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This issue mailed February 24, 1984

☐ Oral Presentation
☐ Project Exhibit Session
(Formerly Poster Session)
☐ Student Paper

Return to: James A. Reinert, Program Chairman
Ft. Lauderdale Research &
Education Center
University of Florida
3205 S.W. College Avenue
Ft. Lauderdale, FL 33314

Deadline for Paper
Submission is 15 May 1984

Author's Name ______________________________

Title of Paper ______________________________

____

Affiliation and Address ______________________________

of the First ______________________________

(Presenting) Author ______________________________

____

Time Required for Presentation (Max. 10 min.) ______________________________

Abstract: *Must* be Provided. Do *not* use more than 75 words.

Suggestion for Evening Bull Session ______________________________

____

THE 67th ANNUAL MEETING OF THE FLORIDA ENTOMOLOGICAL SOCIETY FIRST ANNOUNCEMENT

The Florida Entomological Society will hold its 67th Annual meeting on 24-27 July 1984 at the Holiday Inn, 6515 International Drive, Orlando FL 32809; telephone—1-(305)-351-3500. Room rates will be $58.00, for single, double, triple, or quadruple.

Questions concerning the local arrangements should be directed to:

FREDERICK L. PETITT, Chairman
Local Arrangements Committee
Florida Entomological Society
Walt Disney World-Epcot Center-The Land
P.O. Box 40
Lake Buena Vista, Florida 32830 USA
Phone: 1-(305)-827-7256

To present a paper, the tear out sheet must be postmarked and sent no later than 15 MAY 1984, to:

JAMES A. REINERT, Program Chairman
Ft. Lauderdale Research and Education Center
University of Florida
3205 S.W. College Avenue
Ft. Lauderdale, Florida 33314 USA

Eight minutes will be allotted for presentation of oral papers, with 2 minutes for discussion. In addition, there will be a separate session for members who may elect to present a Project (or Poster) Exhibit.

The 3 oral student papers judged to be the best on content and delivery will be awarded monetary prizes during the meeting. Student authors *must* be Florida Entomological Society Members and *must* be registered for the meeting. Awards will be $125.00, 75.00 and 50.00.

Registration Schedule[1] for Annual Meeting:

	Preregistration	Registration On Site
Full & Sustaining Members	$35.00	$40.00
Student *not* in Student Contest	18.00	20.00
Student *in* Student Contest	13.00	15.00
Each Extra Banquet Ticket	10.00	10.00

[1]Each fee includes one banquet ticket.

PAPER SUBMISSION
Deadline:
15 May 1984

SLIDE POLICY FOR ANNUAL MEETINGS

The following slide policy will govern slide presentations at the Annual Meetings. Only Kodak Carousel projectors for 2 x 2 slides will be available. However motion picture projectors will be available by special request to the Local Arrangements Chairman prior to the date of the meeting.

Authors should keep slides simple, concise, and uncluttered with no more than 7 lines of type on a rectange 2 units high by 3 units wide. All printed information should be readable to an audience of 300 persons.

A previewing room will be designated for author's use. A projectionist will be available in the previewing room at least one hour before each session. Authors are expected to give the projectionist their slides in the previewing room prior to each session. Slides will be returned to the authors after each session in the meeting room.

Authors are expected to organize their slides in proper order in their personal standard Kodak Carousel slide tray (no substitution, please). Only a few slide trays will be available in the previewing room from the projectionist for hardship cases. Slides in the tray should be in correct order starting with slot #1 of the tray and positioned correctly (position of slides to go into tray: 1. upside down, and 2. lettering readable from this position upside down and from right to left). A piece of masking tape should be placed on the slide tray by the author and the following information should be written on the tape: 1. author's name, 2. session date, and 3. presentation time.

TACHINID FLIES (DIPTERA: TACHINIDAE) FROM TARAPACÁ AND ANTOFAGASTA PROVINCES, CHILE III. ADDENDUM

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ABSTRACT

A consolidated key to 47 genera and a comprehensive list of 70 species of parasitic Tachinidae (Diptera) from the desert provinces of Tarapacá and Antofagasta in northern Chile are provided in this paper. *Hypsomyia hispida* Cortés is described as a new genus and species of Eryciini, and *Spanipalpus hiemalis* Cortés as a new species of Cuphocerini. New data on several other species are also included.

RESUMEN

Este trabajo ofrece una clave consolidada para 47 géneros y una lista comprehensiva de 70 especies de taquínidos parasitos (Diptera) de las provincias desérticas de Tarapacá y Antofagasta en el extremo norte de Chile. *Hypsomyia hispida* Cortés se describe como nuevo género y especie de Eryciini, y *Spanipalpus hiemalis* Cortés como nueva especie de Cuphocerini. Se incluye también nuevos antecedentes de especies ya conocidas.

This is the third addendum to the study of the Tachinidae of Tarapacá and Antofagasta, two of the desert provinces in northern Chile extending south from the border with Peru.

The original monograph was published in 1971 (Cortés and Campos), while two previous addenda (Cortés and Campos 1974, Cortés and Hichins 1979) augmented the reported species from this dry desert to 42 genera and 64 species, all of them coming from small agricultural valleys and ravines. The agriculture of this region is represented by corn, alfalfa, beans, and potatoes, as well as numerous other horticultural crops. Citrus, olives, pears, peaches, apples, and grapes are the main perennial crops (Cortés and Campos 1970). The provinces of Tarapacá and Antofagasta together occupy an area of 183,378 square kilometers. This territory is a desert plateau where no rain has been reported for 70 years. In spite of this fact, ground water

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Professor Cortés is a renowned authority on Tachinidae and one of the senior entomologists in Chile. During his professional career he has been influential in developing agricultural entomology in Chile and is a former Director of Agricultural Research. As a professor at both the Universidad de Chile, Santiago, and the Universidad del Norte, Arica, he has guided many students who are now outstanding entomologists. Since 1976 Professor Cortés has been a Research Associate, Florida State Collection of Arthropods, Gainesville. This invitational manuscript was solicited by the Florida Entomological Society, Americas Committee, in order to promote communication between our Society and scientists in Latin America.

and late afternoon dew permits pastures and agricultural crops to subsist. The sandy soils are rich in minerals and devoid of organic matter. The day and night temperatures may differ as much as 30° C but the average annual temperature is 16.7° C with little seasonal change. A more detailed description of this superarid desert and its environment may be found in Cortés and Campos (1971). The distribution of the Tachinidae in Chile is strongly correlated with the altitude and vegetation of the collecting site. Most of the typical forms occur at elevations exceeding 1500 m and a few occur even at 2000-4000 m above sea level. In two contiguous valleys of Azapa and Lluta, Tarapacá Province, the number of genera and species collected was greater at the latter location. This could only be explained by the persistence of natural vegetation in Lluta as contrasted to the agricultural exploitation occurring in Azapa.

The tachinid fauna of Tarapacá and Antofagasta has its faunal affinities with the western Andean region of Peru, Ecuador, and Bolivia, not with southern Chile and Argentina (Cortés and Campos 1970).

This paper presents descriptions of a new genus and species in the Eryciini and a new species in the Cuphocerini. Also included is a key to 47 genera and a checklist of 70 species. Further data on previously known species, such as *Echinomasicera hystrix* Townsend, *Eucelatoria australis* Townsend, *Pyrrhotachina proboscidea* Townsend, et al., are provided in the checklist.

All the examples mentioned in this paper are deposited either in the Collection of the Facultad de Agronomía, Santiago (CFA), or that of the Department of Agriculture, Universidad de Tarapacá, Arica (CICA).

Key to Recorded Genera

1. Wing venation incomplete; 4th longitudinal vein evanescent; transverse apical vein and apical cell lacking or absent .... *Camposodes* Cortés

1′. Wing venation complete; all veins and cells present and well formed; apical cell well developed, petiolated or not 2

2(1′). Apical cell closed before reaching wing margin and distinctly petiolated 3

2′. Apical cell well opened on wing margin, narrowly open on same margin, or else exactly closed, but in any case without a distinct petiole 6

3(2). Borders of prosternum pilose; arista micro-plumose (Proseninae-Dexiinae) .... *Myiodexia* Cortés & Campos

3′. Borders of prosternum bare; arista bare or at most micro-pubescent 4

4(3′). Parafacials with strong row of proclinate bristles; 1st longitudinal vein setulose in all its length (Voriini) .... *Ateloglutus* Aldrich

4′. Parafacial bare or at most with fine hair or tomentum, never with bristles; 1st longitudinal vein bare 5

5(4′). Mesonotum and abdominal tergites destituted of macrosetae; anterior femora with ctenidia of short spines on distal part of postero-ventral border; antennae elongated; apical scutellars absent .... *Gymnosoma* Meigen

5′. Mesonotum and abdominal tergites with well developed strong bristles; femora without row of short spines in any border; antennae short; apical scutellars strong and well decusate .... *Leucostoma* Meigen

6(2′). Ocellar bristles reclinate (Goniini) 7

6′. Ocellar bristles proclinate, divaricate, piliform, undifferentiated or absent 11

7(6). Head in profile dolichocephalic, i.e., at epistoma wider than at antennal level; proboscis longer than head height .... *Dolichocnephalia* Townsend

7′. Head in profile normal, i.e., at epistoma not wider, narrower or at most of equal width than at antennal level; proboscis not longer than head height 8

8(7′). Facial ridges with strong bristles in basal half or more; one pair of median marginals on 1st abdominal tergite (2nd of Crosskey 1973, and in the works of Mesnil) .... *Chaetocraniopsis* Townsend

8′. Facial ridges bare, without bristles above vibrissae 9

9(8′). Clypeus deeply excavated; frons very wide and prominent in both sexes; 3rd antennal joint twice or more length of second .... *Gonia* Meigen

9′. Clypeus normal or moderately excavated; frons 0.50 or less of head width; 3rd antennal joint at most twice length of second 10

10(9′). Apical scutellars absent or piliform .... *Araucosimus* Aldrich

10′. Apical scutellars strong, spine-like and sub-erect .... *Chaetocnephalia* Townsend

11(6′). Proboscis twice geniculate and longer than body length (Siphonini) .... *Siphona* Meigen

11′. Proboscis never more than once geniculate and not longer than body length 12

12(11′). Last section of 5th longitudinal vein half or more length of preceding section 13

12′. Last section of 5th longitudinal vein much shorter or less than half length of preceding section 15

13(12). Facial ridges with bristles almost up to base of 3rd antennal joint; intermediate abdominal tergites without discal bristles; 3rd longitudinal vein with a few setulae on basal node (Exoristini) .... *Plagiprospherysa* Townsend

13′. Facial ridges bare, except at base; parafacials with strong proclinate bristles in upper half at least; 3rd longitudinal vein setulose (Voriini) 14

14(13′). Eyes bare; 1st longitudinal vein setulose in its entire length; intermediate abdominal tergites without discal bristles; lower half of parafacials bare; wings transparent, without maculae .... *Voria* Robineau-Desvoidy

14′. Eyes pilose; 1st longitudinal vein with only a few setulae at base; intermediate abdominal tergites with discal bristles; strong proclinate bristles in the whole length of parafacials; blackish maculae on transverse veins and on

cubitulus of wings .... *Alpinoplagia* Townsend
15(12′). Eyes distinctly and often thickly pilose 16
15′. Eyes bare or practically bare 26
16(15). Posterior tibiae ciliated on postero-dorsal border 17
16′. Posterior tibiae without row of short ciliae in any border 20
17(16). Ocellars piliform, hardly differentiated or absent 18
17′. Ocellars strong and proclinate 19
18(17). Ocellars absent; intermediate aristal joint short; cheeks narrow or inconspicuous (Eumasicerini) .... *Phaenopsis* Townsend
18′. Ocellars piliform, though differentiated; intermediate aristal joint elongate, i.e., much longer than wide; cheeks rounded, 0.40 of eye height (Eryciini) .... *Hypsomyia* Cortes, new genus
19(17′). Male with proclinate fronto-orbitals; eyes thinly pilose; abdominal tergites with strong erect spines; parafacials bare below .... *Echinomasicera* Townsend
19′. Male without proclinate fronto-orbitals; eyes thickly pilose; abdominal tergites only with median marginals; parafacials tomentosum below .... *Winthemia* Robineau-Desvoidy
20(16′). Dorsocentrals and acrostichals absent or undifferentiated and piliform; parafacials thickly pilose; abdominal tergites with dense sub-erect spines; 2nd tergites (3rd of Crosskey 1973, and in the works of Mesnil) with marginal and sub-marginal rows of strong bristles; 5 or 6 laterals on scutellum .... *Androsoma* Cortés & Campos
20′. Dorsocentrals and acrostichals always present and developed 21
21(20′). Head in profile dolichocephalic, i.e., at epistoma wider than at antennal level; palpi short and filiform .... *Dolichostoma* Townsend
21′. Head in profile shorter at epistoma, or at most of equal length as at antennal level; palpi normal or else papiliform 22
22(21′). Facial ridges with well developed bristles at least on basal half 23
22′. Facial ridges bare, without setae, except at vibrissal angle 25
23(22). Apical scutellars absent; borders of prosternum bare, without hair .... *Incamyia* Townsend
23′. Apical scutellars present and decusate 24
24(23′). Intermediate abdominal tergites without discal bristles .... *Euphorocera* Townsend
24′. Intermediate abdominal tergites with discal bristles .... *Ollacheryphe* Townsend
25(22′). Palpi normal; both basal joints of arista elongate; infrasquamal setulae present; parafacials not wider than 3rd antennal joint .... *Trichophoropsis* Townsend
25′. Palpi short or papiliform; only the intermediate joint of arista elongate; infrasquamal setulae absent; parafacials much wider than 3rd antennal joint .... *Bonnetia* Robineau-Desvoidy
26(15′). Ocellars present, proclinate or divaricate 27
26′. Ocellars entirely absent 43
27(26). Ocellars exactly divaricate, neither proclinate nor reclinate; 1st longitudinal vein setulose in more than basal half (Germariini) .... *Chaetodemoticus* Brauer & Bergenstamm
27′. Ocellars definitely proclinate 28

28(27′). Posterior tibiae ciliate on postero-dorsal margin 29
28′. Posterior tibiae without ciliae or row of short uniform setulae in any border 32
29(28). Arista plumose (Dexiinae) .... *Sarcoprosena* Townsend
29′. Arista bare or micro-pubescent 30
30(29′). Facial ridges bare except at base .... *Sturmia* Robineau-Desvoidy
30′. Facial ridges strongly setose at least in basal half 31
31(30′). Parafacials bare in all its length; intermediate aristal joint short .... *Lespesia* Robineau-Desvoidy
31′. Parafacials hairy in its entire length; intermediate aristal joint elongate .... *Protogoniops* Townsend
32(28′). Parafacials bare, without tomentum or bristles in entire length 33
32′ Parafacials with hairs or bristles at least on upper half, or else with well developed facio-orbitals inferiorly 37
33(32). Prosternum bare, with no hair in borders; facial ridges bare; intermediate aristal joint elongate; haustellum longer than head height; intermediate abdominal tergites without discal bristles .... *Siphoactia* Townsend
33′. Prosternum pilose in borders 34
34(33′). Prosternum with only one long setula on each border; apical scutellars absent; two pairs of discal bristles on 2nd abdominal tergite (3rd of Crosskey 1973, and in the works of Mesnil) .... *Urodexodes* Townsend
34′. Prosternum with hairs in borders 35
35(34′). Intermediate aristal joint very elongated; facial ridges bare; both sexes with proclinate fronto-orbital bristles; intermediate abdominal tergites without discal bristles; 3rd antennal joint in both sexes extraordinarily dilated apically as to be nearly triangular (Siphonini in the works of Mesnil) .... *Elfia* Robineau-Desvoidy
35′. Intermediate aristal joint short, not longer than wide; facial ridges setose on basal half 36
36(35′). Intermediate abdominal tergites with discal bristles; apical scutellars absent; male tip of abdomen acuminate (Blondeliini) .... *Hemilydella* Townsend (cif. *Eucelatoria* Townsend)
36′. Intermediate abdominal tergites without discal bristles; apical scutellars present and decusate; male abdomen rounded apically (Sturmiini) .... *Caltagironea* Cortés & Campos
37(32′). Parafacials with row of strong bristles running diagonally down its entire length; frontal bristles not surpassing level of antennae; 4th abdominal tergite elongate, longer than preceding ones (Proseninae) .... *Prosopochaeta* Macquart
37′. Parafacials with only isolated well developed facio-orbitals inferiorly (Tachininae) 38
38(37′). Palpi present though very short; nasute epistoma of almost abnormal development, projecting horizontally over clypeal level; frons very wide in both sexes .... *Ruiziella* Cortés
38′. Palpi absent or minute; epistoma normally warped and projecting gently between vibrissae 39

39(38′). Intermediate abdominal tergites with discal bristles 40
39′. Intermediate abdominal tergites without discal bristles 42
40(39). Proboscis very elongate, haustellum twice head length .... *Pyrrhotachina* Townsend
40′. Proboscis at most of equal length as head height 41
41(40′). Third longitudinal vein setulose up to anterior cross vein .... *Spanipalpus* Townsend
41′. Third longitudinal vein setulose only at basal node .... *Epalpodes* Townsend
42(39′). Third antennal joint in both sexes of same length as 2nd, in females shorter; species normally with ocellar bristles .... *Vibrissomyia* Townsend
42′. Third antennal joint in females slightly longer than 2nd; species sometimes without ocellar bristles .... *Agicuphocera* Townsend
43(26′). Parafacials inferiorly with well developed facio-orbital bristles; palpi sub-normal, short, or else elongate and filiform .... *Peleteria* Robineau-Desvoidy
43′. Parafacials bare, at most tomentose, without facio-orbital bristles; palpi normal or absent 44
44(43′). Palpi absent; abdominal tergites covered with thick sagitate spines .... *Saundersiops* Townsend
44′. Palpi present, normal; tergites of abdomen with usual bristles 45
45(44′). Prosternum bare in borders; facial ridges without setulae, except at vibrissal angle (Tachininae) .... *Archytas* Jaennicke
45′. Prosternum pilose in borders; facial ridges with setulae in basal half or more (Exoristinae) 46
46(45′). Abdomen elongate, conic or acuminate at tip, with discal bristles on intermediate tergites (Blondeliini, cif. couplet 36) .... *Eucelatoria* Townsend
46′. Abdomen short and broad with truncate apex; intermediate tergites without discal bristles (Belvosiini) .... *Triachora* Townsend

Hypsomyia Cortés, New Genus
(Eryciini, Monotypic)

Frons 0.40 of head width. Frontal profile sloping, little longer than facial. Ocellars piliform, weakly proclinate. Post-ocellars hair-like. One pair of parallel inner verticals lightly reclinate. No outer verticals. Eyes thickly pilose. Frontal row of 6-7 convergent bristles, the 2 lower ones surpassing antennal level. No reclinate or proclinate fronto-orbitals in upper frontalia, which is covered by thick long black hair. Profrons little narrower than eye width. Facial ridges strongly arcuate and grossly setose up to middle of 3rd antennal joint. Parafacials about half width of eye and covered with regular longitudinal row-arranged cilia which reach down to cheeks. Clypeus well excavated; epistoma wide, gently warped above facial ridges, level and clearly projecting between vibrissae. Vibrissae hard to differentiate among thick facial and peristomal bristles. Cheeks approximately round, 0.40 of eye's height, without genal bristles, yet heavily covered with uniform black setae. Peristomal bristles thickly set, black, long, and uniform. Head in profile at epistoma about same length as at antennal level. Proboscis normal, palpi normal, yellowish brown, labella developed.

Antennae black, filling clypeus; 2nd joint half length of 3rd, latter thick and dilated apically. Arista thickened nearly up to tip; intermediate joint elongate, many times longer than wide.

Thorax blackish, sub-shining, hardly with longitudinal stripes of pollen, except between acrostichals, and these only in pronotum. Humeri weakly pollinose. All pleura blackish, without pollen. Scutellum reddish, lightly pollinose. Post-scutellum developed. *Chaetotaxia*: humerals 3, straight; post-humerals 2; pre-sutural 1; notopleurals 2; acrostichals 2-?1; dorsocentrals 3-?1 (both post-sutural acrostichals and dorsocentrals hard to differentiate and partly damaged by the pin); pre-alar 1; supra-alars 2; intra-alars 3; post-alars 2; sternopleurals 1-1, of equal length; pteropleural 1, shorter than both sternopleurals. Hypopleuron thickly pilose. Apical scutellars sub-erect and parallel; 3 lateral scutellars. Prosternum pilose in borders; propleuron bare; infra-squamal setulae absent.

Abdomen black, with last 3 segments basally covered by thick cinereous pollen on the 2nd tergite (3rd of Crosskey 1973, and in the works of Mesnil), which divides medially as to form 2 lateral defined pollinose spots which do not reach posterior margin of segment, nor the venter. Third and fourth tergites (4 and 5 of Crosskey 1973, and in the works of Mesnil) with dense heavy pollen which is more golden yellow than former and spread in bands that completely cover dorsum except on narrow posterior margins which are shining black. Tip of abdomen with truncate Belvosiini slit. Sternites black, concealed. Second and third tergites each with 1 pair of median marginals and another of lateral marginals. Fourth well-covered with erect bristles and complete pre-apical row of setae. No discal bristles on abdomen.

Legs black, normal; tibiae yellowish red. Posterior tibia with row of regular, separated setulae on postero-ventral border, of which 1 about middle is the longest. Empodia and pulvilli elongate (male). Wings clear; veins yellowish. Costal spine absent. Apical cell opened on wing margin well above tip of wing. Three setulae at basal node of 3rd longitudinal vein, which duplicate on back side of wing. Squamae white with yellowish rims.

Type of the genus is the following species, *H. hispida* Cortés, n. sp.

Hypsomyia hispida Cortés, NEW SPECIES
(Eryciini, Fig. 1)

MALE: 6.5 mm, black, with dense, bright, silvery pollen on face. Frontal stripe dark brown. Clypeus and epistoma reddish brown. Tergites of abdomen distinctly pollinose as described above. Venter sub-shining black. Middle tibiae and scutellum dark reddish.

TYPE MATERIAL: *Holotype* ♂ (figured), Parque Nacional de Lauca, Las Cuevas (Arica), Chile, about 4,800 m altitude, 22-II-1978, L. Faúndez coll., on vegetation (CFA).

TYPE LOCALITY: Chile, Prov. Tarapacá, Las Cuevas (Arica), Parque Nacional de Lauca, ca. 4800 m altitude.

FEMALE: Unknown.

HOST: Unknown.

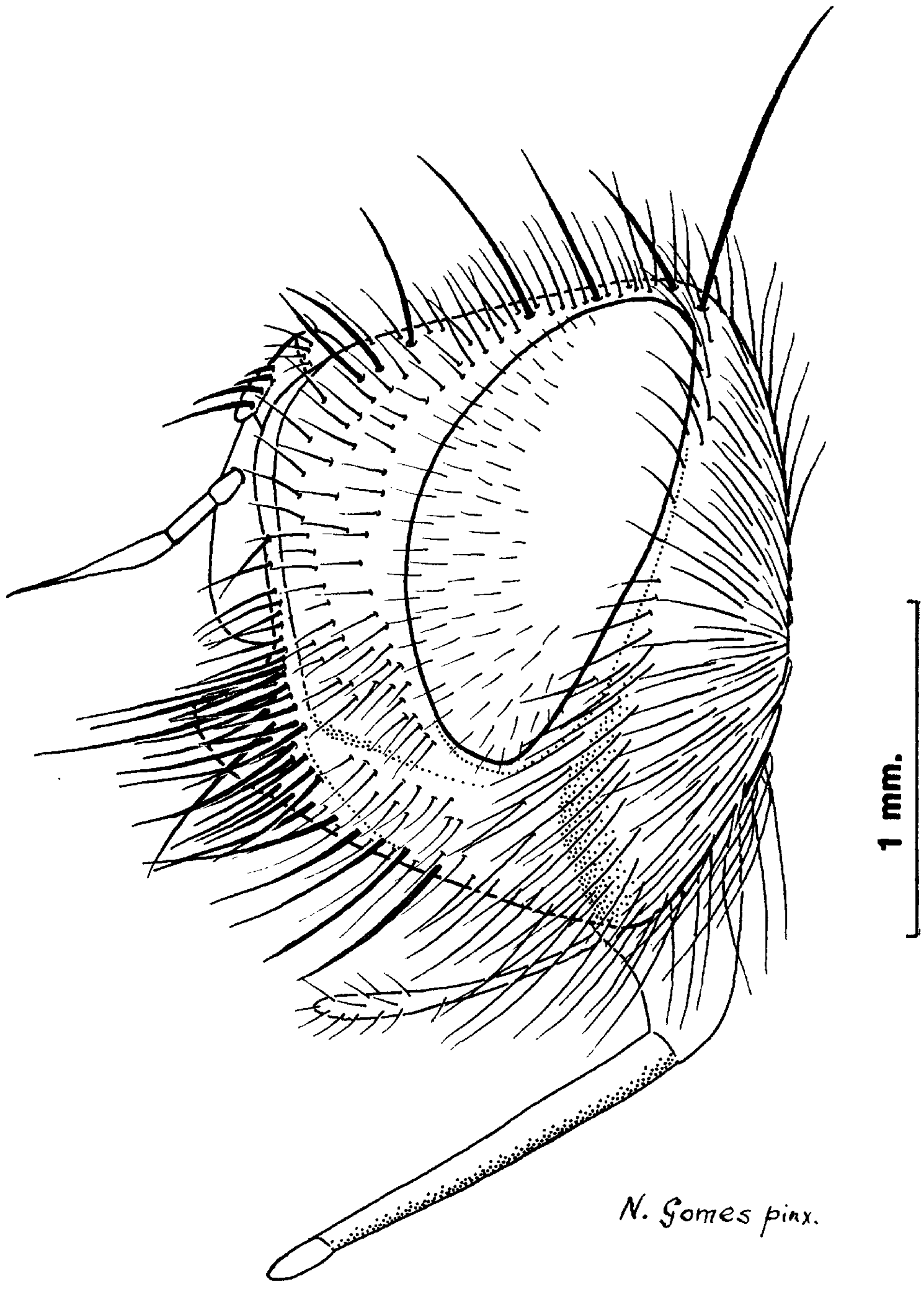

Fig. 1. *Hypsomyia hispida*, n. gen. and n. sp. male. Head profile.

Spanipalpus hiemalis Cortés, NEW SPECIES
(Cuphocerini)

This new species is extra-limital in *Spanipalpus* Townsend because of the presence of well developed discal bristles on intermediate tergites of abdomen which normally do not show in *Spanipalpus*. Yet the examples run undoubtedly to *Spanipalpus* in Townsend's (1939) key to the Cuphocerini. J. H. Guimaraes (1963) described very accurately the genus' main characters, although he later (1971) made *Spanipalpus* (with ocellars) a junior synonym of *Deopalpus* Townsend (without ocellars).

FEMALE: General coloration brassy grey metallic with greenish reflections. Frons yellowish. Face white yellowish with nacreous pollen. Clypeus and epistoma concolorous. Two proclinate, two reclinate, and two strong divergent fronto-orbitals on parafrontalia. Ocellars present and proclinate. Two pairs of verticals of about equal length, inner ones decusate, outer ones divergent. Row of proclinate bristles extending from base of antennae down to cheeks with no differentiated facio-orbital bristles in lower section of parafacials. Cheeks with genal bristles. Vibrissae present and well decusate. Facial ridges bare.

Antennae black, with basal joints reddish yellow. Second joint little shorter than 3rd, which is brownish black. Arista with both basal joints elongate. Proboscis normal, without palpi.

Notum, pleurae and tergites brassy metallic grey, with faint irregular cinereous pollen, which on notum tends to form longitudinal stripes reaching base of scutellum. On tergites this pollen appears more dense or concentrated on sides of segments while along the middle or center runs as a longitudinal narrow stripe reaching tip of abdomen. Sides of abdomen reddish.

Scutellum as notum, with well decusate apicals and 3 lateral bristles. One pair of decumbent discals close to apicals. Abdomen with usual bristles plus 1 pair of well developed discals on intermediate tergites.

Legs normal, tibiae yellowish. Wings clear, costal spine not developed. Third longitudinal vein setulose almost up to anterior cross vein. Weak dark spots on anterior cross vein and at cubitulus of apical cell.

TYPE MATERIAL: *Holotype* ♀, Zapahuira, Arica, 19-VIII-1976, N. Hichins coll., on vegetation (CFA). *Paratype*: ♀, Socoroma, Arica, 19-VII-1977, N. Hichins coll., on *Origanum* flowers (CFA). The size variation of the 2 examples was 6.5-7.0 mm.

TYPE LOCALITY: Chile, Prov. Tarapacá, Zapahuira (Arica), about 2,500 meters altitude.

MALE: Unknown.

HOST: Unknown.

COMPENDIUM OF SPECIES REPORTED FROM TARAPACÁ AND AND ANTOFAGASTA PROVINCES

The species was first attributed to these provinces by Cortés and Campos (1971) unless another citation is given.

1. *Agicuphocera nigra* Townsend 1915, Cuphocerini (Cortés & Campos 1974)
2. *Alpinoplagia boliviana* Townsend 1931, Voriini
3. *Androsoma perhirsutum* Cortés & Campos 1971, Juriniini
4. *Araucosimus superbus* Cortés 1945, Goniini
5. *Archytas incasanus* Townsend 1912, Dejeaniini
   This Peruvian species was treated as *A. divisus* (Walker) 1852 from Brazil, in Guimaraes' 1971 Catalogue.
6. *Archytas marmoratus* (Townsend) 1915, Dejeaniini
7. *Archytas peruanus* Curran 1928, Dejeaniini

8. *Archytas pilifrons* (Schiner) 1868, Dejeaniini
9. *Archytas platonicus* Cortés & Campos 1971, Dejeaniini
10. *Ateloglutus velardei* Cortés & Valencia 1972, Voriini (present paper). 5 examples of both sexes, 2 from Lupica (Arica), 20-I-1982, B. H. V. colls. (CICA), and 3 from Belén Alto, Queñuales (Arica), 29-I-1982, same collectors (CICA)
11. *Bonnetia comta* (Fallén) 1810, Linnaemyini
12. *Caltagironea scillina* Cortés & Campos 1974, Sturmiini (Cortés & Campos 1974)
13. *Caltagironea vera* Cortés & Campos 1974, Sturmiini (Cortés & Campos 1974)
14. *Camposodes evanescens* Cortés 1967, Actiini
15. *Chaetocnephalia andina* Cortés & Campos 1971, Goniini
16. *Chaetocnephalia innupta* Cortés 1945, Goniini
17. *Chaetocraniopsis chilensis* Townsend 1915, Goniini
18. *Chaetodemoticus chilensis* (Schiner) 1868, Germariini
19. *Dolichocnephalia puna* Townsend 1915, Goniini
20. *Dolichostoma arequipae* (Townsend) 1912, Cuphocerini
21. *Echinomasicera hystrix* Townsend 1915, Harrisiini (present paper).
    1 ♀, 12 mm, Socoroma (Arica), 23-VI-1977, G. Díaz (CFA). As the female of this Peruvian species does not seem to have been described, these few characters will complete the description. Two pairs of verticals, inner ones longer and parallel, outer ones shorter, reclinate and decusate. Two proclinate fronto-orbitals in frontalia. Eyes very sparsely thinly pilose. Intermediate joint of arista about twice as long as wide. Cheeks rounded, with genal setae, about 0.25-0.30 of eye height. Wings and squamae infuscated, latter very dark. Third longitudinal vein with 2-3 setulae at basal node. Costal spine undeveloped. Posterior tibiae with row of heavy setae on outer border. Rest of characters as in male.
22. *Elfia frontalis* (Aldrich) 1934, Actiini (as *Lispidea* Coq.)
23. *Epalpodes malloi* Cortés & Campos 1971, Juriniini
24. *Eucelatoria australis* Townsend 1911, Blondeliini
    C. W. Sabrosky (1981) dealt with this New World genus, yet made no special mention of the widely distributed *E. australis* from Peru except under his new *E. digitata* Sabrosky. Having such a large collection of examples from the Neotropics, it would have been worthwhile to define what Thompson (1968) and Cortés (1971) considered to be *E. australis*. Sabrosky considered that both sexes in *Eucelatoria* varied widely from having no ocellar bristles to having well developed ones, with several intergrading possibilities, so this character was not considered reliable. Eight examples from Azapa (Arica) were named *E. digitata* in his paper.

    H. Vargas (unpublished), however, has positively proved that there are 2 host differentiated and genetically different species in Azapa, 1 with and the other without ocellar bristles, that do not inter-breed, that strictly parasitize very different larval hosts, and that cannot be easily differentiated. Such being the case, *E. australis* in the present paper is considered as having no ocellars (check key), and the author prefers to keep Townsend's orginal name until both *australis* Townsend and *digitata* Sabrosky are properly separated biologically

and morphologically.

25. *Euphorocera peruviana* Townsend 1912, Exoristini
26. *Gonia lineata* Macquart 1851, Goniini
27. *Gonia pallens* Wiedemann 1830, Goniini
28. *Gonia* sp. 3, Cortés & Campos 1971, Goniini
29. *Gonia* sp. 4, Cortés & Campos 1971, Goniini
30. *Gonia* sp. 5, Cortés & Campos 1971, Goniini
31. *Gymnosoma neotropicale* Cortés & Campos 1971, Phasiini
32. *Hemilydella fasciata* Townsend 1927, Blondeliini
33. *Hypsomyia hispida* Cortés NEW SPECIES, Eryciini (present paper)
34. *Incamyia chilensis* Aldrich 1928, Blondeliini
35. *Incamyia cinerea* Cortés & Campos 1971, Blondeliini
36. *Incamyia cuzcensis* Townsend 1912, Blondeliini
37. *Incamyia perezi* Cortés & Campos 1971, Blondeliini
38. *Incamyia sandovali* Cortés & Campos 1971, Blondeliini
39. *Incamyia striata* Aldrich 1928, Blondeliini
40. *Lespesia leliae* Cortés & Campos 1971, Eryciini
41. *Lespesia nimia* Cortés & Campos 1971, Eryciini
42. *Lespesia robusta* (Aldrich) 1934, Eryciini (Cortés 1980)
43. *Leucostoma aterrimum* (Villers) 1789, Phasiinae
44. *Leucostoma simplex* (Fallén) 1820, Phasiinae
45. *Myiodexia deserticola* Cortés & Campos 1971, Proseninae-Dexiinae
46. *Ollacheryphe facialis* Townsend 1927, Germariini (Cortés & Hichins 1979)
47. *Peleteria pygmaea* (Macquart) 1850, Tachinini
48. *Peleteria robusta* (Wiedemann) 1830, Tachinini
49. *Phaenopsis arabella* Townsend 1912, Eumasicerini
    This Peruvian species was made a synonym of *Pseudochaeta argentifrons* Coquillett 1895 by Dr. W. R. Thompson (1964)
50. *Plagiprospherysa parvipalpis* (Wulp) 1890, Exoristini
51. *Prosopochaeta caliginosa* Cortés & Campos, Proseninae-Dexiinae
52. *Protogoniops ocellaris* Townsend 1912, Goniini (Cortés & Campos 1974)
53. *Pyrrhotachina proboscidea* Townsend 1931, Cuphocerini (present paper)
    1 ♂, 10.5 mm, in rather poor condition, Talabre, Antofagasta, 8-24-II-1969, L. E. Peña (CFA), which was presented to the author by Dr. J. H. Guimaraes, Museu de Zoología, Sao Paulo, Brazil. It runs quite easily into *Pyrrhotachina* in Townsend's (1939) key to the Cuphocerini, except for the palpi which are not discernible in this example, and 3rd antennal joint (♂) which is twice or more the length of 2nd. The holotype of Dr. Townsend (1931) is a female from Mendoza, República Argentina, and the present male is in poor condition, yet the species shows unique characteristics, such as length of haustellum which is about double the head height, 1 facio-orbital bristle in lower part of each parafacial, both basal joints of arista elongate, 3rd longitudinal vein with long setulae at basal node, costal spine absent, etc., which seems sufficient to confirm the identification.
54. *Ruiziella luctuosa* Cortés 1951, Juriniini
55. *Sarcoprosena luteola* Cortés & Campos 1971, Proseninae-Dexiinae (Cortés & Campos 1974)
56. *Saundersiops cruciatus* Townsend 1914, Juriniini (Cortés & Hichins

57. *Siphoactia peregrina* Cortés & Campos 1971, Siphonini
58. *Siphona geniculata* (DeGeer) 1776, Siphonini
59. *Spanipalpus hiemalis* Cortés, NEW SPECIES, Cuphocerini (present paper)
60. *Sturmia festiva* Cortés 1944, Sturmiini (Cortés & Hichins 1979)
61. *Sturmia insignis* (Wulp) 1882, Sturmiini (Cortés & Campos 1974)
62. *Triachora barbosai* Cortés & Campos 1971, Belvosiini
63. *Trichophoropsis nitens* Townsend 1914, Cuphocerini
64. *Trichophoropsis sabroskyi* Cortés & Campos 1971, Cuphocerini
65. *Urodexodes elongatus* Cortés & Campos 1971, Blondeliini
66. *Vibrissomyia lineolata* (Bigot) 1888, Cuphocerini
67. *Vibrissomyia notata* Cortés 1967, Cuphocerini
68. *Vibrissomyia pullata* Cortés 1951, Cuphocerini
69. *Voria ruralis* (Fallén) 1810, Voriini
70. *Winthemia reliqua* Cortés & Campos 1971, Winthemiini

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LARVA AND PUPA OF *OXYETHIRA LEONENSIS* (TRICHOPTERA: HYDROPTILIDAE)

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ABSTRACT

The first positively associated larva and pupa of *Oxyethira leonensis* Kelley are described. Also given are characteristics to distinguish the final instar larva of *O. leonensis* from that of the previously described North American species, *O. dualis* Morton. *Oxyethira dualis* has middle and hind legs nearly 3 times as long as the fore leg and a mean length greater than 3.10 mm; *O. leonensis* has middle and hind legs nearly 4 times as long as the fore leg and a mean length of 2-3 mm. *Oxyethira leonensis* is a piercer-herbivore known to occur in Florida, South Carolina, and Alabama.

RESUMEN

La primera larva y crisálida positivamente asociadas del *Oxyethira leonensis* Kelley están descritas. También dado son los carácteres para distinguir la larva del *O. leonensis* de *O. dualis* Morton, la especie Norteamericana descrita previamente. *Oxyethira dualis* tiene las patas centrales y traseras casi 3 veces tan largas como la pata delantera y una longitud promedio mayor de 3.10 mm; *O. leonensis* tiene las patas centrales y traseras casi 4 veces tan largas como la pata delantera y la longitud promedio de 2-3 mm. *Oxyethira leonensis* es un herbívoro-perforado que se encuentra en Florida, Carolina del Sur, y Alabama.

The study of Hydroptilidae has historically been hampered by their small size and lack of adequate characteristics necessary for their separation. Although Hydroptilidae contains approximately 50 genera and over 600 species, most larvae remain unassociated with identifiable adults. The genus *Oxyethira* (Eaton) is certainly no exception. Recent work by Kelley (1981, 1982) on *Oxyethira* adults, however, facilitates larval association. Previous work on immature North American *Oxyethira* species is scant. Sibley (1926) provided a description of *O. dualis* with figures of the larval head and thorax. Ross (1944) illustrated *O. dualis* legs. The purpose of this paper is to provide a description of the immature stages of *O. leonensis*.

Identification and association of larva, pupa and adult were accomplished by using the "metamorphotype method" (Milne 1938), where the genitalia of

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Identification and association of larva, pupa and adult were accomplished by using the "metamorphotype method" (Milne 1938), where the genitalia of the mature pupa (pharate adult), and the larval sclerites (retained in the pupal case) are associated.

Oxyethira leonensis Kelley
Fig. 1-10

EGG: Unknown.
LARVA: Last (5th) instar mean length 2.37 mm (n=6, range 1.93-2.82). Head light brown, without any distinguishing marks or patterns (Fig. 1). Frontoclypeal apotome with 2 pairs of setae, and very obvious crenulations (Fig. 2). Genal area also crenulated (Fig. 2). Positions of other setae and sensory pits as illustrated (Fig. 1). Setae and pits numbered according to system of Williams and Wiggins (1982). Each mandible (Fig. 3) with 2 apical (incisor cusps) and 5 subapical (molar cusps) teeth, 2 long setae at the postero-lateral margin and 4 subapical setae. Thoracic nota also light brown and fully sclerotized, with setae and sensory pits as shown (Fig. 4a,b,c). Middle and hind legs (Fig. 5b,c) characteristically almost 4 times as long as fore legs (Fig. 5a), with tarsal claws roughly 1/2 length of tarsi and extending beyond abdominal segment IV. Fore tibia with medio-distal projection. Fore tarsus with claw of approximately equal length. Hind femur curved (Fig. 5c). Abdomen with scattered setae dorso-laterally on segments V through VIII (Fig. 6). Abdominal segment IX with sclerites and anal claw as shown (Fig. 7). Larval case typically bottle-shaped, laterally compressed at the broad end.
PUPA: Pupal mean length male 1.71 mm (n=4, range 1.62-1.76 mm), female 2.21 mm (n=9, range 2.05-2.43 mm). Head and thorax brown, abdomen greenish with 7 apparent segments. Wings dark. Antennae long and coarse. Fore tibia without apical spurs (Fig. 10), middle tibia with 2 apical and 1 preapical spur. Full habitus view in case shown with head toward broad, depressed end (Fig. 9; the longitudinal orientation of the pupa in its case is opposite that of all known *Oxyethira* species larvae, and is rotated 90′). Pupal case with attaching anchors at 4 corners (Fig. 8).

BIOLOGY

Oxyethira leonensis has been previously recorded from Florida (Leon Co., Tall Timbrs Res. Station, 29 V 1973, Kelley 1981), South Carolina (Pickens Co., Lake Issaqueena, Kelley, unpub.), and Alabama (Tuscaloosa Co., Harris, unpub.). I collected 5th instar larvae and pupae attached under the leaves of emergent vascular hydrophytes at the edge of a deep swamp (S.C.: Pickens Co., Three-and-twenty Creek at Highway 178). The first through 4th instars of *Oxyethira* spp. are free-living (Nielson 1948) and of short duration, showing simple hypermetamorphosis (Marshall 1979). The 5th instar is the case building stage and is the principle growing stage (Marshall 1979). *Oxyethira* feed by sucking fluid out of filamentous algae, and may also eat solid food (Nielson 1948). Respiration is cutaneous, with the renewal of oxygen presumably taking place by diffusion into the case and through its walls, since the larva exhibits no respiratory undulations (Nielson 1948). Just prior to pupation, the larva reverses its position in the case, which is now sealed at both ends (stopped with a plug of debris at the narrow end, functionally sealed at the broad end) and fastened to the sub-

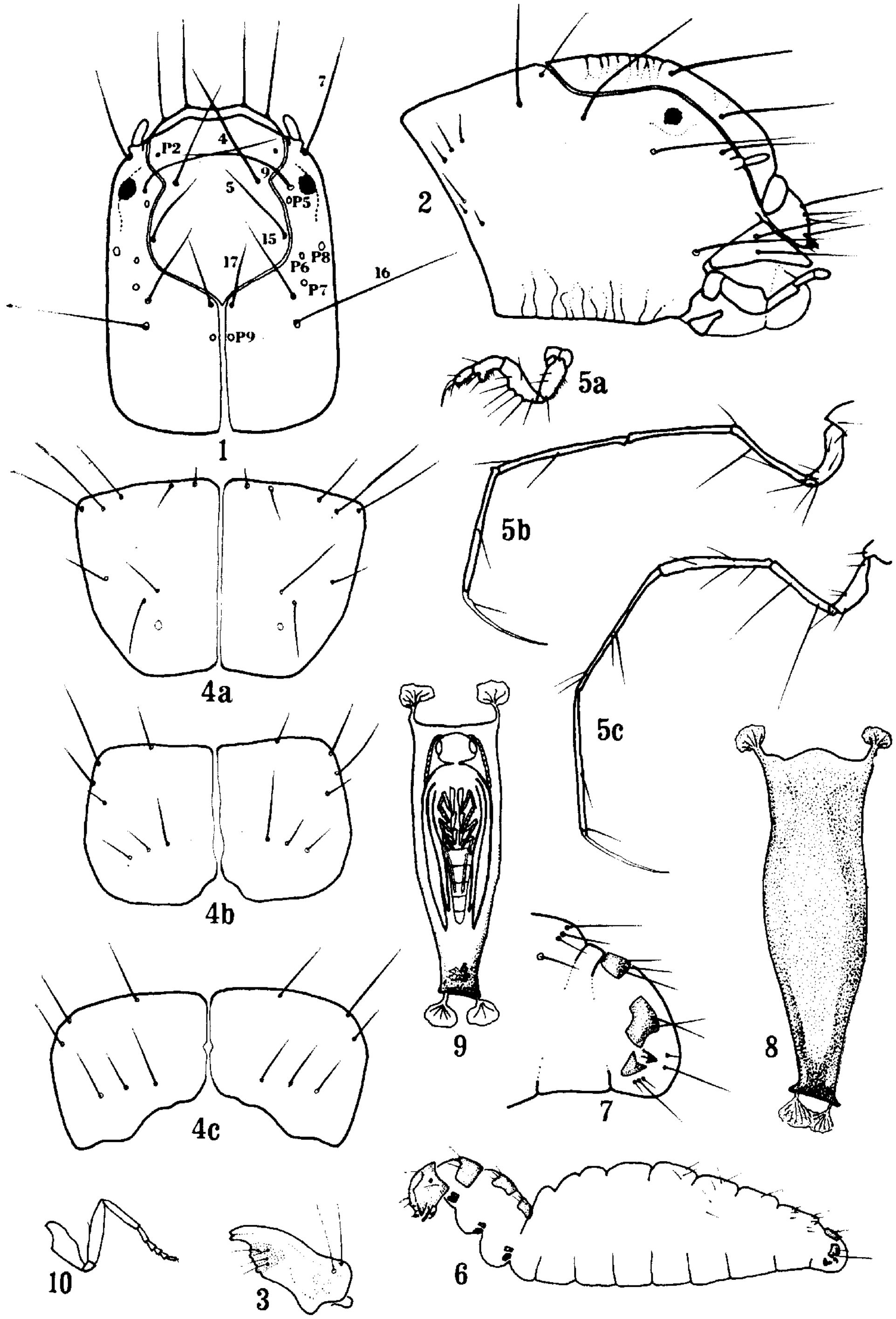

Fig. 1-10. *Oxyethira leonensis* larval and pupal characters. (1) Larval head, dorsal. (2) Larval head, lateral. (3) Left larval mandible, ventral. (4) Larval thoracic nota: (4a) pronotum, (4b) mesonotum, (4c) metanotum. (5) Left larval legs, posterior: (5a) fore, (5b) middle, (5c) hind. (6) Larva, full habitus, without legs. (7) Larval abdominal segment IX, left lateral. (8) Pupal case, dorsal. (9) Pupa, full habitus in case, ventral. (10) Pupal right fore leg, posterior.

strate with 2 posterior and 2 anterior "cables" of silk thread spread apically to form attachment discs. Nielson (1948) reported a pre-pupal stage beginning up to 3 days after the case is closed, and lasting 2 to 6 days, with a pupal stage lasting 8 to 17 days after that.

Distinguishing Characteristics

Of the North American species of *Oxyethira*, only the larva of *O. dualis* has been previously described, as stated above. Using these descriptions, the following characters should be used to separate the 5th instar larva of this species from *O. leonensis*.

Key to 5th Instar Larvae

1. Middle and hind legs nearly 4 times as long as fore leg; larval length 2-3 mm .... *Oxyethira leonensis*

1′. Middle and hind legs nearly 3 times as long as fore leg; larval length greater than 3.10 mm .... *Oxyethira dualis*

Material Examined: All the material examined was collected by the author (S.C.: Pickens Co., Three-and-twenty Creek at County Highway 178, 20-X-1982) and is deposited in the Clemson University Insect Museum.

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SUITABILITY OF *CITRUS* SPP. AND *ARDISIA SOLANACEA* FOR LABORATORY REARING OF THE CITRUS BLACKFLY, *ALEUROCANTHUS WOGLUMI*[1]

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ABSTRACT

No citrus blackfly preference was found for rough lemon plants grown in the laboratory under 16L:8D photophase (artificial light) versus those grown in the greenhouse (natural light). Of 3 plant species, rough lemon (*Citrus limon* [L.] Burm. f. 'Rough'), sour orange (*Citrus aurantium* L.), and *Ardisia solanacea* Roxb., analyzed for their efficacy as citrus blackfly hosts, rough lemon was found to be the most suitable host plant for mass production of citrus blackfly and its parasites.

RESUMEN

La mosca negra de los cítricos no presentó el tener preferencia por las plantas de limón rugoso cultivadas en laboratorio bajo 16L:8D fotofase (luz artificial) versus aquellas cultivadas en invernadero (luz natural). De 3 especies de plantas de limón rugoso (*Citrus limon* [L.] Burm. f. 'Rough'), naranja agria (*Citrus aurantium* L.), y *Ardisia solanacea* Roxb. analizadas por su eficacia como hospederas de la mosca negra de los cítricos, el limón rugoso demostró ser el hospedero más apropiado para la producción en masa de la mosca negra de los cítricos y sus parásitos.

Citrus blackfly (CBF), *Aleurocanthus woglumi* Ashby, a serious pest of citrus of Asian origin, was first found in the Western Hemisphere in Jamaica in 1912 (Ashby 1915). Since then it has been established in Mexico, Central America, and the West Indies (Dietz and Zetek 1920, Quaintance and Baker 1916). It was discovered in Florida in 1939 on Key West from where it was eradicated after a 3 year effort (Newell and Brown 1939) and again in Fort Lauderdale in February 1976 (Hart et al. 1978). By the end of 1979, CBF had infested Broward, Dade, Palm Beach, Lee, Collier, Highlands, Okeechobee, Indian River, St. Lucie, and Brevard counties. A laboratory was built in Fort Lauderdale in 1978 by the Division of Plant Industry and the U.S. Department of Agriculture, Animal and Plant Health Inspection Service (USDA-APHIS) to produce parasites of the CBF for the biological control program in Florida. CBF are highly polyphagous and oviposit on at least 160 plant species belonging to 80 families (Dietz and Zetek 1920, Dowell and Steinberg 1979). This study was devised to determine suitable host plants for CBF mass production. The results of rearing CBF on 3 candidate plants,

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Ardisia solanacea Roxb., rough lemon (*Citrus limon* [L.] Burn. f. 'Rough'), and sour orange (*C. aurantium* L.) under laboratory conditions are reported. These species were selected based on previous works conducted at the USDA/CBF rearing facilities in Texas and Mexico, field observations by Howard (1979) and Dowell and Steinberg (1979), and cultural factors involved in propagations.

MATERIALS AND METHODS

Host preference and mortality of CBF on rough lemon plants grown in the greenhouse versus laboratory.

Rough lemon seeds were sown in a bed of Terra-lite vermiculite saturated with distilled water and placed in a germination chamber at 25°C and 100% RH for 7 days. Germinated seeds were planted, 2-3 seedlings per pot, in 100 white plastic pots (6 cm height x 6 cm diam.) filled with vermiculite saturated with Hoagland's solution (Sanchez et al. 1977) contained in a sterile plastic tray (86x56x20 cm). One tray of rough lemon seedlings was placed in the greenhouse which was regulated at an average temperature of 25°C. Another tray of seedlings was kept in the laboratory and maintained on a 16L:8D photophase at an average temperature of 25°C and 75% RH. At the end of a 12-week growth period, plants of equal height grown in the laboratory were taken to the greenhouse and arranged, alternately, with those grown in the greenhouse. These were housed in 4 rearing hydroponic cages used by Sanchez et al. 1977. Rearing cages (90x44x64 cm) built of plywood were fitted with windows covered with plexiglas or nylon screen (100 mesh) to provide adequate light exposure, ventilation, and for observation. Thirty-five potted plants were fitted into holes drilled through a styrofoam sheet which floated in a plastic tray (86x56x12 cm) containing 20 litres of Hoagland's solution placed inside the cage. This solution was aerated with an air bubbler and a small fan was kept in the cage to increase air circulation.

A 2-year-old CBF stock colony reared on rough lemon plants in the greenhouse was used for this study. Donor rough lemon plants, containing 4,000 to 6,000 male and female CBF pupae ready to emerge, were inverted and sprayed with a mixture of nontoxic black Driad powder paint, agar and distilled water to minimize the CBF ovipositional stimuli on donor plants. After 12 days, the donor plants were removed, and the number of emerged CBF was recorded by counting the characteristic T-shaped opening in the pupal cases. Ten days later the number of eggs and egg spirals were counted on the 15 plants located in the center of the cage. Nymphs were allowed to develop to third and fourth stages (ca. 5 weeks) before they were counted to compare mortality rates of the CBF developing from egg to last instar for each host plant. During the final 5-week period, CBF were allowed to emerge. Mortality rates from egg to emerged adult were then calculated.

Preference and mortality of CBF on rough lemon versus sour orange/Ardisia solanacea Roxb.

Rough lemon and sour orange seedlings were grown simultaneously in the laboratory under a 16-h light cycle for a 12-week period. Plants of equal height were chosen and arranged in an alternate pattern in 3 rearing cages in the greenhouse for a 2-week period, then inoculated with CBF.

Rough lemon and *A. solanacea* Roxb. were grown in the laboratory for a 12-week period, then transferred to the greenhouse for an additional 3-week growth period, which was the time required for *A. solanacea* Roxb. to reach the same height as the rough lemon. Plants were arranged in 3 rearing cages as described above.

The same procedures were followed for inoculation of the plants with CBF, determination of CBF preference for each type of host plant and calculation of mortality rates as previous experiments.

Results and Discussion

No significant difference was found in CBF preference or development on rough lemon plants grown under 16L:8D photophase and natural light. Survival (no. of eggs/no. of CBF emerged) slightly decreased as the level of eggs in the cage increased (Table 1). The mass production of CBF can be obtained with plants cultured either in the greenhouse or in the laboratory with comparable results; however, plants in the greenhouse grew faster and produced more leaves than those in the laboratory.

Of the 2 citrus species studied, rough lemon was a better host than sour orange with a significant difference ($P \leq 0.01$) in the oviposition, development, and survival of CBF (Table 2). When the rearing cage was infested with 36,000 to 40,000 CBF eggs, the percentage of CBF emerging as adults was 50% from rough lemon and 41% from sour orange. In hydroponic solution, rough lemon always grew faster and formed more leaves than sour orange.

A. solanacea germinated and grew more slowly than rough lemon in vermiculite. When the 2 spp. of plants were placed together in the hydroponic cage (both of the same age), *A. solanacea* was shorter than rough lemon; however, this condition was soon reversed as the growth rate of *A. solanacea* proceeded more quickly in the hydroponic solution. Three weeks after the introduction of *A. solanacea* into hydroponics, CBF were introduced into the cage. At the end of the experiment, *A. solanacea* had attained twice the height of rough lemon and had produced more leaves. However, rough lemon was the more favored host for CBF. There was a significant difference at the 1% level in the oviposition, development, and survival of CBF on rough lemon as compared with *A. solanacea* (Table 3). Approximately twice the number of CBF eggs were laid, with half the mortality rate, on rough lemon than on *A. solanacea.*

Our studies show that the rough lemon is the best host for mass production of CBF in the greenhouse. Dowell et al. (1978) also reported that rough lemon was the favored host of CBF in the field. Due to the potential problem of whitefly contamination of greenhouse cultures, *A. solanacea* could be considered a good host for production of CBF as it has been found to be free of citrus whiteflies (Howard 1979). The rearing facility was maintained for 3 years, producing about 2 million CBF each month in 1981, without any contamination of whitefly or foot rot caused by *Phytophthora spp.* Therefore, rough lemon is still considered the most suitable host of CBF, whether grown in the greenhouse or laboratory.

TABLE 1. OVIPOSITION, DEVELOPMENT AND SURVIVAL OF *Aleurocanthus woglumi* ON ROUGH LEMON GROWN IN THE GREENHOUSE (MEAN ± STANDARD ERROR).

Level of infestation (No. eggs/cage)	No. egg spirals per plant	No. eggs per plant	No. 3rd-4th stage per plant	No. CBF emerged per plant	Survival[1]
12,790	33.4 ± 3.3	443.1 ± 56.9	291.4 ± 49.0	173.2 ± 31.1	0.496 ± 0.059
19,040	32.2 ± 3.9	744.5 ± 86.6	498.7 ± 72.8	278.4 ± 53.9	0.509 ± 0.055
32,790	43.4 ± 7.9	1033.5 ± 158.3	573.2 ± 166.1	243.7 ± 50.0	0.431 ± 0.091
33,510	67.8 ± 14.2	1352.2 ± 270.6	911.4 ± 133.7	347.4 ± 108.1	0.412 ± 0.082

[1]Survival = No. CBF emerged/No. of eggs per plant.

TABLE 2. OVIPOSITION, DEVELOPMENT AND SURVIVAL OF *Aleurocanthus woglumi* ON SOUR ORANGE COMPARED WITH ROUGH LEMON GROWN IN THE GREENHOUSE. (T = 27 ± 5°C; MEAN ± STANDARD ERROR).[1]

Level of infestation (No. eggs/cage)	Host species	No. egg spirals per plant	No. eggs per plant	No. 3rd-4th stage per plant	No. CBF emerged per plant	Survival[2]
36,040	Rough lemon	95.8 ± 7.3	1802.4 ± 202.0	1040.8 ± 150.5	873.1 ± 119.7	0.503 ± 0.031
	Sour orange	55.8 ± 9.5	1326.6 ± 305.2	700.2 ± 224.2	521.8 ± 175.4	0.335 ± 0.039
37,660	Rough lemon	101.0 ± 16.1	1708.7 ± 309.0	1092.5 ± 202.2	843.0 ± 111.1	0.503 ± 0.027
	Sour orange	52.1 ± 4.6	1055.7 ± 120.5	611.3 ± 62.3	325.7 ± 20.4	0.412 ± 0.030
38,990	Rough lemon	141.8 ± 9.2	2207.5 ± 127.7	1288.7 ± 103.3	1188.1 ± 92.6	0.481 ± 0.029
	Sour orange	51.0 ± 5.1	860.3 ± 128.3	541.7 ± 72.1	424.8 ± 67.1	0.383 ± 0.042

[1]Means for all parameters are significantly different at $P \leq 0.01$ by F test for each host species within an infestation level.
[2]Survival = No. CBF emerged/No. of eggs per plant.

TABLE 3. OVIPOSITION, DEVELOPMENT AND SURVIVAL OF *Aleurocanthus woglumi* ON ROUGH LEMON COMPARED WITH *Ardisia solanacea* GROWING IN THE GREENHOUSE. (T = 27 ± 5°C; MEAN ± STANDARD ERROR).[1]

Level of infestation (No. eggs/cage)	Host species	No. egg spirals per plant	No. eggs per plant	No. 3rd-4th stage per plant	No. CBF emerged per plant	Survival[2]
8,700	Rough lemon	16.1 ± 2.3	354.0 ± 46.2	269.2 ± 41.4	251.1 ± 31.4	0.472 ± 0.058
	A. solanacea	9.2 ± 1.4	210.3 ± 27.7	85.8 ± 12.7	66.8 ± 11.6	0.309 ± 0.048
16,240	Rough lemon	32.8 ± 5.4	761.2 ± 136.8	610.4 ± 119.9	310.1 ± 53.1	0.380 ± 0.041
	A. solanacea	20.2 ± 4.7	422.0 ± 105.8	160.1 ± 42.1	111.8 ± 29.7	0.219 ± 0.031
60,100	Rough lemon	231.0 ± 54.1	4153.4 ± 944.7	1619.0 ± 296.1	906.8 ± 93.3	0.711 ± 0.027
	A. solanacea	80.0 ± 11.3	1171.2 ± 193.0	403.7 ± 43.8	265.8 ± 33.8	0.333 ± 0.032

[1]Means for all parameters are significantly different at $P \leq 0.01$ by F test for each host species within an infestation level.
[2]Survival = No. CBF emerged/No. of eggs per plant.

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PARASITOIDS OF *DIORYCTRIA* SPP. (PYRALIDAE: LEPIDOPTERA) CONEWORMS IN SLASH PINE SEED PRODUCTION AREAS OF NORTH FLORIDA

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ABSTRACT

Thirteen species of parasitic Hymenoptera and 2 species of tachinid flies were found parasitizing *Dioryctria* spp. coneworms in north Florida slash pine (*Pinus elliottii*) seed orchards. Seven new host-parasite associations were recorded. *Hyssopus rhyacioniae* Gahan (Hymenoptera: Eulophidae) was the most commonly collected parasite of *D. amatella* (Hulst), the most common coneworm attacking north Florida slash pine. Another eulophid (*Pediobius* n. sp.) was common and easily propagated in the laboratory on cabbage looper *Trichoplusia ni* (Hübner) pupae. Its value for release is questionable since it also is a hyperparasite. In limited tests, a new species of *Trichogramma* (Hymenoptera: Trichogrammatidae) parasitized up to 70% of the *D. ebeli* M & M eggs on cones placed in a seed orchard.

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Abstract

Thirteen species of parasitic Hymenoptera and 2 species of tachinid flies were found parasitizing *Dioryctria* spp. coneworms in north Florida slash pine (*Pinus elliottii*) seed orchards. Seven new host-parasite associations were recorded. *Hyssopus rhyacioniae* Gahan (Hymenoptera: Eulophidae) was the most commonly collected parasite of *D. amatella* (Hulst), the most common coneworm attacking north Florida slash pine. Another eulophid (*Pediobius* n. sp.) was common and easily propagated in the laboratory on cabbage looper *Trichoplusia ni* (Hübner) pupae. Its value for release is questionable since it also is a hyperparasite. In limited tests, a new species of *Trichogramma* (Hymenoptera: Trichogrammatidae) parasitized up to 70% of the *D. ebeli* M & M eggs on cones placed in a seed orchard.

