harold G. Fowler[2] Luis Cabello[3]

ABSTRACT: Distribution, nests, and foraging behavior of *Acromyrmex lundi pubescens* (Emery) are detailed from observations made in Paraguay. This leaf-cutter occurs in the Gran Chaco Basin in small isolated woodlands which dot the savannas of the lower Chaco. Nests are variable, and foraging trails are often excavated. Although this species cuts broadleaf plants, it is of little probable economic importance.

Of the leaf-cutting ants (genera *Atta* and *Acromyrmex*) of continental South America, the poorest known is *Acromyrmex lundi pubescens* (Emery). Type specimens from an unspecified locality in Paraguay were described by Emery (1905), and it is also known to occur in the Mato Grosso of Brazil and the Chaco of Argentina (Gallardo 1916, Emery 1922; Santschi 1925; Borgmeier 1927; Goncalves 1961). However, Goncalves (1961) pointed out that nothing was known of its ethology or economic importance. Here we present information on *A.l. pubescens* in Paraguay in an attempt to fill this void.

Within Paraguay, this is the only species of *Acromyrmex* found in the isolated woodlands which dot the savannas of the lower Chaco (Fowler 1977). Colonies of *A. l. pubescens* rapidly occupy the dead or abandoned nests of the dominant grass-cutting *Atta vollenweideri* Forel, as well as the subsequent nuclei of woody plants that rapidly invade the collapsed nests of *A. vollenweideri.* This must be the species of *Acromyrmex* referred to by Jonkman (1976) in his study of succession on nests of *A. vollenweideri.* Besides occupying dead or abandoned nests of *A. vollenweideri*, nests are often built around trunks of *Prosopsis algarobilla* Gris. and *Prosopsis campestris* Gris., and reach up to 1 m in height. Within these conical nests of heavy clay are numerous chambers, 20 cm X 20 cm X 20 cm, for the culture of fungus. Other nests found in the better drained soils of larger, older woodlands are superficial, with excavated chambers 20 cm deep, and thatched over with straw and twigs. These chambers are connected by tunnels

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running horitzontally parallel to the ground surface, at 5 to 10 cm in depth. *A. l. pubescens* is found in these conditions throughout the entirety of the lower Chaco Basin, which may indicate that its distribution is limited by soil conditions. This is suggested by the fact that it only occurs in the heavy clay soils of the Chaco, and not in the red soils of eastern Paraguay. However, it may be that the vegetation which occurs in the different soil types may also restrict the range of *A. l. pubescens.* Also, colonies of *A. l. pubescens,* unlike other species of *Atta* and *Acromyrmex* of the Chaco, dump its detritus on the surface of the soil, facilitating its identification.

Foraging trails are well developed, averaging 2.5 cm in width and extending up to 40 m in length. Nests have numerous trails, with up to 8 being observed for one nest. Trails may originate from the nest itself, or from underground galleries which extend up to 20 m from the nest. Frequently, portions of the trails are excavated, much as in *Acromyrmex crassispinus* (Forel) (Fowler 1976). However, unlike *A. crassispinus,* these portions excavated by *A. l. pubescens* may be up to 10 m in length and may be thatched over in their entirety. This behavior, we believe, shows the transition from surface trails originating directly from the nest, as in *Atta vollenweideri,* to the construction of underground galleries which give rise to the surface foraging trails, as in *Atta sexdens* (L.).

We observed *A. l. pubescens* to forage principally on dicotyledons, with the bulk formed by legumes (*Poiretia latifolia, Desmodium canum, Desmodium barbatum, Vigna* sp., *Prosopsis* spp.), with around 1% of the vegetation cut being comprised of Gramineae. Because of the patchy distribution of this species, and the lack of intensive agriculture in the lower Chaco, the economic importance of *A. l. pubescens* is probably minimal. However, it may be locally destructive to small gardens and bean plantations planted near woodlands by cattlemen, while the selective removal of legumes may locally affect the soil nutrient balance of these nitrogen deficient pasturelands.

ACKNOWLEDGMENTS

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NEW POLICY FOR REVIEW OF MANUSCRIPTS

Early in 1978, the officers and editors of the American Entomological Society developed a comprehensive questionaire and invited 35 eminent, subscribing, entomologist members to evaluate our Society's publications program. A high percentage of replies was received. Many respondents also included valuable additional suggestions and comments.

In general, our overall program received a hearty endorsement. This was especially true of TRANSACTIONS and MEMOIRS, both of which were rated highly.

Comments regarding ENTOMOLOGICAL NEWS were more evenly balanced between pros and cons, with the major recommendations being (1) review of all or most papers by one or more specialists in the subject area and (2) more critical selectivity in the acceptance of papers for this journal. The obvious objective of these recommendations is to upgrade the quality of some papers in ENT. NEWS so that all papers will provide a significant contribution to entomology.

As a result, the editorial committee has decided that, effective immediately, all authors, when submitting papers to ENT. NEWS, are requested to (1) provide the names of two qualified individuals who have critically reviewed the manuscript *before* it is submitted and (2) submit the names and addresses of two qualified authorities in the subject field to whom the manuscript can be referred by the editor for final review.

H.P.B.

A FOOD SOURCE FOR *NECROBIA VIOLACEA* (COLEOPTERA: CLERIDAE)[1]

Rif El-Mallakh[2]

Within the *Necrobia* genus (Coleoptera: Cleridae) *N. ruficollis* and *N. rufipes* have been lavished with attention while *N. violacea* has been largely ignored. Most of the information on *N. violacea* seems to be inferred from knowledge of its relatives. Following is a report on a small but interesting observation made while maintaining a colony of *N. violacea* in the lab.

Necrobia violacea and *Sarcophaga* flies and Dermestidae of undetermined species were kept in fly cages at 25-28°C and 68-72% RH, and maintained on sugar, water and meat of dead rats.

Necrobia violacea were observed inside the pupal cases of the *Sarcophaga* flies. Evidence indicates that the larvae bored into the living fly puparia to eat the contents and/or pupate. Active and quiesent larvae as well as pupae of *N. violacea* have been found in puparia in which the polar entrance-way was sealed with a white secretion common to *Necrobia* (Scott, 1919). Many adult and larval *N. violacea* were found in unselaed puparia indicating predation on the pupal stage of the flies by both adults and larvae, an issue previously in dispute for *N. ruficollis* (Scott, 1919; Balduf, 1969). Adults were observed to prey on and immediately devour dermestid larvae. However, maintainance on *N. violacea* on the meat of dead rats alone (and in the absence of both flies and Dermestidae) indicates that the saprophagous food habit of *N. ruficollis* and *N. rufipes* (Balduf, 1969) also is true of *N. violacea.*

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FOUR NEW SPECIES OF GYPONINAE (HOMOPTERA: CICADELLIDAE) FROM PARAGUAY[1]

Dwight M. DeLong, Bruce W. Triplehorn[2]

ABSTRACT: Four new species of Paraguay Gyponinae, – *Gypona paraguayensis* n.sp., *G. fovea* n.sp., *G. tapera* n. sp., *Curtara basala* n.sp., and a new subgenus, *Curtara* subgenus *Lataba* are described. *Curtara insularis* (Caldwell and Martarell) is a common insect in Paraguay.

Some 100 specimens of Gyponinae were collected in Paraguay during June 1975 by D.H. Blocker, R.J. Elzinga and A.A. Granovsky. Seven species could be specifically identified (males present) representing four genera. One genus was represented by females only. More than half of the specimens were one species, *Curtara insularis* (Caldwell and Martarell). Four species are being described at this time. All holotypes except *C. basala* n.sp. are in the Kansas State University collection. One new species of *Curtara* is placed in a new subgenus *Lataba* n. subgen.

Gypona paraguayensis n. sp.

Figs. (1-5)

Length of male 6.5 mm., female 7 mm. Crown bluntly angled, almost twice as broad at base between eyes as median length, ocelli nearer median line than eyes. Color greenish yellow, a large round black spot behind each eye on pronotum. Forewings with a black spot at base, two on disc and two minute black spots on clavus at terminus of claval veins along commissure.

Female seventh sternum with posterior margin broadly concavely rounded, shallowly notched at middle. Male plates three and one-half times as long as broad, apices rounded. Style with blade slightly concave on dorsal margin, broadened to twice its basal width by a ventrally curved protrusion, narrowed at two-thirds its length, apex sharply pointed. Aedeagus with a pair of processes arising apically then recurved and extending basally almost one-half length of shaft. Pygofer bluntly rounded apically.

Holotype male Paraguay, near Luque and International Airport VI-26-1975, Granovsky, Blocker and Elzinga colls. Paratypes 1 ♀ same as holotype; 2 ♀ Pto. Pte. Stroessner, Para. VI-16-75; 1 ♀ Ponta Pora, Brazil VI-23-75; 2 ♀ Euseblo, Ayala VI-10-75; 1 ♀ Cel Oviedo VI-11-75; all collected by the same collectors. Holotypes and paratypes in the Kansas State University collection, paratypes in the DeLong collection.

G. paraguayensis is placed in the subgenus *Marganalana* and is closely related to *G. nasua.*

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Gypona fovea n.sp.

(Figs. 11-15)

Length of male 9 mm., female 11 mm. Crown roundly produced, two-thirds as wide at base between eyes as median length. Color pale green, crown with a small black spot behind each ocellus, on basal margin.

Female seventh sternum with posterior margin truncate. Male plates about four times as long as broad, apices broadly rounded. Style long, slender, narrowed at middle then narrowed again at four-fifths its length; narrow apical portion curving dorsally, apex blunt. Aedeagus long, very slender, whip-like, curving dorsally, apical portion tapering, hair-like. Pygofer deeply concavely excavated on ventrocaudal margin forming a short pointed spine on ventral margin at two-thirds length of pygofer.

Holotype male, Paraguay, near Luque and International Airport VI-26-75, Elzinga, Granovsky, and Blocker colls. Paratypes; 3 ♀ same as holotype; 1 ♂ Bayer Ranch near Pto. Pte. Stroessner VI-12-75. same colls. Holotype male and paratypes in Kansas State University Collection. Paratypes in DeLong collection.

G. fovea is placed in the subgenus *Marganalana* and is probably related to *S. fusinervosus.*

Gypona tapera n.sp.

(Figs. 6-10)

Length of male 9.5 mm, female 11 mm. Crown broadly rounded, twice as wide at base between eyes as median length. Color pale green tinged with brown. A conspicuous round black spot on pronotum behind each eye.

Female seventh sternum with posterior margin broadly concavely excavated one-half distance to base. Male plates short, broad, length not quite twice median width. Style with apical half long, "foot"-shaped extending dorsally, apex slender, curved caudally, "heel" rounded. Aedeagal shaft broad in ventral view, bearing a pair of subapical processes one-third length of shaft. In lateral view apical portion appears bent dorsally. Apex of pygofer bluntly rounded on dorsocaudal margin. Pygofer bearing a heavily scleritized plate at dorsal margin near apex.

Holotype male Paraguay, San Lorenzo, College of Agriculture VI-24-1975, Granovsky, Blocker and Elzinga colls. Paratypes; 1 ♀ same as holotype; 1 ♀ Eusebro Ayala 2 km. W, VI-10-75; 1 ♀ Brazil, near Foz do Iguaçu VI-14-75, Blocker, Elzinga and Granovsky colls. Holotype and paratypes in the Kansas State University collection, Paratypes in the DeLong collection.

G. tapera is placed in the subgenus *Marganalana* and is related to *G. trita.*

Curtara subgenus *Lataba* n. subgenus

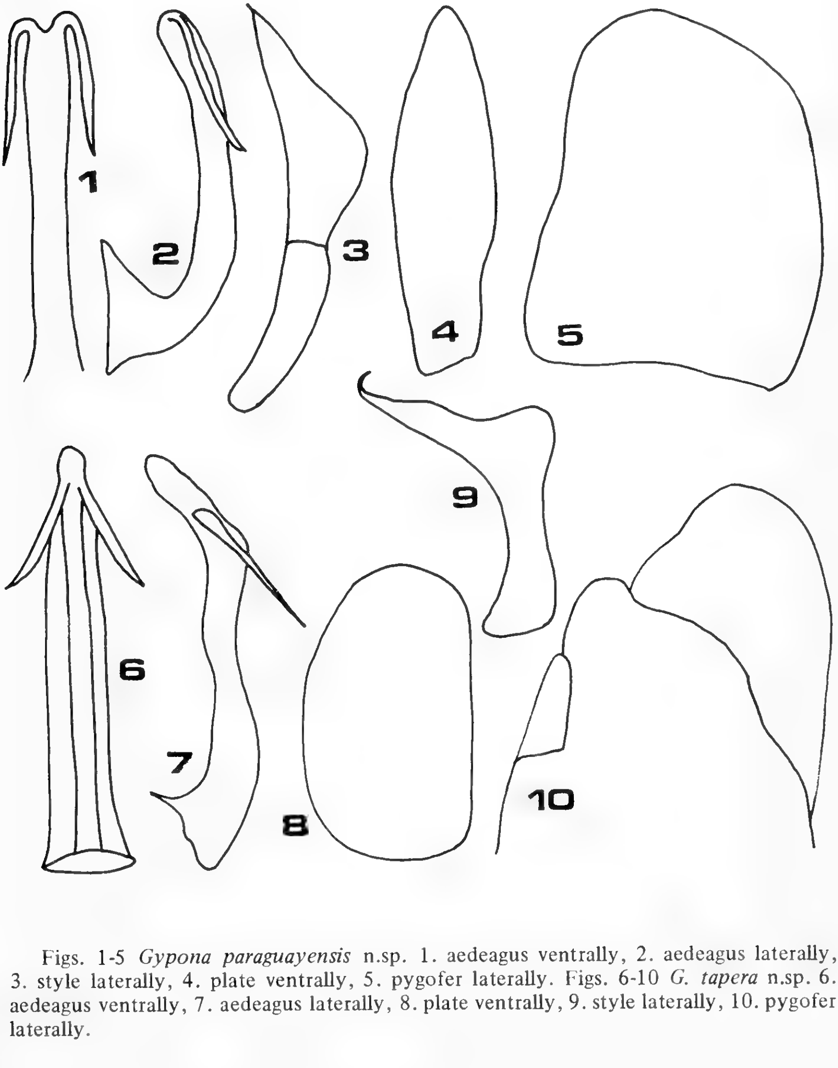
Aedeagus with basodorsally produced portion broad and flattened. Parameres short, slender, about one-half as long as aedeagal shaft and extended parallel to it. Aedeagal shaft with two apical processes. Type of subgenus *Curtara basala* n.sp.

Curtara basala n.sp.

(Figs. 16-20)

Length of male 8.5 mm., female unknown. Crown, short, rounded, almost twice as wide at base between eyes as median length. Color, crown pale brown, a dark brown spot at base, each side, behind ocellus. Pronotum mostly dark brown. Scutellum with dark brown basal angles. Forewings pale brown with rows of dark brown spots between veins; a row along entire claval vein and along costal margin to first apical cell.

Male plates three and one-half times as long as broad, apices broadly rounded. Style long, rather slender, tapering from base to slender, dorsally bent, pointed apex. Aedeagus with rather slender shaft, bearing a pair of subapical processes near apex, which are less than one-fourth length of shaft; dorsally recurved basal portion of aedeagus forming a

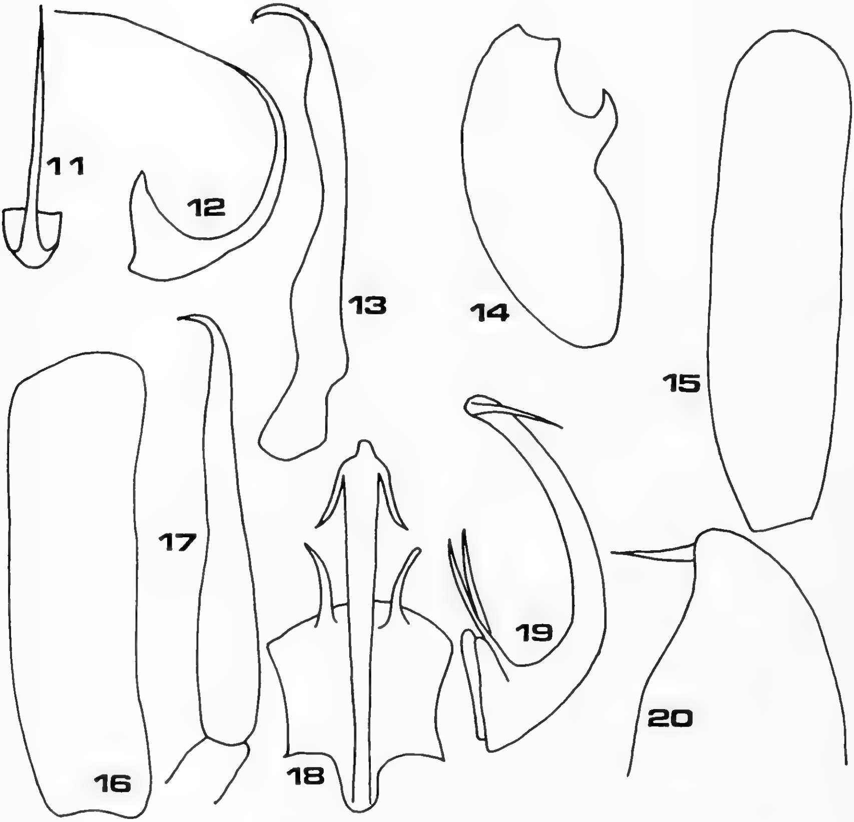


Figs. 1-5 *Gypona paraguayensis* n.sp. 1. aedeagus ventrally, 2. aedeagus laterally, 3. style laterally, 4. plate ventrally, 5. pygofer laterally. Figs. 6-10 *G. tapera* n.sp. 6. aedeagus ventrally, 7. aedeagus laterally, 8. plate ventrally, 9. style laterally, 10. pygofer laterally.

broad plate bearing a pair of short parameres about half length of aedeagal shaft. Pygofer narrowed basally, bearing a long slender ventrally directed spine, one seventh length of pygofer, near apex.

Holotype male, Fiebrig, Paraguay, Paratype ♂ Paraguay, Chaco Exper. Sta. 295 km. N.W. Asuncion on Trans. Chaco Hwy. VI-20-1975, Blocker, Elzinga and Granovsky colls. Holotype in the DeLong collection, paratype in the Kansas State University collection.

Curtara basala is the type of the subgenus *Lataba* and is different from the formerly described species of *Curtara*.



Figs. 11-15 *Gypona fovea* n.sp. 11. aedeagus ventrally, 12. aedeagus laterally, 13. style laterally, 14. pygofer laterally, 15. plate ventrally. Figs. 16-20. *Curtara basala* n.sp. 16. plate ventrally, 17. style laterally, 18. aedeagus ventrally, 19. aedeagus laterally, 20. pygofer apex laterally.

SPIDER PREYS ON SPRUCE BUDWORM EGG MASS[1]

Daniel T. Jennings[2], Mark W. Houseweart[3]

ABSTRACT: A penultimate male *Metaphidippus flavipedes* (G. & E. Peckham) (Araneae: Salticidae) was observed feeding on an egg mass of the eastern spruce budworm, *Choristoneura fumiferana* (Clem.) (Lepidoptera: Tortricidae).

Spiders are generally known to feed on mobile prey, chiefly insects. They employ two principal methods to capture their prey: some spiders build webs or silken snares while others actively hunt their prey. Web-building spiders capture a high percentage of flying insects, although walking insects may also be ensnared. As prey-capturing tactics, vagrant hunting spiders employ stealth and ambush triggered by visual and tactical cues. Few spiders have been observed feeding on immobile prey, and even fewer on insect eggs.

