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PUBLICATION DATES

The President and Governing Board of the Michigan Entomological Society announce the appointment of Ronald S. Wilkinson, F.L.S., F.R.E.S., as Editor of *The Michigan Entomologist*, beginning with the present issue. The sincere gratitude of the Board is due to the retiring Editor, Julian P. Donahue, F.R.E.S., for his efforts in the conception and founding of the journal. Mr. Donahue will continue as Executive Secretary of the Society and Editor of the *Newsletter*.

The Michigan Entomological Society traces its origins to the old Detroit Entomological Society and was organized on 4 November 1954 to "...promote the science of entomology in all its branches and by all feasible means, and to advance cooperation and good fellowship among persons interested in entomology." The Society attempts to facilitate the exchange of ideas and information in both amateur and professional circles, and encourages the study of insects by youth. Membership in the Society, which serves the North Central States and adjacent Canada, is open to all persons interested in entomology. There are three paying classes of membership:

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Dues are paid on a calendar year basis (Jan. 1 - Dec. 31).

Memberships accepted before July 1 shall begin on the preceding January 1; memberships accepted at a later date shall begin the following January 1 unless the earlier date is requested and the required dues are paid. All members in good standing receive the *Newsletter* of the Society, published quarterly. All Active and Sustaining Members (but NOT Student Members) receive issues of *The Michigan Entomologist* published during the calendar year of their membership. Only Active and Sustaining Members may vote in Society affairs.

All dues and contributions to the Society are deductible for Federal income tax purposes.

**SUBSCRIPTION INFORMATION**

Institutions and organizations, as well as individuals not desiring the benefits of membership, may subscribe to *The Michigan Entomologist* at the rate of $6.00 per volume. The first volume will consist of 10 numbers; each number will be at least 32 pages in length. Subscriptions are accepted only on a volume (10 issue) basis. There are no annual subscriptions. Single copies of *The Michigan Entomologist* are available at $0.75 each, with a 20% discount for 25 or more copies sent to a single address.

Inquiries about back numbers, subscriptions and Society business should be directed to the Executive Secretary, Julian P. Donahue, Department of Entomology, Michigan State University, East Lansing, Michigan 48823. Manuscripts and related correspondence should be directed to the Editor (see inside back cover).
A REVIEW OF THE NORTH AMERICAN SPECIES OF THE GENUS
OTITES LATREILLE, WITH DESCRIPTIONS OF TWO NEW SPECIES
(DIPTERA: OTITIDAE)

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In 1961 (Steyskal, 1961), I placed the genus Otites in a key to the North American genera of Otitidae and indicated the synonymy of the genus Ortilimyia. Bibliography and synonymy of the hitherto known species of our area will be found in the Catalog of the Diptera of America North of Mexico (Stone et al., 1965). The only previously published key to our species was by Hendel (1911, as Ortilis), wherein were included Ceroxys latiusculus (Loew) and the four species now known as Otites bimaculatus (Hendel), O. erythrocephala (Hendel), O. pyrrhocephala (Loew), and O. stigma (Hendel). The present treatment excludes Ceroxys but includes O. snowi (Cresson) and two new species here described as O. erythrosceles and O. michiganus, making a total of seven species.

The species form two rather distinct groups based on the width of the fronto-orbital pruinosity and the nature of the closure of the anal cell of the wing, as set forth in the following key. However, O. stigma (Hendel), while referable to the second group, shows characters indicating rapprochement to the first group.

The generic name, although not found in large Greek lexicons, is of a form that corresponds to a rather large class of Greek nouns ending in -ites (ποιητῆς, ἀνήρ, θεότης, πολῖτης). As these words are all of masculine gender, it seems reasonable, in the absence of other decisive evidence, to treat Otites as masculine.

KEY TO THE NORTH AMERICAN SPECIES OF OTITES LATREILLE

1 (6) Frontal orbits broadly white pruinose, pruinosity surrounding several hairs for whole length of front; scutellum bare or hairy on disc; mesonotum nearly shining to heavily pruinose; anal cell with small point in lower corner extending slightly farther apicad than median arcuation of anal crossvein; legs largely black.

2 (3) Disc of scutellum with many hairs, especially toward base; legs with only knees reddish; wings with distinct subbasal brown band
from tip of costal cell to base of discal cell and also some brownish coloration about end of 1st vein; apical wing spot confined to tip of 2nd vein; mesonotum moderately and evenly grayish pruinose. O. bimaculatus (Hendel)

3 (2) Disc of scutellum usually bare, if with several hairs, wing pattern different; legs with knees and mid-basitarsus reddish.

4 (5) Wings hyaline, marked as in O. bimaculatus, but lower part of apical spot rather diffuse and extending into area about tip of 3rd vein; denser pruinosity of mesonotum (viewed from rear) usually concentrated into 3 longitudinal strips in presutural area. O. michiganus, n. sp.

5 (4) Wings whitish, subbasal and apical markings very faint or lacking; mesonotum quite heavily whitish to ochreous pruinose. O. snowi (Cresson)

6 (1) Front with very narrow white pruinose orbital margins not surrounding more than a few hairs (anteriorly); scutellum bare or with a few discal hairs; mesonotum largely shining; anal cell with minute lower point not extending farther apicad than does median arcuation of anal crossvein; legs sometimes largely reddish.

7 (8) Head with occiput, upper parafrontals, antennal grooves, and oral margin blackish; mesonotum lightly and diffusely pruinose; apical wing spot extending well into tip of marginal cell; subbasal wing mark hardly developed; pruinosity of frontal orbits anteriorly sometimes involving bases of a few hairs. O. stigma (Hendel)

8 (7) Head nearly wholly reddish; mesonotum wholly subshining or with pruinose longitudinal stripes; apical wing spot various; subbasal mark sometimes developed; pruinosity of frontal orbits not involving bases of hairs.

9 (10) Legs nearly wholly reddish; mesonotum dully shining; scutellum with a few discal hairs; apical wing spot large and diffuse, extending well into tip of marginal cell; dorsum of abdomen shining. O. erythrosceles, n. sp.

10 (9) Legs largely black; mesonotum subshining or with pruinose longitudinal stripes; scutellum bare; apical wing spot extending no more than slightly into tip of marginal cell; dorsum of abdomen shining or dull.

11(12) Legs wholly black; mesonotum with 3 narrow longitudinal pruinose stripes; abdomen practically polished; subbasal wing mark distinct in tip of costal cell and across bases of 2nd and 3rd veins; apical wing spot extending slightly into tip of marginal cell. O. pyrrhocephala (Loew)

12(11) Knees and mid-basitarsus reddish; mesonotum subshining, without pruinosity; dorsum of abdomen dulled with very fine but dense shagreening; subbasal wing mark indistinct or lacking; apical spot confined to tips of submarginal and 1st posterior cells. O. erythrosceles (Hendel)
First Group

*Otites bimaculatus* (Hendel)

In addition to the characters cited in the key, the male postabdomen is very similar to that figured by me (Steyskal, 1961, figure 4) for *Idana marginata* (Say), but the mesal side of the surstylus at its base bears three strong simple teeth spaced the diameter of their bases apart and the epiphallus (posterior to base of aedeagus) consists of a pair of short but rather narrow processes, the tips of which are turned sharply laterad and end in a sharp point.