RESUMEN

Trece especies parasiticas de Hymenoptera y dos especies de taquínidos fueron encontrados parasitando a gusanos del cono, *Dioryctria* spp., en semilleros de pino (*Pinus elliottii*) en el norte de la Florida. Esto incluye en el registro a siete nuevas asociaciones de hospedero—parasito. *Hyssopus rhyacioniae* Gahan (Hymenoptera: Eulophidae) fue el parasito más comunmente encontrado en *D. amatella* (Hulst), lo cual es el gusano del cono mas común en pinos (*P. elliottii*) en el norte de la Florida. Otro eulophido (*Pediobius* sp. nov.) fue también común y facilmente reproducido en el laboratorio en pupas del gusano de la col *Trichoplusia ni* (Hübner). Su valor para liberación es dudoso ya que también es un hiperparásito. En unas pruebas limitadas, nueva especie de *Trichogramma* (Hymenoptera: Trichogrammatidae) parasitaba hasta un 70% de los huevos de *D. ebeli* depositados en conos en un semillero de pinos.

Dioryctria spp. coneworms can potentially destroy about one half of the annual slash pine seed crop in north Florida if insecticides are not used (Merkel et al. 1965). No detailed studies of *Dioryctria* parasitoids in north Florida have been made but Ebel (1965) listed 10 Hymenoptera and 3 Diptera parasitizing at least one of the 4 *Dioryctria* spp. attacking slash pine, *Pinus elliottii.* Most work on *Dioryctria* parasitoids has been done in Arkansas (Yearian and Warren 1964, Brown 1969, Posey 1969) and North Carolina (Neunzig et al. 1964) on pines other than slash. Our purpose was to determine the parasitoids present and to investigate some aspects of the biology of the more abundant species.

Dioryctria-damaged materials from throughout north Florida slash pine seed orchards and production areas were collected over a 2 year period. These materials were processed to determine the relative abundance of the parasite species, their hosts, and percentage of parasitism.

Collections were made largely in seed orchard areas that were never treated with insecticides, although the systemic insecticide carbofuran (2,3-Dihydro-2,2-dimethyl-7-benzofuranyl methylcarbamate), was commercially applied to the soil in certain seed orchard areas at Yulee, Florida.

METHODS AND MATERIALS

Collections of slash pine cones were made infrequently from September, 1977 through 1978, and monthly throughout 1979. The 1978 collections were made mainly at the U.S.F.S. station in Olustee, Florida. In 1979, collections continued in Olustee and were also made approximately once each month at the Rayonier seed orchard, Yulee, Florida. Additional collections were made in 1979 at the Buckeye Cellulose seed orchard, Perry, Florida and Owen-Illinois seed orchard, White Springs, Florida. Bulk collections of *Dioryctria*-damaged cones harvested from a number of locations (usually 100 or more cones per location) were obtained at the International Forest Seed Company in Tallahassee, during cone harvests each fall.

Slash pine samples (generally in seed orchards) were collected on every trip. A few longleaf and loblolly cone samples were collected on several occasions. Random collections of *Dioryctria*-damaged plant material were made from all quadrants of the trees and from all age groups of trees that were attacked. Samples included vegetative shoots, strobili, conelets, first-and second-year cones, diseased cones, unharvested second-year cones, branches, bark, and fusiform rust cankers. Due to weather and differing field problems each collection varied from 4 or 5 to hundreds of samples.

Each sample was placed separately into a labelled 1-liter ice cream container (Fonda type #109) with a small glass vial (12-18 mm interior diameter) in the top or side. Separate samples allowed definite verification of every host-parasite match since each sample was carefully dissected to identify the host if a parasite emerged. Small samples which might dry out were carefully cut open and the *Dioryctria* larvae placed on fresh slash pine cones or artificial medium to allow larvae to complete development or parasites to emerge. Fresh undamaged cones of any available size were obtained periodically, dipped in hot parawax, and frozen until needed for *Dioryctria* larvae. *Dioryctria* medium was prepared similarly to the method outlined by Fatzinger (1970). Fusiform rust galls caused by the fungus, *Cronartium quercuum* (Berk.) Miyabe *ex.* Shirai f. sp. *fusiforme,* were placed in large emergence cages made of screen and wood, and kept outside for observation. Parasitized larvae were transferred into a bioclimatic cabinet (Ashley and Greany 1978) provided by the U.S.D.A. Forest Service. Humidity was 60 ± 10%, and temeprature was 27 ± 1°C with a 16D, 8L photophase.

RESULTS

Eighteen parasites were reared from *Dioryctria* species coneworms during this study (Table 1). Most of the new parasites recorded were larval parasites. The parasitized larvae were nearly or completely developed when they died. Identification of coneworm larvae was based on morphological differences between mandibles of completely developed larvae of each of the 3 most common *Dioryctria* species in north Florida slash pine seed orchards (Belmont 1979).

The most important finding during this study was the discovery of a new species of *Trichogramma,* identified by Dr. C. Goodpasture, U.S.D.A., Beltsville, Maryland. It parasitized 70-80% of *D. ebeli* eggs. This parasite deserves additional study, but time and financial limitations prevented us from following up on this species discovered late in the study. Methods and materials utilized in collecting this wasp were discussed by Belmont (1979).

Detailed information of the life histories of each parasite was difficult to obtain due to scarcity of the parasites in nature but 2 parasites were abundant enough to study in depth: *Hyssopus rhyacioniae* Gahan (Hymenoptera: Eulophidae) and a new species of *Pediobius* (Hymenoptera: Eulophidae).

Ebel (1965) listed 8 species of parasites on *D. amatella.* Of these all were recovered in the present study as well as 2 species previously unrecorded on this host in Florida: a *Bracon* sp. and *Exochus turgidus* Hg. (Table 1). A single *Trichionotus* sp. (Ichneumonidae) emerged from a Calhoun County, Florida slash pine cone lot (n = 50), heavily infested by *D. amatella.*

Parasitism by *Hyssopus rhyacioniae* Gahan, the most common and important larval parasite of *D. amatella,* ranged from 0-9% per collection. No single species of parasite or combination of parasites effectively controlled *D. amatella* populations, even in one collection area where approximately 27% parasitism occurred due to *Phrynofrontina* n. sp. *Phanerotoma* sp.

TABLE 1. MAJOR ATTACK PERIOD AND MAXIMUM PERCENTAGE OF PARASITISM OF PARASITES REARED FROM *Dioryctria* SPP. CONEWORMS IN NORTH FLORIDA, SEPTEMBER, 1977 TO NOVEMBER, 1979.

Parasites	Major attack period	Host stage attacked	Highest %[1] parasitism observed in 1 collection	*Dioryctria* species		
				amatella	*ebeli*	*clarioralis*
Hymenoptera—Braconidae						
Agathis sp.	Summer	Larva	4.0	X		
Apanteles sp.	Summer	Larva	10.0		X	
Bracon sp.	Summer	Larva	4.0	X[2]		
Macrocentrus sp.	Spring-Summer	Larva	7.1		X[2]	
Macrocentrus dioryctriae Mues.	Summer-Fall	Larva	5.0	X		
Phanerotoma sp.	March-July	Larva	20.0		X	
Hymenoptera—Ichneumonidae						
Campoplex conocola Rohwer	Late Summer-Fall	Larva	2.5	X		
Coccygomimus aequalis Prov.	Summer	Larva	<1.0			
Exeristes comstockii Cresson	Late Summer-Fall	Larva	6.5	X		
Exochus turgidus Holmgr.	Spring and Fall	Larva-Pupa	5.1	X[2]		
Lissonota amatella Tow.	Spring and Fall	Larva	10.5	X		
Trichionotus sp.	Emerged in Fall	Larva	<1.0			
Hymenoptera—Eulophidae						
Hyssopus rhyacioniae	Jan.-Oct.	Larva	9.0	X	X[2]	X[2]
Pediobius n. sp.	Spring and Fall	Pupa	10.4	X	X[2]	
Hymenoptera—Trichogrammatidae						
Trichogramma n. sp. near *brevicapillus* P. & P.	Summer	Egg	70% Field 80% Lab		X	
Diptera—Tachinidae						
Leskiomima tenera (Wd.)	Summer	Larva	<1.0	(unk.—see Belmont, 1979)		
Phrynofrontina n. sp.	Midsummer-Fall	Larva	27.2	X	X	
Xanthophyto n. sp.	Fall	Larva-Pupa	6.6	X	X[2]	

[1](Not entirely cone collections)—see methods and materials.
[2]Previously unrecorded in Florida in this host.

(Hymenoptera: Braconidae) was the major larval parasite of *D. ebeli* and *H. rhyacioniae* was the only larval parasite collected on *D. clarioralis* from slash pine materials. *H. rhyacioniae* also attacked larvae of *D. ebeli.*

Hyssopus rhyacioniae Gahan (Eulophidae)

This gregarious, external larval parasite emerged from coneworm-damaged pine materials collected each month except November and December. Adults emerged from various slash pine materials attacked by *Dioryctria*: fusiform rust cankers, vegetative shoots, conerust-infected cones (caused by the fungus, *Cronartium strobilinum* Hedge. and Hahn) and second-year cones. Parasites were also reared from longleaf pine vegetative shoots, second-year cones, and second-year cones which remained throughout the winter without falling (= third-year cones). The number of *H. rhyacioniae* ranged from 2-70 individuals per host larva but averaged about 30 (n = ca. 25). In the laboratory, *H. rhyacioniae* parasitized and killed healthy 3rd instar to pupating field-collected *D. amatella*, and healthy 2nd instar to pupating lab-reared *D. amatella.*

Adult *H. rhyacioniae* were unaffected after short periods of refrigeration (up to 48 h at 57°F). No further studies of parasite refrigeration were made but Altenkirch (1976) refrigerated *H. thymus* Girault for mass-rearing and release in Spain. Mated field-fresh females were stored at 59°F up to 3 weeks without detrimental effects to the offspring, whether fed or unfed prior to refrigeration.

Egg (24-36 h): 0.14-0.17 mm long (n = 21), white, simple, ovate, slightly arched, posterior end slightly saccate, smoothly rounded, unsculptured at 100x, anterior end with a thin, sticky pedicel approximately 0.1 mm long serving to attach the egg to the host larva.

First instar (24-40 h): 0.16-0.20 mm long (n = 21), white but semi-transparent, somewhat cylindrical, segmented, tapering posteriorly.

Second instar to fully developed larva (ca. 46 h, 2nd inst. to prepupa): The second instar is 0.3-0.8 mm long (n = 21) and similar in appearance to first instar. Body segmentation is less distinct as the midsection begins to swell.

There may be one or possibly more molts before the prepupa is attained, but instars vary in size as they grow rapidly and look similar. Male larval growth is greater than female larval growth since male pupae and adults after just a day or two are always larger than female pupae and adults. Exuviae of all molting larvae are extremely thin and difficult to detect.

Fully developed larva (first phase, 30-40 h; second-phase, 12-20 h): Females 1.1-2.0 mm (n = 7) long, males 1.3-2.7 mm (n = 7) depending mainly upon host size and number of larvae per host.

A. *First phase*: Mouth parts attached to host; ejection of meconium occurs during a 3-6 hour period, generally lasting 3.5-4 hours with 20-65 individual liquid "pellets" released into a "mass" or meconium. Approximately every 3-7 minutes a drop of feces is squeezed out as the tip of the abdomen bends around to place the drop onto the rest of the "mass" attached to the larva's body or other nearby substrate.
B. *Second phase* (prepupal): (Mouthparts disengaged from the host). The meconium has been discharged completely and the interior of the

fully developed larva is completely cream-colored. The exoskeleton becomes milky and drier or more porous-looking, appears to begin to dissolve, but then slowly begins to shed. The prepupa, with little motion, undulates forward very slowly up to 6 or 7 mm until its skin which has been cast behind it, shrivels into a thread-like remains ca. 0.5 mm long.

Pupa: Immediately following ecdysis, the head, thorax, abdomen, rudimentary wings, antennae, and eyes become visible. The entire pupa initially is light ivory-yellow to amber and eventually darkens to amber. Later the head and the outlines of the appendages become dark amber. The head generally darkens about 40 hours after pupation. As the head darkens, a light exocuticular pattern of lines separates left and right dorsal regions on the head and thorax. The cast skin of the prepupa often clings to the end of the abdomen but may eventually dislodge. The pupal maturation process generally follows this sequence: (1) No darkening to head or body (totally straw-colored); slight amber color to highlights and head; outline to compound eyes darkens; eyes tint to pink; eyes darken to red, no punctations in compound eyes. (Duration ca. 85-95 h) (2) Mandibles and ocelli darken and may redden; eyes become dark red with punctations; head becomes dark amber, exocuticular line pattern readily visible on dorsal areas of head and thorax; wing pads become amber; abdomen becomes striped, ivory to straw to ivory. (Duration ca. 10-20 h) (3) Eyes, red-brown; wings become solid dark amber; abdomen becomes striped, brown to straw to brown. (Duration ca. 30-40 h) (4) Head, eyes, and body turn solid dark brown to completely black. (Duration ca. 20-40 h) Total pupal period: $\bar{x} = 160$ h, range 145-195 h ($n = 30$). (5) Adult emerges. Sizes nearly equal those of fully developed larvae but may be slightly larger.

Adult: Female 1.14-1.35 mm long ($n = 50$); male 1.35-2.70 mm long ($n = 25$); solid black, rarely with lighter abdominal banding, thick femurs. Adult life span (unfed): female 10-35 days, male 8-20 days, with ample moisture in the bioclimatic cabinet.

The female appeared to be arrhenotokous, generally producing numerous females and apparently less than 20% males when fertile, and producing only male offspring when unfertilized. These data were based on 26 mated and 2 unmated females only and should be repeated for more precise data.

Pediobius New Species (Eulophidae)

This eulophid attacked pupae of *Dioryctria* spp. and of other Lepidoptera and Diptera. In slash and longleaf pine cones it parasitizes *D. amatella* pupae in the fall and winter and emerges as an adult in the spring. This was verified in the spring of 1979 from cones collected in the fall and winter of 1978-79. It attacks pupae of the *Phrynofrontina* n. sp., a tachinid parasite of *D. amatella* larvae (mainly in the summer in pine cones), but not those of the *Xanthophyto* n. sp., another tachinid coneworm parasite.

Belmont (1979) successfully mass-reared this eulophid on cabbage looper, *Trichoplusia ni* (Hübner), pupae. He also discussed and illustrated certain morphological differences between this eulophid and *H. rhyacioniae*.

Egg (ca. 24 h): Approximately 0.18 mm long ($n = 10$), ovoid, posterior larger than anterior, white, smooth, unsculptured at 60x, similar in shape to *H. rhyacioniae* egg, without pedicel.

First instar (ca. 20 h): 0.20-0.30 mm long (n = 20), similar in shape to *H. rhyacioniae* except more swollen in mid-section.

Second instar through completely developed larvae ($\bar{x}$ = 8.5 days): (n = 100) 0.3 mm (second instar) to 1.80-2.60 mm (completely developed larvae) (n = 20). It is unknown how many molts occur, since each larval stage looks so similar and has developed for a slightly different period of time. Completely developed larvae range from 1.80-2.60 mm (n = 20); although this size larva may undergo one or more molts, the larval size remains the same between 6 and 10 days after hatching. The method of meconium deposition is unknown but occurs in a few hours. Mandibles of this species are sickle-shaped while those of *H. rhyacioniae* larvae are straight (Fig. 1).

Pupa: 1.70-2.50 mm long (n = 50), slightly smaller than completely developed larvae, the pupae are white at first and generally change to straw to black. The pupal stage lasts 3.5-4 days, about 60% (n = 15) shorter than the duration for *H. rhyacioniae*.

Adult: Male—1.35-1.85 mm long (n = 50); female—1.40-2.00 mm long (n = 50) lab-reared specimens. Life span may be up to a week longer than *H. rhyacioniae*.

Color: Both sexes are generally metallic violet-green although heads and thoraxes are generally metallic green with first 2 to 3 tarsal segments on all legs cream-colored.

Less detailed data concerning other *D. amatella* and other *Dioryctria* sp. parasites was discussed by Belmont (1979).

Discussion and Summary

Although additional *Dioryctria* larval parasites probably exist, they are undoubtedly rare in north Florida slash pine. Three probable *Dioryctria* spp. parasites emerged from slash pine material: *Trathela* sp. (Ichneumonidae), an unidentified species in the Mesosteninae (Ichneumonidae), and *Coccygomimnus aequalis* Prov. (Ichneumonidae).

No one parasite species or combination of species had a high enough percent parasitism during the season to substantially reduce or control *Dioryctria* spp. populations.

Refinement of rearing procedures for *H. rhyacioniae* might allow production of large numbers of this parasite for mass-release. This species could successfully reduce the high numbers of actively feeding *Dioryctria* spp. larvae, but by release time, some cones would already be damaged. This is also true for the new species of *Pediobius*. This wasp is also hyperparasitic

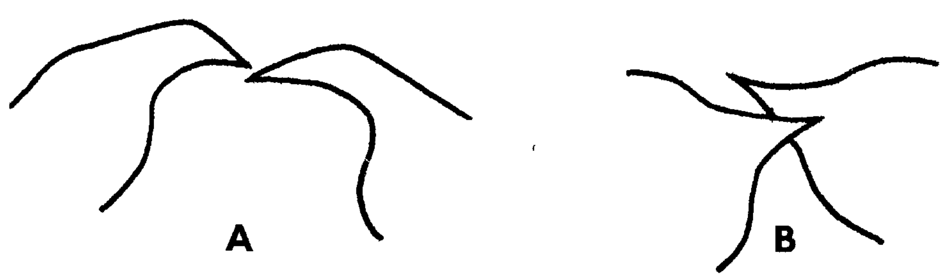

Fig. 1. Mandibles of fully developed larvae of (a) *Pediobius* new species and (b) *Hyssopus rhyacioniae* Gahan.

on the *Phyrnofrontina* n. sp. *Dioryctria* parasite. However, both wasp species have the possibility of effectively suppressing subsequent *Dioryctria* spp. generations through the season by mass releases early in the season.

The greatest hope for effective coneworm control could very well rest with the perfection of a full-scale mass-release program for the new *Trichogramma* egg parasite. Which *Dioryctria* spp. eggs the *Trichogramma* n. sp. attacks must be determined. Since this wasp was rapidly reared in the lab, it offers excellent opportunity for controlling coneworms before any damage occurs.

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NEW RECORDS AND SPECIES OF THE MILLIPED GENUS *CARALINDA* (POLYDESMIDA: XYSTODESMIDAE)

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ABSTRACT

Caralinda causeyi n. sp. and *C. dactylifera* n. sp. are described from Florida and Georgia, bringing the known generic composition to 4 species, 3 of which occur in northern Florida. Two new records of *C. pulchritecta* provide knowledge on variation and expand its known range into southeastern Alabama. A full generic description is now possible for *Caralinda* along with a key to species. Diagnostic illustrations are provided for the new species to aid in determinations.

RESUMEN

Se describen *Caralinda causeyi* sp. nov. y *C. dactylifera* sp. nov. de Florida y Georgia. Así la composición generica conocida incluye 4 especies, con 3 de estas ocurriendo en el norte de Florida. Dos registros nuevos de *C. pulchritecta* aumentan el conocimiento de la variación y extienden la distribución de la especie hasta el sureste de Alabama. Ahora es posible describir en forma completa el género *Caralinda,* y constuir una clave para las especies. Se presentan ilustraciones diagnosticas para todas las nuevas especies para ayudar en las identificaciones.

The milliped genus *Caralinda* is one of the most southern in the Xystodesmidae. It was proposed by Hoffman (1978) for the new species, *beatrix,* collected in Tift County, Georgia, which remains the northernmost generic locality. In 1979 I described a second species, *pulchritecta,* from Jackson County, Florida, and the new congeners diagnosed herein bring the known Floridian fauna to 3 species. *Caralinda* is thus the most diverse xystodesmid genus in Florida, ahead of *Cheiropus* Loomis, *Dicellarius* Chamberlin, and *Pleuroloma* Rafinesque, with only two species each.

We have the late Dr. Nell B. Causey to thank for the new material of *Caralinda.* This paper is based entirely upon specimens in her collection, which was transferred to the Florida State Collection of Arthropods upon her death in 1979. For 20 years she amassed 25 samples and over 75 specimens of what she recognized as a new genus, as evidenced by her identifica-

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The milliped genus *Caralinda* is one of the most southern in the Xystodesmidae. It was proposed by Hoffman (1978) for the new species, *beatrix,* collected in Tift County, Georgia, which remains the northernmost generic locality. In 1979 I described a second species, *pulchritecta,* from Jackson County, Florida, and the new congeners diagnosed herein bring the known Floridian fauna to 3 species. *Caralinda* is thus the most diverse xystodesmid genus in Florida, ahead of *Cheiropus* Loomis, *Dicellarius* Chamberlin, and *Pleuroloma* Rafinesque, with only two species each.

We have the late Dr. Nell B. Causey to thank for the new material of *Caralinda.* This paper is based entirely upon specimens in her collection, which was transferred to the Florida State Collection of Arthropods upon her death in 1979. For 20 years she amassed 25 samples and over 75 specimens of what she recognized as a new genus, as evidenced by her identification labels. She never published a name, however, and Hoffman is thus the author. Dr. Causey nevertheless knew of *Caralinda* long before anyone else, and it seems only proper that a species be named in her honor. She also left her colleagues a vast collection that is an invaluable archive of the Nearctic and Neotropical faunas. I in particular have benefited from this material and am pleased to extend a patronym in recognition of the important contribution to diplopodology that her collection represents.

The new species of *Caralinda* require modification of Hoffman's generic diagnosis (1978), and I therefore present a full description of the genus in addition to the species accounts. Two new locality records of *pulchritecta* provide insight into variation as well as slightly extending its range; *beatrix*, however, is still known only from the type collection. The 4 known species of *Caralinda* are quite different anatomically, yet they occur close together in an area with little topographical relief. This suggests that distributions are probably limited; that the species are probably allopatric; and that the north-south flowing rivers (for example the Chattahoochee, Appalachicola, Flint, and Ochlockonee) may serve as range boundaries. Several additional species probably remain to be discovered, perhaps as far east as the Suwannee River and as far west as Mobile Bay and the Alabama River, the largest watercourses in either direction. All but 2 of the existing samples were collected from November through March, so additional field work should take place at this time of year. From the material at hand, one can reasonably conclude that a sizeable fauna exists and that *Caralinda* may have the largest species composition of any rhysodesmine genus in the eastern United States.

Genus *Caralinda* Hoffman

Caralinda Hoffman, 1978: 365-6; 1979: 158.

TYPE SPECIES: *C. beatrix* Hoffman, 1978, by original designation.

DESCRIPTION: A genus of small xystodesmids with the following characteristics:

Body composed of head and 20 segments in both sexes; size varying from around 16-24 mm in length and 3.5-5 mm in width; W/L ratio similarly varying from about 20-24%. Body essentially parallel-sided in midbody region, tapering at both ends.

Head of normal appearance, smooth, polished. Epicranial suture distinct or indistinct, terminating in interantennal region, not apically bifid; interantennal isthmus broad; genae with or without slight central impressions, not margined laterally, ends broadly rounded and projecting slightly beyond adjacent cranial margins. Antennae moderately slender, variable in length, becoming progressively more hirsute distally, with 4 conical sensory cones on ultimate article, no other sensory structures apparent. Facial setae variable: epicranial, interantennal, clypeal, and labral present; subantennal present or absent; with or without scattered setae in frontoclypeal region; clypeal and labral series usually merging and continuing for about 1/2 length of genal margins.

Terga smooth, polished, occasionally becoming moderately coriaceous. Collum broad, ends subequal to those of following tergite. Paranota moderately to strongly depressed but generally continuing slope of dorsum; scapuloral rim continuing across entire dorsum of body segments.

Peritremata long and narrow, distinctly elevated above paranotal surface; ozopores located just caudal to midlength, opening laterad.

Caudal segments normal for family.

Sides of metazonites generally smooth. Pregonopodal sterna of males modified as follows: that of segment 4 with variable hirsute process between 3rd legs, usually much longer than widths of adjacent coxae; sternum of segment 5 also with variable hirsute process, divided or undivided apically, subequal to or longer than widths of adjacent coxae; sternum of segment 6 flat and recessed to accommodate gonopodal telopodites, wider than preceding sterna. Postgonopodal sterna with lowly rounded, variably hirsute lobes on caudal edges, with variable degrees of pilosity between anterior legs. Gonapophyses short, apically expanded. Coxae without modifications; prefemoral spines straight, acute; tarsal claws slightly bisinuate. Hypoproct broadly rounded; paraprocts with margins slightly thickened.

Gonopodal aperture broadly avoid, extending beyond lateral margins of coxae, with or without slight anteriolateral and posteriolateral indentations, lateral edges level with metazonal surfaces or slightly elevated and flared. Gonopods *in situ* with acropodites overlying 6th sternum, tips not overlapping, prefemoral processes crossing in midline over aperture. Coxae moderate in size, unmodified, attached by sclerotized, median sternal remnant. Prefemur from 1/3 to 1/2 of telopodite length; prefemoral process variable, either erect and apically flared, or bent strongly subcaudad at midlength with terminal corners produced into 2 subacute projections directed oppositely. Acropodite demarcated from prefemur by cingulum, either thin and laminate, or thick and heavily sclerotized; configuration highly variable, but generally forming shield for solenomerite; with or without various thickened lobes or folds; margins smooth or highly serrate. Solenomerite short and acute, usually located around midlength of acropodite, arising from lobe of acropodite, directed ventrad. Prostatic groove arising in pit in prefemur, running along medial side of acropodite to terminal opening on solenomerite.

Cyphopod aperture broad, encircling 2nd legs. Cyphopods *in situ* variable, with receptacle or valves visible in aperture. Receptacle flat and saddle-shaped, or cupped around end of valves. Latter subequal and finely granulate. Operculum minute, hidden under free end of valves.

DISTRIBUTION: South central Georgia, southeastern Alabama, and northern Florida (Fig. 11). The range limits remain to be determined.

SPECIES: Four are known; others probably occur in this general area.

REMARKS: Hoffman (1978) tentatively placed *Caralinda* in the tribe Rhysodesmini as a disjunct member. I agreed with this assessment (Shelley 1980) and stated that the considerable differences between it and other tribal constituents argued for an extremely remote relationship with them.

Caralinda, like *Eurymerodesmus,* is a cool weather genus with species prevalent from November through March. It is therefore poorly known because most collecting has occurred in the warm seasons of the year when it is absent from the epigean fauna. Thus, we have only begun to learn about *Caralinda,* and winter collecting may produce from 2 to 4 additional species between the Suwannee and Alabama Rivers, and perhaps inland as far as the Fall Zone.

Key to Species of *Caralinda* (based on adult males)

1. Acropodite thin and laminate; prefemoral process erect, apically flared; Houston Co., AL, and Jackson Co., FL .... *pulchritecta* Shelley

1′. Acropodite thick and heavily sclerotized; prefemoral process bent strongly subcaudad at midlength, terminal corners produced into 2 subacute projections 2

2(1′). Solenomerite projecting beyond apex of acropodite; latter with central dactyliform process at midlength on medial side; Bay, Walton, and Okaloosa Cos., FL .... *dactylifera* new species

2′. Solenomerite located subterminally, not projecting beyond apex of acropodite; latter with variable lobes but without dactyliform projection 3

3(2′). Apex of acropodite bent strongly submediad, margins finely serrate; Tift Co., GA .... *beatrix* Hoffman

3′. Apex of acropodite expanded into 4 lobes, directed mediad, caudad, anteriad, and ventrad; margins smooth; Thomas, Grady and Brooks Cos., GA, and Leon and Jefferson Cos., FL .... *causeyi* new species

TYPE SPECIMENS: Male holotype and 18 male and 8 female paratypes collected by Wulf Reiss, 13-29-XI-1973, from Tall Timbers Research Station, ca. 22 mi. N Tallahassee, Leon Co., FL. Two male and one female paratypes deposited in North Carolina State Museum collection.

DIAGNOSIS: Prefemoral process bent strongly subcaudad at midlength, apex variable; solenomerite falcate, subterminal, arising from lobe near midlength of acropodite; latter expanded distad into 4 variable lobes, directed mediad, anteriad, caudad, and ventrad.

HOLOTYPE: Length 21.1 mm, width of 3rd segment 4.1 mm, of 6th segment 4.3 mm, of 10th segment 4.3 mm, of 15th segment 4.1 mm; W/L ratio 20.3%.

Color in life unknown; specimen completely bleached by alcohol with no evidence of pattern.

Somatic features similar to those of *beatrix* with following exceptions:

Width across genal apices 2.3 mm, interantennal isthmus 0.8 mm; epicranial suture distinct. Antennae reaching back to middle of 4th paranota, relative lengths of antennomeres $2>3=5>6>4>1>7$. Genae with slight central impression. Facial setae as follows: epicranial 2-2, interantennal 1-1, subantennal 1-1, about 8 scattered setae of varying lengths in frontoclypeal region, genal 2-2, clypeal about 10-10, labral about 14-14, merging with clypeal series and continuing to about midlength of genal margins, about 10 setae on each side.

Terga smooth, polished, highly glossy. Collum broad, not extending beyond margins of adjacent tergite. Paranota moderately depressed, continuing slope of dorsum; caudolateral corners rounded through segment 5, becoming blunt on segment 6 and progressively more pointed posteriorly.

Sternum of segment 4 with long, ventrally directed process between 3rd legs, much longer than widths of adjacent coxae, with 2 pairs of paramedian seta at midlength (Fig. 1); of segment 5 with moderately long, apically hirsute process between 4th legs subsimilar to that of *pulchritecta*,

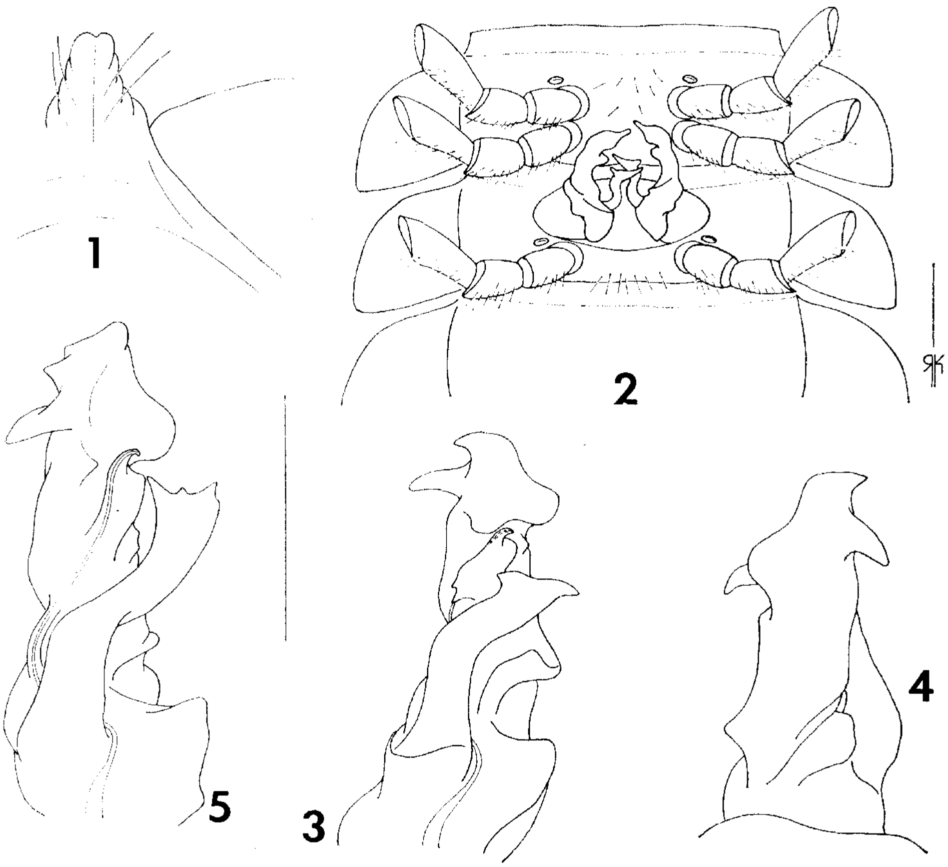

Fig. 1-5. *Caralinda causeyi.* 1) process of 4th sternum of holotype, caudal view. 2) gonopods *in situ*, ventral view of paratype. 3) telopodite of left gonopod of holotype, medial view. 4) the same, lateral view. 5) telopodite of left gonopod of male from Grady Co., GA, medial view. Scale line for Fig. 2 = 1.00 mm; line for other Fig. = 0.8 mm for 1, 1.00 mm for 3-5.

Caralinda causeyi Shelley, NEW SPECIES
Fig. 1-5

5th legs set slightly farther apart than 4th; of segment 6 flat and recessed to accommodate gonopodal telopodites, wider than preceding sterna. Postgonopodal sterna with small, rounded lobes between caudal legs, covered with dense clusters of setae; sparser clumps of setae between anterior legs.

Gonopodal aperture very broad, extending well beyond lateral margins of coxae, indented slightly anteriolaterad and caudolaterad, sides elevated and slightly flared. Gonopods *in situ* (Fig. 2) with coxae protruding ventrad from aperture, acropodites extending anteriad and overlying 6th sternum, prefemoral processes crossing in midline. Gonopod structure as follows (Fig. 3-4): prefemur about 1/3 of acropodite length; prefemoral process curved strongly caudad at midlength, expanded apically into 2 acute projections, directed oppositely. Acropodite set off from prefemur by cingulum, extending sublinearly with lobes as follows: one basally on caudal side, one at midlength on medial surface with 2 small basal teeth, and 4 distally directed mediad, caudad, anteriad, and ventrad; anterior lobe elongate and apically subacute, ventral lobe produced on anterior side into subacute tip, other lobes broadly rounded. Solenomerite a short falcate projection arising apically from lobe at midlength, situated adjacent to medial terminal lobe of acropodite. Prostatic groove arising in pit in prefemur, curving around base of prefemoral process, extending along medial face of acropodite onto lobe at midlength, continuing to terminal opening on solenomerite.

MALE PARATYPES: The male paratypes agree essentially with the holotype.

FEMALE PARATYPE: The female paratype agrees closely with the males in somatic features, except the paranota are more strongly depressed, creating the appearance of a more highly arched body.

Cyphopods *in situ* with edges of valves visible in aperture; valves subequal. Receptacle moderate in size, cupped around medial side of valves.

VARIATION: The gonopods of the available material of *causeyi* are highly variable for such a short geographic distance. The Grady County, Georgia, site is only about 16 miles from the type locality, but the gonopods are strikingly different as shown in Fig. 5. The prefemoral process is apically expanded, and the margin is scalloped, with the outer teeth slightly larger. The basal lobe of the acropodite is reduced, and the prostatic groove passes onto the acropodite along an anteriomedial ridge. The medial lobe at midlength is absent, and the solenomerite arises as a separate projection from the acropodite stem. Apically, the medial lobe is reduced and subtriangular; the anterior and caudal lobes are subsimilar to those of the type; and the ventral lobe has two subterminal teeth on the anterior side.

DISTRIBUTION: Southern Georgia and north central Florida (Fig. 11). The exact limits remain to be determined, but the Appalachicola River probably forms the western boundary. Specimens were examined as follows:

GEORGIA: *Grady Co.*, 3 mi. W. Cairo, 5 ♂, ♀, 26-I-1965, N. B. Causey. *Thomas Co.*, Bar M Ranch near Boston, ♀, 23-III-1973, Sedgwick. *Brooks Co.*, Quitman, 3 ♂, ♀, 14-I-1980, G. Collins.

FLORIDA: *Leon Co.*, Tall Timbers Research Station ca. 22 mi. N Tallahassee, 4 ♂, ♀, 2-25-I-1971; ♂, 29-XI-1971; 17 ♂, 2 ♀, 20-27-XII-1971; 2 ♂, 10-I-1972; and ♀, 13-III-1972, all by W. H. Whitcomb; 19 ♂, 8 ♀, 13-29-XI-1973, and 8 ♂, 4 ♀, 1-3-XII-1973, W. Reiss. TYPE LOCALITY. *Jefferson Co.*, no further data, ♀, 18-IV-1968, collector unknown.

Caralinda dactylifera Shelley, NEW SPECIES
Fig. 6-10

TYPE SPECIMENS: Male holotype and 2 male and 1 female paratypes collected by Roy C. Hallman, 23-II-1962, from Panama City, Bay Co., FL. Male paratype deposited in North Carolina State Museum Collection.

DIAGNOSIS: Prefemoral process bent strongly subcaudad at midlength; solenomerite broadly curved and relatively large, terminal, arising from medial dactyliform projection at midlength of acropodite and extending beyond apex of latter; acropodite broadly expanded and rounded at midlength, with several marginal lobes.

HOLOTYPE: Body highly fragmented, unmeasurable.

Color in life unknown.

Somatic features similar to those of *beatrix* with following exceptions:

Width across genal apices 2.3 mm, interantennal isthmus 0.8 mm;

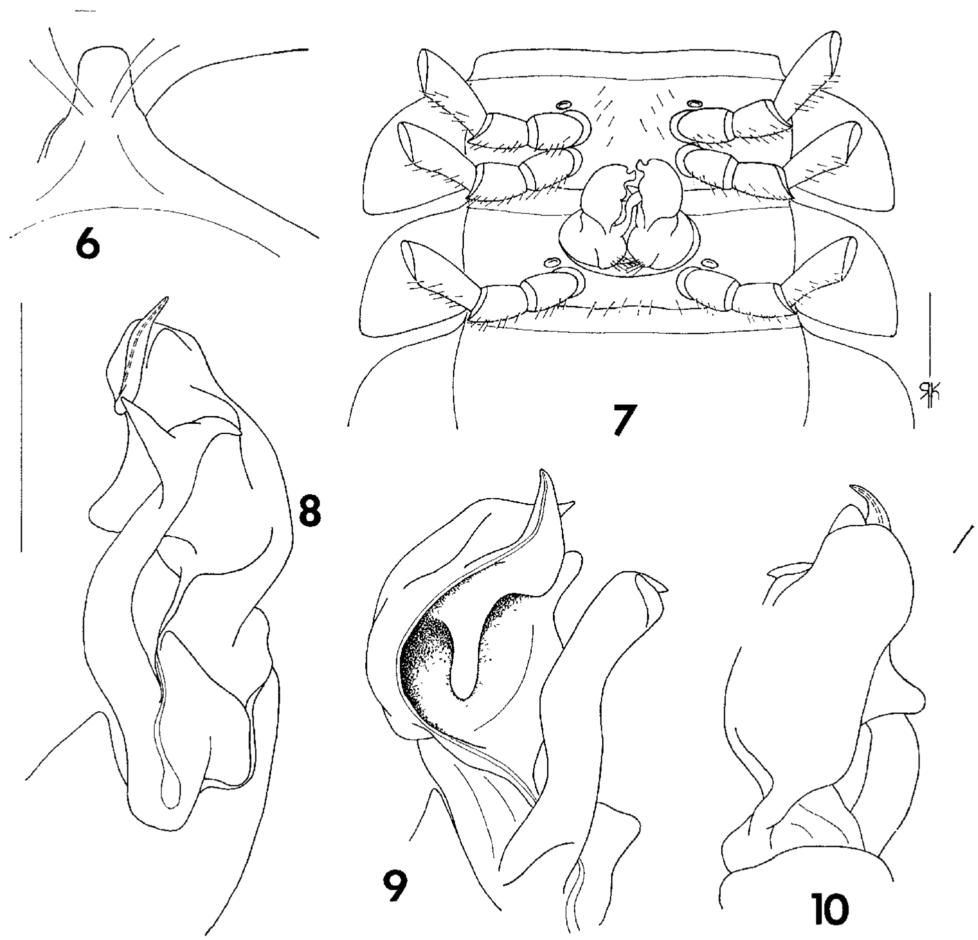

Fig. 6-10. *Caralinda dactylifera.* 6) Process of 4th sternum of holotype, caudal view. 7) gonopods *in situ*, ventral view of paratype. 8) telopodite of left gonopod of holotype, medial view. 9) the same, subdorsal view. 10) the same, lateral view. Scale line for Fig. 7 = 1.00 mm; line for other Fig. = 0.80 mm for 6, 1.00 mm for 8-10.

epicranial isthmus distinct. Antennae reaching back to caudal edge of 3rd paranota, relative lengths of antennomeres 2>3=4=5=6>1>7. Genae with slight central impression. Facial setae as follows: epicranial 1-1, interantennal 1-1, frontal 1-1, clypeal 10-10, labral about 12-12, merging with clypeal series and continuing as dense cluster of setae, 3-4 rows thick, for 1/2 length of genal margins.

Terga smooth, polished. Collum broad, not extending beyond margins of adjacent tergite. Paranota moderately depressed, continuing slope of dorsum; caudolateral corners rounded through segment 5, becoming blunt on segment 6 and progressively more acute posteriorly.

Sternum of segment 4 with long process between 3rd legs, much longer than widths of adjacent coxae, with 2 paramedian setae at base of projection (Fig. 6); of segment 5 with moderately long, apically hirsute process between 4th legs, subsimilar to that of *pulchritecta,* 5th legs set slightly farther apart than 4th; of segment 6 flat and depressed to accommodate telopodites, wider than preceding sterna. Postgonopodal sterna with small, rounded lobes between caudal legs, covered with moderate clusters of setae; sparser clumps of setae between anterior legs.

Gonopodal aperture very broad, extending well beyond lateral margins of coxae, indented slightly anteriolaterad and caudolaterad, sides elevated and slightly flared. Gonopods *in situ* (Fig. 7) with coxae protruding ventrad from aperture, acropodites extending anteriad and overlapping 6th sternum, prefemoral processes crossing in midline. Gonopod structure as follows (Figs. 8-9): Prefemur about 1/3 of telopodite length; prefemoral process curved strongly caudad at midlength, divided apically into 2 acute projections, directed oppositely. Acropodite set off from prefemur by cingulum, with anteriolateral ridge basally, broadly expanded and convex at midlength with prominent, central, dactyliform projection, narrowing slightly distad into broad apex; with lowly rounded or subpyramidal marginal lobes throughout length. Solenomerite broadly curved and located distad on acropodite, arising as continuation of dactyliform projection, medial edge broadly rounded basally, narrowing rapidly to subacuminate tip, extending beyond apex of acropodite. Prostatic groove arising in pit in prefemur, running along basal ridge to anterior surface of acropodite, continuing onto solenomerite and opening apically.

MALE PARATYPES: The male paratypes agree closely with the holotype in all particulars.

FEMALE PARATYPE: The female paratype agrees essentially with the males in somatic features, except the paranota are more strongly depressed, creating the appearance of a more highly arched body.

Cyphopods *in situ* with corner of receptacle visible in aperture. Valves subequal, directed dorsolaterad.

DISTRIBUTION: Florida pan handle (Fig. 11), exact limits remaining to be determined. Specimens were examined as follows:

FLORIDA: *Bay Co.*, Panama City, 3 ♀, XII-1959; ♂, ♀, 17-II-1961; ♂, XII-1961; 2 ♂, 26-I-1962; and 2 ♂, ♀, 23-II-1962, all by R. C. Hallman. Type LOCALITY. *Walton Co.*, 8.5 mi. W DeFuniak Springs, along US hwy. 90,

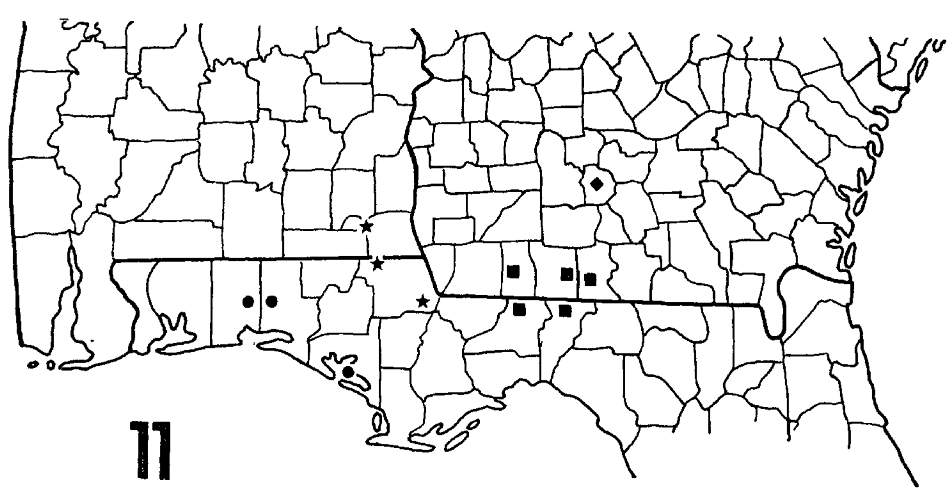

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Fig. 11. Distribution of *Caralinda*. diamond, *beatrix;* squares, *causeyi;* stars, *pulchritecta;* dots, *dactylifera*.

juv. ♀, 22-I-1965, N. B. Causey. *Okaloosa Co.*, no further data, ♀, 14-III-1961, H. A. Denmark.

Caralinda pulchritecta Shelley

Caralinda pulchritecta Shelley, 1979: 184-7, Fig. 1-6.

VARIATION: The new material is very close to the holotype as described and illustrated by me (Shelley 1979). In the Florida male the apex of the acropodite is slightly more elongate, whereas it is reduced in the Alabama males. The acropodite is also less expanded basally in the latter males, and the whole structure leans subcaudad.

DISTRIBUTION: Southeastern Alabama and the adjacent Florida panhandle. The Chattahoochee-Appalachicola River likely forms the eastern range boundary. New specimens were examined as follows:

ALABAMA: *Houston Co.*, Brannon Stand W of Dothan, 2 ♂, 3 juvs., 26-I-1965, N. B. Causey.

FLORIDA: *Jackson Co.*, along FL Hwy. 69 ca. 2.7 mi. N Calhoun Co. line, ♂, 24-I-1965, N. B. Causey.

ACKNOWLEDGMENTS

I am indebted to Howard V. Weems, Jr., Curator of the Florida State Collection of Arthropods, for the opportunity to examine the Causey collection and describe the new species. I also thank Renaldo G. Kuhler, North Carolina State Museum scientific illustrator, for preparing fig. 2 and 7. This research was supported in part by NSF grants numbers DEB 7702596 and DEB 8200556.

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THE GENUS *OZOPHORA* IN FLORIDA (HEMIPTERA: LYGAEIDAE)

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ABSTRACT

The Florida species of the genus *Ozophora* are keyed and described; distribution, food plants and habitats are discussed. *Ozophora gilva, floridana,* and *caroli* from Florida and *levis* from Florida and the Bahamas are described as new. *Ozophora inornata* Barber is synonymized with *reperta* Blatchley; *divaricata* Barber is reported from Florida for the first time; and *concava* (Distant) and *pallescens* (Distant) are removed from the Florida list. The remaining Florida species are *burmeisteri* (Guerin), *trinotata* Barber, *laticephala* Slater & O'Donnell and *picturata* Uhler.

RESUMEN

Se describen las especies de *Ozophora* de Florida, se presenta una clave, y se discuten la distribucion de las especies, sus plantas hospederas, y sus habitates. Se describen como nuevas especies *Ozophora gilva, O. floridana,* y *O. caroli* todos de Florida, y *O. levis* de Florida y las Islas Bahamas. *Ozophora inornata* Barber se considera como un sinónimo de *O. reperta* Blatchley; se registra *O. divaricata* Barber de Florida por primera vez; y se remueven de la lista para Florida *O. concava* (Distant) y *O. pallescens* (Distant). Las restantes especies floridanas son: *O. burmeisteri* (Guerin), *O. trinotata* Barber, *O. laticephala* Slater y O'Donnell, y *O. picturata* Uhler.

The genus *Ozophora* is one of the most complex and taxonomically difficult genera of Western Hemisphere Rhyparochrominae. The distribution is primarily Neotropical where a bewildering number of species of more or less similar size and color pattern occur. Many species occur only in the West Indies where the genus constitutes one of the dominant elements of the rhyparochromine fauna.

The Florida fauna has not been examined carefully since Blatchley's (1926) study. In the present paper we describe 4 new species, report *divaricata* Barber from North America for the first time, remove *concava* (Distant) and *pallescens* (Distant) from the Florida list, refer Blatchley's (1926) records of *pallescens* to *gilva* new species, and synonymize *inornata* Barber with *reperta* Blatchley.

Ozophora is the only genus of the tribe Ozophorini to occur in Florida. It may be recognized by the ventral abdominal spiracles, rather porrect head with longitudinal grooves on the vertex, distinct pronotal collar, calloused and ridged (but not sharply carinate) lateral pronotal margins, rather slender fore femora, shining elevated plate-like mesosternum and lack of abdominal inner latero-tergites. Most species are variegated with yellow and brown, or yellow and black and have a conspicuous white annulus proximally on the 4th antennal segment.

While several species of *Ozophora* are common in Florida relatively little is known of their biology. Sweet (1964) has studied *picturata* in Connecticut, but there are only scattered collecting notes for the other species. Most species are associated with woodland habitats or occur in areas of relatively dense shade. They are definitely not associated with annuals and weeds as are so many of the Florida Rhyparochrominae. Only the fortunate fact that most species of *Ozophora* come readily to lights makes it possible to know even the little we do know of the distribution of the Florida fauna. For example, *floridana* n. sp. and *caroli* n. sp. are certainly not rare species within their proper habitat, and a glance at the paratype series will show this. Despite their frequent appearance in light traps operated in hammocks near Homestead, we have been unable to find them in the field.

Adults and nymphs of *Ozophora* are very active. When disturbed in litter they run rapidly and adults fly surprisingly readily for geophilous rhyparochromines.

The distribution of Florida species, while still imperfectly known, is very interesting. Three species, *floridana* n. sp., *gilva* n. sp. and *trinotata* Barb., are endemic. *Ozophora caroli* n. sp. is known outside of Florida only from 2 apparently conspecific specimens from Mexico, and *levis* only from the Keys, upper Bahamas and Mexico. Thus, for the moment at least, 5 of the 10 Florida species appear to be of restricted distribution. Two of these, *caroli* and *floridana* n. spp., are confined to extreme southern Florida where they appear to occur primarily in dense hammock habitats. *Ozophora gilva* and *trinotata* probably occur throughout peninsular Florida and at least the former even further north.

Of the remaining 5 species, 4 are Neotropical elements. These species are largely confined to extreme southern Florida (although *burmeisteri* Guerin has been reported north to Lake Wales).

Thus, only *picturata*, which is widespread over most of the eastern and central United States, is a "northern" element. Its scarcity in Florida also indicates that it can legitimately be considered a northern species that reaches the southern limits of its range in peninsular Florida.

Only 2 papers have dealt in depth with Florida Lygaeidae. Barber (1914) recognized 3 species of *Ozophora*:*burmeisteri, picturata* and *trinotata*. All are still recognized as members of the fauna. Blatchley (1926) discussed 6 species. The additions are *concava, pallescens* and *reperta*, the last as a new species. His record of *concava* was based on a listing of "Florida" by Van Duzee (1917). Neither Blatchley nor the present authors have been able to discover on what the record was based. *Ozophora concava* is a very distinctive species and nothing resembling it is present in material we have examined. It should be eliminated from the Florida list. The Blatchley record of *pallescens* is referable to *divaricata* Barb.

All measurments are given in mm.

The original references and complete synonomy to all previously described species can be found in Slater (1964).

The following acronyms are used to designate collections in which examined material is located: R.M.B.—R. M. Baranowski collection, J.A.S.—J. A. Slater collection, F.S.C.A.—Florida State Collection of Arthropods, A.M.N.H.—American Museum of Natural History, U.S.N.M.—United States National Museum of Natural History, G.G.S.—G. G. S. Scudder collection and P.D.A.—Peter D. Ashlock collection.

Key to Florida Species of *Ozophora*

1. Pronotum and hemelytra with numerous elongate upstanding hairs present (viewed laterally) 2
1′. Pronotum and hemelytra nearly glabrous, at most with very short inconspicuous hairs present 3
2(1). Posterior femora bearing several rows of very elongate upright hairs, these as long as or longer than diameter of a femur .. *trinotata*
2′. Hairs on posterior femora much shorter, not longer than diameter of a femur .... *burmeisteri*
3(1′). Fore femora armed below with 3 or 4 large spines; body length usually greater than 4.5 mm 4
3′. Fore femora usually armed below with only 2 larger spines, or, if 3 "major" spines present then body length not exceeding 4.5 mm 8
4(3). General coloration of dorsal surface dark chocolate brown, membrane of fore wing dark throughout, lacking an apical pale area .... *levis* n. sp.
4′. General coloration brownish, orangish or yellowish, never predominately dark chocolate brown; apical area of membrane pale or membrane chiefly pale 5
5(4′). Lateral portion of apical corial margin usually at least obscurely tinged with crimson, apical dark macula not extensively invading adjacent apical corial margin. .... *picturata*
5′. Lateral portion of apical corial margin not tinged with crimson (if a slight crimson tinge at extreme apex then dark apical macula extensively invading apical corial margin immediately before extreme apex) 6
6(5′). Fourth antennal segment either lacking a white proximal annulus or annulus very narrow, not nearly covering proximal 1/3 of segment; a small post median dark macula present along each lateral corial margin that at most barely extends mesad of explanate margin; corium without a well differentiated large subapical white macula .... *gilva* n. sp.
6′. Fourth antennal segment with a strongly contrasting large white proximal annulus occupying at least proximal 1/3 of segment; each lateral corial margin with a large post median dark macula that usually extends (although irregularly) completely across corium; corium with a well differentiated large white subapical macula 7
7(6′). Posterior pronotal lobe extensively marked with dark red brown contrasting strongly with pale yellow posterior margin; anterior 1/3 of corium with an elongate dark patch present .... *caroli* n. sp.
7′. Posterior pronotal lobe nearly uniformly light yellowish tan (at most with slightly darker brown stripes), without a strongly contrasting light posterior margin; anterior 1/3 of corium lacking an elongate dark patch .... *floridana* n. sp.
8(3′). Third antennal segment longer than width of head across eyes .... *reperta*
8′. Width of head across eyes greater than length of third an-

tennal segment 9
9(8′). Head with apex of tylus bluntly truncate, scarcely if at all exceeding juga and bent downward at right angle to long axis of body .... *laticephala*
9′. Head with apex of tylus subacuminate, tapering, curving downward but not bluntly truncate, conspicuously exceeding juga .... *divaricata*

Nymphs

Fortunately nymphs are available for 6 of the 10 Florida species. It is possible to separate the species into groups based upon whether or not the abdomen is irrorate (covered with a series of small pale spots) or whether it is variegated with large patches of color. It is interesting that a parallel situation is present in *Dieuches*, a large and complex Eastern Hemisphere genus of the tribe Rhyparochromini. Whether these irrorate-non irrorate conditions in *Ozophora* indicate phylogenetic relationship or parallel developments in response to habitat similarities must await further study.

All *Ozophora* nymphs have 3 dorsal abdominal scent gland openings and a distinct Y-suture present, a combination characteristic of the tribe.

Key to known 5th instar nymphs of Florida *Ozophora*

1. Abdomen irrorate, thickly speckled with small pale spots 2
1′. Abdomen not irrorate, at most a very few widely scattered pale spots present 4
2(1). Hind femora with numerous elongate hairs present, many longer than diameter of femur .... *trinotata*
2′. Hind femora either nearly glabrous or with hairs shorter than diameter of femur 3
3(2′). Fourth antennal segment with a broad white proximal annulus strongly contrasting with dark distal portion of segment; 3rd antennal segment dusky; ratio of length antennal segment III/antennal segment IV greater than 0.85 .... *picturata*
3′. Fourth antennal segment nearly uniformly pale yellow, at most with a narrow obscure pale proximal annulus; 3rd antennal segment pale yellow; ratio of length antennal segment III/antennal segment IV less than 0.80 .... *gilva* n. sp.
4(1′). Dorsal surface clothed with numerous conspicuous upstanding hairs; fore femora each with 4-7 ventral spines present .... *burmeisteri*
4′. Dorsal surface glabrous or nearly so; fore femora each with 2 (occasionally 3) ventral spines present 5
5(4′). Third antennal segment brown except for extreme distal end .... *laticephala*
5′. Third antennal segment with only proximal 1/2 brown, the remainder straw-colored .... *divaricata*

Ozophora burmeisteri (Guerin)

This species is readily distinguishable from all other species of Florida *Ozophora* by the combination of its very dark pronotum and upstanding dorsal hairs. *Ozophora trinotata* also has upstanding dorsal hairs but it is a larger reddish brown species that can be readily distinguished by the key characters given above. Adults of *burmeisteri* have a nearly uniformly black or dark chocolate brown pronotum. The posterior pronotal lobe has a yellow streak midway between the meson and margin, or a pair of yellow spots in the same area. The corium has an apical dark spot and a conspicuous dark macula along the lateral margin 2/3rds the distance from the base. The 4th antennal segment has a conspicuous white annulus and the 3rd segment is slightly swollen distally and dark chocolate brown on the distal 1/3.

Ozophora burmeisteri is very common in southern Florida and comes to lights in large numbers. In December, 1974 we took adults and young nymphs among the fallen seeds of *Ficus religosa* L. and *F. retusa* L. on the grounds of the Agricultural Research and Education Center, Homestead. In the laboratory the insects survived on water and seeds of *Ficus*. Eggs are laid on and in the fruits and adults moved to feed on fresh seeds immediately when the latter were introduced. It thus seems certain that *burmeisteri* can and will breed on seeds of *Ficus*. In May 1979, very large populations were observed breeding in fallen seeds beneath the above mentioned trees. At this time the litter consisted of a large quantity of recently fallen fruit. However, figs almost certainly are not the only host. We have collected beneath *Ficus* trees at many locations on Jamaica. Many species of *Ozophora* have been taken feeding on the seeds of *Ficus*, yet we never collected *burmeisteri* although it ocurs there and is frequently collected at lights.

Blatchley (1926) reports it on the foliage of mangrove (surely a sitting record); Wolcott (1936) on *Crotalaria* sp. in Puerto Rico.

Ozophora burmeisteri has been reported from many islands in the West Indies, Texas, Lower California and Mexico as well as from Florida.

Florida records: Reported by Barber (1914) from Everglade and St. Augustine and by Blatchley (1926) from Chokoloskie, Royal Palm Park and Lake Wales.

Additional Florida records: Homestead (R.M.B., J.A.S., F.S.C.A.); Port Sewall (A.M.N.H.); Everglades Nat. Pk.; Loggerhead Key, Dry Tortugas; Kendall; Orchid Jungle Hammock, Newton Rd., Dade Co.; Flamingo Prairie, Everglades Nat. Pk., (J.A.S.); Biscayne Bay; Belleair (A.M.N.H.). LaBelle, Hendry Co. (J.A.S.); Key West; Stock Island, Monroe Co. (R.M.B.).

Fifth instar nymph (in alcohol, Homestead, Florida)

Head and pronotum largely dark chocolate brown. Head behind epicranial arms paler but with a very broad dark band running behind compound eye. Pronotum with a pair of yellow streaks on either side of midline on anterior 1/3 and posteriorly with a pair of yellow spots midway between meson and margin, the posterior one reaching the posterior margin (these spots sometimes coalesce to form a yellow longitudinal bar midway between meson and margin on posterior lobe). Scutellum marked as in *picturata* but strongly infuscated on antero-lateral angles. Mesothoracic wing pads chiefly dark, distally pale, anteriorly marked as in *picturata*. Abdomen lacking irrorate markings, segment 1 dusky on either side of midline, mesal portion of segment 2 between wing pads dusky gray; this marking continuing over segment 3 but more broadly, extending in a tapering cone nearly to preconnexival margin in middle of segment, posteriorly reaching anterior abdominal scent gland orifice. This gray coloration present on segment 4 as a large ovoid patch between scent gland orifices and more narrowly so on segment 5. Gray markings tinged with reddish laterally on segment 3 and posteriorly on segments 4 and 5. Red markings present along sutures, as in *picturata*. Legs in large part pale yellow; posterior femora with a diffuse but distinct darker annulation distally. Second tarsal segment somewhat infuscated. Antennae with segments I and II pale yellow; segment III becoming reddish brown on distal 1/3; segment IV with a subproximal conspicuous white annulus, otherwise dusky. Body clothed with conspicuous upstanding yellowish hairs over entire dorsal surface.

General form similar to other species of *Ozophora*. Head length 0.63, width 0.75, interocular space 0.40. Pronotum length 0.63, width 0.98. Wing pad length 1.25. Abdomen length 2.60. Fore femora armed below with 5 or 6 dark brown sharp spines. Labial segments length I 0.70, II 0.68, III 0.55, IV 0.35. Antennal segments length I 0.40, II 0.75, III 0.78, IV 0.75. Total body length 4.90.

Fourth instar nymph (in alcohol, Bellevue, St. Elizabeth Parish, Jamaica)

Similar in form and color to instar 5, dark markings on abdominal tergum more reddish brown, covering segment 3 entirely and all of segment 4 except a narrow posterior pale stripe. Reddish markings along sutures of abdomen very conspicuous. Head length 0.55, width 0.73, interocular space 0.40. Pronotum length 0.48, width 0.88. Wing pad length 0.50. Abdomen length 1.30. Labial segments length I 0.55, II 0.53, III 0.45, IV 0.30. Antennal segments length I 0.33, II 0.68, III 0.63, IV 0.85. Total body length 2.90.

Third instar nymph (same as above)

Form and color as in instar 4, but only a single yellow quadrate spot present on mesothoracic wing pads. Yellow streaks of previous instars midway between meson and margin of pronotum present as small spots near posterior margin. Head length 0.43, width 0.50, interocular space 0.33. Pronotum length 0.33, width 0.68. Abdomen length 0.90. Labial segments length I 0.28, II 0.35, III 0.30, IV 0.25. Antennal segments length I 0.25, II 0.45, III 0.45, IV 0.63. Total body length 2.08.

Second instar nymph (same as above)

Form and color as in instar 3, but abdominal terga 2 and 3 completely reddish brown. Posterior half of terga 4 and most of 5 also reddish brown thus forming a transverse pale white band across abdomen at level of second abdominal scent gland orifice. Fourth antennal segment little differentiated in color, lacking a strongly conspicuous white annulus. Pale markings absent on nearly uniformly brown pronotum. Mesonotum with a pale mark on posterior margin adjacent to meson. Head length 0.40, width 0.58; interocular space 0.30. Pronotum length 0.33, width 0.65. Abdomen length 0.80. Labial segments length I 0.40, II 0.38, III 0.30, IV 0.25. Antennal segments length I 0.23, II 0.45, III 0.45, IV 0.58. Total body length 1.75.

