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(Continued on inside of back cover)

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CARTOGRAPHIC COMPARISONS OF EURASIAN GYPSY MOTH DISTRIBUTION (*LYMANTRIA DISPAR* L.; LEPIDOPTERA: LYMANTRIIDAE)[1]

Ronald L. Giese, Mary L. Schneider[2]

ABSTRACT: Historic maps have been reconstructed to a common scale and projection in order to compare Eurasian distribution of the gypsy moth. Sites from the early studies were used, along with new information, to produce 2 new versions of the moth's Old World range. One "modern" map displays locations of documentable reports of gypsy moths. The second presents contoured zones of presence and outbreak. These zones are much more constrained than on the historic maps due to strict contouring conventions. The largest area of periodic outbreak occurs between 0-50°E longitude and 40-55°N latitude. The major area of distribution is typified by an annual precipitation of at least 10 cm, and July and January average isotherms of 15 to 27°C and -18 to 12°C, respectively. Outbreak areas, however, typically receive 25-100 cm of annual moisture. As it relates to climate and vegetation, a more accurate picture of gypsy moth distribution in the Eastern Hemisphere will aid current investigations pertaining to the moth's spread and establishment in new areas in North America; new information will also aid in the search for exotic natural enemies of this pest.

The gypsy moth, *Lymantria dispar* L., has been present in North America for over a century. For many years this pest was confined to the northeastern United States, but changing practices of pesticide usage, natural dispersal, and inadvertent transport on vehicles have resulted in an extended geographic range of the gypsy moth in this country and Canada. It seems clear that containment is no longer possible and a large range expansion on this continent can be anticipated. Just where, and at what rate, establishment in new areas will occur are subjects of current concern.

One important base of information is the historic distribution of the gypsy moth in Eurasia, the source of this introduced species. Knowledge of vegetation, climate, and physical features can provide a necessary backdrop for current investigations dealing with genetics, biological control, population dynamics, and bioclimatology of the gypsy moth. Several of the major historic investigations of gypsy moth distribution over large land areas are written in different languages, and are not commonly available in this country. Though these works contain distribution maps constructed from each author's own sources and data interpretations, direct comparisons are not possible because of differences in map projections and scales. To bring

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[2] Department of Forestry, University of Wisconsin-Madison, Madison, Wisconsin 53706.

together the valuable information contained in these studies, the maps have been redrafted to a common scale and are presented herein in comparable forms, along with pertinent information gleaned from the translated articles. In addition, new maps have been synthesized to display both specific locations of the gypsy moth, and generalized areas classified as to presence and known outbreaks.

MATERIALS AND METHODS

For more convenient comparison, 4 maps derived from the literature were redrafted such that each contained a common scale and projection. All original figures were redrawn onto computer-generated outline maps using the Miller Cylindrical projection with a scale of 1:18,750,000.

Locations for distribution points in Fig. 3 were obtained from a variety of literature and personal communication sources; the specific citations pertaining to individual countries are provided in Table 1 for workers interested in more local phenomena. Locations for gypsy moth presence and outbreaks were accepted from primary and secondary sources when, in the authors' judgement, the information was believed reliable. As used in this paper, "outbreak" denotes a mass appearance of the gypsy moth, as reported in the literature, which causes widespread defoliation. "Presence" denotes an endemic population for which no record of a mass appearance was found. "Distribution" and "range" imply the geographic area occupied by the gypsy moth. Within this area, moth populations may or may not periodically reach outbreak proportions.

The generalized classification map (Fig. 4) was configured using the following conventions:

- –When a zone, either outbreak or presence, constituted "contiguous points" $<5^\circ$ from each other, $.5^\circ$ was added to the outer bounds, and points were connected by smoothing.
- –When a continental boundary lay $\leq 2^\circ$ from a contour line plotted by the $.5^\circ$ criterion (as above), the zone was extended to that boundary (e.g., eastern England; northwestern France).
- –When an "odd" point fell within a zone (e.g., a presence point in an otherwise outbreak zone), it was simply included in that zone if surrounded by the predominant points by $\leq 3^\circ$ (e.g., presence point in western Portugal).
- –When an outbreak and a presence zone were within 2° of each other, the contour was drawn at the midpoint.
- –When the zones were defined by points $>2^\circ<5^\circ$ apart, the outbreak zone took the $.5^\circ$ criterion and the presence zone was extended to the outbreak contour.

- When at least 5° separated any 2 clusters of points of the same type, the corresponding zone was broken according to the first criterion, and the points were considered nonconterminous.
- When a known point fell $\geq 5°$ from any other point, it was plotted according to type and location, but was not included within a contoured zone.
- Major bodies of water were excluded from the zones; however, no attempt was made to exclude montane or desert areas if the general region met the above criteria, even though altitude or absence of hosts might preclude gypsy moth populations.

RESULTS

General Distribution According to Schedl

As far as could be determined, the first generalized map showing Eurasian distribution was published by Schedl in 1936. His records were assembled from both museum specimens and literature sources, and his paper documented numerous presence and outbreak locations. Distribution was shown to cover most of Europe north to 58°N, and south to the northwestern coast of Africa. In eastern Asia, the northern range extended to 52°N, and south to 20°N (Fig. 1A).

General Distribution According to the Commonwealth Institute of Entomology

The most recent transcontinental distribution map available was published 25 years ago (Anon. 1953) (Fig. 1B). Except for England which was not included, the northern range boundary almost everywhere exceeded that of Schedl, while the southern boundary in northern Africa was similar. Eastwards, the limit penetrated further south at most locations. The Commonwealth Institute employed the following criteria for contouring: (1) A broken line was used where the limit was not known. (2) When an area in which the pest was believed absent was surrounded by territories known to be infested, the former area was entirely shaded. Hence, the Gobi desert region was included in the distributional area, but the large arid area in Asia north and east of the Caspian Sea was left blank.

Classified Distribution According to Kozhanchikov

In his book on the tussock moths, Kozhanchikov (1950) considered the distribution of gypsy moths in the Old World. His map (Fig. 2A) indicated presence from Portugal in the west, conterminously to the main Japanese islands in the east. In Europe and North Africa, presence was between 32-61° north latitude; in the Far East, distribution lay between 24° and 56°N. Four outbreak regions were distinguishable within the larger distribution area:

(1) an area in northern Africa above the Atlas mountains; (2) the largest area, covering most of Europe, where the gypsy moth was characterized by population densities and outbreak frequencies greater than in the other regions; (3) an elliptically shaped area in central Asia, including portions of the Tien Shan, Altai, and Sayan Mountain ranges; and, (4) a region in the Far East bordering the Sea of Japan.

Classified USSR Distribution According to Kelus

Although national in scope, the work of Kelus (1941) covered such a large fraction of the gypsy moth range in Europe and Asia that it merited inclusion for comparison with the cross-continental studies. The USSR range shown by Kelus included all shaded areas in Fig. 2B and conformed, in general, with the outer boundaries depicted by Kozhanchikov (1950) within the USSR, though not so far north. Between these outer limits, Kelus showed the range protruding farther south into the semi-arid Siberian lowland area between 60° and 85°E longitude. In European USSR, the northern boundary of the gypsy moth was associated ". . .in its entirety with the area of the oak and does not go beyond the limits of this area" (Kelus 1941). In the Urals and western Siberia, the northern boundary coincided with the northern range of the lime tree (we assume *Tilia cordata* Mill.); in the Far East, the northern limit followed maple.

Kelus separated his distribution information into 3 classifications: presence, outbreak, and possible outbreak. The area identified as outbreak (Fig. 2B) was the zone where mass increases appeared at 8-12 year intervals. In this zone, there was "persistent damage done by the gypsy moth" and its boundaries coincided with the "area occupied by oak." It comprised a large fraction of the European part of the USSR, including the Crimean peninsula. This zone encompassed the entire forest steppe, the region of broadleaved forests, and, to a certain extent, the coniferous-broadleaved forest area.

The "possible outbreak" areas were demarcated as potential zones of increase. Although Kelus established these 7 areas largely according to climatic and vegetative criteria, he did document outbreaks within each area, except the most eastern. Outbreaks in these potential zones tended to be less frequent and occurred in fewer locations.

A Modern Synthesis of Classified Eurasian Distribution

Locations of gypsy moth presence and sites of historic outbreaks (Fig. 3) were documented from a wide variety of world literature and personal communications (Table 1). Besides Schedl (1936), Kozhanchikov (1950), and the Commonwealth Institute (Anon. 1953) whose maps and articles were used extensively, several other authors provided considerable international data: Burgess and Crossman (1929), Forbush and Fernald (1896), and Goldschmidt

Fig. 1A – Eurasian gypsy moth distribution (redrafted from Schedl 1936).

Fig. 1B – Eurasian gypsy moth distribution (redrafted from the Commonwealth Institute of Entomology (Anon. 1953)).

(1934). The frequency of these names in Table 1 is not necessarily a reflection of their contributions, since any outbreak/presence location may have been reported by more than one source. In such cases, the most recent publication was listed in the table. Although the density of points in some countries could have been multiplied greatly (e.g., Yugoslavia), presence or outbreak as a classification was minimally satisfied when an outbreak site (or presence, as a last resort) was determined for a county, province, or similar intra-national division.

Zones of outbreak or presence were established using clusters of points joined according to the criteria given in the methods section. The resulting map (Fig. 4) shows the major areas the gypsy moth is known to inhabit, and those regions where outbreaks have been recorded. While there is good conformance of upper and lower bounds with previously published accounts, the new map is much more constrained internally due to the more rigorous criteria applied to zoning.

The northern limit at Leningrad (60°N 30°E) decreases eastwardly until, at 130°E, the northern range has dropped to 50°. Though more irregular, the southern limit also has a southerly trend toward the east. In Europe and North Africa the lower boundary is 30-32°N, while in the Far East (110°E) the gypsy moth is found down to 20°N.

Two large zones of outbreak occur west of 50°E. The first encompasses Europe and the Mediterranean, including most adjacent mainland areas and all major islands except Cyprus. The second covers eastern Europe and western Asia. Most of the area classified as outbreak is found between 0-50°E longitude and 40-55°N latitude. Though other disjunct outbreak zones appear throughout the range, it is this primary zone in western Eurasia where outbreaks are the most frequent and widespread. Because of the remoteness of the territory to the east of the 50th meridian, outbreaks are less likely to be reported than in Europe. Smaller secondary outbreak areas are also discernible: (a) the Tien Shan area south and southwest of Lake Balkhash; (b) the Altai-Western Sayan region north of 50°N; (c) an area surrounding western Lake Baikal; and, (d) several areas adjacent to the Sea of Japan.

The range boundaries in the upper regions of the Baltic and North Seas are open to question, largely because historical records are not clear whether the moth was a periodic immigrant or an established forest pest. While Kozhanchikov (1950) showed gypsy moth presence in Finland, neither of the generalized maps (Figs. 1A, 1B) collaborated his information. In 1958, 9 male moths were trapped in southern Finland, but Mikkola (1971) determined that all were migrants originating most probably from the Ryazan area of the USSR (about 200-300km southeast of Moscow). Similarly, the only record of a gypsy moth in Denmark between 1960-1970 was a male adult interpreted by Kaaber and Nordgaard (1970) to be a migrant.

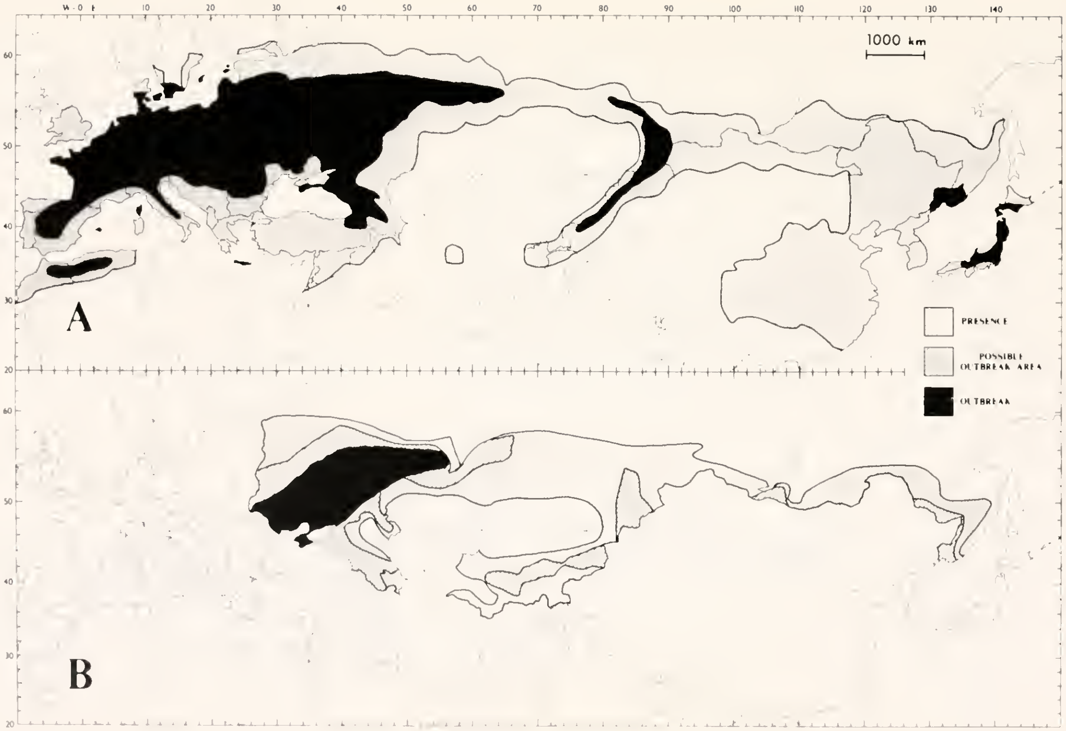

Fig. 2A – Classified Eurasian gypsy moth distribution (redrafted from Kozhanchikov 1950).

Fig. 2B – Classified USSR gypsy moth distribution (redrafted from Kelus 1941).

The distribution situation in England remains tenuous. While the gypsy moth was once found in Cambridgeshire, Huntingdonshire, and Buckinghamshire Counties, Kirby (1897) stated "It is now considered to be almost, if not quite, extinct as a British insect. . . ." Conveying information from the Natural Environment Research Council (Anon. 1975), a recent report noted the "apparently complete disappearance of the gypsy moth from the British Isles." Yet, Taylor[3] has provided presence records for 6 counties since 1961, plus the Scilly and Channel Islands.

In terms of the UNESCO classification of world ecosystems (Reichle 1973), primary gypsy moth distribution is found within the closed forest and open woodland, and to a lesser extent in the shrub regions. Within these larger classifications, distribution is confined chiefly to the following formations: cold deciduous forest, southern mixed forest, cool mixed forests and woodlands, and the southern boreal; lesser areas are found in dry woodlands and grasslands. Climatically, the area of distribution is represented mainly in the humid meso- and micro-thermal regions, but also, to some extent, in the dry steppe. Almost the entire range of gypsy moth distribution lies in areas receiving greater than 10 cm of annual precipitation; outbreak areas are typified by an annual precipitation of 25-100 cm. The intervals 15 to 27°C and -18 to 12°C, for the July and January average isotherms, respectively, coincide with most of the presence areas; however, outbreaks are usually confined to the intervals 15 to 23°C and -18 to 5°C for those months.

For visual purposes, broken lines are used to connect disjunct zones in Fig. 4. Although these must be regarded as unknown limits, they are roughly equivalent to the perimeters shown in Figs. 1 and 2.

Comparisons Between Modern and Historic Maps

Schedl's map (Fig. 1A) is in general agreement with the new map except that the latter exhibits areas beyond Schedl's northern boundary at longitudes 30° and 110°E. Elsewhere, the new range is normally included within that shown by Schedl. The Commonwealth Institute of Entomology map (Fig. 1B) is much more expansive than the new one, although good general conformance is seen at the frontiers. In both the Schedl and Commonwealth maps, Turkey is included in the gypsy moth's range, a phenomen we could document only in part. Likewise, a large, roughly rectangular trough on the new map–from 44°N to the Gulf of Finland, and varying longitudinally from 23° to 28°E–could not be confirmed.

On Kozhanchikov's map (Fig. 2A), the trough mentioned above was classified as outbreak area. The area adjacent to 34°E (between 52-58°N), also outbreak in Fig. 2A, could only be documented as presence on the current map. Reasonable coincidence is seen between the new map's boundaries and Kozhanchikov's, though between 30-60°E his northern limit

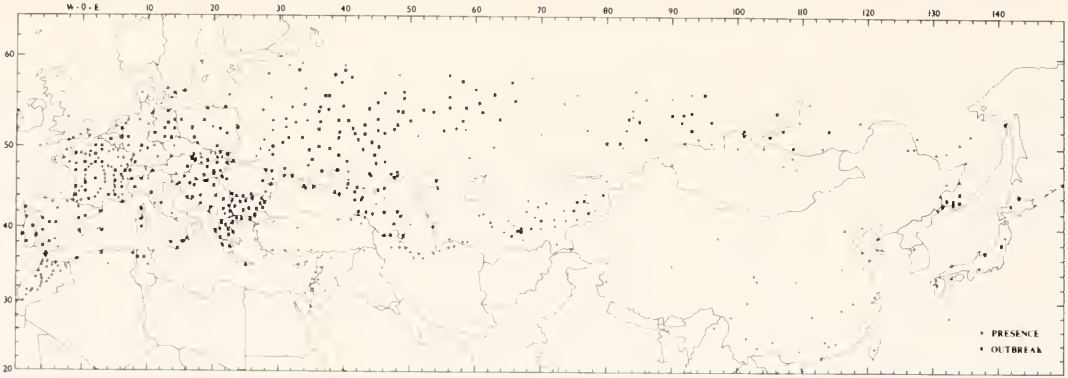

Fig. 3 – Sites of gypsy moth outbreak or recorded presence in Eurasia.

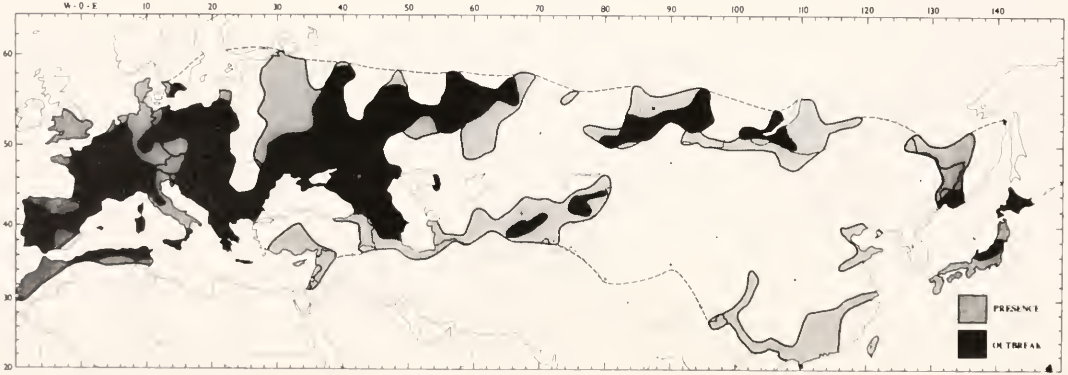

Fig. 4 – Zoned classification of Eurasian gypsy moth distribution (broken lines indicate unkown geographic limits). Individual points are presence (+) or outbreak (*) sites which did not fall within contoured zones.

goes to 63°N–4° higher than the modern map. Between the north and south boundaries, Kozhanchikov's distribution throughout Asia is more pervasive. A rather extensive elliptically shaped region which he classified as outbreak (between 40-55°N and 75-90°E) could not be confirmed on the modern map, except for a small area of agreement in the northwestern section. In other areas, the new map shows a larger outbreak zone in Portugal, and includes more Mediterranean Islands in the outbreak classification.

In the USSR (Fig. 2B), Kelus' range is generally more extensive than shown in the new map. Each area proposed as outbreak in the modern map coincides at least in part with areas he classifies as outbreak or possible outbreak.

Because of tighter constraints in constructing zones, the new map is generally more conservative than previous cartographic attempts. It is felt that incorporation of more recent information, along with more conservative classifications of zones, provides a more realistic basis for drawing biological inferences from geographic information. It would be helpful, of course, if results of gypsy moth research around the world were available from, or at least noted by, some central source. There are several areas, e.g., extreme western USSR (Estonia, Latvia, etc.), for which no gypsy moth information could be found. Considering the seriousness of this pest in nearby areas of Europe, it seems unlikely that knowledge through surveys or research is nonexistent, particularly when 3 of the 4 historic maps indicate the moth's presence. Yet, extensive literature searches and personal inquiries have yielded no information. It is hoped, however, that in spite of these limitations, the modern map may serve to aid and enlighten, in particular, those researchers seeking resolutions to the problems of gypsy moth range expansion in North America as well as those exploring for exotic natural enemies of this pest in the Old World.

Table 1. Sources of presence and outbreak data in Fig. 3.

EUROPE (excluding U.S.S.R.)

Austria
- Fuester et al., 1975
- Howard, 1905
- Howard & Fiske, 1911
- Pschorn-Walcher[4], 1978
- Ripper, 1933

Belgium
- Howard & Fiske, 1911
- Schedl, 1936

Bulgaria
- Chorbadzhiev, 1928
- Frydrychewicz, 1928
- Keremidchiev, 1972
- Mishin & Semevskii, 1971

Czechoslovakia
- Dominguez Garcia-Tejero, 1943
- Heskova, 1973
- Hochmut et al., 1974
- Hruby, 1964
- Schedl, 1936

Denmark
- Boas, 1923

EUROPE (excluding U.S.S.R.)–cont.

England
- Taylor[3], 1978

Finland
- Kozhanchikov, 1950

France
- Anon., 1953
- Brascassat, 1927
- Cadey, 1916
- Cointat, 1948
- Forbush & Fernald, 1896
- Grison, 1973
- Herard[8], 1978
- Howard & Fiske, 1911
- Schedl, 1936

Germany
- Cadey, 1916
- Forbush & Fernald, 1896
- Fuester et al., 1975
- Goldschmidt, 1934
- Howard & Fiske, 1911
- Mishin & Semevskii, 1971
- Schedl, 1936
- Schneider et al., 1974
- Skatulla[5], 1978

Greece
- Georgevits[6], 1978
- Isaakides, 1935
- Kailidis, 1962

Hungary
- Burgess & Crossman, 1929
- Frydrychewicz, 1928
- Hadzistevic & Hadzihalilovic, 1959
- Howard & Fiske, 1911
- Kiss et al., 1965
- Mishin & Semevskii, 1971
- Schedl, 1936

Italy
- Burgess & Crossman, 1929
- Goldschmidt, 1934
- Howard, 1905
- Howard & Fiske, 1911
- Mishin & Semevskii, 1971
- Muesebeck & Parker, 1933
- Nizi & Prosperi, 1973
- Prota, 1974
- Zwölfer, 1972

Netherlands
- Forbush & Fernald, 1896
- Howard & Fiske, 1911

Poland
- Forbush & Fernald, 1896
- Frydrychewicz, 1928
- Herard[8], 1978
- Karg, 1970
- Nunberg, 1925
- Schedl, 1936

Portugal
- Greathead, 1976
- Schedl, 1936
- Zerkowitz, 1946

Rumania
- Constantin, 1956
- Howard, 1905
- Howard & Fiske, 1911
- Marcu, 1970
- Pirvescu, 1964
- Simionescu et al., 1973

Spain
- Aullo, 1926
- Burgess & Crossman, 1929
- Dominguez Garcia-Tejero, 1943
- Forbush & Fernald, 1896
- Greathead, 1976
- Romanyk, 1973
- Schedl, 1936

Sweden
- Forbush & Fernald, 1896
- Lekander, 1951
- Schedl, 1936

Switzerland
- Schedl, 1936
- Zwölfer, 1972

Yugoslavia
- Frydrychewicz, 1928

EUROPE (excluding U.S.S.R.)–cont.

Georgijevic & Vaclav, 1958
Goldschmidt, 1934
Hadzistevic & Hadzihalilovic, 1959
Krnjaic, 1967
Maksimovic et al., 1970
Mishin & Semevskii, 1971
Pschorn-Walcher[7], 1978
Schedl, 1936
Vasic & Jankovic, 1959
Vasiljevic, 1959

ASIA (excluding U.S.S.R.)

Afghanistan
Anon., 1953

Burma
Schedl, 1936

China
Anon., 1953
Forbush & Fernald, 1896
Goldschmidt, 1934
Kozhanchikov, 1950
Schedl, 1936

Cyprus
Anon., 1953
Schedl, 1936

India
Anon., 1953

Iran
Adeli & Soleimani, 1976
Anon, 1957
Herard[8], 1978
Kozhanchikov, 1950
Schedl, 1936

Iraq
Anon., 1953

Israel
Anon., 1953
Schedl, 1936

Japan
Goldschmidt, 1934
Masaki, 1956
Zwölfer, 1972

Korea
Goldschmidt, 1934
Kozhanchikov, 1950

Lebanon
Kozhanchikov, 1950
Talhouk, 1950

Mongolia
Kozhanchikov, 1950
Schedl, 1936

Syria
Schedl, 1936

Taiwan
Anon., 1953

Tibet
Anon., 1953
Schedl, 1936

Turkey
Anon., 1953
Kozhanchikov, 1950

U.S.S.R.

Abdullaev, 1970
Benkevich, 1961a
Benkevich, 1961b
Benkevich, 1962
Bey-Biyenko, 1924
Burgess & Crossman, 1929
Edel'man, 1956
Forbush & Fernald, 1896
Frydrychewicz, 1928
Goldschmidt, 1934
Howard & Fiske, 1911
Kelus, 1941
Kondakov, 1963
Kozhanchikov, 1950
Mikkola, 1971
Mishin & Semevskii, 1971
Pantyukhov, 1962
Ryvkin, 1957

U.S.S.R.–cont.

Schedl, 1936
Vorontsov, 1968

AFRICA

Algeria
Burgess & Crossman, 1929
Kozhanchikov, 1950
Schedl, 1936

Morocco
Burgess & Crossman, 1929
Herard[8], 1978
Kozhanchikov, 1950
Mishin & Semevskii, 1971
Schedl, 1936

Tunisia
Rabasse & Babault, 1975
Schedl, 1936

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[3] Personal communication from L.R., Taylor, Rothamsted Experimental Station, Harpenden, Herts., England, May 17, 1978.

[4] Personal communication from H. Pschorn-Walcher, Commonwealth Institute of Biological Control, Delemont, Switzerland, June 30, 1978.

[5] Personal communication from U. Skatulla, Lehrstuhl für Angewandte Zoologie, Der Ludwig-Maximilians-Universitat, Munich, West Germany, July 27, 1978.

[6] Personal communication from R.P. Georgevits, Forest Research Institute, Athens, Greece, May 31, 1978.

[7] Personal communication from H. Pschorn-Walcher, Commonwealth Institute of Biological Control, Delemont Switzerland, Feb. 28, 1978.

[8] Personal communication from F. Herard, U.S.D.A., European Parasite Laboratory, Sevres, France, Nov. 17, 1978.

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BLACKLIGHT TRAP COLLECTING OF PARASITIC HYMENOPTERA[1],[2]

Paul P. Burbutis[3], James A. Stewart[4]

ABSTRACT: Many species and large numbers of parasitic Hymenoptera were captured in a 15-watt, standard insect survey blacklight trap. It appears that routine trapping of these parasitoids by this method can be used to determine species composition, and their relative abundance and seasonal distribution. This common survey technique, in widespread use for pest species, may hold considerable promise for biological control specialists and in integrated pest management programs.

Radiant energy in the form of blacklight (ultraviolet = 320 - 280 nanometers) is used extensively for insect detection, routine survey and pest management programs. The usefulness of blacklight traps in integrated pest management (IPM), especially for determining the seasonal distribution and abundance of economic species, is widely recognized. Much of the information on insect light trapping is consolidated and treated in depth by Hienton (1974) however no attention is given to the beneficial insects which are strongly attracted to these same sources.

Tests by Weiss et al. (1941, 1942, 1943) show that parasitic Hymenoptera are very specific in their response to blacklight. Frost (1964, 1966, 1969) trapped insects during the winters of 1958 - 1963 in Florida and he lists ca. 80 species of parasitic Hymenoptera collected in this manner. A few other reports either cite unusual collections or the occasional capture of a large-size species of Ichneumonidae. From ca. 900 papers dealing with light trapping of insects less than 30 mention parasitic Hymenoptera as being captured in light traps. In most cases the lack of reference to parasitoids does not mean these forms are absent in trap collections but most likely that they are disregarded or overlooked because of their small size.

The results of preliminary studies in 1968 and 1969, at the USDA Beneficial Insects Laboratory in Moorestown, N.J., suggested that blacklight trapping may provide a mechanism for determining seasonal distribution and relative abundance of parasitoids. Such data could be very useful in biological

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[3] Professor, Univ. of Del., Newark.

[4] Formerly Biologist, USDA, ARS, Moorestown, N.J.

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control especially in evaluating host-parasitoid spacial and temporal relationships and in parasitoid release programs where synchronization with the host is critical. This paper reports on those species of parasitic Hymenoptera captured in 1970 in a standard survey blacklight trap, and presents information on the possible use and importance of this attraction.

Methods and Equipment - A standard 15-watt insect survey trap (Harding et al. 1966) was operated nightly at Moorestown, NJ from April 10 to November 24, 1970. The trap was operated from 1/2 hour after sunset to 8:00 A.M. Specimens captured were either determined daily or frozen until such time as determinations were possible. Preserved specimens are in the reference collection of the Department of Entomology and Applied Ecology, University of Delaware or in the USDA Systematic Entomology Laboratory at the U.S. Museum of Natural History.

Results - A total of 2,931 parasitic hymenoptera were captured and classified into 81 taxa representing 19 families. Many specimens were determined only to higher taxa because the systematic knowledge of the group is incomplete. Several species are recognized as new and further study of those forms determined only to higher taxa will very likely lead to the recognition of other new species.

The following are the parasitic Hymenoptera and the numbers captured:

Braconidae: *Meteorus levinentris* (Wesmael) 166, *M. communis* (Cresson) 51, *M. hyphantriae* Riley 31, *(M. versicolor* (Wesmael) 10, *M. dimidiatus* (Cresson) 9, *M. loxostegei* Viereck 1, *M. tauricornis* (Provancher) 3, *M. trachynotus* Viereck 2, *Streblocera* n. sp. 42, *Microctonus* n. sp. 3, *Leiophron* sp. 1, *Macrocentrus grandii* Goidanich 218, *M. crambivorus* Viereck 970, *M. delicatus* Cresson 17, *M. cerasivorianae* Viereck 2, *M. amicroploides* Viereck 2, *M. ancylivorus* Rohwer 1, *M. aegeriae* Rohwer 1, *Taphaeus* sp. 1, *Zele* n. sp. 9, *Neoblacus* n. sp. 2, *Blacus bissigmatus* (Say) 467, *B.* 5 spp. 26, *Hysterobolus* n. sp. 6, *Centistes* n. sp. 16, *Eubadizon extensor* (L) 9, *E.* 2 spp. 15, *Triaspis* sp. 3, *Aliolus* spp. 7, *Adelius fasciipennis* (Rohwer) 1, *A.* n. sp. 1, *Apanteles* spp. 65, *Microgaster* spp. 5, *microplitis* sp. 1, *Phanerotoma* spp. 27, *Ascogaster* sp. 1, *Aphaereta* sp. 6, *Pseumosema* sp. 2, *Mesocrina* sp. 1, *Asobara* sp. 1, *Opius* spp. 3, *Bracon* spp. 9, *Rogas terminalis* (Cresson) 11, *R.* 4 spp. 35, *Clinocentrus* sp. 1, *Colastes* sp. 1, *Pelecystoma* sp. 1, *Hormius* sp. 5, *Doryctes* sp. 1, *Heterospilus* 1.

Aphidiidae: *Aphidius* spp. 5.

Ichneumonidae: *Ophion bilineatus* Say (Complex) 189, *Encospilus purgatus* (Say) 42, *Netelia* 3 spp. 33, *Temelucha* spp. 43, *Pristomerus* spp. 3, *Coccygominus* sp. 3, *Gelini* 4 spp. 88, *Mesochorus* spp. 40, unidentified Ichneumonidae 105.

Mymaridae 1, Eulophidae 4, Encyrtidae 2, Torymidae 3, Pteromalidae 10, Eurytomidae 1, Figitidae 2, Cynipidae 10, Proctotrupidae 14, Ceraphronidae 2, Diapriidae 9, Scelionidae 3, Platygasteridae 1, Bethylidae 5, Dryinidae 19, Tiphidae 1.

The data indicate that blacklight traps are useful for determining the relative abundance and seasonal distribution of parasitoids. Many of the species collected showed clear population (= flight) peaks and number of generations (Figures 1, 2 and 3). Figures 4, 5 and 6 illustrate the seasonal relationships between several parasitoids and their hosts.

Macrocentrus crambivorous Viereck (Fig. 4), the most abundant parasitoid captured, does not appear to correlate well with its hosts *Crambus* spp. except late in the season. Figure 5 depicts the relationship between *Macrocentrus grandii* Goidanich and one of its main hosts the European corn borer, *Ostrinia nubilalis* (Hubner). These flight data indicate a relationship between the two species, viz. adult parasitoids are most numerous following the peak adult flights of its host. In Figure 6 the armyworm, *Pseudaletia unipuncta* (Haworth), is represented by 3 peak flights and *Meteorus communis* (Cresson) corresponds very well to the first and third host peak but is almost absent in relation to the second one. *Rogas terminalis* (Cresson), another parasite of *P. unipuncta*, appears with each flight peak but at low levels.

Discussion and Conclusions - The results of this study show that many parasitic Hymenoptera can be collected in the standard blacklight insect survey trap and that such trapping can also be useful for determining their relative abundance and seasonal distributions. Blacklight trapping holds considerable promise for the specialist in biological control. For those parasitoids attracted to blacklight, a commonly used, quantitative method is available for determining the synchronization of parasitic species with their hosts. Also, a technique that measures adult parasitoids could be valuable for evaluating their impact as mortality agents.

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The authors wish to thank Dr. P.M. Marsh and Dr. R.W. Carlson, USDA Systematic Entomology Lab., for their help in identifying some parasitic Hymenoptera.

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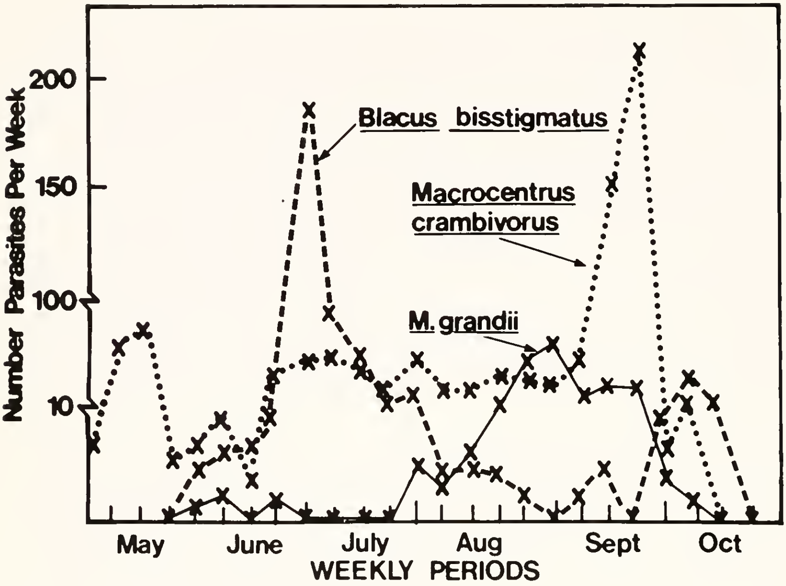

Fig. 1. Seasonal distribution and abundance of *Blacus bisstigmatus, Macrocentrus crambivorus* and *M. grandii*.

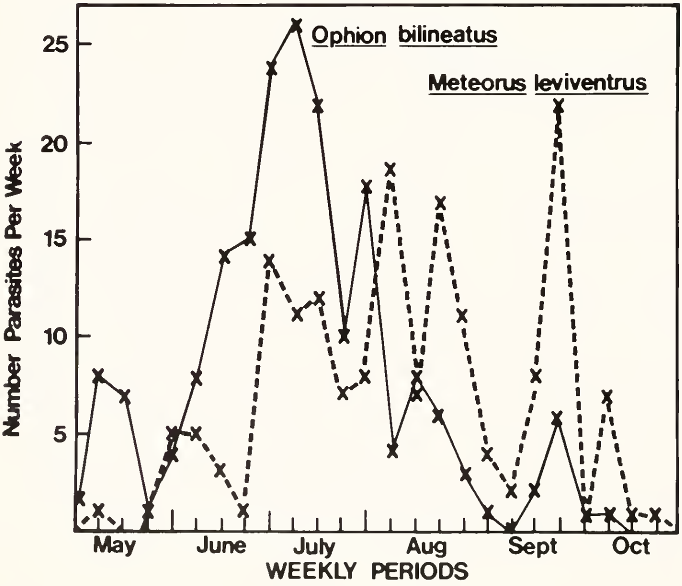

Fig. 2. Seasonal distribution and abundance of *Ophion billineatus* and *Meteorus leviventrus*.

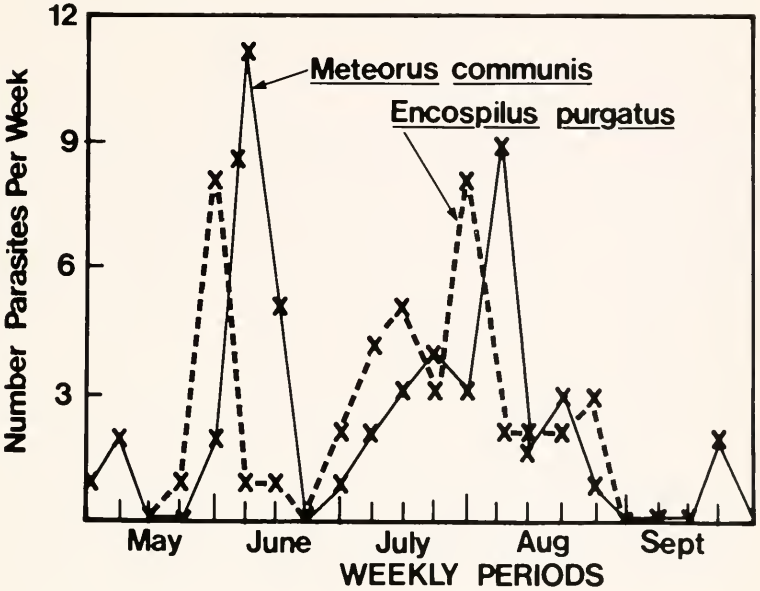

Fig. 3. Seasonal distribution and abundance of *Meteorus communis* and *Encospilus purgatus*.

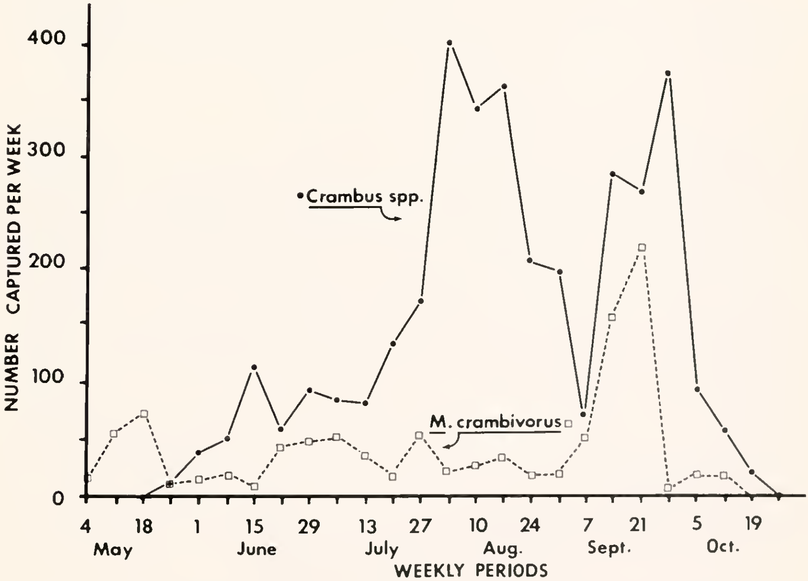

Fig. 4. Seasonal distribution and abundance of *Crambus* spp. and the parasitoid *Macrocentrus crambivorus*.

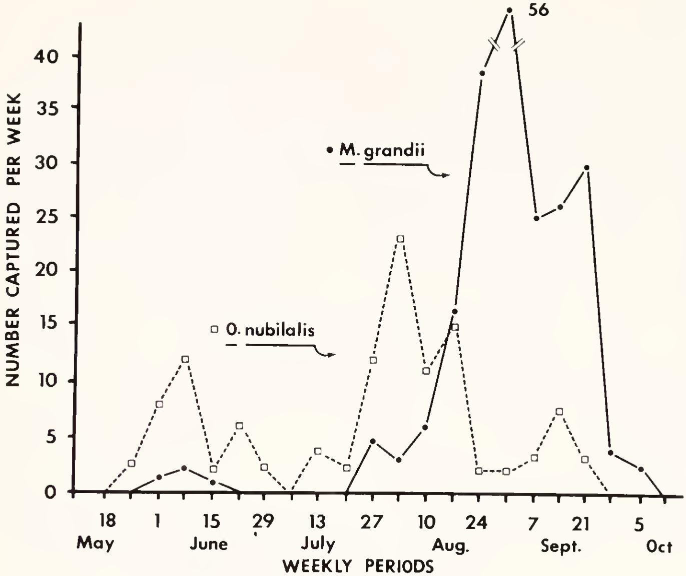

Fig. 5. Seasonal distribution and abundance of *Ostrinia nubilalis* and its parasitoid *Macrocentrus grandii*.

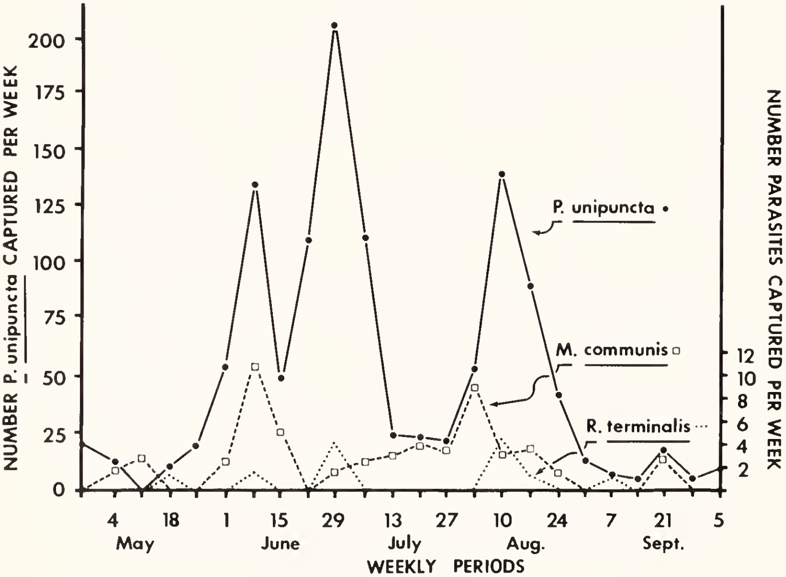

Fig. 6. Seasonal distribution and abundance of *Pseudaletia unipuncta* and its parasitoids *Meteorus communis* and *Rogas terminalis*.

MALLOPHAGA OF WILD MAMMALS OF INDIANA[1]

John O. Whitaker, Jr., Rebecca J. Goff[2]

ABSTRACT: Biting lice, Mallophaga, on wild mammals of Indiana were found as follows: *Geomydoecus illinoiensis* on *Geomys bursarius, Suricatoecus quadraticeps* on *Urocyon cinereoargenteus, Trichodectes octomaculatus* on *Procyon lotor, Stachiella kingi* on *Mustela nivalis, S. larseni* on *Mustela vison, Neotrichodectes minutus* on *Mustela frenata, Neotrichodectes interruptofasciatus* on *Taxidea taxus, Neotrichodectes mephitidis* on *Mephitis mephitis,* and *Tricholipeurus parallelus* and *T. lipeuroides* on *Odocoileus virginiana*. Not found to date were *Suricatoecus vulpis* (which could be synonymous with *S. quadraticeps*) from *Vulpes vulpes, Heterodoxus spiniger* and *Trichodectes canis* from *Canis latrans*, and *Felicola felis* from *Lynx rufus*.

There are very few reports of biting lice, Mallophaga, from wild mammals of Indiana, although biting lice are very host specific and thus one is able to predict quite accurately the species one would expect to find. We know of only three previous reports of Mallophaga on Indiana mammals. Tuszynski and Whitaker (1972) and Malecki (unpublished thesis) reported *Geomydoecus geomydis* (Osborn, 1891) from the Pocket gopher, *Geomys bursarius*. However, this louse has now been reidentified as *G. illinoiensis* Price and Emerson, 1971. Wilson (1957) reported *Trichodectes mephitidis* on *Mephitis mephitis* from Wayne County, Indiana.

During studies on the mammals of Indiana (Mumford and Whitaker, in preparation), a large number of most of the species of wild mammals of Indiana have been examined for ectoparasites.

The purpose of the present paper is to report on the biting lice, Mallophaga, found during these studies.

MATERIALS AND METHODS

Mammals for these studies have been captured in various ways. Some have been shot or trapped, road kills have been extensively examined, while other animals have been donated to us from citizens of Indiana. Animals for study were generally placed in plastic bags as soon as possible after capture, and often were frozen until they could be examined.

Mainly we have used direct observation of mammals, using dissecting needles to probe while viewing the fur and skin of the mammals under 10 to 70 power of a dissecting microscope. Our second major method was by wash-

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[1] Received October 18, 1978.

[2] Department of Life Sciences, Indiana State University, Terre Haute, Indiana 47809.

ing mammals in a detergent solution, and a few mammals were processed by dissolving techniques.

Mallophagans were identified by the senior author and a few representative specimens were sent to Dr. K.C. Emerson (2704 North Kensington Street, Arlington, VA 22207) for verification. Without his help this study would not have been possible.

RESULTS

For this report only those animals harboring biting lice, or for which the species regularly harbors biting lice, are included (Table 1). A total of nine species of mammals were found to harbor biting lice, each having one species of louse, except the White-tailed deer, which harbored two.

Thus a total of 10 species of biting lice were found on wild mammalian hosts in Indiana. Of these, the pocket gopher was a rodent, and the deer was an artiodactyl. The rest were in the order Carnivora. No bobcats, *Lynx rufus*, were examined. Only two species, the red fox, *Vulpes vulpes* (14 examined), and the Coyote (4 examined), did not harbor mallophagans, of the mammals examined from the order Carnivora. Mallophagans would be expected on both of these species if enough individuals were examined, *Heterodoxus spiniger* (Enderlein) and *Trichodectes canis* (deGeer) on the coyote, *Felicolor felis* (Werneck) on the bobcat. *Suricatoecus vulpis* (Denny, 1842) would be expected on *Vulpes*, although there is a question as to whether the species on *Vulpes vulpes* in North America might be *S. quadraticeps* of *Urocyon* (Emerson, 1972). All other carnivores known to exist at present in Indiana harbored biting lice.

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Table 1. Mallophaga from wild mammals of Indiana.

	Number of lice		Hosts with parasite	
	Total	Average	Number	Percent
Hosts and Parasites				
Geomys bursarius. Pocket Gopher (85 examined)				
Geomydoecus illinoiensis Price and Emerson 1971	1817	21.4	85	100.0
Canis latrans. Coyote (4 examined, no lice found)				
Vulpes vulpes. Red fox (14 examined, no lice found)				
Urocyon cinereoargenteus. Gray fox (42 examined)				
Suricatoecus quadraticeps (Chapman, 1897)	167	4.0	10	23.8
Procyon lotor. Raccoon (54 examined)				
Trichodectes octomaculatus Paine, 1912	1609	29.8	29	53.7
Mustela nivalis. Least Weasel (8 examined)				
Stachiella kingi (McGregor, 1817)	466	58.3	4	50.0
Mustela vison. Mink (9 examined)				
Stachiella larseni Emerson, 1962	49	5.4	4	44.4
Mustela frenata. Long-tailed weasel (15 examined)				
Neotrichodectes minutus (Paine, 1912)	18	2.0	4	26.7
Taxidea taxus. Badger				
Neotrichodectes interrupto-fasciatus (Kellogg and Ferris, 1915)	4	0.6	2	28.6
Mephitis mephitis. Striped skunk (10 examined)				
Neotrichodectes mephitidis (Packard, 1972)	3335	333.5	7	70.0
Lynx rufus (none examined)				
Odocoileus virginiana. White-tailed deer (3 examined)				
Tricholipeurus parallelus Osborne, 1896)	39	13.0	3	100.0
T. lipeuroides (Megnin, 1884)	2	0.7	1	33.3

THE MALE OF *BAETIS MACDUNNOUGHI* IDE AND NOTES ON PARTHENOGENETIC POPULATIONS WITHIN *BAETIS* (EPHEMEROPTERA:BAETIDAE)[1, 2]

W.P. McCafferty[3], D.K. Morihara[4]

ABSTRACT: The discovery of males of *Baetis macdunnoughi* Ide in Indiana and Illinois indicates that the species is parthenogenetic only in northern populations. Somewhat similar reproductive phenomena involving other North American *Baetis* species suggest that obligatory, thelytokous parthenogenesis is an adaptation to relatively colder environments. The male imago of *B. macdunnoughi* is described for the first time and is similar to *Baetis pygmaeus* (Hagen).

Baetis macdunnoughi Ide has previously been known only from females (Ide, 1937). Suspected thelytokous parthenogenesis was confirmed for Wisconsin populations in laboratory experiments by Bergman and Hilsenhoff (1978). We have recently examined males of *B. macdunnoughi* from southern Indiana and southern Illinois. Of 55 larvae, 22 were males. One adult male was reared and is described below.

Parthenogenesis in this species therefore may be apparently completely developed only in Canadian and Wisconsin populations. Populations in Illinois and Indiana (where the sex ratio appears to be approximately 1:1) are known only from southern unglaciated regions of these states. Reproductive differences between the northern and the possibly older, isolated southern populations are evidently being maintained by this geographic disjunction.

Interestingly, a similar relationship of southern, sexually reproducing populations and northeastern, completely parthenogenetic populations is present in *Baetis hageni* Eaton (Bergman and Hilsenhoff, 1978). *B. hageni* and *B. macdunnoughi* are not closely related, and the similar reproductive phenomenon may be a result of historical population adaptations to climatic or temperature regime differences between northern and southern areas.

An hypothesis that parthenogenesis in certain *Baetis* is related to cold adaptation is supported by the additional observation that *Baetis foemina* McDunnough and *Baetis hudsonicus* Ide are both known only from the

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[2] Purdue University Agricultural Experiment Station Journal No. 7287.

[3] Department of Entomology, Purdue University, West Lafayette, IN 47907

[4] Max-Planck-Institut für Limnologie, 232 Plön, Postfach 165, Germany (West)

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Canadian Tundra and are both known only as females. Also in some populations of the western *Baetis bicaudatus* Dodds, only females are known (Dodds, 1923), and a correlation with cold mountainous environments may possibly exist.

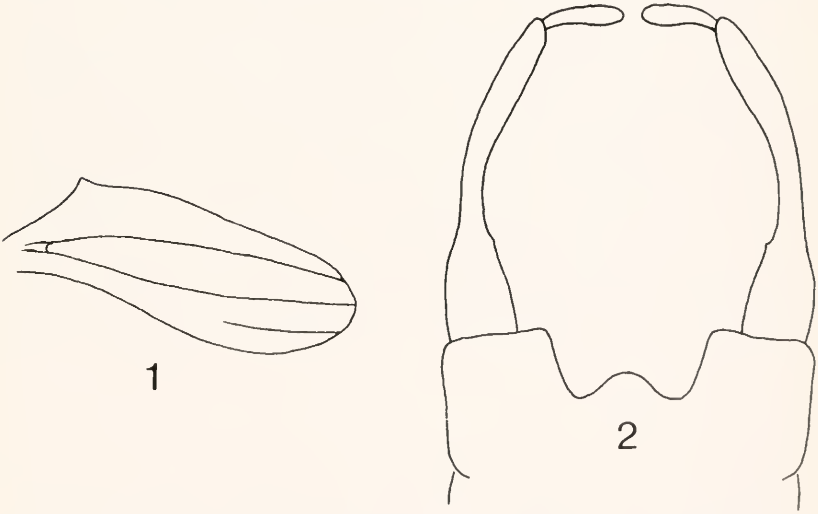
Parthenogenesis is evidently the most selectively favored form of reproduction in relatively colder, or stressed, environments for some species. Mayflies with parthenogenetic potential may therefore be capable of existing in certain environments that they would otherwise be incapable of. A selective advantage for parthenogenesis could result either when populations are too small to insure high frequencies of mate acquisition or when climatic conditions conducive to mating are highly limited or unpredictable.

Known parthenogenesis in six other *Baetis* species in North America and Europe is apparently facultative, deuterotokous, and non-geographic (Degrange, 1960; Bergman and Hilsenhoff, 1978). This type of parthenogenesis may be expected in many mayfly species (McCafferty and Huff, 1974; Huff and McCafferty, 1974).

The following description of the adult male of *B. macdunnoughi* confirms this species' close relationship with *Baetis pygmaeus* (Hagen).

Baetis macdunnoughi Ide

Adult Male – Length of body 3.5 mm, fore wing 3.8 mm, hind wing 0.7 mm. Head brown; antennal flagella paler. Thorax and coxae brown; remaining leg segments transluscent, tinted with brown; fore legs with femora and tarsi slightly shorter than tibiae.



Figs. 1 and 2. *Baetis macdunnoughi* adult male. 1. Hind wing. 2. Genitalia, ventral view.

Wings hyaline. Fore wings with marginal intercalaries absent from first interspace. Hind wings (Fig. 1) with prominent, acute costal projection; anterior margin beyond costal projection undulate; 2 longitudinal veins and 1 long intercalary. Abdominal segments 2-6 transluscent white, tinted with brown; spiracles faintly pigmented; segments 7-10 opaque, tawny brown, with terga darker than sterna; forceps white, tinted with brown; cerci white. Genitalia in ventral view (Fig. 2) with basal enlargement of forceps conical; elongate portion broad in apical 2/3; terminal segment long and slender, more than 4 times longer than wide.

Material Examined – 1 ♂ imago lab reared, IN: Perry Co., Poison Cr. approx. 5 mi. NW Derby. V-14-1976. A.V. Provonsha, M. Minno. Deposited in the Purdue University Entomological Research Collection.

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LARVAL DESCRIPTION AND HABITAT NOTES OF THE FISHFLY *NEOHERMES CONCOLOR* (DAVIS) (MEGALOPTERA: CORYDALIDAE)[1]

Donald C. Tarter[2], William D. Watkins[3], David A. Etnier[4]

ABSTRACT: Larval fishflies *(Neohermes concolor)* were collected under leaf litter near a spring seep in the Cherokee National Forest, Polk Co., Tennessee. Following a laboratory pupation period of one month, one adult male and female emerged in the rearing cage. A detailed description of the morphology of the larval stage is presented in this paper.

Three eastern genera of fishflies, *Chauliodes* Latrielle, *Nigronia* Banks and *Neohermes* Banks, are found in the subfamily Chauliodinae. Banks (1908) erected the genus *Neohermes* for some American species then placed in the genus *Chauliodes.* Based on the genitalia of eastern and western adults of *Neohermes,* Flint (1965) recognized five species in the genus: *N. filicornis* (Banks) and *N. californicus* (Walker), both from western North America; and *N. angusticollis* (Hagen), *N. matheri* Flint, and *N. concolor* (Davis) from eastern and central North America. Baker and Neunzig (1968) reared first-instar larvae of *N. concolor* from laboratory reared egg masses, but older larvae have remained unknown for the three eastern species.

Other authors, including Tarter et al. (1977), Knight and Siegfried (1977), Tarter et al. (1976a, b), Watkins et al. (1975), Tarter et al. (1975), Peterson (1974), Tarter and Watkins (1974), Cuyler (1965), Neunzig (1966), Hazard (1960) and Parfin (1952), have reported distributional, taxonomic and ecological information on fishflies in eastern North America.

Based on the adult male, *Neohermes concolor* has been recorded from 21 states in the central, northeastern and southeastern portions of the United States (Flint, 1965; Tarter et al., 1976a, b). The emergence period ranged from 21 April (Pennsylvania) to 19 August (New York) (Tarter et al., 1976b). In eastern Kentucky (Boyd County), Tarter et al. (1976a) noted that emergence occurred from 12 June to 16 July, and peaked in early July.

Chauliodes larvae can be identified by a pair of long, unequal respiratory tubes containing the spiracles of the 8th abdominal tergite. The body is without papillae, or with only a few on the posterior part of abdomen. In *Nigronia* larvae these respiratory tubes are shorter and equal in length, and

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[1] Received August 24, 1978

[2] Dept. of Biol. Sci., Marshall Univ., Huntington, WV 25701

[3] Ashland Oil Inc., Res. & Dev. Dept., Catlettsburg, KY 41129

[4] Dept. of Zool., University of Tennessee, Knoxville, TN 37916

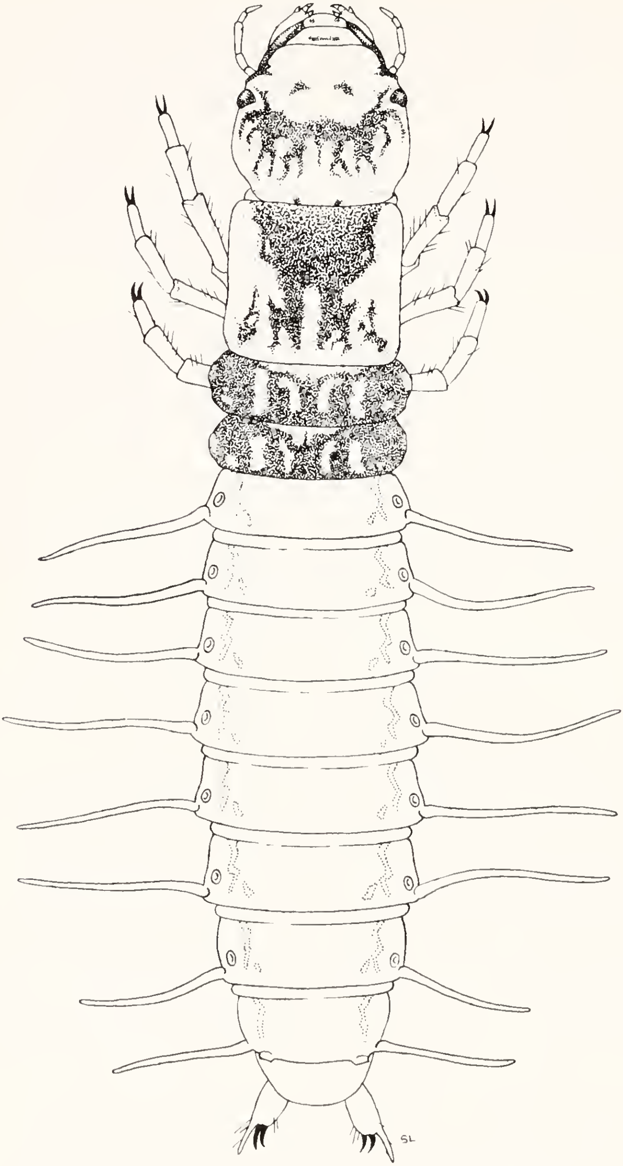

Figure 1. Larval stage of the fishfly *Neohermes concolor.*

the body is covered with papillae. *Neohermes* larvae lack respiratory tubes on the 8th abdominal tergite; the spiracles are sessile (Fig. 1).

On 16 April 1977, three larval fishflies were collected under leaf litter near a spring seep in the Cherokee National Forest, Polk Co., Tennessee, and returned to the laboratory at Marshall University. Following a pupation period of one month, one adult male and female emerged. Earlier instar larvae were collected from the same habitat.

Neohermes concolor

Chauliodes concolor Davis, 1903, Bull. N.Y. State Mus. 68:462. Specimen Described.– One mature larva (19.6 mm) (Fig. 1) collected at the Cherokee National Forest Campground, Polk Co., about 3 mi off U.S. 411 on Tennessee Route 30, under leaf litter near a spring seep 13 March 1976.

Head. – Length, 4.18 mm; Width, 3.71 mm; Labrum, length 0.33 mm and width 1.08 mm, light brown with two dark brown spots on lateral lobes of anterior margin, one long seta per dark spot and six setae on anterior border; clypeus light brown with yellowish margins; frons light brown; vertex light brown with few dark brown areas; occiput yellow with distinct brown pattern; antenna five segmented, basal segment 0.26 mm, 2nd segment 0.34 mm, 3rd segment 0.61 mm, 4th segment 0.21 mm, and 5th segment 0.26 mm; mandibles dark brown distally, asymmetrically toothed.

Thorax. – Pronotum width 3.90 mm, length 3.30 mm, yellow with dark brown pattern; mesonotum width 4.00 mm, length 1.63 mm, dark brown with two curved yellow areas medially and two straight yellow areas laterally; metanotum width 4.05 mm, length 1.38 mm, pattern similar to mesonotum; thoracic legs yellowish, numerous setae on femur, tibia, and tarsus.

Abdomen. – Length, 9.1 mm; light brown dorsally with yellowish markings near spiracles; lateral appendages yellow with a light brown coloration at the base dorsally and slightly longer than width of segment; no respiratory tubes on 8th tergite, spiracle sessile (Fig. 1).

ACKNOWLEDGEMENTS

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A PHORETIC RELATIONSHIP BETWEEN A CHIRONOMID LARVA AND AN OPERCULATE STREAM SNAIL[1, 2]

Eugene R. Mancini[3]

ABSTRACT: Approximately 8000 *Goniobasis semicarinata* (Say) [Gastropoda:Pleuroceridae] were quantitatively collected from three sampling stations in the Mosquito Creek drainage system, Harrison County, Indiana from summer 1976 through summer 1977. Each of the snails was examined for the presence of sand grain cases inhabited by *Rheotanytarsus* sp. (Diptera: Chironomidae). The percentages of mature snails used as phoretic symbionts by the chironomid larvae were as high as 56% at one sampling station during one summer season and were routinely greater than 35% at two of the three stations during all seasons. In addition, approximately 10% of these snails demonstrated multiple infestations. This is the first record of a chironomid larva using an operculate stream snail as a phoretic symbiont.

Symbiotic relationships between mollusks and insects have been reported occasionally in the literature (Steffan 1967), and those relationships have generally been restricted to pulmonate snails and dipteran larvae. The nature of the relationship between a gill-breathing operculate snail *Goniobasis semicarinata* and a chironomid larva which constructs sand grain cases on the snail's shell in the Mosquito Creek drainage system, Harrison County, Indiana was investigated from summer 1976 through summer 1977.

Snails were collected by Surber sampler using a stratified random transect sampling design at three stations within the 66-km^2 drainage area. The snails at each station represented a distinct population as defined by Mayr (1969), since they were physically isolated from one another.

The symbiotic relationship was studied on the basis of percentage occurrence within the snail populations. Each snail collected in an individual sample was examined for the presence of sand grain cases occupied by chironomid larvae.

Ninety larvae were randomly collected from snail shells during the sampling period. The head capsule from each larva was mounted in CMCP (Turtox) mounting medium and identified with a compound microscope. Of the 90 larvae obtained from the shells of *G. semicarinata*, 89 were identified as

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[2] This paper is based on a portion of the research conducted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, Department of Biology, University of Louisville, Louisville, Kentucky.

[3] Water Resources Laboratory, University of Louisville, Louisville, Kentucky 40208
Present address: Woodward-Clyde Consultants, 3489 Kurtz Street, San Diego, California 92110.

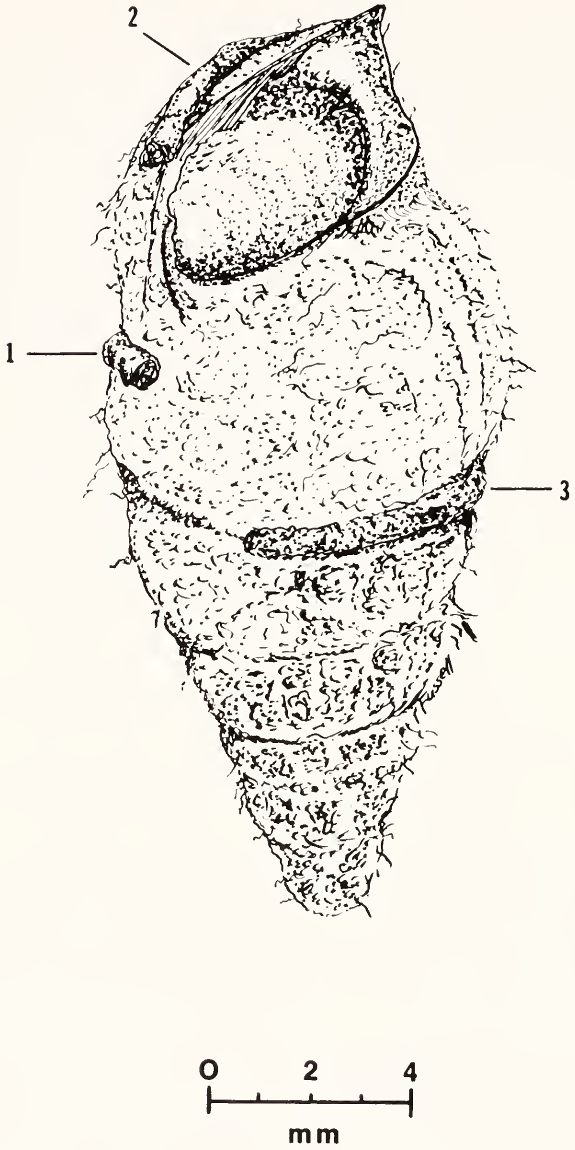

Figure 1. A mature *goniobasis semicarinata* shell with attached *Rheotanytarsus* sp. sand grain cases (from Mancini 1978).

Rheotanytarsus sp. The single exception was an unidentified coleopteran larva which was inhabiting a previously abandoned *Rheotanytarsus* sp. case.

A typical mature snail with three chironomid cases attached to the shell is illustrated in Fig. 1. The locations of the cases are not random, and the numbers 1, 2, and 3 designate the first, second, and third most common case sites occupied on a mature snail shell.

The percentages of live snails used as symbionts by the larvae are presented in Table 1. It should be pointed out that percentages of occurrence were higher for mature (greater than 1.5 years of age) snails than for immature individuals, and that multiple infestations occurred in approximately 10% of the affected snails. Indeed, one snail was found with seven inhabited *Rheotanytarsus* sp. larval cases attached to its shell.

Van Benthem-Jutting (1938) reported that larvae of *Parachironomus varus* lived and fed on *Physa fontinalis* and supported the theory with evidence of mutilated sections of the foot and mantle digitations. In addition, van Benthem-Jutting also found that the larvae had a preferred case-building site on the snail's shell along the parietal wall of the aperture near the free edge of the peristome.

In the Mosquito Creek drainage system the relationship between *G. semicarinata* and *Rheotanytarsus* sp. seems to be phoretic as I have found no

Table 1. Percentages of live, mature, and young-of-the-year (Y-O-Y) *G. semicarinata* used as phoretic symbionts by *Rheotanytarsus* sp. in the Mosquito Creek drainage, summer 1976 through summer 1977.

Population and Age Group	SEASON		
	Summer 1976	Winter 1976-1977	Summer 1977
A Mature	42.0	54.4	37.0
1975 Y-O-Y	33.3	50.0	–
1976 Y-O-Y	3.9	12.6	24.4
1977 Y-O-Y	–	–	3.8
B Mature	0	10.4	8.4
1975 Y-O-Y	12.5	0	–
1976 Y-O-Y	0.6	1.7	12.3
1977 Y-O-Y	–	–	0
C Mature	56.3	39.3	50.6
1975 Y-O-Y	47.6	–	–
1976 Y-O-Y	9.1	2.4	90.0
1977 Y-O-Y	–	–	0

evidence to suggest that the fly larva feeds on the snail. Such a relationship has not been reported previously for any aquatic operculate snail with any other insect larva or for this chironomid genus and any other snail.

Roback (1977) in reporting a phoretic relationship between a large hemipteran, *Cryphocricos peruvianus*, and a chironomid larva *Eukiefferiella* sp. suggested that these relationships may be relatively common in nature. These data from the Mosquito Creek drainage system do, indeed, demonstrate this relationship to be common, at least on a local level.

ACKNOWLEDGEMENTS

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A NEW *MAEMACTES* ATTACKING ALFALFA IN MEXICO (COLEOPTERA; CURCULIONIDAE)[1]

Charles W. O'Brien[2,3]

ABSTRACT: *Maemactes pestis*, a new species from Mexico, is known to attack alfalfa by burrowing as larvae in the crowns and roots of the host plants. The species is described and a diagnosis separating it from *ruficornis* Boheman is included, along with illustrations of the male phallus and the female spermatheca and 8th sternite of both species.

Kissinger (1963) reviewed the genus *Maemactes* and keyed the seven species then recognized as valid. As he indicated in his paper, little was known concerning their biology. His new species *punctatus* was taken from an *Andropogon* clump and *cribratus* LeConte was taken under cowchips. His new species *imitator* was intercepted in quarantine on orchid plants. I have collected large numbers of specimens of *ruficornis* Boheman under stones in mountain meadows and have beaten *perforatus* Champion from jungle edge in Panama. Because so little is known concerning this genus it is of considerable interest to report on this new species which is potentially a serious pest of alfalfa in Mexico, burrowing in the roots and crowns of the host plants.

All of the specimens of the new species herein described were collected by Dr. M.H. Schonhorst who, with others, is preparing a paper on the life history of this weevil and the economic damage to alfalfa that it causes. He collected the specimens from infested plants transplanted from field plots. He split open the roots of supposedly infested plants and those with larvae were transferred to clay pots in a greenhouse. These were covered with screen boxes and the adults which emerged months later were collected. Some larvae, pupae and teneral adults were also collected from their galleries in the roots of the alfalfa (Schonhorst, pers. comm.). I shall describe the immature stages in a future paper.

Maemactes pestis O'Brien, n. sp.

Holotype male. - Elongate oblong, sides subparallel, black to brownish black, clothed with moderately sparse, suberect, brown to blackish, fine setae.

Rostrum moderately stout, not merging evenly with head, base strongly broadly

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[1] Received September 8, 1978.

[2] Laboratory of Aquatic Entomology, P.O. Box 111, Florida A&M University, Tallahassee, FL., 32307.

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gibbous, *ca.* twice as wide at base as at apex, basal 1/3 with large, lateral, coarse, contiguous punctures, becoming smaller, sparser, and less coarse towards apex. **Head** with large, coarse, rugose punctures between eyes, on frontal area punctures large and coarse, laterally becoming smaller and separated, with narrow punctate groove above eye, vertex with smaller, finer, more separated, distinct punctures; frons depressed, not foveate, between eyes *ca.* 3/4 as wide as rostrum at narrowest point; eyes narrow, transverse, acutely oval, *ca.* 1/2 as long as wide. **Prothorax** scarcely wider than long, laterally rounded, expanded from base to before middle and there strongly narrowed to nontubulate apex, apex slightly more than 1/2 width of base; notum rather planate, punctures moderate, separated by 1/2 to about their diameter, rather evenly distributed, though with indefinite median line, surface shining, indistinctly finely reticulate; suberect setae arising from center of punctures, pleural margin with larger, denser, subcontiguous punctures; pleuron with larger, separate punctures, surface matte, strongly reticulate. **Scutellum** small, round, densely clothed with yellowish brown, subrecumbent, scalelike setae. **Elytra** elongate, with humerus subangulate, very weakly developed; slightly swollen behind and below humerus, subparallel to declivity, there narrowed and broadly evenly rounded to apex; intervals weakly convex, uneven in width, 1-3 subequal in width to large, quadrate, deep strial punctures, outer intervals *ca.* 1/2 to 3/4 width of strial puncture; all intervals with rather large punctures, outer intervals with single row, 2nd and 3rd with uneven row or rarely an interrupted double row, 1st with 2 rows in apical 2/3, all punctures with rather indistinct, short, curved, yellowish to brownish setae (more obvious in lateral view); strial punctures narrowly separated by slightly depressed ridges, striae evident only at base and from declivity to apex. **Legs** moderately stout, elongate; coxae densely clothed with recumbent to subrecumbent, white to golden brown, scalelike setae; femora evenly, densely, coarsely punctate, with short, subrecumbent, scalelike setae; fore femur unarmed, mid and hind femora with small distinct tooth; tibiae very densely, shallowly, coarsely punctate, all clearly mucronate on inner apical angle. **Venter** rather evenly, coarsely, shallowly punctate; lateral punctures larger, coarser and denser, each puncture with subrecumbent, fine to scalelike seta; abdominal sternite 1 broadly deeply medially depressed, depression continuing on sternite 2; 2 as long as 3 and 4 together, distinctly longer than 5; apex of sternite 5 and visible portion of pygidium very densely clothed with recumbent to suberect, golden-brown, scalelike setae; pygidial tergite distinctly laterally expanded at apex, apex acutely declivous. Length: pronotum and elytron, 5.9 mm.

Allotype female. - Very similar to male; abdominal sternites 1 and 2 very slightly depressed; pygidial tergite not expanded laterally at apex, apex obtusely declivous. Length: pronotum and elytron, 6.0 mm.

Material examined. - On hand for this study were 190 specimens, including 61 adults of this species. Numerous larvae and pupae were also available.

Range. - Known only from the State of Guanajuato, Mexico, 5 km. N. of Celaya.

Holotype male and allotype female, Mexico: State of Guanajuato, 5 km. N. Celaya, ex roots alfalfa, M.H. Schonhorst, emerged 25-30-VI-1977, ex plants coll'd Jan.-Mar. 1977. Paratypes, same data (59); same locality, VIII-1975, in crown alfalfa, larvae damaging crown, assoc[iation] likely, foliage chlorotic, M. Schonhorst (2).

Deposition of holotype and allotype, author's collection. Paratypes are deposited in the following collections: author's, Tallahassee, FL.; University of Arizona, Tucson, AZ.; British Museum (Natural History), London, England; U.S. National Museum, Washington, D.C.; E.L. Sleeper collection, Long Beach, CA; and D.G. Kissinger, Loma Linda, CA.

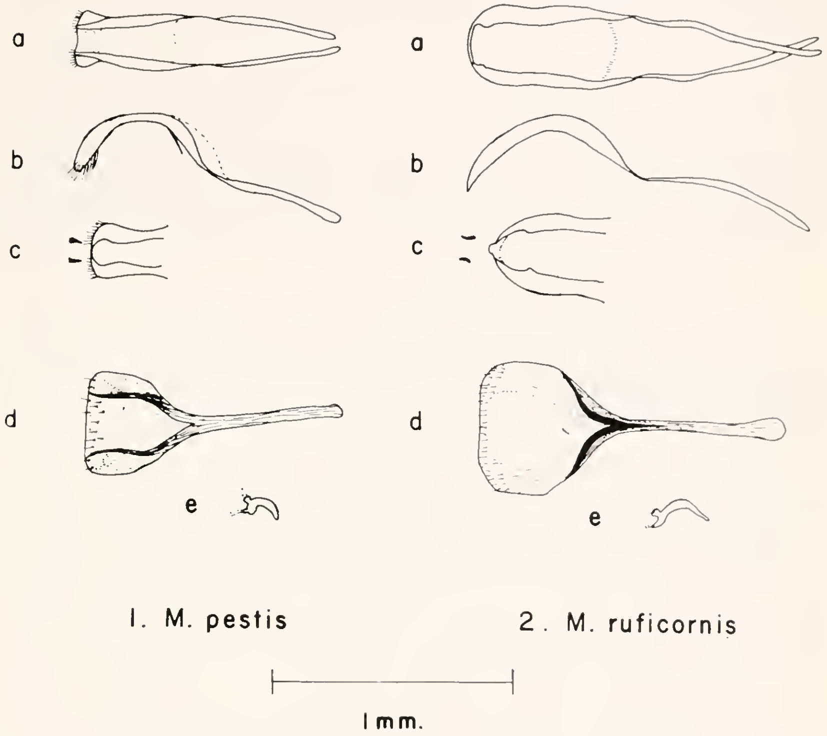

Figure 1. *Maemactes pestis* O'Brien, n. sp.

Figure 2. *M. ruficornis* Boheman; a, dorsal view of phallus; b, lateral view of phallus; c, apicodorsal view of phallus; d, dorsal view of female 8th sternite; e, lateral view of spermatheca.

Kissinger treated this species as *ruficornis* Boheman but I have seen Boheman's type in Stockholm and the species are quite distinct. They can be readily separated by the following characters. The intervals of *ruficornis* are relatively flat and very uneven in width, often with the alternate intervals 2 to 3 times as wide as the sutural interval. Strial punctures are large, very unevenly distributed, and usually elongate oval. Punctures of the intervals are small, in single uneven rows on the narrow intervals and irregularly distributed on the wide intervals. Elytral setae are small, recumbent, and scarcely visible. The rather acute apex of the male phallus (fig. 2b) will readily separate the species.

The rather uniform weakly convex elytral intervals with moderately large distinct single or double rows of punctures and evenly distributed quadrate to round strial punctures, along with the distinct though small suberect setae of *pestis* and the broad truncate apex of the male phallus (fig. 1a) are diagnostic. And *pestis* is not likely to be confused with the other species which either possess scales or erect fine setae or have characteristics of *ruficornis*.

ACKNOWLEDGEMENT

I wish to thank Dr. M.H. Schonhorst, Department of Plant Sciences, University of Arizona, Tucson, who collected all of the specimens of *pestis* herein studied and who allowed me to retain the type specimens and made available his notes on the biology of this important species.

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ARTHROPODS ASSOCIATED WITH HELLEBORINE ORCHID, *EPIPACTIS HELLEBORINE* (L.) CRANTZ, AT DUNNVILLE, ONTARIO[1]

W.W. Judd[2]

ABSTRACT: From July 19 to August 7, 1977, helleborine, *Epipactis helleborine*, was in bloom at Dunnville. A harvestman, *Phalangium opilio*, spiders, *Araneus* sp. and *Tetragnatha versicolor*, and insects (Miridae, Syrphidae, Formicidae, Halictidae, Coccinellidae, Curculionidae) were found on the plants. The weevil, *Stethobaris ovata*, chewed the flowers and destroyed them on more than half the plants.

The helleborine, *Epipactis helleborine* (L.) Crantz, is a European orchid which was introduced into North America, first being noted at Syracuse in 1879. It was found first in Ontario near Toronto at Lambton Mills in 1890 and since then has spread over much of the southern part of the province (Soper and Garay, 1954).

In 1977 a considerable growth of this plant was found in Haldimand County in Lot 1, Concession IV South of the Dover Road, Dunn Township, recently annexed to the Town of Dunnville. The lot comprises about 90 acres and is rectangular, with its south end at the north shore of Lake Erie. There are two woodlots in it. The southerly one is at the lakeshore, surrounding summer cottages, and the northerly one is at the north end of the lot. The two woodlots are separated by a quarter of a mile of cultivated fields and pasture. Plants of helleborine were growing in both the woodlots in 1977.

The structure of the flower of helleborine and its pollination have been studied by various authors who note that the pollinating agents are almost exclusively wasps of the family Vespidae (Darwin, 1877; Judd, 1972; Knuth, 1909; Meeuse, 1961). In 1977 an investigation was done of the insects associated with this plant in the lot at Dunnville.

In the middle of July numbered stakes were placed beside twenty of the plants in the southerly woodlot and each day the number of flowers in bloom on these plants was counted. Blooming began on July 19 and continued for a three-week period until August 8, with maximum blooming occurring on July 28, 1978 (Table I). During this period the plants were examined daily and a harvestman, spiders and insects found at them were collected. Periodically, plants in the northerly woods were also examined.

Identifications were made by the following taxonomists who, unless

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[1] Received November 1, 1978.

[2] Department of Zoology, University of Western Ontario, London, Ontario, Canada.

otherwise noted, are with the Biosystematics Research Institute, Agriculture Canada, Ottawa: D.E. Bright (Curculionidae), D. Brown (Miridae), G. Gibson (Halictidae), M. Ivanochko (Formicidae), R. Leech, Alberta Environment, Edmonton, Alberta (Araneida), L. Masner (Vespidae), J.R. Vockeroth (Syrphidae). The harvestman was identified with keys in Edgar (1966). All specimens are deposited in the collection of the Department of Zoology, University of Western Ontario except two beetles, *Stethobaris ovata* (LeC.), kept in the National Collection, Ottawa.

ACCOUNT OF COLLECTIONS

Phalangida

Phalangiidae

Phalangium opilio L. – One female harvestman was found sprawled over several flowers on a plant on August 1. It is a species commonly found in Ontario (Edgar, 1966).

Araneida

Araneidae

Araneus sp. – Two immature spiders were on a light web spun over flowers on one plant on July 22 and another was on a plant on August 5.

Tetragnathidae

Tethragnatha versicolor Walckenaer – Two spiders were found, one on a light web on flowers of one plant on July 21 and another on a web on a plant on July 24.

Tetragnatha sp. – Five immature spiders were on a web spun over flowers on one plant on August 5.

No insects or other prey were found in the webs spun by the spiders. Spiders of the genera *Araneus* and *Tetragnatha* are common web-spinning spiders in eastern North America (Comstock, 1967; Gertsch, 1949).

Insecta

Miridae

Plagiognathus obscurus Uhler – One bug was on a flower of a plant in the northerly woods on July 24. Bugs of this genus have been found at flowers of dogwood in Dunn Township (Judd, 1975).

Syrphidae

Toxomerus marginatus Say – One hover fly was on a flower on July 25. This species has been found on flowers of dogwood near the helleborine plants (Judd, 1975).

Formicidae

Lasius alienus (Foerst.) – One ant was running about over flowers on a plant on July 25. This species is widely distributed in North America (Krombein, 1958).

Halictidae

Lasioglossum (Dialictus) sp. – One bee was at a flower on July 23. Various species of this genus have been found at flowers of dogwood near the helleborine (Judd, 1975).

Coccinellidae

Hippodamia parenthesis (Say) – One lady beetle was crawling over the flowers on a plant on July 24. This species is a common one in eastern North America (Blatchley, 1910; Dillon and Dillon, 1961).

Curculionidae

Stethobaris ovata (LeC.) – Several beetles were found on the plants, both in the southerly and northerly woodlots, from July 21 to August 5. The beetles attacked the flowers by chewing circular holes in the sepals of unopened flowers and working through into the centre of the flowers. A flower so attacked turned black and withered. Of the twenty numbered plants in the southerly woodlot only ten produced flowers that bloomed through the period of blooming. One of these plants bloomed on July 21 but it was attacked by the beetles and its flowers were blackened and withered by the following day. Ten plants produced no blooms, their flowers being destroyed by the beetles. Thus, more than half of the plants were prevented from setting seed by the attacks of *S. ovata*. Several plants in the northerly woodlot were likewise found attacked by the beetles. It is thus evident that *S. ovata* is potentially a major pest of helleborine.

Stethobaris ovata has been reported from Ontario previously (Blatchley and Leng, 1916). D.E. Bright, who identified the specimens from Dunnville, reported in a letter that beetles of this species from South March, Ontario, deposited in the National Collection, were found feeding on *Habenaria hyperborea*, *Cypripedium calceolus* and *Cypripedium acaule*, all of which are orchids. It thus appears that *S. ovata* habitually feeds on plants of the Orchidaceae.

Pollination

Over the three-week period during which the helleborine was in bloom very few insects were found at the flowers, and these were species not regularly recorded as pollinators of this plant. The commonest insect found on the flowers, *Stethobaris ovata*, destroyed the flowers, and only the one bee, *Lasioglossum* sp., was actually in a flower, the other insects being found crawling over the outside of the flowers. However, after the plants had bloomed, several flowers were found with well-developed ovaries and abundant seed.

It has frequently been observed that helleborine is pollinated almost exclusively by wasps of the family Vespidae which carry pollinia on their heads from one flower to another (Darwin, 1877; Judd, 1972; Knuth, 1909; Meeuse, 1961). At Owen Sound in Ontario Judd (1972) found three species of *Vespula (arenaria, consobrina, vidua)* pollinating the plants. The commonest of these was *V. arenaria* (Fabr.). Within 700 feet of the helleborine plants in the southerly woodlot at Dunnville there were two active colonies of *V. arenaria* which had built their nests under the eaves of cottages. At no time were these wasps seen at the flowers, but it is likely that they were the pollinators, visiting the flowers at times when the plants were not being observed.

TABLE 1. Numbers of flowers of helleborine in bloom on twenty plants

July														
Date	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Number	0	4	13	23	34	37	48	55	59	59	65	57	50	39

August								
Date	1	2	3	4	5	6	7	8
Number	30	22	16	13	8	3	1	0

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REDESCRIPTIONS OF THREE NEOTROPICAL COREID GENERA OF UNCERTAIN TRIBAL PLACEMENT (HETEROPTERA)[1]

R. O'Shea[2]

ABSTRACT: O'Shea and Schaefer (1978) have shown that two neotropical tribes of the Coreidae: Coreinae, Acanthocerini and Nematopodini, should be separated from the strictly Old World genera (Mictini sensu stricto). Three neotropical genera do not belong in any of these tribes, and cannot at present be placed in any coreine tribe. These genera, *Mammurius* Stål, *Curtius* Stål, and *Molchina* Amyot and Serville are described here, with tentative suggestions as to their relationships. The included species are listed, and those not seen are marked by an asterisk.

Mammurius Stål 1862a : 278

TYPE SPECIES: *Mammurius mopsus* Stål 1862b : 293.

Body small, robust, stout; head quadrate to somewhat triangular, post-ocular tubercles very small, antennifers small, widely separated, tylus projecting markedly anteriorly of antennifers, antennae long, slender, terete, segment 1 stouter than 2-4, 2 longer than 1, 3 a little longer than 1, 4 shorter than 3, robustly fusiform; pronotum very steeply declivent, callar region, collar not very distinct, lateral margins nodulose with anterior angles marked by large nodulose projection, humeral angles slightly produced laterally into short broad spine, posthumeral margins sinuate, somewhat nodulose, posterior margin smooth, posterior angles sharp, produced posteriorly; scutellum punctate; metathoracic scent gland apparatus small, situated relatively ventrally; labium relatively long, reaching intermediate coxae, mesosternum lacking median furrow; all femora armed at least with small spines distally on ventral surface, posterior femora incrassate in both sexes, more in male, armed distally with large spines; posterior tibiae flattened, ventral margin armed with row of small teeth in both sexes; posterior angles of abdominal segments unarmed, spiracles nearer lateral than anterior margins; paramere broader apically than distally, with short curved tip (Fig. 1); aedeagus with paired dorsal sclerites, large distodorsal sac, smaller medioventral sacs, vesica helical (Fig. 2).

NOTES: Stål (1862a) described *Mammurius* in part of his serial work "Hemiptera Mexicana," and described the only included species, *M. mopsus*, in the next part (Stål 1862b).

Mammurius is distinguished from nematopodine genera by its size (less than 15mm long). Its tylus extends considerably anteriorly, even compared with the outwardly similar genus, *Piezogaster* Amyot and Serville.

The genitalia are not very similar to those of the nematopodines. The

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[1] Received August 24, 1978.

[2] Systematic and Evolutionary Biology Section, Biological Sciences Group, University of Connecticut, Storrs, Conn. 06268 U.S.A. Present Address: Imperial Medical Center of Iran, Corner of Jahan Koudak and Jordan Ave., Tehran, Iran.

dorsal sac of the conjunctiva and the helical vesica suggest that *Mammurius* may be related to the *Acanthocephala*-group (cf. Schaefer, 1965: Fig. 110).

Included species:

cubanus Barber and Bruner 1947: Chile
mopsus Stål 1862: Mexico, (Arizona)

Curtius Stål 1870: 143

TYPE SPECIES: *Mictis*? *marginalis* Dallas 1852: 401; monobasic.

Mictoides Walker 1871: 38, syn. nov.

TYPE SPECIES: *Mictis*? *marginalis* Dallas 1852: 401; selected here.

Redescription of the genus: Body large, stout, broad, not depressed; head subquadrate, postocular tubercles forming smooth curve with eye, antennifers well developed, widely separated, tylus projecting further anteriorly than antennifers; antennae long, slender, terete, segment 1 slightly curved, more robust, 2 subequal in length to 1, 3 shorter than 2, 4 slightly longer than 2, fusiform; pronotum not very steeply declivent, callar region, collar distinctly marked, lateral margins relatively smooth, anterior angles rounded, humeral angles sharp, posterior, posthumeral margins smooth, posterior angles rounded; scutellum transversely striate; mesosternum lacking median longitudinal furrow, metathoracic scent gland opening placed relatively laterally; anterior femora with small spines distally on ventral surface in male, lacking in female, other femora armed at least with distoventral spines, posterior femora of male very markedly incrassate, with spines on ventral surface, dorsal surface smooth; posterior tibiae of female more or less terete, of male flattened, curved, slightly dilated ventrally with a large tooth at about midpoint, smaller spines distally; posterior angles of abdominal segments more or less square, unarmed, spiracles much nearer anterior than lateral margins; paramere with curved shaft (Fig. 3), distinct narrow curved tip (Fig. 4); conjunctiva of aedeagus with divided unsclerotized distodorsal sac, paired distolateral sacs (Fig. 5); vesica helical.

NOTES: Walker (1871) erected the genus *Mictoides* for *Mictis marginalis* and *M. triguttata*. But Mayr (1865) had already placed *triguttata* in *Sagotylus*, and Stål (1870) had already placed *marginalis* in *Curtius*. The two species are not congeneric, so *Mictoides* has no validity nomenclaturally or biologically. Since Walker (1871) did not select a type from the two included species, I am selecting *marginalis*, which automatically makes *Mictoides* a synonym of *Curtius*.

Stål (1870) pointed out a number of differences between *Curtius* and *Sagotylus*, which do have a similar habitus. Thus in *Curtius* (as opposed to *Sagotylus*): antennal segment 4 is longer than 3; the humeral angles are different; spines are lacking on the anterior margin of the pronotum; a lobe is lacking on the male metasternum above the coxa; there are ridges on the venters of the anterior abdominal segments, near the transverse sutures. In addition *Curtius* lacks a large tooth, present in *Sagotylus* on the ventral

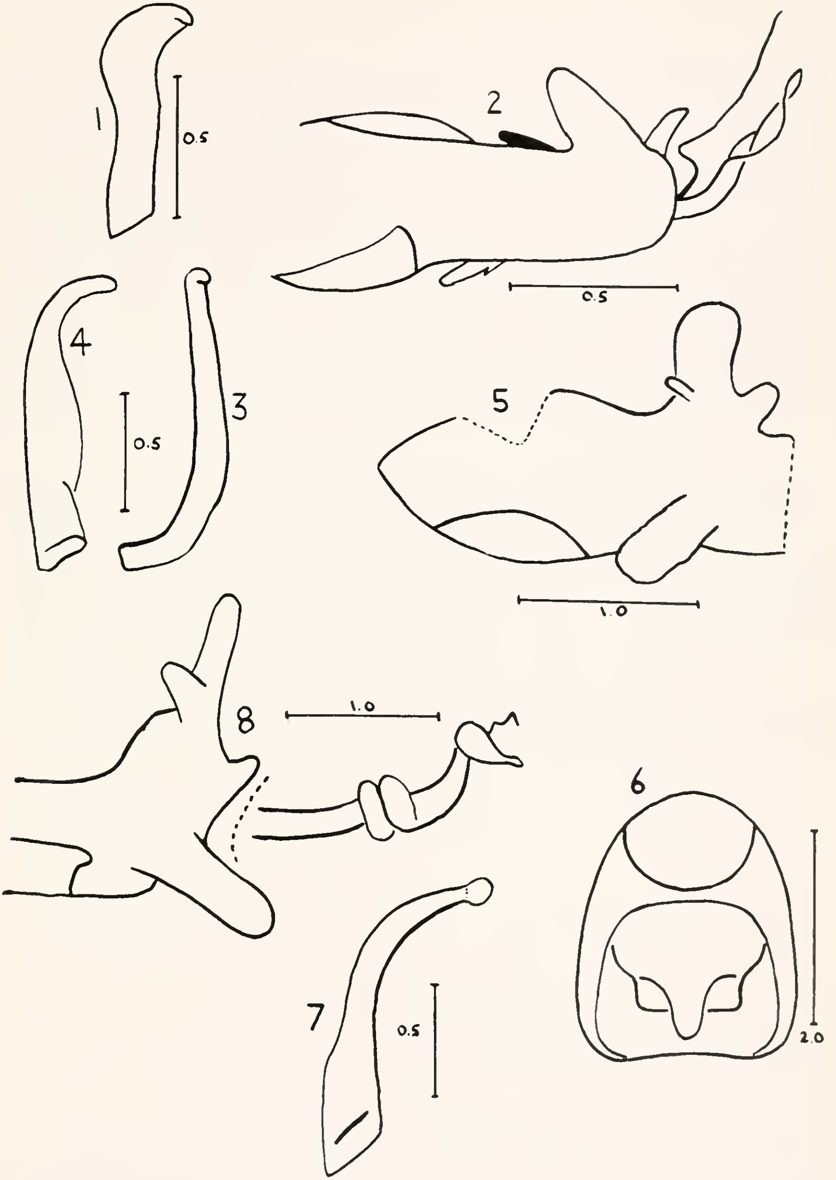

Fig. 1. *Mammurius mopsus* - paramere; Fig. 2. *Mammurius mopsus* - aedeagus; Fig. 3. *Curtius marginalis* - paramere; Fig. 4. *Curtius marginalis* - paramere; Fig. 5. *Curtius marginalis* - aedeagus; Fig. 6. *Molchina* sp. - male genital capsule; Fig. 7. *Molchina* sp. - paramere; Fig. 8. *Molchina* sp. - aedeagus.

margin of the posterior femora of the male.

The parameres of *Curtius* are strongly sclerotized and curved (Figs. 3, 4), whereas those of *sagotylus* are membranous and lack curved tips. *Curtius* has a totally unsclerotized conjunctiva (Fig. 5), whereas *Sagotylus* has paired medioventral sclerites as well as distodorsal and distoventral lobes.

The aedeagus and paramere of *Curtius* are neither nematopodine nor acanthocerine. Some doubts have been expressed in the past as to the placement of the genus. Much of the following applies also to *Molchina*, the genus I describe next, and will not be repeated there.

Stål (1870) placed *Curtius* and *Molchina* in a group, the Mictina. Later Stål (1873) mentioned these genera again, stating in a section on Spartoceraria, "Ad Physomeraria et Corearia appropinquant Spartoceraria americana ..... Ad hanc divisionem (i.e., Physomeraria) *Spartocera* et affinia, nec non *Curtius* et *Molchina* pertinent."

Bergroth (1913) added *Curtius* and *Molchina* to the Spartoceridae Lethierry and Severin 1894 to form his Menenotaria, a course also followed by Blöte (1936). *Curtius* and *Molchina* do not seem to belong in the Spartocerini, among whose characters Schaefer (1965) included: femora unspined apically, posterior femora slender, paired ventral conjunctival appendages membranous.

Although the males have incrassate femora, the two genera do not belong in the Nematopodini. Their conjunctivas are entirely membranous and have distinct dorsal sacs. Nematopodine conjunctivas do not have dorsal sacs and usually have three pairs of sclerotized appendages. *Curtius* and *Molchina* also have helical vesicas, whereas nemtopodine genera have curved vesicas.

I prefer to leave *Curtius* and *Molchina*, for the present, as genera of uncertain placement, until more American coreid genera can be examined.

Included species:
marginalis Dallas 1852; Colombia, Ecuador
= *affinis* Dallas 1852 (synonymized by Lethierry and Severin (1894)).
= *culta* (Distant) 1893 (synonymized by O'Shea (1974)).

Molchina Amyot and Serville 1843: 188-189

TYPE SPECIES: *Lygaeus compressicornis* Fabr. 1794: 138; monobasic.
Euplatycoris Walker 1871: 103-104 (synonymized by Bergroth, 1913).

TYPE SPECIES: *Euplatycoris bellicornis* Walker 1871:104; monobasic.

Body large, broad, stout, relatively depressed posteriorly especially in males; head subquadrate, postocular tubercles forming smooth curve with eye, antennifers prominent, situated close together, projecting distinctly anteriorly of tylus; antennae long, slender, terete (except segment 3), segment 1 curved, relatively stouter, 2 shorter than 1, 3 subequal in length to 2, dilated on both sides for whole length, 4 curved, fusiform, very long usually about twice as long as 3; pronotum steeply declivent, callar region, collar distinct, lateral margins nodulose, especially posterior part, anterior angles obtuse, more or less rounded, humeral angles produced laterally into short broad, or long narrow, sharp spine, posthumeral, posterior margins slightly nodulose, posterior angles not clearly marked; scutellum transversely striate; mesosterum without median longitudinal groove; metathoracic scent gland opening placed relatively laterally; posterior trochanter of males armed with small spine; all femora armed at least with distal spines on ventral surface, posterior femora incrassate, especially in male, ventral margin of male posterior femora armed with row of small spines, dorsal margin smooth; posterior tibiae of female more or less terete, of male flattened, curved, slightly dilated ventrally, armed with large tooth about 2/3 from proximal end, and smaller more distal teeth; abdominal segments 3, 4 of male armed medioventrally with large tubercles, posterior angles sometimes rounded, but usually forming small distinct spines, spiracles nearer anterior than lateral margins of segments; male genital capsule with posterior margin forming shelf, into which projects posteriorly a median tongue (Fig. 6); paramere with relatively short base, long curved tip widening apically (Fig. 7); conjunctiva of aedeagus with divided distodorsal lobe bearing paired lobes, paired distoventral lobes; vesica helical (Fig. 8).

NOTES: *Molchina* can be separated from other genera in the Nematopodini or Acanthocerini (i.e., those American genera whose males have incrassate femora, and are not in the Acanthocephalini) by the following combination of characters: humeral angles armed with distinct spines, third antennal segment dilated, and male abdominal segments 3 and 4 with median ventral tubercles. In addition, the paramere, aedeagus, and male genital capsule are all unlike those of the nematopodine genera.

The systematic placement of *Molchina* is discussed with the previous genus, *Curtius*.

Included species:
compressicornis (Fabr.) 1794; N. Brazil, Guianas
granulata Stål 1870; N. Brazil
= *bellicornis* (Walker) 1871 (synonymized by Bergroth, 1913)
hopei (Perty) 1833; N. Brazil, Peru
**linnei* Stål 1859; N. Brazil
**molitor* Breddin 1898; Bolivia
**obtusidens* Blöte 1936; Panama

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LARGE CAPACITY PITFALL TRAP[1]

Mark W. Houseweart[2], Daniel T. Jennings[3], James C. Rea[4]

ABSTRACT: Describes materials, procedures, advantages and disadvantages of using large capacity pitfall traps to inventory ground-dwelling fauna in spruce-fir forests.

Numerous investigators have designed and used pitfall traps for collecting ground-inhabiting arthropods (see Southwood, 1966 and Thiele, 1977 for a general account; and Uetz and Unzicker, 1976 for a critical review). The simplest design is a cup, jar, can or bottle sunk into the ground so that the mouth is level with the soil surface. Walking insects and other arthropods fall into the trap and are retained by a preservative or killing agent. More elaborate designs include traps with funnels, roofs, barriers, aprons and time-sort devices.

As part of a study on natural enemies of the eastern spruce budworm, *Choristoneura fumiferana* (Clem.), pitfall traps were used to inventory the ground-dwelling fauna. Spruce budworms are susceptible to predation from ground-inhabiting predators during the spring and summer larval-dispersal periods, and when large larvae and pupae drop from host trees to the forest floor. Because our study spanned the spring rainy season, a large capacity pitfall trap, which would not overflow, was needed. This Note describes the materials, procedures, advantages and disadvantages of using these large capacity traps.

MATERIALS

The components needed for construction of the traps are readily available from most scientific stockrooms or biological supply houses and from hardware/lumber yards. Each trap (Fig. 1) consists of a 150 mm plastic funnel, a 2-liter plastic bottle, and a 30 x 30 x 0.6 cm apron fashioned from tempered

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[1] Received November 6, 1978. Cooperative Forestry Research Unit, Journal Article Series No. 7.

[2] Assistant Research Professor, Cooperative Forestry Research Unit, School of Forest Resources, University of Maine, Orono, Maine 04469

[3] Principal Research Entomologist, Northeastern Forest Experiment Station, USDA Building, University of Maine, Orono, Maine 04469

[4] Research Technologist, Cooperative Forestry Research Unit, University of Maine, Orono, Maine 04469

hardboard. The funnel has a 15.4 cm outside diameter, tapering to a straight sided spout with a 2.54 cm diameter hole. The spout fits snugly into the neck of the 2-liter bottle, thus alleviating the necessity for a clamping device.

The hardboard (0.6 cm stock) is cut into a piece 30 cm^2 to form an apron. A sabre saw is then used to cut a 14.9 cm diameter hole in the center of the board. The hole is tapered to provide an optimum fit between the funnel and board. Reinforcing ridges along the funnel sides are trimmed with a knife to allow smooth contact between the funnel and tapered hole. Cut aprons are treated (2 coats) with polyurethane varnish to prevent warping.

INSTALLATION AND SERVICE

Traps were installed in the field by digging 20-25 cm diameter holes with a sharp-nose spade. Care was taken to dig a vertical hole only slightly larger than the bottle and funnel, and yet deep enough to allow the bottle to swing freely off the hole bottom. Aprons were placed over the holes and the bottle-funnel unit suspended from the board (Fig.1).

A 1:1 mixture of ethylene glycol and 70% ethanol was added to each trap bottle as a killing-preservative agent. We used ca. 300 ml of this mixture per bottle, thus allowing ample space for dilution by rain.

Traps were installed in both strip-cut and dense spruce-fir forests of northern Maine. They were serviced weekly by: 1) lifting out the funnel-

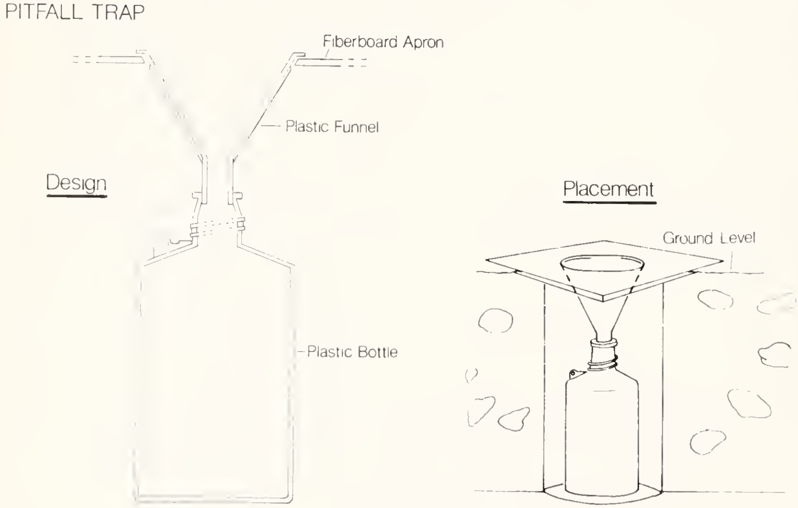

Fig. 1. Design and placement of large capacity pitfall trap.

bottle unit, 2) removing the funnel, 3) swirling the liquid around in the bottle, 4) emptying the liquid and trapped contents into a wire-mesh strainer, and 5) rinsing the strainer with trapped contents into a large collecting jar. Part of the liquid was saved and used to rinse the strainer; part was added to each collecting jar for transportation and temporary storage. Additional ethanol was added to the collecting jars since they were kept a period of time before sorting.

To replenish the liquid in each trap bottle, a fresh mixture of 1:1 ethylene glycol/ethanol was added to any excess, diluted solution. Bottle and funnel were then reassembled and placed back in the apron hole. In most cases, aprons were left in place, thus habitat disturbance was kept to a minimum.

ADVANTAGES/DISADVANTAGES

These large capacity pitfall traps are simple, easily constructed, easily serviced and relatively inexpensive. Approximate costs of materials per trap are:

150 mm Nalgene[R] plastic funnel	$0.34
2-liter, narrow-mouth Nalgene plastic bottle	0.71
30 x 30 x 0.6 cm tempered hardboard	0.19

Total cost of materials was ca. $1.24 per trap.

[R] Use of registered trademarks does not constitute endorsement.

Care should be taken to purchase only bottles and funnels that fit properly together. A loose fit or too tight a fit prevents proper union of the bottle and funnel, thus presenting problems during installation and servicing.

A rain cover was not used in our pitfall-trap studies, although one could easily be added if desired. However, such structures may attract or repel certain arthropods. Morrill (1975) found that a greater variety of insects were captured in traps without covers than those with covers. One distinct disadvantage of coverless traps is the possible inclusion of aerial dispersing forms, such as ballooning spiders.

The principal advantage of a large capacity trap can quickly be realized during rainy weather. Our collections were made weekly; at most 1 liter of liquid had accumulated in some bottles. A screen covered hole could be cut and installed in the upper portion of the bottle to allow excess fluid to drain while retaining the pitfall sample; however, this was not needed during our study.

Like Wojcik, et al., 1972, we experienced some problems with traps floating out of the ground, especially in wet areas. This problem was easily rectified by attaching weights to the sides of the bottles.

The particle board aprons are an essential component of our trap design. They serve as a support for suspending the funnel-bottle unit and provide a runway for surface arthropods. Cutler, Grim and Kulman (1975) found that traps with aprons caught twice as many dionychous spiders compared to traps without aprons. The aprons should be varnished to prevent warping.

Our trap has been successfully used to compare the ground-invertebrate fauna of strip-cut and dense spruce-fir forests of northern Maine. We have collected spiders, carabid beetles, ants, opilionids and a variety of other arthropods, including larvae of the spruce budworm. Shrews, frogs and salamanders have also been captured without damage to the traps, although one frog did plug a funnel spout. Bears ripped some traps out of the ground and chewed the bottles and funnels; however, this destruction is probably not unique to our trap design. In general the traps are durable and can be re-used for several seasons.

ACKNOWLEDGEMENTS

We are grateful to Drs. C.D. Dondale, H.M. Kulman, R.M. Reeves, F.B. Knight and G.W. Simpson for their review comments. Also, we appreciate the talents of Mr. Wayne N. Dixon for illustrating Figure 1.

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A NOTE ON *CICINDELA LONGILABRIS* SAY (COLEOPTERA: CICINDELIDAE)[1]

Norman L. Rumpp[2]

In Entomological News (1902:167) William J. Fox, Secretary, reporting on the March 1902 meeting of the Feldman Collecting Social in "Doings of the Societies" wrote:

"Mr. Laurent stated that the true *Cicindela longilabris* and the variety *laurentii* do not seem to commingle, the variety keeping to the woods, whereas the typical form occurs along roadways."

This is an important observation which reinforces my stated opinion of the behaviors of *C. longilabris* and *C. montana* in the few known locations where the two species come in proximity to each other. It is my opinion that Laurent's observation of the behavior that he reported for *laurenti* was correct because *laurenti*, as a subspecies of *C. longilabris*, indeed occurs in woodland, or at the edge of woods, much as the nominate form does. However, Laurent may have been mistaken in his reference of the nominate form, which he called *Cicindela longilabris*, when he was actually observing *C. montana*. This latter species does stay in the open, and may be found along roadways (dirt roads in 1902).

Fox did not state the location where Laurent made his observation, nevertheless, I feel that it is reasonable to assume, from the known range of ssp. *laurenti*, that it was made somewhere in the northern sections of the eastern Rocky Mountains Range of Colorado where my map on page 6 of the Idaho Report, dated March 1978, showed the probable overlap of *C. longilabris laurenti* with *C. montana*. From this it is inferred that such an overlap exists.

Thanks to André Larochelle for mentioning the Fox quotation, and to Howard Boyd for furnishing me with a copy of the Fox quotation.

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[1] Received September 25, 1978.

[2] 3446 Bahia Blanca W., Laguna Hills, Calif., 92653

NEW RECORDS FOR DRYOPOID BEETLES IN MISSISSIPPI[1]

P.K. Lago, D.F. Stanford[2]

ABSTRACT: The known ranges of *Chelonarium lecontei* Thomson (Chelonariidae) and *Psephenus herricki* (DeKay) (Psephenidae) are extended to include Mississippi.

Brown (1975) reported the known distributions of aquatic dryopoid genera in North America. The lone North American species of Chelonariidae, *Chelonarium lecontei* Thomson has been recorded from Tennessee, North and South Carolina Florida and Alabama; (Brown, 1972, 1975). Specimens of *C. lecontei* were collected at black light traps in Lafayette and Benton counties in Mississippi. One specimen was obtained at each site, 20 June 1977 and 8 July 1978, respectively.

Psephenus herricki (DeKay) is the most widely distributed member of the genus in North America, and is the only species of *Psephenus* occurring east of the Great Plains. The species has been reported from all states east of the Mississippi River with the exceptions of Florida and Mississippi, and a few states west of the Mississippi (Brown and Murvosh, 1974). Thirty-two larvae of *P. herricki* were collected from a shallow, rocky stream in Tishomingo County, Mississippi on 22 July 1978. This represents the first collection record for the family Psephenidae in the state.

Brown, H.P. 1972. Aquatic dryopoid beetles (Coleoptera) of the United States. Biota of freshwater ecosystems, identification manual No. 6, U.S. Environmental Protection Agency, Washington, D.C. 82 p.

Brown, H.P. 1975. A distributional checklist of North American genera of aquatic dryopid and dascilloid beetles. Coleop. Bull. 29(3): 149-160.

Brown, H.P. and C.M. Murvosh. 1974. A revision of the genus *Psephenus* (water penny beetles) of the United States and Canada (Coleoptera, Dryopoidea, Psephenidae). Trans. Amer. Entomol. Soc. 100: 289-340.

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[1] Received November 7, 1978.

[2] Department of Biology, University of Mississippi, University, Mississippi 38677.