The type of *O. bimaculatus* is from Southern Colorado; that of the synonym *carboma* Cresson from Carbon County, Wyoming, and that of *longicauda* Hendel from Wells, Elko Co., Nevada. I have examined material from the following localities: Colorado (Florissant, Teller Co.); Wyoming (Carbon Co., type of *carboma*; Lyman, Uintah Co.; Yellowstone Park); Utah (St. George, Washington Co.; Salt Lake City, Salt Lake Co.); Washington (Sprague, Lincoln Co.); Oregon, (Wheeler Co.; Worden, Klamath Co.); Nevada (Red House Ranch, Eureka Co.; Wells, Elko Co.; Winnemucca, Humboldt Co.); California (Big Pine, Inyo Co.; Hallelujah Jct., Spauldings, and Susanville, Lassen Co.; Tule Lake district and Goose Lake, Modoc Co.; Fales Hot Springs, Mono Co.; 4 mi. west of Quincy, Plumas Co.); Manitoba (Baldur; Stony Mountain).

*Otites michiganus*, new species

*Male.* Length of wing. 5.5 - 6.0 mm.

Head largely orange or reddish, only proboscis, large areas on upper occiput next to eyes, ocellar triangle, upper parafrontals, and sometimes clypeus blackish. Third antennal segment obovate to a little reniform (dorsal margin concave), 1.6 - 1.75 times as long as wide, apical two-thirds to three-fourths often strongly infuscated; arista 2.2 times as long as third segment.

Thorax black. Mesonotum covered with rather thin grayish pruinosity when viewed from rear, with three longitudinal stripes of denser pruinosity; hairs black, rather short and reclinate.

Legs black, only knees narrowly and mid-basitarsus, except tip, reddish.

Wings slightly infumated, nearly hyaline, with brown markings as follows: Humeral cell and small basal part of costal cell; subbasal marking consisting of apical one-third of costal cell and contiguous area tapering and fading out into base of discal cell; antero-apical spot extending basad two-thirds of distance from wing tip to posterior crossvein (thereby well into tip of marginal cell), basal margin irregularly transverse, darkest anteriorly and fading out in first posterior cell; halter and squamae pale yellowish.

Abdomen shining black, with sparse and very fine microsetae, distinctly but lightly pruinose only close to base. Postabdomen very similar
to that of *O. bimaculatus*, but base of mesal side of surstylus with three closely spaced simple strong teeth and farther mesad a few strong setae; epiphallus (posterior to base of aedeagus) consisting of a closely adjacent pair of short, parallel-sided, obtusely tipped processes.

**Female.** Length of wing, 5.6 - 6.2 mm.; ovipositor with fine wavy crossbands of light pruinosity; otherwise similar to male.


*Otites snowi* (Cresson)

As this species is very similar to poorly colored specimens of the foregoing species, I examined the postabdomen of a male of *O. snowi* for comparison with the others in this group. There are five strong but rather short teeth mesobasally on the surstylus, rather closely spaced, and the epiphallus consists of a pair of short, acutely triangular processes.

The type of *O. snowi* is from Hamilton County, Kansas. I have examined material from the following localities: Kansas (Clark Co.; Hamilton Co., metatopotype); Nebraska (Mitchell, Scotts Bluff Co.); Utah (Hanks-ville, Wayne Co.); New Mexico (Las Cruces, Dona Ana Co.); s.w. Santa Fe, Santa Fe Co.; Socorro, Socorro Co.); California (Needles, San Bernardino Co.).

**Second Group**

*Otites erythrocephala* (Hendel)

This is apparently a rare species in our area. I have seen only a toptype from Pine Lake (San Bernardino Co.), California, and several specimens collected by A. L. Melander "Up Sta. Ana River [San Bern-ardino Co.], Calif."
Otites erythrosceles, new species

Male. Length of wing 4.2 - 5.2 mm.
Head largely orange or reddish, only proboscis, ocellar triangle, large areas on upper occiput next to eyes, and sometimes antennal grooves blackish. Antenna with third segment sometimes weakly infuscated apically; third segment obovate to somewhat reniform (dorsal margin concave), 1.4 - 1.6 times as long as broad; arista three times as long as third segment.
Thorax black, only lower edge of humerus, propleuron, and small area above fore coxa reddish. Mesonotum shining, covered with rather long, nearly erect black hairs.
Legs reddish, only apical half of fore tibia, apical four segments of middle tarsus, and nearly all of other tarsi dark brown to blackish.
Wings yellowish hyaline, only marking consisting of brown anterio-apical spot extending basad two-thirds of distance from wing tip to posterior crossvein (thereby well into tip of marginal cell), basal margin irregularly transverse, darkest anteriorly and fading out in middle of first posterior cell.
Abdomen shining black, sometimes a little brownish near base.
Female. Length of wing, 4.7 - 5.7 mm.; otherwise similar to male.
Types. Holotype ♂ and allotype ♀ in copula on one pin, two pairs of paratypes, Wells, Elko Co., Nevada, June 24, 1927 (J. M. Aldrich); 2♂ 1♀ same locality, July 12, 1911 (J. M. Aldrich); one pair in copula, Bridgeport, Mono Co., California, July 18, 1936 (G. E. and R. M. Bohart); no. 57888 in U.S. Natl. Mus.
The relationships of this species may be gleaned from the key.

Otites pyrrhocephala (Loew)
Although O. pyrrhocephala (Loew) was the first species described from North America in 1876 and has often been mistakenly identified with other species, the only specimens I have seen are one each from Blairsden, Plumas Co., Calif.; Jamesburg, Monterey Co., Calif.; 4 mi. west of Quincy, Plumas Co., Calif.; and Ormsby Co., Nevada. The type is from "California;" I have not seen it.

Otites stigma (Hendel)
Cotypes of this species are from "Colo." and Erwin, Kingsbury Co., South Dakota. I have seen material from the following localities: Nebraska (Sheridan Co.); Minnesota (Crookston, Polk Co.); North Dakota (Bismarck, Burleigh Co.; Beach, Golden Valley Co.; Edgeley, LaMoure Co.; Grafton, Walsh Co.; Lake Metigoshe, Turtle Mountains, Bottineau Co.; Tower City, Cass Co.); Colorado ("Colo."); Platte Canyon, Park Co.); Wyoming (Lander, Fremont Co.; Laramie, Albany Co.; Lyman, Uintah Co.; Sheridan, Sheridan Co.); Washington (Kamiah Butte, Whitman Co.); Manitoba (Aweme; Deloraine; Douglas Lake; Treesbank;
Winnipeg); Alberta (Lethbridge; Medicine Hat; St. Paul); Saskatchewan (Abernethy; Bestville; Dundurn; Indian Head; Pheasant Creek; Radisson; Rutland).