First instar (in alcohol, Homestead, Florida)

Head, pronotum, mesonotum and large transversely rectangular patches on metanotum reddish brown strongly contrasting to pale yellow testaceous abdomen; latter with a broad red transverse stripe running across segments 4 and 5. Legs nearly uniformly pale. Third and 4th antennal segments slightly infuscated, the latter lacking a pale subproximal annulus. Head length 0.28, width 0.38, interocular space 0.23. Pronotum length 0.15, width 0.35. Abdomen length 0.63. Labial segments length I 0.25, II 0.20, III 0.18, IV 0.20. Antennal segments length I 0.13, II 0.23, III 0.23, IV 0.35. Total body length 1.35.

Egg (same as above)

Egg robust, elongately elliptical, thickly clothed with short truncated hairs over entire surface; 4 short thick micropylar processes present anteriorly, grouped closely around meson. Length 1.63, width 0.70.

Ozophora caroli Slater and Baranowski, NEW SPECIES
(Fig. 1)

Body elongate, relatively stout. Head, anterior pronotal lobe and broad rays extending through posterior pronotal lobe dark red brown. Anterior pronotal collar broadly pale yellow on either side of a median red brown spot; entire posterior margin of pronotum broadly, sinuately yellow, strongly contrasting with adjacent reddish brown rays. Scutellum chiefly dark red brown, but with raised elliptical calloused area yellow shading anteriorly to reddish brown. Hemelytra chiefly testaceous, clavus suffused distally with chocolate brown. Corium with an elongate rectangular chocolate brown macula between radius and medius at level of apex of scutellum and with a very large white subapical macula that nearly reaches apical corial margin. Corium dark chocolate brown distad of subapical pale macula and with a broad, transverse, irregular, mesally widening vitta anterior to white macula. A large pale, nearly white spot near each inner corial angle. Membrane largely fumose, apex broadly white, veins pale translucent; a pale spot near center of membrane at level of middle of apical corial margin. Ventral and pleural surfaces of head, thorax and abdomen uniformly red brown. Legs and labium pale testaceous with an obscure subdistal dark band on posterior femora. Antennal coloration much as in *floridana;* segments I, II and III pale yellow with distal end of III, proximal end and distal 3/4th of IV contrasting dark chocolate brown. Body nearly glabrous above, lacking conspicuous upstanding hairs.

Head large, strongly convex across vertex; tylus somewhat declivent extending beyond middle of first antennal segment. Head length 0.78, width 0.95, interocular space 0.48. Pronotum with calli very prominent, shining and differentiated from adjacent pruinose areas of anterior lobe, widely separated mesally, transverse impression deep; lateral pronotal margins strongly sinuate, evenly ridged. Pronotum length 0.95, width 1.48. Scutellum feebly impressed mesally on basal 1/2; calloused lateral areas not strongly raised. Scutellum length 0.88, width 0.78. Claval commissure length 0.75. Corium with lateral margins moderately sinuate, little reflexed. Midline distance apex clavus-apex corium 1.10; midline distance apex corium-apex membrane 0.88. Fore femora moderately incrassate armed below with 3 conspicuous sharp spines on distal 1/2. Posterior femora with a single sharp spine below distally. Labium reaching to but not beyond metacoxae; 1st segment attaining base of head. Labial segments length I 0.85, II 0.75, III 0.50, IV 0.43. Antennae conventionally terete, slender. Antennal segments length I 0.55, II 1.23, III 1.0, IV 1.43. Total body length 5.28.

HOLOTYPE: *Florida*: ♂ Dade County, Ross and Castello Hammock 2-VI-1970 (R. M. Baranowski) (blacklight trap). In U.S.N.M. No. 73798.

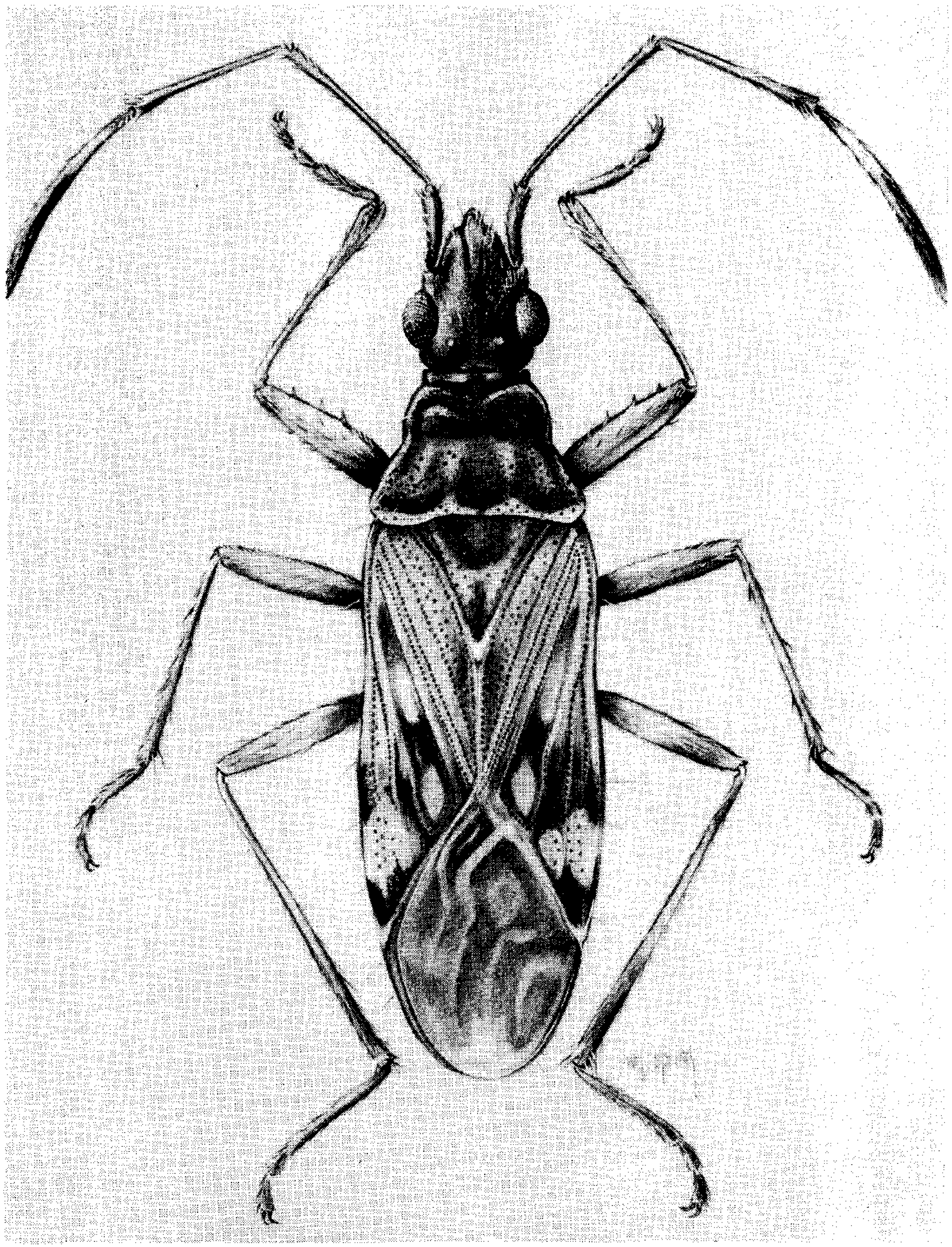

Fig. 1. *Ozophora caroli* Slater & Baranowski, NEW SPECIES, dorsal view.

PARATYPES: *Florida*: 1 ♀ Dade Co., Kendall 19-II-1951 (A. M. Nader); 1 ♂, 1 ♀ Dade Co., Orchid Jungle Hammock, Newton Rd. 12-V-1970 (R. M. Baranowski) (blacklight trap); 1♂, 1 ♀ same 20-V-1970; 2 ♀ Dade Co., 26000 S. W. 197 Ave. (R. M. Baranowski) (blacklight trap); 1 ♂, 10 ♀ Dade Co., Ross & Castello Hammock 26-III-1970 (R. M. Baranowski) (blacklight trap); 2 ♂, 4 ♀ same 14-IV-1970; 1♂, 4 ♀ same 2-VI-1970; 1 ♀ same 3-VI-1970; 4 ♂, 4 ♀ same 21-VII-1970; 1 ♂, 1 ♀ same 29-III-1976 3 ♀ same 24-III-1977. In A.M.N.H., F.S.C.A., R.M.B., and J.A.S. collections.

This species resembles *floridana*, with which it occurs in the hammocks of southern Florida, in having a conspicuous white apex to the membrane, a large white corial macula, a prominent red brown head, an anterior pronotal lobe with differentiated calli, and 3-spined fore femora. It is, however, quite a different appearing species than *floridana* having a more robust and less elongate appearance. In particular, the head is relatively much larger and more prominent than in *floridana*. The strongly differentiated pale posterior margin of the pronotum and dark chocolate brown markings on the anterior 1/2 of the hemelytra also will serve readily to differentiate the 2 species.

Occasionally a small 4th spine is present on the fore femora.

The type series is all from light traps in hammocks in Dade County but we have examined 2 specimens from Chiapas, Mexico, 9 mi. N. Ocozocoautla, 18 July 1973 (Mastro and Schaffner) (taken at light) that are very closely related to, if not conspecific with, this species. They differ chiefly in having darker antennae.

Ozophora divaricata Barber

This is one of the smallest and one of the most brightly marked of the Florida *Ozophora*. The posterior pronotal lobe has a series of longitudinal chocolate brown markings that coalesce posteriorly to give the appearance of 3 loops. The hemelytra are strongly marked with conspicuous dark chocolate brown patches including an apical corial one. A small dark macula is also present along the lateral hemelytral margin on the distal 1/3 that does not extend mesad to the radial vein. The fore femora usually have only 2 ventral spines. The 4th antennal segment has a pale proximal annulus, but it is short and often dull yellow rather than white.

Ozophora divaricata is part of a complex group of West Indian species whose relationships we discuss in detail elsewhere. *Ozophora divaricata* is abundant in the Bahamas and occurs throughout the Greater Antilles, but has not been taken in the Lesser Antilles although several very closely related species occur there.

We have collected it under *Pluchea odorata* Cassini in Jamaica and on North Key Largo, Florida and under *Gynoxys incana* (SW) Less and *Conyza karuninskianus* DC in Jamaica.

It has not previously been reported from Florida.

Florida records: Hendry Co., LaBelle (JAS); Manatee Co., Bradenton, Perico Is.; Monroe Co., N. Key Largo; Dade Co., Ross & Castello Hammock; Dade Co., Orchid Jungle Hammock, Dade Co., Homestead; Everglades Nat. Pk. (RMB).

The Florida specimens from Key Largo and LaBelle are strongly, contrastingly dark chocolate brown to black and light yellow to white. They closely resemble most specimens from the Bahamas and Greater Antilles. The long series from Perico Island (Bradenton) on the other hand is predominately pale tan and has a quite different general appearance. This series was taken on a tidal flat and thus the pale color may have been selected for strongly. We have been unable to find meristic or genital differences to distinguish the Bradenton population from other Florida specimens of *divaricata*.

Fifth instar nymph (in alcohol, Irishtown, Jamaica)

Head, pronotum, scutellum and mesothoracic wing pads variegated with brown and with testaceous pale markings as follows: on head a median line, a curved spot behind each eye, a small spot anterior to eye and a small narrow bar below each eye; on pronotum a median line and an irregular longitudinal line extending forward from humeral angles almost to anterior margin; on scutellum midline, an elongate streak on anterior margin midway between meson and lateral margins and an elongate "bar" extending along but not in contact with lateral margin; on mesothoracic wing pads, a stripe extending from anterior margin to middle of inner margin at a level posterior to apex of scutellum, an elongate, slender triangular spot adjacent to scutellum and an elongate area slightly caudad of middle of lateral margin of wing pad. Pro-, meso- and metapleura dark brown with an elongate light bar adjacent to but not touching dorsal margin of metapleuron. Abdomen brown with irregularly placed pale markings. Legs uniformly straw-colored. Antennae straw-colored but with proximal 1/2 of segment III darker and basal 1/3 of segment IV white.

Head length 0.64, width 0.76, interocular space 0.64. Pronotum length 0.52, width 1.0. Mesothoracic wing pads length 1.16. Abdomen length 2.20. Labial segments length I 0.56, II 0.52, III 0.32, IV 0.24. Antennal segments length I 0.32, II 0.68, III 0.60, IV 0.80. Total body length 4.40.

Fourth instar nymph (same as above)

Similar in form and color to instar 5; outermost pair of pale lines on pronotum reduced to pale spots at postero-lateral angle. Third antennal segment uniformly brown. Head length 0.56, width 0.60, interocular space 0.36. Pronotum length 0.40, width 0.72. Mesothoracic wing pads length 0.52. Abdomen length 1.68. Labial segments length I 0.40, II 0.40, III 0.24, IV 0.28. Antennal segments length I 0.24, II 0.48, III 0.40, IV 0.60. Total body length 3.12.

Third instar nymph (same as above)

Specimens faded but with faint irregularly placed pale markings present on abdomen. Head length 0.38, width 0.44, interocular space 0.32. Pronotum length 0.22, width 0.88. Abdomen length 0.92. Labial segments length I 0.28, II 0.28, III 0.20, IV 0.20. Antennal segments I 0.19, II 0.30, III 0.30, IV 0.44. Total body length 1.76.

Second instar nymph (same as above)

Specimens also faded; head and pronotum appearing to be uniformly tan. Abdomen yellowish, markings not evident. Head length 0.36, width 0.38, interocular space 0.24. Pronotum length 0.18, width 0.38. Abdomen length 0.70. Labial segments length I 0.24, II 0.20, III 0.14, IV 0.16. Antennal segments length I 0.14, II 0.26, III 0.26, IV 0.40. Total body length 1.40.

First instar nymph (same as above)

Similar in form and color to instar 2. Head length 0.26, width 0.32, interocular space 0.16. Pronotum length 0.18, width 0.34. Abdomen length 0.64. Labial segments length I 0.16, II 0.14, III 0.14, IV 0.14. Antennal segments length I 0.10, II 0.16, III 0.16, IV 0.30. Total body length 1.20.

Egg (same as above)

Elongate oval with opercular end somewhat flattened. Four micropylar

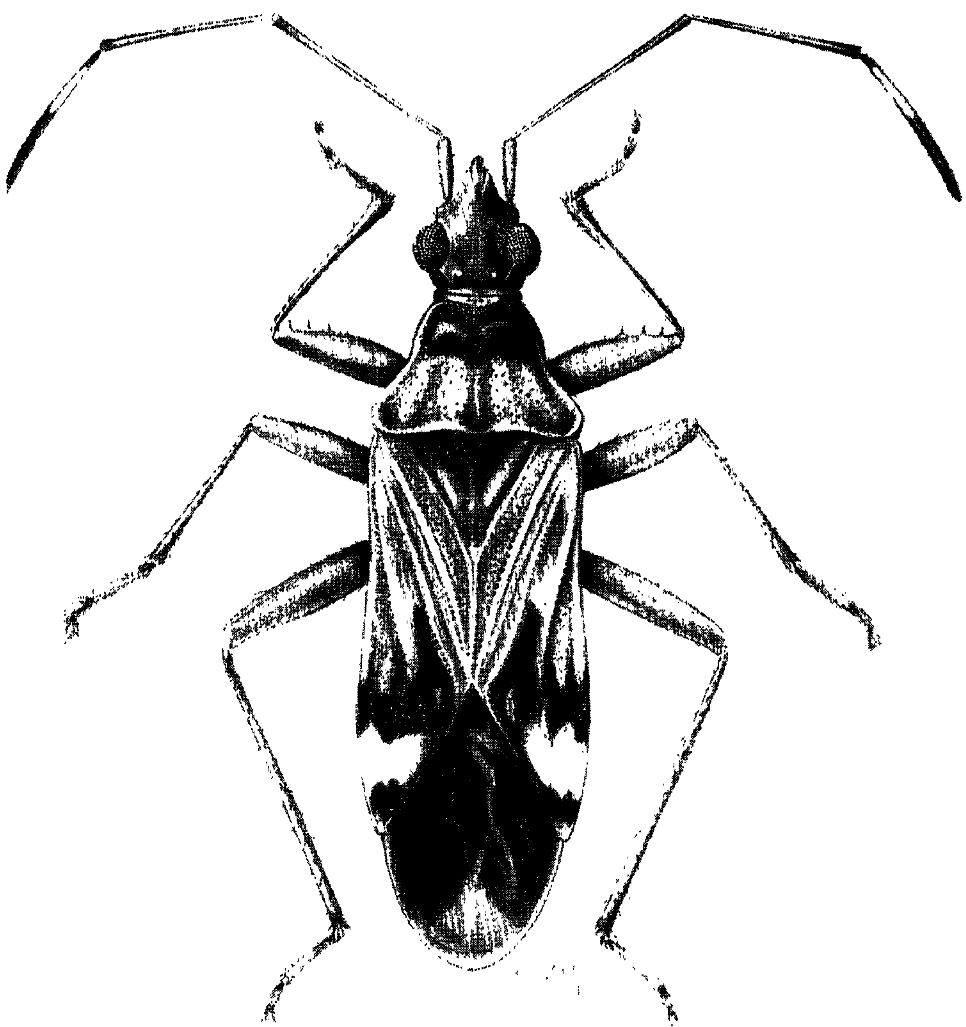

Fig. 2. *Ozophora floridana* Slater & Baranowski, NEW SPECIES, dorsal view.

processes present. Surface covered with minute spines (spicules). Length 0.94, width 0.36.

Ozophora floridana Slater and Baranowski, NEW SPECIES
(Fig. 2)

Body elongate, nearly parallel sided. Head and anterior pronotal lobe bright reddish brown. Distal end of tylus, anterior pronotal collar, posterior pronotal lobe, clavus and anterior half of corium nearly uniformly pale testaceous, sometimes almost dull orange. Scutellum somewhat darker yellowish tan. Posterior half of corium with a large conspicuous irregular white macula that nearly reaches apical corial margin. Apex of corium and area anterior to white macula dark chocolate brown, this dark coloration extending between radius and medial veins anteriorly to level of middle of claval commissure. A pale yellow spot present near inner angle of corium. Apical corial margin dark chocolate brown for the most part, becoming yellowish adjacent to white macula and near meson. Membrane chiefly dark fumose with veins slightly paler and with a broad white apex. Ventral and pleural surfaces of head, thorax and abdomen nearly uniformly bright red brown with posterior metapleural lobe dull white. Legs uniformly light yellow, nearly white, without conspicuous dark distal banding on femora although hind femora slightly suffused with pale tan. First, 2nd and 3rd antennal segments light yellow with distal end of antennal segment III, distal 2/3rd of IV contrasting dark chocolate brown. Fourth antennal segment with a broad conspicuous white annulus on proximal 1/3 except extreme base. Body nearly glabrous above, lacking conspicuous elongate hairs.

Head nondeclivent, only slightly convex across vertex; eyes set slightly away from antero-lateral pronotal margins; tylus reaching at least midway to distal end of 1st antennal segment. Head length 0.78, width 0.73; interocular space 0.35. Pronotum with calli large, conspicuous, elliptical, impunctate; otherwise conventional. Pronotum length 0.93, width 1.40, length anterior lobe 0.30, length posterior lobe 0.55. Scutellum with divergent raised calloused areas extending antero-laterally and impunctate but not strongly contrasting in color, apex narrowly white. Scutellum length 0.78, width 0.73. Claval commissure length 0.75. Corium with lateral margins shallowly sinuate and very narrowly explanate, midline distance apex clavus-apex corium 1.23; midline distance apex corium-apex membrane 0.90. Fore femora moderately incrassate, armed below on distal 1/2 with 3 sharp spines, ventral inner face of femora with numerous small brown setae. Hind femora armed below near distal ends with a single sharp spine. Labium elongate, exceeding hind coxae and reaching onto abdominal sternum 3; 1st segment attaining or slightly exceeding base of head. Labial segments length I 0.90, II 0.95, III 0.75, IV 0.40. Antennae slender, terete. Antennal segments length I 0.53, II 1.48, III 1.23, IV 1.53. Total body length 5.90.

HOLOTYPE: ♂ *Florida*: Orchid Jungle Hammock, Newton Road, Dade County 20-V-1970 (R. M. Baranowski) (black light trap). In U.S.N.M., No. 73796.

PARATYPES: *Florida*: 1 ♂ Dade Co., Ross and Castello Hammock 18-XI-1968 (R. M. Baranowski) (blacklight trap); 1 ♂, 2 ♀ same 5-VI-1969; 1 ♀ same 2-X-1969; 1 ♂ same 10-X-1969; 1 ♀ same 23-III-1970; 1 ♀ same 2-VI-1970; 1 ♂ same 3-VI-1970; 2 ♂, 7 ♀ same 18-V-1970; 8 ♂, 6 ♀ same 19-V-1970; 7 ♂, 6 ♀ same 4-X-1970; 1 ♂ same 20-X-1975; 2 ♂ same 24-III-1977; 7 ♂, 8 ♀ Dade Co., Castello Hammock 20-X-1969 (R. M. Baranowski) (blacklight trap); 31 ♂, 29 ♀ same 17-X-1969; 1 ♀ same 9-XI-1972; 1 ♀ same 17-IX-1976; 16 ♂, 15 ♀ same 20-X-1976; 2 ♂, 13 ♀ same 28-X-1976; 2 ♂ same 30-X-1976; 2 ♀ same 9-XI-1976; 1 ♂ Dade Co., Homestead 12-V-1969, (R. M. Baranowski) (blacklight trap); 1 ♂ same 18-V-1969; 6 ♂, 4 ♀ same 22-V-1969; 2 ♀ same 6-X-1969; 1 ♀ same 7-X-1969; 1 ♀ same 10-X-1969; 1 ♂ same 11-X-1969; 1 ♂ same 13-X-1969; 3 ♀ same 24-X-1969; 2 ♂ same 27-III-1970; 1 ♂ same 24-XI-1974 (J. A. Slater); 1 ♂ same 15-XII-1974; 6 ♂, 6 ♀ Dade Co., Orchid Jungle Hammock, Newton Rd 22-V-1969 (R. M. Baranowski) (blacklight trap); 5 ♂, 9 ♀ same 27-V-1969; 4 ♂ same 5-VI-1969; 1 ♂, 1 ♀ same 9-VI-1969; 4 ♀ same 17-VI-1969; 2 ♂, 3 ♀

same 21-VI-1969; 1 ♂, 2 ♀ same 1-X-1969; 3 ♀ same 2-X-1969; 1 ♀ same 9-X-1969; 3 ♀ same 28-X-1969; 1 ♂, 1 ♀ same 18-III-1970; 1 ♀ same 23-III-1970; 2 ♂, 10 ♀ same 26-III-1970; 8 ♂, 8 ♀ same 2-IV-1970; 3 ♀ same 3-IV-1970; 14 ♂, 8 ♀ same 28-IV-1970; 45 ♂, 28 ♀ same 12-V-1970; 3 ♂, 6 ♀ same 19-V-1970; 1 ♂, 1 ♀ same 20-V-1970; 3 ♀ same 6-X-1975; 5 ♂, 2 ♀ same 20-X-1975; 5 ♂, 6 ♀ Dade Co., Agr. Res. & Ed. Ctr., Homestead 14-X-1969 (R. M. Baranowski) (blacklight trap); 1 ♂, 2 ♀ same 21-X-1976; 3 ♀ Dade Co. Agr. Res. & Ed. Ctr. Homestead 17-XI-1982 (H. Glenn) on *Schinus terebinthifolius;* 26 ♂, 33♀ Dade Co., 26000 SW 197 Ave. 6-V-1977 (R. M. Baranowski) (blacklight trap); 40 ♂, 90 ♀ same 8-V-1977; 9 ♂, 17 ♀ same 9-V-1977; 4 ♂, 2 ♀ same 19-V-1977; 10 ♂, 5 ♀ same 31-V-1977; 20 ♂, 21 ♀ same 23-V-1977; 6 ♂, 4 ♀ same 6-VI-1977; 12 ♂, 16 ♀ same 24-V-1977; 1 ♀ same 17-IX-1977; 1 ♀ same 23-III-1978. In U.S.N.M., A.M.N.H., F.S.C., P.D.A., J.A.S. and R.M.B. collections.

This is a member of the *quinquemaculata* complex and quite distinct from other Florida species. It may be separated from all other Florida *Ozophora* by the nearly uniformly light orange yellow posterior pronotal lobe, clavus and anterior 1/2 of the corium. In some specimens these areas are almost orange.

It occurs frequently in light traps with *caroli* and the 2 have a somewhat similar appearance by virtue of the white apex to the membrane of the hemelytra and the large white macula distally on the corium. *Ozophora floridana* is however a much more elongate, slender species. The attenuated head has a much less convex vertex, lacks the dark rays on the posterior pronotal lobe and has a longer labium.

The most closely related material that we have examined is a single male from 6 miles southeast of Siguatepeque, Honduras, collected by the O'Brien party in July 1974. This specimen presumably represents a new species and differs from *floridana* in lacking the prominent white apex to the corium, having the pale macula posteriorly on the corium not extending mesad of the radial line and in having distinct infuscations or rays on the posterior pronotal lobe. This Honduran specimen has a rather similar appearance to *reperta* but has 3 forefemoral spines and the general body conformation of *floridana.*

Ozophora floridana can usually be recognized by the pale posterior pronotal lobe. However the typical dark rays found in many species of *Ozophora* are sometimes present. Even when these rays are well developed the uniformly or nearly uniformly pale clavus and anterior part of the corium are diagnostic.

Ozophora floridana appears to be confined primarily to hammocks and pine woods in extreme southern Florida. Recently (17-XI-1982) an adult was taken on *Schinus terebinthifolius* Raddi and 2 adults and several nymphs were taken in the seed litter under the plants. We have examined hundreds of specimens of *Ozophora* from a number of West Indian Islands but have not seen this species other than from southern Florida and believe it to be endemic.

Ozophora gilva Slater and Baranowski, NEW SPECIES
(Fig. 3)

Head and anterior pronotal lobe light red brown, tylus paler. Posterior pronotal lobe and hemelytra in large part very pale testaceous, almost

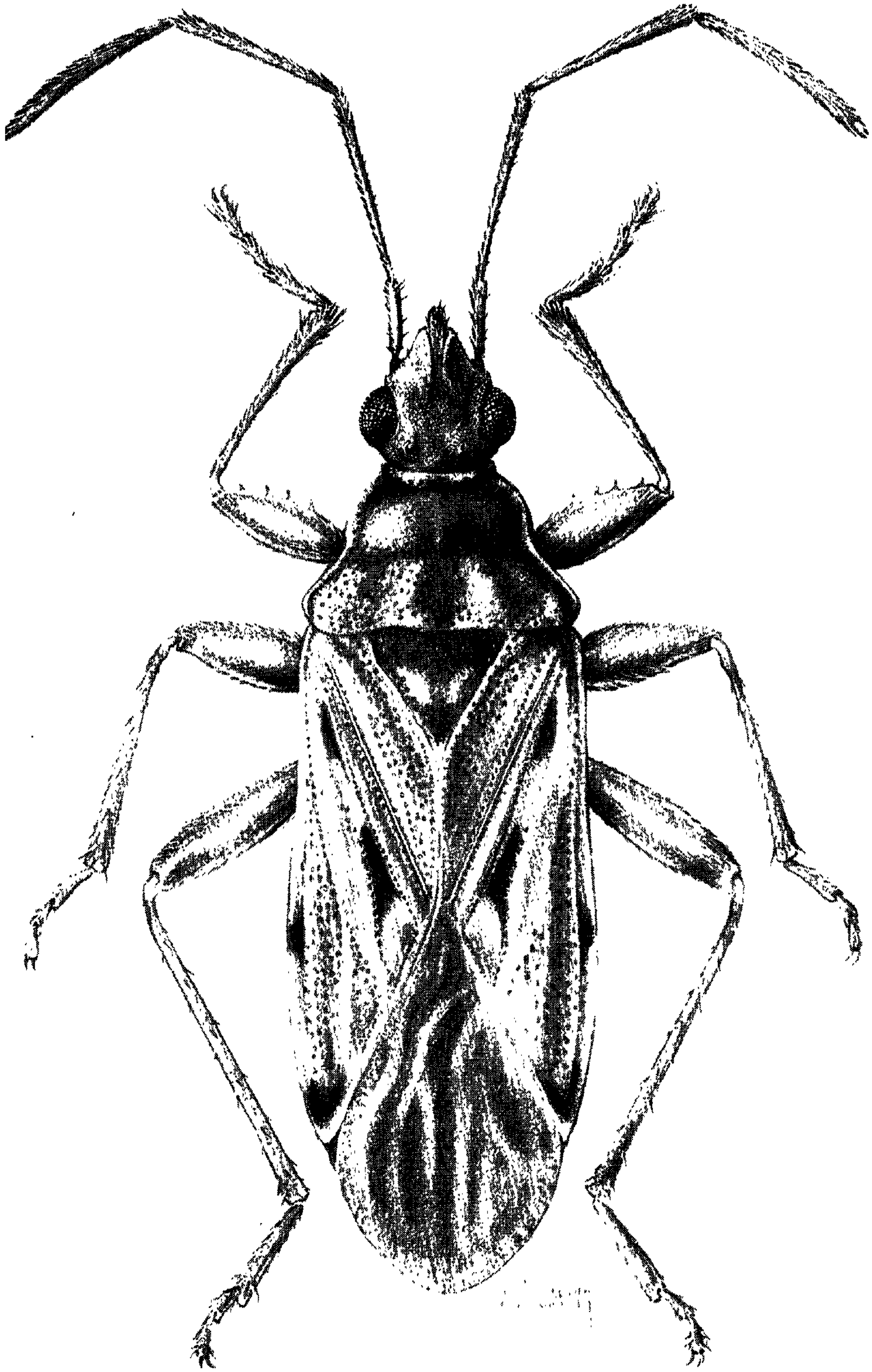

Fig. 3. *Ozophora gilva* Slater & Baranowski, NEW SPECIES, dorsal view.

white; the former with characteristic pale tan vitta. Scutellum olive colored with white apex. Clavus nearly uniformly pale testaceous, very slightly infuscated with tan just posterior to level of apex of scutellum. Corium largely pale testaceous marked with chocolate brown at apical angle, a very small spot along costal margin posterior to level of distal end of claval commissure, a large quadrangular patch near inner angle of corium which encloses a large pale elliptical white spot at its posterior end, and a very small obscure infuscation between radius and medius at level of apex of scutellum. Apical corial margin completely pale. Membrane uniformly very light brown. Ventral and pleural surfaces uniformly reddish brown. Legs, labium and antennae pale testaceous, nearly white. Middle and hind femora with an obscure but definite dark brown annulus present subdistally. Apical segment of labium dark brown. Antennal segments pale testaceous; 4th segment lacking a distinct white subproximal annulus. Punctation typical for genus. Dorsal surface of body lacking upstanding hairs, nearly glabrous.

Head short, tylus not extending beyond middle of 1st antennal segment; vertex moderately convex; head length 0.65, width 0.80, interocular space 0.38. Pronotum with calli prominent, impunctate, not meeting on midline; transverse impression complete and deep. Pronotum length 0.83, width 1.28. Scutellum length 0.73, width 0.70. Claval commissure length 0.73. Corium with lateral margins slightly sinuate and moderately reflexed; midline distance apex clavus-apex corium 1.08; midline distance apex corium-apex membrane 0.83. Fore femora moderately incrassate, each armed below with 4 dark brown sharp spines on distal half; each hind femur with a single sharp spine distally on ventral surface. Labium reaching to but not beyond hind coxae, 1st segment not exceeding base of head. Labial segment length I 0.63, II 0.65, III 0.48, IV 0.33. Antennae terete. Antennal segments length I 0.48, II 1.13, III 0.88, IV 1.10. Total body length 4.80.

HOLOTYPE: ♂ *Florida*: Edgewater 24-II-1939 (C. A. Frost). In U.S.N.M. No. 73797.

PARATYPES: *Florida*: 2 ♂, 1 ♀ Edgewater 20-II-1939 (C. A. Frost); 1 no abd. same 24-II-1939; 1 ♂, 2 ♀ same 5-III-1939; 2 ♀ same 6-III-1939; 2 ♂ same 14-III-1939; 1 ♀ Dade Co., Orchid Jungle Hammock, Newton Rd 12-V-1970 (R. M. Baranowski) (blacklight trap); 1 ♂ Manatee Co. Bradenton 27-IV-1965; 1 ♀ Citrus Co. Inverness 27-IV-1965; 1 ♂ Hardee Co. Wauchula 13-IV-1965; 1 ♀ Pinellas Co., Largo 27-IV-1965; 1 ♂ Coronado Beach 26-II-1939 (C. A. Frost); 1 ♀ Leon Co., Tallahassee 10-III-1974 (C. W. O'Brien) (uv trap); 2 ♀ Highlands Co., Archbold Biol. Sta. 7-8-VI-1969 (J. Harrington, T. Schuh, J. Slater) (at light); 1 ♀ Alachua Co. 15-V-1950 (E. W. Michelson); 1 ♀ Gainesville 18-VIII-1969 (F. W. Mead) (blacklight trap); 1 ♀ Lake Co., 2 mi S. Tavares, Rt 448 25-IV-1967 (R. E. Woodruff) (blacklight trap); 1 ♂, 1 ♀ Polk Co., Pierce 5-XI-1949 (R. F. Hussey) (taken in Spanish moss); 1 ♀ Lakeland 9-IV-1948 (R. F. Hussey) (at light); 1 ♂, same 5-V-1948; 1 ♀ same 16-III-1948; 1 ♂ same 23-XII-1947 (taken in Spanish moss); 1 ♂, 1 ♀ same 21-XI-1948 (breeding on Spanish moss); 1 ♀ Dunedin 10-I-1930 (W. S. Blatchley); 2 ♂ same 6-II-1926; 1 ♂ same 26-II-1926; 1 ♂ same 10-III?; 1 ♀ same 22-III-1926; 2 ♂ same 23-III-1921. U.S.N.M., F.S.C.A., G.G.S., Purdue Univ. (Blatchley Coll.), R.M.B. and J.A.S. collections.

This is a very distinctive species by virtue of its extremely pale, nearly white, appearance. The light coloration of the clavus and corium obliterates the posterior white macula so that the corium appears completely pale with the exception of the 3 contrasting dark chocolate brown markings indicated above. An additional distinctive feature of this pale species is the lack of a distinctly contrasting white annulus on the 4th antennal segment. In some specimens an annulus is present but very short and not strongly contrasting as it is in most species of *Ozophora.* In the most vividly colored specimens there are some dark brown spots on the middle and fore femora. The posterior margin of the pronotum is white and the raised calloused divergent lateral areas of the scutellum may have a white differentiated area toward their posterior portions. In some specimens there is also a dark chocolate brown spot on the membrane adjacent to the middle of the apical corial margin and the apex of the membrane may appear white, as in many other species of the genus. There is also a slight variation in the spination of the fore femora. The most proximal spine is always small and sometimes is lost so that in many specimens 3 spines rather than 4 are present on a fore femur.

This is the species reported as *pallescens* (Distant) from Dunedin by Blatchley (1926). Blatchley's specimens were taken from the leaf axils of a thistle on Hog Island, and by beating Spanish moss and sweeping ferns in dense hammocks on the mainland.

Fifth instar nymph (dry, Edgewater, Fla.)

General coloration pale testaceous, marked with dark brown as follows: head, a broad irregular stripe on pronotum on either side of midline adjacent to narrow pale meson, a broad even stripe midway between meson and lateral margin and a lateral stripe just within explanate lateral flange, this latter becoming obsolete posteriorly, broadening anteriorly and coalescing with next stripe. Scutellum marked with dark brown on either side of midline narrowing posteriorly along prescutellum and metanotum; inner 1/2 of mesothoracic wing pads (invaded anteriorly by an elongate yellow quadrate mark); posterior 1/2 of wing pads except for a broadly pale apex, the dark brown area extending anteriorly as a stripe through middle of wing pads and along lateral margins within explanate flanges. Abdomen strongly irrorate, darker anteriorly, 1st segment nearly white dorsally; sclerotized areas around abdominal scent gland openings narrowly elliptical. Legs, antennae and labium pale yellow, femora and tibiae obscurely spotted with darker brown; 2nd tarsal segment and apex of labium infuscated. Antennae with 4th segment slightly infuscated, very slightly paler at proximal end and lacking a distinctly differentiated white annulus. Ventral and pleural surfaces of head and thorax dark red brown. Abdomen irrorate below becoming nearly uniformly fumose on segment 2, progressively less so through 3 and 4. Segment 4 with a white macula near anterior margin on either side of midline. All abdominal segments uniformly pale laterally. Dorsal surface without upstanding hairs.

Head length 0.63, width 0.75, interocular space 0.43. Pronotum length 0.58, width 1.05. Wing pads length 1.18. Abdomen length 1.88. Labial segments length I 0.58, II 0.55, III 0.40, IV 0.28. Labium extending posteriorly between metacoxae. Antennal segments length I 0.38, II 0.85, III 0.68, IV 0.88. Fore and hind femora armed as in adults. Total body length 3.84.

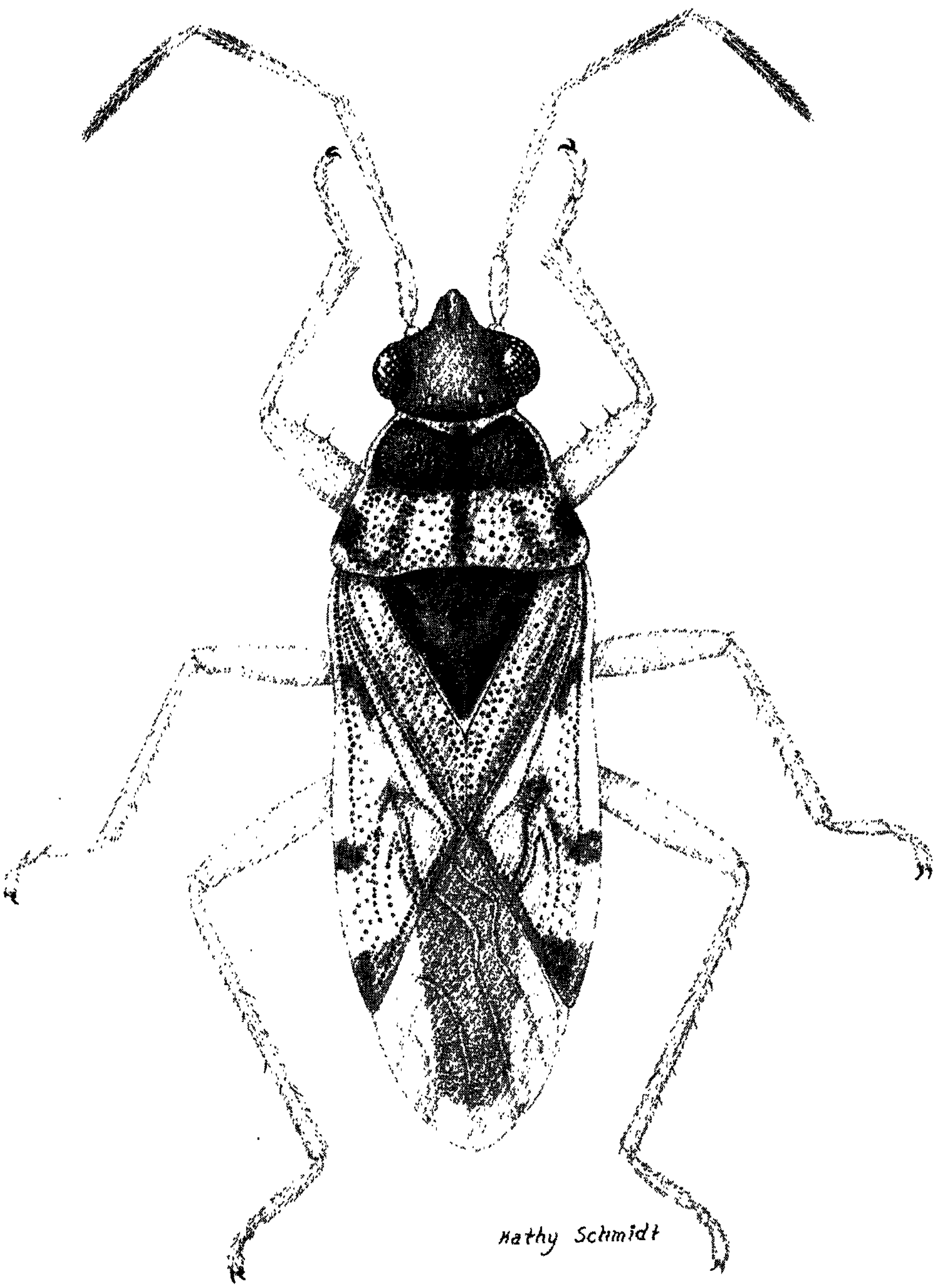

Fig. 4. *Ozophora laticephala* Slater & O'Donnell.

Ozophora laticephala Slater & O'Donnell
(Fig. 4)

Slater & O'Donnell 1979, J. Kansas Ent. Soc. 52: 161.

This recently described species is, together with *divaricata* one of the smallest of the Florida *Ozophora*. It is readily recognizable by its relatively stout body, pale white lateral pronotal margins, lack of a strongly contrasting white annulus proximally on the 4th antennal segment and especially by the broad head with its short strongly truncate down-turned tylus.

In Jamaica *laticephala* is often present in large numbers feeding upon *Ficus* seeds on the ground. This is the species that Slater (1972) notes as occurring in a population estimated at over 1/4 million individuals feeding on fallen seeds of a single tree of *Ficus trigonata* L. on Jamaica.

In early March, 1982 we collected a large series of adults and nymphs in seed litter under a large *Ficus microcarpa* L. (f) growing at the Univ. of Florida Agricultural Research and Education Center, Homestead. A large population of *Cligenes distinctus* (Distant) and a few individuals of *Ozophora burmeisteri* were also present. This particular tree had been under observation for many years. *Cligenes distinctus, Ozophora burmeisteri* and *Neopamera neotropicalis* (Kirkaldy) have been collected in moderate numbers but prior to 1982 not a single specimen of *Ozophora laticephala* had been taken. It seems entirely possible that in view of the extensive collecting by the junior author and others, including light trap collecting, that this West Indian species is a recent introduction in southern Florida. It may well be restricted to *Ficus* sp. as a breeding host.

It is primarily a West Indian species that occurs in the Bahamas, is widespread in the Greater Antilles but not yet known to occur in the Lesser Antilles.

Slater & O'Donnell (1979) reported *laticephala* from Florida for the first time based upon a series taken at Stock Island (Key West). They describe the nymphs and figure the 5th instar.

Ozophora levis Slater and Baranowski, NEW SPECIES

General coloration predominately dark reddish brown, marked with contrasting pale yellow as follows: anterior pronotal collar; humeral pronotal angles; a pair of narrow vittae on posterior pronotal lobe, each midway between meson and lateral margins; a small macula near middle of elevated "Y" on scutellum; elevated claval vein; a diffuse area on corium immediately within lateral explanate flange at level of middle of claval commissure; legs; antennae and labium. Lateral explanate flange of corium white, interrupted near apex where only extreme lateral margin is narrowly yellow. Coxae yellowish brown. Apical 1/2 of 4th labial segment, clavus and suffuse areas on 1st antennal segment brown. Fourth antennal segment light brown, somewhat paler basally but lacking a strongly differentiated white annulus. Dorsal surface lacking conspicuous upstanding hairs. Head and anterior pronotal lobe nearly impunctate; posterior pronotal lobe, scutellum and clavus prominently punctate, punctures separated from one another by a distance greater than diameter of a puncture.

Head elongate, extending anteriorly nearly to middle of 1st antennal segment, tylus only slightly declivent. Head length 1.0, width 1.0, interocular space 0.44. Pronotum with well developed anterior collar; lateral margins obtusely ridged, deeply sinuate; humeri evenly rounded; transverse impression complete; posterior margin shallowly concave before scutellum. Pronotum length 0.92, width 1.56. Scutellum with prominent Y-shaped elevation, length 0.90, width 0.82. Hemelytra with lateral corial margins very shallowly sinuate; length claval commissure 0.80. Midline distance apex clavus-apex corium 1.40. Midline distance apex corium-apex membrane 0.92. Metathoracic scent gland auricle straight, not curving posteriorly. Fore femora armed below on distal 1/2 with 4 large dark brown spines and an additional small spine near distal end. Hind femora with 4 small ventral spines present on distal 1/2. Labium reaching metacoxae. Labial segments length I 0.94, II 0.90, III 0.70, IV 0.46. Antennal segments length I 0.64, II 1.68, III 1.36, IV 1.70. Total body length 5.84.

HOLOTYPE: ♂ *Florida*: Key Largo 25-II-1956 (at light) (R. A. Morse). In U.S.N.M. No. 100055.

PARATYPES: *Florida*: 2 ♂, 4 ♀ same as holotype. 1 ♀ Key Largo 25-II-1956 (H. V. Weems, Jr.). 1 ♂ Plantation Key 3-V-1957 (at light) F. W. Mead). 4 ♂, 1 ♀ Big Pine Key 26-III-1973 (C. W. & L. B. O'Brien); 2 ♂, 1? (abdomen missing) Key West 25-IV-1969, (F. A. Buchanan) blacklight trap. In A.M.N.H., F.S.C.A., R.M.B. and J.A.S. collections.

This species is readily recognizable by its predominately dark reddish brown (sometimes almost chocolate brown) coloration. The only other very dark colored species of *Ozophora* in Florida are *burmeisteri* and *trinotata* both of which have conspicuous upstanding dorsal pubescence present.

Some specimens of *levis* have the corium darker colored than does the holotype described above. In such cases the pale areas are strongly contrasting and appear as distinct yellow maculae laterally at the level of the middle of the claval commissure, near the inner-apical corial margin, as a large pale area on the lateral corial margin (at the level of the middle of the apical corial margin) and at the extreme apex of the corium. Although most specimens have the 2nd and 3rd antennal segments almost uniformly pale, occasionally the distal ends of both segments are infuscated. The number of fore femoral spines appears to be almost constant, but the number of hind femoral spines varies from 3 to 6.

In addition to the type series there are several additional specimens that we consider to be conspecific. The most important of these are 3 specimens from Quintana Roo, Mexico (1 ♂, 1 ♀ Allen Point 17-IV-1960 (J. F. G. Clarke) 1 ♀ Tukun 20-IV-1960 (J. F. G. Clarke) in the U.S.N.M. These 3 specimens appear to be similar to the type series in all respects.

Two specimens from the Bahamas are perhaps conspecific but do differ in some respects. Both of these specimens (1 without abdomen from Andros Island, Fresh Creek 23-IV-1953, the other a male from Great Abaco Isl., Marsh Harbour 6-V-1953, both collected by E. V. Hayden & L. Giovannoli at light during the Van Voast-A.M.N.H. Bahamas Isls. Exped.) differ from all of the paratypes and the Mexican specimens in having the ridged lateral pronotal margins pale and strongly contrasting with the anterior pronotal lobe. The posterior pronotal lobe has the commonly found looped pattern of alternating dark and light vittae with the dark vittae coalescing posteriorly to form the so called loop. The 2 specimens are considerably lighter than the type material and the Andros Island specimen has a distinct well defined although white annulus on the 4th segment.

The male from Great Abaco Island is remarkable in having bilaterally symmetrical 3-segmented oligomerous antennae. Oligomery is not uncommon in *Ozophora* but bilateral oligomery in Lygaeidae is a very rare phenomenon. These Bahamian specimens may represent an undescribed species but clarification must await additional material.

Ozophora levis is part of a difficult West Indian complex whose clarification is beyond the scope of this paper. From Mayaguana Island in the Bahamas we have examined an enormous series that is very similar in external appearance to *levis*. However, *levis* has 6 coils to the vesica (as does the male from Great Abaco Island), an evenly curving flange on the basal attachment area of the paramere and non-flaring sperm reservoir "wings". Specimens from Mayaguana by contrast have a 10-coiled vesica, a rather truncated or rectangular basal attachment paramere area and widely flaring sperm reservoir wings. The latter type of genitalic structures are very similar to the condition found in material from the Turks and Caicos Islands, Hispaniola and Jamaica. However, specimens from the Greater Antilles probably are at least subspecifically distinct from those from the Bahamas as the latter have quite differently colored hemelytra, a somewhat more elongate head, a less densely punctate posterior pronotal lobe and a more elongate prominently white 4th antennal segment annulus. *Ozophora pallidofemora* Scudder from the Caymans is also probably a member of this complex but is readily distinguishable from any of the above populations as it has a "notched" humeral pronotal area.

Ozophora picturata Uhler

This is a large species with a relatively porrect head and anteriorly tapering pronotum. The easiest recognition feature for Florida specimens is the presence of a distinct crimson streak along the posterior portion of each apical corial margin. In very pale specimens this color is almost lost but still evident in all specimens we have examined. *Ozophora picturata* is usually a vividly marked species with a prominent broad subproximal white annulus on the 4th antennal segment, and the pale subapical corial macula only a little differentiated from the pale areas of the anterior half of the corium.

Sweet (1964) has studied the biology of *picturata* in Connecticut where it "is strictly an inhabitant of forest floors, ranging from oak-hickory forests to shrubby consolidation seres". He found it to be the only seed feeding lygaeid found in the climax-oak hickory community that covers so much of the northeastern United States. The habitat in Florida is not known, but it surely will prove to be a woodland speices.

Ozophora picturata has the most northern distribution of any species of *Ozophora*. It is known to occur from New England west at least to Iowa and south to Texas and Florida. Some Caribbean, Central American and California records may be correct but need verification.

Florida records: Reported by Barber (1914) from Biscayne Bay and Kissimmee and by Blatchley (1926) from Dunedin, Lakeland and Royal Palm Park.

Additional Florida records: Lakeland, Polk Co.; Davis, I.; Hillsborough (G. G. S.); Tall Timbers Res. Sta., Leon Co., Woodyard Hammock; Tallahassee; Wakulla Springs; Spring Creek, Wakulla Co. (J. A. S.); Winter Park; Lake Placid (A.M.N.H.); Bowling Green; Gainesville; Orchid Jungle Hammock, Newton Road, Dade Co.; Volusia Co.; Homestead; Monticello (R. M. B.). Lakeland; Liberty Co.; Camp Terreya; Jackson Co.; Cottondale (Univ. Mich.).

Fifth instar nymph (in alcohol, Storrs, Connecticut)

General coloration and markings similar to *gilva* but coloration darker.

Dark stripes on pronotum wider on either side of pale midline but midlateral stripe much more slender; dark markings on scutellum tapering evenly posteriorly in rather a cone shaped manner. Abdominal markings quite different from those of *gilva*, irrorate spots rather obsolete, absent posterior to segment 4. Abdomen conspicuously marked with red along sutures, these red markings splitting laterally to form a "Y". Midway along margin the anterior arm of the "Y" leaving the suture and extending to the middle of the segment, that on terga VI extending antero mesad to reach lateral edges of abdominal scent gland opening between terga 5 and 6; area between the Y-shaped arms infuscated with dusky gray, becoming paler posteriorly. Legs nearly uniformly pale, third tarsal segment infuscated. First and 2nd antennal segments light yellow, 3rd segment dark chocolate brown somewhat paler toward proximal end, 4th segment with an extremely conspicuous white annulus occupying entire proximal 1/2 of segment, distal 1/2 of segment IV dusky brown. A broad reddish brown longitudinal stripe occupying greater portion of lateral thoracic surface which is ventrally pale yellow. Abdomen below slightly irrorate, dusky gray with reddish bands along anterior margins of sutures separating sterna 5, 6, 7 and 8; infuscated with reddish on lateral portions of segments 2 and 3.

Armed below on fore and hind femora as in adult. Labium elongate extending well onto 3rd abdominal sternum. Head length 0.78, width 0.88, interocular space 0.48. Pronotum length 0.73, width 1.20. Mesothoracic wing pads length 1.48. Abdomen length 2.23. Labial segments length I 0.93, II 0.95, III 0.78, IV 0.43. Antennal segments length I 0.63, II 1.30, III 1.03, IV 1.23. Total body length 4.70.

Fourth instar nymph (same as above)

Similar in form and color to instar 5. Striping on head, pronotum and scutellum more regular and even. Abdominal segment 2 almost completely dark gray; segment 3 dark gray anteriorly; this color tapering posteriorly in middle to reach lateral angles of abdominal scent gland opening between terga 3 and 4 but with a central yellow transverse macula in this tapered portion.

Head length 0.68, width 0.73, interocular space 0.43. Pronotum length 0.55, width 0.85. Mesothoracic wing pad length 0.63. Abdomen length 1.75. Labial segments length I 0.73, II 0.70, III 0.53, IV 0.28. Antennal segments length I 0.50, II 1.00, III 0.85, IV 0.93. Total body length 3.70.

Ozophora reperta Blatchley, New Synonymy

1954. *Ozophora inornata* Barber, American Mus. Novit. N. 1682 p. 5-6.

This is a small dull brown species, without a strongly contrasting white macula present on the distal portion of the corium. It is conspecific with *inornata* Barber from the Bahamas. In most of the Bahamian specimens we have examined the explanate flange of the lateral edge of the corium is pale except for the apical dark spot, whereas in all Florida specimens there is a conspicuous although often small dark chocolate spot 1/3 the distance from the apex. Florida specimens are also usually more vividly colored on the posterior pronotal lobe. The fore femora usually have only 2 ventral spines distally but occasionally 3 are present. The calli are usually conspicuously elevated above the pronotal surface. The 3rd antennal segment is darkened at the distal end and the 4th segment has a broad proximal white annulus.

This is apparently a scarce species as, despite intensive light trap collecting for a number of years at the localities listed below, only 10 specimens has been taken.

In addition to the southern Florida records, *reperta* is known only from the Bahamas and the Dominican Republic. Barber (1954) originally described *inornata* from South Bimini Island and Barber & Ashlock (1960) listed it from Allans Cay (Abaco Cays), New Providence I., Mayaguana I. and from a Cay 3.5 miles S.W. of North Caicos I. We have also examined material from Cat Island and Andros I. It apparently occurs throughout the Bahamas. We have also examined 5 specimens from the Dominican Republic ("Prov. E. Seibo Miches 9-VI-1976 (R. E. Woodruff) blacklight trap.

Florida records: Originally described by Blatchley (1926) from 6 specimens "swept from weeds along the margins of everglades", Royal Palm Park. Blatchley (1930) designated as type (Lectotype) a ♀ from Royal Palm Park, 4 April 1925. We have examined 3 ♂'s (part of the same series) from the above locality 20-III-1924 and have attached paratype labels.

Additional Florida records: Orchid Jungle Hammock, Newton Rd., Dade Co. and Naranja (R. M. B.); Homestead (R.M.B., J.A.S.).

Ozophora trinotata Barber

This is a large reddish brown species, recognizable by the upstanding dorsal pubescence, unusually long hind femoral hairs and completely dusky hemelytral membrane. The corium has a narrow but conspicuous distally placed pale macula and a broad chocolate fascia immediately anterior to it, which extends entirely across the wing. There is no pale spot present near the inner angle of the corium. As with a number of the darker species of *Ozophora* there is considerable variation in color. In very dark specimens the characteristic longitudinal rays are conspicuously present on the posterior pronotal lobe, whereas in pale reddish brown specimens these rays are indistinct or absent.

Little is known of the biology. Blatchley (1926) reported it from ferns, certainly not a host plant. It is commonly taken in blacklight traps in hammocks in the Homestead area. We have taken breeding populations in dense vegetation in the Florida Keys and on 4 March 1982 numerous nymphs and a few adults were taken on Long Key feeding on the fallen seeds of *Conocarpus erecta* L. in a relatively damp shaded depression.

Florida records: Originally described by Barber (1914) from Marco; Everglade: Ft. Myers, Ormond; Biscayne Bay and Belleair. Reported by Blatchley (1926) from Dunedin and Royal Palm Park and by Torre-Bueno (1931) from Royal Palm Park as *binatata* (*sic.*).

Additional Florida records: Wauchula (R.M.B. & G.G.S.); Cortez (G.G.S.); Key Biscayne; Ocala Nat. Forest, Zay Prairie, 3 mi. N. Hwy. 40; Manatee Co.; Gumbo Limbo Trail, Everglades Nat. Pk.; Archbold Biol. Sta.; Big Pine Key; Silver Springs (J.A.S.); Gainesville (R.M.B. Schuh, J.A.S.); Boca Grande, Lee Co.; Ozello, Citrus Co.; St. Johns; St. Augustine; Punta Rassa, Lee Co.; Bradenton, Manatee Co.; Shove Acres, Pinellas Co.; Largo, Pinellas Co.; Captiva, Lee Co.; South Bch., St. Lucie; Siesta Keys, Sarasota; Sanibel, Lee Co.; Beruliarand (sp?), Lee Co.; Vero Beach, Indian River (G.G.S.); St. Pk., Key Largo; Long Key (R.M.B., J.A.S.) Highlands Hammock St. Pk.; Edgewater; Paradise Key (P.D.A.); Homestead; Orchid

Jungle Hammock, Newton Road, Dade Co.; Key Largo; Hog Bay, Desoto Co.; Ft. Green; Ross & Castello Hammock, Dade Co.; Flamingo Prairie, Everglades Nat. Pk.; Naranja, Venice, Manatee Co.; Bowling Green, Stock Island, Monroe Co.; 9 mi SSW Ocala, Marion Co. (R.M.B.); Lake Placid; Winter Park; Sebring and Sebastian (A.M.N.H.), Labelle, Hendry Co. (J.A.S.). Marion Co., Ocala Nat'l. For.; Marion Co. Micanopy; Lake Co.; Pinellas Co., 2.4 mi E. Tarpon Spr. Putnam Co., 1.7 mi. N. Satsuma (Univ. Mich).

Fifth instar nymph (in alcohol Key Largo, Florida)

Body elongate, elliptical, strongly tapering anteriorly from abdomen. Head reddish brown with darker markings behind eye and laterally on vertex. Pronotum also dark reddish brown, a pale yellow mark on anterior collar area midway between meson and margin and an irregular pale spot on posterior margin midway between meson and margin, this faintly indicated as a stripe anteriorly. Mesothoracic wing pads strongly striped and variegated with dark brown and pale yellow. Abdomen conspicuously irrorate, segments 2 and 3 marked with gray as in *burmeisteri;* sutures usually narrowly margined with pink or red (sometimes abdomen strongly suffused with red laterally and mesally). Legs uniformly pale yellow, posterior femora lacking a subdistal dark annulus. Antennae pale yellow, 4th segment with proximal 1/2 to 1/3 white but much less strongly differentiated from distal coloration than in many species of *Ozophora.* Thickly clothed above with upstanding yellow and dark brown hairs. Hairs on posterior femora elongate, as long as or longer than diameter of femur, as in adult. Fore femora armed below with 3 conspicuous spines, sometimes a tiny spine distad of these and with a series of 4 or 5 elongate hairs proximad. Labium reaching abdomen. Head length 0.80, width 1.0, interocular space 0.50. Pronotum length 0.78, width 1.35, Mesothoracic wing pad length 1.53. Abdomen length 3.40. Labial segments length I 0.80, II 0.85, III 0.70, IV 0.38. Antennal segments length I 0.53, II 1.35, III 1.20, IV 1.48. Total body length 5.60.

Fourth instar nymph (in alcohol, Long Key, Florida)

Similar in form and color to instar 5. Darkened area across segments 2 and 3 more strongly suffused with red. Posterior portion of tergum 3 and anterior portion of tergum 4 white, together forming a distinct pale transverse fascia across center of abdomen interrupted only by dark area around anterior abdominal scent gland openings. Hind femora with rather elongate hairs but these not as long as diameter of femur. Head length 0.68, width 0.78; interocular space 0.43. Pronotum length 0.55, width 0.90. Mesothoracic wing pads length 0.50. Abdomen length 1.48. Labial segments length I 0.63, II 0.60, III 0.48, IV 0.33. Antennal segments length I 0.40, II 0.95, III 0.93, IV 1.13. Total body length 3.20.

Third instar nymph (same as above)

Similar in form to instar 4. Abdomen in large part pale yellow, a conspicuous transverse red fascia across abdomen covering segment 2 and anterior portion of segment 3. Abdominal segments 4 through 7 with irregular scattered red markings. These particularly prominent laterad. Broad white annulus proximally on 4th antennal segment still clearly evident. Head length 0.50, width 0.60; interocular space 0.33. Pronotum length 0.28, width 0.60. Abdomen length 1.65. Labial segments length I 0.33, II 0.35, III 0.30, IV 0.23. Antennal segments length I 0.23, II 0.53, III 0.50, IV 0.68. Total body length 2.90.

Second instar nymph (same as above)

General coloration similar to instar 3 but red markings on abdomen forming 2 distinctly separated transverse fascia, the anterior one on segments 2 and 3, the posterior one on segments 4 and 5. Posterior to 2nd red fascia conspicuous red markings present laterally along sutures of segments 6 and 7. Head length 0.30, width 0.38, interocular space 0.23. Pronotum length 0.15, width 0.37. Abdomen length 0.78. Labial segments length I 0.30, II 0.23, III 0.25, IV 0.23. Antennal segments length I 0.15, II 0.28, III 0.28, IV 0.43. Total body length 1.50.

First instar (same as above)

Head, pronotum, mesonotum and large transverse areas on metanotum dull yellow brown, strongly contrasting with nearly white abdomen; latter with a single transverse broad red fascia running across tergum 5 and adjacent areas of terga 4 and 6. Red fascia continued around body well onto sternum but not meeting at midline ventrally. Fourth antennal segment uniformly pale, nearly white. Head length 0.28, width 0.38; interocular space 0.25. Pronotum length 0.15, width 0.43, Abdomen length 0.58. Labial segments length I 0.30, II 0.25, III 0.20, IV 0.23. Antennal segments length I 0.15, II 0.25, III 0.25, IV 0.43. Total body length 1.15.

Egg (same as above)

Similar to that of *burmeisteri* in shape and having the surface thickly covered with a short coat of truncate hairs. Five short thick micropylar processes present around anterior pole. Length 1.0, width 0.45.