On 20 July 1977 at ca. 1600 EDT we observed a jumping spider feeding on a green, uneclosed egg mass of the eastern spruce budworm, *Choristoneura fumiferana* (Clem.). At the time, we were looking for uneclosed budworm egg masses on young balsam fir trees, *Abies balsamea* (L.) Mill., on Scott Paper Company lands in Blake Township, Piscataquis County, ca. 30 km (18 miles) north of Greenville, Maine. Many of these young fir trees had been heavily defoliated by the spruce budworm. Budworm larval feeding is generally completed by mid-to late June and is followed by pupation, adult moth emergence, mating, and egg laying. The spider, a penultimate male, was observed feeding on an egg mass deposited on a balsam fir needle, ca. 1.4 m (4.5 ft.) above ground. Estimated tree height is 2.4 m (8 ft); dbh = ca. 5 cm.

Upon closer inspection the spider was disturbed and stopped feeding; whereupon, we captured the spider in a 2.0 dram screw cap vial. The egg mass was also collected and placed in the vial with the spider. At this time, the egg mass was green; developing larval-head capsules were not visible through the egg chorions. Closer examination of the egg mass revealed a

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slightly darkened area where the spider was seen feeding.

Spider and egg mass were held in rearing for several days and subsequent observations at infrequent intervals failed to detect any further feeding on the egg mass. However, once the eggs hatched, ca. 5 days after collection, the spider readily captured and fed on 1st instar budworm larvae.

After egg eclosion, spider and egg mass were separated and the spider reared to maturity on houseflies for species determination. The spider is a male *Metaphidippus flavipedes* (G. & E. Peckham), family Salticidae. This species is commonly found on conifers and deciduous trees (Jennings, 1976). Turnbull (1956) found *M. flavipedes* associated with budworm on Douglas-fir, *Pseudotsuga menziesii* (Mirb.) Franco in British Columbia. Renault and Miller (1972) reported this salticid as one of the most common species of arboreal spiders in fir-spruce forests of New Brunswick.

We stained the egg mass in the laboratory (Jennings and Addy, 1968) and found that the 3-row egg mass (5.45 mm long) contained 32 eggs (Fig. 1). Twenty-seven eggs had successfully hatched; 5 eggs apparently failed to hatch and presumably were fed upon by the spider. The total (32) is slightly higher (+7) than that predicted for this size egg mass by Leonard, Simmons, and VanDerwerker (1973).

The extent of spider predation on budworm egg masses is not known. Morris (1948) reported that several species of spiders found on mature balsam fir trees prey on both budworm larvae and eggs; however, the spiders were not identified. Spiders have also been observed feeding on eggs of another forest defoliator, the Douglas-fir tussock moth, *Orgyia pseudotsugata* (McDunnough). Wickman (1977) observed spiders (species undetermined) opening tussock moth eggs and extracting the 1st instar larvae; however, spiders were more commonly observed preying on newly emerged larvae. Other instances of spiders feeding on lepidopterous eggs are summarized by Buschman, et al. (1977)

Because budworm egg masses are difficult to find and predator feedings may be interrupted by observers, we need quantitative methods of detecting spider predation on eggs. Such methods would permit assessing the extent and importance of this source of mortality. Spider-induced egg mortality should be included in studies of the population dynamics of the spruce budworm.

Spider and egg mass are deposited in the arachnid collection of The American Museum of Natural History, New York.

ACKNOWLEDGEMENTS

We are grateful to Drs. Boyd E. Wickman, Bruce Cutler, and Mr. T. R. Renault for their review comments.

Figure 1. Spruce budworm egg mass (5.45 mm long) fed upon by *Metaphidippus flavipedes.*

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THE OCCURRENCE OF AN INTERSEX INDIVIDUAL OF *PSYCHOMYIA FLAVIDA* (TRICHOPTERA)[1]

Bernard G. Swegman[2]

ABSTRACT: The occurrence of an intersex specimen of *Psychomyia flavida* in a light trap collection is reported.

The occurrence of large numbers of females and few males of *Psychomyia flavida* in light trap collections is quite common; Anderson (1976), Leonard et al. (1949), Marshall (1939), Nimmo (1966), Sibley (1926). Corbet (1966) offers evidence that the species is parthenogenetic. At present 2 males and 3080 females have been identified in a UV light-trap collection from Linesville Creek, Crawford County, Pennsylvania, 41°41'N, 80°24'W.

An intersex specimen which is clearly a female with male characteristics is present in this collection (fig. 1). The tenth tergite of this specimen is pro-

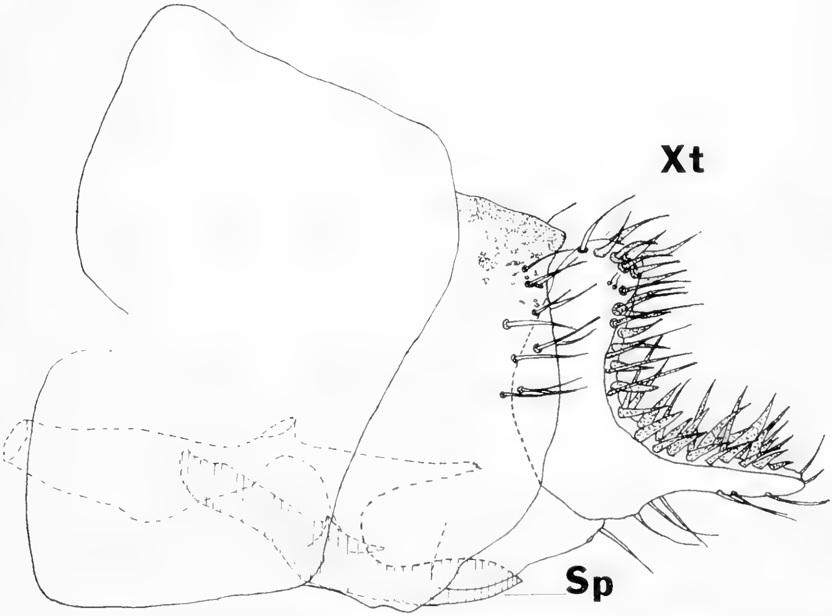

Fig. 1. *Psychomyia flavida* intersex specimen. Lateral view of genitalia. Sp, sternal plate chracteristic of female; Xt, tenth tergite characteristic of male.

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duced into heavily spined flap-like appendages as in a male; however, they appear somewhat underdeveloped and are not as robust nor of the same shape as in a typical male (see Ross 1944). Neither cerci nor claspers are present, but within the abdomen are several sclerotized structures which may be rudimentary male reproductive parts. The homologies of these structures are uncertain and they are not included in the figure. The ventral plate of the female is present as is the bursa copulatrix. The specimen was gravid.

This is the first report of intersexuality in the Order Trichoptera.[3]

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[3] Dr. A. Nimmo has collected intersex specimens of the genus *Rhyacophila* from Alberta, Canada (personal communication). He also has informed me of a mention in the literature concerning this phenomenon in Trichoptera; however, the source is unknown.

BRACHYMYRMEX MUSCULUS, A NEW ANT IN THE UNITED STATES[1]

George C. Wheeler, Jeanette Wheeler[2]

While driving across southern Louisiana on 23 January 1976, we stopped briefly at a wayside park near Madisonville in Saint Tammany Parish. In addition to resting we collected samples from four ant nests. The first three proved to be *Iridomyrmex humilis*; the fourth was a *Brachymyrmex* but not *depilis.* The latest key to this genus is by Santschi in 1923. In this we identified our sample as *musculus.* Mr. R.R. Snelling kindly confirmed our identification.

A live oak trunk had been sawed off about 12 inches above the ground; our ants were in sawdust among the above-ground roots. A colony of *Iridomyrmex humilis* was also in the sawdust about two feet from the *Brachymyrmex.*

Forel described *B. musculus* in 1899 as a subspecies of *B. tristis* from Costa Rica. In 1901 he raised it to specific rank and listed a Mexican locality (Cuernavaca, Morelos). Dr. D.R. Smith has given us the two records in the United States National Museum: Mirador in Vera Cruz, Mexico and Watlings Isl. in the Bahamas. Mr. Snelling has given us the records (all Mexican) in the Los Angeles County Museum of Natural History—*Vera Cruz*: Camarón; 8 mi NW Sontecomapan; Los Tuxtlas. *Oaxaca*: 12 mi SE Huajuapan de León 6100'; 13 mi NW Oaxaca 5500'. *Morelos*: Cuernavaca.

The discovery of *Brachymyrmex musculus* in Louisiana poses an interesting question: is the species native or introduced? We think the evidence for introduction is overwhelming. If it were native it should also occur in Texas, where it could hardly have escaped discovery by both W.M. Wheeler and W.S. Creighton. New Orleans is an ideal port-of-entry for tropical pests. The Argentine ant was probably introduced there. Madisonville would be separated from New Orleans by Lake Ponchartrain, which is about 25 miles wide, were it not for the causeway which gives almost direct vehicular connection across the lake.

These two species may be separated by the following key:

1a. Concolorous strong brown to reddish yellow; no erect hairs on thoracic dorsum; pubescence on gaster dense; workers 1½-2 mm long . . . . *depilis*

1b. Concolorous very dusky red; thoracic dorsum with 6-8 stout hairs about 0.1 mm long; pubescence on gaster not concealing shining surface; workers 1¼-1½ mm long . . . . *musculus*

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ERRATUM

In the paper "The North American and Caribbean Species of *Systelloderes* (Hemiptera: Enicocephalidae)" by G. Kritsky in Entomological News 89: 2 & 3: 65 - 73, March & April 1978 the following typographical errors should read: page 66, line 13, first word "enicocephalid"; line 15, third word *"inusitatus"*; line 26, second word "enicocephalid"; page 68, line 2, second word "Callanga"; page 69, line 2, 13th word *"doriai"*; page 70, line 33, fourth word "Spination"; page 72, line 47, third word *"tenuis"*; page 73, line 2, fourth word *"dorsalus"*; and line 13, seventh word "Arnaud".

In the paper "A New Species of *Hymenocoris* from Mexico (Hemiptera: Enicocephalidae)" by G. Kritsky in Entomological News 89: 2 & 3: 74 - 76, March & April 1978 legends 4 and 5 on page 75 should read "4. *H. hintoni* antenna." "5. lateral view of *H. hintoni* head."

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A METHOD OF SAMPLING SHORE BEETLES[1]

Paul M. Holeski[2]

During a recent study (Holeski & Graves, 1978) of some shore inhabiting beetles (Carabidae, Heteroceridae, Staphylinidae) it was desirable to have a method of determining the number of adult individuals in a given area. Knowing the number of individuals of each species taken from a constant area several times over the season of activity could be useful in determining such information as population peaks of individual species and numbers relationships among the various species present.

A frame of bar iron and hardware cloth (Figure 1) was constructed to measure 0.092^2 meters (1^2 foot). Samples were taken by walking in the water along the shore and randomly dropping the frame onto the shore. The frame was heavy and sharp enough to slightly penetrate the soil surface. Insects running over the soil surface were hand captured and then water was poured into the frame to force those beetles not on the surface to emerge

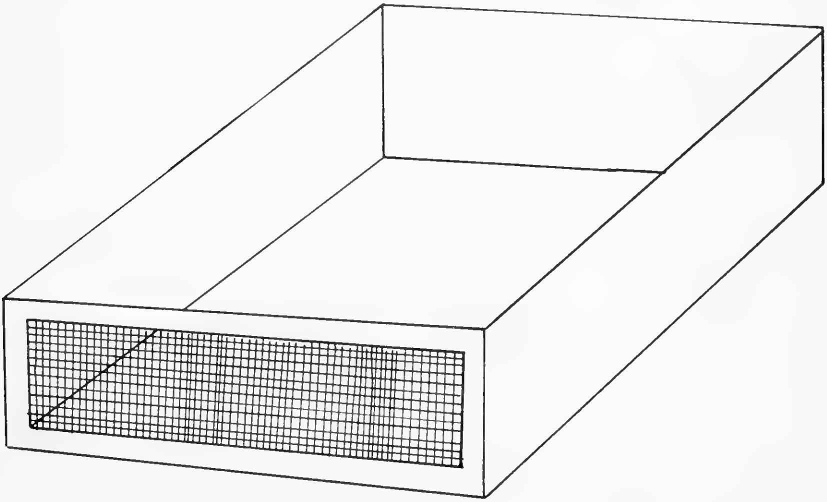

Figure 1. A frame constructed of bar iron and hardware cloth and used to sample shore beetles. Dimensions are 30.5 x 30.5 x 7.6 centimeters (12 x 12 x 3 inches).

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from cracks and burrows. Excess water escaped through the screen side of the frame. As most of the shore beetles do not readily take flight, or at least attempt to escape by running or hiding before taking flight, this method of sampling allowed the capture of most of the individuals within the area of the frame. Some escape did occur by flight or crawling over the sides of the frame when an unusually large number of individuals were within the frame and could not be hand picked rapidly enough. This problem could be remedied by constructing a frame of smaller dimensions. Overall, this method appears to be a simple and satisfactory way of quantitatively sampling shore beetle populations.

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A NEW J.G. NEEDHAM DEVICE FOR COLLECTING ADULT MAYFLIES (AND OTHER OUT-OF-REACH INSECTS)[1]

George F. Edmunds, Jr.[2], W.P. McCafferty[3]

ABSTRACT: A useful device for collecting out-of-reach insects is described.

James G. Needham (1880-1950) was an innovative designer of devices for the collection of aquatic insects. While we were examining a file on correspondence between Jay R. Traver and J.G. Needham we found a sheet hand written by Needham in May, 1929 illustrating (fig. 1) a useful device for collecting adults. We immediately recognized the value of the "new" device.

> "A suggestion for collecting adult mayflies from the highway bridges. Set a big feather. Wedge its quill in the tip of a *light* cane. . . and glue it there. . . . Wet the vane with some adhesive that is soluble in water – say honey. Touch the wings of the mayflies as they sit on the concrete. They will adhere until picked off. Dilute adhesive so that it will not adhere too strongly, pulling off the tails. Merely wetting the vane with alcohol may do: I have not tried it."

We have been frustrated many times by being unable to reach resting adults, not only under bridges, but around lights on buildings, on lighted signs, etc. Certainly such a device would be useful for a variety of insects.

A number of modifications of the device are possible depending on the needs and practices of the collector. In place of a light cane, a jointed fiberglass fishing rod could be used, or an end piece could be adapted to a long insect net handle. While a feather is a good working item, a piece of clear plastic may not frighten away the insects. Tack-Trap® or Tanglefoot® may be good sticky materials if suitable mild solvents are carried for removing the specimens. It may be that the original Needham device is best for mayflies: a feather and alcohol.

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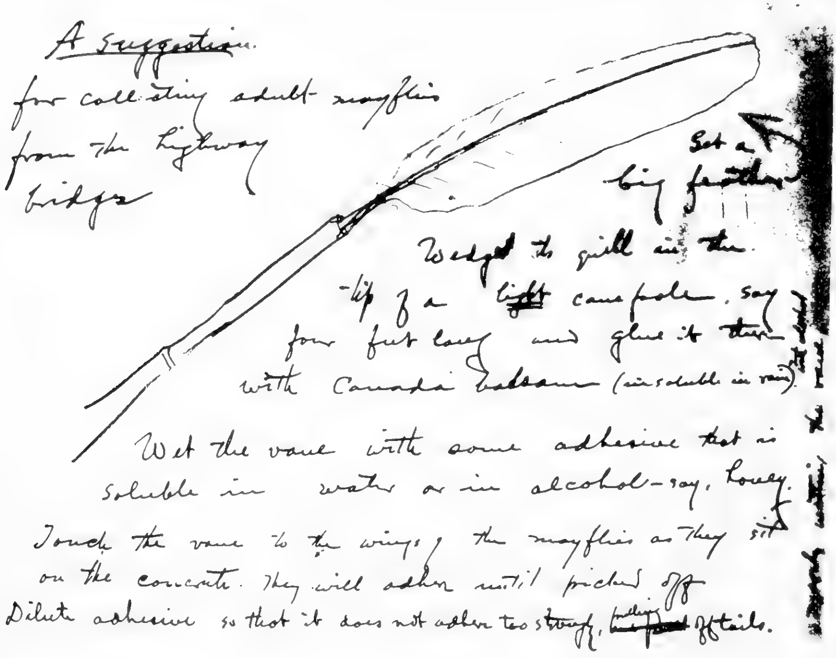

A suggestion.
for collecting adult mayflies
from the highway
bridges

Get a
big feather

Wedge its quill in the
tip of a light cane pole, say
four feet long and glue it there
with Canada balsam (insoluble in rain).

Wet the vane with some adhesive that is
soluble in water or in alcohol—say, honey.

Touch the vane to the wings of the mayflies as they sit
on the concrete. They will adhere until picked off.
Dilute adhesive so that it does not adhere too strongly, pulling off tails.

Fig. 1. Sketch and notes by J.G. Needham.

TWO NEW RECORDS FOR *DASYLECHIA ATROX* (WILLISTON) (DIPTERA: ASILIDAE), WITH A REVIEW OF ALL PREVIOUS RECORDS[1]

Stephen W. Bullington[2]

ABSTRACT: The first new record for *Dasylechia atrox* (Williston) is Champaign Co., Illinois. The specimen was captured in a metal malaise trap located at the edge of a deciduous forest. A second new record is Washtenaw Co., Michigan. This specimen has a honey bee, *Apis mellifera* L., as prey. Two additional captures and the literature referring to all previous records are reviewed.

A female of the rare asilid, *Dasylechia atrox* (Williston), was collected on 26 Jul. 1973 in Champaign Co., Illinois. It was found in Trelease Woods on the University of Illinois campus at Urbana by Lloyd R. Davis, Jr. This record extends the range of *D. atrox* into Illinois; is the first record from a malaise trap; and may be the only specimen collected in the last 20 years. The asilid was found dead within a cyanide killing jar attached to the malaise trap. The metal trap, designed to collect mosquitoes, was checked daily between 7 and 9 AM. The trap was situated in the ecotone between a relict of the eastern deciduous forest and a reconstructed prairie. The forest contained mainly red oak (*Quercus rubra* L.) and pawpaw (*Asimina triloba* (L.) Dunal); the prairie, grass of similar height to the trap. Stinging nettle (*Urtica dioica* L.) abounded in the ecotone. The trap was operated for the entire summer but only one *D. atrox* was collected. This specimen is deposited in the author's personal collection.

The collection at the United States National Museum contains three specimens. The first specimen was collected in Ann Arbor, Washtenaw Co., Michigan by F.M. Gaige. The only other information on the label is "In back of the museum." The specimen has a honey bee, *Apis mellifera* L., as prey. This is a new county record for the asilid. The second specimen was collected in Michigan on 13 Aug. 1888. The third was collected in Ohio by S.W. Bromley. The second and third specimens are not state records, but have not been recorded in the literature.

Published records for only 15 specimens exist. Williston (1883) described the asilid from a Pennsylvania specimen collected by S. Auxer. A second specimen was collected at Lansing, Michigan by J.M. Aldrich (Aldrich, 1905). It was collected on 27 Aug. 1888 and once had a small beetle as prey, but this has been lost (Baker and Fischer, 1975). The third specimen was collected in New Brunswick, Middlesex Co., New Jersey on 28 Aug. by John B. Smith (Smith, 1910). Smith characterizes the collecting site as "Piedmont Plain.