LITERATURE CITED


We note with regret that the Brooklyn Entomological Society has suspended publication of the Bulletin "indefinitely" after issuing the volumes for 1964-65 in June, 1966. The historic Bulletin has been a major force in American entomology for eighty-seven years, and all those interested in the history of our subject will lament its absence. We hope that the Society will soon resuscitate the Bulletin, and continue a tradition that should not be allowed to end.

R.S.W.
SOME NOTES ON HETEROPTERAN TRICHObothRIA*

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There has been much recent interest in the comparative morphology of the Heteroptera. This work has emphasized the land bugs, or Geocorisae, and has been concerned with working out the relationships and taxonomic placement of the higher categories (categories above the genus), and with the phylogenetic lines and sequences of these higher categories. The geocorisine groups with which I have been most concerned are in the closely related superfamilies Lygaeoidea, Pyrrhocoroidea, and Coreoidea (see Schaefer, 1964, for a discussion of the relationships among these groups). Another superfamily, the Pentatomoidea, is less closely related. All four of these superfamilies have arolia and pseudarolia, and all four have trichobothria. Because they possess this last character in common, the four are grouped together under the name Heteroptera Trichophora (Tullgren, 1918), a name of no nomenclatorial standing but nevertheless convenient.

Trichobothria are long hairs arising from often darkened sockets on the relatively bald abdominal venter. They are usually easy to distinguish from other hairs, because they are longer, have a darkened base, and are arranged symmetrically in a distinctive pattern on each segment.

These patterns and the number of trichobothria in them are characteristic of the higher categories of the Trichophora. Since the trichophoran families are closely related, and since this close relationship has been established on evidence from other morphological features than trichobothria, one might look for phylogenetic significance in the variety of patterns. However, very little is known about the function and phylogenetic origin of trichobothria. I shall speculate here on their function and their phylogenetic significance, but more must be learned about trichobothria before speculation becomes knowledge.

The ventral position of trichobothria supports the idea that they are tactile, telling the insect something about the substrate over which it is moving. Another possibility is that they aid in flight, by detecting changes in the force and direction of air currents. However, many of their possessors fly only rarely and clumsily; others do not fly at all, and there is no correlation between presence of trichobothria and brachyptery, as there is, for example, between the absence of ocelli and brachyptery.

*A shorter version of this paper was read at the annual meeting of the Entomological Society of America, December, 1965.

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Several people, most recently Leston and Pringle (1964), have suggested that trichobothria are sound-receptors. Some objections can be raised to this idea, but they may not be valid. One objection is that all members of the Trichophora have trichobothria, although sometimes few in number; yet only in relatively few trichophorans have sound-producing structures been discovered. There are two possible answers to this objection. First, stridulatory devices have been found in many heteropterans heretofore thought to lack them. Second, the sounds may be produced not by special mechanisms but by the impact of some part of the body against the substrate (Haskell, 1961). This latter method might explain why trichobothria are ventral. If they were designed to receive airborne sounds, one would expect them to be dorsal, particularly in these rarely flying insects.

Another objection to the idea that trichobothria are sound-receptors is the presence of stridulatory devices in heteropterans lacking trichobothria (non-trichophorans). This objection too is not wholly valid. Some of the Aradidae and Reduvioidae have stridulatory devices and appear to lack trichobothria. However, trichobothria have been found by Stys (1964, in epist.) in some reduviids, and trichobothria will perhaps be found in others. Moreover, it is possible that various setae, not externally modified to appear as trichobothria, may function as sound-receptors. There is no doubt that a great many land Heteroptera produce sounds, but as far as I am aware no "hearing" mechanism has been discovered, unless it be the trichobothria.

Leston and Pringle (1964) hypothesize that trichobothria receive species-specific sounds and thereby prevent hybridization of closely related species. This seems unlikely as the sole purpose of these sounds and their reception, for trichobothria are found in immature as well as adult trichophorans. Nevertheless, I know of no immature terrestrial trichophoran that produces sound, and indeed many sound-producing structures are associated with adult features (like wings); perhaps, then, trichobothria serve different functions in nymphs and adults. If so, adult sound might well have a courting function and serve also as an isolating device.

Whatever their function—and sound-reception seems the most likely one—the symmetrical arrangement of trichobothria is certainly of functional significance. The symmetry implies directionality. It implies, that is, an ability of the insect to tell the direction from which the stimulus is arriving. This of course would be highly useful in sound reception; it would be necessary for detecting air currents; and the symmetry would even be useful if trichobothria are devices for the exploration of the substrate, since it would allow better judging of gradients of humidity, chemicals, etc. This attribute of directionality does not distinguish between possible functions.

Closely controlled behavioral and electrophysiological experiments are needed before one can do more than speculate on the function(s) of trichobothria.
The patterns of trichobothria on the abdominal venter are quite constant at the higher taxonomic levels. The Pentatomoida (Figs. 7-8) have two trichobothria laterally on sterna three through seven. In members of the lygaeoid-pyrhocoroid-coreoid complex (Figs. 1-4), there are usually three trichobothria on segments three through six, and two on the seventh. In addition, the clusters on segments three and four are medial, while the remainder are lateral, near the spiracle. The important differences in members of this complex are in the arrangement of trichobothria, and the arrangement of the clusters relative to the spiracle. (Spiracles are usually ventral in the Trichophora. Occasionally some are dorsal, as in the Slaterellinae, but the phylogenetic significance of this is not clear.)

Figure 5 shows the trichobothrial pattern of *Idiostolus*. This and the genus *Triseus* were placed in a separate subfamily (Idiostolinae) of the Lygaeidae by Scudder in 1962; in 1964 Stys raised them to a superfamily, primarily on the basis of their trichobothrial numbers and patterns. In a recently completed morphological study, I have taken a middle view and have placed the two genera in a family, Idiostolidae, in the superfamily Lygaeoidea (Schaefer, 1966). *Idiostolus* shows some very advanced morphological features and some very generalized (or primitive) ones, among which is the trichobothrial number.

All trichophorans with fewer than the usual number of trichobothria are advanced with respect to many other morphological characters. It is reasonable, then, if far from conclusive, that the large number of

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Figures 1-8. Trichobothrial patterns of representative Heteroptera Trichophora. The diagrams (adopted from Scudder, 1963) represent the left side of abdominal sterna II through VII. The left-hand border of each diagram represents the ventral midline of the abdomen. The diagrams are not to scale.

Symbols: x = trichobothrium; o = spiracle
*Idiostolus* trichobothria is primitive. Another indication that this large number is primitive is the plasticity of position of several of the trichobothria. In the large clusters of segments three and four the arrangement was extremely variable in my specimens, and occasionally a trichobothrium was even missing. I emphasize the absence of *direct* proof that this large number is a primitive characteristic, but there is no evidence, direct or indirect, that it is not.