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THE *OZOPHORA PALLESCENS* COMPLEX IN THE WEST INDIES WITH THE DESCRIPTION OF FOUR NEW SPECIES (HEMIPTERA: LYGAEIDAE)

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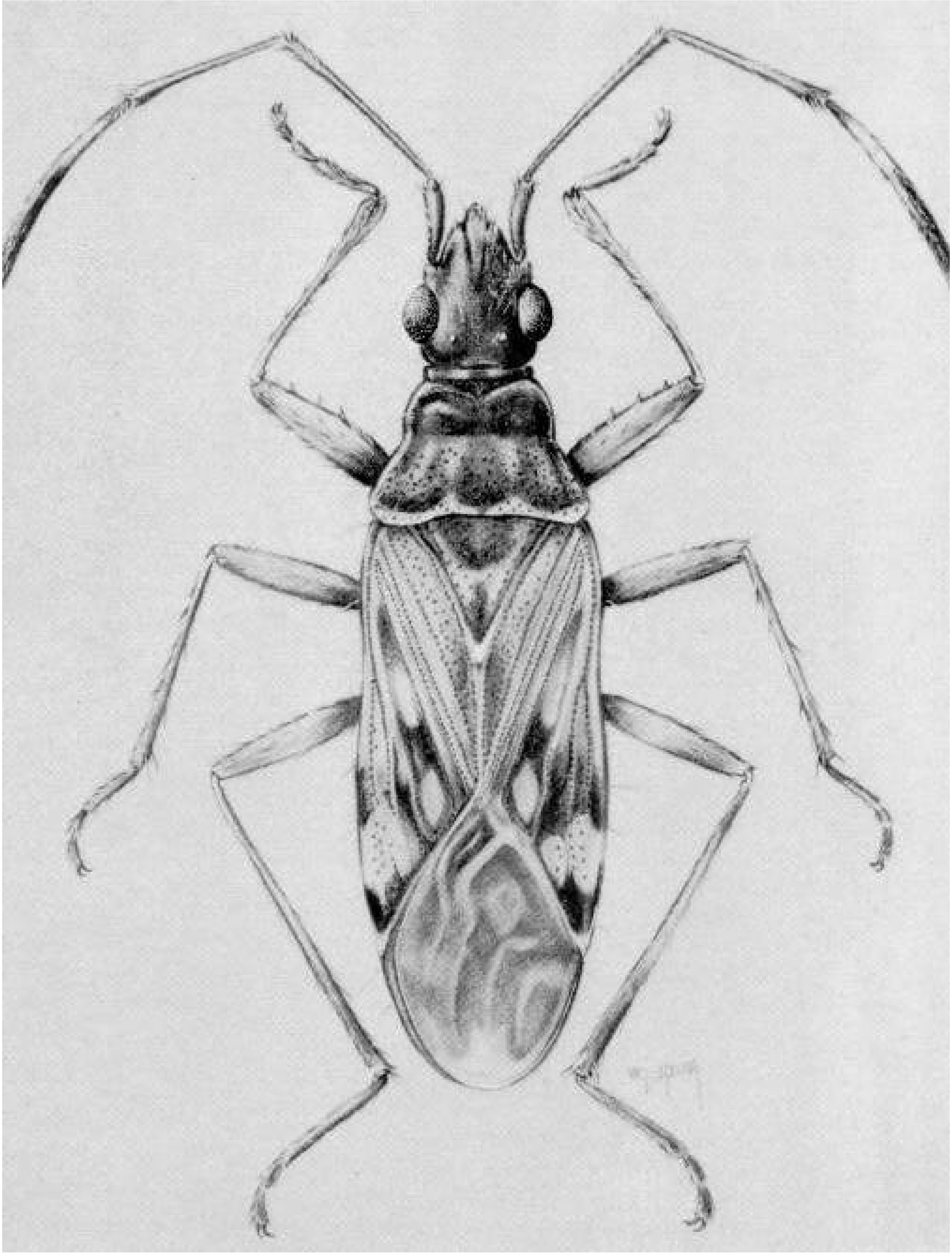
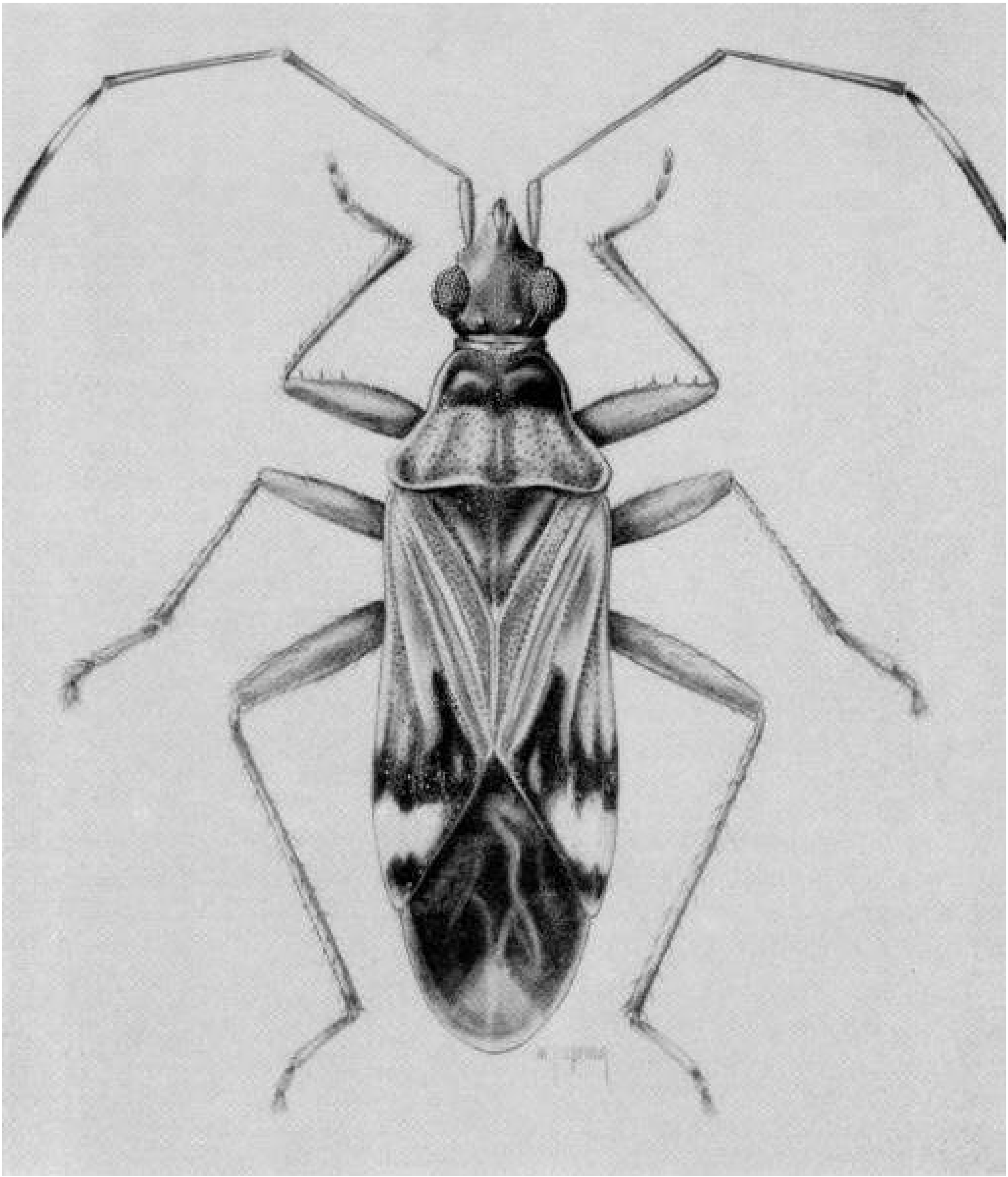
ABSTRACT

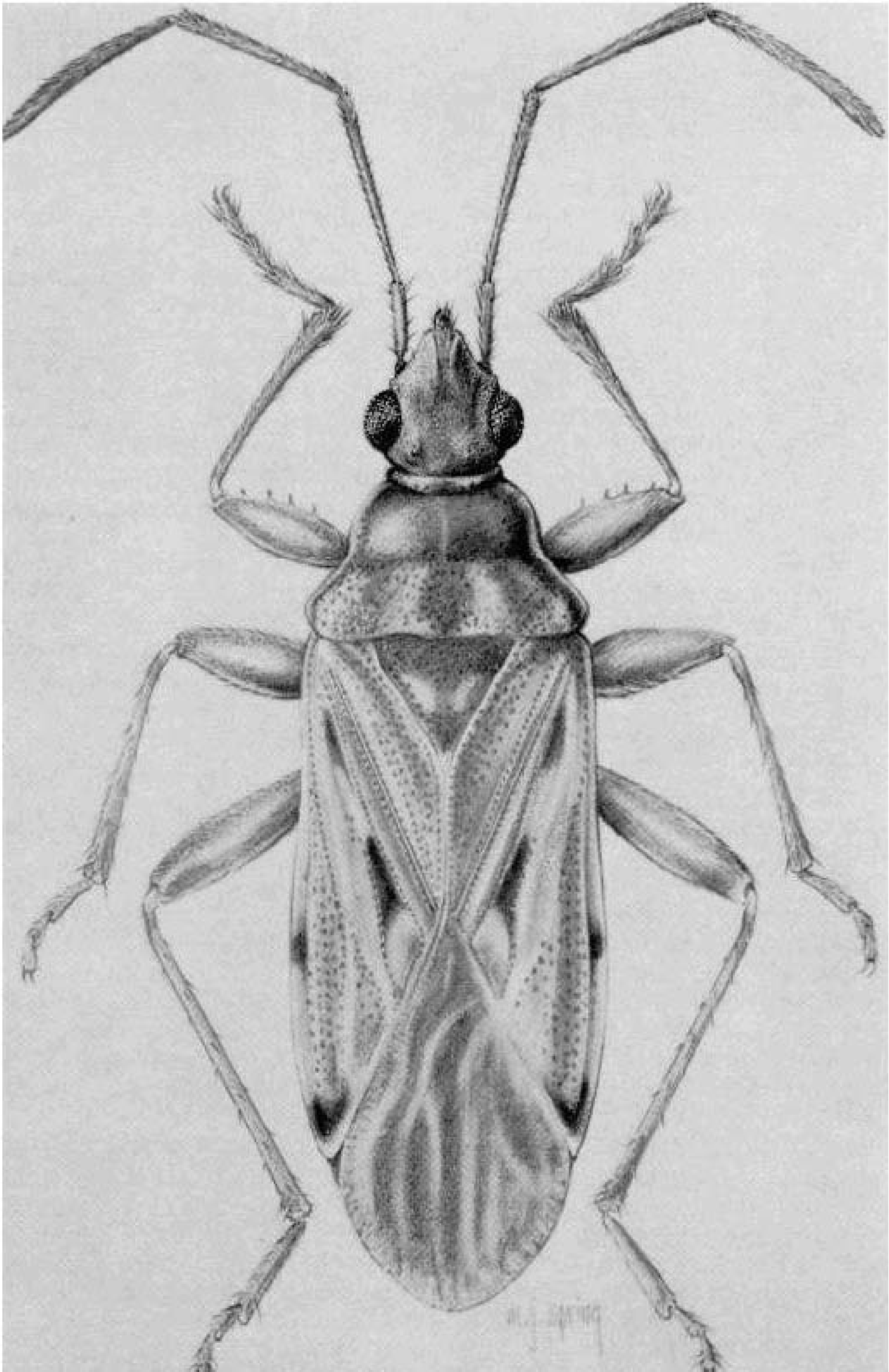
The *Ozophora pallescens* complex is defined and its distribution and relationships in the West Indies discussed. *Ozophora majas, caribbee, cobbeni* and *helenae* are described as new. *Ozophora divaricata* Barber, *subimpicta* Barber, *miniscula* Scudder and *pallescens* (Distant) are assigned to the complex. Descriptive discussions, a key and genital capsule figures are included for all species. Dorsal view illustrations are included for *helenae, cobbeni, majas* and *subimpicta.* Barber's 1939 records of *pallescens* from Puerto Rico are referred to *divaricata.* Zoogeographic implications suggesting the presence of a Greater Antillean and a Lesser Antillean component are discussed.

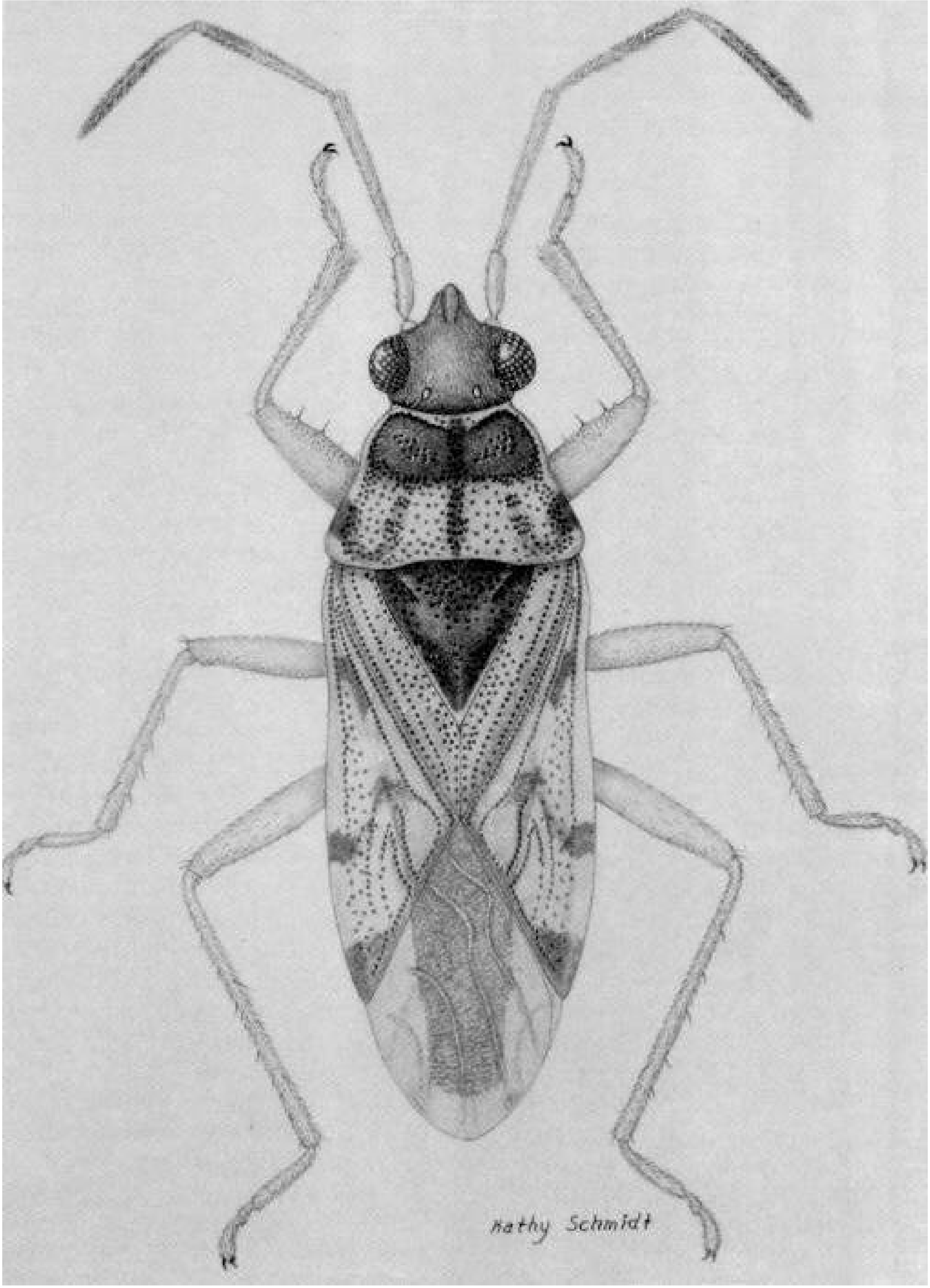
RESUMEN

Se define el complejo del género *Ozophora* y se discute su distribución y





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RESUMEN

Se define el complejo del género *Ozophora* y se discute su distribución y sus relaciones en las Antillas. Se describen como nuevas especies *Ozophora majas, caribbee, cobbeni* y *helenae.* Se asignan al complejo las especies *divaricata* Barber, *subimpicta* Barber, *miniscula* Scudder y *pallescens* (Distant). Se incluyen discusiones descriptivas, una clave y figuras de las genitalias para todas las especies. Se incluyen ilustraciones de vistas dorsales de *helenae, cobbeni, majas* y *subimpicta.* Los registros de Barber 1939, de la especie *pallescens* de Puerto Rico, se refieren a *divaricata.* Se discuten las implicaciones zoogeográficas, las cuales sugieren la presencia de las componentes de las Antillas Mayores y Antillas Menores.

The present paper treats a complex of small species in the genus *Ozophora.* These insects are widespread in the West Indies and also occur in southern Florida, Central and South America. This work is confined primarily to the West Indies and members of the complex from other areas are discussed only as necessary to understand the group in the West Indies.

The relationships of these insects are among the most difficult that we have encountered in the genus *Ozophora,* itself a notoriously difficult genus.

We have called this the "*pallescens* complex" from the nominal species described many years ago by Distant (1893) from Panama. The complex may be defined as very small to minute species; usually with only 2 (sometimes 3) major spines on the ventral surface of the fore femora; prominent convex calli; a dark anterior pronotal lobe with concolorus lateral margins; and, a smooth, sometimes almost "glossy" surface to the posterior pronotal lobe where the punctures tend to be more widely separated than is the case with many other species of *Ozophora.* In addition, there are frequently 3 "looped" dark areas on the posterior pronotal lobe, a strongly variegated hemelytral color pattern and pale legs. This definition does not completely exclude a few species that we do not include here. A complete understanding of monophyletic groups within *Ozophora* must await a revision of the entire genus, now underway. We feel reasonably certain that despite some difficulty in definition we are dealing with a very closely related monophyletic group. This is evident by the difficulty of distinguishing species in the complex. The species are very similar, and although with experience it is often possible to recognize individual species on external features of color, shape and relative body proportions, there is so much individual variation and so many minor inter-island differences that few of these external features are actually diagnostic. Fortunately we have had available for study long series from a number of the West Indian islands including a considerable proportion that we have personally collected.

To accurately identify a number of the species in this complex, it is necessary to examine the configuration and details of the male genital capsule. One of the most reliable characters we have found is what Schaefer (1977) calls the cuplike sclerite which is most easily observed when examining the posterior portion of the genital capsule. In *Ozophora* this sclerite, when viewed posteriorly, appears as a pair of large elongate lobes connected dorsally (Fig. 1; and 2a,d,g,j). The configuration and width of the space between the lobes and the shape of the lobes themselves are diagnostic for species determination. Other features of the genital capsule useful for species determination include the shape of the caudo-dorsal edge of the capsule. This may appear as a narrow, sharply delineated lip (Fig. 1e,h) or as a relatively broad rolled edge (Fig. 2b). When viewed dorsally the caudo-dorsal edge may be evenly rounded (Fig. 1f) or variously produced (Fig. 1c,i,l; 2c,f,i,l).

The dorsal opening of the genital capsule, as in other lygaeids, has an inward projecting pair of arms. These arms may be either simple (Fig. 1f; 2c,f,i) or bifid (Fig. 1c,i). In some cases the differences are subtle and require some experience. Comparative material is helpful especially for small species such as *caribbee* n.sp., *majas* n.sp. and *divaricata*. In *caribbee* (Fig. 1e,f) the posterior margin of the capsule curves in a nearly even arc from the venter to the dorso-caudal edge. This edge is narrow and terminates in a definite lip. In *divaricata* (Fig. 2b,c) the posterior margin of the capsule is distinctly angulate ventrally rather than forming an even arc and the dorso-caudad area is strongly produced and thickened into a heavy rolled margin. The capsule shape of *caribbee* n.sp. is remarkably constant throughout the West Indies with no evident variation from island to island. In *divaricata* the Florida population has the posterior dorso-caudad margin strongly produced, but less abruptly angulately so, than specimens from the Bahamas.

Differences in genital capsule shape for the other species are included in the individual species discussions.

Eventually this group will be an excellent subject for an exhaustive island by island statistical analysis as was done for the *Anolis* lizards.

Ozophora pallescens, subsequent to its original description by Distant (1893) from Panama, has been reported from many islands of the West Indies, Mexico and Florida (Slater 1964). As noted below most of the West Indian and all of the Florida records are referable to other species. Other authors have described species that we consider to be members of the *pallescens* complex. Barber (1939) described *subimpicta* from Puerto Rico and Hispaniola, and Barber (1954) described *divaricata* from Bimini. His determination labels demonstrate that he was aware that this species also occurred in the Greater Antilles. Scudder (1958) described *O. miniscula* from the Caymans, and while working on material from the Dutch Islands recognized an undescribed species from Saba, the formal description of which he has allowed us to include in the present paper.

The opportunity to collect on a number of the West Indian islands has enabled us to better understand something of the habitats and host plants of a number of the species. The large amount of material we have amassed has proven to be essential to an understanding of systematic relationships, both in assessing the degree of variability of color and meristic features, and more importantly, in being able to establish the reliability of features of the genital capsule in this complex.

We recognize 8 species in this complex in the West Indies, one that reaches Florida, one that reaches Central America and at least one and probably more that will be found to occur in South America.

The West Indian species may be segregated into 2 groups, the first, consisting of *cobbeni* n.sp. and *majas* n.sp., is characterized by the area of the inner margin of the genital capsule opening possessing bifid arms (Fig. 1c,i). The second subgroup consists of *caribbee* n.sp., *divaricata* Barber, *subimpicta* Barber, *pallescens* Distant, *miniscula* Scudder and *helenae* n.sp. In these species the arms consist of a single attenuated rather finger-like process (Fig. 1f; 2c,f,i) that may in some species possess a slight enlargement near the base (Fig. 1l, 2l).

Ozophora cobbeni n.sp. and *majas* n.sp. are thus far known only from the Lesser Antilles; *cobbeni* from Saba south to St. Lucia and *majas* from Saba, Montserrat and Dominica.

The other group is more widely distributed in the West Indies being known from Florida to Central and South America. The West Indian distribution of some of these species is interesting and, while the implications cannot be fully understood until mainland populations are analyzed, deserves some comment.

Ozophora caribbee n.sp. probably occurs throughout the West Indies. It is common on the "wet" islands of the Lesser Antilles (Grenada north to Guadeloupe) and occurs on all 4 major islands of the Greater Antilles (but is scarce). It occurs sympatrically with *cobbeni* n.sp. on Dominica and Guadeloupe. We have not yet seen material from the intervening islands. Material from Trinidad differs slightly but will probably prove to be conspecific.

Ozophora subimpicta apparently is confined to the Greater Antilles where it is abundant and widespread. *Ozophora helenae* n.sp. is also thus far known only from the Greater Antilles. *Ozophora miniscula* remains known only from the Caymans.

Since a large amount of material has been available for study, these distributions, while certainly not definitive, do indicate in general the basic distribution patterns. At least 2 species occur on most islands (4 species are already known from Jamaica and Dominica) and there is a definite segregation into a component that is primarily Lesser Antillean and one that is Greater Antillean. This is a distributional pattern that seems to be present in other groups of West Indian *Ozophora* and which will be discussed in subsequent contributions.

All measurements are given in mm.

The original references and complete synonymy to all previously described species can be found in Slater (1964).

Key to Species

1. Total length of antenna greater than 3.75 mm .... *subimpicta*

1′. Total length of antenna less than 3.60 mm 2

2(1′). Scutellum except for apex, dark chocolate brown .... *helenae* n.sp.

2′. Scutellum not chocolate brown 3

3(2′). Elongate lobes of cuplike sclerite in genital capsule touching ventrally; space between lobes, narrow, pointed dorsally; (Fig. 1a) arms projecting from lateral walls of dorsal opening of genital capsule bifid (Fig. 1c) .... *majas* n.sp.

3′. Elongate lobes of cuplike sclerite not touching ventrally, but may be close (Fig. 1g, 2a) arms from lateral walls either bifid or simple 4

4(3′). Caudo-dorsal edge of capsule appearing as a sharply delineated lip (Fig. 1e,h, 2h) 5

4′. Caudo-dorsal edge of capsule variously produced but not appearing as a sharply delineated lip. (Fig. 1b, 2k) 7

5. Arms projecting from lateral walls of dorsal opening of genital capsule bifid (Fig. 1i) .... *cobbeni* n.sp.

5′. Arms projecting from lateral walls of dorsal opening of genital capsule simple (Fig. 1f, 2i) 6

6(5′). Caudo-dorsal lip of genital capsule restricted to center (Fig. 2i) .... *miniscula*

6′. Caudo-dorsal lip of genital capsule apparently extending entire width of capsule (Fig. 1f) .... *caribbee* n.sp.

7(4′). Caudo-dorsal lip of genital capsule produced into a relatively broad rolled edge (Fig. 2b); arms projecting from lateral walls of genital capsule opening simple (Fig. 2c); lobes of cuplike sclerite rounded at ventral ends (Fig. 2a) .... *divaricata*

7′. Caudo-dorsal lip of genital capsule without a broad rolled ridge, only a suggestion of a lip (Fig. 1k); arms projecting from lateral wall of genital capsule opening simple, but with a slight enlargement at base (Fig. 1l); lobes of cuplike sclerite truncate at ventral ends (Fig. 1i) .... *pallescens*

Ozophora majas Baranowski and Slater, NEW SPECIES
Fig. 1a,b,c; 3

General coloration brownish. Head, anterior pronotal lobe, thorax laterally and ventrally and abdomen dark brown. Pronotal collar, posterior pronotal lobe except for pale brown vittae that coalesce posteriorly to give the appearance of 3 "loops", legs and labium yellowish. Antennae yellow-brown with the basal 1/3 of segment IV pale. Scutellum with basal 1/3 dark brown, remaining 2/3 yellowish. Clavus and corium pale yellow with brown punctures. Clavus with a faint brownish spot just posterior to anterior end of claval commissure. Corium with a wide brown band extending from posterior end of claval commissure and narrowing to lateral margins; a pale spot present near wide inner end of dark transverse fascia; apical tip of corium brown. Membrane smoky brown, veins paler.

Head straight, nondeclivent, interocular space slightly convex, tylus almost reaching middle of 1st antennal segment. Head length 0.50, width 0.60, interocular space 0.30. Lateral margins of pronotum sinuate, transverse impression shallow but extending across pronotum, calli elevated, smooth. Pronotum length 0.56, width 0.98. Scutellum length 0.46, width 0.48. Claval commissure length 0.46. Midline distance apex clavus—apex corium 0.80. Fore femora armed below on distal 1/3 with 3 prominent spines. Middle and hind femora unarmed. Antennal segments length I 0.30, II 0.70, III 0.56, IV 0.74. Labium reaching but not extending beyond mesocoxae, 1st labial segment not extending beyond base of head. Labial segments length I 0.36, II 0.40, III 0.28, IV 0.24. Total body length 3.24.

HOLOTYPE: ♂ *Montserrat*, West Indies: St. Georges Hill, 7-V-1968 (P. C. Drummond) Blacklight. In United States National Museum of Natural History No. 73804.

PARATYPES: *Montserrat*: 1 ♂ same data as holotype; *Dominica*: 2 ♀ Pont Casse, 23-VI-1971 (J. A. Slater, R. M. Baranowski, J. E. Harrington); 1 ♂ June-July (H. W. Foote), Yale Exp. 1913; 1 ♀ Pont Casse, 1 mi N., "April 15, 1965" (D. R. Davis); 1 ♂ Pont Casse, 23-XI-1964 (P. J. Spangler); *Saba Island*, Netherlands Antilles: 1 ♂ Mt. Scenary, 800-840 m. "Jan 12-14, 1968" (Borys Malkin). In United States National Museum of Natural History, R. M. Baranowski and J. A. Slater collections.

This species name is formed from that of Mary Jane Spring, staff artist

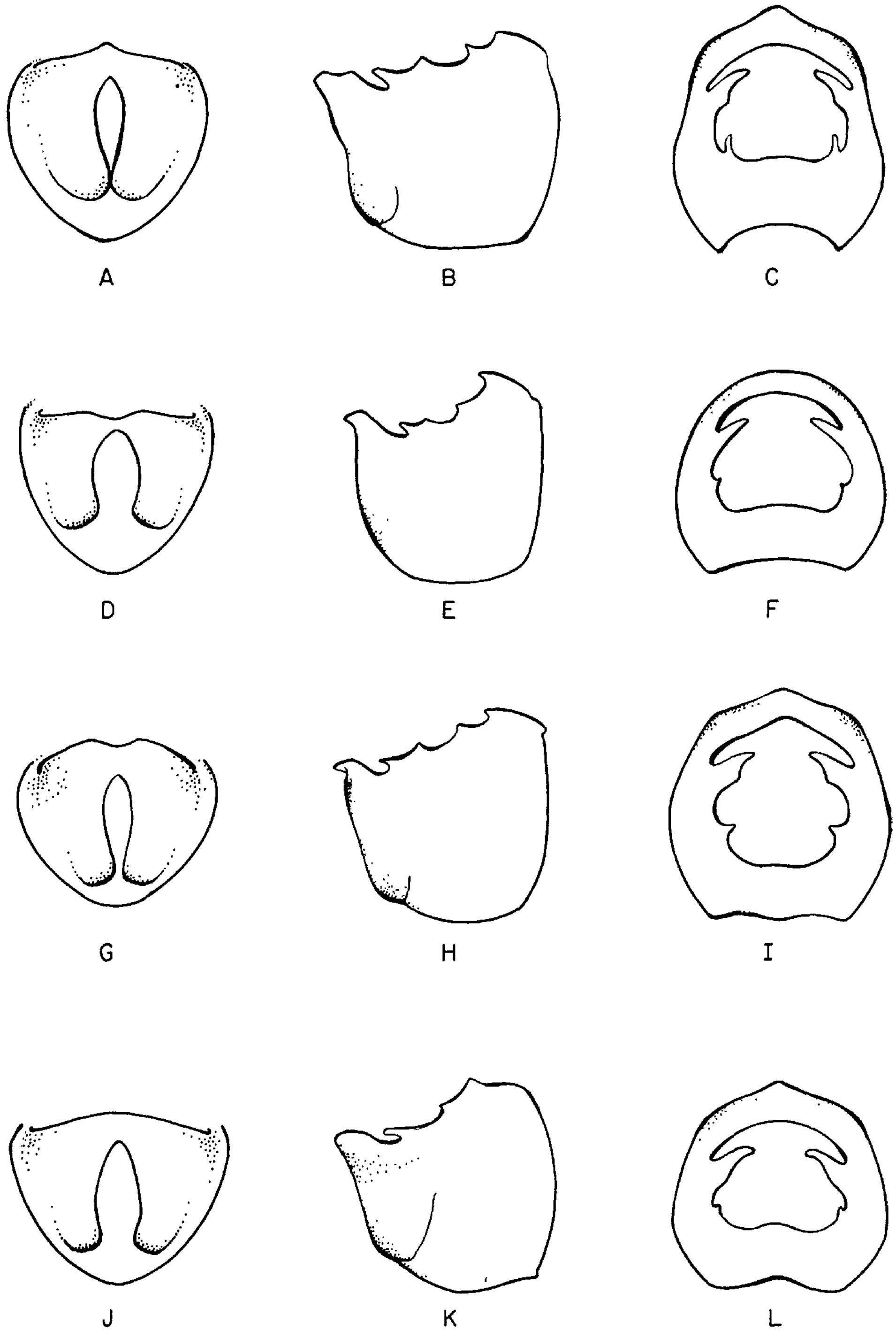

Fig. 1. Genital capsules, left to right, posterior, lateral and dorsal views; a, b, c, *Ozophora majas;* d, e, f *caribbee;* g, h, i *cobbeni;* j, k, l *pallescens.*

of the University of Connecticut, who has contributed so much to the quality of our work on the Hemiptera.

Ozophora majas is extremely similar in general appearance to *caribbee*, but differs markedly in the appearance of the genital capsule, for in addition to having the bifid inner arm of the genital capsule, *majas* lacks the narrow dorso-caudal lip (Fig. 1b). From *cobbeni* with which it shares the bifid arm, the separation between the lobes of the cuplike sclerite is diagnostic (Fig. 1a,g).

Ozophora caribbee Baranowski and Slater, NEW SPECIES
Fig. 1d,e,f

General coloration brownish, head, anterior pronotal lobe, thorax laterally and ventrally and abdomen dark brown; pronotal collar, irregular spots on posterior pronotal lobe and posterior lateral angles, legs and labium yellowish; antennae slightly darker with basal 1/3 of segment IV pale; scutellum with basal portion dark brown, distally becoming lighter with 2 elongate diagonal yellow spots; clavus and corium pale yellow with brown punctures; margin of clavus bordering scutellum and claval commissure brown, a transverse brown band extending from posterior end of claval commissure to lateral corial margin, a pale spot present in band at inner angle, margin along membrance and apex of corium brown; membrane smoky brown, veins paler.

Head straight, nondeclivent, interocular space slightly convex, tylus not reaching middle of 1st antennal segment. Head length 0.55, width 0.63, interocular space 0.30. Lateral margin of pronotum sinuate, transverse impression shallow, extending across pronotum, calli smooth. Pronotum length 0.60, width 0.88. Scutellum length 0.50, width 0.50. Claval commissure length 0.45. Midline distance apex clavus—apex corium 0.75. Midline distance apex corium-apex membrane 0.50. Fore femora armed below on distal 1/3 with 2 prominent and 1 smaller spine, middle and hind femora unarmed. Antennae slender, antennal segments length I 0.35, II 0.73, III 0.60, IV 0.83. Labium reaching but not extending beyond mesocoxae, 1st segment not extending beyond base of head. Labial segments length I 0.38, II 0.45, III 0.25, IV 0.20. Total body length 3.13.

HOLOTYPE: ♂ *St. Vincent*, West Indies: Charolotte Parish, 4 mi NW Georgetown, Soufriere trail, 2100-2800 ft, 1-VII-1975 (R. M. Baranowski). In United States National Museum of Natural History, no. 73786.

PARATYPES: *St. Vincent*: 11 ♂, 7 ♀ same data as holotype; 2 ♂, 5 ♀ same, 21-VI-1973 (Baranowski, O'Rourke, Picchi, Slater); 1 ♂, 2 ♀ Charlotte Parish, Montreal, 20-VI-1973 (Baranowski, O'Rourke, Picchi, Slater); 1 ♂ P. R. Uhler collection (no additional data); 1 ♂ P. R. Uhler collection (H. H. Smith). *Dominica*: 1 ♂ 0.5 mi N. Bagatette, 1000′, 9-III-1965 (J. F. G. & T. M. Clarke) 1 ♂ Pt. Lolo, 0.5 mi W. 25-I-1965, at light (W. W. Worth); 1 ♀ Bagatette, 9-III-1965 (J. F. G. & T. M. Clarke) Breddin-Archbold-Smithsonian Bio. Surv. Dominica). *Guadeloupe*: 3 ♂, 3-Riveres, 7-VII-1960 (Piege lx); 1 ♀ Trois Riveres, La Madeleine, 7-VIII-1960, Lre. S.A.; 1 ♀ Duclos, 25-VI-1971, light trap (L. Gruner); *Grenada*: 17 ♂, 19 ♀ St. Andrews Parish, Lake Grand Etang, 17-VI-1973 (Baranowski, O'Rourke, Picchi; Slater); 1 ♂, 1 ♀ Grand Etang, IX-1910 (Allen & Brues) 3 ♂, 4 ♀ Balthazar, Windward Side, (H. H. Smith) 2 ♂ Grand Etang, 1900 ft

(H. H. Smith). *Puerto Rico*: 5 ♂, 4 ♀ Rio Grande Co. 5 mi S. Palmer, 30-III-5-IV-1969 (T. Schuh); 8 ♂, 9 ♀ Maricao fish hatchery, 8-11-VIII-1961 (Flint, Spangler); 2 ♂, 1 ♀ Rio Piedras, 24-VIII-1961, at light (Flint, Spangler); 6 ♂, 2 ♀ Maricao, VII-1960 (J. Maldonado C.) 1 ♂, 1 ♀ Mayaguez, XII-1964 (Ricardo Jorge), 1 ♂, 1 ♀ Viequez Is. 28-IV-1930 (M. D. Leonard); 1 ♂ Puerto Real, Viequez, 10-VII-1930 (M. D. Leonard); 1 ♂ Mayaguez, 22-V-1969, (M. H. Muma); 1 ♂ Penon Collao, Selinas, 5-VIII-1953 (at light) (J. A. Ramos, J. Maldonado); 1 ♀ Cabo Rojo, 30-XI-1930 (Miguel A. Diaz); 1 ♀ km 22, Yanco-Lares Rd, 18-VII-1953 (J. A. Ramos, J. Maldonado); 1 ♀ Luquillo, El Verde, 3-III-1953, blacklight trap (R. E. Brown); 1 ♂, 5 ♀ Luqillo Nat. For. El Junge Rd. Km 20, 5-VII-1977, blacklight trap (R. E. Woodruff). *Cuba*: 1 ♂ Mina Carlota, Trinidad Mts. VII-39 (Parsons); *Dominican Republic*: 3 ♂ San Francisco Mts., 28-VIII-1905 (Aug. Busck); 1 ♀ same, 29-VIII-(1905?).

In United States National Museum of Natural History, Florida State Collection of Arthropods, R. M. Baranowski and J. A. Slater collections.

As previously noted this is a very small species, most closely resembling *cobbeni* and *majas* in general appearance but readily separable by the configuration of the genital capsule (Fig. 1d,e,f).

Ozophora divaricata Barber
Fig. 2a,b,c

Barber (1954) described *divaricata* from 2 specimens collected on South Bimini Island, Bahamas. Barber's original description is very good, but the pronotal pattern is more variable than described by Barber, some specimens having a yellowish posterior pronotal lobe with the 3 "loops", others with darker markings (see discussion under *helenae*). The antennae vary from being uniformly dark brown to light brown with the distal tip of the 3rd segment dark and the basal 1/3 of the 4th whitish. Measurements of the holotype are: Head length 0.53, width 0.68, interocular space 0.33; Pronotum length 0.63, width 1.10, Scutellum length 0.46, width 0.65. Claval commissure length 0.55. Distance along midline apex clavus-apex corium 0.90. Distance along midline apex corium-apex membrane 0.63. Labial segments length I 0.55, II 0.53, III 0.40, IV 0.25. Antennal segments length I 0.35, II 0.80, III 0.60, IV missing. Total body length 3.80.

In addition to color variation, considerable inter-island differences occur in shape and size. For example, the total length of antennal segments I-IV from 5 specimens selected at random from Mayaguana, Bahamas ranged from 2.8-3.0; from Anguilla & Peter Island, British West Indies 2.58-2.72, from the Dominican Republic 2.50-2.68, from Cuba 2.42-2.70, and from Florida 2.58-2.88.

This minute species has been collected on Key Largo, FL in seed litter under *Pluchea odorata* Cassini, a marsh fleabane (Compositae, Asteraceae). We have also collected it in Jamaica under *Gynoxys incana* (SW) Less and *Erigeron karvinskianus* DC (Compositae, Asteraceae).

SPECIMENS EXAMINED: *Jamaica*: 24 ♂, 23 ♀ Parish of St. Andrew, Irishtown, 6-VII-1971 (J. A. Slater, R. M. Baranowski, J. E. Harrington); 4 ♂, 5 ♀ same, blacklight trap; 4 ♂, 4 ♀ same, 5-VII-1971; 2 ♂, 5 ♀ Parish of St. Andrew, Kingston, Mona, 15-X-1971, blacklight trap (R. M. Baranowski); 3 ♀ same, 16-X-1971, 2 ♂, 3 ♀ same 17-X-1971; 2 ♂ same,

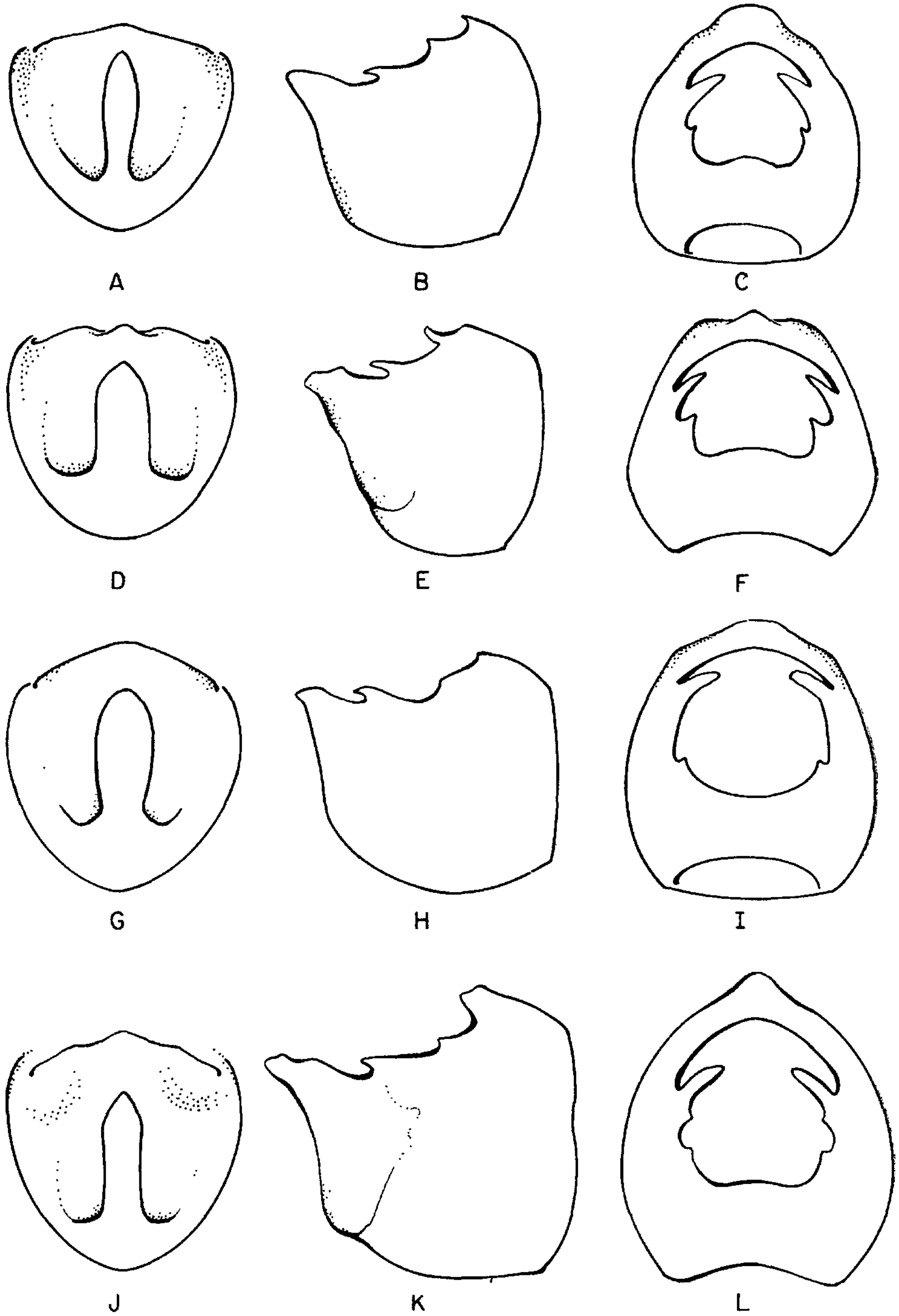

Fig. 2. Genital capsules, left to right, posterior, lateral and dorsal views; a, b, c *divaricata;* d, e, f, *helenae* g, h, i *miniscula;* j, k, l *subimpicta.*

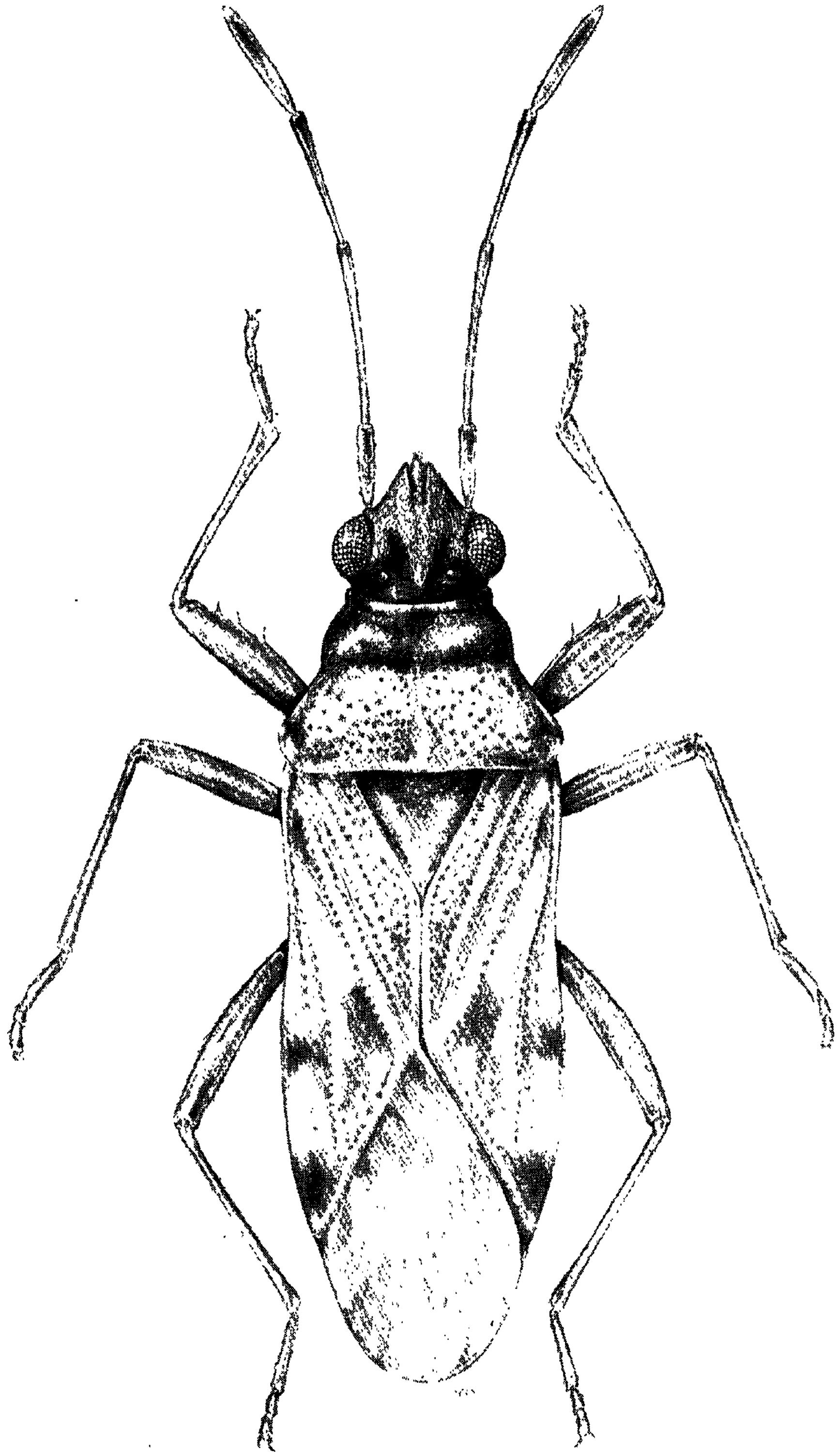

Fig. 3. *Ozophora majas* Baranowski and Slater, NEW SPECIES, dorsal view.

18-X-1971; 1 ♂, 7 ♀ same, 19-X-1971; 1 ♂ Parish of St. Andrew, Holywell For. Camp, 4000′, 23-VII-1972 (R. M. Baranowski); 1 ♂ Parish of St. Andrew, Strawberry Hill nr. Irishtown, 2750′, 15-VII-1972 (R. M. Baranowski); 1 ♂ Parish of St. Andrew, Bamboo Lodge nr. Irishtown, 2500′ (R. M. Baranowski); 1 ♂, 1 ♀ same 23-VII-1972, blacklight trap; 14 ♂, 3 ♀ Parish of St. Andrew, Holywell For. Camp, 4000′, IX-X-1971, blacklight trap (M. Winegar); 4 ♀ same, 2-V-1972; 1 ♂, 2 ♀ same, 20-VI-1972; 2 ♀ same, 23-XI-1971; 1 ♀ same 26-VI-1972; 1 ♀ same, 29-VII-1971; 1 ♂, 2 ♀ same 11-VIII-1971; 2 ♂ same, 15-II-1972; 1 ♀ same 10-VII-1972; 1 ♀ same 4-VIII-1972; 1 ♂ same, 8-II-1972; 1 ♂ same, 27-I-1972; 1 ♂, 1♀ Parish of St. Andrew, Hardwar Gap, Holywell Cabins, 21-V-1969 (R. E. Woodruff); 1♂ same 22-V-1969 (R. E. Woodruff, P. C. Drummond); 2 ♀ Parish of St. Andrew, Kingston Dam Rd., 8-V-1969, blacklight trap (R. E. Woodruff); 1 ♂, 5 ♀ Parish of St. Thomas, 5.8 mi N. Bath, Beacon Hill Rd., 19-V-1969, blacklight trap (R. E. Woodruff); 2 ♂, 2 ♀ Parish of Manchester, Mandeville, 23-VIII-1969, blacklight trap, (J. Howard Frank); 1 ♂, 2 ♀ same, 24-VIII-1969 (R. E. Woodruff); 1 ♀ same, 9-XII-1969. (E. G. Farnworth); 1 ♂, 1♀ Parish of Manchester, 3-4 mi. w. Mandeville, 1-VII-1971 (J. A. Slater, R. M. Baranowski, J. E. Harrington; 1 ♂, 1 ♀ Parish of Manchester, De Carteret College, Mandeville, 15-V-1969 (R. E. Woodruff); 1 ♀ same, 20-V-1969; 8 ♂, 13 ♀ Parish of Manchester, 3 mi N. Mandeville, 1-VII-1971, (J. A. Slater, R. M. Baranowski, J. E. Harrington); 1 ♂ Clarendon Parish, Alston, 2000′, 9-I-1973, blacklight trap (C. Crickett); 1 ♂, Parish of St. Catherine, Worthy Park Est. 10-V-1969, blacklight trap (R. E. Woodruff); 1 ♀ same 17-V-1969; 1 ♂, 2 ♀ same, 10-VI-1975; 3 ♀ same, 21-XI-1968; 1 ♀ same, 9-XI-1968; 1 ♀ same, 11-XI-1968; 1 ♂, 1 ♀ same, 2.2 mi. N. on Camperdown Rd., 10-V-1969; 1 ♀ Parish of St. Catherine, Linstead, 10-XII-1970 (J. A. Slater, R. M. Baranowski); 1 ♀ same, 4-VII-1971, blacklight trap (J. A. Slater, R. M. Baranowski, J. E. Harrington); 3 ♀ Parish of St. Catherine, Worthy Park Est., 23-V-1970, blacklight trap (E. G. Farnworth); 8 ♂, 13 ♀ Parish of Trelawny, 1.9 mi N. Burnt Hill, 16-V-1969, blacklight trap (R. E. Woodruff); 4 ♀ Parish of St. Elizabeth, Bellevue, 30-VI-1971 (J. A. Slater, R. M. Baranowski, J. E. Harrington); 1 ♂, 1 ♀ St. Anne's, Runaway Bay, 20-VIII-1973 (S. S. Duffey); 1 ♀ Parish of St. Catherine, Caymanas Est., 17-XI-1968, blacklight trap (S. A. Apeji); 2 ♀ Port Antonio, 16-VII-1952, at light (A. M. Laessle); 3 ♀ Westmoreland Parish, 0.5 mi W. Negril, Negrillo Cottages, 200 yds beach, 10-XII-1968, UV light (E. G. Farnworth); 2 ♀ Parish of Portland, nr Milbank along Rio Grande R., 18-V-1969, blacklight trap (R. E. Woodruff); 1 ♂ Kingston, Tip Top Hotel, 7-V-1969, blacklight trap (R. E. Woodruff); 1 ♀ St. Thomas Par., Golden Grove, 26-VII-1960 (C&P Vaurie); 1 ♀ Parish of Trelawny, Tyre, 2 mi N Troy, 26-VIII-1969 (R. E. Woodruff) 1 ♂ Port Antonio (A. E. Wight); 1 ♂ Mandeville (A. E. Wight); 1 ♂ Whitefield Hall, Blue Mts, nr 4500 ft, 13-20-VIII (Darlington); 1 ♂ Trelawny, Baron Hill, 16-20-III-1931 (E. L. Bell); 1 ♀ Trelawny, Baron Hill (L. Perkins). *Dominican Republic*: 15 ♂, 16 ♀ Prov. Attagracia, Nisibon, 9-VI-1976, blacklight trap (R. E. Woodruff); 1 ♂, 6 ♀ same, 8-VI-1976; 2 ♂, 2 ♀ Altagracia Prov., Nisibon, 8-10-VI-1976, Malaise trap (R. E. Woodruff, E. E. Grissell); 1 ♂ Santiago Prov., La Cumbres, 15-VI-1976, blacklight trap 3000′ (R. E. Woodruff); 1 ♀ La Romana Prov. (Higuera); 15-VII-1977, blacklight trap (R. E. Woodruff, E. Folch); 2 ♂, 3 ♀ El Seibo Prov., Pedro Sanchez, Gulf &

Western Club, 10-VI-1976, blacklight trap (R. E. Woodruff); 1 ♂ Pedernales Prov., 21 km N. Cabo Rojo, 18-VI-1976, blacklight trap (R. E. Woodruff); 1 ♂, 1 ♀ same, 19-VI-1976; 1 ♂ Santiago Prov., Pedro Garcia, 23-VIII-1967, at light (J. C. Schaffner); 1 ♂ S of Santiago, foothills Cord. Cent. VI-1938 (Darlington) 1 ♀ Prov. La Romana, La Romana, 29-IX-1976, blacklight trap (E. Folch). *Haiti*: 1 ♂ Port au Prince, Thor, 10-12-X-1970, blacklight trap (J. E. Porter); 1 ♀ Le Trov, 1925 (W. A. Hoffman); 1 ♀ San Francisco Mts. 14-IX-1905 (Aug. Busck). *Anguilla*: 3 ♂, 3 ♀ Flat Top Point, 13-IV-1958, at light (J. F. G. Clark). *Virgin Islands*: 1 ♀ Peter Island, Little Bay, 30-III-1958 (J. F. G. Clarke); 1 ♀ St. Thomas, 29-V-1956 (W. R. Fyre). *Barbuda*: 2 ♂ Oyster Pond, 6-IV-1956 (J. F. G. Clarke). *Antigua*: English Harbor, 20-IV-1956 (J. F. G. Clarke). *Cuba*: 7 ♂, 13 ♀ Prov. Matanzas, Varadero, 1-5 m. 11-4-1966. lgt. (F. Gregor) (6C); 2 ♂, 5 ♀ Habana-Alamar, 27/3-2/4-1965, lgt. (Jar. Prokop); 2 ♂, 2 ♀ Prov. Habana, Habana-Almar-Cojimar, 2-10 m, 10-16/6-1966, lgt. (Jar. Prokop); 1 ♂, 2 ♀ same, 1/7-5/7-1966; 1 ♀ same, 20-25/7-1966; 1 ♀ same, 4-5/5-1966; 1 ♀ same 26-31/7-1966; 1 ♂, 1 ♀ same, 10-24/8-1966; 2 ♀ Habana-Marinao, 15 m. 20/7-20/8-1966, lgt. (F. Gregor); 2 ♀ Prov. Matanzas, Arroyo Bermjeo, 80-100 m. 13-2-1966, lgt. (Jar. Prokop); 1 ♂ San Vicente, P.R. 6-10-VI-1956 (C. & P. Vaurie); 1 ♂ Prov. Santa Clara Solidad, 3-15-VI-1939 (C. T. Parsons) 1 ♀ same, 24-30-V-1939; 1 ♂ Soledad, 27-VI-1925 (Geo. Salt); 1 ♀ "Cuba, on string beans", New York City, N. Y. 9-IV-1941; 1 ♂, 1 ? (abdomen broken) P. R. Uhler collection. *Bahamas*: Mayaguana Is., 2 ♂, 2 ♀ 1-VII-1963, blacklight trap (C. Murvosh); 38 ♂, 64 ♀ same 3-VIII-1963; 4 ♂, 2 ♀ same, 10-VIII-1963; 1 ♂ same, 14-VIII-1963; 1 ♂, 1 ♀ same, 19-VIII-1963; 5 ♂, 7 ♀ same, 20-VIII-1963; 19 ♂, 47 ♀ same, 24-VIII-1963; 27 ♂, 28 ♀ same, 25-VIII-1963; 16 ♂, 35 ♀ same, 26-VIII-1963; 11 ♂, 19 ♀ same 27-VIII-1963; 111 ♂, 166 ♀ same, 28-VIII-1963; 16 ♂, 19 ♀ same 30-VIII-1963; 2 ♂, 6 ♀ same, 1-IX-1963; 1 ♂, 1 ♀ Abaco Cays, Allans Cay, 9-V-1953, at light (E. B. Hayden, G. B. Rabb) Van Voast-A.M.N.H. Bahama Isls. Exped.; 1 ♀ New Providence Isl., Nassau, 16-IV-1953 (E. B. Hayden) Van Voast-A.M.N.H. Bahama Isls. Exped.; 1 ♀ Rum Cay nr. Port Nelson, 16-III-1953 (E. B. Hayden, L. Giovannoli) Van Voast-A.M.N.H. Bahama Isls. Exped.; 1 ♀ Long Island, Stella Maris 7-I-1977 (R. M. Baranowski) blacklight trap. *Puerto Rico*: 1 ♀ (mutilated) Ponce 12-IX-1947 (Cold Well). *Florida*: 18 ♂, 20 ♀, Manatee Co., Bradenton, Perico Isl. 18-IV-1972, tidal flat (F. W. Mead); 21 ♂, 14 ♀ Monroe Co. N. Key Largo, 18-IV-1977 (R. M. Baranowski); 2 ♀ same 15-IV-1977; 4 ♂, 2 ♀ same 19-IV-1977; 5 ♀ same, 6-V-1977; 1 ♀, Upper Key Largo, 11-XI-1972 (C. W. & L. B. O'Brien); 1 ♀ Monroe Co. Everglades Nat. Pk., Flamingo Prairie, blacklight trap, 8-IV-1972 (R. M. Baranowski); 2 ♂, 2 ♀ Dade Co. Orchid Jungle Hammock, Newton Rd. blacklight trap, 26-III-1970 (R. M. Baranowski); 1 ♀ same 2-X-1969; 1 ♂, 2 ♀ Dade Co., Ross & Castellow Hammock, blacklight trap 18-III-1970 (R. M. Baranowski); 1 ♀ same 2-VI-1970; 2 ♀ Dade Co. Homestead, 11-IV-1969 blacklight trap (R. M. Baranowski); 1 ♀ same 11-VIII-1968; 1 ♀ same 10-X-1969; 2 ♀ same 18-V-1969; 1 ♀, same 26-XI-1969; 1 ♂ same 27-III-1970; 2 ♀ Everglades Nt. Pk. Gumbo Limbo Trail. 27-III-1973 (night) (C. W. & L. B. O'Brien); 2 ♀ Dade Co., V-1949.

Barber (1939) listed *pallescens* from a number of localities in Puerto Rico including Dorado, 23 May 1930 and Vieques, 28 April 1930. We have examined 1 specimen from Dorado and 2 from Vieques which represent the

Barber material. Although all 3 are ♀'s and partially mutilated they appear to pertain to *divaricata* and the records are referred here.

It seems unlikely that the true *pallescens* occurs in Puerto Rico.

Ozophora pallescens (Distant)
Fig. 1j,k,l

Redescription of Lectotype: (♂, V. de Chiriqui [Panama]. 2-3000 ft. Champion).

General coloration pale straw yellow. Head and anterior pronotal lobe bright reddish brown, apex of tylus yellow. Pronotal collar with a brown median and two lateral spots, area between light yellow. Posterior pronotal lobe chiefly pale yellow but with a faint series of longitudinal brown stripes. Scutellum chiefly red brown, an elongate stripe on either side of midline. Hemelytra with suffused darker marking on distal third of clavus, a large pale spot bordered by dark brown near inner angle of corium, the brown coloration extending anteriorly to level of middle of claval commissure. Apex of corium except extreme margins also dark brown and a faint dark brown spot along lateral margin just posterior to level of claval commissure. Membrane chiefly pale with darker stripes between veins not irrorate. First 3 antennal segments almost uniformly pale yellow, 3rd segment very slightly infuscated at the extreme distal end, 4th segment absent. Legs nearly uniformly pale yellow, a distinct but dull suffused subdistal dark annulation on hind femur. Tylus extending to or almost to middle of 1st antennal segment. Head length 0.60, width 0.68, interocular space 0.32. Distance antenniferous tubercle-apex tylus 0.22; distance anterior margin eye to apex tylus 0.30; distance posterior margin eye to apex tylus 0.56. Pronotum length 0.74, width 1.16. Scutellum length 0.62, width 0.58. Claval commissure length 0.62. Corium length 2.24. Midline distance apex clavus-apex corium 0.98; midline distance apex corium-apex membrane 0.74. Antennal segments length I 0.46, II 1.0, III 0.86, IV missing. Labium apparently extending only between mesocoxae. Labial segment length I 0.48 (others obscured). Total labial length 1.66. Total body length 4.40.

The specimens from the Lesser Antilles differ from the Panamanian population in having the arms of the cuplike sclerite more widely separated. However, externally, and in all other features of the genital capsule, there do not appear to be significant differences between the West Indian and mainland specimens. Furthermore, in a specimen from Belize, the distance between the arms is similar to that of West Indian specimens.

While these differences are recognizable, we feel it is premature to recognize the island population as a formal subspecies until the study underway on mainland neotropical specimens is completed. Nevertheless these differences do indicate that a degree of genetic isolation has already been established.

Although apparently common in Central and South America, *pallescens* is relatively rare in the West Indies. We have collected it only on Guadeloupe and additionally have seen 1 specimen from Dominica.