A CRITICAL POINT DRIER USED AS A METHOD OF MOUNTING INSECTS FROM ALCOHOL[1]

G. Gordh, J.C. Hall[2]

ABSTRACT: The use of a critical point drier for mounting insects from alcohol is described. Advantages over standard methods are given which include: 1) Many specimens can be handled at one time, 2) pigment colors remain life-like, 3) specimens do not collapse, 4) appendages need no teasing and, 5) specimens are not brittle.

A major problem confronting museum workers has been the preparation of material for study which had been collected or stored in alcohol. The "standard" methods of removing insect specimens from alcohol and mounting them on points or minutens has involved the transfer or movement of the material through various liquids, viz. ethyl acetate, xylene and cellosolve (ethylene glycol monoethyl ether) (Sabrosky, 1957, 1966; Vockeroth, 1966). Other chemicals that have been used include chloroform, ether and acetone. The disadvantages of the currently used methods include: 1) Time involved in transferring the specimens or the liquids, 2) necessity of teasing the appendages away from the body, especially the wings, 3) shriveling, 4) resultant hardening or brittleness of the specimens and 5) the toxicity of compounds such as xylene and acetone.

All biological tissue contains water. To maintain three dimensional morphology of tissue or organisms for study, it is necessary to replace the physiological water with another fluid (preservative) or eliminate the water from the specimen without distortion. Drying specimens is achieved by evaporation, freeze drying or critical point drying. The evaporative method of drying is the oldest and most commonly used procedure in museum work, but it is undesirable because surface tension forces developed during drying cause severe distortion of soft tissue and more rigid tissues that contain large amounts of water. Alternatively, freeze drying techniques have been developed to prepare material for study, but the process is time consuming, requires elaborate equipment and is not always successful. Freeze drying can distort or destroy ultrastructure by differential thermal expansion or the formation of ice crystals from unbound water. We believe that the process of critical point drying is ideal for all forms of preparation involving small bodied insects.

The physical principles behind critical point drying are simple. In review, liquefaction of gasses occurs when the cohesive forces binding molecules together are greater than the kinetic energy disrupting them. Two physical parameters are important to the phenomenon – critical temperature and

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[1] Received November 17, 1978.

[2] Division of Biological Control University of California, Riverside, California 92502.

pressure. Critical point drying involves passing a specimen through an intermediate fluid (acetone, ETOH, Freon) and into a transitional fluid (CO_2, Freon, nitrous oxide) and subjecting it to the critical temperature and pressure.

We discovered that insect specimens critically point dried emerged in excellent condition for point mounting and subsequent study. The procedures involved are simple and comparatively rapid. Specimens in alcohol, any percentage, are placed in a small mesh screen basket with lid. They are then dehydrated by taking them through a series of increasing concentrations of ethyl alcohol, we use 10% increments, ending in a solution of 100% ETOH. The specimens within the basket are passed through two washes of 100% ETOH. Specimens that have been preserved in 70% ETOH can be taken through the alcohol series without rehydration. We have obtained excellent results by leaving the basket of specimens in concentrations of alcohol for 20 - 30 minutes. In the case of freshly collected specimens in alcohol or small Lepidoptera larvae, a longer period of time in each concentration is required, eg. 1-2 hours. It is safe to leave any specimens for longer periods in concentrations of alcohol above 50%. After removal from the last wash of absolute alcohol, the specimens, with the basket, are placed within the chamber of the critical point drier and are processed according to drier instructions.

There are several critical point driers on the market. Some of the transitional fluids used in critical point driers include Freon, CO_2, and nitrous oxide. The driers we use can be used with either Freon or liquid CO_2. Liquified CO_2, research grade, is the transitional fluid we prefer because it is easiest to use, comparatively inexpensive, is less noxious and provides more uniform results than other fluids. We have used Freon-13 as a transitional fluid and have not noted any differences in specimens treated with this fluid as compared to CO_2. We have not tested Freon-23 or Freon-116, but they may be useful for some biological materials because each has a characteristic critical pressure and temperature. When Freon is used as a transitional fluid, specimens must be run through a series of increasing concentrations of Freon starting with 10% and ending in pure Freon. This adds an additional procedure over the use of CO_2.

There are distinct advantages to critical point dried specimens over the "standard" methods employed. These advantages include: 1) Many specimens can be handled simultaneously, 2) pigment colors remain life-like, 3) specimens do not collapse or shrivel, 4) no manipulation of the appendages is required and 5) the specimens are not brittle. Relative to this latter point the appendages can actually be manipulated and are more supple than in air dried specimens. A further advantage is that the museum preparator is free to conduct other duties while the specimens are being processed.

We have critical point dried Chalcidoidea, Proctotrupoidea and other various small Hymenoptera with excellent results. The turgid condition of the insect allows us to study not only segmentation of small parts, eg. labial palpi, but also sculptural features of the integument. Diptera belonging to the Nematocera and other small acalyptrate flies have been critical point dried. The setation and pilosity remains as in life and the small bristles are less apt to be broken off. Soft bodied arthropods such as Collembola, Thysanura, small Lepidoptera larvae, spiders and mites have all been critical point dried. In the case of the latter two groups the abdomen remains turgid and the legs do not curl up as in air dried specimens. Cockroach oothecae and various Hymenoptera and Diptera pupae have also been critical point dried with success.

We can foresee, with the use of the critical point drier, at least partial, if not total elimination of alcohol collections in museums. Insects and spiders normally stored in alcohol can be critically point dried then stored, if desired in air-tight vials. This eliminates the need to constantly replenish the alcohol in alcohol stored material. Colors that fade with years of storage in alcohol are preserved with critical point drying. This is especially important for Lepidoptera larvae.

A word of caution: if the specimens are not completely dehydrated or the alcohol is not completely purged from the chamber in the critical point dryer, the specimens will eventually shrivel as in air dried material. If after processing, it is determined the specimens are not completely dried, they can be returned to absolute alcohol for a short time then rerun through the critical point drier.

At present the only disadvantage we have noted is that in general museum use one is limited by the small size of the chamber, 1 inch diameter x 1 inch high. Large larvae must still be stored in some preservative or other until such time that a critical point drier is developed with a large enough chamber to accommodate the larger specimens.

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A NEW SPECIES OF *SPATHIUS* NEES FROM WASHINGTON (HYMENOPTERA:BRACONIDAE)[1, 2]

Mark Deyrup[3]
Department of Entomology, Purdue University, West Lafayette, IN 47907

ABSTRACT: The braconid *Spathius matthewsi* n.sp. is described from two specimens reared from *Rhyncolus brunneus* Mannerheim (Coleoptera:Curculionidae) in western Washington.

Matthews' 1970 revision of the genus *Spathius* Nees of North America north of Mexico includes 21 species, only 3 of which occur on the west coast of North America. A recent study of the insect community of dead Douglas-fir (*Pseudotsuga menziesii*) (Mirb.) Franco in western Washington produced two specimens of an undescribed *Spathius*. Considering the variability of some species of *Spathius*, it is undesirable to describe a new species from two specimens, but there is little chance that additional specimens will be obtained during the next few years. The specimens seem sufficiently distinctive in morphology, host, and geographic range to preclude the possibility that they represent a described species of *Spathius*.

Spathius matthewsi, n.sp.

Description of Holotype female

Body: length 2.9 mm; ratio of length of ovipositor sheath to length of forewing 1.15; testaceous; vertex, posterior half of gaster, tip of ovipositor brown; wings lightly infumated, with a hyaline band through stigma to posterior border.

Head: antenna 3.8 mm, 26 flagellomeres, each with 2 straight apical setae 1.5-2 times length of curved setae sparsely covering flagellomere; face finely transversely striate, sparsely finely punctate, with fine hairs; frons shining, smooth, with a few delicately etched fine transverse striae anterior to ocellar triangle; ocellar triangle raised, smooth, shining; vertex and temples smooth, shining.

Thorax, including propodeum: lateral grooves of prothorax delimited by a dorsal carina and with several transverse carinae; mesonotum convex and declivitous anteriorly; lobes of mesonotum evenly granulate; notauli deeply impressed, converging posteriorly to a broad depressed area having wide transversely carinulate lateral areas and a narrow granular median line; scutellar furrow crossed by 6 evenly spaced carinae; scutellum triangular, convex, with a recumbent seta on each side at apical third; upper half of mesopleuron longitudinally rugose, lower half granulate; sternaulus shallow, without transverse

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[1] Received August 24, 1978.

[2] Purdue Agricultural Experiment Station Journal No. 7296.

carinae, a weak carina along lower edge of sternaulus, becoming stronger at posterior end of sternaulus and continuing to mesocoxal cavity; prepectal carina complete, prepectal area finely rugose; propodeum granulate dorsally, rugose laterally, basal carina absent, lateral and dorsal carinae weak, propodeal carinae becoming well developed, conspicuous on posterior third of propodeum; areola poorly defined apically, well defined basally, areola almost twice as long as greatest width, area petiolaris well defined, longer than wide.

Leg: fore tibiae with 2 rows of prominant spines; outer lobe of hind tibiae with two inconspicuous bristles; ratio of lengths of hind tarsomeres from basal tarsomere to apical tarsomere 5.0/2.0/1.0/.9/1.5.

Wing: subdiscoideus not interstitial; first intercubitus longer than second abscissa of radius; length of forewing from tegula to apex 2.8 mm.

Abdomen: petiole slightly arched at base, rugose, longitudinally strigose in broad apical area; tergite 2+3 with basal lateral faintly reticulated patch on each side, tergites 2-7 otherwise smooth, shining; ovipositor sheath 3.2 mm; dorsal petiole length/dorsal length of tergite 2+3 1.75.

Holotype female and damaged paratype: Tahuya, Mason Co., Washington, 21 June 1975 (M. and N. Deyrup); from gallery of *Rhyncolus brunneus* Mannerheim (Curculionidae) in *Pseudotsuga manziesii.* Holotype and paratype will be deposited in the U.S. National Museum.

Male: Unknown.

Remarks. The carina extending from the posterior end of the sternaulus is a diagnostic character of the *trifasciatus* group of *Spathius* (Matthews, 1970); the relationship to the *trifasciatus* group will be more certain if the male of *S. matthewsi* proves to have swollen femora. *Spathius matthewsi* keys out to *S. trifasciatus* Riley in Matthews' 1970 key. *Spathius trifasciatus* may be distinguished from *S. matthewsi* by the following characters: darker color; transversely striate frons, ocellar triangle, and anterior vertex; longitudinal carinae in depressed area where notauli converge; rugose dorsum of propodeum; confluent areola and area petiolaris; 6 to 10 spines on outer lobe of hind tibia. In addition, *S. trifasciatus* is an eastern and midwestern species associated with scolytids in *Carya* and other broadleaf trees (Matthews, 1970).

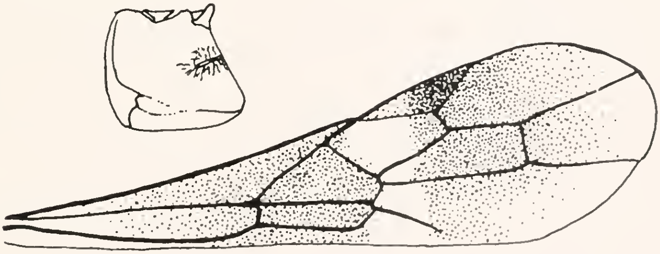

Figure 1. Mesopleuron and forewing of *Spathius matthewsi.*

The host, *Rhyncolus brunneus* Mannerheim, is not a bark weevil like the other weevil hosts of Nearctic *Spathius*, but a true wood borer usually found in dead dry standing conifers. Possible alternate hosts are not likely to be weevils but rather anobiids of the genera *Xestobium* and *Coelostethus*.

This species is named for Dr. Robert Matthews in appreciation of his excellent revision of Nearctic *Spathius*.

ACKNOWLEDGEMENT

The author wishes to thank Dr. Paul Marsh of the Systematic Entomology Laboratory, U.S. Dept. of Agriculture, for his efforts in comparing a specimen of *S. matthewsi* with species in the U.S.N.M. collection.

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HERBERT HOLDSWORTH ROSS
1908–1978

Dr. Herbert H. Ross, former Assistant Chief, Acting Chief (1962), Principal Scientist, and Head, Section of Faunistic Surveys and Insect Identification of the Illinois Natural History Survey, died at noon Thursday, November 2, 1978, in Athens, Georgia. He was 70.

Born in Leeds, England, Dr. Ross received his early education in British Columbia, Canada, and graduated with his bachelor's degree in agriculture from the University of British Columbia. He received his M.S. and Ph.D. from the University of Illinois.

Dr. Ross began his career with the Illinois Natural History Survey in 1927 as an assistant entomologist, and was appointed head of the section of faunistic surveys and insect identification in 1935. He became principal scientist in 1956, and the Survey's first assistant chief in 1963. He also held the rank of professor of entomology with the University of Illinois.

Dr. Ross retired from the Survey in August 1969 after more than 41 years of service. He immediately accepted an appointment as Professor of Entomology at the University of Georgia and retired again in 1976.

He was a past president and secretary-treasurer of the Entomological Society of America, past president and secretary of the Society for the Study of Evolution and past president of the Society of Systematic Zoologists. He was a member of Sigma Xi, the Royal Entomological Society of London, Ecological Society of America, American Association for the Advancement of Science, American Institute of Biological Sciences, Society of Systematic Zoologists, and others. He was a corresponding member of the American Entomological Society.

A prolific writer, Dr. Ross published over 200 technical research papers and books. "A Textbook in Entomology," published in 1948, gained immediate recognition as one of the most popular books in the field, and it has been translated into several foreign languages. Later books included "Understanding Evolution" published in 1966 by Prentice-Hall; "Evolution and Classification of the Mountain Caddisflies, "University of Illinois Press, 1956; and "A Synthesis of Evolutionary Theory," printed in 1962 by Prentice-Hall.

BOOK REVIEW

The recent abundance of general entomological texts, possibly resulting from the inadequacy of existing works, presents an interesting problem in the selection of a text for approximately 1,500 beginning entomology students each year. Does the decision rest in the cost of the text to the student or in the informational content to benefit the student? Can a compromise be made between the number of texts necessary for adequate course information coverage and the number of texts available? These are but two questions that must be considered.

The most recent work, *Introduction to Insect Biology and Diversity*[1], contains nearly all of the necessities for a good, well-balanced introductory text. Drs. Daly, Doyen and Ehrlich have produced a book that equally treats insects, their biology and systematics without surpassing 1,000 pages. They did it in half of that and perhaps at the sacrifice of applied entomology. The book is divided into four parts: Insects as organisms, population biology of insects, insects in relation to environment and insect diversity. Part one explores insect morphology, physiology and behavior through sociality and is adequate at the introductory level. Part two should have been left in *The Process of Evolution* by Ehrlich, Holm and Parnell[2]. Part three is an interesting approach in several chapters to the logical associations between insects and their environment or habitat. One wonders about the value of long lists of order, family - habitat or trophic associations, especially at the expense of sections on migration, dispersal, aggressive mimicry, insect structures, insect defenses (non camouflage, mimicry), insect zoogeography, island endemism, etc. The retention of parasitoid (hyper-, multiple, super-, and ecto-) when its use has been greatly curtailed in the recent literature seems somewhat unorthodox.

The authors are to be congratulated on their workable, uncomplicated, accurately illustrated keys to orders, suborders and families. The breakdown of Coleoptera is a welcome and needed improvement, as is the modern approach to Lepidoptera. (Will no one ever provide a good Siphonaptera key?) The treatment of the common families and omission of the rarely collected families adds to the usability of this book in an introductory course.

There is an adequate glossary of approximately 450 terms. One questions some items in the glossary (auxillary sclerites are three not four; pleurum, the unused form of pleuron). Perhaps that is being too critical. The separate taxonomic and subject indexes are useful, but is it really more economical to print See also references than to repeat page numbers in an index for multiple topics? The reference citations, around 700, are more than in comparable texts. There is wasted paper (pages 295, 301, 304, 305 -, 472, 473, etc.) but the authors are probably not responsible for this. The figurative material is well done and adequately explained in both captions and directly on the illustrations. The photographs are of high quality.

As a possible suggestion for future editions, chapters on collecting, insects as pests and benefical insects would add to an otherwise good introductory text in general entomology. A less expensive paperback edition would be more warmly received by students.

[1] **Daly, H.V., J.T. Doyen, and P.R. Ehrlich.** 1978. Introduction to insect biology and diversity. McGraw-Hill Book Company. San Francisco, CA. 564p. $19.50.

[2] **Ehrlich, P.R., R.W. Holm, and D.R. Parnell.** 1974. The process of evolution. McGraw-Hill Book Company. San Francisco, CA. 378p.

– R.W. Rust, Department of Biology, University of Nevada, Reno, NV 89557

INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

The following Opinions (listed by number) have been published recently by the Internat'l Commiss. on Zool. Nom. (see Bull. Zool. Nom. Vol. 35, part 2, 31 Oct., 1978).

1107 (p. 88)	Conservation of *Dermacentor andersoni* Stiles, 1908 (Acarina, IXODIDAE).
1110 (p. 99)	*Microterys* Thomson, 1875 (Hymenoptera, CHALCIDOIDEA): conserved under the plenary powers.
1111 (p. 101)	*Leucospis gigas* Fabricius, 1793 (Hymenoptera, LEUCOSPIDAE) conserved under the plenary powers.
1112 (p. 104)	*Madiza* Fallén, 1810 (Diptera, MILICHIIDAE): designation of a type-species under the plenary powers.

The Commission cannot supply separates of Opinions.

The required six months' notice is given of the possible use of plenary powers by the Internat'l Commiss. on Zool. Nom. in connection with the following name, listed by case number: (see Bull. Zool. Nom. 35, part 2, 31 Oct., 1978).

640 *Notonecta striata* Linnaeus, 1758 (Insecta, Hemiptera): designation of a neotype under the plenary powers.

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 2), 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.

SECOND INTERNATIONAL CONGRESS OF SYSTEMATIC AND EVOLUTIONARY BIOLOGY

The Second International Congress of Systematic and Evolutionary Biology (ICSEB–II) will be held at the University of British Columbia, Vancouver, Canada, 17-24 July 1980.

The provisional list of symposia topics include:

1. Arctic Refugia dn the Evolution of Arctic Biota
2. Origins and Evolution of the North Pacific Marine Biota
3. Evolution of Reproductive Strategies
4. Evolutionary Epigenetics
5. Evolution of Community Structure
6. Green Algae and Land Plant Origins
7. Macromolecular Mechanisms in Evolution
8. Allozymes and Evolution
9. Coevolution and Foraging Strategy
10. Evolution of Colonizing Species
11. Rare Species and the Maintenance of Gene Pools
12. Paleobiology of the Pacific Rim

Additional Symposia may be included.

Sessions for contributed papers and for papers in specialized fields, taxonomic as well as methodological will also be organized.

Those interested in receiving an information circular in the Spring of 1979, should write to:

Dr. G. G. E. Scudder, Department of Zoology, The University of British Columbia,
2075 Wesbrook Mall, Vancouver, B. C. V6T 1W5, Canada.

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.

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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.

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

BEETLE T-SHIRT FOR SALE: Yellow T-shirt with a large *Goliathus giganteus* and its name above the beetle, printed in black. Shirts are 50% cotton & 50% polyester. Send $5.50 with size (men's S-M-L-XL) to Scientific T-Shirt, 82 Shirley Ave., Buffalo, NY, 14215. NY State residents add sales tax.

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WANTED: Records of any recent observations or collections of *Dendrotettix quercus* Packard (Orthoptera: Acrididae) in either New Jersey or on Long Island, N.Y. Write Philip E. Marucci, Blueberry-Cranberry Research Center, Rutgers Univ., Chatsworth, N.J., 08019.

INSECT PINS – standard black, $9.50 per thousand. Clair Armin, 191 W. Palm Ave., Reedley, Calif., 93654

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Wanted. Adult specimens of Lampyridae of the world, except U.S. and Canada. State condition, number, variety and price. Also, older lampyrid literature, reprints. J.E. Lloyd, Entomol., Univ. of Florida, Gainesville. 32611

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IMPROVED TRAPS AND TECHNIQUES FOR THE STUDY OF EMERGING AQUATIC INSECTS[1]

Laurent LeSage, A.D. Harrison[2]

ABSTRACT: A description is given of floating pyramidal emergence traps which can be used in running and standing water and semi-aquatic habitats. They have a wood or ABS tubing base and the netting is fine muslin. There are two versions of the traps: Model DAY collects efficiently for a period of 24 hours or less and can be emptied rapidly as the whole net can be removed by a fast stripping method. Model WEEK permits samples to be taken over longer periods (2-15 days) and is suitable for taxonomic purposes, surveys over wide regions or studies of large lakes and rivers. Both models can be used for quantitative or qualitative limnological studies such as daily and seasonal emergence patterns, life tables and the effects of peculiar ecological factors. The construction, dimensions and the methods of setting the traps are described in detail and special problems, such as the frequency of emptying, water condensation, predators, and the criteria for the choice of models are discussed.

Mundie (1971) and Morgan (1971) review the literature on emergence traps for limnological studies; most traps are designed for standing water (Lindeberg 1953; Corbet 1965, Frank 1965, Mundie 1971, McCauley 1976) or wetlands (Lammers 1977) and cannot operate in lotic situations. Even the 3-sided pyramidal trap (Mundie 1964, 1966) or the stream box trap of Hamilton (1969) are overturned by spates or quickly plugged by large amounts of drifting detritus. The strong floating trap of Langford & Daffern (1975) is very resistant to spates and works well in running water but its size limits its use to large rivers.

Two types of traps are described, the first, Model DAY, designed to collect emerging insects for a period of 24 hours or less and, the second, Model WEEK, designed to collect for a period of up to one week. Both models could be used on wetlands, standing or running water under various weather conditions and are not selective for different groups of insects. New techniques have also been developed to reduce the time involved in the collecting and preservation of the trapped insects.

MODEL "DAY"

Construction

The base of the trap (Figs. 1a & 2) is made of 4 pieces of wood, 75 cm long, 7 cm wide, 1.5 cm thick, joined together; the free internal surface is

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[1] Received December 30, 1978

[2] Department of Biology, University of Waterloo, Waterloo, Ontario, N2L 3G1

0.37 m^2. Four strips of polystyrene ("styrofoam"), 10 cm wide and 5 cm thick are nailed underneath to give bouyancy. A strip of wood is fixed along the inner top edge of the base, shaped as in Fig. 1 for net attachment. Four wooden rods 1.5 cm diameter for holding the top plate are joined to the base and the plate by spiral (twisted) nails through drilled holes. The top plate is made of 1.5 cm plywood and is 15x15 cm. A hook in the middle of the plate

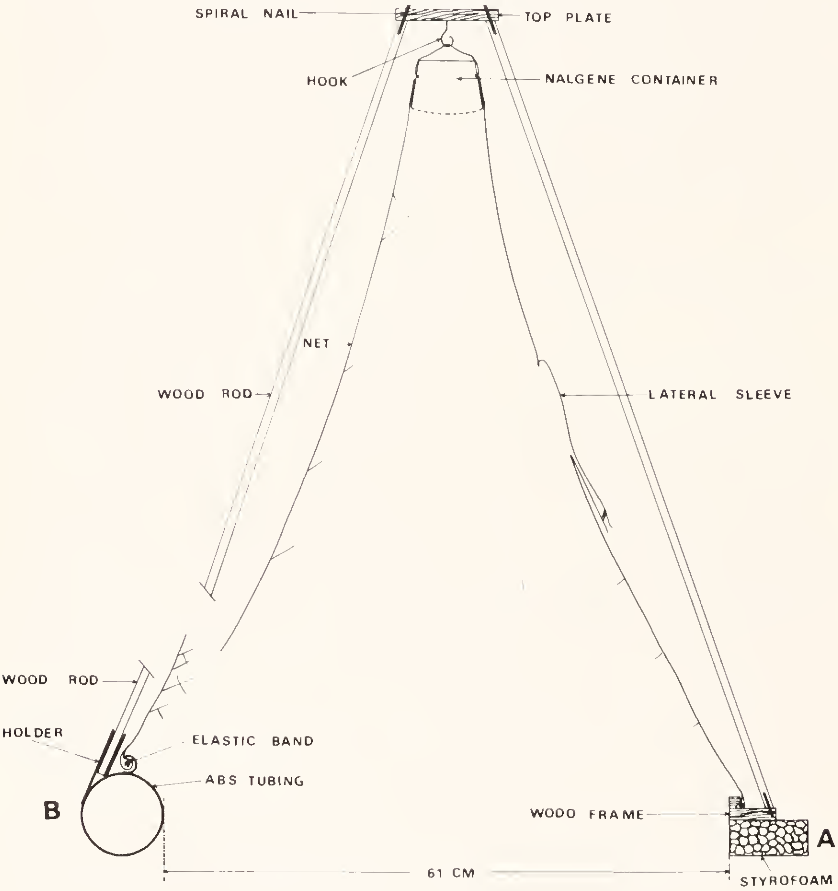

Figure 1. Cross section through a pyramidal floating trap showing parts. A–model DAY with wood frame, net and container. B–ABS tubing base for model WEEK.

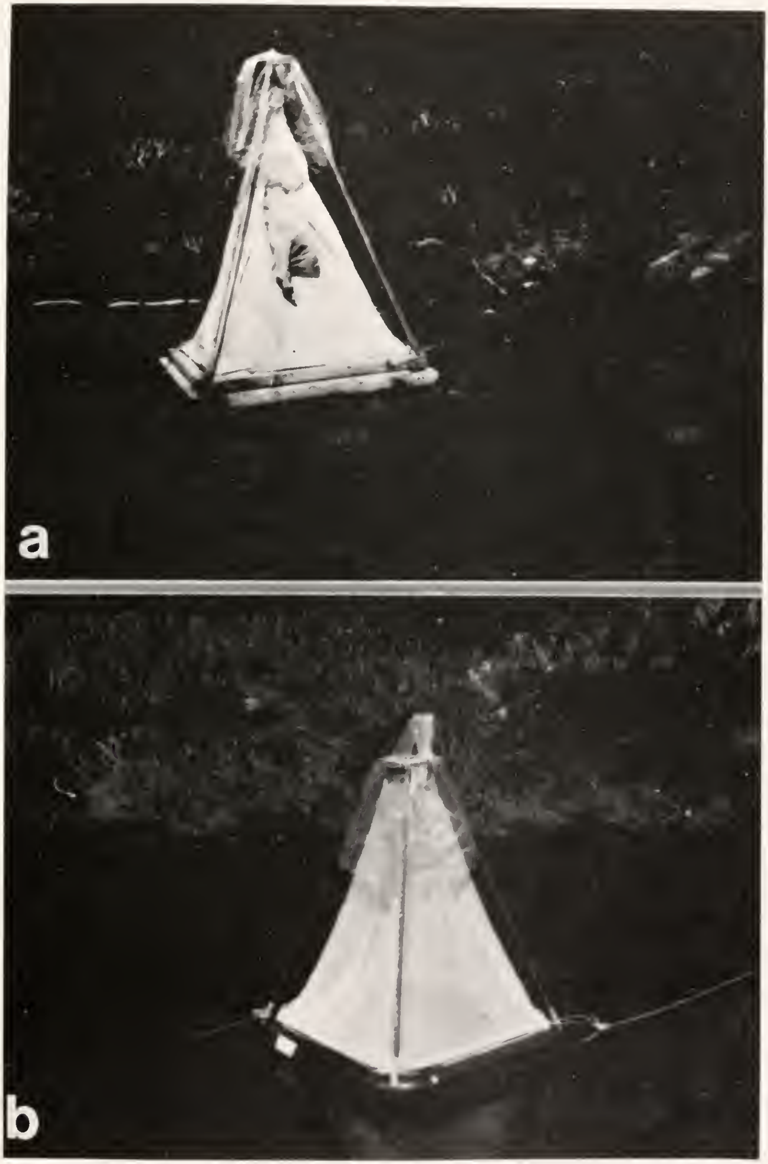

Figure 2. A–trap model DAY set in the field at Salem Creek, Elmira, Ontario. B–a trap model WEEK set over a pool.

holds the top of the net. A transparent plastic bag, covering the top one-third of the trap is stapled around the plate for protection against rain and wind.

The net is made of four panels of synthetic muslin (Tergal tissue-27 mesh/cm, opening of 240/cm. The panels are about the same size as the four sides of the frame but 1 cm extra is allowed on each side for stitching and the base of each panel is 1.5 cm wider than the frame so that the completed net can be easily put on and taken off the frame. A strong elastic band is threaded through the hem of the net to hold it in the groove formed by the basal strip of wood (Fig. 1a). The top of the net is fixed to a small Nalgene container with fiberglass tape. A cord, resistant to ethyl acetate, is used to hang the container and net to the frame.

Operation

This model is specially designed for fast processing of emerged insects. It has now been tested successfully over two years of daily collections and has also been emptied hourly for a study of diel emergence patterns.

The "stripping method", which is not affected by the number of insects in the net, can be summarised as follows:

A. To attach the net:

1. Hang the top Nalgene container to the frame.
2. Take the two far corners of the net, one in each hand (Fig. 3a).
3. Fix the far side of the net in the groove, pull the net towards you and secure the lateral and near sides (Fig. 3b).

B. To empty the traps:

4. Tap the base of the net to encourage any insects that may be resting there to move upwards. Remove the base of the net and hold it closed (Fig. 3c).
5. Detach the top of the net, turn the net upside down and shake 3 to 5 times to concentrate the insects in the top container (Fig. 3e). This step is optional as most insects will have already moved to the top, but advisable as small, fragile insects (Ceratopogonidae, Chironomidae, etc.) seem to be protected against eventual damage by next steps.
6. Introduce the upper half to two-thirds of the net gently, without packing, into a large killing bottle containing ethyl acetate and snap the cap (Fig. 3d). A useful killing bottle can be made from a large one-gallon jar with three paper towels moistened with ethyl acetate on the bottom. It was found convenient to use two such jars at a time so that another trap could be emptied while the insects from the first were being killed.
7. While insects are being killed (allow two minutes), re-set the trap with a spare net.
8. When insects are killed, remove the net from bottle and shake all of them down into the container (Fig. 3e).

9. Hold container in one hand and, with the other, turn the net completely inside out (Fig. 3f).

10. Empty the contents into a large funnel with a tube attached (Fig. 3g). A 30 cm diameter Nalgene funnel on a support is ideal and a 2.5 cm diameter plastic test tube fits snugly onto it.

11. Tap the funnel when working in dry conditions or wash down the organisms with 70% ethanol from a wash bottle, while holding the receiving tube with the other hand. Label each tube with the corresponding trap number.

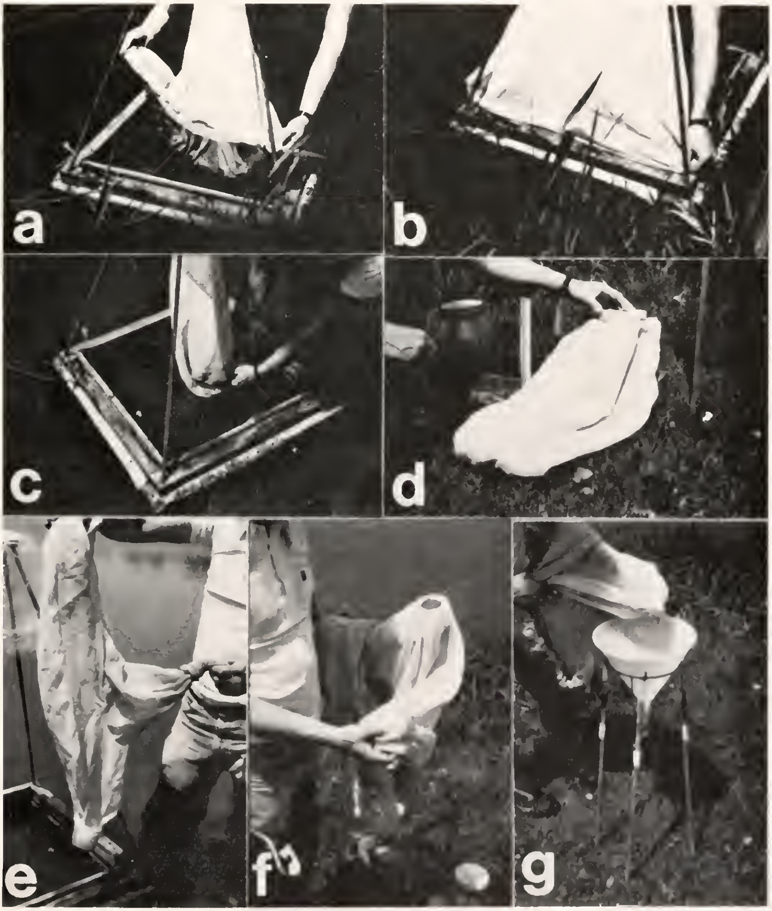

Figure 3. A–G Illustration of different steps of the stripping method for emptying traps model DAY. See the text for details.

12. The traps should be emptied at the same time each morning, or as soon after noon as possible, and always in the same order to obtain an accurate 24-h. emergence.

MODEL "WEEK"

Pyramidal version

Construction and dimensions correspond to model DAY but traps are more sturdy and the floating base is made from ABS drainage tubing (Figs. 1b, 2b). This base consists of four straight pieces, 10 cm diameter and 51 cm long joined into a square with all joints sealed and thoroughly waterproof. The groove for holding the base of the net is made from 2 cm diameter polychlorovinyl (PCV) tubing bonded to the top of the base with epoxy cement; the outer one-third of this tube is cut away (Fig. 1b). A small piece of the same PCV tubing is fixed upright at each corner to receive the rods supporting the net; however, as a satisfactory joint (ABS-PCV) is difficult to make, a stronger joint was obtained in later models from pieces of ABS folded into the shape required (by gentle heat) and glued with ABS cement. The rods are the same size as those used in model DAY. The net for model WEEK is almost the same as described for model DAY; the distinguishing feature is that it is made to fit on a collecting head instead of the container, and that the base of the net is fixed tightly by introducing a supplementary non-elastic cord in the hem to eliminate eventual blowing out of nets by strong gusts of wind.

Small collecting heads are made readily from transparent plexiglass and Nalgene bottles (Figs. 4, 5). The plexiglass base has an 8x8 cm aperture; holes are drilled in the 4 corners to take screws and one side is recessed to allow for the positioning of a Nalgene collecting bottle when the head is completed. The concentrator is attached above the base; this is made of four pieces of plexiglass (dimensions in Fig. 4) to form a long sloping side, a short vertical side and two triangular enclosing sides, shown. The vertical side has a 4x4 cm aperture near the top to allow insects to pass into the collector.

The collector consists of two Nalgene bottles each 12 cm high. One is fixed upside down, as shown, and has a lateral hole corresponding to that of the concentrator, the second one screws onto this and is replaceable. As Nalgene is difficult to glue, it is necessary to bolt the bottle to the lid and the side of the concentrator; these joints should be sealed with silicone cement. The attachment for the replaceable bottle is made of a Nalgene bottle cap pierced with as large a hole as possible; this has to be attached with screws to the fixed bottle and the replaceable bottle can be screwed into it.

The collecting head itself is attached by screws to a square wooden plate

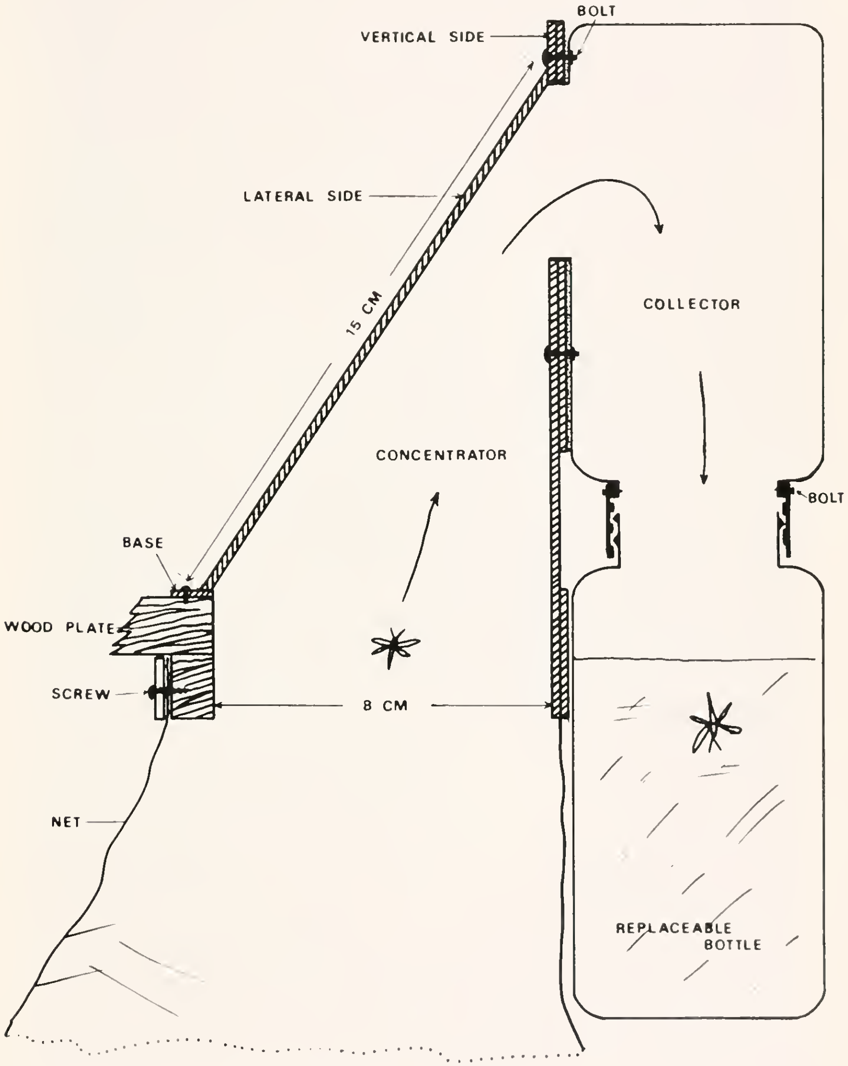

Figure 4. Cross section through a collecting head for model WEEK showing parts and hypothetical flight followed by trapped insects.

(15x15 cm), with an aperture of 8x8 cm, that is attached to the four rods fitting into the floating base as in model DAY. The net is the same as that used in model DAY but here the top of the net is fixed directly to the wooden plate by means of a small piece of wood attached by screws. A protecting plastic bag is stapled around the plate as in model DAY.

Operation

Insects can be collected rapidly merely by replacing bottles. Collecting bottles are 3/4-filled with a mixture of 2 parts of 70% alcohol to one part of commercial ethylene glycol. The volume of the preservative remained fairly constant for a week or more. Trapping efficiency is improved if 5 ml of dishwashing detergent is added to each liter mixture to lower the surface tension. The trap can be left for two weeks if 1:1 70% ethanol and ethylene glycol are used then a large collecting bottle must be employed. In the laboratory insects should be transferred to fresh 70% ethanol.

As spiders and other predators may give trouble it is recommended that nets be made with a lateral sleeve so that these can be removed at each visit.

Truncated version

It was observed in the field that some insects were clearly not caught by the collecting head just described and it was suspected that these species avoided the opening. It was decided, therefore, to construct a trap with an enlarged collecting head but with the same size of base. This was achieved by truncating the trap and fitting a head with a 20x20 cm aperture (Fig. 5b), that is an aperture more than 5x the previous model.

Although no large-scale test was carried out, the truncated version appeared to be more effective from field observations because the number of insects noted resting on the net was generally smaller, the larger aperture produced less shade, eventual obstruction by spiders webs was considerably reduced, and the dead floating insects observed sometimes under the pyramidal version were not present.

OBSERVATIONS, REMARKS AND COMPARISONS

Model DAY was used for two spring-fall seasons and model WEEK for one season for a study on the life cycles of stream chironomids in the Salem Creek near Elmira, Ontario; the results of this are to be published elsewhere. In this section field observations, and problems encountered in sampling are discussed and these traps compared with previously described ones.

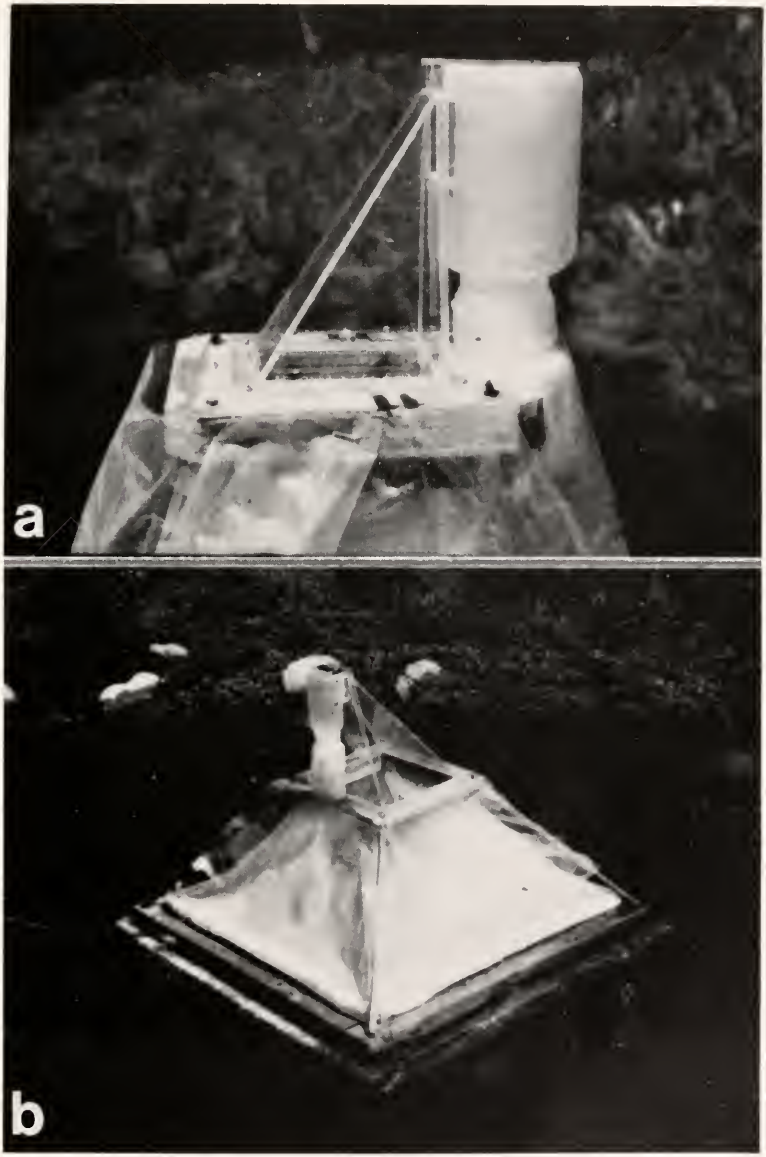

Figure 5. A–Close-up of a collecting head of trap model WEEK. B–Truncated version of trap model WEEK.

Construction

The material for both traps can be found in any general hardware store. The traps are easy to build and do not require special tools. No differences in efficiency were noted between those traps with a base of wood or those with ABS tubing. Model DAY costs about $20.00 (U.S. 1976) and model WEEK, with ABS tubing about $30.00 for material, labour not included. If limited funds are available, model WEEK can be made with a wooden base and any model WEEK can be adapted for daily use.

Styrofoam strips are eventually damaged after a year or so or loose their bouyancy and must be replaced. The ABS base is more durable and remains bouyant.

Shape

Traps with triangular, square, rectangular and round bases have been proposed (Mundie 1971, Morgan 1971); the shape is probably not important in standing water but in lotic situations traps must disturb the water flow as little as possible; the square base was found to be best adapted for this purpose, specially when anchored with one angle facing the current. The square base, furthermore, is more convenient for setting traps half on the bank and half in the water and altogether more versatile than the fixed box trap of Morgan (1971).

Size

Morgan, Wadell and Hall (1963) found a correlation between the size and efficiency of emergence traps in standing water; they concluded in their series that a base of 0.46 m^2 proved optimal and that one of 0.37 m^2 was the second best.

A base of 0.37 m^2 was adopted for our study for several reasons. First, the traps are not too bulky and not too heavy, an important factor for floating in running water. Second, the traps are not too large to be placed over a single substratum type, or a small secondary branch stream, without overlapping more than one microhabitat. Third, they are large enough not to interfere excessively with water flow in the area they enclose, and large enough to cover large objects such as tree stumps, rocks, piles of twigs, riparian vegetation, etc. Also they can be placed half in the water and half on the bank to sample the fauna of stream margins. The 0.37 m^2 size, therefore, seems to be a good compromise between the need for portability and convenience and the need for obtaining reliably large samples.

Net

The mesh must be less than 300 μm if all the insect fauna is to be collected (Morgan 1971); many Ceratopogonidae, Orthocladiinae and other small insects can escape through window screen or cotton gauze, often used (Needham 1908, Adamstone & Harkness 1932, Miller 1941, Scott & Opdyke 1941, Vallentyne 1952). Several synthetic curtain muslins are now available commercially, these are cheap, translucent, strong and finely meshed (openings of 200-250 μm) and ideal for emergence traps. After three years of use our nets are still in good condition.

Scott & Opdyke (1941), using floating tent traps, showed that those made of opaque material caught fewer insects than those made of white muslin. Our "Tergal" muslin nets are very pale blue and cut off very little light.

The fine muslin material also provides a good support for nymphs, subimagos and adults as they can easily grip it while moulting or maturing. Subimaginal and nymphal exuviae are often found on the net and are easily collected and preserved for eventual association with adults.

Setting in the field

Traps are secured so that they always sample at the same spot independent of water level fluctuations. In fast-flowing water traps do not move very much laterally but tend to sink in current over 2 m/s. Bouyancy is increased if the attachment rope is fixed high up on to a pole or a tree so that the angle between this rope and the water surface is 45° or more even during high water periods (Fig. 2b). The rope should be at least 2 m long to give the trap freedom to respond to changes in level and turbulence. It is suggested that the traps be fixed in position and their flotation tested during a spate or high spring levels if disasters and possible losses are to be avoided. It may be necessary to change the location of some traps or to attach supplementary bouys if the current is too fast. In pools or in standing water the efficiency of the traps may be reduced by their tendency to move in the wind (Morgan, Waddell & Hall 1963, Morgan 1971). They can be stabilized by driving poles around them to hold them steady or by extra anchors.

Frequency of emptying

The frequency of emptying the traps is probably the most important factor in any study of emergence. In most studies, even "quantitative" ones, traps are emptied every second day and sometimes after even longer periods (Hall, 1963, Morgan, Waddell & Hall, 1963, Macan 1964, Anderson & Wold 1972). Hamilton (1969) could find no significant differences between emptying daily and every second day. Nevertheless, in our studies in Salem Creek, insects left in the net for 24 h. after emergence showed a mortality of 81-100%, depending on the group of insects involved and the weather. All small insects were dead and dry and only larger specimens such as Trichoptera, Plecoptera, Ephemeroptera and Diptera still survived 48 h. later. When the wind was strong or the night cold all insects died.

During 500 days of daily emptying few dead animals were noticed floating on the water surface. In Salem Creek the emergence peak is after sunset or late afternoon for most insects and so these were resting or flying about the net for 10-15 hours as they were collected soon after noon the next day. It is estimated from dead insects found floating that model DAY and the net stripping emptying method account for more than 99% of emerged insects and are ideal for quantitative studies.

Condensation

In Ontario daily fluctuations in temperature throughout the collecting season can produce considerable quantities of dew in open plastic and glass containers. For this reason tent traps made of polyethylene (Sublette & Dendy 1959) are inappropriate in this climate. No serious condensation was found on the muslin netting and even small insects remained dry. Protection from rain and wind was provided by the plastic covering at the top of the trap.

Condensation problems in the collecting head of model WEEK were resolved by piercing vents through the sides of the concentrator or collector and covering them with muslin.

Predation by various invertebrates

In our study spiders were the most important predators but their deprivations were much reduced by daily emptying. Other predators such as the Gyrinidae, Gerridae and fishes probably preyed on some emerging insects but previous authors have considered these as a minor source of error (Morgan, et al. 1963). Spiders may become a serious problem when traps are emptied weekly as they tend to spin their nets over the entrance to the collecting head. Their influence is minimized when the larger head (20x20 cm) is used; the losses they cause can be roughly estimated by examining the webs for insects remains.

Dragonflies and Empidae do not have time to cause damage in the daily collecting program and soon fly into the bottle in model WEEK.

Special groups of insects

Living specimens are available for special studies; they can be picked out of the trap in the field or the whole net can be brought into the laboratory for processing.

Very small insects such as Ceratopogonidae, Orthocladiinae, etc., are collected successfully, specially by model DAY: the net stripping method of emptying is better for these than any other method described so far. Very short lived insects, such as the Tricorythidae are more easily sampled by model WEEK than model DAY, specially in the case of those species which will not rest on the muslin but fall into the bottle, nevertheless.

Dried specimens (Tabanidae, Tipulidae, Odonata, Coleoptera, etc.) may be obtained from both models. With model DAY they can be killed with either ethyl acetate or potassium cyanide prior to pinning and, in model WEEK the collecting bottle can be replaced with a deep version of a classical killing bottle with KCN. In this case bottles should be emptied often, daily if possible.

Semiaquatic groups, insects pupating on the banks or species that crawl to the shore to emerge can be collected by setting traps part on land and part over water or by setting them over special microhabitats such as log piles, small boulders, marginal vegetation and on sand and mud flats.

Choice of model

Each model has its advantages and limitations. Both are easy to build and sample nearly all kinds of microhabitats in running and standing water. The time involved in emptying is very short and independent of the number of specimens in the trap. As they both float they do not disturb the substratum underneath which can therefore be sampled over long periods.

The main advantage of model DAY is that it collects a 24-h. emergence efficiently; it is, therefore, recommended for quantitative or life-cycle studies. It is also very useful for the study of diel emergence patterns. The use of a number of traps together minimizes losses due to bad weather, spates, predators and cattle and gives data suitable for statistical interpretation.

Model WEEK is ideal for taxonomic purposes as specimens are well preserved and traps can be emptied rapidly. It is also useful when traps cannot be emptied daily, when only the general pattern of emergence is needed, or when a large area has to be surveyed. It is also more convenient for special situations such as deep lakes and large rivers and more effective than model DAY for trapping insects with a very short adult life.

The truncated version of model WEEK represents the best compromise when quantitative results are needed but time is not available for daily sampling. The large aperture reduces considerably any inhibitions insects may have against entering the collecting head and the time involved for emptying is only a few minutes at each visit.

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ECTOPARASITES OF MAMMALS AND BIRDS FROM FORT DIX, NEW JERSEY[1] [2]

Harold J. Harlan[3] , Richard D. Kramer[4]

ABSTRACT: New state records are detailed for 17 arthropod ectoparasite species collected from mammals and birds at Fort Dix, New Jersey. Thirty-four additional ectoparasitic arthropod species are included in a host-ectoparasite list from a total of 108 hosts of 21 different species.

This study was undertaken to supplement existing knowledge of known or potentially medically important ectoparasitic arthropods at Fort Dix, Burlington County, New Jersey. Presence, prevalence and host range data were sought on ticks, fleas and mites which are known or potential vectors of human pathogens.

Previous records of ectoparasites from New Jersey have been published by: Cooley (1938, 1946), Fox (1940), Trembley and Bishopp (1940), Cooley and Kohls (1944, 1945), Ferris (1951), Hansens and Hadjinicolaou (1952), Baquaert (1954), Burbutis and Hansens (1955), Race (1955), Burbutis (1956), Hansens (1956), Burbutis and Mangold (1956), Clifford, et. al. (1961), Manischewitz (1966), Herrin (1970), and Whitaker and Wilson (1974). Collections from Burlington County were limited in or absent from most of these records.

During 1974, the Health and Environment Activity of the Medical Department Activity, Fort Dix, NJ, conducted a small animal trapping and ectoparasite surveillance program as part of their routine pest surveillance mission.

Most of those 1974 collections are included here. All new state records included herein have been examined and confirmed by taxonomic specialists. Any specimen whose identification was questionable due to condition, preparation artifacts or improper instar for determination, was omitted from these data. No taxon is reported as a new state record if it could not be determined to be such a record. New state records do not include subspecies nor

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[1] Received January 23, 1979

[2] All opinions and ideas expressed herein should be attributed to the authors, who are solely responsible for both content and accuracy, and in no way purport to reflect any position or policy of the Department of the Army or the Department of Defense.

[3] Major, Medical Service Corps, U.S. Army, presently assigned to the Preventive Medicine Division (Atlantic), USA MEDDAC, Box "S", Fort Gulick, Canal Zone, APO Miami 34008.

[4] Captain (promotable), Medical Service Corps, U.S. Army, presently assigned to the USAEHA, Regional Division – South (Bldg 180), Fort McPherson, GA 30330.

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taxa determined to genus only (although the latter are included in the host-ectoparasite list in order to reflect their occurrence and observed hosts).

METHODS

Small animals and birds were trapped in box-type live traps, anesthetized, and examined for ectoparasites. Fleas and some immature ticks were mounted in balsam on slides whereas lice and most mites were mounted in Hoyer's medium, ringed with clear fingernail polish. Some mites and late nymphal instars were preserved in 70 percent ethanol. Louse flies were attached with casein glue to paper points. These collections and processing procedures are detailed in Bram (1978). Host animals were identified using Burt and Grossenheider (1964), Peterson (1968) and Blair, et. al. (1968). Arthropod specimens reported here have been deposited in the collections of: the senior author, the Ohio State University (Columbus), the University of Kentucky (Lexington), the University of Minnesota (St. Paul), the California State University (Long Beach), the U.S. Army Academy of Health Sciences (Fort Sam Houston, TX) and the U.S. National Museum.

RESULTS AND DISCUSSION

Ectoparasites were collected from mammals and birds at Fort Dix, Burlington County, New Jersey during 1974. Examination of 108 animals yielded 321 fleas (9 species), 964 biting lice (6 species), 517 sucking lice (7 species), 261 ticks (7 species), 259 mites (20 species), and 5 louse flies (2 species). Seventeen ectoparasite species are reported from New Jersey for the first time.

New state records are detailed below. All other collections are included in the host-ectoparasite list for the purpose of recording their occurrence and observed hosts in the study area. All specimens reported here were collected on the Fort Dix military reservation. Numbers of ectoparasite specimens reported herein should not be used for any quantitative purposes because the investigators did not attempt to collect all the ectoparasites from heavily infested hosts.

Anoplura listed below follow the classification of Stojanovich and Pratt (1965); Mellophaga follow Emerson (1972 a, 1972 b); Siphonaptera follow Hopkins and Rothschild (1953); Acari follow Krantz (1971); Hippoboscidae follow Baquaert (1959); vertebrate hosts follow Blair, et. al. (1968). Parenthetic numbers following host names indicate numbers of infested individuals examined. Life stage abbreviations for ectoparasite specimens include: L = larva(e), N = nymph(s), H = hypopus (hypopi), M = adult male(s), F = adult female(s).

Class: ACARI

Order: PARASITIFORMES

Family: LAELAPIDAE

Eulaelaps stabularis (Koch)

1 M, 3 F, ex. *Didelphis marsupialis* L., 20-III-1974; 1 M, ex. *D. marsupialis*, 23-IV-1974; 1 M, ex. *Peromyscus leucopus* (Rafinesque), 2-VIII-1974, 4 F, ex. *Rattus norvegicus* (Berkenhout), 26-VI-1974; new state record.

Hirstionyssus staffordi Strandtmann and Hunt

1 N, 3 F, ex. *Mephitis mephitis* (Schreber), 29-III-1974; 2 F, ex. *M. mephitis*, 1-IV-1974; new state record.

Haemogamasus reidi Ewing

1 N, 7 F, ex. *Glaucomys volans* (L.), 18-X-1974; new state record.

Family: MACRONYSSIDAE

Ornithonyssus wernecki (Fonseca)

3 N, 1 F, ex. *D. marsupialis*, 4-III-1974; 5 F, ex. *D. marsupialis*, 16-III-1974; 2 F, ex. *D. marsupialis*, 20-III-1974; 3 N, ex. *D. marsupialis*, 21-III-1974; new state record.

Order: ACARIFORMES

Family: MYOBIIDAE

Archemyobia inexpectatus Jameson

2 F, ex. *D. marsupialis*, 16-III-1974; new state record.

Family: LABIDOPHORIDAE

Dermacarus hylandi Fain

29 H, ex. *Tamius striatus* (L.) (8): 29-III-1974, 19-IV-1974, 5-VI-1974, 27 and 30-VIII-1974 (2), and 26-IX-1974 (2); new state record.

Family: CHEYLETIDAE

Cheyletus eruditus (Schrank)

1 N, 4 F, ex. *P. leucopus*, 23-IV-1974; new state record.

Family: TROMBICULIDAE

Trombicula fitchi Loomis

3 L, ex. *G. volans*, 18-X-1974; new state record.

Class: INSECTA

Order: ANOPLURA

Family: HAEMATOPINIDAE

Neohaematopinus sciuropteri (Osborn)

4 N, 5 F, ex. *G. volans*, 18-X-1974; new state record.

Family: HOPLOPLEURIDAE
Hoplopleura erratica (Osborn)

21 N, 2 F, ex. *T. striatus*, 5-VI-1974; 56 N, 6 M, 11 F, ex. *T. striatus* (2), 30-VIII-1974; 27 N, 3 M, 19 F, ex. *T. striatus*, 12-IX-1974; 18 N, 5 M, 9 F, ex. *T. striatus*, 26-IX-1974; new state record.

Hoplopleura trispinosa Kellogg and Ferris

4 N, 1 M, 8 F, ex. *G. volans*, 18-X-1974; new state record.

Hoplopleura sciuricola Ferris

13 N, 4 M, 6 F, ex. *Sciurus carolinensis* Gmelin, 11-III-1974; 1 N, 1 M, ex. *S. carolinensis*, 18-III-1974; 2 N, 3 M, 12 F, ex. *S. carolinensis*, 15-IV-1974; 4 N, 9 F, ex. *S. carolinensis*, 21-IV-1974; 22 N, 10 F, ex. *S. carolinensis*, 30-IV-1974; new state record.

Order: MALLOPHAGA
Family: TRICHODECTIDAE
Neotrichodectes mephitidus (Packard)

28 N, 39 M, 129 F, ex. *M. mephitis*, 29-III-1974; 41 N, 24 M, 75 F, ex. *M. mephitis*, 1-IV-1974; new state record.

Although geographic records for mallophaga are usually de-emphasized by most experts due to the extreme mobility of their bird hosts, this state record is worthy of note. This becomes readily apparent when one considers that their hosts were collected at least 30 miles from the nearest state border, a skunk's normal lifetime activity range is less than a six mile radius, and they seldom, if ever, migrate (Verts, 1967).

Order: SIPHONAPTERA
Family: PULICIDAE
Pulex simulans Baker

1 M, 4 F, ex. *Canis familiaris* L., 8-XI-1974; new state record.

Smit (1958) resurrected this species from synonymy with *Pulex irritans* L. Many workers since then have accepted and reinforced the validity of *P. simulans* as a separate taxon. Palmer and Wingo (1972) presented a key for separating these two species with supporting illustrations. Wilson (1966) summarized previously known records of *P. simulans* but did not report any records from New Jersey.

Family: RHOPALOPSYLLIDAE
Polygenis gwyni (C. Fox)

1 M, 1 F, ex. *M. mephitis*, 1-IV-1974; 2 M, 5 F, ex. *D. marsupialis*, 23-V-1974; new state record.

Order: DIPTERA
Family: HIPPOBOSCIDAE
Ornithoica vicina (Walker)

1 M, ex. *Lanius excubitor* L., 29-VIII-1974; new state record.

Pseudolynchia canariensis **(B. Macquart)**

1 M, 3 F, ex. *Columba livia* Gmelin, 7-VI-1974; new state record.

HOST-ECTOPARASITE LIST

Class: AVES
Order: COLUMBIFORMES
Family: COLUMBIDAE
C. livia – domestic pigeon
  Campanulotes bidentatus (Burmeister) – M:P*
  Columbicola columbae (L.) – M:P
  *P. canariensis*** – D:H

Order: PASSERIFORMES
Family: CORVIDAE
Cyanocitta cristata (L.) – blue jay
  Brueelia sp. – M:P
  Haemaphysalis leporispalustris (Packard) – P:I

Family: EMBERIZIDAE
Pipilo erythrophthalmus (L.) – rufous-sided towhee
  H. leporispalustris – P:I

Family: ICTERIDAE
Quiscalus quiscula (L.) – common grackle
  Ambloyomma americanum (L.) – P:I
  H. leporispalustris – P:I
  Myrsidea fuscomarginata (Osborn) – M:M
Tangavius aeneus (Wagler) – bronzed cowbird
  Myrsidea thoracica (Giebel) – M:M

Family: LANIIDAE
Lanius excubitor L. – northern shrike
  H. leporispalustris – P:I
  *O. vicinia*** – D:H

*Key to ectoparasite taxa (i.e. Order: Family) in alphabetic order:
A:A = Acariformes:Anystidae, A:Ca = Acariformes:Camisiidae, A:E = Acariformes: Erythraeidae, A:Lab = Acariformes:Labidophoridae, A:My = Acariformes:Myobiidae, A:T = Acariformes:Trombiculidae, AN:H = Anoplura:Haematopinidae, An:Ho = Anoplura:Hoplopleuridae, D:H = Diptera:Hippoboscidae, M:M = Mallophaga:Menoponidae, M:P = Mallophaga:Philopteridae, M:T = Mallophaga:Trichodectidae, P:An = Parasitiformes:Analgidae, P:C = Parasitiformes:Cheyletidae, P:I = Parasitiformes:Ixodidae, P:L = Parasitiformes:Laelapidae, P:M = Parasitiformes:Macronyssidae, S:C = Siphonaptera:Ceratophyllidae, S:H = Siphonaptera:Hystrichopsyllidae, S:P = Siphonaptera: Pulicidae, S:R = Siphonaptera: Rhopalopsyllidae.
**Indicates a new state record.

Family: MIMIDAE
Dumetella carolinensis (L.) – catbird
    Mesalgoides sp. – P:An

Family: TURDIDAE
Hylocichla mustelina (Gmelin) – wood thrush
    H. leporispalustris – P:I

Class: MAMMALIA
Order: CARNIVORA
Family: CANIDAE
C. familiaris – domestic dog
    Ctenocephalides felis (Bouche) – S:P
    Dermacentor variabilis (Say) – P:I
    *P. simulans*** – S:P
    Rhipicephalus sanguineus (Latreille) – P:I

Family: FELIDAE
Felis catus L. – domestic cat
    Androlaelaps fahrenholzi (Berlese) – P:L
    C. felis – S:P
    D. variabilis – P:I

Family: MUSTELIDAE
M. mephitis – striped skunk
    *H. staffordi*** – P:L
    *N. mephitidus*** – M:T
    Odontopsyllus multispinosus (Baker) – S:C
    *P. gwyni*** – S:R

Family: PROCYONIDAE
Procyon lotor (L.) – raccoon
    A. americanum – P:I
    A. fahrenholzi – P:L
    C. felis – S:P
    D. variabilis – P:I
    Ixodes texanus Banks – P:I
    O. multispinosus – S:C
    Ornithonyssus bacoti (Hirst) – P:M

Order: LAGOMORPHA
Family: LEPORIDAE
Sylvilagus floridanus (J.A. Allen) – Eastern cottontail
    A. fahrenholzi – P:L
    Cediopsylla simplex (Baker) – S:P
    D. variabilis – P:I
    H. leporispalustris – P:I
    Ixodes dentatus Marx – P:I
    Neotrombicula whartoni (Ewing) – A:T
    O. multispinosus – S:C
    Tencateia sp. – A:A

Order: MARSUPIALIA
Family: DIDELPHIDAE

M. marsupialis – opossum
- *A. inexpectatus*** – A:My
- *Camisia* sp. – A:Ca
- *C. eruditus*** – P:C
- *C. felis* – S:P
- *Ctenophthalmus pseudagyrtes* Baker – S:H
- *D. variabilis* – P:I
- *E. stabularis*** – P:L
- *Laelaps echidnina* Berlese – P:L
- *O. multispinosus* – S:C
- *Orchopeas howardii* (Baker) – S:C
- *Orchopeas leucopus* (Baker) – S:C
- *O. bacoti* – P:M
- *O. wernecki*** – P:M
- *P. gwyni*** – S:R

Order: RODENTIA
Family: CRICETIDAE

P. leucopus – white-footed mouse
- *A. fahrenholzi* – P:L
- *C. eruditus*** – A:C
- *E. stabularis*** – P:L
- *O. leucopus* – S:C
- *O. bacoti* – P:M

Reithrodontomys humulis (Audubon and Bachman) – Eastern harvest mouse
- *Euschoengastia peromysci* (Ewing) – A:T

Family: MURIDAE

R. norvegicus – Norway rat
- *C. pseudagyrtes* – S:H
- *E. stabularis*** – A:L
- *L. echidnina* – P:L
- *Polyplax spinulosa* (Burmeister) – An:Ho
- *Radfordia ensifera* (Poppe) – A:My

Family: SCIURIDAE

G. volans – Southern flying squirrel
- *H. reidi*** – P:L
- *H. trispinosa*** – An:Ho
- *Miyatrombicula cynos* (Ewing) – A:T
- *N. sciuropteri*** – An:H
- *O. howardii* – S:C
- *T. fitchi*** – A:T

S. carolinensis – gray squirrel
- *A. fahrenholzi* – P:L
- *D. variabilis* – P:I
- *H. sciuricola*** – An:Ho
- *Laelaps nuttalli Hirst* – P:L
- *Neohaematopinus sciuri* Jancke – An:H

O. howardii – S:C
Sciurus niger L. – Eastern fox squirrel
  L. nuttalli – P:L
  Neohaematopinus sciurinus Mjoeberg – An:H
  O. howardii – S:C
T. striatus – Eastern chipmunk
  Balustium sp. – A:E
  C. pseudagyrtes – S:H
  *D. hylandi*** – A:Lab
  Epitedia wenmanni (Rothschild) – S:H
  E. peromysci – A:T
  *H. erratica*** – An:Ho
  Ixodes scapularis Say – P:I

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CO-OCCURRENCE OF A MARINE AND A FRESHWATER SPECIES OF LIMNICHIDAE (COLEOPTERA)[1]

William D. Shepard[2]

Members of the family Limnichidae are small, riparian beetles often collected on objects (sticks, stones, vegetation, etc.) projecting from the water. Limnichids frequent freshwater habitats except for the subfamily Cephalobyrrhinae which is adapted to tidal mud flats and, hence, termed "marine" although they probably are protected by bubbles on the undersurfaces of various objects when submerged.

On 14 March 1977, I collected *Throscinus politus* Casey (a marine species) and *Eulimnichus ater* (LeC.) (a freshwater species) on San Antonio Bay near the Aransas National Wildlife Refuge, in Aransas Co., Texas. Both species were taken from wood and rocks exposed at low tide or nearshore mud flats. At the time, the only freshwater runoff into the bay was from a single seep a few meters long in which there were several immature crayfish. Upon entering the bay, though, the water was quickly diluted by the seawater and tasted salty just a few centimeters from the mouth of the seep. A "normal" assemblage of marine invertebrates existed on the mud flat and right up to the mouth of the seep.

It is tempting to envision the evolution of a marine existence for the Cephalobyrrhinae by a series of gradual steps from living near streams entering such shallow bays to on-shore windrows of detritus and, finally, to objects intermittently exposed by the gentle tides of these bays. Undoubtedly, heavy rains are an aid in transporting freshwater species into or near the bays.

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[1] Received December 8, 1978

[2] Department of Zoology, University of Oklahoma, Norman, Oklahoma, 73019

LITTER AND SOIL INHABITING MICROCOLEOPTERA OF SOUTHWEST NORTH DAKOTA[1,2]

James W. Smith[3], Christian Y. Oseto[4], and Edward U. Balsbaugh, Jr.[5]

ABSTRACT: A two year study in southwest North Dakota yielded sixteen species in thirteen families of microcoleoptera (< 2.0 mm body length) that inhabit litter and the soil surface. During the summers of 1976-77, a soil arthropod survey was undertaken in Dunn, Hettinger, McKenzie, and Slope counties as part of the Regional Environmental Assessment Program (REAP). REAP was initiated to evaluate environmental and socioeconomic impacts caused by coal development activities in the region.

In conjunction with the Regional Environmental Assessment Program (REAP) for southwest North Dakota, a study of the microcoleoptera, or minute beetles, was undertaken to determine which species inhabit the soil in the study area in question. REAP was established to provide baseline data for assessing impacts of industrial development. The term micro-coleoptera carries no nomenclatorial status as a category of beetles, but was arbitrarily used to mean any member of the order Coleoptera less than 2.0 mm. total body length. In southwest North Dakota, we found 13 families of beetles which included members less than 2.0 mm. long. The study area consisted of four counties in North Dakota, located in the southwest corner of the state. The study was undertaken during June, July, and August of 1976 and 1977.

METHODS

Diverse habitat types are represented in the four study sites in Dunn, Hettinger, McKenzie, and Slope counties. The sites can be characterized as follows:

Dunn County–a 1.6 hectare site in a stand of bur oak, *Quercus macrocarpa* Michx., situated between a pasture and an oat field. The oat field margin is largely composed of alfalfa, *Medicago sativa* L. A stock watering pond is located near the oak stand.

Hettinger County–the site is located in a shelterbelt of *Amelanchier alnifolia* Nutt. and *Caragana arborescens* Lam., situated between a cultivated wheat field and a farm-

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[3,4,5] Graduate Research Assistant, Assistant Professor of Entomology, and Associate Professor of Entomology respectively, North Dakota State University, Fargo, N.D. 58105

stead. *Setaria lutescens* (Weigel) Stuntz and *Agoseris cuspidata* (Pursh.) Raf. are found in the rows between the trees, and *Astragalus canadensis* L. was found as the major volunteer in the belt.

McKenzie County–a 4 hectare site located in an upland pasture to the north and a wooded ravine to the south. The major pasture grass is little bluestem, *Andropogon scoparius* Michx., and the major tree species in the ravine are quaking aspen, *Populus tremuloides* Michx., and american elm, *Ulmus americana* L. Blue grama, *Bouteloua gracilis* (HBK) Lag. is also found extensively down the slope of the pasture.

Slope County–a study area located on a hillside of mixed prairie–wooded habitat. Ponderosa pine, *Pinus ponderosa* Laws., columnar juniper, *Juniperus scopulorum* (Sargent) Rydb., and creeping juniper, *J. horizontalis* Moench, make up the major woody species; the dominant grasses were little bluestem, *Andropogon scoparius* Michx., and side-oats grama, *Bouteloua curtipendula* (Michx.) Torr. The substrate on the slopes is rocky. One extensive area of moss is present, along with a dense cover of 2.5 or more cm. of pine needles.

Soil samples were obtained with a soil sampler whose core was 8 cm. diameter and 20 cm. depth. The top layer of duff and decaying vegetation was included, along with any green plants picked up in the core. The cores were placed in plastic bags, coded with a REAP file number, and returned to the laboratory. In the laboratory, soil-inhabiting arthropods were extracted using a modified Tullgren funnel. The soil sample was placed in the funnel so that the only avenue of escape was into the collecting tube. A 60 watt incandescent bulb, in conjunction with a rheostat control, provided variable levels of heat intensity. Low heat was used initially, and heat was increased after 24 hours. After 48 hours, the collection tube was removed and beetles which met the criterion of 2.0 mm length or less were transferred to 70% ethanol for storage and further study. Each sample was assigned a REAP file number identical to the one it received in the field.

Determinations were made with a binocular dissecting microscope. Beetles were placed in a well slide (16 mm diameter by 2 mm depth) along with enough glycerine to submerge the beetle. In those instances where a beetle was curled excessively, a shallow well slide (16 mm diameter by 0.5 mm depth) and a coverslip were utilized to force the beetle into an extended posture for better viewing. The slide was illuminated by a double light source which facilitated the observation of lightly sclerotized and jointed parts, especially segments of appendages. The glycerine eliminated problems with reflection off the fluid surface, and permitted easy manipulation of the specimen. After determination to species, beetles were washed in 70% ethanol, dried, pointed using Gelva® as the mounting medium, and deposited in the North Dakota Insect Reference Collection (NDSU), Fargo, ND.

RESULTS

Sixteen species of microcoleoptera in as many genera and thirteen families were identified from the samples in southwest North Dakota. Certain of these beeltes appear to be habitat specific, while others are more generally distributed (Table 1). Some microcoleoptera were collected in such low numbers that no definite conclusions can be drawn about their habits and habitats.

Cryptophagidae: *Anchicera ovalis* Casey–This species was found associated with leaf litter in the aspen wooded ravine. The beetles are thought to feed on mold, fleshy fungus, decayed leaves, and similar materials (Arnett, 1971).

Orthoperidae: *Arthrolips decolor* LeConte–This beetle was present in large numbers in the grassland communities. It feeds on decomposing plant material and the spores of fungi (Hatch, 1957). Some orthoperids are thought to be carnivorous (Arnett, 1971). Several adult specimens of *A. decolor* were cleared in lactophenol so that the alimentary canal could be seen directly through the body wall. Gut analyses made on these REAP orthoperids were inconclusive because the alimentary canal was empty.

Orthoperus scutellaris LeConte–This beetle was present in the leaf litter soil cores in Dunn and Hettinger counties and feeds on fungal spores and decomposing plant material (Hatch, 1957).

Ptiliidae: *Ptilium columbianum* Matthews–*P. columbianum* was found in Dunn and Slope counties, in tree covered areas and in moss. It is notable for its large size [for a *Ptilium*], elongate form, pale color, and very long antennae (Matthews, 1884).

Acratrichis sp.–These were found in a stand of aspen in October of 1976 and were collected only one time.

Staphylinidae: *Habrocerus schwarzi* Horn–Blatchley (1910) said that *H. schwarzi* is boreal and may be found in northern Indiana. This record is from the leaf litter in McKenzie county, which is composed mainly of aspen. Four undetermined Aleocharinae were taken in McKenzie, Hettinger, and Slope counties in four different samples.

Lathridiidae: *Melanophthalma americana* Mannerheim–This beetle is reported to be common and has been reared from *Abies lasiocarpa* (Hook.) Nutt. (Hatch, 1962). Our specimens presented some difficulty because of variation. Some of the specimens were clearly *M. americana* while others had many characteristics of *M. cavicollis* Mann. Fall (1899) spoke of the problem: "The very limited material [of *M. americana*] . . . gave no indication of the really unusual variability to which many species of this family are known to be subject, and. . . which are now seen to be so completely connected by intermediates. . . that their subsequent recognition by students is a practical impossibility.". Using the extremes of variability present, we dissected and examined genitalia. All beetles appeared to be one species and were determined to resemble *M. americana* more than *M. cavicollis. M. americana* was present at all sites except McKenzie county, and apparently is not dependent on *Abies lasiocarpa* for its life cycle, but instead is adaptable and widely dispersed in southwest North Dakota.

Pselaphidae: *Pselaphus ulkei* Bowman–This beetle, with antennae-like palpi (Hatch, 1962, pl.X, fig. 7), was taken in an extensive growth of moss in Slope county, in October, 1976. This late season collection was done as a reconnaissance survey of the area for selection of the next year's collecting sites, and only a couple of the 1976 sampling sites were visited. The moss was chosen because it had previously been rich in organisms, especially minute beetles. The moss was collected extensively throughout the 1977 visits, but no more *P. ulkei* were found. However, the REAP survey ended in August, and no October collection trips were possible in 1977. Hatch (1962) said that *P. ulkei* occupies areas that were recently glaciated, and so may be considered boreal.

Scaphidiidae: *Baeocera apicalis* Fall–Blatchley (1910) took *B. apicalis* by sifting damp leaves from low moist ground. The REAP survey shows *B. apicalis* to be present in the McKenzie ravine in leaf litter and in the previously mentioned moss in Slope county. Arnett (1971) said that little is known concerning the adult habits and ecology.

Leiodidae: *Agathidium politum* LeConte–Not much is published concerning these contractile beetles which can roll up into a ball, except that they frequent logs bearing fungal growth, especially beneath loose bark. These beetles were taken in a pine-juniper stand which had numerous fallen branches.

Carabidae: *Polyderis laevus* Say–This tiny carabid was taken along the north edge of the shelterbelt in Hettinger county. Blatchley (1910) claimed it is one of the smallest carabids. Our specimens are 1.2 mm. He recorded *P. laevus* from under leaves along the borders of marshes. Lindroth (1966) stated: "This species seems not to be riparian. Darlington informs me that he has found it under stones in good soil.". The REAP Hettinger site was not close to any river or creek, so that *P. laevus* is almost certainly not riparian.

Bruchidae: *Abutiloneus seminulum* Horn–This species was present along the edge of a wheat field in Dunn county. Blatchley (1910) reported *A. seminulum* from dogwood flowers. Horn (1873) described this species from sweeps, with the comment: "[*A. seminulum*] occurs over a wide extent of country, specimens being known from Pennsylvania, Nebraska, Dacota (sic), and California.".

Chrysomelidae: *Longitarsus testaceus* Melsheimer–One specimen was taken in the McKenzie wooded ravine on October 8, 1976. Balsbaugh and Hays (1972) collected large series of *L. testaceus* on *Cirsium* spp., which was probably *C. undulatum* (Nutt.) Spreng., or bull thistle. Bull thistle is common in the REAP collecting sites. Blatchley (1910) noted that *L. testaceus* hibernates beneath logs and mullein leaves. Although it was not observed at the McKenzie site, mullein is present in southwest North Dakota, and the date of collection would lead one to believe that *L. testaceus* was hibernating. *L. testaceus* is a resident of northwest South Dakota, viz. in Buffalo, Spearfish, Sturgis, and Wall (Kirk and Balsbaugh, 1975).

One specimen each of two other beetle families, **Scydmaenidae** and **Colydiidae**, were taken in the shelterbelt in Hettinger county. Unfortunately, they were irreparably damaged and not determined further. No other representatives of either family were taken in the REAP collections.

DISCUSSION

Many beetles that would qualify as microcoleoptera are better collected by methods not employed in this study: treehole duff sifting, windowpane trap, aerial stickyboards or traps, beating brush piles, and blacklight trapping. However, the entomology section of REAP was designed primarily to monitor soil arthropods, and so only those minute beetles living in or on the soil were collected. Future surveys for microcoleoptera which employ the above collecting methods or others not mentioned will probably yield a much greater diversity of micro-coleoptera for southwest North Dakota.

Table 1. Summary of litter and soil inhabiting microcoleoptera collected in southwest North Dakota by year, month, location, and type of habitat.

BEETLE	YEAR	MONTH	COUNTY-SITE
Carabidae			
Polyderis laevus Say	77	Jy,A	H7
Staphylinidae			
Habrocerus schwarzi Horn	76	A	M4
undetermined Aleocharinae	77	J,Jy,A	M4,H5,H7,H9
Pselaphidae			
Pselaphus ulkei Bowman	76	0	S10
Leiodidae			
Agathidium politum LeConte	77	Jy	S9
Ptiliidae			
Ptilium columbianum Matthews	76,77	J,Jy,A	D3,S9,S10
Acratrichis spp.	76	0	M4
Scydmaenidae			
undetermined sp.	76	Jy	H5
Scaphidiidae			
Baeocera apicalis LeConte	76,77	J,O	M4,S10
Cryptophagidae			
Anchicera ovalis Casey	76	Jy,A	D2,M4
Orthoperidae			
Arthrolips decolor LeConte	76,77	Jy,A,S	D1,D2,S8
Orthoperus scutellaris	76,77	Jy,S	D3,H7
Lathridiidae			
Melanophthalma americana Mann.	76,77	Jy,A,O	D1,D2,H5,H7,S9,S10
Colydiidae			
undetermined sp.	76	Jy	H6
Chrysomelidae			
Longitarsus testaceus Melsheimer	76	O	M4
Bruchidae			
Abutiloneus seminulum Horn	77	Jy	D1

J=June; Jy=July; A=August; S=September; O=October; D1=Dunn-oats; D2=Dunn-grassland; D3=Dunn-oak woodland; M4=McKenzie-aspen woodland; H5=Hettinger-shelterbelt; H6=Hettinger-E. edge belt; H7=Hettinger-N. edge belt; S8=Slope-grassland; S9=Slope-pine-juniper woodland; S10=Slope-moss.

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A LIST OF KNOWN ROBBER FLIES OF PENNSYLVANIA (DIPTERA: ASILIDAE)[1]

Todd E. Shelly[2]

ABSTRACT: Pennsylvania county records and capture dates are presented for 84 asilid species known from the state.

Within the past several decades scant attention has been given to the taxonomy or distribution of asilids of the eastern Nearctic region. Despite accounts of eastern *Diogmites* (Artigas 1966), Michigan asilids (Baker and Fischer 1975), and Arkansas asilids (Scarbrough 1972), several of the most recent notes include Brimley (1922), Bromley (1925, 1931, 1946a, b, 1947, 1950 a, b), Champlain and Knull (1923), Fattig (1945), and McAtee and Banks (1920). While initiating a revision of the genus *Laphria*, I examined 1699 specimens collected from Pennsylvania and noted county and date of capture for each. In the resulting list, the number of specimens examined of each species is also presented to provide a rough estimate of relative abundance. Note, however, that inter-generic comparisons of relative abundance, in particular, should be drawn carefully since large and hence more conspicuous species are more likely to be captured than smaller species. Note too that capture dates do not refer to the known flight period over a species' total geographic range but instead refer only to the range of known Pennsylvania capture dates. For more information on flight range and general biology of east coast asilids, the reader is referrred to the aforementioned articles plus Bromley (1923), Scarbrough and Sipes (1973), Scarbrough and Norden (1977), and Scarbrough (1978).

For each species in the following list Roman numerals are followed by (I) Pennsylvania counties within which at least one individual was captured, (II) range of Pennsylvania capture dates, and (III) number of specimens examined by the author. Unfortunately, for several rare species, the few specimens collected were only labelled "Pa." and in these cases the county and date of capture information is noted as being "Unrecorded". The asilid classification and nomenclature system followed is that of Martin and Wilcox (1965).

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[1] Received for publication: November 6, 1978.

[2] Dep't. of Entomology and Applied Ecology, Univ. of Delaware, Newark, Delaware, 19711.

Current address: Department of Biology U.C.L.A., Los Angeles, CA 90024

KNOWN ASILIDAE OF PENNSYLVANIA

Leptogastrinae

1. *Beameromyia pictipes* (Loew). I. Delaware, Monroe II. June 16-July 12 III.2
2. *Leptogaster atridorsalis* Back. I. Delaware, Montgomery, Philadelphia, II. June 6-July 14 III. 5
3. *Leptogaster flavipes* Loew. I. Allegheny, Bucks, Centre, Delaware, Lehigh, Monroe, Montgomery, Philadelphia, Westmoreland II. June 4-July 24 III. 44
4. *Leptogaster incisuralis* Loew. I. Delaware II. June 13-June 24 III.2
5. *Leptogaster virgata* Coquillet. I. Allegheny, Bucks, Delaware II. July 2-August 1 III.3
6. *Psilonyx annulatus* (Say). I. Delaware, Fayette, Montgomery, Philadelphia II. July 5-September 4 III. 18
7. *Tipulogaster glabrata* (Wiedemann). I. Allegheny, Lehigh, Montgomery, Westmoreland II. June 13-August 17 III. 21

Dasypogoninae

8. *Ceraturgus cruciatus* (Say). I. Centre, Chester, Cumberland, Dauphin, Huntingdon, Lebanon, Lehigh, Monroe, Philadelphia, Potter II. June 3-July 30 III.33
9. *Ceraturgus similis* Johnson. I. Unrecorded II. Unrecorded III.1
10. *Crytopogon falto* (Walker). I. Centre, Forest, Huntingdon, Mifflin, Potter II. June 9-July 4 III. 12
11. *Crytopogon laphriformis* Curran. I. Bucks II. May 14 III. 1
12 *Crytopogon lyratus* Osten Sacken. I. Tioga II. August 2 III. 1
13. *Crytopogon maginalis* Loew. I. Centre, Huntington II. June 19-August 4 III.2
14. *Dioctria (Dioctria) baumhaueri* Meigen. I. Centre II. June 9 III. 1
15. *Dioctria (Eudioctria) albius* Walker. I. Allegheny, Bradford, Centre, Fayette, Lebanon, Lehigh, Monroe, Montgomery, Philadelphia, Potter, Somerset, Westmoreland II. May 25-August 6 III. 91
16. *Dioctria (Eudioctria) brevis* Banks I. Centre, Lehigh, York II. June 9-July 21 III.13
17. *Dioctria (Eudioctria) tibialis* Banks. I. Montgomery, Philadelphia, Westmoreland II. June 22-July 13 III. 3
18. *Diogmites basalis* (Walker). I. Allegheny, Bucks, Dauphin, Delaware, Fayette, Lehigh, Luzerne, Monroe, Philadelphia, Pike, Sullivan II. July 13-August 30 III.29
19. *Diogmites discolor* Loew. I. Adams, Allegheny, Berks, Bucks, Centre, Dauphin, Delaware, Franklin, Lancaster, Philadelphia II. July 9-September 2 III.41
20. *Diogmites misellus* Loew. I. Monroe II. Unrecorded III.2
21. *Diogmites platypterus* Loew. I. Centre, Clearfield II. July 30-August 13 III.9
22. *Echthopoda formosa* Loew. I. Delaware II. July 1 III. 2
23. *Heteropogon macerinus* (Walker). I. Berks, Blair, Cumberland, Dauphin, Lehigh, Montgomery, Somerset II. July 11-September 15 III. 22
24. *Holocephala abdominalis* (Say). I. Delaware, Erie, Fayette, Lancaster, Montgomery, Philadelphia, Westmoreland II. June 15-September 1 III. 98
25. *Holocephala calva* (Loew). I. Centre, Delaware, Fayette, Lehigh, Montgomery II. June 23-August 22 III.31

26. *Holopogon (Holopogon) guttulus* (Wiedemann). I. Lehigh, Monroe, Montgomery II. June 14-July 15 III. 4
27. *Holopogon (Holopogon) phaeonotus* Loew. I. Dauphin, Lehigh II. Unrecorded III.4
28. *Stichopogon argenteus* (Say). I. Unrecorded II. Unrecorded III. 1
29. *Stichopogon trifasciatus* (Say). I. Lehigh II. June 28-August 18 III. 2
30. *Taracticus octopunctatus* (Say). I. Allegheny, Montgomery, Philadelphia, Westmoreland II. July 3-July 11 III. 8

Laphriinae

31. *Andrenosoma fulvicauda* (Say). I. Allegheny, Bucks, Dauphin, Venango II. June 13-August 16 III. 4
32. *Atomosia glabrata* (Say). I. Allegheny, Delaware, Philadelphia, Westmoreland II. June 8-August 11 III.9
33. *Atomosia puella* (Wiedemann). I. Allegheny, Centre, Chester, Dauphin, Delaware, Lehigh, Monroe, Montgomery, Philadelphia, Westmoreland II. June 2-August 22 III. 47
34. *Atomosia pusilla* Macquart. I. Centre, Delaware, Lancaster, McKean, Philadelphia II. June 21-July 21 III. 16
35. *Atomosia rufipes* Macquart. I. Bucks, Delaware II. June 24-August 17 III. 3
36. *Atomosia sayii* Johnson. I. Delaware, Monroe, Philadelphia II. June 30-July 31 III.23
37. *Cerotainia albipilosa* Curran. I. Centre, Delaware, Lehigh, Montgomery II. June 18-July 28 III. 7
38. *Cerotainia macrocera* (Say). I. Allegheny, Berks, Dauphin, Delaware, Fayette, Lehigh, Montgomery, Philadelphia, Westmoreland II. June 19-August 12 III.16
39. *Dasylechia atrox* (Williston). I. Philadelphia II. July 28 III. 1
40. *Lampria bicolor* (Wiedemann). I. Delaware, Monroe II. June 30 III.2
41. *Laphria aeata* Walker. I. Monroe II. Unrecorded III. 1
42. *Laphria affinis* Macquart. I. Philadelphia II. June 18 III. 1
43. *Laphria aktis* McAtee. I. Allegheny, Dauphin II.May 27-June 27 III.11
44. *Laphria canis* Williston. I. Allegheny, Bucks, Centre, Cumberland, Dauphin, Delaware, Fayette, Huntingdon, Lehigh, Montgomery, Philadelphia, Westmoreland II. May 29-August 25 III. 67
45. *Laphria champlainii* (Walton). I. Cumberland II. June 29-July 7 III. 8
46. *Laphria divisor* (Banks). I. Allegheny, Delaware, Philadelphia, Washington II. June 12-July 8 III.9
47. *Laphria flavicollis* Say. Allegheny, Berks, Centre, Chester, Cumberland, Delaware, Fayette, Lehigh Philadelphia, Washington II. May 9-August 2 III. 161
48. *Laphria gilva* (Linnaeus). I. Philadelphia II. June 25 III. 1
49. *Laphria grossa* (Fabricius). I Centre, Cumberland, Delaware, Lehigh, Philadelphia II. June 3-July 28 III. 25

50 *Laphria index* McAtee. I. Allegheny, Dauphin, Montgomery, Tioga, Westmoreland II. June 2-August 25 III. 13

51. *Laphria ithypyga* McAtee. I. Beaver, Delaware, Huntingdon, Philadelphia, Somerset II. June 19-September 4 III. 17
52. *Laphria posticata* Say. I. Centre, Delaware, Huntingdon, Lehigh, Union II. May 10-August 20 III. 16

53. *Laphria sacrator* Walker. I. Forest, Sullivan II. June 7-August 5 III. 7
54. *Laphria sadales* Walker. I. Monroe II. July 12, III. 1
55. *Laphria saffrana* Fabricius. I. Allegheny II. Unrecorded III. 1
56. *Laphria scorpio* McAtee. I. Centre II. July 14 III. 1
57. *Laphria sericea* Say. I. Allegheny, Centre, Dauphin Fayette, Huntingdon, Monroe, Washington, Westmoreland II. May 21-August 13 III. 40
58. *Laphria sicula* McAtee. I. Allegheny, Centre, Fayette, Montgomery, Philadelphia, Westmoreland II. June 4-August 13 III. 32
59. *Laphria thoracica* Fabricius. I. Allegheny, Centre, Cumberland, Dauphin, Delaware, Lehigh, Montgomery, Washington II. May 17-July 19 III. 73
60. *Laphria virginica* (Banks). I. Dauphin, Philadelphia II. June 15-July 18 III. 3
61. *Laphria winneman* McAtee. I. Allegheny, Centre, Forest, Huntingdon, Philadelphia II. June 15-July 11 III. 18

Asilinae

62. *Asilus auricomus* Hine. I. Elk, Monroe, Philadelphia II. August 27-Ocotober 12 III.6
63. *Asilus erythocnemius* Hine. I. Pike II. July 8 III. 1
64. *Asilus lecythus* Walker. I. Admas, Allegheny, Bucks, Centre, Dauphin, Fayette, Monroe, Montgomery, Westmoreland II. June 20-July 23 III. 55
65. *Asilus sericeus* Say.I. Allegheny, Centre, Delaware, Forest, Huntingdon, Lebanon, Lehigh, Monroe, Montgomery, Perry II. May 20-September 1 III. 78
66. *Asilus virginicus* Banks. I. Centre, Cumberland II. June 10-July 8 III. 2
67. *Efferia aestuans* (Linnaeus). I. Allegheny, Berks, Bucks, Centre, Cumberland, Delaware, Huntingdon, Lawrence, Luzerne, Mercer, Monroe, Montgomery, Philadelphia, II. June 6-August 24 III. 108
68. *Efferia pogonias* (Wiedemann). I. Allegheny, Centre, Dauphin, Delaware, Erie, Luzerne, Monroe, Philadelphia, Pike II. July 12-September 21 III. 23
69. *Neoitamus flavofemoratus* (Hine). I. Berks, Centre, Chester, Clearfield, Crawford, Dauphin, Delaware, Fayette, Monroe, Montgomery, Philadelphia, Somerset, Westmoreland II. May 29-August 11 III. 33
70. *Neoitamus orphne* (Walker). I. Allegheny, Berks, Cameron, Centre, Fayette, Lebanon, Mifflin, Monroe, Philadelphia, Tioga, Westmoreland II. May 21-August 20 III. 70
71. *Ommatius tibialis* Say. I. Allegheny, Fayette, Westmoreland II. July 15-August 20 III. 4
72. *Proctacanthus philadelphicus* Macquart. I. Lehigh, Philadelphia II. July 28-August 27 III.2
73. *Proctacanthus rufus* Williston. I. Lehigh II. July 14 III. 1
74. *Promachus bastardii* (Macquart). I. Allegheny, Centre, Delaware, Montgomery, Philadelphia, Westmoreland II. June 24-September 2 III. 26
75. *Promachus rufipes* (Fabricius). I. Centre, Cumberland, Dauphin II. July 28 - September 26 III.7
76. *Promachus vertebratus* (Say). I. Allegheny, Bucks, Centre, Clearfield, Dauphin, Huntingdon II. July 1-September 5 III. 19
77. *Tolmerus antimachus* (Walker). I.Allegheny II. July 13 III. 1
78. *Tolmerus johnsoni* (Hine). I. Delaware II. July 14 III. 1

79. *Tolmerus maneei* (Hine). I. Unrecorded II. Unrecorded III. 1
80. *Tolmerus notatus* (Widemann). I. Bucks, Centre, Cumberland, Delaware, Fayette, Lebanon, Luzerne, Monroe, Montgomery, Philadelphia, Potter, Tioga, Westmoreland II. May 28-September 12 III. 72.
81. *Tolmerus novascotiae* (Macquart). I. Delaware, Lehigh, Philadelphia II. July 2-September 4 III. 11
82. *Tolmerus paropus* (Walker). I. Luzerne, Monroe II. July 9-August 15 III. 3
83. *Tolmerus sadyates* (Walker). I. Centre, Erie, Fayette, Huntingdon, Tioga, Westmoreland II. July 17-September 22 III. 27
84. *Tolmerus snowii* (Hine). I. Delaware, Monroe, Philadelphia II. June 9-August 25 III. 8

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VARIATION OF THE MALE CLASPER OF *CERACLEA ANCYLUS* (VORHIES) (TRICHOPTERA: LEPTOCERIDAE) IN SASKATCHEWAN[1]

Douglas H. Smith[2]

ABSTRACT: Variation in the genitalia of adult males of *Ceraclea ancylus* (Vorhies) is discussed and the possibility of misidentifying variant specimens is noted.

To separate closely related species, taxonomists select diagnostic characters based primarily on an examination of the preserved material and the published taxonomic information available for each species. Often, however, knowledge of the variation within a species is incomplete because certain parts of the range of a species are poorly collected. A character chosen to distinguish a species in one part of its range may not serve to distinguish that species in another part of its range. This paper reports on the difficulty of identifying certain male specimens of the species *Ceraclea ancylus* (Vorhies) using a recently constructed key to adult males of the genus *Ceraclea* because these specimens possess an unusual and previously undescribed variation of the clasper.

The males of the North American caddisfly species *Ceraclea ancylus* (Vorhies) have been previously characterized as having a clasper which has a long ventral lobe tipped with a single large apical spine (see Betten, 1934; Ross, 1944; Morse, 1975). The presence of a subapical spine on the male clasper of *C. ancylus* has never been indicated in publications dealing with this species. This paper reports on the finding in Saskatchewan, Canada of males of *C. ancylus* from several different localities whose claspers bear a subapical spine.

RESULTS

Of ten adult males of *C. ancylus* collected by me in Saskatchewan, three specimens (each from a different locality, Figure 1) had a subapical spine on a clasper, either on the right clasper (one specimen) or on the left clasper (two specimens). No specimens were found with a subapical spine on both claspers. The genitalia of each of the three variant males, in respect of the shape of the aedeagus (compare Figure 4 with Figure 9D in Morse (1975)) and the shape of the ventral lobe and the mesal ridge of the clasper (compare Figures 2 and 3 with Figure 774C in Ross (1944) and Figure 95C in Morse

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[1] Received January 16, 1979

[2] Department of Biology, University of Saskatchewan, Saskatoon, Saskatchewan, Canada S7N OWO

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(1975), respectively) indicate that these specimens belong to the species *C. ancylus* (Morse, pers. comm., 1978; excluding references to figure numbers).

DISCUSSION

Morse (1975) provides keys for the identification of adult males of the genus *Ceraclea.* Specimens of *C. ancylus* lacking the subapical spine on the claspers can readily be identified using Morse's key to the males of the subgenus *Arthripsodina.* Variant male specimens of *C. ancylus* described above can not be identified using Morse's key because at step 28, for North American *Ceraclea* material, the key leads to *Ceraclea flava* (Banks) if a subapical spine is present on both claspers and to *C. ancylus* and *Ceraclea neffi* (Resh)* if a subapical spine is absent on both claspers. On the basis of the subapical spines it is impossible to determine the identity of the variant males of *C. ancylus* in Morse's key since they have a subapical spine on one clasper. Fortunately, the morphology of the aedeagus and the mesal ridge of the clasper are distinctly different between *C. ancylus* and *C. flava* so that these two species can readily be distinguished (compare drawings 93D with 95D and 93C with 95C in Morse (1975)).

Morse (pers. comm., 1978) speculated that the occasional presence of the subapical spine on the male clasper of *C. ancylus* may result from introgressive hybridization, from a mutation or from ancestral genes for the subapical spine which can occasionally express themselves in some Saskatchewan populations. Presumably, if hybridization caused the appearance of the subapical spine on the clasper of *C. ancylus* males, *C. ancylus* would have to interbreed with adults of the closely related species, *C. flava,* the males of which have a subapical spine on each clasper. *C. flava* was recorded by Cushing (1961) from the Montreal River system in the boreal forest region of Saskatchewan. However, I have been unable to verify the occurrence of this species in Saskatchewan during three years of intensive collecting of caddisflies in the same region. Oliver (1960) conducted light trap studies near Lac La Ronge, Saskatchewan and, although he recorded *C. ancylus* in this study, he also did not collect adults of *C. flava.* If *C. flava* does not occur in Saskatchewan, then hybridization has to be ruled out as an explanation for the appearance of a subapical spine on either clasper of *C. ancylus* males in Saskatchewan. It is more likely that the presence of the subapical spine in certain *C. ancylus* individuals is the result of a mutation or of the occasional expression of a recessive gene or group of genes in some Saskatchewan populations of *C. ancylus.*

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*Both variant and normal males of *C. ancylus* can be separated from *C. neffi* on the basis of the shape of the ventral lobe of the claspers, the width of the tenth tergite, in lateral aspect, and the morphology of the aedeagus (see Morse, 1975).

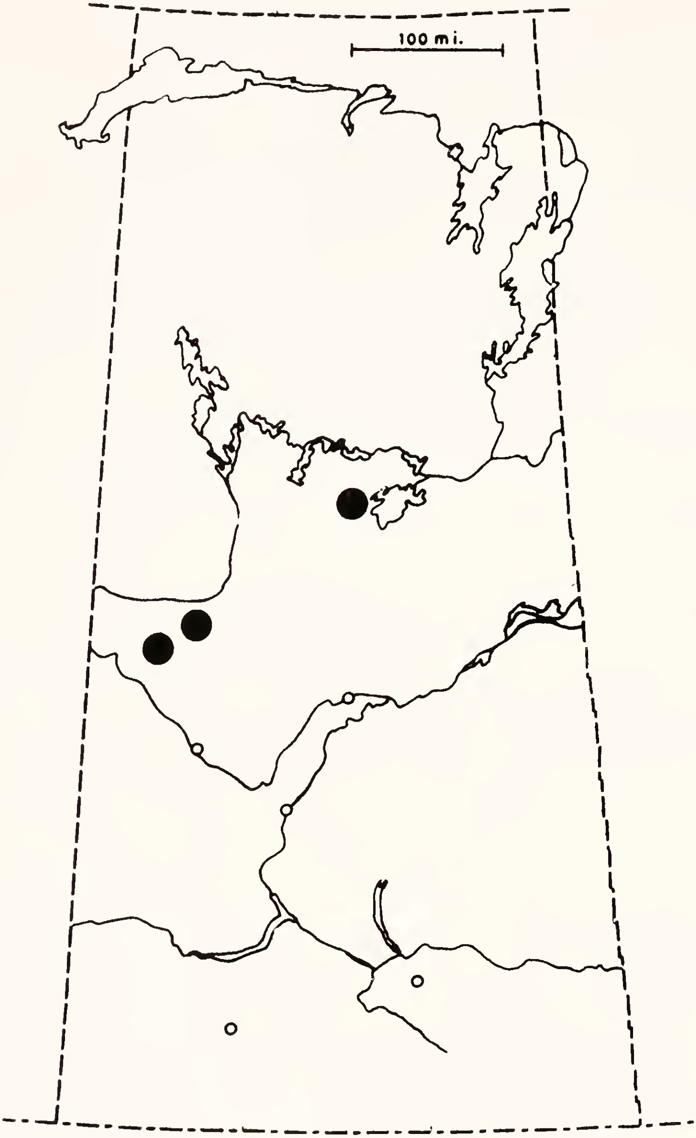
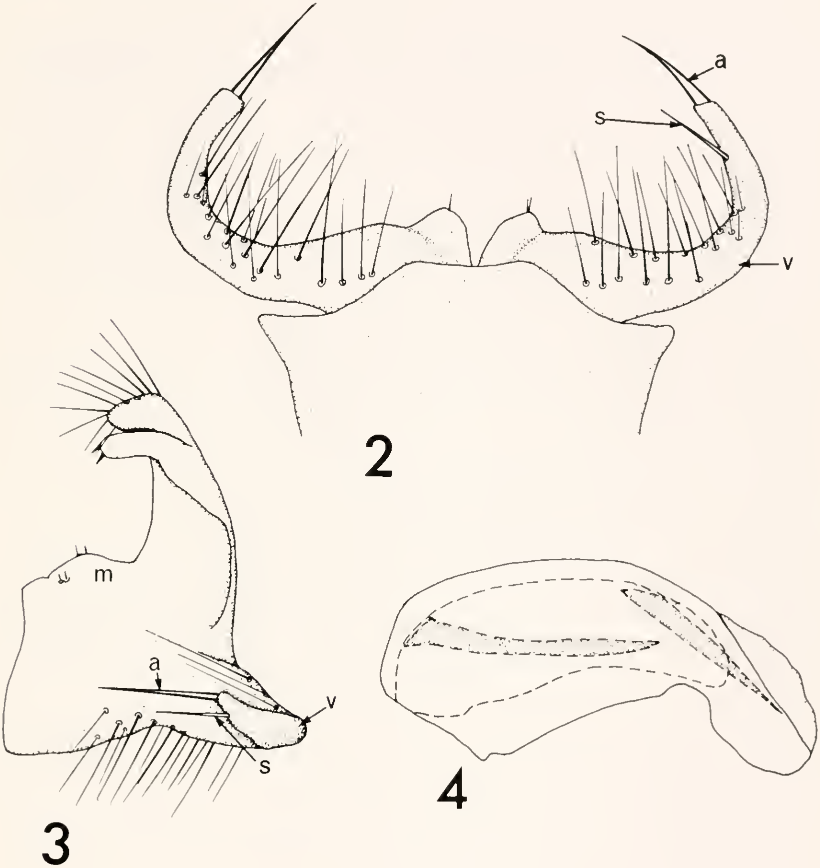


Fig. 1. Saskatchewan collection sites of variant adult males of *Ceraclea ancylus*.



Figs. 2-4. Genitalia of variant *Ceraclea ancylus* males: 2, ventral aspect of genitalia; 3, clasper, caudal aspect; 4, aedeagus, lateral aspect; a = apical spine, m = mesal ridge of clasper, s = subapical spine, v = ventral lobe of clasper.

ACKNOWLEDGEMENTS

I wish to express my sincere thanks to Dr. D.M. Lehmkuhl for his supervision and encouragement during the course of my studies, for making available facilities and equipment without which this research would not have been possible, for financial support from his National Research Council grant and for his constructive criticisms during the preparation of the manuscript. I would also like to thank the Institute for Northern Studies for the scholarship which enabled me to study Saskatchewan caddisflies. Special thanks are due to Dr. John Morse from the Department of Entomology and Economic Zoology, Clemson University, Clemson, South Carolina for identifying specimens of *Ceraclea ancylus* and for his many useful comments concerning these specimens. I would also like to thank Dr. C. Gillott and Dr. L. Burgess for reviewing the manuscript.

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INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

The following Opinion has been published recently by the International Commission on Zoological Nomenclature (see Bulletin of Zoological Nomenclature, Volume 35, part 3, February '79).

Opionion No. 1115 (p. 175) *Nysson* Latreille (Hymenoptera, SPHECIDAE) validated as from 1796.

The Commission cannot supply separates of Opinions.

FOUR NEW SPECIES OF *CULMANA*, GYPONINAE (HOMOPTERA:CICADELLIDAE) FROM PERU AND BOLIVIA[1]

Dwight M. DeLong[2]

ABSTRACT: Four New Species of *Culmana* – Gyponinae – from Peru and Bolivia, *C. concava* n.sp., *C. dualana* n.sp., *C. bacula* n.sp., and *C. spinella* n.sp., are described.

The genus *Culmana* was described (1972) by DeLong and Freytag, and *C. torqua* DeL. & Frey. was designated as the type. A synopsis of the genus was published (1972) in which eight species were treated, seven of which were described as new. Four new species are described at this time. The genus *Culmana* is related to *Polana* and *Scaris*.

Culmana concava n.sp.

(Figs. 1-5)

Length of male 10 mm, female unknown. Crown two and one-half times as wide at base between eyes as median length. Color, crown brown with a round black spot behind each ocellus at base. Pronotum brown, a series of faint darker brown spots along anterior margin. Scutellum brown, basal angles darker brown. Forewings dark brown, three small black spots on clavus along commissure and two on corium.

Male genital plates two and one-half times median width, apices narrow, rounded. Style with blade shallowly concavely rounded on ventral margin near base, apical fifth curved dorsally, apex blunt, rounded. Aedegal shaft bearing two short, lateral, subapical spines at five-sixths length of shaft. Apex with three spines, a median and two lateral, which curve dorsally. Pygofer bluntly pointed apically, with a plate beneath pygofer wall, each side, which is rounded apically and does not extend to apex of pygofer.

Holotype male, Santa Isabel, Dept. Cusco, Peru XII-10-1952, Felix L. Waytkowski coll., in the North Carolina State University collection.

C. concava is related to *lucida*.

Culmana dualana n.sp.

(Figs. 6-10)

Length of male 10.3 mm, female unknown. Crown two and one-half times as broad at base between eyes as median length. Color, dark brown anteriorly, light brown posteriorly, with a small round black spot behind each ocellus at base. Pronotum dark brown. Scutellum pale brown, with dark brown basal angles. Forewings dark brown with two very small black spots on clavus along commissure, three larger spots on corium.

Male genital plates narrow on basal third, three times as long as median width, apices

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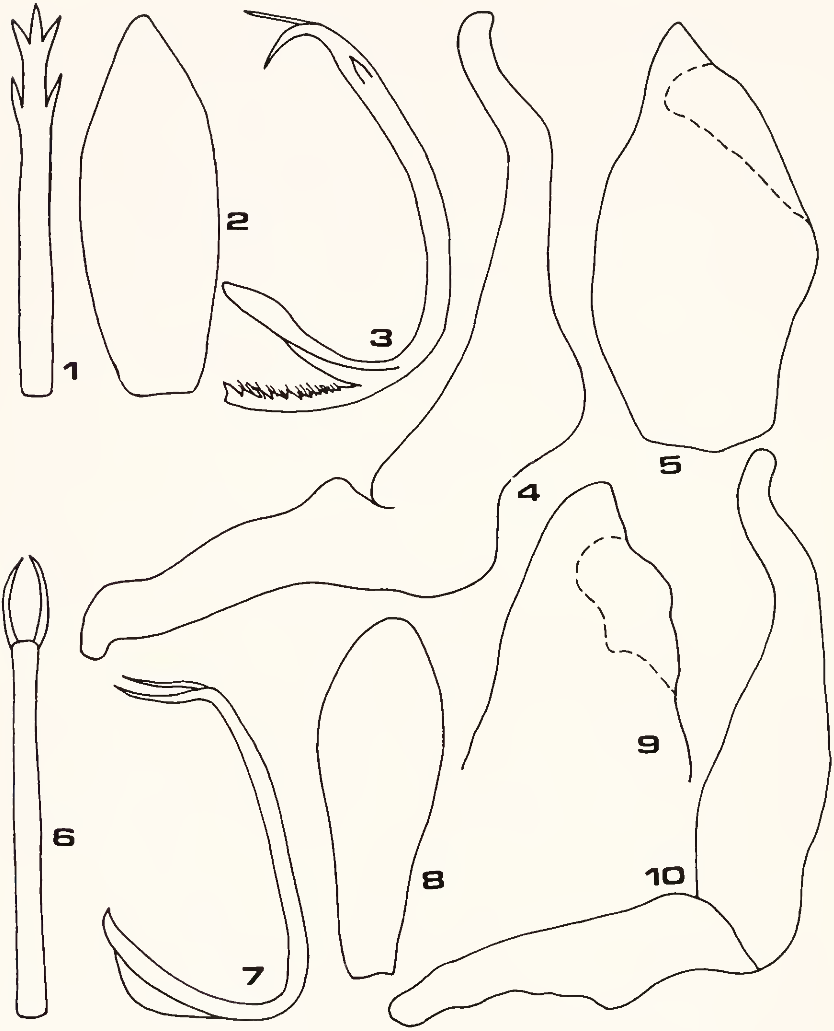
[1] Received December 11, 1978

[2] Department of Entomology, Ohio State University.



Figs. 1-5 *Culmana concava* n.sp. 1, aedeagus ventrally, 2. plate ventrally, 3. aedeagus laterally, 4. style laterally, 5. pygofer laterally. Figs. 6-10 *C. dualana* n.sp. 6. aedeagus ventrally, 7. aedeagus laterally, 8. plate ventrally, 9. pygofer laterally, apical portion, 10. style laterally.

rounded. Style with blade broadly, concavely excavated on ventral margin at two-thirds its length; apical eighth curved dorsally, apex blunt, rounded. Aedeagal shaft slender, bearing a pair of slender, apical, pincer-like processes, one-fifth length of shaft, extending caudally. Pygofer narrowed apically, bluntly rounded, bearing a plate beneath pygofer wall, each side, which is rounded apically and does not extend to apex of pygofer.