Although it appears that many other trichophoran patterns could be derived from the idiostolid pattern by eliminating selected trichobothria, the *Idiostolus* trichobothrial arrangement on the fifth sternum cannot be directly ancestral to any other. There are only two trichobothria on the fifth sternum of *Idiostolus* and three in most other members of the lygaeoid-pyrrhocoroid-coreoid complex.

*Idiostolus* may be advanced with respect to this character on the fifth sternum, and primitive elsewhere. This seems unlikely. If the *Idiostolus* pattern does resemble that of the presumed common ancestor of the complex, a third lateral trichobothrium may have been developed in either of two ways. An existing seta may have been modified to a trichobothrium, or a medial trichobothrium may have been shifted laterally. Such a medial trichobothrium would have been homologous to one of the two found in *Idiostolus* but now absent elsewhere in the complex. The variability of trichobothrial position in *Idiostolus* indicates that such a shift might have occurred before these positions became “fixed.” Also, other migrations of a trichobothrium and part of the fifth sternum occur normally in the *Lethaeini* (Lygaeidae) and at least once anomalously in the coreid *Anasa tristis* De Geer (Schaefer, in press).

In one small group of the lygaeoid-pyrrhocoroid-coreoid complex the fifth-sternal pattern resembles the idiostolid pattern. Members of the lygaeid subfamily Slaterellinae have two lateral trichobothria and no median ones on the fifth sternum (Fig. 6). However, the number of trichobothria on the other segments is also much reduced. If this reduction of trichobothria on the fifth sternum in the Slaterellinae is advanced (as I have suggested above it is), and if the reduction in the Idiostolidae is primitive (as I believe it is), the similarity between the two patterns on the fifth sternum is not phylogenetically significant.

It seems clear, then, that the idiostolid trichobothrial pattern, although certainly primitive, is *not* directly ancestral to any existing pattern. At least one intermediate form must be postulated to provide evidence for a lateral migration of one of the two median trichobothria on sternum five. But the idiostolid pattern very probably comes the closest to representing that of the trichophoran ancestor. Much other evidence suggests strongly that that ancestor was lygaeid-like (Schaefer, 1964); and it is significant that the general morphology of the Idiostolidae is very similar to that of the Lygaeidae (Schaefer, 1966).

The other group of the Heteroptera Trichophora is the Pentatomoidea. The origins, relationships, and phylogeny of the major groups in this superfamily are very poorly known. The pentatomoid trichobothrial
patterns are more advanced than most of those in the lygaeoid-pyrrhocoroid-coreoid complexes, as there are no more than two trichobothria per segment. This is true even of the most primitive groups, the Thaumastellidae (Stys, 1964) and (probably) the Garsauriinae (Cydnidae). These two trichobothria are arranged in various ways--transverse, oblique, longitudinal--and they may bear varying relationships to the spiracle. The thaumastellid pattern (Fig. 7) may well be the primitive one, and that of the Pentatomidae (Fig. 8) the more advanced. Ruckes (1962) has described these patterns, and, from his descriptions, it may be possible to work out some general evolutionary trends. I shall do this soon as part of a general study of the morphology and relationships of the Pentatomoidea.

Further studies of the relationships between the major trichophoran groups will contribute much to a better understanding of the origin and evolution of trichobothria. But a knowledge of structure is not enough, and, as I have said, final understanding awaits experimental evidence for trichobothrial function.

ACKNOWLEDGMENTS

I thank Drs. M. H. Sweet (Texas A&M University, College Station) and D. E. Leonard (Connecticut Agricultural Experiment Station, New Haven) for suggesting improvements in this paper and for fruitful conversations on the ideas in it. I thank Dr. Sweet further for providing some papers unavailable to me.

Finally, I am grateful to my wife, Stephanie Schaefer, for the diagrams.

LITERATURE CITED


ANOTHER RECORD OF WILLIAMSONIA FLETCHERI IN MICHIGAN
(ODONATA: CORDULIIDAE)

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Williamsonia fletcheri Williamson was first taken in the United States in the upper peninsula of Michigan near Manistique, Schoolcraft County (Gloyd, 1932). On June 4, 1966, I collected two males of this rare species at Island Lake, a small lake heavily overgrown with jack pine and poplar in southeastern Grand Traverse County. The specimens were identified by Mrs. Leonora Gloyd of the University of Michigan.

This is the first report of this species from the lower peninsula of Michigan, and the second for the United States.

LITERATURE CITED

A NEW SPECIES OF THRAULODES FROM NEW MEXICO
(EPEMEROPTERA: LEPTOPHLEBIIDAE)

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While working on the Ephemeroptera collection in the Entomology Museum at Michigan State University, the author came upon a single specimen of *Thraulodes* which appeared to be a new species. Although it is only in fair condition (the preserving fluid having dissipated under field conditions), the colors are well preserved and very distinctive. The specimen was sent to Dr. Jay R. Traver, University of Massachusetts, who confirmed suspicions that the specimen was new. I have been informed by Dr. Traver that she and Dr. George F. Edmunds Jr. are presently engaged in a revisionary study of the genus for North and South America, and it should be in press shortly.

*THRAULODES BRUNNEUS* sp. nov.
(Figs. 1-3)

**MALE IMAGO.**

*Size.* Body 8 1/2 mm.; forewing 9 mm.

*Head.* Blackish brown with large pale areas mesad to bases of antennae; frontal margin of head hyaline. Antennae light brown; lower eyes black, upper eyes red-brown.

*Thorax.* Overall light brown, excepting pronotum black on anterior and lateral margins, and with a distinct full-length, median black stripe; meso- and metanota light yellow-brown, apex of scutellum dark brown; propleura almost completely blackened by a mark extending from base of forewing to forecoxa. Black markings almost completely encircling mesocoxal cavity, present dorsally at metacoxal cavity, and also extending between the two cavities. Prosternum purplish; meso- and metasterna light yellow-brown.

*Legs.* First and third pairs missing beyond the trochanters. All coxae light brown with black markings; protrochanters dark brown, meso- and metatrochanters pale. Basal two-thirds of mesofemur pale, apical third with a reddish brown band, the proximal margin of which is not darkened. Mesotibia and tarsus pale, claws and apical half of distal tarsal segment reddish brown as in *T. speciosus*.

*Wings.* (Fig. 1). Hyaline. Forewing with longitudinal veins pale brown, crossveins and base of fork of MA darker brown. Basal crossveins in costal and subcostal spaces, and in following spaces in basal half of wing disc darkest; most of these crossveins also margined with
brown. Humeral crossvein, base of R₁, and bullae on subcosta and on second radial are surrounded by a smoky cloud. Stigmatic area white, crossveins slanting and slightly anastomosed (more so in left wing than in right). The second anal vein of the right wing forked. Basal third of hindwing with crossveins and longitudinal veins pale brown; apical two-thirds with all veins hyaline. Humeral crossvein and portion of subcosta surrounding its point of attachment are dark blackish brown.