MATERIAL EXAMINED: *Dominica*: 1 ♂ Clarke Hall, 10-II-1965 (J. F. G. & Thelma Clarke) Breddin-Archbold-Smithsonian Bio. Survey Dominica; *Guadeloupe*: 3 ♂, 3 ♀ Duclos, 25-VI-1971 (J. A. Slater, R. M. Baranowski,

J. E. Harrington); 3 ♂, 5 ♀ Duclos, 25-VI-1971 (L. Gruner); 1 ♂, Crete Village, 26-VI-1971 (J. A. Slater, R. M. Baranowski, J. E. Harrington).

Ozophora subimpicta Barber
Fig. 2j,k,l; 4

This species was originally described from Puerto Rico and Hispaniola and has subsequently been reported by Barber (1954) from Cuba.

It is a moderate sized species of *Ozophora* but the largest species of the *pallescens* complex. *Ozophora subimpicta* may be readily recognized by its size, by frequently having a prominent reddish apical corial macula, a pale or irregularly marked posterior pronotal lobe, a predominantly pale corium, and the scutellum dark brown mesally by diagonal pale yellow lateral vittae but the meson distally just before the white apex with a dark streak. The lateral margins of the anterior pronotal lobe are unicolorous with the disc.

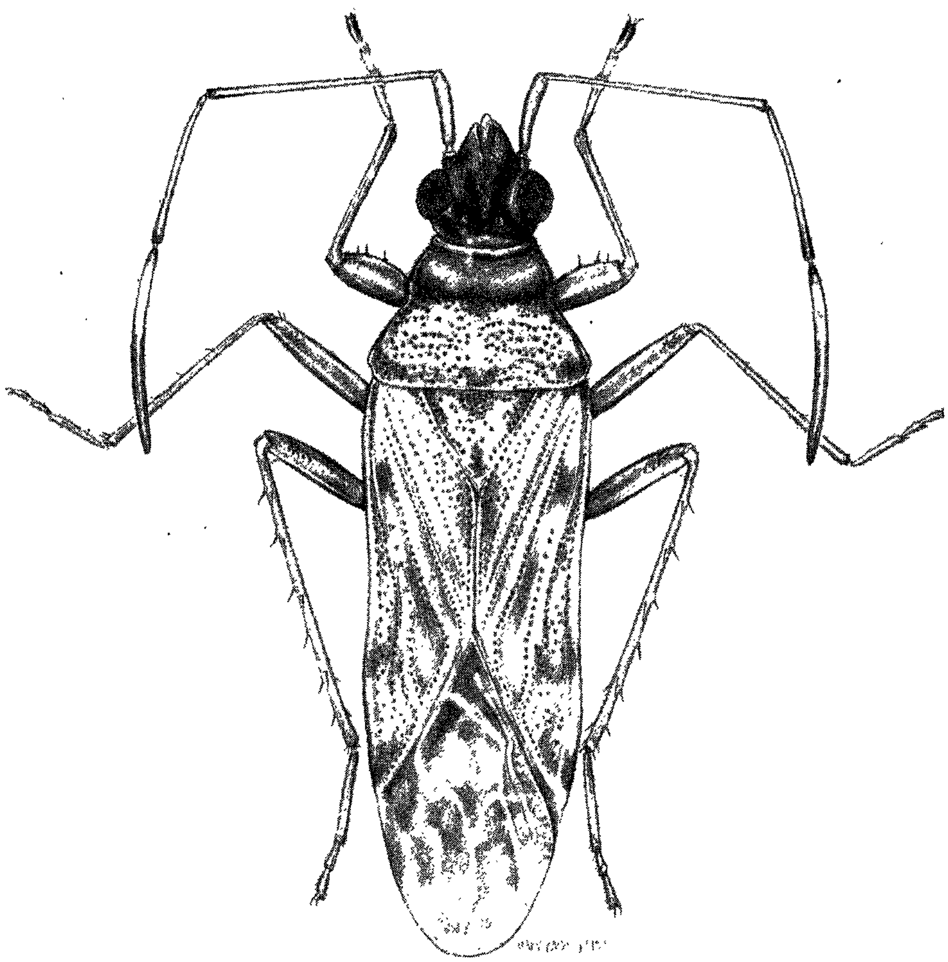

Fig. 4. *Ozophora subimpicta* Barber, dorsal view.

Barber's original description is quite good, but there is considerable variation and some of this appears to be geographically significant.

Puerto Rican specimens are usually pale with the dark macula midway along the lateral corial margin small and usually confined to the explanate margin itself. In a random sample from Puerto Rico only 3 of 54 specimens have the corium irregularly infuscated all, or most of the way across. The scutellum is usually as described above but especially pale examples lack the dark sub-distal median streak and sometimes the scutellum is entirely pale. Antennal segments II and III are almost invariably uniformly pale yellow. Occasionally the distal end of the 3rd segment (4 of 46 sampled) is somewhat infuscated. The corial apex varies considerably in color. Frequently it is distinctly reddened. Sometimes the red color is confined to the distal end of the apical corial margin. The distal portion of the corium may lack the red color, be pale centrally with brown lateral margins, or rarely be completely brown. (Possibly the red color may fade with age but not because of preservation in alcohol. Most of the Jamaican material was so collected and the apical corial margin is usually red in these specimens). The posterior pronotal lobe is usually nearly pale yellow (except for the darker punctures) with a median dark mark near the posterior margin and slight darkened areas near the humeral angles.

A series of 13 recently collected specimens from 4 localities on Hispanola differs considerably from Puerto Rican material. All 13 specimens have the 2nd antennal segment uniformly pale and the 3rd segment strongly infuscated (nearly black) on the distal portion. The corial apex is dark brown in 6 specimens, nearly uniformly pale in one, the outer 1/2 pale and inner 1/2 dark in 2 and conspicuously red in 4. The mid-lateral corial spot is confined to the explanate margin in 10 specimens and continues mesally as an irregular fascia in 3. These specimens usually have irregular dark markings on the posterior pronotal lobe and the hemelytra so that the overall appearance is of a more variegated insect than is true of most Puerto Rican specimens.

In the enormous series available for study from Jamaica only a very few specimens do not have the distal ends of both the 2nd and 3rd antennal segments conspicuously black or chocolate brown and strongly contrasting with the pale yellow of the remainder of the segments. The apical corial macula is usually tinged with red, but most frequently this red color is bordered both laterally and mesally with a dark brown streak. Often it is present as an elliptical area completely encircled with chocolate brown. Occasionally the apical macula is completely dark and sometimes red is replaced with yellow (faded? but most of the Jamaican material is recently collected). The midlateral dark corial spot is occasionally restricted to the area of the explanate margin but more frequently there is a more or less complete transverse irregular dark fascia across the corium and all degrees of variation can be observed. These Jamaician specimens also tend to have the posterior pronotal lobe infuscated. Commonly a well differentiated pale median longitudinal stripe can be distinguished down the middle of the posterior pronotal lobe.

In addition to the material cited below it should be noted that 3 of the paratypes of *Ozophora quinquemaculata* Barber from Hispaniola (1-Sanchez, Dominican Republic; 2-San Lorenzo, Dominican Republic) are actually specimens of *subimpicta*.

Thus far *subimpicta* is known only from the Greater Antilles where it is a common and widespread species. While it would be possible to recognize geographic subspecies it does not really seem desirable to do so at the present time.

General coloration pale yellow to light brown. Head, anterior pronotal lobe, thorax laterally and ventrally, abdomen and distal 1/2 of 4th antennal segment usually dark brown. Posterior pronotal lobe, legs and labium pale yellowish, darker pronotal vittae frequently present. Scutellum yellowish but median basal area and a small elongate spot near posterior tip brownish. Clavus sometimes with a faint brown spot just posterior to anterior end of claval commissure. A brown macula usually present along lateral corial margin at level of apex of scutellum, Apex of corium brown, reddish or pale with a dark margin. Membrane brown with pale veins.

Head non-declivent, moderately convex across vertex, tylus not reaching middle of 1st antennal segment. Head length 0.73, width 0.80; interocular space 0.33. Lateral margins of pronotum sinuate, slightly explanate anteriorly, transverse impression shallow, extending across pronotum, calli smooth. Pronotum length 0.80, width 1.25. Scutellum length 0.68, width 0.70. Claval commissure length 0.63. Distance along midline apex clavus-apex corium 0.80; distance along middle apex corium-apex membrane 0.75. Fore femora armed below on distal 1/3 with 3 major and 1 minor spine distad of the major spines. Labium reaching mesocoxae, labial segments length I 0.63, II 0.65, III 0.53, IV 0.33. Antennae elongate, slender, typical for genus. Antennal segments length I 0.53, II 1.30, III 1.0, IV 1.28. Total body length 4.40 (Measurements taken from a ♂ from Los Jazmines, Pinar del Rio Province, Cuba).

SPECIMENS EXAMINED: *Cuba*: 2 ♂, 2 ♀ Prov. Pinar del Rio, Los Jazmines, 200 m. 9-V-1966, lgt. (F. Gregor) (11); 2 ♀ same, 26-VII-1976; 1 ♂ Prov. Las Villas Trinidad, 150 m. 19-VI-1966, lgt. (F. Gregor) (23a); 1 ♀ Pico Turquino S. side VI-1936, 3000-5000 ft (Darlington); 1 ♀ San Blas, Trinidad Mts. 5-V-1932 (S. C. Bruner, A. Atero); 1 ♀ Pico Turquino, 3750 ft, 10-29-VI-1936 (J. Acuna). *Puerto Rico*: 1 ♀ Aibonito, 14-17-VII-1914. PARATYPES: 1 ♂, 1 ♀ Mayaquez, 24-29-VII-1914, *Paratypes;* 1 ♂, 1 ♀ Adjuntas, 8-13-VI-1915, *Paratype;* 1 ♂, 1 ♀ Villalba, 1700′ 7-V-1940 (W. A. Hoffman); 1 ♂ Ponce, Camp Maravilla 2-III-1946, at light; 1 ♀ Ponce, 10-VII-1946 (L. T.) (J. Maldanado Capriles); 9 ♂ 13 ♀ Luquillo, Rt 930, 18-I-1969, blacklight trap (P. C. Drummond); 4 ♂, 7 ♀ Luquillo, El Verde, 3-III-1973, blacklight trap (R. E. Brown); 1 ♂ Carite For. Res. Hwy 184, K21H9, 20-VII-1979 (G. B. Marshall); 18 ♂, 14 ♀ Luquillo Nat. For. El Junque Rd. Km 20, 20-VII-1977, blacklight trap (R. E. Woodruff); 7 ♂, 7 ♀ Bosque de Luquillo, along Rt. 930, blacklight trap (T. J. Walker). 5 ♂, 5♀ Cialitos Cruces 7 kms Ciales 3200 ft. at White light 2-II-12-III-1973 (Walter Plath Sr); 2 ♂, 2 ♀ Luquillo Forest, El Junque Biol. Sta. Molindero Rd. 2100′, 2-I-1963 (Paul and Phyllis Spangler), at blacklight; 1 ♀ same 31-XII-1962; 3 ♂, 2 ♀ Maricao fish hatchery, at light 8-11-VIII-1961 (Flint, Spangler); 2 ♂ Carib. N.F. Big Tree Trail 19-VII-1979 (L. B. O'Brien); 3 ♀ Luquillo Nat. For. El Junque Rd. Km. 20, 5-VII-1977 (R. E. Woodruff), blacklight trap; 2 ♀ Luquillo, Rt 930, 17-I-1960 (T. J. Walker, P. C. Drummond), blacklight trap; 5 ♀ Dona Juano Cr. Tora Nego For. 14-15-VIII-1962 (Flint & Spangler); 1 ♀ El Junque, 24-28-II-? (C. T. Parsons) 10♂, 10 ♀ Maricao. Lt VII-1940 (J. Maldonado C.) 1 ♀ Luquillo El Verde

(Sp. ?) 3-III-1973 (R. C. Brown) blacklight trap; *Dominican Republic*: 1 ♂ Sanchez, 13-18-VI-1915 paratype; 1 ♀ La Vega Prov. 9-VIII-1967, Mts. (L. H. Rolston); 3 ♂, 4 ♀ Santiago Prov. La Cumbres 15-VI-1976 (R. E. Woodruff), blacklight trap 3000′; 1 ♀ Ft Hills Cord. Cent. S. of Santiago VI-1938 (Darlington); 1 ♂ La Vega 18 km SE Constanza 4-VIII-1979 (C. W. O'Brien) 1 ♀ S. Frnscso Mts. 14-IX-1905 (Aug. Busck); 2 ♂, 3 ♀ 1 no abd. R. Devoe 1976 blacklight trap; *Jamaica*: 39 ♂, 29 ♀ Par. Portland, Green Hills Inst. Jamaica Cabin. 13-XII-1969 blacklight trap (E. G. Farnworth); 2 ♂, 3 ♀ same 17-VIII-1969 (R. E. Woodruff); 1 ♀ same 28-XI-1968; 4 ♂, 2 ♀ Portland, Hardwar Gap at Green Hills 11-III-1966 (T. H. Farr & W. D. Duckworth); 1 ♀ same 1-XI-1959 (T. H. Farr) 1 ♂ Par. St. Catherine, Worthy Park Est. XI-1968, blacklight trap (R. E. Woodruff); 1 ♀ same, 9-XI-1968; 1 ♂ same 10-XI-1968; 2 ♀ same 11-XI-1968; 1 ♂, 3 ♀ same 16-XI-1968; 13 ♂, 6 ♀ 1 ? (no abd.) same 21-XI-1968; 3 ♂, 3 ♀ same 10-V-1969; 1 ♀ same 11-V-1969; 1 ♀ same 13-V-1969; 1 ♀ same 17-V-1969; 1 ♀ same 2-VIII-1969; 1 ♂, 1 ♀ Par. St. Catherine, Worthy Park, 2.2 mi N. on Camperdown Rd. 10-V-1969, blacklight trap (R. E. Woodruff); 2 ♂, 3 ♀ Par. St. Catherine, Linstead, 9-XII-1970, blacklight trap (Slater & Baranowski); 2 ♂, 3 ♀ 3,4-VII-1971 (Slater, Baranowski, Harrington); 1 ♀ Par. Manchester, DeCorteset College, Mandeville 18-V-1969, blacklight trap (R. E. Woodruff); 1 ♂ same 19-V-1969 (Kent Stanton); 1 ♂ Mandeville 24-VIII-1969, blacklight trap (R. E. Woodruff); 1 ♂, 1 ♀ same 9-XII-1969 (E. G. Farnworth); 1 ♂, 1 ♀ same 29-VII-1971 (Slater, Baranowski, Harrington); 1 ♀ Mandeville 15-XI-1919, 2131 ft; 1 ♀ Par. St. Andrew, 4000′, Hollywell Forest Camp 20-X-1971, blacklight trap (M. Winegar); 1 ♂, 5 ♀ same 22-X-1971; 3 ♂ same 30-X-1971; 5 ♂, 7 ♀ same 17-XI-1971; 4 ♂, 2 ♀ same 25-XI-1971; 4 ♂, 2 ♀ same 29-XI-1971; 1 ♂ same 9-XII-1971; 13 ♂, 15 ♀ same 14-XII-1971; 22 ♂, 15 ♀ same 8-II-1972; 8 ♂, 7 ♀ same 15-II-1972; 5 ♂, 6 ♀ same 2-III-1972; 1 ♀ same 10-V-1972; 1 ♂ same 23-V-1972; 2 ♂, 1 ♀ same 26-VI-1972; 7 ♂, 4 ♀ same 15-VII-1972; 11 ♂, 13 ♀, same 29-VII-1972; 2 ♂, 1 ♀ same 4-VIII-1972; 1 ♂, 4 ♀ same 13-VIII-1972; 1 ♂, 1 ♀ 16-VIII-1972; 35 ♂, 24 ♀ same IX-X-1971; 1 ♂ Par. St. Andrew Hardwar Gap Hollywell Cabins 2-V-1969 (R. E. Woodruff); 1 ♂ same 22-V-1969 (R. E. Woodruff & P. C. Drummond); 2 ♂, 5 ♀ same 16-VI-1975 (R. E. Woodruff), blacklight trap; 1 ♂ Hardwar Gap 1-XI-1959 (T. H. Farr); 1 ♂ Morces Gap 15-I-1960 (T. H. Farr); 2 ♀ Cinchona Heights 4-IV-1965 (T. H. Farr); 1 ♂ Kingston, Mona 16-X-1971 (R. M. Baranowski), blacklight trap; 1 ♂, 1 ♀ Par. St. Thomas 5.8 mi N. Bath, Beacon Hill 19-V-1969 (R. E. Woodruff), blacklight trap; 1 ♂ Bath 1.30-31/20 about 250′; 1 ♀ Rocky Ravine near Abby Green, 4000′ (G. R. Proctor); 1 ♀ Par. Trelawny 1.9 mi N. Burnt Hill 16-V-1969 (R. E. Woodruff), blacklight trap; 1 ♂, 1 ♀ Tyre 2 mi N. Troy 9-XII-1969 (E. G. Farnworth); 18 ♂, 9 ♀ Par. St. Ann, Runaway Bay 20-VIII-1973 (S. S. Duffey); 1 ♀ same 28-VI-1970; 1 ♀ same 25-VII-10-VIII-1971; 1 ♂ St. Ann, Mt. Diablo 19-XI-1959 (T. H. Farr); 2 ♀ New Castle 16-20-II (E. B. Bryant); 1 ♂, 1 ♀ Main Range Blue Mts 5-7388 ft. 17-19-VIII-1934 (Darlington); 1 ♂ Pt. Antonio (A. E. Wight).

Both ♂ specimens from Prov. del Rio, Cuba exhibit oligomery and in one the antennae are bilaterally oligomerus. Although oligomery is not uncommon in geophilous Rhyparochrominae, bilateral oligomery is a rare phenomenon. Leston (1952, 1953) reported and figured a case of bilateral oligomery in *Spilostethus pandurus* (Scop.) (as *Lygaeus*) stating that such a phenomenon apparently had not been previously noted. This is not the case. Hussey (1950) reported it in a specimen of *Ptochiomera nodosa* Say from Lakeland, Florida, and Torre-Bueno (1917) reported it in *Scolopostethus atlanticus* Horvath from White Plains, NY. Indeed, the generic name, *Tritomacera* Costa, apparently was based on just such a specimen of *Scolopostethus.*

The bilaterally oligomerus specimen of *O. subimpicta* is particularly interesting because the oligomery is not strictly bilaterally symmetrical. The 1st antennal segment is similar on both sides. The right 2nd segment is appreciably longer than the left (1.58 vs 1.32) and has a more normal appearance since the distal end is somewhat thickened; the 2nd segment of the left antenna is evenly cylindrical throughout its entire length. The right terminal segment also has a more "normal" shape, being slenderly fusiform and somewhat curved throughout its length with a narrow white basal annulus. By contrast, the left terminal antennal segment is nearly straight and actually somewhat thickened distally before tapering near the extreme apex. There is a broad white annulus on the basal 1/2 ((but some distance from the infuscated brown basal area). It is evident that whether or not the injuries that presumably led to the oligomery occurred at different periods in the insect's development, the resultant response has been quite different in the 2 antennae.

We have also observed symmetrically bilateral oligomery in a male of *divaricata* from Mayaguana Island in the Bahamas and in a specimen of *Ozophora levis* Slater & Baranowski from the Florida Keys.

Ozophora miniscula Scudder
Fig. 2g,h,i

This species was described from a single male from Grand Cayman Island and remains known only from the holotype which we have reexamined.

Scudder's original description is very complete. This species is of a richer ferrugineous color than any of the other species and the surface of the posterior pronotal lobe more irregular and the punctures relatively larger and coarser.

O. miniscula is closely related to the true *pallescens*, the genital capsules of the 2 differing only in the somewhat more produced posterior rim of *pallescens* (Fig. 1-k,2-h). The antennal proportions of the lectotype of *pallescens* and the holotype of *miniscula* are identical. Clearly a series of *miniscula* is desirable to determine the variability.

Ozophora helenae Baranowski and Slater, New Species
Fig. 2d,e,f; 5

General coloration pale yellow and dark chocolate brown. Dark coloration present as follows: entire head, anterior pronotal lobe including lateral margins and scutellum (extreme apex of latter white); 3 looped areas on posterior pronotal lobe, the median loop broadly dark, completely lacking any indication of a light median line; (lateral looped areas invaded with yellow; humeral angles and a spot along posterior pronotal margins on either side of midline pale); mesal area of clavus; an elongate slash on corium between

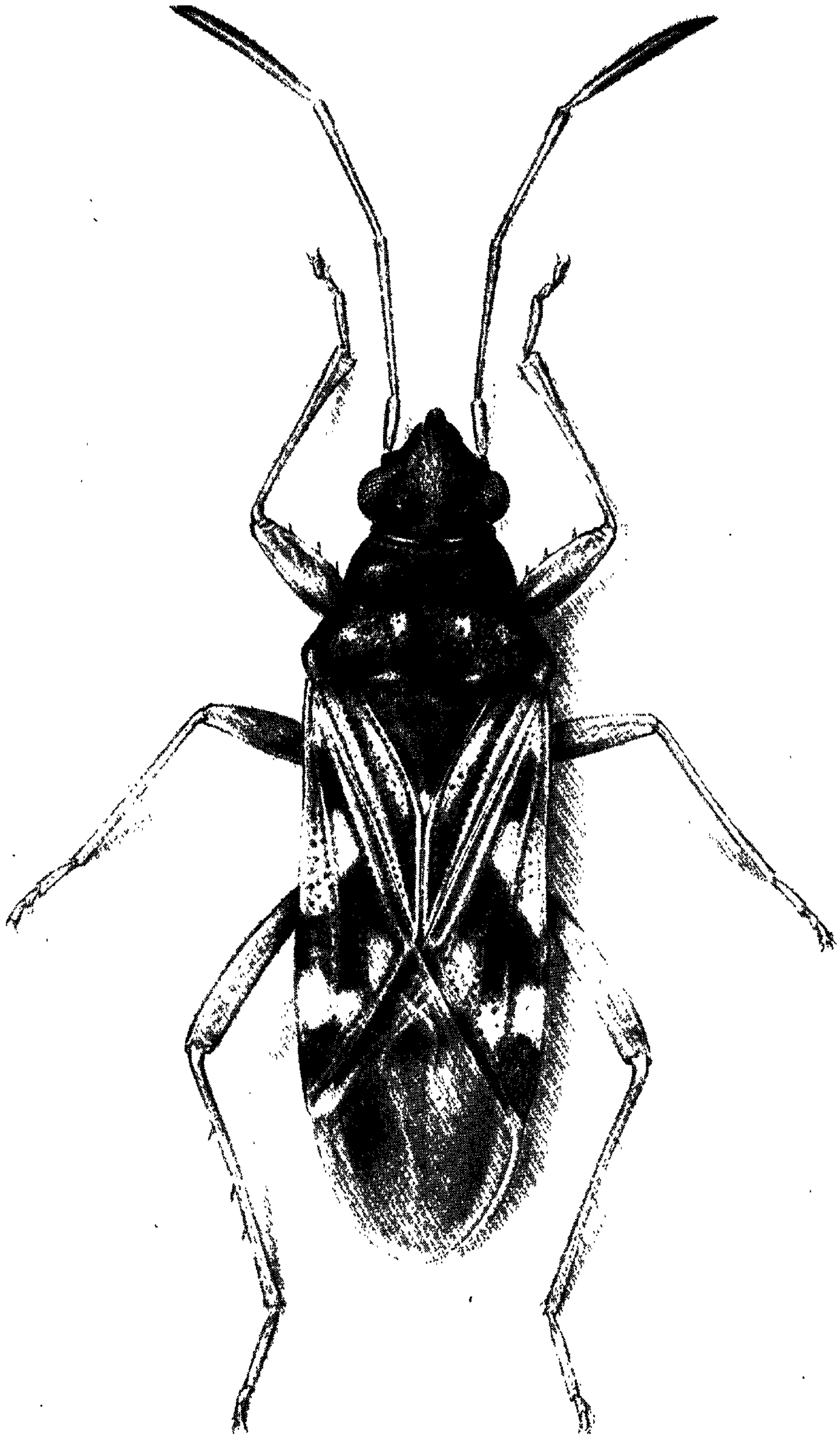

Fig. 5. *Ozophora helenae* Baranowski and Slater, NEW SPECIES, dorsal view.

radius and medius at level of apex of scutellum; a complete mesally broadening transverse fascia (a pale macula near inner corial angle); subapical corial macula (extreme apex pale yellow); entire lateral corial margin before apex; greater part of membrane, but latter with apex white and veins suffused with pale yellow or dull white. Anterior pronotal collar pale yellow, darkened at midline. Pleural and ventral surfaces dark red brown to chocolate brown. Distal ends of acetabula, legs, labium and first 3 antennal segments pale straw yellow. Antennal segments I and III lacking darker infuscations on distal ends. Segment IV dark brown with a short relatively obscure dull yellowish annulus. Dorsal surface lacking numerous upstanding hairs.

Head non-declivent, tylus extending at least to middle of 1st antennal segment. Eyes large, almost in contact with antero-lateral pronotal angles. Head length 0.50, width 0.64; interocular space 0.34. Body shape very similar to that of *divaricata*. Pronotum length 0.58, width 0.98. Scutellum lacking a median elevation. Scutellum length 0.52, width 0.52. Claval commissure length 0.50. Midline distance apex clavus-apex corium 0.78; midline distance apex corium-apex membrane 0.56. Metathoracic scent gland auricle short, straight, not curving posteriorly. Fore femora with 3 short thick dark spines on distal 1/2 of ventral surface. First labial segment remote from base of head, labium extending well between mesocoxae. Labial segments length I 0.40, II 0.40, III 0.28, IV 0.22. Antennal segments length I 0.28, II 0.72, III 0.61, IV 0.88. Total body length 3.32.

HOLOTYPE: ♂ *Dominican Republic*: Pedernales Prov., 21 km. N. Cabo Rojo, 18-VI-1976, blacklight trap (R. E. Woodruff). In United States National Museum of Natural History, no. 100250.

PARATYPES: *Dominican Republic* 1 ♀ same data as holotype; 2 ♀ same, 19-VI-1976. *Jamaica*: 2 ♀ Parish of Trelawny, Tyre, 2 mi N. of Troy, 26-VIII-1969 (R. E. Woodruff); 1 ♂ Parish of Manchester, Mandeville, 24-VIII-1969, blacklight trap (R. E. Woodruff); 1 ♀ same, 26-VIII-1969; 1 ♂ same, 29-VII-1971 (J. A. Slater, R. M. Baranowski, J. E. Harrington); 1 ♀ Parish of St. James, Montego Bay, Albion Crescent, 24-VIII-1969, blacklight trap (R. E. Woodruff); 1 ♀ Clarendon Parish, Alston, 2000 ft, 9-I-1973, blacklight trap (C. Crickett); 1 ♀ St. Anne's Runaway Bay, 21-VI-1970 (S. S. Duffey); 1 ♂ Mandeville (A. E. Wight); 2 ♀ Pt. Antonio (A. E. Wight). *Cuba*: 1 ♀ Sierra Maestra X-1941 (J. Acuna). In United States Natural Museum, Florida State Collection of Arthropods, R. M. Baranowski and J. A. Slater Collections.

This species is very similar to *divaricata* and occurs sympatrically with it at least on Hispaniola and Jamaica. The definitive difference between the 2 lies in the extremely broad separation between the "arms" of the cuplike sclerite in *helenae* n.sp. (Fig. 2d) as contrasted with the close approximation of these arms in *divaricata* (Fig. 2a).

Ozophora helenae tends to be a much darker species than is *divaricata*. Where the 2 occur together they can readily be distinguished by the complete dark chocolate brown coloration of the scutellum in *helenae*. *Ozophora divaricata* always has a pair of pale scutellar maculae. In *helenae* the mesal area of the posterior pronotal lobe including the midline is always uniformly dark. In *divaricata* there is usually a pale median streak present. In fact, on Jamaica and Hispaniola we have not seen a specimen of *divaricata* that lacks this pale pronotal streak. In the Bahamas (where *helenae* has not been taken) females of *divaricata* occasionally, and males rarely, lack the pale pronotal streak, but do possess the pale scutellar markings. In most specimens of *divaricata* the pale subbasal annulus on antennal segment IV is usually wide, white and conspicuous. In *helenae* it is always relatively obscure and narrow.

We are pleased to name this species for Mrs. Helen Baranowski in recognition of her help and encouragement for many years.

Ozophora cobbeni Scudder, NEW SPECIES
Fig. 1g,h,i; 6

Subshining, without upstanding hairs.

Head ferruginous; proximal 3 segments of antenna flavo-ochraceous with distal portion of 3 brownish; 4th antennal segment brown, slightly paler proximally, but without a distinctly differentiated proximal pale annulation. Anterior lobe of pronotum ferruginous; collar flavescent with a median brown mark and shading to brown laterally; posterior lobe of pronotum flavo-ochraceous with ferruginous punctures, a C-shaped brown mark on outer 1/3 near humeral angles and an obsolete brown stripe on either side of pale midline and confluent posteriorly. Scutellum ferruginous with an oblique lateral flavescent dash on either side of meson, extreme apex ochraceous. Hemelytra ochraceous with ferruginous punctures; clavus with a central longitudinal brown streak, this narrowing and fading out well before base; distal 1/2 of corium brown with a distinct irregular pale subapical spot on lateral margin and a pale round or oval spot near inner angle; apical margin of corium with a narrow flavescent area in centre; membrane brownish with veins pale and with a pale spot near apical angle of corium, apex distinctly pale. Venter ferruginous; posterior margin of metapleura ochraceous. Legs ochraceous.

Head impunctate; ocelli large and set on a line joining hind margins of eyes; ocelli removed from eyes by slightly more than the diameter of an ocellus; when viewed laterally extending to just below antennal tubercles, head removed from anterior margin of collar by distance equal to diameter of an ocellus; Head width 0.60, interocular space 0.30; labium attaining middle coxae; antennal measurements 0.27, 0.50, 0.48, 0.70.

Pronotum distinctly punctate on posterior lobe, but except for center, anterior lobe impunctate; hind margin of pronotum slightly impressed before base of scutellum; pronotal width 0.93, pronotal length 0.53; anterior lobe with a distinct collar and slightly more than 1/2 (0.56) as long as posterior lobe. Scutellum distinctly punctate, except pale lateral dashes impunctate; scutellum width 0.55, length 0.40. Hemelytra reaching just beyond end of abdomen; clavus with 3 distinct rows of punctures and about 6 extra punctures between middle row and that nearest scutellum; claval commissure equal to length of scutellum; lateral margin of corium very slightly sinuate, but not greatly upturned. Fore femora with 3 subapical slender spines. Total length 3.0.

FEMALE. Structure and color similar to male. Head width 0.73; antennal measurements 0.33, 0.63, 0.57, 0.73; pronotal width 1.22. Pronotal length 0.70. Total length 3.60.

HOLOTYPE: ♂ *Saba*, Netherlands Antilles. Hellsgate, St. Cruz, 17-XII-

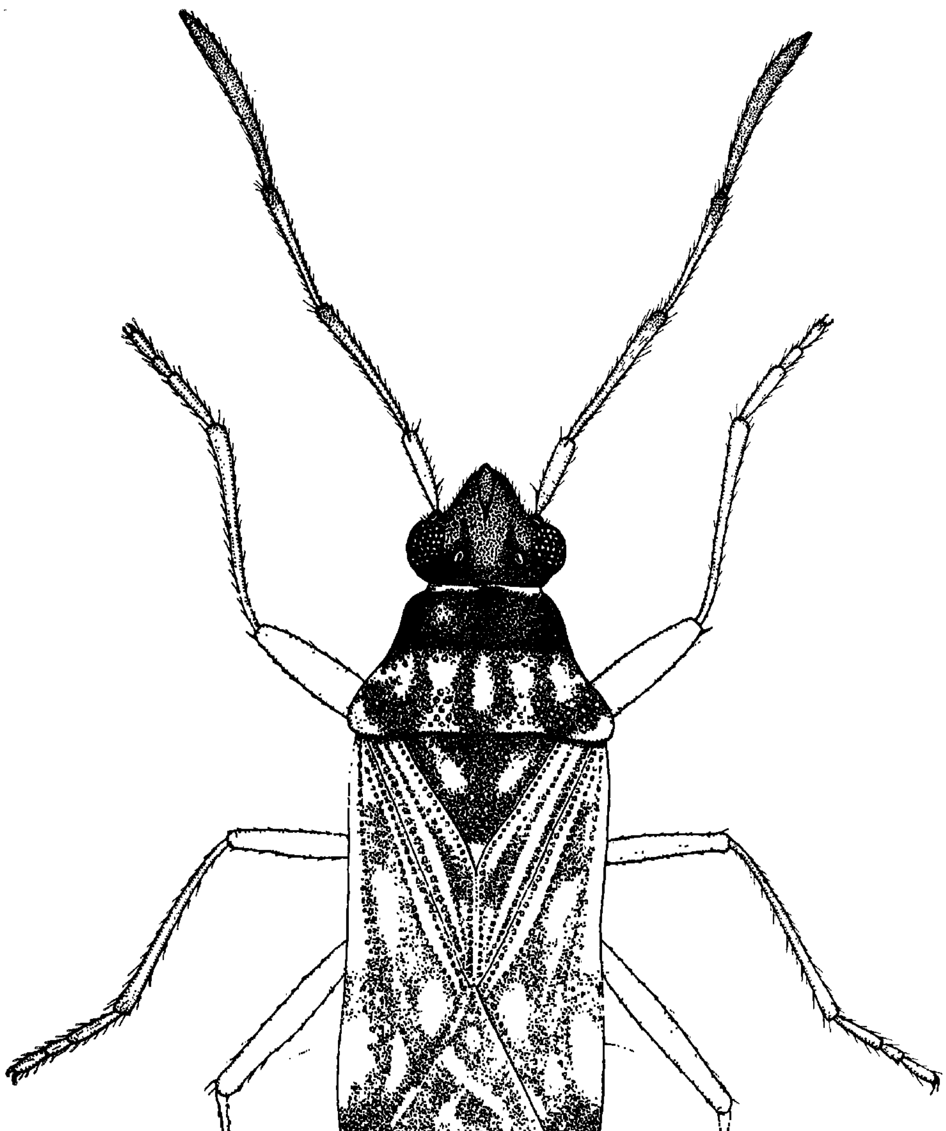

Fig. 6. *Ozophora cobbeni* Scudder, NEW SPECIES, dorsal view.

1956 (R. H. Cobben). In United States National Museum of History, No. 100252.

PARATYPES: *Saba*: 1 ♂ same data as holotype: 2 ♂, 1 ♀ Rondez-vous, 25-XII-1956 (R. H. Cobben); 1 ♂, 2 ♀ Windward Side, IX-XII-1956 (R. H. Cobben); 1 ♀ Windward side, lamp, XII-56 (R. H. Cobben).

In G. G. E. Scudder and Laboratory of Entomology, Agricultural University, Wageningen, Netherlands collections.

ADDITIONAL MATERIAL EXAMINED: *Saba*: 1 ♀ Mt. Scenary, 800-840 m 12-14-I-1968 (B. Malkin); 1 ♂ Windward side, 11-15-I-1968 (B. Malkin). *Guadeloupe*: 2 ♂, 1 ♀ Rougeole, 25-VI-1971 (Slater. Baranowski, Harrington); 1 ♀ Vernou, V-1958 (R. L.); 1 ♀ 3-rivers (Piege Lx) 7-VII-1960, vers 160 pt. *Montserrat*: 1 ♂, 3 ♀ St. Georges Hill, 7-V-1968, blacklight trap (P. C. Drummond). *Martinique*: 8 ♂, 17 ♀ Sainte-Anne, 20-VI-1971 (Slater, Baranowski, Harrington). *Dominica*: 2 ♂, 2 ♀ Roseau, 23-VI-1971 (Slater, Baranowski, Harrington), blacklight trap; 1 ♂, 1 ♀ Melville Hall Airport, 25-VI-1971 (Slater, Baranowski, Harrington); 3 ♂ Layou R. mouth, 20-I-1965 (W. W. Wirth); 1 ♂ Bagatelle, 9-III-1965 (J. F. G. Clarke, Thelma M. Clarke); 1 ♂ Springfield Estate, 20-26-VIII-1963 (O. S. Flint); 1 ♀ Laudet, 11-VI-1911; 1 ♀ Trafalgar Falls, 1200′, 5-6-IV-1966 (R. J. Gagne); 1 ♀ Fond Colet, 5-9-X-1964 (P. J. Spangler); 1 ♀ path to Cabrits, 2-IV-1966 (R. J. Gagne); 2 ♂ Portsmouth, 1,2-IV-1966 (R. J. Gagne) at light; 2 ♀ Freshwater Lake, 21-I-1966 (W. W. Wirth); 1 ♀ Pont Casse 23-XI-1964 (P. J. Spangler); 1 ♀ same, 20-IX-1965 (D. I. Jackson); 1 ♀ 4.5 mi w. Pont Casse, 27-I-1965 (W. W. Wirth) at light; 1 ♂, 1 ♀ Clarke Hall Estate, 27-V-1966 (G. Steyskal); 2 ♂, 1 ♀ same 29-V-1966; 1 ♀ same 30-V-1966; 1 ♂, 1 ♀ same 28-III-1966 (R. J. Gagne), 1 ♂ same 30-III-1966, 2 ♀ same, 3-IV-1966; 1 ♀ same, 6-8-X-1966 (A. B. Curney); 1 ♀ same, 11-20-I-1965 (W. W. Wirth) light trap; 1 ♂ same 1 mi E, 19-VI-1966 (D. R. Davis); 1 ♂ same 7-I-1965 (J. F. G. Clarke, Thelma M. Clarke); 1 ♀ same, 25-II-1964 (Dale F. Bray); 6 ♂, 3 ♀ same, 22-VI-1964 (O. S. Flint, Jr.); 2 ♀ Clarke Hall 22-V-1964 (O. S. Flint, Jr.). *St. Lucia*: 2 ♂, 1 ♀ Castries 14-IV-1959 (Fairview); 2 ♀ 2 mi N. Castries 22-VI-1973 (Baranowski, O'Rourke, Picchi, Slater). *Antigua*: 1 ♂ English Harbor 26-IV-1956 (J. F. G. Clarke).

This species was originally recognized as undescribed by Dr. G. G. E. Scudder while he was engaged in work on the lygaeid fauna of the Netherlands Antilles as part of Dr. Rene Cobben's analysis of the Hemiptera fauna. This new species is to be credited to G. G. E. Scudder.

ACKNOWLEDGEMENTS

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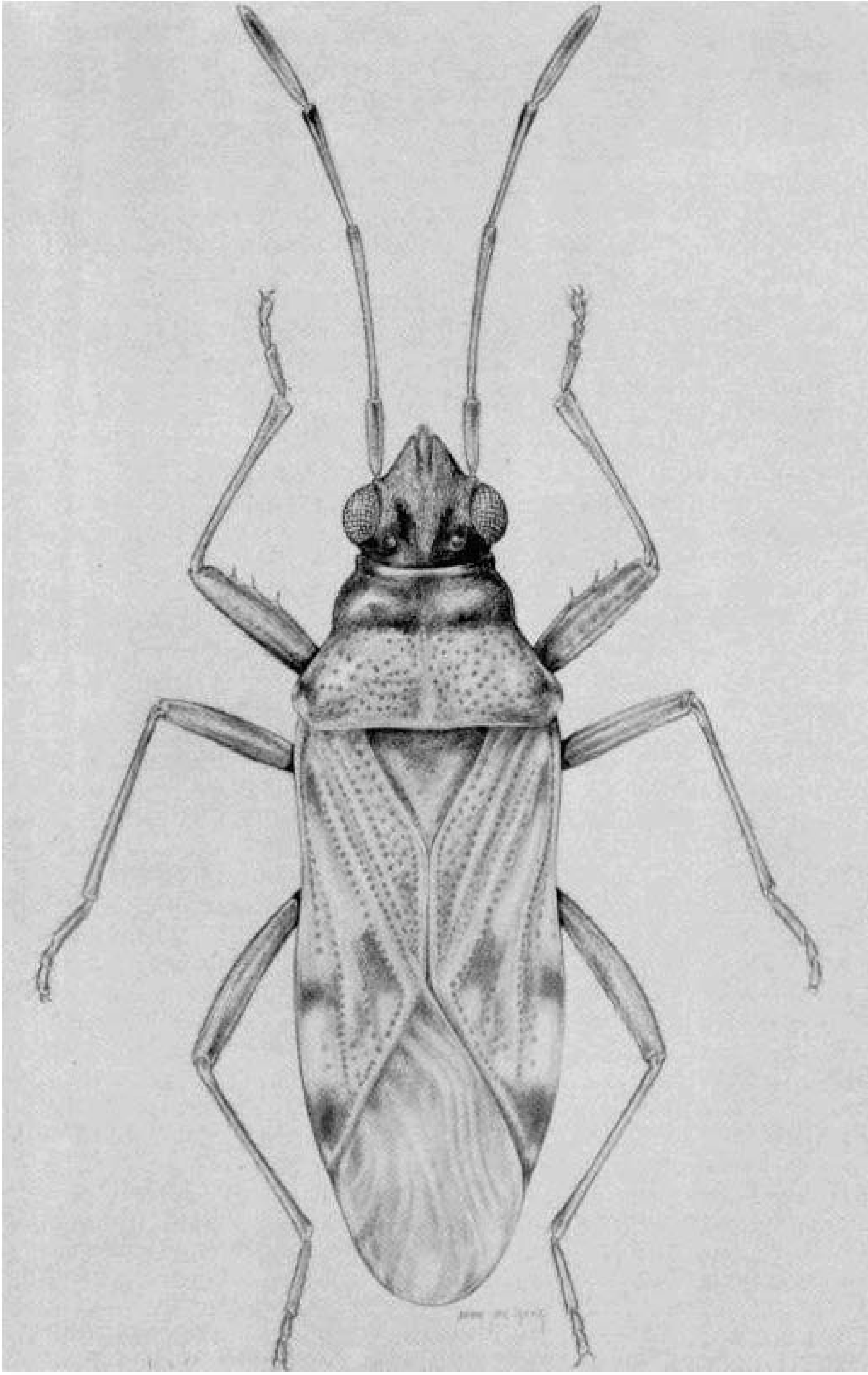

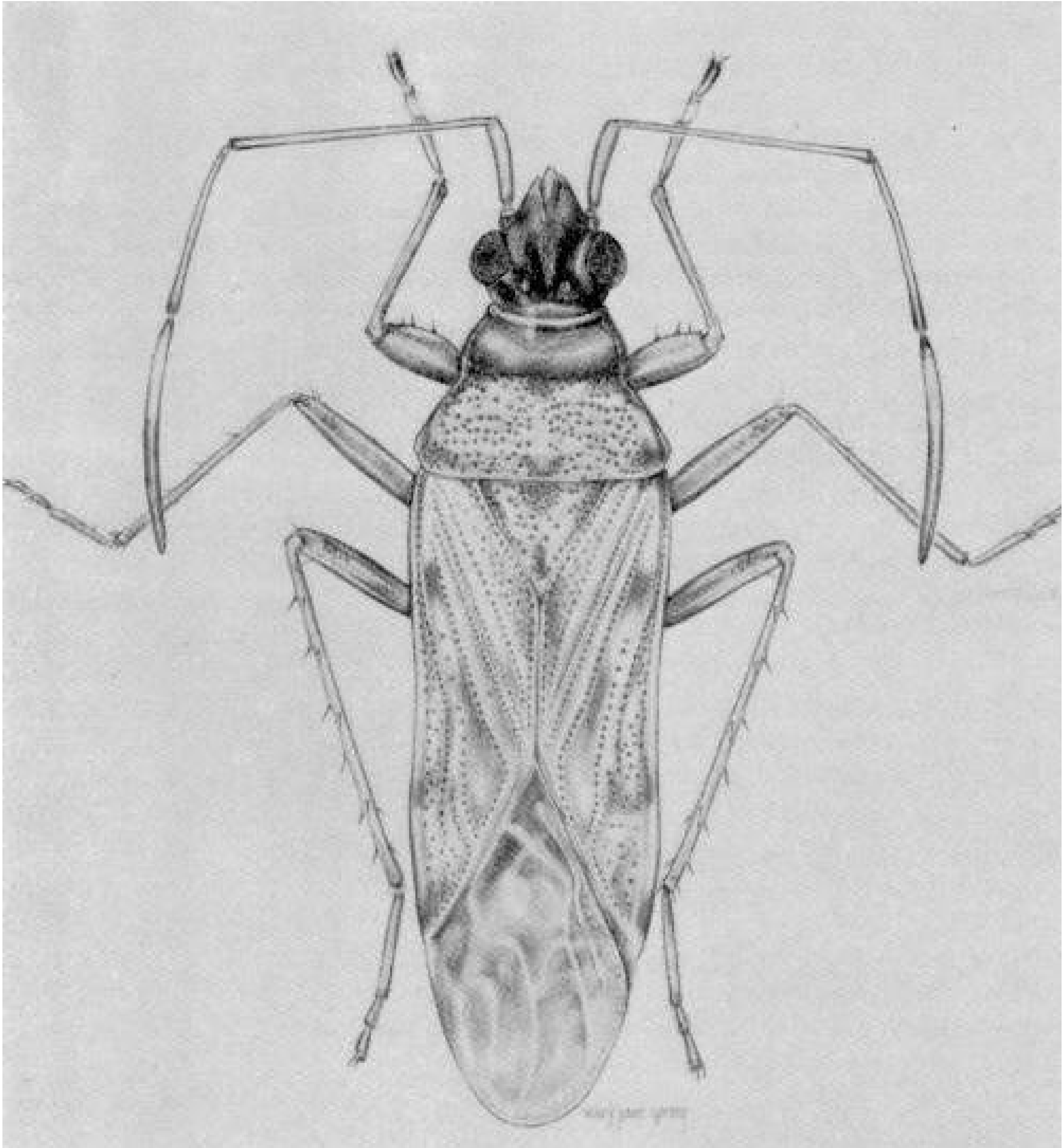

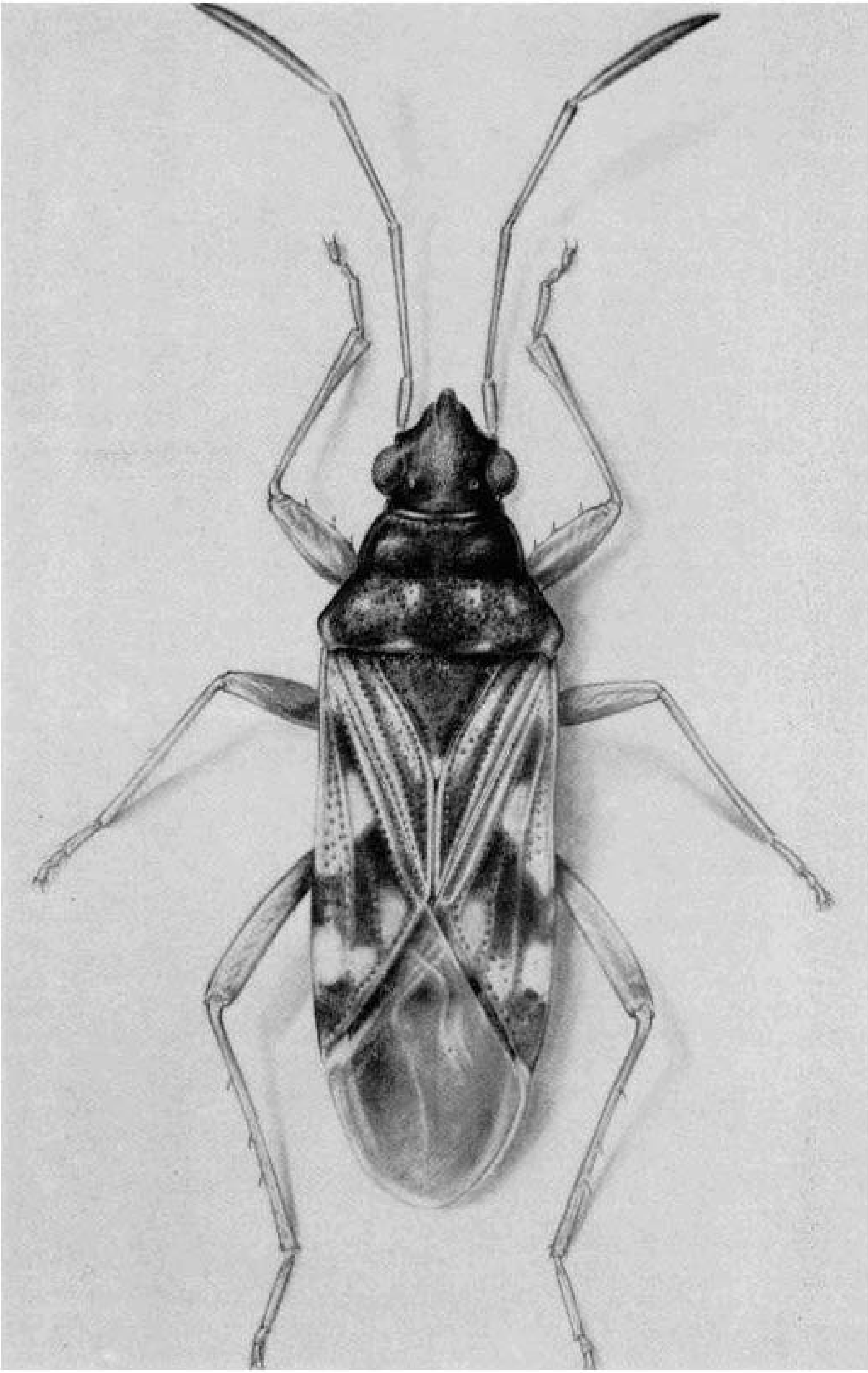

NEW MICRO-CADDISFLIES FROM THE SOUTHEASTERN UNITED STATES (TRICHOPTERA: HYDROPTILIDAE)

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ABSTRACT

Males of 6 new species of Hydroptilidae (Trichoptera) from the southeastern United States are described and illustrated: *Hydroptila carolae* n.sp. from South Carolina, *H. disgalera* n.sp. from Alabama and South Carolina, *H. ouachita* n.sp. from Louisiana, *H. poirrieri* n.sp. from Louisiana and Mississippi, *H. tridentata* n.sp. from South Carolina, and *Oxyethira kingi* n.sp. from Florida.

RESUMEN

Se describen y se ilustran los machos de seis especies nuevas de Hydroptilidae (Trichoptera) del sudeste de los Estados Unidos: *Hydroptila carolae* sp. nov. de Carolina del Sur, *H. disgalera* sp. nov. de Alabama y Carolina del Sur, *H. ouachita* sp. nov. de Louisiana, *H. poirrieri* sp. nov. de Louisiana y Mississippi, *H. tridentata* sp. nov. de Carolina del Sur, y *Oxyethira kingi* sp. nov. de Florida.

The southeastern United States contains a great variety of micro-caddisflies. More than 90 species in 12 genera are known to occur in this region and additional collecting will undoubtedly reveal many new species. Recent regional faunal summaries have reported 16 species of Hydroptilidae from Arkansas (Unzicker et al. 1970), 35 species from Florida (Blickle 1962; Harris, Lago, and Scheiring 1982), 28 species from Louisiana and Mississippi (Harris, Lago, and Holzenthal 1982), 49 species from North and South Carolina (Unzicker et al. 1982), 38 species from Tennessee (Etnier and Schuster 1979), and 40 species from Virginia (Parker and Voshell 1981). Kelley and Morse (1982) provided distributional information for 23 species of *Oxyethira* occurring in the Southeast. In this paper we describe males of 6 new species of Hydroptilidae from the coastal plains of Alabama, Florida, Louisiana, Mississippi and South Carolina.

Terminology for genitalic structures generally follows that of Marshall (1979) with the following modification. We prefer the term "subgenital process" over Marshall's "subgenital plate." In the *Hydroptila consimilis* group this structure appears to originate laterally from segment IX and is sclerotized primarily along its margin, with a pair of distal setae. It may be homologous to the subgenital processes of *Oxyethira* which may be parallel, convergent or apically fused (Kelley 1982).

Abbreviations for genitalic structures in Fig. 1-6 apply to the following terms: *ap.*: apodeme; *b.p.*: bilobed process; *inf.*: inferior appendages; *int.*: intermediate appendages; *par.*: paramere; *spb.*: subgenital process; *s.p.*: sternal process of abdominal segment VII; VII, VIII, IX, X: terminal abdominal segments 7-10, respectively. A, B, and C in Fig. 1-6 are lateral, dorsal and ventral views respectively. D is a dorsal view of the phallus.

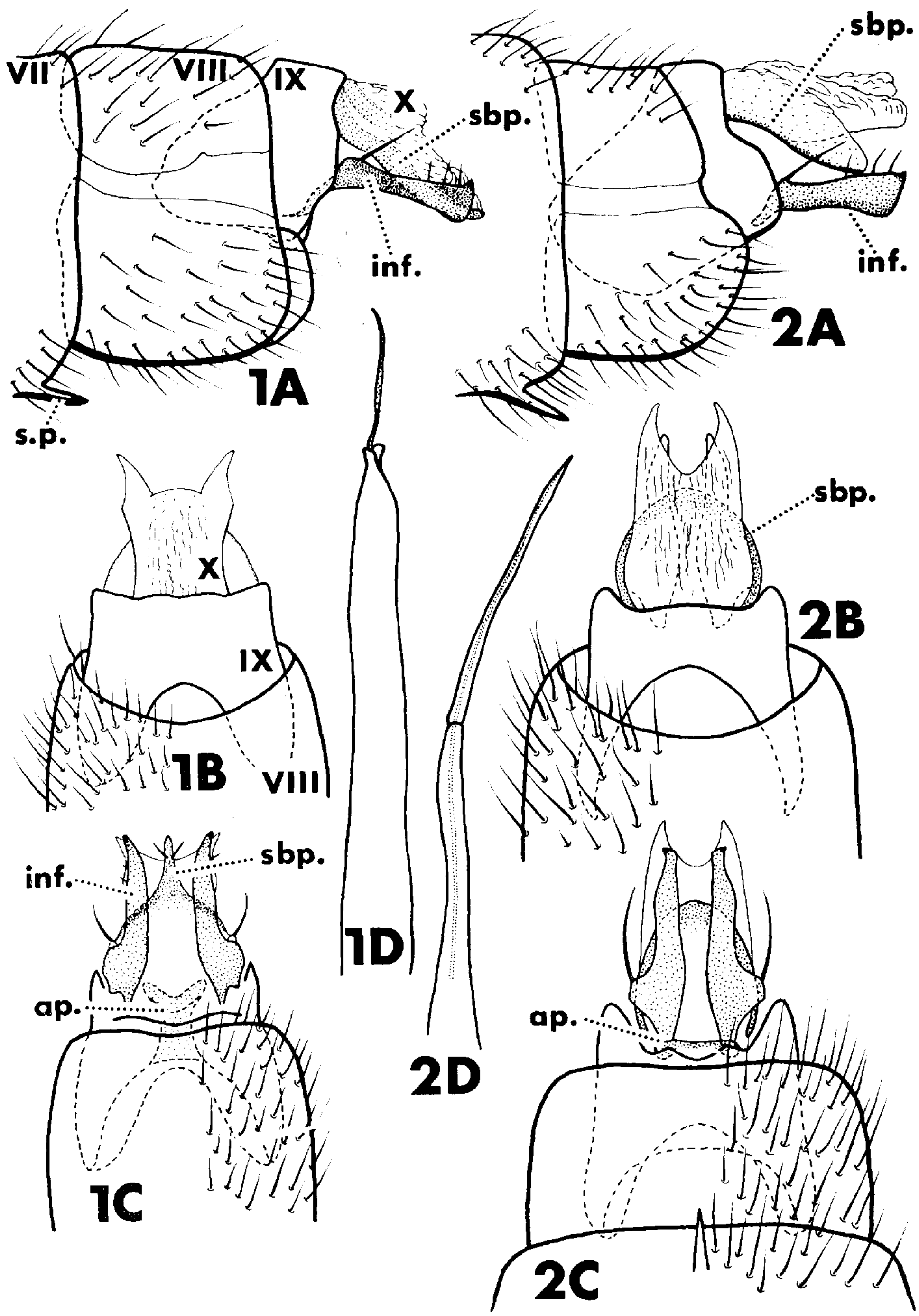

Fig. 1-2. Male genitalia of *Hydroptila* n. spp. 1, *H. carolae* n. sp.; 2, *H. disgalera* n. sp. See text for abbreviations.

Types will be deposited in the National Museum of Natural History, Smithsonian Institution (USNM), the Illinois Natural History Survey (INHS), the Florida State Collection of Arthropods (FSCA) and the Clemson University Insect Museum (CLEM) as indicated below.

Hydroptila carolae Holzenthal & Kelley, NEW SPECIES
Fig. 1A-D

Hydroptila sp. 3, Morse et al. 1980, p. 91.

This species, a member of the *H. consimilis* group of Marshall (1979), is remarkably similar to *H. quinola* Ross in overall plan of the genitalia, but differs greatly from that species in the structure of the phallus. In *H. quinola* the phallus is thin and tapered to its apex. In the new species the phallus is very long with a tubular basal portion and a thin stylet-like apical portion.

MALE: Length 3.5 mm. Brown in alcohol. Antennae 30-segmented. Abdominal segment VII with sternal process (*s.p.*). Segment VIII quadrate in lateral view; heavily setose. Segment IX half width of VIII and extending anteriorly into that segment; with a large meso-ventral apodeme (*ap.*). Segment X largely membranous; in dorsal view with pair of diverging apico-lateral extensions. Subgenital process (*sbp.*) as long as inferior appendages (*inf.*); in ventral view, evenly rounded baso-laterally, tapering to a sharp apical projection bearing 2 divergent subapical setae. Inferior appendages (*inf.*) well separated basally, short; in lateral view, somewhat club-shaped, narrowest in middle; apico-dorsal corner pointed; apico-ventral corner rounded; each with a single large baso-dorsal seta and 2-3 small subapico-dorsal setae. Phallus long, extending anteriorly into segment VI; basal portion tubular, apical portion thin and stylet-like; paramere absent.
HOLOTYPE: ♂, *South Carolina*: Aiken Co.: Savannah River Plant, Upper Three Runs Creek at SRP road 8-1, 18-X-1980, col. R. W. Kelley, R. W. Holzenthal (USNM).
PARATYPES: Same data as holotype, 4-IX-1976, 4 ♂, col. D. Herlong, S. Prichard (CLEM); same, 29-III-1977, 18 ♂ (INHS); same, 17-V-1977, 1 ♂ (CLEM); same, 1-IX-1979, 1 ♂ col. R. W. Kelley, E. McEwan (FSCA).
ETYMOLOGY: Named in honor of the junior author's wife, Carol.
DISTRIBUTION: Thus far known only from the type locality.

Hydroptila disgalera Holzenthal & Kelley, NEW SPECIES
Fig. 2A-D

Hydroptila quinola Ross ?, Morse et al. 1980 p. 91.

This is also a *H. consimilis* group species similar in general appearance to *H. quinola* Ross. It differs most strikingly from that species and the previous one in the shape of the subgenital process. In ventral view, this process is acuminated in *H. quinola* and evenly rounded in *H. disgalera*. Its phallus is almost identical to that of *H. quinola*. Most males of this species lack the elaborate cephalic scent caps typical of the genus.

MALE: Length 2.6 mm. Brown in alcohol. Antennae 30-segmented. Abdominal segment VII with sternal process. Segment VIII somewhat quadrate in lateral view, tergum slightly shorter than sternum; heavily setose. Segment IX 3/4 width of VIII, with a small meso-ventral apodeme (*ap.*). Segment X largely membranous; in dorsal view with pair of converging to parallel apico-lateral extensions. Subgenital process (*sbp.*) semi-circular in ventral view. Inferior appendages (*inf.*) well separated basally, short; in lateral view with dorsal and ventral edges slightly sinuate and gradually expanded apically; apico-dorsal corner pointed; apico-ventral corner rounded; each with a single large baso-dorsal seta and 2-3 small subapico-

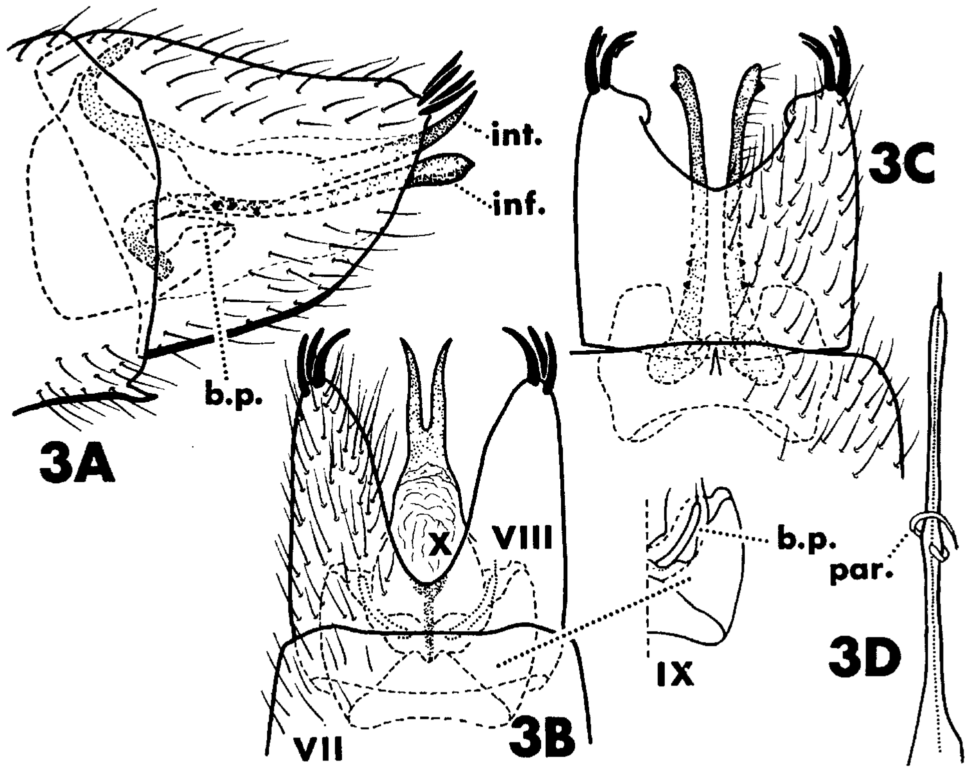

Fig. 3. Male genitalia of *Hydroptila ouachita* n. sp. See text for abbreviations.

dorsal setae. Phallus long; basal portion simple and slender, apical portion tapered to apex; paramere absent.