Holotype, male, Santa Isabel, Dept. Cusco, Peru. XII-1-1952, Felix L. Waytkowski coll., in the North Carolina State University collection.

C. dualana is related to *turba*.

Culmana bacula n.sp.

(Figs. 11-15)

Length of male 10.5 mm, female unknown. Crown three times as wide between eyes at base as median length. Color, anterior margin of crown cream colored, bordered with black above. Median portion of crown brown with black median line and a round black spot behind each ocellus, at base, Pronotum with two proximal round black spots near anterior margin. A large black area, with white center, on anterior portion of pronotum behind inner margin of each eye. Disc and posterior portion of pronotum brown. Scutellum dark brown with four white spots, equidistant, across anterior margin, and one on margin at middle, each side. Forewings dark brown with two black spots on clavus and three on corium.

Male genital plates two and one-half times as long as median width, apex narrowed, rounded. Style with a rounded notch on ventral margin of basal third of blade. Blade slightly enlarged at two-thirds its length by a rounded bulge on ventral margin, apex narrow, rounded. Aedeagal shaft with apex roundly notched, forming two short apical spines. Enlarged portion just basad of notch with two prominent spines, each side. A process arises on ventral margin, subapically and extends almost to apex of apical processes. Pygofer with a rod-like process arising beneath pygofer wall and extending beyond apex of pygofer. Apex of process blunt.

Holotype male, Machu Picchu, Peru XI-25-67, D.M. DeLong coll., in the DeLong collection.

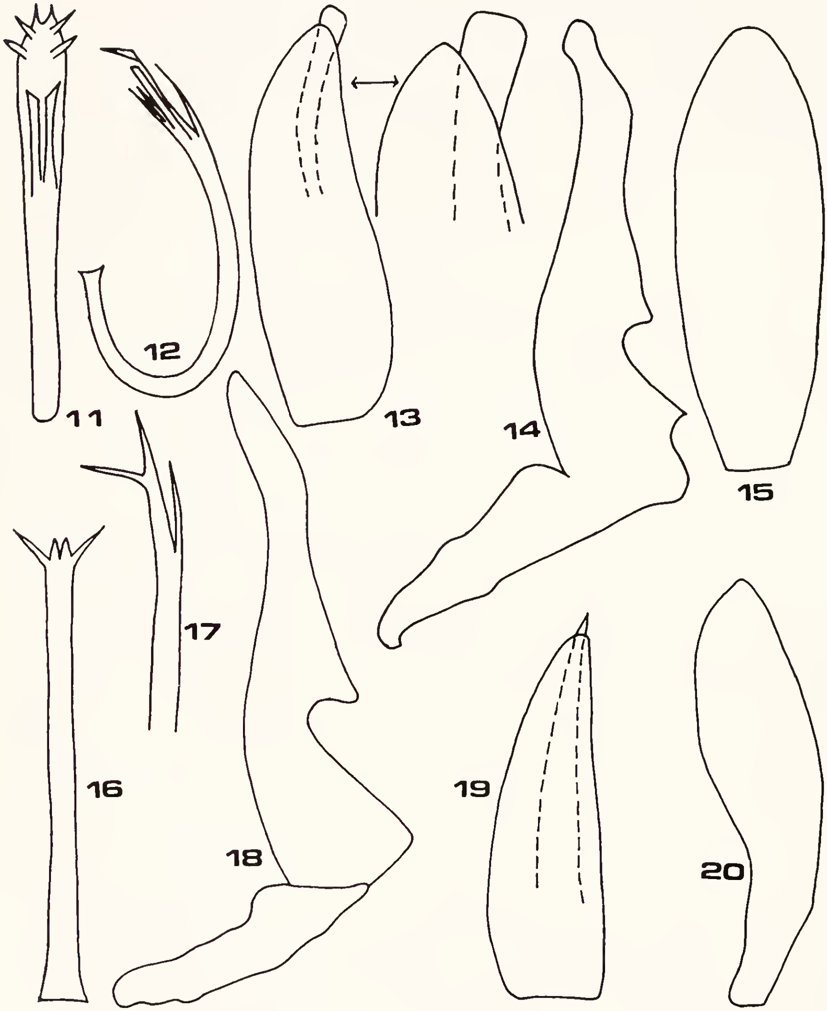
C. bacula is related to *fascia* and *excava*.

Culmana spinella n.sp.

(Figs. 16-20)

Length of male 10.5 mm, female unknown. Crown two and one-half times as wide at base between eyes as median length. Color, anterior margin of crown pale brown, median black line and a round black spot behind each ocellus, at base. Pronotum mostly dark brown with black and white irregular coloration. Two small proximal black spots near anterior margin. White areas behind each eye. Scutellum dark brown with a white spot at middle, each side. Forewings brown with black spots on corium and two on clavus along commissure.

Male genital plates elongate, slender at base, four times as long as median width, apices narrow, rounded. Style with blade deeply roundly excavated on ventral margin at one-third length of blade, bent slightly, dorsally, subapically, apex narrow, rounded. Aedeagal shaft bearing a pair of short, proximal, median teeth and a spine about one-eighth length of shaft extending laterocaudally, each side. Pygofer pointed at apex, with a slender plate-like process on inner pygofer wall. Process pointed at apex extending



Figs. 11-15 *C. bacula* n.sp. 11. aedeagus ventrally, 12, aedeagus laterally, 13. pygofer laterally 14. style laterally, 15. plate ventrally, Figs. 16-20 *C. spinella* n.sp. 16. aedeagus ventrally, 17. aedeagus laterally, apical portion, 18. style laterally, 19. pygofer laterally, 20. plate ventrally.

slightly beyond apex of pygofer.

Holotype male, Uenlagarde le Paz, Bolivia, in the U.S. National Museum.

C. spinella is related to *excava*.

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________. 1972. Studies of the Gyponinae: The genus Culmana and seven new species (Homoptera:Cicadellidae). Jour. Kans. Entomol. Soc. 45:405-413.

DEFLECTION DISPLAY OF GRAY HAIRSTREAK BUTTERFLY[1]

Hervey Brackbill[2]

A predator-deflection display that I believe has not been reported before for this butterfly was given by a Gray Hairstreak *(Strymon melinus* Hübner) at Woodlawn, Baltimore Co., Md., on 29 August 1978. The insect flew onto a petunia plant in a flower box. When I went close I found it settled with body vertical but head downward; with the wings closed above its back, the tails of the hindwings thus stuck up like antennae. This, along with the eyelike appearance of the black-centered orange spot on the adjacent wing edge, made what was actually the rear of the insect resemble the head. Soon I became aware that the butterfly was enhancing this appearance by making the false antennae wave, which it did by "shuffling" its still closed hindwings–moving one forward slightly, the other backward slightly. This it continued until, shortly, it flew away.

Wickler (Mimicry in Plants and Animals, McGraw-Hill, N.Y., 1968:75) notes the form and coloration of this butterfly but says nothing of its behavior. He and Cott (Adaptive Coloration in Animals, Oxford Univ. Press, N.Y., 1940:372) both report this behavior in some species of the related *Thecla*. Hailman (Optical Signals, Indiana Univ. Press, Bloomington and London, 1977:182) recently predicted that it would be found in hairstreaks.

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[1] Received for publication: November 6, 1978

[2] 2620 Poplar Drive, Baltimore, Md., 21207.

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A NORTH AMERICAN HOST OF THE YELLOWJACKET SOCIAL PARASITE *VESPULA AUSTRIACA* (PANZER) (HYMENOPTERA: VESPIDAE)[1 2]

Hal C. Reed, Roger D. Akre[3], and W.B. Garnett[4]

ABSTRACT: The social parasite, *Vespula austriaca* (Panzer), was found in two colonies of *V. acadica* (Sladen) in northern Idaho. These parasitized colonies were smaller than normal, queen-right *V. acadica* colonies.

Vespula austriaca (Panzer) is a relatively rare Holarctic yellowjacket (Miller, 1961) that has no worker caste and is an obligate social parasite in the nest of other species of yellowjackets. This species has been recorded in the nests of *Vespula rufa* (L.) in Europe (Robson, 1898; Carpenter and Pack-Beresford, 1903; Chitty, 1903; Pack-Beresford, 1904; Weyrauch, 1937; Biegel, 1953; Archer, 1977) and *V. rufa schrencki* Radoszkowski in Japan and East Siberia (Yamane and Kubo, 1970). Only 16 colonies have been reported containing the parasite, and one of these records (Harrison, 1915) is questionable. The few behavioral data available (Robson, 1898; Weyrauch, 1937; Yamane and Kubo, 1970) indicate that the *V. austriaca* female invades an established *V. rufa* nest, kills the host queen, and is aggressive towards the host workers that rear her brood. Evans (1903) presented collection dates of a number of *V. austriaca* females which showed they are active about a month later than queens of their host, *V. rufa*, presumably an adaptation to invade already established nests. The only other behavioral information available about this species is that queens are attracted to the synthetic attractant, heptyl butyrate, so this material can be used to sample occurrence of this species (Reierson and Wagner, 1978).

Vespula austriaca has not been reported from a nest of a Nearctic species. However, distributional data indicate it may be parasitic on several species of the *V. rufa* species group, with *V. acadica* (Sladen) being the most likely host (Wagner, 1978; Akre et al., 1979). Our previous field studies of yellowjackets in Idaho, Oregon, and Washington also suggested this species as the most likely host.

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[1] Received January 6, 1979

[2] Scientific paper number 5262, Washington State University, College of Agriculture Research Center, Dep't. of Entomology, Pullman 99164. Work conducted under projects 4037 and 0037. Financed in part by National Science Foundation Grant BNS 76-81400.

[3] Research Assistant and Entomologist, respectively.

[4] Assistant Professor, Raymond Walters College, University of Cincinnati, Cincinnati, Ohio 45236.

COLLECTION DATA

During a field study of *V. acadica* biology in northern Idaho, two parasitized colonies were collected in July 1978 in the St. Joe National Forest 4 miles northeast of Harvard (Latah County). The collection area was located in a mature forest, with closed canopy, which borders Strychnine Creek. The major trees present are grand fir (*Abies grandis* (Douglas) Lindl.) and Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) with some western red-cedar (*Thuja plicata* Donn). This has been described as a *Thuja plicata-Pachistima myrsinites* habitat type of Daubenmire and Daubenmire (1968). Both colonies were situated in deeply shaded areas in decaying logs on the forest floor. The first colony was collected 10 July and was comprised of 4 *V. acadica* workers and a *V. austriaca* female. The nest consisted of an upper comb (29 pupal, 59 larval, and 53 egg cells) and a lower reproductive comb (12 egg cells). The second colony was collected 18 July and had 5 *V. acadica* workers in addition to the *V. austriaca* female. This nest also had two combs. The upper comb had 20 pupae, 38 larvae, and 31 eggs, while the lower, reproductive comb had only two cells, one with an egg. The entrance tunnels and cavities surrounding the nests were examined carefully for remains of the host queen, but none were found.

In addition to the social parasite, both colonies were infested with the common pupal parasitoid, *Sphecophaga vesparum burra* Cresson (Hymenoptera:Ichneumonidae). During collection of the first colony (10 July), 3 adult *Sphecophaga* flew out of the nest, and 6 cocoons were present in the worker comb. An additional 39 adult *Sphecophaga* emerged over the next 4 weeks. The second colony (18 July) contained 4 adult *S. v. burra,* but no cocoons were visible in the combs. However, 16 adults were collected within the next 4 weeks. The second nest also contained *Melittobia acasta* (Walker) (Hymenoptera:Eulophidae) which parasitized one yellowjacket larva and one pupa in addition to 3 *S. v. burra* prepupae in overwintering cocoons. Other reports of *Melittobia* spp. in vespine nests include Zabriske (1894), Gaul (1940) and Gaul (cited in Thomas, 1960).

COMPARISONS

Table 1 summarizes and compares all available information on host records and sizes of colonies parasitized by *V. austriaca.* The parasite appears to have a detrimental effect on colony size of *V. rufa* as seen in comparisons between normal and parasitized colonies (see also Archer, 1977). A comparable situation was seen in parasitized colonies of *V. acadica* which averaged 4.5 workers and 125 cells as opposed to 48 workers and 426 cells in normal colonies. In this regard it is similar to another yellowjacket social parasite,

Table 1. **Comparison of colonies of yellowjackets parasitized by *Vespula austriaca****

COLONY SIZE AT COLLECTION

Host species	Collection date	Literature source	Country or geographical area	Host		Parasite		Nest Size #combs	#of cells:	
				☿	♂	♂	♀		small	large
V. rufa	July	Robson 1898	British Isles	21	?	44	4	2	285[f]	120[f]
	August 7	Carpenter & Pack-Beresford 1903	British Isles	86	3-5	46	9[a]	2	342[f]	150[f]
	August 6	Pack-Beresford 1904	British Isles	4[b]	0	11[c]	0	2	285[f]	150[f]
	July 28	Archer 1977	British Isles	6	0	23	19[a]	2	321	136
V. rufa (normal, mature colonies)[d]		Archer 1977	British Isles	–	–	0	0	3.4	481	649
V. rufa schrenki	July 27	Yamane and Kubo 1970	Japan	9	12	?	3[e]	2	120	15
V. acadica	July 10	1978	Idaho, USA	4	0	0	1	2	147	12
	July 18	1978	Idaho, USA	5	0	0	1	2	89	2
V. acadica (normal colonies)										
	July 12	Roush & Akre 1978	Idaho, USA	39	0	0	0	2	278	93
	July 28	Roush & Akre 1978	Oregon, USA	85	10	0	0	2	393	267
	August 5	Roush & Akre 1978	Oregon, USA	20	0	0	0	2	189	59

[a] one was original parasite queen [b] one was dead [c] only one was alive [d] $\bar{x}$ of 7 nests

[e] one was parasite queen and 2 others were found dead and dismembered within the nest cavity.

[f] estimated from cell sizes of *V. atropilosa* colonies and comb dimensions of *V. rufa* colonies given in the literature. The number of large cells (reproductive combs) is quite variable, thus only the minimum calculated value is given.

*Note added in proof: Additional parasitized nest reported by Archer, M.E. 1978. Naturalist 103: 133-34.

Dolichovespula arctica (Rohwer) (Greene et al., 1978).

Additional parasitism by *Sphecophaga* and *Melittobia* may also have contributed to the small size of both colonies. However, the ichneumonid parasite was also found in five of 8 *V. acadica* colonies without *V. austriaca* (Roush and Akre, 1978) and these colonies were larger.

ACKNOWLEDGMENTS

We thank A. Greene, C.A. Johansen, E.C. Klostermeyer, P.J. Landolt, and K. Raffa for suggestions on improving the manuscript.

Appreciation is extended to Mr. E.C. Dahms, Senior Curator, Queensland Museum, Australia for determining *Melittobia acasta.*

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A COLLAPSIBLE INSECT EMERGENCE TRAP FOR USE IN SHALLOW STANDING WATER[1]

William S. Ettinger[2]

ABSTRACT: A trap to collect emerging aquatic insects in shallow (< 15 cm) standing water is described. Trap construction is nitex netting over an aluminum framework. The trap encloses a defined substrate surface area of 0.1 m^2 and captures all aquatic insects emerging within that area. When retrieved the trap can be collapsed to retain all insects.

Study of the aquatic insect community in a shallow (<15 cm) pond requires collection of emerging adults for precise species identification and determination of emergence periods of individual species. For this purpose I designed an emergence trap of nitex netting stretched over an aluminum framework (Fig. 1). Trap design is that of a collapsible triangular prism, unlike conical and essentially rigid emergence traps described by Corbet (1965), McCauley (1976), and Lammers (1977). Trap collapsibility allows easy catch retrieval with forceps after sacrifice and facilitates economy of storage and ease of transportation.

CONSTRUCTION

The trap framework consists of two rectangular sections (each 47.3 x 31.5 cm) constructed of angle aluminum (1.5 x 12.7 x 12.7 mm) hinged together along one edge (Fig. 2). One piece of appropriate mesh netting is stretched tautly over both sections, including the hinged joint, and fastened securely with flat aluminum strips and bolts. The triangular sides of the trap (47.3 x 47.3 x 31.5 cm) are netting reinforced along the bottom (short) edge with rubber tape (Fig. 2A) and fastened to the framework as described above. The side netting is attached so that it stretches tautly when the trap is opened to sample area 0.1 m^2. Two aluminum strips 32.0 cm long (Fig. 2B) are bolted at one end to one framework section. The trap is spread open and appropriate holes are drilled in the opposite ends to fit over 5 x 40 mm bolts (Fig. 2C) attached to the other section. Bolts (Fig. 2D) are used to secure the strips when the trap is closed.

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[1] Received December 4, 1978

[2] Logan Florist, 824 Spruce St., Pottstown, PA 19464

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OPERATION

The open trap is set directly on the substrate. Upon retrieval the base is lifted clear of the substrate, but kept submerged to prevent escape of the catch. The movable strips are disengaged and immobilized with bolts (Fig. 2D). The triangular netting is folded into the trap as it is closed. When the trap is closed, the edges of the two aluminum base pieces fit together to contain the catch. The trap is then removed from the water. The catch can be sacrificed with alcohol in the trap, or it can be transported live to the laboratory.

OBSERVATIONS

Although the trap rests directly on the substrate surface, substrate disruption can be minimized by careful trap placement. Movement of water and

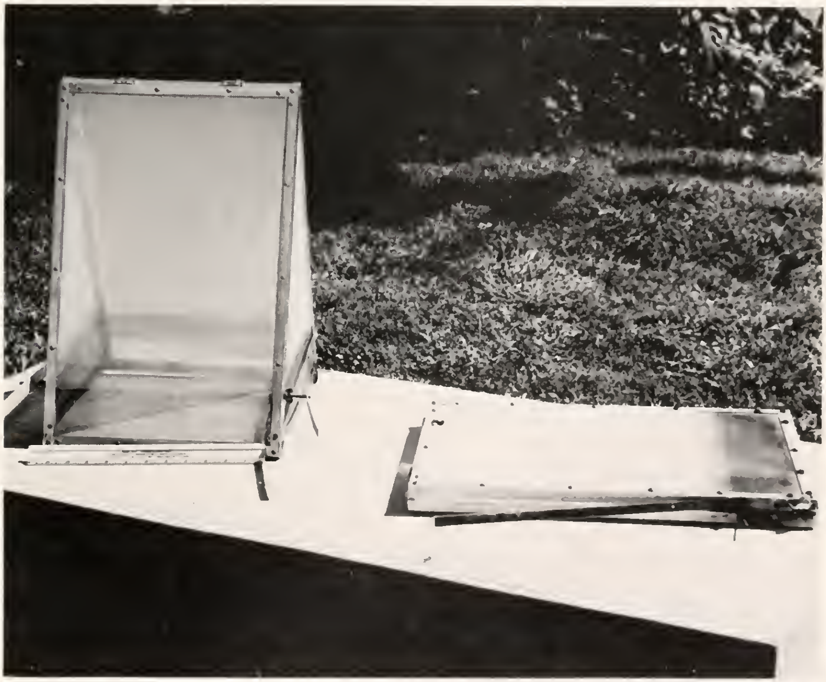

Fig. 1. Emergence traps designed to collect aquatic insects in shallow standing water, in open and closed positions.

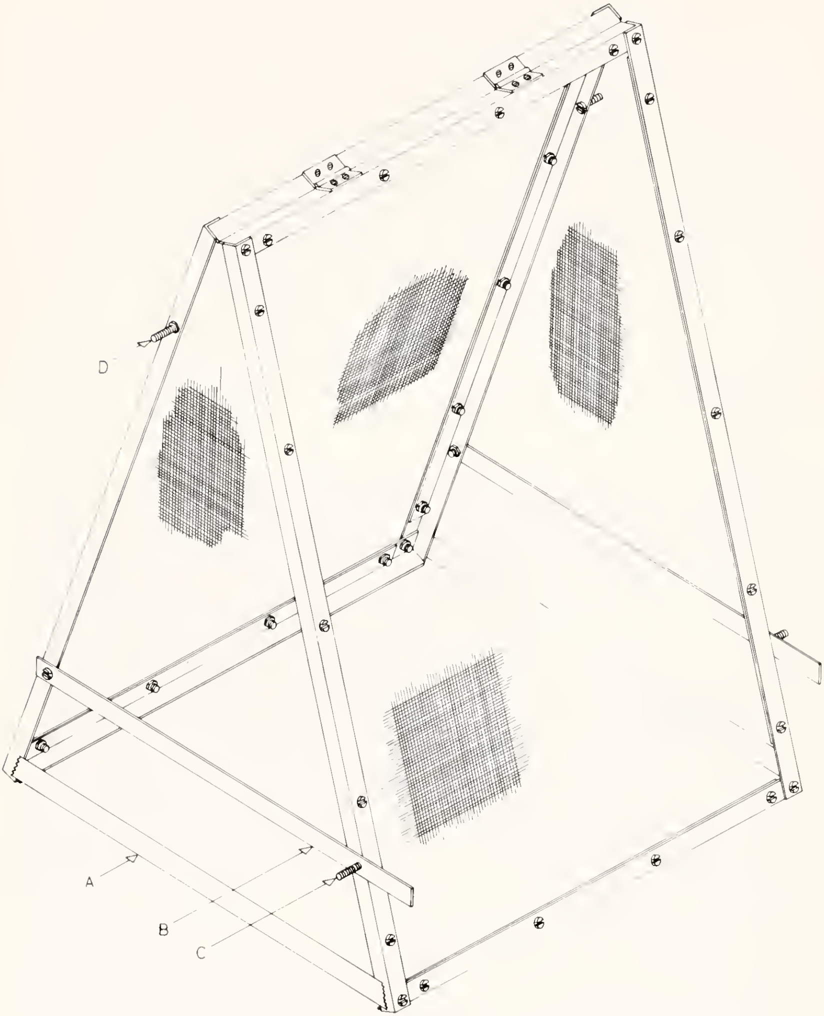

Fig. 2. Isometric projection diagram of the emergence trap showing construction details. A, rubber tape reinforcing folding side of net; B, aluminum strip used to keep trap open; C, bolt used to secure aluminum strip with trap open; D, bolt used to immobilize aluminum strip with trap closed.

diffusion of dissolved substances into and out of the trap should be facilitated, not impeded, by the netting.

The submerged netting was observed to discolor after several weeks of trap use, presumably from organic materials or algae in the water. However, I periodically cleansed the netting with detergent which minimized discoloration, but did not eliminate it.

No catch retention "baffle" such as those included by Mundie (1971) and McCauley (1976) in their designs is a part of my trap. It is assumed that natural mortality is insignificant over a trapping period of two days. The netting provides ample "foothold" for emerging insects since large numbers of exuviae, potentially useful for association with adults, are recovered from it.

One trap collected 1464 specimens of 30 species of Diptera, Ephemeroptera, and Odonata during 375 days of operation May-October 1975 and March-October 1976. It was blown over by wind only once during the period.

ACKNOWLEDGMENTS

I thank W.G. Duffy, J.H. Mundie, T.P. Poe, and R.P. Rutter for critical review of the manuscript. Sanders & Thomas, Inc. reproduced the isometric projection diagram.

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NEW RECORDS OF ODONATA FOR ALABAMA AND TENNESSEE, WITH SIGNIFICANT RANGE EXTENSIONS FOR SEVERAL SPECIES[1]

Kenneth J. Tennessen[2]

In this paper, five species of Odonata are added to the state list of Alabama, and three are added to the state list of Tennessee.

Calopteryx angustipennis (Selys) in Alabama

Charles Gooch and I collected a total of seven males and eight females of *C. augustipennis* on May 9 and May 13, 1977, at Butler Creek, near Hwy. 11, Lauderdale County, Alabama. Discovery of *C. augustipennis* in this locality significantly increases the known range of this species, which, before this collection, included Georgia, Indiana, Kentucky, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, and West Virginia (Johnson 1974). The Butler Creek locality extends the range by about 300 km southwest of a line drawn through the previously known western localities (Fig. 1). Butler Creek is a clear, swiftflowing, shallow stream with mostly gravel and rock substrate.

Johnson (1974) found that the sternum of segment 10 was black in *C. angustipennis* males from Kentucky, Pennsylvania, and Tennessee, whereas it was white in males from North Carolina, South Carolina, and West Virginia. He questioned this variability in a character that is apparently displayed to the female during reproductive behavior. All seven males from Butler Creek have a white spot on the sternum of abdominal segment 10, but the size of the spot varies.

The other species of *Calopteryx* known to occur in Alabama are *C. maculata* (Beauvois) and *C. dimidiata* Burmeister. The known range of *C. dimidiata* was also extended with the collection of a male at Butler Creek, on August 22, 1977, and a female at Indian Creek, in Wayne County, Tennessee, on August 16, 1977. These localities lie in the supposed distributional hiatus between eastern Tennessee and northern Louisiana shown by Johnson (1973; 1974).

Archilestes grandis (Rambur) and *Lestes congener* Hagen in Alabama

E. Pickard and I collected a single male of each species at a strip mine

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[1] Received January 2, 1979

[2] Tennessee Valley Authority, Division of Environmental Planning, Water Quality and Ecology Branch, E & D Building, Muscle Shoals, AL 35660.

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Figure 1. Known distribution of *Calopteryx angustipennis* (Selys) in eastern United States (modified with permission from Johnson, 1974).

pond off Hwy. 233, in Marion County, Alabama.

Neurocordulia yamaskanensis (Provancher) in Alabama and Tennessee

A total of 21 males and 3 males of *N. yamaskanensis* were collected between June 6 and June 25, 1976, along the south shore of Wilson Lake, Colbert County, Alabama. Also, nymphs were found clinging to large, sunken logs near the shore. On June 3, 1976, A.H. Price and R.N. Brown collected a teneral female of *N. yamaskanensis* in a field near the Tennessee River, east of Saltillo, in Decatur County, Tennessee. These localities extend the known range far to the southwest of that previously recorded: Connecticut, Kentucky, Maine, Michigan, Missouri, Ohio, Pennsylvania, and West Virginia (Needham and Westfall 1955); Wisconsin (Hilsenhoff 1972); and Virginia (Roback and Westfall 1967).

Gomphus (Stylurus) *townesi* Gloyd in Alabama

On August 2, 1973, I collected one female of *G. townesi* at the Conecuh River near Hwy. 4, Escambia County, Alabama.

Gomphaeschna furcillata (Say) and *Celithemis verna* Pritchard in Tennessee

On May 19, 1976, I collected one male of *G. furcillata* that was flying around a pond at Savage Point, near Dunlap, in Sequatchie County, Tennessee. R.N. Brown collected a nymph believed to be *Celithemis* from this same pond on May 12, 1976. Although the nymph itself was not identified with certainty, a male of *Celithemis verna* emerged on June 7.

ACKNOWLEDGEMENTS

I thank Clifford Johnson for information concerning records of *Calopteryx angustipennis* and for permission to reproduce and revise his published figure of its distribution. I thank Minter J. Westfall, Jr., and Carl Cook for checking records of the species included in this paper.

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ASSESSMENT OF MATING STATUS OF FEMALE GRASSHOPPERS[1]

David B. Weissman[2]

ABSTRACT: A technique is described whereby the spermatheca and duct are removed from field-caught adult female grasshoppers and stained for spermatozoa, thus enabling the mating status of the individual to be determined.

During studies on reproductive strategies of grasshoppers in areas of California with a Mediterranean climate (Weissman and French, 1979), it was necessary to determine the time of insemination by a technique independent of observing field pairs *in copulo.* An alternative method is especially important in species with low densities where spermatophore transfer might take only 30-40 minutes (see, for example, Pickford and Gillott, 1971; Haskell, 1960) and, consequently, go unobserved. This paper describes such a method, whereby, using testicular spermatozoa for comparison, it was ascertained that females of the oedipod grasshopper *Trimerotropis occidentalis* (Bruner) went unmated for 9-14 weeks after becoming adult as part of their reproductive dormancy strategy (see Weissman and French, 1979, for details).

METHODS

The spermatheca and its duct (see Uvarov, 1966, p. 145 for anatomy) of the female, and the testes of the male are removed in insect saline from recently captured adults and immediately fixed in freshly prepared 3 parts 100% ethanol: 1 part glacial acetic acid. The structures may be examined immediately, or can be stored in fixative in a freezer for years. The spermatheca and duct are blotted dry of fixative, placed on a glass slide, stained with lacto-propionic orcein, macerated with a small rod, protected with a coverslip, and examined at low (125X) power with a compound microscope. Three to five follicles are isolated from a testis and treated in the same manner.

RESULTS AND DISCUSSION

Spermatozoa are easier to detect in the spermatheca after they have been

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[1] Received March 1, 1979

[2] Associate, Department of Entomology, California Academy of Sciences, Golden Gate Park, San Francisco, Ca. 94118

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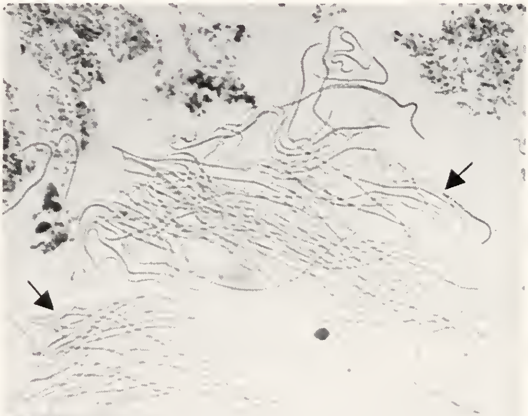
initially appreciated, in the absence of other confusing structures, by first examining testicular follicles where *mature* sperm should be readily visible (Fig. 1). Spermathecal spermatozoa will appear identical (Fig. 2), but cellular wall structures (Figs. 3, 4, and 5) can also have a stringy appearance similar to spermatozoan bundles. In unmated females, this distinction between wall components and sperm is both crucial and especially difficult. The final decision with reference to actual insemination should be made only after searching properly squashed spermatheca and finding diagnostic isolated spermatozoon (Fig. 6).



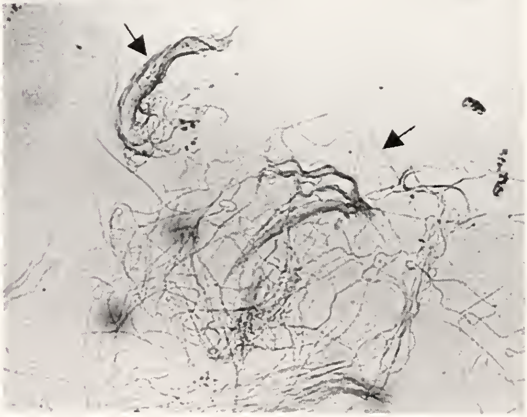


Figure 1. Mature spermatozoa appear as long filaments (arrows) in partial testis squash of *Trimerotropis occidentalis.*

Figure 2. *T. occidentalis* female with spermathecal squash revealing presence of sperm (arrows) morphologically indistinguishable from those seen in Fig. 1.

Figures 3, 4, and 5: Various spermathecal suborgan structures (arrows), most likely of wall origin, from a female *T. occidentalis,* that must be distinguished from spermatozoa. The grasshopper was in reproductive dormancy and unmated at time of capture.

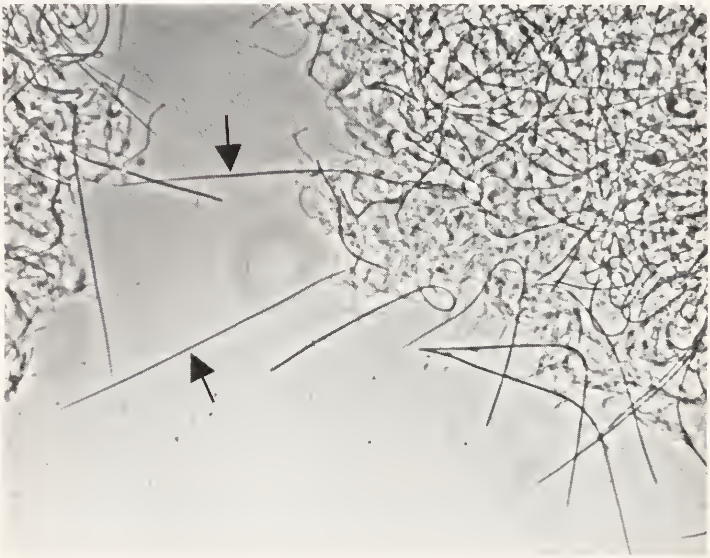


Figure 6: "Single" spermatozoon (arrows, under phase contrast) as seen in *T. occidentalis* spermathecal squash. Similar structures are not seen in virgin females and are diagnostic of insemination.

Using this method, I was also able to confirm the delayed mating in the spur-throated grasshopper *Melanoplus devastator* Scudder, as originally postulated by Middlekauff (1964). This technique should be applicable to all invertebrates possessing a spermatheca, or its functional equivalent.

ACKNOWLEDGMENT

I thank T.J. Cohn for helpful comments upon an earlier draft.

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ADAPTIVE CHANGES IN MORPHOLOGY AND BEHAVIOR OF *CLOSSIANA SELENE* LARVA (LEPIDOPTERA: NYMPHALIDAE)[1]

Christine L. Turnbull[2]

ABSTRACT: The morphological and behavioral changes in the immature stages of *Clossiana selene*, a nymphalid found in Europe, are examined. A possible explanation for the adaptive significance of these changes is the varying array of predators and parasites which attack each instar.

The larvae of many lepidopterans undergo complex changes in morphology and behavior during development (Ford, 1945). Changes in color; number, size and pattern of hairs, spines and tubercles; and behavior such as the alarm response, occur as the instars progress. The present study investigates the possible adaptive significance of these changes in the larva of *Clossiana selene* Schiffermueller (Nymphalidae).

This butterfly occurs locally in woodlands, especially clearings, margins and damp areas, throughout most of Britain (South 1941). Its food plant is the violet, *Viola canina*. The first brood of adults emerges in June and July and eggs are laid within twelve days of emergence. There are five larval instars and each instar is morphologically distinct from any other. In Britain the majority of larvae enter hibernation during August as second, third, or fourth instars and begin feeding again the following April. The remainder feed up quickly after emerging from the egg, taking only twenty one or twenty two days to complete their larval development. Consequently they pupate and emerge as adults in the August of the same year. Matings from these individuals result in larvae which quickly grow to the third instar and hibernate before cold conditions ensue (Tutt, 1896; Frohawk, 1934).

The interruption of development by hibernation results in larval activity during two distinct seasons. More precisely, the first, second and third instars occur in summer from mid-June through August, (or August through September for the partial brood), while the majority of fourth and fifth instars are active in spring, mainly April through May. Instars occurring at different times of the year are likely to encounter different predators and parasitoids. In this paper I explore the possibility that changes in instar morphology and behavior can be explained in part by changes in kind and frequency of major larval enemies through time.

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[1] Received February 13, 1979

[2] Department of Biological Sciences, Northwestern University, Evanston, Illinois 60201

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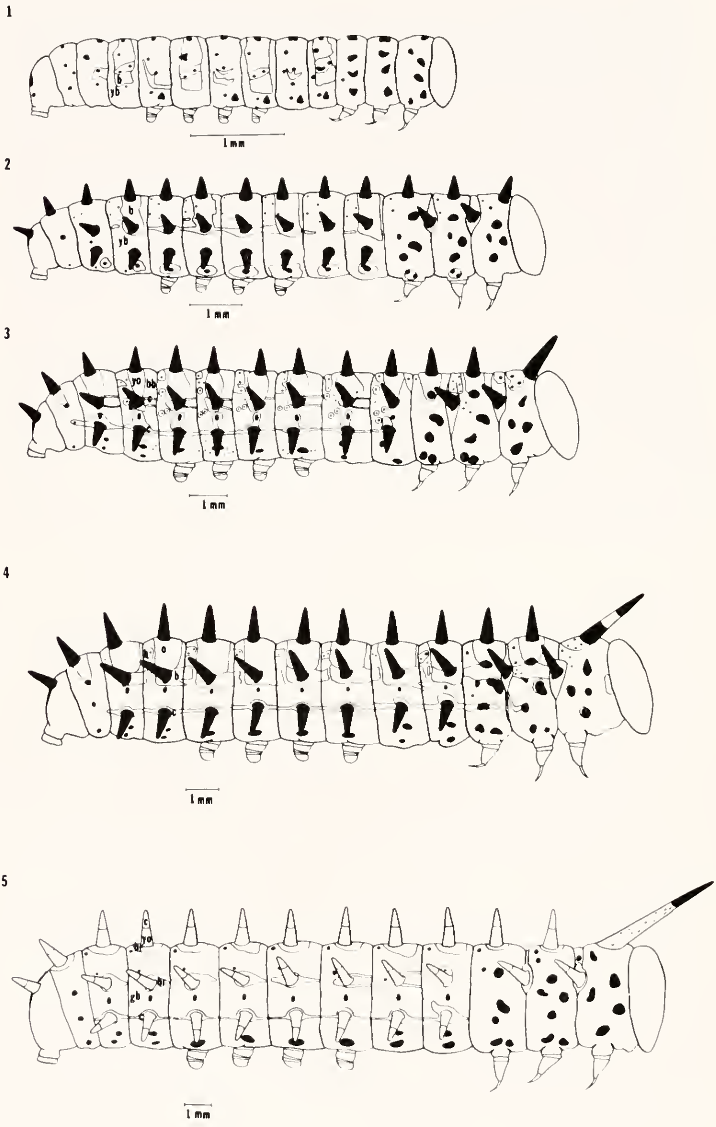

Fig. 1. Morphology of the five larval instars of *Clossiana selene*. The armature is drawn without hairs and spines. Symbols: b=black, yb=yellow-brown, yo=yellow ochre, bb=blue-brown, o=orange, br=brown, gb=grey-blue.

METHODS

One hundred and eight *Clossiana selene* larvae were kept in separate containers in well-shaded conditions similar to those found in their normal habitat. Each container was approximately twelve inches in height and consisted of a potted food plant with a closely fitting, ventilated plastic cover. Each larva remained in its container except for periods of study, and faeces were removed on alternate days. The plants were watered from the bottom. Records were kept on the morphology, especially the changes in size, armature (tubercles and spines) and color, and the behavior of each instar.

RESULTS

Morphology: The changes in morphology throughout the five instars of *Clossiana selene* are illustrated by Fig. 1. Changes occur between instars at ecdysis, and within each instar, once the coloration after ecdysis is complete, the only morphological feature to alter is the size. The first instar larva will grow from approximately 1.5 mm to 4.5 mm then ecdyse; the second instar increases to approximately 10 mm; and the third, fourth and fifth instar larvae increase in size to 14.5, 18, and 22 mm respectively before ecdysing.

The armature of the first instar is sparse and consists of tiny, fine hairs scattered over the surface and a few small clusters of fine spines protruding from shiny, black spots. Immediately upon ecdysis the black tubercles of the second instar larva are apparent, each bearing many spines projecting in diverse directions (see Fig. 2). Larger and more numerous hairs and spines are also present at this stage. Large tubercles and larger and more numerous spines feature in the third instar. The prothoracic tubercles are more prominent and extend to approximately one and a half times the length of the others. The tubercles have a size gradient with the largest ones situated dorsally and the smallest towards the ventral surface. The tubercles, hairs and spines are bigger in the fourth and fifth instars, corresponding to the increase in body size. Throughout, each large black spot usually bears two or three spines and each small dot has a single hair projecting from the center.

There is an overall increase in the number of spines over the body surface and on each tubercle between each instar, resulting in a densely coated fifth instar individual. By comparison the first instar individual appears naked.

The undersurface of every instar is dark grey-brown, mottled with lighter and darker areas, but the coloration of the dorsal surface varies with the instar. The first instar larva is mainly yellow-brown with some small black

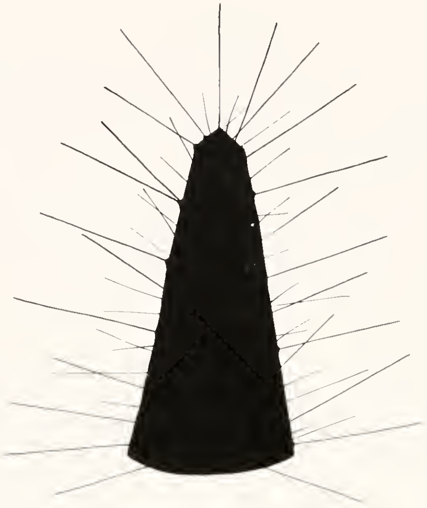

Fig. 2. A single tubercle from a fourth larval instar to show spines.

patches and several shiny black spots. The second instar resembles the first except for appearing generally darker because of the tubercles and more extensive black patches. The third instar is mainly dark blue-brown in color with lateral cream bands, dorsal yellow ochre pataches and some charcoal markings. The fourth (and first post hibernation) instar is lighter and brighter, being pale grey-blue with a lateral cream band, and the previously yellow ochre regions are now orange and more extensive. It also bears the prominent prothoracic tubercles which are differentiated into black and grey. The fifth instar appears as the brightest of all the stages being mainly dark grey-blue with lateral cream and brown bands and dark brown markings, and the general tubercles are differentiated into yellow ochre and cream. The spines remain black throughout the instars.

Behavior: The larvae feed mainly at night and generally on the undersurface of the leaves.

Defensive behavior of the first and second instar larvae differs from that of the third, fourth and fifth instars. In the former stages the larva is passive and any mechanical disturbance results in dislodgement from the leaf. However, in the latter stages the larva actively curls into a ball when disturbed and lies on its side with the head tucked in, protected by the last few abdominal segments, and the tubercles radiating in all directions. The larva often drops to the ground during this process.

DISCUSSION

The agents which reduce the numbers of the early instars of butterflies in general appear to be adverse weather conditions (heavy rain), fungal and viral diseases and parasites. The later stages and adults suffer from attack by parasites and invertebrate and vertebrate predators (Ford, 1945; Harcourt, 1966).

It is most probable that the principal selective force for particular color patterns is predation by vertebrates (especially birds in Britain) (Ford, 1945; Carpenter, 1937). Most of the nymphalid larvae have warning coloration, are armed with spines and are conspicuous on the food plant (Ford, 1945). In the case of *Clossiana selene*, the coloration and armature becomes well developed in the fourth and fifth instars and the earlier instars are generally much less conspicuous. The first, second and third instars, which are active predominantly mid-June through August, are small (less than 14.5 mm), moderately spiny and mainly a subdued yellow or blue-brown with black markings and spots. After hibernation the fourth and fifth instars are larger, eventually reaching 22 mm in length, have dense spines and large tubercles, especially on the prothorax, and exhibit bright colors with highly variable markings including orange and cream. While the background is dark grey-blue, the overall impression is bright therefore, the colors do not appear to be explicable in terms of thermoregulation, for example, the absorption of heat on emergence from hibernation.

The coloration and armature of the last two instars may be a response to heavy predation by birds. The appearance of most fourth and fifth instar larvae coincides with the breeding season of birds and the rearing of fledglings. While insect predation by birds can be very heavy at this season they are known to generally avoid hairy, conspicuous larvae and the coloration and armature of caterpillars are both important in deterring predators (Judd, 1899; Jones, 1932). The rolling behavior of the fourth and fifth instars when disturbed probably aids in repelling predators through the display of spines and tubercles.

Larvae avoid parasitoids by a variety of mechanisms including hiding, violent struggling when the parasitoid is near, falling from the food plant, the possession of a tough cuticle, or any combination of these (Askew, 1971). Since the early instars of *Clossiana selene* have relatively few and small spines and tubercles, and are relatively drabbly colored, their defense appears to be mainly by crypsis and catalepsis. It is these instars which may be the most vulnerable to parasitoids. Larvae and pupae of butterflies are parasitized by at least two major orders of insects, the Hymenoptera and the Diptera. Nothing is known of the specific parasites of *Clossiana selene* but the family

Nymphalidae is heavily parasitized by both orders (Thompson, 1944) and the incidence of parasitism is especially great during the early instars. The Tachinidae are the more generalized parasites and several species, for example, *Phryxe vulgaris*, attack close relatives of *Clossiana selene* (Audcent, 1942). It is very likely that patterns of parasite attack on *Clossiana selene* are very similar.

The available data and literature suggest that the changes in the morphology and behavior of the *Clossiana selene* instars is a response to changes in the relative frequency of its major enemies before pupation. The changes are perhaps exaggerated as a result of the larvae being active in two distinct seasons. Parasitoids are likely to be present at all times but the larvae are most vulnerable to them during the early instars. By contrast, predation by birds is likely to be at a maximum during the active period of the later instars which bear the largest spines and tubercles and which exhibit the brightest and most variable colors.

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INSECTS VISITING BLOOM OF WITHE-ROD *VIBURNUM CASSANOIDES* L. IN THE ORONO, MAINE AREA[1]

Eugene R. Miliczky, Eben A. Osgood[2]

ABSTRACT: Insects visiting flowers of *Viburnum cassanoides* L. were collected throughout its bloom period. Representatives of five insect orders and 33 families were identified including four families of native bees which may be the most important pollinators. Cerambycidae and Syrphidae were well represented in numbers of individuals and species, and two new species of Syrphidae were found.

Viburnum cassanoides L., withe-rod, is a woody shrub, common in the northeastern United States and frequently grows at the margins of wooded areas, along roadsides, and in larger clearings. During bloom its small white flowers are produced in clusters (cymes) two to four inches in diameter. Experiments by Miliczky and Osgood (1979) demonstrated its dependence upon insects for pollination. Their work also showed that an operational spray of Sevin-4-oil® for spruce budworm control was detrimental to native bees, the most important insect pollinators, and that fruit set of *V. cassanoides* was adversely affected. Fruit set in sprayed areas was less than 1/5 that in control areas. Of the many species of bees collected during that study, those in the genus *Andrena* were by far the most abundant, followed in order by *Dialictus* spp. and parasites in the genus *Nomada.*

Casual observations and limited collecting during 1977 showed that large numbers of small flies and several species of small beetles were associated with the bloom, but native bees, syrphid flies, and larger species of beetles were few in number, or absent. The principal objectives of the current study were to determine the array of bees and other insects which visit flowers of *V. cassanoides,* and if present, to determine the species of andrenids and some of the other apparently important pollinator groups. The andrenid species found on *V. cassanoides* could then be compared with those collected in Malaise traps in the study by Milickzy and Osgood (1979). Information on other visitors would also suggest additional insect groups to study in future work on the effect of insecticides on fruit set of this species.

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[1] Received March 12, 1979

[2] Dept. of Entomology, University of Maine, Orono, Maine 04469, Graduate Student and Professor of Entomology respectively.

MATERIALS AND METHODS

The study was conducted from June 14 to July 1, 1978 when withe-rod was in bloom. Smaller species of insects were collected from blooms with a sweep net, or entire flower clusters were placed in a killing jar. Larger beetles were hand-collected and many bees and syrphids were selectively captured with a net as different species were observed. With the exception of Empididae, which were preserved in alcohol, all specimens were pinned, and all pinned specimens were examined under a microscope for the presence of pollen. Most specimens were taken in Orono on the University of Maine campus, and additional specimens were collected in Passadumkeag about 20 miles north. Collections were made throughout the day on most days of the bloom period, weather permitting.

RESULTS AND DISCUSSION

Extensive collections of insects visiting the bloom of *V. cassanoides* showed that several groups were much better represented than we previously thought. More than 16 species of native bees were collected, and 8 of the 11 species of andrenids collected were among those taken in Malaise traps by Miliczky and Osgood (1979).

Members of the genus *Dialictus* and other Halictidae were commonly seen on the bloom but the genus *Nomada* was not observed. Ten species of cerambycids and 32 species of syrphids, including 2 new species, were also collected. In addition, representatives of 28 other families were found on the bloom. Many of these were apparently casual visitors playing little, if any, role in pollination, although Empididae were particularly abundant. Collections in other areas would undoubtedly yield many additional species.

Many species of native bees, syrphid flies and cerambycid beetles were carrying pollen loads or were liberally dusted with pollen and may be the most important groups of pollinators of *V. cassanoides.* But native bees, with their highly pubescent bodies, well-known behavior patterns when collecting food for their young, and the frequency with which they were seen on bloom, may be of primary importance in pollination of this plant.

Following is a list of insects collected on *V. cassanoides* in this study. Those marked with an asterisk were bees carrying pollen loads or bees and other insects liberally dusted with pollen. All specimens are deposited in the collection of the Department of Entomology, University of Maine at Orono except syrphids noted in the list as "kept" which are in the USNM collection.

Insects Collected on Bloom of *V. cassanoides*

Hemiptera
- Miridae
- Lygaeidae

Homoptera
- Cicadellidae

Coleoptera
- Scarabaeidae
  - *Hoplia trifasciata* Say
  - *Trichiotinus affinis* (Gory & Percheron)
- Elateridae
  - *Ampedus* ? *rubricus* Say
  - *Miscellaneous – several species
- Lampyridae
  - *Photuris pennsylvanica* (DeGeer)
- Cantharidae
  - *Cantharis fraxini* Say
  - *C. scitulus* Say
- Cephaloidae
  - *Cephaloon* sp.
- Alleculidae
  - *Isomira* ? *quadristriata* Couper
- Oedemeridae
  - *Asclera ruficollis* Say
- Mordellidae
  - *Anaspis* ? *rufa* Say
  - *Mordellistena* sp.
- Cerambycidae
  - **Anoplodera chrysocoma* (Kby.)
  - **A. mutabilis* (Newman)
  - **A. sexmaculata* (L.)
  - **A. vittata* (Swederus)
  - *Cyrtophorus verrucosus* (Olivier)
  - **Evodinus monticola* (Randall)
  - *Grammoptera* sp.
  - **Leptura lineola* Say
  - *Molorchus bimaculatus* Say
  - *Miscellaneous – 1 species
- Chrysomelidae
  - *Orsodacne atra* (Ahrens)
- Curculionidae – 4 species
- Miscellaneous – 1 species

Diptera
- Syrphidae
  - **Blera badia* (Walker)
  - *Brachyopa notata* O.S. – kept
  - *Chalcosyrphus vecors* (O.S.)
  - *Cheilosia rita* Curran
  - *Cheilosia* n. sp. – kept
  - *Chrysogaster antitheus* (Walker)
  - *Doros aequalis* Loew
  - **Eristalis arbustorum* (L.) – kept
  - **E. dimidiatus* Wied.
  - **E. obscurus* Telford
  - **E. transversalis* Wied.
  - *Heringia* sp.
  - **Mallota posticata* (Fabr.)
  - *Metasyrphus lapponicus* (Zett.)
  - *Microdon ruficrus* Will.
  - *M. tristis* Loew
  - *Orthoneura pulchella* (Will.)
  - *Parasyrphus generalis* (Will.)
  - *Parasyrphus* n. sp. – kept
  - **Sericomyia chrysotoxoides* Macq.
  - *S. lata* (Coquillet)
  - *Somula decora* Macq.
  - *Sphegina rufiventris* Loew
  - *Syritta pipiens* (L.)
  - *Syrphus rectus* O.S.
  - **Temnostoma alternans* Loew
  - *T. balyras* (Walker)
  - **T. barberi* Curran
  - **T. vespiforme* (L.)
  - *Xylota atlantica* Shannon
  - *X. confusa* Shannon
  - *X. segnis* (L.)
- Empididae
- Pipunculidae
- Conopidae
- Sepsidae
- Anthomyiidae
- Muscidae
- Calliphoridae
- Sarcophagidae

Hymenoptera
- Tenthredinidae
- Cynipidae
- Gasteruptiidae
- Formicidae
- Vespidae
  - *Odynerus* sp.

- Sphecidae
  - *Ectemnius* sp.

- Colletidae
  - *Hylaeus modestus modestus* Say

- Halictidae
  - *Evylaeus quebecensis* (Craw.)
  - **Lasioglossum* sp.
  - **Dialictus* spp.

- Andrenidae
  - **Andrena algida* Smith
  - **A. alleghaniensis* Vier.
  - **A. carlini* Ckll.
  - **A. crataegi* Robt.
  - **A. cressoni* Robt.
  - **A. dunningi* Ckll.
  - **A. miranda* Smith
  - **A. miserabilis* Cresson
  - **A. regularis* Wall.
  - **A. nivalis* Smith
  - **A. vicina* Smith

- Apidae
  - **Bombus terricola* Kirby

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ADDITIONAL RECORDS OF SIPHONAPTERA IN SOUTHERN NEW ENGLAND[1] [2]

A.J. Main,[3] A.B. Carey,[3] M.G. Carey,[3] V.A. Nelson[4]

ABSTRACT: A total of 2703 fleas representing 23 species and subspecies were collected between 1969 and 1979 in southern New England. Several new distributional records, including five species not previously reported from Connecticut, are presented. Eighteen new host records for New England are listed.

Since an earlier report on fleas in New England (Main, 1970), we have had the opportunity to examine an additional 2703 specimens collected in Connecticut and Massachusetts. Represented in these collections were 22 species (plus two subspecies), including five not previously reported from Connecticut (Main, 1970; Miller and Benton, 1973).

This paper is a compilation of these new records. As in the earlier publication, distribution is presented by state and county; however, extensions of previously reported ranges are marked with an asterisk (*). New parasite-host associations for New England are noted with a double asterisk (**). The percentage of fleas collected from each vertebrate species in the present survey is given in parenthesis in the list of hosts.

PULICIDAE

Cediopsylla simplex (Baker)

Distribution: CONN: Middlesex, New London,* New Haven;* MASS: Nantucket,* Plymouth.

Host Associations: This rabbit flea was taken from *Sylvilagus floridanus* (70%), *Urocyon cinereoargenteus* (18%), *Vulpes vulpes* (6%), *Canis familiaris*** (4%), and *Oryctolagus cuniculus*** (2%)

New Records: Fifty-four specimens (19 ♂♂, 35 ♀♀) were collected from 17 mammals of five species.

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[2] This study was supported in part by Biomedical Research Support Grant Number 5 S07 RR 05443 and National Institutes of Health Grant Number 5 R01 AM 20358.

[3] Department of Epidemiology and Public Health, Yale University School of Medicine, 60 College Street, New Haven, Connecticut 06510

[4] Department of Biology, Southern Connecticut State College, New Haven, Connecticut 06515

Ctenocephalides felis felis (Bouche)

Distribution: CONN: Middlesex,* New Haven, New London;* MASS: Plymouth

Host Associations: The cat flea was collected from the following species of mammals: *C. familiaris* (33%), *Felis domestica* (18%), *Homo sapiens* (18%), *Procyon lotor* (7%), *Mephitis mephitis* (7%), *Didelphis virginiana* (4%), *O. cuniculus* (4%), *Tamiasciurus hudsonicus*** (4%), and *U. cinereoargenteus*** (4%).

New Records: Twenty-seven specimens (5 ♂♂, 22 ♀♀) were collected from 15 mammals representing nine species.

VERMIPSYLLIDAE

Chaetopsylla lotoris (Stewart)

Distribution: CONN:* New Haven;* MASS: Hampshire, Plymouth.

Host Associations: This raccoon flea was taken from *P. lotor, U. cinereoargenteus,* and *M. mephitis.***

New Records: Belchertown (Hampshire Co.) Mass., 16 III.69, 1 ♀ ex *P. lotor*; Milford (New Haven Co.) Conn., 1. III.71, 1 ♀ ex *M. mephitis*; Plymouth (Plymouth Co.) Mass., 12. XI.72, 1 ♀ ex *U. cinereoargenteus.*

HYSTRICHOPSYLLIDAE

Atyphloceras bishopi Jordan

Distribution: CONN: Middlesex;* MASS: Bristol.

Host Associations: This vole flea was taken from *Clethrionomys gapperi* (75%) and *Microtus pinetorum* (25%).

New Records: Easton (Bristol Co.) Mass., 19.XI.69, 3 ♀♀ ex *C. gapperi*; Moodus (Middlesex Co.) Conn., 22.X.78, 1 ♂ ex *M. pinetorum.*

Epitedia faceta (Rothschild)

Distribution: CONN:* Middlesex.*

Host Associations: This flying squirrel flea was taken from *Glaucomys volans.*

New Records: Killingworth (Middlesex Co.) Conn., 25.XI.78, 1 ♀ ex *G. volans.*

Epitedia wenmanni wenmanni (Rothschild)

Distribution: MASS: Bristol, Hampshire, Plymouth.

Host Associations: This species parasitizes a wide variety of mammals including *C. gapperi* (77%) and *Peromyscus leucopus* (and nest) (23%).

New Records: Thirteen specimens (7 ♂♂, 6 ♀♀) were collected from nine mammals of two species.

Epitedia wenmanni testor (Rothschild)

Distribution: CONN: Middlesex,* New London.*

Host Associations: Like *E. w. wenmanni, E. w. testor* is found on a variety of small mammals including *P. leucopus* (80%), *M. pennsylvanicus* (15%), and *D. virginiana*.

New Records: Twenty specimens (9 ♂♂, 11 ♀♀) were collected from 16 mammals of three species.

Tamiophila grandis (Rothschild)

Distribution: CONN: Middlesex,* New London.*

Host Associations: This chipmunk flea was collected from *Tamias striatus* (67%) and *P. leucopus* (33%).

New Records: East Haddam (Middlesex Co.) Conn., 21.X.78, 1 ♀ and 5.XI.78, 1 ♀ both ex *T. striatus*; Old Lyme (New London Co.) Conn., 28.X.78, 1 ♀ ex *P. leucopus*.

Ctenophthalmus pseudagyrtes pseudagyrtes Baker

Distribution: CONN: Middlesex,* New London;* MASS: Franklin, Nantucket.*

Host Associations: This species is found on a wide variety of mammals including *P. leucopus* (17%), *M. pennsylvanicus* (17%), *T. striatus* (13%), *M. pinetorum* (11%), *Scalopus aquaticus* (11%), *Parascalopus breweri* (11%), *C. gapperi* (11%), *D. virginiana* (4%), *Mustela frenata* (2%), *Blarina brevicauda* (1%), *S. floridanus* (1%), and *M. mephitis*** (1%).

New Records: During this study, 151 specimens (67 ♂♂, 84 ♀♀) were taken from 76 mammals of 12 species.

Doratopsylla blarinae Fox

Distribution: CONN: Middlesex,* New London,* New Haven.

Host Associations: This shrew flea was taken from *B. brevicauda* (76%), *P. leucopus* (23%), and *C. gapperi* (1%).

New Records: Eighty-two specimens (33 ♂♂, 49 ♀♀) were taken from 29 mammals of three species.

Stenoponia americana (Baker)

Distribution: CONN: Middlesex,* New London;* MASS: Bristol, Nantucket,* Plymouth.

Host Associations: This white-footed mouse flea was found on *P. leucopus* (and nest) (85%), *M. pinetorum*** (9%), *T. striatus* (4%), *M. pennsylvanicus* (2%).

New Records: A total of 46 specimens (21 ♂♂, 25 ♀♀) was found on 31 mammals of five species.

CERATOPHYLLIDAE

Ceratophyllus diffinis Jordan

Distribution: MASS: Plymouth.*

Host Associations: Specimens were taken from *Geothlypis trichas*** (50%), *Troglodytes aedon* (25%), and *Seiurus aurocapillus* (25%).

New Records: Four specimens (1 ♂, 3 ♀♀) were taken from four birds of three species.

Ceratophyllus gallinae (Schrank)

Distribution: MASS: Plymouth.*

Host Associations: This poultry flea was taken from *H. sapiens.*

New Records: Manomet (Plymouth Co.), Mass., 19.IV.70, 1 ♀ ex *H. sapiens.*

Megabothris asio asio (Baker)

Distribution: CONN: Middlesex,* New Haven,* New London;* MASS: Bristol, Nantucket.

Host Associations: This meadow vole flea was taken from *M. pennsylvanicus* (88%), *P. leucopus* (6%), and *Zapus hudsonius*** (6%).

New Records: Seventeen specimens (9 ♂♂, 8 ♀♀) were taken from nine rodents of three species.

Nosopsyllus fasciatus (Bosc)

Distribution: CONN:* New Haven*.

Host Associations: This rat flea was taken from *D. virginiana.***

New Records: Hamden (New Haven Co.) Conn., 13.X.73, 3 ♂♂, 1 ♀ Madison (New Haven Co.) Conn., 31.I.74, 3 ♂♂, 2 ♀.

Opisodasys pseudarctomys (Baker)

Distribution: CONN:* Middlesex;* MASS: Bristol.*

Host Associations: This flying squirrel flea was taken from *G. volans.*

New Records: Easton (Bristol Co.) Mass., 22.III.70, 1 ♀ and Killingworth (Middlesex Co.) Conn., 25.XI.78, 1 ♂ both from *G. volans.*

Orchopeas howardii howardii (Baker)

Distribution: CONN: Fairfield,* Middlesex,* New London,* New Haven; MASS: Plymouth.

Host Associations: This squirrel flea was taken from a wide variety of mammals: *S. carolinensis* (69%), *M. mephitis*** (15%), *T. hudsonicus* (8%), *P. lotor* (4%), *D. virginiana*** (2%), *G. volans* (1%), *T. striatus* (1%), *C. familiaris*** (1/2%), and *M. pennsylvanicus* (1/2%).

New Records: A total of 285 specimens (102 ♂♂, 183 ♀♀) was collected from 88 mammals of nine species.

Orchopeas leucopus (Baker)

Distribution: CONN: Middlesex,* New London,* New Haven;* MASS: Bristol, Nantucket,* Plymouth.

Host Associations: This *Peromyscus* flea was found on *P. leucopus* (and nest) (98%), *M. pennsylvanicus* (1%), *T. striatus* (1/2%), *C. gapperi, M. pinetorum,*** and *H. sapiens.***

New Records: During the present survey, 673 specimens (217 ♂♂, 456 ♀♀) were taken from 269 mammals representing six species.

Oropsylla arctomys arctomys (Baker)

Distribution: CONN: Middlesex, New Haven,* New London; MASS: Plymouth.

Host Associations: This woodchuck flea was taken from *Marmota monax* (87%), *P. lotor*** (7%), and *U. cinereoargenteus* (7%).

New Records: Twenty-five specimens (12 ♂♂, 13 ♀♀) were taken from five mammals of three species.

LEPTOPSYLLIDAE

Odontopsyllus multispinosus (Baker)

Distribution: CONN:* New Haven,* New London;* MASS: Plymouth.

Host Associations: This rabbit flea was taken from *S. floridanus.*

New Records: Mt. Carmel (New Haven Co.) Conn., 12.V.44, 1 ♂, Manomet (Plymouth Co.) Mass., 8.IV.77, 1 ♀, Old Lyme (New London Co.) Conn., 25.VII.78, 1 ♂, 1 ♀ all from *S. floridanus.*

Peromyscopsylla hamifer hamifer (Rothschild)

Distribution: CONN: Middlesex.*

Host Associations: This vole flea was collected from *M. pennsylvanicus* and *pinetorum.***

New Records: Moodus (Middlesex Co.) Conn., 28.X.78, 1 ♂ ex *M. pennsylvanicus* and 29.X.78, 1 ♂ ex *M. pinetorum.*

Peromyscopsylla hesperomys hesperomys (Baker)

Distribution: CONN: Middlesex,* New London.*

Host Associations: This *Peromyscus* flea was found on *P. leucopus.*

New Records: Five specimens (2 ♂♂, 3 ♀♀) were taken from five white-footed mice.

ISCHNOPSYLLIDAE

Myodopsylla insignis (Rothschild)

Distribution: CONN: Litchfield. MASS: Hampden.

Host Associations: This bat flea was taken from *Myotis lucifugus.*

New Records: A total of 1272 specimens (469 ♂♂, 803 ♀♀) was collected from 192 little brown bats.

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LECTOTYPE DESIGNATION OF *OCHTHERA SCHEMBRII* RONDANI (DIPTERA: EPHYDRIDAE) AND RESULTING SYNONOMIES[1] [2]

Philip J. Clausen[3]

ABSTRACT: A lectotype and two paralectotypes are designated for *Ochthera schembrii* Rondani and three new synonomies are listed.

At the time of completion of my revision of the nearctic, neotropical, and palearctic species of the genus *Ochthera* (Clausen, 1977), I was unable to locate the type series of *Ochthera schembrii* Rondani. Consequently, in the revision, I considered the species as a *nomen dubium.*

I have just recently located and borrowed three specimens of *schembrii* which were in the Rondani collection in the Museo Zoologico de "La Specola," Universita Degli Studi, Via Romana, 17-50125 Firenze (Florence), Italy. Mr. Martelli of the Museo Zoologico "thinks that the specimens in our possession are undoubtedly those upon which Rondani based his description," and is the type series.

Unfortunately, the three specimens are females and all are quite moldy. They each bear only an elliptical label with the collection number "2107" printed in red.

Poor as they are, if these specimens represent the type series, one should be designated as the lectotype for nomenclatorial stability. Therefore, I am herein designating the female specimen with 1 wing mounted on a point and the abdomen in a microvial as the lectotype, and the remaining two females (one with the head missing) as paralectotypes. All are in the collection of the Museo Zoologico.

An examination of the lectotype clearly shows that it is conspecific with *Ochthera mantispa* Loew. Rondani described *schembrii* in March of 1847 and Loew described *mantispa* in December of the same year. It has already been determined that *Ochthera angustitarsus* Becker (1903) and *Ochthera setigera* Czerny (1909) are conspecific with *mantispa,* and complete synonomies are listed for these names in Clausen, 1977. Thus, the valid name for the

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[2] Paper No. 10,675, Scientific Journal Series, Minnesota Agricultural Experiment Station, St. Paul, Minnesota 55108.

[3] Department of Entomology, Fisheries and Wildlife, University of Minnesota, St. Paul, MN 55108

species becomes *Ochthera schembrii* Rondani while *mantispa* Loew, *angustitarsus* Becker, and *setigera* Czerny become junior synonyms.

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BOOKS RECEIVED AND BRIEFLY NOTED

ARTHROPOD PHYLOGENY. A.P. Gupta, ed. Van Nostrand Reinhold. 1979. 762 pp. $32.50.

Thirteen presentations on the evolution of arthropod taxa, including discussions on arthropod morphology, anatomy, embryology and physiology and the evolution of hexapod classes.

AMERICAN SPIDERS. (second ed.) W.J. Gertsch. Van Nostrand Reinhold. 1979. 274 pp. $24.95.

This revised, popular natural history of the Araneae focuses on their numbers and kinds, morphology, life histories and behavior. Besides many manuscript improvements, a feature of this edition is the extensive series of new colored and black and white illustrations.

IMMS' OUTLINES OF ENTOMOLOGY. (sixth edition) O.W. Richards and R.G. Davies. Chapman & Hall & John Wiley & Sons. 1978. 254 pp. $22.50 cloth. $9.95 ppbk.

An introductory text book to the study of insects, including the more important features in their structure, modes of life, classification, biology and phylogeny.

MANUAL FOR THE IDENTIFICATION OF THE LARVAE OF THE CADDISFLY GENERA *HYDROPSYCHE* AND *SYMPHITOPSYCHE* IN EASTERN AND CENTRAL NORTH AMERICA. G.A. Schuster and D.A. Etnier. Environmental Monitoring & Support Laboratory, Office of Research & Development, U.S. Environmental Protection Agency, Cincinnati, Ohio, 45268. 1978. 129 pp. Free of charge from Cincinnati office or from senior author at State Biological Survey of Kansas, Univ. of Kansas, Lawrence, Kans. 66044

Full descriptions of larvae of 39 species of these two genera are presented along with information on their diagnosis and biology. A complete key is provided with over fifty figures.

A NEW DISTRIBUTION RECORD AND A MORPHOLOGICAL VARIANT OF *TERPNACARUS GLEBULENTUS* THERON (ACARI: TERPNACARIDAE)[1]

B. McDaniel[2], P.D. Theron[3]

ABSTRACT: A new distribution record and morphological variant of *Terpnacarus glebulentus* Theron from South Dakota (Acari: Terpnacaridae).

Members of the genus *Terpnacarus* Grandjean have recently been studied by Theron (1976) and a new species, *T. glebulentus* Theron was described from South Africa. Members of the genus *Terpnacarus,* to our knowledge, have not been recorded from the United States except for the statement by Krantz (1970, 1978) of an undescribed species from Oregon.

Recent ecological soil surveys in South Dakota revealed specimens so similar to *T. glebulentus* Theron, collected from South Africa, that we have elected to regard them, for the present, as belonging to this species.

Sixty-two adult females were collected 1 mile south of Chester, South Dakota by B. McDaniel, April 11, 1977 near the shore of Lake Madison under *Elaeagnus angustifolia* L. (Russian Olive Tree) with a stand of *Panicum virgatum* (Switchgrass) with an understory of *Poa pratensis* (Kentucky bluegrass) and sedges.

The adult females can be divided into 2 groups, depending on the number of internal genital setae. The holotype female, as well as 17 female paratypes from South Africa and all South Dakota females, bears 2 pairs of internal genital setae while 3 pairs are present in 6 of the female paratypes from South Africa. There is also a difference in the hysterosomal setal formula which ranges from 22 pairs (2-2-2-2-2-4-4-4) on females collected from South Dakota to as high as 24 pairs (2-2-2-2-2-4-5-5) on the holotype female, along with 17 female paratypes. The 6 female paratypes with 3 pairs of internal setae have a hysterosomal setal formula totaling 23 pairs (2-2-2-2-2-4-4-5). The variation in the hysterosomal setal formula involves the posterior 2 rows in each case. There is a slight difference in the leg chaetotaxy of the 2 groups found in South Africa.

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[1] Received March 10, 1979

[2] Entomology-Zoology Department, South Dakota State University, Brookings, South Dakota 57007

[3] Institute for Zoological Research, Potchefstroom, University for C.H.E., South Africa

It should be pointed out that the two South African forms, those females with 2 and 3 internal genital setae, were found to appear sympatrically in several localities and eggs have been found in both groups.

In a study of the life cycle of *T. glebulentus,* Theron (1976) was only able to obtain females through nine generations and stated that the probability exists that reproduction is entirely parthenogenetic. This is upheld thus far as no males were found and several females contained eggs within their body in the material collected from South Dakota.

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PREDATOR ESCAPE BEHAVIOR BY FALL CANKERWORM LARVAE, *ALSOPHILA POMETARIA* (LEPIDOPTERA: GEOMETRIDAE)[1]

G. Scott Deshefy[2]

ABSTRACT: Silk emission and dropping behavior in larvae of the fall cankerworm, *Alsophila pometaria,* enable the species to escape predation and ultimately reestablish contact with its tree host.

The fall cankerworm, *Alsophila pometaria* (Harris), is an omnipresent geometrid defoliator of deciduous forests in Canada, from the Maritime Provinces to Alberta, and in the eastern U.S. south to North Carolina and west to Missouri and Montana. Caterpillars are dimorphic, and a five to six week larval period in approximate synchrony with host tree foliation and with mid-summer increases in leaf tannins is a characteristic of the species' univoltine life cycle (Feeny, 1970; Schneider, in press).

While conducting an investigation at Coweeta Hydrologic Laboratory in the Nantahala Mountains of North Carolina, I observed fall cankerworm larvae responding to leaf-branch disturbances by writhing and subsequently dropping from trees on which they fed. In conjunction with this behavior, silk was produced, fibers anchored to grazed leaves, and strands emitted anteriorly as the insect dropped. With cessation of disturbance, suspended larvae were observed returning to host leaves by ingesting suspensory silk. Although this behavior may function also in larval wind dispersal, its primary function appears to be anti-predatory. Dropping behavior was experimentally induced by jarring infested branches, perhaps simulating perturbations of birds or other large predators, whereas swaying movements and wind disturbances proved ineffective in eliciting the response. A recent study of genetic variability in the fall cankerworm at Coweeta Hydrologic Laboratory has revealed possible *Alsophila pometaria* larval genotype-host tree associations (Deshefy, unpublished data). Additionally, the species is parthenogynogenetic (Mitter and Futuyma, 1977), and apterous adult females often deposit egg clusters on the same tree from which they dropped during prepupal metamorphosis (Schneider, in press). These data, combined with possible host specific synchrony of the insect's life cycle, suggest that, just as female aptery leads to possible recolonization of the same tree host over

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[1] Received March 3, 1979

[2] Department of Zoology, Clemson Univ.

several generations, the described emission of silk and related dropping behavior similarly enable larvae to return to the same tree after successfully avoiding predation. These behavioral responses therefore appear to operate as an anti-predator adaption geared for reestablishing contact between the escaping phytophage and its individual tree host.

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AN IMPROVED METHOD FOR PRESERVING COLOR PATTERNS IN PINNED INSECTS[1]

Stephen B. Berté[2]

ABSTRACT: A method for drying pinned insects is described which preserves their color patterns better than the standard air-drying technique. The process, which involves the use of acetone, offers an added advantage in that specimens can be dried and ready for labeling and storage 48 hours after being collected.

While identifying adult dytiscid beetles, I found that taxonomically important markings of many specimens often became obscured when the animals were air-dried. In an effort to circumvent this problem, I employed a method of preservation which I had been using for adult Odonata which involves the immersion of specimens in acetone followed by a brief period of air-drying.

The use of acetone for preserving odonate color patterns was employed by European workers as early as the 1950's (Robert 1959). More recently, White & Morse (1973) described a technique involving the placement of specimens in paper envelopes and immersing these in an acetone bath for 24 hours. After this period, the specimens are removed from the bath, air-dried for 24 hours, and stored in cellophane envelopes.

To process pinned specimens, freshly killed animals are pinned in the usual way and submerged in acetone. After 24 hours they are removed from the bath, pinned in a block to air-dry and then labeled and stored in the usual manner. Fresh acetone may cause processed specimens to be too brittle; this problem can be alleviated by diluting the acetone with water. After some use the acetone becomes diluted with water and dissolved lipids and is no longer effective as evidenced by processed specimens which are too pliable and/or whose colors and color patterns are not preserved as well as they could be. The number of times that a quantity of acetone can be used depends upon both the size and number of insects which have been treated. A word of caution: as acetone is highly flammable and its vapors can be harmful, care should be exercised in its use and all work should be done in a well ventilated area.

The degree to which the preservation of colors and color patterns is enhanced by this method varies from one species to the next, but in no case have I observed specimens to look worse after the treatment as compared

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[1] Received February 28, 1979

[2] Department of Biology, University of Calgary, Calgary, Alberta, Canada T2N 1N4.

to the standard air-drying technique. In the Odonata colors are generally well preserved but the eyes react differently to the treatment, some remaining apparently unchanged while others turn white (even between specimens of a given species). In most dytiscid adults, color patterns are enhanced, thus aiding in the recognition of key characters, but in notonectids and corixids the effect is not as marked. On the other hand, the colors and patterns of acridid grasshoppers are extremely well preserved.

As White & Morse point out, the method is probably successful for three reasons, the first of which is that the destruction of specimens due to bacterial growth is prevented. Secondly, acetone dehydrates the specimen, thereby reducing the time necessary for drying. Finally, because lipids act as barriers to the evaporation of water, their removal by the technique also facilitates rapid drying.

The acetone method of preserving insect specimens is superior to the standard air-drying process in that colors and patterns are, at the least, unaltered as compared to the old method and usually are markedly better preserved. In addition, specimens can be dried and ready for labeling and storage 48 hours after they have been collected. If at a later date it becomes necessary to extract the genitalia from specimens, the pinned insects can be immersed in boiling water for a minute of two. This renders the insects sufficiently pliable to make the necessary dissections possible without destroying the specimens.

ACKNOWLEDGEMENTS

I would like to thank Dr. G. Pritchard and the Izaak Walton Killam Foundation for support.

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NEW DISTRIBUTION RECORD FOR *MICROMEGISTUS BAKERI* TRAGARDH (ACARINA:PARANTENNULIDAE)

B. McDaniel[3], Eric G. Bolen[4]

ABSTRACT: A new distribution is established for *Micromegistus bakeri* Tragardh from Padre Island, Texas on a carabid beetle *Scarites subleranous* Fabricius.

Several specimens of the mite, *Micromegistus bakeri* Tragardh were extracted from a single soil sample collected on Padre Island, Nueces County, Texas, on October 16, 1978. This soil sample, collected in a sparsely vegetated mud-flat bordering the Laguna Madre, also contained a specimen of *Scarites subleranous* Fabricius, a carabid beetle. According to Arnet (1960), *S. subleranous* inhabits burrows in damp clay soil in the vicinity of streams or marshes.

Three specimens of *M. bakeri* were found in the vial containing *S. subleranous.* Two of these, a protonymph and a male, were unattached. A single larva was attached at the junction of trochanter and femur II, a favored site recorded by Nickel andElzinga (1970) for a newly hatched larva.

Nickel and Elizinga (1970) reported the collection of *M. bakeri* from three carabid species, *S. subleranous, Evarthrus sodalis colossus* Le Conte and *Patrobus longicornis* (Say) from Kansas. Tragardh (1948), who described *M. bakeri,* collected it from *S. subleranous* from Mississippi.

The collection of *M. bakeri* Tragardh from south Texas extends the known distribution of this species from its type locality of Mississippi and from those collected from Kansas by Nickel and Elzinga (1970) to the Texas Gulf Coast. We thank the U.S. National Park Service, Padre Island National Seashore, for authorization to collect soil samples for this study.

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[2] South Dakota Agric. Exp. Sta. Jour. Ser. No. 1588

[3] Entomology-Zoology, South Dakota State University, Brookings, South Dakota

[4] Dean's Office, The Graduate School, Texas Tech University, Lubbock Texas

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Twelve papers on insect diversity from taxonomic, phylogenetic and ecological viewpoints. Number nine in a series of symposia of the Royal Ent. Soc. of London.

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Eight papers present different aspects of malarian parasites or malaria in the fields of taxonomy, ecology, cell biology, biochemistry, genetics and chemotherapy.

A THIRD SPECIMEN OF *CELIDOPHYLLA ALBIMACULA* (ORTHOPTERA: TETTIGONIIDAE) AND REMARK ON THE EMERGENCE OF DIPTERA FROM INSECT CARRION[1]

Charles L. Hogue[2]

ABSTRACT: A female *Celidophylla albimacula* (third-known specimen) is recorded from Costa Rica, having been found dead on the ground like the only other existing female specimen. The author suggests caution regarding conclusions that sarcophagid larvae emerging from the latter specimen indicate true parasitism.

The photograph of a female *Celidophylla albimacula* Saussure and Pictet published recently by Allen Young (1978) caused me to recall that I had acquired a specimen of the same species, under somewhat similar conditions, likewise in Costa Rica. It is also a female and is deposited in the collection of the Entomology Section of the Natural History Museum of Los Angeles County, Califormia. Unfortunately, the actual collector (who found the specimen lying dead in the road and brought it to the author) did not remember the exact locality, having inadvertently mixed the insect with some other biological samples. It was found in August 1964. Because of the extreme rarity and distinctiveness of this species, it seems worthwhile to make note here of this additional specimen.

Young comments on the emergence of sarcophagid larvae from his still-living but incapacitated female, which was lying on the forest floor. While it is possible that the larvae were indeed parasites, my own experience in the tropics with large moribund and dead insects that accumulate on the ground under lights makes me cautious toward this conclusion. Such insect carrion attracts Sarcophagidae in the same manner as does vertebrate carcasses and other saprogenous matter, and the larviparous habit of many species of this fly family, as well as the warm climate, result in very rapid infestation by and development of their larvae. I think it premature, therefore, to ascribe parasitism by this family to *Celidophylla albimacula* even provisionally, on the basis of Young's observations.

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[1] Received March 3, 1979

[2] Curator of Entomology, Natural History Museum of Los Angeles County, Los Angeles, California 90007.

A MISSISSIPPI RECORD FOR INTRODUCED DUNG BEETLE, *ONTHOPHAGUS TAURUS* SCHREBER (COLEOPTERA: SCARABAEIDAE)[1]

Paul K. Lago[2]

ABSTRACT: *Onthophagus taurus* Schreber is recorded from Mississippi. This represents the western-most reported U.S. Locality for this European dung beetle which was first collected in North America in Florida during 1971.

The occurrence of a common European dung beetle, *Onthophagus taurus* Schreber, in North America was first reported by Fincher and Woodruff (1975). The first recorded specimen was collected during August 1971 in Santa Rosa County, Florida. Between 1971 and 1975, additional specimens were collected throughout southwestern Georgia, the Florida panhandle and a few counties in southeastern Alabama. The Santa Rosa County record marked the western limit of the reported range (Fincher and Woodruff, 1975).

On 15 April 1977, I collected 21 specimens of *O. taurus* under cow dung 16 miles southeast of Wiggins, Stone County, Mississippi. This record represents a westward range extension of nearly 150 miles beyond that which was previously known. Fincher and Woodruff (1975) suggested that the species was introduced at an undetermined coastal locality in the Florida panhandle. On the basis of their theory, the Mississippi record indicates that the species is radiating from the point of introduction, rather than moving to the east and north as indicated by the collection records of Fincher and Woodruff (1975).

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[1] Received March 17, 1979

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

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BIOGEOGRAPHIC PATTERNS IN FLIGHT CAPACITY OF NEARCTIC GRASSHOPPERS (ORTHOPTERA:ACRIDIDAE)[1]

Daniel Otte[2]

ABSTRACT: The North Ameican species of Gomphocerinae and Acridinae display several interesting biogeographic trends. The proportion of obligately flightless species increases southwards towards the tropics and westwards from the central prairies to the Pacific coast, and is also higher on islands. Facultative nonflying species are unknown in Central America and the Caribbean region and are most common in northern and northeastern parts of the United States. Species ranges are smallest for obligate nonflyers, while obligate flyers and facultative flyers do not differ significantly.

While preparing a handbook on the North American grasshoppers, all described valid species of slant-faced grasshoppers (Gomphocerinae and Acridinae) from Panama northwards and the Caribbean region were studied and their ranges plotted. Several interesting biogeographic patterns and trends relating to condition of flight were noticed and are reported here. Unfortunately the number of species involved is not large enough in most comparisons to indicate that the differences observed are statistically significant. The species examined are listed in Table 1 along with the geographic center of their ranges, the estimated size of their ranges and whether or not they can fly. Distribution areas were estimated by placing a grid (176 km to a side) over a distribution map and counting the squares which included a part of the species range.

(1) Roughly 48% of the species are *obligate flyers,* species in which both sexes are always capable of flight during some part of their adult life (here called *F-species).* Approximately 18% are *facultative flyers,* species in which at least one sex or some individuals of either sex are capable of flight *(f-species).* The remaining 37% are *obligate nonflyers,* species in which flying or long-winged individuals have not been found *(N-species).* Flying ability in both *F-* and *f-species* varies considerably; some species are capable of flying up to 50 m or more when disturbed *(Rhammatocerus* and *Mermiria* species), others can fly a few meters at most *(Parapomala).*

(2) The *f-species* category includes the following combination of flying and nonflying individuals: (a) both sexes are usually capable of flight, but in some geographic regions they are flightless (e.g., *Amphitornus coloradus, Ageneotettix deorum, Horesidotes cinereus,* and *Opeia obscura)*; (b) males are capable of flight but females are usually not (e.g., *Aeropedellus clavatus*); (c) both sexes are usually unable to fly, but occasional individuals are long-winged and capable of flying (e.g., *Chorthippus curtipennis, Dichromorpha elegans)* and *D. viridis, Chloealtis conspersa* and *C. abdominalis,* and *Boopedon nubilum).*

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[2] Department of Entomology, Academy of Natural Sciences, Philadelphia, Pennsylvania, 19103.

(3) The forewings of males are usually longer than those of females. The reason seems to be that males in this group use their forewings in stridulating and retain them principally for this reason. In only one species is the male apparently capable of flight and the female unable to fly *(Aeropedellus clavatus).*

(4) On the continent the proportion of *N-species* decreases northwards and is significantly lower in regions A, B, and C (Fig. 1) than in regions H (X^2 test: $p<.05$, $df=1$). Moving from region H to A in the central part of the continent, percentages of *N-species* decrease as follows: Central America 56%, southern Mexico 33%, northern Mexico and SW United States 15%, central prairies 8%, northern prairies 12%. Differences among regions A, B, C, and E are not significant (X^2 tests); but the difference between regions A or C and G are significant at the 0.1 level. Along an eastern transect the trend is similar: Caribbean regions 67%; Florida and SE United States 14%, NE United States 0%.

(5) The proportion of *f-species* decreases southwards. Through the center of the continent region A has 24% *f-species*; regions B and E have 15%; region G has 11% and region H has 0%. In southern Mexico, Central America and the Caribbean region the Gomphocerinae can either fly or they cannot.

(6) Along the east-west transect through the United States the west has a higher proportion of *N-species* than the east, but the proportion of *f-species* is higher in the east than the west. However, this is a trend and the difference is not statistically significant at the 0.05 level.

(7) High altitude populations of a species are more likely to be flightless than low altitude populations. Among the Gomphocerinae the pattern is seen only in *Amphitornus coloradus* and *Ageneotettix deorum.* The flightless populations of *Ageneotettix deorum* are known only from higher elevations in Arizona and Colorado, and the short-winged form of *Amphitornus coloradus* has been collected only at higher elevations in the Tushar Mountains in Utah and in the San Francisco Mountains and Kaibab Plateau in Arizona.

(8) *N-species* have smaller ranges on the average than either *f-species* or *F-species.* This trend is evident in frequency histograms in Fig. 1. Interestingly, *F-species* and *f-species* do not differ significantly in range size.

Many of the short-winged and flightless species of grasshoppers in Central America are associated with forests, forest openings and forest margins, or mountain ridges. The ranges of most of them are small when compared to those of flying species from the same region, so the small ranges appear to be a direct consequence of their flightlessness and not due to the relatively constricted land mass. The cause of flightlessness in Central America and the Caribbean may be a greater stability of habitats and hence reduced selective pressures for dispersability. Alternatively, the species tend to be restricted to islands or islands of suitable habitat within forests and may be subject to some of the same pressures promoting winglessness on oceanic islands. With loss of flight and the consequent reduction in vagility, isolated populations are less likely to exchange genetic material over the longer term, and thus may speciate more rapidly. Because the ranges of many of the Central American species are very restricted, I believe it is likely that many more species will be discovered when forest and mountain habitats are more thoroughly explored, and this will further

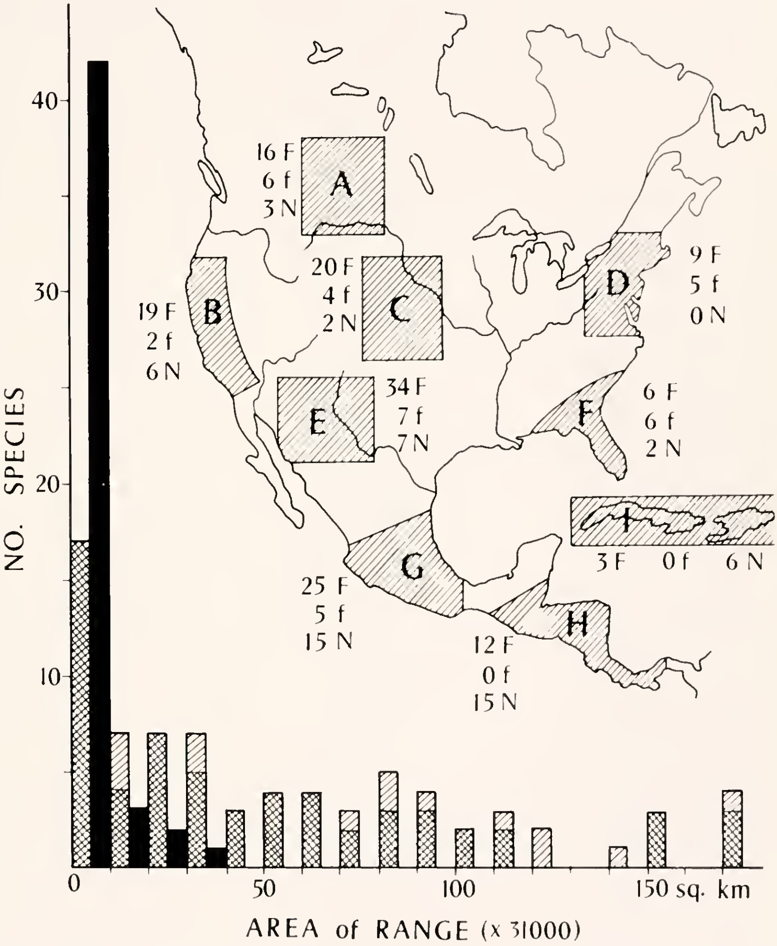

Fig. 1. The map shows areas compared for numbers of F-, f-, and N-species. Proportions of these categories differ significantly between region H and regions A, B, C, and E. The frequency histogram illustrates that relatively many more N-species (black) have small ranges, and none have large ranges. Mean range size of f-species (hatched) and F-species (cross-hatched) do not differ significantly ($P < 0.05, X^2$ test).

increase the proportion of flightless species. Some of the flying species in Central America are most common in weedy and disturbed habitats leading one to wonder if the number of flying species is now higher than it was prior to human disturbance.

Table 1. List of species included in this survey,along with range size and functional condition of wings. F, capable of flight; N, unable to fly. The / separates the condition of males on the left and females on the right. When / is absent both sexes are alike. Parentheses indicate the rare condition: Example: F.N./F(N) indicates flying and nonflying males are both common, but that nonflying females are uncommon.

	Approximate center of range	Estimated range size (sq km)*	Flight
Acantherus piperatus	New Mexico	25	F
Achurum carinatum	Florida	20	N
Achurum minimipenne	NE Mexico	7	N
Achurum sumichrasti	C Mexico	40	F
Acrolophitus hirtipes	Colorado	74	F
Acrolophitus nevadensis	N Arizona	9	F
Acrolophitus maculipennis	No. Mexico	30	F
Acrolophitus pulchella	Idaho	<1	F
Aeropedellus clavatus	Montana	80	f/N
Ageneotettix brevipennis	No. Mexico	9	N
Ageneotettix deorum	Colorado	188	F(N)
Ageneotettix salutator	NW Mexico	16	F-N
Amblytropidia elongata	C Mexico	15	F
Amblytropidia mysteca	E Texas	86	F
Amblytropidia trinitatis	Panama	20++	F
Amphitornus coloradus	Colorado	144	F(N)
Amphitornus durangus	W Mexico	2	F
Aulocara brevipenne	No. Mexico	2	N
Aulocara elliotti	Colorado	156	F
Aulocara femoratum	Colorado	95	N(F)
Boopedon auriventris	Kansas	17	N
Boopedon dampfi	S Mexico	6	N
Boopedon diabolicum	C Mexico	7	N
Boopedon empelios	W Mexico	1	N
Boopedon flaviventris	W Mexico	18	N
Boopedon gracile	Texas	34	F/N(F)
Boopedon nubilum	Colorado	75	N(F)/N(F)
Boopedon rufipes	C Mexico	6	N
Bootettix argentatus	No. Mexico	44	F
Bootettix joerni	No. Mexico	3	F
Chiapacris eximius	C Mexico	1	N
Chiapacris nayaritus	W Mexico	1	N?
Chiapacris velox	S Mexico	3	F
Chloealtis abdominalis	Montana	57	N(F)/N(F)
Chloealtis aspasma	NW USA	1	N
Chloealtis conspera	Minnesota	114	N(F)/N(F)

	Approximate center of range	Estimated range size (sq km)*	Flight
Chloealtis dianae	N California	5	N
Chloealtis gracilis	S California	6	N?
Chorthippus curtipennis	North Dakota	250+	N.F./N.F
Chrysochraon petraea	NW USA	3	N
Cibolacris crypticus	W Mexico	5	F
Cibolacris parviceps	S Arizona	51	F
Cibolacris samalayucae	No. Mexico	2	F
Compsacrella poecila	Cuba	1	N
Cordillacris crenulata	Colorado	67	F
Cordillacris occipitalis	Colorado	90	F
Dichromorpha elegans	SE USA	33	N(F)
Dichromorpha prominula	W Mexico	16	F
Dichromorpha viridis	Misissippi	125	N(F)
Eritettix abortivus	Texas	22	N
Eritettix obscurus	Florida	6	N
Eritettix simplex	Iowa	115	F
Esselenia vanduzeei	C California	3	N
Eupnigodes megacephala	C California	5	N
Eupnigodes sierranus	C California	7	F
Heliaula rufa	New Mexico	31	F
Horesidotes cinereus	S Arizona	14	F(N)
Horesidotes deiradonotus	W Mexico	2	N(F?)
Leurohippus stoneri	Antigua	<1	N
Ligurotettix coquilletti	W Arizona	22	F
Ligurotettix planum	No. Mexico	17	F
Melanotettix dibelonius	C Mexico	4	N
Mermiria bivittata	Oklahoma	95	F
Mermiria intertexta	SE USA	17	F
Mermiria picta	E Texas	83	F
Mermiria texana	W Texas	35+	F
Metaleptea brevicornis	C America	200+	F
Opeia obscura	Colorado	127	F(N)
Opeia atascosa	W Mexico	6	N
Orphula azteca	C America	24	F
Orphula vitripenne	Yucatan	2	F
Orphulina balloui	C America	20+	F
Orphulella aculeata	C Mexico	4	F
Orphulella brachyptera	Cuba	1	N
Orphulella concinnula	South America	150+	F
Orphulella decisa	Caribbean	1	N
Orphulella losamatensis	N South America	50+	F
Orphulella nesicos	Caribbean	1	N
Orphulella orizabae	C Mexico	6	F
Orphulella pelidna	Nebraska	200+	F
Orphulella pernix	Costa Rica	1	N

	Approximate center of range	Estimated range size (sq km)*	Flight
Orphulella punctata	N South America	150+	F
Orphulella quiroga	C Mexico	7	N(F)
Orphulella scudderi	Cuba	4	F
Orphulella speciosa	Missouri	110	F
Orphulella tolteca	C Mexico	4	F
Orphulella trypha	Caribbean	1	N
Paropomala wyomingensis	New Mexico	65+	f
Paropomala pallida	Arizona	55	f
Paropomala virgata	New Mexico	22	F
Phaneroturis cupido	C America	2	N
Phaneroturis tantillus	C America	1	N
Phlibostroma quadrimaculatum	Kansas	80+	f
Prorocorypha snowi	NW Mexico	3	N
Psoloessa brachyptera	C Mexico	2	N
Psoloessa delicatula	Colorado	111	F
Psoloessa meridionalis	C Mexico	14	N(F)
Psoloessa microptera	NE Mexico	2	N
Psoloessa texana	W Texas	95	F
Pseudopomala brachyptera	S Dakota	85	N.F
Rhammatocerus viatorius	S Mexico	33+	F
Rhammatocerus cyanipes	N South America	20	F
Silvitettix aphelocoryphus	C America	1	N
Silvitettix audax	C America	1	N
Silvitettix biolleyi	C America	3	N
Silvitettix chloromerus	C Mexico	3	N
Silvitettix communis	C America	2	N
Silvitettix gorgasi	C America	1	N
Silvitettix maculatus	C America	6	N
Silvitettix rhachicoryphus	S Mexico	2	N
Silvitettix ricei	S Mexico	1	N
Silvitettix salinus	S Mexico	2	N
Silvitettix thalassinus	C America	10	N
Silvitettix whitei	S Mexico	1	N
Stenobothrus brunneus	Montana	42	F
Stenobothrus shastanus	Oregon	35	N
Stethophyma gracile	Minnesota	60	F
Stethophyma lineata	Minnesota	60+	F
Stethophyma celata	Iowa	30+	F
Syrbula admirabilis	E Texas	100+	F
Syrbula festina	S Mexico	6	F
Syrbula montezuma	No. Mexico	73	F
Xeracris minimus	S California	8	F
Xeracris snowi	W Arizona	7	F

**x 31,000*

CHORUSING IN *SYRBULA* (ORTHOPTERA: ACRIDIAE). COOPERATION, INTERFERENCE COMPETITION, OR CONCEALMENT?[1]

Daniel Otte[2], Jasper Loftus-Hills[3]

ABSTRACT: The function of chorusing behavior in grasshoppers is discussed. Experiments with females placed into a sound arena and exposed to tape recorded male songs suggest the relationship between chorusing males is principally competitive. But a mutualistic element may also exist.

Male orthopterans attempting to attract females by means of acoustic signals (calls) may interact in one or more of the following ways (Alexander, 1975; Otte, 1977; Morris, Kerr, and Fullard, 1978): (a) The calls of the two males can be more or less *independent* of one another, but an indirect competition exists if both males attempt to attract the same female. (b) The calls of two males may *alternate* with one another. Such alteration could result if it benefits both males to call during silent pauses in the other's call sequence so as to ensure that critical information-containing elements of song remain distinct. (c) Males can sign synchronously, thereby minimizing the noise-to-signal ratio and reducing mutual interference. (d) A group of males may sing simultaneously but asynchronously. In some species relatively long silent periods alternate with periods when many males sing simultaneously (Jacobs, 1953; Haskell, 1957; Otte, 1970, 1972). Whether choruses constitute a form of cooperation among males in attracting females or are the result of competition among males is the subject of the present paper (see also Morris, Kerr, and Fullard, 1978). (e) Nonsinging males may position themselves near singing males and attempt to *intercept* females that are attracted by song (Otte, 1972, 1977, Cade, 1979). (f) Nonsinging males may behave aggressively toward singing males and attempt to *guard* females or areas likely to harbor females against other males (Alexander, 1961; Otte and Joern, 1975; Otte, 1977; Cade, 1979).

Syrbula admirabilis (Uhler) is a common eastern United States grasshopper in which nonsynchronous chorusing has been demonstrated (Otte 1972). Courtship in this species is extraordinarily complex and in the field and laboratory the songs of males are typically clumped in time so that lengthy silent periods alternate with periods of intense singing. Some

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[1] Received May 14, 1979.

[2] Department of Entomology, Academy of Natural Sciences, Philadelphia, Pennsylvania 19103.

[3] Formerly of the Universities of Melbourne, Texas, Cornell and Michigan

clumping in space also seems to take place, but the latter has not been convincingly demonstrated. In typical laboratory interactions, involved singing males, a leader, and one or more followers can be discerned. One male (the leader) usually starts a bout of singing and is joined after some seconds by one or more males (the followers) and all males sing several times in succession before all singing stops.

Typical songs consist of a series of leg strokes (10-50) and the duration of a song varies from 10 seconds to more than 30 seconds. Follower males usually begin singing long before the leader finishes his song. Sexually receptive responsive females respond to calling males either by stridulating or by walking to the males or both.

The experiments reported here were designed to answer the following questions: (a) Does the song of one male interfere with that of another when the songs are produced at the same time? (b) Does the leader or the follower in a chorus involving two males have the advantage in attracting females: i.e., is a female attracted to the first or the last song she hears? (c) Are several closely spaced males more effective in attracting females than a single male an equal distance from the female?

Methods

Two kinds of arenas were used in these experiments. The first was an elongate arena, a 7 ft. x 1 ft. x 1 ft. wire-gauze cage, divided evenly into 7 sections. Florescent lights were placed over the top of the cage to give equal illumination to all sections. The entire cage was covered with a layer of cheesecloth to reduce visual disturbance from the outside. A group of 30-40 virgin females was placed into the central section during each trial. A trial consisted of playing the songs of males from speakers to one or both ends of the arena for a period of one hour and then counting the number of females assembled in the two end sections. During this period some females may have first oriented to the song and then walked away, but such behavior was not recorded. The following three experiments were conducted using the elongated arena.

Experiment 1: Control. Females were placed into the central section of the arena; a speaker was placed at each end; both speakers remained silent. The number of females moving into the two end sections was counted.

Experiment 2. A tape containing the song of a single male was played through a speaker at one end, while another speaker at the opposite end remained silent. The interval between successive songs was 30 seconds. The speaker producing the song was switched to the opposite end of the arena between trials.

Experiment 3. A tape containing the song of one male was played through a speaker at each end. The timing was so arranged that a male (the leader) began singing at one end, and when he was halfway through his song, the male at the other end (the follower) began to sing. A 30-second interval separated the end of the follower's song and the next beginning of the leader's song. In this fashion the advantage of leader or follower could be assessed.

Because the data from elongate arenas seemed somewhat equivocal we conducted the next series of experiments in a square arena with dimensions 5 ft. x 5 ft. and with walls 1 ft. high. The arena had cheesecloth floor and walls and was illuminated from above with florescent lights. Female responses were scored by counting females moving into the central 1 ft. x 1 ft. square next to each wall (A), as well as the number entering the wider 3 ft. x 1 ft. sections (B). Speakers were placed outside the arena at the center of a side and rotated regularly around all four sides between trials to randomize the possible effects of other stimuli. The two speakers used during each trial were always placed at opposite sides. Five females were used in each trial. Each trial consisted of playing the tapes for 30 consecutive minutes. The following experiments were conducted using the square arena:

Experiment 4: Response of females to a single male song were determined by playing a call through a speaker while keeping the opposite speaker silent.

Experiment 5: In this experiment we attempted to determine whether the leader or follower in a two-male chorus has the advantage in attracting females. The two songs consisted of 50% overlap between leader and the follower and were played from speakers at opposite ends of the arena. Sound intensities were held equal.

Experiment 6: In this experiment females were given a choice of approaching a speaker playing the songs of two males singing simultaneously (100% overlap in songs, but no synchrony of individual leg strokes), or to a speaker with the song of one male. Two-male choruses and one-male songs alternated with one another regularly, with a 15-second pause between songs. Intensities of sound from the two speakers were identical, except when the individual pulses of the two males occasionally overlapped.

Tape recordings used in the above experiments were made in the laboratory at the same temperatures at which experiments were conducted (80° F). A loop was made of one full song. The same loop was used to make up all songs used in these experiments. The influence of subtle differences between songs was thus eliminated. The loop was re-recorded onto a continuous tape to produce an uninterrupted series of songs separated by 30-second intervals. Original tape recordings were made with a Uher 4000

Report L tape recorder and a Uher Dynamic Microphone Model M514. Playbacks were made with a Uher Stereo tape recorder with songs emanating from the two speakers recorded onto separate tracks. Speakers were manufacturd by Kudelski, Switzerland.

Females were collected in the field, either as late instar nymphs or as adults. They were kept separated from males in 2 ft. x 2 ft. x 2 ft. wire-gauze cages for at least a week before testing. Oviposition pans were provided for egg laying. Females used in experiments 1-3 were virgins. Females used in experiments 4-6 were field-caught and may or may not have copulated before capture. Many of these females laid eggs prior to experimentation. Experiments were carried out at 80°F.

Results

The following kinds of responses of females to playback of male songs were observed: (a) no detectable response—females remained motionless or moved about in a seemingly random fashion: (b) females stridulated in response to the male song but did not move toward the speakers; (c) females moved toward the speaker without stridulating; (d) females moved toward the speakers where they stridulated. Only response types *c* and *d* were used to score female responsiveness to particular speakers.

Results of Experiments 1-3 are summarized in Table 1. In general, when no sound was produced, females moved in equal numbers to both ends of the elongate arena (Expt. 1), but the broadcasting of male songs at one end caused females to move in greater numbers to that end (Expt. 2). When given a choice of going either to the leading or the following song (Expt. 3) females were attracted equally to both.

Results of Experiments 4-6 are summarized in Table 2. Experiment 4 demonstrated that females were attracted to the taped songs. Experiment 5 suggested that the leading male in the two-male chorus has a slightly greater chance of attracting females than the follower, but the difference was not significant at the 0.05 level. The results of Experiment 6 suggest that there is neither interference nor signal augmentation between two calls sung simultaneously. Two males singing at the same time and in the same place are not any more or less effective in attracting females than a single male. Because two males sang from the same place in the lab, it is possible that lab females perceived the two males as a single calling male.

Discussion

S. admirabilis females sometimes respond to the songs of males by remaining stationary and stridulating; consequently their preference for one

Table 1. Results of experiments using an elongate arena.

Experiment 1: Control: Silent speaker at each end.				
Number of females reaching each end:				
	Silent speaker	Silent speaker	No. trials	Significance*
	14	12	4	n.s.
Experiment 2: Song playback at one end; speaker at the other end.				
	Speaker with song	Silent speaker		
	65	23	17	$p < .01$
Experiment 3: Song playback at both ends; 50% overlap between songs.				
	Leader	Follower		
	25	24	7	n.s

*X^2 test; n.s.= not significant at 0.05 level.

Table 2. Movements of females in a square arena. Position of speakers was rotated between all trials. Numbers in parentheses indicate proportions of females. Five females were used in each trial. Not all females responded during each trial Sides 1 and 4 indicate opposite sides of the arena.

	Side of arena					
	1 speaker	2	3	4 no speaker	No. trials	X^2 significance level (between 1 and 4)
Experiment 4: Responses of females to one speaker.						
central section (A)	28 (.45)	12 (.19)	13 (.21)	9 (.15)	22	$p < .001$
larger section (B)	45 (.41)	22 (.20)	25 (.23)	18 (.16)		$p < .001$
Experiment 5: Responses of females to two speakers at opposite ends with 50% overlap in songs.						
	1st song			2nd song		
central section (A)	20 (.32)	16 (.25)	16 (.25)	11 (.17)	29	n.s.
larger section (B)	40 (.29)	33 (.24)	32 (.24)	31 (.23)		n.s.
Experiment 6: Responses to two speakers at opposite ends – one speaker with two overlapping songs, the other with one song.						
	1st song			one male		
central section (A)	23 (.37)	11 (.18)	10 (.16)	18 (.29)	31	n.s.
larger section (B)	42 (.31)	26 (.19)	25 (.19)	43 (.31)		n.s.

or another song type is more difficult to assess than in a species where sexually receptive females always approach the male song. Nevertheless, the results obtained furnish partial explanations to the significance of male chorusing.

We arrived at the following tentative conclusions: The relationship between chorusing *Syrbula* males is primarily competitive. We base this conclusion on the observations that (a) two males singing at different places but at the same time divide the females exposed to the songs of both males (Expts. 3, 5) and (b) two males singing at the same time and at the same place are not any better at attracting females than a single male (Expt. 6). We speculate that the best strategy of a male might be to sing alone and thereby avoid interference from other males, or, failing that, to be the first male to sing, thereby gaining a slight advantage over followers in attracting females, and, finally, to begin singing immediately after or during the song of another male, thus ensuring that at least some sexually receptive females will come to him or that females will be temporarily distracted and remain uninseminated by competing males. The fact that two males singing simultaneously from the same place are as effective as a single male in attracting females suggests that song interference does not involve the obscuring of critical information-containing elements, but may involve the difficulty that females have in orienting on the sound of one male when another male is singing in a different direction.

Although the preliminary results we obtained do not support this notion, an element of cooperation between males is nevertheless conceivable. It is possible that females could be attracted to areas containing numerous males, or that they might tend to reside longer in areas with many active males. So, while competition could be operating among males *within* a chorus (or a clump), a chorus of males may serve to attract a disproportionate share of females, thereby causing the female quota per male to increase over that of solitary males. See Morris, Kerr, and Fullard (1978) for an excellent discussion of this phenomenon.

A further (or alternate) advantage to chorusing may lie in the difficulty that predators have in locating one individual when several are simultaneously active. This notion, discussed in more detail elsewhere (Otte,1977) has no supporting evidence beyond the fact that we found it difficult at times to focus attention on one male when several others were active.

Chorusing behavior in *Syrbula admirabilis* may well be much more complicated than we have suggested. We have as yet not established whether some males customarily adopt a following role and others a leading role or whether the roles tend to be age dependent. It is quite clear that a given male may either be a leader or follower, but the factors determining which of the two he will be are poorly understood. The behavior of a single member of an assembly of males within hearing range of one another (common in nature) may call for a complex strategy. It is conceivable for example that in a 3-male chorus the first and last male could have an advantage over the male singing in between. There might then be a premium set on being the first or last male to sing in a chorus. Also, the following considerations would seem to have a bearing on male strategies. (a) The amount of energy available for singing is finite, so that the male can be expected to sing only a certain number of songs each day. (b) If other males are near, a male might be best off if he could sing alone. (c) If a male cannot sing alone, he might be best off being the first male to sing. (d) The formation of a chorus may be the passive consequence of all males attempting to solve the problem of competition in the same way — by trying to sing alone and at the same time to interfere with the songs of neighbors as often as possible.

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NEW RECORDS OF HETEROCERIDAE (COLEOPTERA) FROM OHIO[1]

Paul M. Holeski[2]

Pacheco (1964) treated, in a monograph, the family Heteroceridae (the variegated mud-loving beetles) in the New World. At that time he described 20 new species, validated many of the previously described species, and reported distribution records. Later he listed the species north of Mexico in catalog form (Pacheco, 1978).

Two species, *Neoheterocerus sandersoni* Pacheco and *Neoheterocerus longilobulus* Pacheco, did not have records from Ohio although both species have been collected in Illinois to the west and in some of the Atlantic coast states to the east. Numerous individuals of these species were collected on the shores of low gradient streams in northwest Ohio 1972-1974 (Holeski and Graves, 1978). They occurred in both heavily shaded wooded areas and in open pastures on a substrate of 30% to 50% clay and silt which normally made up the exposed shore area and stream deposits in the area.

Seven other heterocerid species, *Lanternarius mollinus* (Kiesenwetter), *Centuriatus auromicans* (Kiesenwetter), *Dampfius collaris* (Kiesenwetter), *Dampfius undatus* (Melsheimer),*Neoheterocerus pallidus* (Say), *Tropicus pusillus* (Say) and *Lapsus tristis* (Mannerheim) were also collected at this time. Three of these, *Centuriatus auromicans* (Kiesenwetter), *Dampfius collaris* (Kiesenwetter) and *Lapsus tristis* (Mannerheim) were not reported from Ohio in Pacheco (1978) but specimens previously collected in the state are present in the Ohio State University Museum and have been confirmed by the author.

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[1] Received April 25, 1979.

[2] Rt. 1 Warsaw, Ohio, 43844.

A CHECKLIST OF CADDISFLIES (TRICHOPTERA) FROM MASSACHUSETTS[1]

Richard J. Neves[2]

ABSTRACT: Collections of adult Trichoptera were made in the Connecticut and Hoosic River Basins, western Massachussets, between 1974 and 1978. Of the 157 species collected, 88 represent new records for the state. A complete checklist of previously published and newly recorded species is presented, totaling 189 species.

Initial records of caddisflies from Massachusetts were first assembled by Banks (1892), who later added several species to the state list. These early collections were made primarily in the eastern part of the state, while Betten (1934) and Flint (1960) provided additional collection records for western Massachusetts. Other reported species are scattered throughout the literature, and much of the early species nomenclature has undergone change and synonymy. A current and more complete list of species is therefore needed.