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At the edge of the red shale, which dips below the sand and clay a little to the south." The fourth specimen was collected at Ithaca, New York in Aug. by J.A. Hine (Leonard, 1928). The fifth and sixth specimens were collected in Ohio in 1933 (Bromley, 1936). They were collected on 29 Aug. by C.F. Walker as they circled him while in an open pasture, with oak and red maple as the dominant trees on gravelly, morainic soil (Baker and Fischer, 1975). The seventh specimen was collected in Columbus, Ohio. It was found on The Ohio State University campus, on the steps of the Botany and Zoology Building on 24 Jul. 1934 by C. Vennard (Bromley, 1936). The eighth specimen is in the James S. Hine Collection at the Ohio State Museum and has no data (Bromley, 1936). The ninth specimen is in the Charles Dury Collection at The Ohio State University, was presumably collected in Ohio, and has a *Melissodes bimaculata* (lepeletier) (Apidae) as prey. An attached note reads "In open grove, resting on exposed branch, in rather low ground" (Baker and Fischer, 1975). The tenth specimen was collected in Columbus, Ohio, flying around inside a class room in the Botany and Zoology Building on The Ohio State University campus. R.W. Strandtmann collected it on 5 Jul. 1942 (Bromley, 1947). The eleventh specimen was discovered in 1948 in a student collection, by Dr. J.N. Knull, curator of The Ohio State University Insect Collection. The specimen had no label (Bromley, 1950). The twelfth specimen was collected in Sharon, Ohio on 7 Jun. 1949 by a student (Bromley, 1950). The thirteenth specimen was collected by Frank M. Hull at Iowa State College. It was trapped on the window of a basement laboratory (Hull, 1962). One of the remaining two records is from Utah; one, from Kansas (Bromley, 1936).

ACKNOWLEDGEMENTS

The author is grateful to Drs. R.J. Gangé and L.V. Knutson for allowing him to see the specimens in the collection at the United States National Museum.

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THE HORSE FLIES AND DEER FLIES OF KENTUCKY: NEW STATE RECORDS AND A REVISED ANNOTATED CHECKLIST (DIPTERA: TABANIDAE)[1]

Alta M. Burnett, Charles V. Covell, Jr., L. L. Pechuman[2]

ABSTRACT: Collecting data are reported for 54 species of Tabanidae from Kentucky, including 13 new state records. The revised checklist is ordered according to Stone *et al.* (1965), *A Catalog of the Diptera of America North of Mexico.*

The tabanid fauna of Kentucky was first treated extensively by Townsend (1955), who listed 34 species with localities, dates, and names of collectors. His study was based on specimens at the University of Kentucky collected by S.J. Anderson, H. Garman, H. H. Jewett, B. F. Quisenberry, P.O. Ritcher, H. Tilson, and L. H. Townsend. Determinations were made by C. B. Philip and Alan Stone. Since publication of that work, *Chrysops aestuans* Van der Wulp and *C. striatus* Osten Sacken were found to be misidentified and so are removed from the list.

The present list includes 54 species, 13 of which are reported here for the first time. Of the remaining 41, 31 are from Townsend (1955), and 10 were recorded in Philip (1947), Philip *in* Stone *et al.* (1965), and other literature not cited here.

The records presented here are based on specimens in the University of Louisville collection, recent additions to the University of Kentucky collection, and information from the extensive files of the third author, who also made most of the determinations.

The arrangement of genera and species follows that of Philip *in* Stone *et al.* (1965). Thus species are listed alphabetically within each genus, not in any presumed phylogenetic order. Information cited by Townsend (1955) is not repeated here (with three exceptions). Months in which captures were made refer to our records; however, in three cases months of capture are indicated in parentheses because they were derived from Townsend's dates. In addition species for which we have no additional information are listed along with references to pages in Townsend's paper, on which the names appear, to make this a complete listing of all Tabanidae known from Kentucky at this time. Counties are indicated with specific localities when they first

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appear in the list.

SUBFAMILY PANGONINAE

Genus STONEMYIA Brennan

Stonemyia isabellina (Wiedemann). Philip *in* Stone *et al*., p. 321.

Genus GONIOPS Aldrich

Goniops chrysocoma (Osten Sacken). Butler Co.; Pine Mountain Settlement School, Harlan Co. (female collected by Covell on night of 8 July, 1977, when attracted to the buzzing sound she made while ovipositing); Robinson Forest, Breathitt Co. June - Aug.

SUBFAMILY CHRYSOPINAE

Genus CHRYSOPS Meigen

Chrysops callidus Osten Sacken. Anchorage, Lake Sympson, Louisville, and Sleepy Hollow, Jefferson Co.; Bernheim Forest, Bullitt Co.; Calvert City, Marshall Co.; Fleming Co.; Land Between the Lakes, Trigg Co.; Levi Jackson State Park, Laurel Co.; Lexington, Fayette Co.; Mannsville, Taylor Co.; Meade Co.; Oldham Co.; Robinson Forest; Sinai, Anderson Co. May - Aug, Oct.

Chrysops carbonarius Walker. Cumberland Falls State Park, Whitley Co. June.

Chrysops flavidus Wiedemann. Townsend, p. 70 (June).

Chrysops geminatus Wiedemann. Townsend, p. 70 (June, July).

Chrysops impunctus Krober. Natural Bridge State Park, Powell Co. June.

Chrysops macquarti Philip. Cumberland Falls State Park; Daniel Boone National Forest, Laurel and Pulaski Counties; Horner Bird and Wildlife Sanctuary (University of Louisville's research farm), Oldham Co.; Louisville; Robinson Forest; vicinity of Muldraugh, Meade Co.; Wolfe Co. June, July.

Chrysops moechus Osten Sacken. Daniel Boone National Forest, Pulaski Co.; Meade Co.; Robinson Forest. June, July.

Chrysops niger Macquart. Lexington; Louisville; Prospect, Jefferson Co. May.

Chrysops pikei Whitney. Caneyville (specimen reported by Townsend as *striatus* Osten Sacken); Glendale, Hardin Co.; Hancock Co. June.

Chrysops separatus Hine. Grayson Co. Apr.

Chrysops univittatus Macquart. Bardstown, Nelson Co.; Crailhope, Green Co.; Daniel Boone National Forest, Leslie Co.; Grant Co.; Horner Bird and Widlife Sanctuary; Lexington; Louisville; Natural Bridge State Park; Robinson Forest. June - Sept.

Chrysops upsilon Philip. NEW STATE RECORD. Ballard Wildlife Refuge, Ballard Co.; Land Between the Lakes; Oldham Co. July, Sept.

Chrysops vittatus Wiedemann. Ballard Wildlife Refuge; Crailhope; Daniel Boone National Forest, Leslie Co.; Jefferson Co.; Land Between the Lakes; Lexington; Oldham Co.; Wolf Creek Lake, Wayne Co. June, July.

SUBFAMILY TABANINAE

Genus LEUCOTABANUS Lutz

Leucotabanus annulatus (Say). Fulton Co.; Land Between the Lakes; Lexington; Taylor Co. June - Aug.

Genus TABANUS Linnaeus

Tabanus abdominalis Fabricius. Cumberland Gap, Bell Co.; Jefferson Co.; Louisville. May, July, Oct.

Tabanus americanus Forster. Lexington. Sept., Oct.

Tabanus atratus Fabricius. Daniel Boone National Forest, Leslie Co.; Fern Creek, Jefferson Co.; Finchville, Shelby Co.; Frankfort, Franklin Co.; Mason Co.; Oldham Co. May - Sept.

Tabanus calens Linnaeus. Bernheim Forest; Carlisle, Nicholas Co.; Dry Ridge, Graves Co.; Land Between the Lakes; Livia, Daviess Co.; Louisville; Mammoth Cave National Park, Edmonson Co.; Oldham Co.; Robinson Forest; Russell Co.; Shelby Co. July - Oct.

Tabanus cymatophorus Osten Sacken. Philip *in* Stone *et al*., p. 333.

Tabanus equalis Hine. Bernheim Forest; Springfield, Washington Co.; June - Aug.

Tabanus fairchildi Stone. Reported from Kentucky by Philip (1947).

Tabanus fulvulus Wiedemann. Kenlake State Park, Calloway Co.; Land Between the Lakes; Levi Jackson State Park; Robinson Forest. June, July.

Tabanus fuscicostatus Hine. Taylor Co. May.

Tabanus gladiator Stone. NEW STATE RECORD. Louisville. Aug., Sept.

Tabanus lineola Fabricius. Georgetown, Scott Co.; Gethsemane, Nelson Co.; Louisville; Robinson Forest. Apr., June, July.

Tabanus longus Osten Sacken. Townsend, p. 71 (Aug.).

Tabanus melanocerus Wiedemann. Gethsemane; Robinson Forest. July, Aug.

Tabanus molestus Say. Louisville; Robinson Forest. May, July, Aug. Philip *in* Stone *et al.* reported "var. *mixis* Philip" also from Kentucky.

Tabanus mularis Stone. NEW STATE RECORD. Land Between the Lakes. June, July.

Tabanus nigrescens Palisot de Beauvois. Golden Pond, Trigg Co. July.

Tabanus nigripes Wiedemann. NEW STATE RECORD. Robinson Forest. July.

Tabanus pallidescens Philip. NEW STATE RECORD. Bernheim Forest; Bullitt Co.; vicinity of Columbia, Adair Co.; Daniel Boone National Forest, Leslie Co.; Hindman, Knott Co.; Lyon Co.; Robinson Forest; Wayne Co. June - Aug.

Tabanus proximus Walker. NEW STATE RECORD. Cayce, Marshall Co. July.

Tabanus pumilus Macquart. NEW STATE RECORD. Jefferson Co.; Lexington. May, June.

Tabanus quinquevittatus Wiedemann. Glasgow, Barren Co.; Jefferson Co.; Land Between the Lakes; Mannsville. May - Aug.

Tabanus reinwardtii Wiedemann. Towsend (p. 72) cited a reared specimen from Lexington, emerged Aug. 4.

Tabanus sackeni Fairchild. Bullitt Co.; Land Between the Lakes; Mammoth Cave National Park; Oldham Co.; Robinson Forest; vic. Paducah, McCracken Co. July, Sept., Oct.

Tabanus sagax Osten Sacken. NEW STATE RECORD. Daniel Boone National Forest, Pulaski Co. June.

Tabanus similis Macquart. Bernheim Forest; Big Bone Lick, Boone Co.; Jefferson Co.; Lexington. May, June.

Tabanus sparus Whitney. Robinson Forest. June, July. These specimens represent "var. *milleri* Whitney."

Tabanus sublongus Stone. NEW STATE RECORD. Golden Pond. Aug.

Tabanus subsimilis Bellardi. Bernheim Forest; Jefferson Co.; Land Between the Lakes; Lexington; Robinson Forest. Apr. - Sept. Townsend (p. 72) listed this as *T. vittiger schwardtii* Philip, now a synonym of *subsimilis.*

Tabanus sulcifrons Macquart. This species, according to Townsend (p. 72) and our own records, is the most common horse fly in Kentucky. Bernheim Forest; Campbellsville, Taylor Co.; Crailhope; Gethsemane; Glasgow; Horner Bird and Wildlife Sanctuary; Jefferson Co.; Land Between the Lakes; Leon, Carter Co.; Livingston Co.; London, Laurel Co.; Lyon Co.; Maysville, Mason Co.; Meade Co.; Midway, Woodford Co.; Natural Bridge State Park; Owingsville, Henry Co.; Paintsville, Johnson Co.; Pine Mountain State Park, Bell Co.; Princeton, Caldwell Co.; Quicksand, Breathitt Co.; Richmond, Madison Co.; Shelbyville, Shelby Co.; Shepherdsville, Bullitt Co.; Sulphur, Henry Co.; Wayne Co.; Williamstown, Grant Co; Whitesville, Letcher Co. Apr., June - Sept.

Tabanus trimaculatus Palisot de Beauvois. Gethsemane; Horner Bird and Wildlife Sanctuary; Jefferson Co. May - July.

Tabanus turbidus Wiedemann. Mammoth Cave National Park. July.

Tabanus venustus Osten Sacken. NEW STATE RECORD. Glendale. July.

Tabanus wilsoni Pechuman. NEW STATE RECORD. Trigg Co. 1964 (no date).

Genus HYBOMITRA Enderlein

Hybomitra cincta (Fabricius). NEW STATE RECORD. Robinson Forest. July, Aug.

Hybomitra difficilis (Wiedemann). Bernheim Forest; Daniel Boone National Forest, Laurel and Pulaski Counties; Fleming Co.; Robinson Forest. May, June.

Hybomitra lasiophthalma (Macquart). Bernheim Forest. Apr., May.

Hybomitra sodalis (Williston). NEW STATE RECORD. Robinson Forest. July.

Genus HAMATABANUS Philip

Hamatabanus carolinensis (Macquart). Bernheim Forest; Jefferson Co. May - Aug.

ACKNOWLEDGEMENTS

We wish to thank the following for their assistance: Dr. Paul H. Freytag, Dept. of Entomology, University of Kentucky, for the loan of specimens; Alan Brownell, Carl Kaster and Susan Heady of the Biology Dept., University of Louisville, for operating Malaise traps in Bernheim Forest and processing specimens; and the Arts and Sciences Research Committee, University of Louisville, and the Isaac Bernheim Foundation, Louisville, Kentucky, for the financial aid that made much of the collecting possible.

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HYDROPTILIDAE FROM KANSAS (TRICHOPTERA)[1]

Steven W. Hamilton, Guenter A. Schuster[2]

ABSTRACT: Twenty-two species of hydroptilids are reported as new to Kansas. Two of these species were previously known only from the type locality and two others represent interesting range extensions. Distributions within Kansas are given and North American distributions are listed by state.

Records of Trichoptera from Kansas are few. None of the 22 hydroptilid species recorded here have ever been reported from Kansas, although the presence of many offer no surprise when overall North American distributions are considered. This is indicative of the lack of work on Kansas caddisflies.

The records given here are of adults taken from light trap samples. All were collected by the staff of the State Biological Survey of Kansas between 1974 and 1977 as part of its comprehensive aquatic invertebrate survey program.

Several species have been found only locally in the state. Seven of these; *Hydroptila armata* Ross, *H. grandiosa* Ross, *H. perdita* Morton, *Neotrichia falca* Ross, *N. vibrans* Ross, *Stactobiella delira* (Ross), and *S. palmata* (Ross) are found only in the southeastern corner of Kansas. This area of the state is part of the Ozarkian plateau.

Only species of special interest are annotated. All North American records available for each species are given so that the distributions in Kansas can be taken into proper perspective.

We feel enough data is now available to warrant a listing of species and localities. We expect further collection and study will increase our understanding of Kansas distribution and add a few more species to this list.

Hydroptila Dalman

H. ajax Ross

Collection Records from Kansas: Chautauqua Co., Caney R. at Cedarvale, 15 Jun 1977; Clark Co., St. Jacobs Well, 12 Jul 1976; Cowley Co., Grouse Cr., NE of Cameron City, 15 Jun 1977; Douglas Co., Wakarusa R., S. of Lawrence, 8 Jul 1976; Ellsworth Co., Kanopolis Reservoir, 8 Jun 1977; Geary Co., Geary Co. St. Lake, 10 May 1977; Humboldt Cr., 15 mi SE of Junction City, 11 May 1977; Russell Co., Wilson Reservoir, 29 July 1976.

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Distribution in North America: Illinois, Indiana, Kansas, Kentucky, New York, Oklahoma, Oregon, Washington and Wyoming.

H. angusta Ross

Kansas: Chase Co., Cottonwood R. at Cottonwood Falls, 31 Aug 1977; Chautauqua Co., Caney R. at Cedarvale, 15 Jun 1977; New Sedan City Lake, 29 Jul 1975 and 2 Aug 1977; Elk City Reservoir, 3 Aug 1977; Cherokee Co., Spring R., E of Baxter Springs, 2 Aug 1976; Coffey Co., Neosho R. at Burlington, 15 Jun 1976; Crawford Co., Lake Crawford, E of Farlington, 3 Aug 1976; Douglas Co., Wakarusa R. S of Lawrence, 8 Jun 1976; Kansas R. at Eudora bridge, 3 Aug 1976; Ellsworth Co., Kanopolis Reservoir, 15 July 1976, 17 and 19 Jun 1977; Horsethief Canyon at Kanopolis Reservoir, 15 Jun 1977; Geary Co., Geary Co. St. Lake, 10 May 1977; Jewell Co., Jewell Co. St. Lake, 5 Aug 1977; White Rock Cr. below Lovewell dam, 17 Aug 1977; Linn Co., Marais des Cygnes Wildlife Refuge at the Marais des Cygnes R. N of Hwy 69, 4 Aug 1976; Mitchell Co., Solomon R. at Beloit City Park, 21 Jun 1977 and 4 Aug 1977; Montgomery Co., Montgomery Co. St. Lake, 24 Jun 1976; Russell Co., 29 July 1976 and 25 July 1977; Woodson Co., Woodson Co. St. Lake, 6 Sept 1976; Yates Center City Lake, 16 Sept 1976.

North America: Illinois, Indiana, Kansas, Kentucky, Missouri, New Mexico, Ohio, Oklahoma and Texas.

H. armata Ross

Kansas: Cherokee Co., Shoal Cr. S of Galena at K-26 bridge, 28 Apr 1977 and 15 Jul 1977.

North America: Arkansas, Illinois, Indiana, Kansas, Kentucky, Michigan, Minnestoa, New Hampshire, Oklahoma, Quebec, Tennessee, Texas and Wisconsin.

H. consimilis Morton

Kansas: Atchison Co., Atchison Co. St. Lake, 24 May 1977; Ellsworth Co., Kanopolis Reservoir, 8 Jun and 3 Aug 1977; McPherson Co., McPherson Co. St. Lake, 9 Jun 1977; Ottawa Co., Ottawa Co. St. Lake, 9 Jul 1977; Russell Co., Wilson Reservoir, 29 Jul 1976; Scott Co., Lake Scott St. Park at spring, 16 Jul 1975, 31 May and 1 Jun 1977; Trego Co., Cedar Bluff Reservoir, 11 Jul 1977.

North America: Trancontinental.

H. grandiosa Ross

Kansas: Cherokee Co., Shoal Creek S of Galena at K-26 bridge, 31 Jul 1975; Crawford Co., W Branch Drywood Cr., NE of Farlington, 20 Jul 1977.

North America: Arkansas, Illinois, Indiana, Kansas, Minnesota, Missouri, Oklahoma, Texas and Wisconsin.

H. pecos Ross

This record represents a considerable range extension for this species. It was initially described from the Pecos River at Carlsbad, New Mexico (Ross, 1941), and later reported from the Boulder River in Colorado and the N. Platte and Bluegrass Rivers in Wyoming (Denning, 1947). The Kansas locality, Spring Creek, is a shaded, clear, cool stream about 1.5 m wide. This species has been collected in April (Ross, 1941), and August (Denning, 1947), and is here reported in July.

Kansas: Trego Co., Spring Cr., NE of the Nat'l. Fish Hatchery, Cedar Bluff Reservoir, 26 Jul 1976.

North America: Colorado, Kansas, New Mexico and Wyoming.

H. perdita Morton

Kansas: Cherokee Co., Spring R., E of Baxter Springs, 2 Aug 1976; Shoal Cr. S of Galena at K-26 bridge, 28 Apr and 15 Jul 1977.

North America: Arkansas, Illinois, Kansas, Kentucky, Michigan, Minnesota, New York, Ontario, Pennsylvania and Quebec.

H. rono Ross

Ross and Spencer (1952) reported this species as "widespread through western montane regions". It is here recorded from the same collection site as *H. pecos* Ross, which represent a considerable range extension. Collections of *H. rono* are known only from June and July.

Kansas: Trego Co., Spring Cr., NE of the Nat'l. Fish Hatchery, Cedar Bluff Reservoir, 26 Jul 1976.

North America: British Columbia, California, Kansas, Montana, Oregon, Utah and Wyoming.