HOLOTYPE: ♂, *South Carolina*: Aiken Co.: Savannah River Plant, Upper Three Runs Creek at SRP road 8-1, 11-V-1979, col. R. W. Kelley, E. McEwan (USNM).

PARATYPES: Same data as holotype, 4-IX-1976, 2 ♂, col. D. Herlong, S. Prichard (USNM); same, 29-III-1977, 21 ♂ (INHS); same, 3-V-1977, 7 ♂ (INHS); same, 17-V-1977, 8 ♂ (FSCA); same, 8-VIII-1977, 1 ♂ (FSCA); same, 12-IV-1979, 2 ♂, col. R. W. Kelley, E. McEwan (CLEM); same, 11-VI-1979, 1 ♂ (CLEM); same, 6-VIII-1979, 2 ♂ (CLEM); same, 1-IX-1979, 1 ♂ (CLEM); same, 20-VIII-1980, 1 ♂ (CLEM); *Alabama*: Mobile Co.: Cedar Creek at Indian Grave Creek, 12-V-1982, 1 ♂, col. S. C. Harris, P. O'Neil (FSCA); Indian Grave Creek E of Citronelle, 29-IX-1981, 31 ♂, col. S. C. Harris, P. O'Neil (INHS); Little Creek, 4 miles SE Citronelle, 29-IX-1981, 2 ♂, col. S. C. Harris, P. O'Neil (USNM); Perry Co.: Oakmulgee Creek at Hwy 30, 20-IX-1981, 1 ♂, col. S. C. Harris, P. O'Neil (CLEM).

ETYMOLOGY: Latin for "without cap" in reference to the absence of cephalic scent caps in most males of the species.

DISTRIBUTION: Common and widely distributed in southern Alabama. In South Carolina known only from the type locality.

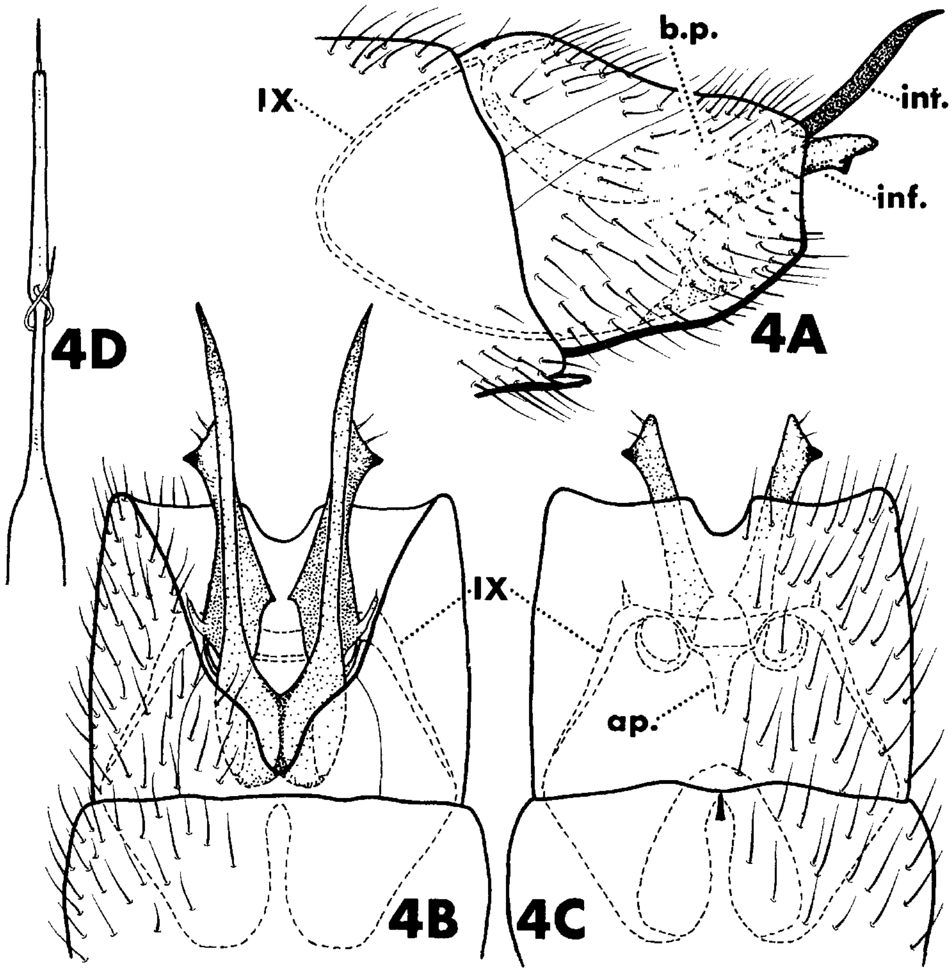

Fig. 4. Male genitalia of *Hydroptila poirrieri* n. sp. See text for abbreviations.

Hydroptila ouachita Holzenthal & Kelley, NEW SPECIES
Fig. 3A-D, inset

Although superficially resembling *H. acadia* Ross, a member of the *H. waubesiana* group of Marshall (1979), this species is easily distinguished from other species by its possession of long saber-like intermediate appendages and by the presence of 3 dark sclerotized points in the basal region of the inferior appendages.

MALE: Length 2.5 mm. Brown in alcohol. Antennae 28-segmented. Abdominal segment VII with sternal process. Segment VIII in lateral view somewhat triangular, longer than wide and with dorsal margin straight and ventral margin curved; apico-dorsal corner bearing 4 heavy, black, mesally directed spines; in dorsal view with a deep, broad, V-shaped mesal excision, ventrally with a shallower mesal excision; heavily setose. Segment IX short, completely retracted within VIII; dorsally reduced to narrow bridge. Segment X long; lightly sclerotized basally; with a pair of saber-like intermediate appendages (*int.*). Inferior appendages (*inf.*) close together basally; long, extending beyond posterior margin of VIII; in lateral view narrow, shaped like a shepherd's crook; each with 3 dark sclerotized points just before midlength and a single dark subapical point; bilobed process (*b.p.*) present. Phallus long and narrow; with a spiralled paramere (*par.*) at midlength; ejaculatory duct protruding at apex.

HOLOTYPE: ♂, *Louisiana*: Jackson Parish: Schoolhouse Spring, T17N, R1W, Sec 12. 30-III-1973, col. J. C. Morse (USNM).

PARATYPES: Same data as holotype, 5 ♂ (INHS); same, 24-VIII-1973, 6 ♂, col. J. C. Morse, J. Louton (CLEM).

ETYMOLOGY: Named for the Ouachita River.

DISTRIBUTION: Known only from the type locality, a small artesian spring.

Hydroptila poirrieri Holzenthal & Kelley, NEW SPECIES
Fig. 4A-D

Hydroptila n.sp., Harris, Lago, and Holzenthal 1982 p. 510.

Another member of the *H. waubesiana* group, this species resembles *H. ouachita* n.sp. in general plan of the intermediate appendages and phallus, but can be distinguished readily from that species by the absence of the heavy black spines of segment VIII.

MALE: Length 2.3 mm. Brown in alcohol. Antennae 27-segmented. Abdominal segment VII with sternal process. Segment VIII roughly trapezoidal in lateral view, posterior margin about half width of anterior margin; in dorsal view with a deep broad V-shaped mesal excision; ventrally with a much smaller U-shaped mesal excision; heavily setose. Segment IX completely retracted within VII and VIII; hexagonal-shaped in dorsal and ventral views, with a narrow meso-dorsal excision and a meso-ventral apodeme (*ap.*). Segment X apparently reduced to a pair of extremely long, thin, sickle-shaped intermediate appendages (*int.*) extending well beyond posterior margin of VIII. Inferior appendages (*inf.*) close together basally, short, finger-shaped in lateral view; each with a subapical, ventro-lateral dark point; basal region ring-shaped when viewed ventrally; bilobed process (*b.p.*) present. Phallus long; widest basally, markedly narrow and parallel-sided between base and paramere, apex beyond paramere slightly enlarged; paramere present at midlength and spiralled once completely around phallus; ejaculatory duct protruding at apex.

HOLOTYPE: ♂, *Mississippi*: Clarke Co.: Chunky Creek at dirt road, 7.1 km. NW of Hwy. 11 in Enterprise, 13-X-1979, col. R. W. Holzenthal (USNM).

PARATYPES: *Louisiana*: Tangipahoa Parish: Big Creek, approx. 3 mi. E of Amite, 24-IV-1976, 1 ♂, col. M. E. Dakin (USNM); *Mississippi*: Amite Co.: West Fork Amite River at unmarked gravel road, 14.5 air km. SSW of Liberty, 28-V-1979, 2 ♂, col. R. W. Holzenthal (FSCA); Covington Co.: Ocatoma Creek, 0.3 km. W of Sanford, 30-VIII-1979, 2 ♂, col. R. W. Holzenthal (USNM); Lincoln Co.: Homochitto River at Hwy. 550, 6.8 km. W of Caseyville, 1-VIII-1979, 10 ♂, col. R. W. Holzenthal (CLEM); Pike Co.: Topisaw Creek at Hwy. 44, 0.6 km. W of Pricedale, 29-IX-1979, 9 ♂, col. R. W. Holzenthal (CLEM); Tishomingo Co.: Tishomingo State Park, 8-IX-1980, 1 ♂, col. P. K. Lago (CLEM).

ETYMOLOGY: Named in honor of Dr. Michael A. Poirrier, University of New Orleans.

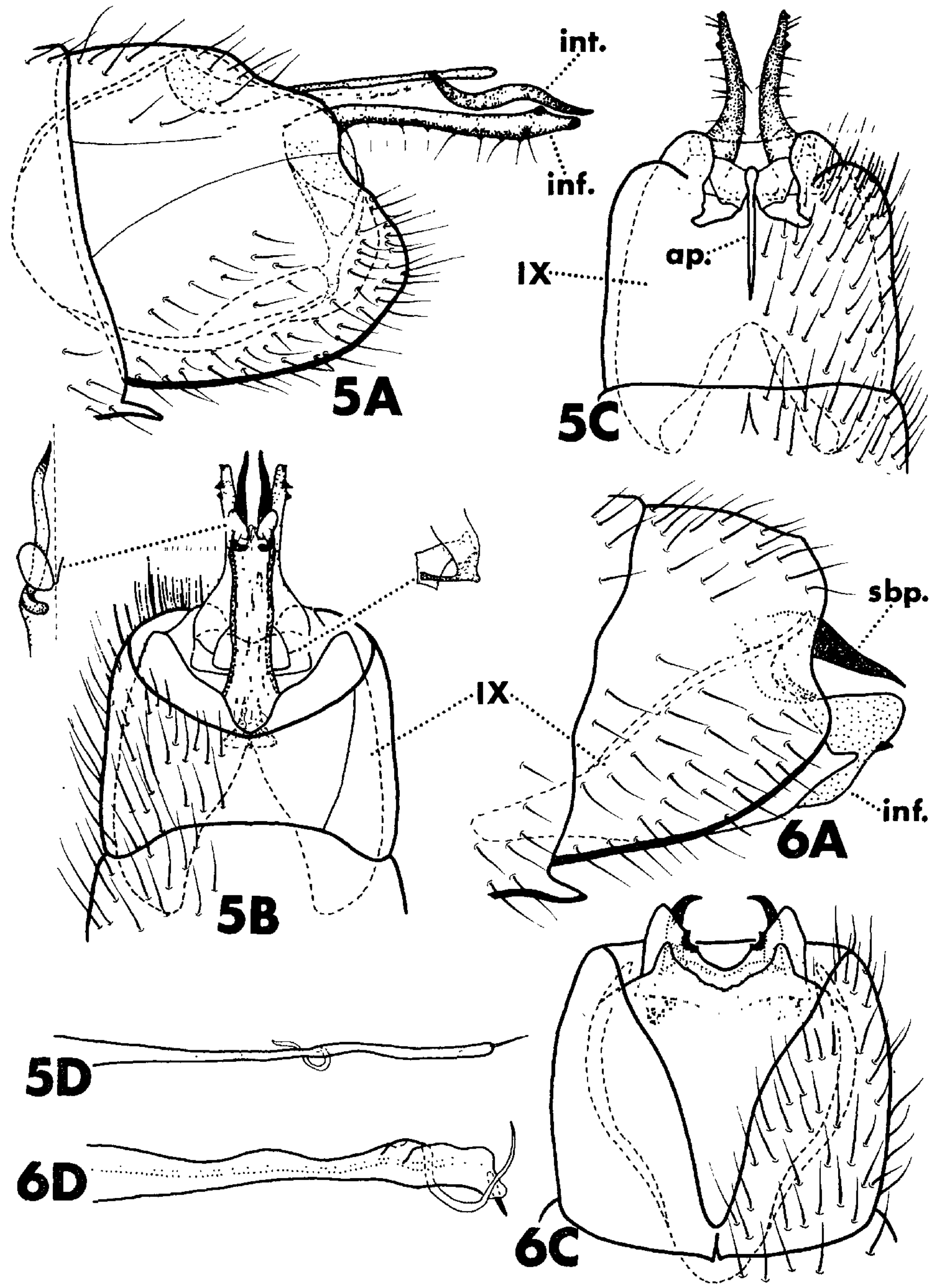

Fig. 5-6. Male genitalia of Hydroptilidae, n. spp. 5, *Hydroptila tridentata* n. sp.; 6, *Oxyethira kingi* n. sp. See text for abbreviations.

DISTRIBUTION: As noted by Harris, Lago, and Holzenthal (1982) this species is common and widely distributed in southeastern Louisiana and Mississippi.

Hydroptila tridentata Holzenthal & Kelley, NEW SPECIES
Fig. 5A-D, insets

This species is a member of the *H. waubesiana* group. It bears some resemblance to *H. delineata* Morton in the structure of the intermediate appendages, but the 3 prominent, dark apical points of the inferior appendges render it distinct.

MALE: Length 2.4 mm. Brown in alcohol. Antennae 30-segmented. Abdominal segment VII with sternal process. Segment VIII somewhat angular in lateral view, posterior margin sinuate; heavily setose. Segment IX completely retracted within VIII; dorsally reduced to a very narrow bridge; with 2 ear-shaped ventro-lateral posterior projections and a meso-ventral apodeme (*ap.*). Segment X complicated, consisting of a basal membranous portion bounded laterally by sclerotized strips and a pair of apical, sinuate intermediate appendages (*int.*). Inferior appendages (*inf.*) basally contiguous; L-shaped in lateral view, long and thin; each with 3 prominent, dark apico-lateral points and several setae along ventral edge; complex brace-like structure basally; bilobed processes absent. Phallus long and thin; hook-shaped paramere present just beyond midlength; ejaculatory duct protruding at apex.

HOLOTYPE: ♂, *South Carolina*: Dorchester Co.: Four Holes Swamp, Goodsons Lake, 7-V-1976, col. J. C. Morse (USNM).

PARATYPES: Same data as holotype, 2 ♂ (INHS); same, 3 ♂ (CLEM); *South Carolina*: Aiken Co.: Savannah River Plant, Tinker Creek at SRP road 8-1, 18-V-1977, 1 ♂, col. D. Herlong, S. Prichard (FSCA).

ETYMOLOGY: Latin, in reference to the three dark teeth-like points on the inferior appendages.

DISTRIBUTION: Known only from the localities listed in the type series.

Oxyethira kingi Holzenthal & Kelley, NEW SPECIES
Fig. 6A, C, D

Oxyethiva n. sp. 13, Kelley 1982 p. 183, Fig. 178, ♂.

This species is a member of the *Oxeythira santiagensis* group. Unlike other members of the group the postero-ventral processes of segment IX are short.

MALE: Length 2.6 mm. Brown in alcohol. Number of antennal segments unknown. Abdominal segment VII with apico-mesal sternal process. Segment VIII quadrate in lateral view; in ventral view with a deep, broad, V-shaped mesal excision; heavily setose. Segment IX with dorsum lacking, ventrally produced anteriorly into segment VII; dorso-lateral edges heavily sclerotized; postero-ventral margin with 2 short processes. Segment X entirely membranous, inconspicuous upon clearing. Subgenital process (*sbp.*) sharply pointed, mesally curved at apex, not fused. Inferior appendages (*inf.*) triangular in shape, basally connected, with paired, dark teeth on each mesal margin. Phallus with spiralled subapical process and single apical seta.

HOLOTYPE: ♂, *Florida*: Miami, Plant Inspection Station, black light, 21-XII-1964, col. J. C. Buff (65-2910) (USNM).

ETYMOLOGY: Named in honor of Dr. Edwin W. King, Professor Emeritus, Clemson University.

DISTRIBUTION: Known only from the type locality.

ACKNOWLEDGMENTS

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We wish to thank Mrs. Donna Picard for typing the manuscript.

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NEW RECORDS OF PHILONTHINI FROM THE CIRCUM-CARIBBEAN REGION (COLEOPTERA: STAPHYLINIDAE)

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Abstract

The only species of *Gabronthus* previously reported from the New World was *G. thermarum* (Aubé). Re-examination of specimens on which Circum-Caribbean records were based, together with additional specimens, showed that 2 *Gabronthus* species actually occur there. *Gabronthus thermarum* occurs in Florida (U.S.A.), Jamaica, Puerto Rico, Antigua, St. Kitts, Guadeloupe, and Costa Rica. *Gabronthus mgogoricus* Tottenham, previously reported only from Africa, occurs in Florida, Jamaica, Haiti, Puerto Rico, and U.S. Virgin Islands, and seems to be the more abundant of the 2 species, at least in Florida and possibly throughout the Greater Antilles. *Hesperus baltimorensis* (Gravenhorst), *H. apicialis* (Say), and *Laetulonthus laetulus* (Say) are newly reported from Florida. The following new records are reported for *Philonthus* species: *P. discoideus* (Gravenhorst) from Costa Rica, *P. lomatus* Erichson from Haiti, *P. ventralis* (Gravenhorst) from Haiti, Costa Rica, and Florida. Diagnostic features are given of the adult head of the 2 *Gabronthus* species and of the aedeagus of all 8 species. Typically, *H. apicialis* adults have dark elytra, but in southeastern Florida there exist adults with red elytra as in *H. baltimorensis*.

Spread of the 4 Old World species (*G. mgogoricus, G. thermarum, P. discoideus, P. ventralis*) probably is due to human agency in providing transport and/or in rearing animals (cows, horses, goats, etc.) whose dung seems to be a preferred habitat. In contrast, *H. baltimorensis, H. apicialis* and *L. laetulus* are likely to become rarer by human destruction of the moist, hardwood forest in eastern North America where they exist.

Resumen

La única especie de *Gabronthus* previamente reportada del Nuevo Mundo era *G. thermarum* (Aubé). Un nuevo examen de los espécimens sobre los cuales se basaban los records del Caribe, junto con espécimens adicionales, demonstró que en realidad 2 especies de *Gabronthus* ocurren en la región. *Gabronthus thermarum* ocurre en la Florida (E.U.A.), Jamaica, Puerto Rico, Antigua, St. Kitts, Guadeloupe, y Costa Rica. *Gabronthus mgogoricus* Tottenham, previamente reportado solamente de Africa, ocurre en la Florida, Jamaica, Haití, Puerto Rico, y las Islas Vírgenes Norteamericanas, y parece ser la mas abundante de las dos especies por lo menos en la Florida y posiblemente a través de las Antillas Mayores. *Hesperus baltimorensis* (Gravenhorst), *H. apicialis* (Say), y *Laetulonthus laetulus* (Say) se reportan por primera vez en la Florida. Los siguientes registros son nuevos para especies de *Philonthus*: *P. discoideus* (Gravenhorst) en Costa Rica, *P. lomatus* Erichson en Haití, *P. ventralis* (Gravenhorst) en Haití, Costa Rica, y la Florida. Se presentan rasgos diagnósticos de la cabeza de los adultos de las dos especies de *Gabronthus* y del edeago de las 8 especies. Tipicemente los adultos de *H. apicialis* tiene elitros negros, pero en el sureste de la Florida existen adultos con élitros rojos semejantes a los de los adultos de *H. baltimorensis*.

La difusión de las 4 especies del Viejo Mundo (*G. mgogoricus, G. thermarum, P. discoideus*, y *P. ventralis*) probablemente se debe a agencias humanas que los han proveído transporte y/o crías de animales (vacas, caballos, chivos, etc.) cuyo estiércol parece ser una habitacion preferida. En contraste, *Hesperus baltimorensis, H. apicialis*, y *L. laetulus* probablemente se harán mas escasos debido a la destrucción de los bosques húmedos de madera brava en el este de Norte America, donde existen.

Some species of the genus *Philonthus* Stephens have received attention in the ecological and economic literature because of the large size and abundance of individuals, as well as the predatory habits of adults and larvae. Although the species of the western Palearctic region are now reasonably well known taxonomically, this is not yet true of the species of the remainder of the world. Many hundreds of species have been attributed to the genus in the 150 years since its original description, so the task of a world-wide revision will be onerous.

In the Palearctic region, Coiffait (1974) has included genera such as *Erichsonius* Fauvel, *Gabrius* Stephens, *Spatulonthus* Tottenham, *Hesperus* Fauvel, *Neobisnius* Ganglbauer, and *Cafius* Stephens together with *Philonthus* in the tribe Philonthini, to be differentiated from the tribes Quediini and Staphylinini, all within the subfamily Staphylininae. Elsewhere, the difference between Philonthini and Staphylinini is at least blurred by characteristics of numerous other genera not considered by Coiffait (1974). Similarly, the generic limits of *Philonthus* are obscured in regions except for the Palearctic, by existence of *Philonthus*-like species, some of which have been assigned to genera whose limits are no better defined than are those of *Philonthus*. It is clear that a worldwide revision of *Philonthus* would demand extensive examination of genera related to *Philonthus* in order to establish generic limits. Some groups of species might be segregated from *Philonthus* as distinct genera, whereas some existing generic names might be relegated to synonymy under *Philonthus*.

Knowledge of *Philonthus* and related genera cannot reasonably be suspended until a worldwide revision is completed. Ecological and economic studies require identification of specimens collected. The rational approach to this puzzle is to avoid (or at least minimize) changes in nomenclature at the generic level, but to augment existing species descriptions with illustrations and distributional records. This paper was conceived as a response to requests to identify *Philonthus*-like specimens collected in Florida. The specimens were of an Old World species not heretofore recorded from the New World. They belonged to *Gabronthus* Tottenham, which had been segregated from *Philonthus* as a distinct genus. The opportunity was then taken to augment distributional records for *Philonthus* and related genera (*Hesperus, Laetulonthus*) from the Circum-Caribbean region (the West Indian Islands and Central America, the countries of South America bordering the Caribbean Sea, eastern Mexico, and the U.S.A. states bordering the Gulf of Mexico).

Materials and Methods

Specimens for identification were provided by W. H. Whitcomb, G. D. Propp, and M. C. Thomas (Gainesville, FL), R. W. Lundgren (Normal, IL)

(RWLC), and R. E. Woodruff (Florida State Collection of Arthropods: FSCA). These were compared with the specimens in my collection (JHFC) and with specimens from the United States National Museum (USNM). The literature was searched for further information, and correspondence was initiated with L. H. Herman (New York) and P. M. Hammond (London). Dissections and drawings were made under a stereoscopic dissecting microscope with a linear scale in one eyepiece.

Gabronthus Tottenham

Gabronthus thermarum (Aubé)

Synonymy, distribution, and description were given by Blackwelder (1943). The species is reported from Europe, Africa, the West Indies and, according to Horn (1884) and Ulke (1902), from the United States. However, Tottenham (1955) recognized that many species have been confused under this name, and some distribution records of *G. thermarum* may prove to be erroneous. Examination of specimens from the Circum-Caribbean region demonstrated that 2 species of *Gabronthus* occur there, and of these *G. thermarum* adults may be distinguished by the head (Fig. 1a) and aedeagus (Fig. 2a).

Distribution of *G. thermarum* in the Circum-Caribbean region must now be re-evaluated. Some of the specimens used by Blackwelder (1943) in recording distribution of this species are located in USNM and have been re-examined; slightly more than half were not of *G. thermarum*. Collection records for *G. thermarum* are as follows: JAMAICA, St. Catherine Parish, Worthy Park, 13-V-1969, u.v. light trap,R. E. Woodruff (1 ♂, 1 ♀: FSCA), 10-V-1969, u.v. light trap, R. E. Woodruff (1 ♀: FSCA); PUERTO RICO, Mayagüez District, Guánica, 10-XII-1935, H. L. Dozier (1 ♀: USNM), Boquerón, 16-XI-1935, H. L. Dozier (2 ♂♂: USNM); ANTIGUA, St. John

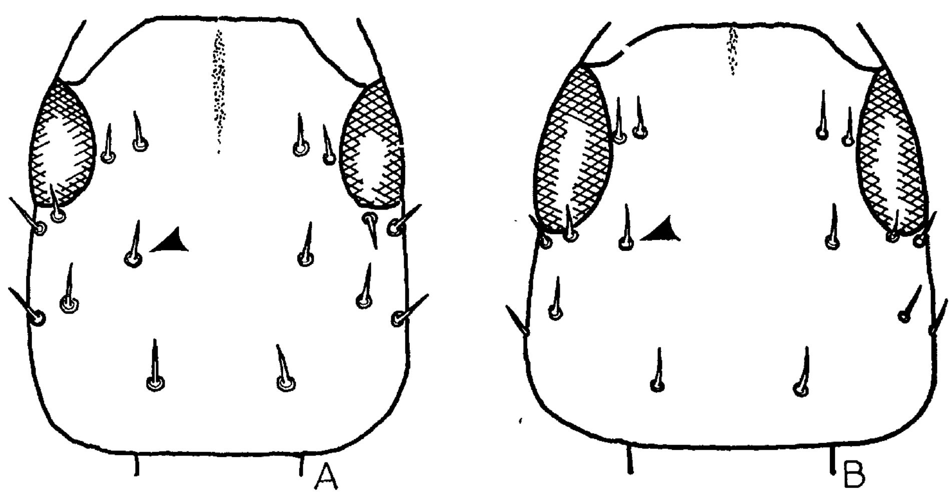

Fig. 1. Heads of adult *Gabronthus*, 1a: *G. thermarum* in which the eye is relatively small and its posterior margin is well anterior of the arrowed puncture, 1b: *G. mgogoricus* in which the head is relatively broader posteriorly, the eye is larger and extends posteriorly to the level of the arrowed puncture.

Parish, near botanic garden, 14-VIII-1936, in pile of decaying grass, R. E. Blackwelder (1 ♀: USNM), St. Mary Parish, near Ffrye's Point, 23-VIII-1936, in cow dung, R. E. Blackwelder (1 ♀: USNM), St. Paul Parish, 1 mi. S. of All Saints, 26-VIII-1936, in cow dung, R. E. Blackwelder (1 ♂: USNM); ST. KITTS, St. Mary and St. Peter Parish boundary, Key Gut, 7-X-1936, in cow dung, R. E. Blackwelder (1 ♀: USNM); GUADELOUPE, Basse Terre, 2 km S. of Capesterre, 30-X-1935, in ox dung, R. E. Blackwelder (1 ♂: USNM); COSTA RICA, Guanacaste, Playa Tamarindo, 25-VII-1979, in pile of grass clippings on sea beach, J. H. Frank (5 ♂♂: JHFC); U.S.A., Florida, Dade Co., Homestead, 18-IV-1983, in rotting fruit of *Artocarpus heterophyllus* Lamarck, J. H. Frank (1 ♂: JHFC); Martin Co., Stuart, 4-I-1980, in pile of rotting fruit, R. W. Lundgren (3 ♂♂, 1 ♀: RWLC).

Gabronthus mgogoricus Tottenham

Tottenham (1955) described this species from eastern and southern Africa. Heretofore, its occurrence in the New World has not been recognized. Adults are distinguished from those of *G. thermarum* by the head (Fig. 1b) and aedeagus (Fig. 2b).

The following collection records establish its occurrence in the Circum-Caribbean region. JAMAICA, St. Catherine Parish, Caymanas Estate, 17-XI-1968, u.v. light trap. S. A. Apeji (22: JHFC); Manchester Parish, Mandeville, 25-VIII-1969, u.v. light trap, J. H. Frank (1 ♀: JHFC), 26-XII-1970, on freshly dug earth, J. H. Frank (1 ♂: JHFC), 6-8-II-1971, u.v. light trap, J. H. Frank (1 ♀: JHFC), Newport, 27-II-1969, on wet concrete, J. H. Frank (2 ♂♂: JHFC); St. Elizabeth Parish, Santa Cruz, 24-II-1937, flying at dusk, E. A. Chapin and R. E. Blackwelder (1 ♀: USNM); Trelawny Parish, Troy, 16-II-1937, flying at dusk, E. A. Chapin and R. E. Blackwelder (1 ♂: USNM); HAITI, Département de l'Ouest, ca. 2 mi. E. of Trou Caïman, 26-XI-1970, in donkey dung, J. H. Frank (1 ♂, 3 ♀♀: JHFC), ca. 0.5 mi. W. of Trou Caïman, in sheep dung, J. H. Frank (1 ♂: JHFC), Cul de Sac, 26-VIII-1935, in horse manure, R. E. Blackwelder (1 ♀: USNM); PUERTO RICO, Bayamon District, Rio Plata just below Toa Alta 15-XII-1936, in cow dung and horse manure, R. E. Blackwelder (1 ♀: USNM); Aguadilla District, about 13 mi. E. of Maricao, 3-X-1935, in human excrement, R. E. Blackwelder (1 ♂: USNM); Mayagüez District, Lajas, 22-XI-1935, H. L. Dozier, (1 ♂: USNM), Sabana Grande, 27-XII-1935, H. L. Dozier (1 ♀: USNM); U.S. VIRGIN ISLAND, St. Croix, near Parasol on western road through mountains to north coast, 7-XI-1936, in cow dung, R. E. Blackwelder (2 ♂♂, 1 ♀: USNM); U.S.A. Florida, Dade Co., Homestead, 18-IV-1983, in rotting fruit of *Artocarpus heterophyllus* Lamarck, J. H. Frank (1 ♂: JHFC); St. Lucie Co., Lakewood Park, 9-IX-1972, u.v. light trap, J. H. Frank (1 ♂: JHFC); Indian River Co., Vero Beach, 18-VII-1976, M. C. Thomas (1 ♂, 1 ♀: JHFC), 1-X-1976, u.v, light trap, M. C. Thomas (2 ♀♀: JHFC), 4-II-1977, under debris on sea beach, M. C. Thomas (1 ♀: JHFC), S. of Vero Beach, 15-VII-1976, u.v. light trap, J. H. Frank and M. C. Thomas (1 ♂, 1 ♀: JHFC), 7-VIII-1976, u.v. light trap, J. H. Frank and M. C. Thomas (1 ♂: JHFC); Flagler Co., Palm Coast, 16-III-1983, in organic material behind dune line, M. C. Thomas (1 ♂: JHFC); Marion Co., Ocala, u.v. light trap, 26-VI-1977, M. C. Thomas (1 ♀: JHFC); Alachua Co., Gainesville, pitfall traps in soybean field, W. H. Whitcomb and/or T. Haya-

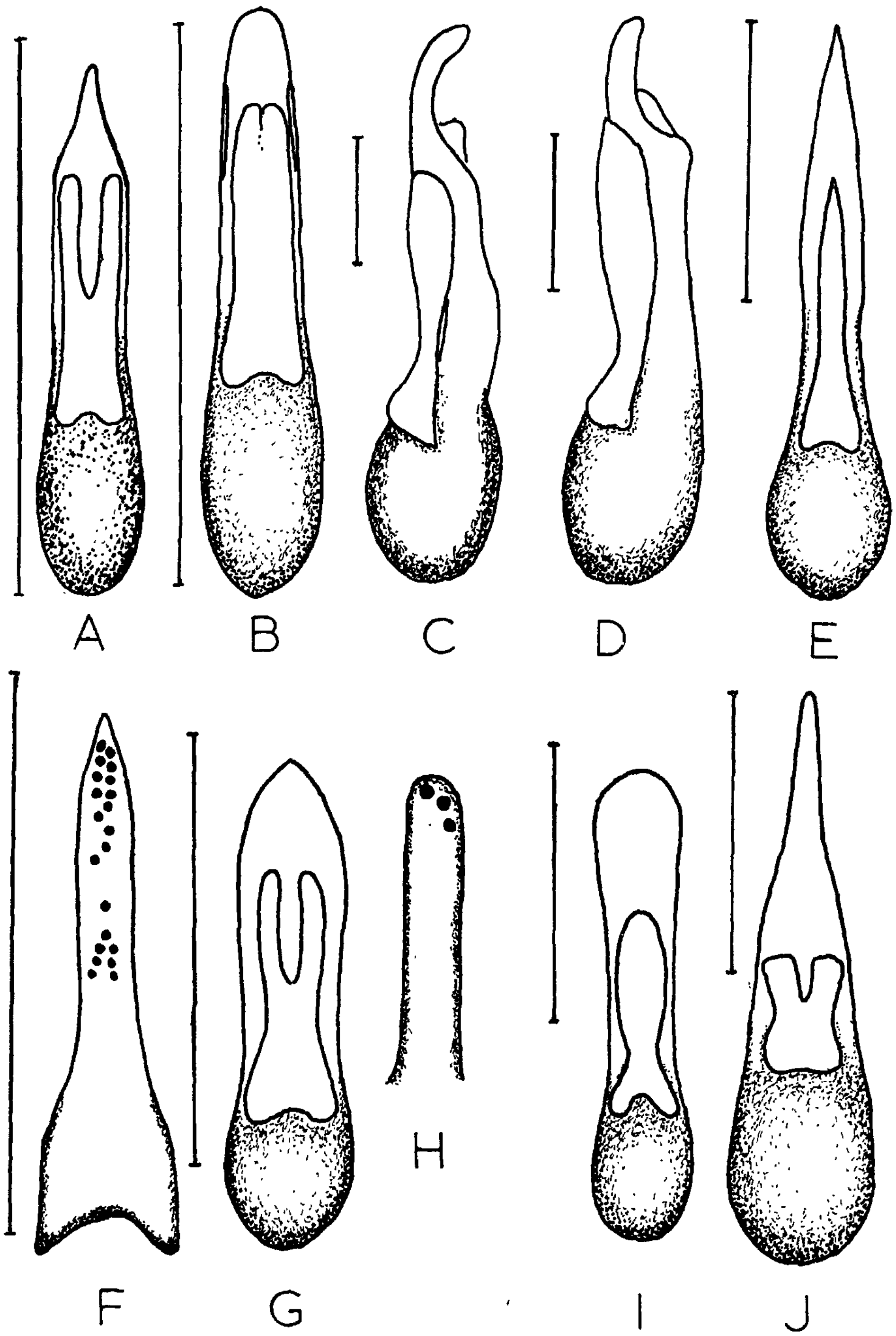

Fig. 2. Aedeagi of adults, 2a: *Gabronthus thermarum*, 2b: *G. mgogoricus*, 2c: *Hesperus baltimorensis* (lateral), 2d: *H. apicialis* (lateral), 2e: *Laetulonthus laetulus*, 2f: paramere of *L. laetulus* showing peg setae on side adpressed to median lobe, 2g: *Philonthus discoideus*, 2h: apex of one of the branches of the paramere of *P. discoideus* showing peg setae on side adpressed to median lobe, 2i: *P. lomatus*, 2j: *P. ventralis*. Scale line = 0.5 mm.

kawa (5-VIII-1980 (1), 12-21-VIII-1980 (2), 24-VIII-1981 (27): JHFC); Levy Co., Williston, 19-VI-1978, pitfall trap, W. H. Whitcomb (1 ♂: JHFC); Taylor Co., Adams Beach, 8-VI-1981, sea drift, P. M. Choate (1 ♂: JHFC); Madison Co., 5 mi. N.E. of Madison, 8-VII-1980, pitfall traps in soybean field, W. H. Whitcomb (3: JHFC); Baker Co., Macclenny, 24-VI-1981, in carrion, G. D. Propp (1 ♂, 1 ♀: JHFC); Leon Co., Tallahassee, 7-I-1980, under board near small colony of ants, R. W. Lundgren (1 ♂; RWLC).

Hesperus Fauvel

Hesperus baltimorensis (Gravenhorst)

Moore (1958) stated that this species has been recorded from the "middle and southern states" of the U.S.A. and Indiana, and that he had seen specimens from New York, Alabama, and Missouri. The species has not been reported from Florida and the following record therefore is new. U.S.A., Florida, Liberty Co., Torreya State Park, 26-III-1983, M. C. Thomas (2 ♂♂: JHFC). The aedeagus is illustrated in Fig. 2c. A redescription was given by Moore (1958).

Hesperus apicialis (Say)

Moore (1958) reported examining specimens from Ohio, Missouri, and Alabama, and stated that the species was elsewhere recorded from "Canada to Georgia" and from Indiana. The following records are new for Florida. U.S.A., Florida, Leon Co., Tall Timbers Research Station, 1-VII-1978, in old tire, oak-beech-magnolia hammock, W. E. Bradshaw (2 ♂♂, 1 ♀: JHFC); Liberty Co., Torreya State Park, 14-X-1978, at fermenting sap under bark of oak, M. C. Thomas (1 ♀: JHFC); Indian River Co., Fellsmere, mosquito suction trap, W. L. Bidlingmayer, 10-16-VII-1975 (1 ♂), 16-21-VII-1975 (1), 21-VII-1975 (1 ♀), 27-III-2-IV-1976 (1), 16-20-V-1976 (1), 12-XI-1976 (2 ♀♀): JHFC). The aedeagus is illustrated in Fig. 2d. A redescription was given by Moore (1958), who noted that the adult head is more densely punctate and the antennae less robust than in *H. baltimorensis.*

Moore (1958) and Scheerpeltz (1971) claimed that the red elytra of *H. baltimorensis* adults contrast with the black elytra of *H. apicialis* adults. Whereas the northern Florida specimens of *H. apicialis* have black elytra, those from Indian River Co. have red elytra and, on the basis of color alone, could be misidentified as *H. baltimorensis.*

Laetulonthus Moore and Legner

Laetulonthus laetulus (Say)

Synonymy, distribution, and description were given by Moore and Legner (1973). As the only member of the genus, this species is stated to occur from Canada to Georgia and westwards to Texas. The paederoid coloration of adults distinguishes them from adults of most related genera and species in North America. However, adults of certain Central American genera and species of similar coloration and structure have not yet been compared; it is here that relatives should be sought.

The following collection records establish *L. laetulus* as occurring in

Florida. U.S.A., Florida, Columbia and Baker County boundary, junction of highway 90, 29-XI-1976, u.v. light trap, C. Ross (1 ♂: FSCA); Liberty Co., Torreya State Park, 14-X-1978, at fermenting sap under bark of oak, M. C. Thomas (1 ♂: JHFC). The aedeagus of the male from Liberty Co. is illustrated in Fig. 2e, and its paramere showing the arrangement of peg setae in Fig. 2f.

Philonthus Stephens

Philonthus discoideus (Gravenhorst)

Synonymy, distribution, and description were given by Blackwelder (1943). The species has a wide distribution in the Old World and is known from several West Indian Islands and various parts of the U.S.A., including Texas. It has been confused in the literature with *P. rectangulus* Sharp which is reported from both North America (Tottenham 1935, Hatch 1957) and South America (Coiffait and Saiz 1968), but not from Central America or the West Indies. It is reported to have a close relative in Chile, *P. emmelinae* Coiffait and Saiz (1968), whose description was based on one specimen only, with very little difference from typical specimens of *P. discoideus*.

Adults of *P. discoideus* differ from those of *P. rectangulus* only by the following external characteristics. Article I of the metatarsus is not longer than article V (cf. distinctly longer). The anterior transverse suture of the basal abdominal tergites is straight (cf. bisinuate, with median, posteriorly-directed point). The elytra are brown with yellowish margin and suture (cf. entirely blackish brown with bronze reflection). The aedeagus is illustrated in Fig. 2g; each branch of the furcate paramere bears a row of 3 peg setae near the apex (Fig. 2h) (cf. 7 or 8 peg setae arranged as an inverted V).

The following record of *P. discoideus* extends the known distribution southwards: COSTA RICA, Guanacaste, El Viejo, 21-27-VII-1979, u.v. light trap, J. H. Frank (1 ♂, 5 ♀♀: JHFC). These specimens appear typical of the species. A male specimen from Jamaica (JHFC) is atypical only in having 4 peg setae near the apex of each branch of the aedeagal paramere.

Philonthus lomatus Erichson

This species is widely distributed in North America according to Horn (1884) who redescribed it and occurs in Florida (confirmed by specimens examined: JHFC) and other southern parts of the U.S.A. The aedeagus was illustrated by Hatch (1957) and Smetana (1965), and is shown in Fig. 2i.

The following record appears to be the first for the West Indies: HAITI, Departement de l'Ouest, Kenscoff, ca. 1,400 m, 18-XI-1970, under stone by river, J. H. Frank (3 ♂♂, 1 ♀: JHFC).

Philonthus ventralis (Gravenhorst)

Synonymy, distribution, and description were given by Blackwelder (1943). The species has a wide distribution in the Old World, and is known from various parts of the U.S.A., including Texas, various West Indian Islands, and French Guyana. Blackwelder (1943) admitted difficulty in distinguishing adults from those of *P. discoideus*, but the aedeagi of males are distinctive (Fig. 2j cf. Fig. 2g).

The following records are new for Haiti, Costa Rica, and Florida. HAITI, Département de l'Ouest, ca. 2 mi. E. of Trou Caïman, 26-XI-1970, in donkey dung, J. H. Frank (1 ♂: JHFC); COSTA RICA, Guanacaste, Playa Tamarindo, 25-VII-1979, in pile of grass clippings on sea beach, J. H. Frank (1 ♂: JHFC); U.S.A., Florida, Indian River Co., Vero Beach, 1-II-1976, Berlese funnel extract of cow dung, J. H. Frank (1 ♂: JHFC).

DISCUSSION

It is unfortunate that until recent decades authors of taxonomic treatises on Staphylinidae usually failed to record habitats in which specimens were collected. Blackwelder (1943) set a standard for recording such information which now proves informative for species occurring in the West Indies. Little published information is available for *Philonthus* and related genera occurring only in North America, so the habitat data given in the text of this paper are supplemented below by data from specimen labels in my collection (JHFC).

It appears that *Hesperus baltimorensis*, *H. apicialis*, and *Laetulonthus laetulus* are found in moist, eastern, hardwood forests, and are associated there with wet leaf litter and fermenting sap. Adults are capable of flight. Evidently northern species, their range has extended southwards into Florida insofar as suitable habitat is available, i.e., principally in northern Florida. With deforestation in eastern North America (Anderson 1982), these 3 species are likely to become rarer.

In contrast, *Philonthus lomatus* is found in more open habitats, but apparently is restricted to wet, riparian sites where it is associated with decaying plant materials. Adults are capable of flight. Its distribution is much wider than that of the *Hesperus* and *Laetulonthus* species mentioned above, because of its less restrictive habitat.

In further contrast, *G. thermarum*, *G. mgogoricus*, *Philonthus ventralis*, and *P. discoideus* have been found in quite arid habitats. All are Old World species known from Africa, Europe (except *G. mgogoricus*), and Asia (except *G. mgogoricus* and *G. thermarum*), and have been introduced into the New World. Adults of all are capable of flight. However, within their habitat, they exist in moist microhabitats, sometimes composed of carrion or decaying plant materials, but especially of dung. All of Blackwelder's (1943) collection records from West Indian microhabitats for *P. discoideus* were from dung, as were most of those for *P. ventralis* and '*P. thermarum*' (= *G. thermarum* + *G. mgogoricus*). We may speculate that the present distribution of these species in the New World is due to human agency in providing transport to the New World and/or in providing a plentiful supply of microhabitats (animal dung) by rearing cattle, horses, donkeys, sheep and goats, none of which is native to the Circum-Caribbean region.

ACKNOWLEDGMENTS

I thank D. R. Whitehead (Washington, D.C.) for arranging a loan of West Indian specimens of *Gabronthus* from USNM, M. C. Thomas (Gainesville), P. M. Choate (Gainesville), W. E. Bradshaw (Eugene) and W. L.

Bidlingmayer (Vero Beach) for giving me specimens they had collected in Florida. P. M. Hammond (London) kindly confirmed the identity of New World *G. mgogoricus* by comparison with African specimens in the British Museum (Natural History). L. H. Herman (New York) admitted lack of New World *Gabronthus* specimens in the collection of the American Museum of Natural History. A. Smetana (Ottawa) and R. E. Woodruff (Gainesville) reviewed the manuscript and suggested improvements. J. R. Rey (Vero Beach) translated the abstract into Spanish. The author is a Research Associate of the Florida State Collection of Arthropods, Gainesville, Florida. University of Florida Institute of Food and Agricultural Sciences, Journal Series No. 4749.

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A NEW *PARATRECHINA* (HYMENOPTERA: FORMICIDAE) FROM MACHU PICCHU, PERU

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ABSTRACT

Paratrechina burgesi n. sp. is described from 2 collections of workers from the vicinity of the Machu Picchu ruins. It is the first known species of *Paratrechina* with a reddish head and mesosoma and a black gaster, a color pattern common in some other ant genera.

RESUMEN

Paratrechina burgesi sp. nov. se describe de dos colecciones de obreras colectadas en la vecindad de las ruinas de Machu Picchu. Representan los primeros ejemplares de una especie de este género que tiene la cabeza y el mesosoma rojizos y el gáster negro, un tipo de coloración común en algunos otros géneros formícidos.

Mr. Richard Burges of the USDA Imported Fire Ant Project in Gainesville, Florida returned from a trip to Peru with specimens of some of the more conspicuous surface-foraging ants from Machu Picchu. Among these were 3 workers of a striking, bicolored *Paratrechina,* quite distinct from any described South American species of the genus. Later I found 11 workers of this ant at Harvard's Museum of Comparative Zoology (MCZ) collected by Dr. William L. Brown, Jr. at the same locality. My present research is a revision of the North American *Paratrechina.* I feel that this unusual Andean species should be described now, while I have the MCZ specimens on loan. This will add to the knowledge of the fauna of a region that is, at best, poorly known myrmecologically.

METHODS AND TERMINOLOGY

Point-mounted specimens were measured at 50X (eye measurements at 80X) with an ocular micrometer, and the measurements were converted to the nearest 0.01 mm equivalent. Measurements and setal counts taken were as follows:

HL —head length in full face view from posterior margin of head to anterior margin of clypeus.
HW —maximum width of head in full face view.
EL —maximum diameter of compound eye.
SL —straight line distance from basal collar of scape to its terminus.
PW —maximum width of pronotum.
WL —length of mesosoma (thorax plus propodeum) from anterior edge of pronotum (not including anterior flange) to posterior corner of metapleuron.

FL —length of fore femur.
SM —number of erect macrochaetae on scape.
PM —number of erect macrochaetae on pronotum, left of sagittal plane.
MM—number of erect macrochaetae on mesonotum, left of sagittal plane.

In addition the following indices were calculated:

Cephalic Index: $\frac{HW \times 100}{HL}$

Ocular Index: $\frac{EL \times 100}{HL}$

Scape Index: $\frac{SL \times 100}{HL}$

Femoral Index: $\frac{FL \times 100}{HL}$

SI ("SI_2" in the terminology of Ward 1980) is used here as the only indicator of scape length following Snelling (1976). This index is a more practical measure of the relative length of the scape for this genus.

Paratrechina workers have 2 major types of setae. The larger type is usually brown to black in color, erect and finely barbulate. The barbules are readily discernible at 200X. The smaller setae are brown to whitish, closely appressed to the body surface and simple. Following traditional terminology, the 2 hair types are, when considered collectively, referred to as pilosity and pubescence, respectively. The individual hairs comprising the pilosity are called macrochaetae (after Emery 1906). There is no currently acceptable term for the setae comprising the pubescence. Buren (1968) used the designation "pubescent hairs" in an attempt to make up for this deficiency, but his term is not adopted here.

Paratrechina burgesi Trager, NEW SPECIES
Fig. 1-4

MATERIAL STUDIED: PERU, Machu Picchu, 2600-2800 m, 28-II-1967-1-III-1967, William L. Brown, Jr., #H-176, 1 worker holotype and 10 paratypes. Same locality, on path near ruins, 8-V-1982, Richard J. Burges, 3 worker paratypes.

WORKER: *Diagnosis*: A medium-sized, bicolored, shiny, terrestrial species. The head and trunk are light brownish red and the gaster piceous brown. The body is largely free of pubescence and the integument is smooth and shining. Pilosity long and conspicuous on scapes, head and thorax, the distal 1/4 to 1/2 of the 8 largest thoracic macrochaetae strongly curved or bent anteromesad. This species does not closely resemble any other New World *Paratrechina.*

Description: Holotype worker: HL 0.80; HW 0.68; SL 1.00; PW 0.47; WL 1.00.

Head (Fig. 1): Longer than broad, CI 85, sides distinctly convex; occipital border weakly convex, scape about 1¼X longer than head, SI 125; head about 4½X as long as eye, EL 0.17, OI 21, mandible with 6 teeth arrayed as in Fig. 2.

Mesosoma (Fig. 3): In profile, pronotum weakly convex; mesonotum flat;

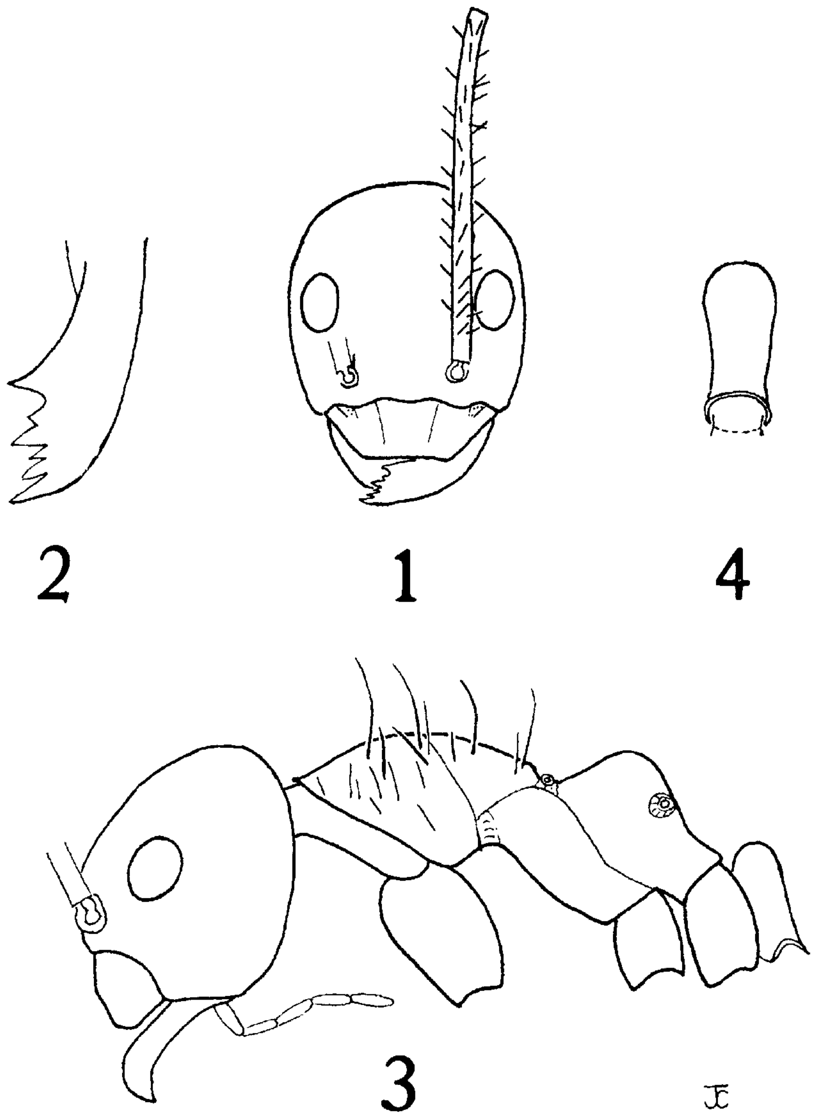

Fig. 1-4. *Paratrechina burgesi* Trager, worker (1) head, dorsal view; (2) left mandible; (3) lateral view, only promesonotal pilosity shown; (4) petiole, rear view.

tops of metathoracic spiracles somewhat below a line running through the mesonotal profile; propodeum strongly convex, notably higher in profile than promesonotum; legs rather long, FL 0.81, FI 101; these last 2 features reminiscent of the form of *P. caeciliae* Forel, to which this species does not otherwise appear closely related.

Petiole: In profile (Fig. 3), blunt and evenly rounded dorsally; from behind (Fig. 4), straight-sided and slightly wider dorsally than at base, dorsum distinctly convex.

Vestiture: Cephalic pubescense fine, not readily visible at below 30X and limited to patches behind the eyes extending to the rear border; absent on pronotum; fine whitish pubescence present on nesonotum and adjacent parts of mesopleura and metanotum, and on dorsal face of propodeum; petiole and gaster without pubescence. Numerous curved blackish macrochaetae on dorsum of head, those on the rear border somewhat longer; macrochaetae quite numerous (for the genus) on promesonotum: PM 14, MM3, the 8 largest of the promesonotal hairs 2X as long as any others on the thorax and curved or bent anteromesad over the distal 25-50% of their length. The antennae and legs densely pubescent, femora with 2 or 3 rows of evenly spaced macrochetae on the convex outer surface; scape pilosity abundant for the genus: SM 41.

Color: Scapes, head, thorax and coxae light brownish red; funiculi, legs, propodeum and petiole somewhat darker; anterior 2/3 of first tergite dark brown, remainder of gaster piceous.

Sculpture: Some weak punctation on head and pronotum obscures shininess only slightly. Remainder of sclerites smooth and strongly shining, except at tip of gaster where there is heavy punctation on the rear border of the 4th gastral tergite and sternite and the entire 5th tergite and sternite.

Variation: HL 0.70-0.84, HW 0.61-0.76, SL 0.92-1.04, PW 0.44-0.53, WL 0.90-1.13, FL 0.71-0.86, CI 85-92, SI 123-134, OI 20-23, FI 97-105, SM 37-44, PM 9-16, MM 2-6. Other than in measurements, all specimens studied fit closely the description of the holotype, except that the 2 largest individuals have a slightly concave rear border of the head. In some individuals, the larger thoracic hairs are nearly straight. The Burges specimens yield the upper end of the above ranges of measurements and are lighter colored.

REMARKS

Mr. Burges (Pers. comm.) saw more specimens of *P. burgesi* running about in full daylight. The bright bicoloration of this species is very unusual for the genus.

The holotype and 3 paratypes on the same pin will be deposited at the Museu de Zoologia, Universidade de São Paulo, Brasil. The other paratypes collected by Brown will be returned to MCZ. The 3 paratype specimens collected by Burges will be deposited in the author's personal collection, the Florida State Collection of Arthropods in Gainesville, and the Los Angeles County Natural History Museum.

ACKNOWLEDGEMENT

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ACOUSTICAL SIGNALS OF PASSALID BEETLES: COMPLEX REPERTOIRES

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ABSTRACT

Adult passalids produced sounds of 7 basic structural types in at least 13 different behavioral contexts. A given type in a particular behavioral context may be termed a "signal". A total of 31 signals were recorded from 57 species. The presence of the same basic signals in both New World tribes suggests an early origin of the fundamental repertoire. The 14-signal repertoire of *Odontotaenius disjunctus* (Ill.) is larger than previously known for any arthropod and more extensive than those of many vertebrates. The large repertoire is associated with a high level of sociality. *Dendroctonus* beetles, similarly highly social, also have a large repertoire with some signals resembling those of passalids. Convergence in sound signals and social behavior may derive from occupation of similar microhabitats (tree trunks).

RESUMEN

Adultos de Passalidae produjeron sonidos de siete tipos estructurales básicos en por lo menos 13 contextos diferentes de comportamiento. Un tipo dado de sonido en un contexto particular se llama una "señal". De 57 especies se grabaron 31 señales. La presencia de las mismas señales básicas en ambas tribus del Nuevo Mundo sugiere un origen antiguo del repertorio fundamental. El repertorio de *Odontotaenius disjunctus* consta de 14 señales, y es más grande que los previamente conocidos para cualquier artrópodo o aún para muchos vertebrados. El repertorio extensivo está con un alto nivel de socialidad. Los coleópteros *Dentroctonus* también tienen un alto nivel de socialidad asociado con un repertorio acústico muy desarrollado, con ciertas señales parecidas a las de los pasálidos. La convergencia entre señales auditivas y comportamiento social de estos dos grupos puede ser derivada de la ocupación de microhabitates parecidos (troncos de árboles).

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Abstract

Adult passalids produced sounds of 7 basic structural types in at least 13 different behavioral contexts. A given type in a particular behavioral context may be termed a "signal". A total of 31 signals were recorded from 57 species. The presence of the same basic signals in both New World tribes suggests an early origin of the fundamental repertoire. The 14-signal repertoire of *Odontotaenius disjunctus* (Ill.) is larger than previously known for any arthropod and more extensive than those of many vertebrates. The large repertoire is associated with a high level of sociality. *Dendroctonus* beetles, similarly highly social, also have a large repertoire with some signals resembling those of passalids. Convergence in sound signals and social behavior may derive from occupation of similar microhabitats (tree trunks).

Resumen

Adultos de Passalidae produjeron sonidos de siete tipos estructurales básicos en por lo menos 13 contextos diferentes de comportamiento. Un tipo dado de sonido en un contexto particular se llama una "señal". De 57 especies se grabaron 31 señales. La presencia de las mismas señales básicas en ambas tribus del Nuevo Mundo sugiere un origen antiguo del repertorio fundamental. El repertorio de *Odontotaenius disjunctus* consta de 14 señales, y es más grande que los previamente conocidos para cualquier artrópodo o aún para muchos vertebrados. El repertorio extensivo está con un alto nivel de socialidad. Los coleópteros *Dentroctonus* también tienen un alto nivel de socialidad asociado con un repertorio acústico muy desarrollado, con ciertas señales parecidas a las de los pasálidos. La convergencia entre señales auditivas y comportamiento social de estos dos grupos puede ser derivada de la ocupación de microhabitates parecidos (troncos de árboles).

Passalids are large (body length 9 to more than 100 mm), primarily tropical beetles that live in tunnels in rotting wood (Schuster 1978). They produce sounds by rubbing 2 spinose areas on the sixth abdominal tergite against the metathoracic wings (Babb 1901, Reyes-Castillo 1970). That sound production is an important aspect of the beetle's behavior and not just incidental is suggested by the presence in some species of wings that are reduced to thin straps enlarged distally. These wings are useless for flight but retain the stridulatory function (Reyes-Castillo 1970). The larvae produce sounds by scraping the reduced metathoracic legs against a file on the mesothoracic coxae (Reyes-Castillo and Jarman 1980).

This paper summarizes the passalid acoustical repertoire and relates this repertoire to what is known concerning sound repertoires of other Coleoptera. Relatively little is known concerning sound repertoires of insects outside the Orthoptera, Homoptera, and Hemiptera. The only other beetle repertoires studied comparatively have been those of Scolytidae (Barr 1969), Hydrophilidae (Ryker 1976), and Cerambycidae (Michelsen 1966). Furthermore, none of the groups mentioned, except perhaps the Scolytidae, has members with the high level of social behavior found in Passalidae (Schuster and Schuster, unpubl.). Study of the acoustical repertoire of passalids, therefore, should be particularly valuable in elaborating the interrelation of communication and social behavior.

Materials and Methods

Logs were carefully dissected in the field (Peru, Colombia, Ecuador, Panama, Costa Rica, Guatemala, Belice, Mexico, U.S., Dominican Republic and Puerto Rico, principally) to determine which passalids were found in the same tunnel system. Each such group was caged separately in a terrarium or in a large (15 cm x 2 cm) petri dish. These were kept in my home in places which would maximize the chance of observing relatively rare behavior such as courtship or aggression. One method effectively stimulating such behavior was to introduce other passalids that had been isolated for a week or more into these petri dishes. Sounds could easily be recorded by placing a microphone near the dish. Ambient temperature was measured for each recording. Sounds were recorded on various tape recorders (Schuster 1975a), including a Sony TCN-767 cassette recorder for the Guatemalan specimens. Variation in tape speed was less than 5%. Tape analysis was done with a Kay Electric Co. Sonagraph audiospectrograph. Sounds were played into the Sonagraph at original tape speed. The Sonagraph voltage meter was kept at a level of —5 or below. At least 1, and usually many more, audiospectrographs were made and analyzed for each sound type of each species of beetle.

Field monitoring of logs occupied by *Odontotaenius disjunctus* (Illiger) in the United States and by *Passalus affinis* Percheron in the Dominican Republic was done by placing a microphone against the log. Logs chosen for field studies were small (7.5 cm to 20 cm dia. x 50 cm to 120 cm long) to facilitate log monitoring and tracing tunnel systems subsequent to monitoring. Once selected, the undisturbed log was monitored for spontaneous sounds; then a single beetle was introduced into the entrance of a passalid tunnel present in the log. The introduced beetle had been previously marked by engraving an identification number on the pronotum with an insect pin.

All 9 of the introduced beetles had been collected within 2 weeks of introduction, 5 on the same day they were introduced. All were handled only with gloves and forceps. After monitoring, tunnel systems were completely traced, all passalids collected, and the adults sexed. Field temperatures were measured in the air next to the upper surface of the log in the shade because it was impossible to locate a measuring device closer to an undisturbed passalid. Temperatures inside different parts of a shaded log will vary from the air temperature by as much as 6°C, depending on the time of day, with the air temperature changing much faster than the log temperature. This was determined in separate observations by use of a Bailey Instrument Co. BAT-4 Thermocouple indicator and 3 thermocouple probes.

RESULTS

Recordings were made of at least 1 kind of sound from 57 species in 13 different behavioral contexts. Species for which sounds were produced only in the disturbance context are not listed in Table 1.