Abdomen. (Figs. 2, 3). Tergites 1-3 dark chocolate brown; tergite 2 with three small hyaline areas on anterior margin, and tergite 3 with two small hyaline areas on the anterior margin. Tergites 4-6 hyaline, each with large dark chocolate brown posterolateral triangles connected posteriorly by a narrow band of the same color. Tergites 7-10 a lighter red-brown, with posterior margin on tergite 10 white, and anterolateral corners of segment 7 hyaline. All tergites black on posterior margins.

Sternite 1 light chocolate brown, sternites 2 and 3 dark chocolate brown. Sternites 4-6 dark chocolate brown on posterior three-fourths to four-fifths; the narrow anterior portion hyaline. Sternites 7-9 reddish brown as in their respective tergites. Black posterior marginal coloration fades medially on all sternites.

Genitalia. Terminal two segments of forceps missing. Forceps base very pale brown. Basal segment of forceps ventrally with apical third, and dorsally with apical two-thirds dark smoky; basal portion white. Penes similar to those of T. speciosus and T. arizonicus.

Caudal Filaments. Absent.

FEMALE. Unknown

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Figs. 2-7, dorsal (even numbers) and lateral (odd numbers) abdominal color patterns. Figs. 2 and 3, T. bruneus, holotype (terminal two segments of forceps missing); Figs. 4 and 5, T. speciosus; Figs. 6 and 7, T. arizonicus.

Diagnosis. The abdominal color pattern of Thraulodes brunneus is quite distinct from that of Thraulodes speciosus described by Traver (1934; Figs. 4, 5) and Thraulodes arizonicus described by McDunnough (1942; Figs. 6, 7), the only other North American Thraulodes known at the present time. The almost completely darkened venter and the large postero-lateral dark triangles on tergites 4-6 are sufficient to separate T. brunneus from the other two species, both of which have very light venters and much smaller triangles. Also, the darkened third tergite serves to separate T. brunneus from T. speciosus; and the darkened second and third tergites separate T. brunneus from T. arizonicus (the respective tergites are mostly hyaline in T. speciosus and T. arizonicus). Abdominal segments 7-10 are much like those of T. speciosus, lacking the creamy colors found in T. arizonicus. The new species, therefore, is named T. brunneus because of its dark brown coloration. Although the penes are of the same type found in the other two species, the forceps are distinctive in having the apical one to two-thirds of the basal segment quite darkened. Color patterns about the thorax will also aid in distinguishing the species.

The wing of T. brunneus, like that of T. speciosus, differs from T. arizonicus by the presence of margined crossveins. The wing venation of T. brunneus is also more like that of T. speciosus than T. arizonicus.

Morphologically, T. brunneus is more like T. speciosus than T. arizonicus, and this parallels their geographic distribution. The only known locality for T. speciosus is in the Chiracahua Mountains, Arizona, about 75 miles southwest of the T. brunneus site, while the only known locality for T. arizonicus is near Flagstaff, Arizona, some 250 miles northwest of the T. brunneus site.

ACKNOWLEDGMENTS

I am greatly indebted to Dr. Jay R. Traver, who has given me much help and inspiration ever since I became interested in the Ephemeroptera. Her help and critical reading of the manuscript are very much appreciated.

I thank the following individuals for load of specimens under their care, as indicated: V. K. Mayo (T. speciosus, personal collection), L. L. Pechuman (T. speciosus, types, Cornell University), and J. E. H. Martin (T. arizonicus, types, Canadian National Collection).

I also wish to thank Richard J. Snider for his excellent abdominal drawings and help in arrangement and preparation of the plate, and Julian P. Donahue for reading the manuscript.

LITERATURE CITED


THE BEHAVIOR OF ATLANTICUS TESTACEUS (ORTHOPTERA: TETTIGONIIDAE) ON THE E. S. GEORGE RESERVE, MICHIGAN

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Several reports deal in part with the systematics, distribution, or habits of one or another of the shield-backed katydids of the orthopteran genus *Atlanticus*. Included are Blatchley (1920), Cantrall (1943), Caudell (1907), Davis (1893), Hebard (1934), McNeill (1891), Rehn and Hebard (1916), and Scudder (1894). One species of the genus, *A. testaceus* (Scudder), is found commonly throughout Michigan and has interesting habits. As the species' feeding behavior was poorly understood, the author undertook an investigation dealing with that subject. The results are in press. During the course of that study much information was obtained on certain non-feeding aspects of the species' behavior. Findings with respect to the latter are given below.

The project was carried out during the 1958-1961 field seasons at the University of Michigan's Edwin S. George Reserve, a biological preserve near the village of Pinckney, Livingston County, Michigan. The general area is described in detail in Cantrall's excellent report on the Reserve's Orthoptera (1943) and in less detail in the author's monograph on food selection in Orthoptera (1961). The specific sites of study, Southwest Field and Southwest Woods, are described in Gangwere (1965) and Gangwere (in press), respectively. The latter two reports may also be consulted for information on the techniques used during the study.

DAILY ACTIVITIES

*Nymphs*. The behavior of *Atlanticus testaceus* varies with age, time of day, and other factors. The juveniles are geophilous and always in close association with dry leaf litter. Their daily regime is as follows. They spend much time in the shade of fallen leaves, motionless, their antennae sometimes twirling. Occasionally they walk briskly a short distance (twirling their antennae and using their palpi as they move), or they hop rather than walk. Then they pause for a time but eventually resume their infrequent movements until they find themselves in a clump of vegetation, where they are likely to rest for a more protracted

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period. Always they remain alert. If they encounter suitable food and are hungry, they eat for a period of time usually less than 15 minutes. The above pattern of alternate activity and inactivity is characteristic of their daytime period. Toward dusk, the nymphs gradually accelerate their activities until movement is maximal and almost constant during early evening, but always the young animals remain near the ground. Finally, in early morning (2:00 A. M. or later), they become completely inactive, not to resume movement until late the following morning.

**Adults and Last-Stage Nymphs.** The behavior of adults is similar to that of young juveniles, except that they are slower in their movements. undergo a nocturnal ascent of the vegetation, and have certain activities peculiar to the sexually mature. Adults, like juveniles, have a periodicity best described as incompletely nocturnal (Gangwere, 1958); they are most active at night but also move significantly during the day, especially under cloudy conditions. They spend the daylight hours hiding beneath leaves and debris, often at the base of shrubs or stout herbs and only occasionally move over the surfaces of the leaves. (Caged animals perch on the sides of their container unless crumpled paper or dried leaves are placed on the cage floor, in which case they, too, hide during the day.) By late morning (approximately 10:00-11:00 A. M.) the adults exhibit a slight, temporary increase in movement and perhaps engage in light feeding and stridulation, always followed by resumption of inactivity. Toward late afternoon (3:00-5:00 P. M.), the males (still clustered on the ground near the bases of plants) begin a period of more accelerated stridulation. Then at dusk the last-stage nymphs and adults of both sexes become phytophilous; they climb the vegetation and perch horizontally atop leaves or branches or vertically on stems, from which position the males begin intensive and practically uninterrupted stridulation for the rest of the evening. They stop stridulating occasionally, move a short distance to the next higher position from which they resume calling, until eventually they reach the top of the plant (sometimes a height up to 10 or 15 feet from the ground). The males call from various positions on a limited number of plants, while the females move about from plant to plant, occasionally stopping to rest or eat. Females that climb plants holding perching males may mate. After midnight both sexes become increasingly inactive (though they remain alert and their antennae continue to twirl), and calling becomes depressed. Descent from the vegetation is initiated by 2:00 or 3:00 A. M., is most marked about 4:00 A. M., and is completed before dawn, when the animals come to rest on the ground and under leaf litter. The cycle begins anew the next day.