H. scolops Ross

This species was previously known only from the holotype, which was collected along the Ohio River at Shawneetown, Illinois (Ross, 1938). The holotype was collected in May, as was our single male specimen.

Kansas: Atchison Co., Atchison Co. St. Lake, 24 May 1977.

North America: Illinois and Kansas.

H. waubesiana Betten

Kansas: Butler Co., Blue Stem Lake, 14 Jul 1976; Chase Co., Chase Co. St. Lake, 31 Aug 1977; Cherokee Co., Spring R., E. Baxter Springs, 2 Aug 1976; Coffey Co., Neosho R. at Burlington, 15 Jun 1976; Cowley Co., Cowley Co. St. Lake, 17 Jun 1975; Crawford Co., W. Branch Drywood Cr., NE of Farlington, 20 Jul 1977; Douglas Co., Wakarusa R.S. of Lawrence, 8 Jul 1976; Ellsworth Co., Horsethief Canyon at Kanopolis Reservoir, 15 Jun 1977; Beaver Ponds, NE St. Park at Kanopolis Reservoir, 8 Jun 1977; Jewell Co., Jewell Co. St. Lake, 5 August 1977; White Rock Creek below Lovewell dam, 17 Aug 1977; Linn Co., Marais des Cygnes Wildlife Refuge at Marais des Cygnes R. N of Hwy. 69, 4 Aug 1976; McPherson Co., McPherson Co. St. Lake, 9 Jun 1977; Ness Co., S. Fork Walnut Cr. at K-283 bridge, 28 Jul 1976; Ottawa Co., Ottawa Co. St. Lake, 9 Jul 1977; Riley Co., swamp below Tuttle Creek Reservoir dam, 11 May 1977; Russell Co., Wilson Reservoir, 25 and 29 Jul 1976; Trego Co., Spring Cr. NE Nat'l. Fish Hatchery, Cedar Bluff Reservoir, 26 Jul 1976; Woodson Co., Yates Center City Lake, 16 Sept 1976.

North America: Ubiquitous east of the Rocky Mountains.

Ithytrichia Eaton

I. clavata Morton

Kansas: Chase Co., Chase Co. St. Lake, 21 Aug 1977; Riley Co., swamp below Tuttle Creek Reservoir dam, 11 May 1977.

North America: Transcontinental.

Mayatrichia Mosely

M. ayama Mosely

Kansas: Chautauqua Co., Caney R. at Cedarvale, 15 Jun 1977; Cowley Co., Grouse Cr., NE of Cameron City, 15 Jun 1977; Douglas Co., Kansas R. at Eudora, 3 Aug 1976.

North America: Widely distributed east of the Rocky Mountains.

Neotrichia Morton

N. falca Ross

Previously this species was known only from Illinois and has not been reported in the literature since Ross (1944).

Kansas: Crawford Co., W. Branch Drywood Cr., NE of Farlington, 20 Jul 1977.

North America: Illinois and Kansas.

N. minutisimella (Chambers)

Kansas: Chase Co., Cottonwood R. at Cottonwood Falls, 31 Aug 1977; Douglas Co., Wakarusa R. S of Lawrence, 8 Jul 1976; Linn Co., Marais des Cygnes Wildlife Refuge at the Marais des Cygnes R. N of Hwy. 69 bridge, 4 Aug 1976.

North America: Arkansas, Florida, Illinois, Indiana, Kansas, Kentucky, Louisiana, Missouri and Oklahoma.

N. okopa Ross

Kansas: Chase Co., Chase Co. St. Lake, 31 Aug 1977; Chautauqua Co., Caney R. at Cedarvale, 15 Jun 1977.

North America: Arkansas, Florida, Illinois, Indiana, Kansas, Kentucky, Missouri, New York, Oklahoma, Ontario, Texas and Wisconsin.

Orthotrichia Eaton

O. aegerfasciella (Chambers)

Kansas: Atchison Co., Atchison Co. St. Lake, 24 May 1977; Chase Co., Chase Co. St. Lake, 31 Aug 1977; Crawford Co., Lake Crawford, E of Farlington, 3 Aug 1976; Jewell Co., White Rock Creek below Lovewell dam, 17 Aug 1977; Montgomery Co., Montgomery Co. St. Lake, 24 Jun 1976; Neosho Co., Neosho Co. St. Lake, 18 July 1977; Ness Co., S. Fork Walnut Cr., K-283 bridge, 28 Jul 1976; Ottawa Co., Ottawa Co. St. Lake, 19 Jul 1977; Pottawatomie Co., Pottawatomie Co. St. Lake #1, 10 Aug 1976; Republic Co., old wooded pond NW of Haworth, 6 Aug 1977; Woodson Co., Woodson Co. St. Lake, 7 Aug 1974 and 6 Sept 1976; Yates Center City Lake, 16 Sept. 1976.

North America: Widespread east of the Rocky Mountains.

O. cristata Morton

Kansas: Chautauqua Co., New Sedan City Lake, 29 Jul 1975; Douglas Co., Fish experiment ponds, Univ. of Kansas, 2 Jul 1975.

North America: Widespread east of the Rocky Mountains.

Oxyethira Eaton

O. dualis Morton

Kansas: Ellsworth Co., seepy spring, SW of S end of Kanopolis dam, 17 Jun 1977; Trego Co., Spring Cr., NE of the Nat'l. Fish Hatchery, Cedar Bluff Reservoir, 26 Jul

1976.

North America: Arkansas, California, Kansas, Missouri, New Mexico, New York, Texas and Virginia.

O. pallida (Banks)

Kansas: Atchison Co., Atchison Co. St. Lake, 23 Jun 1977; Little Delaware R., NW of Kennekuk, 23 Jun 1977; Chase Co., Chase Co. St. Lake, 3 Aug 1977; Chautauqua Co., New Sedan City Lake, 29 Jul 1975; Caney R. at Cedarvale, 15 Jun 1977; Cherokee Co., Spring R., E of Baxter Springs, 2 Aug 1976; Cowley Co., Cowley Co. St. Lake, 17 Jun 1975; Crawford Co., Lake Crawford, NE of Farlington, 3 Aug 1976; Douglas Co., Fish experiment ponds, Univ. of Kansas, 2 Jul 1975; Wakarusa R. S of Lawrence, 8 Jul 1976; Ellsworth Co., Kanopolis Reservoir outflow, 15 Jul 1976 and 3 Aug 1977; Beaver ponds, NE St. Park, Kanopolis Reservoir, 8 Jun 1977; Gove Co., Hackberry Cr. at Gove, 27 July 1976; Leavenworth Co., Leavenworth Co. St. Lake, 7 Aug 1975 and 27 Sept 1977; Lyon Co., Emporia St. Univ. Nat. Hist. Reserve, SW of Americus, 15 Sept 1977; Mitchell Co., Solomon R. at Beloit, 4 Aug 1977; Montgomery Co., Montgomery Co. St. Lake, 24 Jun 1976; Neosho Co., Neosho Co. St. Lake, 18 Jul 1977; Ottawa Co., Ottawa Co. St. Lake, 9 Jul 1977; Republic Co., old wood pond, NW of Haworth; 6 Aug 1977; Riley Co., swamp below Tuttle Creek Reservoir dam, 11 May 1977; Rooks Co., S. Fork Solomon R. S of Stockton, 22 Jul 1976; Scott Co., Lake Scott St. Park at spring, 16 Jul 1975; Trego Co., Spring Creek, NE of the Nat'l. Fish Hatchery, Cedar Bluff Reservoir, 26 Jul 1976; Woodson Co., Woodson Co. St. Lake, 19 Jun 1975 and 6 Sept 1976.

North America: Widespread east of the Rocky Mountains.

O. zeronia Ross

Kansas: Chautauqua Co., New Sedan City Lake, 29 Jul 1975.

North America: Illinois, Kansas, Maine, Michigan, Minnesota, New Hampshire and Tennessee.

Stactobiella Ross

S. delira (Ross)

Kansas: Cherokee Co., Shoal Cr. S of Galena at K-26 bridge, 23 Apr 1977.

North America: Arkansas, Colorado, Idaho, Kansas, Kentucky, Maine, New Hampshire, North Carolina, Oklahoma, Tennessee, West Virginia, Wisconsin and Wyoming.

S. palmata (Ross)

Kansas: Cherokee Co., Shoal Cr. S of Galena at K-26 bridge, 23 Apr 1977.

North America: Illinois, Kansas, Kentucky, Maine, New Hampshire, Oklahoma, Tennessee and Wisconsin.

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________. 1941. Descriptions and records of North American Trichoptera. Am. Ent. Soc. Trans., 67(1084): 35-126.

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PLECOPTERA RECORDS FROM WEST VIRGINIA[1]

Ralph F. Kirchner[2]

ABSTRACT: *Allocapnia ohioensis* Ross and Ricker and *Isoperla gibbsae* Harper are reported for the first time from West Virginia.

Ross and Ricker (1971) published records of *Allocapnia ohioensis* Ross and Ricker from Indiana, Kentucky, Ohio and New York; their distribution map for the species did not include West Virginia. I obtained adult specimens of *A. ohioensis* from Lusher Hollow of Mud River, Cabell County, West Virginia (38° 24'; 82° 16') during February and March, 1977.

Harper (1971), in his description of *Isoperla gibbsae*, reported specimens from Quebec and New York. Hitchcock (1974) recorded specimens from Connecticut. I took adults and nymphs of *I. gibbsae* from Twelvepole Creek, near Shoals, Wayne County, West Virginia (38° 19'; 82° 27') in April, 1976.

ACKNOWLEDGEMENTS

Dr. H.H. Ross, Department of Entomology, The University of Georgia, identified the specimens of *Allocapnia*; Dr. P.P. Harper, Département de Sciences biologiques, Université de Montréal, determined the species of *Isoperla*; I thank both of them.

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Ross, H.H. and W.E. Ricker, 1971. The classification, evolution and dispersal of the winter stonefly genus *Allocapnia. Ill. Biol. Monogr. 45: 1-166.*

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A RECENT RECORD OF *CURICTA PRONOTATA* KUITERT, (HEMPTERA:NEPIDAE) FROM ITS TYPE LOCALITY[1]

Mark B. DuBois [2]

ABSTRACT: *Curicta pronotata* Kuitert has been recently re-collected at its type locality. This is the first known collection of *C. pronotata* in the United States since 1899.

Kuitert (1949) described *Curicta pronotata* from three specimens collected in the Huachuca Mountains, Arizona (1899). This species has since been collected from several localities in northern Sonora, Mexico (Polhemus, 1976), but has not been found again in the United States.

Recently (March 19, 1977) my wife and I collected some aquatic insects in the Huachuca Mountains. Among the species collected was one specimen of *Curicta pronotata* (compared with type and paratypes). This specimen was collected at approximately 5600 feet in Garden Canyon, Huachuca Mts., Arizona from a semi-permanent stream (Garden Canyon Creek). This stream dries to a series of small pools in late summer.

This stream was approximately 18 inches wide and 10 inches deep at this elevation. A small marshy area surrounded the stream at this point. *Equisetum* sp. was one of the dominant plants.

The adult, a male *Curicta pronotata*, was found clinging to the side of a partly submerged log. Several other insects including gyrinids, immature chironomids, and immature Trichoptera were also collected in this stream. All specimens collected are currently in my personal collection.

It is hoped this paper will stimulate collecting of *Curicta* in the surrounding mountain ranges.

ACKNOWLEDGEMENTS

I thank Drs. G. Schuster and G. Byers for their reading of this paper.

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[2] State Biological Survey of Kansas, The University of Kansas, 2045 Avenue A, Campus West, Lawrence, Kansas 66044

A NEW LOCALITY FOR *SIPHLONISCA AERODROMIA* (EPHEMEROPTERA: SIPHLONURIDAE)[1]

S.B. Fiance[2]

An unidentified adult male of *Siphlonisca aerodromia* Needham was discovered in the Cornell University collection. The vial bears a label reading "Lake Melville, LABRADOR. July 10, 1952, W.Z. Lidicker. Collected on boat 1 mi. off Northwest River, wind south." Previously, *S. aerodromia* was known only from a very few specimens from the type locality on the Sacandaga River in New York. The species has not been recorded since the 1930's. *S. aerodromia* is very unusual in that adults possess very large lateral flanges on abdominal segements 5 - 9. A more complete description of the species can be found in Edmunds et al. (1976). This male specimen therefore represents a new locality and also the first known specimen of this rarely collected species taken in 20 years. The specimen and slide of genitalia are deposited in the Cornell University Entomology collection.

ACKNOWLEDGEMENT

I thank Dr. George F. Edmunds, Jr., Dep't. of Biology, Univ. of Utah, for confirming the identity of the specimen.

LITERATURE CITED

Edmunds, G.F., Jr., S.L. Jensen, and L. Berner. 1976. The mayflies of North and Central America. Univ. Minnesota Press, Minneapolis. 330 p.

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[1] Accepted for publication: April 4, 1978

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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. Authors can be very helpful by indicating, in pencil in the margin of the manuscript, approximate desired locations within the text of accompanying figures, tables and other illustrations.

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

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A NEW SPECIES OF *BAETISCA* FROM WEST VIRGINIA (EPHEMEROPTERA: BAETISCIDAE)[1]

Donald C. Tarter[2], Ralph F. Kirchner[3]

ABSTRACT: A new species of *Baetisca* is described from West Virginia. The type locality is Laurel Fork of Pigeon Creek, Mingo County, West Virginia. Other records include Logan and Nicholas Counties, West Virginia and Smyth and Washington Counties, Virginia.

Presently, there are eleven species in the mayfly genus *Baetisca* known from the United States, with a twelfth species found in eastern Canada (Edmunds et. al., 1976). Seven species of *Baetisca* are reported as occurring in the southeast. The authors are now presenting the description of another new southeastern species.

Prior to this investigation, the following species of *Baetisca* were recorded for West Virginia: *B. bajkovi* Neave, *B. callosa* Traver and *B. carolina* Traver (Needham et. al., 1935 and Faulkner and Tarter, 1977). Other investigators, including Berner (1940, 1955), Edmunds (1960), Lehmkuhl (1972), McDunnough (1932), Pescador and Peters (1974) and Schneider and Berner (1963), have reported information on the genus *Baetisca*.

Due to the lack of adult specimens, the authors are using the nymphs for their descriptions. The nymphal characteristics of *Baetisca* are so diverse that they are more suitable for differentiation of species.

Baetisca berneri, new species

Baetisca berneri is closely related to *B. carolina*, a species described by (Traver, 1931) in Guilford County, North Carolina. The nymphs are significantly different and can be easily separated.

There are very distinct dark bands near the base of the caudal filaments of *B. berneri*, (Figure 1), while absent in *B. carolina*. *Baetisca berneri* is also characterized by intense pigmentation and broad banding on the legs (Figure 1) which is lacking in *B. carolina*. *Baetisca berneri* has a much darker and more solid brownish to black coloration on the ventral surface of the head, thorax, and abdomen than *B. carolina*. The ventral surface of *B. carolina* has more of an irregular or mottled appearance. *Baetisca carolina* is more densely spotted on the head and mesonotal shield, with the spots being larger than on *B. berneri*. The spots on the abdominal tergites of *B. carolina* are also larger and darker than those on *B. berneri*. In *B. berneri* the small antero-lateral extensions of the mesonotum are distinctly sharper and more pointed or spine-like than in *B. carolina*.

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HOLOTYPE: Nymph (male). Body length excluding genal spines 9.2 mm; head width including eyes 2.7 mm; caudal filaments 2.3 mm.

HEAD: Yellowish-brown with dark reddish-brown granulations; genal spines well developed and upturned, distal 0.15 mm a dark brown; distance between distal points of the genal spines 1.91 mm; genae fringed with small fine hairs; frontal projections moderately developed. Eyes black; ocelli inconspicuous. Antennae mostly a brownish unicolor with only a slight darkening of distal segment.

THORAX: The mesonotal shield with well developed lateral spines; dorsal spines absent. Width of mesonotal shield from tip to tip of lateral spines 5.75 mm; length from anterior to posterior margin 5.65 mm. Mesonotal shield with dark reddish-brown spots arranged in rows and whorls; thoracic sterna an almost solid dark brown coloration.

LEGS: Legs with very distinct and intensely pigmented banded markings. A very broad blackish band nearly covers length of the femur; smaller bands on medial portion of tibia and tarsus. Protarsus 1.9 times length of tibia; mesotarsus 1.6 times length of tibia; metatarsus 1.7 times length of tibia. Numerous fine hairs along length of femur; hairs sparse on tibia and tarsus.

ABDOMEN: Postero-lateral margins of abdominal segments 6-9 weakly serrate. Abdominal segments 7-9 with brownish median spot on tergite. Sterna almost solid brownish-black coloration except segments 8 and 9 scattered and mottled.

CAUDAL FILAMENTS: Filaments marked with very distinct blackish banding at base; cerci and terminal filament equal in length, 2.3 mm, and fringed with long hairs; annulate markings appear their entire length.

ALLOTYPE: Nymph (female). Same description as the holotype male except for the following descriptive measurements. Body length excluding genal spines 11.1 mm; head width including eyes 3.0 mm; caudal filaments 2.6 mm.

HEAD: Distance between distal points of the genal spines 2.15 mm; distal 0.17 mm a dark brown. The eyes of the female much smaller and more triangular in shape than the male.

THORAX: Width of the mesonotal shield from tip to tip of lateral spines 7.35 mm; length 6.75 mm.

LEGS: Protarsus and mesotarsus 1.80 times the length of tibia; metatarsus 1.75 times the length of tibia.

HOLOTYPE: Male nymph, preserved in alcohol. West Virginia, Mingo County, Laurel Fork, 13 April 1974. In laboratory of Aquatic Entomology, Florida A & M University, Tallahassee, Florida.

ALLOTYPE: Female nymph, preserved in alcohol. Same station and collection data as male holotype. In laboratory of Aquatic Entomology, Florida A & M University, Tallahassee, Florida.

PARATYPES: Size range measurements differed somewhat between the male and female nymphs (Table 1). Nine male and eleven female nymphs preserved in alcohol. Same station and collection data as holotype and allotype. Male and female paratypes were deposited in the collections of the University of Florida, Cornell University, and Illinois Museum of Natural History. The remaining specimens are stored in the West

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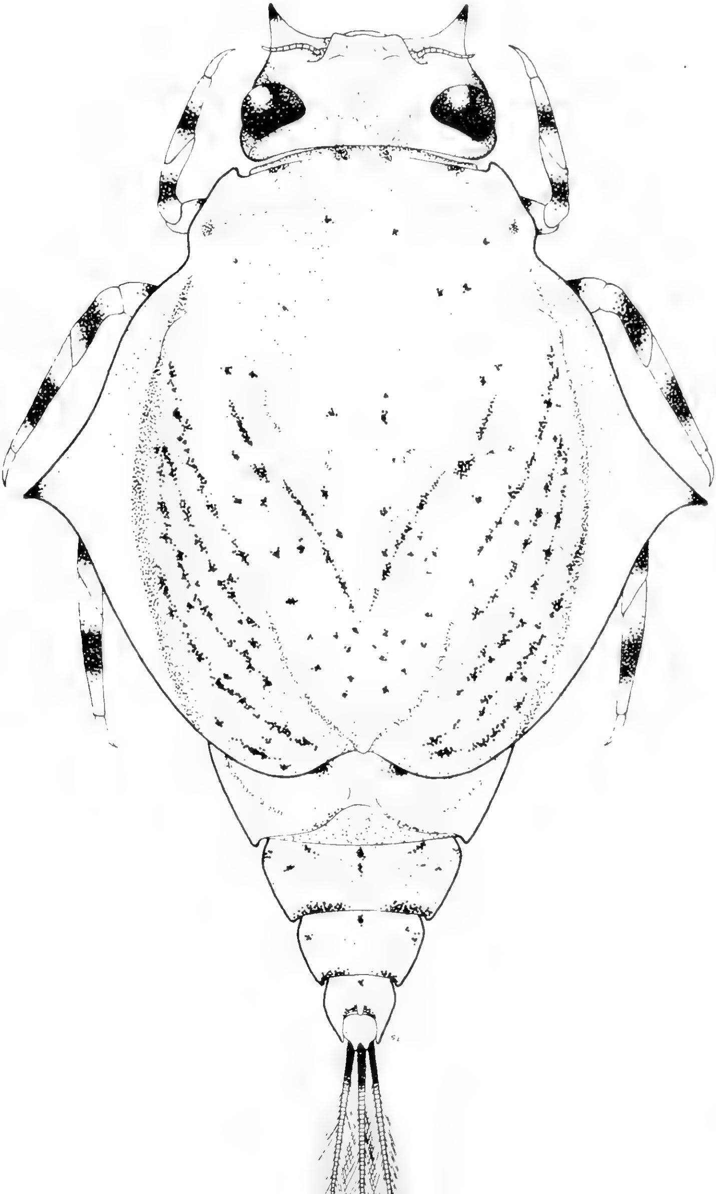
Figure 1. Dorsal view of a mature female nymph of *Baetisca berneri*, new species.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Virginia Benthological Survey at Marshall University.