Passalid sounds may be described in terms of pulses, bars, and phonatomes. The first 2 terms depend only on sound structure, whereas the latter requires knowledge of how the sound is produced. A pulse is a "wave train isolated or nearly isolated in time (discrete) when viewed with an oscilloscope" (Morris and Pipher 1972). A bar consists of a pulse or pulse train isolated from other sound by silences greater than 0.005 sec at 26°C (Fig. 1). Bars are usually the smallest unit of a passalid sound that a human hears distinctly. A series of bars produced at a constant rate with bars of approximately equal duration forms a simple bar train; at a varying rate and/or

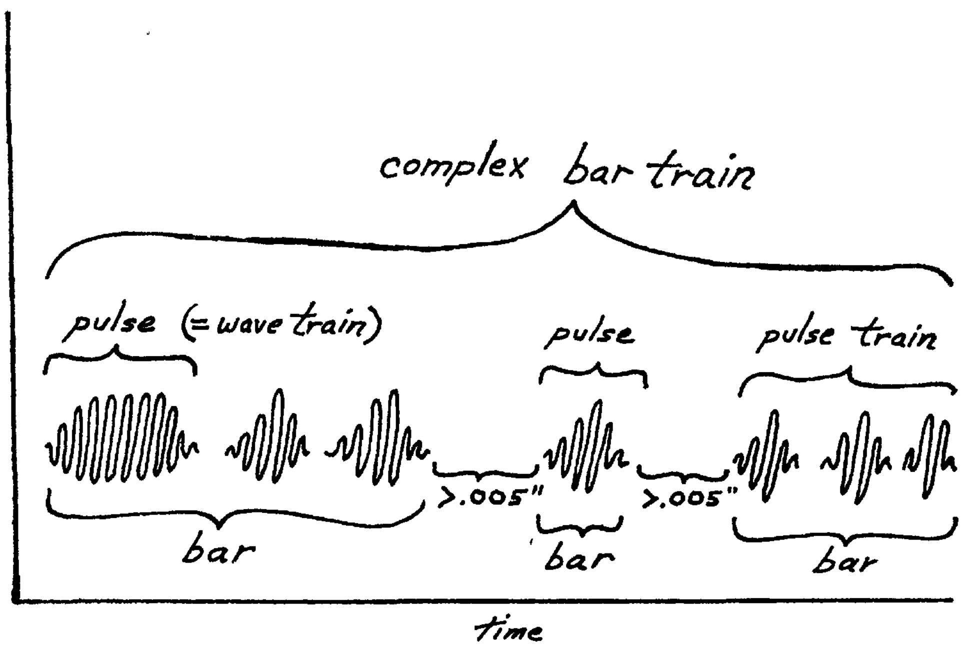

Fig. 1. Illustrated terminology of passalid sound units. A pulse may be produced by a single tooth-strike of the stridulatory apparatus; however, some pulses are apparently wave trains that are run together, produced by more than one tooth strike.

with bars of unequal duration, a complex bar train. The silence between bars in a bar train is usually less than 1 sec at 26°C, maximally 2 sec. A phonatome, in the sense of Walker and Dew (1972) and Leroy (1966), is the sound produced by a complete cycle of movement of the stridulatory apparatus (the abdomen, in adult passalids). Passalid sounds apparently contain no significant energy at ultrasonic levels; most energy is below 16000 HZ (Schuster 1975a).

I recognize 7 structurally distinct sound types produced by passalids (Fig. 2). Examples of actual audiospectrograms of each type are given in Schuster (1975a). These types are defined in the following key to adult passalid sounds at 26°C adapted from Schuster (1975a):

1. Bars longer than 0.06 sec; phonatome consists of 1 bar .... TYPE A
1′. Bars shorter than 0.06 sec; phonatome consists of 1 or more bars 2
2(1′). Complete sequence (all sounds produced in a given behavioral context) consists of 1 bar, or a series of bars produced in an irregular pattern .... TYPE D
2′. Complete sequence of sounds consists of a series of bars produced in a regular pattern 3
3(2′). Sequence composed of paired units, each unit (a bar or bar train) less than 0.05 sec long and interpair silences greater than 0.8 sec .... TYPE F
3′. Sequence composed principally of unpaired units, ocassional paired units not as above 4
4(3′). Phonatome consists of 1 bar; sequence a simple bar train .... TYPE B
4′. Phonatome consists of more than 1 bar; sequence a complex bar train 5
5(4′). Eighty percent or more of bars longer than 0.01 sec .... TYPE C
5′. Eighty percent or more of bars shorter than 0.01 sec 6
6(5′). End of phonatome with 2 or more bars longer than 0.01 sec .... TYPE G
6′. End of phonatome with at most 1 bar longer than 0.01 sec .... TYPE E

Interspecific and intraspecific variation in sound types does exist but variation of a given sound type falls within the range of variation given in the key. One of the greatest interspecific variations of a given sound type is illustrated by the exceptional Type C sound produced by *Odontotaenius zodiacus* (Truqui) during aggression. Its phonatome is 0.31 to 0.41 sec long at 25°C and consists of 15 to 25 closely spaced bars. It has been heard on various occasions produced by at least 3 males.The 13 other species known to produce Type C sounds during aggression exhibit phonatomes lasting 0.09 to 0.39 sec at 25°C with from 4 to 14 bars/phonatome. Their bar production rate is less than 0.67 of that of *O. zodiacus*. In spite of being so different from Type C sounds produced by other species these of *O. zodiacus* are still easily recognized, even by ear, as Type C sounds.

A given sound type in a given behavioral context forms an acoustical signal. The same basic signal may occur in various species, e.g., most passalids make a Type A disturbance signal (Schuster 1975a). Previous workers have described 7 acoustical signals for the family (Alexander et al. 1963, Baker 1971, Schuster and Schuster 1971, Meyer-Rochow 1971). These plus the ones I have observed now total at least 31 signals (Table 1). This

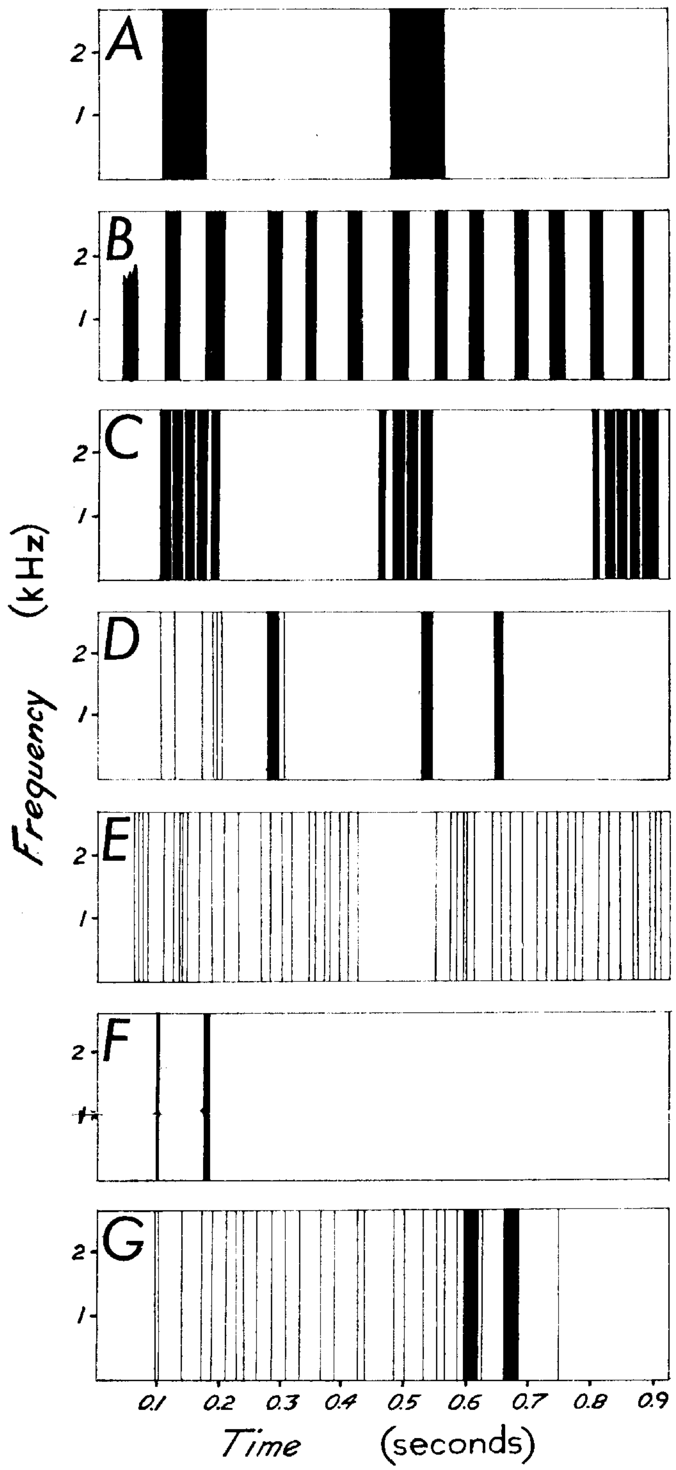

Fig. 2. Sound types produced by Passalidae. Semi-diagramatic drawings of audiospectrograms: Type A—(female courtship signal, 30°C), Type B—(female aggressive signal, 29°C), Type C—(male courtship initiation signal, 29°C) all *Passalus punctatostriatus;* Type D—(mild aggressive signal, 30°C), Type E—(male aggressive signal, 30°C) both *P. punctiger;* Type F—(post-aggression signal during "push-ups", 25½°C) *P. convexus;* Type G—(signal produced while feeding alone, 28°C) *P. punctiger.*

TABLE 1. SOUND TYPES OBSERVED IN 13 BEHAVIORAL CONTEXTS FROM 32 SPECIES OF THE 2 TRIBES OF NEW WORLD PASSALIDAE. THE BEHAVIOR CONTEXTS ARE: 1) COURTSHIP INITIATION; 2) COURTSHIP MALE ROLE; 3) COURTSHIP, FEMALE ROLE; 4) POST-COPULATION; 5) STRONG AGGRESSION, MALE AGGRESSOR; 6) STRONG AGGRESSION, FEMALE AGGRESSOR; 7) STRONG AGGRESSION, AGGRESSEE; 8) MILD AGGRESSION; 9) POST-AGGRESSION PUSH-UPS; 10) ALONE, FEEDING; 11) ALONE, WALKING; 12) ALONE, INACTIVE; 13) DISTURBANCE. PARENTHESES INDICATE THAT THE SOUND IS RARE, NOT ALWAYS OCCURRING IN THAT BEHAVIORAL CONTEXT; — = NO SOUND; * = SOUND OBSERVED IN INTERSPECIFIC AGGRESSION; # = SOUND PRODUCED BY FEMALE. FOR DESCRIPTION OF SOUND TYPES SEE FIG. 1. FOR MORE PRECISE CHARACTERIZATION OF BEHAVIORAL CONTEXTS SEE SCHUSTER (1975a) AND SCHUSTER (1975b).

Species	Behavioral Contexts												
	1	2	3	4	5	6	7	8	9	10	11	12	13
PASSALINI													
Passalus (*Pertinax*) *inops*											(B)		A/CB
P. (*P.*) *affinis*	C	A		A	CE	BE	A						A
P. (*P.*) *caelatus*	C	A											A(C)(F)
P. (*P.*) *convexus*	C	A	A			B		A	F			E	A
P. (*P.*) *dominicanus*							A				(B)		A
P. (*P.*) *punctatostriatus*	C	A	A		C	B							AB
P. (*Mitrorhinus*) *spinifer*	C	A										E	AB
P. (*Passalus*) *coniferus*	C	A	A		C								A
P. (*P.*) *elfriedae*	C	A			C								A
P. (*P.*) *interruptus*	C	A			C	E*							A
P. (*P.*) *interstitialis*						(E)	(B)*						AB
P. (*P.*) *jansoni*						E*							A
P. (*P.*) *punctiger*	C	A	A	A	CE(B)			DE		G		D	A
P. (*P.*) near *toriferus*	C	A			E*	E*							A
Spasalus crenatus					C								A(C)
PROCULINI													
Chondrocephalus sp. n.	C	—	—										A
C. granulifrons	C		(A)										A
Popilius eclipticus	C	C	A					E			B		

TABLE 1 (Continued)

Species	Behavioral Contexts 1	2	3	4	5	6	7	8	9	10	11	12	13
P. haagi	C	A			C								A
Vindex sculptilis	CB#	B	—										A
Proculejus brevis					C			E					AB
Petrejoides sp. n.	C	A			C	B							A (C)
Heliscus sp. n.?					C								A
Oileus rimator	CB#	—	—	A	C	B							A
O. sargi	CB				C								A
Odontotaenius zodiacus	C	—	(A)	CB	C	C					(B)		A (C)
O. striatopunctatus	—	—	—		CE	B (C)		D					AB
O. disjunctus	C	A	A	ADE	CE	BE	A	D			(B)	D	A
Verres corticicola	C	—	(B)									D	A
V. hageni	C	—	—	A	C			D				D	A
Veturius platyrhinus								(D)					A
Publius agassizi	CAA#	—	—		C								A

total does not include larval acoustical signals, present in all species. For *Odontotaenius disjunctus* (Ill.) (formerly *Passalus cornutus* Fabr. and *Popilius disjunctus* Illiger, the common passalid of the Eastern U.S.), I have observed 5 sound types in 11 contexts, for a total of 14 different signals, the most known for any passalid species.

Discussion

Adult passalid acoustical signals can be arranged in 4 general behavioral categories: 1) mating sequence, 2) aggression, 3) disturbance, and 4) other solo, i.e., signals produced in other contexts when not contacting another individual.

The mating sequence consists of 4 stages: 1) courtship initiation, 2) courtship, 3) copulation, and 4) post-copulation (Schuster 1975b). Copulation is not listed in Table 1 because sounds normally do not occur during this stage. Courtship-initiation and post-copulatory sounds are, in most cases, produced by the male. Females of some passalid species produce an acoustical courtship signal. Cerambycidae (Michelsen 1966) and Scolytidae (Wilkinson et al. 1967) are the only Arthropoda previously known to produce acoustical female courtship signals.

Aggression may be categorized as either strong or mild (Schuster 1975a). In the former, either sex may aggress with behavior essentially the same, but sound type produced differing between the sexes. The aggressee sometimes produces a signal which is apparently not sex dependent. Mild aggression is also apparently not sex dependent. In one species, *Passalus convexus* Dalman, a characteristic post-aggression signal occurred.

Disturbance sounds may be elicited by manipulating or blowing on a beetle. In nature, they are produced when the beetle is attacked by a predator and, at least in the case of attack by crows (Buchler et al. 1981), have a deterrent function. They may be homologous to the signal produced by the aggressee mentioned above.

Sound is produced in contexts not directly related to mating, aggression, or disturbance. It is occasionally heard when the beetle is not in direct contact with another individual, while it is feeding, walking, or inactive.

On the basis of acoustical signals, New World passalids may be divided into two groups: species with, and species without, a male courtship signal (Table 1). The species that lack the signal are all members of the New World tribe Proculini, but other Proculini and all Pasalini in which courtship has been observed possess the male courtship signal. This implies that, since the Proculini may be derived from the pantropical Passalini, the acoustical courtship signal was secondarily lost in some Proculini.

The presence of similar signals in members of both tribes of the subfamily Passalinae suggests an early evolution of the major components of the acoustical repertoire. Acoustical signals of the Old World subfamily Aulacocyclinae, are virtually unknown.

The interspecific similarity of passalid acoustical signals is in contrast to the variety found in some insect groups. For example, in Orthoptera and Cicadidae, acoustical calling signals are the primary means of long-distance sex-attraction. The development of species-specific differences in such signals is selectively advantageous in areas of sympatry because they will bring together only conspecifics. In Passalidae, acoustical calling signals are unknown. Many do have courtship signals, however, and it has been postulated that, in closely related species together occupying restricted niches (e.g., dung, rotting logs), courtship signals, rather than calling signals, should evolve toward species-specificity due to the high probability of chance encounter between males and females of different species (Alexander et al. 1963). In Passalidae, up to 10 species may occupy the same rotting log (Luederwaldt 1931), yet courtship-initiation and courtship signals (as well as other signals) appear similar among various species, at least in being composed of the same basic sound types (Types C and A, respectively, being the most common). However, I have never found the tunnel systems of 2 species definitely interconnecting, even though approaching within 1.5 cm of each other. Sound might function in preventing beetles from tunneling into areas occupied by other species (and conspecifics?), similar to what apparently occurs intraspecifically in *Dendroctonus* beetles (Scolytidae) (Rudinsky and Michael 1973). That interspecific recognition occurs without sound mediation when passalids are in direct contact is suggested by strong, but silent, aggression in 0.5 of 14 laboratory mixing experiments in which aggression occurred (Schuster 1975a). Intraspecific aggression is usually accompanied by sound.

In nature, pheromones may play an important role in interspecific recognition. *Dendroctonus* use both sound and pheromones in communication. Nothing is known concerning passalid pheromones, though I have noted a distinct odor associated with *O. disjunctus*, *Verres hageni* Kaup, *Proculus mniszechi* (Kaup), and *Veturius platyrhinus* (Westwood).

An interesting example of convergent evolution is seen in certain structural similarities of passalid signals with those of *Dendroctonus*, a genus of wood-inhabiting beetles with a high level of social behavior and a large sound repertoire. In *D. pseudotsugae* Hopkins and *D. ponderosae* Hopkins, as in passalids (and many other organisms), courtship begins with behavior quite similar to aggresion, then switches to the decidedly different courtship behavior (Rudinsky and Ryker 1976, Ryker and Rudinsky 1976). The sounds also reflect this change. During aggression and courtship-initiation, males of *Dendroctonus* and Passalidae produce an interrupted sound composed of distinct subunits (Type C in Passalidae, Fig. 1). Switching to courtship, the male changes its sound type to 1 without distinct subunits, in both Passalidae (Type A, Fig. 1) and *Dendroctonus* (Ryker and Rudinsky's uninterrupted chirp). In certain crickets, aggressive signals and courtship *interruption* signals are similar (Alexander 1962); on passing to courtship, a structural change occurs, but it is nor parallel (interrupted to uninterrupted sounds) to the changes occurring in Passalidae and *Dentroctonus*. The similarity in courtship between Scolytidae and Passalidae extends to copulation; they are the only beetles known to copulate venter to venter (Schuster 1975b).

Presumably, the high level of sociality and similar mating positions of passalids and some scolytids are adaptations to the similar concentrated resource microhabitat they inhabit (tree trunks) (Wilson 1971). Social insects are known for their elaborate communication and advanced subsocial insects tend to have advanced repertoires e.g., *Anurogryllus muticus* (now called *A. arboreus*), the cricket with the greatest number (6) of acoustical signals (Alexander 1962) is also highly subsocial (West and Alexander 1963).

Alexander (1966) stated that *A. muticus* possesses "a greater variety of acoustical signals than is known for any other kind of insect, or for any fish, amphibian, or reptile, and even many birds". Despite differences in our respective ideas as to what constitutes a given signal, it appears that the passalid *O. disjunctus* has the largest acoustical repertoire known for a species of arthropod. This advanced repertoire is correlated with the highest degree of social behavior known outside the Isoptera and Hymenoptera in which passalids help their parents in the care of sibling pupal cases (Schuster and Schuster, in preparation).

End Notes

I thank T. J. Walker and L. B. Schuster for criticisms of the manuscript, all the many people who have helped me collect passalids and P. Reyes-Castillo for aid in species determinations. I am grateful to the following people and organizations for the hospitality, facilities, support and research opportunities they provided: P. Reyes-Castillo; M. and B. Robinson and The Smithsonian Tropical Research Institute; W. and M. J. Eberhard; B. MacLeod; T. J. Walker; J. W. Hardy; P. Aguilar; Luis Liceras; J. C. Webb and J. Benner and the I. A. B. B. Laboratory of U. S. D. A. in Gainesville, Florida; Alcoa Exploration Company; University of Mexico Biological Station; Universidad Nacional Agraria de la Selva, Tingo María, Perú; University of Florida; U. S. Peace Corps-Perú; Organization for Tropical Studies; N. S. F.; and Universidad del Valle de Guatemala. Special thanks go to L. B. Schuster for the initial stimulus for this work and for help in all phases. Thanks to Elvira Valenzuela and María Dolores de Moreno for typing the manuscript.

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TERRESTRIAL ARTHROPODS OF NORTHWEST FLORIDA SALT MARSHES: ARANEAE AND PSEUDOSCORPIONES (ARACHNIDA)

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ABSTRACT

A description of the species of arachnids inhabiting various vegetational zones in northwest Florida salt marshes is presented. Data on qualitative abundance, habitat preference, and seasonality are given for each of 47 species collected during the 15-month study. *Sergiolus ocellatus* (Walck.) (Gnaphosidae) is reported from Florida for the first time, and the collection of *Misumenops bellulus* (Banks) (Thomisidae) is a northernmost record for the state. A new genus and species of pseudoscorpion is also reported.

RESUMEN

Se presenta una descripción de las especies de arácnidos que habitan en varios tipos de vegetación de las marísmas del noroeste de la Florida. Se incluyen datos sobre la abundancia, habitación, y occurrencia temporal de cada una de las 47 especies capturadas durante el programa de muestreo de 15 meses de duración. *Sergiolus ocellatus* (Walck). (Gnaphosidae) es reportado en la Florida por primera vez, y la captura de *Misumenops bellulus* (Banks) (Thomisidae) representa la colección más septentrional de esta especie en la Florida. Se reporta tambien la captura de varios individuos de un nuevo género ye especie de seudoescorpión.

Below we report on the species of arachnids collected during a 15-month study of the terrestrial arthropod communities of northwest Florida tidal marshes. In previous contributions we described the species of Coleoptera (McCoy and Rey 1981) and of Hemiptera-Homoptera (Rey and McCoy 1982) of these marshes. Descriptions of other arthropod groups will follow.

METHODS

The species reported here were collected between June 1975 and August 1976 during a study of the arthropod fauna of salt marshes of the St. Marks area, Wakulla County, Florida. The majority of specimens were collected via removal sweeping with standard sweep-netting methods (Southwood 1966). After sweeping the vegetation, we placed the contents of the nets inside plastic bags and returned these to the laboratory for sorting and tabulation. Representative specimens of each species were then sent to appropriate authorities for identification. The sweep-net collections were supplemented with visual sampling at irregular intervals throughout the study period.

Samples were taken monthly or quarterly at 20 sites within 4 major habitat types: 1) *Spartina alterniflora* Loisl. fringe, 2) *Juncus roemerianus* Scheele marsh, 3) *Distichlis spicata* (L) Greene meadow, and 4) halophytic shrub zone. In this area of Florida, *S. alterniflora* occurs mostly as narrow fringes bordering the coast and on the exposed surfaces of oyster bars and sand bars. In contrast, *Juncus roemerianus* forms extensive pure stands at slightly higher elevations. The halophytic shrubs occur on narrow sand levies deposited by winds and tides between the *Spartina* fringes and the *Juncus* stands and is a mixed-species community in which *Baccharis halimifolia* L., *Lycium carolinianum* Walt., and *Myrica cerifera* L. predominate. The *Distichlis* meadow is also a mixed-species community occurring in small patches above the *Juncus* marsh. The most abundant species is *Distichlis spicata*, but *Spartina patens* (Ait.) Muhl., *Borrichia frutescens* (L.) D.C., *Limonium carolinianum* (Walt.) Britt., and *Salicornia virginica* L. also are found on the same patches. McCoy and Rey (1981b) may be consulted for a more detailed description of the sampling methods and of the vegetation zones.

RESULTS

A total of 47 species belonging to 14 families was collected during the 15-month sampling period. These are listed in Table 1, along with data on their relative abundances, seasonality, and habitat preferences. This tabulation probably underestimates the number of predominantly ground-dwelling species which are less prone to be collected by sweeping.

Fifteen morphotypic species of Acarina collected are not included in the tabulation, as most have not been identified beyond family. These species are included within 8 families: Laelapidae, Phytoseiidae, Euzerconidae, Bdellidae, Caligonellidae, Trombidiidae, Passalozetidae, and Galumnidae. All were rare, except for a cosmopolitan galumnid, and a passalozetid (*Passalozetes* sp.) which was very abundant on *Juncus* on some occasions.

Of the species in Table 1, 29 were collected in the *Juncus* marsh, 23 in the *Spartina* fringes, 22 in the *Distichlis* meadows, and 23 on the halophytic shrubs. Individuals of *Sergiolus ocellatus* (Walck.) (Gnaphosidae) were collected during March, April, and May on *Spartina*, *Juncus*, and the halophytic shrubs (Table 1). These were the first Florida records for this species (D. Richman, pers. comm.). Additionally, the collections of *Misumenops bellulus* (Banks) (Thomisidae) on the shrubs during May and September represent the northernmost record of this species in Florida (D. Richman, pers. comm.). An undescribed genus and species of pseudoscorpion was collected on the *Distichlis* meadow and halophytic shrubs. This species is probably identical to one collected in the Cayman Islands, Jamaica, and the Bahamas (W. Muchmore, pers. comm.).

DISCUSSION

Barnes (1953) studied the coastal spider fauna of North Carolina and reported a total of 139 species of spiders from various localities near Beaufort, NC. In his study, however, Barnes sampled a number of habitats that are not included in the present one, either because they do not occur in our areas, or because they are found at higher elevations with much less fre-

TABLE 1. LIST OF THE SPECIES OF ARACHNIDS IDENTIFIED FROM OUR COLLECTION. LETTERS REFER TO THE 4 HABITAT TYPES: S = *Spartina alterniflora* FRINGE, J = *Juncus roemerianus* MARSH, D = *Distichlis spicata* MEADOW, B = HALOPHYTIC SHRUB ZONE. ONE ASTERISK FOLLOWING THESE LETTERS DESIGNATES THE SPECIES AS "COMMON" (3-10 INDIVIDUALS IN A SINGLE COLLECTION), 2 ASTERISKS AS "VERY COMMON" (10 + INDIVIDUALS), AND NO ASTERISKS AS "UNCOMMON" (LESS THAN 3 INDIVIDUALS).

		MONTH											
Family	Species	J	F	M	A	M	J	J	A	S	O	N	D
	PSEUDOSCORPIONES												
Cheliferidae	*Paisochelifer* sp.	J		SD	S*	S	B			S*D*	SD*	D	S
Chernetidae	*Parachernes littoralis* Muchmore	B		D			B			JB			S
	Gen. sp. nov. [nr. *Parachernes*][1]			D			B						
	ARANEAE												
Araneidae	*Acanthapeira venusta* (Banks)	JD	JS**	JS**	SD	S*D*	D	SDB	JD		J	J*S*	J*S*D
	Neoscona pratensis (Hentz)	JB	JD	JS D*B		JS*	J*BD	J*SD	JSB	DB	JSD	S	J
	Argiope trifasciata (Forskal)								J	J			
	Argiope sp.									J			
	Singa eugeni Levi								D				
	Cyclosa sp.												D
	Nephila clavipes (L.)								JD				
	gen. et sp. indet.				S								B
Lycosidae	*Pardosa* sp.		J			S							
	Pirata sp.					S							
	Lycosa sp.							J					

TABLE 1 (Continued)

		ARANEAE											
		MONTH											
Family	Species	J	F	M	A	M	J	J	A	S	O	N	D
Oxyopidae	*Oxyopes* sp. nr. *salticus* (Hentz)											DB*	
	Peucetia viridans Hentz						B						
Micry-phantidae	*Grammonota trivittata* (Banks)		S* D	JS**	SD	JS*B	JS	SB	SDB*	JS*D B**	S*D	J	JS*
	Ceraticelus sp.			D									
Thomisidae	*Misumenops bellulus* Banks		B							B			
	Misumenops sp.	B		SDB**	D	D	B	B			SD*B	JB	B*
	Tibellus sp. nr. *chamberlini* Gertsch						J						
	Tibellus sp.					J				J			
	Xysticus sp.	B										B	
	Philodromus sp.											B	
Dictynidae	*Dictyna altamita* (Gertsch & Davis)	J		J					S*			D	
Tetra-gnathidae	*Tetragnatha branda* Levi	JS*B	S**D B*	J*S* D*B	JS* DB*	J**S* D*B	J**S D*B*	J**D S**B	SB	J** S**	JS* D*	J*S* D**B*	S** J*B*
	Tetragnatha laboriosa Hentz	B*		JB*	S	J	JB*	SDB		JS** D	JS D*B	JD B**	JB*
	Tetragnatha sp.	B*		J	S	J	JB*	SDB	JS** D	JS** D*	JS DB	JD* B**	J
Theridiidae	*Dipoena* sp.			J									
Linyphiidae	*Florinda coccinea* (Hentz)						J						JS DB

TABLE 1 (Continued)

Family	Species	ARANEAE MONTH J	F	M	A	M	J	J	A	S	O	N	
Gnaphosidae	*Sergiolus ocellatus* (Walck.)			S	JB	B							
	gn. et sp. indet											S	
Clubionidae	*Clubiona littoralis* Banks				S			D	D		S	D	
	Clubiona sp.	J*								S			
	gn. et sp. indet.								D	DB	S	S	
Salticidae	*Hentzia palmarum* (Hentz)	JB			B	JB	JB	DB	JSD B**	J** B*	J*S B**	J*B	SB
	Hentzia sp.							B			B		D
	Metaphidippus galathea (Walck.)									J			
	Metaphidippus sp.							B*		SB			
	Marpissa bina (Hentz)					J		S*	S	S		J	S
	Marpissa pikei (Peckham)	D	S*D*	JS* D*	S	D	J*D*	J** SD*	JS** D*B	J*D S*	JD	J	JSB
	Marpissa wallacei Barnes	D	S		S					S*B*			
	Marpissa sp.										S		
	Eris marginata (Walck.)			D		JB*	JDB	JB	SB	B	B		DB
	Phidippus sp.								J				
	Synemosyna sp. nr. *Petrunkevitchi* (Chapin)									J			
	Synageles noxiosa (Hentz)	J			J		J	J	J	J		S	J

[1]Det. W. B. Muchmore (Univ. Rochester)

quent flooding than those considered here. Examples of these are *Uniola paniculata* and *Spartina patens* zones; a mixed herbaceous community consisting primarily of *S. patens, Andropogon littoralis, Andropogon glomeratus,* and *Panicum* sp., accompanied by a variety of composites such as *Aster* and *Eupatorium;* and *Persea-Ilex-Quercus* forests that are found immediately seaward of the climax live-oak forests of the region. If we restrict our attention to North Carolina spiders collected by sweeping the same vegetational zones as those considered in this study, then the number of species from North Carolina is reduced to 41, which is comparable to the 44 collected at St. Marks (Table 1). Eight species and 22 genera were common to the Florida and North Carolina collections.

In Florida, 10 species were collected only in the *Juncus* zone, but the other habitats had few exclusive species (3 in the *Distichlis* meadows, and 4 on the shrubs). In North Carolina, the numbers of species collected in only one of the zones under consideration were: 1 on *Juncus,* 16 on *S. alterniflora,* 1 in the *Distichlis* meadows, and 15 on the shrubs. These differences probably reflect the different zonation patterns of the 2 areas. The large number of species occurring only in the *Juncus* marsh in Florida is probably due to the fact that this plant is the only one that forms extensive stands in the area, whereas in North Carolina, *Juncus* stands may be surrounded by equally large stands of *Spartina alterniflora.*

The differences in the numbers of exclusive species on *S. alterniflora* and in the halophytic shrub zones of Florida and North Carolina have similar explanations. In North Carolina, *S. alterniflora* forms relatively large stands starting at the shoreline so that individuals moving within the *S. alterniflora* marsh will usually remain in the same habitat, except those near the patch edges. In the narrow Florida fringes, however, even routine movements may carry individuals into a different vegetation type, or out to sea. Likewise, the shrub zone in Florida is very narrow so that small movements may carry individuals into the surrounding *Juncus* or *Spartina* zones. In North Carolina, the shrub zone is broader than in Florida and occurs at higher elevations, adjacent to *Persea-Ilex-Quercus* stands and mature live-oak forests thus facilitating the recruitment of species from outside the salt marsh.

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CONTACT TOXICITIES OF TEN INSECTICIDES TO THE SUGARCANE GRUB, *LIGYRUS SUBTROPICUS* (COLEOPTERA: SCARABAEIDAE)

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ABSTRACT

Contact toxicities of 10 insecticides were measured for 3rd instar larvae of the sugarcane grub, *Ligyrus subtropicus* Blatchley. LD_{50} value and confidence interval, slope, and relative toxicity of each insecticide are presented as determined by probit analysis. The relative toxicities of the insecticides were carbofuran > fensulfothion > fonophos > isophenphos > 6 other insecticides tested. Associated field studies on the 2 most toxic insecticides, carbofuran and fensulfothion are discussed.

RESUMEN

La toxicidad por contacto de 10 insecticidas fueron medidas durante el tercer estado de crecimiento de las larvas de un escarabajo de la caña de azucar, *Ligyrus subtropicus* Blatchley. El valor LD_{50} con el intervalo de confianza, la pendiente, y la toxicidad relativa de cada insecticida son presentados con los resultados del analisis probit. Las toxicidades relativas fueron como en seguida: carbofuran > fensulfothion > fonophos > isophenphos > 6 otros insecticidas. Los estudios de campo relacionados con los dos insecticidas mas toxicos, eso es, carbofuran y fensulfothion, son discutidos.

Florida's most valuable field crop, sugarcane, is grown primarily in the Lake Okeechobee area of south Florida. Since 1971, several species of Scarabaeidae have been damaging sugarcane in south Florida. Of these pests, the white grub, *Ligyrus subtropicus* Blatchley is the species of primary economic importance (Gordon and Anderson 1981). In extreme infestations, sugarcane plants fall over due to lack of support caused by the root-feeding larvae. Currently, sugarcane growers must disc-up and replant badly infested fields or, if possible, flood fields to kill grubs (Summers 1977), since no chemical control is known for this pest in sugarcane. The only information on toxicants for *L. subtropicus* is by Reinert (1979) and concerns the insecticidal control of a grub complex, including *L. subtropicus*, found in bermudagrass (*Cynodon* x *magenissii* Hurcombe). Unfortunately, *L. sub-*

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tropicus was not analyzed separately from the overall grub complex making it difficult to evaluate the efficacy of the toxicants against this species. Reported here are the contact toxicities of 10 insecticides to the sugarcane grub, *L. subtropicus*.

MATERIALS AND METHODS

Third instar grubs of *L. subtropicus* were obtained during September 1982 through April 1983 from commercial sugarcane fields in south Florida by digging under sugarcane stools. After field collection, grubs were retained at room temperature (22°C to 25°C) in 7.56 liter plastic buckets filled with muck soil and sliced carrots for food.

Acetone-insecticide solutions (2 µl/grub) were topically applied to the lateral thorax of individual grubs with a micro-syringe. The 10 insecticides (acephate, carbofuran, ethoprop, fensulfothion, fonophos, isofenphos, lindane, monocrotophos, phorate, turbufos) were technical grade material. A preliminary screening using concentrations over 5 degrees of magnitude (0.001-10%) was made for each insecticide. Thereafter, 7 intermediate dosages in geometric progression (1x, 2x, 4x, etc.) were chosen for each insecticide so that the lowest and highest would yield ca. 0 and 100% mortality, respectively. Twenty-five grubs were tested for each of the 7 dosage levels of each insecticide. After each dosage application, 5 grubs were placed in a 19 x 13 x 8 cm high plastic pan filled with moist muck soil and sliced carrots. Grubs were then maintained in a temperature cabinet in constant darkness at 20°C along with acetone treated grubs (controls). Some insecticides continued to cause mortality up to 14 days post-treatment and, hence, 14 days post-treatment was used to record mortality. Pike et al. (1978) also noted the "slow" action of several insecticides which were topically applied on the grub, *Phyllophoga anxia* (LeConte). At the end of 2 weeks, most dead grubs were already decomposing and remaining grubs were considered dead if they did not twist their bodies in response to prodding with a pencil. Percent mortality was corrected for natural mortality by use of acetone-treated controls (Abbott 1925). The average weight of individual grubs tested was 3.28 g determined from 50 individuals weighed during different months during the study period. Data were subjected to probit analysis using the Statistical Analysis System (SAS) computer program (Barr et al. 1979). Relative toxicity (%) was determined by dividing the lowest LD_{50} obtained among the 10 insecticides by the LD_{50} of each insecticide and multiplying x 100.

RESULTS AND DISCUSSION

Table 1 presents topical toxicities, 95% confidence intervals, slopes of the dosage-response lines, and relative toxicities of the 10 insecticides to third instar grubs of *L. subtropicus*. This grub stage is present after sugarcane is harvested in the fall-winter, and would be the logical target stage for soil insecticides which are more easily applied to fields at this time. The method of topical application used in this study has been widely used to measure insecticide toxicity (e.g., Busvine 1971). Unfortunately, this method has not been used previously on *L. subtropicus* and it is therefore difficult to compare our data directly with others. However, our results are

TABLE 1. LD_{50} (μg/GRUB) FOR 3RD INSTAR WHITE GRUBS, *Ligyrus subtropicus*, TREATED WITH 10 INSECTICIDES.

Insecticide	LD_{50}	95% confidence interval	Slope[1]	Relative toxicity (%)
Carbofuran	0.67	0.38- 1.07	0.92	100
Fensulfothion	1.01	0.79- 1.22	3.10	66
Fonophos	3.31	2.06- 5.17	0.42	20
Isofenphos	3.34	2.04- 5.28	1.86	20
Monocrotophos	4.42	3.13- 7.17	1.61	15
Terbufos	5.36	4.14- 6.71	2.21	13
Lindane	6.01	3.42-11.27	0.82	11
Ethoprop	9.46	7.81-11.49	2.37	7
Phorate	21.44	15.99-28.87	1.91	3
Acephate[2]	>222.20	—	—	<1

[1]Probit analysis on log. 10 of dose.
[2]Saturated solution (11.1%) at 23°C applied at 2 μl/grub.

remarkably similar to those of Pike et al. (1978) on another white grub, *P. anxia*. The sequence of topical toxicity of 4 insecticides common to both studies was the same in that the carbofuran LD_{50} < fensulfothion LD_{50} < fonophos DL_{50} < terbufos LD_{50} (Table 1). Furthermore, carbofuran and fensulfothion produced the lowest LD_{50}'s among the insecticides tested in both studies. Both of these insecticides have been shown to be consistently effective in reducing white grub populations in various field studies. In Texas, the 2 insecticides were effective against the white grub, *Phyllophaga crinita* (Burmeister) by Teetes (1973), Fuchs et al. (1974), and Huffman et al. (1976). In Ohio, fensulfothion consistently gave excellent control of cyclodiene-resistant larvae of the Japanese beetle, *Popillia japonica* (Newman) under a wide range of conditions in turf (Lawrence and Niemczyk 1976). In Florida, both carbofuran and fensulfothion was effective against a grub complex, including *L. subtropicus*, infesting bermudagrass (*Cynodon* x *magenissi* Hurcombe) (Reinert 1970). Carbofuran and fensulfothion are moderately persistent in soil based on their biological activity (Harris 1972).

As noted earlier, no chemical control is currently known for *L. subtropicus* in Florida sugarcane partly due to difficulties in field insecticidal evaluations for the pest. In Florida sugarcane *L. subtropicus* is found mainly in muck soil (Gordon and Anderson 1981). Effectiveness of soil insecticides is reduced because of the high (>85%) organic content of the muck soil (Lilly 1956, Harris 1972). Furthermore, field evaluation of soil insecticides can only be made during the late fall to spring period after sugarcane fields have been harvested. At this time *L. subtropicus* is at its lowest field density making statistical analysis difficult. Data from this study are useful for selecting toxicants for more extensive field evaluation for *L. subtropicus* control in Florida sugarcane.

ENDNOTES

This is University of Florida, IFAS Experimental Journal Series No. 4714. Use of a trademark name does not constitute a guarantee or warranty of the product and does not imply its approval to the exclusion of other products that may also be suitable. We thank Dr. G. H. Snyder for a statistical suggestion and Dr. J. Alvarez for the Resumen translation. This work was supported in part by a grant from the Florida Sugarcane League.

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FALL ARMYWORM (LEPIDOPTERA: NOCTUIDAE) DAMAGE TO FIFTEEN VARIETIES OF SORGHUM

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ABSTRACT

Feeding damage by fall armyworm, *Spodoptera frugiperda* (J. E. Smith), among 15 sorghum varieties and correlations of this damage with 5 plant variables were measured. The population distribution of the insect on plants of one variety was also measured. Results showed significant differences in

of the product and does not imply its approval to the exclusion of other products that may also be suitable. We thank Dr. G. H. Snyder for a statistical suggestion and Dr. J. Alvarez for the Resumen translation. This work was supported in part by a grant from the Florida Sugarcane League.

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Resumen

El daño causado por el gusano, *Spodoptera fugiperda* (J. E. Smith) al alimentarse de 15 variedades de sorgo dulce y las correlaciones de dicho daño con 5 variables de la planta fureon medidas. La distribución de la población de este insecto en plantas de una variedad fue tambien medida. Con resultados mostraron diferencias significantes en el daño a las 15 variedades de sorgo. El rendimiento seco, la altura y la madurez estuvieron correlacionadas de manera significantiva con el daño a las variedades. El Brix y la sacarosa no mostraron una correlación significativa con el daño. La distribución de la poblacion de las larvas en las plantas de sorgo mostraron diferencias significantes de la distribución Poisson en la direción de la uniformidad.

In recent years, there has been interest in development of sweet sorghum (*Sorghum bicolor,* L. Moench) varieties in south Florida which can be adapted for sugar and ethanol production (Elawad et al. 1980.). The fall armyworm, *Spodoptera frugiperda* (J. E. Smith) is an insect pest which feeds readily on sweet sorghum and is also found in south Florida. Fall armyworm (FAW) infests sorghum in the whorl and heading stages and causes plants to assume a ragged appearance. When FAW densities are high, severe damage to foliage may result and growers often become concerned about possible adverse effects on yield (Henderson et al. 1966). In 1982, 15 sweet sorghum varieties were grown in south Florida to measure FAW feeding damage among the varieties. This study reports on FAW feeding damage among 15 varieties and correlations of this feeding damage with certain characteristics of the varieties. In addition, the population distribution of FAW on sorghum plants of one variety is noted and discussed.

Materials and Methods

Fifteen sweet sorghum varieties were planted on 1 April 1982 on a Pahokee muck soil (Lithic Medisaprist). A randomized complete block design having 5 replicates of each of the 15 varieties was used at the Agricultural Research and Education Center, Belle Glade, Florida. Plots were 6.1 m long by 4 rows wide (50 cm centers). Due to the high fertility of the organic soils, there was no fertilizer application. A preemergence herbicide, atrazine (3.36 kg ai/ha) and propachlor (1.12 kg ai/ha), was applied. Ten days after this application, the test location was plowed and then rotovated twice. After stand establishment, plant populations were thinned to ca. 265,000 plants/ha. Dipel® (*Bacillus thuringiensis*) was applied on 4 May at 0.56 kg ai/ha and no pesticides were used after this date.

FAW larvae were causing extensive damage to the varieties in early June. All plants at this time were in the whorl to early heading stage of development which are the usual stages for FAW infestation in sorghum (Henderson et al. 1966). FAW damage ratings were made from sorghum plants sampled from 9 June to 16 June 1982 with one replicate of each variety sampled per day. Ten plants were sampled from each of the 5 replicates of each variety for a total 750 plants. Each plant was cut at the base of the plant in the field, bagged, and stored at 5° C for later examination. The presence or absence of FAW feeding damage to each plant in each variety was noted, and the percent infestation of plants in each variety was determined from this data. Feeding damage was rated from no damage (0) to severe damage (+5) for each plant. All ratings were performed by the same person to reduce possible bias and was completed within 2 weeks after plant removal from the field.

While sampling for FAW damage, it was noted that the damage appeared less severe on taller and/or more mature varieties. Therefore, height measurements and maturity ratings were also made on each variety within 1 week of the FAW damage sampling. Height measurements and maturity ratings were taken from 10 plants randomly chosen in each replicate of each variety. Height measurements were taken from the stool base to the top visual dewlap (TVD) leaf or flowering head. Physiological maturity ratings were determined using growth stages noted by Vanderlip (1972). At harvest (1 August), whole sorghum plants from 6.1 m of the inner 2 rows were cut and weighed. Ten stalks were randomly chosen from each harvested plot, weighed (wet), and dried for 72 hours at 60° C to obtain dry and wet yields to measure dry fraction (%). Ten additional stalks were obtained at harvest and juice was extracted using a sugarcane sample mill. Aliquots of the juice were analyzed to obtain degrees brix and pol readings using a Abbe-32 refractometer and Lippich Polarizer, respectively. Percent sucrose and juice purity was calculated using brix and pol readings (Meade and Chen 1977). Correlation analyses were performed on FAW damage versus the height, maturity, brix, dry fraction, and % sucrose of the 15 varieties.

An additional test was conducted to determine the population distribution of FAW larvae on sweet sorghum plants (var. 'Rio') in a 0.202-ha field during June. Sorghum plants in this field were in a young stage of growth (30 to 60 cm high) and were supporting sufficient numbers of larvae for distribution analysis. Extreme susceptibility of early growth sorghum to fall armyworm damage has also been noted by McMillian and Starks (1967). Two hundred and fifty randomly chosen sorghum plants were cut, bagged and frozen on 23 June 1982. Thereafter, each plant was examined and the number of fall armyworm larvae/plant recorded. Results were subjected to a X^2 goodness of fit for the Poisson distribution to determine the population distribution.

Results and Discussion

In this study, there were significant differences in feeding damage by FAW larvae among 15 sweet sorghum varieties (Table 1), with one variety Richardson Sugar Red, having the least feeding damage. In screenhouse tests, McMillian and Starks (1967) also found significant differences in FAW feeding damage among 30 sorghum varieties tested. These varieties were different from those used in our study and comparisons were not possible.

There were significant correlations between FAW feeding damage and various plants variables among 15 sorghum varieties (Table 2). Plant

TABLE 1. INFESTATION OF 15 SORGHUM VARIETIES[1] BY FALL ARMYWORM LARVAE.

Variety	% Infestation	Damage Rating[2,3]
Richardson Sugar red	68	1.62 a
NC + 932	96	2.70 b
Redtop Kanday XTRA	98	2.86 bc
Conlee Agaline	90	2.96 bcd
Mn 1056	94	3.20 bcde
Mn 1500	96	3.32 cdef
Conlee NRG	92	3.34 cdef
Mn 960	90	3.42 cdef
Mn 1034	98	3.50 def
Theis	100	3.52 def
MER 717	96	3.56 ef
Mn 1048	92	3.60 ef
Mn 81 E	96	3.66 ef
Brandes	94	3.88 f
Mn 1060	94	3.88 f

[1]50 plants sampled per variety.
[2]Each plant visually rated 0 (no damage) to 5 (severe damage).
[3]Means in the column followed by the same letter are not significantly different at the 0.05 confidence level as determined by Duncan's multiple range test.

height and maturity were significantly correlated (—0.80 and —0.76, respectively) with FAW damage among varieties (Table 2). However, it is not known if more damage was inflicted on slower growing and maturing varieties, or if varieties were slower growing and maturing due to FAW damage as noted by Henderson et al. (1966). At harvest, feeding damage was also significantly correlated to dry fraction (%), but not brix nor sucrose (%).

The distribution of FAW larvae on young sorghum plants in the second field is shown in Table 3. If the larvae were randomly distributed on the plants, a Poisson distribution is expected where the variance (s^2) is equal to the mean ($\bar{x}$). However, the FAW distribution differed significantly ($p < 0.01$) from the Poisson as measured by a x^2 goodness of fit test. The variance of 0.60 is less than the mean of 0.80 larvae/plant in the direction of a more

TABLE 2. LINEAR CORRELATION OF FALL ARMYWORM FEEDING DAMAGE WITH FIVE PLANT VARIABLES OF 15 SORGHUM VARIETIES.

Variable	Regression equation[1]	Correlation coefficient	Probability[2]
Brix	y = 9.0 + 1.4X	+.45	0.09
Dry Fraction (%)	y = .21 + .02X	+.57	0.02
Height (cm)	y = 22.5 — 28X	—.80	0.0003
Maturity Rating	y = 7.1 — .92X	—.76	0.001
Sucrose (%)	y = 6.6 + .41X	+.17	0.54

[1]Equation derived from mean values from each variety, x = feeding damage in equation.
[2]Probability of null hypothesis of no correlation.

TABLE 3. FREQUENCY DISTRIBUTION OF FALL ARMYWORM LARVAE ON SORGHUM PLANTS.[1]

	Number of larvae		sorghum plant		
	0	1	2	3	4
Observed	96	114	36	3	1
Expected[2]	112.5	90	35	10	2.5

[1]250 sorghum plants (var. Rio) randomly sampled from 0.202 hectare field.
[2]Expected from Poisson distribution. A x^2 goodness of fit test showed the observed distribution differs significantly ($p < 0.01$) from the Poisson distribution.

uniform distribution which implies competition between the larvae (Southwood 1966). Reasons for the distribution are probably related to the extremely aggressive nature of the larvae towards each other (Vickery 1929) as also observed in this study.

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PRESIDENT'S MESSAGE

The Florida Entomological Society has met the challenge of the 80's with a most progressive attitude for the future. Past leadership has "opened the door" to many positive improvements, for example, encouraging broader membership within the Society; creating more avenues for communicating the business of our Society; improved sites and scientific programs for our annual meeting; offering greater opportunity for student members and improving the quality of the *Florida Entomologist* to withstand the vigorous critique of academia.

As the first President-Elect of our Society, I have had a whole year, free from program responsibilities, to observe and contemplate about the challenges that face the Society in the future. As your President in the coming year, I look forward with enthusiasm to meeting these challenges under the collective leadership of the Executive Committee.

Our success for maintaining the high standards set before us in the coming year depend on our willingness to work hard and strive for perfection. I see no need for major change or broad new programs. Rather I see a need to improve and "fine tune" all areas of responsibility within the Society. I challenge each committee chairman to carefully evaluate their projects and programs to make sure they are serving the needs of the Society. I challenge our key staff, Business Manager and Editor, to carry out their major commitments to the Society so efficiently that our reputation for high standards continues to grow.

Finally, I would like to ask every member of our Society to support our plans for the upcoming Caribbean Conference in 1985. The opportunity for exchange of scientific ideas and information among all entomologists in the Caribbean region is tremendous. Let's aggressively pursue every opportunity for making this conference a great success. Through the outstanding work of Past President Abe White, the *ad hoc* committee and its chairman, Carl Barfield, the possibility of a conference has become a reality and we are well on our way.

In closing, I would like to thank on behalf of the Society Past-President, Abe White, for the outstanding job he did this past year and for the big success of the Clearwater meeting. I look forward to working with and for each of you in the coming year—reporting our progress from time to time.

CLAYTON W. MCCOY, President
Florida Entomological Society

SCIENTIFIC NOTES

A CAGE AND SUPPORT FRAMEWORK FOR BEHAVIORAL TESTS OF FRUIT FLIES IN THE FIELD—A field cage has been used and standardized for evaluating the mating propensity and competitiveness of mass-reared fruit flies under outdoor conditions (D. L. Chambers, C. O. Calkins, E. F. Boller, Y. Itô, & R. T. Cunningham. 1983, Z. Ang. Ent. 95: 285-303). The cage, constructed from Saran® screen of 20 x 20 mesh is cylindrical with a flat floor and ceiling. It measures 2.9-m diam and 2.0-m high. Sixteen metal grommets, for guy wire attachment, are fitted exteriorly at each seam where the wall joins the top and bottom. This provides external support of the cage. Access to the cage is through a vertical zipper in the wall. In addition, the floor is fitted with a 2-way zipper that allows a host plant to be caged.

Initial quality control and behavioral tests using this cage were conducted in a Guatamalan coffee finca where the cage was supported by ropes tied to surrounding shade trees and the bottom was secured by metal stakes driven into the ground and tied to the grommets. Subsequent tests were not always conducted where suitable supporting structures (trees or other elevated objects) were present. This resulted in uneven tensions placed on the upper section of the cage causing it to bulge and sag. When cages were erected on sandy or rocky substrates, the metal stakes were not adequate to support the cage in place. Thus it became necessary to design a free-standing framework to hold the cage and to provide tie-downs that would allow the cage to be stretched uniformly in all directions, consequently eliminating folds, sags and wrinkles behind which test insects could rest.

The framework is constructed with 2.5 cm (one-inch) pipe and connections of polyvinylchloride (PVC), Schedule 40. The frame consists of 2 octagonal rings (diam 316 cm) supported by vertical pipe 220-cm long (Fig. 1). Each ring consists of 8, 45-degree connectors and 8 T-connectors interspersed by pipe 61-cm long (Fig. 2). The T-connectors accept the vertical 220-cm support pipes.

To erect the cage, it is first laid on the ground in a collapsed fashion with the ceiling on top and within the upper ring. Then heavy cord is threaded through each grommet and tied to the midpoint of each 61-cm section of the ring. When the ceiling has been stretched tight and secured, the ring is lifted and the upright supports are inserted into the T-connectors. The bottom ring is then put into position and the lower end of the uprights are inserted into the opposing T-connectors. Then the bottom of the cage is stretched and secured similarly to the ceiling. Erection of the cage and frame is easily accomplished with 2 people in about 30 min.

When erected, the cage has no folds, sags or bulges and can be easily picked up and moved by 2 people to desired areas. Because the PVC pieces fit tightly without gluing, they can be disassembled easily for transport and storage. The cost of the materials for the frame is about $82 (Gainesville, 1983). With reasonably careful handling the materials should last indefinitely. (Mention of a commercial or proprietary product does not constitute an endorsement by the USDA.) We thank F. L. Lee and S. Masuda for ideas and assistance in completing the cage support.—C. O. CALKINS AND J. C. WEBB, Insect Attractants, Behavior, and Basic Biology Research Laboratory, Agric. Res. Serv., USDA, Gainesville, FL 32604 USA.

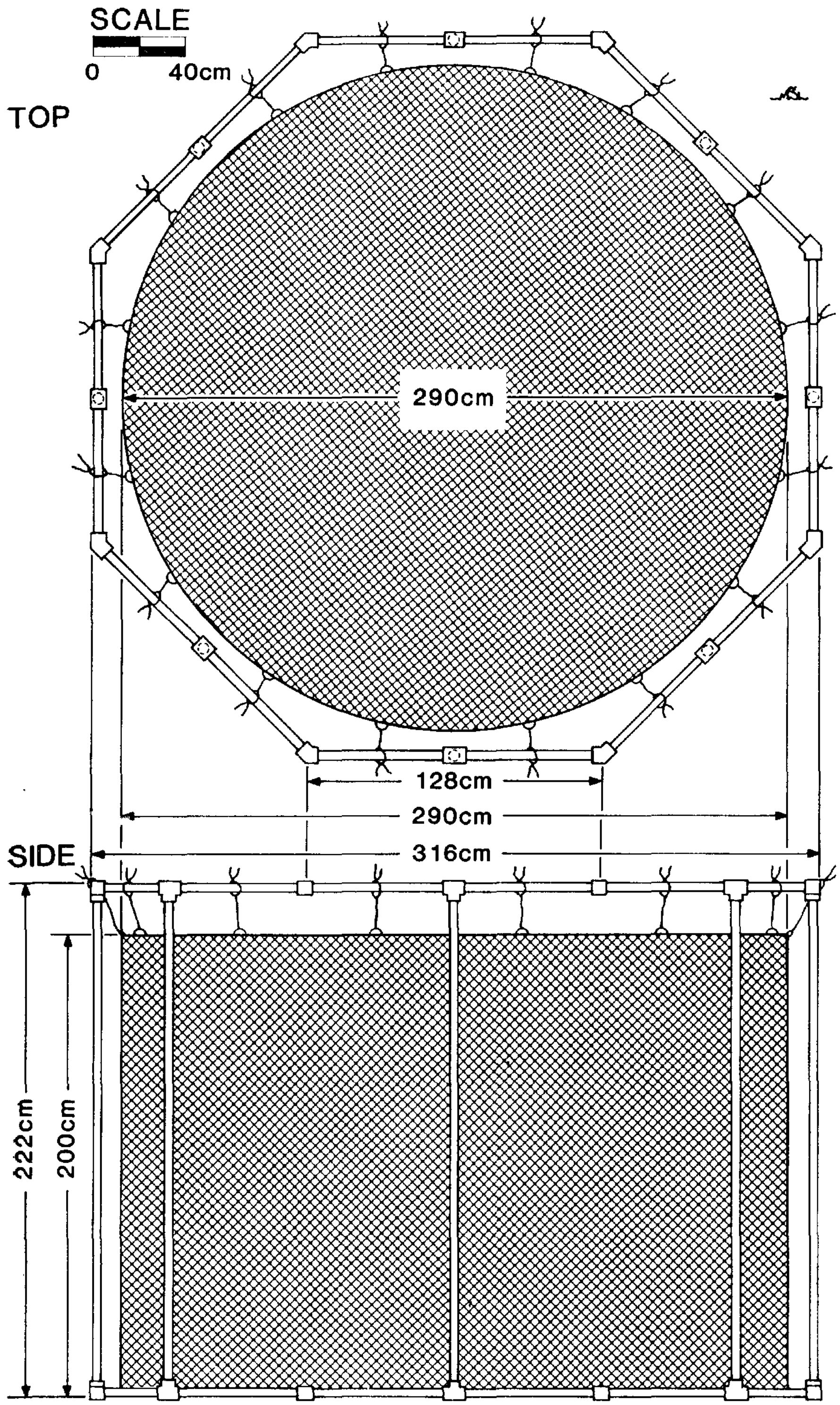

Fig. 1. Supporting frame for field cage.

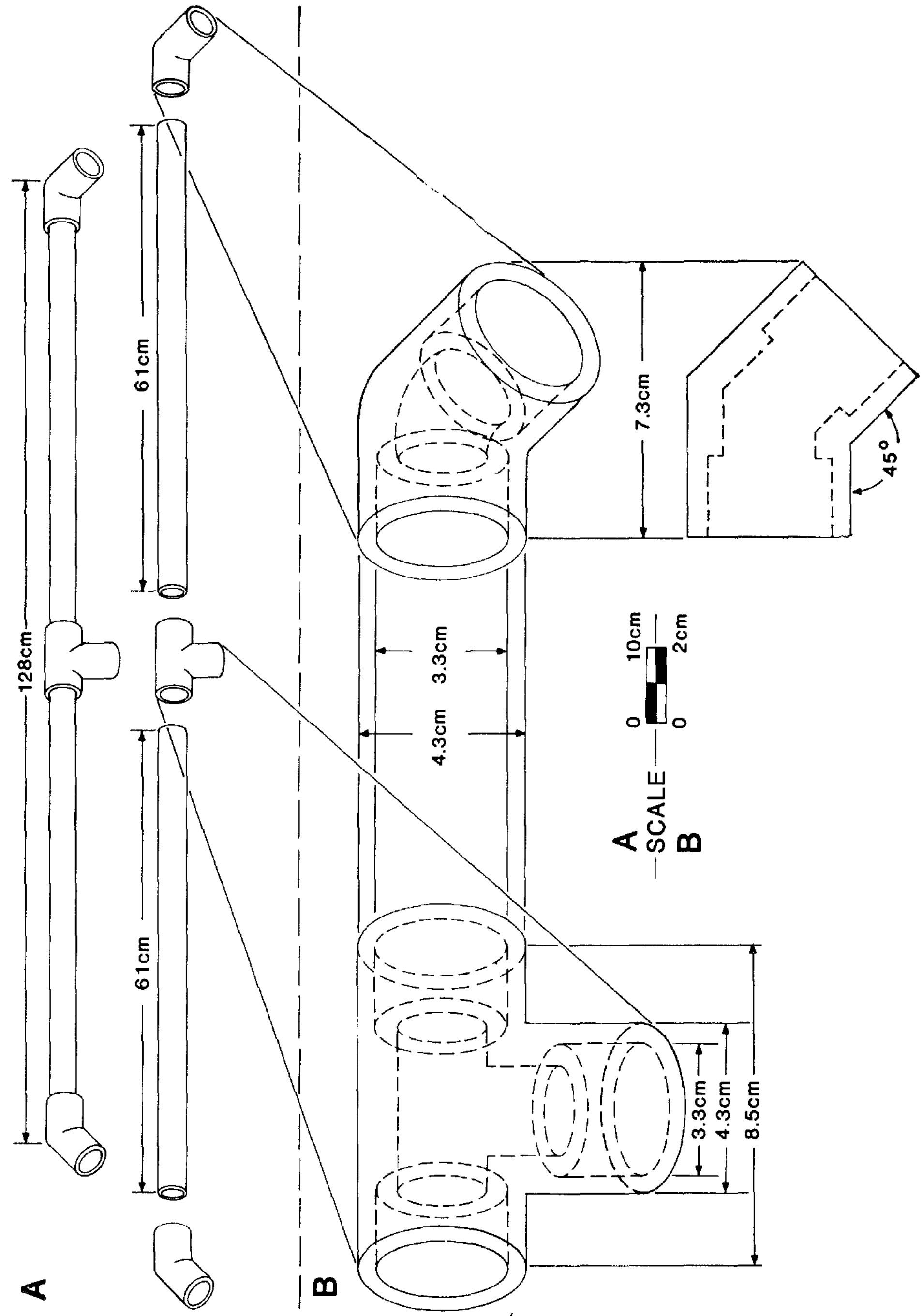

Fig. 2. Ring sections of supporting frame showing how polyvinylchloride pipe and connections are assembled.

CLONAL SPECIFICITY OF *IPS* AND *PITYOPHTHORUS* SPP. (COLEOPTERA: SCOLYTIDAE) IN A SLASH PINE SEED ORCHARD —The concept of food preference in insects is well documented in the literature, especially in terms of mono-, oligo-, and polyphagy. Further refinement occurs in host plant selection with the presence, absence, or alteration of various plant attributes, e.g., structures, phenological maturation, physiological processes, metabolic byproducts, and nutritional composition (Matthew, R. W. and J. R. 1978. Insect Behavior, J. Wiley & Sons, NY. 513 p). In the southeastern United States, members of the genera *Ips* and *Pityophthorus* are usually associated with weakened or injured trees, rarely healthy trees (Baker, W. L. 1972. Eastern Forest Insects. USDA For. Serv. Misc. Publ. No. 1175. 642 p). A degree of specificity of food preference is described based on a beetle infestation observed in a pine seed orchard located in central Florida.