The stridulation of *Atlanticus testaceus* has been described in the literature (Cantrall, 1943, Davis, 1893, et al.), so its general character is well known. Other aspects of the stridulation and associated behavior are not as well known. The pitch of the call is altered under cool conditions and becomes a short, sputtery creak rather than its usual *zzzzp-zzzzp-zzzzp-zzzzp* expressed again and again. It appears
that more than one kind of call characterizes the species. There may possibly be a distinct mating sound, for a mature female approaching a calling male may elicit a change in his even trill to a slower, interrupted clatter. There is sometimes an alarm call. *Atlanticus* males, when picked up or otherwise disturbed, sometimes emit a single loud *zik*, often in association with escape behavior. These *Atlanticus* perched on vegetation either dodge behind a leaf or stem or else leap to the ground where they hide. Those animals on the ground leap violently several times until they locate a hiding place, where they crouch motionlessly. If prodded, they crouch more deeply on their flexed hind legs and make ready to leap. They bite viciously if given the opportunity, but are not able to break the human skin.

**PERIODISM**

In southern Michigan *Atlanticus testaceus* is nymphal in early spring and matures during late spring and early summer. Within a week or two after the onset of maturation in the population, peak numbers of adults are encountered, and the males begin to stridulate. Toward late summer and fall the insects gradually decline in numbers until the killing frosts, when they disappear entirely. On the Reserve the author has taken nymphs as early as April 8; the first adults as early as June 4; and the last adults in fall as late as October 26.

**HABITAT OCCUPANCY**

There is unanimity in the literature that *Atlanticus testaceus* is a woodland species or at least is closely associated with woodland. Blatchley's statement (1920) that it "frequents for the most part dry open woodland, thinly wooded rocky slopes, and borders of thickets" is representative of accounts given in the older literature. Cantrall (1943) refined these observations with respect to the *Atlanticus* of the George Reserve but concurred in his emphasis on the insect's dependence on woodland conditions. He noted that early juveniles are nearly always located in sunny spots in rather open forest, older nymphs in woodland and in field margins seldom more than twenty yards from woodland, and adults in woodland including even shady forest situations. He concluded that, with maturity, those katydids that stray from their woodland habitations promptly die or make return migrations to the more favorable woodland environment.

Results of the present study suggest the need for a different interpretation of the species' habitat occupancy (at least with respect to the George Reserve). Young nymphs in Southwest Field and Southwest Woods are closely localized in the field-wood ecotone and in an extension of this ecotone, the mouth of a road leading into Southwest Woods. (A similar distribution is noted in other areas of the Reserve.) The young katydids frequent sunny places where there is sparse vegetation, bare ground, and dry leaf litter. At this stage they are not found in
Southwest Woods, in its “oak openings” (open places where the sunlight shines through onto the leaf litter), in the uplands of Southwest Field, or in the field depressions. Older nymphs and adults, in contrast, wander. They may be found in the ecotone but also are encountered throughout the field and, to a lesser extent, within the woods, the orchard, and even in neighboring Southwest Marsh (where they cannot live for long). Toward late summer the adults are most common in the field, particularly in its depressions, though some can be heard calling from within the woods and orchard.

This fluctuating habitat occupancy is a consequence of the species’ changing needs at different times during the life cycle. Based on data of this investigation (viz., occurrence of the youngest nymphs and a single oviposition record in nature), the Atlanticus of Southwest Field and Southwest Woods oviposit in the ecotone. (If they do so elsewhere, it is doubtful that the eggs hatch.) Once hatched, the young nymphs find the ecotone a suitable habitation where the requisite sunlight, sparse vegetation, and dry leaf litter are provided. They are limited to the ecotone at this stage, for they cannot long survive the rigors of either open field conditions (where there is no leaf litter or other protective debris) or shady woodland conditions (where there is leaf litter but no sunlight). They are possibly able to exist in “oak openings” of the woods, but this distribution involves departure from the more optimal conditions of the ecotone and travel through the shady woods. As the nymphs approach maturity, they become less dependent on protection afforded by leaf litter and can migrate to space themselves (territoriality?) or to seek mates on perching sites. They need not return to the ecotone proper except to oviposit.

What explains the disparity between these results and those of Cantrall, obtained in the same general area twenty years earlier? The explanation can be found in the effects of succession. It appears that Atlanticus testaceus is really an ecotonal—not a woods-dwelling—species. In the late 1930s, when Cantrall studied the insect, the character of the field was still largely determined by the cultivation and grazing practices to which it had so recently been subjected; it had progressed little beyond the stage of open pasture. The woods, too, were comparatively open and subject to thorough grazing by a large deer population that kept the undergrowth minimally developed. The field-wood ecotone was completely lacking. The extensive “oak openings” presumably offered the only sites for oviposition by adult females and occupation by newly hatched juveniles. Though the older nymphs and adults often migrated, they were obliged to return to the woods for oviposition and, above all, for perching. Both Southwest Woods and Southwest Field were, therefore, in a state of stress, from which they have now recovered. Today a distinct ecotone is developed for nymphal occupation and adult perching and oviposition. Furthermore, many parts of the field, now so overgrown that they themselves are almost ecotonal in nature, also afford suitable perching sites and habitations for older nymphs and adults.
Such an hypothesis requires demonstration that the sluggish, flightless *Atlanticus* last-stage nymphs and adults are capable both of migrations of the magnitude discussed above and of residence in one place over an extended period of time. Marking and recapture experiments were carried out. A total of 231 adult *Atlanticus* were marked by daubing the pronotum with paint. Of these, 40 individuals were recaptured one or more times. Maximal, average, and minimal distances that marked insects moved over a period of several weeks were, respectively, 550, 120, and 0.0 feet. All movements of individuals seemed random; no concerted migrations of major segments of the population from one habitat to another were detected. The results confirm the fact that individual animals can readily move throughout the two communities when the occasion demands or, on the other hand, may remain associated with a single plant for many days at a time.