LOCALITY RECORDS: Mingo County, West Virginia, Laurel Fork of Pigeon Creek, 13 April 1974. Holotype, allotype, and paratypes (Donald C. Tarter, Ralph Kirchner, Gerald Faulkner, and Tom Mayberry). Smyth County, Virginia, Big Laurel Creek, 20 February 1975 (Ralph Kirchner). Nicholas County, West Virginia, Panther Creek, 25 July 1975 (Dwight Chaffee and Jack Humphrey). Logan County, West Virginia, Copperas Mine Fork of Island Creek, 10 February 1976 (Ralph Kirchner and Tom Mayberry). Washington County, Virginia, Straight Creek of Big Laurel Creek, 19 March 1976 (Ralph Kirchner).

TYPE LOCALITY: Laurel Fork of Pigeon Creek, near Lenore, Mingo County, West Virginia. Collection site 3.2 km (2 mi) upstream from the head of Laurel Lake, elevation 273.6 m (903 ft). Stream width approximately 4.6 m (15 ft) with the water depth ranging from shallow riffles to 74 cm (2 ft). The substrate consists of rock with gravel and sand occurring in places. This is a mountain type stream draining steep densely forested slopes.

HABITAT PREFERENCE: The nymphs seemed to prefer slow to medium water speeds, with depths ranging from 15 to 46 cm, and a substrate mixture of sand, gravel, and small stones. They were found clinging to gravel and small stones, and were also observed resting in the sand with the outer edge of their carapace covered (Morris, 1976).

This new *Baetisca* species is named in honor of Dr. Lewis Berner, University of Florida, in recognition of his contributions to the genus *Baetisca* and the order Ephemeroptera.

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We express our appreciation to Dr. Manuel L. Pescador, Florida Agricultural and Mechanical University; and Mr. Dwight L. Chaffee, a graduate student in the Depart-

Table 1. Size Range Measurements (millimeters) of Male and Female Paratypes of *Baetisca berneri*

Measurements	Male	Female
Body length	5.35 – 9.10	6.95 – 11.00
Head width	1.68 – 2.69	1.95 – 2.99
Mesonotal length	3.15 – 5.60	4.16 – 6.94
Mesonotal width	3.43 – 5.75	4.69 – 7.45
Caudal filaments	1.48 – 2.31	1.91 – 2.62
Distance between the genal spine tips	1.47 – 1.85	1.49 – 2.29

Table 1. Size Range Measurements (millimeters) of male (9) and female (11) paratypes of *Baetisca berneri.*

ment of Biological Sciences at Marshall University for their help in the preparation of this manuscript. Also, we thank Steve Lawton for illustrating the nymph and Vickie Crager for typing the manuscript.

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A TAXONOMIC AND DISTRIBUTIONAL STUDY OF ADULT LIMNEPHILID CADDISFLIES OF WEST VIRGINIA (TRICHOPTERA:LIMNEPHILIDAE)[1]

Paul L. Hill, Donald C. Tarter[2]

ABSTRACT: This paper represents the first systematic study of the limnephilid Trichoptera fauna of West Virginia. State and county records are reported for 24 species of the family Limnephilidae. Twenty state records were noted during the study period. *Pycnopsyche scabripennis* (Rambur) was by far the most abundant and widely distributed species and *Nemotaulius hostilis* (Hagen) and *Leptophylax gracilis* Banks were the least abundant species. Since the family Limnephilidae is a northern cold-hardy group, West Virginia became the southern limit of distribution for eight of the twenty-four species.

Until the present, only four limnephilid caddisflies have been reported from West Virginia: *Pycnopsyche divergens* (Walker), *P. lepida* (Hagen), *P. scabripennis* (Rambur) and *P. subfasciata* (Say) (Ross, 1944; Betten, 1950; and Hill et al., 1977). Limnephilid species are primarily northern in distribution. The habitats of the larval stage include lakes, ponds, marshes, streams, seeps and rivers. Twenty-four species were identified from light trap specimens throughout West Virginia. Twenty species are previously unpublished records for the state. West Virginia is the southern limit for eight species (Hill, 1977).

FAMILY LIMNEPHILIDAE

*State records

*1. *Ironoquia punctatissmus* (Walker)

Grant Co. (WVDA); Monroe Co., Hollywood (WVDA); Putnam Co., Hurricane (WVDA); Raleigh Co., Beckley (WVDA); Randolph Co., Valley Bend (WVDA); Tucker Co., Blackwater Falls State Park (USNM); Webster Co., Cranberry River (MU).

*2. *I. kaskaskia* (Ross)

Randolph Co., Valley Bend (WVDA).

*3. *Platycentropus radiatus* (Say)

Hardy Co., Trout Pond (WDW); Monroe Co., Hollywood (WVDA); Pendleton Co., Spruce Knob Lake (MU); Pocahontas Co., Tea Creek (MU); Raleigh Co., Grandview State Park (MU); Tucker Co., Red Creek (MU).

*4. *Nemotaulius hostilis* (Hagen)

Pocahontas Co., Arbovale (WVDA).

*5. *Hydatophylax argus* (Harris)

Monroe Co., Hollywood (WVDA); Nicholas Co., Summersville (WVDA); Pocahontas Co., (WVDA).

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*6. *Leptophylax gracilis* Banks
Monroe Co., Hollywood (WVDA).

*7. *Limnephilus moestus* Banks
Pocahontas Co., Cranberry Glades (MU); Randolph Co., Gandy Creek (MU); Tucker Co., Blackwater Falls State Park (USNM).

*8. *L. indivisus* Walker
Jefferson Co., Kearneyville (WVDA); Monroe Co., Hollywood (WVDA); Randolph Co., Valley Bend (WVDA).

*9. *L. submonilifer* Walker
Putnam Co., Hurricane (WVDA); Randolph Co., Valley Bend (WVDA).

*10. *Pycnopsyche circularis* (Provancher)
Monroe Co., Hollywood (WVDA); Putnam Co., Hurricane (WVDA).

11. *P. divergens* (Walker)
Pocahontas Co., Cranberry Glades (Hill et al., 1977).

*12. *P. luculenta* (Betten)
Greenbrier Co., Summit Lake (MU); Monroe Co., Hollywood (WVDA); Randolph Co., Red Creek (MU); Webster Co., Cranberry River (MU).

13. *P. scabripennis* (Rambur)
Braxton Co., Two-Lick Run (MU); Kanawha Co., O'Possum Creek (WVDA); Mercer Co., Flattop Lake (MU); Monroe Co., Hollywood (WVDA); Nicholas Co., Cherry River (MU); Pendleton Co., White's Run (MU); Pocahontas Co., Cranberry River (MU); Putnam Co., Hurricane (WVDA); Raleigh Co. (WVDA); Randolph Co., Red Creek (MU), Valley Bend (WVDA); Webster Co., Cranberry River (MU) and Ross (1944) no county designated.

14. *P. subfasciata* (Say)
Jefferson Co., Kearneyville (WVDA); Monroe Co., Hollywood (WVDA); Randolph Co., Valley Bend (WVDA) and Betten (1950) no county designated.

*15. *P. indiana* (Ross)
Pendleton Co., Smoke Hole Camp (USNM).

16. *P. lepida* (Hagen)
Monroe Co., Hollywood (WVDA); Putnam Co., Hurricane (WVDA); Pocahontas Co., Greenbank (WVDA); Randolph Co., Valley Bend (WVDA); Webster Co., Cranberry River (MU) and Ross (1944) no county designated.

*17. *P. gentilis* (McLachlan)
Hampshire Co., South Branch of Potomac River (WDW); Nicholas Co., Summersville Reservoir (WDW); Randolph Co., Red Creek (MU).

*18. *P. guttifer* (Walker)
Greenbrier Co., Summit Lake (MU); Pendleton Co., Smoke Hole Camp (USNM); Pocahontas Co., Tea Creek (MU); Tucker Co., Red Creek (MU); Webster Co., Cranberry River (MU).

*19. *Pseudostenophylax uniformis* (Betten)
Pendleton Co. (USNM); Summers Co., Bluestone State Park (USNM); Tucker Co., Blackwater Falls State Park (USNM).

*20. *P. sparsus* (Banks)
Grant Co. (WVDA); Hardy Co., Lost River State Park (WDW); Tucker Co., Blackwater Falls State Park (USNM).

*21. *Neophylax autumnus* Vorhies
Pendleton Co., Spruce Knob Lake (MU); Putnam Co., Hurricane (WVDA); Raleigh Co., Beckley (WVDA); Randolph Co., Red Creek (MU), Valley Bend (WVDA).

*22. *N. consimilis* Betten
Braxton Co., Two-Lick Run (MU); Monroe Co., Hollywood (WVDA); Randolph Co., Valley Bend (WVDA).

*23. *N. stolus* Ross
Pendleton Co., Smoke Hole Camp (USNM).
*24. *Goera calcarata* Banks
Pendleton Co., Smoke Hole Camp (USNM).

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BOOK REVIEW

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HPB

BIOLOGICAL OBSERVATIONS ON *ZOROTYPUS HUBBARDI* CAUDELL (ZORAPTERA)[1]

David J. Shetlar[2]

ABSTRACT: The nymphal period for *Zorotypus hubbardi* Caudell (Insecta: Zoraptera) was found to be 30 to 50 days; the adult lifespan was 30 to 40 days. Observations on food, reproduction, social interaction and caste determinations are made. A culture method is described.

Zorapterans are small termite-like insects which were first recognized as an order in 1913. The approximate twenty species found in the world are in a monotypic genus and have two distinct castes. The common caste is apterous, cream-colored and eyeless. The other caste is darkly pigmented, has compound eyes and ocelli, and is alate and capable of shedding the wings.

The Nearctic *Zorotypus hubbardi* Caudell is usually found in old termite galleries (though not true inquilines), lumber mill sawdust piles and under dead tree bark. Few observations on the biology of *Z. hubbardi* have been made. Most papers deal with records which have extended the known range (Gurney 1959; Riegel 1963, Shetlar 1967).

Z. hubbardi's known range seems to include the territory south of a line running from southern Pennsylvania across to lower Iowa and south through mid-Texas. Riegel (1963) suggested that dispersal northward was made by mated alate females borne on the wind. The limiting factor of northern extension seems to be severe winters. He also stated that most northern colonies exist in fermenting sawdust piles which maintain warm internal temperatures through decomposition over winter. Thus, after a few years a colony would be doomed to failure unless a new site was found. Mingot and Sillings (1969) suggested that *Z. hubbardi* could naturally withstand colder climates. Zorapterans have often been found with termites, enicocephalid bugs as well as collembolans and mites (Gurney 1938).

No investigator has been able to rear and observe zorapterans over a long period of time. During this study a culture method was developed using modified techniques derived from the attempts of Gurney (1938). With this successful rearing technique, studies were undertaken to determine the essentials of the zorapteran life cycle and caste system.

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MATERIALS AND METHODS

On January 24, 1967, a colony of *Z. hubbardi* was discovered in a rotten log in Oliver's Woods Wildlife Preserve, The University of Oklahoma, Norman, Oklahoma. About 100 specimens were preserved and an additional 20 to 25 specimens were collected alive. Another large colony was discovered in an old log in the Preserve on March 11. About 100 individuals were placed in culture. On August 28, three colonies were discovered in Northeast Oklahoma City, two in old termite galleries and one under loose bark. Individuals were again taken alive and cultured. Finally, a colony was discovered in Huntsville State Park, Texas on November 26, 1967 from which live specimens were taken for culture.

Gurney (1938) was able to keep individuals in a culture for approximately five and a half months. His rearing chambers consisted of two glass jars about four inches high by two inches in diameter, lined with thin strips of decaying wood, and loosely filled with decaying sawdust. Reigel (1963) observed that *Z. hubbardi* apparently ate molds and dry yeast.

An initial culture was started by placing wood chips from the log of a wild colony in a 4-inch finger bowl and sprinkling dried yeast over the top. This culture soon had eggs and new nymphs. Other stock cultures were then established in a similar manner. The finger bowls were covered with glass plates to reduce moisture loss. Water was sprinkled, by hand, over the wood in the bowls every three to four days or earlier if the culture appeared to be drying. Individuals or small groups of individuals were maintained on wood chips in 76 x 15mm glass petri dishes. All the cultures were sprinkled every five to six days with active dry yeast. The cultures were not maintained under constant day/night cycles, or under constant temperature.

Test chambers for the studies of social behavior and the life cycle were made of petri dishes supplied with filter paper and yeast. Another chamber was constructed by pouring plaster of Paris into a three-inch finger bowl to a depth of 20mm. Holes, 15 mm in diameter, were drilled in the plaster and each hole was covered with 22mm x 22mm cover glass. The plaster was kept moist and the holes were supplied with yeast.

To study the behavior and molting times, the zorapterans were marked with India ink, magic marker^{R}, enamel, and vital dyes such as fast green, methylene blue and neutral red.

The length of the nymphal period was calculated by setting up a chamber with 10 adults which were counted every other day. By using rather smooth pieces of wood in the chamber, eggs could be counted and date of detection noted. By keeping the adult population at 10 and replacing lost individuals from another culture, dates that the population exceeded 10 were noted and the extra adults were removed. Using the date of laid eggs, hatching and appearance of extra adults, a crude measure of the nymphal period was made.

Observations of living material were made with the aid of a 16x magnifying glass and a B&L dissecting microscope fitted with 15x oculars and 6.5x, 0.7x, 1x, and 3x objectives. Observations were best made after a period of total darkness followed by low illumination from a 50 watt incandescent bulb approximately ten feet away from the cultures.

RESULTS AND DISCUSSION

A. Life Cycle

Great difficulties were encountered in finding out the number of instars. Isolation of individuals into separate chambers, with wood or in plaster cells, always resulted in the death of the individual in a few days. Also, the exuvia seem to be eaten or are extremely fragile because no exuvia were found.

Marking by using enamel resulted in death or the enamel would not adhere to the cuticle. Marking with India ink or Magic Marker^R met with similar results. With vital dyes the zorapterans would either eat the dye or the dye was absorbed into the tissues below the cuticle.

The length of the nymphal period was calculated to be from 30 to 50 days. It was found that the average number of days taken from hatching egg to adult was 44 days with a range of 27 to 51 days.

Adult lifespan was found to be about 30 to 40 days. One adult was found to have lived 68 days and Gurney (1938) cites that he kept adults for 75 days. However, it is unclear whether Gurney was observing the same adults.

B. Food

Zorapterans have been noted to feed on various fungal hyphae and spores, as well as animal materials (Gurney, 1938; Riegel, 1963). In this study, only freshly collected specimens were seen to have contained any fungal hyphae even though the culture chambers often had molds and fungal masses present. The principal plant food taken by the captive zorapterans was yeast. This was determined by dying the yeast with neutral red and observing the yeast particles in the gut. It may be that the molds and fungi present were unsuitable.

One of the culture chambers contained a population of entomobryid collembolans which, from time to time, were quite abundant. Adult zorapterans taken from this culture and dissected often had fragments of legs and cuticle in the gut. Twice, a last instar nymph and an adult *Z. hubbardi* was seen to attack a living mite, roll it over, or pick it up by its mandibles. These attempts did not cause the death of the mite, which merely withdrew its head and legs. The mite was soon dropped and left. Similar attacks on mites were observed by Gurney (1938). Encounters with the collembolans were quite different. When the zorapteran touched the collembolan with its antennae, the collembolan would jump or run rapidly away. The zorapteran would then undergo random searching movements, stop and wave its antennae, or rapidly run in the opposite direction. No zorapteran was actually seen to capture a live collembolan.

Freshly killed collembolans, mites, termites, and a small piece of beef were placed in a culture containing zorapterans of different ages. Within one to two days the arthropod remains disappeared except for pieces of cuticle, especially head capsules and leg fragments. The beef was untouched and soon developed mold. Observations by Gurney (1938) and Riegel (1963) that zorapterans eat the remains of their own species was confirmed in this study. Freshly killed specimens were placed in a culture and they usually disappeared in a day.

Zorapterans were often observed carrying insect remains, but upon occasion were seen carrying pieces of wood or sand grains. They never seemed to do anything with these objects, but usually dropped them within a short time.

Dissection of fresh specimens in saline never revealed protozoans, but bacteria were abundant. Examination of fecal material revealed no sporozoans.

C. Reproduction

Gurney (1938) was fortunate enough to see an apterous adult climb upon the dorsal surface of another facing in the same direction. After the genitalia were united, the dorsal individual climbed forward dragging its mate behind.

Couples in copula were seen only four times. Twice, mere movements of the culture caused the joined pair to separate and in another observation, the

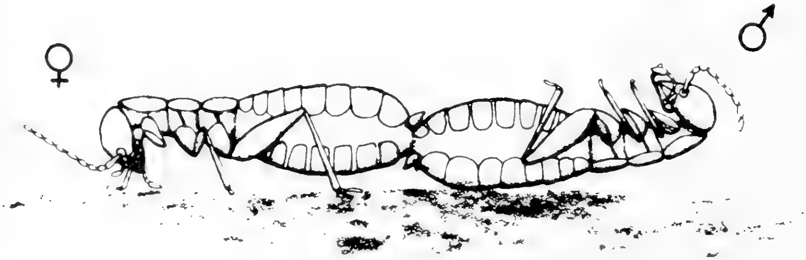

Figure 1. Copulation of *Zorotypus hubbardi* Caudell.

pair remained together for about two minutes. From the last copulation one of the individuals was captured immediately after separation. The female was found to be the forward upright specimen and the male was the posterior upside down specimen (Fig. 1).

This may explain the function of the median dorsal hook located along the posterior margin of the eighth abdominal tergite of the male as described by Crampton (1920). The hook should be looked at histologically to see if a gland might be present which releases a pheromone. Under high power magnification, no pore could be found nor could a gland be seen without staining.

Fecundity was estimated by setting up a chamber with five females and five males. Twenty-seven eggs were collected in forty-eight days, at which time the last female died. This means that an apterous female may produce five to seven eggs in her lifetime and it may take her about ten days to produce an egg. It would be most interesting to check the fecundity of alate females to see if they have a higher rate, since these are thought to establish new colonies (Riegel, 1963).

D. Social Organization

This study confirms the speculation by previous workers (Gurney, 1938, Delamare-Deboutteville, 1948) that *Zorotypus* is gregarious rather than actually social. The most common encounter of zorapterans seems to be antenna lashing and immediate avoidance. In a test of colony recognition, individuals from cultures collected from different wild populations were transferred to various chambers. No difference in behavior of either introduced or local individuals was noted.