From 1974 to 1978, I collected Trichoptera by light-trapping and sweep-netting along aquatic habitats in the Connecticut and Hoosic River Basins, Franklin, Hampshire, and northern Berkshire County, Massachusetts (Fig. 1). The 31 sampling sites in the study area represented diverse habitats to more completely sample the caddisfly fauna (Table 1). Most collecting sites in Franklin and Hampshire County were light-trapped at least twice, early and late summer. From 84 light-trap and 40 sweep-net collections during the 5-yr. period, approximately 40,000 adults were captured and identified. Species identifications were based on adult male specimens; all Trichoptera were preserved in 70% isopropanol and are in the author's collection. Light-trap collections of Hydroptilidae have not yet been examined.

Checklist of Species

The list below contains 157 species collected during this survey with month(s) and site(s) of capture. Additional species will undoubtedly be reported as more extensive sampling occurs in other counties of the state. New records are indicated by an asterisk (*); 32 species not collected during this survey but previously reported from Massachusetts are included with

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[1] Received April 27, 1979.

[2] Virginia Cooperative Fishery Research Unit, Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State University, Blackburg, Virginia 24061.

reference citation. Species not figured in Ross (1944) are followed by a reference to an illustration of the male genitalia. The classification scheme follows that of Wiggins (1977), and species and genera within families are arranged alphabetically.

Rhyacophilidae

Rhyacophila acutiloba Morse and Ross; Morse and Ross, 1971. May, June; (3,16,20,21).
R. atrata Banks; Ross, 1938a. May, June; (3,8,16,20).
R. carolina Banks; Schmid, 1970. June to October; (3,4,5,8,11,16,18,19,20,21).
R. carpenteri Milne; Schmid, 1970. Milne 1936.
R. fuscula (Walker). May to September; (2,3,5,8,9,16,18,19,21).
R. glaberrima Ulmer. July, August; (13,16,20,21).
R. invaria (Walker); Schmid, 1970. June, July; (19,20,21).
**R. melita* Ross; Ross, 1938b. May, June; (20).
R. minor Banks; Ross, 1956 (as *minora).* May, June; (8,16,20).
R. nigrita Banks; Schmid, 1970. May, June; (20,21,28).
R. torva Hagen; Schmid, 1970. Denning 1948b.
R. vibox Milne, June; (19).
**R. vuphipes* Milne; Schmid, 1970. August; (2)

Glossosomatidae

Agapetus iridis Ross. June; (13,18)
**A.pinatus* Ross; Ross, 1938b. June to August; (16,18,20,21).
A. rossi Denning; Leonard and Leonard, 1949. June; (10,13).
**Glossosoma lividum* (Hagen); Ross, 1956. July, August; (2,16,20).
**G. nigrior* Banks; Denning, 1942 (as *Eomystra unica).* April to October; (3,10,16,17,18, 20,21).
**Protoptila maculata* (Hagen). June to August; (1,2,6,7,8,10,15).
**P. palina* Ross. August; (7)

Hydroptilidae

Agraylea multipunctata Curtis. June to September; (1,3,6,8,15,17,18,22,24).
**Dibusa angata* Ross. June; (16,20).
**Orthotrichia aegerfasciella* (Chambers); Ross, 1944 (as *americana*). July; (25).

Philopotamidae

**Chimarra aterrima* Hagen. June to August; (3,7,8,13,14,16,18,19,20,24,31).
**C. obscura* (Walker). June to September; (2,3,6,7,10,11,12,13,14,16,18,23,24).
**C. socia* Hagen. June to August; (16,20).
**Dolophilodes distinctus* (Walker); Ross, 1944 (as *trentonius*). January to December; (2,3,4,5,6,7,8,10,12,14,16,17,18,19,20,21,24).
**Wormaldia moesta* (Banks); Ross, 1944 (as *Dolophilus*). May to July; (20).

Psychomyiidae

**Lype diversa* (Banks). June to August; (7,18,20,31).
**Psychomyia nomada* (Ross). June to September; (2,3,7,8,10,17,18,20).

Polycentropodidae

*_Cernotina spicata_ Ross. July; (20).
*_Neureclipsis crepuscularis_ (Walker). June to August; (2,20,21).
N. timesis Denning. Denning 1948c.
Nyctiophylax affinis (Banks); Morse, 1972. June to August; (10,11,18,20,23).
N. moestus Banks; Ross, 1944 (as _vestitus_). June, July; (7,18,19).
Phylocentropus hansoni Root. Root 1965.
*_P. lucidus_ (Hagen). May to August; (5,12,13,18,20,25).
*_P. placidus_ (Banks). June to August; (7,8,11,12,18,20,23).
*_Polycentropus albipunctus_ (Banks); Ross, 1938a. June to August; (18,20).
*_P. aureolus_ (Banks). June; (11).
P. cinereus Hagen. June to August; (3,4,5,6,7,8,9,12,16,18,20,21,24).
P.clinei (Milne); Denning, 1956. Milne 1936.
*_P. confusus_ Hagen. June to August; (3,4,7,9,18,20).
P. crassicornis Walker. June, July; (13,,18,19).
*_P. elarus_ Ross, June, July; (4,5,8,19,25).
*_P. flavus_ Banks. June, July; (8,9).
P. grellus (Milne); Ross, 1938b. Milne 1936.
*_P. iculus_ Ross; Ross, 1941a. June to August; (1920).
P. interruptus (Banks). June, July; (3,8,9,16,18,20,23).
*_P. maculatus_ Banks, June to August; (5,7,19,20,25).
*_P. pixi_ Ross. June; (20).
*_P. remotus_ Banks. June to August; (5,7,17,18,20).

Hydropsychidae

*_Aphropsyche doringa_ (Milne); Ross, 1944 (as _aprilis_). June; (19).
*_Cheumatopsyche campyla_ Ross. June to August; (1,3,6,7,8,10,12,16,18,20,21,22,24).
*_C. gracilis_ (Banks); Gordon, 1974. June, July; (3,9,12,13,14,20,21).
C. halima Denning; Gordon, 1974. June to August; (4,8,12,13,14,16,18,19,20,21,24,25).
*_C. minuscula_ (Banks). June, July; (18,20,21,23).
C. pasella Ross. May to August; (1,2,3,4,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,-23, 25).
C. pettiti (Banks); Ross, 1944 (as _analis_). June to September; (2,3,7,8,10,12,13,14,16,18, 20,21,26,31).
C pinaca Ross; Gordon, 1974. June to August; (3,8,13,14,16,18,19,20,21,24).
*_C. wrighti_ Ross; Gordon, 1974. June, July; (20).
Diplectrona modesta Banks. July, August; (4,5,7,8,12,16,18,20).
*_Hydropsyche betteni_ Ross. June to August; (3,12,16,17,18,20,26,29,31).
*_H. bronta_ Ross. June to August; (3,12,16,17,18,20,26,30).
H. impula Denning. Denning 1948a.
*_H. morosa_ Hagen. June to August; (2,3,6,8,9,12,16,18,20,21,26)
*_H. phalerata_ Hagen. June to August; (1,2,3,6,8,10,12,13,15,18,23).
*_H. recurvata_ Banks. May to July; (6,20).
*_H. riola_ Denning; Denning. 1942. May, June; (20)
*_H. slossonae_ Banks. June to October; (3,8,16,20,21).
*_H. sparna_ Ross. May to October; (1,2,3,4,5,7,8,9,10,12,13,14,15,16,18,19,20,24).
*_H. ventura_ Ross; Ross, 1941a. June; (8,20).
*_H. walkeri_ Betten and Mosely. June, July; (2,20).
*_Macronema zebratum_ (Hagen). June to August; (2,6,10).
Parapsyche apicalis (Banks); Milne and Milne, 1938. May, June; (12,20).

Phryganeidae

Agrypnia glacialis Hagen, Johnson 1930.
A. vestita (Walker), July, August; (10,16,20).
Banksiola calva Banks; Wiggins, 1956. Banks 1943.
B. concatenata (Walker); Wiggins, 1956. June; (12)
B. crotchi Banks; Ross, 1944 (as *selina*). June to August; (7,10,12,18,19,20,24).
B. dossuaria (Say); Wiggins, 1956. June to August; (4,5,9,13,16,18,19,20,23).
B. smithi Banks; Wiggins, 1956. Banks 1951.
Oligostomis ocelligera (Walker). Betten 1934.
O. pardalis (Walker); Ross, 1944 (as *Eubasilissa*). Wiggins 1977.
Phryganea cinera Walker. Betten 1934.
P. sayi Milne. June to August; (10,18)
Ptilostomis angustipennis (Hagen). Betten 1934.
P. ocellifera (Walker). June to August; (3,6,7,8,9,12,13,17,18,19,24).
P. postica (Walker). August; (11).
P. semifasciata (Say). June to August; (7,13,16,18,20).

Brachycentridae

Brachycentrus numerosus (Say). Flint 1966.
**Micrasema charonis* Banks. June to August; (18,20).
M. rusticum (Hagen). Denning 1948c.
**M. sprulesi* Ross, 1941a. May; (20).
**M. wataga* Ross. June; (18).

Sericostomatidae

Agarodes distincta Ulmer; Ross and Scott, 1974. June; (23).
A. grisea Banks. June; (13,18,19).

Odontoceridae

Psilotreta hansoni Denning; Denning, 1948c. June; (8).
**P. frontalis* Banks. June, July; (5,12,20).
**P. labida* Ross. May, June; (20).

Molannidae

**Molanna blenda* Sibley, June, July; (8,13,19,20).
**M. musetta* Betten. June to September; (20).
**M. tryphena* Betten. June, July; (16,20).
**M. uniophila* Vorhies. August; (31).

Helicopsychidae

**Helicopsyche borealis* (Hagen). June to August; (2,16,17,20,21).

Calamoceratidae

**Heteroplectron americanum* (Walker); Betten, 1934 (as *Ganonema nigrum*). June; (16,20).

Leptoceridae

**Ceraclea ancylus* (Vorhies); Ross, 1944 (as *Athripsodes*). June, July; (20).
**C. cancellata* (Betten); Ross, 1944 (as *Athripsodes*). June; (6,9,12,16,20,21).
**C. excisa* (Morton); Morse, 1975. June; (20).
**C. maculata* (Banks); Ross, 1944 (as *Athripsodes transversus*). June to August; (1,3,6,7,8, 10,15,17,18,23,24).
C. ruthae (Flint); Morse, 1975. June to August; (3,4,9,18,20).
**C. tarsipunctata* (Vorhies); Ross, 1944 (as *Athripsodes*). June to August; (1,3,4,6,7,8,10, 11,12,15,16,17,18,19,20,21,23,24).
**C. transversa* (Hagen); Ross, 1944 (as *Arthripsodes angustus*). June to August; (18,20,21).
**Leptocerus americanus* (Banks). July; (7,16,20).
Mystacides longicornis (Linnaeus). Yamamoto and Wiggins 1964.
M. sepulchralis (Walker). June to September; (2,16,18,20,21,24).
Nectopsyche albida (Walker); Betten and Mosley, 1940. Haddock 1977.
N. pavida (Hagen); Ross, (as *Leptocella*). July; (18).
**Oecetis avara* (Banks). June to August; (1,2,7,8,10,11,13,14,15,19,20,22).
O. cinerascens (Hagen). June to September; (1,2,3,7,11,12,15,16,20,21,22,23).
**O. ditissa* Ross; Ross, 1966. August; (3,7,18).
O. inconspicua (Walker). June to September; (1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,17,18, 19,22,23,24,25).
O. osteni Milne. June to September; (7,11,20,23).
**O. persimilis* (Banks). June to September; (2,3,4,6,7,8,10,13,16,18,20).
**Setodes incerta* (Walker). July, August; (16,20).
Triaenodes aba Milne. Ross 1944.
T. ignita (Walker). June, July; (18,20).
**T. inflexa* Morse; Morse, 1971. July to September; (20)
**T. injusta* (Hagen). June to August; (10,18).
**T. marginata* Sibley. June, July; (13,20).
**T. nox* Ross; Ross, 1941a. June to August; (18,20).
**T. tarda* Milne. June, August; (7).

Lepidostomatidae

Lepidostoma americanum (Banks); Ross, 1946. July, August; (7,18,20).
**L. bryanti* (Banks); Leonard and Leonard, 1949. June; (8,13,19,20).
L. costalis (Banks); Ross, 1946. August,September; (20).
L. frosti (Milne);Ross, 1946. July, August; (8,19,20).
L. griseum (Banks); Ross, 1946. Flint and Wiggins 1961.
**L. latipennis* (Banks); Ross, 1946. August, September; (20,21).
**L. lydia* Ross; Ross, 1939. June; (8,19).
**L. ontario* Ross; Ross, 1941a. June; (13,20).
L. prominens (Banks); Ross, 1938a. Denning 1949.
L. reosa Denning; Denning, 1954. June; (20).
L. sackeni (Banks), Flint and Wiggins 1961.
L. sommermanae Ross. Flint and Wiggins 1961.
L. swannanoa Ross; Ross, 1939. April to June; (2,3,19,20,21).
**L. togatum* (Hagen); Betten, 1934. June to August; (3,20).
L. vernalis (Banks). Flint and Wiggins, 1961. May to August; (13,20).

Limnephilidae

Anabolia bimaculata (Walker); Ross, 1944 (as *Limnephilus*). July, August; (16,19,20).
**A. consocia* (Walker); Ross, 1944 (as *Limnephilus*). August; (18).
**A. sordida* Hagen; Ross, 1944 (as *Limnephilus*). June to August; (13,27).
**Apatania incerta* (Banks); Ross, 1938a (as *Apatelia*). April, May; (20,21).
Asynarchus montanus Banks; Banks, 1920 (as *Anabolia curta*). Banks 1920.
Frenesia difficilis (Walker); Betten and Mosely, 1940. November; (16,20).
F. missa (Milne). November; (20).
Glyphopsyche irrorata (Fabricius). May; (20).
Goera calcarata Banks; Ross, 1947. June to August; (4,18,20,21).
G. fuscula Banks; Ross, 1947. Flint 1960.
G. stylata Ross. June; (8).
Hydatophylax argus (Harris); Betten, 1934. June; (3,16,20).
Ironoquia parvula (Banks); Schmid, 1951. Flint 1958.
I. punctatissima (Walker). August, September; (16,18,20).
Lenarchus crassus Banks; Ross and Merkley, 1952. Banks 1920.
Limnephilus indivisus Walker. June to August; (2,12,20).
**L. moestus* Banks. June, July; (6,9,13,14,16,20).
L. ornatus Banks. Ross 1944.
**L. rhombicus* (Linnaeus). August; (13).
L. sericeus (Say). August, September; (13,20).
L. submonilifer Walker. June to September; (8).
Nemotaulius hostilis (Hagen); Betten, 1934 (as *Glyphotaelius*). June to August; (8,11,20).
Neophylax concinnus McLachlan; Ross, 1944 (as *autumnus*). September; (20,21).
N. consimilis Betten; Betten, 1934. August to October; (16,20).
**N. fuscus* Banks. September, October; (20).
N. nacatus Denning; Denning, 1941. Denning 1948c.
**N. oligius* Ross; Ross, 1938b. August, September; (20).
**Onocosmoecus quadrinotatus* (Banks); Banks, 1943 (as *Dicosmoecus*). September; (20).
Platycentropus indistinctus (Walker); Betten, 1934. Banks 1943.
P. radiatus (Say). June to September; (7,16,18,19,20,23).
**Pseudostenophylax sparsus* (Banks); Ross, 1944 (as *Drusinus virginicus*). June to August (8,9,12,13,19,20).
P. uniformis (Betten); Ross, 1944 (as *Drusinus*). June, July; (12,13,19).
Pycnopsyche aglona Ross; Betten, 1950. Ross 1941b.
P. circularis (Provancher); Betten, 1950. September; (20).
P. divergens (Walker); Betten, 1950. August; (13).
P. gentilis (McLachlan); Betten, 1950. August to October; (3,13,16,20).
P. guttifer (Walker). August to October; (3,7,16,18,20,21,24).
**P. lepida* (Hagen). July to September; (16,18,20).
**P. limbata* (McLachlan); Betten, 1950. September; (20).
P. luculenta (Betten). August, September; (16,20).
P. scabripennis (Rambur); Betten, 1950. July to September; (2,3,6,7,8,13,16,18,20,21).
P. subfasciata (Say). Betten 1950.

Table 1. List of sampling sites and their location in the study area.

Franklin County

1 Connecticut River, Sunderland and Whately.
2 Deerfield River, Deerfield and Greenfield.
3 Sawmill River, Leverett.
4 Spaulding Brook, Leverett.
5 Roaring Brook, Leverett.
6 Sugarloaf Brook, South Deerfield
7 Atkins Reservoir, Shutesbury.
8 Sunderland Reservoir, Sunderland
9 Lake Wyola, Shutesbury
10 Cranberry Pond, Sunderland
11 Leverett Pond, Leverett.
12 North Mountain Road Pond, Sunderland.
13 Sunderland Hatchery, Sunderland
14 Mohawk Brook, Sunderland

Hampshire County

15 Connecticut River, Northampton and Hatfield.

Hampshire County (Cont.)

16 West Branch, Westfield River, Huntington.
17 Mill River, Amherst and Hadley.
18 Cushman Brook, Amherst.
19 Amethyst Brook, Pelham.
20 Factory Brook, Middlefield.
21 Walker Brook, Chester
22 Lake Warner, Hadley.
23 Arcadia Lake, Belchertown.
24 Factory Hollow Pond, Amherst.
25 Echo Hill Pond, Amherst.

Berkshire County

26 Green River, Hancock.
27 Notch Brook, North Adams.
28 Anonymous brook, Savoy.
29 Bogastow Brook, Millis.
30 Mauserts Pond, Williamstown.
31 Bog Pond, Savoy.

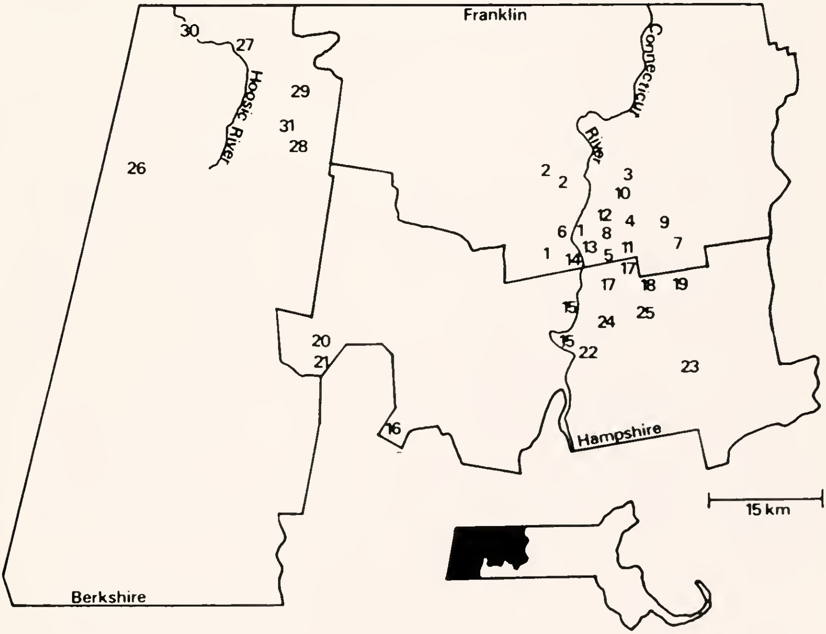

Fig. 1. Location of sampling stations for Trichoptera in western Massachusetts.

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NEW STATE RECORD OF FISHFLY *NIGRONIA SERRICORNIS* (SAY) IN ALABAMA (MEGALOPTERA:CORYDALIDAE)[1, 2]

Joseph F. Scheiring[3]

The fishfly *Nigronia serricornis* (Say) is reported for the first time from Alabama. Previously, *N. serricornis* has been reported from 25 states east of the Rocky Mountains including Tennessee, Georgia, Florida, and Louisana in the southeastern United States (Tarter et al., 1976). Approximately 362 larvae were taken from several localities in Cheaha Creek (T18S, R7E, Sec 15) and Three Mile Creek (T18S, R7E, Sec 22) in Talledaga National Forrest (Clay Co.) from November of 1976 to January of 1979, and from several localities in Little Yellow Creek (T20S, R9W, Sec 4, Tuscaloosa Co.) from September of 1977 to April of 1979. The larvae were found in fast flowing, rocky streams having good water quality. Larvae were collected in all months of the year with the highest density being found from May through July and the lowest from February through April. Prior to this state record, only one lotic fishfly, *N. fasciatus* (Walker) collected in Clay Co., has been reported from Alabama (Tarter et al., 1976).

I have not found larvae of *N. serricornis* in coastal plain streams in Alabama. This situation was also reported in Georgia by Caldwell (1976). Tarter et al., (1976) stated that the larvae are inhabitants of streams with high to intermediate gradients. Knight and Siegfried (1977), however, reported that *N. serricornis* occurred on a wide variety of substrates in numerous types of lotic habitats in Michigan, and Caldwell (1976) noted that it was found in limestone sink areas in the Florida panhandle.

I would like to thank H. Boschung, P. O'Neill, and J. Williams for the Clay County specimens and T. Russo and A. Cole for some of the Tuscaloosa County specimens. The many useful comments of S. Harris and T. Connell on an earlier draft of this note are appreciated. Voucher specimens have been placed in The University of Alabama Aquatic Insect Collection. This study was supported, in part, by grant no. 916 from The University of Alabama Research Grants Committee.

LITERATURE CITED

Caldwell, B.A. 1976. The distribution of *Nigronia serricornis* and *Nigronia fasciatus* in Georgia and water quality parameters associated with the larvae (Megaloptera: Corydalidae) Bull. Georgia Acad. Sci. 34:24-30.

Knight, A.W. and C.A. Siefried. 1977. The distribution of *Corydalus cornutus* (L.) and *Nigronia serricornis* (Say) (Megaloptera: Corydalidae) in Michigan. Great Lakes Entomol. 10:39-46.

Tarter, D.C. W.D. Watkins, M.L. Little, and J.T. Goodwin. 1976. New State records of fishflies(Megaloptera: Corydalidae). Ent. News 87:223-228.

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[1] Received May 29, 1979.

[2] Contribution number 24 from the Aquatic Biology Program, The University of Alabama.

[3] Ecology and Systematics Section, Department of Biology, The University of Alabama, Tuscaloosa, AL 35486.

DISTRIBUTION OF AQUATIC DRYOPOIDEA (COLEOPTERA) IN MAINE[1]

Terry M. Mingo[2]

ABSTRACT: The distribution of aquatic dryopoid species in Maine is presented. Observations on distribution and habitat are summarized and mechanisms affecting distribution are discussed. Eight species are reported from the state for the first time.

Aquatic Dryopoidea are represented in Maine by four families: Elmidae, Dryopidae, Psephenidae, and Ptilodactylidae. Species belonging to these families form a characteristic element of the freshwater benthic fauna, particularly along actively flowing systems (LeSage and Harper 1975). Many species are sensitive to a variety of pollutants and are thus important as water quality indicators (Finni and Skinner 1975).

Eighteen dryopoid species have been reported from Maine by Brown (1972), Brown and Murvosh (1974), Brown and White (1978), Mingo, Courtemanch, and Gibbs (in press), Mingo (1978), and White (1978). However, the superfamily has received little attention in the state and comprehensive studies are lacking.

The present study was undertaken to examine the distribution of aquatic dryopoid beetles in Maine.

METHODS AND MATERIALS

Field collections were made from 160 locations. Primary sampling emphasis was placed on small streams and rivers having stony substrates using techniques described by Brown (1972). Large, deep rivers are poorly represented in this study due to sampling difficulty. Deliberate attempts were made to collect specimens from riffle areas, aquatic vegetation (including mosses) and submerged, decaying wood. Specimens bearing encrustations were cleaned with concentrated hydrochloric acid and by brushing with a fine, camel-hair paint brush as described by Brown (1972) and Hilsenhoff (1973). All specimens were preserved in the field in 70% ethanol.

Species identifications were made using keys by Brown (1972), Hilsenhoff (1973), and White (1978). Voucher specimens are on deposit in the aquatic insect collection at the Department of Entomology, University of Maine at Orono.

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[1] Received April 25, 1979

[2] Department of Entomology, University of Maine, Orono, ME. 04469

RESULTS

The distribution of species collected during this study is presented in Figures 1-4. Observations on distribution and habitat are summarized in Table I. Species not previously reported from Maine are preceeded by an asterisk.

DISCUSSION

In a study of the aquatic Dryopidea of Quebec, LeSage and Harper (1975) observed that the distribution of species was controlled by two factors: latitude and geologic formation. The influence of latitude was expressed as a decrease in the number of species from south to north. All species collected (31) occurred in the general area of the 45th parallel while only two persisted beyond the 50th.

A similar effect was observed for Maine species. With the exception of one, all species (27) occurred in an area generally approximating the 45th parallel. This number decreased in the northern extremes of the state (approximately the 47th parallel) where only 10 species were collected.

LeSage and Harper (1975) also noted that Quebec could be divided into three general regions based on the underlying geologic formation of each. These regions were: the Laurentian Highlands dominated by Pre-cambrian shield, the St. Lawrence Lowlands characterized by very old, undisturbed sedimentary formations, and the Appalachian Region characterized by greatly deformed metamorphic formations and massive igneous intrusions. Each region had distinctive water chemistry and contained a unique dryopoid fauna.

Only the Appalachian Region occurs in Maine. This region encompasses the south eastern areas of Quebec and extends eastward to include Maine, the Maritime provinces and the Gaspe Penninsula. Adjacent to Quebec, the north western area of Maine is dominated by mountains and displays considerable variability in elevation. The remainder of the state, while geologically similar, exhibits greatly reduced topographic variation.

Species collected during this study were placed into one of four groups depending on their abundance and distribution. The four groups were: upland species, lowland species, generally distributed species, and rare species. It is believed that the first two groups reflect the interaction of latitude and elevation.

Upland Species

Species placed in this category were collected primarily from the smaller head-water streams of the mountainous areas of northern and western Maine. Twelve species were taken in this region, however, only two *(Oulimnius latiusculus* (LeConte) and *Optioservus trivittatus* (Brown)) are considered to be typical of the area.

O. latiusculus was represented in the south eastern and coastal areas of the state by the collection of single specimens but displayed a marked increase in abundance toward the mountainous areas of the north west where it was the most frequently collected member of the superfamily. Due to this increasing gradient of abundance, *O. latiusculus* is considered to be an upland species.

O. trivittatus had a less extensive range by comparison but displayed a similar gradient of abundance. It was common in the north west and rare in the south eastern and coastal areas.

Lowland Species

All species except one occurred in the south eastern and coastal areas of the state. However, only nine species are considered to be typical of the region. These species include: *Ancyronyx variegata* (Germar), *Dubiraphia quadrinotata* (Say),*Dubiraphia minima* (Hilsenhoff), *Macronychus glabratus* (Say), *Promoresia elegans* (LeConte), *Promoresia tardella* (Fall), *Stenelmis concinna* (Say, and *Stenelmis mera* (Sanderson).

The more common species in this group displayed gradients similar to that of the upland species but with an opposite orientation. Lowland species were common in the south eastern and coastal areas and rare in the north western areas.

Generally Distributed Species

Three species *(Optioservus ovalis* (Le Conte), *Ectopria nervosa* (Melsheimer) and *Psephenus herricki* (DeKay)) were broadly distributed in the state but did not exhibit distinct gradients of abundance.

O. ovalis was common and frequently collected in most areas of the state.

E. nervosa was collected only as larvae and must therefore be considered a tentative identification. Specimens of this species were usually represented in collections by single larvae.

P. herricki was locally abundant but not frequently collected.

Rare Species

Thirteen species exhibited local distributions and were usually represented in collections by single specimens. These are listed in Table I as rare species and are included in the previous groups solely on the basis of geographic location.

A previously undescribed species of *Dubiraphia* has been collected (Mingo 1978) and appears to be restricted to a single location. Specimens have been taken on several occasions and are presently under study.

SUMMARY AND CONCLUSIONS

The distribution of dryopoid beetles in Maine appears to be controlled by the interaction of two factors: latitude and elevation. The role of geologic formation as described by LeSage and Harper (1975) can not be evaluated as only one major geologic type persists in the state.

The influence of latitude was expressed as a decrease in the number of species from south to north. All species, except one, occurred in the south eastern and coastal areas of the state while only 10 occurred in the northern most extremes.

The influence of latitude and elevation was reflected in two general distribution types: upland species typical of the north western mountainous areas, and lowland species typical of the lower elevations of the south eastern and coastal areas. The more common and widespread species in each group displayed a decrease in abundance toward the opposite regions.

Undoubtedly further investigation will reveal the presence of additional species, fill in distributional gaps and increase the ranges reported here. Eight species are reported from the state for the first time.

ACKNOWLEDGEMENTS

I wish to express my thanks and sincere appreciation to Dr. Harley P. Brown for verifying my determinations. Dr. Howard Y. Forsythe, Jr. and Dr. Eben A. Osgood critically reviewed the manuscript.

Special thanks to Ms. Jolene Walker for typing the manuscript.

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White, D.S. 1978. A revision of the nearctic *Optioservus* (Coleoptera: Elmidae), with descriptions of new species. Systematic Entomology 3: 59-74.

Table I. Distribution and Habitats of Dryopoid Beetles in Maine

	Distribution			Habitat	
	Upland	Lowland	General	Stream Size	Substrate
Dryopidae					
**Helichus basalis* LeConte		R		M	Wood
Helichus fastigiatus (Say)		R		M	Wood
**Helichus lithiophilus* (Germar)		R		M	Wood, Roots
Elmidae					
Ancyrontx variegata (Germar)		C		S M L	Wood
Dubiraphia minima Hilsenhoff		C		S M L	Vegetation, Wood, Moss
Dubiraphia quadrinotata (Say)		C		S M L	Vegetation, Wood ,Moss
Dubiraphia vittata (Melsheimer)		R		S	Vegetation
Dubiraphia n. sp.		R		S	Vegetation
Macronychus glabratus (Say)		C		S M L	Wood, Roots
Microcylloepus pulillus LeConte		R		M	Wood
**Microceylleopus p. pusillis* LeConte		R		M	Wood
Optioservus ovalis LeConte			C	S M L	Gravel. Stones
Optioservus trivittatus (Brown)	C			S M L	Gravel, Stones
Oulimnius latiusculus (LeConte)	C			S M L	Sand, Gravel
Promoresia elegans (LeConte)		C		S M L	Vegetation, Gravel, Stones
Promoresia tardella (Fall)		C		S M L	Vegetation, Moss, Gravel, Stones
**Stenelmis concinna* Sanderson		C		S M L	Sand, Gravel, Stones
Stenelmis crenata (Say)		C		S M L	Wood, Gravel, Stones, Rubble
Stenelmis bicarinata LeConte	R			L	Stones, Rubble
**Stenelmis markeli* Motschulsky		R		S M L	Wood, Sand, Gravel
Stenelmis mera Sanderson		C		S M L	Gravel, Stones, Rubble
**Stenelmis mirabilis* Sanderson		R		S	Gravel, Stones
**Stenelmis musgravei* Sanderson		R		S	Gravel, Stones
**Stenelmis sandersoni* Musgrave		R		S M	Sand, Gravel Stones
Psephenidae					
Ectopria nervosa (Melsheimer)? (larvae only)			C	S M L	Wood, Stones, Rubble
Psephenus herricki (DeKay)			C	S M L	Wood, Stones, Rubble
Ptilodactylidae					
Anchytarsus bicolor (Melsheimer) (larvae only		R		S	Sand, Gravel with Wood

*new state record
?tentative identification

R rare species
C common species

S small streams
M medium streams
L large streams & rivers

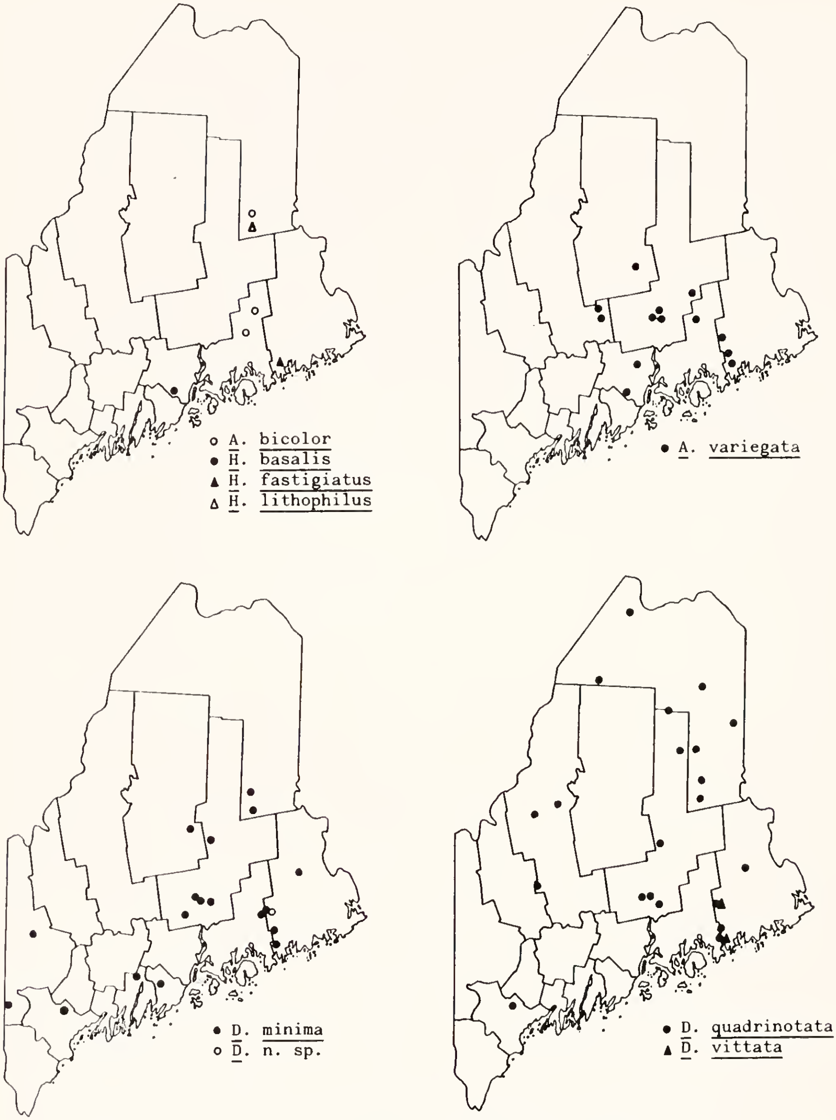

Figure 1. Distribution of *Anchytarsus*, *Helichus*, *Ancyronyx*, and *Dubiraphia* species in Maine.

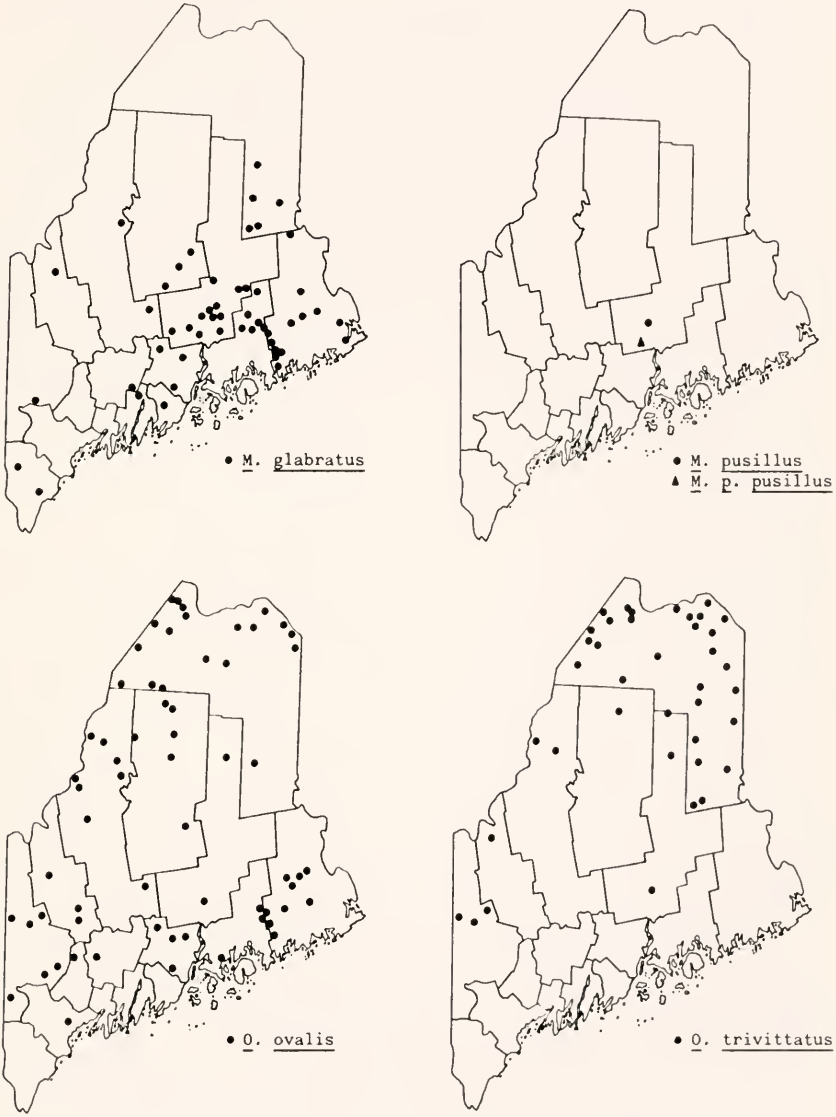

Figure 2. Distribution of *Macronychus*, *Microcylloepus*, and *Optioservus* species in Maine.

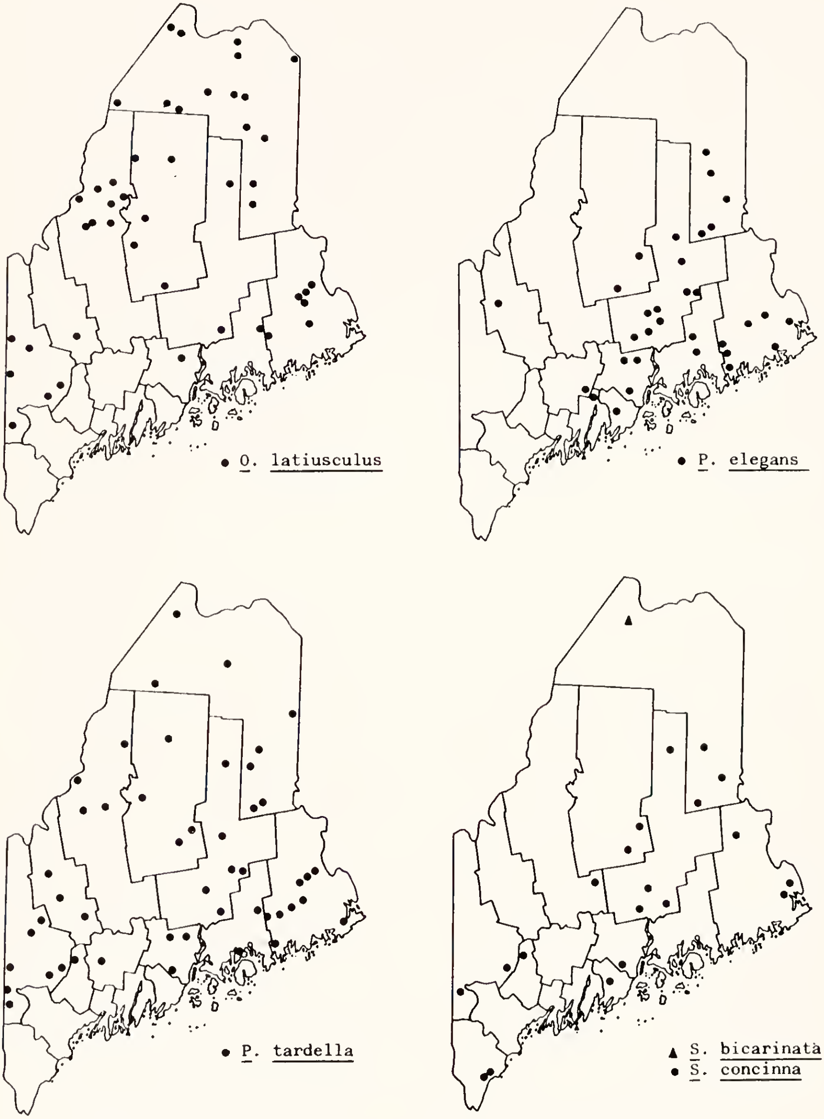

Figure 3. Distribution of Oulimnius, Promoresia, and Stenelmis species in Maine.

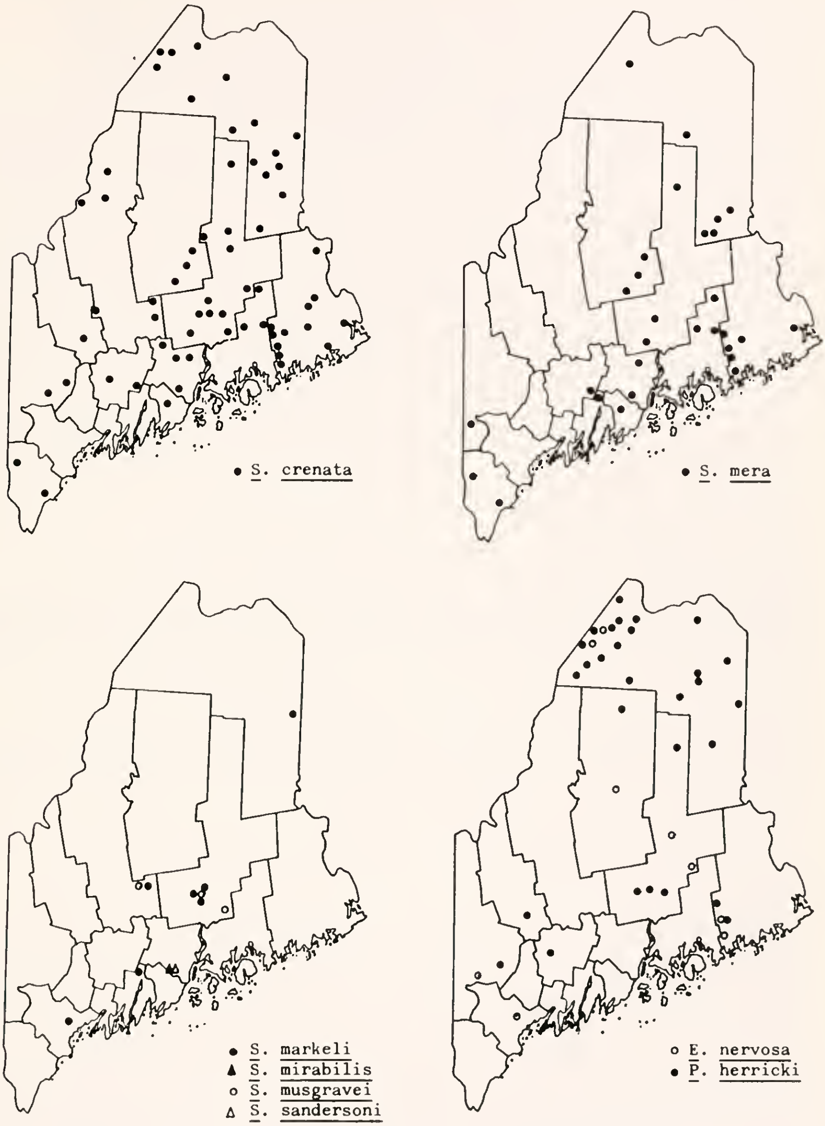

Figure 4. Distribution of *Stenelmis*, *Ectopria* and *Psephenus* species in Maine.

BOOKS RECEIVED AND BRIEFLY NOTED

ESSENTIAL INVERTEBRATE ZOOLOGY, 2nd ed. M.S. Laverack & J. Dando. Halsted Press, John Wiley & Sons. 1979. 194 pp. Ppbk. 8¼ x 9¼. Illus. $12.95.
Intended as a text for an introductory course on invertebrate phyla. Authors have attempted to condense known material on body form and organ functions of animals into a very concise form, so much so that Insecta is treated only briefly as a class and insect orders are completely omitted. Well illustrated.

ARTHROPOD PHYLOGENY WITH SPECIAL REFERENCE TO INSECTS. H. Bruce Boudreauz. John Wiley & Sons. 1979. 320 pp. $21.50.
Based on a course in entomology the author has taught for the past twenty years, this is a well organized text on the nature and origin of arthropods and insects. This book should be of real value in courses on insect evolution and phylogeny.

THE PREPARATION AND CURATION OF INSECTS. Annette K. Walker & Trevor K. Crosby, New Zealand Dep't. of Scientific & Industrial Research (DSIR) and Ent. Soc. of New Zealand. 1979 55 pp. $2.50. Obtain copies from Science Info. Div., DSIR, PO Box 9741, Wellington, N.Z. or Mrs. B.M. May, Distrib. Sec., Ent. Soc. of N.Z., 6 Ocean View Road, Huia, Auckland, N.Z.
This booklet explains methods and techniques for preparaing insects for an insect collection and how the collection should be curated and managed.

THE SEMIAQUATIC AND AQUATIC HEMIPTERA OF CALIFORNIA. Bulletin of the California Insect Survey, Vol. 21. Arnold S. Menke, ed. Univ. of California Press. 1979. 166 pp. Ppbk. 8¼ x 11. $16.00.
This manual is essentially an improved and updated treatment of Chapter 7 on Aquatic Hemiptera in Aquatic Insets of California, 1956, R.L. Usinger, ed.

A SURVEY OF THE LEPIDOPTERA, BIOGEOGRAPHY AND ECOLOGY OF NEW CALEDONIA. Series Entomologica vol. 15. J.D. Halloway. Dr. W. Junk B.V. 1979. 588 pp. $85.35.
A quantitative survey of the night-flying macrolepidoptera and an assessment of the Rhopalocera and microlepidoptera of New Caledonia, together with reviews of the geology, phytogeography and general zoogeography as background for the Lepidoptera fauna and its geography.

SOCIAL INSECTS. Vol. 1 Henry R. Hermann, ed., Academic Press. 1979. 437 pp. $36.00.
First of a three-volume treatise intended to collate the works of modern researchers working in the field of insect sociobiology. Vol. 1 incorporates modern theory with certain concepts of insect sociality, particularly through genetic, behavioral and evolutionary pathways..

BUMBLEBEE ECONOMICS. Bernd Heinrich. Harvard Univ. Press. 1979. 245 pp. 2 pls. $17.50.
Survival for the bumble bee depends, in part, on its ability to regulate body temperature through a complex energy exchange. It is this management of energy resources around which the author centers his discussion of physiology, behavior, and ecological interaction. Using bumblebees as the biological model, the central theme of this book is economics based on energetics.

TWO NEW SUBGENERA AND THREE NEW SPECIES OF *POLANA* (HOMOPTERA: CICADELLIDAE) FROM PERU AND COLUMBIA[1]

Dwight M. DeLong[2]

ABSTRACT: Two new subgenera, *Polana* subgenus *Striapona* and subgenus *Validapona*, and three new species, *P. (Striapona) desela* n. sp. (Peru), *P. (Validapona) lamina* n. sp. (Colombia) and *P. (Nihilana) quadrina* n. sp. (Colombia), are described.

The genus *Polana* was described by DeLong (1942). A synopsis of *Polana* treating 87 species was published by DeLong and Freytag (1972). Two additional species have been described by DeLong and Wolda (1978). Two new subgenera and three new species are described at this time.

Subgenus *Striapona*, n. subgen.

Type-Species *Polana (Stiapona) desela*, n. sp.

Crown produced, apex bluntly, roundly, angled margin thick, bluntly angled with front. Ocelli nearer anterior than posterior margin of crown and closer to eyes than to median line. Crown depressed behind thick anterior margin. Coronal margin, entire crown and central portion of pronotum marked with conspicuous, often deeply cut, transverse striae. Basal processes of male aedeagus quite broad.

The subgenus *Striapona* is closely related to the subgenus *Bohemanella* but the head is entirely different, crown more produced, with thicker margin and aedeagal processes different.

Polana (Striapona) desela, n. sp.
(Figs. 1-6)

Length of male 10mm, female unknown. Crown produced and rounded, twice as wide between eyes at base as median length. Ocelli nearer anterior than posterior margin and nearer to proximal eye than to median line. Crown depressed behind thick margin, bluntly angled with front. Coronal margin, entire crown and median portion of crown, especially disc, marked with conspicuous, often deep transverse striae. Color, face dark brown; crown dark brown to black. Pronotum pale brown, basal margin black, a large oval spot on disc dark brown, opaque, veins scarcely visible.

Genitalia of male with plates two and one-half times as long as median width, apices bluntly angled. Style with blade slightly narrowed on ventral margin near base, apex narrow and slightly recurved at tip. Aedeagal shaft rather short and robust, apex curved ventrally, tip rounded; basal processes rather broad, extending to apex of aedeagal shaft, apices in ventral view bluntly angled. Pygofer with caudal margin broad, rounded.

Holotype male, Iquitos Peru, XI., 1920 in the DeLong Collection.

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[1] Received April 30, 1979.

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

Subgenus *Validapona,* n. subgen.

Type-species *Polana (Validapona) lamina,* **n.** sp.

Head narrow, crown broadly rounded, almost parallel margined, scarcely produced, twice as broad at base between eyes as median length. Ocelli slightly nearer anterior than posterior margin of crown, twice as distant from median line as from proximal eye. Margin thick, but not rounded, dorsally as in *Polana.* Apical portion of aedeagal shaft with broad laminae extending laterally, aedeagus without basal processes. Pygofer with a long spear-like process, arising at base,extending ventrally, then caudally, along ventral margin to apex of pygofer.

Validapona is intermediate between *Curtara* and *Polana.* Viewed from above it appears related to *Curtara;* and from a lateral view, it appears as a *Polana.* The narrow head is more like species of *Polana.*

Polana (Validapona) lamina, n. sp.

(Figs. 7-12)

Length of male 13 mm, female unknown. Crown broad, rounded, almost parallel margined, twice as wide between eyes at base as median length. Ocelli closer to eyes than to median line. Crown without definite margin. Color crown pale, brown, darker brown at center. Pronotum pale brown with darker brown spots across basal area, a dark brown area on disc and apical margin dark brown. Scutellum brown with darker brown angles. Forewings white, heavily mottled with dark brown spots, veins brown.

Male genitalia with plates four times as long as median width, apices rounded. Style with apical portion of blade narrowed and curled. Aedeagal shaft narrowed, blunt at apex with thin scleritized plates extending laterally from apical portion of shaft. Continuous plate on apical third of ventral surface; two dorsal plates extend laterally from dorsal surface. Pygofer tapered and bluntly angled at apex, long slender sclerotized process arising on cephalad margin each side, extending ventrally then caudally beyond apex of pygofer.

Holotype male, Colombia, Choco Dept., Camp Teresita, April 1967, in the DeLong Collection.

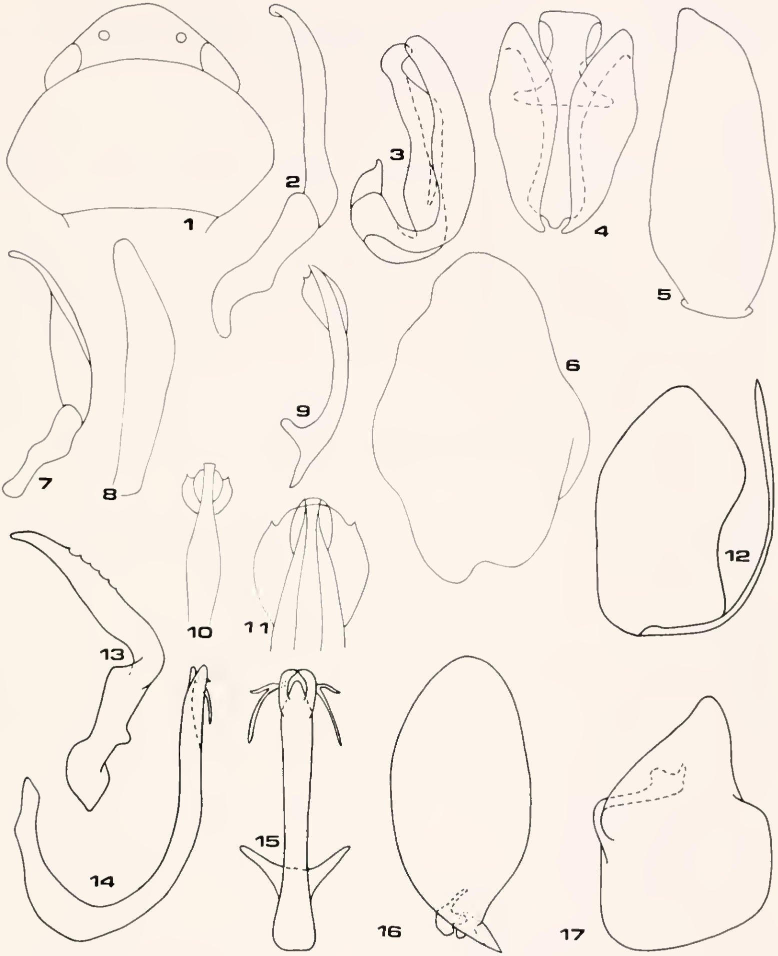
Polana (Nihilana) quadrina, **n.** sp.

(Figs. 13-17)

Length of male 9.5 mm., female unknown. Crown more than twice as wide between eyes at base than median length. Ocelli closer to eyes than to median line and closer to anterior margin than to base of crown. Color, clypeus and postclypeus pale brown. Crown, pronotum, and scutellum pale brown, caudal portion of pronotum and basal angles of scutellum darker brown. Forewings brown with two transverse rows, of 4 spots each, across wings. First row across middle of clavus with two spots on commissure and one spot on anterior portion of each discal cell. Second row across apex of clavus with two spots on commissure and one on caudal cross vein of each discal cell; veins brown.

Male plates broad, twice as long as median width, apices narrow and rounded. Style gradually narrowing from one-third its length to a narrow, bluntly pointed, dorsally curved apex; blade serrate on ventral margin of median third. Aedeagal shaft bluntly pointed at apex with two blunt subapical portions curving and contiguous beyond apex. A bifid lateral process arising from each subapical process curving laterad and basad. Each lateral process bifad near base; caudad portion one-fourth length of basad portion and extending laterally; basal portion extending basad. Pygofer with a spine-like process arising dorsally, extending basad more than half width of pygofer, subapically enlarged, apex narrow, pointed.

Holotype male labeled "Colombia, 1941 (L. Richter)" in the North Carolina State University collection.



Figs. 1-6 *Polana (Striapona) desela,* n.sp. 1. head and pronotum dorsally, 2. style laterally, 3. aedeagus laterally, 4. aedeagus ventrally, 5. plate ventrally, 6. pygofer laterally. Figs. 7-12. *Polana (Validapona) lamina,* n.sp. 7. style laterally, 8. plate ventrally, 9. aedeagus laterally, 10. aedeagus ventrally, 11. aedeagus ventrally, apical portion, 12. pygofer laterally. Figs. 13-17. *Polana (Nihilana) quadrina,* n.sp. 13. style laterally, 14. aedeagus laterally, 15. aedeagus ventrally, 16. plate ventrally, 17. pygofer laterally.

P. quadrina is related to *P. concinna* (Stal). These can be separated by the characters of the style and aedeagus as illustrated.

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DeLong, Dwight M. 1942. A Monographic Study of the North American Species of the Subfamily Gyponinae (Homoptera: Cicadellidae) exclusive of *Xerophloea.* Ohio State University, Graduate School Studies, Contrib. Zool., Entomol.No. 5. Biol. Series XIV 187: 35 pls.

________________ **and Paul H. Freytag**,1972, Studies of the World Gyponinae (Homoptera: Cicadellidae) The Genus *Polana* Arq. Zool. S. Paulo. 22(5):239-324.

________________ **and Henk Wolda** 1978.New Species of *Polana* and *Curtara* (Gyponinae - Homoptera: Cicadellidae) from Panama. Ent. News 89: (9 & 10):227-230.

INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

The Commission hereby gives six months notice of the possible use of its plenary powers in the following cases, published in *Bull. Zool. Nom.* vol. 35, part 4, May 31, 1979 and vol. 36, part 1, July 1, 1979 and will welcome comments and advice on them from interested zoologists. Correspondence should be addressed to the Secretary, I.C.Z.N., c/o British Museum (Natural History), Cromwell Road, London, SW7 5BD, United Kingdom.

2161 *Lethocerus* Mayr, 1853 (Hemoptera, Belostomatidae); proposed conservation in place of *Iliastus* Gistel (1847).

2234 *Lespesia* Robineau-Desvoidy, 1863; proposed designation of a type species under the plenary powers (Diptera, Tachinidae).

2255 *Tipula ferruginea* Fabricius, 1805 (Diptera, Tipulidae): proposed conservation.

2221 *"Staphylinus fulgidus"* as the type species of several nominal genera (Coleoptera, Staphylinidae).

The following opions have been published recently by the I.C.Z.N. in the same above isues of the *Bull, Zool. Nom.* The Commission regrets it can not supply separates of Opinions.

1118 (p. 212) Conservation of*iTribolbina carnegiei* Latham, 1932, (Acarchnida)

1119 (p. 216)*Amaurobisu* C.L. Koch, 1837, and *Coelotes* Blackwell, 1841 (Araneae): conserved under the plenary powers.

1120 (P 221) *Noctua armigera* Hubner, (1808) (Lepidoptera) conserved.

1125 (p. 22) *Ceratophyllus soricis* Dale, 1878. (Insecta: Siphonaptera); designation of a neotype under the plenary powers.

TWO DISSECTION KNIVES FOR THE MORPHOLOGIST, HISTOLOGIST, AND SYSTEMATIST, WITH SUGGESTIONS FOR THEIR USE [1, 2, 3]

Norman T. Baker[4]

ABSTRACT: Two easily built, in expensive, high quality knives are described and discussed for use by insect morphologists, histologists and systematists.

The study of arthropod morphology is often hampered by the lack of suitable tools for dissection, both in the classroom and in the research laboratory. In the past few years I have developed two excellent knives which are dependable, easy to construct, and quite inexpensive. The first knife is used for the initial gross dissections. The second is used for the finer, more delicate dissections to see individual muscles, sclerites or other organs. The knives are useful in both traditional anatomic work and in histological preparations. Also both knives are sharp enough to cut thru an exoskeleton without crushing as most microdissection scissors do.

Materials and Construction

The first knife is constructed simply of an Xacto^R Knife blade holder, No. 3001 and disposable double edge razor blades used for shaving. There are considerable differences from one brand of razor blade to the next in hardness, brittleness and the ability of the manufacturer to give a truly sharp cutting edge. A variety of blades may have to be tried before finding one suitable for your particular purposes or animal. In general I have found the stainless steel varieties do not have cutting edges well suited to slicing thru an exoskeleton. The best in my experience is the Gillette-Platinum Plus^R blades. A pair of small sharp tin-snips and a pair of small needle-nose pliers are also necessary. Each razor blade is first cut into quarter sections as shown (Fig. 1). Each quarter is then trimmed as shown (Fig. 2). It will be

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[1] Received June 29, 1979.

[2] Mention of particular commercial products does not constitute endorsement by the University of Minnesota or its staff or students.

[3] Paper No. 10,858 Scientific Journal Series. Mn. Agric. Expt. Stn., St. Paul 55108. Received for publication. NIH Grant No. A1-09559.

[4] Department of Entomology, Fisheries and Wildlife, University of Minnesota, St. Paul, NM. 55108.

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impossible to trim the blade to a sharp point. Wax or grease put on the blade during manufacturing must be removed by soaking in chloroform or xylene. The resulting blade is then inserted into the Xacto knife blade holder. The cutting edge of the blade should be set at an angle to the knife handle so that when held in the hand the cutting edge is roughly parallel to the bottom of the dissecting dish (Fig. 3). The terminal end of the blade will be curved. The curve can be removed by gently bending the blade in the opposite direction with the needle-nosed pliers. The blade should not be gripped tightly with the pliers but only held loosely to avoid unnecessary bending. The edges cut by the tin snips will be quite ragged especially when viewed under a dissection microscope. A method to smooth the ragged edges will be described later. The final result is a dissection knife that is easily used, well balanced and has a supply of thin disposable high quality blades at low cost.

The second knife is more complicated to construct and requires a 1 cc. Tuberculin syringe, an 18 gauge metal hypodermic needle, a common sewing needle large enough in diameter to fit the opening of the 18 gauge hypodermic and a small Apollo^R Ceramic sharpening stone available from Arkansas Abrasive, Inc. Hot Springs, Ark. You will also need a pair of wire cutters. Carborundum and Hard Arkansas sharpening stones are not suitable. To construct this knife, the plunger is pulled from the syringe and its rubber cap removed. The wide flange on the base of the syringe is removed and discarded (Fig. 4a). A sewing needle is heated at the needles eye, and while hot, stuck into the tip of the plastic plunger of the syringe (Fig. 4b). The needle and plunger should be straight. When the needle has cooled, the rubber cap is forced down over the needle and onto its former position on the plunger (Fig. 4c). The assembled plunger and needle are then reinserted into the tube of the syringe. The needle should extend thru the terminal hole of the syringe (Fig. 4d).

Next, take the hypodermic needle and remove all but 3-4 mm by clipping it with wire cutters (Fig. 4e). The closed end of the needle is opened by grinding away the stump perpendicularly on the sharpening stone. The hypodermic base is then inserted onto the needle and syringe (Fig. 4f). The projecting point of the sewing needle can then be ground into a small knife suitable for the type of dissection you wish. It is best to make a dozen or so of these at once so that a variety of knife shapes will help insure that a sharp one is usually available. When the needle knife is extended, the hypodermic needle base supports the base of the needle. After the knife is used on a dissection, the syringe plunger can be pulled just far enough to withdraw the point of the knife into the tube of the hypodermic needle where its point and cutting edge are protected from abuse (Fig. 4h). Knives constructed in this fashion last for years provided they are not dropped on their points or otherwise abused.

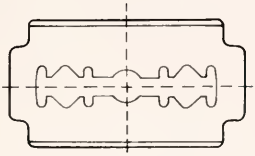


Fig. 1

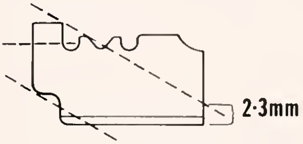


Fig. 2

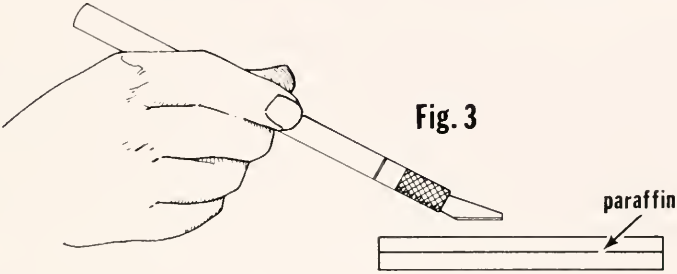


Fig. 3

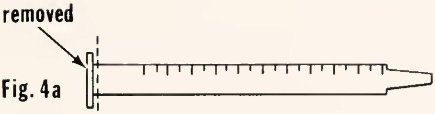


Fig. 4a

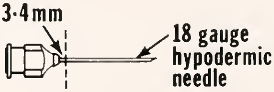


Fig. 4e

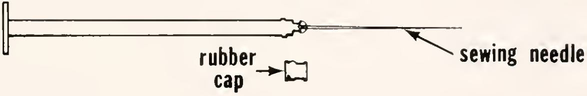


Fig. 4b

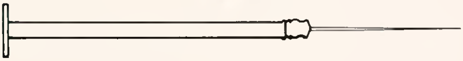


Fig. 4c

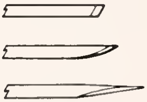


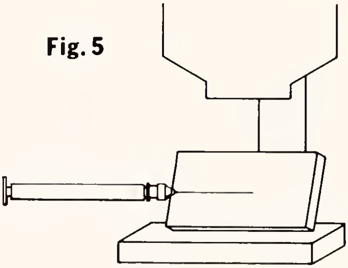
Fig. 4g

Fig. 4d

Fig. 4f

Fig. 4h

Fig. 5



Grinding something as small as either of these two knives to the proper shape must be done delicately. Both must be ground under the dissecting microscope on the sharpening stone. The stone is held at a slight angle from vertical (Fig. 5) so that the steep slope of the stone is in view in the microscope. The trick to carefully grinding and shaping both knives is to slide the stone back and forth while holding the knife stationary and in view in the microscope. The stone should be placed on a small tissue to avoid scratching the microscope stage. The razor knife should have the ragged edge on the tip of the blade ground smooth to avoid tearing the tissues within the specimen. Do not attempt to sharpen the cutting edge of the razor to a better edge than it has. It is impossible. The needle knives are shaped and sharpened in the same fashion. Although it is impossible to fashion a cutting edge on the needle knives as sharp as that on the razor blade, the needle knives can be sharpened well enough to suit most purposes. Both knives are held at about a 5° angle to the stone with only enough pressure to contact the stone.

The third tool is a simple inexpensive probe. It is constructed from disposable 1 cc Tuberculin syringes with 27 gauge, one-half inch disposable needles and minuten pins. The syringes and hypodermic needles are generally sold as allergy or diabetic syringes. The probe is easily constructed by inserting a minuten pin into the end of the hypodermic needle and crimping it in place with a pair of pliers in the manner described by Galbreath and Galbreath (1977). Several should be prepared at once.

Discussion

These two knives and probe are obviously quite inexpensive yet are of sufficient quality to make them usable on a day-to-day basis without excessive costs. They are also within the limits of a student's budget.

Consistent high quality dissections can be easily prepared by first injecting and flushing the specimen with a formalin fixative. The specimen should remain in the fixative a few hours (with shaking) and then rinsed and stored in ethanol before dissection or histological sectioning. To protect the cutting edges of the knives and the points of forceps, all work should be done in a Petri dish with paraffin in the bottom. Specimens are most easily held with the common curved tip forceps. Small cavities scooped out of the paraffin help protect the specimen from distortion and crushing.

The razor knife is used with a back and forth slicing motion anywhere on the body of a specimen, much like carving a turkey. I commonly make sagittal or parasagittal sections of the entire body of an arthropod with relatively little distortion or crushing of the body and internal anatomy. Obviously, other dissection planes can be had to see any particular aspect of the arthropod's anatomy. The needle knives are then used to dissect away overlying muscles, sclerites or other tissues covering particular organs. The probes are used mainly as pointers or to position specimens or dissections for further work. Bending the point into a hook and using the hook to dissect specimens or organs from a specimen results in messy dissections with torn unclear edges. Muscle insertions and ligaments between sclerities and other organ placements are often torn loose. These knives are also of use to the taxonomist and systematist for genetalic dissections. The genitalia are either cleanly sliced from the abdomen with the razor knife or the articulating membranes between segments can be sliced thru with the needle knives.

Another aspect of considerable importance is dissecting small animals is the relative hydration and dehydration of the body of the specimen. Dissections are best done in ethanol. However, quite hard specimens are easier to slice and dissect apart in 30% ethanol than in 80% or 95% ethanol. Soaking the specimen in higher concentrations of ethanol temporarily stiffens the body, and makes very soft specimens such as larvae much easier to slice open and dissect. This also applies to museum specimens about to have their genitalia removed for taxonomic examination. Relax the specimens in a humidor as you normally would but then place them for a day in a humidor containing 80% ethanol. Remove them from the humidor and do the dissection immediately since they will dry out very quickly.

Relatively few books on microscopical technique give adequate instructions on tools for dissections either for anatomic examination or for organ preparation prior to histological sectioning. Kennedy (1932), McClung (1937), Eltringham (1930) Kingbury and Johannsen (1972) and many other such texts all describe a variety of tools, but in most cases the knives they describe are too large or too thick and bulky to be of use. Other texts such as Peterson (1964) usually assume that high quality scalpels and other dissection instruments are readily available. In most cases they are, provided one has the money - something with which most arthropod morphologists, systematists and histologists are not overly endowed. The two knives described here are sufficiently sharp and thin that dissections can be routinely and easily made.

ACKNOWLEDGEMENTS

Dr's. A. Glenn Richards, H.M. Kulman, and E.F. Cook are gratefully acknowledged for reviewing this manuscript.

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ANNOUNCEMENTS

Beltsville Agricultural Research Center Symposium V, Biological Control In Crop Production -Science and Education Administration, Agricultural Research, Beltsville, MD May 18-21, 1980. Contact: E.M. Dougherty, Chairman, Publicity Committee, BARC Symposium V, Building 011A, Beltsville Agricultural Research Center - West, Beltsville, MD 10705.

The Society of Kentucky Lepidopterists is devoted to any aspect of interest in butterflies and moths. While the particular focus of the group is Kentucky, members from any part of the nation and world are welcome. Membership dues are $3.00 per year for regular members, and $1.50 per year for associate members. Associate members receive publications and participate in activities when they can, but do not hold office or vote on Society affairs. All members receive the newsletter of the Society, "Kentucky Lepidopterists," by first class mail on a quarterly basis. Other published items appear irregularly, including reprints of interesting articles long out of print. Send application and any inquires to: Dr. Charles V. Covell, Jr., Department of Biology, University of Louisville, Louisville, KY. 40208 U.S.A. Make checks payable to The Society of Kentucky Lepidopterists.

A NEW SPECIES OF BRUCHOMYINE FLY FROM ECUADOR (DIPTERA:PSYCHODIDAE)[1]

Charles P. Alexander[2]

The unusually interesting subfamily Bruchomyinae of the dipterous family Psychodidae has attracted considerable attention in recent years. At this time I am describing a further new species of the oldest genus in the subfamily, *Nemopalpus* Macquart (1838). I also include a list of the 17 species presently known from the New World as well as a list of the more important references. The two other genera in the subfamily are *Bruchomyia* Alexander, 1920, with 8 species presently recorded from the New World, all restricted to South America, (Fairchild, 1952: 276) and the very distinct *Tonnoiromyia* Alexander) 1940, from Tropical Africa, known by a single species that has the greatest number of antennal segments, 113, presently known in the entire order Diptera.

The following species of New World *Nemopalpus* are known:

antillarum Fairchild, 1952 - Hispaniola.
arroyoi de Leon, 1950 - Guatemala.
brevinervis Barretto and d'Andretta, 1946 - Brasil (São Paulo).
dampfianus Alexander, 1940 -Mexico.
dissimilis Barretto and d'Andretta, 1946 - Brasil (São Paulo).
immaculatus Freeman, 1949 - Brasil (Santa Catharina).
maculipennis Barretto and d'Andretta, 1946 - Brasil (a synonym of *pilipes* Tonnoir).
mopani de Leon, 1950 - Guatemala.
moralesi de Leon, 1950 - Guatemala.
multisetosus Alexander, sp.n., in present paper - Ecuador.
nearcticus Young, 1974 - United States (northern Florida).
pallipes (Shannon and Del Ponte), 1927 - Argentina. (in *Bruchomyia*).
pilipes Tonnoir, 1922 - Paraguay.
sziladyi Tonnoir, 1940 - Costa Rica.
torrealbai Ortiz, 1963 - Venezuela.
vexans Alexander, 1940 - Brasil (Rio de Janeiro) - possible synonym of *pilipes*.
yucatanensis Vargas and Najera, 1958 - Mexico.

Nemopalpus multisetosus sp.n.

Size small (wing of male 3.2 mm.); general coloration of body brown; antenna of male very

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[1] Received April 17, 1979.

[2] Contribution from the Department of Entomology, University of Massachusetts, Amherst, Mass.

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long (about 5 mm.), flagellar segments elongate-cylindrical, with very abundant long delicate setae over their entire lengths, these curved, directed outwardly, the tips inward; wings with cell R3 short; male hypopgium with the dististyle broadbased, expanded outwardly, the inner angle extended into a long narrow blade, outer angle with a shorter acute spinelike point.

Male. - Length about 4mm.; wing 3.2 mm.; antenna about 5 mm.

Rostrum brown; palpi light brown, terminal segment elongate, subequal to the combined three proximal ones. Antennae (Fig. 1) distinctive; elongate, about one-half longer than the wing; flagellar segments elongate-cylindrical, the outer ones progressively shorter and more slender; each segment with abundant very long setae over their entire lengths, all of these very delicate filaments directed outwardly, their apices curved slightly inwards, as shown. Head brown; eyes large; vertex narrow.

1

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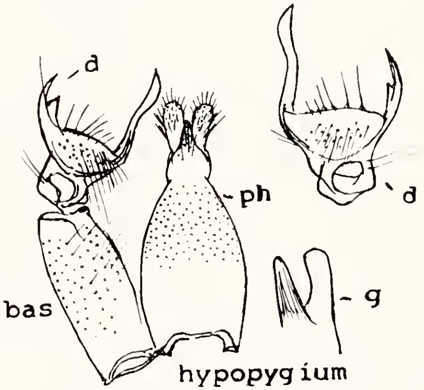

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Fig. 1. Head and antenna of male; showing the basal nine segments of antenna and enlargements.

Fig. 2. Wing venation.

Fig. 3. Male hypopygium; details of structure.
Symbols: bas - basistyle
d - dististyle
g - gonapophysis
ph - phallosome.

Thorax almost uniformly medium brown; notum with very abundant long erect pale setae; pleura slightly paler and more glabrous. Halteres dark brown, stem with yellow setae. Legs with coxae and trochanters yellow; femora yellowed basally, slightly darker outwardly, tibiae and tarsi yellowed; claws very small, simple. Wings (Fig. 2) slightly darkened; veins brown, with very abundant long brown trichiae, costal fringe longer. Venation as shown; cell R_3 short.

Abdomen brown. Male hypopygium as shown (Fig. 3); dististyles, d, and phallosome, p, distinctive, structure as shown.

Holotype, ♂, Pompeya, Ecuador, May 1965 (L.E. Peña).

The most similar described species appears to be *Nemopalpus sziladyi* Tonnoir, from Costa Rica, later reported from Panama by Fairchild (1952) who provides figures of the male hypopygium (Ann. Ent. Soc. America, 45: 271, figs. 27-29; 1952). Additional to the hypopygial differences, the male antenna of the present fly is quite remarkable and distinctive, as described and figured, the abundant distinctive vestiture of the flagellar segments having suggested the specific name.

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*Young, D.G. 1974. Bruchomyiinae in North America with a description of *Nemopalpus nearcticus* n.sp. (Diptera: Psychodidae). Florida Entomologist, 57:109-113, 10 figs.

*The papers by Fairchild (1952) and Young (1974) are of particular interest and value in the present study.

NEW GEOGRAPHICAL DISTRIBUTION RECORDS FOR TWENTY-EIGHT SPECIES AND SUBSPECIES OF TABANIDS IN WEST VIRGINIA (DIPTERA:TABANIDAE)[1,2]

J.D. Hacker, L. Butler, L.L. Pechuman[3]

ABSTRACT: One new state record and 63 new county records for 28 species and subspecies of tabanids are listed for West Virginia. The new state record is *Leucotabanus annulatus* (Say).

One new state record and sixty-three new county records for twenty-eight species and subspecies of tabanids are listed for West Virginia.

The new state record is for *Leucotabanus annulatus* (Say). This species was previously recorded from scattered areas of Maryland, Virginia, Kentucky, Ohio and Pennsylvania. The West Virginia specimen was swept at dusk, indicating crepuscular or nocturnal behavior for *L. annulatus.* Larvae have been collected from rot holes in trees, in decaying logs and in soil beneath forest litter (Pechuman, 1973).

All specimens collected by Coffman, Hacker and Lippert are in the West Virginia Department of Agriculture collection and were determined by L.L. Pechuman. Specimens collected by Amrine, Begley, Butler, Estep, Fisher, McDonald, and Swope are held in the West Virginia University collection. These specimens were determined by L. Butler. Tabanids collected by E. Estep were retained by Estep.

For each species the information is given in the following order: Locality of collection, county, initials of collector and date of collection.

Chrysops callidus Osten Sacken. Barboursville, CABELL, JDH, June 1, 1978. Big Ugly Public Hunting Area, LINCOLN, LB, August 2, 1978. Bear Rocks Lake, OHIO, JDH, May 25, 1977. Spencer, ROANE, LB. May 22, 1978.

C. calvus Pechuman and Teskey. Route 33-2 mi. east of county line CALHOUN, LB, May 27, 1978.

C. cincticornis cincticornis Walker. McClintic Wildlife Station, MASON, JDH, June 6, 1978. Grace, HAMPSHIRE, CCC, June 20, 1978.

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[1] Received July 10, 1979.

[2] Published with approval of the Director of the W.Va. Univ.Agric. Exp. Sta. as scientific paper No. 1607.

[3] Respective addresses: Survey Entomologist, West Virginia Dept. of Agriculture, Plant Pest Control Div., Charleston, WV 25305; Professor of Entomology, Div. of Plant Sciences, West Virginia University, Morgantown, WV 26506; Professor of Entomology, Dept. of Entomology, Cornell University, Ithaca, NY 14853.

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C. flavidus Wiedmann. McClintic Wildlife Station, MASON, LB, August 2, 1978.

C. geminatus Wiedmann. Shannondale, JEFFERSON, CCC, July 27, 1978. Cherry Run, MORGAN, CCC, July 5, 1978. Bergoo, WEBSTER, JDH, July 13, 1978. Lewis Wetzel Public Hunting Area, WETZEL, LB, July 3, 1978.

C. impunctus Krober. Bergoo, WEBSTER, JDH, July 13, 1978.

C. macquarti Philip. Shannondale, JEFFERSON, CCC, June 28, 1978.

C. moechus Osten Sacken. Fork Creek Public Hunting Area, BOONE, LB, June 14, 1978. Big Ugly Public Hunting Area, LINCOLN, LB, August 2, 1978.

C. niger Macquart. Stumptown, GILMER, LB, May 27, 1978. Cherry Run, MORGAN, CCC, June 27, 1978.

C. univittatus Macquart. Jacksons Mill, LEWIS, JDH, July 24, 1978.

**Leucotabanus annulatus* (Say). Big Ugly Public Hunting Area, LINCOLN, LB, August 2, 1978.

Hybomitra difficilis (Wiedemann) Junior, BARBOUR, LB, June 2, 1978. Kanawha Run - Sutton Lake, BRAXTON, LB. May 28, 1978. Greenland, GRANT, CCC, July 7, 1978. Cherry Run, MORGAN, CCC, June 6, 1978. Spencer - 2 mi. west, ROANE, LB, May 27, 1978. Dolly Sods, TUCKER, JWA, May 29, 1978.

H. lasiophthalma (Macquart) Route 33 - 2 mi. east of county line, CALHOUN, LB, May 27, 1978. Greenland, GRANT, CCC, June 7, 1978. Cherry Run, MORGAN, CCC. May 31, 1978. North Bend State Park, RITCHIE, JDH, June 23, 1978. Spencer - 2 mi west, ROANE, LB, May 27, 1978.

H. sodalis (Williston). Greenland, GRANT, CCC, one male, July 13, 1978.

Tabanus americanus Forster. Arden, BERKELEY, KM, September 5, 1978. Bluefield, MERCER, JB, August 13, 1978.

T. atratus Fabricius. Arthurdale, PRESTON, RS, August 26, 1978.

T. calens Linnaeus. Kanawha Run - Sutton Lake, BRAXTON, LB, August 10, 1978. Big Ugly Public Hunting Area, LINCOLN, LB, August 2, 1978.

T. fulvulus Wiedmann. Cherry Run, MORGAN, CCC, July 17, 1978.

T. molestus molestus (Say) St. Albans, KANAWHA, JDH, June 15, 1978. WEBSTER, DF, Summer 1978.

T. lineola Fabricius. North Bend State Park, RITCHIE, JDH, June 23, 1978.

T. pallidescens Philip. St. Albans, KANAWHA, JDH, June 1, 1978. North Bend State Park, RITCHIE, JDH, June 23, 1978.

T. pumilis Macquart. Arthurdale, PRESTON,PS, June 12, 1978

T. quinquevittatus Wiedemann. Kanawha Run - Sutton Lake, BRAXTON, LB, August 16, 1989. Dallas, MARSHALL, GL, August 6, 1976. Cherry Run, MORGAN, CCC, July 5, 1978. North Bend State Park, RITCHIE, JDH, June 23, 1978.

T. sackeni Fairchild. Kanawha Run - Sutton Lake, BRAXTON, LB, August 16, 1978. Greenland, GRANT, CCC, July 27, 1978. Greenbrier State Forest, GREENBRIER, LB, August 27, 1978. Chester, HANCOCK, JDH, August 15, 1978. Shannondale,JEFFERSON, CCC, August 3, 1978. Big Ugly Public Hunting Area, LINCOLN, LB, August 2, 1978. Chief Cornstalk Public Hunting Area, MASON, LB, August 2, 1978. WEBSTER, DF, August 8, 1978. Proctor District, WETZEL, EE, July 25, 1978.

T. sparus milleri Whitney. Greenland, GRANT, CCC, July 13, 1978. Cherry Run, MORGAN, CCC, June 13, 1978. North Bend State Park, RITCHIE, JDH, June 23, 1978.

T. subsimilis subsimilis Bellardi. Arden, BERKLEY, KM, July 29, 1978.

T. sulcifrons Macquart. Proctor District, WETZEL, EE, August 2, 1978.

T. superjumentarius Whitney. North Bend State Park, RITCHIE, JDH, June 23, 1978.

*New State Record.

Abbreviations for collectors:

JWA, James W. Amrine; JB, JW Begley; LB, Linda Butler; CCC, Charles C. Coffman; EE, E. Estep; DF, D. Fisher; JDH, J. Douglas Hacker; GL, G. Lippert; KM, Kenneth McDonald; LLP, LL Pechuman; PS, Phyllis Swope; RS, Ron Swope.

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Pechuman, L.L. 1973. Horse flies and deer flies of Virginia (Diptera: Tabanidae). The insects of Virginia: Part 6. Research Division Bulletin 81, Virginia Polytechnic Institute and State University, Blacksburg, Virginia.

BOOKS RECEIVED AND BRIEFLY NOTED

SEXUAL SELECTION AND REPRODUCTIVE COMPETITION IN INSECTS. Murray S. and Nancy A. Blum, eds. Academic Press. 1979. 463 pp. $23.00

Papers presented at a symposium on reproductive behavior at the Behavior section of the 15th International Congress of Entomology, Washington, DC, 1976. Many of the papers presented have been expanded and updated and additional papers added so that the final product represents a synthesis of biological concepts that emphasizes intrasexual reproductive competition as a driving force in sexual selection.

CHEMICAL ECOLOGY: ODOUR COMMUNICATION IN ANIMALS. F.J. Ritter, ed. Elsevier/North-Holland Biomedical Press. 1979. 427 pp. $54.75.

Proceedings of the Advanced Research Institute on Chemical Ecology: Odour Communication in Animals, held in The Netherlands, 1978. Thirty three papers dealing with four major topics: Present-day knowledge of fundamental aspects of olfaction; Odor communication in mammals; communication by multicomponent odors in insects; and commercial production and application of pheromones and related compounds in pest control.

COAL SLURRY OBSERVED AS HABITAT FOR SEMIAQUATIC BEETLE *LANTERNARIUS BRUNNEUS* (COLEOPTERA: HETEROCERIDAE), WITH NOTES ON WATER QUALITY CONDITIONS[1]

William S. Vinikour[2]

ABSTRACT: The variegated beetle, *Lanternarius brunneus* (Melsh.), was found inhabiting a slurry area at an orphaned coal mine site in Illinois. Water quality analyses indicated the beetle lived in coal fines and mud saturated with water indicative of acid mine drainage, i.e., pH <4.0 and elevated sulfate and heavy metal concentrations. This is the first report of Heteroceridae occurring in this type of habitat and in conditions normally toxic to other aquatic or semiaquatic insects.

Scant information exists concerning the biology and environmental tolerances of Heteroceridae. This note reports an unusual habitat type, with accompanying water quality conditions, for *Lanternarius brunneus* (Melsheimer).

Habitat for larvae and adult Heteroceridae is listed as mud, sand, or clay along the banks of rivers, streams, lakes, and ponds where they construct galleries in which to live and breed (Pacheco, 1963; Arnett, 1973; Brown, 1972). Except for legs adapted for burrowing, the Heteroceridae have no physical or respiratory specializations for aquatic life, and will leave their galleries if they are flooded with water (Dillon and Dillon, 1972). However, close association with water results in saturation of their habitat and its exposure to the water quality conditions of the neighboring water body.

On 2 June 1976 numerous galleries of *Lanternarius brunneus* were observed in the coal slurry refuse area of an orphaned mine site near Staunton, Macoupin County, Illinois. The heterocerid galleries, composed of fine coal and mud, occurred along the shoreline areas of small bodies of standing water in the slurry area. Other than water striders, the heterocerid was the only semiaquatic or aquatic macroinvertebrate collected from the slurry refuse area. The extent of slurry refuse occupied by the galleries indicated that the beetles were tolerant of the harsh environmental conditions. Heteroceridae have been reported to be scavengers or predators and to feed upon unicellular algae (Pacheco, 1963; Pierre, 1946). Terrestrial insects were commonly sited in the slurry area. Also, an unidentified unicellular green alga was observed on the bottom of water-covered parts of the slurry area. It can therefore be assumed that a food source for the beetles existed.

As is common in midwestern orphaned mine sites, the coal slurry refuse area was severely impacted by conditions associated with acid mine drainage, i.e., low pH and high heavy metal and sulfate concentrations. The standing water adjacent to the heterocerid galleries had the following water

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[1] Received May 3, 1979.

[2] Land Reclamation Program, and Environmental Impact Studies, Argonne National Laboratory, Argonne, Illinois 60439.

quality values: pH -<4.0, conductivity - 7500 µmhos/cm (at 25°C), acidity -4413 ppm. alkalinity - 0.0 ppm, sulfate - 3875 ppm, chloride - 159 ppm, calcium - 458 ppm, sodium - 98 ppm, and magnesium - 237 ppm. Values for some of the heavy metals analyzed were: Fe - 1810 ppm, Mn - 31.9 ppm, Cd -0.87 ppm, Pb -15.7 ppm, Zn - 95 ppm, Cu - 0.69 ppm, Al - 482 ppm, and Ni -2.65 ppm.

The heterocerid *Lanternarius brunneus* is able to tolerate the extreme acid mine drainage conditions reported above. Only two other publications were found that reported water quality values for heterocerids. Roback and Richardson (1969) found *Heterocerus ventralis* (Melsh.) at a site receiving intermittent acid mine drainage. Water quality conditions, however, were not as severe as that in the Staunton slurry area, i.e., pH -7.2, conductivity - 683 µmhos/cm, acidity - 9.0 ppm, alkalinity -62 ppm, sulphate - 330 ppm, chloride -24 ppm, calcium - 98 ppm, magnesium - 27 ppm, manganese - 1.58 ppm, Fe - 2.48 ppm, Pb - 0.13 ppm, and Cu - 0.1 ppm. La Rivers (1950), reporting Nevada distribution records, noted that *Lanternarius brunneus* had been collected from the Hot Springs area at a pH ranging from 7.1 to 8.5.

Lanternarius brunneus can clearly tolerate an environment saturated with poor quality water that would be toxic to other aquatic insects, e.g., zinc and iron (see Clarke, 1974). It would be of interest to determine whether *L. brunneus* is unique in the Heteroceridae in being able to inhabit coal slurry refuse areas, or whether the entire family can tolerate such conditions.

ACKNOWLEDGEMENTS

I would like to extend my gratitude to Dr. Warren U. Brigham, Illinois Natural History Survey, Urbana, for identification of the beetle, and to Dr. Richard Olsen, Argonne National Laboratory, for supplying water quality data and reviewing the manuscript. This work was financially supported by the following agencies: U.S. Department of Energy, Contract No. W-31-109-Eng-38; Abandoned Mined Land Reclammation Council of Illinois, Project No. 555-090-004; and Illinois Institute of Natural Resources, Project No. 80.043.

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CADDISFLIES (TRICHOPTERA) OF THE CRANBERRY GLADES IN WEST VIRGINIA[1]

D.C. Tarter, P.L. Hill[2]

ABSTRACT: This investigation represents the first detailed study of the caddisflies of the Cranberry Glades of West Virginia. Records are presented for 24 species representing 8 families and 13 genera.

Examination of adult caddisflies from black light traps of Marshall University (MU) students and records from the United States National Museum (USNM) have provided distributional information on caddisflies from the Cranberry Glades in West Virginia. In this investigation, records are given for 24 species that represent 8 families and 13 genera. Until recently, the study of caddisflies from the Glades has been neglected. Hill et al. (1977) reported the limnephilid *Pycnopsyche divergens* (Walker) and Hill and Tarter (1978) recorded *Limnephilus moestus* Banks and *Pycnopsyhe scabripennis* (Rambur). Hill et al. (1978) recorded the phryganeids *Agrypnia vestita* (Walker), *Ptilostomis ocellifera* (Walker) and *P. semifasciata* (Say).

Cranberry Glades is a refugium in mountainous Pocahontas County where northern plants and animals have survived in the Southern Appalachians, It is an area of approximately 600 acres at the headwaters of the Cranberry River, which flows through the bog; the elevation is 3375 feet (Darlington, 1943). Kennison, Cranberry and Black Mountains surround the Glades and are approximately 4000-6000 feet.

Rhyacophilidae

Rhyacophila carolina Banks	1 male, 1 female; 28-VII-76(MU)
R. fuscula (Walker)	2 males, 1 female; 3-IX-77(MU)

Polycentropidae

Polycentropus pentus Ross	Adult; 21-VI-68(USNM)
P. maculatus Banks	Adult; 21-VI-68(USNM)
P. clinei (Milne)	3 males; 30-VII-76(MU) and 3 males; 5-VIII-77(MU)
Nyctiophylax moestus Banks	Adult; 21-VI-68(USNM)
N. affinis Banks	1 male; 25-VII-77(MU)

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[1] Received July 10, 1979.

[2] Department of Biological Sciences, Marshall University, Huntington, West Virginia 25701.

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Psychomyiidae

Phylocentropus lucidus (Hagen)	1 male; 30-VII-76(MU)

Hydropsychidae

H. sparna Ross	31 males, 16 females; 27-VIII-76(MU) and 2 males, 1 female; 3-IX-77(MU)
H. scalaris group	3 females; 26-VIII-76(MU)
Diplectrona modesta Banks	1 male; 24-IX-76(MU)

Lepidostomatidae

Lepidostoma griseum (Banks)	1 male; 29-VIII-76(MU)
L. sackeni (Banks)	1 male; 29-VIII-76(MU)

Molannidae

Molanna blenda Sibley	1 male; 28-VIII-76(MU)

Phryganeidae

Ptilostomis ocellifera (Walker)	1 male; 10-VI-76(MU)
P. semifasciata (Say)	Adult: 22-VI-68(USNM)
Agrypnia vestita (Walker)	2 males, 1 female; 30-VII-78(MU)

Limnephilidae

Limnephilus moestus Banks	3 males, 1 female; 30-VIII-76(MU)
Ironoquia punctatissimus (Walker)	1 male; 30-VII-76(MU)
Pycnopsyche guttifer (Walker)	6 males; 30-VII-77(MU)
P. luculenta (Betten)	10 males; 3-IX-77(MU)
P. divergens (Walker)	40 males; 28-VIII-76(MU)
P. scabripennis (Rambur)	10 males; 26-VIII-76(MU)
P. lepida (Hagen)	2 males; 26-VIII-76(MU)

ACKNOWLEDGEMENTS

A special note of appreciation to Dr. Oliver S. Flint, Jr., Curator of Neuropteroids, United States National Museum, for suggestions on the manuscript and help in the identification of the caddisflies.

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REDISCOVERY OF *HYGROTUS SYLVANUS* (FALL) (COLEOPTERA: DYTISCIDAE)[1]

Gregory L. Daussin[2]

ABSTRACT: *Hygrotus sylvanus* (Fall), not reported since 1890 and suspected of being extinct, was collected in Anoka and Isanti Counties, Minnesota, along with its closest relative, *Hygrotus laccophilinus* (LeConte). These collections represent new state records for both species. Brief habitat descriptions are given for both species.

While conducting a survey of aquatic Coleoptera of Cedar Creek Natural History Area (C.C.N.H.A.), located in Anoka and Isanti Counties, Minnesota, I collected 15 specimens of *Hygrotus sylvanus* (Fall).

Originally described in the genus *Coelambus* Stephens (Fall, 1917, 1919), it is now placed along with its closest relative, *Hygrotus laccophilinus* (LeConte) in species-group II of the Nearctic *Hygrotus* (Anderson, 1971).

This group is morphologically very different from other species in the genus, in having the clypeus unmargined, the body broadly ovate anteriorly, widest before the middle and pointed behind (Anderson, 1976). Both species are essentially concolorous (reddish-brown) above and below. However, *H. laccophilinus* is partially infuscate on the ventral surface.

Based on its previously known limited range (known only from the type locality and one other suspect locality) and since none had been collected since 1890, Anderson (1976) suspected *H. sylvanus* was extinct. The recent collections in Minnesota dispel Anderson's suspicion and represent a range extension of approximately 1000 mi.

Both *H. sylvanus* and *H. laccophilinus* have been collected from C.C.N.H.A. and represent new state records for Minnesota. Anderson (1976) reports *H. laccophilinus* as widely distributed from New England to the Great Lakes along the Canadian border. The collection records of *H. sylvanus* from Minnesota and New York, although disjunct, suggest a similar distribution.

H. sylvanus was collected from 3 separate localities at C.C.N.H.A. One specimen was from a small moss-lined pool in a floating sedgemat, a shallow, marshy area dominated by cattails and sedges yielded another, and the remainder were collected in small, temporary snow-melt pools that formed amongst sedge clumps in a mixed fen.

H. laccophilinus was collected in a greater variety of habitats. These include slow, weedy creeks and vegetation choked, shallow waters of small ponds, lake

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[1] Received July 2, 1979.

[2] Graduate student, Department of Entomology, Fisheries and Wildlife, University of Minnesota, St. Paul, Minnesota 55108.

margins and marshes. It was also taken in the moss-lined pools of the floating sedge mat.

As these two species are quite similar in appearance, close examination is required for their separation. Anderson (1971, 1976) provides excellent keys for the separation of the species-groups of Nearctic Hygrotus and species keys for groups I, II and III.

ACKNOWLEDGEMENTS

I wish to thank Dr. Edwin F. Cook and Dr. Russell D. Anderson for reviewing the contents of this note. Dr. Anderson also confirmed my identification of *Hygrotus sylvanus* (Fall).

A research stipend from the Field Biology Program, University of Minnesota provided financial support at C.C.N.H.A.

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THE USE AND SIGNIFICANCE OF PESTICIDES IN THE ENVIRONMENT. F.L. McEwen and G.R. Stephenson. John Wiley & Sons. 1979. 538 pp. $27.50.
The purpose of this book is to provide, in one volume, an overall treatment and evaluation of the pros and cons of pesticides. The book is really a text on pesticides in the environment, including the reasons for their use, their benefits, their nature, their potential for good or harm, the penetration of pesticides into the environment, the effects of pecticides on target and nontarget organisms and legislative controls on pesticide use.

PESTS OF GRAIN LEGUMES: ECOLOGY AND CONTROL. S.R. Singh, H.F. Van Emden and T. Ajibola Taylor, eds. Academic Press. 1978. 454 pp. $30.00
Based on an International Symposium on Pests of Grain Legumes, held at the International Institute of Tropical Agriculture, Ibadan, Nigeria, 1976. This book contains the published proceedings of the Symposium and so becomes a reference on many aspects of grain entomology.

PEST MANAGEMENT PROGRAMS FOR DECIDUOUS TREE FRUITS AND NUTS. D.J. Boethel and R.D. Eikenbary, eds. Plenum Press. 1979. 256 pp. $29.50.
Collection of papers from a symposium on the subject at the 1977 E.S.A. National Meeting, plus added invitational papers. This book presents the current status of pest management programs in orchard ecosystems.

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TAXONOMY AND BIOLOGY OF *LEMA TRIVITTATA* SAY, A VALID SPECIES WITH NOTES ON *L. TRILINEATA* (OLIV.) (COLEOPTERA:CHRYSOMELIDAE)[1]

Richard E. White[2], William H. Day[3]

ABSTRACT: Although *Lema trivittata* Say has generally been treated as a subspecies of *L. trilineata* (Oliv.), it is a valid species. Data included are: a complete synonymy with a description, a diagnosis covering points of difference between *L. trivittata* and *L. trilineata* with a table summarizing the differences, distribution, biology, and collection notes. There are illustrations of *L. trivittata* and its nearest relative *L. trilineata*.

Most publications since Schaeffer (1933) have followed him in treating *Lema trivittata* Say as a subspecies of *Lema trilineata* (Olivier), the threelined potato beetle. The minor external differences between the two species and the incomplete distribution data available to Schaeffer doubtless contributed to his erroneous conclusion.

Biological investigations by the junior author have established that *L. trivittata*, which feeds primarily on *Datura*, is a valid species distinct from *L. trilineata trilineata*, which feeds primarily on *Solanum* and *Physalis*. Cross matings of the 2 species show that they do not interbreed successfully. The morphological characters, plant hosts, and similar distributions reinforce the findings of the breeding experiments. The biological data are confirmed by studies done by B.J. Landis in Columbus, Ohio years ago (H.S. Barber notes) and C.H. Bare in Michigan (personal communication).

Following is a resume of our knowledge of *Lema trivittata*. This includes synonymy (with complete references), a description, a diagnosis, distribution, and biology. Because *L.t. trilineata* is the nearest relative of *L. trivittata*, the diagnosis presents the characters that distinguish the two. Reference is also made to *L.t. trilineata* in the distribution and biology sections.

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[1] Received November 8, 1978.

[2] Systematic Entomology Laboratory, IIBIII, Agricultural Research, Sci. & Educ. Admin., USDA, c/o National Museum of Natural History, Washington, D.C., 20560.

[3] Beneficial Insects Research Laboratory, Sci. & Educ. Admin. USDA; 501 So. Chapel St., Newark, Delaware, 19713.

Synonymy and description

Lema trivittata Say, NEW STATUS

(Fig. 5)

Lema trivittata Say, 1824:429; Lacordaire, 1845; 421, 545; Emmons, 1854: 134; Jacoby, 1880: 6; Jacoby & Clavareau, 1904: 15; Clavareau, 1913: 81; Leng, 1920: 287, Schaeffer, 1933: 301 (lapsus, *trilineata* intended); Blackwelder, 1946: 632; Monros, 1960: 208; Kogan & Goeden, 1970: 529.

Crioceris trivittata, Harris, 1833: 580.

Lema trilineata ssp. *trivittata* Say, Schaeffer, 1933: 302-3; Knowlton & Smith, 1935: 242; Brimley, 1938: 221; Blackwelder, 1939: 61; Löding, 1945: 126; Fattig, 1948: 6; Balsbaugh & Hays, 1972: 21.

Lema immaculicollis Chevrolat, 1835: 112; Lacordaire, 1845: 419; Jacoby, 1880: 6; Jacoby & Clavareau, 1904: 15; Clavareau, 1913: 81; Leng, 1920: 287; Schaeffer, 1933: 302; Blackwelder, 1939: 61; Blackwelder, 1946: 632; Monros, 1960: 208; Kogan & Goeden, 1970: 529.

Lema trivirgata LeConte, 1859: 22 (junior homonym; not Lacordaire); Clark, 1866: 31; Crotch, 1873: 94; Jacoby, 1880: 6; Jacoby & Clavareau, 1904: 15; Snow, 1907a: 56; Snow, 1907b: 180; Cockerell & Fall, 1907: 194; Clavareau, 1913: 81; Leng, 1920: 287; Schaeffer, 1933: 302; Blackwelder, 1939: 61; Blackwelder, 1946: 632; Monros, 1960: 208; Kogan & Goeden, 1970: 529.

Lema lecontei Clark, 1866: 31 (replacement for *trivirgata* LeConte); Jacoby, 1880: 6; Jacoby & Clavareau, 1904: 15; Clavareau, 1913: 81; Leng, 1920: 287; Blackwelder, 1946: 632; Monros, 1960: 208; Puttler, 1966: 475; Kogan & Goeden, 1970: 529.

Lema nigrovittata Schaeffer (misidentification, not Guerin), 1933: 302; Blackwelder, 1939: 61; Monros, 1960: 208.

General. — Body length (anterior margin of pronotum to elytral apex) nearly 2 times as great as width; head 0.9 times as wide as pronotum; pronotum from 0.57 to nearly 0.60 times as wide as elytra. Body mostly yellow orange, sometimes dull orange or dull yellow, dark markings black.

Head. — Yellow orange to dull orange; vertex sometimes with a pair of black spots, one each side of middle, spots sometimes expanded posteriorly, may join, in which case base of head then black from sides to vertex; frons infrequently with a single black spot at middle, sometimes also with black along dorso-anterior margin of each eye and on labrum and clypeus. Sparse, yellowish pubescence around eyes, on genae, front of vertex, frons, clypeus, and labrum. Frontal lines forming an X, upper arms of X deeper into surface, wider than lower arms. Vertex anteriorly usually with a shallow, longitudinal groove, behind groove with a small fovea, groove sometimes joining fovea. Surfaces, except for most of vertex, more or less coarsely punctate. Antennae attaining humerus, over 0.6 times as long as an elytron; 1st 2 segments smooth, shining, remaining segments punctate, not shiny; 1st segment dull yellow to dull orange, 2nd segment usually predominantly pale, remainder dark, 3rd and 4th segments dark, sometimes pale beneath, remaining segments black. Last segment of maxillary palpus about 2 times as long as wide, widest just before base, tapering apically, tip blunt; last segment of labial palpus similar in form but a little wider.

Pronotum. — Dull yellow to dull orange, often with a black spot each side before middle, spots variable in size, distance separating spots varying from 7 times maximum diameter of a spot to equal to maximum diameter. Slightly wider than long; distinctly, broadly constricted at middle; with a small, distinct fovea at middle before base, joining a fine, arcuate, transverse line, a 2nd, similar line between fovea and base; with coarse, not dense punctures between constriction and anterior margin, also along midline to fovea.

Elytra. — Dull light yellow to orange, usually yellow-orange, each elytron with black (rarely dark brown) on sutural interval; with black stripe (rarely dark brown) on 7th, 8th, and 9th intervals as in Fig. 5; elytron with 10 distinct rows of punctures, punctures much smaller in elytral apex; rows 6-9 abbreviated near humerus; each interval bearing a row of minute punctures, these smaller toward elytral apex.

Ventral surface. — Most of ventral surface and legs dull yellow to dull orange; side of mesosternum and metepisternum black, at maximum development of black markings with much of side of mesosternum, and much of coxae black, sometimes with black on apex of 1st abdominal segment, rarely also with black on metasternum. Legs dull yellow to dull orange, tibial apices dark brown to black, tarsi dark brown to black; often with femoral apices more or less darkened. Prosternum with fine, arcuate, transverse lines; mesosternum with moderate-sized, not dense punctation; metasternal punctation fine, most dense anteriorly at side, nearly absent at middle; abdominal punctation fine, most dense at sides, sparse at middle of each segment.

Length. — 5.1-7.3 mm.

Most of Say's original description of *Lema trivittata* describes *L. t. trilineata* as well as it does *L. trivittata*; however, there is mention of the tibiae being black at the tip. This is a very strong indication that Say's name is here correctly applied, for in *L. trivittata* the tibiae are predominantly light and black only apically; in *L.t. trilineata* the tibiae are nearly always predominantly black. There is no type for *L. trivittata*, because almost all of the Thomas Say collection is lost. The senior author plans revisionary work on N. American Criocerinae, and therein will select a neotype.

The past erroneous placement of *Lema trivittata* as a subspecies of *Lema trilineata* casts doubt on the identity of beetles identified in various papers simply as *Lema trilineata*. One such study is that by Force, 1966. In this paper the chief host plants of the beetle studied were given as species of *Datura*. Since both *Lema trivittata* and *L. trilineata daturaphila* Kogan and Goeden occur in California, either could have been the object of the study, though it is likely that the latter was.

Diagnosis

When alive, adults of *L. trivittata* and *L.t. trilineata* are separable by color characters. *Lema trivittata* has the head and pronotum yellow orange and the median yellow stripe of an elytron has white borders. Live specimens of *L.t. trilineata* have the head and pronotum orange, and the median yellow stripe of an elytron is not bordered by white, and may be yellow orange; infrequently the yellow stripe is reduced by the expanded black stripes on each side. Also, the eggs of *L. trivittata* are yellow and are covered by a sticky dark substance thickest at the polar ends. The eggs thus are dirty yellow with the ends nearly black. The eggs of *L.t. trilineata* are all yellow and have little sticky coating.

The color differences of living adults fade upon death. However, other color differences persist, and these are summarized on Table 1. These differences are presented in the order of their diagnostic value, with the first 2 characters being the most useful in separating the 2 species. The first character also serves to distinguish *L. trivittata* from *L.t. daturaphila*, which occurs in southern California. Color characters and male genitalia (examined by the senior author) show that *L.t. daturaphila* is correctly placed as a subspecies of *L. trilineata.*

The male genitalia of *L. trivittata* and *L.t. trilineata* show differences in degree of chitinization of the internal sac armature. Note the greater darkness of these parts, especially in lateral view, in the cleared genitalia of *L. trivittata* (Fig. 1, 2) as compared with that of *L.t. trilineata* (Fig. 3, 4). Other apparent differences as seen in the dorsal view outlines are likely not of significance.

An examination of larvae of these species by the senior author has not shown differences that will allow certain separation of the two.

Below is a key that will allow separation of the adults of *L. trivittata* and *L.t. trilineata.*

1. Lateral black stripe on elytron at widest encompassing 2-2 1/2 (rarely nearly 3) intervals; tibiae usually black for less than 1/2 length .... *L. trivittata*

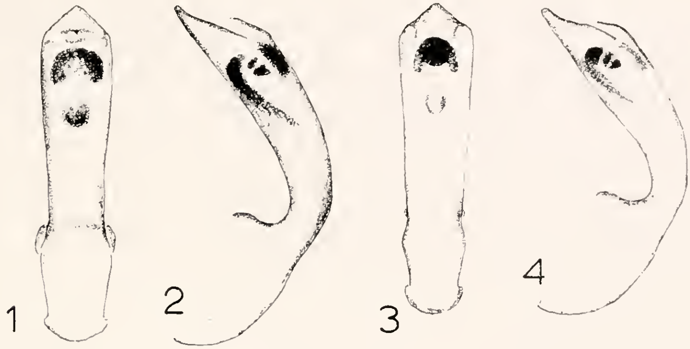
Lateral black stripe on elytron encompassing 3-4 intervals or wider; tibiae nearly always black for more than 1/2 of length .... *L.t. trilineata*

Distribution

In the USNM collection there are about 550 specimens of *L.t. trilineata* and about 650 specimens of *L. trivittata* that have been collected from a great number of different localities in the United States. Both occur nearly throughout the United States east of the Mississippi River, and thence diagonally to southwestern United States. Both have been taken in Iowa, Colorado, Utah, and California, but in no western states farther north than these. The species appear to be almost totally sympatric in their distribution.

Biology

In 1967 the junior author worked at Moorestown, New Jersey, and was involved with introduction of parasites of the cereal leaf beetle, *Oulema melanopus* (L.). During attempts to find alternate native hosts for certain of the parasites, a species of *Lema* that was abundant on *Datura* in central New Jersey proved to be a satisfactory alternate host.



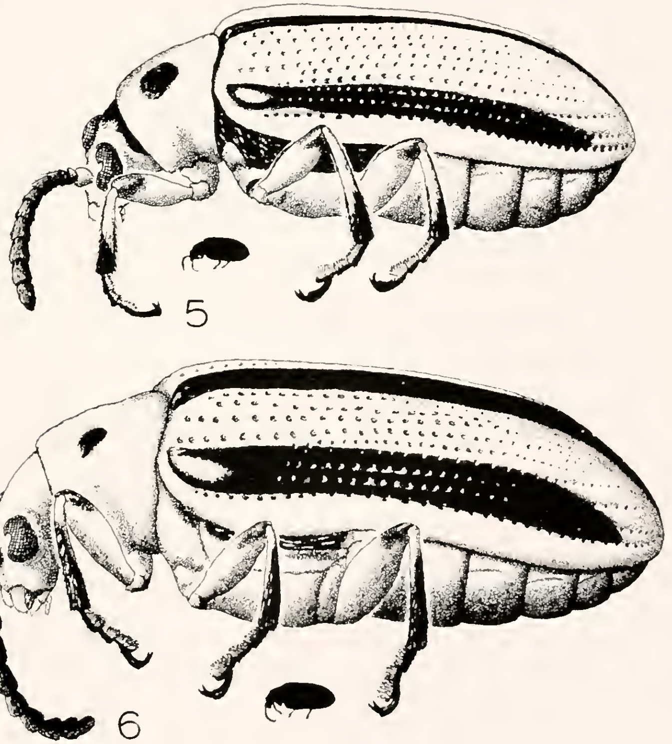


Fig. 1-4, cleared male genitalia: 1. *L. trivittata* Say, dorsal view. 2. *L. trivittata*, lateral view. 3. *L.t. trilineata* (Oliv.), dorsal view. 4. *L.t. trilineata*, lateral view.

Fig. 5-6, adults in lateral view; small figures equal actual size. 5. *L. trivittata*. 6. *L.t. trilineata*.

According to Schaeffer (1933) the *Lema* that was found feeding on *Datura* was a subspecies of *L. trilineata* (Olivier), the threelined potato beetle, a species that was once an important pest of potatoes in the U.S. However, the junior author noted several points of difference between these 2 populations. These observations, especially host plant differences, suggested that the 2 were actually different species. This possibility was tested in the laboratory.

The *Lema* specimens from *Datura* (*L. trivittata*) were maintained on *D. stramonium*, and *L.t. trilineata* was reared on *Solanum Dulcamara* L. Newly emerged females were segregated to prevent mating; 4 (2 from each host) were individually placed in small plastic cages, each with a male from the opposite host plant. During the next 3 weeks while the beetles were supplied with foliage of the 2 host plants, the number of matings was observed and the number of eggs produced was recorded. Confinement of a male with a female lasted from 19 to 22 days. The viability of the eggs was determined by observing them in petri dishes supplied with damp filter paper. The results are shown on Table 2. Numbers (1-8) were assigned to the beetles of each species used in the tests.