The habitat selection outlined above for *Atlanticus testaceus* in Southwest Field and Southwest Woods is not necessarily characteristic of the species at other places in its range, though it could well be typical. According to Cantrall (personal communication), large populations of nymphs have been observed in other states in such places as along a fence row separating pastures of blue grass and in open pastures containing bramble. In such cases some factor other than leaf litter must provide the protection needed by the young *Atlanticus*. The fence and the taller vegetation growing in its shade could be the factor in the first example; numerous piles of cow dung, eminently suitable for protection, could be the factor in the second.

ACKNOWLEDGMENTS

Professor I. J. Cantrall, Museum of Zoology, University of Michigan, Ann Arbor, Michigan, kindly read the manuscript of the foregoing report. Professor A. M. Wenner, Department of Biology, University of California at Santa Barbara, and Mr. J. K. Hiltunen, U. S. Fish and Wildlife Service, Ann Arbor, gave invaluable assistance during completion of many of the observations and experiments. Mrs. Patricia DeBlois, Department of Biology, Wayne State University, typed the final copy of the manuscript. To these persons the author is indebted.

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The feeding behavior of Atlanticus testaceus (Orthoptera: Tettigoniidae), in press.


LAMINATING LEPIDOPTERA FOR EDUCATIONAL USE

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A convenient method of teaching farmers, 4-H members and students to recognize various species of Lepidoptera is now being used in Michigan with wide success. In the process, insect wings are mounted on cardboard and sealed between layers of clear plastic. The resulting "laminations" have several advantages over pin-mounted Lepidoptera, and are admirably suited for any use that requires constant handling. The finished mounts are impervious to museum pests, are dust-proof, may be cleaned with ease, and are easily stored in a loose-leaf binder. The plastic is flexible, thus danger of damage from bending is slight.

Specimens chosen for the lamination process should be typical ones, in first-class condition. The insects are mounted on pins, spread and dried in the normal fashion. A thin coat of clear nail polish is then applied to the undersides of the wings where the primaries overlap the secondaries; thus they are held together in the position in which they were mounted (Fig. 1). When the polish is dry, each pair of wings is gently seized near the thorax with entomological forceps, and severed from the body with a slight twisting motion.

Figures 1-4, steps in the process of laminating wings of Lepidoptera. Fig. 1, applying nail polish to glue fore- and hindwings together. Figure 2, affixing the wings to the card. Fig. 3, inserting the card in the laminating machine. Fig. 4, the finished product, in this case one of the many cards produced to illustrate economic pests. Photos by Julian P. Donahue.
The wings are now fixed to a sheet of light white cardboard which serves as the central element in the laminated “sandwich” (Fig. 2). They may be held in place by a few drops of nail polish, and should be close together so as to simulate a pin-mounted appearance. If desired, faint pencil lines may be drawn on the cardboard to facilitate neat and symmetrical mounting; these may be carefully erased afterwards. The scientific and common names of the insect are written in India ink below the specimen, the process is repeated for each butterfly or moth to be included, and the mount is ready for laminating.

The procedure for this final step depends upon the type of machine used. The mounts produced at Michigan State University for 4-H use and pest identification are processed in an Apeco “Ply-on” laminator. The cardboard sheet containing the specimens is inserted between two rollers at the front (Fig. 3) and the finished mount appears shortly behind. After trimming with a pair of shears, the lamination is ready for use (Fig. 4).

Laminations are not designed to replace the standard method of mounting and storing Lepidoptera, and it should be remembered that only a well-labeled collection of pinned insects has lasting scientific value. Nevertheless, plastic mounts are very convenient and inexpensive teaching aids (an 8 1/2” x 11” lamination costs approximately twenty cents) and certainly other uses will be found for them; the method is even now being adapted to the more fragile insect orders. Further information may be had from the coordinator of the program, John H. Newman, Department of Entomology, Michigan State University, East Lansing, Michigan 48823.

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ERRATA, VOL. 1, NO. 2

We regret that several errors appeared in our paper on *Phragmatobia*. The additions and corrections are as follows. P. 38, between PM and UMMZ, insert “ROM Royal Ontario Museum, Toronto, Ontario (Glenn B. Wiggins and J.C.E. Riotte).” P. 46, last line under Illinois, change “22” to “32”; the third specimen, erroneously referred to in the paper as *P. fuliginosa*, is not designated as a paratype. P. 46, last line, add “Clarke, 21 May 1905, A. K. Wyatt, 1♀ (CNHM)”; this small specimen was mistakenly listed as *P. fuliginosa* on p. 52. P. 52, 4th line under Colorado, the Hayden Mts. specimen is from Ouray Co. P. 52, last line under Illinois, delete Peoria Co. record. P. 52, first line under Indiana, delete Clarke record. P. 73, fig. 36, delete southernmost circle in Illinois.

Julian P. Donahue and John H. Newman
This issue's cover illustration is the frontispiece to an anonymous English *History of Insects*, published at London in 1839. The top-hatted gentleman pursuing the butterfly is using a clap-net, so called because once the insect was within the gauze bag, the operator "clapped" the frames together, thus securing his prey.

The peculiar device was constructed of two jointed rods, similar in principle to those used today for fly-casting, not joined at the tips but enclosed within the hem of a net. The clap-net originated in the seventeenth century and was first used by "fowlers" or market hunters who used it to trap small birds. It was certainly applied to entomology before 1742, when the London artist Benjamin Wilkes mentioned its use in a broadsheet of collecting directions (Wilkinson, 1966).

Despite the fact that the bag-net (the ancestor of our modern form) had been used on the Continent since the seventeenth century, the clap-net gained such popularity in England that it did not decline in favor until after 1850. A photograph reproduced by Ford (1963) shows that die-hard advocates of the clap-net were still using it at the end of the nineteenth century.

Among the articles of apparatus depicted in the cover illustration is the simple water-net for collecting aquatic insects, and another device resembling a pair of scissors with gauze-covered frames attached to the tips. This is the forceps net, affectionately called the "flappers" by early entomologists. It was used for taking insects from foliage; the frames were closed upon the specimen, which was then transfixed with a pin inserted through the gauze. The forceps net originated on the Continent, and was popular in England at least eighty years before its illustration in *History of Insects*.

We do not know which of these nets was the first to be used in North America. The earliest specimens of American Lepidoptera extant are those from the collection of James Petiver; they are now housed in the British Museum (Natural History), London. Some were sent to Petiver from such localities as Massachusetts, Maryland and the Carolinas as early as the 1690s, and their condition shows that some sort of net may well have been used in their capture. Petiver sent nets to entomological investigators in Massachusetts and the West Indies as early as 1711; these were fitted with a hoop or hoops and thus were not clap-nets, but no more details are known. Later collectors in eighteenth-century America used the clap-nets and "flappers" furnished by the London goldsmith and entomologist Dru Drury. The first American illustration of collecting nets seems to be a lithograph designed by Titian Ramsay Peale for a prospectus (1833) of his ill-fated *Lepidoptera Americana*. The plate is conveniently reproduced by Poesch (1961) and shows a bag-net and forceps.