Even though actual social behavior was not observed, aggregation seems to have an effect on individual survival as isolated individuals soon die. An observation made several times while collecting specimens was the presence of a characteristic odor. This odor was noted each time specimens were sucked into an aspirator. The odor was slightly sweet and aromatic, reminiscent of odors produced by some of the aquatic Coleoptera. This odor may be an alarm odor, defensive, or aggregation odor.

E. Determination of the Alate Caste

The mechanism of determination of alate individuals was not found in this study, but the following observations are included.

Since winged males have been found, determination of winged individuals by sex linkage does not seem plausible. However, with the majority of alates being female, the determination may be sex-influenced or sex-related.

Individuals collected by Riegel (1963) had slightly pigmented eyes, but were adult wingless females. A series of individuals with even more striking alate-apterous qualities were found in this study. Four adult females had caudo-lateral extensions of varying length arising from the meso- and metathoracic nota (Fig. 2). These same females had pigments corresponding to the position of the eyes, but no cuticular structures such as cornea were seen.

Crowding does not seem to have an effect on production of winged individuals. Laboratory colonies ranged from ten to fifty individuals but no differences in numbers of alates were found.

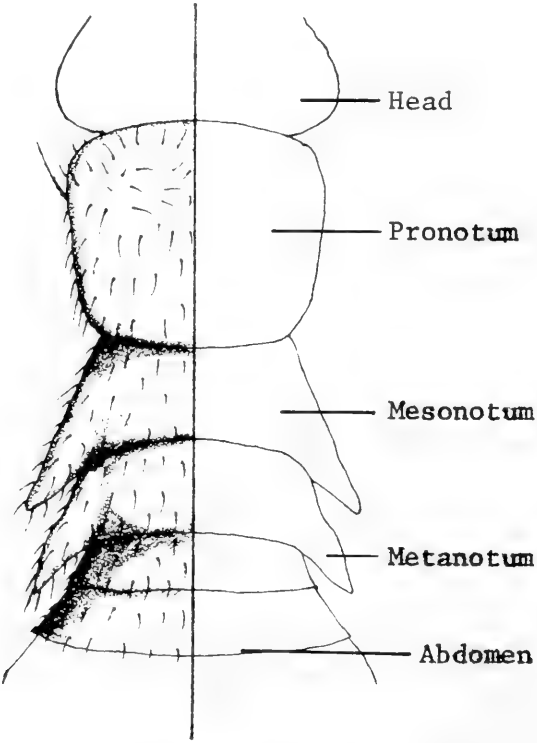

Figure 2. Dorsal aspect of apterous *Zorotypus hubbardi* Caudell showing mesonotal and metanotal lateral projections.

SUMMARY

An easy method for culturing zorapterans using wood chips and dried yeast was developed and used to study the biology of *Z. hubbardi*.

The zorapterans were active scavengers eating disabled or dead arthropods, yeasts and molds. The nymphal period was about 40 days and the adults lived 30 to 40 days. Copulation occurred with the female upright and the male dragged on its dorsum behind the female. Females may lay 5 to 7 eggs.

No social organization was observed though isolated individuals usually died within a short period of time. Encounters among individuals generally resulted in avoidance behavior or a short period of antennal palpating.

Alate determination was still not elucidated but intermediate individuals with eye pigments and lateral thoracic projections were observed.

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NOMENCLATURAL HISTORY AND REDISCOVERY OF *PENTACOMIA (BECKERIUM) LEPTALIS* (BATES) (COLEOPTERA: CICINDELIDAE)[1, 2]

Robert R. Murray[3]

ABSTRACT: Three specimens of *Pentacomia (Beckerium) leptalis* (Bates) were collected 2 mi NE Candelaria Loxicha, Oaxaca, Mexico. Other than references to the type series this is the first published collection record for this species since its description in 1881. The specimens are compared to the type series and notes on their habitat and behavior are given.

This species was first described as *Odontochila leptalis* Bates (1881) from specimens collected at Cerro de Plumas by Hoge and at Juquila, Oaxaca, Mexico by Boucard. In 1897 Horn removed the species from *Odontochila* and placed it in his monotypic genus *Beckerium*. In 1910 *Beckerium* was placed in species group IV of the genus *Prothyma* Hope by Horn who also listed it in *Prothyma* in the Coleopterum Catalogus (1926). Rivalier (1969) restricted the genus *Prothyma* to the tropical eastern hemisphere and used the generic name *Pentacomia* Bates to include the small *Odontochila*-like species which inhabit Central and South America. Rivalier also grouped the 26 species of *Pentacomia* into 5 subgenera and placed *P. leptalis* in the monotypic subgenus *Beckerium* Horn. The name for the species is now *Pentacomia (Beckerium) leptalis* (Bates).

The Cerro de Plumas locality listed by Bates (1881) cannot be located. Horn (1897), under *Cicindela rufiventris mellyi* Chaudoir, lists the locality of Cerro de Plumas as questionably being in Veracruz. Selander and Vaurie (1962) indicate that this may be Cerro de Palmas, Veracruz, which also cannot be located on maps available to me. The second locality, Juquila, Oaxaca, is placed at 16° 14'N, 97° 18'W at an elevation of 4900' by Selander and Vaurie (1962). Bates (1881) did not indicate the number of specimens in the type series and no ecological data were given. Horn (1897) using information from one of the collectors of the types (Hoge), notes that *P. leptalis* was collected in rather large numbers at dusk on forest paths, flying to [or sitting on] ferns.

Other than the collection data supplied by Hoge in Horn (1897), probably in reference to the type series, no records indicating the collection of *P. leptalis* have been published since the original description 97 years ago. There

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are no recently collected specimens in the British Museum of Natural History (BMNH) (G.G. Kibby, pers. comm.) or North American collections. Because of the lack of information on the species, I believe it is important to record its recent collection and the ecological and behavioral information associated with it.

Three specimens (1 ♂, 2 ♀) were collected 2 mi NE Candelaria Loxicha, Oaxaca, Mexico, 15° 54'N, 96° 31'W on 18 July 1974 at an elevation of 1400'. This locality is near the Juquila, Oaxaca locality of Bates (1881). The specimens were collected by me between 1030 and 1400 hours (CST) running on a shaded footpath located in dense tropical undergrowth. They did not attempt to fly. Later examination revealed that the second pair of wings is fully developed and the elytra are not fused so that flight is possible.

Specimens of *P. leptalis* in the BMNH were borrowed for comparative purposes. There are 14 specimens (10 ♂, 4 ♀; 1 ♂ and 1 ♀ are headless) which probably represent the original type series. A single ♂ is labeled Juquila and the remaining 13 specimens are from Cerro de Plumas. One ♂ from Cerro de Plumas collected by Hoege is labeled "sp. figured, Type". Two additional specimens are labeled cotype. However, since the number of specimens in the original type series is not mentioned and no type was designated the entire series should be considered as syntypes.

The ♂ from 2 mi NE Candelaria Loxicha is slightly larger whereas the 2 ♀'s are slightly smaller when compared with 5 ♂'s and 2 ♀'s from Cerro de Plumas. The elytral length of the Candelaria Loxicha ♂ measured from apex of the scutellum to elytral apex is 4.03 mm while 5 ♂'s from Cerro de Plumas average 3.85 mm (range 3.81-3.92). The elytra of the 2 Candelaria Loxicha ♀'s are 4.09 and 4.14 mm in length while the elytra of 2 ♀'s from Cerro de Plumas are 4.20 and 4.31 mm in length. All specimens are immaculate and green dorsally, but the Candelaria Loxicha ♂ agrees more closely with the brownish green color of the single Juquila ♂, and the 2 Candelaria Loxicha ♀'s tend toward the greener color of the Cerro de Plumas specimens. Other than these slight color and size differences there are no apparent morphological differences between the 2 series and they are considered conspecific. One Candelaria Loxicha ♀ of *P. leptalis* will be deposited in the Department of Entomology, Texas A&M University collection.

ACKNOWLEDGEMENTS

I wish to thank Mr. G.G. Kibby of the British Museum of Natural History (BMNH) for his cooperation and assistance in the loan of the type series of *P. leptalis*. Field work in Mexico was supported by both the Department of Entomology, Texas A&M University and NSF grant # GB29318. Assistance with German translations was provided by R.S. Peigler, Texas A&M University. R.L. Huber, St. Paul, Minnesota aided in the identification of the specimens.

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NEW SPECIES OF *POLANA* AND *CURTARA* (GYPONINAE) (HOMOPTERA:CICADELLIDAE) FROM PANAMA[1]

Dwight M. DeLong[2], Henk Wolda[3]

ABSTRACT: Two new species of *Polana, P. nigrolabes* n.sp. and *P. chena* n.sp., and two species of *Curtara, C. culpa* n.sp. and *C. cumbresa* n.sp., all from Panama are described.

The known species of *Polana* were treated by DeLong and Freytag (1972) and the known species of Panama *Curtara* were listed or described by the same authors (1976). Two species of *Polana, P. nigrolabes* n.sp. and *P. chena* n.sp., and two species of *Curtara, C. culpa* n.sp and *C. cumbresa* n.sp., from Panama are described. The holotypes are in the DeLong collection, Ohio State University.

Polana nigrolabes n.sp.

(Figs. 1-5, 21)

Length of male 7 mm., female 8.5 mm. Crown with margin only slightly produced, almost transverse, more than one-half as long at middle as basal width between eyes. Ocelli large, closer to eyes than to median line. Color dull yellowish green. Pronotum with a round black spot behind each eye. Forewings white, subhyaline, with four round black spots, three on clavus and one on corium, numerous smaller brownish spots on each wing.

Female seventh sternum with posterior margin slightly roundly produced.

Male genitalia with plates three and one-half times as long as median width, narrowed apically, apices rounded. Style bent dorsocaudally at middle, apex blunt, curved dorsally, bearing a narrow, caudally directed, process a short distance from apex. Aedeagus stout, short, with apex curved dorsally and narrowed, pointed. The apex split dorsoventrally forming two lateral portions. Pygofer narrowed to about half the basal width at middle, apex rounded.

Holotype male, Barro Colorado, C.Z. VII-8-1974, H. Wolda coll. Paratype female B.C.I. Canal Zone, VII-1973, H. Wolda coll.

P. nigrolabes is related to *P. quadrilabes* and is placed in the subgenus *Polanana.*

Individuals of this species identified by the junior author are not uncommon in the light-traps in the forest on Barro Colorado Island during the rainy season, especially from August to November. The species has also been found on Maje Island in the Bayano Lake, some 100 meters east of Barro Colorado Island.

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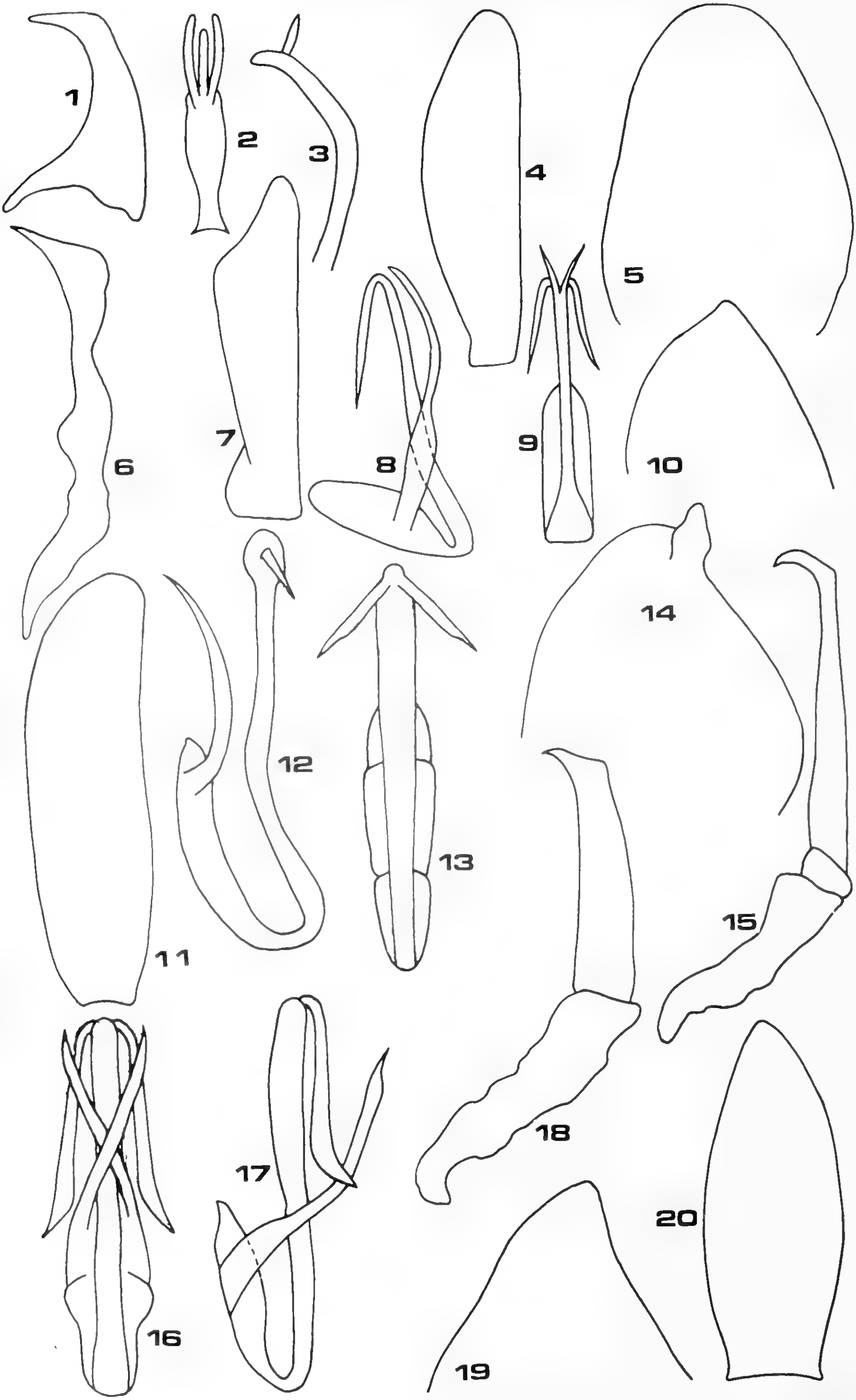
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Polana chena n.sp.

(Figs. 6-10,22)

Length of male 6.2 mm, female 6.5 mm. Crown with ocelli closer to anterior margin than to base of head, two-thirds as long at middle as basal width between eyes. Color, crown dull yellow. Pronotum yellowish green when alive, with disc and area behind eyes dark gray; with four large round black spots close anterior margin, one close to each lateral margin and one behind inner margin of each eye. Scutellum dull yellowish green. Forewings greenish subhyaline, veins inconspicuous.

Female seventh sternum with posterior margin narrowly, concavely excavated (U-shaped) each side of a median lobe, produced well beyond length of lateral angles and slightly notched at middle.

Male genitalia with plates broadened at two-thirds their length, narrowed to rounded apices, four and one-half times as long as width at middle. Style with blade irregular in shape, enlarged just before dorsocaudally pointed, produced, short apex. Aedeagal shaft bearing a pair of long slender processes, almost half as long as shaft, extending basad. Parameres rather broad at base, narrowed at one-third their length and produced as slender portions to apex of shaft, apices pointed, Pygofer narrowed apically, apex bluntly pointed.

Holotype male, Las Cumbres, Panama at light X-14-1974, H. Wolda coll. Paratypes: male same except VIII-26-74, Female same except IX-18-74.

P. chena is related to *P. falsa* and is placed in the subgenus *Polanana*. It is rare in the light-trap in Las Cumbres and has been observed on Barro Colorado Island, Canal Zone, and on Majé Island, in the Bayano area, Panama, only in the rainy season.

Curtara culpa n.sp.

(Figs. 11-15,23)

Length of male 9.5 mm, female 11 mm. Crown with thin margin, more than twice as


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Figs 1-5,21 *Polana nigrolabes* n.sp. 1. aedeagus laterally, 2 aedeagus ventrally, 3. style laterally, 4. plate ventrally, 5. pygofer laterally. 21. ♀ seventh sternum. Figs. 6-10,22 *P. chena* n.sp. 6. style laterally, 7. plate ventrally. 8. aedeagus laterally, 9. aedeagus ventrally, 10. apical portion of pygofer, laterally. 22. ♀ seventh sternum. Figs. 11-15,23 *Curtara culpa* n.sp. 11. plate ventrally, 12. aedeagus laterally, 13. aedeagus ventrally, 14. pygofer, apical portion laterally, 15. style laterally, 23. ♀ seventh sternum. Figs. 16-20, 24 *C. cumbresa* n.sp. 16. aedeagus ventrally, 17. aedeagus laterally, 18. style laterally, 19, pygofer, apical portion laterally, 20. plate ventrally, 24. ♀ seventh sternum.

wide at base between eyes as median length. Color, crown pale brown. Pronotum greenish brown with white spots on anterior half. Scutellum yellowish brown with dark brown basal angles. Forewings pale brown with a row of white spots extending diagonally from middle of scutellum to costa, apical costal cells without pigmentation.

Female seventh sternum with posterior margin shallowly concavely excavated each side of a broad median lobe which is produced to same length as lateral angles.

Male genitalia with plates three and one-half times as long as width at middle, apices rounded. Style with apical half of blade slender, apex curved dorsally and pointed. Aedeagal shaft in ventral view stout, bearing a pair of stout subapical processes, about one-fifth length of shaft, directed basolaterally. Parameres short, slender, sharp pointed, extending caudally almost to tip of shaft. Pygofer bearing a thumb-like process just ventral to the narrow rounded apex.

Holotype male, Las Cumbres, Panama, VI-9-1974, at light, H. Wolda coll. Paratype female same except V-9-76.

C. culpa is related to *C. esona* and is placed in the subgenus *Curtara*. It comes to lights occasionally during the rainy season, both in Las Cumbres and on Barro Colorado Island (Canal Zone). It has also been observed at Coco Solo (Canal Zone).

Curtara cumbresa n.sp.

(Figs. 15-20,24)

Length of male 8.5 mm., female 9.5 mm. Crown rather abruptly produced at anterior margins of eyes, broadly rounded, almost transverse, more than half as long at middle as basal width between eyes. Color pale brown, crown with a dark brown area margining each eye, extending from anterior margin to base and gradually broadened basally. Pronotum with a series of dark brown spots close anterior margin and extending behind eyes. Scutellum with anterior portion darker brown and apical half paler brown. Forewings pale brown with irregular dark brown spots at base, along costa and on clavus. The largest spot at two-thirds length of clavus next to commissure.

Female seventh sternum posterior margin with U-shaped excavations each side of a narrow median lobe produced slightly beyond the length of the lateral angles.

Male genitalia with plates two and one-half times as long as width at middle, apex bluntly pointed. Style blade rather broad, apex curved dorsally and sharp pointed. Adedeagal shaft stout, bearing a pair of apical processes half as long as shaft, broadened just before pointed apex. Parameres long, slender, almost straight, with pointed apices. Pygofer with apex bluntly pointed.

Holotype male, Las Cumbres, Panama, at light, III-10-1973. H. Wolda. coll. Paratype female Barro Colorado, Canal Zone, IX-7-75, H. Wolda coll.