After the first confinement period each female was put with a male of its own population. This was to determine if the fertililty of the 2 groups of beetles would differ when selfed. At this time the original beetles were nearly 4 weeks old, so the same number of newly emerged beetles (numbers 5-8) were confined so males and females of a population were together, and the results were observed.

When the beetles from the 2 different hosts were crossed (Table 2), few matings and eggs resulted, and all eggs were infertile. Later, when these females were placed with males of the same population, many more eggs were produced by the *L. trivittata* females, and many hatched. There was also moderately good hatching of the eggs produced by the 2 pairs of younger beetles (numbers 5-8). When selfed, the older specimens of *L.t. trilineata* (numbers 1-4) were not active, mated little, and produced no eggs. However, the 2 younger pairs of this species (numbers 5-8) did mate and produce a fair number of eggs, many of which hatched. It is suspected that the lack of reproductive success of *L.t. trilineata* pairs numbered 1-4 was the result of the advanced age of the beetles, or to reproductive diapause.

The results of the mating tests indicate that the 2 populations of beetles are reproductively isolated. This, together with the different hosts, similar distribution patterns, and morphological differences, indicate that they should be regarded as different species.

Table 1. Color differences, dead specimens of *L. trivittata* and *trilineata*.

Character	*L. trivittata*	*L. trilineata trilineata*
lateral black stripe on elytron	at widest encompassing 2-2 1/2 (rarely nearly 3) intervals, never joins sutural stripe	encompassing 3-4 intervals or wider, may join sutural stripe (dark form)
legs	tibiae usually black for less than 1/2 length; femora sometimes black apically	tibiae nearly always black for more than 1/2 of length; femora usually not black apically
sternal side pieces	often broadly black	sometimes narrowly black
paired black spots on pronotum	large to small, often absent	large to (often) small, infrequently absent
head	often orange throughout, black, when present, usually basal, sometimes around eyes and on labrum-clypeus	often orange throughout, black, when present, usually between eyes, sometimes also basal
ventral surface	coxae and abdomen sometimes (rarely also metasternum) partly black	pale, rarely partly black

Table 2. Breeding experiments with *L. trivittata* and L. trilineata.

	Lema species				
	Females	Males	Matings observed	Eggs	Hatched
Cross matings	*trivittata* 1	*t. trilineata* 3	2	42	0
	trivittata 2	*t. trilineata* 4	1	0	-
	t. trilineata 1	*trivittata* 3	4	0	-
	t. trilineata 2	*trivittata* 4	7	17	0
Self matings	*trivittata* 1	*trivittata* 3	3	219	42%
	trivittata 2	*trivittata* 4	7	576	32%
	trivittata 5	*trivittata* 7	13	266	32%
	trivittata 6	*trivittata* 8	4	139	19%
	t. trilineata 1	*t. trilineata* 3	0	0	-
	t. trilineata 2	*t. trilineata* 4	2	0	-
	t. trilineata 5	*t. trilineata* 7	4	29	31%
	t. trilineata 6	*t. trilineata* 8	5	14	100%

Collection notes

The numerous adults of these 2 species in the USNM collection frequently bear notes which indicate the plants on which the specimens were collected; these records are given below. Notes of this sort may indicate the actual larval host, a plant on which the adult feeds, or may indicate a plant on which the adult was simply resting. There is always the possibility that errors may have been made in the recording of field notes.

The first 4 records listed below for *L. trivittata* are known larval hosts; the first 6 for *L.t. trilineata* are known larval hosts.

Lema trivittata: jimson weed, ex *Datura, Datura stramonium* L., on *Datura quercifolia* H.B.K., in cornfield, on strawbrry, on *Physalis*, on *Hyoscyamus*, on *Atropa belladonna* L., wild barley, on sunflower, cotton bud, bred from *Solanum*, on *Chamaesaracha conioides* Britton, wheat, on English pea foliage, on tomato leaves, with string bean leaves, feeding on potato, on Irish potato foliage, on okra leaves, on *Melilotus indica* (L.) All. foliage, with parsley roots and leaves, *Solanum elaeagnifolium* Cav.

Lema t. trilineata: *Solanum dulcamara*, on *Physalis alkekingi* L., japanese lantern, reared potato, chinese lantern, on *Physalis*, jimson weed, on corn, on sweet corn, on beans, on *Datura stramonium* L., on *Nicandra physalodes* (L.) Gaertn. (sic), feeding on belladonna.

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AWARDS FOR STUDY

The Academy of Natural Sciences of Philadelphia, through its Jessup and McHenry funds, makes available each year a limited number of awards to support students pursuing natural history studies at the Academy. Awards usually include a stipend to defray living expenses, and support for travel to and from the Academy. Current application deadlines are 1 April and 1 October 1980. Further information may be obtained by writing to: Chairman, Jessup-McHenry Award Committee, Academy of Natural Sciences of Philadelphia, 19th and the Parkway, Philadelphia, Pennsylvania 19103.

THE OCCURRENCE OF *TYRRELLIA CIRCULARIS* KOENIKE IN TEXAS (HYDRACARINA: TYRRELLIIDAE) [1,2]

B. McDaniel[3], Eric G. Bolen[4]

Marshall (1940), in her study of the mite genus *Tyrrellia* Koenike, recorded the distribution of *T. circularis* Koenike from Michigan and California. Koenike (1895) based his description of *T. circularis* on specimens collected near Ottawa, Ontario Canada.

During an ecological study of the mite fauna of the Rob and Bessie Welder Wildlife Foundation near Sinton, San Patricio County, Texas, a single specimen of *T. circularis* (tenoral female), was found from a soil sample taken in a drying mud flat on March 5, 1978.

Material of *T. circularis* has been collected in debris at the margin of Reed's Lane near Grand Rapids, Michigan, in close proximity to water, and from a thermal spring in California and a mineral Hot Springs, Saquache Co., Colorado (Young 1969). The habitat of the single Texas specimen of *T. circularis* was a previously inundated area peripheral to a 75-acre lake on the Welder Foundation. The lake, a shallow basin with only sparse emergent vegetation, is of the "ox-bow" type and is subject to rapid water loss from evaporation in periods of low rainfall. The soil sample containing *T. circularis* was collected 2 meters from the shoreline on a flat, carpeted with decadent culms of clubhead cutgrass (*Leersia hexandra*). Soils at the site are heavy clays that quickly harden upon drying.

We are indebted to Dr. Rober Mitchell, Department of Zoology, The Ohio State University, for the loan of specimens of *T. circularis*. The slide of *T. circularis* collected from Texas is deposited with Dr. Mitchell at Ohio State University.

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[3] Plant Science Department (Entomology, South Dakota State University, Brookings, South Dakota 57007

[4] Dean's Office, The Graduate School, Texas Tech University, Lubbock, Texas.

NOTES ON CERAMBYCIDAE FROM THE SOUTHEASTERN U.S. (COLEOPTERA)[1]

Robert H. Turnbow, Jr.[2], Frank T. Hovore[3]

ABSTRACT: New larval host plants, distributional, ecological and taxonomic records are presented for 36 species and subspecies of Cerambycidae from the southeastern U.S. *Derancistrus rugosus* (Gahan) and *Eburia cinereopilosa* Fisher are recorded from the U.S. for the first time, and new state records for *Tylonotus masoni* (Knull), *Euderces picipes occidentalis* Linsley and *Zaplous annulatus* (Chevrolat) are presented. First larval hosts are reported for *Euderces p. occidentalis*, *E. pini* (Olivier), *Leptostylus albescens* (Haldeman), *Leptostylopsis planidorsus* (LeConte), *Styloleptus minuens* (Hamilton), *Urgleptes kissingeri* Dillon, *Ecyrus dasycerus floridanus* Linsley and *Oberea gracilis* (Fabricius). *Sternidius moderator* (Casey) is placed as a junior synonym of *Sternidius schwarzi* (Hamilton). Comparative, synonymical or supplemental information is given for an additional 9 species.

Although the Cerambycidae of the United States have been actively studied for many years, details of the life histories of many species remain unknown. This is particularly true of the southeastern fauna, which, except for a few brief annotations in regional catalogues, has received little attention. Much of the available biological information for species occurring in the southeast is based upon findings in other portions of their overall distributions, and the recorded hosts for many species do not even occur in the area. Moreover, many of the commonly collected species, such as *Styloleptus biustus* (Lec.), have consistently been confused with other species in the literature, appearing under a variety of generic and specific epithets. Older published accounts, therefore, are frequently quite difficult to interpret within current species concepts.

The records reported here are based upon collections made during 1974-8, and apparently represent new distributional, larval host or ecological records for 36 southeastern longhorn species. Rearing methodologies have been described elsewhere (Turnbow and Wappes, 1978). Unless otherwise indicated, specimens are in the collections of the authors.

Prioninae

Derancistrus (Elateropsis) rugosus (Gahan). — This species has

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[1] Received June 27, 1979.

[2] School of Forest Resources, University of Georgia, Athens, GA. 30602. Mailing address: Department of Entomology, University of Georgia.

[3] Placerita Canyon Nature Center, 19152 W. Placerita Canyon Road, Newhall, CA 91321

previously been recorded only from Cuba and the Bahama Islands (Cazier and Lacey, 1952). A single female matching Zayas' (1975) and Cazier and Lacey's characterization of *D. rugosus* was beaten by R. Turnbow from foilage of living pigeon plum (*Coccoloba diversifolia* Jacq.) on Key Largo, Florida (Monroe Co.) in June, 1978. In general appearance females of *D. rugosus* closely resemble those of *D. lineatus* (L.) and *D. scabrosus* (Gahan), with which it is largely sympatric. From *lineatus* it may be separated by the coarsely, rugosely punctate elytral humeri, and from *scabrosus* by the longitudinal white pubescent vittate on the elytra. In a series of a dozen specimens of *Derancistrus* since reared by F. Hovore and R.L. Penrose from old, dead branches of poisonwood (*Metopium toxiferum* (L.) Krug and Urban) and gumbo limbo (*Bursera simaruba* (L.) Sarg.), several females have feeble traces of white vittae at the elytral apices and have the lateral margins of the abdominal sternites white pubescent, and one female has the dorsal vittae fully developed, as in the Turnbow specimen. The reared specimens were cut from the wood as pupae and prepupae, and no attempt was made to segregate specimens according to host plant. Therefore, although the evidence would suggest that *rugosus* is an infrequent polymorph of *scabrosus* (characters for separating male cited by Cazier and Lacey are extremely subjective), we cannot positively demonstrate synonymy with additional field and rearing data.

Lepturinae

Typocerus badius (Newman). — Linsley and Chemsak (1976) recorded this species as occurring from Georgia to central Florida on flowers of *Olea americana* L. and *Ilex*. The authors and E.F. Giesbert collected large numbers of adults on flowers of farkleberry (*Vaccinium arboreum* Marshall) and *Cornus asperifolia* Michaux near Old Town, Florida (Dixie Co.) in May, 1978. One female was observed ovipositing in a bark fissure on the side of a small (ca. 10 cm. diameter) stump of *Quercus* sp.

Cerambycinae

Methia pusilla (Newman). — *Taxodium* has been cited (Linsley, 1963) as the only host for this species since Craighead's (1923) description of the larva. However, we, and others (Turnbow and Wappes, 1978), have collected large series of this methiine far from any sources of *Taxodium*. Recently, we have reared specimens from dead branches and twigs of live oak (*Quercus virginiana* Miller) collected near Old Town, Florida.

Eburia cinereopilosa Fisher. — In May, 1971, J.E. Wappes collected 5 specimens of this Cuban species at building lights on Marathon Key, Florida (Monroe Co.). These specimens, which represent the first U.S.

record for the species, have the integument reddish-brown (described as blackish in the female holotype, Fisher, 1932), but match in all essential details Zayas' (1975) characterization and illustration of *cinereopilosa.*

Eburia stigma (Olivier). — Blatchley (1923) reported beating specimens of *E. stigma* from foliage of young caribbean pine (based upon a misidentification of *Pinus elliotti* var. *densa* Little and Dorman), and Linsley (1962), citing this record, listed *P. caribaea* as the host. However, Thomas (1977) reported digging a pupa of *E. stigma* from the stump of a hardwood tree, possibly mastic (*Mastichodendron foetidissimum* (Jacq.) Cronquist). We can confirm mastic and add wild tamarind (*Lysiloma latisliqua* (L.) Benth.) as larval hosts of this longhorn. Adults were reared and cut from dead limbs and trunks of these trees on Key Largo. The life cycle is apparently completed in one year.

Tylonotus masoni (Knull). — Linsley (1962) gives the range of this uncommon species as the central U.S., citing localities in Texas, Oklahoma, Missouri, Iowa, Illinois, Indiana and Ohio. The species also occurs in the southeastern states, at least in their northern sections. Specimens have been collected in black light traps in Mississippi (Starkville, Oktibbeha Co., W.H. Cross) and Georgia (Whitehall Forest, Clarke Co., R. Turnbow).

Knulliana cincta ochracea (Bates). — This southeastern subspecies has been recorded from *Carya pecan* (Marsh.) Engl. & Graebn. (Loding, 1945; Fattig, 1947) and *Ostrya virginiana* (Mill.) K. Koch (Knull, 1937). We have reared specimens from woods of dead strangler fig (*Ficus aurea* Nutt.), wild tamarind, poisonwood and buttonwood (*Conocarpus erecta* L.) collected on Key Largo and in the Everglades National Park, Florida (Monroe Co.).

Aethecerinus horni (Lacordaire). — This Florida endemic is extremely rare in collections, a few specimens having been taken in malt traps in scrub oak areas (Woodruff, 1973, p. 173), and one "from flowers of farkleberry (*Vaccinium arboreum*)" (Blatchley, 1914). We collected a large series of adults near Old Town, Florida on stumps, dead branches and living new growth of red bay (*Persea bourboni* (L.) Sprengel), and at fermenting exudates in bark fissures of *Quercus* sp. Mating aggregations were frequently encountered on the scarred buttresses of crown-sprouting stumps, with as many as 13 individuals present in a single aggregation. No positive evidence of larval development or adult emergence was found, even in older dead stumps and logs. Both sexes were observed feeding at the margins of fresh, moist, fermenting bark scars, in company with numerous ants, nitidulids and an occasional specimen of *Ancylocera bicolor* (Olivier).

Curtomerus flavus (Fabricius). — This pale testaceus species has been recorded from a variety of host plants from throughout the American tropics

(Duffy, 1960). In the continental U.S., *C. flavus* is apparently restricted to southern Florida, where we have found it infesting mastic, poisonwood, Jamaica dogwood (*Piscidia piscipuls* (L.)) Sarg. and pigeon plum. Adults may be found at night, running rapidly over the surface of dying or dead host materials.

Elaphidion cryptum Linsley. — Hovore et al (1978) reported collecting adults of this species on freshly cut, down-hanging branches of wild tamarind. The larval host, however, is apparently unknown. We have reared specimens from cut limbs and trunks of poisonwood and red mangrove (*Rhizophora mangle* L.) from Key Largo, Florida.

Anelaphus subtropicus (Casey). — Known Caribbean hosts of this species have been summarized by Duffy (1960). In the U.S., *A. subtropicus* occurs only in southern Florida, where it has been recorded as breeding in *Conocarpus erecta* (Schwarz, 1887). We have reared specimens from wild tamarind (RHT) and poisonwood (FTH) on Key Largo. Adults are attracted to dead and dying hosts and are active on such materials at night. A series of specimens was beaten from recently fire-scorched gumbo limbo foliage, in company with *Methia pusilla* and *Plectromerus dentipes* (Olivier).

Plectromerus dentipes (Olivier). — According to Linsley (1963), the hosts of this species include *Quercus*, *Carya pecan* and *Crossopetalum rhacoma* Hitchc. We have reared specimens from dead limbs and trunks of buttonwood, wild tamarind and poisonwood collected in the Florida Keys. The life cycle is completed in one year.

Plinthocoelium s. suaveolens (Linnaeus). — Linsley (1964) cited *Nyssa uniflora* and *Morus* sp. as the hosts of this subspecies, and Linsley and Hurd (1959) detailed the larval habits of the subspecies *plicatum* (LeConte) in *Bumelia languinosa*. We found *suaveolens* in the stems and roots of *Bumelia* sp. in the pinewood-grasslands of the Everglades National Park. Larval mines were quite extensive in the lower stems of the small, less than 10 cm. diameter plants, often causing them to break off just above ground level. Adults, including mating pairs,were taken in large numbers on flowering *Bumelia*, and occasional individuals were found on blossoms of palmetto.

Neoclytus cordifer (Klug). — This attractive clytine has been recorded from a variety of host materials (Linsley, 1964). We have reared specimens from tallowwood (*Ximenia americana* L.), mastic, Jamaica dogwood and wild tamarind in the Florida Keys, but in contrast to the report of Back (1918), attacks were made only on dying or dead host materials. In the laboratory, these woods were repeatedly reinfested.

Euryscelis suturalis (Olivier). — This strongly dimorphic species is known from the West Indies and southern Florida. In Puerto Rico, *Prosopis* *juliflora* DC. has been recorded as the host (Wolcott, 1936 and 1948; Martorell, 1945, cited in Duffy, 1960). We have reared adults from recently killed mastic and poisonwood from Key Largo.

Euderces picipes occidentalis Linsley. — Two specimens of *E. picipes*, matching precisely Linsley's (1964) diagnosis of the subspecies *occidentalis* (rufous coloration with abdomen and elytral apices piceous), were collected in April, 1975 by F. Hovore, 2 miles west of Ponce De Leon, Florida (Walton Co.). One specimen was taken on a blossom of *Rubus* and the other reared from a branch of *Quercus* sp. girdled by *Oncideres cingluatus* Say. Specimens attributable to this subspecies have also been collected in Stone (Kimberling City, E.G. Riley), Stoddard (Holly Preserve, 2.8 mi. NE Dexter, S.O. Swadener) and Callaway (Reform, S.O. Swadener) counties in Missouri. From these records, it would appear that the subspecies *occidentalis* occurs in a broad area along the southern margin of the species range.

Euderces pini (Olivier). — Linsley (1964) recorded no host for this widespread eastern species, although Loding (1945) reported specimens beaten from oak. R. Turnbow has reared specimens from dead limbs and twigs of dogwood (*Cornus florida* L.), winged elm (*Ulmus alata* Michx.) (both Whitehall Forest) and pecan (Winder, Barrow Co., Georgia). These Georgia specimens differ from typical *pini* by their uniformly piceous integument. This phenotype seems to predominate in populations in northeastern Georgia, although occasionally individuals with dark reddish-brown integument are encountered. Specimens from the central part of the state are similar to those from other parts of the species' range.

Osmopleura chamaeropis (Horn.)— Adults of this uncommon species have long been associated with cabbage palmetto (*Sabal palmetto* (Walt.) Lodd. ex Schultz), with specimens having been collected from blossoms and foliage (Blatchley, 1925; 1928). Recent collections of large series of *O. chamaeropis* at Long Pine Key and Pinelands Trail, Everglades National Park (Dade Co.), by the authors and R.L. Penrose contribute to the knowledge of the habits of this species. Occasional individuals were collected from blossoms or resting on foliage of *S. palmetto*, but the majority were found in the deep interspaces between living stems in the basal rosettes of the palmettos. The cuneate elytra allowed for deep retreat upon disturbance, and the striped head and prothorax blended well with the decomposing litter accumulated in the rosette. Feeding larvae, pupae and teneral adults were collected from dead, dried inflorescences, and from dead leaf bases persisting on the trees. The eggs are apparently laid on green inflorescences or at the bases of the outermost living leaves, as feeding larvae were always found in the most recent, completely dead portions of the plant. A single dead female of *Zagymnus clerinus* (LeConte) was also encountered in the basal rosette of a large cabbage palmetto.

Lamiinae

Leptostylus albescens (Haldeman). — This strikingly marked species apparently has no recorded larval host, although Kirk (1969) reported an adult taken "on oak trunk". F. Hovore has beaten specimens from trunks of dead *Ilex* sp. near Old Town, Florida, and R. Turnbow has reared specimens from trunk sections of sweet gum (*Liquidambar styractiflus* L.) cut in Whitehall Forest, Georgia.

Leptostylus transversus floridellus Dillon. — Typical *L. transversus* is known to breed in dead wood of a wide range of hardwood species, but few of these recorded hosts occur within the range of the subspecies *floridellus*. Champlian *et al* (1925) reared *floridellus* (recorded as *Leptostylus aculifer* Say) from dead gumbo limbo at Paradise Key, Florida. We have reared specimens from this host as well as from mastic in the upper Florida Keys and poisonwood in the lower Keys. Oviposition occurs on the larger diameter woody parts of recently dead trees. Larval development apparently requires one year.

Leptostylopsis planidorsus (LeConte). — Although it occurs throughout the southeastern U.S., this species apparently has no recorded host. We have reared a single female from trunk sections of river birch (*Betula nigra* L.) cut in Whitehall Forest (RHT), and 3 specimens from dead vines (probably a *Vitis* sp.) collected on Key Largo (FTH). Adults were beaten by F. Hovore and R.L. Penrose from *Ulmus* sp. near Enterprise, Volusia Co., Florida.

Leptostylopsis terraecolor (Horn). — Craighead (1923) described the larva of this common species from specimens taken from seeds of *Rhizophora mangle*, and Dillon (1965a) listed mastic and shortleaf fig (*Ficus citrifolia* Mill.) as hosts. We found *L. terraecolor* to be extremely abundant on fire-killed woody vegetation on Key Largo in May, 1977, and on slash in and about the Everglades National Park in May, 1978. Subsequently, specimens have been reared from woody parts of dead poisonwood, wild tamarind, Jamaica dogwood, grape (*Vitis* sp.), strangler fig, gumbo limbo and red mangrove. Specimens have also been reared from dead wood of Florida privet (*Forestiera segregata* (Jacq.) Krug and Urban) collected on Sanibel Island, Florida (Lee Co.). If Zayas (1975) interpretation of *L. incrassatus* (Klug) is correct. *L. terraecolor* would be a junior synonym of that species.

Styloleptus b. biustus (LeConte). — This species has been the subject of considerable taxonomic confusion in the literature, and many of the records attributed to it probably refer to other genera and species. Recorded hosts include such disparate plants as Cassava (Wolcott, 1933), "dried-up pomengranate" (Riley, 1880) and Norway spruce (Kirk and Knull, 1926). However, the majority of records have been from various hardwood species

(Hubbard, 1885; Craighead, 1923; Löding, 1945; Fattig, 1947; and Kirk, 1969, among others). In Florida we have reared it from limbs and trunks of dead strangler fig (near Andytown, Broward Co.), poisonwood (Key Largo) and *Ilex* (near Old Town).

Styloleptus minuens (Hamilton). — This species was originally described (1896) from material beaten from dead vines of *Melothria pendula* L. We have beaten specimens from dead *Metopium* in Miami and from freshly cut, down-hanging branches of *Zanthoxylum fagara* (L.) Sarg. in Grossman Hammock (both Dade Co., Florida), and collected numerous individuals at light in the Everglades National Park. F. Hovore reared a single specimen from dead twigs of gumbo limbo from Key Largo. *Lethes israeli* Zayas (1975), based upon the original description and figure, is very close to, if not synonymous with, this species.

Nyssodrysina haldemani (LeConte). — Chemsak and Linsley (1975) recorded the range of this species as extending from the eastern U.S. to Panama, but Craighead's (1923) description of the larva from *Celtis* apparently represents the only recorded host data. We have reared large numbers of *N. haldemani* from strangler fig taken near Andytown, Florida, and E.F. Giesbert (pers. comm.) has reared it from gumbo limbo from Miami.

Sternidius schwarzi (Hamilton) (=*Sternidius moderator* (Casey): NEW SYNONYMY. — Species in this genus have had a history of taxonomic confusion and misidentification, and although numerous host plant records for southeastern species of "*Leiopus*" exist in the literature, it is difficult to associate them within modern species concepts. The "*Liopus* (sic) *punctatus*" of Craighead (1923), by the range cited, may refer to *S. schwarzi*; if so, persimmon, *Ampelopsis, Cornus* and *Prunus* serve as hosts. Perry (1974) collected adults on *Morus* in Virginia (recorded as *moderator*), and we have taken mating pairs by beating freshly-cut, down-hanging branches of wild tamarind on Key Largo. We have also reared numerous specimens from recently-dead limbs and trunks of Jamaica dogwood and poisonwood from Key Largo, and a few specimens from twigs of a *Rhus* sp. which had been girdled and killed by *Oncideres cingulatus* Say near Spring Hill, Florida (Pasco Co.). Forms assignable to both *schwarzi* and *moderator*, along with numerous intermediate specimens, occur throughout our material.

Urgleptes kissingeri Dillon. — This diminutive species is evidently known only from sothern Florida, and its host is unrecorded. On Key Largo we have beaten adults from dead portions of lantana (*Lantana involucrata* L.), wild tamarind and other hardwoods, and reared specimens from sections of decadent and dead Jamaica dogwood. Further study will undoubtedly show this species to be synonymous with *U. foveatocollis*

(Hamilton); Dillon (1956b) included *foveatocollis* only as an "Incertae Sedis", making no attempt to compare it to his *kissingeri*, despite the fact that both were known from southern Florida.

Zaplous annulatus (Chevrolat). — Recorded only from Florida and Cuba (Linsley, 1935), this obscure little pogonocherine was recently collected in Georgia by R. Turnbow in Whitehall Forest. Single specimens (one of each sex) were taken in a malaise trap and a window trap in June, 1977. Turnbow also collected 3 specimens by beating living foliage of *Ilex* sp. in a recently cut over area near Old Town, Florida.

Ecyrus dasycerus floridanus Linsley. — Although the nominate form of *E. dasycerus* has been recorded from a number of hardwood species (Linsley, 1935), the subspecies *floridanus* apparently has no recorded host. We have taken it commonly at light and by beating slash in the Everglades National Park and on Key Largo, and the senior author has reared specimens from limbs of dead wild tamarind and poisonwood (Key Largo) and from cut limbs of strangler fig collected near Andytown, Florida. Material from Key Largo tends to be somewhat darker than that from the Everglades, and specimens from central Florida are difficult to align with either subspecies. Specimens phenotypically similar to *floridanus* have been collected as far north as Kite (Johnson Co.) in central Georgia, in association with turkey oak (*Quercus laevis* Walter) (RHT).

Ataxia crypta (Say). — This widespread lamiine has been recorded from an unusual array of plant species, including various hardwood trees (*Quercus, Castanea* and *Pyrus*) and a variety of herbaceous or shrubby plants (*Xanthium, Verbesina, Ambrosia, Thurberia, Smilax* and *Gossypium*) (Craighead, 1923). Earlier records may in part refer to *Esthologena hubbardi* (Fisher) described in 1924) which commonly infests annual plants. In the Florida Keys we have found *A. crypta* breeding in the dead, woody trunks of cut mastic.

Ataxia falli Breuning. — Craighead (1923) described the larva of this cryptic species (as *A. sulcata* Fall) from specimens taken from seeds of red mangrove. We have reared specimens from trunk sections of decadent Jamaica dogwood collected on Key Largo, and have beaten it from red mangrove and poisonwood in the same area.

Ataxia spinicauda Schaeffer. — This distinctive species is uncommon in U.S. collections, and although Zayas (1975) indicated that it is commonly collected in Cuba, apparently nothing is recorded of its habits. In May, 1978, A.E. Lewis took a single specimen at light on Key Largo, and in the following month the senior author beat a single female from slash of poisonwood at the same locality. This specimen was taken in company with *A. crypta* and *A. falli*. The slash had been cut during the preceding month.

Spalacopsis filum costulatum Casey. — Hamilton (1895; and 1896, in

Leng and Hamilton) recorded *Melothria pendula* as a host of this subspecies (as *S. linum* Duval) and Tyson (1973) cited a specimen beaten from *Calonyctium aculeatum* (*Ipomoea alba* L.). Adults of *S. f. costulatum* were abundant on slash piles east of the entrance to the Everglades National Park in June, 1978 (RHT); specimens have also been taken on fresh-cut wild tamarind at night, and on dead gumbo limbo (both Key Largo) (FTH). R. Turnbow reared a single female from buttonwood slash, collected near Flamingo in the Everglades National Park (Monroe Co.), the specimen emerging in July, 1977, from wood cut the preceding spring.

Spalacopsis stolata (Newman). — Craighead (1923) described a larva, presumably that *S. stolata*, from specimens taken from stalks of Jerusalem oak (*Chenopodium botrys* L.). Subsequently, specimens have been collected on *Verbesina* and *Flaveria linearis* Lag. (Tyson, 1973). In May, 1978, F. Hovore collected a specimen of *S. stolata* by beating dead gumbo limbo on Key Largo.

Mecas femoralis (Haldeman). — Although recorded from North Carolina to Florida, this species is rare in collections (Chemsak and Linsley, 1973). The authors and R.L. Penrose collected a series of *M. femoralis* flying about and resting on foliage of a small, grasslike *Aster* growing amidst mixed roadside vegetation in a sandhill-scrub oak community, 1-2 miles west of Archer, Florida (Alachua Co.).

Oberea gracilis (Fabricius). — The host and habits of this southeastern species apparently have not been previously described. In early June, 1978, R. Turnbow encountered adults of this species resting on and flying about young (less than 0.5 m. tall) white oaks (*Quercus alba* L.) and southern red oaks (*Q. falcata* Michx.) growing along highway 52 in Hall Co., Georgia. Subsequent observations indicated that *O. gracilis* has a 2-year life cycle in these seedling oaks. Oviposition occurs on the terminals of apparently healthy trees in May and June, and larvae mine down one side of the stem, becoming inactive with the onset of winter. The following spring, mining resumes, with the larva expelling frass through a linear series of round holes. In late June, the tree is girdled, approximately 10-15 cm. above the soil surface. This girdling kills the tree, at which time infested plants are easily recognized. Through the remainder of the year, mining continues down into the root collar, where the larva reverses itself and pupates. The dead portions of the tree distal to the girdle apparently break off during the following winter. Adults emerge, probably through the frass plug at the girdle site, late in the second spring.

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CORIXIDS (HEMIPTERA:HETEROPTERA) ATTRACTED TO AUTOMOBILE ROOF[1]

Carl W. Schaefer[2], Molly I. Schaefer[3]

On July 13, 1978, a hot (ca. 90 F), dry, clear, moderate breezy day, we were collecting just off Arizona State Rte. 61, in Apache Co., about three miles west of the New Mexico border. About a dozen *Hesperocorixa laevigata* (Uhler) flew to the automobile (a turquoise-blue Datsun) over the course of an hour, hitting its roof, often hard enough to be stunned. We collected nine of these insects. We assume the corixids mistook the glare from the automobile for water, and landed heavily to penetrate what they took to be the surface film.

Although there had been flood rains earlier in the Spring, no rain had fallen for at least a week previous. We saw no standing water that day, but the area has water, the Rio Puerco running to the north and the Little Colorado to the south; and the junction near by of several important highways suggests the presence of permanent wells.

We believe the corixids were seeking new waters to colonize. The need to migrate was probably intensified by population pressure, the heavy rains of the previous Spring having provided more than the usual amount of habitat.

Other insects have been similarly confused. The hydrophilid, *Helophorus brevipalpis* Bedel, has been reported attracted to automobile roofs in large numbers (Benham, 1976; Last, 1976); and here in Connecticut several species of mayfly have been seen swarming over an automobile roof (R. Pupedis, pers. comm., 1979). Indeed, in 1932, several thousand corixids, *Arctocorixa nitida* Fieber, plummeted onto "the bright top of the new auto," many of them striking it upside-down and then making swimming motions (Fattig, 1932). Doubtless other records, published and unpublished, exist.

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[1] Received August 20, 1979

[2] Biological Sciences Group, Univ. Conn., Storrs, Conn. 06268

[3] Warrenville Rd., Mansfield Center, Conn. 06250

LECTOTYPE DESIGNATIONS AND REDESCRIPTIONS FOR TWO SPECIES OF NORTH AMERICAN *ATRICHOPOGON* (DIPTERA:CERATOPOGONIDAE)[1]

Willis W. Wirth[2]

ABSTRACT: Lectotypes are designated for *Atrichopogon websteri* (Coquillett) and *A. peregrinus* (Johannsen) and the species are redescribed and illustrated.

Because of the difficulty of determining species of the genus *Atrichopogon* Kieffer from external characters, it is almost essential that descriptions be made at least in part from slide-mounted material. The purpose of this brief note is to select lectotypes for two species described in less complex times from pinned material and to present redescriptions based on characters best seen in slide mounts.

Atrichopogon websteri (Coquillett)
(Fig. 1)

Ceratopogon websteri Coquillett, 1901: 603 (female; Louisiana).

Atrichopogon websteri (Coquillett); Thomsen, 1937: 63 (combination; immature stages; habits); Boesel and Snyder, 1944: 42 (in key to larvae and pupae); Johannsen, 1952: 156 (*websteri* of Thomsen, not Coquillett, in key); Wirth, 1952: 123 (male female redescribed; figs.; distribution); Boesel, 1973: 207 (male, female redescribed; Ohio).

Types. — Described from four females from Ashwood, Tensas Parish, Louisiana, 17.iv.1887, F.M. Webster (Type no. 5467, USN,). One pinned syntype has been lost off the point. Two of the remaining three syntypes have been mounted on slides, and one of these has been labeled Lectotype. From it the following notes are made:

Female. — A relatively small species for *Atrichopogon*, length 1.1 mm; wing damaged, length not measured. Eyes broadly contiguous, pubescent. Antenna (fig. 1a) with lengths of flagellar segments in proportion of 27-20-20-18-18-19-19-19-50-50-54-54-73; antennal ratio 1.75, last segment with apical papilla short and tapering, not subapically constricted. Palpus (fig. 1b) with lengths of segments in proportion of 10-30-50-26-22; palpal ratio 3.1; third segment slightly swollen, spindle-shaped, with moderately deep round sensory pit. Proboscis short; mandible (fig. 1d) slender and pointed, with 20 fine teeth, the teeth somewhat smaller toward tip. Mesonotum with distinct impressed translucent lines (fenestrae); scutellum with four marginal bristles and 2-4 small setae. Hind tarsal ratio 2.8. Wing as in fig. 1c. Spermatheca (fig. 1e) single, short oval with short slender neck, measuring 0.101 mm by 0.072 mm. Membranes of face and pleural membrane of abdomen with close-set microscopic black spicules set in lines as in fig. 1f.

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[1] Received July 18, 1979

[2] Systematic Entomology Laboratory, IIBIII, Agric. Res., Sci. & Educ. Admin., USDA, c/o U.S. National Museum, Washington, D.C. 20560

Male. — Genitalia (fig. 1g) with ninth sternum transverse on posterior margin, bearing about ten long caudomesal setae arranged in a line along margin. Aedeagus with rounded caudomedial point and a single deep fold on each side in the posterior margin of the rounded caudolateral portion.

New Records. — ILLINOIS: Cairo, 14 June 1961, R.B. Selander, on caged *Epicauta*, 5 males, 7 females.

Discussion.— Wirth's (1952) description of this species from California applies to a closely related species or a complex of species. *A. websteri* can readily be distinguished by its pubescent eyes; relatively short antenna; shining, blackish brown mesonotum and scutellum, the former with conspicuous sublateral translucent lines (fenestrae) extending from humeri to ends of scutellum; mandible with rather uniform small teeth, and a single ovoid spermatheca with short slender neck. A diagnostic character is the pattern of microscopic spicules arranged in close-set lines on the abdominal pleura, and in short linear patches on the facial membranes.

I am indebted to R.B. Selander of the University of Illinois for the following notes on his collection of the specimens reported above: "The collection was made in the city park in Cairo, Alexander Co., Illinois, June 14, 1961, about an hour before dusk. I had some cages of live adult meloids sitting on a park table. In the cage containing *Epicauta fabricii* I noticed some tiny flies buzzing around and alighting on the bodies of the beetles. In a cage next to this cage I had some *Nemognatha nemorensis*, but these were not bothered. In another cage containing *Epicauta lemniscata* I saw a few of the flies but most of the flies were attracted to the *E. fabricii* cage. At first I thought the flies had been in the cage since the beetles were collected, but by collecting the specimens periodically, I determined that the flies were definitely coming in to the cages in the park."

In Europe Görnitz (1937) reported *Atrichopogon brunnipes* (Meigen), along with *Notoxus* beetles, *Perilitus* wasps, and *Anthomyia* flies, attracted to the blister-beetle extract cantharidin. *A. brunnipes* is closely related to *A. websteri*, differing notably in its longer proximal antennal segments, hairier wings, more tapering neck on the spermatheca, and distinct caudomedial excavation on the male ninth sternum (Havelka, 1976).

Atrichopogon peregrinus (Johannsen)
(Fig. 2)

Ceratopogon peregrinus Johannsen, 1908: 266 (female; New York).

Types. — Described from an unspecified number of females from Old Forge, New York. Johannsen's syntype series was borrowed from Cornell University through the courtesy of L.L. Pechuman. There were seven pinned females labeled "Old Forge, N.Y., Aug. 1905, J.G. Needham." Johannsen had selected one female and labeled it "Holotype, Cornell U. No.

2287". This specimen is hereby designated "Lectotype." Johannsen labeled the remaining specimens paratypes, nos. 2287-2 to 2287-7. Of these I mounted the two in best condition on microscope slides in Canada balsam and with Dr. Pechuman's permission have retained specimen no. 2287-3 for the collection of the USNM. The four remaining pinned paratypes are somewhat damaged. The following notes are presented from the two slide-mounted paratypes:

Female. — A relatively large uniformly brownish species, wing length 1.55 mm, breadth 0.68 mm. Radial cells (fig. 2d) spacious, first radial cell 0.16 mm long, second radial cell 0.40 mm long; macrotrichia relatively slender and sparse on distal third of cells R5 and M1, at tip of cell M2, in mid portion of cell M4, and along posterior half of anal cell. Halter strongly infuscated. Eyes pubescent. Antenna (fig. 2a) short and stout, proximal segments slightly broader than long; lengths of flagellar segments in proportion of 36-25-25-25-25-25-25-25-60-60-65-65-92; antennal ratio 1.62. Palpus (fig. 2b) short, third segment relatively short and stout, sensory pit near tip, small and moderately deep, opening by a slightly smaller pore; lengths of segments in proportion of 25-45-45-35-32; palpal ratio 1.88. Mandible (fig. 2f) with 19 fine teeth, the distal teeth slightly stronger. Mesonotal fenestrae absent, scutellum with four primary bristles and about ten secondary hairs. Hind tarsal ratio 2.40. A single large ovoid spermatheca (fig. 2e) gradually tapering to a slender, slightly oblique neck; measuring 0.177 mm by 0.108 mm.

Male. — (Braddock Bay, New York). — Wing length 1.47 mm; breadth 0.43 mm; costal ratio 0.66. Antenna with lengths of last three segments in proportion of 77-63-86. Palpus as in fig. 2c. Hind tarsal ratio 2.68. Genitalia (fig. 2g): Ninth sternum with moderately deep, broadly V-shaped caudomedial excavation, three small setae on each side of the excavation near hind margin; ninth tergum broadly rounded caudad. Basistyle short and broad, simple; dististyle slightly longer than basistyle, nearly straight, gradually tapering to moderately slender, slightly bent, simple tip. Aedeagus as figured, posterior margin with well-developed, rounded medial lobe.

Distribution. — Northeastern North America from Alberta to Labrador and south to New York and Massachusetts.

Specimens Examined. —

ALBERTA: Brooks, 6.vii.1955, J.A. Downes, 1 female (Canadian National Collection). Kananaskis, Envir. Sci. Centre, 21.vii.1973, J.A. Downes, on dead insects, 4 females (CNC).

LABRADOR: Goose Bay, 14.viii.1950, J.J. Tibbles, 1 female (CNC).

MANITOBA: Churchill, 31.vii.1953, J.A. Downes, 1 female (CNC).

MASSACHUSETTS: Concord, 27.vii.1961, W.W. Wirth, swept near marshy pond, 1 female.

NEW YORK: Braddock Bay, Monroe Co., 12.vi.1963, W.W. Wirth, near marsh, 1 male, 2 females. Brantingham Lake, Lewis Co., 22.vi.1963, W.W. Wirth, lake margin, 2 females. Portageville, Genesee River, 13.vi.1963, W.W. Wirth, 1 female. Ringwood Reserve, Tompkins Co., 16-17.vi.1963, W.W. Wirth, from swamp, 1 female.

ONTARIO: Algonquin Park, 20.vi.1958, J.A. Downes, on dead insect, 3 females (CNC); 25.vi.1966, S. Smith, spider web, 1 female (CNC); 8.vi.1960, W.W. Wirth, 1 female.

QUEBEC: Gatineau Park, 22.vi.1966, S. Smith, on spider web, 1 female (CNC). Hull, 10.viii.1965, Malaise trap, 1 female. Rowanton Depot, 1.viii.1954, J.A. Downes, 1 female (CNC).

Discussion.— This large, uniformly dark brown species is readily distinguished by its robust build, pubescent eyes, moniliform proximal antennal segments and relatively short distal segments, short and relatively stout third palpal segment with shallow round pit, rather uniform sized, numerous distinct mandibular teeth; broad, rather hairy wing; dark halter; numerous fine hairs on the scutellum; lack of mesonotal fenestrae, and large ovoid spermatheca tapering to slender, slightly oblique neck.

In Boesel's (1973) key this species will run to *A. titanus* Boesel in couplet 4. The species Boesel keyed out as *peregrinus* is a smaller species, wing length 1.30-1.46 mm, mesonotum and scutellum blackish brown, the former without fenestrae or impressed lines, the latter with 4 marginal bristles and 10 secondary hairs; antennal ratio 2.1, proximal segments transverse; legs olive to light brown; wind with second radial cell 2.2 times length of first; macrotrichia present on about 2/3 of cell R5, in cell M1, M2, and sparsely or not at all in cells M4 and anal cell. Characters of the palpal pit, mandibular teeth and spermathecae were not stated, but the short transverse proximal antennal segments and general features of coloration, vestiture, wing venation and macrotrichia indicate that Boesel's *peregrinus* is probably *A. lucorum* (Meigen) or another species of the subgenus *Meloehelea. A. titanus* is apparently close to *peregrinus* but differs according to the characters given by Boesel by its larger size (adjusted wing length 1.7 mm), bare eyes, antennal ratio 2.0, wing with numerous macrotrichia on apical and posterior third; intercalary fork (veins R4+5 of (Boesel) distinctly petiolate but anterior branch of fork weak; second radial cell 2.0 times length of first.

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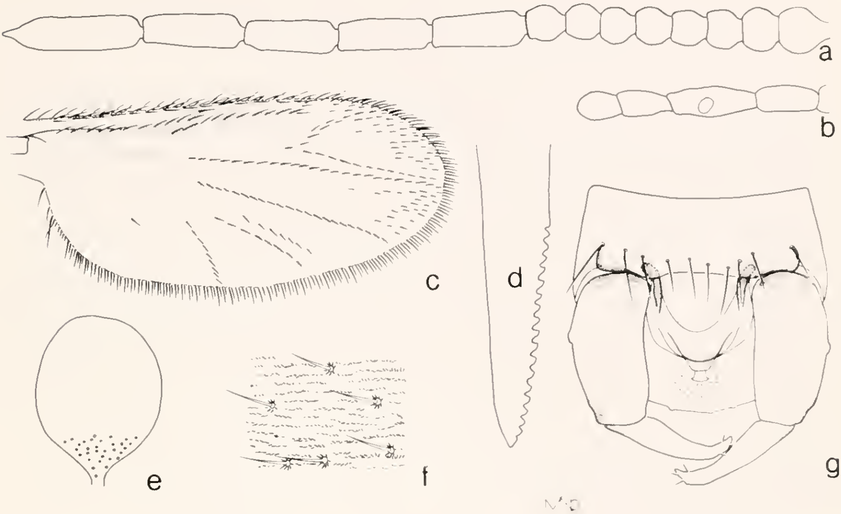

Fig. 1. *Atrichopogon websteri*, a-f, female; g, male: a, antenna; b, palpus; c, wing; d, mandible; e, spermatheca; f, detail of spicules on integument of pleural membrane of abdomen; g, genitalia.

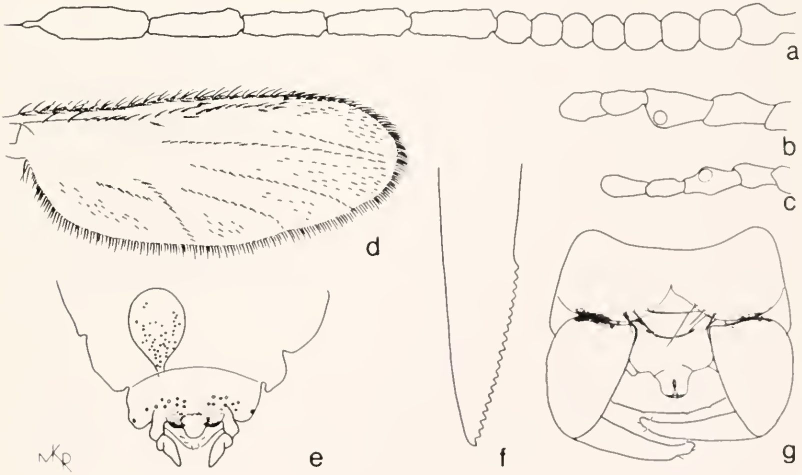

Fig. 2. *Atrichopogon peregrinus*, a-b, d-f, female; c, g, male: a, antenna; b-c, palpus; d, wing; e, genital sclerotization and spermatheca; f, mandible; g, genitalia.

THYSANOPTERA ASSOCIATED WITH HORSERADISH IN ILLINOIS[1]

Charles Gerdes[2]

ABSTRACT: Twelve species of Thysanoptera were identified from horseradish grown in Illinois over a three year period. Four species were of known or potential economic importance and were recorded from other crucifers in Illinois.

The first survey of insects on horseradish in Illinois was by Petty (1955), who examined the crop from 1947 to 1954 and collected two species of Thysanoptera, *Thrips tabaci* Lindeman and *Frankliniella tritici* (Fitch). From 1976 to 1978 another study by the Illinois State Natural History Survey (INHS) resulted in the collection of 12 species of thrips.

Horseradish is a crucifer and constitutes one species. However, it has been known by at least six scientific names (Petty 1955). According to Fosberg (1966) the correct scientific name is *Armoracia rusticana* Gaertner, Meyer, and Scherbius.

METHODS

Most of the thrips were taken from the southwestern Illinois counties of Madison and Saint Clair, the largest area of commercially grown horseradish in the United States. The remainder were taken from test plots of the University of Illinois near Urbana. A total of more than 150 samples were taken from 1976 to 1978. Samples were made at least three times monthly from May to November. The number of samples containing thrips and their range of months of collection were as follows: 1976, 4 samples, May-October; 1977, 11 samples, May-November; 1978, 21 samples, June-October.

The samples were collected as leaf washes by D.W. Sherrod, Research Assistant, INHS. Each sample consisted of 10 leaves, which were placed in a plastic bag for transport. The contents of each bag were placed in a bucket 1/3 filled with water to which one or two drops of detergent were added. With a secure lid the bucket was shaken by hand. The inside of the lid and bucket walls were washed with alcohol to remove all arthropods and decrease suds. The contents of the bucket were poured onto a 100-mesh sieve, from which the arthropods were washed into alcohol and separated.

Most of the thrips were mounted in balsam by the author but many of the females of *Thrips tabaci* were preserved in alcohol. All were determined by the author except for 24 specimens determined by L.J. Stannard, Professor Emeritus, INHS. All were stored in the INHS museum.

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[1] Received August 31, 1979

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

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RESULTS AND DISCUSSION

1. *Thrips tabaci* Lindeman

This species was the most numerous and appeared throughout the growing season (Table 1). Chittenden (1919) reported the onion thrips, *Thrips tabaci*, from the following crucifers but not from horseradish: mustard, cabbage, cauliflower, kale, and turnip, which are all in the genus *Brassica* Linnaeus. In addition INHS specimens were collected from Champaign Co., Illinois, May 1933, from an unidentified crucifer of the genus *Lepidium* Linnaeus. The onion thrips has been an occasional pest of horseradish in Illinois and could invade the crop from these crucifers or any of the other 17 families in Illinois from which it has been collected according to the INHS collection.

2. *Sericothrips variabilis* (Beach)

This species was the second most numerous and had the second greatest range of collection dates (Table 1). Specimens at the INHS museum were taken from at least 16 other families in Illinois but from no other crucifers in the Midwest. The occurrence of this species on horseradish may be of no economic importance. It is especially numerous on soybeans, from which it could easily disperse to many plants.

3. Species of potential economic importance

Frankliniella fusca (Hinds), *Frankliniella tritici* (Fitch), and *Anaphothrips obscurus* (Muller), were the third, fourth, and fifth most numerous species, respectively (Table 1). Specimens of these three species at the INHS museum were collected from 17, 34, and 8 other families in Illinois, respectively. Moreover, all three species were collected from an unidentified species of the crucifer of the genus *Crambe* Linnaeus from Tippecanoe Co., Indiana, July 1971. *Frankliniella tritici* was collected from black mustard, *Brassica nigra* Koch, from Carroll Co., Illinois, July 1947, and Stephenson Co., Illinois, May 1971. At present there is no evidence that these species are of economic importance on horseradish.

4. Minor species

According to the INHS collection none of the remaining seven species in Table 1 has been collected from other crucifers in the Midwest. *Aeolothrips bicolor* Hinds is primarily predacious, occurs throughout Illinois, and could prey on other thrips on horseradish. One aeolothripid larva, too damaged to identify to species, also was collected. The remaining six species, each represented by only one or two specimens, were probably transients. Their collection sites and typical hosts (Stannard 1968) were near the horseradish sites.

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Table 1. Collection data for Thysanoptera associated with horseradish in Illinois.

Species	Adult ♀	Adult ♂	Larvae	Months of Collection	Counties of Collection
Thirps tabaci Lindeman	260	1	8	V-XI	C,M,S
Sericothrips variabilis (Beach)	49	12	1	V-X	C,M,S
Frankliniella fusca (Hinds)	12	0	0	V	M,S
Frankliniella tritici (Fitch)	6	0	0	V,VII,IX	M
Anaphothrips obscurus (Müller)	3	0	0	VI	M,S
Frankliniella tenuicornis (Uzel)	2	0	0	VI,VIII	C,M
Frankliniella unicolor Morgan	1	1	0	VI,IX	S
Pseudodendrothrips mori (Niwa)	2	0	0	VIII,X	M,S
Thrips physapus Linnaeus	2	0	0	V	M
Aeolothrips bicolor Hinds	1	0	0	V	M
Pseudothrips inequalis (Beach)	1	0	0	V	S
Thrips winnemanae Hood	1	0	0	VIII	M

V = May, VI = June, VII = July, etc. C = Champaign, M = Madison, S = Saint Clair.

NEW RECORD AND HOSTS FOR GENUS NR. *PHYCOIDELLA* SAETHER (DIPTERA: CHIRONOMIDAE:ORTHOCLADIINAE)[1]

Selwyn S. Roback[2]

Gordon, Swan and Paterson (1978) recorded specimens of a genus nr. *Phycoidella* Saether (1971) from between the demibranchs of *Anodonta cataracta* Say from New Brunswick, Canada. These larvae appeared to be in the first instar. Efforts to rear these or find possible later instars outside the host mollusc have, to date, been unsuccessful.

Recently Mr. Malcolm F. Vidrine of the University of Southwestern Louisiana, while collecting parasitic *Unionicola* mites from Mollusca, found larvae that appeared to be the above species between the demibranchs, and between the demibranchs and the body of several genera and species of Unionidae. These unionids were collected from 12-mile Creek at LA. Rt. 1045, St. Helena Parish, Louisiana, by Mr. Vidrine and his family. Thanks to the kindness of Dr. Paterson, who sent me larvae found in *A. cataracta* from Lake Morice, N.B., I was able to confirm the identity of the Louisiana specimens with those from New Brunswick. I am also indebted to Mr. Vidrine and Mr. D.J. Bereza (ANSP) for data on the creek as well as the identification of the unionid species involved, and to the Department of Limnology and Ecology, Acad. Nat. Sci. Phila. for support from its research funds.

The presence of these larvae in Louisiana appears to represent a considerable jump in distribution, but this may be more apparent than real. These larvae are very small (about 0.75 mm) and would not be readily noticed by anyone not specifically searching for parasites between the demibranchs of the mollusks. They very likely occur at many localities between New Brunswick and Louisiana.

Habitat — 12-mile Creek is 15-20' wide and 0.5-3.0' deep. The water is clear and cool and the bottom is sandy with medium to fine gravel. The water flow was moderate. There are extensive beds of *Vallisneria* sp. with mud and sand. The highest concentrations of mussels were in the *Vallisneria* beds.

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[1] Received for publication September 28, 1979

[2] Department of Limnology, Academy of Natural Sciences of Philadelphia, 19th and the Parkway, Philadelphia, Pa. 19103.

Hosts — The larvae of genus nr. *Phycoidella* were found between the demibranchs of the following Unionidae:

Anodonta imbecillis Say
Elliptio beadliana (Lea)
Fusconaia sp.
Lampsilus claibornensis (Lea) (=*straminea*)
Villosa vibex (Conrad)

Strophitus subvexus? (Conrad) was also found, but the single specimen collected was not infested.

Larva — The presumed instar I larva has a body length (caudal head margin - apex of A.X) of about 790μ. The head (Fig. 1) is 85μ long by 51μ wide. In dorsal view the sides are parallel. The head depth is 35μ. The first antennal segment is about 8.5μ long, the apical segments (apparently 3) are not clearly discernible. The blade appears as long as the flagellar segments. The mandible (Fig. 2) is about 25μ long and possesses a comblike row of preapical setae and a long apical tooth. It is somewhat suggestive of that found on some species of *Psectrocladius*. The ventromentum (Fig. 3) appears clear with a small number of dorsomental teeth on each side. The anterior prolegs (Fig. 1) possess 4-5 large apical claws and some smaller claws on the shaft.

There were up to 25 larvae per demibranch pair.

Figures 1-3. Genus nr. *Phycoidella*. Fig. 1 - larval head and first thoracic segment, lateral; Fig. 2 - larval mandible; Fig. 3 - larval mentum.

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A CHECKLIST OF THE STONEFLIES (PLECOPTERA) OF VIRGINIA[1]

Boris C. Kondratieff, J. Reese Voshell, Jr.[2]

ABSTRACT: This first comprehensive list of the stoneflies of Virginia records 116 species, including 40 new state records. An additional 21 species that are believed to occur in the state, but have not yet been collected, are also listed. The diversity of biotic associations resulting from the geographic position of the state is probably responsible for the large number of species. The literature containing records of stoneflies and the most applicable taxonomic works for identifying stoneflies from Virginia are reviewed.

From 1976 to 1979 we collected adult stoneflies from many sites in Virginia as part of an ongoing survey of the aquatic insects of the state. This checklist is the first comprehensive summary of the stoneflies of Virginia. Smrchek (1973) listed 70 species from the state, but many of her records were obtained from the literature, and many of her species determinations were based on larvae. Previous records of stoneflies in Virginia are scarce and scattered in the literature. There is no single comprehensive reference which can be used to identify all of the species of stoneflies occurring in Virginia. The fauna of Virginia includes many species which are not included in taxonomic works for other states such as Connecticut (Hitchcock, 1974), Florida (Stark and Gaufin, 1979), Illinois (Frison, 1935), and Pennsylvania (Surdick and Kim, 1976). In addition, several new species that occur in Virginia have recently been described (Kondratieff and Voshell, 1979; Nelson and Kondratieff, in press). Therefore, the purpose of this paper is to provide a complete and up-to-date checklist of the stoneflies of Virginia so that workers in this geographic area can determine the applicability of existing taxonomic literature.

In this checklist we follow the classification of Zwick (1973) as reviewed by Baumann (1976). A total of 9 families, 40 genera, and 116 species are included that have been collected or examined by the authors or that have been reported from Virginia in reliable literature sources. Forty new state records are indicated by #. Species that we have not yet collected, but are reported from Virginia in the literature, are indicated by *. In addition to the 116 species that have been confirmed to occur in Virginia, this checklist includes 21 species that we believe to occur in Virginia because they have been reported in adjacent states; these are indicated by Δ, and the states where they have been collected are listed in parentheses.

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[1] Received August 8, 1979

[2] Department of Entomology, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061

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The 116 species reported herein from Virginia is among the highest number of species reported from a single state in the United States. The number of species occurring in Virginia is approximately the same as that reported by Gaufin and Ricker (1974) for Montana (119). Considerably fewer species have been reported in several southern states: Florida - 26 species (Stark and Gaufin, 1979); Louisiana - 24 species (Stewart, et al., 1976); Texas - 28 species (Szczytko and Stewart, 1977). Fewer species have also been reported in two northeastern states: Connecticut - 74 species (Hitchcock, 1974); Pennsylvania - 90 species (Surdick and Kim, 1976). In the adjacent state of West Virginia various authors (Farmer and Tarter, 1976; Hissom and Tarter, 1976; Kirchner, 1978; Steele and Tarter, 1977; Tarter, et al., 1975; and Tarter, et al., 1976) have reported at least 95 species.

The richness of stonefly species in Virginia is probably indicative of the favorable biogeographic position that the state occupies on the eastern seaboard of the United States. The most complete discussion of biogeography in Virginia can be found in Hoffman (1969). He wrote that "the state embraces no less than five of the major physiographic provinces of eastern United States, with a resultant diversity of topography and habitat types", and that "through the combination of latitudinal location (36.30 to 39.30 N) and a considerable range of vertical relief (sea level to 5,720 feet), a variety of biotic associations determined primarily by climatic factors is found within the political boundaries of Virginia." In addition, there are eight river basins in Virginia, several of which are components of old and geographically significant river systems. The richness of the state fauna is illustrated by two significant range extensions reported in this checklist. *Alloperla idei* was previously reported only from Quebec, and *Allocapnia illinoensis* was previously reported only from Illinois, Maine, Minnesota, New York, Ohio, Ontario, Quebec, and Wisconsin. In summary, it appears that Virginia is a most interesting location for taxonomic and distributional studies of stoneflies and other aquatic insects.

Specimens were examined from the collections of Virginia Polytechnic Institute and State University, the United States National Museum, and Mr. Ralph F. Kirchner. The following references contain records of stoneflies from Virginia: Banks (1904); Baumann (1973, 1974, 1975); Claassen (1931); Frison (1935, 1942); Hanson (1941); Harden and Mickel (1952); Hitchcock (1974); Illies (1966); Needham and Claassen (1925); Ricker (1949, 1952); Ricker and Ross (1968, 1975); Ross and Ricker (1971); Stark and Gaufin (1974, 1976a, 1976b); and Zwick (1973). The taxonomic works that are most applicable for identifying stoneflies collected in Virginia are: Frison (1935, 1942); Hanson (1941); Hitchcock (1974); Needham and Claassen (1925); Ricker (1952); Ricker and Ross (1968, 1975); Ross and Ricker (1971); Stark and Baumann (1978); and Stark and Gaufin (1976a, 1976b).

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Order Plecoptera, Suborder Arctoperlaria

Group Euholognatha
Superfamily Nemouroidea
Family Nemouridae

Subfamily Amphinemurinae

Amphinemura delosa (Ricker)
A. nigritta (Provancher)
A. wui (Claassen)

Subfamily Nemourinae

#*Ostrocerca albidipennis* (Walker)
Δ *O. complexa* (Claassen) (WV)
Δ *O. prolongata* (Claassen) (WV)
O. truncata (Claassen)
Paranemoura perfecta (Walker)
Prostoia completa (Walker)
P. similis (Hagen)
Shipsa rotunda (Claassen)
Soyedina carolinensis (Claassen)
S. vallicularia (Wu)
Δ *Zapada chila* (Ricker) (TN)

Family Taeniopterygidae

Subfamily Brachypterinae

Bolotoperla rossi (Frison)
Oemopteryx contorta (Needham and Claassen)
Strophopteryx appalachia Ricker and Ross
S. fasciata (Burmeister)
S. limata (Frison)
Taenionema atlanticum Ricker and Ross

Subfamily Taeniopteryginae

Taeniopteryx burksi Ricker and Ross
Δ *T. lita Frison* (NC, TN)
T. lonicera Ricker and Ross
T. maura (Pictet)
T. metequi Ricker and Ross
T. parvula Banks
T. ugola Ricker and Ross

Family Capniidae

Allocapnia aurora Ricker
Δ *A. brooksi* Ross (TN)
A. curiosa Frison
Δ *A. forbesi* Frison (TN, WV)
A. frisoni Ross and Ricker
Δ *A. fumosa* Ross (NC, TN)
A. granulata (Claassen)
A. illinoensis Frison
A. loshada Ricker
* *A. maria* Hanson
* *A. mystica* Frison
A. nivicola (Fitch)
A. pygmaea (Burmeister)
A. recta (Claassen)
A. rickeri Frison
Δ *A. stannardi* Ross (NC, TN)
A. virginiana Frison
* *A. vivipara* (Claassen)
A. wrayi Ross
A. zola Ricker
Nemocapnia carolina Banks
Paracapnia angulata Hanson

Family Leuctridae

Subfamily Megaleuctrinae

Megaleuctra flinti Baumann
Δ *M. williamsae* Hanson (TN)

Subfamily Leuctrinae

Leuctra alexanderi Hanson
L. biloba Claassen
L. carolinensis Claassen
L. duplicata Claassen
L. ferruginea (Walker)
L. mitchellensis Hanson
L. monticola Hanson
Δ *L. nephophila* Hanson (NC, TN)
L. sibleyi Claassen
L. tenuis (Pictet)
L. triloba Claassen
L. truncata Claassen
L. variabilis Hanson
Paraleuctra sara (Claassen)

Group Systellognatha
Superfamily Pteronarcyoidea
Family Pteronarcyidae

Allonarcys biloba (Newman)
A. comstocki (Smith)
A. proteus (Newman)
A. scotti (Ricker)
Pteronarcys dorsata (Say)

Family Peltoperlidae

Subfamily Peltoperlinae

- *Peltoperla arcuata* Needham
- *P. maria* Needham and Smith
- Δ *Viehoperla zipha* (Frison) (NC)

Superfamily Perloidea
Family Perlodidae

Subfamily Isoperlinae

- *Isoperla bilineata* (Say)
- *I. clio* (Newman)
- # *I. dicala* Frison
- *I. holochlora* (Klapalek)
- *I. lata* Frison
- *I. marlynia* Needham and Claassen
- # *I. namata* Frison
- # *I. orata* Frison
- *I. signata* (Banks)
- *I. similis* (Hagen)
- *I. slossonae* (Banks)
- Δ *I. transmarina* (Newman) (WV)

Subfamily Perlodinae

- *Cultus decisus* (Walker)
- *Diploperla duplicata* (Banks)
- *D. morgani* Kondratieff and Voshell
- # *D. robusta* Stark and Gaufin
- *Helopicus subvarians* (Banks)
- *Isogenoides hansoni* (Ricker)
- *Malirekus hastatus* (Banks)
- # *Remenus bilobatus* (Needham and Claasen)
- # *Yugus arinus* (Frison)
- *Y. bulbosus* (Frison)

Family Chloroperlidae

Subfamily Chloroperlinae

- Δ *Alloperla aracoma* Harper and Kirchner (WV)
- # *A. atlantica* Baumann
- # *A. banksi* Frison
- *A. biserrata* Nelson and Kondratieff
- # *A. caudata* Frison
- # *A. chloris* Frison
- # *A. concolor* Ricker
- # *A. idei* (Ricker)
- *A. imbecilla* (Say)
- # *A. nanina* Banks
- Δ *A. neglecta* Frison (NC, TN)
- *A. usa* Ricker
- *Hastaperla brevis* (Banks)
- # *Suwallia marginata* (Banks)
- # *Sweltsa lateralis* (Banks)
- *S. mediana* (Banks) (NC,TN)
- *S. naica* (Provancher)
- # *S. onkos* (Ricker)
- # *S. urticae* (Ricker)
- Δ *Rasvena terna* (Frison) (TN, WV)

Family Perlidae

Subfamily Acroneuriinae

- *Acroneuria abnormis* (Newman)
- *A. arenosa* (Pictet)
- Δ *A. arida* (Hagen) (TN)
- *A. carolinensis* (Banks)
- *A. evoluta* Klapalek
- *A. filicis* Frison
- *A. flinti* Stark and Gaufin
- Δ *A. internata* (Walker) (WV)
- *A. lycorias* (Newman)
- Δ *A. perplexa* Frison (WV, TN)
- *Attaneuria ruralis* (Hagen)
- *Eccoptura xanthenes* (Newman)
- *Perlesta placida* (Hagen)
- Δ *P. frisoni* Banks (NC, WV)
- *Perlinella drymo* (Newman)
- # *P. ephyre* (Newman)

Subfamily Perlinae

- Δ *Neoperla choctaw* Stark and Baumann (WV)
- # *N. freytagi* Stark and Baumann
- *Paragnetina fumosa* (Banks)
- *P. immarginata* (Say)
- *P. media* (Walker)
- *Phasganophora capitata* (Pictet)

USE OF A HAND SPRAYER AS A COLLECTING TECHNIQUE[1,2]

William H. Clark, Paul E. Blom[3]

ABSTRACT: A method for collecting fast and agile arthropods in spiny plants that are difficult to reach using conventional collecting techniques is described. The method involves the use of an inexpensive hand sprayer and alcohol to immobilize the organism and long forceps for specimen retrieval.

During the past four years of collecting in Baja California, Mexico we have had difficulty with capture of various organisms in flowers and confined areas (i.e. in cactus spines, among *Agave* and *Yucca* leaves and among foliage of various shrubs). Speed and agility of spiders, flying Coleoptera, Diptera, Homoptera, Thysanura and other arthropods have necessitated the development of a method to immobilize the subject(s) until securing is possible. Such a method appears to have been overlooked by the standard works on the subject (for example: Beirne, 1955; Peterson, 1959; Knudsen, 1966; and Borror *et al.* 1976). Conventional methods in these situations have proven ineffective.

Materials and Methods

Using 70% isopropyl alcohol (strength can be altered depending on use) with a hand sprayer, we were able to immobilize organisms at a distance and then remove them from the plant surface with long forceps. These hand sprayers are inexpensive ($1-2, 1979) and are available in many stores and sold for use in cleaning automobile windshields, for misting and watering house plants, for spraying cleaning compounds, etc. The sprayer we found to be most useful in the field is one with a small, flat, "hip pocket" type of plastic bottle attached. This bottle will hold about 250 ml. of fluid and is approximately 8 x 13 cm in size with a maximum width of about 3.5 cm. The size and shape of the sprayer allows it to be carried in the hip pocket when not in use. Larger bottles may be attached to the sprayer if necessary. The adjustable nozzle of the sprayer allows for selection of either a steady stream or a spray mist, depending on particular requirements of the situation.

Results and Discussion

On past expeditions to Baja California we found the need for such a

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[3] Museum of Natural History, College of Idaho, Caldwell, Idaho 83605.

collecting technique. We found that dumping alcohol on certain insects in hard to reach places immobilized them. First we used any type of plastic bottle that we happened to have handy. These usually put out too large a stream of alcohol, and while giving some success they often washed the insects out of sight or reach. The range and acuracy of these bottles was also less than desirable.

We then decided to try the hand sprayer. In June-July 1979 this method proved very successful in collecting the above mentioned groups of insects in these hard to reach habitats. Topotypes of a new genus of pseudoscorpion were easily obtained from the area surrounding the basal portions of the central fruit stalks of *Yucca whipplei* compared with the very low capture efficiency of last year when collecting the type specimens. Small Buprestidae were collected from cactus flowers with ease by first spraying the flower with alcohol. All beetles within a flower could then easily be picked out with forceps. Only a fraction of the specimens could have been taken with more traditional collecting methods, as these beetles fly readily on disturbance and the flower is surrounded by cactus spines. The alcohol spray had no apparent ill effects on the cactus or other plants on which it was used. Various small and speedy insects, including leafhoppers and Diptera, have been collected on the leaves of the various *Yucca* species in Baja California and the southwestern U.S. with this method. These insects could not have been collected otherwise. The method worked well for insects on the various types of cacti present, as well as on other spiny plants. The method seems to work very well in these spiny environments where the traditional insect nets, beating sheets, forceps and aspirators can not reach and/or are too slow. The method may also prove useful in other less hostile habitats where especially fast and agile arthropods are a problem to collect.

Usually the liquid property of the alcohol mixture will hold the insect in place on a leaf, spine or stem even if it does not kill immediately. Occasionally the specimen may fall from its perch or slide down a main plant stem when hit with the spray. A small piece of fine mesh screen wire or a wire mesh strainer will help pick up the specimen. Once wet the specimen can usually be obtained with long (7 and 12") forceps.

ACKNOWLEDGMENTS

The authors thank Dr. Peter L. Comanor for field assistance in the early stages of the development of this collecting method and Dr. Robert D. Bratz for general assistance with the Baja California expeditions.

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ON THE IDENTITY OF *MOLANNA ULMERINA* NAVAS (TRICHOPTERA:MOLANNIDAE)[1]

Guenter A. Schuster[2,3]

ABSTRACT: A lectotype is designated for *Molanna ulmerina*, and the synonymy which results is given.

In the course of another study some Navas types of North American caddisflies were borrowed from the Akademie der Landwirtschaftswissenschaften of the Deutsches Entomologisches Institut of East Germany. The specimens included the type series of *Molanna ulmerina* Navas. This species was described in a relatively obscure journal (Navas, 1934), and the specimens are not readily available to North American caddisfly workers. Therefore, this note is offered at this time to make clear the true identity of *M. ulmerina.*

Examinations of the specimens resulted in the discovery that *Molanna musetta* Betten is a junior synonym of *ulmerina*. Both species were described in 1934, however, Navas' description appeared in February while Betten's was not published until December of that year. Navas (1934) described this species from four specimens (3 ♂, 1 ♀), but the series sent to me contained only three specimens (2 ♂, 1 ♀). It is assumed that the missing male specimen is still in the Deutsches Entomologisches Institut, and that it was overlooked when the specimens were sent on loan. One of the males sent to me has been designated as the lectotype and has been so marked by a red label reading "LECTOTYPE ♂, *Molanna ulmerina*/ Navas 1934 / G.A. Schuster 1979."

Molanna ulmerina Navas 1934, p. 23-24

Molanna musetta Betten 1934 (NEW SYNONYMY)

LECTOTYPE ♂. (Akademie der Landwirtschaftswissenschaften, Deutsches Entomologisches Institut, Eberswalde, DDR). Collection label: "Framingham (Mass) 1911 13 VI C.A. Frost"; green determination label: "det. Navas, S. J."; pink label "Tipo". Pinned through mesoscutum; both antennae missing beyond segment II; all right tarsi and left hind tarsus missing; 2/3 of right hind wing missing; abdomen broken off and cleared (stored in genital vial attached to pin).

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[1] Received July 14, 1979

[2] State Biological Survey of Kansas, 2045 Avenue A, Campus West, Lawrence, Kansas 66044.

[3] Present address: Dep't. of Biological Sciences, Moore 235, Eastern Kentucky Univ., Richmond, Ky. 40475

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In addition to his description, Navas illustrated the male fore wing and the female hind wing and gave measurements for both male and female specimens. An illustration of the male genitalia was given by Betten (1934) with his description of *M. musetta*. Ross (1944) also illustrated the male genitalia, and gave a diagnosis and the known distribution for the species.

ACKNOWLEDGEMENTS

I am grateful to Dr. Oliver S. Flint, Jr. for suggesting that I borrow the *M. ulmerina* specimens along with those I originally intended to study and for taking the time to search for the Navas paper. I am also thankful to Mr. Alex Slater and Mr. Steve Hamilton for critically reading the manuscript. I would also like to thank Dr. Gunther Petersen of the Deutsches Entomologisches Institut for allowing me to borrow the specimens.

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INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

The following Opinions have been published recently by the International Commission on Zoological Nomenclature in the *Bulletin of Zoological Nomenclature* Volume 36, part 2, 1 August 1979.

Opinion No.

1128: (p. 73) *Platyrchacus* Koch, 1847 (Diplopoda): designation of *Platyrhacus fuscus* Koch, 1847 as type species.
1130: (p. 79) *Lilioceris* Reitter, 1912 (Insecta: Coleoptera): correction of type species.
1134: (p.102) *Zerynthia* Ochsenheiver, 1816 (Insecta: Lepidoptera): conserved under the plenary powers.
1136: (p.107) *Cicadetta strepitans* Kirdaldy, 1909 (Insecta: Homoptera): conserved.
1137: (p.109) *Aphis gossypii* Glover, 1877 (Insecta: Homoptera): validated under the plenary powers.
1142. (p.125) Family group names based on *Platystoma* Meigen, 1803 given precedence over those based on *Achias* Fabricius, 1805 (Diptera).
1143. (p.130) *Kerrichiella* Rosanov, 1965 (Hymenoptera): designation of a type species under the plenary powers.
1144. (p.132) *Phloeotribus* (Coleoptera:Scolytidae) ruled to be a justified emendation of *Phloiotribus* Latreille, 1796.

The Commission regrets that it cannot supply separates of Opinions.

NEW NORTH AMERICAN DISTRIBUTION RECORDS FOR FOUR SPECIES OF STREPSIPTERA[1,2]

Victor Johnson[3], William P. Morrison[4]

ABSTRACT: New state records are reported for *Halictophagus acutus* Bohart from Georgia and Kentucky, *Caenocholax fenyesi* Pierce from Georgia and Arizona, *Elenchus koebeli* (Pierce) from Georgia and Kentucky and *Triozocera mexicana* Pierce from Kansas, Arizona, New Mexico, and Oaxaca, Mexico. The presently known distribution and hosts of these four species is given.

The known distribution of many North American Strepsiptera is very limited. New distribution records are most often obtained as a result of specimens being collected coincidental with other studies, as was the case with the records reported herein. While blacklight collecting in Georgia, Kentucky, New Mexico and Mexico, we obtained new distribution records for 4 species of Strepsiptera. Two new state records were found while examining the Strepsiptera collection at the University of Arizona.

Halictophagus acutus Bohart (Halictophagidae) was originally described from Tennessee, Louisiana, Pennsylvania, the District of Columbia and Atzcapolzalco, D.F., Mexico (Bohart 1943). All specimens were parasitizing *Draeculacephala* spp. (Cicadellidae). No mention of this species has been made in the literature since the original description.

We collected 1 male in Savannah, Georgia, September 28, 1971, with a blacklight trap. Five adult males were dissected from puparia on *Draeculacephala* spp. collected during September and October, 1975, in Lexington, Kentucky. Many additional male puparia, females and larvae were collected in Lexington. Some *Draeculacephala* specimens had multiple parasitism with one having six females and three males of *H. acutus*. The present distribution of *H. acutus* is given in Fig. 1.

H. acutus appears to be host specific — only parasitizing leafhoppers in the genus *Draeculacephala.* As this genus is widely distributed in the U.S., *H. acutus* probably occurs throughout much of the eastern U.S. This parasite appears to be a potentially useful control agent for *Draeculacephala.* During late summer 1975, some populations of these leafhoppers

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[1] Received June 12, 1979

[2] Contribution No. T-10-118, College of Agricultural Sciences, Texas Tech University.

[3] Department of Entomology, University of Kentucky, Lexington, Kentucky 40506.

[4] Department of Entomology, Texas Tech University, Lubbock, Texas 79409.

in Fayette County, Kentucky, had a majority of individuals parasitized by *H. acutus*. The percentage of parasitism varied locally, but the parasites were very common and parasitized leafhoppers could be found in almost all areas sampled.

Elenchus koebeli (Pierce) (Elenchidae) has been reported from Ohio (Pierce 1909), Louisiana (Khalaf 1968) and Mississippi (Khalaf 1969). We collected 14 males from Savannah, Georgia during July-October, 1971 and two males in Kentucky; 1 on August 22, 1975 in Pike County and 1 on July 16, 1971 in Larue County (collected by P.H. Freytag). This species is now known from Ohio, Louisiana, Mississippi, Kentucky and Georgia (Fig. 2). Bohart (1941) gives the host of *E. koebeli* as "various species of *Liburnia*".[5]

Caenocholax fenyesi Pierce (Myrmecolacidae) appears to be widely distributed in the Western Hemisphere. It has been reported from Mexico (Pierce 1909), Panama and Argentina (Bohart 1941), Florida (Meadows 1967), Louisiana (Khalaf 1968) and Mississippi (Khalaf 1969). We collected 13 males during July and August, 1971 in Savannah, Georgia. Additionally, one male from the Santa Rita Mountains, Madera Cn., Arizona collected July 28, 1960, is deposited in the University of Arizona collection. The present distribution of this species is given in Fig. 3. The host of *C. fenyesi* is unknown.

Triozocera mexicana Pierce (Mengeidae)[6] is the only known species of *Triozocera* in North America and the only genus of Strepsiptera known to parasitize Cydnidae (Hemiptera). It has previously been reported from Cordoba, Veracruz, Mexico (Pierce 1909), Texas (Bohart 1941), Mississippi (Khalaf 1968), Louisiana (Khalaf 1969), Florida (Meadows 1967), Kentucky (Johnson and Sperka 1972), Georgia (Johnson 1973), and Oklahoma (Shepard 1979). We collected one male at Tehuantepec, Oaxaca, Mexico, March 18/19, 1976 and one male at Las Cruces, New Mexico, July 28/August 3, 1975. In addition, the University of Arizona has several specimens of *T. mexicana* which were collected at Cochise Stronghold, Cochise County, Arizona, during the summer of 1970 by R.J. Shaw and 1 specimen from Riley County, Kansas, collected by R.L. Bertwell in May 1970. Besides these new state records, 47 male specimens were made available to us which were collected during July and August 1978, in Wichita Falls, Wichita County, Texas by J.C. Cokendolpher and K.M. Brown. These specimens represent a new Texas county record and are deposited in the Midwestern University Museum and Texas Tech

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[5] This genus is now referred to as *Delphacodes*.

[6] Whether *Triozocera* belongs in the family Corioxenidae or Mengeidae is controversial. Most North American literature places the genus in Mengeidae.

Fig. 1. **Distribution of *Halictophagus acutus* Bohart.** Closed squares indicate new distribution records and open squares previous records.

Fig. 2. **Distribution of *Elenchus koebeli* Pierce).** Closed squares indicate new distribution records and open squares previous records.

Fig. 3. Distribution of ***Caenocholax fenyesi*** Pierce. Closed squares indicate new distribution records and open squares previous records.

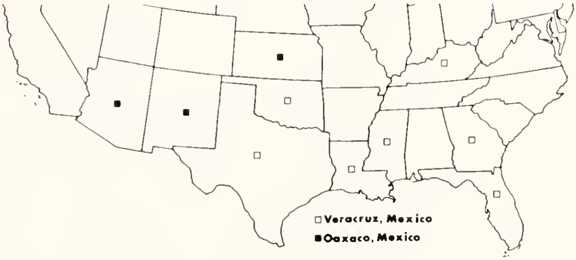

Fig. 4. Distribution of ***Triozocera mexicana*** Pierce. Closed squares indicate new distribution records and open squares previous records.

University insect collection.

T. mexicana is potentially economically important. It parasitizes *Pangaeus bilineatus* (Say) (Johnson 1973) which is a major pest of peanuts in Texas (Smith and Pitts 1974).

T. mexicana has now been reported from Mississippi, Louisiana, Florida, Georgia, Kentucky, Kansas, Texas, Oklahoma, New Mexico, Arizona, and the states of Oaxaca and Veracruz in Mexico (Fig. 4). It is probable that it occurs throughout the distribution area of the host, *P. bilineatus*, which is given by Froeschner (1970) as "across the eastern half of the United States from Massachusetts south to Florida and Bermuda, west to South Dakota, Nebraska, Kansas, Oklahoma, and Texas, thence through Arizona into southern California, and south into Mexico and Guatemala.".

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SUMMER MICROHABITAT DISTRIBUTION OF SOME CENTIPEDES IN A DECIDUOUS AND CONIFEROUS COMMUNITY OF CENTRAL OHIO (CHILOPODA)[1,2]

Richard E. Lee, Jr.[3]

ABSTRACT: Centipedes were collected in a deciduous and coniferous community of central Ohio during the summer of 1972. A total of four orders, six families, and at least 17 species of centipedes were collected. There are few major distributional differences between the deciduous and coniferous communities with regard to the chilopod fauna except for the genus *Garibius* which preferred coniferous habitat and *Sonibius numius*, which favored deciduous areas. Several distributional trends with regard to microhabitat were observed. *Scolopocryptops sexspinosus, Bothropolys multidentatus, Sonibius numius*, and the genus *Garibius* were found exclusively under the bark of dead trees. The two genera, *Nadabius* and *Sozibius*, were dominant in the litter microhabitat. A single specimen of *Zygethobius pontis* was taken which is the first report of this species in Ohio.

Previous workers (Wood, 1865; Bollman, 1893; Chamberlin, 1925; Crabill, 1955, 1958, 1960, and others) investigating North American centipedes have concentrated their efforts on a systematic and distributional investigation of this group. The Ohio chilopod fauna was surveyed by Williams and Hefner in 1928. Few studies, with the exception of Auerback (1951), have considered in detail the specific habitat distribution of centipedes. The purpose of this study was to determine whether or not there were distributional differences in chilopod fauna at two levels: 1) by comparing deciduous and coniferous communities; and 2) by comparing the bark and litter microhabitats within each community.

METHODS:

Collection site. All centipedes were collected at 4-H Camp Ohio, located 13 km east of Utica, Ohio, on the northern edge of Licking County (T.4N R.11W). Camp Ohio's 200 acres is situated on the easternmost extension of the glaciated portion of Ohio. Collections were primarily made on ravine and hillside areas, as this was the forested area of the study site. The second growth mixed hardwood forests are primarily composed of

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[1] Received June 12, 1979

[2] Senior Independent Study Project, Biology Department, College of Wooster, Wooster, Ohio 44691

[3] Present address: Department of Biology, University of Houston, Houston, Texas 77004

white oak (*Quercus alba* L.), sugar maple (*Acer saccharum* March.), American beech (*Fagus grandifolia* Ehrh.), and shagbark hickory (*Carya ovata* Kock). Two eastern white pine (*Pinus strobus* L.) plantations, planted approximately 65 years ago, provided the coniferous habitat for collections.

Procedure. Within the deciduous woods and the pine plantations, centipedes were hand collected from beneath the bark of dead trees and from leaf litter on the forest floor. Spraying with Carnoy's solution (3 parts ethanol: 1 part chloroform; 1 part glacial acetic acid) generally slowed the chilopods so that they could be picked up with forceps. Due to the fineness of the pine litter, all collections in this microhabitat were confined to Tullgren funnel extractions. Determinations were made using A.A.-Weaver's unpublished key to centipedes, College of Wooster, Wooster, Ohio.

RESULTS:

Summer collections totaled 654 specimens, of which one hundred were so immature as to be unidentifiable to the generic level. These collections included representatives of each of the four Nearctic orders of centipedes. The lithobiomorphs comprised the greatest number of both individuals (75.9%) and species (Table 1). Twelve species and the genus *Tidabius* represented this order. Geophilomorphs were represented by *Strigamia bidens* and *Arctogeophilus umbraticus*, while the Scutigeromorpha and the Scolopendromorpha were each represented by a single species.

A comparison (Table 1) of the relative numbers of centipedes from deciduous and coniferous communitues shows that 77.6% (n = 430) of the individuals were collected in deciduous areas. Within the deciduous sample, 64.2% (n = 276) of the specimens were collected under bark, while the remainder were taken from litter on the forest floor.

In the coniferous habitat, 109 specimens were collected under bark and only 15 in leaf litter. The paucity of specimens from pine litter is, at least partially, due to the difficulty of hand collecting in this microhabitat. Thus, the low number of specimens from this microhabitat is likely a result of inadequate collecting techniques rather than a true reflection of the chilopod fauna in this microhabitat.

Six species and one genus were found in relatively large numbers (Table 1). When these taxa are examined according to their microhabitats of leaf litter and bark, several distinct trends are evident (Table 2). All specimens of *Scolopocryptops sexspinosus, Bothropolys multidentatus, Sonibius numius* and the genus *Garibius* were found under the bark of dead trees. *Sozibius pennsylvanicus* and *Nadabius pullus* were disproportionately more abundant in litter (Table 2). *Arctogeophilus umbraticus* appeared to be distributed evenly between the two microhabitats.

Within the bark microhabitat certain distributional trends are evident with respect to the coniferous and deciduous habitats (Table 3). *S. sexspinosus* and *B. multidentatus* appear to be distributed irrespective of the general community type. *S. numius* demonstrated a preference for the deciduous community, while the genus *Garibius* was relatively more abundant in the pine plantations. Members of the genus *Nadabius* predominated (45.3%) in deciduous litter, while *Sozibius* accounted for an additional 37.5% of specimens collected in this microhabitat.

In the first two weeks of August six broods of *Arctogeophilus umbraticus* were observed beneath the bark of *Ulmus americana, Pinus strobus,* and *Quercus alba.* These clutches ranged from 30 to 51 with an average of 39.8 ± 7.7 (S.D.).

DISCUSSION:

The ethopolyid, *Bothropolys multidentatus*, has generally been reported as a dendrophilous species, preferring the high moisture conditions found in certain bark microhabitats (Auerback, 1951; Crabill, 1955). All specimens of this species were collected under bark. Two common large lithobiomorphs, *B. multidentatus* and *Lithobius forficatus*, appear to inhabit similar microhabitats in eastern United States, but are rarely collected together (Auerbach, 1951), Crabill (1958) suggests that *L. forficatus* was introduced from Europe and is normally found near areas of human activity. The results of this study are consistent with these observations, as all specimens of *L. forficatus* were collected along a well-drained road, while *B. multidentatus* was found in more mesic habitats of the study site.

Scolopocryptops sexspinosus is generally collected beneath stones and under bark, deep within rotting logs (Auerback, 1951; Branson and Batch, 1967, and others) as were all specimens in this study. Branson and Batch (1967) report that *Arctogeophilus umbraticus* utilizes a wide range of microhabitats. This geophilomorph was collected in litter and under bark in both deciduous and coniferous communities (Table 1). The genus *Nadabius* has often been reported in leaf litter (Rapp, 1946; Auerback, 1951) and under bark (Branson and Batch, 1967). These collections are in general agreement with the above observations; however, *Nadabius pullus* predominated in litter as did *Sozibius pennsylvanicus.*

Chamberlin (1913) states that *Garibius* is generally found under bark, as were all specimens in this study. Chamberlin also notes that this microlithobiid genus seems to prefer a coniferous community. Since the white pine plantations were planted only sixty-five years ago, it appears that *Garibius* was able to invade the pines and establish a dominant position among the chilopod fauna. This invasion was presumably launched from the surrounding deciduous community where *Garibius* is present in relatively fewer numbers.

R.E. Crabill, Jr. (personal communication) indicated that soil pH may be a major factor regulating chilopod distributions. He suggests that lithobiids prefer soils with low pH as is characteristic of coniferous forests, while geophilomorphs often prefer higher pH soils. The soil pH values for the pine plantations are near 4.5, while in the deciduous areas pH's were variable, but generally higher. In this study the distribution of the lithobiid genus *Garibius* is consistent with the above suggestion as it predominates in the pine plantations. However, the lithobiid *Sonibius numius* and the geophilomorph *Arctogeophilus umbraticus* were distributed irregardless of habitat type.

A more complete picture of chilopod microhabitat distribution would have been obtained if fall and winter collections had been possible. Although relatively few stones were found in the study area, had the importance of the subsaxean habitat been realized at the time collections were made, greater efforts would have been expended to sample this microhabitat.

One specimen of *Zygethobius pontis* was collected within deciduous leaf litter, which is the first report of this species in Ohio. *Z. pontis* was reported by Chamberlin (1912) in Virginia and Tennessee. Specimens of this species have also been collected in West Virginia, Kentucky, Pennsylvania, and North Carolina (A.A. Weaver, personal communication). From these reports, *Z. pontis* appears to be distributed throughout the Appalachian, the Ridge and Valley and the Blue Ridge provinces. Since Licking County falls within the Appalachian province, it might have been expected that this species would be found in this area of Ohio.

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Table 1. Summary of centipede collections.

	MIXED DECIDUOUS		CONIFEROUS		TOTAL
	Litter	Under Bark	Litter	Under Bark	Total
Order Scutigeromorpha					
Family Scutigeridae					
Scutigera coleoptrata (Linne)	1				1
Order Scolopendromorpha					
Family Cryptopidae					
Scolopocryptops sexspinosus (Say)		50		13	63
Order Geophilomorpha					
Family Geophilidae					
Strigamia bidens Wood	1				1
Strigamia sp.	2			1	3
Arctogeophilus umbraticus (McNeill)	21	29	1	15	66
Order Lithobiomorpha					
Family Henicopidae					
Zygethobius pontis Chamberlin	1				1
Family Ethopolyidae					
Bothropolys multidentatus (Newport)		51		18	69
Family Lithobiidae					
Sonibius numius (Chamberlin)		99		16	115
Garibius pagoketes Chamberlin		13		5	18
G. opicolens Chamberlin				2	2
G. monticolens Chamberlin				1	1
Garibius sp.		11		20	31
Nadabius pullus (Bollman)	49	7	7	2	65
N. aristeus Chamberlin	7				7
N. ameles Chamberlin	14	1	1		16
Nadabius sp.		3		13	16
Lithobius forficatus (Linne)		6			6
Sozibius proridens (Bollman)	1	1		1	3
S. pennsylvanicus Chamberlin	47	1	3		51
Sozibius sp.	10	1		2	13
Tidabius sp.		3	3		6
TOTAL	154	276	15	109	554

Table 2. Distribution of centipedes in microhabitats of leaf litter (L) and under bark (B).Chi-square significance level of p <0.001 is denoted by *.

	N	%L	%B	
Expected distribution	554	31	69	
S. sexspinosus	63	0	100	*
B. multidentatus	69	0	100	*
S. numius	115	0	100	*
Garabius species	52	0	100	*
N. pullus	65	86	14	*
S. pennsylvanicus	51	91	9	*
A. umbraticus	66	33	67	

Table 3. Distribution of centipedes in coniferous (C) and deciduous (D) habitats. Chi-square significance level of p <0.001 is denoted by *.

	N	%D	%C	
Expected distribution	385	72	28	
S. numius	115	86	14	*
Garibius species	52	46	54	*
S. sexspinosus	63	80	20	
B. multidentatus	69	73	27	

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A MODIFIED COLLECTION NET FOR CATCHING INSECTS UNDER CLOTH BANDS ON TREES[1,2]

G.A. Dunn[3], R.M. Reeves[4]

ABSTRACT: Insects which rest under cloth bands on trees tend to drop when disturbed and become lost in the litter below. A standard insect collecting net was modified so when pressed against a tree bole the elasticized outer rim conformed with the shape of the tree. A collecting vial was attached at the bottom of the net. The technique made sampling under cloth bands much easier and reduced considerably the number of specimens lost.

Many insects, and particularly ground beetles, are known for their secretive habits, foraging at night and hiding during the day. To search for these cryptic species during the daylight hours is difficult and often unrewarding. Pitfall traps have been used extensively for ground crawling species, but few methods have been devised for collecting arboreal insects of nocturnal habit. Of these burlap bands are probably the best known and have been used for mechanical destruction of gypsy moth larvae (Craighead 1950). Other methods include tree-beating (Harris et. al. 1972), smoking trees (Yamashita et. al. 1970), and mechanical collectors such as Weseloh's (1974) *Calosoma sycophanta* L. trap.

We used cloth bands for determining carabid beetles species found on tree trunks in spruce budworm (*Choristoneura fumiferana* (Clem.)) infested forests in northern New Hampshire. These bands were fashioned from 20 cm wide strips of medium weight canvas. A strip was wrapped around the bole of the tree at breast height and stapled along the bottom edge at about 12.5 cm intervals. The cloth was then cut vertically with a sharp knife (Fig. 1) just above each of the staples and the resulting flaps pulled down. This created a shelter for organisms of secretive or nocturnal habit. Previous experience had warned us that lifting the cloth flaps often led to specimens dropping immediately and becoming lost in the leaf litter at the base of the tree. Thus a collecting tray or net was needed to ensure capture of these dropping specimens.

A standard aerial insect net (30.5 cm diameter) with a heavy duty wire rim was modified for collecting insects on tree trunks. The wire rim was cut

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[3] Former graduate student, present address, Department of Entomology, Michigan State University, East Lansing, Michigan 48824.

[4] Associate Professor of Entomology and Forest Resources, University of New Hampshire, Durham, New Hampshire 03824.

so that approximately one third to one half of the rim opposite the handle was removed (Fig. 2). A small loop was made in the cut ends of the rim and an elastic band approximately 20 cm long was stretched between them giving the rim flexibility when pressed against a tree bole. The net bag was then replaced on the newly constructed rim and the latter attached to the handle. The bottom of the net bag was removed at a point where a 12.5 cm diameter funnel would not be able to slip through. The funnel was then glued to the cut end of the net. The bottom of the funnel was cut so that a removable plastic collecting vial (3.5 cm diameter) would fit snugly but not fall through (Fig. 3).

The procedure when approaching a banded tree was to press the elasticized edge of the net against the tree bole just underneath one of the flaps and the flap lifted. Specimens that do not drop immediately into the collecting vial may have to be dislodged mechanically. Some, like the long legged phalangids, may try to climb out of the net but can usually be guided down into the collecting vial. An elastic width of the 20 cm is recommended because disturbance of one flap sometimes caused specimens in adjacent flaps to drop. Specimens in the collecting vial were eventually transferred into jars with a preserving fluid. In this way more than one tree could be collected from and the specimens combined to give a single sample.

We found this modified collecting net reduced considerably the number of specimens lost and lessened the time necessary to survey each banded tree. The cloth bands were checked once a week for thirteen weeks in 1977 on sixty trees (10 sugar maple, 10 red spruce and 40 balsam fir). Of the 976 specimens collected 52% were spiders, 23% ground beetles, 13% spruce budworm larvae and 11% phalangids. Six species of ground beetles were encountered under the cloth bands with *Platynus decentis* (Say) by far the most abundant. Seasonal abundance of some arthropod species was readily apparent.

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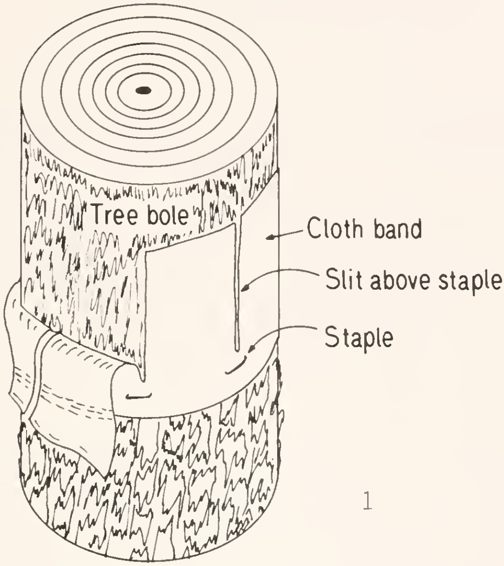

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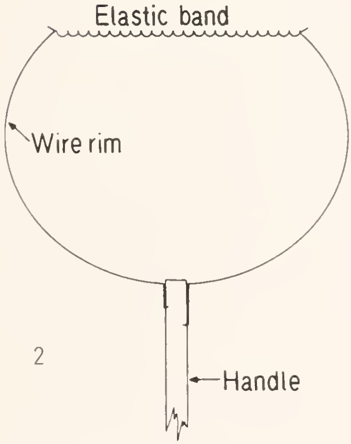

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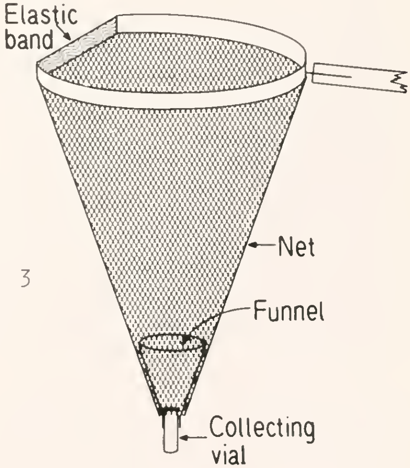

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Figure 1. Attachment of cloth band on tree bole. Figure 2. Modification of wire rim of collecting net. Figure 3. Modification of net for funnel and collecting vial.

USE OF BARRIERS WITH PITFALL TRAPS[1,2]

R. Marcel Reeves[3]

ABSTRACT: The addition of a plastic barrier between two pitfall traps was considered necessary to increase the recovery of marked *Calosoma frigidum* Kirby adults and to facilitate trap establishment in areas where rocks and tree roots were a problem. A three-container pitfall is described to help reduce mammal predation and increase serviceability.

The technique most often used for trapping ground surface crawling invertebrates has been pitfall traps. Their size, shape and construction material varies with the choice usually determined by the individual investigator. They have been used primarily as a survey or phenological tool or to determine relative numbers of insects present. However, their use for assessing absolute population levels has not been very satisfactory (Greenslade 1964; Luff 1975; Thomas and Sleeper 1977).

In a study of the caterpillar-hunter *Calosoma frigidum* Kirby it was necessary to establish large numbers of pitfall traps in a forest where rocks and roots were an important consideration. The behavior of adult *C. frigidum* when encountering an insurmountable object provided a solution. These adults tended to crawl along the edge of such a barrier rather than turning away from it. Why not use barriers to direct adult beetles toward a pitfall trap? Southwood (1966) suggested such an idea in his interceptor traps. The simplest design was to put 2 small pitfalls at either end of a long barrier. In this manner less disturbance of the forest floor was necessary, and at the same time increased efficiency was expected. The name most appropriate for this pitfall modification is "barrier-pitfall".

The following materials were used in the *C. frigidum* study for their durability and low cost. The barriers were plexiglass strips 3 feet (91.44 cm) long, 4-6 inches (10.16-15.24 cm) high, and 1/16-1/8 inch (0.16-.32 cm) thick. The pitfalls were polystyrene specimen containers. At first only a single container was used at each end of the barrier. To reduce predation by insectivorous mammals (racoons, chipmunks, skunks, mice, etc.), and to make specimen removal easier, a three-container system was developed. The outer container [32 ounce (946 ml) capacity, 4 3/4 inch (12.06 cm) diameter by 4 3/4 inch (12.06 cm) deep] remained undisturbed in the

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[1] Received November 23, 1979

[2] Scientific Contribution No. 983 from the New Hampshire Agricultural Experiment Station.

[3] Department of Entomology, University of New Hampshire, Durham, New Hampshire 03824

ENT. NEWS 91(1):10-12

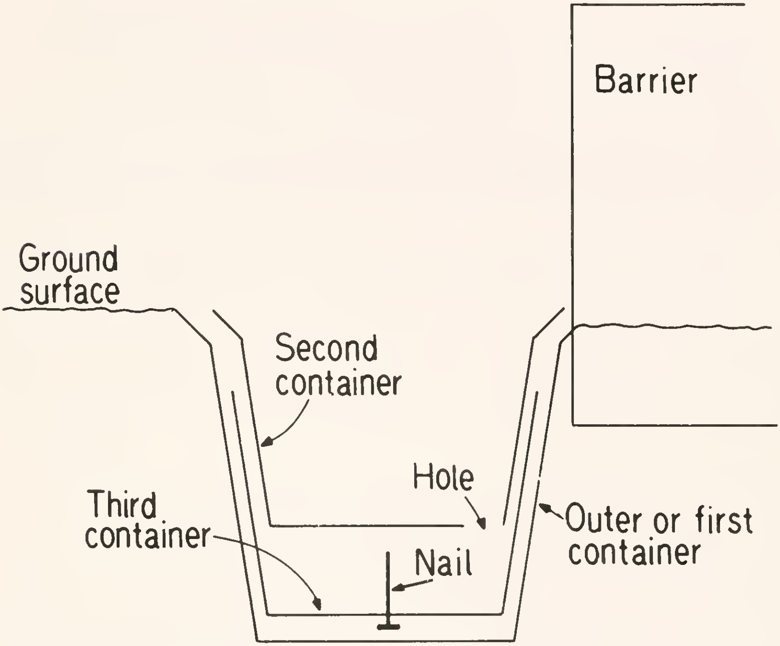

Figure 1. A three-container pitfall with adjacent barrier.

ground. A second container |16 ounce (473 ml) capacity, 4 5/8 inches (11.75 cm) diameter by 3 inches (4.62 cm) deep with a 3/4 inch (1.8 cm) hole cut in the bottom| was placed inside the first. The upper lip of this second container was just wide enough to prevent it from falling down inside the first. Insects falling into the second container would then drop down through the hole into the relatively protected space below. A third container, the same size as the second, had the rim or lip cut off so that it would slide down to the bottom of the first container and be flush at the sides. This served as a "basket" to lift specimens out. A nail pushed up through the bottom of this third container served as a handle to facilitate removal.

Drainage holes were punched in the lower 2 cups when live-trapping to prevent rain water from accumulating. No attempt was made to shield pitfalls from rain. If a preserving fluid was used only the third container or "basket" was provided with drainage holes. When used along banks of streams, rivers, lakes, etc., only a single pitfall, on the land end of the barrier, was necessary with the other end of the barrier extending into the water.

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INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

c/o British Museum (Natural History),
Cromwell Road, London, SW7 5BD, United Kingdom.

1st November, 1979.

The Commission hereby gives six months notice of the possible use of its plenary powers in the following cases, published in *Bull. zool. Nom.* Volume 36, part 3, on 1st November 1979, and would welcome comments and advice on them from interested zoologists. Correspondence should be addressed to the Secretary at the above address.

2240 *Anaspis* Muller, 1764; *Luperus* Muller, 1764; *Lampyris* Muller, 1764; and *Clerus* Muller, 1764 (Insecta, Coleoptera): proposed designation of a type species.
2244 *Ptilium* Gyllenhal, 1827 and *Ptenidium* Erichson, 1845 (Insecta, Coleoptera): proposed conservation.
2246 *Chrysomela flavicornis* Suffrian, 1851 and *C. tibialis* Suffrian, 1851 (Insecta, Coleoptera): proposed conservation.
2146 *Rhodesiella plumigera* (Loew, 1860) (Insecta, Diptera): proposed suppression.

The following Opinions have been published recently by the International Commission on Zoological Nomenclature in the *Bulletin of Zoological Nomenclature*, Volume 36, part 3, 1 November, 1979.

1145 (p. 149) *Dryocoetes* Eichhoff, 1864 (Coleoptera, SCOLYTIDAE): conserved under the plenary powers.
1146 (p. 151) *Xyleborus* Eichoff, 1864 (Coleoptera, SCOLYTIDAE): conserved under the plenary powers.

The Commission regrets that it cannot supply separates of Opinions.

NEW SYNONOMY OF *SUILLIA SORORCULA* CZERNY (DIPTERA: HELEOMYZIDAE)[1]

W.B. Garnett[2]

ABSTRACT: Comparison of specimens from the type locality with species descriptions and examination of variation in reared specimens indicates *Suillia thomsoni* Gill and *S. sororcula* Czerny, heretofore considered distinct populations are conspecific and take the senior name, *S. sororcula* Czerny.

The genus *Suillia* (Diptera: Heleomyzidae), though Holarctic in distribution, has received more attention in Europe and Asia than in the Americas, perhaps because at least one Palearctic species has attained pest status. The Nearctic members of *Suillia* north of Mexico were treated briefly by Steyskal (1944) and more recently by Gill (1962) in his comprehensive revision of the family Heleomyzidae. During investigations of suilliine biology, I discovered the following synonomy and here propose its solution.

Gill (1962) and Steyskal (1944) considered as distinct species *Suillia thomsoni* Gill (= *limbata* (Thomson): see Gill, 1965) and *S. sororcula* Czerny. Due to loss of the only type specimen of *S. sororcula*, both Gill and Steyskal were forced to rely upon the original and sometimes confusing description of Czerny (1926) for their concept of this species. Unfortunately, while Czerny had also discussed *S. thomsoni* in 1924, he never provided a differential diagnosis or key for the two species.

In his analysis of *S. sororcula*, Gill (1962) utilized several specimens collected from the type locality (San Mateo Co., Calif.) and adjacent counties (Contra Costa and Marin). They appeared distinct from *S. thomsoni* and seemed to fit Czerny's description of *S. sororcula*. The differences reported were intensity of body color (paler in *S. sororcula*), pattern and color of pigmentation, width of the cheeks (narrower in *S. sororcula*), cheek to eye ratio (smaller in *S. sororcula*), eye height and width (eye higher than wide in *S. sororcula*), number of rows of buccal setae (only one row in *S. sororcula*), and degree of wing infuscation (less in *S. sororcula*). As Gill noted, the species were otherwise similar even to their genitalia.

Steyskal (1944) differentiated the two species on the basis of head height and width (head higher than wide in *S. sororcula*), eye shape (more oval vertically in *S. sororcula*), degree of spotting on dorsum of thorax (more so in *S. sororcula*), and wing infuscation. Genitalia were not utilized.

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[1] Received September 14, 1979

[2] Department of Biology, Raymond Walters College, Blue Ash, Ohio 45236

I compared 28 specimens identified as *S. sororcula* from Marin Co., California and 1 from Corvallis, Oregon (from collections of Calif. Ins. Surv., Calif. Acad. Sci., and Wash. St. Univ., various collectors, some determined by G.D. Gill) with numerous specimens of *S. thomsoni* from the Pacific states and Idaho (Wash. St. Univ. collection, various collectors, some determined by G.D. Gill). I found the above criteria utilized by Gill and Steyskal to be unreliable in affirming the majority of these identifications, many specimens previously identified as *S. sororcula* fitting the description of *S. thomsoni* better than specimens previously identified as *S. thomsoni*. Furthermore, examinations of many specimens (F_1 and F_2) reared by the author as *S. thomsoni* from females (P) collected in Marin Co., Calif. and Latah Co., Idaho, revealed great enough intersibling and intraspecific variation to obviate use of these characters. This was especially true of male genitalia, distinctive and useful in distinguishing other Holarctic *Suillia* spp.

It seems most likely the holotype was merely a light-bodied form of *S. thomsoni*. Subsequent determinations of "sororcula" were attempts to relate other light-bodied forms of this species to Czerny's description of *S. sororcula* while maintaining "thomsoni" (or "limbata") for the darker form.

Because of the failure of the above criteria, especially genitalia, to consistently separate two populations and because of variability revealed by breeding experiments, I feel that *S. sororcula* Czerny and *S. thomsoni* Gill are conspecific. Since *S. sororcula* Czerny is older, it becomes the senior synonym, and the species including all variants becomes *Suillia sororcula* Czerny.

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EXTENSION OF RANGE FOR TWO SYMPHYLID SPECIES (SYMPHYLA: SCOLOPENDRELLIDAE)[1]

Steven J. Loring[2]

ABSTRACT: Symphylids collected in Michigan have been identified as *Symphylella vulgaris* (Hansen) and *Scolopendrellopsis* (*Symphylellopsis*) *subnuda* (Hansen). *S. vulgaris* has been reported in North America only from California, while *S.* (*S.*) *subnuda* has not previously been reported from North America. This undoubtedly reflects limited collection and sporadic identification.

Symphyla are white, blind, progoneate myriapods which are between 2 and 10 mm long, have a thin integument through which respiration occurs, and posses 12 pairs of legs as adults. They inhabit leaf litter, decaying logs, soil, and similar habitats with high humidity. Although common, these animals are often overlooked by investigators because of their small size and cryptic habits.

Records of Symphyla have been reported from North America since Packard (1873), although it was not until much later that symphylids presently classified in the Family Scolopendrellidae were described from North America (Hilton, 1931). Michelbacher (1939a, b, 1941) described nine new species of nearctic Scolopendrellidae, bringing their total to fifteen.

Since that time virtually nothing has been done with the systematics of the nearctic Symphyla. Taxonomic keys to the Symphyla are few. Edwards (1959a, b) devised keys to the genera of Symphyla and the species found in Great Britain. The only other comprehensive keys available are incomplete and out-dated (Hansen, 1903; Attems, 1926; Verhoeff, 1934). Brief keys to certain genera and species of Symphyla do exist (e.g. Michelbacher, 1942; Scheller, 1978) but are scattered in the literature.

For significant works on the biology of Symphyla, the reader is referred to Michelbacher (1938, 1949), Tiegs (1940, 1945), Edwards 1958, 1959c, 1961), Juberthie-Jupeau (1963), and Manton (1966). In the author's opinion, the classic work by Verhoeff (1934) remains the best single source of information on Symphyla.

The symphylids reported here were collected from southern Michigan and identified as *Symphylella vulgaris* (Hansen) and *Scolopendrellopsis (Symphylellopsis) subnuda* (Hansen). The known distribution of each

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[1] Received May 25, 1979

[2] Department of Zoology, Michigan State University, East Lansing, Michigan 48824.

species has been greatly extended. Descriptions of these animals may be found in Hansen (1903) and Scheller (1978).

Methods

Core samples 15 cm deep were extracted by Tullgren funnels or water flotation. The animals were stored in a solution of 95% ethanol with 1% glycerine added. For viewing and identification purposes, specimens were mounted on microscope slides using Diaphane, CMC-10, or CMCP-9. The latter two mounting media are nonresinous preparations, containing chloral hydrate, purchased from Turtox Biological Supply.

Species

Symphylella vulgaris has been collected from the following locations:

Kalamazoo Co., Kellogg Biological Station, T1S: R9W: S6[3], grass with sandy loam and woods with loam, June 29, 1978, collector: S.J. Loring; four specimens mounted on slides.

Ingham Co., Okemos, T4N: R1W: S34, garden with sandy loam, August 1978, collector: R.M. Snider; five specimens mounted on slides, three stored in ethanol-glycerine.

Ingham Co., East Lansing, T3N: R1W: S7, grass with loam, September 5, 1973, collector: R.M. Snider; one specimen mounted on a slide, nineteen stored in ethanol-glycerine.

Ingham Co., Michigan State University Soil Science Research Station, T4N: R1W: S19, argricultural fields with loamy sand, April-November 1977, April 1978, collector: S.J. Loring; one specimen mounted on a slide, five stored in ehtanol-glycerine.