Due to its light weight and ease of operation the bag-net is now almost universally used, but some Hymenopterists prefer a modern adaptation
of the forceps, still manufactured by several entomological suppliers. We no longer see collectors in top hats, but the forceps net remains to remind us of an earlier era.

R. S. Wilkinson

LITERATURE CITED


REVIEWS OF RECENT LITERATURE


The science of zoology is expanding at such a rate that it is difficult for even the relatively narrow specialist to keep up with the ever-increasing literature on his subject, and almost impossible to assimilate recent findings in the entire field of zoological research. The international congresses of zoology and entomology have helped considerably by facilitating personal contact between workers of different nationalities. On a more modest scale, the symposia of the Royal Entomological Society of London have provided a useful means of bringing together entomologists in an atmosphere conducive to the free exchange of ideas and information.

The present volume is an account of the papers given at the symposium held on the 23rd-24th September 1965: G. Birukow (Göttingen), Orientation behaviour in insects and factors which influence it; P. S. Corbet (Ottawa), The role of rhythms in insect behaviour; P. T. Haskell (London), Flight behaviour; V. G. Dethier (Pennsylvania), Feeding behaviour; A. Manning (Edinburgh), Sexual behaviour; J. D. Carthy (London), Insect communication; E. O. Wilson (Cambridge, Mass.), Behaviour of social insects; J. S. Kennedy (Cambridge, England). Some outstanding questions in insect behaviour. Each paper is followed by an account of the discussion at the symposium. Although the papers are short, averaging about twelve pages, many are extremely useful summaries of present knowledge of their topics, especially Corbet's
lucid paper on rhythms. Some discuss little-explored concepts; Wilson's paper provoked a lively discussion of the social life of insects. The final paper performs the difficult task of furnishing a balanced, yet individual, summary of the symposium. In it, Kennedy successfully destroys the term *klinokinesis*. May it rest in peace!

Anthony Eve.


As W. T. Stearn reminds us in the preface to this attractive and welcome work, "the realm of literature which a knowledge of botanical Latin opens to botanists is a strange barbarous place for classicists; invited into it as an interpreter, a good classical scholar may well feel like Alice meeting Humpty Dumpty through the looking-glass." The same perplexity is experienced by the entomologist; those of us educated in the Latin of Cicero and Pliny are ill equipped to name new species or even to translate Latin descriptions, as biological Latin developed long ago into a stylized form not easily conquered without a specific aid.

Stearn's self-styled "do-it-yourself Latin kit" solves the problem with surprising ease. Although primarily written for the botanist, it is well worth a perusal by the entomologist who faces historical literature with apprehension or simply wishes a meaningful name to bestow upon his latest discovery. Stearn furnishes concise reviews of Latin grammar and syntax, as well as a copious vocabulary. The Greek element in name formation is not forgotten, and directions are given for the solution of such problems as Latinization of native names, anagrams and epithets commemorating persons. There is an excellent index of standard abbreviations used in Latin descriptions. Despite differences between the zoological and botanical codes of nomenclature, all biologists will find W. T. Stearn's *Botanical Latin* to be an invaluable reference work.

R.S.W.

**BRIEF NOTICES**


Although the authors include no specific treatment of the attraction of insects by light, there is much in this work to interest the entomologist. Chapters are included on the measurement and characterization
of light, excitation of molecules by light, chemiluminescence, bioluminescence (containing an examination of this phenomenon in the firefly), and the biological action of light. Some topics discussed in the latter category are: organization and structure of light receptor systems, the control of metabolism by light, direct stimulation, vision, and deleterious effects of light on living organisms.


Papers included in this issue are: Regulation of gene action in insect development; The comparative embryology of the Diptera; Polymorphism in Aphididae; Physiology of caste determination; Insect walking; The behavior patterns of solitary wasps; The utilization and management of bumble bees for red clover and alfalfa seed production; The competitive displacement and coexistence principles; Insects in the epidemiology of plant viruses; A functional system of adaptive dispersal by flight; Ticks in relation to human diseases caused by viruses; The biosystematics of Triatominae; The use and action of ovicides; Mode of action of insecticides; Chemical insect attractants and repellents; Fungal parasites of insects; Management of insect pests; Tea pests and their control; Pest control.

As usual in this series, a spectrum of topics promotes wide reader appeal. Authorship is similarly catholic; scientists of eight nations have contributed to this year's issue.

[Foreign prices have been converted into dollars. In most cases, foreign imprints ordered through U.S. dealers will cost slightly more. New books are almost always less expensive when ordered from a dealer in the country of origin. The Editor will be happy to furnish, upon application, suitable sources for the purchase of foreign entomological books.]

Microfilm copies of the current volume of *The Michigan Entomologist* will be available at nominal cost, to members and subscribers only, at the end of the volume year. Please address all orders and inquiries to University Microfilms, Inc., 300 North Zeeb Road, Ann Arbor, Michigan 48106.
Papers dealing with any aspect of entomology will be considered for publication in *The Michigan Entomologist*. We solicit subjects of particular interest to amateur and professional entomologists in the North Central States and Canada, as well as general papers and revisions directed to a larger audience while retaining an interest to readers in our geographical area. Books will be reviewed with this larger audience in mind. Notes on collecting methods and new techniques are welcomed, as are subjects in the history and bibliography of entomology.

Manuscripts are submitted to one or more qualified referees and are judged on scholarly merit as well as clarity of presentation. Articles of 10 or more printed pages may be published in the course of several issues unless the extra pages are subsidized at cost. Especially meritorious papers of at least 28 pages may be published as single issues if subsidized.

Illustrations are encouraged and will be printed without charge. Photographs should be glossy and 8" x 10" in size while drawings, charts, graphs and maps may be of any size, allowing for reduction. Contributors should follow the recommendations of the *Style Manual for Biological Journals*, available at $3.00 per copy from the American Institute of Biological Sciences, 3900 Wisconsin Avenue, N.W. Washington, D.C. 20016. A pedantic style should be avoided, for scientific accuracy and lucid, interesting prose can exist together.

Manuscripts must be typed, double-spaced, with wide margins on white 8 1/2" x 11" or equivalent foreign size paper. Proofs will be submitted to authors, and must be returned within one week of receipt. Titles should be concise, identifying the order and family discussed. The author of each species mentioned must be given fully at least once in the text. A common name for each species or group should be given at least once when such a name exists. The format of references should follow that used in recent issues. While every care will be taken of authors' manuscripts, neither the Editor nor the Michigan Entomological Society will accept responsibility for accidental loss or damage.

Each author or co-author will receive 25 gratis separates of his paper; authors of notes will receive 10 separates. Additional separates may be ordered at cost upon acceptance of manuscript.

All manuscripts for *The Michigan Entomologist* should be sent to the Editor, Ronald S. Wilkinson, The Library, Michigan State University, East Lansing, Michigan 48823, USA. Other correspondence should be directed to the Executive Secretary (see inside front cover).