C. cumbresa is related to *C. rigida* and is placed in the subgenus *Curtara*. This species is rare in light-traps and has been observed also on Barro Colorado Island (Canal Zone) and near the Pipeline Road (Canal Zone)

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NEW STATE RECORDS AND SEASONAL EMERGENCE PATTERNS OF ALDERFLIES EAST OF THE ROCKY MOUNTAINS (MEGALOPTERA: SIALIDAE)[1]

D.C. Tarter[2], W.D. Watkins[3], D.L. Ashley[2], J.T. Goodwin[4]

ABSTRACT: After examination of 3134 adult male alderflies from 25 states east of the Rocky Mountains, 59 state records are noted for 14 species. The emergence patterns ranged from March 4 (*Sialis vagans* from Arkansas) to September 30 (*S. itasca* from Indiana).

Several investigators, including Ross (1937), Townsend (1939), Parfin (1952), Flint (1964), Tennessen (1968), Tarter and Woodrum (1973a, b), Tarter et al. (1976), and Tarter et al. (1977), have reported distributional records and emergence information on alderflies east of the Rocky Mountains. The genus *Sialis* Latreille contains 23 Nearctic species (Ross, 1937); Townsend, 1939; and Flint, 1964).

NEW RECORDS AND EMERGENCE PATTERNS

Fifty-nine new state records of alderflies are noted after the examination of 3134 adult males from 25 states east of the Rocky Mountains. County records are given in parentheses. Emergence patterns are based on these specimens and the work of Ross (1937), Flint (1964) and Tennessen (1968).

Sialis aequalis Banks has been recorded from 6 states (Maryland, New Jersey, North Carolina, Pennsylvania, Virginia, West Virginia) (Ross, 1937 and Tarter and Woodrum, 1973b). The following 6 states represent new records: Connecticut (Fairfield), Delaware (Kent), Minnesota (Itasca), New York, Ohio (Hocking), South Carolina. Thirty-five adults emerged between March 20 (South Carolina) and June 13 (Minnesota).

Sialis americana (Rambur) has been reported from 4 states (Maryland, Ohio, Virginia, Wisconsin) and the District of Columbia (Ross, 1937; Flint, 1964; Tennessen, 1968). The following 6 states are new records: Connecticut (New Haven), Florida (Alachua), Georgia (Wayne), Louisiana (St. James), South Carolina, Texas. Seventeen adults emerged between April 27 (Florida) and July 7 (Virginia).

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Sialis concava Banks has been reported from Maryland, New York and West Virginia (Ross, 1937 and Tarter et al., 1977). New records include North Carolina (Wake) and Virginia. Seven adults emerged between April 24 (Virginia) to June 12 (West Virginia).

Sialis contigua Flint is known only from Virginia (Flint, 1964). One new record is added from Tennessee. Ten adults emerged from April 10 (Tennessee) to May 19 (Virginia).

Sialis dreisbachi Flint is known only from Michigan (Flint, 1964). One new record is recorded from Minnesota. Six adults emerged between May 26 (Minnesota) and June 31 (Minnesota).

Sialis glabella Ross is known only from Illinois (Ross, 1937). Three adults emerged from May 28 to June 16.

Sialis hasta Ross has been recorded for Arkansas, Michigan and Pennsylvania (Ross, 1937 and Flint, 1964). New records are added from Indiana (Ripley) and Missouri. Forty-two adults emerged between April 7 (Arkansas) and May 24 (Michigan).

Sialis infumata Newman has been reported from 10 states (Illinois, Kansas, Kentucky, Michigan, New Jersey, New York, Ohio, Pennsylvania, Virginia, Wisconsin) (Ross, 1937; Townsend, 1939; Flint, 1964; and Tennessen, 1968). New records include Arkansas (Washington), Indiana (Tippecanoe), Minnesota (Lyon), Missouri, North Carolina (Wake) and South Carolina. Sixty-nine adults emerged from March 19 (South Carolina) to September 16 (Kansas).

Sialis iola Ross has been recorded from 5 states (New Hampshire, New Jersey, New York, Pennsylvania, Virginia) and the District of Columbia (Ross, 1937 and Flint, 1964). Five new records include Connecticut, Maine, North Carolina (Wake), Ohio (Champaign, Miami) and South Carolina. Thirty-five adults emerged between April 1 (North Carolina) and July 7 (Maine).

Sialis itasca Ross has been reported from 14 states (Georgia, Illinois, Kansas, Maryland, Michigan, Minnesota, Missouri, New York, North Dakota, Ohio, Pennsylvania, Virginia, West Virginia, Wisconsin) and the District of Columbia (Ross, 1937; Flint, 1964; Tennessen, 1968; and Tarter et al., 1976). The following 7 states represent new records: Arkansas (Craighead), Indiana (Monroe, LaGrange), Minnesota, North Carolina (Chatham, Wake), Oklahoma, Tennessee (Shelby) and Texas (Brazos). Seventy-seven adults emerged from March 27 (Texas) to September 30 (Indiana).

Sialis joppa Ross has been reported from 10 states (Illinois, Maine, Maryland, New Hampshire, New York, North Carolina, Ohio, Pennsylvania, Virginia, West Virginia) (Ross, 1937; Flint, 1964; and Tarter and Woodrum, 1973a). New records include Connecticut (New Haven), Delaware, Louisiana (St. James), Michigan (Cheboygan), Vermont (Orleans) and Wisconsin (Ozaukee). Thirty-seven adults emerged from April 17 (Ohio) to July 10 (New Hampshire).

Sialis mohri Ross has been recorded from 14 states (Arkansas, Connecticut, Illinois, Indiana, Kentucky, Massachusetts, Michigan, Minnesota, New Jersey, New York, Ohio, Oklahoma, Pennsylvania, Wisconsin) (Ross, 1937 and Flint, 1964). Six new records include Kansas (Douglas), Maine, Missouri, New Hampshire, Rhode Island and Tennessee (Lake, Shelby). One-thousand and seventy adults emerged between March 19 Arkansas) and July 24 (Michigan).

Sialis nina Townsend is known only from Kentucky (Townsend, 1939). The adults were collected on April 1.

Sialis rotunda Banks, generally a western species, has been recorded for Oregon and Washington (Ross, 1937). One male was collected near Quinault Creek in Wisconsin on July 8, 1960.

Sialis spangleri Flint is known only from Maryland (Flint, 1964). One male emerged on May 16, 1963.

Sialis vagans Ross has been recorded for 13 states (Connecticut, Georgia, Illinois, Indiana, Maine, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Pennsylvania, Virginia, Wisconsin) (Ross, 1937 and Flint, 1964). Additional records include Arkansas (Greene), Minnesota (Pine, Itasca), Mississippi (Amite, Lincoln), North Carolina (Wake), Ohio (Summit, Gallia) and Vermont. One-hundred and eighty-eight adults emerged between March 4 (Arkansas) and July 19 (New York).

Sialis velata Ross has been reported from 15 states (Illinois, Kansas, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Hampshire, North Dakota, Texas, Virginia, West Virginia, Wisconsin) and the District of Columbia (Ross, 1937 and Townsend, 1939). New records are noted for Nebraska, North Carolina, Tennessee (Marion) and Vermont. Upon examination of 1536 adults, the adults emerged from April 2 (Kansas) to September 5 (Michigan).

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INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE ANNOUNCEMENT

A.N.(S.) 106

The required six months' notice is given of the possible use of plenary powers by the International Commission on Zoological Nomenclature in connection with the following names listed by case number: (see *Bull. Zool. Nom.* 35, part 1, 31 July, 1978).

680 *Blatta germanica* Linnaeus, 1767 (Insecta, Dictuoptera, Blattodea); proposal to conserve and to designate it as type-species of *Blattella* Caudell, 1903.

2143 Proposal to conserve the specific name *tenebricola*, as published in *Linyphia* by Wider, 1834, but in the sense of Kulczynski, 1887 (Arachnida).

2213 HESPERIIDAE Latreille, 1809 (Insecta, Lepidoptera): request for addition to the Official List.

Comments should be sent in duplicate (if possible within six months of the date of publication of this notice in *Bull. Zool. Nom.* 35, part 1), citing case number to:

R.V. Melville, The Secretary, International Commission on Zoological Nomenclature, c/o British Museum (Natural History), Cromwell Road, LONDON, SW7 5BD, England.

Those received early enough will be published in the *Bulletin of Zoological Nomenclature.*

A COMMUNAL ROOST OF BUTTERFLY *HELICONIUS CHARITONIUS* L. IN COSTA RICAN PREMONTANE TROPICAL WET FOREST (LEPIDOPTERA: NYMPHALIDAE)[1]

Allen M. Young

ABSTRACT: The communal roosting behavior of the Neotropical butterfly *Heliconius charitonius* L. (Nymphalidae: Heliconiinae) was studied briefly at one locality in the wet forest region of northeastern Costa Rica. By marking individual butterflies, it was discovered that females returned less frequently than males, resulting in a 1:3 sex ratio of roosting butterflies. Freshly-eclosed males were also seen on the roost. Individuals of both sexes were inconsistent in appearing at the roost over several days, perhaps a result of phenotypic differences. Considerable recruitment of freshly-eclosed butterflies occurred, while marked butterflies declined in frequency.

Communal roosting has been observed for several species of *Heliconius* butterflies (Nymphalidae: Heliconiinae) in sub-tropical and tropical regions of America (Jones 1930; Poulton 1931; Benson 1971; Turner 1971, 1975; Young and Thomason 1975; Young and Carolan 1976). The adaptive significance of this gregarious behavior in adult *Heliconius* has been discussed (Benson 1972; Gilbert 1975; Turner 1975). Gilbert (1975) suggests that communal roosting in these butterflies evolved as the result of young, inexperienced individuals following and roosting near experienced individuals to improve their ability to find scarce or inconspicuous pollen sources, as pollen feeding is of major importance to the reproductive success of many *Heliconius* (Gilbert 1972). While it may be true that individuals are faithful to a roosting site over a long period of time in some species of *Heliconius* (Benson 1971, 1972), *H. charitonius* Linn. (*H. charitonia*) in montane tropical wet forest of Costa Rica exhibits considerable short-term (daily) variation in roost fidelity (Young and Carolan 1976). The present paper concerns the description of the short-term turnover in roost membership for *H. charitonius* at a Premontane Tropical Wet Forest locality in northeastern Costa Rica.

METHODS

The study area is "Finca La Tigre" near La Virgen de Sarapiqui (220 meters elev.), Heredia Province, in northeastern Costa Rica. This site is

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adjacent to "Finca La Tirimbina" and about two kilometers from a previous study of *H. charitonius* (Young 1976). Both sites are in the Premontane Tropical Wet Forest life zone (Holdridge 1967). On the late afternoon of January 18, 1977 a communal roost of *H. charitonius* was discovered on a fallen tree in secondary growth along a dirt road. Using the technique of studies of *H. charitonius* (Young and Thomason 1975; Young and Carolan 1976; Cook et al. 1976), the butterflies were marked at dawn on February 7, 1977, recording the sex and "age" ("young", "middle", "old") of each individual. Unlike previous studies, the butterflies were marked only on one date. The roost was observed from February 7 to February 27, 1977, during an erratic dry season. For a total of ten evenings (census dates), the roost was visited at 7:00 P.M. and the number of marked and unmarked butterflies recorded, along with a separate tally of freshly-eclosed individuals (new recruits). Although "young" *Heliconius* butterflies have been defined as one month old (Gilbert 1975), in this paper I equate "young" with freshly-eclosed individuals. Daily weather data (rainfall, temperature) were available from "Finca La Tirimbina". Data were also kept on the number of "sub-roosts", as sometimes the roost membership was split into separate groups.

RESULTS

A total of 37 butterflies were marked at the roost on the morning of February 7, and four or five individuals were missed; of the 37 marked, eight were females and 29 were males, a greater than 1:3 sex ratio. About one-third of the butterflies (11) were young or freshly-eclosed, and only seven were old (tattered, worn) individuals, suggesting a roost membership of predominantly middle-age butterflies, probably 1-4 months old (based on Gilbert 1975; Cook et al. 1976), and two or more generations. This contention is also supported by the fact that this roost existed for at least 5 weeks by the end of the study.

The census history of marked butterflies is summarized in Table 1 which, by inspection, shows that individual faithfulness to the roost is highly variable for the short observation period of 20 days. While marked butterflies return to the roost on different dates (Fig. 1), some individuals appear more times than others: two young males (nos. 34, 36), one old female (no. 35), and two middle females (nos. 15, 29) returned eight out of ten evenings. After the first census date, several individuals were never seen again, including young and middle females, and middle and old males (nos. 2, 5, 14, 18, 20, 25, 31 – Table 1). Although the total number of resightings was about the same (16-20) for census dates in the period February 7-16 (see last row in Table 1), there was a noticeable drop in resightings (9-13) following this time (Table 1). The decline in roost membership, including unmarked individuals, occurred at a time of irregular daily rainfall (Fig. 2). For the period February 7-9, the mean maximum temperature (12:00 noon) was 28.5°C and the mean minimum (6:00 P.M.) was 20.0°C; for the period February 14-27, these values were 32.0°C and 19.0°C respectively. There appears to be little or no correlation of roost activity and weather for the observation period.

While few data are available for females (owing to the small sample size), the frequency of resightings for young, middle, and old males was very

Fig. 1. The communal roost of *H. charitonius* showing both marked and unmarked butterflies, February 15, 1977, 6:30 A.M.

similar (Table 2). It is interesting to note that the highest number of resightings for an individual male butterfly, eight, was seen for an old individual as well as two young ones (Table 2).

Although the number of marked butterflies declined later, both the overall frequency of unmarked ones and young ones increased (Table 3). Most of the unmarked butterflies seen after February 9 were freshly-eclosed (Table 3), indicating a recruitment of new adults. Old butterflies were resighted several times: excluding resight data taken on the first census date, 75% of all butterflies marked were resighted at least once during the study period, and there were no instances of an old individual not being resighted at least once. In fact, of the seven old individuals marked, four were resighted several times each during the study period (Table 1).

The daily formation of the roost involved several butterflies settling on the low vegetation beneath the tree, usually within an hour of sunset, and just before dark, they flew up and settled on the branches. Departure from the roost in the morning was very sudden. Inspection of roosting butterflies revealed great variation in pollen load size: whitish pollen loads were very large and crusty on some individuals, smaller on others, and absent on others.

DISCUSSION

Heliconius charitonius is an advanced species of the genus, occurring in a wide variety of habitats, including those created by man (Brown 1972). At "Finca La Tigre" it thrives in a broad spectrum of secondary habitats, and the communal roost studied was found in a recently cut area. Benson (1972) showed that *H. erato* in southwestern Costa Rica has communal roosts characterized by high individual faithfulness over long periods (several months). Although individuals of *H. charitonius* are faithful to roosts over similar periods in montane tropical wet forest in Costa Rica (Young and Thomason 1975), presumably a result of a cohesive population structure (Cook et al. 1976), there is considerable daily variation in individual faithfulness (Young and Carolan 1976). The present data show that individual faithfulness to a communal roost is variable in premontane tropical wet forest. An interesting difference between the previously studied Costa Rican roosts and the present one is the strong bias for males in the latter; the other roosts had about 1:1 sex ratios (Young and Thomason 1975 ;Young and Carolan 1976). As a communal roost is likely to have individuals from more than one generation (Gilbert 1975), it is expected that the frequency of young (reproductive) females on a roost will vary through time as related to their foraging and oviposition activity. The scarcity of females on a roost could be the result of freshly-eclosed (young) females dispersing in search of oviposition sites, very soon after eclosion. Freshly-eclosed females are mated very soon after

Table 1. The census history of *Heliconius charitonius* butterflies experimentally marked (7 February) at a communal roost at Finca La Tigre, near La Virgen de Sarapiqui, Costa Rica, 1977.*

Individual No.	Sex	Age**	Feb 7	Feb 8	Feb 9	Feb 14	Feb 15	Feb 16	Feb 19	Feb 20	Feb 21	Feb 27
1	M	O	X***				X	X				
2	M	O										
3	M	Y	X	X	X							
4	M	M	X	X	X							
5	F	Y										
6	M	M	X		X					X	X	X
7	M	M	X		X	X	X	X	X			X
8	M	M	X									
9	M	M	X	X	X	X	X	X	X		X	
10	M	Y		X	X	X	X	X	X			
11	M	M	X	X	X	X	X	X				
12	M	M				X	X	X		X	X	X
13	M	Y	X		X							
14	M	M										
15	F	M	X		X	X	X	X	X	X	X	
16	M	Y	X	X	X	X	X	X				X
17	M	O			X							
18	M	O										
19	M	O	X	X	X	X	X	X	X	X		X
20	F	M										
21	M	O	X		X	X	X	X	X		X	X
22	M	M				X	X	X	X			
23	F	M			X	X	X	X	X	X	X	
24	M	M		X								
25	F	Y										
26	M	M	X	X					X		X	
27	M	M		X	X							
28	M	Y		X								
29	F	M	X	X		X	X	X	X	X	X	X
30	M	M	X	X				X				
31	F	M										
32	M	Y	X	X	X	X						
33	M	Y	X									
34	M	Y	X		X	X	X	X	X	X	X	X
35	F	O	X	X	X	X	X	X	X	X	X	X
36	M	Y		X	X	X	X	X	X	X		X
37	M	Y		X	X							
TOTAL DAILY RESIGHTINGS			20	17	20	16	16	17	13	9	10	10

*Some butterflies, i.e. entries, 2, 5, 14, 18, 20, 25, and 31 were not resighted at all following the marking, and no resightings are available for them.

**O = old; M = middle age; Y = young

***="X" means this individual was seen on the roost that evening eclosion (Edwards 1881). A larval food plant of *H. charitonius* at the study area, *Tetrastylis lobata* (Young 1976), is widely dispersed as small patches, perhaps promoting a rapid dispersal of newly mated females and thus lowering their frequency at a communal roost over short periods. Females of *H. charitonius* can be faithful to a roost over a long period (Young and

Table 2. Number of resightings of marked butterflies seen at least twice (excluding first census on Feb. 7) at roost.

Age class:	Young	Middle	Old
Females			
N*	0	3	1
Resight freq.	–	7, 7, 8	9
X ± S.D.	–	7.31 ± 0.57	–
Males			
N*	6	9	3
Resight freq.	2, 6, 6, 3, 8, 8	2, 4, 6, 7, 5, 6 4, 3, 2	2, 8, 7
X ± S.D.	5.50 ± 2.50	4.33 ± 1.80	5.66 ± 3.21
Total			
N*	6	12	4
X ± S.D.	5.50 ± 2.50	5.08 ± 2.06	6.50 ± 3.10

N = number of different individuals resighted

Table 3. Frequency of unmarked butterflies, including freshly-eclosed individuals, at the roost.