Scolopendrellopsis (Symphylellopsis) subnuda has been collected from the following locations:

Ingham Co., Michigan State University Soil Science Research Station, T4N: R1W: S19, agricultural fields with loamy sand, April-November 1977, April 1978, collector: S.J. Loring; four specimens stored in ethanol-glycerine.

Ingham Co., Okemos, T4N: R1W: S34, garden with sandy loam, May 8, 1979, collector: S.J. Loring; three specimens mounted on slides, ten stored in ethanol-glycerine.

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[3] T:R:S: refers to the United States Rectangular Surveying System, wherein T and R are north-south and east-west axes, respectively, and S refers to a square-mile block within the thirty six square-mile T:R coordinates.

All specimens will be deposited in the Invertebrata collection at The Museum, Michigan State University.

Discussion

Both species were found throughout the top 15 cm of soil. *S. vulgaris* has previously been reported in North America only from southern California (Hilton, 1931), although it has a world-wide distribution (Scheller, 1978). Similarly, *S. (S.) subnuda* is common throughout much of the world (Scheller, 1978), but has not previously been reported from the nearctic or neotropical regions. The formerly restricted ranges reported for these species is undoubtedly related to the paucity of collected and described American Symphyla.

ACKNOWLEDGEMENTS

The author wishes to thank Dr. Ulf Scheller of Lundsberg, Storfors, Sweden for confirming the identification of *S. vulgaris* and for identifying *S. (S.) subnuda.* Thanks are also extended to Dr. Richard J. Snider, Michigan State University, for his criticism and the use of his laboratory facilities.

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BOOK REVIEW

THE LIFE OF BEETLES. Glyn Evans. 1977. Allen & Unwin, Inc. 9 Winchester Terrace, Winchester, Mass. 01890. Ppbk. (reprint of 1975 hardcover). 232 pp. $7.50.

I don't know how this little book has escaped me for so long, for here is an *excellent* presentation and discussion on the natural history of beetles. The subject matter is substantive, authoritative and scientifically acurate, yet so interestingly written that, once started, one can hardly put the book down for a brief intermission until it has been thoroughly read from cover to cover.

The book contains a wealth of material suited to both amateur and professional Coleopterists, especially in the fields of morphology (Chapters 2 and 3 on "Beetle Forms and Body Functions" and "Reproduction and Life History"), ecology (Chapters 4, 5 and 6 on "Food and Feeding Habits", on "(Protective) Habits and Habitats" and on "Populations and Communities") and economic importance of beetles (Chapter 7 on "Beetles and Man"). Throughout the book the author provides abundant examples and numerous line illustrations in support of the various points made throughout the text.

The appendix includes information on pitfall trapping and keys to woodland beetles in Britain. A glossary, a list of references, a bibliography ând index concludes this fine book. About the only drawback this has for American Coleopterists is that, since it is written by a British entomologist, quite naturally British beetles are used in a large number of instances as examples to support and illustrate the text. However, so much subject matter of a universal nature is provided that this small volume is well worth the little investment to obtain it, read it and have it in one's reference library.

H.P.B.

A NEW *ALLOCAPNIA* FROM VIRGINIA (PLECOPTERA: CAPNIIDAE)[1]

Ralph F. Kirchner[2]

ABSTRACT: A winter stonefly, Allocapnia, is described from Wythe County, Virginia. It appears to be closely related to *A. rickeri* Frison.

Six species of *Allocapnia* have been included in the "*rickeri* group" which is characterized in the male by a short and almost bulbous apical segment of the upper limb of the epiproct in lateral view; this group may be divided into two complexes (Ross and Ricker, 1971). Complex "A" is characterized, in females, by fusion of the seventh and eighth sternites with the fusion forming a distinct heavily sclerotized arcuate ridge; "A" includes *A. cunninghami* Ross and Ricker, *A. zola* Ricker and *A. perplexa* Ross and Ricker. Complex "B" is characterized by the absence of a ridge across the line of fusion of female sternites seven and eight; "B" includes *A. rickeri* Frison, *A. sandersoni* Ricker and *A. stannardi* Ricker, although only about half of *A. stannardi* females are typical (a line of fusion may be indicated by a slight indentation and a faint dark line).

Allocapnia harperi, n. sp.

Types: Holotype (male), allotype and two paratypes (male and female) from Virginia, Wythe County, Jefferson National Forest, East Fork of Stony Fork of Reed Creek; 11 February 1979; Greg T., Matthew W. and Fred R. Voreh; these will be deposited in the United States National Museum. Ten additional specimens were obtained from the type location during 1979 (one male, three females, 27 January; two females, 29 January; two males, two females, 2 March); I will keep these.

Diagnosis: *Allocapnia harperi* is included in complex "B" of the "*rickeri* group" of *Allocapnia* since there is no ridge marking the line of fusion of the female seventh and eighth sternites. In this group, the female is unique in that the posterior margin of the eighth sternite has a relatively broad median projection. A male resembles *A. rickeri* but the shape of the dorsal process of the eighth tergite is distinctive; in lateral view, the lobes of the dorsal process are vertically directed in *A. rickeri* but are posteriorly directed in *A. harperi*; in dorsal aspect, the lobes are rounded in *A. rickeri* but have a triangular appearance in *A. harperi.*

Male (Fig. 1—3): Dark brown, almost black. Micropterous. Length of body, 6—7 mm. Seventh tergite without dorsal process. Process of eighth tergite fairly high and divided into a pair of widely separated lateral lobes which are directed posteriorly to form a deep trough. Apical segment of upper limb of epiproct about one-third length of entire process and diamond shaped in dorsal aspect. Lower limb of epiproct with apical segment fairly shallow and slightly sinuate.

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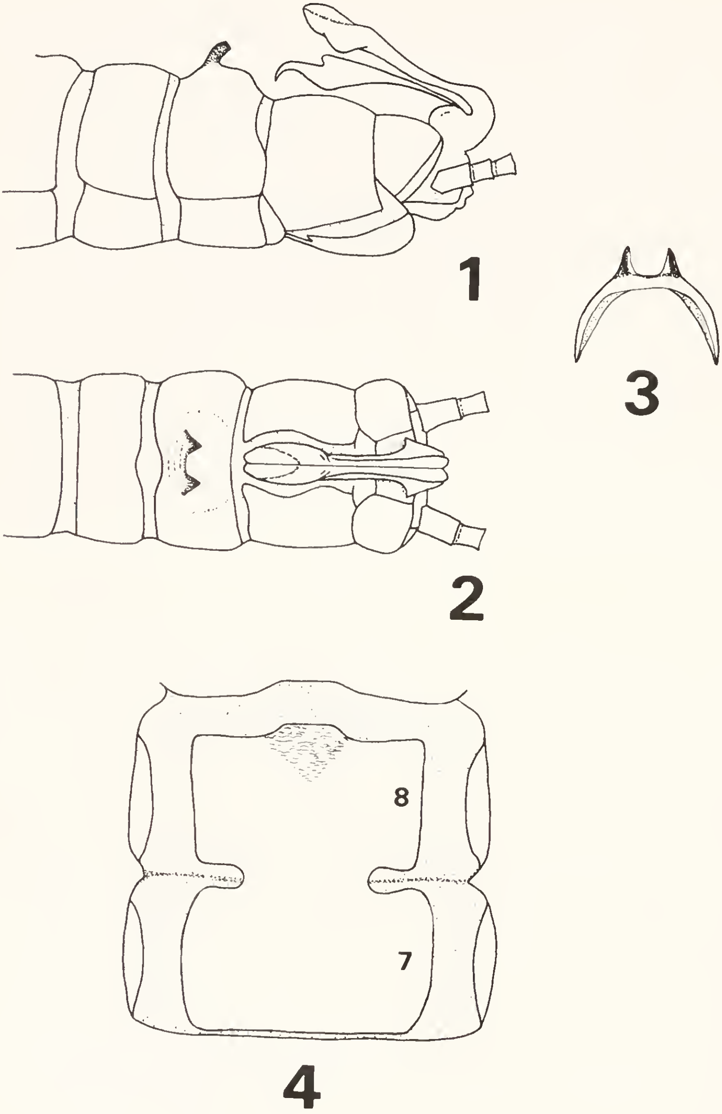
[1] Received August 23, 1979

[2] Kirchner, Rt. 1, Box 412-A, Barboursville, West Virginia 25504.

ENT. NEWS 91(1):19-21



Figures 1-4: *Allocapnia harperi.* 1. Male terminal abdominal segments (lateral). 2. Male terminal abdominal segments (dorsal). 3. Dorsal process of male eighth tergite (posterior aspect). 4. Female seventh and eighth sternites.

Female (Fig. 4): Dark brown, almost black. Micropterous. Length of body, 7—8 mm. Tergites one through eight, each with a membranous mesal stripe; nine and ten fully sclerotized. Seventh and eighth sternites solidly fused without a dividing suture. The posterior margin of the eighth sternite forms of a wide truncate or rounded projection that is transversly and irregularly rugose.

Remarks: This species is named for Dr. P.P. Harper, University of Montreal, Canada. It is known only from the type locality—a spring-fed, rocky and gravelly, fast-flowing stream. Specimens were taken between late December and early March. Other Capniidae associated with *Allocapnia harperi* include *A. loshada* Ricker, *A. nivicola* (Fitch) and *Paracapnia angulata* Hanson.

ACKNOWLEDGEMENTS

I am indebted to Prof. W. Gene Frum, Marshall University; to the late Dr. H.H. Ross, University of Georgia, who confirmed the distinctness and affinity of the new species in December, 1977; Dr. W.E. Ricker, Pacific Biological Station, British Columbia; and Dr. Richard W. Baumann, Brigham Young University.

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BOOKS RECEIVED AND BRIEFLY NOTED

APHID PARASITES (HYMENOPTERA: APHIDIIDAE) OF THE CENTRAL IAN AREA. P. Stary. Dr. W. Junk, bv Pub. 1979. 114 pp. Ppbk. $26.35.

Intended as a critical synthesis of past and present knowledge of parasite fauna of central Asia.

SPECIES OF *APHYTIS* OF THE WORLD (HYMENOPTERA: APHELINIDAE). D. Rosen and P. DeBach. Dr. W. Junk bv Pub. 1979. 801 pp. $136.85.

This monograph presents a biosystematic revision of an important group of natural enemies and so is intended not only as a major contribution to basic science but also to biological control because correct identification of both target pests and their natural enemies is an essential prerequisite for ultimate success in biological control.

OCCURRENCE OF AN ECTOPARASITIC CHIRONOMID (DIPTERA) IN OKLAHOMA[1]

William D. Shepard[2]

ABSTRACT: *Symbiocladius equitans* is newly recorded from the Ozark Mt. region of northeastern Oklahoma. Its host is *Heptagenia* sp. (Ephemeroptera: Heptageniidae).

Symbiocladius equitans (Claassen), as a larva, is an ectoparasite on naiads of various mayflies. Since its description by Claassen (1922), *S. equitans* has been collected in but a few states. Where it has been taken, mountain streams seen to be involved. This is probably a result of habitat requirements of its primary hosts, *Rhithrogena* sp. and *Heptagenia* sp. *S. equitans* is known to use at least three genera of heptageniid mayflies as hosts (Wiens et al. 1975). Some confusion has existed regarding its parasitic relationship with the mayflies. It has been termed a commensal (Pennak 1953) and a phoretic partner (Hilsenhoff 1975). However, both Oldroyd (1964) and Steffan (1965) describe the larva feeding on its host's hemolymph. Parasitism has also been described for *S. rhithrogenae* in Europe (Codreanu 1939) and *Symbiocladius* sp. in Australia (Riek 1974).

S. equitans was collected from two Oklahoma streams, Caney Creek and Baron Fork Creek. Both streams are fourth-order tributaries of the Illinois River in Cherokee Co. This is the first reported collection in Oklahoma and possibly in the central United States. Nearest previous collections are from Colorado (Claassen 1922) and North Carolina (Roback 1966).

The initial collection was on 23 April 1978, when 10 specimens were collected in Caney Cr. and 1 in Baron Fork Cr. Three additional collections were made in Caney Cr. on 22 May 1978, 2 September 1978 and 25 February 1979. Only the September collection produced additional specimens and then only 2 more.

Caney Cr. and Baron Fork Cr. are typified by fast current and deep, gravelly riffles. Water quality measurents taken in the two streams on 23 April were identical: temp. -17°C, diss. solids-105 ppm, diss. oxygen-11 ppm, turbidity-0 JTU. During the September collection at Caney Cr., measurements recorded were: temp. -24°C, pH-7.2, diss. solids-340 ppm.

Many other tributaries and parts of the Illinois River itself that had like water chemistry and appeared quite similar lacked both *Rhithrogena* sp.

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[1] Received November 6, 1979

[2] Oklahoma Biological Survey, University of Oklahoma, 302 Sutton Hall, 625 Elm St., Norman, Oklahoma 73019

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and *S. equitans* although most had *Heptagenia* sp. The only apparent difference between the two streams and all the others was the volume of discharge, with the two streams intermediate between the Illinois River and the rest of its tributaries.

Five larvae and six pupae were collected in April. The larvae were all last instar as evidenced by the presence of pupal structures below the larval cuticle. Both larvae and pupae were enveloped in a transparent, membranous sheath [Oldroyd (1964) describes it as silken and Steffen (1967) as gelatinous] underneath the mayfly naiad's wing pads. The larvae were curled in the sheath so as to have both anterior and posterior ends under the pads. Pupae had only the posterior end under the pads and some were as large as their host. Only single infestations were found although Wiens et al. (1975) and Codreanu (1939) mention instances of double infestations. In September, one intermediate instar larva was found plus a naiad with a sac containing a larval exuvium.

All larvae and pupae collected were attached to naiads of *Heptagenia* sp. This genus was found throughout the Illinois River system. During April, *Rhithrogena* sp. was collected but only at the two sites at which *S. equitans* was found. Many individuals from a range of instars were found but none supported *S. equitans*.

Wiens et al. (1975) have proposed a bivoltine life cycle for *S. equitans* in Canada, with the two generations using two different genera of heptageniids as hosts (see Fig. 1). Oklahoma specimens of *S. equitans* taken from *Heptagenia* sp. in April and September obviously deviate from this model. However, this may reflect only an increased use of *Heptagenia* sp. It is interesting to note that *Rhithrogena* sp. naiads are not found in the Martin River when *Heptagenia* sp. is parasitized (Wiens et al. 1975), whereas they were found in both Oklahoma streams during April with the parasitized *Heptagenia* sp.

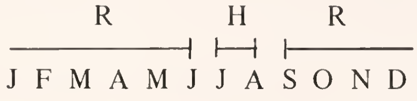

Fig. 1. Proposed annual use of hosts in Canada. R-***Rhithrogena*** sp. H-***Heptagenia*** sp. Adapted from Wiens et al. (1975).

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AN ILLUSTRATED GUIDE TO THE GENERA OF THE STAPHYLINIDAE OF AMERICA NORTH OF MEXICO, EXCLUSIVE OF THE ALEOCHARINAE (COLEOPTERA). Ian Moore and E.F. Legner. Division of Agricultural Sciences, Univ. of California. Pub. No. 4093. 1979. 332 pp. Ppbk, 8½ x 11. $10.00.

This identification guide includes tabular keys to subfamilies, tribes and genera, a full generic description with a drawing of a member of each genus, a selected annotated bibliography to species descriptions, and an index.

SKELETAL MUSCULATURE IN LARVAL PHASES OF THE BEETLE *EPICAUTA SEGMENTA* (COLEOPTERA, MELOIDAE). A. Berrios-Ortiz and R.B. Selander. Dr. W. Junk bv Pub. 1979. 33 pp of text, 184 figures. $26.35.

Detailed anatomical investigation of the species studied to determine the changes that occur in the skeletal musculature during postembryonic larval development. Excellent plates and figures.

FAUNA OF SAUDI ARABIA. Vol. 1. Dist. by Karger Libri. 1979. 372 pp. 12 pl. SFr. 153.

Vol. 1 of this new series covers mainly insects and other arthropods.

FIRST UNITED STATES RECORDS OF *LYGOCORIS KNIGHTI* (HEMIPTERA: MIRIDAE)[1]

A.G. Wheeler, Jr.[2]

ABSTRACT: *Lygocoris knighti* Kelton, a mirid known previously only from the type-locality in southwestern Ontario, is reported from the United States based on collections from *Viburnum recognitum* in New York and Pennsylvania, and *Hydrangea arborescens* in West Virginia.

Knight (1917) placed the taxonomically difficult complex of North American lygus bugs on a firm basis and presented numerous host plant records. His genus *Lygus* included several genera (e.g., *Lygocoris* Reuter) that have been removed from *Lygus* Hahn s.s. Kelton's (1971b) review of the Canadian and Alaskan species of *Lygocoris* included *L. knighti* Kelton, described from the Lake of the Woods region of southwestern Ontario near the Manitoba-Minnesota border. The type - series was taken from 27 June to 8 August 1960 on *Viburnum* sp. (Kelton, 1971 a).

In southcentral Pennsylvania I recently made the second known collection of *L. knighti*, nearly 1,200 miles from the type - locality. On 28 June 1979 I collected a ♂ on the inflorescence of staghorn sumac, *Rhus typhina* L., growing along Fishing Creek, Dauphin Co., northeast of Harrisburg. After Thomas J. Henry identified the specimen, I returned on 30 June and took 4 ♂ ♂ and 3 ♀ ♀ from staghorn sumac, feeding on the flowers with adults of the mirids *L. belfragii* (Reuter), *Lygus lineolaris* (P. de B.), *Neurocolpus nubilus* (Say), *Plagiognathus politus* Uhler, and *Taedia scrupea* (Say). Two ♀ ♀ also were taken on drupes of smooth arrowwood, *Viburnum recognitum* Fernald (restudied), growing 10-15 m from the sumac. On 3 July, 2 additional ♂ ♂ were collected from sumac flowers; 2 ♂ ♂ and 1 ♀ were beaten from *V. recognitum* on 5 July.

On 7 July 1979 I collected *L. knighti* in southcentral New York. At the Cornell University Research Park, Tompkins Co., near Ithaca, 3 ♂ ♂ and 8 ♀ ♀ were taken on *V. recognitum* with nearly equal numbers of *L. belfragii* and *L. communis* (Knight).

A collection of West Virginia Miridae later submitted for identification by T.L. Mason, Jr. also contained *L. knighti*. His capture on 25 June 1979 of 2 ♀ ♀ from wild hydrangea, *Hydrangea arborescens* L., in Hancock Co. at the junction of Rt. 2 and Linneyville Road, actually predated the

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[1] Received August 31, 1979

[2] Bureau of Plant Industry, Pennsylvania Department of Agriculture, Harrisburg, PA 17120

Pennsylvania and New York records. He also collected this mirid (3 ♀♀) from the same species of plant on 13 July in Pendleton Co., Rt. 33, just west of Mouth of Seneca, W.Va.

Although nymphs have not yet been found, it appears that *L. knighti* breeds on inflorescences of smooth arrowwood (and probably other *Viburnum* spp.) and disperses to flowers of other shrubs (sumac, possibly wild hydrangea) when those of its host deteriorate. Sumac flowers are known to attract other species of *Lygocoris* (Knight, 1917; Kelton, 1971 b).

I am fortunate to have had available my colleague and mirid specialist T.J. Henry to positively identify *L. knighti.*

Note added in proof: *L. knighti* has now been identified from North Carolina: 1 ♀, 4.5 mi. no. of Brevard, 30 June 1979. R.E. Pilatowski, on *Hydrangea arborescens*, det. T.J. Henry.

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INSECT PESTS OF FARM, GARDEN, AND ORCHARD. 7th Ed. R.H. Davidson & W.F. Lyon. J. Wiley & Sons. 1979. 596 pp. $22.95.

Updated coverage of major insect pests of North America. Morphology, physiology, classification, biology, ecology and control of insect pests and mites are discussed.

BIOLOGICAL CONTROL AND INSECT PEST MANAGEMENT. 12 papers from contributing authors. Div. Agric. Sciences, Univ. of Calif. Pub. No. 4096. 1979. 102 pp. Ppbk. 8½ x 11. $3.00.

Intended as a source of pest management ideas, topics covered include basic concepts, methods and implementation of pest management.

NEW RECORD FOR *CHIRORHYNCHOBIA MATSONI* (ASTIGMATA: CHIRORHYNCHOBIIDAE)[1]

Jose G. Palacios-Vargas[2]

ABSTRACT: Cueva de San Juan, Tepoztlan, Morelos, Mexico is cited as a new locality record for *Chirorhynchobia matsoni* Yunker, 1970.

The Chirorhynchobiidae is a very bizarre family of mites that are ectoparasites of South American bats. They have developed some specialized modifications such as unsegmented, massive and very esclerotized pedipalps. They attach themselves to the wing membrane of their host with the aid of their highly modified pedipalps and chelicerae. Only two species of this monogeneric family are known and very few specimens have been collected, all of them females.

The first species, *Chirorhynchobia urodermae* was described by Fain in 1967, when he erected the Chirorhynchobiidae to family status, based on a single specimen collected on *Uroderma bilobatum* from Panama, preserved in alcohol. The second species, *C. matsoni* Yunker, 1970, came based on seven specimens of *Anoura geoffroyi*. from Zulia, Venezuela.

The two different genera of bat-host *Uroderma* and *Anoura* belong to two subfamilies of the Phyllostomidae. According to this, one may consider that there may be some host-parasite specificity.

Now we have found one specimen of C. *matsoni* on *Anoura geoffroyi lasiopyga* Peters; it is a female 480 μ long and all characters agree with Yunker's original description, except for the greater width (Type 295 μ) of our specimen (340 μ), probably explained by the large egg contained in the opistosoma of the female.

The new record is: Cueva de San Juan Tepoztlan, Morelos, Mexico, 9-X-1978, J.G. Palacios-Vargas col.

Yunker's specimens were attached by their mouthparts to the trailing edge of the wing membrane. Our specimen was found walking on the foot, about two hours after the bat was killed.

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[1] Received October 6, 1979

[2] Laboratorio de Acarologia, Departamento de Biologia, Facultad de Ciencias, Universidad Nacional Autonoma de Mexico, Mexico, 20, D.F.

The distribution of *Chirorhynchobia matsoni* may be as wide as that of its host and *Anoura geoffroyi lasiopyga* is widely distributed in Mexico, Central and South America.

ACKNOWLEDGEMENTS

I wish to thank to Dr. Bernardo Villa for the determination of the bat and Dr. Anita Hoffmann for her comments to this paper.

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SYSTEMATIC PARASITOLOGY. Vol. 1. No. 1. Dr. W. Junk bv Pub.

A new international journal (in English) intended to cover Nemathelminthes, Platyhelminthes, parasitic Arthropoda and Protozoa and parasitic genera in other invertebrate groups which affect the health of man, animals and plants.

RECENT ADVANCES IN ACAROLOGY. Vols. I and II. J.G. Rodriguez, Ed. Academic Press. 1979. Vol. I, 631 pp. $35.00. Vol. II, 569 pp. $31.50.

Proceedings of the V International Congres of Acarology held August 6-12, 1978, Michigan State Univ., East Lansing, Mich.

THE GREAT DISMAL SWAMP. P.W. Kirk, Jr., Ed. Univ. Press of Virginia. 1979. 427 pp. $20.00.

Comprehensive study including geology, archaeology, history, limnology, atmospheric chemistry, ecology and botany of this Virginia — North Carolina swamp which now is a part of our Nat'l Wildlife Refuge system. Included is a chapter on Aquatic Insects of the Dismal Swamp by J.F. Matta and one on the Ecology of two Dominant Tick species by M.K. Garrett & D.E. Sonenshine.

ON THE PROTUBERANCES PRESENT ON THE LATERAL OVIDUCTS OF POULTRY LICE, *LIPEURUS LAWRENSIS TROPICALIS* PETERS (PHTHIRAPTERA: ISCHNOCERA)[1]

A.K. Saxena, G.P. Agarwal[2]

ABSTRACT: The protuberances present on the lateral oviduct of *Lipeurus lawrensis tropicalis* contain 4-6 large glandular cells which are secretory in function as the accessory glands are absent.

The morphology of lateral oviducts of some of the mallophagan species has been described by Snodgrass (1899), Strindberg (1916 a & b, 1918 & 1919) and Blagoveshtchensky (1959). In general, the lateral oviducts are simple tubes in Mallophaga except in *Goniodes dissimilis* and *Cuclotogaster heterographus* where protuberances are reported to be present on the outer wall of oviducts (Blagoveshtchensky, 1959).

While dealing with the reproductive organs of *Lipeurus lawrensis tropicalis* it is found that the lateral oviducts of these lice have several protuberances throughout their outer wall thus giving a rough appearance to the lateral oviducts. Histologically these protuberances are hollow outgrowths (out pockets) formed by the evagination of basement membrane (fig. 1). The muscular coat at this place is either absent altogether or very feebly developed. Each outpocket contains a group of 4-6 large, oval glandular cells occupying the evaginated area (fig. 1). Each cell contains fuchsinophilic cytoplasm and a round to oval nucleus with a centrally placed nucleolus. While the epithelial cells of the lateral oviducts are tall, columnar and are compactly arranged, each contains a dense cytoplasm, and is surrounded externally by muscular sheath formed by circular muscle fibres.

Though the presence of such protuberances is reported in *G. dissimilis* and *C. heterographus* by Blagoveshtchensky (1959), in the absence of any information on its histology, any function of these could not be assigned by him. In *L. lawrensis tropicalis* it is noticed that the lumen of the lateral oviduct is filled with a kind of secretion (fig. 1) which is lightly eosinophilic in nature. This shows that these cells perform the function of secretion in the absence of accessory glands in this species.

The authors are thankful to the Head, Department of Zoology, Banaras Hindu University for laboratory facilities and to the State Council of Science and Technology, U.P. for financial help under grant No. SCST/4779/B.H.U.(43)/77.

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[1] Received July 14, 1979

[2] Department of Zoology, Banaras Hindu University, Varanasi-221005, India.

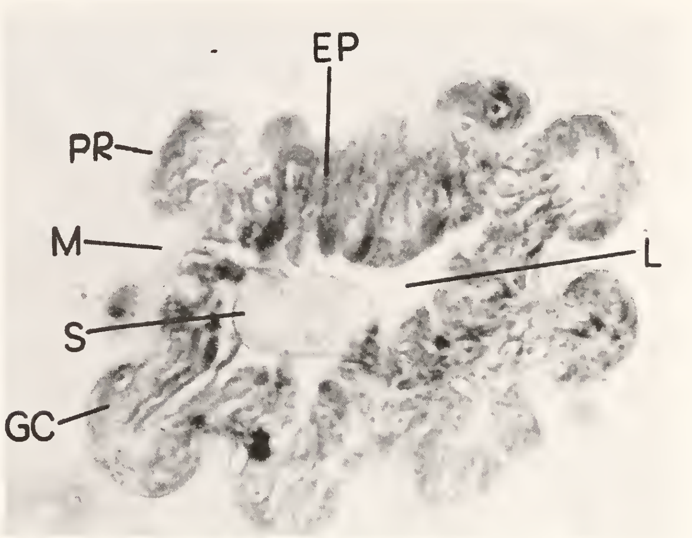

Fig. 1. Transverse section of the lateral oviduct of ***Lipeurus lawrensis tropicalis***. x 630. EP — Epithelium of lateral oviduct, GC-Glandular cells present in the outpockets, L-Lumen of lateral oviduct, M-Musculature, PR-Protuberance, S-Secretion.

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Strindberg, H. 1919. Die Geschlechtsorgane von *Ornithobius bucephalus* Gieb. und *Goniodes falcicornis* N. Zool. Anz., *50* : 219-235.

ORIUS INSIDIOSUS (SAY) (HEMIPTERA: ANTHOCORIDAE) BITING WHITE-FOOTED MICE[1]

William L. Krinsky, Andrew B. Carey, Marion G. Carey[2]

ABSTRACT: *Orius insidiosus* (Say) was found attached to living White-footed mice (*Peromyscus leucopus*) in Old Lyme, Connecticut. This is the first observation of this species attacking a vertebrate other than man.

Two specimens of the anthocorid bug, *Orius insidiosus* (Say) were collected from living White-footed mice (*Peromyscus leucopus*). Two mice were trapped in Sherman traps in Old Lyme, Connecticut on 23.ix.78. One mouse was trapped in an open area that had herbaceous vegetation of low stature (<1 m); the other mouse was trapped in a wooded area. A single anthocorid bug was collected from each mouse. The bugs were attached and appeared to have their mouthparts embedded in the skin of the animals.

O. insidiosus is known to be a predator of small insects and insect eggs on crop plants (Dicke & Jarvis, 1962) and on several occasions, it has been reported biting man (e.g. Tucker, 1911; Malloch, 1916; Riley & Johannsen, 1932).

We believe this is the first report of *O. insidiosus* attacking a vertebrate other than man.

ACKNOWLEDGMENTS

We would like to thank Dr. James A. Slater, University of Connecticut, Storrs, for confirming our identificaion of the anthocorid bugs and we thank him and Dr. Richard C. Froeschner, Smithsonian Institution, for reviewing the manuscript.

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[1] Received December 7, 1979

[2] Section of Medical Entomology, Department of Epidemiology and Public Health, Yale University School of Medicine, New Haven, Connecticut 06510.

NEW NAME FOR *ANCEUS* ROBACK NEC *ANCEUS* RISSO[1]

Selwyn S. Roback[2]

Mr. P. Ashe, of the University College, Dublin, recently brought to my attention that *Anceus* Roback 1963, p. 237 (Insecta: Diptera: Chironomidae) is a junior homonym of *Anceus* Risso 1816, p. 51 (Crustacea: Isopoda: Gnathiidae). Accordingly I should like to propose *Axarus* as a replacement name for *Anceus* Roback nec. Risso.

Risso, A. 1816. Histoire Naturelle des Crustaces des environs de Nice. A La Librarie Greque-Latin-Allemande, Paris: 1-175.

Roback, S.S. 1963. The genus *Xenochironomus* (Diptera: Tendipedidae) Kieffer, taxonomy and immature stages. Trans. Amer. Ent. Soc. 88: 235-245.

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[1] Received February 7, 1980

[2] Academy of Natural Sciences of Philadelphia.

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VOL. 91 MARCH & APRIL 1980 NO. 2

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(Continued on inside of back cover)

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COMMENTARIES IN CULTURAL ENTOMOLOGY

1. DEFINITION OF CULTURAL ENTOMOLOGY[1]

Charles L. Hogue[2]

Note: This is the first in a series of short articles which I plan to publish at irregular intervals on the various aspects of the manifold ways in which insects have colored human culture. Most will be short notes of original findings and interpretations but I want also to provide exposure to unknown or obscure materials buried in literature not readily available, understood or seen by the entomologist. No systematic bibliographic source recognizes the subject and items usually appear only to one who looks for them in old or non-entomological works (often in foreign languages) such as ethnographic and anthropological serials, historical manuscripts and early travel accounts. No attempt will be made to confine publication to a single journal, but I will reference each note by numerals in sequence and cite at appropriate times where same may be found.

A people's culture refers to all of their beliefs and activities. It is possible for a historian or anthropologist to define a human group by its morphological or behavioral attributes. Such characteristics may be divided into three categories: First, we have those concerned with bodily survival, such as food acquisition, shelter construction, transportation, etc., all of which comprise technology. Second, there are the academic pursuits, knowledge gathering and organizing, which we call science. And third, one can group activities which humans practice for "the nourishment of the mind and soul," the arts and humanities.

It is this last set of endeavors, perhaps, more than those of the first two, that give identity to a human cultural group. They are the expression of the true attitude or "essence" of a people for they are concerned with life's meaning to them, not just its function. It is the influence of insects in this aspect of humanity that is the focus of what I call **cultural entomology**.

In my own excursions into the subject I have been amazed at the extent to which insects have invaded the world's cultures, ancient, primitive and modern. Hardly an ethnic unit exists whose customs and beliefs do not exhibit at least some facet with entomological beginnings or connections, a fact not widely appreciated even among ethnozoologists, let alone general anthropologists and historians. Often the effect has been so corrupted or modified by time and telling that it is scarcely still recognizable, an example being the derivation of today's idea of a soul and resurrection from the past symbolic example of insect metamorphosis. But others are purely plain, as the delight we all find in the beauty of the butterfly's wing.

There are only a few cultural entomologists known to me and general publications on the subject are limited. Certainly the field's dean is

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[1] Received January 28, 1980.

[2] Curator of Entomology, Natural History Museum, Los Angeles, California 90007.

Austria's Erwin Schimitschek whose "Insekten als Nahrung, in Brachtum, Kult and Kulture" (Schimitschek, 1968) ought to be the starting place for the student. Lucy W. Clausen made a basic contribution likewise with "Insect Fact and Folklore" (Clausen, 1954) a very popular treatise which, more than any other, has introduced the subject to the English speaking world.

As evidenced by the bibliography given below, many other entomologists have made contributions to certain areas of the overall field. My colleague Steven Kutcher, of Long Beach, California, has lectured on cultural entomology and taught classes in "Insect Appreciation" designed specifically for providing insight into the reasons insects should be considered for their inspirational and historical nature as much as for their scientific or economic importance.

And in this context, I should mention here the various "entomophilosophers" such as William Morton Wheeler, Maurice Maeterlinck, and Jean Henri Fabre, probably the three most famous, who not only described insect phenomena with imagination and brilliance but wrote and spoke of their meaning on a human intellectual plane: "...whither do they go, what befalls them, what becomes of them when they are dead? Why smile at these questions when they are asked of insects, and take them seriously when they relate to man?" (Maeterlinck: The Life of the Ant).

For organizational purposes I recognize the following specific subdivisions of human endeavor as cultural and in which insects may play roles:

1. Literature (fictional, not scientific or informative)
2. Music
3. Performing arts (including drama and dance)
4. Art (including decoration and architecture)
5. History (interpretive)
6. Philosophy (including ethics, metaphysics)
7. Religion
8. Folklore (including mythology, customs)
9. Language
10. Symbolism (including emblemology, heraldry, advertising, etc.)
11. Sociology (including law, politics, government and warfare)
12. Recreation (including toys, games, amusements, novelties, jokes, oddities, and curiosities)

When study of the entomological aspects of any of these areas pertains to a so-called primitive or non-civilized (i.e., aboriginal or prehistorical) society we may refer to it as *ethnoentomology* (although the ethnoentomologist may study scientific and technological aspects as well). This field is growing in importance along side of ethnobotany, ethnopharmacology, etc.

It is difficult to assemble the contributions to cultural entomology. As mentioned in the note preceding this article, there is no recognition of the subject in bibliographies and data banks and part of the reason for this series of articles is to provide a portal to the literature. The selected citations given below represent only the more comprehensive works of which I am aware and I hope readers may add to the list. I have on file also a number of specialized references and examples (and artifacts) of insects in culture which will be used as source material for review and study. To this, I invite inquiry and contributions.

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A neglected area.

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FOOD OF SOME SHORTGRASS PRAIRIE COLEOPTERA[1,2,3]

Robert J. Lavigne[4]

ABSTRACT: Based on diet analysis of adults of some common shortgrass prairie Coleoptera, it was determined that most species studied were polyphagous, but with strong preferences for specific plant species. The species investigated were Cantharidae: *Chauliognathus scutellaris*, Cerambycidae: *Crossidius discoideus sayi*, *C. pulchellus*, Meloidae: *Epicauta ferruginea*, *E. fortis*, *E. parva*, *E. pennsylvanica*, *E. stuarti*, *Lytta biguttata*, *L. viridana*, *Meloe niger*, *Pyrota engelmanni*, *Zonitis sayi*, Scarabaeidae: *Diplotaxis haydeni*, Tenebrionidae: *Bothrotes plumbeus plumbeus*, *Eusattus convexus* and *Glyptasida sordida*.

The gut contents of some miscellaneous species of beetles were analyzed to determine food preference as part of a program to establish trophic levels for the insect fauna of a shortgrass prairie. This was done in conjunction with a survey of shortgrass prairie insect fauna (Kumar et al. 1976) as part of the U.S. International Biological Program Grassland Biome Project.

The study site was located in pastures on the USDA Agricultural Research Service Central Plains Experimental Range in northeastern Colorado. This area, commonly called the "Pawnee Site," is a field research facility of the Natural Resource Ecology Laboratory, Colorado State University and is located approximately seven miles north of Nunn, Colorado (T10N, R66W). Dickinson and Baker (1972) provided a listing of the ca. 300 species of plants on the Pawnee Site available to insects as a food source, of which ca. 100 species are common.

Materials and Methods

Insects to be dissected were collected incidently while other studies were being pursued. Collected specimens were immediately immersed in 70% ethanol. In the laboratory the digestive systems were removed and their contents transferred to microscope slides, utilizing the "microtechniques" method for grasshopper gut analysis of Mulkern and Anderson

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[4] Entomology Section, Box 3354, University Station, Laramie, WY, 82071.

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(1959), Mulkern et al. (1964, 1969). The technique was modified somewhat following the lead of Hansen and Flinders (1969). As these authors indicated, this method "is the most accurate for identifying plant material taken from the stomachs of herbivores," since it compares the characteristics of epidermal plant tissues of known plant species occurring in the habitat with those found in the guts of the plant eaters.

The contents of the insect's digestive tract were mixed with a few drops of Hertwig's solution on the slide surface. The slide was then held over an open flame until it boiled during which the color cleared from the epidermal cells. Several drops of Hoyer's solution were added; the slide was reflamed and a cover glass was placed over the mixture. The slide was allowed to dry in an oven at 65°C for two to three days.

The slides were sent to the Diet Analysis Laboratory at Colorado State University for reading. Twenty fields were examined on each slide and only those fragments recognized as epidermal tissue were recorded for presence of a plant species. The presence of pollen, petals, moss, endogeneous fungi and arthropod fragments was also noted. The data were sent to the Natural Resource Ecology Laboratory for transfer to punch cards for computer analysis.

Percentages and indices were calculated as follows:

Food Plants Ingested — This category was established by the reading, and recorded as percentages of a specific food plant derived from the total number of fields examined. Since the occurrence of more than one plant species in a digestive tract was common, total ingestion could exceed 100%. This probably indicates that the insect did not fill its gut cavity while feeding on one plant, but moved from plant to plant during the feeding process. If a particular plant appeared in the guts of most insect specimens representing a single species, it was assumed that this was the principal acceptable food within the habitat.

Plant Specificity Index — This category was determined (after Mulkern et al., 1969) by multiplying the percent ingestion of the most frequently ingested plant by three, the second most ingested by two and the third by one, summing the quotients and dividing by three. This provided an indication of selectivity with a number approaching 100 indicating that ingestion was restricted to few plant species, while progressively lower figures indicated less restrictive feeding.

Results

Based on field observations of feeding beetles, it is assumed that the plant material ingested by Coleopterous species other than that of the three species of Tenebrionidae was 100 percent live matter. However, once the material was processed on slides, there was no way to distinguish live material from dead. The percentages recorded for food plants are presented as percent dry weight.

Tenebrionid species have been observed feeding on live plant material, although they are generally regarded as scavengers. On the Pawnee Site, I have observed *Edrotes rotundatus* (Say) feeding on leaves of *Cirsium undulatum; Elodes obsoleta* (Say) feeding on petals and stamens of *Chrysothamnus nauseosus; E. hispilabris* (Say) feeding on *Bouteloua gracilis, Oxytropis sericea* and *Sphaeralcea coccinea* (Kumar et al. 1976); *Bothrotes plumbeus plumbeus* (LeConte) feeding on petals and stamens of *C. nauseosus* and on pollen, petals and developing seeds of *Cirsium undulatum* (Lavigne 1976). As opposed to live material, I have observed *Eleodes hispilabris* feeding on the remains of a black carabid, *Eleodes extricata* (Say) feeding on a dead red legged mite and *Glyptasida sordida* (LeConte) feeding on the tip of a twig lying on the soil.

Most of the Coleopterous species studied are generalists, but with strong preferences for certain plant species. Only *Meloe niger* Kirby and *Glyptasida sordida* (LeConte) had plant specificity indices below 55 suggesting that these two species are true generalists. The latter species may well be more scavenger than herbivore, although it could be picking up live material discarded by sloppy insects, such as grasshoppers and meloids. The high index number (97.2) for *Bothrotes plumbeus plumbeus* (LeConte), and the percent (100) feeding on petals and/or sepals, indicates that this species is a true live plant tissue feeder.

CANTHARIDAE

Chauliognathus scutellaris LeConte: Number analyzed - 172; plant specificity index - 80.3; number with empty digestive tracts - 0; percent feeding on petals and/or sepals - 17; percent feeding on pollen - 1.2. HOSTS - FORBS: *Chrysothamnus nauseosus* - 68.9%, *Grindelia squarrosa* - 4.6%, *Senecio spartioides* - 13.6%; GRASSES: *Aristida longiseta* - 4.6%, *Bouteloua gracilis* - 9.1%.

CERAMBYCIDAE

Crossidius discoideus sayi (Say): Number analyzed - 37; plant specificity index - 74.1; number with empty digestive tracts - 6; percent feeding on petals and/or sepals - 74.2; percent feeding on pollen - 22.6. HOSTS - FORBS: *Artemisia frigida* - 4.3%, *Heterotheca villosa* - 3.2%, *Chrysothamnus nauseosus* - 53.5%, *Cirsium undulatum* - 16.1%, *Gutierrezia sarothrae* - 22.8%, undetermined forb - 0.4%.

Crossidius pulchellus LeConte: Number analyzed - 15; plant specificity index - 90; number with empty digestive tracts - 0; percent feeding on petals and/or sepals - 80; percent feeding on pollen - 20. HOSTS - FORBS: *Artemisia frigida* - 0.8%, *Chrysothamnus nauseosus* - 12.5%, *Grindelia squarrosa* - 4.9%, *Gutierrezia sarothrae* - 80%, undetermined forbs 0.05%; GRASSES: *Bouteloua gracilis* - 1.8%.

MELOIDAE

Epicauta ferruginea (Say): Number analyzed - 184; plant specificity index - 83.4; number with empty digestive tracts - 0; percent feeding on petals and/or sepals - 100; HOSTS - FORBS: *Chrysothamnus nauseosus* - 1.1%, *Cirsium undulatum* - 62.7%; *Grindelia squarrosa* - 8.7%, *Gutierrezia sarothrae* - 26.6%,*Helianthus annuus* - 0.1% and *Kochia scoparia* 0.7%.

Epicauta fortis Werner: Number analyzed - 35; plant specificity index - 63.9; number with empty digestive tracts - 0; percent feeding on petals and/or sepals - 51; percent feeding on pollen - 0.9. HOSTS - FORBS: *Artemisia frigida* - 14.5%, *Chrysothamnus nauseosus* - 35.5%, *Grindelia squarrosa* - 15%, *Gutierrezia sarothrae* - 35%.

Epicauta parva (Haldeman): Number analyzed - 115; plant specificity index - 74.3; number with empty digestive tracts - 3; percent feeding on petals and/or sepals - 59; percent feeding on arthropod parts - 0.4; percent feeding on endogeneous fungi - 0.2; percent feeding on the lichen (Parmelia chlorochroa) - 0.3, percent feeding on moss - 0.4. HOSTS - FORBS: *Allium textile* -0.01%, *Artemisia frigida* - 0.3%, *Atriplex canescens* - 1.9%, *Chrysothamnus nauseosus* - 0.03%, *Descurainia pinnata* - 0.2%, *Erigeron candadensis* - 0.1%, *Erigeron divergens* - 0.3%, *Gutierrezia sarothrae* - 0.9%, *Kochia scoparia* - 3.4%, *Lepidium densiflorum* - 1.8%, *Leucocrinum montanum* - 0.05%, *Oxytropis lambertii* - 5.2%, *Oxytropis sericea* - 50.5%, *Polanisia trachysperma* - 0.2%, *Salsola kali tenuifolia* - 1.3%, *Sophora sericea* - 33.1%, unknown forb - 0.1%; GRASSES: *Bouteloua gracilis* - 0.2%, *Bromus tectorum* - 0.1%, *Volpia octoflora* - 0.5%.

Epicauta pennsylvanica (DeGeer): Number analyzed - 115; plant specificity index - 88.8; number with empty digestive tracts - 3; percent feeding on petals and/or sepals - 99.1; percent feeding on pollen - 27.8. HOSTS - FORBS: *Artemisia frigida* - 0.96%; *Chrysothamnus nauseosus* - 4%; *Grindelia squarrosa* - 20%; *Gutierrezia sarothrae* - 74.1%; undetermined forb - 9%. Previously recorded as feeding on pollen of *Gutierrezia sarothrae* by Selander (1954).

Epicauta stuarti LeConte: Number analyzed - 210; plant specificity index - 92.2; number with empty digestive tracts - 7; percent feeding on pollen - 2. HOSTS - FORBS: *Chrysothamnus nauseosus* - 14.8%, *Grindelia squarrosa* - 4.3%, *Gutierrezia sarothrae* - 80.8%. Recorded as feeding on pollen of *Gutierrezia sarothrae* by Selander (1954).

Lytta biguttata LeConte: Number analyzed - 4; plant specificity index - 100; number of empty digestive tracts - 3. HOST - FORBS: *Oenothera albicaulis* - 100%. Previously recorded as occurring on a variety of Compositae by Selander (1960), including *Haplopappus spinulosus, Bahia absinthifolia, B. pedata, Baileya multiradiata, Verbesina encelioides* and *Hymenoxys richardsoni.*

Lytta viridana LeConte: Number analyzed - 105; plant specificity index- 88.3; number with empty digestive tracts - 0; percent feeding on petals and/or sepals - 94; percent feeding on pollen - 1.9. HOSTS - FORBS: *Lathyrus polymorphus* - 1.9%, *Oxytropis sericea* - 27.6%, *Penstemon angustifolius* - 0.9%, *Sophora sericea* - 69.2%; GRASSES: *Aristida longiseta* 0.06%, *Bouteloua gracilis* - 0.1%, *Sporobolus cryptandrus* - 0.04%, *Stipa comata* - 0.1%. Previously recorded as feeding on *Astragalus pectinatus* and *A. bisulcatus* by Fox (1943) and on caragana and peavine by Selander (1960).

Meloe niger Kirby: Number analyzed - 54; plant specificity index - 46.1; number with empty digestive tracts - 0; percent feeding on petals and/or sepals - 0; percent feeding on endogeneous fungi - 0.1. HOSTS - FORBS: *Allium textile* - 12.6%, *Aster tanacetifolius* - 0.6%, *Atriplex canescens* - 0.2%, *Cryptantha fendleri* - 2.2%, *Descurainia pinnata* - 14.2%, *Kochia scoparia* - 1.3%, *Lappula redowskii* - 0.1%, *Lepidium densiflorum* - 10.7%, *Salsola kali tenuifolia* - 8.9%, *Sophora sericea* - 32.4%, *Sphaeralcea coccinea* - 1.9%, *Yucca glauca* - 0.2%, undetermined forb - 1.8%; GRASSES: *Bouteloua gracilis* - 1.1%, *Bromus tectorum* - 12.7%; SEDGES: *Carex heliophila* - 0.5%. Previously recorded as on *Allium* sp., *Anemone* sp., *Asparagus officinalis, Ranunculus* sp., and *Taraxacum officinale* by Pinto and Selander (1970) and on eight forbs and six grasses by Mayer and Johnsen (1978), none of which are recorded herein.

Pyrota engelmanni LeConte: Number analyzed - 72; plant specificity index - 71.3; number with empty digestive tracts - 6; percent feeding on petals and/or sepals - 95.5; percent feeding on endogeneous fungi - 0.86. HOSTS - FORBS: *Artemisia frigida* - 1.4%, *Chrysothamnus nauseosus* - 0.05%, *Oxytropis lambertii* - 17.3%, *Oxytropis sericea* - 39.2%, *Salsola kali tenuifolia* - 0.8%, *Sophora sericea* - 39.4%. GRASSES: *Bouteloua gracilis* - 0.1%, *Volpia octoflora* - 1.5%.

Zonitis sayi Wickham: Number analyzed - 4; plant specificity index - 100; number with empty digestive tracts - 1; percent feeding on inflorences - 100; percent feeding on pollen - 100. HOSTS - FORBS: *Grindelia squarrosa* - 100%.

SCARABAEIDAE

Diplotaxis haydeni LeConte: Number analyzed - 14; plant specificity index - 95.2; number with empty digestive tracts - 11. HOSTS - GRASSES: *Aristida longiseta* - 85.6%, *Bouteloua gracilis* - 14.4%.

TENEBRIONIDAE

Bothrotes plumbeus plumbeus (LeConte): Number analyzed - 36; plant specificity index - 97.2; number with empty digestive tracts - 0; percent feeding on petals and/or sepals - 100. HOSTS - FORBS: *Cirsium undulatum* 5-6%, *Chrysothamnus nauseosus* - 93.1%, *Gutierrezia sarothrae* - 1.4%.

Eusattus convexus LeConte: Number analyzed - 14; plant specificity index - 61; number with empty digestive tracts - 0; percent feeding on arthropod parts - 4.6; percent feeding on moss - 0.3. HOSTS - FORBS: *Artemisia frigida* - 9.7%, *Cryptantha fendleri* - 0.05%, *Helianthus annuus* - 9.8%, *Helianthus petiolaris* - 49.2%, *Kochia scoparia* - 0.6%, *Oenothera coronopifolia* - 3.8%, *Oxytropis sericea* - 2%, *Sphaeralcea coccinea* - 12.9%; GRASSES: *Sporobolus cryptandrus* - 7.1%.

Glyptasida sordida (LeConte): Number analyzed - 7; plant specificity index - 54.1; number with empty digestive tracts - 1; percent feeding on petals and/or sepals - 33.3; percent feeding on arthropod parts - 0.2. HOSTS - FORBS: *Artemisia frigida* - 0.1%, *Cryptantha fendleri* 0.05%, *Erigeron* species - 1.1%, *Mirabilis linearis* - 3.3%; *Oenothera coronopifolia* - 1.7%; *Opuntia polyacantha* - 28.4%; *Plantago purshii* - 13.4%; *Psoralea tenuiflora* - 14.1%, *Sophora sericea* - 3.9%, *Sphaeralcea coccinea* - 0.9%, undetermined forbs - 2%; GRASSES: *Bouteloua gracilis* - 30.5%; SEDGES: *Carex heliophila* - 0.1%.

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DISTRIBUTION OF THE STONEFLIES (PLECOPTERA) OF DELAWARE[1,2]

Robert W. Lake[3]

ABSTRACT: Intensive collecting and rearing of species of this aquatic insect order since 1972 have confirmed the presence of 38 species in Delaware. Nineteen of these were found only in the Piedmont physiographic province, 11 were found in both Coastal Plain and Piedmont and eight exclusively in the Coastal Plain. This is the first published detailed distributional list of Delaware stoneflies.

Little attention was given to the stonefly fauna of Delaware until about 1967 when some of the staff and graduate students of the Department of Entomology and Applied Ecology began to intensively collect aquatic insects. Specimens were identified and incorporated into the reference collection of the department. However, most of the collections were immature stages and in many cases could only be determined to genus. Beginning in 1972, in conjunction with a black fly survey of the State, I collected and reared to adult many species of stoneflies and am confident that most of the species occurring in Delaware have now been collected.

Delaware lies within two natural physiographic provinces, the Piedmont and the Coastal Plain. The Piedmont comprises approximately the northern one-quarter of New Castle County. The remainder of New Castle County and Kent and Sussex Counties, are Coastal Plain with much of the eastern portion being within the tidal zone and unsuitable as stonefly habitat (Fig. 1).

At this time 38 species of stoneflies are known from the State. Nineteen of these were found only in the Piedmont, 11 were found in both Coastal Plain and Piedmont and eight exclusively in the Coastal Plain (Table 1).

Distribution records given below include county, nearest town and designation of stream where specimens were collected. In a few instances, adults were collected some distance from streams in UV light traps or around incandescent lights.

This is the first published detailed distributional list of Delaware stoneflies.

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[3] Associate Scientist, Department of Entomology & Applied Ecology, University of Delaware, Newark, DE 19711.

LIST OF SPECIES

Family Nemouridae

Genus *Amphinemura*

A. nigritta (Provancher)

New Castle Co: Blackbird, Blackbird Creek & tributaries. Newark, tributaries of White Clay Creek. Ashland, tributary of Red Clay Creek.

A. wui (Claassen)

New Castle Co: Corner Ketch, tributary of White Clay Creek.

Genus *Ostrocerca*

O. prolongata (Claassen)

Kent Co: Pearsons Grove, Jordan Branch.

Genus *Prostoia*

P. completa (Walker)

Kent Co: Pearsons Grove, Jordan Branch.

Sussex Co: Ellendale State Forest, tributary of Gravelly Branch. Woodenhawk, tributary of Marshyhope Creek.

Genus *Soyedina*

S. carolinensis (Claassen)

New Castle Co: Newark, tributaries of White Clay Creek. Ashland, tributary of Red Clay Creek. Talleyville, Thompson's Bridge, tributary of Brandywine Creek.

Family Taeniopterygidae

Genus *Strophopteryx*

S. fasciata (Burmeister)

New Castle Co: Ashland, tributary of Red Clay Creek. Newark, tributary of White Clay Creek. Blackbird, Blackbird Creek.

Genus *Taeniopteryx*

T. burksi Ricker & Ross

New Castle Co: Blackbird, Blackbird Creek & tributaries. Newark, tributary of White Clay Creek. Ashland, tributary of Red Clay Creek.

Kent Co: Frederica, Pratt Branch. Sandtown, Cow Marsh Creek.

Sussex Co: Smith Hill, James Branch. Stockley, Stockley Branch.

T. maura (Pictet)

New Castle Co: Blackbird, Blackbird Creek and tributaries. Ashland, tributary of Red Clay Creek.

T. nivalis (Fitch)

New Castle Co: Thompson, tributary of White Clay Creek. Ashland, tributary of Red Clay Creek. Mermaid, Mill Creek.

Family Capniidae

Genus *Allocapnia*

A. nivicola (Fitch)

New Castle Co: Newark, Tributaries of White Clay Creek. Talleyville, Thompsons Bridge, tributary of Brandywine Creek.

A. recta (Claassen)

New Castle Co: Blackbird, tributaries of Blackbird Creek. Newark, tributaries of White Clay Creek. Corner Ketch, tributary of White Clay Creek. Ashland, tributaries of Red Clay Creek. Talleyville. Thompsons Bridge, tributary of Brandywine Creek. Glasgow, Belltown Run.

Kent Co: Frederica, Pratt Branch. Felton, Murderkill River. Pearson's Grove, Jordan Branch.

Sussex Co: Woodenhawk, tributaries of Marshyhope Creek.

A. rickeri Frison

Kent Co: Pearsons Grove, Jordan Branch.

A. virginiana Frison

Kent Co: Felton, Murderkill River.

Sussex Co: Woodenhawk, Tributary of Marshyhope Creek.

A. wrayi Ross

New Castle Co: Townsend & Blackbird, tributaries of Blackbird Creek.

Genus *Paracapnia*

P. angulata Hanson

New Castle Co: Corner Ketch, tributary of White Clay Creek.

Family Leuctridae

Genus *Leuctra*

L. ferruginea (Walker)

New Castle Co: Newark, tributaries of White Clay Creek. Ashland, tributary of Red Clay Creek. Rockland, tributary of Brandywine Creek.

Sussex Co: Millsboro, Famys Branch.

L. sibleyi Claassen

New Castle Co: Newark, tributary of White Clay Creek.

L. tenuis (Pictet)

New Castle Co: Ashland, tributary of Red Clay Creek.

Genus *Paraleuctra*

P. sara (Claassen)

New Castle Co: Newark, tributaries of White Clay Creek.

Sussex Co: Millsboro, Famys Branch.

Family Peltroperlidae

Genus *Peltoperla*

P. maria Needham & Smith

New Castle Co: Ashland, tributaries of Red Clay Creek. Corner Ketch, tributaries of White Clay Creek. Thompson, tributaries of White Clay Creek. Talleyville, Thompsons Bridge, tributary of Brandywine Creek.

Family Perlodidae

Genus *Diploperla*

D. duplicata (Banks)

New Castle Co: Newark, tributaries of White Clay Creek. Corner Ketch, tributaries of

White Clay Creek. Mermaid, Mill Creek. Blackbird, Blackbird Creek & tributary. Ashland, tributary of Red Clay Creek. Talleyville, Thompsons Bridge, tributary of Brandywine Creek.

Genus *Remenus*
R. bilobatus (Needham & Claassen)
New Castle Co: Newark & Corner Ketch, tributaries of White Clay Creek.

Genus *Isoperla*
I. coushatta Szczytko & Stewart
New Castle Co: Blackbird, Blackbird Creek. Glasgow, Belltown Run. Newark tributaries of White Clay Creek.
Kent Co: Andrews Lake, Spring Creek.
Sussex Co: Woodenhawk, tributary of Marshyhope Creek.

I. clio (Newman)
New Castle Co: Blackbird, Blackbird Creek & tributary.
Kent Co: Frederica, Pratt Branch. Milford, McCauleys Pond.
Sussex Co: Millsboro, Famy's Branch.

I. frisoni Illies
Sussex Co: Woodenhawk, tributary of Marshyhope Creek. Millsboro, Famy's Branch.

I. holochlora (Klapálek)
New Castle Co: Newark & Corner Ketch, tributaries of White Clay Creek.
Pleasant Hill, tributary of Pike Creek. Ashland, tributary of Red Clay Creek.

I. montana (Banks)
New Castle Co: Corner Ketch, tributary of White Clay Creek.

I. similis (Hagen)
New Castle Co: Newark & Corner Ketch, tributaries of White Clay Creek. Ashland, tributaries of Red Clay Creek. Mermaid, Mill Creek. Hockessin. Pike Creek. Talleyville, tributary of Brandywine Creek.

I. transmarina (Newman)
New Castle Co: Corner Ketch, tributary of White Clay Creek.

Family Perlidae

Genus *Paragnetina*
P. immarginata (Say)
New Castle Co: Mill Creek

P. media (Walker)
New Castle Co: Mill Creek & Brandywine Creek

Genus *Phasganophora*
P. capitata (Pictet)
New Castle Co: Brandywine Creek

Genus *Acroneuria*
A. abnormis (Newman)
New Castle Co: Newark & Corner Ketch, tributaries of White Clay Creek. Talleyville, tributaries of Brandywine Creek. Ashland, tributary of Red Clay Creek. Pike Creek.

A. arenosa (Pictet)
Sussex Co: Milton, Omar & Seaford.
Adults, collected in UV light traps.

Genus *Eccoptura*

E. xanthenes (Newman)

New Castle Co: Newark & Corner Ketch, tributaries of White Clay Creek. Ashland, tributary of Red Clay Creek. Talleyville, tributary of Brandywine Creek. Newark tributary of West Branch of Christina Creek. Blackbird, Blackbird Creek.

Genus *Perlesta*

P. placida (Hagen)

New Castle Co: Newark, tributaries of White Clay Creek. Blackbird, Blackbird Creek. Ashland, tributary of Red Clay Creek.

Sussex Co: Smith Hill, James Branch. Millsboro, Famys Branch. Milford, Herring Branch, Woodenhawk, tributary of Marshyhope Creek. Milton, collected in UV light trap.

Family Chloroperlidae

Genus *Hastaperla*

H. brevis (Banks)

New Castle Co: Newark & Corner Ketch, tributaries of White Clay Creek.

Genus *Sweltsa*

S. onkos (Ricker)

New Castle Co: Newark & Corner Ketch, tributaries of White Clay Creek.

Table 1. Distribution of stonefly species in Delaware by physiographic provinces

Piedmont	Coastal Plain	Coastal Plain & Piedmont
Peltoperla maria	*Allocapnia rickeri*	*Taeniopteryx burksi*
Taeniopteryx nivalis	*Allocapnia virginiana*	*Taeniopteryx maura*
Leuctra sibleyi	*Allocapnia wrayi*	*Strophopteryx fasciata*
Leuctra tenuis	*Ostrocerca prolongata*	*Leuctra ferruginea*
Allocapnia nivicola	*Prostoia completa*	*Paraleuctra sara*
Paracapnia angulata	*Acroneuria arenosa*	*Allocapnia recta*
Amphinemura wui	*Isoperla clio*	*Amphinemura nigritta*
Soyedina carolinensis	*Isoperla frisoni*	*Eccoptura xanthenes*
Paragnetina immarginata		*Perlesta placida*
Paragnetina media		*Isoperla coushatta*
Phasganophora capitata		*Diploperla duplicata*
Acroneuria abnormis		
Remenus bilobatus		
Isoperla holochlora		
Isoperla montana		
Isoperla similis		
Isoperla transmarina		
Hastaperla brevis		
Sweltsa onkos		

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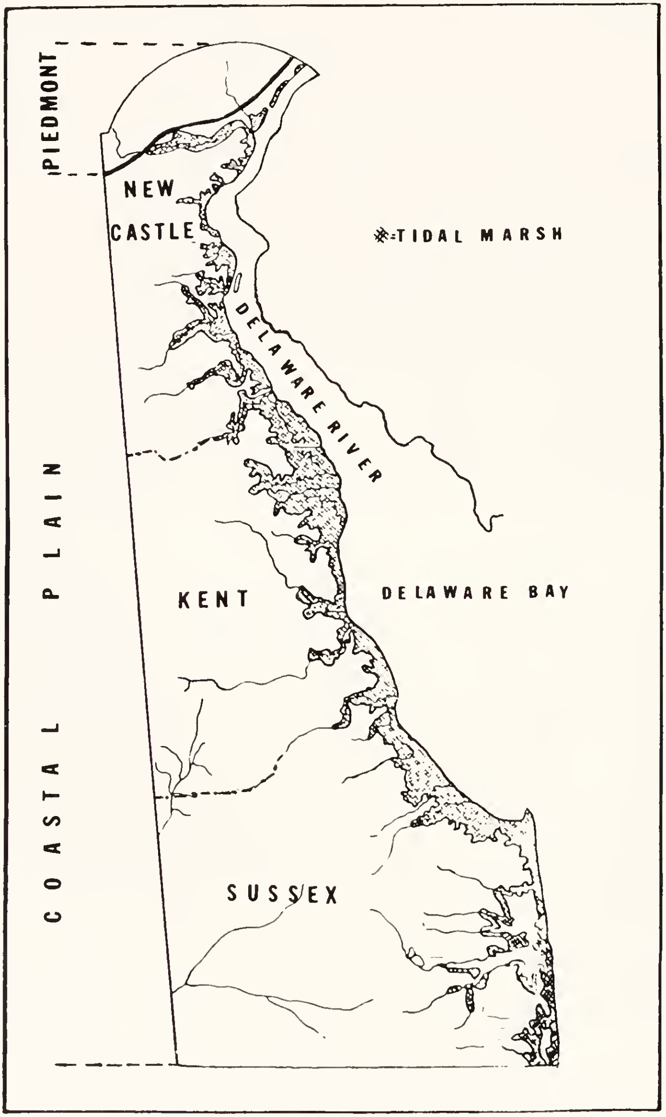

Fig. 1. Map of Delaware showing counties, tidal marshes and physiographic provinces.

LIST OF THE STONEFLIES (PLECOPTERA) OF WEST VIRGINIA[1]

Donald C. Tarter[2], Ralph F. Kirchner[3]

ABSTRACT: Examination of museum and literature records and personel collections have resulted in a list of 106 species comprising 37 genera from nine families of stoneflies. Nine new state records are added to the plecopteran fauna of West Virginia.

Stoneflies represent an integral component of the zoobenthos in the streams of West Virginia. Presently, 106 species comprising 37 genera and nine families are recorded for the state. Nine state records are added to the list of stoneflies. The classification system of Illies (1966) is followed in this paper; he listed 9 families, 57 genera and 183 species of stoneflies known to occur in the eastern United States. Of these, 65 percent of the genera and 58 percent of the species have been found in West Virginia. The abundance of stonefly species probably resulted from the Pleistocene glaciers which left West Virginia untouched and therefore an "island refuge" for stoneflies. In North America, only two other states and one province have more than 100 species recorded; Montana - 119 (Gaufin and Ricker, 1974), Virginia - 116 (Kondratieff and Voshell, 1979) and Quebec - 103 (Harper, 1971; Harper and Roy, 1974).

Several range extensions are noted. *Alloperla chloris* Frison (CT, NY, VA, QUEBEC), *Leuctra tenella* Provancher (ME, MN, NEW BRUNSWICK, NJ, NY, NOVA SCOTIA, PA) and *Utaperla gaspesiana* Harper and Roy (QUEBEC) have a southern range extension, while *Neoperla stewarti* Stark and Baumann (AR, KY, MS, OH, WI) has an eastern range extension. Information concerning drainage basins, streams, habitat, dates and sex are recorded in the West Virginia Benthological Survey at Marshall University.

A few investigators, including Hissom and Tarter (1976), Farmer and Tarter (1976) and Steele and Tarter (1977), have reported detailed investigations on the distribution of stoneflies in West Virginia. Other studies, including Baumann (1974), Claassen (1931), Frison (1935, 1942), Harper and Kirchner (1978), Illies (1966), Kirchner (1978), Needham and Claassen (1925), Ricker (1952), Ricker and Ross (1968, 1969, 1975), Ross and Ricker (1964, 1971), Stark and Baumann (1978), Stark and Gaufin (1976), Tarter (1976), Tarter et al. (1975, 1976, 1977)

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[1] Received January 10, 1980.

[2] Department of Biological Sciences, Marshall University, Huntington, West Virginia 25701

[3] Route 1, Box 412-A, Barboursville, West Virginia 25504

and Zwick (1973), have noted stonefly records for the state.

Holotypes of the following species are from West Virginia: *Allocapnia curisoa* Frison 1942, *A. frisoni* Ross and Ricker 1964, *A. loshada* Ricker 1952, *Alloperla aracoma* Harper and Kirchner 1978, *Taenionema atlanticum* Ricker and Ross 1975 and *Taeniopteryx ugola* Ricker and Ross 1968.

Order Plecoptera
Suborder Arctoperlaria
Group Euholognatha
Superfamily Nemouroidea
Family Leuctridae
Subfamily Leuctrinae

Leuctra alexanderi Hanson
L. biloba Claassen
L. carolinensis Claassen
L. duplicata Claassen
L. ferruginea (Walker)
L. maria Hanson
L. sibleyi Claassen
*_L. tenella_ Provancher
L. tenuis (Pictet)
L. truncata Claassen
Paraleuctra sara (Claassen)
Zealeuctra claasseni (Frison)
Z. fraxina Ricker and Ross

Family Taeniopterygidae
Subfamily Brachypterinae

Bolotoperla rossi (Frison)
Strophopteryx appalachia Ricker and Ross
S. fasciata (Burmeister)
Taenionema atlanticum Ricker and Ross

Subfamily Taeniopteryginae

Taeniopteryx burksi Ricker and Ross
T. maura (Pictet)
T. metequi Ricker and Ross
T. nivalis (Fitch)
T. parvula Banks
T. ugola Ricker and Ross

Family Nemouridae
Subfamily Amphinemurinae

Amphinemura delosa (Ricker)
A. nigritta (Provancher)
*_A. wui_ (Claassen)

Subfamily Nemourinae

Ostrocerca albidipennis (Walker)
O. complexa (Claassen)
O. prolongata (Claassen)
O. truncata (Claassen)
*_Prostoia completa_ (Walker)
P. similis (Hagen)
Soyedina carolinensis (Claassen)
S. vallicularia (Wu)

Family Capniidae

Allocapnia curisoa Frison
A. forbesi Frison
A. frisoni Ross and Ricker
A. granulata (Claassen)
A. indianae Ricker
A. loshada Ricker
A. maria Hanson
A. mystica Frison
A. nivicola (Fitch)
A. ohioensis Ross and Ricker
A. pygmaea (Burmerster)
A. recta (Claassen)
A. rickeri Frison
A. vivipara (Claassen)
A. zola Ricker
Paracapnia angulata Hanson
P. opis (Newman)

Group Systellognatha
Superfamily Pteronarcyoidea
Family Pteronarcyidae

Allonarcys biloba (Newman)
A. comstocki (Smith)
A. proteus (Newman)
Pteronarcys dorsata (Say)

Family Peltoperlidae
Subfamily Peltoperlinae

Peltoperla arcuata Needham
P. maria Needham and Smith

Superfamily Perloidea
Family Perlodidae
Subfamily Isoperlinae

Isoperla bilineata (Say)
I. burksi Frison
I. clio (Newman)
I. cotta Ricker
I. dicala Frison
I. gibbsae Harper
I. holochlora (Klapalek)
I. lata Frison
I. marlynia Needham and Claassen
I. namata Frison
I. orata Frison
I. richardsoni Frison
I. similis (Hagen)
I. transmarina (Newman)

Subfamily Perlodinae

Cultus decisus (Walker)
Diploperla robusta Stark and Gaufin
Helopicus subvarians (Banks)
Isogenoides hansoni (Ricker)
Malirekus hastatus (Banks)
Remenus bilobatus (Needham and Claassen)
Yugus arinus (Frison)
Y. bulbosus (Frison)

Family Chloroperlidae
Subfamily Chloroperlinae

Alloperla aracoma Harper and Kirchner
**A. chloris* Frison
A. imbecilla (Say)
A. usa Ricker
Hastaperla brevis (Banks)
**Rasvena terna* (Frison)
Suwallia marginata (Banks)
**Sweltsa lateralis* (Banks)
S. mediana (Banks)

Subfamily Paraperlinae

**Utaperla gaspesiana* Harper and Roy

Family Perlidae
Subfamily Acroneuriinae

Acroneuria abnormis (Newman)
**A. arenosa* (Pictet)
A. carolinensis (Banks)
A. evoluta Klapalek
A. filicis Frison
A. internata (Walker)
A. lycorias (Newman)
A. perplexa Frison
Eccoptera xanthenes (Newman)
Perlesta placida (Hagen)
P. frisoni Banks
Perlinella drymo (Newman)

Subfamily Perlinae

Neoperla choctaw Stark and Baumann
**N. stewarti* Stark and Baumann
Paragnetina media (Walker)
P. immarginata (Say)
Phasganophora capitata (Pictet)

*State record

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NEW DISTRIBUTION RECORD FOR *MICROCTONUS NITIDULIDIS* LOAN (HYMENOPTERA: BRACONIDAE)[1,2]

W.A. Connell[3]

Microctonus nitidulidis Loan was described from Ohio where it had been found parasitizing the strawberry sap beetle, *Stelidota geminata* (Say) in 1977 and 1978 (Weiss, Williams and Loan, 1978, Naturaliste Canadien 105:323-26). *M. nitidulidis* is a thelyotokous parasitoid whose only known host is the *S. geminata* adult.

M. nitidulidis also occurs in Delaware. Five of these small wasps were reared from 220 *S. geminata* adults collected August 26, 1979 at Newark, DE. in a bait trap placed along the margin of a vegetable garden adjacent to an abandoned apple orchard. Emergence took place between September 9 and 12. Identification was made by Dr. P.M. Marsh, Systematic Entomology Laboratory, U.S. Department of Agriculture, Washington, D.C.

The host, *S. geminata* occurs throughout the eastern and central United States and portions of adjacent Canada. It is also present in California (Weiss and Williams, 1978, Proc. No. Centr. Br. Entomol. Soc. Amer. 33:55-6, Abstract). Its range extends through Central America and the Caribbean to Brazil.

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[3] Entomology and Applied Ecology, University of Delaware, Newark, DE 19711.

STELIDOTA GEMINATA (SAY) INFESTATIONS OF STRAWBERRIES (COLEOPTERA:NITIDULIDAE)[1,2]

W.A. Connell[3]

ABSTRACT: Reports of *Stelidota geminata* (Say) infestations in strawberries date from the 1950's, but prior to that this fruit was harvested commercially at an earlier stage of maturity, before becoming attractive to this beetle.

Known reports of infestations of strawberry fruit by the strawberry sap beetle, *Stelidota geminata* (Say), date from the 1950's. The Cooperative Economic Insect Report, listed infestations in Wisconsin 1954, 1962, Virginia 1958, Maryland 1964 and Michigan 1966, 1967, 1968, 1970, 1971 (USDA 1954-71). Unfortunately these are not quantitative records, nevertheless they indicate that this beetle became abundant enough to attract attention. Some other records of *S. geminata* infesting strawberries are from specimens sent to the USDA Insect Identification Laboratory. These are: Delaware 1952, 1976, Florida 1959, Maryland 1959, 1961, 1966, 1977, Virginia 1961, Arkansas 1961, Michigan 1963, Georgia 1969, Indiana 1974, and Ohio 1977. Again these records give only a vague idea of population densities. *S. geminata* occurs in the United States from New Hampshire to Florida and west to Wisconsin, Iowa and Texas. It also is present in California. Its range includes part of adjacent Canada (Weiss and Williams, 1978). Southward the range extends through Central America and the West Indies into Brazil.

Say (1825) described this beetle from eastern North America. The strawberry also is a native species, so it is unlikely that *S. geminata* developed a sudden fondness for strawberries in the early 1950's. It should be noted that the strawberry provides one of the earliest fruits available to this beetle each year, as this may have a bearing on the occurrence of outbreaks. *S. geminata* adults are attracted to ripe, overripe and injured fruits of a great many plants, some of which were listed by Weber and Connell (1975). However such fruit is attacked only when on or near the ground. For instance they invade apple, peach and citrus fruit only when these have fallen to the ground, but they damage the fruit of low-growing species as they ripen and while yet on the plant. Among these are

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[3] Entomology and Applied Ecology, University of Delaware, Newark, DE 19711.

ENT. NEWS, 91(2):55-56

strawberries and mayapples (the fruit of *Podophyllum peltatum* L., a prominent ground cover plant of eastern deciduous forests).

In Delaware and neighboring states there is a possible relationship between a change in strawberry harvesting methods and the reports of infestations of this crop. Prior to the 1950's strawberries were picked by hired laborers, often migrants. They were trained to gather only sound fruit in the early stages of ripening, so that it would ripen after it reached market, 2 or more days later. Such fruit is not attractive to *S. geminata* unless damaged mechanically or by diseases, such as brown rot. Rising labor costs made this method of harvesting strawberry fruit unprofitable. The few acres of the crop surviving into and after the 1950's were so-called "pick-your-own" operations. Buyers picking berries for their own use tend to select red-ripe fruit. These are quite attractive to *S. geninata*. Such a berry may appear to be perfect, but when picked and the blossom end examined, there may be a small dark brown beetle abandoning a hole in which it has been feeding. The buyer-picker discards such contaminated berries, becomes frustrated if this happens frequently, sometimes complains to the owner, or to his employee at the check-out stand, and departs in search of a planting without beetles. The beetles seldom reach the check-out stand, because any disturbance initiates escape and concealment movements. Few beetles reach the picking boxes and nearly all of those soon escape.

S. geminata adults are rarely captured in traps used for collecting flying insects, an observation that suggests they fly only to a limited extent. They are essentially ground dwelling beetles with almost cryptic behavior. They enter the fruit substrate from the underside where it is in contact with the ground. If disturbance results in exposure, they somewhat awkwardly, but rather quickly move to hide again.

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BLACKLIGHT TRAP COLLECTING OF TACHINIDS[1,2]

Paul P. Burbutis[3], James A. Stewart[4,5]

ABSTRACT: Several hundred specimens of tachinids, representing 14 species, were captured in a standard 15-watt insect survey blacklight trap. These, and other entomophage collections previously reported on, indicate that this widely-used insect survey method has additional practical value for use in Integrated Pest Management and biocontrol programs.

Recently Burbutis and Stewart (1979) reported on the collection during 1970 of parasitic Hymenoptera by a standard Ellisco®blacklight trap. The results indicated that this routine and widely-used technique could also be employed to determine species composition, relative abundance and seasonal distribution of many of these entomophagous insects. For those Hymenopteran species attracted to blacklight the method could be of considerable practical value as a monitoring tool in Integrated Pest Management programs.

In addition to the above mentioned parasites several hundred tachinids were identified among these trap collections and the information that follows pertains to these specimens. The trap was equipped with a 15-watt GE F15T8BL lamp. For additional details on methods and equipment see Burbutis and Stewart (1979).

Results and Discussion

During the summer of 1970, 440 tachinid specimens, representing 14 species, were collected. The two most numerous species (and numbers captured) were *Admontia degeerioides* (Coquillett) (201) and *Olenchaeta kansensis* (Townsend) (102). Five species were somewhat common with collections ranging from 20 to 100 specimens each: *Eutrixa exilis* (Coquillett), *Dinera grisescens* (Fallen), *Periscepsia laevigata* (Wulp), *Athrycia cinerea* (Coquillett) and *Paradidyma affinis* Reinhard. The

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[3] Professor, University of Delaware, Newark.

[4] Formerly Biologist, USDA, ARS, Moorestown, N.J.

[5] The authors wish to thank Dr. C.W. Sabrosky, of the USDA Systematic Entomology Laboratory at the United States National Museum, for the tachinid determinations.

remaining 7 species were: *Paradidyma singularis* (Townsend), *Catharosia n.* sp., *Minthozeilia* sp., *Ceratomyiella conica* Townsend, *Blondelia* sp., *Elfia manca* Greene, and *Elfia* sp.

Considerable work is needed to determine whether other tachinids can be sampled by this method. Also, studies are needed to show which ecological situations are best suited for its use. Reardon et al. (1977) presented data showing that Malaise and McPhail traps will differentially trap various species of tachinids. The numbers of tachinids collected per trap, over a similar 4-month period in our blacklight trap, compares favorably with, and in most instances exceeds, the numbers collected in the Malaise and McPhail traps. If trapping of adult parasites is to be used for measuring the impact of parasites on their hosts then the blacklight trap, a tool in common use for monitoring pest species, should have further application than is generally practiced.

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STUART W. FROST

1891 — 1980

Dr. S.W. Frost, a long-time member of the American Entomological Society died January 21, 1980 at his home in State College, Pennsylvania. A graduate of Cornell University (Ph. D. 1928), Dr. Frost wrote over 200 papers and was an authority on Leaf Mining Insects. In addition, he founded the Frost Entomological Museum at Penn State University and continued to work there after his retirement from the University in 1957. Memorial contributions may be made to the Frost Entomological Museum Memorial Fund at Penn State University, University Park, PA 16802.

NEW RECORDS FOR SOME CANADIAN HORSE FLIES AND DEER FLIES (DIPTERA: TABANIDAE)[1]

A.W. Thomas[2]

ABSTRACT: *Hybomitra brennani* is recorded from Alberta; *Tabanus nigrovittatus* is recorded from Cape Breton Island, northern New Brunswick, and Quebec; *Chrysops fuliginosus* is recorded from Quebec; *Haematopota rara, Atylotus duplex, Atylotus thoracicus, Chrysops aberrans, Chrysops delicatulus, Chrysops montanus,* and *Tabanus reinwardtii* are recorded from New Brunswick.

Hybomitra brennani (Stone) is considered an eastern species as Philip (1965) gave its distribution as New Hampshire and Quebec. On 14 July 1973, I collected three females in a Manitoba fly trap located in a *Sphagnum* bog, 32 km southeast of the town of Slave Lake, Alberta. I have also seen another 20 females taken in a similar trap in the same vicinity by R.L. Hooper, 3 — 29 July 1973.

Tabanus nigrovittatus Macquart is a salt marsh species with a range along the Atlantic coast to Prince Edward Island (Pechuman 1964). On 23 August 1977, I took three females, attacking man, on Cheticamp Island, Inverness County, Cape Breton Island, Nova Scotia. Between 28 July and August 2, 1979, specimens of *T. nigrovittatus* were collected from nine localities from Neguac, Northumberland County on the northeast coast of New Brunswick to Charlo, Restigouche County on the Bay of Chaleur, New Brunswick. The intermediate localities are not listed as I expect this species to be present in all salt marsh habitats along this coastline. One female was collected, attacking man, at Miguasha, Gaspé Peninsula, Quebec, on 1 August 1979.

Chrysops fuliginosus Wiedemann is a salt marsh species ranging from Florida to Nova Scotia (Philip 1965). On 1 August 1979, one female was taken, attacking man, in a salt marsh at Pointe-à-la-Garde, on the Bay of Chaleur, Gaspé Peninsula, Quebec.

Thomas (1978) recorded 43 species of tabanids from New Brunswick. During 1978 and 1979, a further 8 species were collected:

Haematopota rara Johnson; 1 female in flight trap, 21 July 1978, Bull Pasture Bog, Sunbury Co.

Atylotus duplex (Walker); 2 males, 1 female in flight trap, 9-14 July 1979, Fredericton, York Co.

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[1] Received November 13, 1979.

[2] Maritimes Forest Research Centre, Canadian Forestry Service, Department of the Environment, P.O. Box 4000, Fredericton, N.B. Canada

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Atylotus thoracicus (Hine); 15 males, 15 females in flight trap, 13-26 July 1978, Bull Pasture Bog, Sunbury Co.

Chrysops aberrans Philip; 37 females in flight trap and attacking man, 19-25 July 1978, Moores Mills, Charlotte Co.; 56 females, attacking man, 19 July — 17 August 1979, Scotch Ridge, Charlotte Co.

Chrysops delicatulus Osten Saken. This species was recorded as occurring in New Brunswick by McIntosh (1903). The specimens collected were to be deposited in the United States National Museum, Washington. The specimens were apparently lost as Philip (1965) gave Maine as the northeast limit and Pechuman (1974 *in litt.*) gave southern Quebec and southern Maine as the northern limit. I collected four females in a *Sphagnum* bog, 13-15 July 1979, using a Manitoba fly trap, about 5 km north of Lepreau, Charlotte Co.

Chrysops fuliginosus Wiedemann; 12 females attacking man and in a Manitoba fly trap, 13-15 July 1979, Chance Harbour, Saint John Co.

Chrysops montanus Osten Sacken; 1 female in flight trap, 19 July 1978, Moores Mills, Charlotte Co.

Tabanus reinwardtii Wiedemann; 1 female in flight trap, 10 July 1979, Fredericton, York Co.

These 8 species, together with *Hybomitra itasca* (Philip) collected by Lewis and Bennett (1977), bring the total number of species known from the province to 52.

ACKNOWLEDGEMENT

I thank Dr. L.L. Pechuman, Cornell University, for his confirmation of my identifications of *A. duplex*, *A. thoracicus*, *C. delicatulus*, *C. montanus*, and *H. brennani*.

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NEW RECORDS FOR *PHYLLOPHAGA* (COLEOPTERA: SCARABAEIDAE) IN MISSISSIPPI[1]

Paul K. Lago[2]

ABSTRACT: The ranges of *Phyllophaga balia* (Say), *P. incuria* Sanderson, *P. marginalis* (LeConte), *P. (Phytalus) omani* Sanderson and *P. (Phytalus) obsoleta vanalleri* (Schaeffer) are extended to include Mississippi. The subgenus *Phytalus* is reported from the state for the first time. *P. marginalis insolita* Cartwright is reported for the first time since its description.

Langston (1927) treated the *Phyllophaga* of Mississippi and recorded 46 species from the state. During subsequent years, few additional species were reported from the state, probably due to the thoroughness of Langstons' work and the lack of collecting activity. Luginbill and Painter (1953) added but two species to the Mississippi list.

In 1976 a general survey of the Scarabaeidae of Mississippi was begun. Collecting activities associated with this survey, along with the examination of specimens from the insect collections at the University of Mississippi, Mississippi State University and Louisiana State University, has revealed the presence of five species of *Phyllophaga* not previously known to occur in Mississippi. Of the five species, two are in the subgenus *Phytalus* and represent the first records of this subgenus in the state. A total of 53 species of *Phyllophaga* are now known from Mississippi.

With the exception of the specimen of *P. (Phytalus) omani* Sanderson, which is in the LSU collection, representatives of all species reported here are contained in the University of Mississippi insect collection.

NEW RECORDS

Phyllophaga balia (Say).. *Lafayette Co.*, Oxford. 6-IV-1978. P.K. Lago, at blacklight, 1♂. Although principally north central in distribution, *P. balia* has been recorded from Arkansas, Tennessee and Alabama (Luginbill and Painter, 1953) and its presence in Mississippi is not surprising.

Phyllophaga incuria Sanderson. *Hancock Co.*, Gainesville, 10-V through 15-VI-1966, H.R. Hepburn, 9♂; Waveland, 14-VI-1966, H.R. Hepburn, 1♀. Luginbill and Painter (1953) record *P. incuria* from Oklahoma and Texas. The above records represent a considerable range extension for the species.

Phyllophaga marginalis (LeConte). *Lafayette Co.*, 8 mi. NE Oxford, 20-IV-1977, P.K.

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[1] Received December 20, 1979.

[2] Department of Biology, University of Mississippi, University, MS 38677.

Lago, 6♂, at light. *Neshoba Co.,* 1.5 mi. N Dixon, 9-V-1979, P.K. Lago, 1♀, on *Sassafrass albidum* (Nutt.) Nees. *Oktibbeha Co.,* Ag. Coll. Ms. (Mississippi State University), 20-IV-1928, W.S. McClellen, 1♂. *Wilkinson Co.,* T3N-R1W-Sec. 7, 21-IV-1979, A.E. Zuccaro, 2♂. These records indicate that *P. marginalis* is widely distributed in the state, however specimens are seldom encountered. The presence of *P. marginalis* in Mississippi was expected in light of its known range.

Phyllophaga marginalis insolita Cartwright. *Tishomingo Co.,* Tishomingo St. Park, 17-VI-1977, P.K. Lago, 1♂. This pubescent form of *P. marginalis* has been reported only from the type material collected in Alabama (Cartwright, 1944; Luginbill and Painter, 1953).

Phyllophaga (Phytalus) obsoleta vanalleri (Schaeffer). *Adams Co.,* Natchez, 12-VI-1978, 11-VII-1978, A.E. Zuccaro, 2♂; Homochitto Nat. For., 19-VI-1979, P.D. Hartfield, 1♂. *Harrison Co.,* Gulfport, 4-VI-1927, F.P. Amsley, 1♂. *Holmes Co.,* Durant, 8-VI-1927, G.R. Williams, 9♂. *Lafayette Co.,* Oxford, six collection dates from 1-VI through 11-VII (1977-1979), P.K. Lago and D.F. Stanford, 21♂, blacklight. *Lincoln Co.,* Brookhaven, 24-V-1927, N.D. Peets, 4♂. *Oktibbeha Co.,* Starkville, nine collection dates from 6-III through 23-VIII (1943-1976), W.H. Cross and W.D. Fancher, 11♂, blacklight. *Pearl River Co.,* Poplarville, 25-V-1927, J.E. Lee, 1♂. *Pontotoc Co.,* 1 mi. N Pontotoc, 21-VI-1977, R.B. Head, 2♂. *Scott Co.,* Golden Memorial St. Park, 21-VI-1978, S. Hurdle, 2♂. *Tishomingo Co.,* Tishomingo St. Park, five collection dates from 6-VI through 22-VII (1977-1978), P.K. Lago and F. Searcy, 12♂, blacklight, 2♀ from oak (*Quercus* sp.). *Warren Co.,* T14N-R3E-Sec. 30, 21-VI-1979, P.D. Hartfield, 1♂. Saylor (1939) reported this specis from Texas, Louisiana and Alabama, thus its presence in Mississippi was predictable. Males are highly attracted to blacklight, however light traps yielded no females. The two females examined were collected from oak, which is apparently the first host recorded for this species.

Phyllophaga (Phytalus) omani Sanderson. *Harrison Co.,* Biloxi, 28-IX-1929, K.L. Cockerham, 1♂. Sanderson (1937) described this species from two specimens collected in Alabama and Georgia. Saylor (1939) reported having one specimen in his collection from "North America" and Sanderson (1939) reported another specimen from Georgia, bringing the number of known specimens of *P. (Phytalus) omani* to four (3♂ and 1♀). The above Mississippi record represents the fifth reported specimen of this apparently rare species.

ACKNOWLEDGEMENTS

I wish to thank Dr. Joan B. Chapin (Louisiana State University) and Dr. Leon W. Hepner (Mississippi State University) for the loan of specimens. I would also like to acknowledge the collecting efforts of Sara Hurdle and Edward Zuccaro.

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INSECT FIELD WORK OPPORTUNITIES IN BARBADOS, LESSER ANTILLES[1]

Stewart B. Peck, Jarmila Peck[2]

The native insect faunas of the Lesser Antillean islands are still poorly known. For instance, in many groups of small beetles we still know little more than what was described nearly a century ago by Rev. A. Matthews from Grenada and St. Vincent. Many entomologists are now inclined to "write-off" many of the lesser Antillean islands for field work because of extensive deforestation and habitat disruption, and the high cost of visiting them.

However, a surprisingly productive exploratory trip in March 1979 showed that this was not entirely the case in Barbados. Very reasonable accommodation and excellent library and laboratory facilities for field work can be obtained at the Bellairs Research Institute (of McGill University), 1 km N of Holetown, on the coast north of Bridgetown. The institute is set up as a marine biology station, but any researcher is welcome (see Sander, 1973). A letter to the station Director can obtain current rates and more detailed information. Special vacation package air fares can be arranged from eastern cities with travel agents, as well as reservations for a "mini-moke" car from Sunset Crest Car Rentals at Holetown. These small 4-passenger cars are the most economical available and are the most time efficient way for a worker to visit a selection of field areas.

Barbados has undergone an incredible deforestation; most of it within 15 years after the introduction of sugar cane as a crop in 1645. It now covers more than 80% of the island. Less than 5% of the island's area has been continuously wooded throughout the past 300 years. The human population density of 1560/km^2 is one of the world's highest. However, a remarkable amount of native plants (6 are endemic) and native insects have survived in rough country along rocky escarpments and in the series of deep gullies that radiate from the island's center. Useful references in understanding the vegetation and its history as a guide to insect habitats, and their history and location, are: Gooding, 1974; Randall, 1970; Watts, 1970, and 1978. These give background data on geology, geography, weather, topography, etc., and additional references. Gooding (1974) and a most useful 1:50,000 topographic map are obtained in an information kiosk in the Independence Square Car Park, just south of the Inner Basin, downtown Bridgetown.

An attractive mix of introduced and native vegetation is preserved in Welchman Hall Gully, about 8 km E of Holetown, operated with an

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[1] Received December 4, 1979.

[2] Departments of Biology and Geology, Carleton University, Ottawa K1S 5B6, Canada.

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admission fee as a botanic garden by the Barbados National Trust. Plant collecting is not allowed, but discrete insect collecting is possible if the vegetation is not disturbed. Tree trunk and black light collecting at night would be good here because of the trail system. The Gulley is technically closed at night, but it is not supervised and one can simply walk in. Questions about ones activities should be satisfied with a polite reply that it is insect research in conjunction with Belairs Institute. Sweeping and beating that will mar the vegetation should not be attempted. This type of collecting is possible in the many other available gully forests, e.g., Jack-in-the-box Gully. Watts (1978) discusses the high abundance of native subcanopy plant species (and presumably their insect associates) found in woodlots of introduced mahogony (*Swietenia mahogoni*) which are common around the island.

The finest native forest site is Turner Hall Woods, about 20 h (50 acres), located on a hill slope between 180-240 m(600-800') elev. It has a high and complete canopy, and is a multi-story tropical mesophytic (seasonal semideciduous) forest, located about 10 km NE of Holetown. This remnant gives an excellent idea of the nature of the former mesophytic forests of Barbados. It is reached by foot through a sugar cane field-road from the spur road to the east between Turners Hall and Mose Bottom villages. This foot path runs the length of the Woods and comes out at the village of Cheltenham. We collected here by sweeping, Malaise trap, litter sifting, and baited pitfall traps. Our results were rich and diverse considering that it was the middle of the dry season. Turners Hall Woods should be most rich and productive in the wet season from June to December, when it receives about 2/3 of its yearly rainfall of about 70 inches. The island average is 60 inches, but some coastal areas are decidedly semi-arid.

More entomological field work on Barbados is crucial for an understanding of the dynamics of the evolution and dispersal of Caribbean insects. Botanically and geologically it is one of the best known islands. It is a relatively isolated non-volcanic oceanic island which has been available for overwater colonization only since the early Pleistocene. This gives a valuable reference point in time, since which the flora and fauna have arrived. The dynamic capabilities of insect species may be deduced from what has and has not arrived and differentiated in this time.

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

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(Continued on inside of back cover)

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A NEW SPECIES OF *LIMNELLIA* MALLOCH (DIPTERA: EPHYDRIDAE) FROM MT. RAINIER, WASHINGTON[1]

Wayne N. Mathis[2], Richard S. Zack[3]

ABSTRACT: *Limnellia rainer*, new species, is described from Mt. Rainier, Washington.

While the second author was conducting field studies on the Ephydridae of Mt. Rainier Washington, the new species described here was discovered. Zack's field of work was done in conjunction with his thesis studies on the natural history of the shore flies of the Pacific Northwest. Although we have but one specimen, it is being described now to make its name available for other studies (Zack, in preparation) and because we have no doubt as to its status.

The description and key couplets follow the format of Mathis (1978) in his recent revision of the nearctic species of *Limnellia*. For further information on the generic relationships and details of other nearctic species, consult Mathis (1978).

Key (adapted from Mathis, 1978:260)

3.' Cell R_1 uniformly and entirely lightly infumated, lacking contrasting white areas .... *L. rainier*, n.sp.
— Cell R_1 with several white areas (irregularly shaped), constrasting distinctly with lightly infumated background .... 4.

Limnellia rainier Mathis and Zack, n.sp.
(Figs. 1-5)

Diagnosis.—Specimens of *L. rainier* are distinguished from those of congeners by the following combination of character states: Setose portion of face uniformly whitish gray, tomentose; antennal foveae shallowly impressed; wing pattern as in Fig. 1; legs unicolorous, blackish; male terminalia as in Figs. 2-4.

Description.—A small shore fly, length approximately 2 mm (abdomen measured separately).

Head: head width-to-height ratio 1 : 0.62. Frons tomentose, dull, mostly brown, anterior margin and small area near vertex gray to grayish brown, parafrons mostly blackish; face weakly arched transversely, antennal foveae shallowly impressed but evident, facial coloration uniformly and entirely whitish gray, lacking transverse brown bands. Eye height-to-width ratio 1 : 0.89; eye-to-cheek ratio 1 : 0.12.

Thorax: Legs generally unicolorous, mostly blackish. Wing pattern (Fig. 1) as follows:

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[1] Received February 6, 1980

[2] Department of Entomology, NHB 169, Smithsonian Institution, Washington, D.C. 20560

[3] Department of Entomology, Washington State University, Pullman, Washington 99163

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Cell R_1 uniformly lightly infumated, lacking white spots entirely; cell R_3 with 4 white areas interspaced about equally from base to apex, basal white area slightly smaller than more apical ones; cell R_5 with 3 white areas and 2 darkened areas in between, first darkened area at same level as posterior crossvein, second darkened area at about apical one-third, both white and darkened areas closely appressed to vein R_{4+5}; vein R_{4+5} irregularly sinuate; discal cell with 1 white area along posterior margin at apical one-fourth, cell M with almost ring area white, faint, inconspicuous. Wing length-to-width ratio 1:0.48; costal vein ratio 1:0.27; M_{1+2} vein ratio 1:0.60. Halter with pedicel yellowish brown, capitellum blackish brown.

Abdomen: Male terminalia as follows: Epandrium (Fig. 4) in posterior view higher than wide, dorsum rounded, with cercal cavity width greater than one-half epandrial width at same level, widest subventrally; surstyli broadly fused medially, with shallow emargination dorsally and ventrally, ventral emargination more abruptly formed; aedeagus (Fig. 3) dissimilar from other *Limnellia* species, with a ventral and posteroventral projections, former more or less parallel sided, blunt apically, latter tapered to acute apex; gonite (Fig. 2) elongate, tapered, recurved apically.

Type Material.—Holotype male is labeled: "WASH: Pierce Co. Mt. Rainier N.P. Cayuse Pass, 4694' 14 Jul 1978, R.S. Zack, coll. ♂/HOLOTYPE *Limnellia rainier* Mathis and Zack [both labels handwritten, the last one red]." The holotype is in the National Museum of Natural History, Smithsonian Institution, USNM type number 76519. The abdomen and right wing have been removed. The abdominal structures have been dissected and are in an attached microvial; the wing has been slide mounted.

Geographic Distribution.—Known only from the type-locality on Mt. Rainier, Washington.

Natural History.—The holotype was collected in a small, Canadian Zone, wet-meadow (Taylor, 1922) located at the western boundary of Mt. Rainier National Park (Fig. 5). At 4694 foot elevation the meadow is surrounded by a mixed coniferous forest. The single male was taken while sweeping grasses along the margins of a small, snow-melt stream. Besides grasses, identifiable heavy vegetation included blueberry (*Vaccinium* sp.) and a species of montane lily (*Erythronium* sp.) that was beginning to emerge through the snow. Although collected in mid-July the area was still under considerable snow cover.

The presence of an adult when early seasonal conditions persisted suggests that the species overwinters in either the adult or pupal stage, the former more likely. Nothing is known of the behavior, food habits, or immature stages of this species. Other ephydrids collected at the same time included *Scatella stagnalis* (Fallén), *Hydrellia griseola* (Fallén), *H. platygastra* Cresson and *H. proclinata* Cresson. All were present, however, in extremely low numbers.

Etymology.—The specific epithet, *rainier*, is a noun in apposition and alludes to the type-locality, Mt. Rainier.

Remarks.—This is the twelfth species of the genus *Limnellia* to be discovered in the Nearctic Region. It is also the third from Mt. Rainier, the others being *L. balioptera* Mathis and *L. turneri* Mathis.

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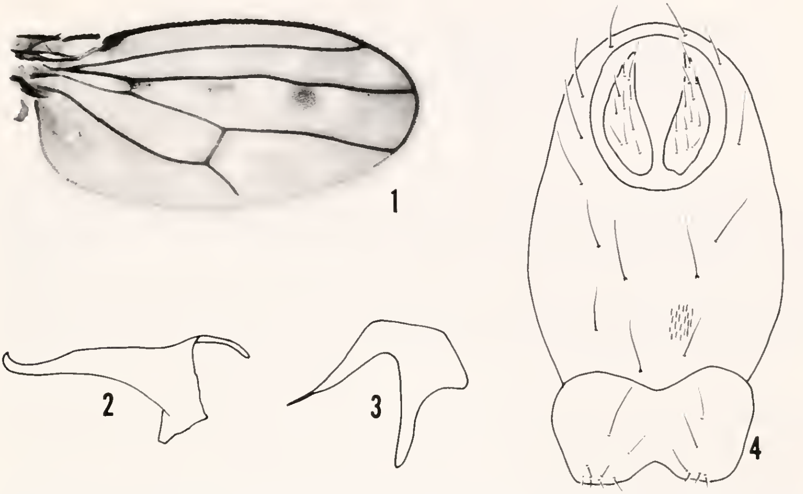

Figs. 1-4. *Limnellia rainier*, n. sp. 1, wing; 2, left gonite, lateral view; 3, aedeagus, lateral view; 4, cerci, epandrium, and surstyli, posterior view.

Fig. 5. Type-locality habitat of *Limnellia rainier*, n. sp.

CITHERONIA REGALIS LARVAE (LEPIDOPTERA: CITHERONIIDAE) FEEDING ON MISTLETOE IN MISSISSIPPI[1]

Robert C. Graves[2], Charles L. Graves[3]

On August 31, 1978 we removed part of a heavy infestation of the parasitic epiphyte American mistletoe, *Phoradendron flavescens.* (Pursh.) Nutt., from the branches of a large blackjack oak, *Quercus marilandica* Muenchh., located in Leake County, Mississippi, 2 miles north of Ludlow. Three "hickory horned-devils" (larvae of *Citheronia regalis* Fabr.) were feeding on three separate mistletoe plants. No larvae were seen on the oak leaves, but a search of the entire tree was not possible.

Caterpillars and mistletoe were removed for observation. The larvae fed voraciously on the thick mistletoe leaves, defoliating the plants and leaving only the tough, woody stems. Feeding continued both day and night and several cups of large feces were eliminated by the larvae.

On September 4 the larvae and two 17 x 12 x 7 in. grocery bags packed with mistletoe plants were transported to Bowling Green, Ohio, where feeding continued as before. Nearly all of this mistletoe was defoliated by the caterpillars.

On September 8 the larvae changed from green to blue-green in color, stopped feeding, exhibited active searching behavior and left the mistletoe. Each larvae was introduced into a gallon jar half filled with moist sandy soil. The larvae burrowed into the sand, leaving no obvious openings at the surface.

One jar was kept over winter in a cool basement (10°C.). It was brought to room temperature (20°C.) in early summer, 1979, and a royal walnut moth emerged July 31, 1979 in perfect condition. This moth flew normally before it was killed and mounted. The wingspread was 11.5 cm. No adults emerged from the other jars which were kept at room temperature.

To our knowledge, this is the first published report of American mistletoe as a host plant for *Citheronia regalis*. *Phorandendron flavescens* is a troublesome parasite of several tree species, especially oaks. As 3 last-stage larvae of *C. regalis* were capable of eating the amounts of mistletoe stated above, each larva is capable of defoliating several mistletoe plants. If mistletoe should be a fairly common food for *C. regalis* larvae, this species may be of some importance in the biological control of this plant.

We are pleased to acknowledge the advice of Bryant Mather, Clinton, Mississippi, for which we are most appreciative.

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[1] Received February 15, 1980

[2] Dept. of Biological Sciences, Bowling Green State University, Bowling Green, Ohio 43403.

[3] 627 Crestview Drive, Bowling Green, Ohio 43402.

PHORETIC RELATIONSHIPS BETWEEN CHIRONOMIDAE (DIPTERA) AND BENTHIC MACROINVERTEBRATES[1,2]

Tina R. White, John S. Weaver III, Richard C. Fox[3]

ABSTRACT: Seven streams in the Piedmont and Coastal Plain regions of South Carolina were sampled to determine the frequency and composition of aquatic phoretic relationships. In one stream, as many as 71.4% of the Odonata collected hosted phoretic midges. *Stenonema smithae* Traver (Ephemeroptera: Heptageniidae) and *Nectopsyche exquisita* (Walker) (Trichoptera: Leptoceridae) also were found with phoretic Chironomidae. In a population of snails at Wildcat Creek, 80.0% were phoretic symbionts. Aquatic phoretic relationships were concluded to be relatively common in the regions studied, probably due in part to the prevalence of sand-bottomed streams.

In recent years there has been increased interest in and documentation of phoretic associations between aquatic organisms. Phoresy is defined (Steffan 1967) as a partnership in which one organism transports the other, either permanently or as a characteristic and essential element in the life cycle. Steffan (1967) reported Chironomidae to be associated phoretically with Trichoptera, Diptera, Ephemeroptera, and Plecoptera. Roback (1977) found *Eukiefferiella* sp. living on a naucorid (Hemiptera). Rosenberg (1972) reported finding one libellulid (Odonata) nymph supporting a *Paratanytarsus* sp. larva, after examining several hundred libellulid nymphs. White and Fox (1979) discovered *Rheotanytarsus exiguus* Johannsen on a *Macromia georgina* Selys (Odonata: Macromiidae) nymph. They also discovered pupae of *Oxyethira azteca* (Mosely) (Trichoptera: Hydroptilidae) on the same odonate.

Parasitic relationships have been reported fairly frequently by chironomids on bivalves (Forsyth and McCallum 1978, Hynes 1976). However, Mancini (1979) was the first to show phoretic relationships between chironomids (*Rheotanytarsus* sp.) and snails.

The consensus of most aquatic phoresy research is that for chironomids this phenonemon is relatively uncommon. In opposition, Roback (1977) felt that phoretic relationships are fairly common. In an attempt to document the frequency of aquatic phoretic relationships. collections of aquatic macroinvertebrates were made in the Piedmont and Costal Plain

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[2] Published by permission of Director, South Carolina Agricultural Experiment Station, Technical Contribution No. 1771.

[3] Department of Entomology and Economic Zoology, Clemson University, Clemson, South Carolina 29631.

regions of South Carolina.

Methods

Collections were made from Pickens County: Wildcat Creek; Anderson County: Big Garvin Creek, Little Garvin Creek, Watermelon Creek, Browns Creek, and Rock Creek; Horry County: Simpson Creek, all from March through July 1979. Specimens were preserved in 80% ETOH, and then examined under a microscope for phoretic associations. Chironomids were mounted on slides and determined by appropriate taxonomic specialists. At Wildcat Creek, 45 snails (*Elimia acutocarinata* (Lea)) were collected randomly, and the number of chironomid larvae/snail was ascertained. Rocks upon which the snails were attached were searched carefully, and all chironomids on the rocks were preserved.

Results and Conclusions

All seven streams collected in this study yielded specimens exhibiting phoretic relationships. Mayflies, caddisflies, dragonflies and damselflies were found bearing chironomid larvae (Table 1). Of all dragonflies (Anisoptera) collected, only *Boyeria vinosa* (Say) (Aeshnidae) and *Macromia* spp. (Macromiidae) were found with phoretic midges. Both of these genera are sprawlers and wait motionless for prey to come within reach before attacking. These long waiting periods evidently allow the chironomids time to build their cases on the nymphs. Midges also were

Table 1. Hosts, phoretic chironomids, biogeographical regions and localities.

Host	Chironomidae		Biogeographical Region	Locality
	species	# of larvae		
Boyeria vinosa (Say)	*Rheotanytarsus* sp.	2	Piedmont	Watermelon Creek
B. vinosa	*Rheotanytarsus* sp.	2	Piedmont	Browns Creek
B. vinosa	*Rheotanytarsus* sp.	3	Piedmont	Rock Creek
B. vinosa	*Rheotanytarsus* sp.	1	Piedmont	Rock Creek
B. vinosa	*Rheotanytarsus* sp.	4	Piedmont	Rock Creek
B. vinosa	*Rheotanytarsus* sp.	1	Piedmont	Rock Creek
B. vinosa	*Rheotanytarsus* sp.	2	Piedmont	Rock Creek
B. vinosa	*Rheotanytarsus* sp.	4	Piedmont	Little Garvin Creek
Calopteryx maculata (Beauvois)	*Rheotanytarsus* sp.	4	Coastal Plain	Simpson Creek
Nectopsyche exquisita (Walker)	*Rheotanytarsus* sp.	1	Coastal Plain	Simpson Creek
Stenonema smithae Traver	*Rheotanytarsus* sp.	1	Coastal Plain	Simpson Creek
S. smithae	*Rheotanytarsus* sp.	1	Coastal Plain	Simpson Creek
Macromia sp.	*Rheotanytarsus* sp.	4	Coastal Plain	Simpson Creek
Macromia sp.	*Rheotanytarsus* sp.	1		
	Tanytarsus sp.	1	Piedmont	Big Garvin Creek
Macromia georgina Selys	*Tanytarsus* sp.	3	Piedmont	Big Garvin Creek
B. vinosa	Chironomini	2	Piedmont	Watermelon Creek

found on *Stenonema smithae* Traver (Ephemeroptera: Heptageniidae), *Nectopsyche exquisita* (Walker) (Trichoptera: Leptoceridae), and *Calopteryx maculata* (Beauvois) (Odonata: Calopterygidae) which also may remain in one place for long periods.

For the Odonata, tabulation of the location of the phoretic midges on the nymphs showed that 21 chironomid larvae built cases on the legs of the nymphs, 11 larvae on the thorax and wing pads, and 2 larvae built a case on the dragonfly head. No Odonata were found with chironomid cases on the abdomen or the venter of the body. The lack of chironomid cases on the venter is not surprising, for the nymphs are sprawlers which allows no access to the venter by the chironomids. The absence of phoretic chironomids on the abdomen may be due to the continuous expansion and contraction of the abdominal segments. This movement probably would tend to detach a chironomid case over time. The head, thorax, wing pads, and legs are relatively immobile and appear to make a good site for permanent attachment.

Stenomena smithae in one instance demonstrated phoretic attachment on the thorax. However, the other, early instar specimen had the chironomid case attached to the cerci (Figure 1). It would seem that the cerci would be a precarious attachment position.

Frequency of phoretic occurrence varied greatly among streams. Browns and Little Garvin Creeks each yielded 1 phoretic relationship, Big

Figure 1. *Rheotanytarsus* sp. larva in phoretic association on *Stenonema smithae* Traver.

Garvin and Watermelon Creeks 2 relationships each, and Simpson and Rock Creeks 5 relationships each. In Rock Creek there were only 7 odonates collected, and 5 of these specimens had phoretic chironomids (71.4%).

Many case-building chironomids build their cases on rocks and other objects. Little Garvin and Browns Creeks have a few rocks dispersed throughout the stream bed. Rock Creek is predominantly and Simpson Creek is entirely sand-bottomed. Thus, as the percentage of rocks, detritus, etc. decreases in a stream, phoresy by chironomids on aquatic insects increases.

Three taxa of larval Chironomidae were found to be phoretically associated in this study: *Rheotanytarsus* sp., *Tanytarsus* sp. and unidentifiable Chironomini. *Rheotanytarsus* sp. was the most common phoretic midge, occurring on 87.5% of all hosts. One *Macromia* sp. nymph yielded one *Tanytarsus* sp. and one *Rheotanytarsus* sp. larva. This was the only example of two phoretic species on one host in this study. *Tanytarsus* sp. occurred on two hosts, and unidentified Chironomini on one host. This predominance of Chironominae is not surprising, for the larvae of many of the species of this subfamily build cases.

Wildcat Creek, a rocky-bottomed stream, yielded no phoretic chironomids on aquatic insects. However, of the 45 specimens of *Elimia acutocarinata* (Lea) collected at Wildcat Creek, 36 (80.0%) yielded phoretic midges (*Rheotanytarsus* sp.) (Figure 2). The majority of host snails supported 2 *Rheotanytarsus* sp. larvae, but the number of phoretic relationships ranged from 0 to 4.

The location of the chironomid cases on the snail shells was random, and occurred in every direction (Figure 3). This is in opposition to observations by Mancini (1979) who found that *Rheotanytarsus* sp. had 3 preferred attachment positions on *Goniobasis semicarinata* (Say) in Indiana. Careful examination showed no damage to any of the fleshy portions of the snail, which supports the conclusion that the chironomid larvae were not feeding on the snails.

Chironomid larvae collected from rocks where the snails also were collected included *Rheotanytarsus* sp., but the numbers for this species were no higher than those of other midge taxa. The snail shells therefore must be a preferred site for *Rheotanytarsus* sp. larvae at Wildcat Creek although the reason for this preference is unknown. Perhaps the smooth surface of the snail shell is an easier attachment site than the rough surface of the rock.