Date	No. unmarked	Portion of these freshly-eclosed	No. marked butterflies	% unmarked
Feb 8	5	2	17	23%
9	7	3	20	26%
14	5	4	16	24%
15	8	5	15	34%
16	10	7	17	37%
19	13	8	13	50%
20	12	6	9	57%
21	14	7	10	58%
27	11	8	10	52%

Thomason 1975) and they exhibit home range movements (Cook et al. 1976). Furthermore, over long periods, it is expected that both males and females of advanced *Heliconius* species will exhibit high roost faithfulness and home range movements for location and exploitation of adult food sources (Gilbert 1975). Over short periods, however, various environmental and phenotypic factors may lead to individual differences in roost faithful-

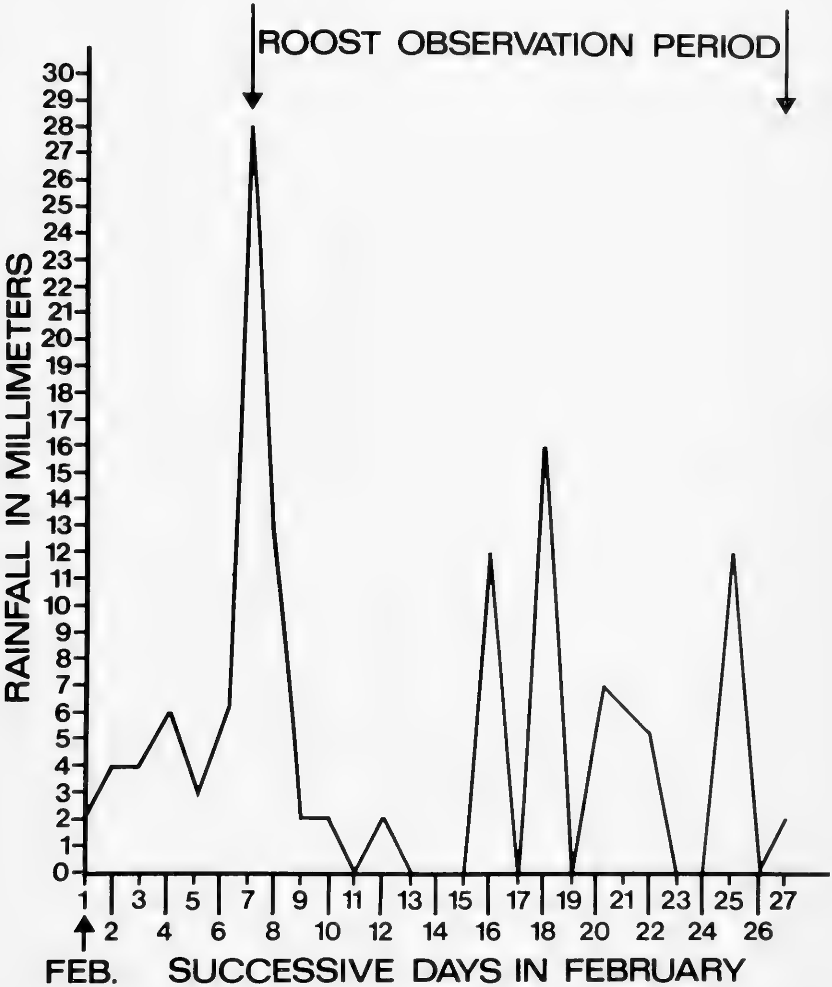

Fig. 2. Daily rainfall (in mm) at Finca La Tirimbina; data courtesy of Dr. J. Robert Hunter. Communal roosting was observed for both wet and dry days.

ness. As a long term form of adaptive behavior, communal roosting increases recruitment of new individuals to the group and perhaps increases breeding success (Brown 1970).

Short term variation in roost faithfulness may be due to several factors such as phenotypic differences in mobility, location of adult food sources and oviposition sites, and weather. Older butterflies may exhibit high roost faithfulness as a result of becoming very familiar with the surrounding habitat. Gilbert (1975) emphasizes that *Heliconius* use land marks in daily movements and older butterflies are more experienced at doing this. The data show that old butterflies were very faithful to the roost. The data also support the hypothesis of Gilbert (1975) that young butterflies roost with older ones as a means of becoming more familiar with the habitat: there was a steady recruitment of young adults throughout the study period.

The data indicate that some butterflies of both sexes show up regularly at a roost. Following the reasoning of Gilbert (1975) selection should favor high residentiality in *Heliconius* as a means of allowing butterflies to be efficient foragers of patchy resources. In addition to a larval food plant, *Tetrastylis lobata* (Passifloraceae) (Benson et al. 1976; Young 1976), adult food plants such as *Cissus biformifolia* (Vitaceae), *Anguria warcewiczii*, and *Gurania costaricensis* (both Curcubitaceae) are very patchy over large areas of secondary growth that surround the roost site.

Brown (1972) considers advanced species of *Heliconius* to possess flexible behavior. An example of such flexibility in *H. charitonius* might be the changing of roost sites in a habitat. Whether or not optimal roosting sites are limiting factors has not been determined. Young and Thomason (1975) suggested that absences of marked butterflies from a communal roost of *H. charitonius* could be due to individuals using different roosts on different days. Multiple roosts of *H. charitonius* in a small area have been found (Jones 1930). In the present study, such a factor could have contributed to some of the daily turnover in roost membership, although this effect is small since resightings were high for several individuals. Prolonged absences from a communal roost or a sudden decline in roost membership is likely not related to local weather conditions.

Turner (1975) suggested that communal roosting in *Heliconius* evolved as a mechanism to ensure home range movements, rather than as the result of these butterflies being unpalatable to predators. The palatability of *H. charitonius* is undetermined. Under Turner's model, communal roosting is viewed as an opportunistic, flexible behavior subject to modification as factors affecting home range movements change. Thus, the observed short-term turnover in roost membership of *H. charitonius* in the present study is supportive of Turner's model. Perhaps under the alternative explanation of unpalatability, roost faithfulness over short periods would be higher in order to ensure the operation of collective behavior associated with educating naive predators.

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MECONEMA THALASSINUM (ORTHOPTERA: TETTIGONIIDAE), PREY OF *SPHEX ICHNEUMONEUS* (HYMENOPTERA: SPHECIDAE) IN WESTCHESTER COUNTY, NEW YORK.[1]

Enrico Sismondo[2]

ABSTRACT: *Meconema thalassinum*, a Palearctic katydid previously reported from Long Island, has now been found in Westchester County, New York, where it is preyed upon by a Sphecid wasp, *Sphex ichneumoneus*.

Meconema thalassinum (De Geer) is a small Palearctic katydid which in recent years has become established in Long Island (Gurney 1960, 1960a; Johnstone 1970). I now report its occurrence in Westchester County, New York, where I have recorded the following adult specimens: 1. Male, Scarsdale, 20 July 1974; 2. Female, Scarsdale, 14 August 1975; 3. Male, Larchmont, 18 July 1976; 4. Female, Scarsdale, 22 August 1976; 5. Male, Scarsdale, 31 July 1977. Specimens No. 1 and 2 have been deposited in the collection of the American Museum of Natural History.

The males were found on or under maple trees, between 2200 and 2400 hours. The females had been captured and paralyzed by *Sphex ichneumoneus* (Linnaeus). A small nesting aggregation of these wasps became established in my driveway in 1975: during that year, and again in 1976 and 1977, they have provisioned their nests exclusively with *Meconema*. This choice of prey is a recent adaptation, as the Meconematinae are not native to the New World; in the Old World, apparently, the Meconematinae are not on record as prey of the genus *Sphex* (Bohart and Menke 1976).

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USEFULNESS OF LARVAL OSMETERIA IN DETERMINING NATURAL CLASSIFICATION IN ALEOCHARINAE (COLEOPTERA: STAPHYLINIDAE)[1]

Ian Moore

ABSTRACT: The presence or absence of the osmeterium in the larvae of Aleocharinae should be useful in determining natural relations.

The discovery of the osmeterium of the larva of certain members of the subfamily Aleocharinae (Badgley and Flescher 1956) and its further elucidation (Moore et al. 1975) strengthens doubts concerning the validity of the present classification of that large subfamily of rove beetles.

The osmeterium of certain Aleocharinid larvae is borne on the eighth abdominal segment. It is an organ similar to that which is present on the thorax of the larvae of swallow-tailed butterflies. Its presence is indicated by the occurrence of a heavily pigmented chitinized tumescence in the center of the eighth tergite. This tumescence is composed of two plates or opercula which are separated by a transverse slit. When the larva of *Oligota oviformis* is touched with a camel-hair brush, the opercula part and the short bright orange osmeterium is briefly protruded. Badgley and Fleschner speculated that the osmeterium is a protective device which may exude an offensive odor and consequently aid in escape from predation.

The presence or absence of an osmeterium is easily determined in preserved specimens by the occurrence of the swollen pigmented chitinized opercula.

It seems highly unlikely that the osmeterium of the larvae of the Aleocharinae could have developed more than a single time during the evolution of the subfamily. If it evolved only once then all genera with the organ stem from a common ancestor. For example, *Bryothinusa* with its "primative" adult mouth parts may be closely related to *Diaulota* with "normal" adult trophi.

In the following list (Table 1), according to the classification of Bernhauer and Schubert (1910-1916), three genera whose larvae lack the osmeterium are placed in tribes which also contain genera where the osmeterium is present. This still prevalent classification, dating back to Erichson (1839-40), is based largely on the segmentation of the tarsi and

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mouth parts. It has been a classification of convenience declared of doubtful validity from an evolutionary point of view by Seevers (1965) and others.

It would seem preferable to group together those genera in which the osmeterium is present in the larvae. It is not possible to do this at present because very few larvae of this large subfamily are known. However, some consideration should be given to the presence of this organ in any further reclassification of the group.

Table 1. Some genera of the Aleocharinae whose larvae have or lack an osmeterium and the tribes in which they were placed by Bernhauer and Schubert (1910-1916).

1. Genera with osmeterium	Tribe
1. *Oligota*	Oligotini
2. *Alianta*	Myrmedoniini
3. *Lomecusha*	Myrmedoniini
4. *Bryothinusa*	Bolitocharini
5. *Halmaeusa*	Bolitocharini
6. *Bolitochara*	Bolitocharini
7. *Gyrophaena*	Bolitocharini
8. *Phytosus*	Bolitocharini
9. *Thectura*	Bolitocharini
10. *Diaulota*	Bolitocharini
11. *Liparocephalus*	Bolitocharini
12. *Phloeopora*	Aleocharini
13. *Microglotta*	Aleocharini
2. Genera without osmeterium	
14. *Cyphea*	Bolitocharini
15. *Atheta*	Myrmedoniini
16. *Aleochara*	Aleocharini

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HOMONYMY NOTES IN THE BOMBYLIIDAE (DIPTERA). III.[1]

Neal L. Evenhuis[2]

ABSTRACT: The following new names are proposed for the family Bombyliidae: *Villa myximyia, Villa philippii, Villa schineri, Villa zonipennis, Aureomoeba, Dasypalpoides, Neobombylodes, Robertsella, Timiomyia, Unduloptomyia, Veribubo.*

Following is the third list of name changes proposed for preoccupied names in the family Bombyliidae.

Villa myximyia, new name for *Villa muscaria* (Coquillett) 1892: 178 (as *Anthrax*). Preoccupied by *Villa muscaria* (Pallas) 1818: 13 (as *Anthrax*).

Villa philippii, new name for *Villa vitripennis* (Philippi) 1865: 671 (as *Anthrax*). Preoccupied by *Villa vitripennis* (Loew) 1860: 217 (as *Anthrax*).

Villa schineri, new name for *Villa nigricosta* (Schiner) 1868: 126 (as *Anthrax*). Preoccupied by *Villa nigricosta* (Macquart) 1850:416 (as *Anthrax*).

Villa zonipennis, new name for *Villa varipennis* Roberts 1928: 121. Preoccupied by *Villa varipennis* (Macquart) 1850: 412 (as *Anthrax*).

The following names of genera and subgenera were found to be preoccupied and the name changes below are proposed.

Aureomoeba, new name for *Chrysamoeba* Sack 1909: 510. Preoccupied by *Chrysamoeba* Klebs 1892: 406 in Protozoa. *Chrysamoeba* Sack is presently considered a junior synonym of *Anthrax* Scopoli.

Dasypalpoides, new name for *Dasypalpus* Macquart 1840: 390. Preoccupied by *Dasypalpus* Rafinesque 1815: 121 in Trichoptera. *Dasypalpus* Macquart is presently considered a junior synonym of *Megapalpus* Macquart.

Neobombylodes, new name for *Bombylodes* Paramonov 1940: 65. Preoccupied by *Bombylodes* Fauvel 1904: 43 in Coleoptera. It is interesting to note that *Bombylodes* Fauvel was a new name proposed for *Bombylius* Fauvel which is preoccupied by *Bombylius* Linnaeus in the Bombyliidae.

Robertsella, new name for *Cyrtomorpha* White 1917: 185. Preoccupied by *Cyrtomorpha* Graff 1882: 202 in Turbellaria.

Timiomyia, new name for *Tamerlania* Paramonov 1931: 203. Preoccupied by *Tamerlania* Skrjabin 1924: 86 in Trematoda.

Unduloptomya, new name for *Comastes* Osten Sacken 1877: 256. Preoccupied by *Comastes* Jan 1863: 99 in Reptilia. *Comastes* Osten Sacken is presently considered a junior synonym of *Heterostylum* Macquart.

Veribubo, new name for *Tumulus* Hull 1973: 403. Preoccupied by *Tumulus* Montero-

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sato 1888: 176 in Mollusca. *Tumulus* Hull is presently treated as a subgenus of *Thyridanthrax* Osten Sacken.

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EFFECT OF TEMPERATURE ON LONGEVITY OF *ODOIPORUS LONGICOLLIS* (OLIV.) (COLEOPTERA: CURCULIONIDAE)[1]

G.S. Shukla, A.K. Tripathi[2]

Since insects are poikilotherms, temperature plays an important role in their behavioral as well as physiological activities. *Odoiporus longicollis*, the banana pest, lives inside longitudinal tunnels made by them in the banana pseudostem (Shukla and Kumar, 1970). For the study of several physiological aspects in relation to temperature, maximum and minimum temperatures for the survival of this insect in laboratory must be known. The present paper deals with the survival of this insect at different temperatures to find out the most suitable temperature range for culture.

Adults of *O. longicollis* were collected from the banana gardens at Campierganj, Gorakhpur (Uttar Pradesh, India). Batches of 10 insects were kept at different temperatures in petridishes with some pieces of banana pseudostem.

At 0°C it was observed that insects cease activity within five minutes, go into cold paralysis and die after thirty minutes. At 6 – 9°C they are feebly active and die after twelve to thirteen days. At 10 – 15°C the insects are comparatively more active than at previous temperatures and die after twenty five to twenty six days. The temperature range between 17-27°C was found to be most suitable for normal activities. At 30-35°C they show increased activity, moving fast in the petridish and die after four to five days. They manifest great restlessness at 37 – 41°C for about eleven to twelve hours after which they die. At 42-45°C they go into heat paralysis after 15 minutes and die after thirty minutes. Above this temperature they die within ten to fifteen minutes.

In the cowpea aphid, *Aphis craccivora*, greatest longevity was recorded at 12.8°C (Radke, *et al.*, 1973). Nieschulz (1933) observed normal activity in *Musca domestica* at 15 – 22.5°C and in *Fannia canalicularis* at 22 – 32°C. Since *O. longicollis* shows normal activity at 17 – 27°C, this is about in between the two flies, *M. domestica* and *F. canaliculairs.*

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BOOKS RECEIVED AND BRIEFLY NOTED

INSECT BEHAVIOR. Robert W. and Janice R. Matthews. John Wiley & Sons. 1978. 507 pp. $22.50

A comprehensive overview of fundamental concepts of animal behavior as they relate to insects. The comparative evolutionary approach taken helps understand how a number of major behavioral systems function while many experiments and investigations show how behavioral research can be conducted. The first four chapters concern behavior of the individual insect – how it moves, orients, disperses and feeds. The next three chapters on communication then lead to considerations of defensive, reproductive and social behaviors in the final three chapters.

THE YEAR OF THE ANT. George Ordish. Charles Scribner's Sons. 1978. 139 pp. $9.95

An imaginary account of a hypothetical wood ant of the *Formica rufa* group. The life cycle of a female worker is serialized from March through October somewhere in the Adirondack Mts. of New York.

ADVANCES IN INSECT PHYSIOLOGY. Vol. 13. J.E. Treherne et al, ed. Academic Press. 1978. 376 pp. $35.25

Contents of this volume include: Long-Chain Methyl-Branched Hydrocarbons, D.R. Nelson; Insect Visual Pigments, R.H. White; Structure & Function of Insect Peptides, R.P. Bodnaryk; Insect Flight Metabolism, A.E. Kammer & B. Heinrich; and Neuroethology of Acoustic Communication, N. Elsner & A. Popov.

BIOCHEMICAL DIFFERENTIATION IN INSECT GLANDS. W. Beermann, ed. Springer-Verlag. 1977. 215 pp. $35.90

This is Vol 8 of Results and Problems in Cell Differentiation, a series of topical volumes in Developmental Biology. Contents of this volume include: Differentiation of the Silk Gland – a Study of Differential Gene Action, Y. Suzuki; The Eggshell of Insects – Differentiation-Specific Proteins & Control of their Synthesis & Accumulation during Development, F.C. Kafatos et al; and The Salivary Gland of *Chironomus* (Diptera) – a Study of Cell Differentiation.

INSECTS AND OTHER ARTHROPODS OF MEDICAL IMPORTANCE. Kenneth G.V. Smith, ed., British Museum (Natural History) and John Wiley & Sons Ltd. 1978 edition. 561 pp. 12 pl. $36.00

This volume replaces A Handbook for the Identification of Insects of Medical Importance by John Smart, the subject matter of which was largely restricted to the tropical zones of the Old World. The present work is expanded to include the whole world and fuller treatment of groups of minor medical importance is given. A fuller treatment has also been given to arthropods other than insects.

This taxonomic work is intended primarily for the identification of insects and other arthropods of importance in human medicine. Each of the sixteen contributors is a specialist on the taxonomy of the group concerned with practical field experience of arthropod-borne diseases.

DIAGNOSTIC MANUAL FOR THE IDENTIFICATION OF INSECT PATHOGENS. George O. Poinar, Jr. and Gerard M. Thomas. Plenum Press. 1978. 218 pp. $19.50

This manual was prepared for the diagnosis of insect diseases caused by infectious agents. Through the use of illustrated keys, it identifies and describes all the common genera or groups of pathogens causing infectious diseases of insects, including fungi, protozoa, bacteria, viruses and rickettsias. Although emphasis is placed on identification, general background information on the various pathogens is also included.

BIOSYSTEMATICS IN AGRICULTURE. John Wiley & Sons. 1978. 340 pp. $24.00

A series of eighteen papers on biosystematics and taxonomy presented at a symposium at the Beltsville Agricultural Research Center, May 8-11, 1977.

WHITEFLY OF THE WORLD. L.A. Mound and S.H.Halsey. British Museum (Natural History) and John Wiley & Sons. 1978. 340 pp. $29.00

A systematic catalogue of the Aleyrodidae (Homoptera) of the world, with systematic listings of host plants and natural enemies.

ORDNUNG COLEOPTERA (LARVEN). Bernhard Klausnitzer. Dr. W. Junk BV Pub. 1978. 378 pp. $73.00 (ppbk.)

Descriptions, keys and figures to the identification of larval Coleoptera. (In German)

DISPERSAL CENTRES OF SPHINGIDAE (LEPIDOPTERA) IN THE NEOTROPICAL REGION. Harald Schreiber. Dr. W. Junk B.V., Pub. 1978. 195 pp. $31.75

An analysis of the present distribution pattern of animal or plant organisms and a subsequent chorological investigation enable us to discover structures of an earlier distribution pattern beyond the establishment of recent ranges. This provides insight into the dynamics of dispersal processes that have taken place since then. The purpose of this work is to elaborate such structures in the Neotropical region, based on the distribution of the Sphingidae and to interpret them by means of a comparative study of the species and subspecies involved.

TABANINI OF THAILAND ABOVE THE ISTHMUS OF KRA (DIPTERA: TABANIDAE). John J.S. Burton. Entomological Reprint Specialists. 1978. 165 pp. $15.00

A taxonomic account, with keys and 79 photographic figures of frons and antennae, of the tabanid fauna of Thailand.

HANDBOOK OF COMMON NEW GUINEA BEETLES. J.L. Gressitt & R.W. Hornabrook. Wau Ecology Institute, PO Box 77, Wau, Papua New Guinea. 1977. 87 pp. $4.50. (Order from B.P. Bishop Museum, Honolulu)

Handbook for identification of the larger and more important families of beetles occurring in New Guinea. Included is a key to the families of beetles treated. At least one representative of each major family is illustrated, sixteen in color.

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