Phoretic relationships are indeed relatively common in the Piedmont and Coastal Plain regions of South Carolina. This may be due in part to the predominance of sand-bottomed streams in these regions.

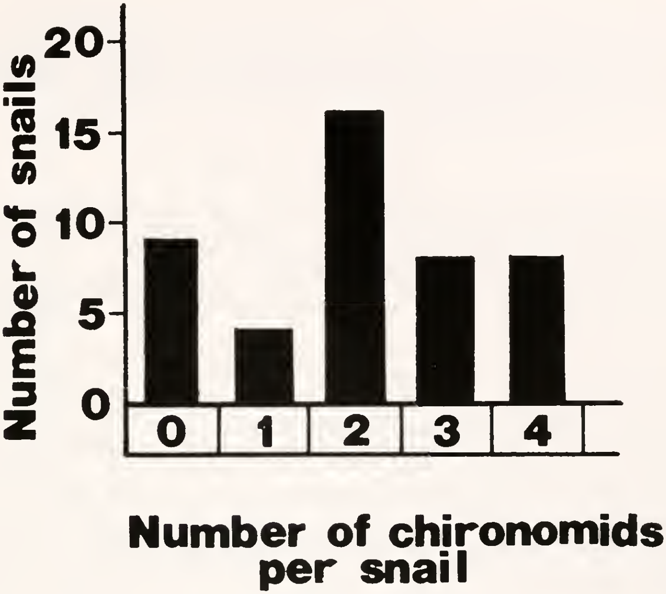

Figure 2. Number of snails collected and number of phoretic midges/snail.

Figure 3. Location of phoretic midges on *Elimia acutocarinata* (Lea).

ACKNOWLEDGEMENTS

Our sincere thanks are extended to the following individuals for their invaluable assistance: Dr. Gerald Carner, photography; Dr. Manuel Pescador, Ephemeroptera determinations; Mr. William M. Beck, Jr., Chironomidae determinations; and Dr. J.B. Burch and Mr. John Suloway, Mollusca determinations.

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GLENN E. WIXOM

Glenn E. Wixom, a member of the American Entomological Society, was born on August 9, 1909 in Oroville, California and died there on June 3, 1979. He attended Butte College and was employed by the postal department at Oroville for 33 years. He was active in scouting and developed his interest in entomology and natural history from his youth.

In 1966 he published privately, through the Appelman Press, Oroville, the first of some 14 Technical Bulletins entitled "Orthoptera of Western North America subfamily Acridinae." These works contain keys, descriptions and distributional data of acridine grasshoppers. No new taxa were described. These papers were distributed widely to museums, universities and specialists alike. In the mid 1970s he took a collecting trip to South America and presented his collection of very well preserved Orthoptera to the California Academy of Sciences and University of Idaho.

RELATIONSHIP BETWEEN JACK PINE BUDWORM EARLY LARVA DENSITY TO FREQUENCY OF INFESTED VEGETATIVE AND STAMINATE FLOWER BUDS[1,2]

K.M. Clancy[3], D.M. Benjamin[4], R.L. Giese[5], R.B. Stewart[6]

ABSTRACT: Population surveys of the life stages of the jackpine budworm, *Choristoneura pinus pinus* Freeman, conducted annually since 1959, detect outbreaks and delineate areas of high densities. For newly emerged early spring larvae, the number of larvae per sample was discovered to be related to the frequency of vegetative and staminate flower buds infested. We present a mathematical model for this relationship and describe its exploitation in increased survey efficiency.

Populations of the jack pine budworm, *Choristoneura pinus pinus* Freeman, have been monitored annually in Wisconsin jack pine, *Pinus banksiana* Lamb., forests by the Wisconsin Department of Natural Resources since 1959 to assess the status of this serious defoliator. On the basis of these surveys, areas harboring high numbers are deliniated and outbreaks predicted.

The pine types susceptible to the budworm often are of relatively small acreage and widely scattered: consequently, surveys are laborious and time consuming. After several years of surveying for newly emerged early spring larvae, it was observed that the number of larvae in a sample was related to the frequency of vegetative buds and flower buds infested. This research note presents a mathematical model for this relationship and describes how it can be utilized to increase the efficiency of surveys for young budworm larvae.

Methods:

Jack pine budworm larvae overwinter in the second instar beneath a webbed hibernaculum spun on the bark of their host. Soon after buds break dormancy and shoot elongation begins in mid-May, larvae emerge and mine

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[1] Received January 6, 1980

[2] Research supported by the College of Agricultural and Life Sciences, University of Wisconsin - Madison, and the Wisconsin Department of Natural Resources Grant.

[3] Research Assistant, CALS

[4] Professor of Entomology, CALS

[5] Professor and Chairman Forestry, CALS

[6] Entomologist (Retired) WDNR Northwest Area

into vegetative and staminate flower buds. Sampling for these early stage larvae is conducted on permanent 40 acre plots distributed throughout the jack pine type. Fifteen vegetative and 15 staminate flower buds are examined from at least 5 trees per plot, and the number of larvae in each bud is tallied. This procedure was followed from 1959 through 1966. Then it was observed that a meaningful relationship existed between the number of buds infested among the 30 examined and the total number of larvae. The critical population density of budworm larvae at which severe defoliation could be expected was empirically estimated to be 25 larvae per 30 buds. An eye-fit curve of the frequency density relationship was designed in 1967, and it was used subsequently to determine the total number of larvae on survey plots. The increased efficiency was reflected in an approximate 40% time savings per plot with no measurable decline in accuracy.

From 1971 through 1973, early larval surveys were conducted on 54 plots in Douglas County, Wisconsin. On each plot, 15 vegetative and 15 staminate flower buds were examined and the number of larvae in each bud was recorded. These data were utilized to develop the mathematical model describing the density-frequency relationship. (Figure 1). Several multiple regression equations involving logarithmic and polynomial transformations were tested to mathematically model the relationship. The trinomial equation, where Y=total larvae per plot, and X=total infested buds per plot was selected as the best model:

$$Y = -0.579 + 1.376X - 0.0356X^2 + 0.00174X^3$$

This regression analyses showed that the density of larvae was closely related to the frequency of buds infested, and that the correlation ($R^2 = 95.153\%$) was very high.

It is recommended that the model be employed in surveying for early stage jack pine budworm larvae. Vegetative and flower buds may be examined for presence or absence of larvae. The critical level of 25 larvae per 30 buds will be attained when 19 of 30 buds are infested.

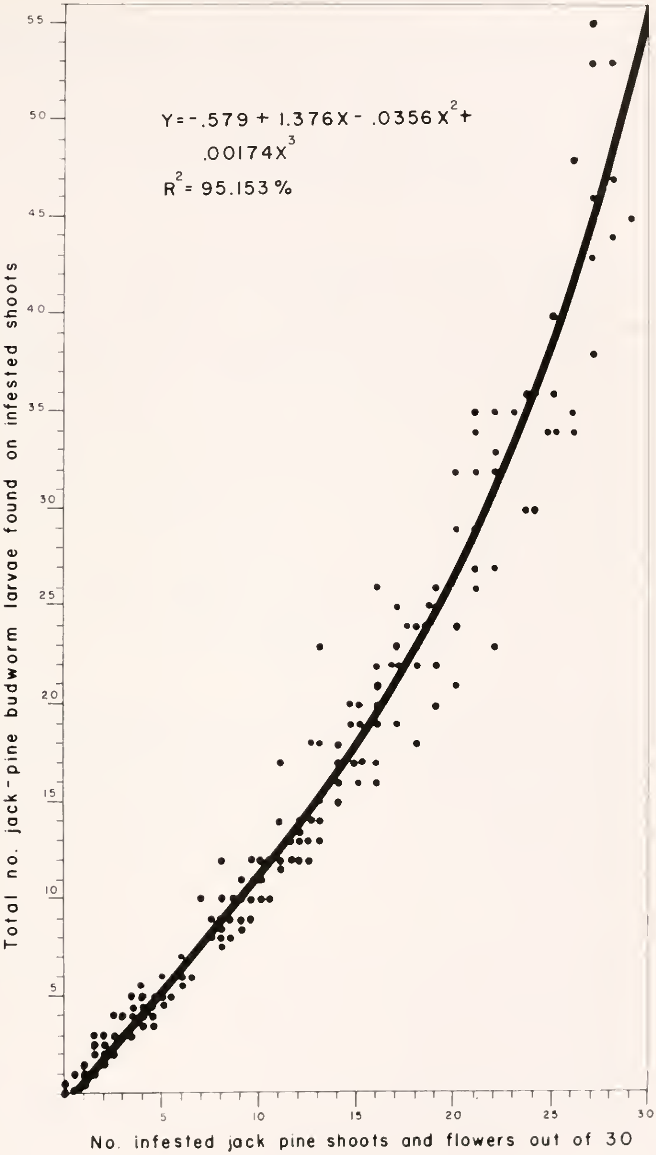

Figure 1. Relationship between early larval jack pine budworm density and the number of infested shoots and flowers. Douglas Co., Wis. 1971-73.

BOOK REVIEW

CATALOG OF HYMENOPTERA IN AMERICA NORTH OF MEXICO. Karl V. Krombein, Paul D. Hurd, Jr., David R. Smith, and B.D. Burks. 1979. Smithsonian Institution Press, Washington, D.C. Vol. 1. Symphyta and Apocrita (Parasitica), xvi+ pp. 1-1198; Vol. 2. Aprocrita (Aculeata), xvi (repeated) + pp. 1199-2208; Vol. 3. Indexes, xxx+ pp. 2211-2735. (Obtain from Superintendent of Documents, Government Printing Office, Washington D.C. 20402; Vol. 1, Stock No. 047-001-00139-7, $30.00; Vol. 2, Stock No. 047-001-00140-1, $28.00; Vol. 3, Stock No. 047-001-00138-9, $20.00).

A catalog of organisms should provide a means of relating nomenclature (a form of retrieval coding) to the species of the World. By giving distribution data for a more restricted area, a checklist of the species of that region is provided for use in reporting biological information. This catalog, because it takes into consideration the nomenclature of the Hymenoptera throughout the World amply meets the requirements of a catalog that is a synthesis of the accumulated data. However, a catalog is out of data even before it is published; but when it is possible to use a computer as a tool for the construction of a catalog, and as a warehouse for the storage of information, most of this inherent out-of-datedness is overcome.

Karl V. Krombein and his associates, all dedicated taxonomists, through long hours of exacting and unexciting searching of the literature have put together a data base from which have been produced three volumes that can only be described as exciting. Exciting because they represent a tool as useful to biologists as any electronic sensing device can be and certainly with a much longer "shelf life!"

These books reflect the philosophies and work of several individuals employed by two separate and distinct government agencies, the Smithsonian Institution and the U.S. Department of Agriculture. The results of this cooperative effort is an example of their steady, unselfish determination combined to produce a synthesis of the available knowledge about the Hymenoptera in North America north of Mexico.

The printed volumes may be obtained as noted above and are, therefore, available for the daily use of specialists in the systematics of these insects and for all biologists interested in any of these groups. In addition, the data base in computer storage may be updated as necessary. The program used for storing information permits queries for data in many different combinations. Such print-outs are great time savers because they eliminate the need to thumb through the book in search of specialized data. Although no indication is given in the text as to how to gain access to the data base, interested persons certainly will be advised as to its availability by those in charge.

At first glance this edition (more than 2735 pages) appears to be very much larger than the previous catalog (1951, and supplements in 1958 and 1967) with a total of 2309 pages, because of the much larger page. Although the type area per page has increased from 26 x 45 picas to 35-54 picas, the page contents has not changed (compare page 907 of the 1951 catalog with page 1524 of the new catalog). The additional pages represent approximately a 15% increase in size. Even so, this is a notable gain in information in the past 20 years and very likely is the result of the availability of the first catalog.

The text has been expanded somewhat to include more data about the insects themselves. More on prey, predators, and parasites is included along with biological notes on the families, subfamilies, and other taxa. The index volume gives a table of the number of genera and species detailed by family along with a superfamily ranking by percentage of total species. Taxonomic and nomenclatural changes are listed; this includes new genera, new species, new names, and new synonyms. New combinations resulting from generic transfers are listed,

Continued on page 84

NEW SOUTH AMERICAN XESTOCEPHALINE LEAFHOPPERS (HOMOPTERA:CICADELLIDAE)[1]

Dwight M. DeLong[2]

ABSTRACT: Seven new species of South American Xestocephaline leafhoppers, *Xestocephalus cinctus* n.sp. (Peru), *Portanus dentatus* n.sp., (Peru), *P. cellus* n.sp. (Peru), *P. tridens* n.sp. (Bolivia and Brazil), *P. filamentus* n.sp. (Brazil), *P. avis* n.sp. (Peru), and *P. cephalatus* n.sp. (Peru), are described.

Two genera of Xestocephalinae, *Xestocephalus* and *Portanus*, are known to occur in South America. The genus *Xestocephalus* was described by Van Duzee (1894) and *X. pulicarius* V.Dz. was designated as the type. A synopsis of the genus was published by Linnavuori (1959). Six new tropical species were added by DeLong & Linnavuori (1978). Some 22 species are now placed in *Xestocephalus*. The genus *Portanus* was described by Ball (1932). He designated *Scaphoideus stigmosus* Uhler as the type. A key to the known species of *Portanus* was published by Kramer (1964). Some 24 species have now been described and placed in *Portanus*. One new species of *Xestocephalus* from Peru and six new species of *Portanus* from Peru, Bolivia and Brazil are described at this time. All types are in the DeLong collection, Ohio State University.

Xestocephalus cinctus n.sp.
(Figs. 1-2)

Length of female 5 mm, male unknown. Crown bluntly angled, more than half as long at middle as width at base between eyes. Color brown, crown with a darker brown transverse band between eyes along margin just above ocelli. Forewings dark brown subhyaline, two dark brown spots on costa near apex of wing. Face brown with remnants of a darker brown band just beneath ocelli.

Female seventh sternum with posterior margin broadly angularly excavated one-third distance to base with a median notch, apex of angled portion concavely rounded.

Holotype female, Sinchona, Peru, November 1943, J.G. Sanders coll.

X. cinctus can be separated from all other described species by the dark brown transverse band on the crown.

Portanus dentatus n.sp.
(Figs. 3-6)

Length of male 6 mm, female unknown. Crown produced, bluntly angled, three-fourths as long at middle as width at base between eyes. Color, crown pale brown with a pair of reddish

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[1] Received January 10, 1980

[2] Department of Entomology, Ohio State University.

brown spots between anterior portion of eyes. Pronotum dark brown with pale, irregular stipple. Scutellum pale brown. Forewings dark brown with white spots on apical half of costa, on claval vein at apex and along veinlets of apical cells.

Male genital style chelate with claws elongate, one claw slightly longer and spine like. Aedeagus elongate, apical portion sheath-like with apex bluntly rounded. With two spines extending dorsocaudally just caudad to broadened median portion which is pointed dorsally. Basal portion of aedeagus more than twice as wide as apical portion. Pygofer bearing a spine on ventocaudal margin.

Holotype male, Sinchona, Peru, November 1934, J.G. Sanders, coll.

P. dentatus is related to *P. retusus* Lv. & DeL. but can be distinguished by the different aedeagus as illustrated.

Portanus cellus n.sp.

(Figs. 7-10)

Length of male 7 mm, female unknown. Crown two-thirds as long at middle as width at base between eyes. Color, crown dark brown, two rows of two white dashes between ocelli. Pronotum dark brown with paler brown irregular stipple. Scutellum dark brown. Forewings brownish subhyaline with paler areas and white alternate markings on wings. Claval veins white where they join commissure.

Male genital style chelate, elongate, with one "claw" short and thick, the other narrow and elongate, longer than the broader portion. Aedeagus with a constricted neck-like portion, forming a larger part apically and a much larger portion basally, the apex is broadly rounded. Pygofer narrowed apically and forming a projected, rounded, tubercle-like apex.

Holotype male, Sinchona, Peru, November 1943, J.G. Sanders coll.

P. cellus is similar in appearance to *P. dentatus* DeL. and may be separated by the male genital structures.

Portanus tridens n.sp.

(Figs. 11-14)

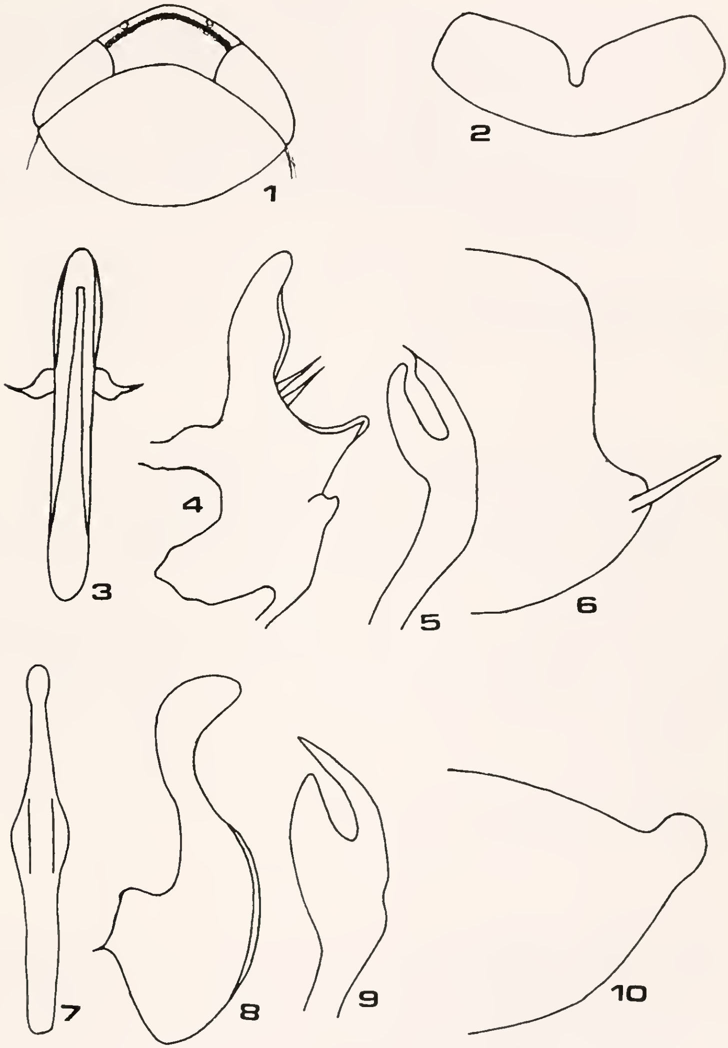
Length of male 5 mm, female 5.5 mm. Crown bluntly angled, almost as long at middle as basal width between eyes. Color, crown pale brown. Pronotum and scutellum dark brown. Forewings dark brown subhyaline, veins mostly marked with white and brown alternating dashes, Apex of wing smoky.

Female seventh sternum with posterior margin roundly produced.

Male genital style chelate with "claws" short, rounded, with one portion slightly longer, apex spine-like. Aedeagus elongate with apex broadened and tridentate. The median spine is broadened and more produced. The spine on each side at base extends caudolaterally and with concavity between the median and each lateral spine. Pygofer narrowed and rounded apically.

Holotype male, Bolivia, San Esteban 49 km N.Sta. Cruz., Dec. 7, 1959. el. 1120 ft. Paratypes: 2 males, 5 females same data as holotype; 3 males Sao Paula, Brazil, pres. Epitacle pta. Albane, X-'54 J. Lane coll; 1 male Ter. Amapa, Rio Felicle, Brazil VIII-2-'55.

P. tridens is related to *P. chelatus* DeL. and can be separated by the three pronged apex of the aedeagus.



Figs 1-2 *Xestocephalus cinctus* n.sp. 1. head and pronotum, 2. female seventh sternum. Figs. 3-6 ***Portanus dentatus*** n.sp. 3. aedeagus ventrally, 4. aedeagus laterally, 5. apex of style, laterally, 6. pygofer laterally, apical portion. Figs. 7-10 ***P. cellus*** n.sp. 7. aedeagus ventrally, 8. aedeagus laterally, 9. apex of style, laterally, 10. pygofer laterally, apical portion.

Portanus filamentus n.sp.

(Figs. 15-18)

Length of male 7 mm, female unknown. Crown a little wider at base than median length. Color, crown pale brown with two dark brown spots, almost equidistant from eyes and from each other, at anterior margins of eyes. Pronotum pale brown with dark brown mottling. Scutellum with anterior portion pale brown, posterior half yellowish. Forewings pale brown, veins reddish brown. Claval vein alternating reddish brown and white.

Male genital plates elongate, five times as long as median width, apices broadly rounded. Style narrowed subapically, apical sixth enlarged, apex rounded. Aedeagus long, slender, curved, filamentus. Pygofer with ventral portion heavily sclerotized bearing a stout, caudal, dorsally curved spine at apex.

Holotype male, Serra de Navia, Brazil A.P., II-7-1961 J. & B. Bechyne colls.

P. filamentus is related to *P. lex* Kramer and can be distinguished by the male genital structures.

Portanus avis n.sp.

(Figs. 19-22)

Length of male 6.5 mm, female unknown. Crown bluntly angled, three-fourths as long at middle as basal width between eyes. Color brown, apex of crown broadly white, ocelli white and two white spots between them. Basal half with irregular white areas. Pronotum brown with an irregular white area next to middle of each eye, and with irregular white stipple. Scutellum white with dark brown basal angles. Forewings pale brown, subhyaline, a whitish area on corium, brown spots where claval veins join commissure and some veins with alternate brown and white coloration.

Male genital styles chelate with the "claws" elongate, one claw more slender and elongate than the other. Aedeagus elongate, slightly broadened apically, head-like and broadened at middle; median portion broadest, basal portion narrow. Pygofer narrowed apically, rounded and bearing a long apical spine on ventral portion.

Holotype male, Sinchona, Peru, November 1943, J.G. Sanders coll. Paratype male same data as holotype.

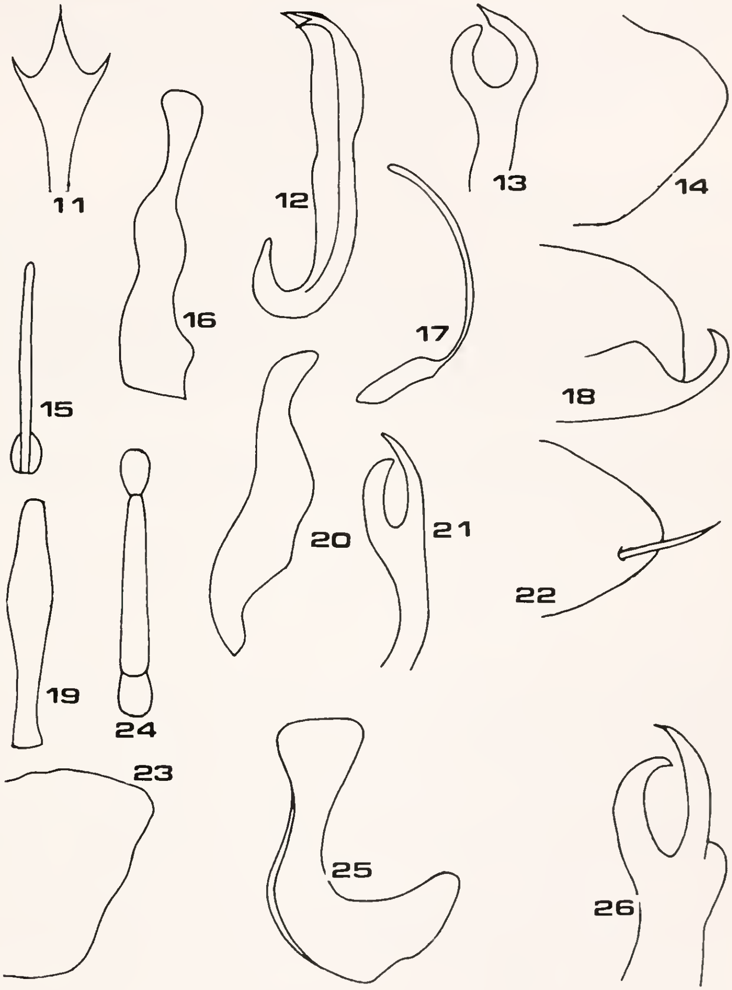
P. avis is related to *P. dentatus* but the structure of the aedeagi as illustrated will distinguish these species.

Portanus cephalatus n.sp.

(Figs. 23-26)

Length of male 9 mm, female unknown. Crown bluntly angled, two-thirds as long at middle as basal width between eyes. Color, crown with white margin and large white spots around ocelli. Most of crown brown. A pair of small white spots between ocelli, an elongate white spot next to each eye. Pronotum brown with numerous minute round paler areas and a broad white border around eyes. Scutellum white with dark brown basal angles. Forewings brown with paler white irregular markings and a prominent white cross on corium. Cross veins of apical cells and apex of wing dark brown.

Male genital styles chelate with "claws" elongate, one portion distinctly longer and less curved than the other. Aedeagus sheath-like with a broadened truncate apical portion, rounded dorsally and ventrally, and a much broader, curved, basal portion. Pygofer almost truncate apically.



Figs. 11-14 ***P. tridens*** n.sp. 11. aedeagus ventrally, apical portion, 12. aedeagus laterally, 13. style laterally, apical portion, 14. pygofer laterally, apical portion. Figs. 15-18 ***P. filamenta*** n.sp. 15. aedeagus ventrally, 16. style laterally, 17. aedeagus laterally, 18. pygofer laterally, apical portion. Figs. 19-22 ***P. avis*** n.sp. 19. aedeagus ventrally, 20. aedeagus laterally, 21. style laterally, apical portion, 22. pygofer laterally, apical portion. Figs. 23-26 ***P. cephalatus*** n.sp. 23. pygofer laterally, apical portion, 24. aedeagus ventrally, 25. aedeagus laterally, 26. style laterally, apical portion.

Holotype male, Sinchona, Peru, November 1943, J.G. Sanders coll. Paratype male same data as holotype.

P. cephalatus is related to *P. avis* DeL. and can be separated by the structure of the aedeagus as illustrated.

LITERATURE CITED

Ball, E.D. 1932. New Genera and Species of Leafhoppers related to *Scaphoideus* Jour. Wash. Acad. Sci. 22: 9-19.

DeLong, D.M. and R.E. Linnavuori 1978. New tropical *Xestocephalus* (Homoptera: Cicadellidae) and Illustrations of little known species. Jour. Kans. Ent. Soc. 51 (1):35-41.

Kramer, J.P. 1964. A key for *Portanus* with new records and descriptions of new species (Homoptera:Cicadellidae:Xestocephalinae). Proc. Ent. Soc. Washington 66 (1): 5-11.

Linnavuori, R.E. 1959. Revision of the Neotropical Deltocephalinae and some related subfamilies (Homoptera). Ann. Zool. Soc. 'Vanamo' 20(1): 1-370. (pages 35-45)

Van Duzee, E.P. 1894. Descriptions of some new North American Homopterous Insects. Bull. Buffalo Soc. Nat. Sci. 5: 205-216.

Continued from page 78

followed by new status of a name by raising a taxon from the subspecies to the species category. "The bulk of this volume consists of separate indexes to the taxa of North American Hymenoptera and to their hosts, parasites, prey, pollen and nectar sources, and predators."

Unfortunately the catalogers did not tell the user what happened to certain names that have been completely omitted from the catalog—probably because the species do not occur in the area treated even though these names were in the 1951 catalog and, of course, remain in the literature about the species of the area covered. For example, the species *Trichrysis parvula* Fab. is listed on page 722 of the 1951 catalog, giving its hosts as *Sceliphron cementarium* and *Hylaeus varifrons*. The same species appears in the 1958 supplement, p. 95, with the hosts as *Trypoxylon rubro-cinctum* and *T. clavatum*; and on p. 308 of the 2nd supplement, 1967, the name is still in use. The name does not appear in the new catalog! Instead, *Trichrysis tridens* (Lepeletier), listed as a synonym of *T. parvula* Fab. in 1951, is apparently the correct name for our species. The other synonyms of *T. tridens* match those of *T. parvula* in 1951, but, only one host is listed, *Trypargilum politum*. The only parasite of *Sceliphron caementarium* in U.S. listed is *Chrysis fuscipennis* Brulle, which is suggested as adventive from Hawaii.

This leaves the user with questions about the association of biological data with the names of species—a problem still inherent in all catalogs and, indeed, all biological literature, and one that obviously cannot be handled by a computer, at least, not yet!

Ross H. Arnett, Jr.
Biological Research Institute

SHELLS OF *PHYSA GYRINA* (GASTROPODA: PHYSIDAE) OBSERVED AS SUBSTITUTE CASE-MAKING MATERIAL BY *GLOSSOSOMA INTERMEDIUM* (TRICHOPTERA: GLOSSOSOMATIDAE)[1]

Richard V. Anderson[2], William S. Vinikour[3]

ABSTRACT: A specimen of *Glossosoma intermedium* (Klapálek) was collected that had incorporated snail shells into its last instar case.

Incorporation of mollusc shells as case-making material by Trichoptera has been previously reported. Such usage is primarily restricted to selected species in the family Limnephilidae. For example, *Philarctus quaeris* uses snails and sphaeriid clams for all or part of its case; and *Grensia praeterita* apparently incorporates operculars of prosobranch snails into its case (Wiggins, 1977). Species in the family Glossosomatidae normally construct portable saddle-cases composed of rock fragments of fairly uniform size (Wiggins, 1977). However, we have collected an anomaly to the standard case, in which a last instar *Glossosoma intermedium* (Trichoptera: Glossosomatidae) (Klapalek) incorporated three shells of *Physa gyrina* (Gastropoda: Physidae) into its case (Figure 1).

The specimen was collected on 12 February 1980 from Trout Park Nature Preserve, a relic spring-fed brook system in Elgin, Illinois. This is the only locality in Illinois where *Glossosoma intermedium* supposedly occurs (Ross, 1944); and in portions of the brooks the cobble substrates are literally covered with them. Their abundance in this system lends further support to the rarity of snail shells as case material in glossosomatids. To date we have closely scutinized thousands of *G. intermedium* in the field and have only collected the one specimen using snail shells. Pennak (1978) states that members of a caddisfly species will usually select the same material and construct their case in the same way, but will substitute materials if the normal case-making material is not available. In the Trout Park brooks more than adequate case-making rocks are available, even considering the large numbers of *Glossosoma* inhabiting the streams.

The majority of *G. intermedium* at Trout Park construct their cases from granules of miscellaneous metamorphic rocks, e.g. granite gneisses and quartzites. In some localities, especially lower velocity portions of the brooks, some cases are composed of unaltered and clastic limestones, e.g.

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[1] Received March 14, 1980

[2] Department of Biological Sciences, Western Illinois University, Macomb, IL 61455.

[3] Division of Environmental Impact Studies, Argonne National Laboratory, Argonne, IL 60439.

ENT. NEWS 91(3): 85-87

tufa, marl and coquina fragments. The anamalous case we collected was composed primarily of limestone fragments as well as the three snail shells. The specimen was collected adjacent to the main stream channel on a submerged piece of wood; water depth was approximately 5 cm. Current velocity was reduced in this area and the substrate was predominantly sand-silt. However, other *G. intermedium* observed in the area did not have snail shells incorporated on their cases. Although the shells were empty upon collection, it cannot be concluded whether the caddisfly used empty shells or living snails. Aggregates of dead snails have not been observed, while live snails are fairly dense, often occurring in conjunction with *G. intermedium.* This would have allowed the caddisfly to gather three snails within close proximity of each other. The weight of the empty shells (~0.005g) is approximately that of the rock fragments normally incorporated into late instar cases, while living snails weigh twice this amount. The use of snail shells does not seem to add to the streamlining of the case, but could provide protection from potential predation in much the same manner as rock fragments.

ACKNOWLEDGEMENTS

We would like to thank the Illinois Nature Preserves Commissiion, Illinois Department of Conservation, and the City of Elgin for permission to collect at Trout Park. Nicholas Beskid identified the case materials. Special thanks to Karla Vocke for shooting and developing the photograph of the specimen. We would also like to thank Drs. Lawrence Jahn and Elisabeth Stull for their review of the note.

LITERATURE CITED

Pennak, R.W. 1978. Fresh-water invertebrates of the United States. Second edition. John Wiley & Sons, New York. 803 p.

Ross, H.H. 1944. The caddis flies, or Trichoptera, of Illinois. Bull. Illinois Natural History Survey, 23(1): 1-326.

Wiggins, G.B. 1977. Larvae of the North American caddisfly genera (Trichoptera). University of Toronto Press, Toronto, 401 p.

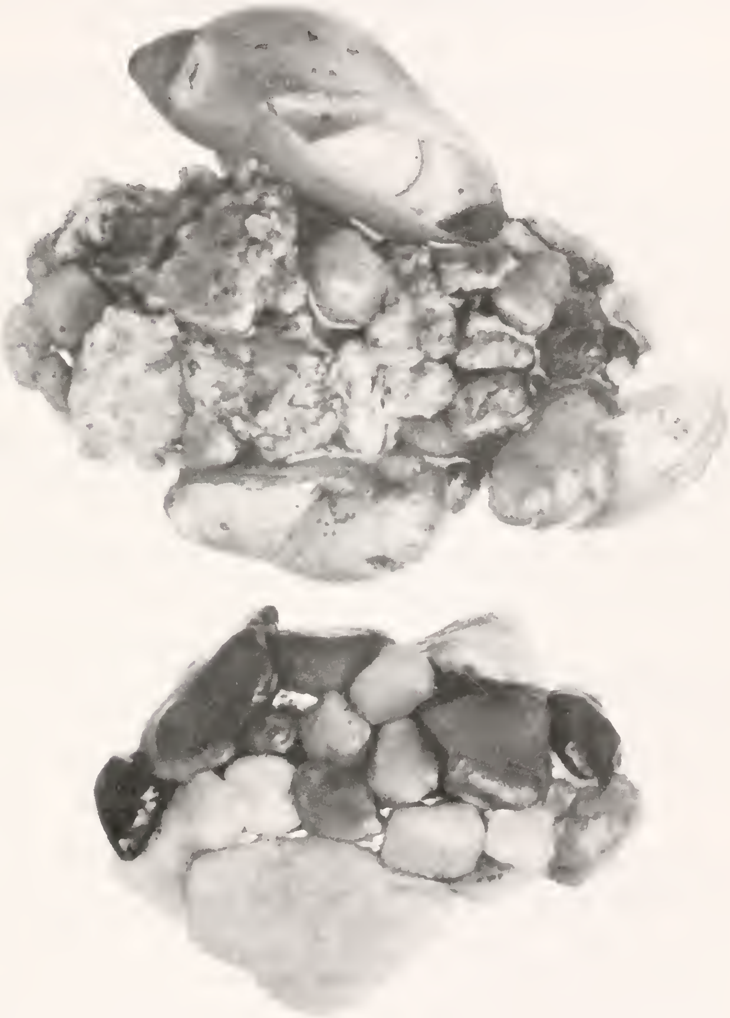

Figure 1. Anomolous *Glossosoma intermedium* case (incorporating three *Physa gyrina* shells) contrasted to normal case. Case length 7.5 mm. Both cases contained a prepupa.

BOOKS RECEIVED AND BRIEFLY NOTED

CARABID BEETLES: THEIR EVOLUTION, NATURAL HISTORY, AND CLASSIFICATION. Terry L. Erwin, George E. Ball, Donald R. Whitehead, Anne L. Halpern. 1979. Dr. W. Junk by Publishers, The Hague, Netherlands. 635 pages. $115.00.

Proceedings of First International Symposium of Carabidology, Smithsonian Inst., Washington, D.C., August 21, 23 & 25, 1976. Includes papers on historical perspectives, systematics, classification and phylogeny, zoogeography, paleontology, natural history and ecology and techniques.

INSECT — FUNGUS SYMBIOSIS: NUTRITION, MUTUALISM, AND COMMENSALISM. Lekh R. Batra, ed. 1979. John Wiley & Sons, N.Y. 276 pages. $27.50.

Proceedings of symposium at Second International Mycological Congress, Univ. of So. Florida, Tampa, August 27 - Sept. 3, 1977. Ten papers on the general theme of fungus-arthropod mutualism and commensalism.

ADVANCES IN INSECT PHYSIOLOGY. Vol. 14. J.E. Treherne, M.J. Berridge & V.B. Wigglesworth, eds. 1979. Academic Press, N.Y. 440 pages. $57.00.

Six more contributions in this series on insect physiology. Subject headings are Atmospheric Water Absorption in Arthropods, Insect Vitellogenin, Physiology of Moulting in Insects, Morphology of Insect Muscle Fibre Membrane, Pattern Formation in Insect Natural Development and Scent Glands in Heteroptera.

INSECTS AND OTHER INVERTEBRATES OF THE WORLD ON STAMPS. Willard F. Stanley, ed. 1979. Handbook No. 98, American Topical Assoc., 3308 No. 50th St., Milwaukee, WI 53216. 136 pages. $10.00.

A checklist of insect stamps from 1859 forward. Text is arranged in three sections: 1) Butterflies and Moths, 2) Other insects, and 3) Other invertebrates. Each section contains both a taxonomic listing and a country listing.

NOTICE

The Symposium on Insect Behavioral Ecology, as published in March, 1980 issue of the *Florida Entomologist*, is available for use in the classroom.

Contents include an Introduction: Insect Behavioral Ecology: Coming of Age in Bionomics or Compleat Biologists Have Revolutions Too, J.E. Lloyd; Competitive, Charming Males and Choosy Females: Was Darwin Correct?, R. Thornhill; Alternative Male Reproductive Behaviors, W. Cade; Phonotaxis in Mole Crickets: Its Reproductive Significance, T.G. Forrest; Diversity in the Nesting Behavior of Mud-daubers (*Trypoxylon politum* Say: Sphecidae), H.J. Brockmann; Evolution of Exclusive Postcopulatory Paternal Care in the Insects, R.L. Smith; Migrating Lepidoptera: Are Butterflies Better Than Moths?, T.J. Walker; and Sexual Selection and Insect Sperm, J. Sivinski.

Paper-bound "volumes" (111 pages) may be ordered in multiples of 25, at $65.00 including shipping and handling, from E.O. Painter Printing Co., DeLeon Springs, Florida 32028 until 15 June 1980.

SYSTROPUS COLUMBIANUS (DIPTERA: BOMBYLLIDAE) REARED FROM LARVA OF LIMACODID MOTH[1,2]

Annette Aiello[3]

ABSTRACT: *Systropus columbianus* (Bombyliidae: Systropinae), was reared from a limacodid larva (Lepidoptera) in Panama.

Members of the bombyliid subfamily Systropinae are elongate flies resembling sphecoid and vespoid wasps. With few exceptions all reared species are parasitoids, as larvae, on caterpillars of Limacodidae (Lepidoptera) (du Merle 1975). An additional instance of a systropine parasitoid of a limacodid caterpillar is reported here.

Systropus columbianus (Karsch) (Figure 1), the biology of which previously was unknown, was reared from the larva of an unidentified limacodid (Figure 2) collected 20 July 1978 on Contractor's Hill near the Miraflores Locks, Panama Canal by Ms. Nili Boren. The host, which fed on *Gustavia superba* (H.B.K.) Berg (Lecythidaceae), was dark greenish brown and had a dark green dorsal abdominal "saddle" bordered by yellow. Its large tubercles were covered with red-brown setae.

The caterpillar molted on 25 July, and again on 5 August. On 14 August (middle rainy season) it constructed a cocoon. Eight months later, on 26 March 1979 (end of dry season), the pharate adult fly pushed open the cap at the end of the limacodid cocoon and emerged part way from it. The adult fly then left its pupal skin.

No moth pupa was ever formed; the fly larva killed and consumed most of the final instar caterpillar. The fly egg or larva must either have been dormant or relatively inactive within the caterpillar through at least two molts, or was contacted by the host on its food plant at some later time. An adult female fly could not have reached the caterpillar after its collection; it was immediately placed in a screened cage in a Ziploc® plastic bag, kept in an air-conditioned room.

The reference number for all the parts, cast skin, final instar remains, and cocoon of the limacodid, plus larval skin, pupal skin, and adult bombyliid is Aiello lot 78-93.

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[1] Received December 12, 1979

[2] This work was done at the facilities of Smithsonian Tropical Research Institute, P.O. Box 2072, Balboa, Panama

[3] Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, U.S.A. 02138

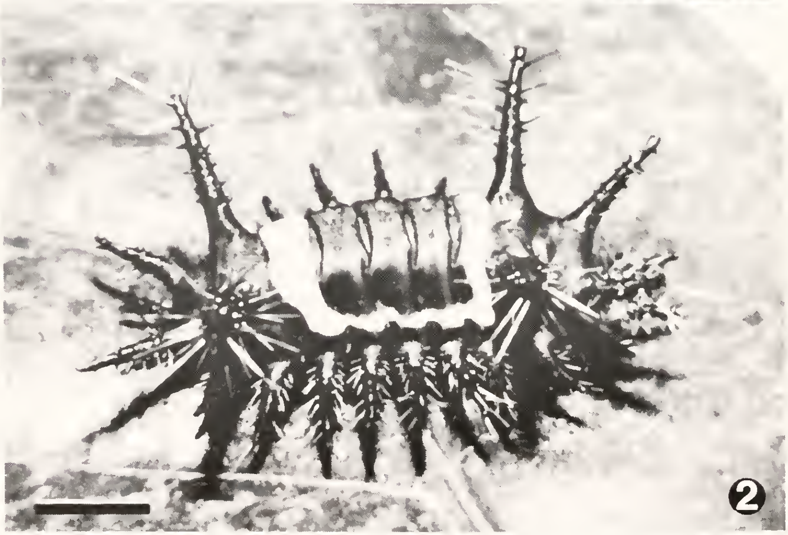

Figure 1. *Systropus columbianus*, adult soon after eclosion. Bar scale = 6 mm.

Figure 2. Host (Limacodidae) of *Systropus columbianus*. Bar scale = 5 mm.

Caterpillars identical in appearance, although feeding on *Quasia amara* L. (Simaroubaceae), were collected on Barro Colorado Island, Panama by Dr. Robin Foster on 27 April 1979. The reference number for this second rearing, two larvae in ethanol, and two adult moths, their pupal skins and cocoons, is Aiello lot 79-31. As of November 1979, nothing had emerged from three additional cocoons from this same lot.

All specimens mentioned above have been deposited in the Museum of Comparative Zoology, Harvard University.

ACKNOWLEDGEMENT

I would like to thank Lloyd Knutson for identification of the fly and for help with literature on *Systropus*.

LITERATURE CITED

du Merle, P. 1975. Les hôtes et les stades pré-imaginaux des diptères Bombyliidae: revue bibliographique annôtee. Bulletin West Palearctic Regional Section, International Organization for Biological Control 1975/4 (289 pp.).

INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

c/o British Museum (Natural History), Cromwell Road, London, SW7 5BD, United Kingdom.

A.N. (S.) 112 25th February, 1980.

The Commission hereby gives six months' notice of the possible use of its plenary powers in the following cases, published in *Bull. Zool. Nom.* Volume 36, part 4, on 18th February 1980, and would welcome comments and advice on them from interested zoologists. Correspondence should be addressed to the Secretary at the above address, if possible within six months of the date of publication of this notice.

1237 *Carabus caerulescens* Linnaeus, 1758, *C. cupreus* Linnaeus, 1758, and *Cicindela rupestris* Linnaeus, 1767 (Insecta, Coleoptera): designation of type specimens.

2219 *Ceutorhynchus* Germar, 1824 and *Rhinoncus* Schönherr, 1826 (Insecta, Coleoptera): proposed conservation and designation of type species.

2294 *Bellota* Peckham & Peckham, 1892 (Araneae): proposed designation of type species.

R.V. Melville,
Secretary.

IS *ESPERANZA TEXANA* BARBER (HEMIPTERA: ALYDIDAE) EXTENDING ITS RANGE?[1]

Richard C. Froeschner[2]

ABSTRACT: *Experanza texana* Barber, previously reported from Texas, Louisiana and Florida, is here reported also from Mississippi, Georgia and South Carolina. A recent expansion of range is suggested. The species is characterized among North American Alydidae.

Esperanza texana was originally described from Texas by Barber (1906, Bull. Brooklyn Inst. Arts and Sci., 1:269). Subsequently a 1926 collection in Louisiana was reported by Johnston (1927, Bull. Brooklyn Ent. Soc., 22:221) and a 1948 capture in Florida by Hussey (1948, Bull. Brooklyn Ent. Soc., 43:115). On the basis of specimens in the national collection in the U.S. National Museum of Natural History this insect can be reported here from Georgia (Albany, 1954; Bainbridge, 1941; Tifton, 1963); Mississippi (Lincoln Co., 1938); and South Carolina (Estill, 1965). The advance in dates as one considers the localities from Texas eastward to Florida and northward to South Carolina suggests an expansion of range has been taking place during the last several decades.

Observations on the habits and biology of this species are needed.

Among the North American alydids, *E. texana* is readily recognized by the following characters taken together: The pronotal humeri and posterior femora are without spines, and the apex of the scutellum is prolonged into a short, very acute, noticeably upturned spine. Torre-Bueno (1941: Ent. Amer., 21:78), in his key to the genera of Alydidae in America north of Mexico, erroneously stated "Scutellum not spined at apex."

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[1] Received May 15, 1980

[2] Department of Entomology, NHB Stop 127, Washington, D.C. 20560

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(Continued on inside of back cover)

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STATISTICAL MEASURES OF INTERSPECIFIC ASSOCIATION BETWEEN THE FLEAS OF THE GRAY-TAILED VOLE, *MICROTUS CANICAUDUS* MILLER[1]

G. David Faulkenberry[2], Richard G. Robbins[3]

ABSTRACT: Statistical methods for analyzing interspecific associations of vertebrate ectoparasites are discussed. The o- and Q-statistics, based on relative odds, are used to measure the degree of association between different flea species on the gray-tailed vole, *Microtus canicaudus* Miller. These statistics are shown to be preferable to the negative correlation factor.

The gray-tailed vole, *Microtus canicaudus* Miller, sometimes considered a subspecies of the montane vole *Microtus montanus* (Peale), occurs abundantly in grassy, uncultivated fields between the Cascade and Coast Ranges of western Oregon and Washington (Hall and Kelson, 1959; Ingles, 1965; Maser and Storm, 1970). From February 1973 to January 1974, a study was made of the population dynamics and ecology of the fleas that parasitize this vole in the vicinity of Corvallis, Oregon (Robbins, 1976). Five hundred and eleven fleas representing eight species and three families were recovered from the pelts of 377 comparably collected voles. *Catallagia charlottensis* (Baker) was by far the most abundant flea present (252 specimens) and together with *Atyphloceras multidentatus* (C. Fox) (100 specimens) accounted for nearly 70% of the specimens collected. Other species, in order of abundance, were *Peromyscopsylla selenis* (Rothschild) (62 specimens), *Monopsyllus wagneri* (Baker) (44 specimens), *Hystrichopsylla occidentalis* Holland (25 specimens), *Nosopsyllus fasciatus* (Bosc d'Antic) (14 specimens), *Corrodopsylla curvata* (Rothschild) (11 specimens), and an undetermined *Rhadinopsylla* (3 specimens).

Ordinarily, the gray-tailed vole constructs its nest in a chamber located 15-30 centimeters below the surface of the ground (Pearson, 1972); however, should objects be present at the surface the vole will build under these. For this study, wide wooden panels were scattered at random over three ecologically similar collecting sites, and at regular monthly intervals

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[1] Received: June 20, 1979.

[2] Department of Statistics, Oregon State University, Corvallis, OR 97331

[3] Department of Entomology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560

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voles that had been observed building nests under these panels were captured by hand. Each vole was then immediately transferred to a large, labeled plastic jar containing fresh grass clippings and pieces of fruit. All jars were fitted with wire mesh lids. Because some voles died or injured themselves in transit or were found naturally injured in the field, only 377 of 428 voles collected in this manner could be used in the statistical tests that follow.

In the laboratory, all voles were killed by quickly wrapping them in cotton blankets saturated with chloroform. This technique prevented the escape of any ectoparasites and preserved them in the positions they had occupied on their host's body while it was alive. All fleas were recovered by vigorous brushing and careful searching of the pelt, a process that generally required half an hour per animal. To prevent flea loss, these operations were performed against a light-colored background.

Holland's (1949) argument that humidity and temperature are the principal factors influencing flea populations was confirmed by Parker (1958) in a survey of fleas on the antelope ground squirrel, *Citellus leucurus leucurus* (Merriam). This argument has also been repeatedly confirmed in the laboratory. Working with several species of unfed adult fleas, Leeson (1932) demonstrated that high temperatures and low humidities tend to shorten life while, conversely, low temperatures and high humidities prolong life. This is especially true of the lightly sclerotized preimaginal stages of fleas which are extremely sensitive to the saturation deficiency or drying power of the air. Petrie and Todd (1923), Uvarov (1931), Mellanby (1933), Edney (1947), Sharif (1948), and Humphries (1967) all observed that at high saturation deficiencies there is a pronounced increase in the death rate among larvae and pupae.

Although the present study is based on only one year of field work, flea populations at all three collecting sites experienced similar seasonal fluctuations that were positively correlated with humidity and negatively correlated with temperature (surface meteorological data compiled for Corvallis by the National Climatic Center, U.S. Department of Commerce). The Willamette Valley in which Corvallis is situated is an area of warm, dry summers and cool, wet winters. For this reason, infested voles were most often collected during the mild spring and early winter months, while uninfested voles predominated during summer and midwinter. Only 198 (52.6%) of the voles taken over the 12-month collecting period were infested, and of these 119 (60.1%) carried one flea species, 59 (29.8%) carried two, and 20 (10.1%) carried three or more. Such low infestation rates suggest that competition on the host animal is not a factor in determining species abundance; rather, the complex web of selective pressures and biotic relationships characteristic of the nest probably constitutes the regulatory mechanism. Regardless of cause, it is of interest to know the extent to which different flea species may be expected to occur together on their host, and this paper presents statistical methods for analyzing such interspecific associations.

Data Summary and Analysis

Six of the eight flea species collected during this study were uncommon or accidental on the gray-tailed vole. It was therefore convenient to treat these six species as one with the result that only three species categories were considered. The first of these, category A, contained all specimens of *Atyphloceras multidentatus;* category C contained all *Catallagia charlottensis;* and category O contained all other flea species. The eight possible combinations of these categories are listed in Table 1 together with the observed and expected number of voles per combination. A bar over a letter indicates the absence of that category. Thus, 13 voles were infested with A, C and O, while 30 voles were infested with C and O but not with A.

Table 1. Numbers of gray-tailed voles infested with different combinations of flea species.

Flea Species Combination	Observed Number of Voles	Expected Number of Voles*
ACO	13	5.55
$\overline{A}CO$	30	25.20
$A\overline{C}O$	10	11.05
$AC\overline{O}$	22	17.18
$\overline{AC}O$	39	50.20
$A\overline{CO}$	23	34.23
$\overline{A}C\overline{O}$	61	78.07
$\overline{ACO}$	179	155.52
Totals	377	377.00

*Expected numbers are calculated from the hypothesis of independence.

The data in Table 1 imply that A was present on 18.0% of the voles collected for this study, C was present on 33.4%, and 0 was present on 24.4%. Expected frequencies were calculated from the hypothesis that each flea species behaves independently; that is, the probability of obtaining a vole infested with species A is unaffected by the presence or absence of C and O. To illustrate the calculations for this hypothesis, the expected number of voles with the combination $\overline{A}\ C\ O$ is

$$nP(\overline{A})\ P(C)\ P(O) = (377)\left(\frac{309}{377}\right)\left(\frac{126}{377}\right)\left(\frac{92}{377}\right) = 25.20$$

If events $\bar{A}$, C and O occur independently, then the probability of their joint occurrence is the product of their marginal probabilities.

It is clear from Table 1 that all three species categories occurred together with greater frequency than would be expected under the hypothesis of independence. In addition, pairs of categories occurred more often than expected (with the exception of $A\bar{C}O$), and the number of uninfested voles was greater than expected. On the other hand, voles infested with only one species category were collected less often than expected in every case. These observations seem to indicate positive association between species. To further investigate this possibility, it is necessary to employ two-way tables such as those shown in Table 2.

Table 2. Two-way associations.

A x C

	C	$\bar{C}$	
A	35	33	68
$\bar{A}$	91	218	309
	126	251	377

$Q = .435$
$o = 2.54$
$X_c^2 = 11.176$

A x O

	O	$\bar{O}$	
A	23	45	68
$\bar{A}$	69	240	309
	92	285	377

$Q = .280$
$o = 1.78$
$X_c^2 = 3.392$

C x O

	O	$\bar{O}$	
C	43	83	126
$\bar{C}$	49	202	251
	92	285	377

$Q = .362$
$o = 2.14$
$X_c^2 = 8.924$

The Q- and o-statistics appearing under each two-way table are widely used measures of association based on relative odds. The Q-statistic is obtained as follows:

$$Q_{AC} = \frac{\frac{35}{91} - \frac{33}{218}}{\frac{35}{91} + \frac{33}{218}} = \frac{(35)(218) - (33)(91)}{(35)(218) + (33)(91)} = .435$$

This statistic compares the relative odds of obtaining a vole that is infested with A when C is present and when C is absent. If the odds of obtaining a vole that is infested with A are higher when C is present, then Q will be positive, meaning that there is a positive association in the table. The range for Q is −1 to +1 (the same as the product-moment correlation coefficient for continuous data) where −1 indicates that the two flea categories never occur together or they are never both absent and +1 indicates that one category is observed only in the presence of the other. A Q-value of zero indicates no association in the sense that the odds of obtaining one category are the same whether or not the other is present. In Table 2, all Q-values are positive.

To obtain the o-statistic, it is necessary to calculate the ratio of the odds. For example, in the A x C table, the odds of obtaining A with C present are 35/91, while the odds of obtaining A with C absent are 33/218. The ratio of these odds is

$$o_{AC} = \frac{35/\ 91}{33/218} = \frac{(35)(218)}{(33)(\ 91)} = 2.54$$

Here, the odds of obtaining A when C is present are 2.54 times greater than when C is absent — a clear indication of positive association. An o-value of 1 indicates independence (*i.e.,* the odds of obtaining A are the same for C and $\overline{C}$), and an o-value less than 1 corresponds to the concept of negative association. Fleiss (1973) presents further discussion of the Q- and o-statistics and provides methods for calculating confidence intervals; Goodman and Kruskal (1954) discuss the Q-statistic as well as other measures of association.

Either o or Q may be used as a measure of association, but to formally test for independence the chi-square test (X^2) is used. The calculated chi-square values, using the continuity correlation factor (Fleiss, pp. 19-20), are given in Table 2 for each two-way table. It is clear that each pair of categories in Table 2 is positively associated. A x C and C x O show the highest degrees of association with X^2 tests significant at the .005 level, and A x O is only somewhat less positive with a X^2 significant at .10.

Such two-way tables, where two categories are summed over the third category, serve to illustrate common measures of association. However, the usual order of statistical analysis involves first testing for second order interaction to determine whether it is reasonable to sum over the third category. Testing for second order interaction means testing the hypothesis that the association of two categories is the same in the presence or absence of the third category. If the hypothesis is not rejected, then it is reasonable to form two-way tables by summing over the third category. Thus, for the categories A x C with O present and absent, the o-values are 1.69 and 2.81, respectively. While these values differ somewhat, they both indicate association in the same direction, that is, they are both greater than 1, and if they are compared using Plackett's (1962) test for second order interaction, the resulting $X^2 = .742$ with 1 degree of freedom. Since this value is not significant, there is no evidence of second order interaction.

Fluctuations in Flea Populations

As mentioned earlier, high temperatures and low humidities corresponded with a low percentage of infested gray-tailed voles during summer months, thereby increasing the frequency of the combination

$\overline{A}\ \overline{C}\ \overline{O}$. Unless taken into account, fluctuations in ectoparasite populations, whatever their cause, can lead to spuriously high but nonetheless statistically significant positive measures of association. To obtain a true measure of interspecific association, all sample data must be comparable. To approximate this condition, the data for the months May through September during which only 87 infested voles were observed have been excluded from Table 3, which is otherwise similar to Table 1. In Table 3, combinations A C O, $\overline{A}$ C O and A C $\overline{O}$ again occur more often than expected, while A $\overline{C}$ O occurs less often than expected. The number of uninfested voles remains greater than expected, and the number of voles bearing only one flea category is less than expected in each case.

Table 3. Numbers of gray-tailed voles infested with different combinations of flea species — excluding months May through September.

Flea Species Combination	Observed Number of Voles	Expected Number of Voles
ACO	13	7.42
$\overline{A}CO$	29	25.70
$A\overline{C}O$	9	11.63
$AC\overline{O}$	21	17.90
$\overline{AC}O$	34	40.25
$A\overline{CO}$	22	28.04
$\overline{A}C\overline{O}$	50	61.78
$\overline{ACO}$	112	97.08
Totals	290	289.80

Again, the Plackett test for second order interaction is not significant, meaning that two-way tables for each pair of categories can be formed by summing over the third category. These two-way tables appear in Table 4. In each case, the odds ratio is greater than 1 (though less than the corresponding measure in Table 2), indicating that the number of voles infested with one flea category is higher when another flea category is also present. The chi-square statistic is significant for A x C and C x O but is not significant for A x O.

Table 4. Two-way associations — excluding May through September.

A x C

	C	$\overline{C}$	
A	34	31	65
$\overline{A}$	79	146	225
	113	177	290

o = 2.03

X_c^2 = 5.569

A x O

	O	$\overline{O}$	
A	22	43	65
$\overline{A}$	63	162	225
	85	205	290

o = 1.32

X_c^2 = .574

C x O

	O	$\overline{O}$	
C	42	71	113
$\overline{C}$	43	134	177
	85	205	290

o = 1.84

X_c^2 = 4.913

Whether positive or negative, the interspecific relations between parasitic arthropods may be interpreted in many ways. In the case of the gray-tailed vole, there is evidence that temperature and humidity are the chief factors regulating flea populations. Because the several flea species associated with this vole are abundant only during months of mild, wet weather, they tend to be found together or not at all. Measures of interspecific association are liable to change with time, and therefore attempts to provide such measures must not be limited to one season. However, exaggerated measures may result if data are collected without regard to population fluctuations.

Allred's Negative Correlation Factor

Allred (1971) presented an analysis of mammalian ectoparasite associations in which he used a measure that he called the "negative correlation factor," defined as follows:

$$\text{Negative Correlation Factor} = \frac{(\text{Expected Infestation Rate}) - (\text{Actual Infestation Rate})}{\text{Expected Infestation Rate}}$$

"where the expected rate equals the sum of the actual rates of infestation of the respective, individual groups". Any two ectoparasite species A and B may occur in the following proportions:

		Species B	
		Present	Absent
Species A	Present	P_{11}	P_{12}
	Absent	P_{21}	P_{22}

Therefore, the negative correlation factor may be redefined as

$$\frac{(P_{12} + P_{21}) - P_{11}}{P_{12} + P_{21}}$$

Allred multiplied this factor by 100 to generate a range extending from $-\infty$ to 100. Large values were said to signify a lack of association; however, no distributional properties were given or referenced. In addition, this statistic has no intuitive feature, as does the odds ratio, making it difficult to determine what a particular value of the negative correlation factor means.

A further difficulty posed by use of the negative correlation factor is illustrated in Table 5 where identical negative correlation factors result from radically different data sets. Here, the negative correlation factor dictates that each data set receive the same interpretation. However, in data

Table 5. Identical negative correlation factors obtained from different data sets.

Data Set X

	B	$\bar{B}$	
A	40	160	200
$\bar{A}$	160	640	800
	200	800	1000

N.C.F. = 87.5

o = 1

Q = 0

Data Set Y

	B	$\bar{B}$	
A	40	0	40
$\bar{A}$	320	640	960
	360	640	1000

N.C.F. = 87.5

o = ∞

Q = 1

set X, 20% of the host animals are infested with species A regardless of the presence or absence of species B. In other words, each ectoparasite species is behaving independently, a fact that may be verified by use of the o- and Q-statistics. On the other hand, in data set Y, species A infests 4% of the host animals and species B infests 36%. Species B is far more abundant with the result that B is observed on animals that are not infested with A but A is never observed on animals that are not also infested with B. This complete association of A with B is indicated by the extreme values of o and Q. Because the negative correlation factor fails to discriminate between such data sets, it is inadequate as a measure of association and should be discarded in favor of standard statistical measures such as the o- and Q-statistics.

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BOOK REVIEW

HOW TO KNOW THE BEETLES. 2nd ed. R.H. Arnett, Jr., N.M. Downie & H.E. Jaques. 1980. Wm. C. Brown Co., Dubuque, Iowa. 416 pp. $9.70.

This revision of Jaques' original (1951) edition of the same title has been expanded to include representatives of *all* North American families of Coleoptera. This very desirable addition makes this edition more complete and comprehensive than its predecessor. Another desirable addition is the inclusion of a brief listing of some general references on beetles.

Throughout the text, the authors have done a good job of updating nomenclature changes which have occurred over the past 30 years. However, it is unfortunate they apparently did not have families reviewed by family authorities. This could have prevented possible errors such as those listed under *C. scutellaris* (pg. 68), an exact word carry-over from the 1st edition. A review would have dropped *modesta,* merely a melanic phase of also mentioned *rugifrons,* and also would have dropped *nigrior,* a melanic form of previously listed *unicolor.* This then might have allowed other subspecies as *lecontei* Hald. to be included in their stead.

In the main, illustrations in this edition are simple enlargements of those in the earlier edition, but the enlargements apparently were made to fit a pre-determined set space rather than any consideration being given to scale or relation to actual size of the specimen. One example of the resulting misconception of size relationships is seen when one compares the illustration of *Ataenius spretulus* (Hald.) (Fig. 423) whose 54 mm. illustration depicts a 4-5 mm. insect while a 45-60 mm. ♂ specimen of *Dynastes tityus* (L.) (Fig. 438) is depicted in a 38 mm.

(continued on page 109)

NEW DISTRIBUTIONAL RECORD OF *DOLANIA AMERICANA* (EPHEMEROPTERA: BEHNINGIIDAE)[1]

Patricia L. Finn, David D. Herlong[2]

ABSTRACT: Nymphs of *Dolania americana* were collected from Black River, Sampson County, North Carolina. This collection represents a new state record and a new Northern range extension for the species. Environmental conditions were found to be similar to previously published collection localities.

Benthic macroinvertebrate collections from Black River, Sampson County, North Carolina (Figure 1) in August 1974 yielded four nymphal specimens of the mayfly *Dolania americana* Edmunds and Traver. This collection represents a new state record as well as a new Northern range extension for the species.

Prior reports of this species are for four areas: the Blackwater River in northwestern Florida (Peters and Jones 1973; Peters and Peters 1977; the Satilla River in southeast Georgia (Benke et al. 1979); Upper Three Runs Creek, a tributary of the Savannah River, at the Savannah River Plant near Aiken, South Carolina, (Edmunds and Traver 1959, also cited were paratype collections from the Savannah River proper, but S.S. Roback, by personal communication, states these latter collection sites were incorrect); and an unidentified locality in southwestern Louisiana (Tsui and Hubbard 1979).

The nymphs were collected using a petite ponar dredge at a depth of 4 m in the main flow of the river. The substrate was composed of shifting sand as found at the other sites. The water quality of Black River is similar to the previous collection localities (Table 1), being a "blackwater" river having a low pH and being high in humic substances that give the water its characteristic tea-colored appearance. The watershed of Black River above the collection site (1916.6 km^2) is a mixture of farmland and forest areas (pine-hardwood mixture and gum-cypress swamp). The collection locality was approximately 1.6 km upstream of the junction of South River and Black River. South River is very similar to Black River and the occurrence of *D. americana* in South River and other nearby creeks is possible.

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[1] Received April 5, 1980

[2] Carolina Power & Light Company, Harris Energy & Environmental Center, Route 1, Box 327, New Hill, North Carolina 27562

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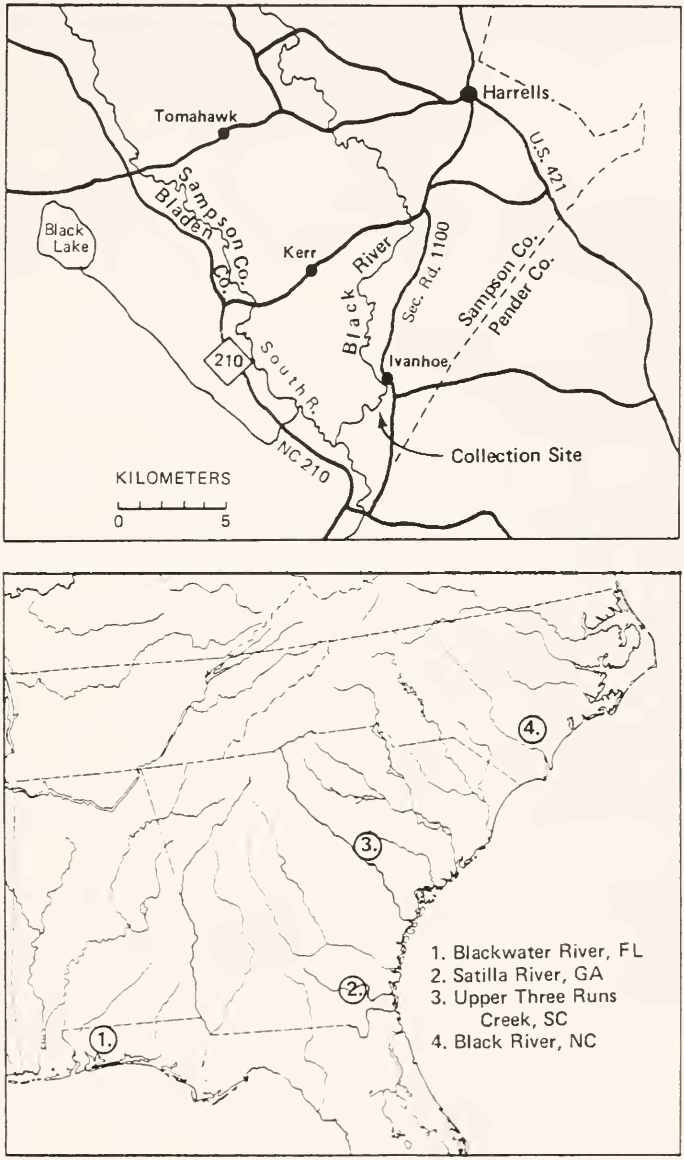

Fig. 1. Collection localities of *Dolania americana* in North Carolina (above) and the southeast United States (below).

Table 1. Some water chemistry parameters from Black River, Upper Three Runs Creek[1], Blackwater River[2] and the Satilla River[3]

	Black River	Upper Three Runs Creek	Blackwater River	Satilla River
pH	5.2-6.6	4.9-6.7	5.0-6.3	4.3-6.7
DO	5.2	—	6.8-9.0	4.7-11.6
Alk (mg/1 $CaCo_3$)	1-2	0.2-3.5	2-3	0.0-9.0
Hardness ($CaCo_3$)	12-20	—	—	7-20
Conductivity (μmhos/cm)	—	20-28	—	28-63

[1] Morse et al. 1980.

[2] Beck 1973.

[3] Benke et al. 1979.

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NESTING BIOLOGY OF *HOPLITIS BISCUTELLAE* (COCKERELL) (HYMENOPTERA: MEGACHILIDAE)[1]

Richard W. Rust[2]

ABSTRACT: The nesting biology of *Hoplitis biscutellae* (Cockerell) is described and illustrated. This species uses mud cells of *Sceliphron caementarium* (Drury) for nesting. Cell walls and plugs are of *Larrea tridentata* (Moc. & Ses.) flower parts, leaves and resin. Pollen provision and analysis shows a single source, *Larrea tridentata*. The bee overwinters in a cocoon as a post-defecating larva.

The genus *Hoplitis* Klug contains 45 species in the Nearctic, north of Mexico (Eickwort 1970, Michener 1968, Hurd and Michener 1955). Before 1975, biological information was known for 8 species (reviewed by Clement and Rust 1975). Since then information is available for 8 more species: *H. robusta* (Nylander) (Clement and Rust 1975), *H. hypostomalis* (Michener), *H. copelandica* (Cockerell), *H. abjecta* (Cresson) (Parker 1975[3]), *H. hypocrita* (Cockerell), *H. fulgida* (Cresson), *H. sambuci* Titus (Clement and Rust 1976), *H. enceliae* (Cockerell), *H. elongata* (Michener) (Parker 1977[3]).

The purpose of this paper is to report on the nesting biology of *Hoplitis (Dasyosmia) biscutellae* (Cockerell). This species presents several unusual nesting characteristics for any species of *Hoplitis,* namely the extensive use of *Larrea tridentata* (Moc. & Ses.) resin and plant parts in cell formation and closure. Hurd and Linsley (1975) report on the oligoletic relationship of *H. biscutellae* to *Larrea.* Stephen, et al. (1969), Linsley and MacSwain (1943), Parker and Bohart (1966, 1968) and Erickson, et al. (1976) provide additional accounts on the biology, parasites and predators of *H. biscutellae.*

Nest Site: An extensive nesting site of *Sceliphron caementarium* (Drury) was found on a slightly over hanging rock face near the northern Surprise Spring, 2Km east of the Grapevine Ranger Station, Death Valley National Monument, California (37°00'N - 117°20'W, elevation 853M). The nesting site occupied an area of some 25-30M^2 on the north to

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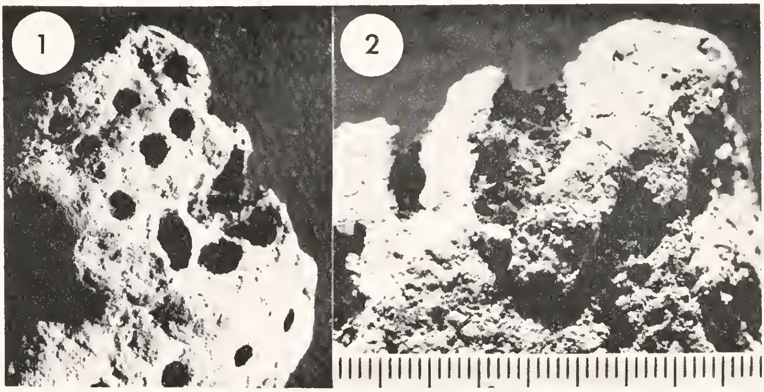
[1] Received February 8, 1980.

[2] Department of Biology, University of Nevada, Reno, NV 89557.

[3] Parker (1975,1977) reported the biological information under the generic name of *Anthocopa.* This is a familiar use of *Anthocopa,* since Michener (1968) has suggested *Anthocopa* be synonymized with *Hoplitis.* However, no formal synonymy based on a study of Holarctic fauna has been made, see Hurd (1979: 2020).

northeast exposure of the face. Lower portions of the nest complex had been washed away by earlier run-off waters. There was no nesting activity when the site was found in October 1978. Examination of the nest complex showed reuse of the *Sceliphron* nests by other insects. However, most reused nests had heavy signs of predation or parasitism. Three sections of relatively unattacked nests were removed and returned to the laboratory for examination and rearing. *Hoplitis biscutellae* and *S. caementarium* were the only Hymenoptera reared from the sections.

Nest and Cell Construction: Twenty cells of *Hoplitis biscutellae* were found in one of the nest sections (Figs. 1, 2). The other nest sections contained only *S. caementarium.* The 20 cells were located in 8 *S. caementarium* cells with a mean number of 3 cells per wasp cell (range 1-4). The bee cells were basically arranged in an oblique-linear series within the wasp cells. The wasp cells were not cleaned out nor did they appear to have been enlarged by *H. biscutellae.* Several wasp cells contained pieces of the wasp cocoon. Bee cells were composed of plant parts (petals, sepals and leaf pieces) mixed with plant resin. Comparison of the plant parts with herbarium specimens showed that the parts were from *Larrea tridentata,* creosote bush. The plant parts-resin mixture formed the rigid walls of the urn-shaped cells. The inner cell was smooth and polished and the outside rough and uneven. A mixture with less resin filled the spaces between the bee cells and the wasp cell wall (Fig. 2). The resulting cell wall varied from 0.5-1.5mm or even greater in thickness in the filled areas. In several bee



Figs. 1 and 2. Nesting biology of *Hoplitis biscutellae* Cockerell. Fig. 1-Outer surface of *Sceliphron caementarium* (Drury) nest containing *Hoplitis biscutellae* nests. Fig. 2-Inner surface of the same nest section showing the resin-plant part of cell walls of one *Hoplitis biscutellae* nest.

cells, pieces of the *S. caementarium* cocoon were worked into the cell wall. The cell cap was a smooth, concave resin plug about 1mm thick, lacking plant parts. Seventeen measurable cells were 9.7±0.14mm (S.E.) long, 5.8±0.12mm greatest diameter, with 5.0±0.08mm openings (cell caps). The last cell in a series was capped and this cap formed a simple nest plug.

Stephen, et al. (1969) mentioned the repeated use by *H. biscutellae* of *S. caementarium* cells, as many as eight times.

Provisions: One cell contained an uneaten pollen-nectar mass. The provision filled the bottom 2/3 of the cell and was yellow-orange in color. The mass was very sticky and tacky when the cell was opened in January 1979. Comparison of the cell pollen with pollen from herbarium specimens of *Larrea tridentata* showed that they were the same. Several samples of the cell pollen showed 100% *Larrea* pollen. Examination of pollen grains from fecal pellets from other bee cells also showed *Larrea* pollen.

Feces: The feces of *H. biscutellae* were 0.2-0.3mm wide and 1.0-1.2mm long and slightly curved. They were orange to red-brown and had a shallow groove along the long axis. Intact pellets were found in the top portion of the cell. Laterally and in the cell bottom the fecal pellets were smeared onto the cell wall forming a layer approximately 0.5-1.0mm thick. This fecal layer appears to have an inner coating of larval salivary secretion that produced a relatively hard, uniform layer. When intact fecal pellets and pieces of the fecal layer were placed in 70% ethanol, the fecal pellets dissolved without teasing; whereas, the fecal layer retained its shape and only broke up with teasing.

Cocoon: The cocoon of *H. biscutellae* was composed of two layers, the outer being associated with the fecal layer. The inner layer was thin, light brown to tan matrix with numerous white silk threads visible in it. At its apex, the cocoon was formed by a dense layer of whitish-orange silken threads that formed the upper 0.5-0.8mm of the cocoon. When this layer was removed, there was a small, slightly raised "nipple" area on the top of the inner cocoon.

Development: When the nest was opened in January, the bees were post-defecating larvae. The larvae were given a cold treatment (5°C) for 90 days and then placed at room temperature (20°C). Eight of the nine larvae pupated in an average of 22.1±1.1 days after warming began and 20.4±0.5 days later they emerged. All eight were females. The ninth larva remained alive (active) and was placed back in cold treatment in December 1979. It was removed from cold treatment on March 28, 1980 and pupated on April 17, 1980, the second season.

Nest Associations: Three of the cells contained meloid larvae (reared to *Nemognatha* sp.), 2 cells contained bombyliid larvae (reared to *Anthrax* sp.), 2 cells contained a clerid larve (*?Trichodes* sp.) and 1 cell contained an unknown larval hymenopterous parasite (*?Montodontomerus*). Exuviae of dermestid larvae were found in one of the empty cells associated with active bee cells.

Linsley and MacSwain (1943) reported the attack of *Trichodes ornatus* on *H. biscutellae.* Parker and Bohart (1966, 1968) found *Nemognatha macswaini* Enns, *Anthrax irroratus* Say, *Stelis* sp. (Megachilidae), *T. ornatus, Cymatodera* sp. (Cleridae) and woodpeckers as parasites and a predator of *H. biscutellae.* Erickson, et al. (1976) also reported *N. macswaini* association with the bee.

Discussion: The nesting biology of *H. biscutellae* has several unusual features when compared to other species of *Hoplitis.* Characteristic of *H. biscutellae* is the extensive use of *Larrea* resin in cell construction; no other North American *Hoplitis* thus far studied uses resin in cell wall and cell cap formation. Resin and incorporated materials are the nesting materials of other megachilid genera, e.g. *Chalicodoma, Trachusa, Dianthidium,* and *Chelostoma.* The presence of a weakly developed "nipple" on the cocoon top is unusual. Most *Hoplitis* cocoons have either a well-developed nipple *(H. hypocrita, H. fulgida, H. hypostomalis)* or they lack one *(H. sambuci, H. robusta, H. copelandica, H. abjecta, H. elongata).* Parker (1977) reports that *H. enceliae* has a "flat or slightly raised area (nipple) distinct from the surrounding surface". The formation of complete cells inside existing burrows by *H. biscutellae* is similar to *H. hypostomalis,* another hot desert species, and *H. copelandica,* a mountain species. *Hoplitis abjecta* and *H. elongata* form complete cells in exposed sites. The extensive use of *Larrea* products (pollen, ?nectar, resin, flower parts, etc.) in nesting may represent the narrowest relationship of any *Hoplitis* species. *Hoplitis abjecta, H. elongata* and *H. enceliae* appear to be oligoletic on *Penstemon* and *Encelia,* respectively.

ACKNOWLEDGMENTS

I would like to thank the personnel of the National Park Service, Death Valley National Monument, especially Peter Sanchez for allowing me to work in the Monument. Dr. Hugh Mozingo made herbarium specimens of *Larrea tridentate* available to me for study and comparison. The assistance of S.L. Clement, L.M. Hanks and journal reviewers in manuscript preparation is appreciated.

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BOOK REVIEW

(continued from page 101)

illustration. Even though size is given in numbers beneath each illustration, use of a more realistic illustration scale or, at the very least, use of a uniform scale line for all illustrations would have helped to better visually interpret relative size. This is especially true for beginners, for whom this book is primarily intended.

The placement of illustrations in relation to their key words, specific names and descriptions is quite confusing and nowhere nearly as easy to follow as in the earlier edition where the illustrations were cut into the left hand margins of the descriptive material immediately below the key words. This is particularly true when the key words and specific name are on the lower half of a column, followed by a substantial blank space and then the reader must go to the top of the next column or to the top of the next page to connect the illustration and description to the key words. If the publisher had not been so rigid in its illustration parameters, much of this confusion could have been avoided by the use of modified picture sizes and, in addition, a great deal of waste space could have been conserved.

In general, the authors have done a commendable job with this revised edition. I wish I could say as much for the publisher whose policies re illustrations and format size (not as convenient to use as earlier edition) together with those almost inadvertent typos (pg. viii, line 13, Beetle*s*; pg. 1, 1.9. wing; pg. 1, 1. 18. animals *or*; pg. 3. 1. 38 weigh*t*) leave considerable to be desired. In spite of these deficiencies, the text is a worthwhile addition to the library of all coleopterists.

H.P.B.

OCCURRENCE OF TWO ANTHOPHILOUS DIPTERA ON *GEUM RADIATUM* (ROSACEAE) IN NORTH CAROLINA[1,2]

F.E. Brackley[3], J.F. Burger[4]

ABSTRACT: Two species of Diptera, *Hylemya* (*Paregle*) *aestiva* (Anthomyiidae) and *Chrysotus costalis* or *C. subcostata*, are reported visiting flowers of *Geum radiatum* (Rosaceae), a precinctive species restricted to mountain "balds" of Tennessee and North Carolina. Anthophily in Diptera is discussed. The collection locality for *H. aestiva* is a significant southern extension of its known distribution.

During a botanical excursion to North Carolina in July, 1979, F.E. Brackley and John Korpi of the University of New Hampshire, collected a male of *Hylemya (Paregle) aestiva* (Meigen) (Anthomyiidae) visiting a flower of *Geum radiatum* Michx. (Rosaceae). The collection site, Tater Bald, is located in Watauga County, near Boone, North Carolina.

Hylemya aestiva is a holarctic anthomyiid fly occurring in North America from Alaska to Nova Scotia, south to Washington, Colorado and New Hampshire (Stone *et al.*, 1965; F.C. Thompson, personal communication). Hennig (1968) places this species in the genus *Nupedia* Karl. There is some sentiment for elevating the subgeneric categories of *Hylemya* to generic status, but nomenclature in this paper follows the 1965 North American Diptera Catalog. The present record from North Carolina represents a significant range extension for this species.

Hennig (1968), citing several sources, stated that *H. aestiva* (as *Nupedia aestiva)* was known to visit flowers of Ranunculaceae, Compositae, Saxifragaceae, Umbelliferae and Caryophyllaceae. He also stated that *H. aestiva* oviposits on and develops in cattle droppings. A related species, *Hylemya (Paregle) cinerella* (Fallen), is commonly reared from cattle dung in North America.

Hylemya aestiva has rather unique mouthparts, the proboscis being elongate, slender, and strongly sclerotized, in contrast to the short, stout, fleshy proboscis of other *Hylemya* (*Paregle*) species. The elongate proboscis may be an adaptation for probing blossoms and consuming nectar

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[2] Scientific Contribution Number 1030 from the New Hampshire Agricultural Experiment Station.

[3] Department of Botany and Plant Pathology, University of New Hampshire, Durham, NH 03824

[4] Department of Entomology, University of New Hampshire, Durham, NH 03824

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or pollen. The proboscis resembles that of some blood-sucking species and the male observed on *Geum radiatum* painfully poked the skin of the senior author when it was collected.

Anthophily has been reported for a related anthomyiid, *Hylemya (Delia) liturata* (Meigen, visiting *Rorippa islandica* (Oeder) Borbas (Cruciferae) (= *R. palustris)* rarely and *Chrysanthemum leucantheum* L. frequently (Mulligan and Kevan, 1973). Proctor and Yeo (1972) reported that a common muscid fly, *Fannia canicularis* (L.) visits flowers.

A female of *Chrysotus costalis* (Loew) or *C. subcostata* (Loew) (Dolichopodidae) also was collected from a flower of *Geum radiatum* at the same locality. Identification of this fly is tentative, since only the males of *Chrysotus* can be identified with certainty. Some Dolichopodidae appear to be occasional visitors to flowers and have been found on another Rosaceous species, *Potentilla reptans* L. (Proctor and Yeo, 1972). However, *Chrysotus* spp. have not been previously identified as anthophiles. Little is known of the adult food habits of Dolichopodidae except that some species are predators of other insects.

The host flower for these Diptera, *Geum radiatum*, is a rare species precinctive to a few balds in the mountains of North Carolina and Tennessee (Justice and Bell, 1968). Diptera were observed on flowers of *G. radiatum* at several other sites within its range. *Geum radiatum* possesses a showy, scentless, yellow flower with characteristics known to be attractive to Diptera (Mosquin and Martin, 1967; Faegri and van der Pijl, 1979). It is uncertain whether both *Geum radiatum* and the flies observed in this study benefit from their association. Flies may obtain nectar for flight energy and may consume pollen as a protein source for ovarian development. Whether they actually pollinate *G. radiatum* is unknown. All Geums are normally outcrossers but are also self compatible (Gajewski, 1957). *Geum radiatum* also is able to reproduce vegetatively, due to the rhizomatous habit. It usually produces abundant seeds with a characteristic long fringed style well adapted for wind distribution.

The importance of Diptera as pollinators in arctic and sub-arctic environments has been documented by Kevan (1972) and McAlpine (1965), and it is likely that species of Dolichopodidae, Anthomyiidae and other Diptera may be more commonly anthophilic at higher elevations than previously reported.

The Diptera were identified by JFB and the male of *Hylemya aestiva* has been deposited in the U.S. National Museum, Washington, D.C. The specimen of *Chrysotus* is in the collection of the Department of Entomology, University of New Hampshire. Voucher specimens of *Geum radiatum* from Tater Bald, North Carolina are deposited in the Hodgdon Herbarium (NHA) at the University of New Hampshire.

ACKNOWLEDGEMENTS

We wish to thank F.C. Thompson and G.C. Steyskal, Systematic Entomology Laboratory. USDA, for confirming identification of *H. aestiva,* I.W. Carpenter and Steven Morrow, Appalachian State University, Boone, N.C. for directions to the collecting site and G.E. Crow, Department of Botany and Plant Pathology, University of New Hampshire, Durham, NH for reviewing the manuscript.

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NOTICE

A joint meeting of the IV Congreso Latinoamericano de Entomologia, VI Congreso Venezolano de Entomologia, II Congreso de la Sociedad Panamericana de Acridiologia and the I Simposio de Lepidopterologia Neotropical will convene in Maracay, State of Aragua, Venezuela, from July 5-10, 1981.

An extensive scientific program is being planned which will include several paper sessions alternated with symposia and conferences. In addition to these activities, there will be educational, artistic and commercial exhibits related to insects.

The Organizing Committee invites all persons interested in entomology to participate in and contribute to this scientific event.

Further information may be obtained from Secretario General, IV Congreso Latinoamericano de Entomologia, Instituto de Zoologia Agricola, Apartado 4579, Maracay 2101-A, Estado Aragua, Venezuela

OBSERVATIONS ON MALE BEHAVIOR OF THE EASTERN YELLOWJACKET, *VESPULA MACULIFRONS* (HYMENOPTERA: VESPIDAE)[1]

David C. Post[2]

ABSTRACT: Males of *Vespula maculifrons* patrolled conspicuous trees and bushes in an old field in southern Wisconsin. Mating behavior is described from observations of portions of five natural copulations and two copulations with a tethered queen.

Large numbers of male Vespinae flying rapidly around and between prominent vegetation (patrolling) have been previously reported for six species of *Vespula* and two species of *Dolichovespula* (MacDonald, et. al., 1974 and cited references). These are apparently mating aggregations, since the males occasionally contact and mate with females (Spradbery, 1973; MacDonald, et. al., 1974). Within the genus *Vespula* male patrolling appears to vary little among species. The aggregation and mating behavior reported here for the first time for *V. maculifrons* appear to conform to the pattern described in both *V. germanica* and *V. pensylvanica* (see MacDonald, et. al., 1974).

Observations were made from 22 September to 4 October 1978, in the University of Wisconsin Arboretum, Madison, Wisconsin. The site was an old field, 60m by 180m, containing open grassy areas with honeysuckle *(Lonicera xylosteum)*, grey dogwood *(Cornus racemosa)*, smooth sumac *(Rhus glabra)*, black cherry *(Prunus serotina)*, bur oak *(Quercus macrocarpa)*, black oak *(Q. velutina)*, and buckthorn *(Rhamnus cathartica)*.

Male Patrolling Behavior

Male activity was first noticed on 22 September; no activity was evident when the same area was visited on 8 and 16 September. Males were observed daily from 28 September to 4 October. On clear days activity began between 0900-0930 hrs and lasted to 1400-1500 hrs. On cloudy days activity occurred only during periods of sunshine.

Males flew around and between conspicuous trees and bushes. Around smaller trees and bushes (less than 3m tall) the males hesitated briefly, circling the plant before quickly flying on to the next tree. Around taller trees (3-10m) males flew in zigzags in all directions; most of the flight activity occurred around the upper half of the tree. More males were seen

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[1] Received April 18, 1980.

[2] Department of Entomology, University of Wisconsin, Madison, Wisconsin 53706.

flying around taller trees than shorter trees. Around any one tree the number of males varied from one to approximately 50. An estimated 2000 males were present in the area. An adjacent pine stand also contained patrolling males, although not in as large numbers as in the field. No other *Vespula* species were observed patrolling these areas.

During their patrols males occasionally perched briefly on a leaf, and in some cases walked around and/or groomed before flying off. Males were not consistent in whether they faced toward or away from the tree while perched on a leaf. Perched males remained on a leaf longer from 1000-1200 hrs ($\bar{x}$ = 37.75s; S.D. = 24.37; n = 24) than from 1200-1500 hrs ($\bar{x}$ = 16.65s; S.D. = 17.86; n = 20) (t = 3.14; $0.002 < P < 0.005$). Grooming occurred more frequently during afternoon hours (50% of the landings) than the morning hours (37.5% of the landings). When two males perched on the same leaf, they showed no visible response toward each other. Perched males (n = 75) never mouthed or rubbed their gaster on the leaf, suggesting no application of a pheromone.

Bumblebees, syrphid flies, conspecific males and other flying insects elicited no response from the patrolling males.

In an attempt to determine if males patrol a specific area or route (home range), twenty males were individually marked with paint (Testor's PLA) on the thorax and gaster. After marking, the males returned to the tree from which they were caught, apparently unaffected by the marking. Yet, only two males were seen again on the same tree; one the day after and the other two days after marking. The marked males were not seen during brief observations in other areas of the field. However, the marked males may have escaped my detection, due to the large number of males patrolling the tops of the trees. These observations suggest that males do not confine their patrolling to one small area (i.e., two or three trees), but either patrol the vegetation randomly or patrol large home ranges within the field.

Mating Behavior

Portions of five natural copulations and two complete copulations with a tethered queen (gyne) were seen. The queen was tethered by tying one end of a thread (one meter in length) around her abdominal petiole and the other end to a bamboo pole. There were no obvious differences in the sequence or duration of the matings in the two situations. All observed copulations (natural and tethered) took place between 1025 hr and 1325 hr.

The full sequence of male approach through copulation was observed only with the tethered queen. The tethered queen was approached while perched on a leaf, not while in flight. The male flew in a zigzag fashion, downwind from the queen, for less than 30s, gradually flying closer and finally landing on the leaf next to the queen. He then antennated the queen and climbed, with his claspers extended, onto her gaster from behind. The male then climbed onto her thorax and coupled with her. Approximately 20s after coupling was established the male flipped backwards venter up and fanned his wings. If the queen clung to the underside of the leaf, the male hung in mid-air, or if the queen sat on top of the leaf, the male laid back on the leaf. The male then groomed his forelegs with his mouthparts, while occasionally the queen groomed her forelegs and mouthparts. Grooming lasted 4 min. and 7.58 min. in the two tethered situations. The complete phase of male fanning was not seen in two natural pairings, but the portions seen lasted 58s and 4.42 min. In all copulations the queen then turned ventrally and bit the male's tergites while the male continued to fan his wings. This phase lasted 2 min. and 1.35 min. in tethered pairs and 2.2 min. and 13.45 min. in natural pairs. The male then released the queen and immediately flew away. Under natural conditions the queen flew out of the area 24s later and in another situation, after being pounced on by another male, 35s later.

During the copulations other males (10-15) flew within one meter of the pairs, but did not approach or respond to them in any way.

Discussion

V. maculifrons patrolling behavior is similar to male behavior of *D. sylvestris* (Sandeman, 1938), *D. norwegica* (Wynne-Edwards, 1962), *V. austriaca* (Pack-Beresford, 1901), *V. rufa* (Spradbery, 1973), *V. vulgaris* (Schremmer, 1962), *V. germanica* (Thomas, 1960; Schremmer, 1962), *V. atropilosa* and *V. pensylvanica* (MacDonald, et. al., 1974). In all cases males patrol among conspicuous objects, with no evidence of a male marking pheromone.

In all vespine species, except *V. atropilosa,* in which it has been observed, male behavior during copulation appears to be similar. *V. atropilosa* males, under caged conditions, frequently initiated mating in mid-air and remained coupled with the queen for shorter durations of time than the other above species, apparently because of continual harassment from other males (MacDonald, et. al., 1974).

It is thought that the biting behavior of the queen may stimulate the male to release her (Richards, 1937). In *V. maculifrons* this behavior also gives the impression that the queen is trying to escape. This difficulty in uncoupling may function to protect against usurpations by other males. However, since other males apparently do not attempt to usurp copulating males (except for males of *V. atropilosa*), it may be considered a form of post-copulatory guarding (see Parker, 1970, 1974). Queens are known to mate more than once in cages (MacDonald, et. al., 1974) and while tethered (see above) and occasionally another male may attempt to grasp the queen immediately following copulation (see above). A second mating may result in sperm competition and eventual precedence of the second male's sperm over the first male's, suggesting a possible advantage for male guarding (Parker, 1970, 1974). The male, by retaining his hold on the female for a relatively long duration (1.35 to 13.45 min.) facilitates remaining with the queen until she is likely to fly out of the field, away from possible mates.

ACKNOWLEDGMENTS

I thank Robert L. Jeanne, Robert W. Matthews, and Ronald L. Rutowski for suggestions on improving the manuscript.

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NEW RECORDS OF NEARCTIC *SIALIS* (MEGALOPTERA: SIALIDAE), WITH EMPHASIS ON MISSISSIPPI FAUNA[1]

Bill P. Stark[2], Paul K. Lago[3]

ABSTRACT: New distributional data are presented for 11 Nearctic *Sialis* species. Six of these, including four from Mississippi, represent new state records. Male genitalia of five and female genitalia of three Mississippi species are illustrated.

A recent study by Tarter et al. (1978) included the first published reports of *Sialis (S. vagans* Ross) in Mississippi. In this paper we report the occurrence of four additional species [*S. americana* (Rambur), *S. glabella* Ross, *S. iola* Ross and *S. mohri* Ross] in the state; male genitalia for each species and female terminalia for *S. americana, S. mohri* and *S. vagans* are illustrated to aid in species recognition. Unreported records of six additional species are listed from six other states. Two of these, *S. infumata* Newman (Oklahoma) and *S. velata* Ross (Idaho), represent new state records.

The following abbreviations indicate collections in which specimens studied are deposited: BM-Bryant Mather Collection, Clinton, MS.; BPS-Bill P. Stark Collection; UM-University of Mississippi; UU-University of Utah.

MISSISSIPPI RECORDS

Sialis americana (Rambur) (Figs. 1, 2, 12)

Males are distinguished by an elongate bifid genital plate which is apically truncate in lateral view. The terminal plate is emarginate caudally and appears to show some variation from illustrations in Ross (1937). The female eighth sternum is rectangular and bears a mesal depression.

Material examined. — *Adams Co.,*Natchez, 22-V-1978, P. Lago, 1♀(UM). *Hinds Co.,* Clinton, 20-V-1977, B. Stark, 1♀(BPS). *Lafayette Co.,* Oxford, 19-V-1977, S. Hurdle, 1♂(UM); 2-VI-1977, S. Hurdle, 1♂(UM); 30-V-1978, P. Lago, 5♂11♀(UM); 5-VII-1978, D. Stanford, 1♀(UM).

Comments. — Widely distributed but known from few specimens. Tarter et al. (1978) reported *americana* in adjacent Louisiana.

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[1] Received May 24, 1980.

[2] Biology Department, Mississippi College, Clinton, MS 39058.

[3] Department of Biology, University of Mississippi, University, MS 38677.

Sialis glabella Ross (Figs. 3, 4)

Males are most similar to *americana* but are readily distinguished by lateral and dorsal aspect of the genital plate. The apex of the *glabella* genital plate is rounded rather than truncate in lateral view and the arms of the genital plate are broader distally in dorsal view than in *americana*. No females were available for study.

Material examined. — *Adams Co.*, Natchez, 13-V-1977, A. Zuccaro, 1♂(UM).

Comments. — Previously known only from Illinois (Ross, 1937).

Sialis iola Ross (Figs. 5, 6)

Males are distinguished by the relatively smaller genital plate which bears a few fine setae and which is apically hooked in lateral aspect. Dorsally the genital plate has sinuate lateral margins and the bifid tips are acute apically. The single female examined has mesal notches on the posterior margins of sterna 7 and 8.

Material examined. — *Marshall Co.*, 28-IV-1978, D. Standord. 1♂(UM). *Tishomingo Co.*, 12-V-1973, 4 mi E Iuka, C. Bryson, 1♀(BM).

Comments. — Previously known from Atlantic Coastal states from Maine to South Carolina along with Ohio and New Hampshire (Tarter et al., 1978).

Sialis mohri Ross (Figs. 9, 10)

Males are distinguished by long curved arms of the terminal plate and long narrow lobes of the genital plate; the terminal plate arms have an apical spine and sparse dorsal setae. The female eighth sternum bears 2 lateral sclerites and a small mesal sclerite.

Material examined. — *Hinds Co.*, Jackson, 28-III-1980, T. Dent, 1♂(BPS); 6 mi. w. Raymond, 8-IV-1980, B. Stark, 1♂1♀(BPS). *Lafayette Co.*, Puskus Lake, 31-III-1977, P. Lago, M. McEwen and E. Zuccaro, 16♂13♀(UM); 23-IV-1979, R. Goodwin, 1♀(UM); T75-R2W-Sec. 34, 17-IV-1980, P. Lago and M. Mann, 10♂6♀(UM).

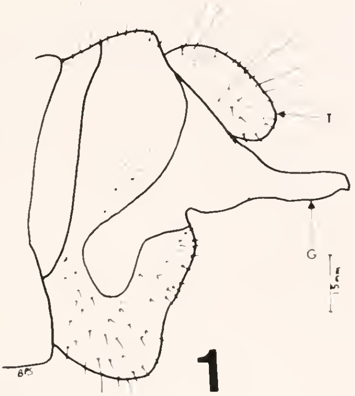
Comments. — Widely distributed and common in eastern North America and previously reported in adjacent Arkansas and Tennessee (Tarter et al., 1978).

Sialis vagans Ross (Figs. 7, 8, 11)

Males are distinguished by the ventral extension of sternum 9 over the genitalia. The genital plate is broad basally and acute apically in lateral aspect; dorsally the plate is notched apically and lateral margins are sinuate. The female eighth sternum is almost divided by a constriction in the mesal depression.

Material examined. — *Amite Co.*, East Fk. Amite Riv., 29-III-1978, B. Stark, 1♀(BPS); 7 mi E Smithdale, 17-III-1977, B. Stark, 3♂1♀(BPS). *Green Co.*, 3.5 mi. S. McLain, 7-IV-1979, P. Lago, 1♀(UM). *Lafayette Co.*, Oxford, 7-IV-1977, S. Hurdle, D. Stanford and A. Zuccaro, 9♂11♀(UM); 13-IV-1978, M. Mann, 1♂10♀(UM); 17-IV-1978, D. Stanford, 1♂, blacklight trap (UM); 3-IV-1979, D. Stanford, 1♂(UM); 26-IV-1979, D. Massey, 2♂(UM); 9 mi. NE Oxford, 19-IV-1979, D. Massey, 2♀(UM). *Lincoln Co.*, 7 mi. N Summit, 25-III-1977, B. Stark, 10♂5♀(BPS); 29-III-1978, B. Stark, 8♂11♀(BPS); 7-IV-1979, B. Stark, 1♂(BPS). *Rankin Co.*, Pearl, 17-IV-1971, B. Mather, 1♀(BM). *Stone Co.*, 13 mi. SE Wiggins, 6-IV-1979, P. Lago, 2♂4♀(UM).

Comments. — Amite and Lincoln county records given here for *vagans* were previously reported by Tarter et al. (1978).



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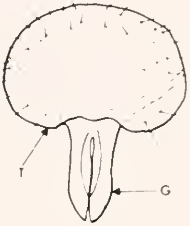

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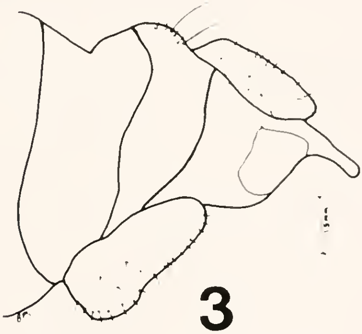

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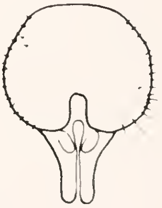

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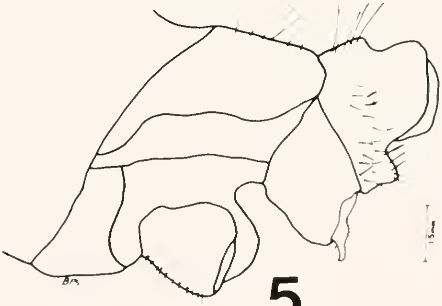

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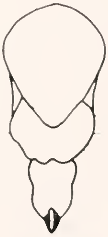

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Fig. 1. *Sialis americana,*♂ terminalia, lateral. Fig. 2. *S. americana,*♂ terminal and genital plates, ventral. Fig. 3. *S. glabella,* ♂ terminalia, lateral. Fig. 4. *S. glabella,* ♂ terminal and genital plates, Ventral. Fig. 5. *S. iola,* ♂ terminalia, lateral. Fig. 6. *S. iola,* ♂ terminal and genital plates, ventral.

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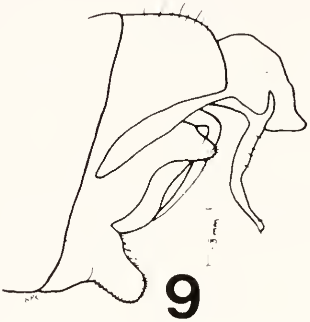

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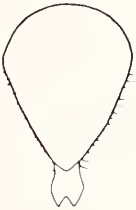

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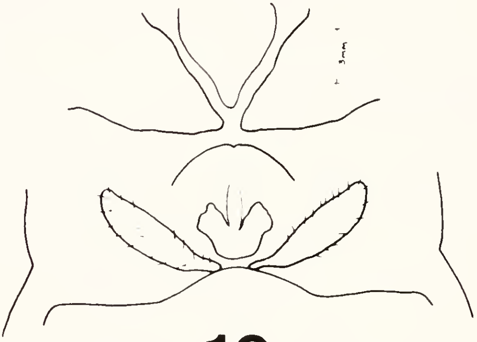

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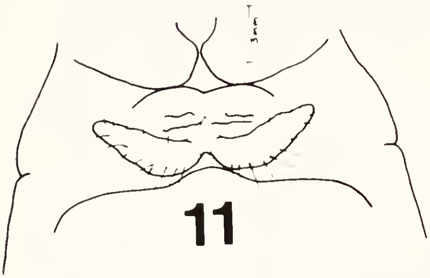

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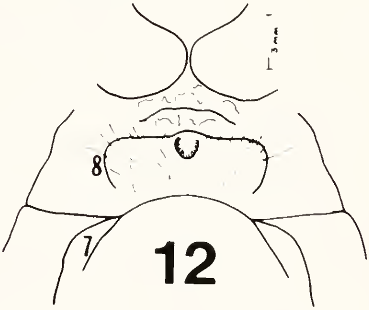

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Fig. 7. *S. vagans,* ♂ terminalia, lateral. Fig. 8. *S. vagans,* ♂ terminal and genital plates, ventral. Fig. 9. *S. mohri,* ♂ terminalia, lateral. Fig. 10. *S. mohri,* ♀ terminalia, ventral. Fig. 11. *S. vagans,* ♀ terminalia, ventral. Fig. 12. *S. americana,* ♀ terminalia, ventral.

ADDITIONAL RECORDS OF NEARCTIC *SIALIS*

Sialis californica Banks

Material examined. — Oregon: *Douglas Co.,* Muir Crk., Hwy 230, 10-VII-1979, B. Stark & K. Stewart, 1♂(BPS). Washington: *Pierce Co.,* Chamber's Lake, Ft. Lewis, 25-V-1970, B. Stark, 10♀(BPS).

Sialis hamata Ross

Material examined. — Wyoming: Grand Teton Natl. Pk., Gros Ventre Riv., 7 mi N Jackson, 28-VI-1964, S. Jensen & J. Richardson, 1♂(UU).

Sialis hasta Ross

Material examined. — Missouri: *Greene Co.,* Pearson Crk., Springfield, 21-IV-1979, B. Stark, K. Stewart & S. Szczytko, 1♂1♀(BPS).

Sialis infumata Newman

Material examined. — Oklahoma: *Pittsburg Co.,* Brushy Crk., Haileyville, 8-IV-1971, 1♂(BPS).

Sialis occidens Banks

Material examined. — California: *Plumas Co.,* Gold Lake outfall, 5-VII-1979, B. Stark & K. Stewart, 1♂4♀(BPS).

Sialis velata Ross

Material examined. — Idaho: *Bannock Co.,* Portneuf Riv., 9 mi N Lava Hot Springs, 20-VI-1964, S. Jensen & J. Richardson, 1♂(UU).

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A RAPID, STEAM BATH METHOD FOR RELAXING DRY INSECTS[1,2]

John S. Weaver III, Tina R. White[3]

ABSTRACT: The steam-saturated environment of a modified steam bath apparatus provides a safe, reliable method for relaxing dry, fragile insect specimens in 10-15 minutes.

A taxonomist's examinations of specimens at distant museums or even at home often may be limited by time. Using conventional methods, many hours may pass before dried specimens are sufficiently relaxed.

Four methods for relaxing dried insects were recommended by Borror, DeLong and Triplehorn (1976). The first utilizes a sealed, moist disinfected chamber in which specimens must be retained for 24-48 hours. This method is reliable, but too time-consuming. The second method entails submerging specimens in boiling water for a few minutes. Although this is a rapid method, it may cause damage to delicate insects, and is only recommended for beetles and other hard-bodied specimens. In the third method, entire specimens may be relaxed by dipping them in Barber's fluid (a mixture of alcohol, water, ethyl acetate and benzene) for several minutes. Antennae and other delicate structures may be lost in the fluid, and matching specimens to parts is sometimes impossible. A fourth method of relaxing is to inject water into the specimen with a hypodermic needle. This method is particularly useful for Lepidoptera, but is not recommended for small insects.

Gloyd (1980) discussed three additional relaxing methods. The first involves applying household ammonia to the specific body surfaces of dragonflies. This method is effective, but may cause fading of body colors. A second method similarly utilizes "OT" solution (sodium dioctyl sulfosuccinate), a surface active agent which is used in conjunction with insecticides, and is available commercially. This chemical may cause a cloudy film on specimens. A third method is utilized for soft-bodied insects which have been stored in alcohol, and over time the alcohol has evaporated. These insects may be restored by soaking them in a salt solution for 24-48 hours.

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[2] Published by permission of Director, South Carolina Agricultural Experiment Station, Technical Contribution No. 1784.

[3] Department of Entomology and Economic Zoology, Clemson University, Clemson, South Carolina 29631.

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The aforementioned methods, although effective, may be damaging to delicate insects and are often messy. To provide a more convenient alternative to these, we have devised a fast and gentle method for relaxing brittle arthropods. This method simply involves placing the specimen in a steam bath apparatus for 10-15 minutes. We recommend a device similar to that shown in Figure 1. Any pot with a lid will suffice to produce steam, but we prefer a one liter Pyrex beaker with a watchglass for a lid. A wire screen or sieve can be utilized to provide a solid platform on which to place the specimens. The screen should be located a few cm above the water surface and about ten cm below the lid. This arrangement provides adequate clearance to place a large cork with several pinned insects attached to it on the screen platform. The watch glass should be placed upside down to allow condensing water droplets to slide down the inside of the beaker instead of dropping onto the specimens.

Water should be approximately five cm deep in the beaker. It is important to check the water level periodically. If there is not sufficient steam the intense heat may dry the specimen further, and even may cause it to disintegrate. The heating plate should be set just high enough to boil the water. Unmounted specimens may be placed in small Syracuse watch glasses to avoid unnecessary handling. Condensation of water in the steam bath may cause saturated wings or antennae to stick to wet surfaces. This can be avoided by placing a small piece of absorbent tissue paper between the watch glass and the insect.

Special attention should be given to insects mounted on points. This procedure could cause water-soluble adhesives to dissolve, allowing specimens to fall off points. To prevent mixing of specimens and labels, and to protect the specimens should they become detached, it is recommended that pinned specimens be placed at least 3 cm apart, with a ball of cotton pinned directly underneath each specimen.

Specimens of Coleoptera, Ephemeroptera, Plecoptera, Orthoptera, Trichoptera, Odonata and Megaloptera have been successfully relaxed within 10-15 minutes of having been placed in the steam bath. Genitalia of large stag beetle were easily extracted, and wings and appendages of other specimens were pliable following 10-15 minutes of exposure to the dense steam. Larger, heavily sclerotized specimens occasionally may require a slightly longer exposure to the steam.

Many different combinations of laboratory or kitchen implements may be modified to create a suitable steam bath. This method was first performed by placing a few caddisflies in a one-egg poacher. A six-egg poacher might prove to be useful to relax a number of different lots of specimens.

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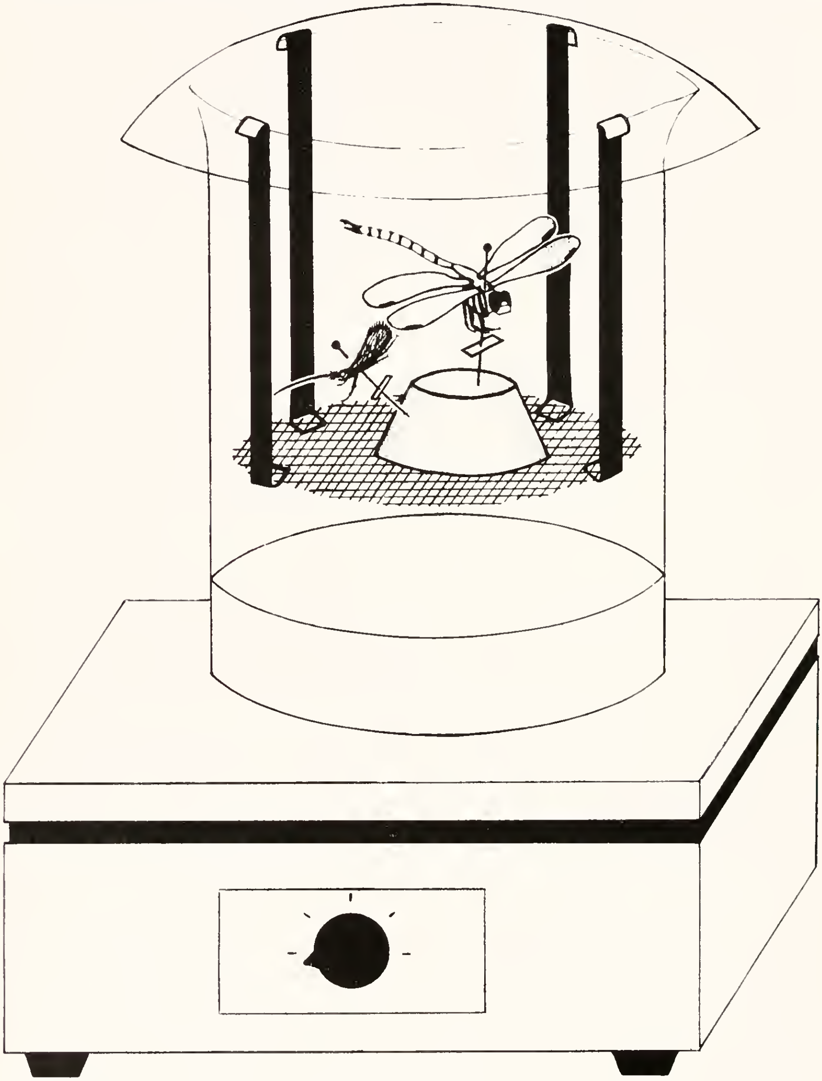

Fig. 1. A modified steam bath for relaxing dry insects.

NEW SPECIES OF *POLANA* (HOMOPTERA: CICADELLIDAE) FROM BOLIVIA, PERU, PANAMA, AND FLORIDA[1]

Dwight M. DeLong[2]

ABSTRACT: Six new species of *Polana* are described. Two species, *P. caputa* n.sp. (Bolivia) and *P. carla* n.sp. (Peru) placed in the subgenus *Polana*, and four species, *P. robusta* n.sp. (Florida), *P. tortora* n.sp. (Bolivia), *P. acutica* n.sp. (Panama) and *P. cochlea* n.sp. (Panama), placed in the subgenus *Nililana*.

The genus *Polana* was described by DeLong (1942). A synopsis of *Polana* treating 87 species by DeLong and Freytag was published (1972). Species have since been described by DeLong (1976), (1979). DeLong and Wolda (1978) and DeLong and Triplehorn (1979). Six species are described at this time. All types are in the DeLong collection.

Only one species, *P. quadrinotata* (Spangberg) has previously been recorded for the United States, occurring in the southwestern portion, near Mexico. The species described at this time from Florida, *P. robusta,* is not closely related to *P. quadrinotata*. It is related to *P. spindella* DeLong and Freytag and *P. gelara* DeLong and Freytag which occur in Mexico and Columbia.

Polana caputa n.sp.
(Figs. 1-5)

Length of male 8 mm., female unknown. Crown more than half as long at middle as basal width between eyes. Margin of crown and just above margin with deep concentric grooves and striae. Color, crown brown, light brown along basal margin. Pronotum pale brown with large dark brown broken spots along anterior margin and behind eyes. A small brown circular spot just anterior to large yellow spots, in a yellowish blotch. Scutellum pale yellow with dark brown basal angles and a pale brown area between them. Forewings subhyaline with conspicuous yellow veins and irregular brown spots on clavus, corium and costa.

Male genital plates four times as long as wide at middle, apices rounded. Style slender, abruptly enlarged subapically, then forming a short slender apex. Aedeagal shaft slender, encased by a cylindrical portion on basal half and bearing an apical elongate structure resembling a bird's head with pointed dorsal "beak". Pygofer narrowed and truncate apically.

Holotype male, Bolivia, Department of Santa Cruz, 2 km. S. Montero, Muyurina.

P. caputa is placed in the subgenus *Polanana* and is different from described species, probably closest to *P. truncata.*

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[1] Received April 4, 1980.

[2] Department of Entomology, Ohio State University

Polana carla n.sp.

(Figs. 6-10)

Length of male 8 mm., female unknown. Crown more than twice as wide at base, between eyes as median length. Color, crown pale brown with black coloration around antennae, a round black spot at base, each side, behind ocelli. Pronotum mostly dark brown, a yellowish basal marginal area with black spots behind eyes, and lateral margins, narrowly yellow. Scutellum yellow with dark brown basal angles, and pale brown median longitudinal area with black markings at center. Forewings white, subhyaline, with basal half of clavus, corium area extending to costa, and apical area, pale brown to black.

Male genital plates almost twice as long as width at middle, apices rounded. Style slightly widened by convex bulge on ventral margin near base of shaft, apex bluntly pointed. Aedeagal shaft bearing a non-scleritized portion at apex, also bearing a pair of subapical processes which arise near apex, are almost half as long as shaft, and extend caudolaterally. Pygofer narrowed and bluntly pointed apically.

Holotype male Sinchona, Peru, August 1934. J.G. Sanders coll.

P. carla is placed in the subgenus *Polana* and is related to *P. falsa.*

Polana robusta n.sp.

(Figs. 11-15)

Length of male 8 mm., female 8.5 mm. Crown short, parallel margined, three times as wide at base, between eyes, as median length. Broadly rounded to front. Ocelli widely separated and near anterior margin. Color, crown pale brown, ocelli red. Pronotum pale brown, two large black spots, the larger spots next margin, behind each eye, one third distance to base. Scutellum pale brown. Forewings pale brown, veins dark brown. Two dark brown cross veins on corium and two dark brown terminal spots on first and second claval veins at commissure.

Female seventh sternum with posterior margin concavely rounded, each side, between broadly rounded lateral angles and a median produced lobe. The lobe is one-third width of segment, slightly notched at middle, and is produced to the length of the lateral angles.

Male genital plates two and one-half times as long as width at middle, apices rounded. Style with a conspicuous, ventral pointed tubercle, at half its length, apex bluntly pointed. Aedeagal shaft curved, narrow, bearing a pair of apical processes extending basad, one-third distance to base. A pair of processes arise at base and curve ventrally, then apically and dorsally, extending three-fourths length of shaft. Pygofer bearing a dorsal, hooked process which extends apically and vertically on each side.

Holotype male, Edgewater, Florida, April 8, 1938, D.M. DeLong coll. Paratype female, same data.

P. robusta is related to *P. gelara* and *P. spinella.* They can be separated externally by the shorter head to *P. robusta* and the darker coloration of the forewings. The genitalia can be used for their separation as illustrated.

Polana tortora n.sp.

(Figs. 16-20)

Length of male 7.5 mm., female unknown. Crown one-third as long at middle as basal width between eyes. Ocelli nearer to eyes than median line, and nearer to anterior than to posterior margin of crown. Color, crown pale brown. Pronotum pale brown with darker brown blotches along anterior margin, behind eyes, and disc darker brown. Scutellum dark brown, apex paler brown. Forewings brownish gray, veins brown, brown spots at end of first and second claval veins along commissure, and on cross veins of corium.

Male genital plates three and one-half times as long as width at middle, apices narrow, rounded. Style straight, with curved hook at apex causing the apical tip to extend basad.

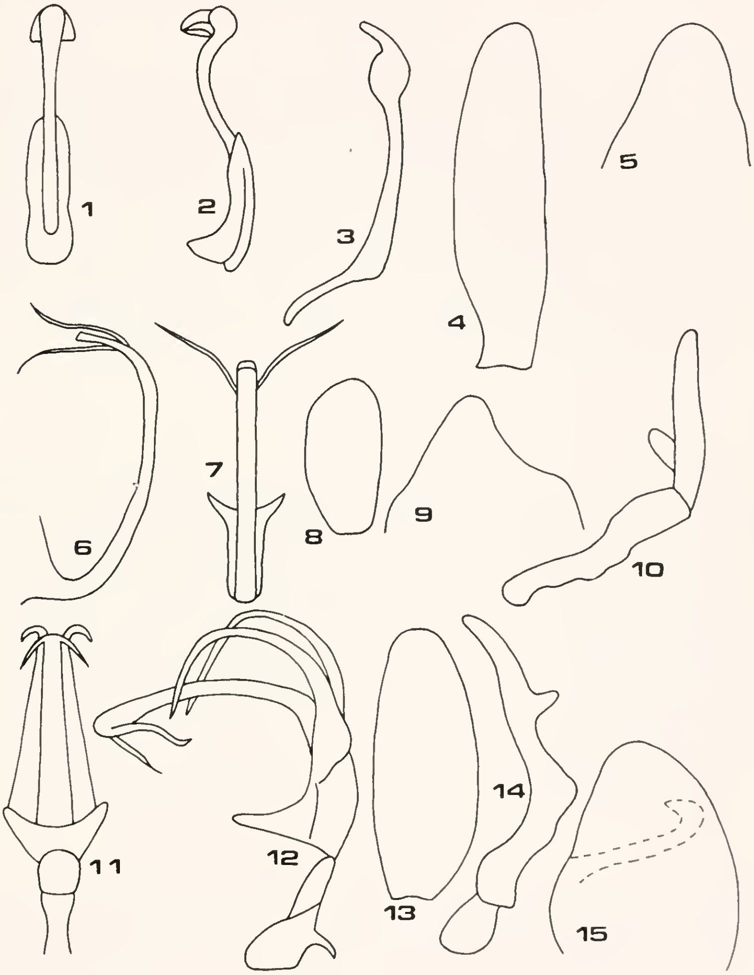

Plate I, Figs. 1-5 *Polana caputa* n.sp. 1. aedeagus ventrally, 2. aedeagus laterally, 3. style laterally, 4. plate ventrally, 5. pygofer, apical portion, laterally. Figs. 6-10 *P. carla* n.sp. 6. aedeagus laterally, 7. aedeagus ventrally, 8. plate ventrally, 9. pygofer, apical portion, laterally, 10. style laterally. Figs. 11-15 *P. robusta* n.sp. 11. aedeagus ventrally, 12. aedeagus laterally, 13. plate ventrally, 14. style laterally, 15. pygofer, apical portion, laterally.

Aedeagal shaft curved and gradually tapered to apex which is only slightly scleritized and appears divided. Pygofer dorsal hook with one tooth.

Holotype male, Santa Cruz, Bolivia, June 1, 1967, Peredo coll.

P. tortora is placed in the subgenus *Nihilana* and is related to *P. bena.*

Polana scutica n.sp.
(Figs. 21-25)

Length of male 7 mm., female unknown. Crown short, almost parallel margined, more than three times as wide at base, between eyes, as medial length. Ocelli nearer to eyes than to median line and closer to anterior than to posterior margin of crown. Color, crown brown, disc darker brown. Scutellum pale brown, basal angles darker brown. Forewings subhyaline, veins darker brown. Brown spots at apices of claval veins at commissure and on cross veins of corium. Apical portion of forewings pale brown.

Male genital plates three times as long as width at middle, apices narrow, rounded. Style bent dorsally and narrowed at two-thirds its length, apex narrow, blunt. Aedeagal shaft narrow, curved 180°, apical half narrowed, apex divided, forming two pointed apical tips. Pygofer with a dorsal hooked process bearing one tooth.

Holotype male, Panama, Las Cumbres, June 8, 1973, Henk Wolda coll.

P. scutica is placed in the subgenus *Nihilana* and is related to *P. fina.*

Polana cochlea n.sp.
(Figs. 26-30)

Length of male 7.5 mm., female unknown. Crown short, scarcely produced, less than half as long at middle as basal width between eyes. Ocelli nearer to eyes than to median line. Color, pale brown, a pair of small round black spots on basal margin behind ocelli. Pronotum pale brown, a round black spot behind each eye, at one-third length of pronotum, and a row of small black spots extending between them, parallel with anterior margin. Scutellum pale brown. Forewings brownish gray, veins brown. Dark brown coloration on commissure at tips of claval veins, cross veins of corium and apical cell cross veins.

Male genital plates more than three times as long as width at middle, apices narrowed, rounded. Styles widened at middle, by an enlargement on ventral margin, apical half tapered to a narrow, bluntly pointed apex. Aedeagal shaft roundly broadened at apex, bearing a pair of separated apical spines which extend caudally. Pygofer bearing a dorsal hooked spine on inner margin of pygofer dorsal wall.

Holotype male, Panama, Las Cumbres, June 8, 1973, Henk Wolda coll.

P. cochlea is placed in the subgenus *Nihilana* and is related to *P. rixa.*

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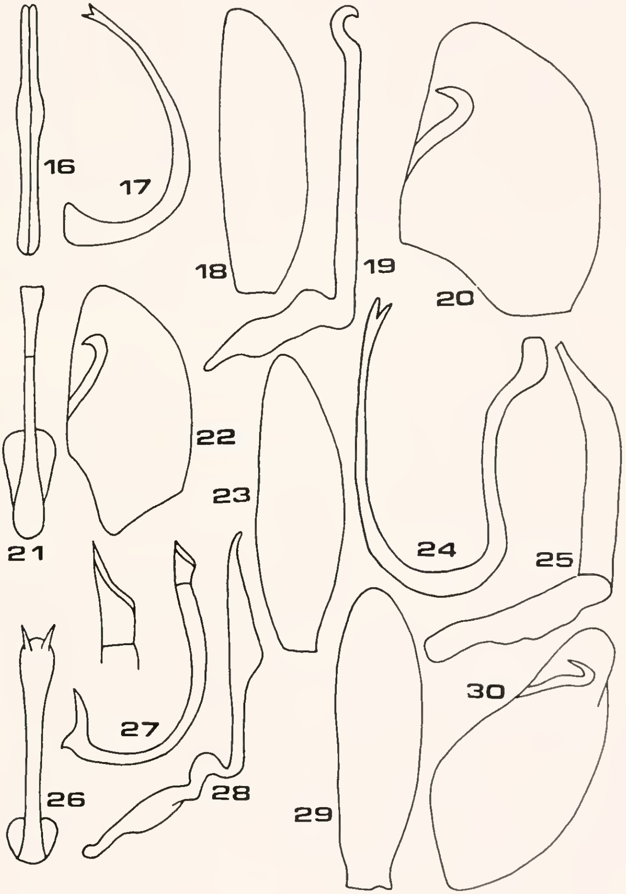

Plate II, Figs. 16-20 *Polana tortora* n.sp. 16. aedeagus ventrally, 17. aedeagus laterally, 18. plate ventrally, 19. style laterally, 20. pygofer laterally. Figs. 21-25 *P. scutica* n.sp. 21. aedeagus ventrally, 22. pygofer laterally, 23. plate ventrally, 24. aedeagus laterally, 25. style laterally. Figs. 26-30 *P. cochlea* n.sp. 26. aedeagus ventrally, 27. aedeagus laterally, 28. style laterally, 29. plate ventrally, 30. pygofer laterally.

STARVATION LONGEVITY OF *LOXOSCELES LAETA* (NICOLET) (ARANEAE)[1]

D.C. Lowrie[2]

ABSTRACT: Data are reported on the longevity of *Loxosceles laeta* and its ability to withstand starvation and lack of water.

Anderson's (1974) comparison of the energetics and life styles of the spiders *Lycosa lenta* Hentz and *Filistata hibernalis* Hentz has demonstrated the importance of withstanding starvation for long periods in spiders. This report is on the longevity of *Loxosceles laeta* (Nicolet) and its ability to withstand starvation. Bonnet (1935, 1939) and the work of others cited in the Bibliographia Araneorum (Bonnet 1945) contain some data on longevity but only under normal conditions of feeding. My data should be important for physiologists who would test the relationship between longevity and ability to withstand physical stress such as starvation and lack of water. Also, it is important in understanding how these species withstand starvation episodes associated with accidental dispersion by humans.

Results and Discussion

The only good data I could find on starvation longevity in spiders is Anderson's (1974) on adult filistatids. They lived for a mean of 276 days without food. With food they have lived over eleven years (Bonnet 1945; Lowrie 1966). The *Loxosceles laeta* raised in this study lived under conditions of various amounts and some variety of food and were fed fairly regularly every several days. They were kept in either of two sizes of plastic vials (about 40 cm^3 and 80 cm^3) with tight snap caps. None of the spiders were given water and seldom, except during feeding, was the cap removed. They had very little water vapor in the vial as room humidity seldom exceeded 30%. They were kept at room temperature, ranging from 15°C to 20°C. During starvation there was no sign of stress as they remained plump and active until death. Field collections in Chile (Schenone et. al., 1970) indicate this spider is a common inhabitant of houses, seldom, if ever, being found in the field. Thus, except for the confinement within vials, the spiders were living under somewhat "natural" conditions.

The data reported here are on individuals raised from a single egg sac. Each of 48 spiderlings was placed in a separate dry vial after it emerged from the sac on 27 July 1970. By December 1973 10 immatures had died

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[1] Received March 1, 1980.

[2] Prof. Emeritus, California State University at Los Angeles.

but there were 38 adults still alive (22 males and 16 females). Until 26 December 1973 these spiders were fed mealworms (usually weekly) and about ten meals of other insects. By this time they were over three years old and were adults. From then until 22 July 1976 they were partially starved, being fed one mealworm each on four occasions at long intervals (ranging from three to ten months). Since 22 June 1976 until the last female died on 17 July 1978, a maximum of 755 days, the fourteen females that were then alive had survived an average of 453 days (1.24 years) more without food (Table 1).

TABLE 1: Life cycle data on ***Loxosceles laeta*** fed on a varied diet.

	Days to Adulthood		Days as Adult		Total Days of Life		No. Days of Starvation
Sex	F	M	F	M	F	M	F
No. Specimens	16	22	16	22	16	22	14
Mean	762	818	1745	598	2507	1417	453
S.D.	104	194	327	197	300	97	171
Range of means by t test (95% Level)	707-818	733-905	1571-1919	511-685	2348-2667	1374-1460	354-551
Actual Range of Individuals	669-973	547-1200	1028-2108	227-912	1746-2872	1101-1494	219-755

These females took an average of 762 days (2.1 years) to reach maturity and lived an average of 1745 days (4.8 years) as adults under conditions of partial food deprivations. The males averaged 818 days (2.2 years) to maturity but only lived 598 days (1.6 years) as adults and were all dead when the period of total starvation began. These data on days to maturity do not agree with those of Galiano (1967). Her data, based upon 51 females and 75 males, indicate a mean of 406.5 days for males while females averaged 315.3 days to reach maturity. Her spiders took about half the time to reach maturity of the ones I raised. This may be due to several factors: the feeding regime, sample size, or a more uniform genetics with a slower growth rate of my one egg-sac sample.

These data indicate that this species is capable of prolonged life with little food and no free water. These conclusions probably apply also to other species in the genus. One specimen of *Loxosceles deserta* Gertsch, collected by Wendell Icenogle in the El Paso Mountains of Southern California in 1969 and raised by me, lived under the same conditions after capture and survived until 25 July 1977. The ability of *Loxosceles laeta* to withstand long periods without water or food certainly helps to explain its wide dispersal. It has been found in Helsinki, Finland; Vancouver and Toronto, Canada; Boston and the Los Angeles area, in the United States (Gertsch 1967; Huhta 1972; Keh 1970; Levi and Spielman 1964), as well as ranging widely in South America (Gertsch 1967).

ACKNOWLEDGMENTS

I acknowledge the aid of Mel Thompson in the early rearing of some specimens. I thank Dr. Findlay Russell and the University of Southern California Medical School for some funds for early rearing expenses.

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COMMENTS ON OPILIONES DESCRIBED FROM WESTERN NORTH AMERICA BY SCHENKEL[1]

James C. Cokendolpher[2]

ABSTRACT: Examination of the type specimens of harvestmen described by Schenkel from western North America reveals several new synonymies and a new combination. *Microgyas banksi* is considered a junior synonym of *Leuronychus pacificus* (Banks), while *Leuronychus gertschi* and *Nelima goodnighti* are regarded as synonyms of *Leiobunum? exilipes* (Wood). *Liomitopus leavis* is conspecific with *Leptobunus californicus* Banks, while *Eurybunus simplex* is transferred to the genus *Globipes*. The relationships of *Liopilio glaber, Globipes rugosus,* and *Protolophus longipes* are briefly discussed.

In 1951, E. Schenkel published the second part of the paper on the arachnids collected by H. Schenkel-Rudin in western North America. At the end of this second part ten species of harvestmen are treated; only two of which, *Ortholasma rugosa* Banks and *Phalangium opilio* Linne were not described as new. In addition, three monotypic genera were described. Forcart (1961) designated lectotypes from the type series described by Schenkel. During revisionary studies of several opilionid genera of western North America I noted some synonyms; a few initially based on a series of illustrations prepared of some of the types by Dr. William A. Shear. By examining the type specimens, deposited in Naturhistorisches Museum Basel (NMB), I was able to confirm the suspected synonymies. Due to the growing interest in North American Opiliones and the need of the synonymies in other studies, I have chosen to present my comments, the four new synonymies, and one new combination prior to the publication of revisions. The distribution stated for each species is based on museum specimens examined by me during revisionary studies.

Microgyas banksi Schenkel (1951:47-49, fig. 46). The male holotype (NMB no. 82-a; Forcart, 1961:53) from La Jolla, California, is a *Leuronychus pacificus* (Banks). As *Microgyas* is monotypic, it must be considered a junior synonym of *Leuronychus* Banks. This species differs from all known *Leuronychus* spp. by having the coxae, genital operculum, and ventral surface of the abdomen covered with rounded tubercles. *Leuronychus pacificus* is common along the coast from Baja California Norte to the northern boundary of British Columbia.

Liomitopus leavis Schenkel (1951:49-51, fig. 47). The male lectotype and female paralectotype (NMB no. 81-a; Forcart, 1961:53) from Yo-

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[1] Received April 5, 1980.

[2] The Museum and Department of Biological Sciences, Texas Tech University, Lubbock, Texas 79409.

semite, California, are *Leptobunus californicus* Banks. As *Liomitopus* is monotypic, it is a junior synonym of *Leptobunus* Banks. *Leptobunus californicus* differs from all known *Leptobunus* spp. by having the distal tip of the penis many times longer than the paired primary setae of the glans, seminal receptacles with convoluted loop posteriorly, and by having no brown markings on the palpal tibiae. *Leptobunus californicus* is primarily found in the eastern portion of California and adjoining Nevada.

Liopilio glaber Schenkel (1951:51-53, fig. 48). The female lectotype and immature paralectotype (NMB no. 91-a; Forcart, 1961:53) from Canmore, Banff National Park, Alberta, are the only described specimens of this genus. A second species (undescribed) of the genus occurs in Alaska and southwestern Yukon Territory. The genus *Liopilio* is very similar to *Leptobunus*, but differs by having the patellae and tibiae of the palps swollen and densely covered with fine setae. The mal palpal tarsus of *Liopilio* has a ventral row of denticles. It is bare in *Leptobunus*. The paired setae of the penis glans are near the stylus-glans junction in *Liopilio*. In *Leptobunus* the setae are on the median portion of the glans. *Liopilio glaber* is now known from a few localities in the Rocky Mountains along the boundary of Alberta and British Columbia.

Eurybunus simplex Schenkel (1951:53-55). The female holotype (NMB no. 89-a; Forcart, 1961:52) from Berkeley Hills, California, is a member of the genus *Globipes* Banks. *Globipes simplex* is very similar to the southern California *Globipes spinulatus* Banks. *Globipes simplex* differs from *G. spinulatus* by being uniformly colored and over-all less spiny (tibiae II with no dorsal spines or tubercles). *Globipes simplex* is known only from a few localities in central California.

Globipes rugosus Schenkel (1951:55-57, fig. 49). The male lectotype and male (reported as a juvenile) paralectotype (NMB no. 90-a; Forcart, 1961:53) from La Jolla, California, are closely related to the Texas *Globipes formosus* (Banks) and an undescribed species from Chihuahua and Durango. All three differ from typical *Globipes* spp. by having one or no pseudosegments on tibiae II, angular leg tibiae (less so in I and III) cross section, and by having the tubercles on the legs arranged in distinct rows. Unlike other *Globipes* spp., *G. rugosus* have the chelicera covered with many pointed tubercles. In addition, the median dorsal tubercles of the abdomen are large and closely spaced in *G. rugosus*. *Globipes rugosus* is known only from three males collected in the San Diego area in California.

Protolophus longipes Schenkel (1951:57-59, fig. 50). The male lectotype, three male and two female paralectotypes (NMB no. 96-a and 96-b; Forcart, 1961:54) are similar to *Protolophus niger* Goodnight and Goodnight and *Protolophus tuberculatus* Banks. *Protolophus longipes* differs by the slender nature of the appendages, palpal patellae of both sexes extended on inner margin, and the over-all small body size. Specifically, *P. longipes* differs from *P. niger* by having five paired abdominal tubercles; and from *P. tuberculatus* by having tibiae II longer than the body in males. *Protolophus longipes* is known from a few specimens taken near the type locality, forest near Guerneville and Monterio, California.

Leuronychus gertschi Schenkel (1951:59-61, fig. 51). The male lectotype and immature paralectotype (NMB no. 95-a; Forcart, 1961:53) from Russian Rivers near Guerneville, California, are *Leiobunum* ? *exilipes* (Wood). *Leiobunum* ? *exilipes* differs from all other western species referred to *Leiobunum* by having the tarsus of the palps light while the other segments are black, and legs are uniform brown to black without white bands. *Leiobunum* ? *exilipes* is known from scattered localities in California, Nevada, Montana, Oregon, and British Columbia.

Nelima goodnighti Schenkel (1951:61-62). The immature holotype (NMB no. 98-a; Forcart, 1961:53) from forest near Guerneville and Monterio, California, is essentially identical to the paralectotype of *Leuronychus gertschi*, which was collected only a few kilometers away. Like *L. gertschi*, this species is a junior synonym of *Leiobunum* ? *exilipes*.

ACKNOWLEDGMENTS

I am grateful to Dr. Ernst Sutter for the loan of the Schenkel type specimens. Drs. Rod Crawford and William A. Shear made valuable suggestions and comments on the manuscript.

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"TRAP NESTS" FOR STUDYING DESERT WEB-BUILDING SPIDERS (ARANEAE: PHLOCIDAE)[1]

Harold G. Fowler[2,3]

ABSTRACT: Pitfall traps are useful trap nests for studying populations and behaviors of arid-land web-building spiders, which are normally cryptic in behavior.

Krombein's (1967) monumental studies on wood-boring bees and wasps indicated the potential benefits of experimental habitat modification in investigations of populations and behaviors of cryptic insects. Similarly to trap-nesting insects, web-building spiders are known to exhibit preferences for habitat characteristics when selecting web sites (Cherrett, 1964; Duffey, 1966; Colebourn, 1974; Enders, 1976). Thus, web-building spiders should be considered likely candidates to utilize simulated habitat features ('trap nests'). In my studies of Chihuahuan Desert Phlocidae, which normally colonize abandoned rodent burrows (Muma, 1975*a*), crude pitfall traps have proven to be suitable "trap nests", as hinted at by Muma (1975*a*).

Traps used for my studies were standard 3.785 1 (1 gallon) tin cans, buried flush to the lip, and covered with a small, slightly elevated wooden plank. All "trap nests" contained neither collecting flasks nor preservative. Due to these characteristics, these traps were very similar to the entrances of abandoned rodent burrows, and were therefore ideal "trap nests" for desert web-builders. In the study area, abandoned burrows were scarce, thus enhancing the attractiveness of these traps as web sites for colonizing individuals. Moreover, the wooden plank could be removed easily, and spiders could be counted or observed *in situ.*

Over a 20-week period, populations of *Psilochorus imitatus* Gertsch and Mulaik were followed with the aid of these "trap nests", on the Jornada Experimental Range, Dona Ana County, NM. Traps were opened, checked, and the number of spiders recorded. The pattern of occupancy of 49 "trap nests" are given in Fig. 1.

Frequency of utilization of a trap was a good indicator of the total number of *P. imitatus* recorded from that trap. This suggests that web site

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[1] Received May 8, 1980.

[2] Department of Biology, New Mexico State University, Las Cruces, NM 88003
Present address: Department of Entomology, Rutgers University, New Brunswick, NJ 08903.

[3] Research supported by the National Science Foundation, grant DEB-77-1633, to Walter G. Whitford.

tenacity (Enders, 1976) may have a stabilizing effect on population structure, and also emphasizes the importance of the availability of suitable habitats in the recruitment of other spiders into the area. The large catches of *P. imitatus* in pitfall traps in the near-by Tularosa Basin (Muma, 1975*b)* can thus be attributed to the behavior of these spiders while searching for suitable web sites (Muma, 1975*a*).

Although the value of pitfall trapping in population studies of cursorial arachnid populations is still subject to debate (Turnbull, 1973; Uetz and Unzicker, 1976), in desert communities this sampling technique is extremely valuable (Muma, 1975*a*). I have found pitfall traps valuable in

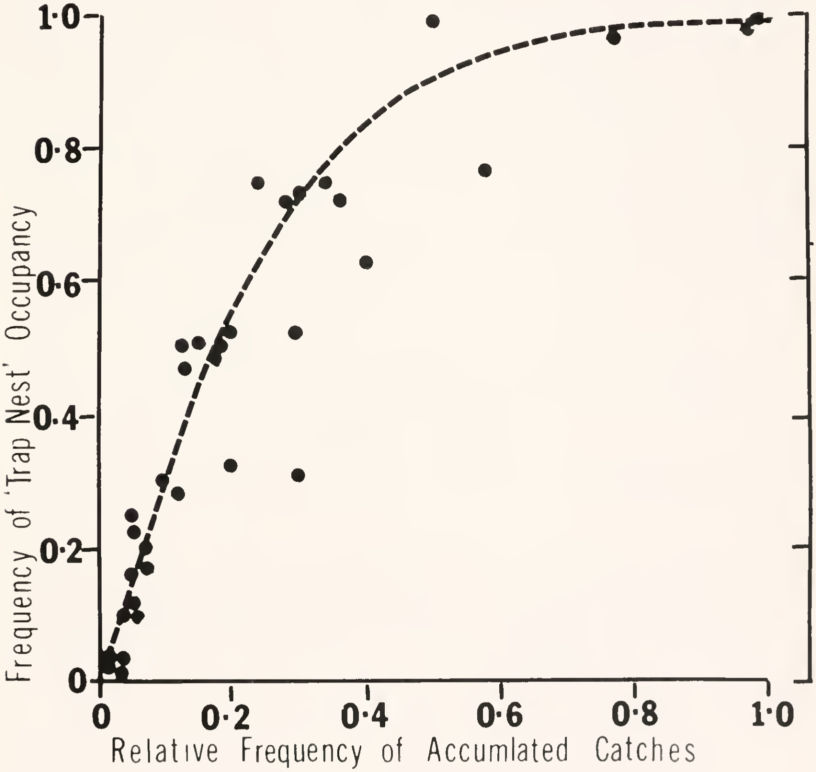

Fig. 1. The relationship between the frequency of weekly trap nest utilization, and the accumulated number of *P. imitatus* recorded from each trap over a 20-week period, expressed as a frequency relative to the trap with the greatest accumulated catch.

assessing populations of web-builders, as well as permitting studies on their behavioral ecology. No other means of sampling, with which I am familiar, would even disclose the presence of these spiders in desert environments.

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INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

c/o British Museum (Natural History), Cromwell Road, London, SW7 5BD, United Kingdom.

16th May, 1980

A.N.(S.) 113

The Commission hereby gives six months' notice of the possible use of its plenary powers in the following cases, published in *Bull. Zool. Nom.* Volume 37, part 1, on 8th May 1980, and would welcome comments and advice on them from interested zoologists. Correspondence should be addressed to the Secretary at the above address, if possible within six months of the date of publication of this notice.

2197 *Peggichisme* Kirkaldy, 1904 (Hemiptera Heteroptera); proposed designation of a type species.

2216 LYMANTRIIDAE Hampson,[1893] (Insecta Lepidoptera); proposed precedence over ORGYIIDAE Wallengren, 1861 and DASYCHIRIDAE Packard, 1864.

2264 *Harminius* Fairmaire, 1852 (Insecta, Coleoptera); proposed designation of a type species.

2291 *Chrysolina* Motschulsky, 1860 (Insecta, Coleoptera); proposed conservation.

ROMALEA GUTTATA (HOUTTUYN), NAME CHANGE FOR WELL-KNOWN "EASTERN LUBBER GRASSHOPPER" (ORTHOPTERA: ROMALEIDAE)[1]

D. Keith McE. Kevan[2]

The "Eastern lubber grasshopper," so called, for example, in the latest revision of the list of "Common Names of Insects and Related Organisms" published by the Entomological Society of America (Sutherland, 1978), is known almost universally throughout schools and colleges all over North America, though its natural distribution is restricted to the southeastern United States. Because it is a very large insect that is frequently available in very large numbers, it is one of the "type" arthropods for biology classes and, as such, is among those animals widely sold by biological supply houses. For a very long time the insect has been called *Romalea* (sometimes incorrectly *Rhomalea) microptera.* The specific part of the name is attributable to Palisot de Beauvois (1805-21). The name appeared in his work as *Acridium micropterum* (on p. 146, and in Orthoptères pl. IV, fig. 4), and is usually cited as dating from 1805, even by Rehn and Grant (1961: 253). The year 1805 is, however, that for the issue of only the first two of the fifteen *"livraisons"* that made up the work (they are dated "An. XIV", according to the French Revolutionary calendar — the only parts to use this — and they may not have appeared until 1806, as some maintain). In fact, parts of the work continued to appear until 1821 (after Palisot's death), and the one with which we are here concerned (Livraison 9), was not published until 1817 (Griffin, 1937).

There are thus two available senior synonyms for *Romalea microptera.* The first is *"Gryllus (Locustae) Guttatus"* proposed by Houttuyn (1813: Register to Vol. 2, p. 12) in his completed edition of Caspar Stoll's *"Natuurlijke en naar het leven nauwkeurige gekleurde Afbeeldingen en Beschrijvingen der Spoken, Wandelende Bladen, Zabel-Springhaanen,* etc", the first parts of which appeared much earlier; it refers to Stoll's original "Trek-Springhaanen" (Stoll', 1787-88: 23 and pl. Xb, fig. 34). The other is *Dictyophorus reticulatus* of Thunberg (1815: 259). There is no doubt that both of these names apply to the same species as Palisot's *Acridium micropterum,* and a name change is therefore unavoidable under the rule of priority. Indeed, Blanchard (1840: 40), long ago, gave the name

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[1] Received May 2, 1980.

[2] Department of Entomology and Lyman Entomological Museum and Research Laboratory, Macdonald Campus, McGill University, Ste-Anne de Bellevue, Que, Canada, H9X 1CO.

guttata precedence over *microptera*, whether or not he consciously did so on the basis of publication date. He was not followed by others.

Although the Eastern lubber grasshopper is so widely known as *Romalea microptera*, it is scarcely possible to plead a case to the International Commission on Zoological Nomenclature for the retention of this name on the grounds that the senior synonyms are *nomina oblita*, for both have been cited as supposedly junior synonyms comparatively recently (Rehn and Grant, *loc. cit.*). Nor is there a case on the grounds that confusion would result from the use of the valid prior name, for the genus is monotypic. The only basis for arguing for retention of *Romalea microptera* would be stability of nomenclature in the case of a well known species. Even then, the case would not seem to be strong, for the amount of literature on the species (as contrasted with the number of people who are familiar with it) is, surprisingly, rather limited.

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HETEROMELES ARBUTIFOLIA (ROSACEAE: POMOIDEAE) FOUND TOXIC TO INSECTS[1,2]

D.L. Dahlman,[3] Victor Johnson[4]

ABSTRACT: Leaves of *Heteromeles arbutifolia* Roem. (Rosaceae: Pomoideae) were found to be cyanogenic. Shredded leaves of this plant were toxic to insects in closed containers.

Heteromeles arbutifolia Roem., a member of the Rosaceae, subfamily Pomoideae, is a common shrub in southern California and northern Lower California. It is found both in the wild and occasionally in landscaping (Preston, 1976). Commonly called Christmasberry, holly, toyon or tollon, it is a spreading evergreen plant that reaches considerable size. We have encountered it from sea level to about 5,000 feet.

Several species of Coniopterygidae (Insecta: Neuroptera) are predators of mites and whiteflies that feed on *H. arbutifolia*. The observations reported here resulted from our attempts to rear two coniopterygid species (*Conwentzia barretti* (Banks) and *C. californica* Meinander) from larva to adult in the laboratory. We placed early instar larvae on leaves of *H. arbutifolia* infested with mites and then placed the leaves in 7 dram plastic snapcap vials. Occasionally, a leaf was too large to fit into the vial and the edges were trimmed to make it fit. We noticed that the coniopterygid larvae placed on trimmed leaves died soon after placement into the vials but no mortality was observed in larvae in vials containing untrimmed leaves. We suspected that the trimming of the leaves released some agent toxic to the larvae. To confirm this, we placed several larvae in vials with untrimmed leaves and several in vials containing shredded leaves. Within 2-3 minutes, the larvae in the vials with the shredded leaves were dead. Adult Coniopterygidae, unidentified specimens of Isopoda, Acaria (mites feeding on *H. arbutifolia* leaves), Dermaptera, Coleoptera (Carabidae), Hymenoptera, Homoptera, Diptera, and Lepidoptera placed in vials with shredded leaves were all killed. One shredded leaf knocked down about 20 muscid Diptera in less than 1 minute. Whiteflies are only occasional prey of these coniopterygid species and were unavailable for tests. Since the shredded leaves produced an odor similar to hydrogen cyanide, the

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[3] Associate professor, Department of Entomology, University of Kentucky, Lexington, Kentucky 40546.

[4] USDA, Box 22277, Lexington, Kentucky 40522.

Guignard sodium picrate paper test (Harborne, 1973) was used to test for the presence of hydrogen cyanide. Freshly shredded plant material was placed into test tubes and a strip of picrate test paper was held in place inside the tube by means of a neoprene stopper. A change in color from yellow to red-brown within 1 hr indicated enzymatic cyanogenesis.

All tests with leaves collected at different times of the year were positive for hydrogen cyanide. However, older or senescent leaves seemed to be less active. Fruit collected in early March was negative, even after 24 hr, a time sufficient to indicate nonenzymatic liberation of hydrogen cyanide.

Plants which synthesize compounds which are capable of liberating hydrogen cyanide upon hydrolysis are commonly known as cyanogenic plants. Cyanogenic glycosides, which are responsible for this cyanophoric capability in most cyanogenic plants, are known to occur in at least 800 species of plants representing 70 to 80 families (Seigler, 1975). Highest concentrations are usually found in leaves but other plant tissues have been shown to contain cyanogenic compounds. The Rosaceae are notable for their cyanogenetic substances, and cyanogenesis is especially pronounced in the Pomoideae (Alston and Turner, 1963). Therefore, it is not unusual that cyanogenesis was observed.

Several insects which feed on cyanogenic plants have been shown to contain enzymes capable of detoxifying cyanide (Jones, 1972). Arthropods we found feeding on *H. arbutifolia* included mites, whiteflies, scales, leafhoppers (Cicadellidae), and caterpillars (Arctiidae).

We hope that this report will stimulate further investigations into the ecological advantages of cyanogenicity to the plant and its effects on phytophagous organisms. In addition, this information can prove useful to entomologists who live (or work) within the distribution range of *H. arbutifolia.* We found that leaves of this plant were an effective killing agent for insects and could be used in temporary killing jars. We shredded several leaves, packed them into the bottom of a small jar, covered the leaves with tissue and then placed a piece of filter paper over the tissue. This served to kill insects placed in the jar.

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TAKING *AMBLYCHILA CYLINDRIFORMIS* SAY BY BARRIER-TYPE PITFALL TRAP (COLEOPTERA: CICINDELIDAE)[1]

Gary A. Dunn[2]

ABSTRACT: Two specimens of *Amblychila cylindriformis* Say were taken by barrier pitfall trap at Angostura State Recreation Area, Fall River Co., SD on 15-viii-1979. This indicates that barrier pitfall traps may be useful in capturing this uncommon and unusual tiger beetle.

Amblychila cylindriformis Say is an inch-long, flightless tiger beetle confined to the prairies west of the Missouri River and east of the Rocky Mountains. It is known from localities in western Oklahoma to southwestern South Dakota and westward to northeastern New Mexico and eastcental Wyoming.

These beetles are nocturnal, appearing after dusk to search for food, and retiring before dawn. They spend the daylight hours in mammal or self-excavated burrows (Vaurie, 1955).

During the summer of 1979 I had an opportunity to visit Angostura State Recreation Area, 15 miles SW of Hot Springs, Fall River Co., SD, where *Amblychila cylindriformis* is known to occur (Howden, 1970). I arrived at the recreation area early in the afternoon of 14-viii. It was cool (13°C), cloudy and windy. The prospects for collecting *cylindriformis* by flashlight later that evening did not seem good. Therefore, I decided to set out 10 barrier pitfall traps instead of making a visual search.

Each trap consists of a pair of 1 liter plastic cups and a 15 cm x 1 m plexiglass barrier. The cups are buried with the rims at ground level; the barrier spans the distance between the two cups. The traps were placed in small, sandy openings among the prairie vegetation.

I returned to the recreation area the following morning at 0930 hours (15-viii) to check the traps. The weather had gradually worsened overnight for it was now drizzling. As I approached trapline 1 (0.8 km N of Campground 4), I spotted a specimen of *cylindriformis* descending into a large mammal burrow. I quickly grabbed the specimen before it disappeared from sight. The traps in traplines 1, 2, and 3 contained many tenebrionids, and a few carabids but no cicindelids. However, two of the traps in trapline 4 (0.4 km E of Campground 2) contained single specimens

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[1] Received April 7, 1980.

[2] Extension Specialist, Department of Entomology, Michigan State University, East Lansing, MI 48824.

of *cylindriformis.* The bottoms of the cups containing the tiger beetles were colored bright pink from digestive fluids.

Despite unfavorable weather conditions, and limited abundance of *cylindriformis* in this area at the extreme northeastern corner of its range, the barrier pitfall trap proved useful in capturing *Amblychila cylindriformis.* Pitfalls may prove to be an efficient and more convenient method of collecting this tiger beetle.

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INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

c/o British Museum (Natural History), Cromwell Road, London, SW7 5BD, United Kingdom.

16th May, 1980

ITZN 59

The following Opinions have been published recently by the International Commission on Zoological Nomenclature in the *Bulletin of Zoological Nomenclature,* Volume 37, part 1, 8th May 1980.

Opinion No.

1147 (p. 11) Status, for the purposes of the type fixations, of the remains of Chironomid Larvae (Insecta, Diptera) provided by Thienemann to Kieffer for the description of new species based on the adults reared from those larvae.

1148 (p. 27) Stabilisation of the generic name *Orchelimum* Audinet-Serville, 1838 and the specific name *Orchelimum vulgare* Harris, 1841 (Insecta, Coleoptera) by use of the plenary powers.

The Commission regrets that it cannot supply separates of Opinions.

R.V. Melville, *Secretary*

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A DESCRIPTION OF THE MALE *NEOGONATOPUS NIGER* (FENTON) (HYMENOPTERA: DRYINIDAE)[1,2]

Paul H. Freytag[3]

ABSTRACT: The male of *Neogonatopus niger* (Fenton) is described from a series of five males reared in the laboratory from a single field collected female. Comparison with other species in the genus *Neogonatopus* make it necessary to emend the generic description to include species (such as *niger)* which have the male genitalia with the dorsal processes shorter than the gonoforceps.

A female of *Neogonatopus niger* (Fenton) was reared from a field collected specimen of *Scaphoideus (S.) paludosus* Ball, family *Cicadellidae,* on *Impatiens* from Lexington, Fayette Co., Kentucky. This female oviposited in nymphs of this same leafhopper, which were collected from the same locality and held several days, prior to oviposition, to be relatively sure they were not previously parasitized. The offspring of this female were all males and the description that follows is based on this material which represents the first known males of this species.

Neogonatopus niger (Fenton)

Length of male 2-2.5 mm, female 2.25-2.5 mm.

Male: Entirely blackish brown or black. Externally resembling other members of this genus, especially *ombrodes.* Genitalia (Figures 1-2) with short dorsal processes of gonoforceps, extending only half length of gonoforceps, somewhat paddle-shaped and expanded near apex. Entire genital capsule the size of *ombrodes.*

Female: As described earlier by Fenton (1924), and illustrated by myself (Freytag, 1977).

Material Examined: One female and five male specimens reared on *Scaphoideus (S.) paludosus* Ball on *Impatiens* during the fall of 1979 in Lexington, Kentucky. The female and three males are deposited in the University of Kentucky Collection, and the other two males are deposited in the Bishop Museum, Honolulu, Hawaii.

This is the only species of *Neogonatopus* known so far that has the male dorsal processes of the gonoforceps shorter than the gonoforceps. In my key to species (Freytag, 1977) *niger* males will key out in the same couplet with *ombrodes.* These two species can be separated by the length of the dorsal

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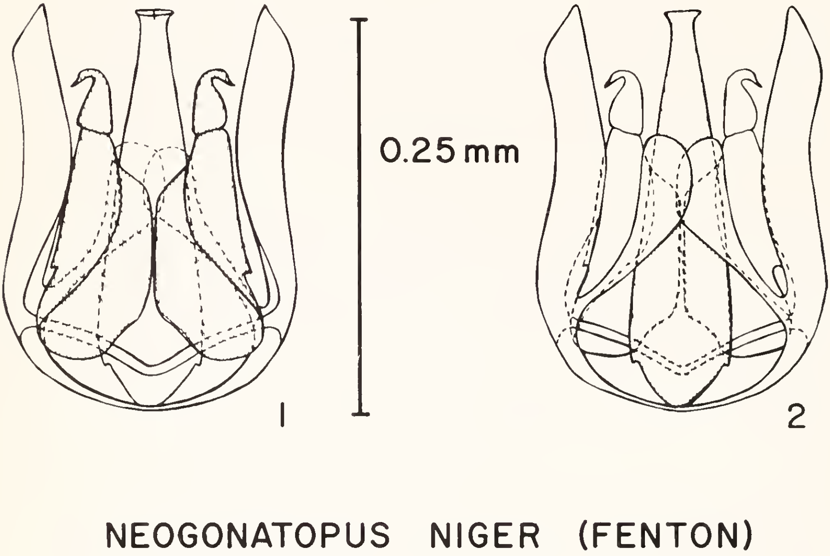
[3] Department of Entomology, University of Kentucky, Lexington, KY 40546.

processes of the gonoforceps, *niger* having short processes and *ombrodes* having long processes.



Figures 1 & 2. *Neogonatopus niger* (Fenton) male genitalia. 1. Ventral view; 2. Dorsal view. Both drawn to the same scale. Vosella shaded in ventral view. Aedeagus shaded in dorsal view. Genital collar removed.

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BIOLOGICAL NOTES ON THE SPIDERS OF SOME CITRUS GROVES IN CENTRAL AND SOUTHERN CALIFORNIA[1,2]

D.P. Carroll[3]

ABSTRACT: This list of the spider species found in several citrus groves in central and southern California is supplemented with biological notes on the more abundant species. Spiders outnumbered all other large predators in the citrus canopy and were also abundant in the litter. *Oxyopes scalaris* (Oxyopidae), *Thiodina* cf. *T. sylvana* (Salticidae), *Misumenops* spp. (Thomisidae) and *Trachelas pacificus* (Clubionidae) were the most abundant vagrant spiders in the canopy. Diet of these spiders is discussed, with emphasis on the spiderlings. Abundant web-building spiders in the canopy were typically small-sized species. These included *Theridion leechi* (Theridiidae), *Erigone dentosa* (Linyphiidae) and *Dictyna reticulata* (Dictynidae). *Hololena* spp. (Agelenidae) were the only abundant web-building large spiders. Sac spiders (Clubionidae) are probably the most promising natural enemies of citrus pest arthropods.

California citrus groves provide a habitat for a variety of spider species, some of which may reduce pest populations, but no general study of them has been published. Collections by researchers at the University of California, Riverside, and the USDA Boyden Entomological Laboratory provided the opportunity to study the spider fauna of citrus groves at varied locations. Field biologies of some species were investigated at the University of California Lindcove Field Station near Exeter, California.

METHODS

Arboreal spiders were taken between 1975 and 1979 by inspection and beating of navel orange foliage in groves at Lindcove Field Station and U.C. Riverside, and in 1973, using a D-VAC® vacuum apparatus, from commercial navel orange groves in Tulare and Fresno counties. Little or no insecticides were applied to the principal groves.

Litter spiders and other arthropod predators were separated by Berlese funnel from samples collected in 1975 from lemon and navel orange groves at U.C. Riverside, and at Orosi in Tulare County. Additional litter collections were taken between 1975 and 1979 from navel orange groves at Lindcove Field Station using pitfalls (Morrill, 1975), direct inspection and Berlese funnels.

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[3] Current address: Tree Fruit Research Center, 1100 N Western Avenue, Wenatchee, WA 98801.

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Diets of the principal arboreal species were observed on the trees at Lindcove under natural conditions and in several field experiments. In the latter, first instar spiderlings, hatched in the laboratory, were placed within infestations of citrus thrips [*Scirtothrips citri* (Moulton)], or citrus red mite [*Panonychus citir* (McGregor)], and allowed to run freely while their reaction to the prey was observed. Flashlights aided observations of nocturnal spiders.

RESULTS

In the citrus canopy, spiders outnumbered all other large predators. Sedentary spiders, which snare their prey in webs, and vagrant spiders, which wander about searching for their prey, were represented in approximately equal numbers.

The arboreal vagrant spider fauna was remarkably similar among all of the orchards studied and uniformly included lynx spiders, jumping spiders, crab spiders and sac spiders. Most frequently encountered during the day were the brown lynx spider, *Oxyopes scalaris* Hentz (Oxyopidae) and jumping spiders (Salticidae), particularly *Thiodina* cf. *T. sylvana* (Hentz). Crab spiders (Thomisidae) in the genera *Misumenops* and *Xysticus* were also abundant. Day hunters were replaced at night by sac spiders, *Trachelas pacificus* Chamb. & Ivie (Clubionidae) and related species of Clubionidae and Anyphaenidae.

Brown lynx spiders, *O. scalaris,* usually overwintered as partly grown juveniles and completed maturation in the spring. Between June and September females could be found on brood webs, generally on the outside canopy. Young lynx spiders were abundant by the middle of the summer. Although easily disturbed, these spiderlings were observed eating citrus thrips and a few mites. Hunting lynx spiders sit motionless, usually facing down a twig, for a few minutes, then move to another spot. They rapidly respond to moving prey approaching from any direction, but motionless prey are not attacked. Judging by their small size and hunting strategy, the spiderlings probably eat large numbers of thrips when these are moving about on the twigs in the late afternoon and presumably also numerous small flies and wasps. In the laboratory they will eat leafhopper nymphs and gnats. Larger individuals were observed in the field eating ichneumonid wasps, midges, crane flies and tortricid moths. Cutler et al. (1977) have published a review of the biology of this species.

The jumping spider *Thiodina* cf. *T. sylvana* overwintered in late instar juvenile or mature adult stages. Females were found with egg sacs, usually in rolled leaves in the canopy, from May to September, with early instars most common in June and July. The spiderlings most commonly ate flies and midges, which they perceived at distances greater than 10 cm. and invariably pursued, but they occasionally attacked small wasps, mites and thrips. First instar *Thiodina* spent up to an hour consuming one midge, compared to about five minutes for a mite or a thrips. Thrips were usually passed unnoticed. Citrus red mites were often rejected; of 17 adult and 17 nymphal mites attacked during the tests, only 2 adults and 8 nymphs were eaten. The spiderlings also rejected scale crawlers, mealybugs and aphids, and fled from ants. The prey did not have to move to be seen if it contrasted strongly enough with the background. Spiderlings attacked apparently motionless thrips, mites, midges, and on two occasions, small pieces of bark. Larger instar *Thiodina* ate various flies, including Syrphidae, Muscidae, Chironomidae and Empididae, and small moths such as Tortricidae. They have been observed in other ecosystems eating lynx spiders (B.T. Carroll, pers. comm.).

In one Lindcove orchard of young navel orange trees, *Thiodina* was uncommon but another jumping spider, *Phidippus johnsoni* (G. & E. Peckham), rarely taken in other orchards, was abundant. *P. johnsoni* probably has a diet similar to that of *Thiodina,* although the spiderlings were more apt to eat mites once captured. In one trial six out of six mites captured were eaten. Larger individuals were observed eating flies and, in one case, a small spider. Gravid *P. johnsoni* were often found overwintering in silken nests in litter or under boards.

Adult crab spiders, *Misumenops lepidus* (Thorell), occupied the canopy in May and June, with the new generation apparent in June. No feeding observations were made on citrus. In other crops such as cotton, *Misumenops* spp. have been reported to eat predominantly flying insects such as flies, wasps, bees, moths and bugs (Muniappan & Chada, 1970; Whitcomb et al., 1963). Another crab spider, *Xysticus californicus* Keys., inhabited both the canopy and the litter. One female in a rolled leaf in the canopy was guarding an egg sac in April.

The abundant sac spider *Trachelas pacificus,* was most prevalent in both the canopy and the litter in the summer and fall, but juveniles and adults were present year around. Since the litter is a population reservoir for this spider, abundance of prey in the litter may influence abundance of spiders in the canopy. These spiders usually spend the day in loose silk nests in rolled leaves or other enclosed spaces. At night they wander rapidly over the canopy, groping for primarily slow-moving or sessile prey such as thrips, mites, insect eggs and lepidopterous larvae. During feeding trials young spiders were very efficient at finding thrips, even under the fruit calyx, but many thrips escaped by flying or dropping off the leaves. Of 43 contacts observed, 19 or slightly less than half were successful captures. This is not abnormally low for predators (Salt, 1967). Spiderlings ate up to six thrips per hour so that each may eat a maximum of 50 thrips per night. Even at this unlikely rate of predation, however, it is doubtful that enough spiders would be present to control a rapidly increasing thrips population. On the other hand, thrips, along with species of innocuous prey, might support a population of sac spiders large enough to control a potential outbreak of lepidopterous or other pests. In the laboratory young *T. pacificus* ate mites, *Trichoplusia* eggs (Noctuidae) and agromyzid flies. In one incidence of cannibalism in the field a large individual ate a smaller one.

Chiracanthium inclusum (Hentz) (Clubionidae) and *Aysha incursa* (Chamb.) (Anyphaenidae) occurred in the canopy of some orchards. After extensive laboratory tests of *Aysha* sp. (identified as *A. decepta* Banks but almost certainly *A. incursa*) feeding on citrus thrips, Bravo-Mojica (1975) concluded that this sac spider probably consumed a large number of thrips. Peck (1970) has published a biology of *C. inclusum.*

The danger of sac spider predation may account in part for a curious habit displayed by *Thiodina, Misumenops* and *Oxyopes* (see Cutler et al., 1977). These diurnal vagrant spiders all spend the night hanging on a dragline, in what might be termed "suspended bivouac" by analogy with the similar practice of alpine climbers. The effectiveness of this defence was proven in one instance when a large *T. pacificus* stumbled onto the end of a bivouac line of an *M. lepidus.* The crab spider immediately cut the line and dropped to safety. Not all diurnal vagrant spiders use "suspended bivouac". *P. johnsoni,* for example, spends the night in a heavy silk retreat with multiple entrances.

Among the canopy web-building spiders the most common were small spiders of three families, each of which predominated in a different season. Appearing first were *Theridion leechi* Gertsch & Archer (Theridiidae) and other *Theridion* spp., which were abundant from March to May. They built delicate sheet webs across a single leaf, catching primarily small flies, midges and psocids, but also some thrips, tiny wasps, mites and aphids. Following the Theridiids was a population of *Erigone dentosa* O. P.-Cambridge (Linyphiidae) which appeared in the middle of May and lasted into July. *Erigone* webs were usually spread over several leaves and snared small flies, gnats, psocids, mites and other small insects. The last of the tiny web-builders to appear were the Dictynidae. *Dictyna reticulata* Gertsch & Ivie, abundant in some years from June through August, built irregular webs across one or more leaves. Smiliar webs of *D. calcarata* Banks, found in one year in July, caught numerous small flies and leafhoppers, and many were covered with hundreds of male California red scale *[Aonidiella aurantii* (Mask.)*].*

Thick sheet webs built by *Hololena* n. sp. (Agelenidae), a large funnel-web spider common in many groves, contained various flies, midges, parasitic wasps, small moths, psocids, leafhoppers, bugs, lacewings and spiders. *Hololena* spiderlings, abundant in the spring, built tiny webs across one or more leaves, resembling the webs of the common small web-building spiders. Both adults and spiderlings hide in a tubular retreat and run on the top of the web. At Lindcove, *Hololena* matured in October and later.

Several species of orbweb-weaving spiders were moderately abundant in some groves. *Uloborus diversus* Marx (Uloboridae) built its delicate horizontal webs usually in the skirts of the canopy or in the fork of the trunk. Some webs caught a few thrips. *Tetragnatha versicolor* Walck. (Tetragnathidae) also built a horizontal orbweb but did not occur in large numbers. Several species of Araneidae, which build vertical orbwebs, inhabited some orchards, and more species will undoubtedly be found. A spring population of *Neoscona oaxacensis* (Keys.) spiderlings occurred in one Riverside orchard. Adults of this large spider appear in the fall (Chirri, 1977). *Cyclosa* sp., a small spider which collected discarded prey, primarily small flies, in a streak across the center of its orbweb, was active at Riverside in the late spring.

Spiders were consistently abundant in citrus litter, but the species composition differed widely from grove to grove. Litter faunas of some orchards were characterized by one or more dominant species, such as *Scotinella* cf. *S. duncani* Chamb. (Clubionidae), *Spirembolus pusillus* Millidge (Linyphiidae) or Oecobius annulipes Lucas (Oecobiidae), that were absent from other orchards. Glatz (1967) stated that the diet of *O. annulipes* was exclusively formicine, but webs of this spider on buildings often contain some flies as well as ants. The litter of most orchards supported a large assemblage of spiders species from a variety of families. Among the vagrants, *Trachelas pacificus* and *Zelotes rusticus* (L. Koch) (Gnaphosidae) were usually abundant beneath the litter surface. In the laboratory *Z. rusticus* ate some psocids, a major litter fauna component. Wolf spiders (Lycosidae) ran on the surface of the litter around standing water. The small *Oardisa ranykisa* (McCook) predominated during the summer, whereas three larger species, *Lycosa gosiuta* Chamb., *Schizocosa mccookii* (Mont.) and *Tarentula kochii* Keys., were more common during the late fall and winter. *Castianeira thalia* Reiskind (Clubionidae) juveniles were active in winter, maturing in the spring. A small jumping spider, *Pellenes formosus* Banks (Salticidae), stalked flies on sunny litter surfaces in the spring, summer and fall. *Sitticus* cf. *S. callidus* Gertsch & Mulaik (Salticidae) was taken in pitfall traps throughout the summer and fall. Web-building spiders of the litter included a large number of small species in the families Linyphiidae and Dictynidae. Most of the Linyphiidae were uncommon or only seasonally abundant, but *Erigone dentosa* was present year around, sometimes at extremely high densities. *Dictyna agressa* Ivie and *D. calcarata* Banks were common, as were the slightly larger spiders of the genus *Tricholathys* (Dictynidae). *Tidarren haemorrhoidale* (Bertkau) (Theridiidae) occasionally built a large web at the base of a tree trunk.

DISCUSSION

Since most species of spiders in the citrus groves feed primarily on innocuous species of insects, the impact of spiders on citrus pests is probably minimal. The one exception is the sac spiders (Clubionidae and Anyphaenidae) whose prey includes a number of important pest species such as Lepidoptera, mites and thrips. A recent experiment in Israel (David Rosen, pers. comm.) on apple trees demonstrated that when all sac spiders, primarily *Chiracanthium* sp., were removed from the trees the survival of *Spodoptera* sp. (Noctuidae) caterpillars hatching from egg masses on cards was very high, whereas if the spiders were left on the trees very few caterpillars survived. Likewise it is possible that sac spiders are contributing to control of lepidopterous pests in California citrus groves.

The arboreal spider fauna observed in California citrus groves differed notably from that observed by Muma (1975) in Florida. Among the vagrants, only sac spiders were abundant in Florida citrus. Jumping spiders were uncommon and lynx and crab spiders were very rare. The web-building component was more similar to that of California, with Dictynidae, Theridiidae and Uloboridae common, but Linyphiidae were seldom abundant, Agelenidae were absent, and Araneidae were much more abundant than in the California groves. Some of these differences may be due to the biogeography of the spiders involved. For instance, *Erigone dentosa* and the genus *Hololena* both have exclusively western ranges. Other differences between the two faunas may be due to ecological or agronomic factors.

List of Spiders Seen in California Citrus Groves

Family Genus & Species	Records[1]	Habitat
Filistatidae		
Filistata geophila Chamb. & Ivie	Lin.	Litter
Oecobiidae		
Oecobius annulipes Lucas	Riv.	Litter
Uloboridae		
Uloborus diversus Marx	Lin., Fre.	Tree
Dictynidae		
Dictyna agressa Ivie	Lin., Oro. Riv.	Litter
Dictyna calcarata Banks	Lin.	Tree, Litter
Dictyna cf. *D .joaquina* Chamb. & Gertsch	Lin.	Litter
Dictyna reticulata Gertsch & Ivie	Lin., Fre.	Tree
Dictyna saepei Chamb. & Ivie	Lin.	Tree

[1] Lin. = Lindcove, Tulare County; Oro = Orosi, Tulare County; Riv. = Riverside, Riverside County; Fre. = Fresno County.

Tricholathys hirsutipes (Banks)	Lin., Oro.	Litter
Tricholathys jacinto Chamb. & Gertsch	Riv.	Litter
Oonopidae		
Orchestina moaba Chamb. & Ivie	Riv.	Litter
Dysderidae		
Dysdera crocata C. Koch	Riv.	Litter
Pholcidae		
Psilochorus sp. (juv.)	Lin.	Litter
Theridiidae		
Theridion leechi Gertsch & Archer	Lin.	Tree
Theridion melanurum Hahn	Lin.	Tree
Theridion rabuni Chamb. & Ivie	Fre.	Tree
Tidarren haemorrhoidale (Bertkau)	Lin.	Base of Trunk
Linyphiidae		
Erigone autumnalis Emerton	Lin.	Litter
Erigone dentosa O.P.-Cambridge	Lin., Oro., Fre., Riv.,	Tree, Litter
Eperigone eschatologica Crosby	Lin.	Litter
Grammonota gentilis Banks	Lin.	Litter
Spirembolus phylax Chamb. & Ivie	Lin.	Litter
Spirembolus proximus Millidge	Lin., Oro.	Litter
Spirembolus pusillus Millidge	Lin., Oro.	Litter
Spirembolus redondo (Chamb. & Ivie)	Riv.	Litter
Walckenaeria spiralis (Emerton)	Lin.	Litter
Araneidae		
Araniella displicata (Hentz)	Lin.	Tree
Cyclosa sp. (juv.)	Riv.	Tree
Neoscona oaxacensis (Keys)	Lin., Riv.	Tree
Tetragnathidae		
Tetragnatha versicolor Walck.	Lin.	Tree
Agelenidae		
Hololena n. sp.	Lin.	Tree
Hololena sp. (juv.)	Riv.	Tree
Lycosidae		
Lycosa gosiuta Chamb.	Lin., Riv.	Litter
Pardosa ramulosa (McCook)	Lin., Riv.	Litter
Pardosa californica Keys	Lin.	Litter
Schizocosa mccookii (Mont.)	Lin.	Litter
Tarentula kochii Keys.	Lin.	Litter
Oxyopidae		
Oxyopes salticus Hentz	Lin.	Tree
Oxyopes scalaris Hentz	Lin., Fre., Riv.	Tree
Gnaphosidae		
Drassyllus insularis (Banks)	Riv.	Litter
Poecilochroa cf. *P. montana* Emerton	Riv.	Litter
Poecilochroa sp.	Oro.	Litter
Zelotes rusticus (L. Koch)	Riv., Oro., Lin.	Litter

Zelotes n. sp.	Lin.	Litter
Clubionidae		
Agroeca trivittata (Keys)	Lin., Oro., Riv.	Litter
Castianeira cf. *C. crocata* (Hentz)	Lin., Riv., Oro.	Litter
Castianeira thalia Reiskind	Lin., Oro.	Litter
Chiracanthium inclusum (Hentz)	Lin.	Tree
Scotinella cf. *S. duncani* Chamb.	Riv.	Litter
Trachelas deceptus (Banks)	Riv.	Litter
Trachelas pacificus Chamb. & Ivie	Lin., Oro., Riv.	Litter, Tree
Anyphaenidae		
Aysha incursa (Chamb.)	Riv.	Tree
Thomisidae		
Misumenops lepidus (Thorell)	Lin.	Tree
Misumenops sp. (juv.)	Riv., Fre.	Tree
Xysticus californicus Keys.	Lin., Oro., Riv.	Tree, Litter
Philodromidae		
Ebo pepinensis Gertsch	Riv.	Litter
Salticidae		
Metaphidippus vitis (Cock.)	Riv.	Tree
Pellenes formosus Banks	Lin.	Litter
Phidippus johnsoni (G. & E. Peckham)	Lin., Riv.	Tree
Sitticus cf. *S. callidus* Gertsch & Mulaik	Lin., Oro.	Litter
Thiodina cf. *T. sylvana* (Hentz)	Lin., Fre., Riv.	Tree

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TWO AGGREGATIONS OF *CALOSOMA FRIGIDUM* (COLEOPTERA: CARABIDAE) IN ONTARIO DURING 1976[1]

William J. Crins [2]

ABSTRACT: Two aggregations of the carabid, *Calosoma frigidum* Kirby, are described from Ontario. Large populations in Algonquin Park during June 1976 occurred concurrently with large populations of a prey species, *Operophtera bruceata* (Hulst).[3] Observations about movements of the beetles within areas of high density are presented, and a high degree of flight activity was particularly significant. The second aggregation involved a mass flight of *C. frigidum*, and evidence is provided which suggests that meteorological factors were partly responsible for the flight.

The Frigid Calosoma (*Calosoma frigidum* Kirby) is a large ground beetle of wooded habitats (Gidaspow 1959). It is widespread throughout southern Canada and the United States, occurring from Newfoundland to British Columbia, and south to Georgia and Texas (Burgess and Collins 1917, Gidaspow 1959). In spite of the wide range occupied by this species, little has been written regarding its movements or other aspects of its natural history. This is surprising in light of the fact that this species, and members of the genus *Calosoma* in general, are voracious predators of the larvae and pupae of many forest Lepidoptera and, as such, are potentially important as biological control agents. Poulin and O'Neil (1969) have shown that *C. frigidum* may be an important predator of the introduced pestiferous slug, *Arion ater* (L.).

The present note describes some of the features related to two separate aggregations of *C. frigidum* in Ontario. The first involves an apparent close relationship with a concurrent outbreak of a prey species; the second is related to mass migration (cf. Johnson 1969).

1. The Algonquin Park Aggregation

During the period of 4-12 June 1976, large numbers of *C. frigidum* were observed in woodlands in Peck and Canisbay Townships, Algonquin Provincial Park, Nipissing District, Ontario. The forests in which they were found were generally dry mesic, sugar maple (*Acer saccharum* Marsh.)-dominated woodlands over thin, loamy soils. These forests were being

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[1] Received June 6, 1980

[2] Department of Biology, Erindale College, University of Toronto, Mississauga, Ontario, Canada L5L 1C6.

[3] (Lepidoptera: Geometridae)

defoliated by large populations of the Bruce Spanworm (*Operophtera bruceata* (Hulst)). The beetles were observed only once in forests not fitting the above description, and it seems likely that the abundant food source available in the maple forests influenced the distribution of beetles within the stands. In Alberta, *C. frigidum* also seems to be restricted to mature forest stands (Dr. H. Goulet, pers. comm. 1978).

In Algonquin Park, many adult beetles were observed carrying *O. bruceata* larvae in their mandibles. Although much of the foraging activity occurred on the litter layer of the forest floor, many adult beetles were observed climbing the trunks of trees and foraging on the branches and foliage at heights of 7 meters or more above the forest floor. They were also observed to fly from place to place beneath the canopy quite frequently. It is interesting to note that Dr. Goulet (pers. comm. 1978) observed flight only once during five summers of study in Alberta. It is possible that flight activity is related to the type of prey being exploited. If a large number of prey can be obtained on the ground, the need for flight is greatly reduced. This could be so when cutworms (Lepidoptera:Noctuidae) serve as a food source for *C. frigidum,* as in some of the Alberta studies. *O. bruceata* larvae are most abundant in the canopy levels in hardwood forests. Thus, although some larvae were on the forest floor, a far larger pool of food was available at higher levels in the forests in Algonquin Park, and this may account for the high degree of flight activity observed there.

The beetles were no longer present after 12 June, presumably having become dormant. Goulet (pers. comm. 1979) found that all adults had become dormant by 15-20 June in his Alberta studies.

During the latter part of May and early June 1977, *C. frigidum* was again common in the same hardwood forests in Algonquin Park, but *O. bruceata* had almost disappeared. It is possible that *C. frigidum* was partly responsible for this rapid decline.

2. The Lake Erie Aggregation

At approximately the same time as the Algonquin Park aggregation discussed above, another, more spectacular aggregation occurred along the north shore of Lake Erie in Elgin County, Ontario. An anonymous collector provided the following note, which is located with a series of specimens, in the collection of the Department of Environmental Biology, University of Guelph.

> "This species of *Calosoma* (i.e., *frigidum*) was found in excessive numbers in Iroquois Beach Provincial Park on or about June 15, 1976. Specimens were first reported climbing on swimmers. Observers reported that there were 'hundreds of thousands' of beetles in the water, on the beach and 'were 5 beetles deep on the supports of the boat pier'."

In all likelihood, this represents an example of a sudden mass flight, as discussed by Johnson (1969). This type of flight is thought to be influenced by meteorological factors. Six meteorological criteria for mass flights were reviewed by Johnson (1969, p. 287). These are:

1. The maximum temperatue on the day of the flight must equal or exceed 20°C.
2. The average temperature must be greater than that of the previous day.
3. There can be no precipitation on the day of the flight.
4. There must be at least one hour of sunshine on the day of the flight.
5. The dew-point must be between 5°C and 15°C.
6. The atmosphere must be stable above approximately 5000 feet (ca. 1500 meters).

An analysis of weather maps for the week preceding the flight indicates that a front was beginning to move into the Great Lakes region on 11 June. This front became occluded just west of Lake Superior on 12 June, and by 13 June, the occlusion was centered over the lower Great Lakes. Violent weather, in the form of tornadoes, torrential rains, and hailstorms, was associated with this system from Chicago to Toronto (Atmospheric Environment Service 1976, Taubensee 1976). On 14 June, the front passed, and the lower Great Lakes region was situated in the warm sector. Taubensee (1976) also points out that the average temperatures from 7-20 June were several degrees (°F) above normal. Thus, although data for all six criteria are not at hand, it is apparent that at least three or four of the criteria are fulfilled, and this circumstantial evidence suggests that the *C. frigidum* flight might well have been influenced by meteorological factors. Johnson (1969) suggested that mass flights actually form part of a continuous event that remains unnoticed until special weather conditions cause a mass exodus or concentrate insects that are already flying into lower levels of the atmosphere. This may be true for some insect groups, but mass flights have never before been documented for *C. frigidum*, and only one report describes a possible mass flight in the genus *Calosoma* (Doane and Schaefer 1971, for *C. sycophanta* (L.)). Those authors also commented on the rarity of the event.

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INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

c/o British Museum (Natural History), Cromwell Road, London, SW7 5BD, United Kingdom.

30th June, 1980
and 7th October, 1980

A.N.(S.) 114

The Commission hereby gives six months' notice of the possible use of its plenary powers in the following cases, published in *Bull. zool. Nom.* Volume 37, part 2, on 19th June 1980, and would welcome comments and advice on them from interested zoologists. Correspondence should be addressed to the Secretary at the above address, if possible within six months of the date of publication of this notice.

1175 *Heterelis* Costa, 1887 (Insecta, Hymenoptera): proposed procedure for concluding the case.

2048 *Leptinotarsa* Chevrolat, 1837 (Insecta, Coleoptera): revised proposals for conservation.

The following cases were published in *Bull. zool. Nom.* Volume 37, part 3, on 25th September 1980.

2138 *Sphinx tipuliformis* Clerck, 1759 (Insecta, Lepidoptera), proposed conservation.

2139 *Sesia andrenaeformis* Laspeyres, 1801 (Insecta, Lepidoptera), proposed conservation.

2149 *Chermes fusca* Zetterstedt, 1828 (Insecta, Homoptera) a secondary homonym in *Psylla* Geoffroy, 1762: proposed validation.

(Continued on page 160)

NOTES ON CONIOPTERYGIDAE (NEUROPTERA) FROM THE ETHIOPIAN REGION[1,2]

Victor Johnson[3]

ABSTRACT: *Coniopteryx borealis* Tjeder is recorded for the first time from the African continent. A neotype is designated for *Semidalis nigrivena* Fraser, and its synonymy with *Semidalis mascarenica* is confirmed.

Upon examining specimens of Coniopterygidae in the Illinois Natural History Museum collection, two interesting specimens were found. These were one male each of *Coniopteryx borealis* Tjeder and *Semidalis mascarenica* Fraser.

The specimen of *C. borealis* was labelled "12 mi. sw. of Mateur, Tunisia, Aug. 31, 1943, G.T. Riegel and J.H. Materne" and represents a new country and continent record. This species was previously known from Norway, Sweden, Findland, Denmark, Scotland, France, Germany, Switzerland, Austria, Czechoslovakia, Romania and USSR (Meinander, 1972).

The second specimen is of interest because it confirms the synonomy of *Semidalis nigrivena* with *S. mascarenica.* Fraser described *S. mascarenica* from Madagascar (1952) and *S. nigrivena* from Reunion Island (1957). The description of *S. nigrivena* was based on "a number of both sexes but mostly males from the Rempart de Belouve, Reunion, I-55, collected by Dr. R. Paulian." He indicated that the type was deposited in the Institute de Recherche Scientifique, Madagascar. Fraser gave as inadequate description of both *S. mascarenica* and *S. nigrivena* and indicated that the 2 species were very similar. He apparently considered *S. nigrivena* to be a valid species based on its new insular distribution.

Meinander (1972) considered *S. nigrivena* a synonym of *S. mascarenica* from Madagascar. He concluded that the types of both species were lost as they were not in the Institut de Recherche Scientifique, Madagascar, British Museum (Natural History) or Museum National d'Histoire Naturelle. The present specimen is genitalically identical to Meinander's illustration of *S. mascarenica;* the collection data is identical to that of *S. nigrivena* given by Fraser.

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[2] The investigation reported in this paper (No. 80-7-50) is in connection with a project of the Kentucky Agricultural Experiment Station and is published with approval of the Director.

[3] Formerly Research Assistant in the Department of Entomology, University of Kentucky, Lexington, Kentucky 40546. Current Address: USDA-APHIS-PPQ, Box 22277, Lexington, Kentucky 40522.

Since the holotype of *S. nigrivena* is apparently lost and there is a specimen with identical collection data as the original type series, I hereby designate the Illinois History Natural Survey specimen as a neotype of *S. nigrivena.* Additionally, as the specimen is genetalically identical to *S. mascarenica,* I concur with Meinander that until demonstrated otherwise, *S. nigrivena* should be considered a synonym on *S. mascarenica.*

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INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

(Continued from page 158)

2160 *Lamprocabera* Inoue, 1958 (Insecta, Lepidoptera), proposed designation of type species.

2258 *Ptinella* Motschulsky, 1844, and *Nephanes* Thomson, 1859 (Insecta, Coleoptera), proposed conservation.

2283 *Aphis callunae* Theobald, 1915 (Insecta, Aphidoidea), proposed conservation.

1583 *Athyreus* Macleay, 1819 and *Glyptus* Brulle, 1835 (Insecta, Coleoptera), proposed conservation.

The following Opinions and Direction No. 108 have been published recently by the International Commission on Zoological Nomenclature in the *Bulletin of Zoological Nomenclature,* Volume 37, part 2, 19th June 1980.

Opinion No.

1155 (p. 89) *Saperda inornata* Say, 1824 (Insecta Coleoptera): designation of a neotype by the use of the plenary powers.

1157 (p. 96) *Sphex viatica [sic]* Linnaeus, 1758 (Insecta Hymenoptera): designation of lectotype.

The Commission regrets that it cannot supply separates of Opinions or Directions.

R.V. Melville
Secretary

CARNIVORY IN *EPHEMERELLA INERMIS* EATON NYMPHS (EPHEMEROPTERA: EPHEMERELLIDAE)[1]

Lynda D. Corkum[2]

ABSTRACT: A photograph is presented of an *Ephemerella inermis* Eaton nymph with the anterior portion of a Tanytarsini (Diptera: Chironomidae) larva protruding from its mouth. Few unidentified animal fragments have been reported in gut contents of large nymphs of this species, which is commonly a detritivore.

Ephemerellid nymphs are typically detritivores and/or herbivores, however there have been occasional reports of animal fragments in the guts of these mayflies (Hamilton, 1979). I collected an *Ephemerella inermis* Eaton nymph with the anterior portion of a Tanytarsini larva protruding from its mouth (Fig. 1) from the Highwood River, Alberta (50° 47'00" N, 113° 49'13" W) on 12 June 1979 at 2130 h M.S.T. (water temperature was 15°C). At the sample site, 133.1 km downstream from its source in the Rocky Mountain Forest, the river is a 4th order stream. Here, the river (50 m wide and 1047 m above m.s.l.) flows through hilly grassland. The nymph was taken in a 3-min kick net sample (mesh opening = 180 microns) over a stream bottom of shale, rock and sand; aquatic macrophytes were absent. Although there was no overhanging vegetation, poplars, willow shrubs and grasses were common beside the river. Streambank erosion was evident upstream. At the site, mean current velocity and flow 3 cm above the substrate (Gurley current meter) was 1.33 m/s and 0.79 m/s, respectively.

Mayfly nymphs (51.3%) and chironomid larvae (20.6%) dominated the kick fauna. Of the mayflies, 35.5% were *Ephemerella* nymphs; 17.7% of the chironomids were *Tanytarsini* larvae.

I analyzed the gut contents of 50 other *E. inermis* nymphs from the kick sample (21 females: head capsule width = 1.39 mm ±0.147, total body length excluding caudal filaments = 6.76 mm ±0.868; 29 males: HCW = 1.39 mm ±0.195, TBL = 6.34 mm ±0.947) similar in size to the *Ephemerella* predator (male: HCW = 1.52 mm, TBL = 6.39 mm). Gut contents of these other nymphs consisted of detrital particles; no evidence of animal fragments were found. Hamilton (1979) reported that over 90% of food ingested by all size classes of *E. inermis* nymphs was detritus.

Early workers considered that any animal fragments found in the guts of ephermerellid nymphs were accidently taken (likely as dead matter) when

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[1] Received May 27, 1980

[2] Department of Zoology, University of Alberta, Edmonton, Alberta, Canada T6G 2E9

plant material was consumed (Percival & Whitehead, 1929; Muttkowski & Smith, 1929). Muttkowski and Smith (1929) reported that 18.5% of the gut contents of *Drunella* sp. nymphs and 3.7% of *Ephemerella* sp. nymphs consisted of animal matter.

Carnivory among ephemerellid nymphs has most frequently been reported in species of the genus *Drunella: coloradensis, cornuta, doddsi, flavilinea, grandis* and *spinifera* (Gilpin & Brusven, 1970; Shapas & Hilsenhoff, 1976; Hamilton, 1979). Animal fragments have been shown to dominate the gut contents of relatively large nymphs of only two species, *D. cornuta* (Shapas & Hilsenhoff, 1976) and *D. spinifera* (Gilpin & Brusven, 1970; Hamilton, 1979). Identified prey contents of these species are chironomid larvae and/or ephemeropteran nymphs. Few unidentified arthropod fragments have been reported in *E. inermis* (Hamilton, 1979), *E. inermis/infrequens, Serratella tibialis* and *Timpanoga hecuba* (Gilpin & Brusven, 1970). From the photograph (Fig. 1), it is evident that a relatively large *E. inermis* nymph can capture a dipteran larva.

Fig. 1. Photograph of *Ephemerella inermis* nymph with a Tanytarsini larva protruding from its mouth.

ACKNOWLEDGEMENTS

I thank R.W. Mandryk and R.H. Seward for taking the photograph.

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MURRAY I. COOPER

We regret to announce the recent passing of Murray I. Cooper. He was a long time and active member of the American Entomological Society, including service as President and Chairman of the Finance Committee of the Society.

Dr. Cooper was a graduate of Cornell University and earned his PhD in Entomology from the University of Illinois. He was a pest control entomologist and was active in several professional organizations, including the Philadelphia Section of the Institute of Food Technologists, the Society of Sigma Xi, the American Registry of Professional Entomologists and Pi Chi Omega. A World War II veteran, he was retired from the Army with the rank of Captain. He is survived by his wife, the former Meta Flamberg who resides at 244 Buckboard Rd., Willow Grove, Pa. 19090, two daughters, a son, a sister, a brother and three grandchildren.

ADULT FEEDING IN TWO SPECIES OF CHIRONOMIDAE (DIPTERA)

Richard M. Seward

For years it was reported that adult Chironomidae do not feed, and that all energy for the adult functions of reproduction and dispersion was derived through the catabolism of fat reserves which were accumulated during the larval stage. Recent reports (Downes, 1974; Schlee, 1977) indicate adult feeding on nectar and honeydew is widespread; indeed, between those two sources, they list a total of 44 genera observed feeding. Downes (1974) suggests this behavior prolongs adult activity, especially flight.

Recently, I observed hundreds of adult Chironomidae, both males and females, feeding on droplets of sugary liquid which collected in the flowers of an ornamental *Rhododendron* after a heavy rain (1 June 1980, Pittsburgh, Pensylvania, U.S.A., 19:00 hours). At least two species were present, *Smittia* sp. and *Pseudosmittia* sp.. Both genera have previously been reported to feed on honeydew (Downes, 1974). Representative specimens were collected and preserved in 70% ethyl alcohol.

Dissection of several females revealed the presence of immature follicles in the ovaries. However, no fat bodies were evident in the abdominal cavity. Together, these two observations indicate these females had already oviposited the initial egg batch and were beginning to mature a second batch. Most of the females collected were in this condition. Presumably, female chironomids imbibe plant sugars to obtain the energy needed for both oogenesis of subsequent egg batches and dispersion to favorable sites for oviposition. Supportive of this, is evidence gathered during my doctoral research (Seward, 1980) which suggests the maturation of additional egg batches is a common phenomenon. Likewise, presumably, males feed to prolong their ability to produce sperm and locate potential mates.

In light of these observations and evidence previously gathered, I feel the importance of adult feeding in the Chironomidae on the reproductive functions has not been realized. For many species, the intake of plant sugars probably allows females to mature and oviposite additional egg batches and males to sustain their reproductive function.

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[1] Received August 19, 1980

[2] Department of Biological Sciences and the Pymatuning Laboratory of Ecology, University of Pittsburgh, Pittsburgh, PA 15260

DISTRIBUTION OF LEAFHOPPERS IN SUBFAMILIES CICADELLINAE AND GYPONINAE (HOMOPTERA: CICADELLIDAE) IN WEST VIRGINIA[1,2]

J.W. Begley, L. Butler[3]

ABSTRACT: A statewide survey of leafhoppers (Homoptera: Cicadellidae) conducted during 1978 and 1979, confirmed the presence of 40 species of cicadellids in the subfamilies Cicadellinae and Gyponinae. This paper represents the first systematic study of West Virginia's leafhopper fauna.

Until the present study, there have been no published surveys on leafhoppers found in West Virginia. This paper represents the first attempt to survey this state's fauna of cicadellids at the subfamily level.

The results reported herein are from a study initiated in May, 1978, with field collections made during the summers of 1978 and 1979. Sixteen species of Cicadellinae and 24 species of Gyponinae have been recorded from 45 of West Virginia's 55 counties.

The following distribution records include county, location, date collected, collector, and present disposition of the specimen(s) if other than West Virginia University.

LIST OF GENERA AND SPECIES

Subfamily CICADELLINAE

Tribe Proconiini

Genus ***Paraulacizes*** Young

P. irrorata (Fabricius): BERKELEY, Martinsburg, 5-VIII-77, PC, BOONE, Greenwood, 1-VI-79, LB. GILMER, Cedar Ck. S.P., 4-VII-77, LB. GRANT, Seneca Rocks, 12-X-75, PL. GREENBRIER, Jct. 39/Summit Lk. Rd., 14-VI-79, LB. HARDY, Rig., 4-VIII-79, LB. HARRISON, Shinnston, 20-IX-72, LM. JEFFERSON, 15-VI-79, CS. KANAWHA, Hernshaw, 7-IX-79. LB. LINCOLN, Big Ugly P.H.A., 27-VI-79. LB. LOGAN, Chapmanville, 1-VI-79. LB. MCDOWELL, Panther S.F., 22-VI-79. LB. MINGO, Laurel Ck. P.H.F.A., 14-VI-79, LB. MONONGALIA, Morgantown, 15-IX-74, MB. OHIO, Bear Rock LK., 18-IV-78, MR. PRESTON, Reedsville, 2-IX-?. POCAHONTAS, Droop Mtn.,

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[3] Division of Plant and Soil Sciences – Entomology West Virginia University, Morgantown 26506

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2-IX-?. RITCHIE, Harrisville, 29-V-79, LB. SUMMERS, Pipestem S.P., 26-VI-79, JB. TUCKER, Dolly Sods, 3-VIII-75, LB. WAYNE, Cabwaylingo S.F., 21-V-77, LB. WIRT, Elizabeth, 29-VII-?. WOOD, Mountwood Pk., 2-VII-79, LB. WYOMING, Kopperston, 1-VI-79, LB.

Genus ***Oncometopia*** Stal

O. orbona (Fabricius): GRANT, 13-VII-79, TM. GREENBRIER, Greenbrier S.F., 11-VII-76, LB. JEFFERSON, Shenandoah Jct., 9-XI-79, CS. MONONGALIA, 21-VI-?, M. PENDLETON, Brandywine Rec. Area, 23-VI-76, LB. RANDOLPH, Roaring Plains, 13-VIII-75, LB. SUMMERS, Hinton, 30-VI-?.

Genus ***Draeculacephala*** Ball

D. antica (Walker): BRAXTON, Kanawha Run/Sutton Lk., 20-VII-79, LB. BROOKE, Castleman Lk., 30-V-79, JB. DODDRIDGE, Jct. 50/18, 23-VII-79, LB. FAYETTE, Babcock S.P., 2-V-79, LB. GREENBRIER, Greenbrier S.F., 14-IV-77, LB. HANCOCK, Weirton, 30-V-79, JB. HARDY, Moorefield, 11-VI-79, JW. JEFFERSON, Bardane, 13-VII-79, HH. LINCOLN, Big Ugly P.H.A., 26-VII-79, LB. LOGAN, Chief Logan S.P., 18-V-79, LB. MARION, Colfax, 7-VI-78, JB. MARSHALL, Saint Joseph, 26-VIII-78, JB. MASON, McClintic Wildlife Sta., 1-VIII-78, LB. MCDOWELL, Panther S.F., 11-VIII-79, LB. MERCER, Dan Hale Reservoir, 10-V-78, JB. MINERAL, Larenim Pk., 9-VI-79, LB. MINGO, Laurel Ck. P.H.A., 12-VII-79, LB. MONONGALIA, Morgantown, 8-IX-77, JB. MONROE, Wayside, 16-VIII-77, JB. NICHOLAS, Birch River, 29-V-78, JB. OHIO, Short Creek, 30-V-79, JB. PRESTON, Reedsville, 22-V-78, JW. RALEIGH, Beaver, 1-VI-79, LB. RITCHIE, Jct. 50/74, 23-VII-79, LB. SUMMERS, Crumps Bottom, 1-VI-79, LB. TUCKER, Blackwater Falls, 22-V-79, JB. WAYNE, Cabwaylingo S.F., 22-VI-79, LB. WETZEL, Burton, 6-VI-78, JB. WOOD, Mountwood Pk., 29-V-79, LB.

D. mollipes (Say): BOONE, Fork Ck. P.H.A., 14-VI-78, LB. BRAXTON, Kanawha Run/Sutton Lk., 20-VII-79, LB. HARDY, Moorefield, 25-VII-79, JW. HARRISON, Bridgeport, 7-VI-79, CS. KANAWHA, Cabin Creek, 14-VI-79, LB. LINCOLN, Big Ugly P.H.A., 31-V-79, LB. MARION, Colfax, 1-VI-78, JB. MARSHALL, Saint Joseph, 26-VIII-78, JB. MCDOWELL, Panther S.F., 10-VIII-79, LB. MINGO, Laurel Ck. P.H.F.A., 11-VIII-79, LB. MONONGALIA, Morgantown, 28-V-78, JB. NICHOLAS, SUMMERSVILLE, 11-V-79, JB. POCAHONTAS, Watoga S.P., 21-VIII-78, JB. PRESTON, WVU Forest, 25-V-78, JB. RITCHIE, Harrisville, 2-VII-79, LB. SUMMERS, Crumps Bottom, 1-VI-79, LB. WAYNE, Cabwaylingo S.F., 9-VIII-79, LB. WOOD, Mountwood Pk., 2-VIII-79, LB. WYOMING, Hanover, 12-VIII-79, LB.

D. delongi Young & Davidson: DODDRIDGE, Jct. 50/18, 23-VII-79, LB. OHIO, Wheeling, 31-VIII-27, PM, NMNH. RITCHIE, Harrisville, 2-VII-79, LB.

D. producta (Walker): HARRISON, Bridgeport, 9-VI-79, CS. LEWIS, Jane Lew, 24-VI-78, JB. MASON, McClintic Wildlife Sta., 1-VIII-78, LB. MONONGALIA, Triune, 7-VI-79, LB.

D. portola Ball: BOONE, Low Gap, 2-IX-79, RS. CABELL, Milton, 21-VI-79, LB. HARDY, Moorefield, 25-VII-79, JW. HARRISON, Stonewood, 24-VI-78, JB. LEWIS, Jane Lew, 24-VI-78, JB. LINCOLN, Big Ugly P.H.A., 31-V-79, LB. MARION, Mannington, 24-IX-27, EB, NMNH. MARSHALL, Saint Joseph, 24-VI-78, JB. MERCER, Bluefield, 10-V-78, JB. MINERAL, Larenim Pk., 9-VII-79, LB. MINGO, Laurel Ck. P.H.F.A., 11-VIII-79, LB. MONONGALIA, Morgantown, 22-VIII-78, JB. POCAHONTAS, Thornwood, 26-VI-79, LB. SUMMERS, Sandstone Falls S.P., 8-IX-79, LB.

Genus ***Tylozygus*** Fieber

T. bifidus (Say): BOONE, Comfort, 27-VI-79, LB. BRAXTON, Kanawha Run/Sutton Lk., 20-VII-79, LB. DODDRIDGE, West Union, 2-VII-79, LB. GREENBRIER, Greenbrier S.F., 24-IX-77, LB. JEFFERSON, Bardane, 4-VI-79, HH. KANAWHA, Hernshaw, 7-IX-79, LB. LINCOLN, Big Ugly P.H.A., 26-VII-79, LB. LOGAN, Chief Logan S.P., 17-VIII-79, LB. MARION, Fairmont, 21-VIII-27, PM, NMNH. MARSHALL, Saint Jospeh, 26-VIII-78, JB. MASON, McClintic Wildlife Sta., 26-VIII-78, LB. MERCER, Bluefield, 14-VIII-79, JWB. MINERAL, Larenim Pk., 9-VII-79, LB. MINGO, Nolan, 22-VI-79, LB. MONONGALIA, Morgantown, 3-VII-74, LB. OHIO, Middle Creek, 6-VII-76, GL. RITCHIE, Jct. 50/74, 23-VII-79, LB. SUMMERS, Crumps Bottom, 26-VI-79, LB. TUCKER, Olson Overlook, 19-VII-79, LB. WOOD, Mountwood Pk., 2-VII-79, LB.

T. geometricus (Signoret): KANAWHA, Cabin Creek, 18-V-79, LB. LINCOLN, Big Ugly P.H.A., 26-VIII-78, LB. LOGAN, Sharples, 8-IX-79, LB. MCDOWELL, Panther S.F., 10-VIII-79, LB. MINGO, Maher, 10-VIII-79, LB. TAYLOR, Tygart Lk. S.P., 1-VI-78, JB. WAYNE, Cabwaylingo S.F., 9-VIII-79, LB.

Genus ***Plesiommata*** Provancher

P. tripunctata (Fitch): BOONE, Peytona, 14-IX-79, LB. DODDRIDGE, West Union, 2-VII-79, LB. GREENBRIER, Greenbrier S.F., 24-IX-77, LB. LINCOLN, Big Ugly P.H.A., 27-VI-79, LB. MINGO, Laurel Ck. P.H.F.A., 11-VIII-79, LB. MONONGALIA, Morgantown, 8-IX-77, JB. PRESTON, Bruceton Mills, 27-X-79, PW. SUMMERS, Crumps Bottom, 26-VI-79, LB. WAYNE, Cabwaylingo S.F., 9-VIII-79, LB. WOOD, Mountwood PK., 2-VII-79, LB.

Genus ***Helochara*** Fitch

H. communis Fitch: BROOKE, Castleman Run Lk., 18-IV-79, MR. GREENBRIER, Greenbrier S.F., 30-VII-79, LB. HARDY, Moorefield, 5-VIII-77, LB. LEWIS, Jane Lew, 24-VI-78, JB. MARION, Colfax, 1-VI-78, JB. MONONGALIA, Harris Lk., 22-V-78, JB. OHIO, Bear Rock Lk., 18-IV-79, MR. PRESTON, WVU Forest, 25-V-78, JB.

Genus ***Sibovia*** China

S. occatoria (Say): BOONE, Peytona, 17-VIII-79, LB. WAYNE, Cabwaylingo S.F., 9-VIII-79, LB.

Genus ***Amphigonalia*** Young

A. gothica (Signoret): FAYETTE, Babcock S.P., 10-VII-79, LB.MARSHALL, Saint Joseph, 26-VIII-78, JB. MINERAL, Larenim Pk., 3-VIII-79, LB. MINGO, Laurel Ck. P.H.F.A., 11-VIII-79, LB. MONONGALIA, Harris Lk., 14-IX-77, JB. OHIO, Short Creek, 20-V-79, JB. PRESTON, Terra Alta, 17-IX-77, NB. PUTNAM, Winfield, 21-VI-79, LB. RALEIGH, Beckley, 16-VI-78, DR. TUCKER, Blackwater Falls, 22-V-79, JB. WETZEL, Littleton, 30-V-79, JB.

Genus ***Graphocephala*** Van Duzee

G. coccinea (Forster): BERKELEY, Inwood, 21-VI-78, JW. BOONE, Peytona, 7-IX-78, LB. CABELL, Milton, 21-VI-79, LB. DODDRIDGE West Union, 2-VII-79, LB. FAYETTE, Babcock S.P., 8-IX-78, LB. GRANT, Smoke Hole, 8-VII-79, LB. GREENBRIER, White Sulphur Springs, 9-VII-40, WR, NMNH. JEFFERSON, KEARNEYSVILLE, 7-VIII-55, KK. KANAWHA, Cabin Creek, 14-VI-79, LB. LEWIS, Jane Lew, 24-V-78, JB. LOGAN, Mallory, 13-VI-79, LB. MARION, Fairmont, 6-VI-77, TM. MCDOWELL, Panther S.F., 10-IX-77, LB. MERCER, Bluefield, 3-VII-77, JB. MINGO, Laurel Ck. P.H.F.A., 14-VI-79, LB. MONONGALIA, Morgantown, 10-VII-74, LB. PENDLETON, North Fork Mtn., 8-VII-79, LB. POCAHONTAS, Watoga S.P., 21-VIII-78, JB. PRESTON, 18-VIII-76, LB. PUTNAM, Winfield, 21-VI-79, LB. RALEIGH, Lk. Stevens, 23-VI-79, LB. RITCHIE, Harrisville, 2-VII-79, LB. SUMMERS, Crumps Bottom, 26-VI-79, LB. TUCKER, Olson Overlook, 19-VII-79, LB. WAYNE, Cabwaylingo S.F., 10-IX-77, LB. WOOD, Parkersburg, 18-VI-75, TM. WYOMING, Glen Fork, 13-VI-79, LB.

G. versuta (Say): BOONE, Sylvester, 14-VI-79, LB. BRAXTON Kanawha Run/Sutton Lk., 20-VII-79, LB. DODDRIDGE, Jct. 50/18, 23-VII-79, LB. KANAWHA, Cabin Creek, 18-V-79, LB. LINCOLN, Big Ugly P.H.A., 26-VII-79, LB. LOGAN, Chapmanville, 1-VI-79, LB. MARSHALL, Moundsville, 9-VIII-75, GL. MCDOWELL, Panther S.F., 22-VI-79, LB. MINGO, Laurel Ck. P.H.F.A., 12-VII-79, LB. MONONGALIA, Harris Lk., 14-IX-77, JB. RALEIGH, Lk. Stevens, 8-IX-79, LB. RITCHIE, Jct. 50/74, 23-VII-79, LB. SUMMERS, Crumps Bottom, 1-VI-79, LB. WAYNE, Crum, 22-VI-79, LB. WOOD, Mountwood Pk., 2-VII-79, LB. WYOMING, Hanover, 10-VIII-79, LB.

Subfamily GYPONINAE

Genus ***Rugosana*** DeLong
R. querci DeLong: FAYETTE, Babcock S.P., 8-IX-78, LB. JEFFERSON Bardane, 23-VII-79, HH. MERCER, Bluefield, 14-IX-79, JWB.

Genus ***Gyponana*** Ball
G. scrupulosa (Spang.): MERCER, Bluefield, 9-VIII-79, JWB.

G. palma DeLong: HARRISON, East View, 12-VII-79, CS. MCDOWELL, Panther S.F., 22-VI-)79, LB. MERCER, Bluefield, 13-VI-79, JWB.

G. contractura DeLong: WAYNE, Garretts Ck., 21-VI-79, LB.

G. ortha DeLong: BOONE: Low Gap, 2-IX-79, RS. LOGAN, McConnel, 13-VI-79, LB. MINGO, Laurel Ck. P.H.F.A., 12-VII-79, LB. WAYNE, Cabwaylingo S.F., 9-VIII-79, LB.

G. conspira DeLong: LINCOLN, Big Ugly P.H.A., 26-VIII-78, LB.

G. amara DeLong: MINGO, Nolan, 22-VI-79, LB.

G. parallela DeLong: MINGO, Laurel Ck. P.H.F.A., 14-VI-79, LB.

G. extenda DeLong: MERCER, Bluefield, 7-IX-79, JWB. MONONGALIA, Triune, 1-IX-79, LB. WOOD, Mountwood Pk., 21-VIII-79, LB.

G. morosita DeLong: JEFFERSON, Bardane, 11-V-79, HH. WAYNE, Cabwaylingo S.F., 9-VIII-79, LB.

G. turbina DeLong: FAYETTE, Babcock S.P., 7-VIII-79, LB. JEFFERSON, Bardane, 23-VII-79, HH. MCDOWELL, Panther S.F., 11-VIII-79, LB. MERCER, Bluefield, 9-VIII-79, JWB. WOOD, Mountwood Pk., 21-VIII-79, LB.

G. fagi DeLong: MCDOWELL, Panther S.F., 11-VIII-79, LB. MINGO, Nolan, 22-VI-79, LB.

G. gladia DeLong: MONONGALIA, Triune, 17-VII-79, LB. WAYNE, Cabwaylingo, S.F., 22-VI-79, LB.

G. tenella (Spang.): LINCOLN, Big Ugly P.H.A., 26-VIII-78, LB.

G. pingua DeLong: MCDOWELL, Panther S.F., 11-VIII-79, LB.

G. pingua DeLong: MCDOWELL, Panther S.F., 11-VIIi-79, LB.

Genus ***Gypona*** Germar
G. melanota Spangberg: MONONGALIA, Morgantown, 28-VIII-73, RP.

Genus ***Penthimia*** Germar
P. americana Fitch: HANCOCK, Weirton, 30-V-79, JB. POCAHONTAS, Tea Creek Campground, 9-VIII-76, LB.

Genus ***Ponana*** Ball
P. scarlatina (Fitch): MORGAN, Cacapon S.P., 16-VII-79, LB.

P. puncticollis (Spangberg): TAYLOR, Tygart Lk., 1-VI-78, JB.

P. limbatipennis (Spangberg): WETZEL, Lewis Wetzel P.H.A., 3-VII-78, LB.

P. limonea Ball & Reeves: GRANT, Mt. Storm, 4-VI-78, LB. MONONGALIA, Morgantown, 10-VII-74, LB.

P. pectoralis (Spang.): LINCOLN, Big Ugly P.H.A., 31-V-79, LB. MONONGALIA, Triune, 2-VI-79, LB.

P. aenea DeLong: FAYETTE, Babcock S.P., 10-VII-79, LB. WEBSTER, Big Ditch Lk., 13-VI-79, LB.

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Swope, Ronny	RS
Wagner, William	WW
Wales, Paul	PW
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ADULT LIMNEPHILID CADDISFLY RECORDS IN WEST VIRGINIA (TRICHOPTERA: LIMNEPHILIDAE)[1]

Donald C. Tarter, Paul L. Hill[2]

ABSTRACT: This study presents five state records and 46 county records of limnephilid caddisflies of West Virginia. State records include *Frenesia difficilis* Walker, *Limnephilus ornatus* Banks, *L. rhombicus* (Linnaeus), *Neophylax aniqua* Ross and *N. wigginsi* Sykora and Weaver. A total of 30 limnephilids are known from West Virginia.

Hill and Tarter (1978) recorded 24 species of the family Limnephilidae for West Virginia. Other papers that include limnephilid records are reported by Ross (1944, 1962), Betten (1950), Hill et al. (1977) and Tarter and Hill (1979). Examination of adult caddisflies from black light traps of the West Virginia Department of Agriculture (WVDA), West Virginia University students (WVU) and Marshall University students (MU) have provided 5 state and 46 county records. Thirty species of limnephilid caddisflies are known from West Virginia.

Family Limnephilidae

*1. *Frenesia difficilis* Walker
Monongalia Co., Triune, 23-IX-79, 13 males (WVU); Randolph Co., Red Creek, 1-V-79, 1 male (MU).

**2. *Georita betteni* Ross
Pocahontas Co., Three Falls of Hills Creek (MU).

**3. *Hydatophylax argus* (Harris)
Fayette Co., Babcock State Park (WVU); Jefferson Co., Batdane (WVDA); Randolph Co., Valley Bend (WVDA).

**4. *Ironoquia kaskaskia* (Ross)
Wayne Co., Dickson Dam (MU).

**5. *I. punctatissmus* (Walker)
Harrison Co., East View (MU); Wayne Co., Dickson Dam (MU).

**6. *Limnephilus indivisus* Walker
Braxton Co., Sutton Lake (WVU)

*State Records
**County Records

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[1] Received August 13, 1980

[2] Department of Biological Sciences, Marshall University, Huntington, WV 25701

**7. *L. moestus* Banks
Preston Co., Cranesville Bog (WVU).

*8. *L. ornatus* Banks
Monroe Co., Hollywood, 25-VI-79, 1 male (WVU); Putnam Co., Hurricane, 18-VII-79, 1 female (WVDA).

*9. *L. rhombicus* (Linnaeus)
Jefferson Co., Sheperdstown, 16-V-79, 2 males, 1 female (WVDA).

**10. *L. submonilifer* Walker
Lincoln Co., Ugly Creek (MU); Preston Co., Cranesville Bog (WVU).

**11. *Nemotaulis hostilis* (Hagen)
Randolph Co., Valley Bend (WVDA); Tucker Co., Olson Overlook (WVU).

*12. *Neophylax aniqua* Ross
Randolph Co., Valley Bend, 27-IX-77, 1 female (WVDA).

**13. *N. consimilis* Betten
Lincoln Co., Big Ugly (WVU)

*14. *N. wigginsi* Sykora and Weaver
Randolph Co., Valley Bend, 27-IX-77, 2 males (WVDA).

**15. *Platycentropus radiatus* (Say)
Mineral Co., Burlington (WVU); Monongalia Co., Triune (WVU); Preston Co., Cranesville Bog (WVU); Summers Co., Bluestone Reservoir (WVU).

**16. *Pseudostenophylax sparsus* (Banks)
Harrison Co., Bridgeport (WVU); Jefferson Co., Batdane (WVU); Monongalia Co., Triune (WVU); Preston Co., Cranesville Bog (WVU); Putnam Co., Hurricane (MU); Wood Co., Mountwood (WVU).

**17. *P. uniformis* (Betten)
Fayette Co., Babcock State Park (WVU); Monongalia Co., Triune (WVU).

**18. *Pycnopsyche divergens* (Walker)
Webster Co., Cranberry River (MU).

**19. *P. gentilis* (McLachlan)
Lincoln Co., Big Ugly Creek (MU); Monroe Co., Hollywood (WVDA); Pendleton Co., Spruce Knob Lake (MU); Preston Co., Cranesville Bog (WVU); Raleigh Co., Beckley (WVDA); Wetzel Co., Fish Creek (MU).

**20. *P. guttifer* (Walker)
Monroe Co., Hollywood (WVDA); Randolph Co., Valley Bend (WVDA).

**21. *P. lepida* (Hagen)
Lincoln Co., Big Ugly (WVU); Raleigh Co., Beckley (WVDA).

**22. *P. luculenta* (Betten)
Braxton Co., Two-Lick Run (MU); Pendleton Co., Spruce Knob Lake (MU); Preston Co., Cranesville Bog (WVU); Raleigh Co., Beckley (WVDA).

**23. *P. scabripennis* (Rambur)
Lincoln Co., Big Ugly (WVU); Monongalia Co., Triune (WVU); Preston Co., Cranesville Bog (WVDA).

**24. *P. subfasciata* (Say)
Lincoln Co., Big Ugly Creek (MU).

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NOTICE

PERIOD OF REDUCED SERVICE – DEPT. OF ENTOMOLOGY, ROYAL ONTARIO MUSEUM

As part of the renovation and expansion program of the Royal Ontario Museum, the Department of Entomology will be moved next year to improved facilities. During the period Jan. 1 to July 1 of 1981, however, we regret that we will be unable to honour requests for loans of specimen material or to accommodate visiting scholars wishing to examine the Research Collection of Arthropods. For further information, write D.W. Barr or G.B. Wiggins, Department of Entomology, Royal Ontario Museum, 100 Queen's Park, Toronto, Ontario, Canada M5S 2C6.

ABERRANT OVIPOSITION BY THE CADDISFLY *TRIAENODES TARDUS* MILNE (TRICHOPTERA: LEPTOCERIDAE)[1]

David A. Belluck[2], Barbara A. Pennington[3], and John D. Unzicker[4]

ABSTRACT: Gravid females of the caddisfly *Triaenodes tardus* Milne were attracted to an ultraviolet light at ponds in Urbana, Illinois in the summer of 1979. During the three month study, females deposited large numbers of egg masses upon a yellow car which was reflecting light from the ultraviolet source. The authors suggest that aberrant oviposition by *T. tardus* on the automobile may be a combination of reflected light and surface texture.

Gravid females of the caddisfly *Triaenodes tardus* Banks were attracted by an ultraviolet light and captured within 90 minutes of the onset of dusk from 3 June through 31 August 1979 at ponds in Urbana, Illinois. The ultraviolet light (Wards blacklight insect trap with an 8-watt bulb) was positioned .6 m above ground level directly in front of a yellow sheet draped over a yellow car, approximately 10 m from the nearest pond.

Eggs within females were visible clearly through the abdominal wall. Many had doughnut-shaped egg masses partially extruded from the posterior end of their abdomens. Within a few minutes of alighting upon a "suitable surface," (in this case an automobile) a female would release and cement an egg mass to the substrate. Females with protruding egg masses oviposited almost immediately after landing. Normally, female caddisflies oviposit close to or directly upon the surface of the water or underwater, thus placing their egg masses near or in suitable larval habitat.

Aberrant oviposition occurred most frequently when *T. tardus* was exposed to ultraviolet light. Surfaces in the area upon which *T. tardus* were copulating (including the walls of a building located approximately 20 m from the nearest pond) bore only a few egg masses if there was no ultraviolet light, whereas great numbers of egg masses occurred upon the body of the yellow car in the presence of an ultraviolet light.

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[1] Received June 6, 1980

[2] Department of Entomology, University of Illinois and Illinois Natural History Survey, Urbana, Illinois 61801

[3] University of Illinois, Urbana, Illinois 61801

[4] Section Faunistic Surveys and Insect Identification, Illinois Natural History, Survey, Urbana, Illinois 61801

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Although some caddisfly egg masses can withstand comparatively long periods of exposure to the atmosphere (Wiggins 1973), our observations indicate that *T. tardus* egg masses become dessicated within 10 to 15 min. after oviposition. Thus, aberrant oviposition of *T. tardus* egg masses leads to certain death for the developing embryos. We believe that the attraction of the gravid female of *T. tardus* to the automobile for oviposition might be a combination of reflected light and surface texture. During the 3 mo. period this study was conducted, no female oviposited upon the yellow sheet placed on the car, although the sheet was reflecting light from the same ultraviolet source.

Observations of insects attracted to objects with reflective surfaces during the day have been reported frequently in the literature. Kennedy (1938), Neville (1960), and Neck (1976) reported female dragonflies [*Anax junius* (Drury), *Pantala flavescens* (Fabricius), and *Belonia croceipennis* (Selys) (as *Libellua*), respectively] being attracted to reflective automobile surfaces such as the windshield or roof. Schaefer and Schaefer (1979) reported corixids (*Hesperocorixa laevigata* (Uhler)) attracted to a blue automobile roof. Fattig (1932) described several thousand corixids (*Hesperocorixa nitida* Fieber) descending upon the bright roof of a new automobile. In a personal communication to Schaefer and Schaefer (1979), R. Pupedis told of several species of mayflies swarming over automobile roofs in Connecticut.

Last (1976) and Benham (1976) noted that the hydrophilid beetle *Helophorus brevipalpis* Bedel was attracted to automobile roofs. Riegel (1963) reported the dytiscid beetle *Laccophilus fasciatus* Aubé attracted to storm windows placed horizontally. Leech (1938) observed *Agabus verisimilis* Brown as well as certain other genera of Dytiscidae and some Hydrophilidae landing on the shining surface of a car or the freshly painted roof of a house. Leng (1913) also noted that Dytiscidae have been reported being attracted to glass on a greenhouse.

Data from the literature suggest that aquatic insects commonly mistake the highly reflective surfaces of objects, such as automobiles, for aquatic habitats. Our observations demonstrate that ultraviolet light reflected from an automobile surface at night is sufficient to cause aberrant oviposition by *T. tardus.*

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NOTICE

The U.S. Dep't of Agriculture, in cooperation with the International Programs and Studies Office of the National Association of State Universities and Land Grant Colleges, is undertaking a special personnel-location project for the benefit of technical cooperation programs in Arabic-speaking countries. The objective is to develop a working file of qualified personnel who might be available to serve as consultants, either in the U.S., or on short or long assignments in these countries.

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Any individuals who may be qualified and interested are urged to write to Afif I. Tannous, Project Consultant, Nat'l. Assoc. of State Universities & Land Grant Colleges, 1 Dupont Circle, N.W., Washington, D.C. 20036, for further information and application form.

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