The Withlacoochee seed orchard, managed by the Florida Division of Forestry, consists of ca. 109 ha of planted pines. Slash pine, *Pinus elliottii* Engelm., predominates in the area (79%), followed by sand pine, *Pinus clausa* (Chapm.) Vasey, (18%), and longleaf pine, *Pinus palustris* Mill., (3%). Most plantings are spaced at 4.6 m X 9.0 m and the grafted scions originated from superior trees in north and central Florida.

In early March 1981, an intensive survey was prompted by the general observations of seed orchard personnel that slash pine (age = 12-20 years) with extensive foliage discoloration were scattered throughout a 22 ha area (blocks AX-1 and AX-2). A map was constructed to facilitate anticipated sanitation cuttings of beetle-infested trees. Subsequently, I found that 58 of 60 beetle-infested trees were of clone 702; the other 2 trees were of clone 1. Even more striking was that only 66 ramets of clone 702 were present in the specified area and these were randomly distributed throughout the 22 ha (as determined by the nearest neighbor technique) (Clark, P. J., and F. C. Evans. 1954. Ecology 35: 445-453.) (Fig. 1).

Beetle species present in all trees were *Ips avulsus* (Eichh.), *Ips grandicollis* (Eichh.), and *Pityophthorus* spp.; less prevalent were *Ips calligraphus* (Germ.) (25% of beetle-infested trees). Most beetle activity was concentrated in the branches and upper stems; few beetle attacks were present below a height of 2.1 m.

Other than the signs associated with beetle infestation, there were no obvious differences between infested clone 702 trees and other trees (n = 90 clones). However, a paired tree comparison, wherein for 46 ramets of clone 702 a neighboring tree (randomly distributed among all clones) was chosen and similarly measured, suggests that 1 or more of the beetle species selected trees with significantly poorer growth ($P<0.001$, Student's t-test). The mean diameter at breast height for clone 702 versus paired trees was 18.3 cm $\pm$ $SE_{\bar{x}}$ 0.5 cm and 21.6 cm $\pm$ 1.0 cm, respectively; height performance was 9.5 m $\pm$ 0.2 m and 10.7 m $\pm$ 0.3 m, respectively.

The probability of 58 trees of a 66 tree subset being randomly selected from a 3006 tree population with only 2 "false" selections is remote. To illustrate the probability calculation: we have a seed orchard (blocks AX-1, -2) containing a population of n trees ($n = 3006$) of which n_1 are 702 ramets ($n_1 = 66$) and $n_2 = n - n_1$ are other trees ($n_2 = 2940$). We draw a random sample of r trees ($r = 60$) without replacement, i.e., the beetle-infested trees. We wish to determine the probability that the group so

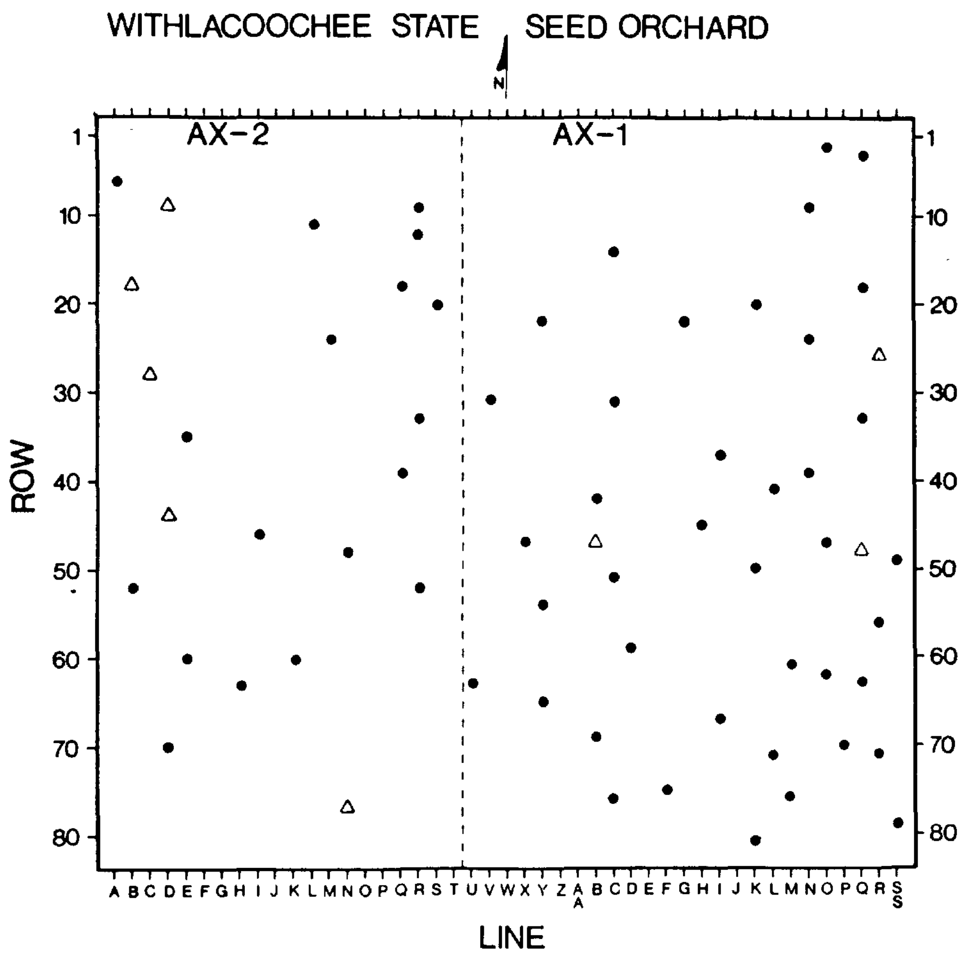

Fig. 1. Distribution of Clone 702 ramets in the slash pine seed orchard located in Withlacoochee State Forest. AX-1 and AX-2 are compartment designations. • = bark beetle infested tree; △ = uninfested tree. Total number of ramets = 66.

chosen (r) will contain exactly k trees (k = 58 clone 702 trees). The variate k is said to have the hypergeometric distribution, and the probability is written as follows (Meyer, S. L. 1975. Data Analysis for Scientists and Engineers. J. Wiley & Sons, Inc. NY 513 p):

$$h(k; r, p, n) = \frac{\binom{pn}{k}\binom{qn}{r-k}}{\binom{n}{r}} \quad \text{where } p = \frac{n_1}{n} \text{ and } q = 1 - p$$

$$= \frac{\binom{66}{58}\binom{2940}{2}}{\binom{3006}{60}}$$

$$= 2.637 \times 10^{-117}$$

The probability of 58 ramets of a possible 66 of a specific clone being randomly beetle-infested is small indeed.

Reasons for the observed selection are not known, but infested trees were poorer growers in comparison with other trees in the seed orchard. Such trees are oftentimes attacked in a forest stand. The sequence of arrival of beetle species on individual trees is not known. Any one of the 4 species may have been the initial or last arrived for any tree. Regardless, one or more beetle species did demonstrate a clonal specificity encompassing a 22 ha area, an occurrence not previously documented for *Ips* or *Pityophthorus* spp.—W. N. DIXON, Forest Entomologist, Contribution No. 554, Division of Plant Industry, Bureau of Entomology; Division of Forestry, P. O. Box 1269, Gainesville, FL 32602, USA.

LUMINOUS DEFENSE IN AN EARTHWORM—We found several earthworms, possibly *Microscolex phosphoreus* (Megascoleoidae), in Alachua County, Florida that emitted light. Green-glowing haemolymph was discharged from the mouth and/or anus when the worm was forcibly handled and also flowed from wounds (see Wampler. 1981. Comp. Biochem. Physiol. 71A: 599-604). Earthworm lights in general have been supposed to be defense mechanisms serving either as warnings of unpalatability or as means of startling subterranean, presumably negatively phototactic predators (e.g. Gilcrist. 1919. Trans. Roy. Soc. South Africa 7: 203-12; Jamieson and Wampler. 1979. Australian J. Zool. 27: 637-69). To our knowledge no previous observations of predator reactions to luminous earthworms have been made.

Microscolex phosphoreus was palatable to a dermapteran *Labidura riparia* (Labiduridae) and an immature lycosid spider, both nocturnal predators collected within meters of where the worms were found on the surface after a heavy rain. In the laboratory each was placed with a worm in a 9 cm. dia. petri dish. Although worms managed to smear glowing fluid on their attackers and the predators "jaws" were frequently alight, worms were consumed without hesitancy. However a subterranean carnivore, the mole cricket, *Scapteriscus acletus* (Gryllotalpidae), reacted to luminescence. While one cricket quickly ate a *M. phosphoreus*, another dropped its prey as it began to luminesce, rapidly withdrew 2 cm and rubbed its head with the forelegs. The worm managed to crawl 9 cm before being reattacked. Again luminous fluid was emitted whereupon the cricket withdrew 2 cm. On a third encounter the worm was completely consumed.

Our sample suggests to us that the earthworms were palatable but that a predator can be startled by annelid bioluminescence, particularly if its hunting behaviors evolved underground in darkness. Thanks to J. E. Wampler for references. This is Florida Agricultural Experiment Station Journal Series No. 4545—JOHN SIVINSKI AND TIM FORREST, Dept. of Entomology and Nematology, University of Florida, Gainesville, Fla. 32611 USA.

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LUMINOUS DEFENSE IN AN EARTHWORM—We found several earthworms, possibly *Microscolex phosphoreus* (Megascoleoidae), in Alachua County, Florida that emitted light. Green-glowing haemolymph was discharged from the mouth and/or anus when the worm was forcibly handled and also flowed from wounds (see Wampler. 1981. Comp. Biochem. Physiol. 71A: 599-604). Earthworm lights in general have been supposed to be defense mechanisms serving either as warnings of unpalatability or as means of startling subterranean, presumably negatively phototactic predators (e.g. Gilcrist. 1919. Trans. Roy. Soc. South Africa 7: 203-12; Jamieson and Wampler. 1979. Australian J. Zool. 27: 637-69). To our knowledge no previous observations of predator reactions to luminous earthworms have been made.

Microscolex phosphoreus was palatable to a dermapteran *Labidura riparia* (Labiduridae) and an immature lycosid spider, both nocturnal predators collected within meters of where the worms were found on the surface after a heavy rain. In the laboratory each was placed with a worm in a 9 cm. dia. petri dish. Although worms managed to smear glowing fluid on their attackers and the predators "jaws" were frequently alight, worms were consumed without hesitancy. However a subterranean carnivore, the mole cricket, *Scapteriscus acletus* (Gryllotalpidae), reacted to luminescence. While one cricket quickly ate a *M. phosphoreus*, another dropped its prey as it began to luminesce, rapidly withdrew 2 cm and rubbed its head with the forelegs. The worm managed to crawl 9 cm before being reattacked. Again luminous fluid was emitted whereupon the cricket withdrew 2 cm. On a third encounter the worm was completely consumed.

Our sample suggests to us that the earthworms were palatable but that a predator can be startled by annelid bioluminescence, particularly if its hunting behaviors evolved underground in darkness. Thanks to J. E. Wampler for references. This is Florida Agricultural Experiment Station Journal Series No. 4545—JOHN SIVINSKI AND TIM FORREST, Dept. of Entomology and Nematology, University of Florida, Gainesville, Fla. 32611 USA.

DESTRUCTION OF EGGPLANTS IN MARION COUNTY, FLORIDA BY RED IMPORTED FIRE ANTS (HYMENOPTERA: FORMICIDAE)—The presence of the red imported fire ant, *Solenopsis invicta* Buren (RIFA), in cultivated fields in the southeastern U.S. has been recognized since 1948, but the feeding of this species on the eggplant, *Solanum melongena* (L.), is not documented. Lyle and Fortune (1948. J. Econ. Ent. 41(5): 833-4), Arant and Eden (1949. Spec. Rpt. Alabama Exp. Sta. Prog. Rpt., Serv. 42) and Wilson and Eads (1949. Spec. Rpt. Alabama Dept. Conserv., 1-511) reported destruction of various garden vegetables and row crops by *S. invicta* with estimated losses as high as $500,000. Glancey et al. (1979. J. Georgia Ent. Soc. 14(3): 198-201) estimated the loss from *S. invicta* feeding of about 65% of the yield of a field of hybrid corn in Stonewall, MS. The loss was estimated to be in excess of $10,000. Lofgren and Adams (1981. Florida Ent. 64(1): 199-202) reported a reduction of 14.5% of the yield in fields of soybeans infested with *S. invicta* vs. non-infested fields. Their study covered 8 paired fields representing 2 counties in Georgia and one in North Carolina.

In late July, 1982, Mr. Ralph Brown, Florida Department of Agriculture and Consumer Services, alerted the author to damage to a field of egg plant, *Solanum melongena,* attributed to *S. invicta.* The field, located in Marion County, Florida ca. 10 miles south of Fairfield on SR 225, consisted of ca. 12 ha of rich, well drained loamy sand of the Hague-Zuber Fellowship Association. The field was divided into 2 sections, each with a different planting date. Field No. 1 (ca. 4.0 ha) was planted 28 June, while field No. 2 (ca. 8.1 ha) was planted 12 July. *S. invicta* infestations were initially observed by the grower along the periphery of the fields shortly after planting, but were not considered significant. Concern was expressed, however, following a survey of field No. 2 when heavy infestations of RIFA were observed feeding on plants throughout the field.

Initial plant density counts were made on field No. 2 on 26 July when plants were 15-30 cm tall. Ants were active over most of the field and were attacking entire plants in many cases. Plant density was determined for 18 m of row in each of 20 rows, selecting each 10th row. The transect line for these counts was established to run from the southwest corner of the field northeasterly to the center of the field (row 90), thence southeasterly to the southeast corner of the field. Dead and/or missing plants were recorded (Table 1). The second plant density count (9 August) included the category, dwarfed/stunted. This category was added when the grower reported no yield from these plants. This transect was initiated at the northwest corner of the field and ran diagonally to the center of the field, thence northeasterly to the opposing corner. Theoretical plant density was 20 plants/station. Plant density counts were determined on field No. 1 as indicated above on 2 and 10 August. No further reduction in plant density was noted at the last count, therefore we must consider that damage occurred during the early growth stages.

Heavy attacks of *S. invicta* workers were observed on plants in all sections of the fields with ants depositing tumulus on the growth tips and in the leaf axils of many plants. Heavy scar tissue on leaves and stems was noted, apparently from the feeding of the ants. Ants were also observed actively feeding on tender new growth and, on numerous occasions, were seen girdling the stems (Plate 1 & 2).

TABLE 1. MEAN PLANT DENSITY OF 20 STATIONS (18 M OF ROW EA.) OF EGG PLANT *Solanum melongena*, INFESTED WITH THE RED IMPORTED FIRE ANT, *Solenopsis invicta* BUREN, MARION COUNTY, FL 1982.

Survey date	Avg. no of plants dead or missing	Avg. no of plants dwarfed or stunted	Percent of plants lost to harvest
Field No. 1			
2/VIII	6.70	3.20	49.5
10/VIII	6.70	3.15	49.3
Field No. 2			
26/VII	8.25	—	41.3[1]
9/VIII	8.7	4.15	64.3

[1]Plants not sufficiently mature to detect dwarfism.

Surveys for other potentially damaging insect fauna were made concurrently with the plant density counts and revealed no other plant pests.

Egg plant production normally extends throughout the summer (14-16 weeks). The grower anticipated a yield of 1000 bu/acre for the season, but indicated that he expected a 50% reduction in yield. This expectation was supported by our plant density counts which showed a mean

Fig. 1. Egg plant, *Solanum melongena*, indicating tumulus deposited at growth tip of young plant by *S. invicta*.

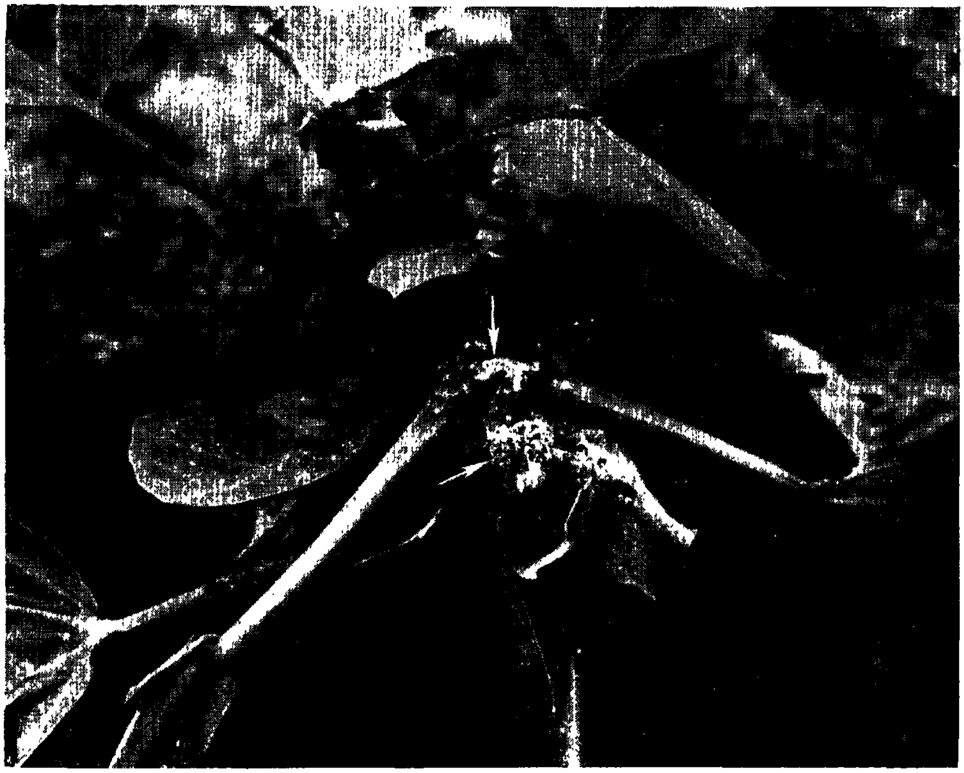
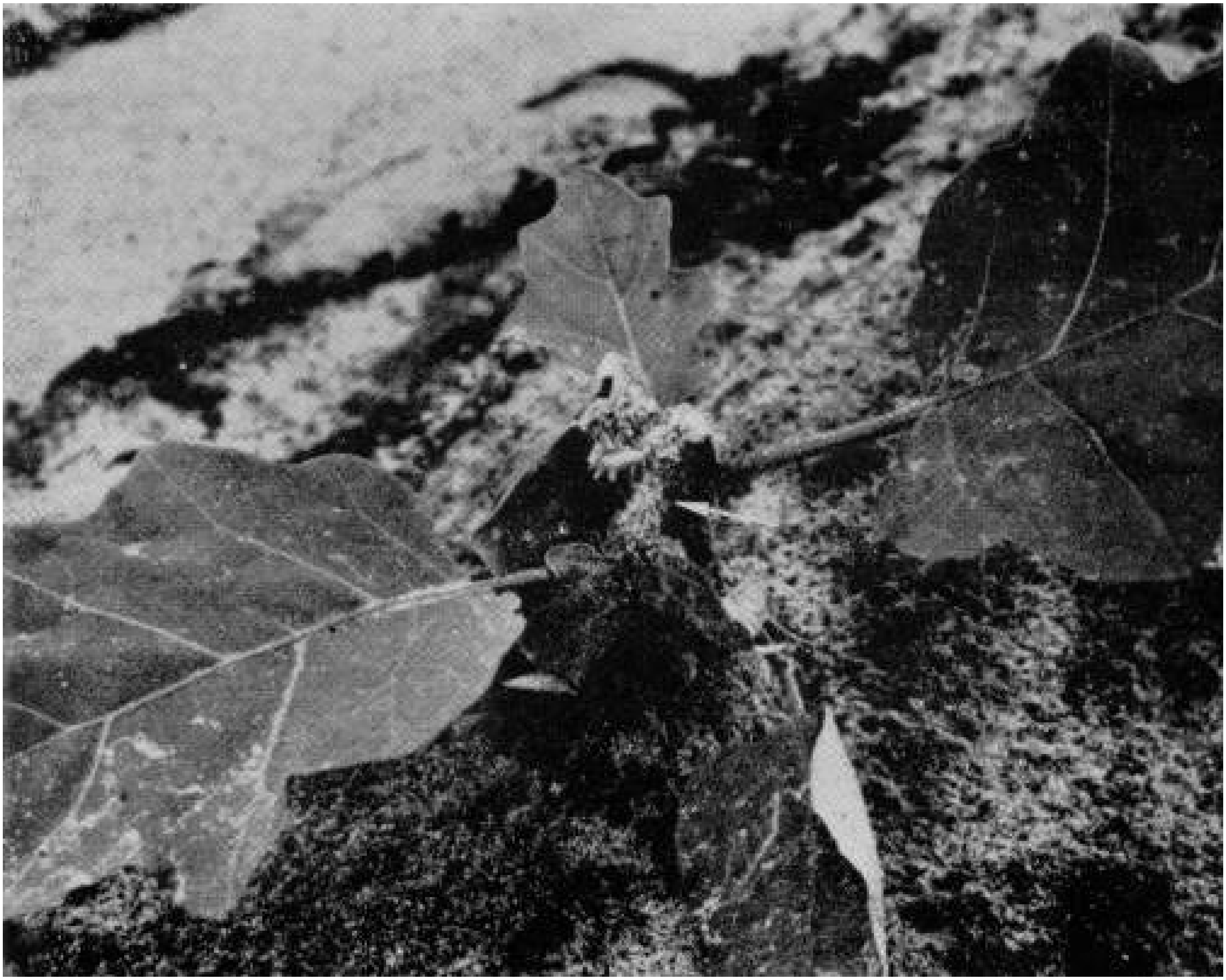


Fig. 2. Young plant indicating damage to growth tip and tumulus deposited in leaf exil by *S. invicta.*

plant reduction of 57%. Data furnished by the Vegetable Crops Department, IFAS, University of Florida, further indicate that under "normal-average" growing conditions one could expect a 5-10% plant reduction (Personal Communication), thus, the loss of 50% of the potential yield appears realistic. Assuming the wholesale value by the buyer and the grower's estimate of 37,000 kg/ha were correct, the RIFA damage to the crop represents a potential loss of $90,000. However, because these figures were based on grower/buyer estimates we also reviewed the data on the basis of information from the Florida Crop and Livestock Reporting Service, Orlando, FL. They reported that the average statewide yield for eggplant in 1982 was 24,342 kg/ha with an average wholesale value of $0.38/kg. Based on these data, the yield of eggplants would have been 292,104 kg with a potential value of $110,999. If one-half of the crop was lost to RIFA, the farmer would have suffered a potential loss of $55,500.—C. T. ADAMS, Agricultural Research Service, U.S. Dept. of Agriculture, Gainesville, FL 32604 USA.



A LEAF MINER, *DICRANOCTETES* SP. (LEPIDOPTERA: ELACHISTIDAE), INFESTING SUGARCANE IN SOUTH FLORIDA—A leaf miner was discovered in sugarcane growing in Hendry County (12 miles west of Clewiston, FL) during 1982. Adult specimens of a microlepidopteran were reared in the laboratory from infested leaves; these were identified as an undescribed species of *Dicranoctetes* (Lepidoptera: Elachistidae) by R. W. Hodges (Systematic Entomology Laboratory, USDA, Beltsville, MD). The percentage of stalks with infested leaves was 0.0, 1.1, 4.5, 1.6, and 1.1% during early June, early July, late July, late August, and mid-September, respectively, based on samples of 1000 stalks/period in a 1.6 ha block of sugarcane (variety CP 65-357). The observed number of miners/leaf did not exceed one. The leaf miner created a longitudinal mine on the underside of leaves that sometimes increased to 12 cm or more in length.

No economic damage by the leaf miner was evident at the infestation levels observed during 1982, but *Dicranoctetes* may cause economic damage to sugarcane at larger infestation levels. According to Long and Hensley (1972. Ann. Rev. Ent. 17: 149-76), leaf miners are minor pests of sugarcane. The elachistid *Dicranoctetes saccharella* (Busck) infests sugarcane in Cuba (Scaramuzza, L. C. and F. V. Barry. 1959. Proc. Tenth Congr. Int. Soc. Sugar Cane Tech. 994-1000). An unidentified species of Elachistidae which can cause "particularly severe" damage to young sugarcane has been reported in Papua and New Guinea (Bourke, T. V. 1968. Proc. Thirteenth Congr. Int. Soc. Sugar Cane Techn. 1416-1423).—DAVID G. HALL, Research Department, Entomology Division, United States Sugar Corporation, Clewiston, FL 33440 USA.

PRESIDENTIAL ADDRESS:
ENTOMOLOGY—A RECOGNIZED PROFESSION?

A. C. (ABE) WHITE
817 W. Fairbanks Avenue
Orlando, FL 32804 USA

As a profession, entomology suffers a lack of recognition by the general public. Evidence is accumulating to show that this lack of public status affects the salaries paid to entomologists, both in academic and in industrial employment.

The problem of recognition was acute thirty-plus years ago when I was leaving the university with a master's degree in entomology. My father, a lawyer, expressed concern to my mother about how an entomologist earned a living. Mother had a favorite cousin who was an entomologist with the USDA and in trying to allay my father's concern said, "I never heard of an entomologist out of a job." My father thought a moment, then condesendingly agreed that he had never heard of an entomologist out of a job, but after another moment of contemplation he added, "but then, who ever heard of an entomologist?"

The problem does not appear as acute today as it was then. The Mediterranean fruit fly, the gyspy moth, the boll weevil and other prominent insects have helped publicize the entomologist, but just periodically and in limited areas. This periodic publicity has not created a sustained public recognition of the profession. The professionals who are most readily visible to the public, such as the pest control operators and mosquito control personnel in Florida, are generally not recognized as entomologists, but are known by their specific activity. As entomologists we may not see the extent of our anonymity—we all know plenty of entomologists!

Let me relate 2 experiences to illustrate my point that the profession is not well known.

On a recent visit to a major southeastern university, I stopped at the information desk for directions to the Department of Entomology. The young lady, probably the wife of a student, consulted her directory and gave me the directions. Then as I was about to leave she asked, "What is entomology?"

More recently my lawn mower needed repair, and rather than recite all of the information needed to make out the work order, I handed the serviceman my card and left the mower to be fixed. When I returned to pick up the mower and gave the cashier my name, he said, "Oh, you're the *entomologist.*" The other 4 employees in the shop popped up to take a look. It turned out that only 1 of the 5 had any idea that entomology was the study of insects, and he had taken some biological science courses.

The problem is not just with the general public. Many employers of entomologists do not recognize the profession, and this is where it can effect the salary scale. A major chemical company was promoting their career scientist program where scientists wishing to follow their chosen field, rather than going into management could be compensated for their years of service and loyalty to the company by receiving salaries above their regular job classification scale. A stipulation for qualification in the program was to be in a *recognized profession.* To satisfy my curiosity I wrote and asked if entomology was listed as a recognized profession. The reply was an attempt to be positive, but it was still disturbing to me. Entomology was not listed as a profession, but entomologists could qualify for the program in the life sciences category. Agronomy, however, was listed as a recognized profession. It was noted that membership in a professional organization would help establish the required recognition.

If we, as entomologists, are interested in a greater public awareness of our profession and in the benefits associated with an improved professional status, I feel the solution is in a strong professional organization. In fact, I know of no profession that has really advanced or achieved recognition and status until it was willing to support a strong professional organization.

Such a strong organization does of course impose regulations and demands on its members, an imposition many entomologists may not yet be willing to accept.

These demands include:

1) Passing an examination to demonstrate professional competency.
2) A program to assure that professional competency is maintained, and
3) The adherence to a code of ethics which establishes guidelines for professional conduct.

The value of the first 2 requirements I easily understood. The value of a code of ethics was more elusive to me. I felt that an ethical person did not need it, and that a code would not make an unethical person act in an ethical manner. But I had missed the point! The code of ethics becomes a standard by which professional performance and conduct can be judged, both by one's peers and by the general public. To be of any value the code must have legal status and impose penalties on the members for malpractice or neglect.

The American Registry of Professional Entomologists, ARPE, is a functioning organization for professional entomologists. I am surprised and disappointed that more entomologists are not interested enough in the advancement of their profession to become members. True, ARPE is not yet the strong organization that is needed to provide the services for an active professional group, but it is a step toward developing professional recognition. ARPE needs the support of entomologists interested in the advancement of their profession. I do not agree with some of the proposed programs of ARPE, nor do I agree with the exclusion of many of the true professionals in entomology, just because they do not feel that the Entomological Society of America offers enough in their specialty field to justify the additional cost. I feel strongly that membership in any recognized association devoted to a particular entomological specialty should be enough qualification for consideration as an ARPE member. In spite of, or perhaps because of such disagreements, I am resolved to remain a member of ARPE and work to develop a strong organization for professional entomology.

Florida now has 100 members in ARPE, the third highest state membership behind California with 181, and Texas with 248 members. This does show that quite a few entomologists in Florida are interested in a professional status; however, there has not been enough interest among these members to form a state chapter, or a state association of ARPE. It is these smaller groups which can effectively promote the profession at the local levels.

It appears that entomologists in Florida are satisfied with their professional recognition and their salaries, because there isn't much effort going into improving their status. This must not be the case in Texas which supports 3 chapters, plus a state association of ARPE; or in California with its state association; or in Mississippi which supports a state association, and has only half the number of ARPE members that Florida has.

The status provided by a professional organization that is self regulating is important to the growing group of entomologists in private consultation and in contract research. It is also very valuable to any entomologist involved in legal expert witness activities, be it voluntary or involuntary. It can also be important in helping entomologists at all levels to achieve and maintain salaries on a par with other scientists in similar endeavors by collecting and reporting salary data on a periodic basis.

Still, I feel the first step is to create a new public image of the entomologist. The relatively few people who do recognize entomology as the study of insects, and who are not associated with entomologists, still see the person with the butterfly net and the magnifying glass. Very few people recognize entomologists as the ones who protect their homes and yards from termites, roaches and chinch bugs; or the ones who control the vectors of such diseases as encephalitis and malaria; or the providers of insect-free fruits, grains and vegetables; or the ones keeping livestock healthy to prevent meat prices from accelerating upward; or the quarantine inspectors who try to prevent the invasion into the United States by foreign species, which could cause serious health or economic problems; or the researchers constantly seeking new methods to control the many insects which prey on man and his commodities; or the teachers preparing the next group of entomologists for their challenges.

My question is this. Are we in entomology ready to organize and to create a new image of the entomologist—an image of a modern scientist developing and using new technology to serve the public in the advancement of its many endeavors which are influenced by insects?

A. C. WHITE, President
Florida Entomological Society
10 August 1983

MINUTES OF THE 66th ANNUAL MEETING OF THE FLORIDA ENTOMOLOGICAL SOCIETY

The 66th Annual Meeting of the Florida Entomological Society was held at the Sheraton Sand Key Resort, Clearwater Beach, Florida, 9-12 August 1983.

The opening session was called to order by President A. C. (Abe) White, Orlando, Florida, at 8:30 a.m. 10 August 1983. The invocation was offered by Howard V. Weems, Jr., Division of Plant Industry, Florida, Dept. of Agric. and Consumer Services, Gainesville. The welcome was by Rita Garvey, City Commissioner of Clearwater. President White then delivered the Presidential Address (printed elsewhere in this issue). Following his Address, President White introduced Dr. F. A. Wood, Dean of Research, IFAS, University of Florida, Gainesville, who gave a short report on the decision by University of Florida IFAS Administrators to consider the *Florida Entomologist* as an acceptable journal of publication for their faculty and research scientists when considering promotion and tenure. President White recognized Mr. Dean Saunders, State Agricultural Liaison for Senator Lawton Chiles who was in attendance at the opening session. The presentation of scientific papers on crop protection and medical entomology including an Invitational Paper by L. E. Beasley, A. Duda and Sons, Ovieda, Florida and a project exhibit session occupied the remainder of the day until later afternoon when the Preliminary Business Meeting was held.

The preliminary Business Meeting was called to order at 5:02 p.m. 10 August 1983 by President White. Sixty-six members were present. Secretary Williams presented the minutes of the 65th Annual Meeting held at the Colony Beach and Tennis Resort, Longboat Key, Florida, 11-13 August 1982 as printed in the December 1982 issue of the *Florida Entomologist*, Volume 65, No. 4: 603-25. M. L. Wright, Jr. moved that the minutes be approved; seconded by D. P. Wojcik; motion carried.

The Annual Round Table Session (Bull Session) was held from 7:30-8:30 p.m. with W. L. Peters presiding. The feasibility of holding joint meetings with South American and Latin American scientific societies was discussed. A report of the Ad-Hoc Committee on Joint Meetings/Caribbean Conferences was given by C. S. Barfield. W. H. Whitcomb discussed the establishment of a research station in the Dominion Republic and made a request for journals, books and other library material. Finally, a lively discussion of the election of officers of the Society by direct mail ballot concluded the session.

The 3rd Annual Past-Presidents' Breakfast was held at 7:00 a.m. Thursday 11 August 1983 with W. L. Peters presiding. A discussion followed of the pros and cons of holding the 1985 Annual Meeting in the Caribbean area. Also, it was decided that in the future, all invitations to the Past Presidents' Breakfast will include the spouses. The program on Thursday morning began with the Insect Behavioral Ecology Symposium with J. E. Lloyd presiding. The afternoon consisted of the Student Paper Contest, T. J. Walker presiding followed by several papers on crop protection.

Thursday evening at 8:00 p.m. the Annual Awards Banquet was held with reports and presentations by the Scholarship Committee, Student Activities Committee and the Honors and Awards Committee. This was followed by an excellent film, "Tiger Beetles", produced and furnished by John Paling of England.

Friday morning consisted of submitted papers on urban entomology and a session on citrus pests with the Final Business Meeting following. More than 80 papers were presented during the two and one-half day meeting.

Report of the Treasurer and Business Manager for Year Ending 1 July 1983

As a result of the vote of the Society at the 1982 Annual Meeting, this fiscal year is only 11 months.

The books were examined and the financial statement prepared by Richardson and Ellison, Certified Public Accountants. Their statement is presented here as part of my report. An audit was not done at their suggestion because of the expense (estimated over $500) and the time (one month) involved. The disclaimers in the letter refer to footnotes and other procedures which they did not consider necessary to include.

Florida Entomological Society Treasurer's Report for the Eleven Month Period Ended 30 June 1983 (Unaudited)

Account Balances—31 July 1982	
Cash on Hand	$ 1.80
Checking Account	722.14
Merrill Lynch—Ready Assets	4,202.55
Certificate of Deposit	12,095.00
Total Account Balances—31 July 1982	$17,021.49
Receipts	
Dues	9,080.00
Subscriptions	4,077.50
65th Annual Meeting	
Registration	2,636.00
Banquet	1,056.00
Past Presidents' Breakfast	85.00
Back Issues	141.00
Miscellaneous	207.85
Interest Income	852.04
Dividends—Merrill Lynch—Ready Assets	236.35
Net Gain on Sales of Corporate Income Fund Securities	705.24
Total Receipts	19,076.98
Disbursements	
Printing	3,000.00
65th Annual Meeting	6,814.82
Postage	1,452.04
Secretarial	215.00
Computer Expenses	290.76
Grants and Scholarships	1,336.25
Business Manager and Editor Salaries	2,200.00
King Report	285.09
66th Annual Meeting	44.63
Miscellaneous Expenses	365.96
Total Disbursements	16,004.55
Account Balances—30 June 1983	
Cash on Hand	60.00
Checking Account	4,942.74
Merrill Lynch—Ready Asset Account	1,090.70
Merrill Lynch—Security Account	.48
Certificate of Deposit	14,000.00
Total Account Balances—30 June 1983	$20,093.92

Merrill Lynch—ready assets: includes dividends to 24 June 1983, paying @3.5%.
Merrill Lynch—security account: monies not applicable to other M.L. accounts.
Merrill Lynch—certificate of deposit: 9.15%/annum, Approx. $640, interest will be paid on 14 October 1983.

Expenses for 65th Annual Meeting	
Cash for change	$ 100.00
Past Presidents' Breakfast	172.50
1000 Programs	277.50
Lady Bug breakfast	49.51
Banquet	3,877.20
Speaker gratuity	450.00
Mailouts	366.73
Equipment rental	278.82
Miscellaneous Expenses	36.56
Hospitality Hour	179.50
Awards	417.55
Coffee breaks	610.25
	$6,814.82

PRINTER'S REPORT[1]
FLORIDA ENTOMOLOGIST AS OF 26 JULY 1983

Volume No.	Cost of Journal	Page Charges Credited	Page Charges Collected	Amount Uncollected
64 No. 3 Sept. 1981	$ 2,496.43	$ 1,930.00	$ 1,750.00	$ 180.00
64 No. 4 Dec. 1981	2,871.39	2,530.00	2,490.00	40.00
65 No. 1 Mar. 1982	6,070.33	5,880.00	5,880.00	Paid in full
65 No. 2 June 1982	2,801.87	2,760.00	—	—
W. L. Peters, H. A. Denmark et al. & E. C. Beck; reprints and page charges, charged to Society		478.00		
		2,282.00	2,160.00	122.00
	$14,240.02	$12,622.00	$12,280.00	$ 342.00
65 No. 3 Sept. 1982	4,790.12	2,790.00	2,790.00	Paid in full
65 No. 4 Dec. 1982	6,378.81	4,500.00	4,080.00	420.00
66 No. 1 Mar. 1983	6,768.14	5,800.00	4,530.00	1,270.00
66 No. 2 June 1983	2,601.56	2,130.00	60.00	2,070.00
	$20,538.63	$15,220.00	$11,460.00	$3,760.00
	—3,000 Partial Payment			
	17,538.63			

[1]The printer bills and collects page charges for the Society and maintains the accounts. The printer holds the balance (if any) to pay printing costs when due.

At this time I have the unhappy task of telling you that I have resigned as Treasurer and Business Manager of the Florida Entomological Society effective immediately. This decision was not lightly reached. It was necessitated partially by extreme personal and professional problems. In addition, I have determined there are strong differences of opinion between myself and other members of the Society on the duties and responsibilities of the Business Manager. Therefore, in the best interests of the Society, I tendered my resignation to President A. C. White at the Executive meeting 9 August 1983.

DANIEL P. WOJCIK
Business Manager and Treasurer

REPORT OF THE PROGRAM COMMITTEE

The Program for the August, 1983 of the Florida Entomological Society consisted of 84 participants, i.e., papers, projects exhibits, and panelist/symposium members.

Six advertisers, taking a full page each of $90.00/page helped defray most of the 1,000 program order. The Committee recommends in 1984 that we seek 9 full page advertisers for $110.00 each. Most of the 6 this year wish to be included in the 1984 program.

Five commercial firms donated a total of $240.00 towards 4 door prizes used at drawings during the meeting.

We recommend that more activity for wives and families at future meetings should be encouraged.

A bill for the program of $2590.00 was presented for reimbursement to M. Lewis Wright, Jr., Chairman, Program Committee. This had been paid by check on 12 August 1983.

A. G. SELHIME
D. DAME
J. E. LLOYD
E. H. TRYON
T. J. WALKER
C. W. CHELLMAN
W. L. PETERS
C. C. CHILDERS
A. KNAPP
M. L. WRIGHT, Chairman

REPORT OF THE PUBLIC RELATIONS COMMITTEE

Two projects that the PR Committee has been involved with in the past have been completed during 1982-83. The Entomology In Action slide program has been updated and will be kept with the Business Manager for loan-outs. Also, an annotated bibliography of books on insects for use by elementary school teachers has been compiled and is available from Dr. R. W. Flowers. Dr. Flowers was primarily responsible for both of these projects.

In an effort to better advertise the annual meeting, a permanent list of professional newsletters, bulletins and journals was compiled for meeting announcement mail-outs. At present the list contains 20 sources which received meeting announcements in April, 1983. A check on many of these sources indicated that most were publishing the FES meeting announcement.

During the week prior to the annual meeting, news releases were sent to all major newspapers throughout the state. Five television stations in the Tampa area were also contacted concerning possible coverage of the meeting.

Other projects that the PR Committee is considering are the development of FES pins, T-shirts and membership cards. Another possibility for future FES meetings is an insect photo contest, in cooperation with the Photographic Society of America.

Membership in the PR Committee grew from 3 to 9 members during the past year and all members have participated by contributing information and ideas for the various projects.

W. N. DIXON
R. W. FLOWERS
J. R. GEIGER
R. G. HAINES
J. E. LLOYD
L. S. OSBORNE
R. H. RAJAPAKSE
C. G. WITHERINGTON
J. R. CASSANI, Chairman

REPORT OF THE SUSTAINING MEMBERSHIP COMMITTEE

During 1982-83 the members of the Sustaining Membership Committee individually contacted approximately 30 candidates qualifying for membership status. As of 1 August 1983, 8 new members accepted the invitation to join the Society. As of June 1983, 52 Sustaining members were recognized in the *Florida Entomologist.* Beginning in 1983, Sustaining members will receive the regular renewal notice for continued membership.

J. R. GEIGER
F. A. JOHNSON
C. G. NORRIS
T. J. STELTER
M. L. WRIGHT
C. W. MCCOY, Chairman

REPORT OF THE FISCAL COMMITTEE

This was the first year that the Auditing and Finance Committees were combined to form the Fiscal Committee. Because of our increased responsibilities, it was the Committee's intention to establish new operating procedures, which would assist in achieving sound financial management of the Society's assets. As a necessary step, the Committee sought to establish a frequently used line of communication with the Treasurer. Unfortunately, the Committee's attempts to communicate with the Treasurer were ignored by him, with the result that the Committee accomplished very little in the past year.

For the past 3 years, the Committee has urged the Treasurer to have the Society's books reorganized by a CPA as they are currently very difficult to audit. This year the Committee informed the President that it would not audit the books unless this was done. Since the President supported this decision and as the books were not reorganized, we have not audited the Society's books for the year 1982-83.

It is hoped that in the future this Committee and the Treasurer will cooperate to achieve sound financial management of the Society's assets.

J. B. BEAVERS
R. J. BURGES
T. R. FASULO, Chairman

REPORT OF THE LONG RANGE PLANNING COMMITTEE

The consensus of this Committee is that the Society's direction is appropriate, that continuity of purpose is being achieved from year to year, and that we should recommend general directions for effort rather than specific activities. Our leadership has been diligent in striving to improve all aspects of our already effective Society, recently by refining the conduct of financial business, the annual meeting, and our committee assignments. In most respects we therefore reiterate the last 2 reports of the Committee (*Florida Entomologist* 64(2), 65(3).

Our Society should continue to encourage participation of students by providing incentives and support. This includes reduced dues, travel support and awards for the annual meeting, membership on committees, 4-H Club sponsorship, and other less apparent benefits. We particularly encourage continuation of the already effective mini-grants project and hope that it may eventually lead to one or more full scholarships.

The annual meeting has been improved immeasurably during the past few years by enhancing our awards banquet, supporting special symposia, inviting and financing notable speakers, reorganizing and advertising the program, adding special events, and by upgrading our meeting locations. We should perpetuate this trend and reconsider the advantages of expanding our meeting by convening with other scientific societies in Florida and the Southeastern U.S.

One of the current trends in American agriculture is a greater exchange of science and technology between the U.S. and Latin America. The Florida Entomological Society has recognized this trend by establishing an Americas Committee, including Spanish abstracts in articles published in the *Florida Entomologist* and initiating development of a Caribbean Congress of Entomology. The Society should increase its investment of resources in this Congress. Moreover, a detailed justification and prospectus should be drafted for this meeting so that explicit direction is provided.

Our Society also should increase its involvement in issues concerning human health and the environment. We could include more topics of current public interest at our annual meeting. For example, we might discuss the safe use of insecticides, innovative insect control products, flea and head lice control, and urban mosquito control. There may be mutual benefits to associating with state and national conservation and natural history organizations. Many of our members are anxious to represent entomology as an environmentally-sound science.

Traditionally, the weakest aspect of our Society has been publicity. Although we have had outstanding public relations efforts, there has not been an adequate and consistent commitment to achieving reasonable recognition of the importance of entomology and our Society. We should redouble our efforts to encourage youth awareness in public schools, provide speakers to schools and clubs, solicit and publish more useful articles, distribute a brochure on the Society, produce plaques or other items signifying membership, and generally promote our profession.

T. J. Fink
D. H. Habeck
R. L. Lipsey
C. S. Lofgren
E. A. Moherek
N. C. Leppla, Chairman

Report of the Americas Committee

The main objective of the committee this year was to follow up the unfinished business, and recommendations made by the members of last year. The activities that were made this year include:

1. The forthcoming publication of the Latin American Entomological

serials in the *Florida Entomologist.* The final draft of the serial is under review and projected to be published in the coming December issue of the journal or at the latest, in the March issue.

2. A paper by a distinguished South American scientist, Dr. Raul Cortés, has been received and reviewed, and will also be published soon in the *Florida Entomologist;* the page charges will be waived.
3. FES members who attended Entomological meetings in Latin America have been appointed delegates of the Society by our President. Official letters of greetings from the President, and recruitment items eg., membership forms and improvised posters were made available to the delegates to carry with them to the meetings.

Other action taken by the committee this year was the circulation of announcements of Latin American Entomological meetings to the committee members. The purpose of this effort was to keep track of FES members planning to attend those meetings so our committee can provide the necessary membership recruitment items that they can carry with them to the meetings.

One of the problems encountered in our effort to encourage Latin American entomologists to join our society is the lack of effective recruitment kit and posters. The committee realizes that there is a serious need to develop a recruitment kit and posters with the Society's official logo, that delegates attending entomological meetings in Latin America, or elsewhere, could easily take to the meetings. Efforts to invite distinguished entomologists from Latin America to publish in the *Florida Entomologist* should be continued.

R. F. Brooks
G. R. Buckingham
C. O. Calkins
F. W. Howard
A. Panizzi
G. L. Wibmer
V. H. Waddill
M. L. Pescador, Chairman

Report of the Membership Committee

At the end of July 1983 there were 1004 subscriptions, an increase of 5 since July 1982. Of these, 703 were regular memberships (523 full, 167 student, 3 emeritus, and 10 honorary), 52 sustaining, 206 were institutional subscriptions, and 43 were gifts or exchanges. During 1982-83, the Society exprienced a net gain of 18 full members, 7 sustaining, 1 honorary, and a net loss of 17 students, 6 subscriptions, and 2 exchanges or gifts. Total membership increased by 5 during 1982-83.

The Membership Committee has compiled a list of members in the Entomological Society of America, but not presently associated with the Florida Society. Two lists were compiled for members in Florida and Georgia. The lists were compiled for a mailout in an effort to increase membership in the Florida Entomological Society.

Claude Adams
Wayne Dixon
Peter Grant
Carol Morris
Bill Schroeder, Chairman

Final Business Meeting

The final Business Meeting was called to order by President White at 12:35 p.m., Friday, 12 August 1983. Fifty-eight members were present.

Report of the Local Arrangements Committee

There 166 persons registered versus 150 registered at last year's meeting. Also, 231 banquet tickets were sold. The 125 rooms guaranteed by the hotel were used in addition to other rooms. Also, rooms at other hotels were used.

R. M. Phillips
D. R. Smith
R. W. Metz, Chairman

Necrology Report

Mr. Paul Edward Frierson, a member of the Society, died in early 1983. He resided in Gainesville, Florida. He was former Assistant Director of the Division of Plant Industry of the Florida Department of Agriculture and Consumer Services. He joined the State Plant Board in 1935.

David F. Williams, Necrologist

Report of the Student Activities Committee

The Society funded 2 projects of the Student Activities Committee, mini-grant awards and student papers contest.

Dr. Annelle R. Soponis coordinated the mini-grants. Twenty-three students applied, representing the states of Florida, Mississippi, and New York. The committee selected the following 10 winners:

Fig. 1. Lee Bloomcamp (left), University of Florida, receives 1st prize check of $125 and a framed certificate from T. J. Walker, Coordinator of the Student Paper Contest. Photograph by Frank W. Mead.

DEBRA E. AKIN, University of Florida
JAMES M. BOSWORTH, University of Florida
PETER M. GRANT, Florida A&M University-Florida State University
SCOTT W. GROSS, University of Florida
CRAIG S. HIEBER, University of Florida
CORTLAND S. HILL, Florida State University
CAROL A. MORRIS, University of Florida
STEVE NARANJO, University of Florida
MARGERY G. SPOFFORD, SUNY, Syracuse
SUSAN C. STYER, University of Florida

Mini-grants were awarded at about $50 each to total $494.25.

Dr. Thomas J. Walker coordinated the Student Papers Contest. Eighteen students participated, and each participant received a complimentary banquet ticket. The judges selected the following 3 winners:

1st place ($125)—LEE BLOOMCAMP, University of Florida.
2nd place ($75)—SHERIDAN K. HAACK, University of Florida.
3rd place ($50)—THOMAS G. ZOEBISCH, University of Florida.

Each winner also received a framed certificate.

Dr. Lance C. Osborne coordinated the Student Workshop as a Poster Contest. The Committee would like to thank the following contributors for their support for these awards:

UNI ROYAL
SAFER AGRO-CHEM
UNION CARBIDE
DOW CHEMICAL
DUPHAR
MERCK SHARP DOHME

Two students participated. The judges selected the following winners:
1st Place—FREDERICK L. PETTIT, University of Florida ($150)
2nd Place—THOMAS J. FINK, Florida A&M University-Florida State University ($100)

T. J. WALKER
L. S. OSBORNE
P. M. GRANT
J. E. COOKMAN
A. R. SOPONIS, Chairman

REPORT OF THE SCHOLARSHIP COMMITTEE

The Florida Entomological Society awarded two $500 scholarship grants to students. Applicants were required to be a member of the F.E.S., to submit transcripts, letters of recommendation from 2 faculty members, a curriculum vita and a statement from the student about his or her future plans in the field of entomology. There were numerous applicants this year and the selection of the winners by the Committee was difficult. The winners this year were:

ALAN BOLTEN, Department of Zoology, University of Florida
THOMAS FINK, Florida State University-Florida A&M University

M. L. PESCADOR
L. BERNER
R. F. BROOKS, Chairman

Fig. 2. Student participants in the Student Papers Contest. Pictured (left to right) are Michael Plagens, Ralph Holzenthal, Lee Bloomcamp, (1st Place), Ben Gregory, Sheridan Kidd-Haack (2nd Place), Rodney Kepner, John Milio, Steve Passoa, William Hudson, Thomas Zoebisch (3rd Place), and John Vaughan. Photograph by Frank W. Mead.

Report of the Honors and Awards Committee

The Members of the Honors and Awards Committee wish to thank those members who assisted us with their nominations and opinions. Special thanks should go to Dr. Dave Williams, Chairman of the Committee last year, for his assistance.

In spite of the assistance of a few members, our Committee experienced the same apparent lack of interest by the General Membership that Honors and Awards Committees have experienced in the past. Despite a written solicitation in the spring mail-out, the Committee received only 2 written nominations and 1 oral nominiation. Thus, the Committee members had to not only decide who among the nominees was most deserving but they also had to provide nominees in the first place. To accomplish this, committee members had to canvass fellow Society members by telephone. The present committee feels that this situation is not adequate in assuring that a representative cross-section of the Society has input and results in committee members assuming more responsibility than is desirable or necessary.

To promote discussion among the General Membership and the Executive Committee, the honors and awards committee wishes to offer some proposals for consideration. First, requesting written, documented nominations should be discontinued except perhaps for nominations for honorary membership. Most persons apparently have neither the time nor the inclination to provide written documentation. Perhaps a list of the potential awards with

Fig. 3. Frederick L. Petitt (left), University of Florida, receives 1st Prize check of $150 from L. S. Osborne, Coordinator of the Student Poster Contest. Photograph by Frank W. Mead.

spaces for writing the names of nominees could be attached to the dues notice. Filling in names might then be no more painless than sending in dues. A second possibility presented for consideration would involve changing the size and scope of the Honors and Awards Committee. The committee could be expanded with requirements that the major groups, i.e. Universities, USDA, Industry, PCO's, etc., would be represented. The larger the committee, though, the more difficult it is to coordinate. Changes in the committee size and structure would require changes in the by-laws. A third possibility for consideration would be to change the function of the committee. Since nominations are usually not forthcoming without some prodding, the committee could continue in its role of identifying nominees and assembling pertinent supportive information for each. The final decision for awardees could be made by the Executive Committee after their consideration of the nominees' credentials. This procedure would insure that a greater cross-section of the membership (as represented by the Executive Committee) would participate in the final selection process. While this latter suggestion would divest the Honors and Awards Committee of some of its Responsibility, this is not the goal of the suggestion. The committee feels that the goal of including more people in the process is desirable.

Presentation of Awards

Our society has many awards for recognizing deserving members including Honorary Memberships, Certificates of Appreciation, Entomologist of the Year, Annual Achievement Awards and Special Awards. No one was

Fig. 4. Thomas J. Fink (right), Florida State University-Florida A&M University, receives 2nd Prize check of $100 from L. S. Osborne, Coordinator of the Student Poster Contest. Fink also was awarded a $500 scholarship grant by the F.E.S. Photograph by Frank W. Mead.

nominated for Entomologist of the Year nor was any individual or group nominated for a Special Award. The committee did not feel it should take it upon itself to make these nominations so awards will not be given in these categories.

Honorary Membership

Among the honors and awards which our Society confers is perhaps the most prestiguous of them all—Honorary Membership. Although Honorary Membership may mean different things to different people, a person who has earned Honorary Member status is certainly respected and recognized for his or her contributions to the Society as well as to the Profession of Entomology. This is especially evident when considering the procedure the Society has designated for electing Honorary Members. A potential honoree must be nominated in writing to the Secretary and then be approved by the Executive Committee. The candidate must then be approved by the membership in a secret mail ballot. At least two-thirds of those balloting must be in approval.

The Bylaws of our Society restrict the number of Honorary Members to 10. At the present time we have 9. It is my privilege tonight to announce the election of our newest Honorary Member.

Our honoree joined the Florida system in 1948 where he endured 28 years until his retirement in May of 1976. He has contributed greatly to Entomology Research, Teaching, and Extension and to the phenomenal growth of

Fig. 5. Alan Bolten (left), Department of Zoology, University of Florida, winner of a $500 scholarship, receives congratulations from Professor Lewis Berner, member of the Scholarship Committee. Photograph by Frank W. Mead.

Entomology statewide. He has always been ready counsel for graduate students and a sounding board for research ideas. He has taught numerous courses and studied insects in greenhouse, ornamental, pasture, fruit, vegetable, and tropical culture. He has had the dubious honor of studying the antics of the lovebugs. He has published numerous journal and popular articles and has to his credit circulars and bulletins dealing with pests of roses and orchids.

His contributions to the Florida Entomological Society are numerous having served on many committees in addition to serving as Treasurer-Business Manager, Vice-President and President. He is a Member of the Entomological Society of America (where he served on the governing board), the Kansas Entomological Society (where he served as Vice-president), Sigma XI (where he served as President of the Florida chapter), the American Registry of Professional Entomologists, Phi Sigma, and Gamma Sigma Delta. He is also a research associate of the Florida State Collection of Arthropods.

It is with a great deal of pleasure that I present to Dr. Louis C. Kuitert this plaque which commemerates his selection as an Honorary Member of the Florida Entomological Society.

Special Award

Last year, the Florida Entomological Society, the State of Florida and the nation lost a dedicated and revered Entomologist. We wish tonight to

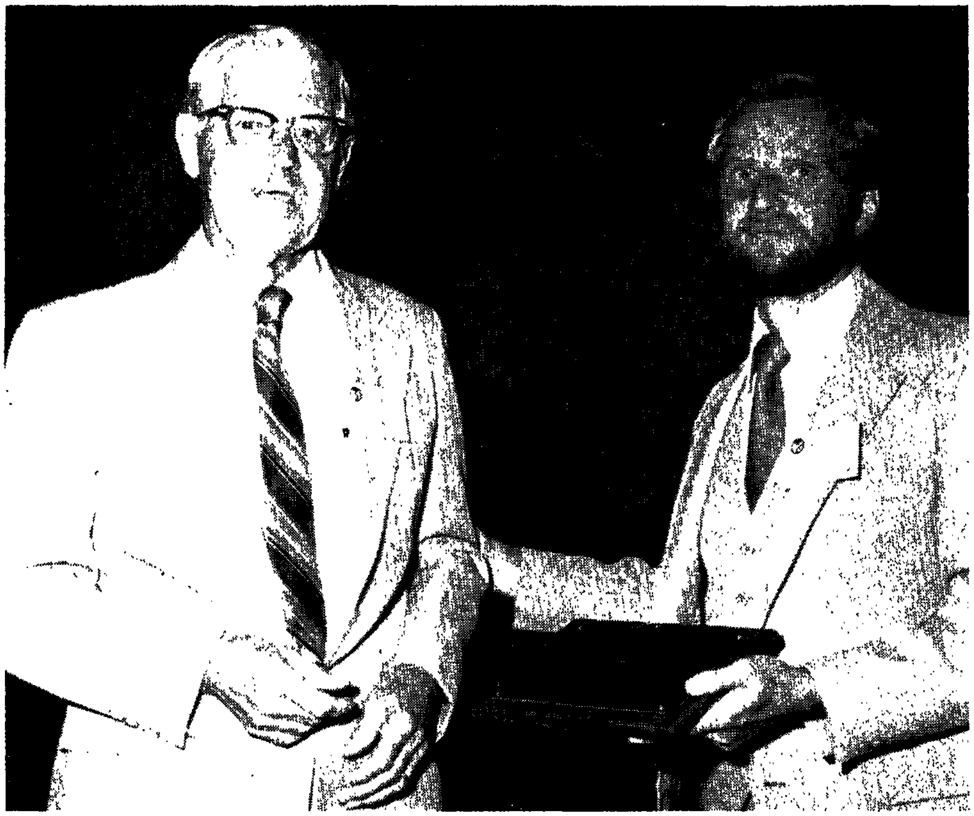


Fig. 6. Dr. Louis C. Kuitert (left), Professor of Entomology (ret.) University of Florida, was presented a plaque commemerating his selection as an Honorary Member of the Florida Entomological Society by D. J. Schuster, Chairman, Honors and Awards Committee. Photograph by Frank W. Mead.

recognize the many accomplishments of Mr. W. G. 'Bill' Genung.

Although Bill was born in Connecticut, he spent nearly all of his life in Florida. His intense interest in and love for Florida certainly earned him the distinctive title of 'Native'.

Bill accepted the position of Assistant Entomologist at the Lake Worth Field Laboratory of the Everglades Experiment Station in 1949 and remained with the Belle Glade Station until his death in 1982.

Although trained as an Entomologist, Bill was an expert on the Fauna and Flora of Florida and its surrounding waters. He was a true naturalist. He studied the ecology, biology and control of insect pests of pastures, cattle, sugarcane, vegetables and agronomic crops. Biological and ecological investigations accompanied or preceded chemical control tests. Biological control agents and cultural practices were always taken into consideration. Integrated pest management programs involving Entomology, Nematology, Plant Pathology and Weed Science were his goal.

In addition to the Florida Entomological Society, Bill was an active member of the Entomological Society of America, the Soil and Crop Science Society of Florida, and the Florida State Horticultural Society. He served and supported our Society in many capacities, the most important of which was as president.

A special award in the form of a plaque will be presented to Dr. Joe Good, Director of the Agricultural Research and Education Center at Belle

Fig. 7. Dr. Joe Good, Center Director at AREC-Belle Glade and Mrs. William G. Genung with the commemorative plaque honoring the contributions of the late W. G. Genung. The presentation was made on 20 October 1983 & the plaque will be displayed at AREC-Belle Glade.

Fig. 8. Dr. James E. Lloyd (left), Professor of Entomology, University of Florida, was presented a Certificate of Appreciation by D. J. Schuster, Chrm. Honors and Awards Committee. Photograph by Frank W. Mead.

Glade. The plaque will be displayed at the Center so that the contributions and service for which we recognize Bill tonight will not be soon forgotten.

Certificate of Appreciation

Our next honoree has been with the University of Florida since 1966 and is a professor in the Department of Entomology and Nematology as well as a courtesy professor in the Department of Zoology.

Fig. 9. Dr. Robert W. Metz (left), Research Associate, FMC Corporation, was presented with a Certificate of Appreciation by D. J. Schuster, Chrm. Honors and Awards Committee. Photograph by Frank W. Mead.

He is internationally recognized as an expert in Firefly Behavior especially with respect to Bioluminescent Communication. He has authored about 30 journal articles and nearly 10 monographs, book chapters and reviews on the subject.

He is a member of numerous professional societies including the Florida Entomological Society for which he has served as Editor of scientific notes for the Florida Entomologist for the past 5 years. He has also served on the Publication Committee and the Program Committee. It is for his efforts in the last regard that we wish to recognize him tonight.

In 1978 Dr. Norm Leppla and our honoree co-organized a symposium for the annual meeting of the Southeastern Branch of the Entomological Society of America. The symposium, entitled "Sociobiology of Sex", was published in the *Florida Entomologist* in 1979. Our honoree has since organized

Fig. 10. Mr. John B. O'Neil (left), American Cyanamid Company, was presented the 1983 Achievement Award in Industry by D. J. Schuster Chrm. Honors and Awards Committee. Photograph by Frank W. Mead.

a symposium on "Insect Behavioral Ecology" for the annual meeting of our own Society every year for the last 5 years. The proceedings of these symposia have been published in the *Florida Entomologist* but have also been bound separately for reprint purposes. Our Society has benefitted in stature as a result of these as well as other symposia. Quoting from the 1982 report of a special committee on future publications: ". . . the reception of these symposia by the entomological community has been very favorable; the Society has even added a few members because of the quality of the symposia and their accessibility through the *Florida Entomologist* . . . the stature of the Society and the *Florida Entomologist* continues to rise partly because of the symposia."

It is a pleasure to present this certificate of appreciation to DR. JAMES E. LLOYD for his efforts in organizing these symposia.

Certificate of Appreciation

Our next honoree hails from West Virginia. He is a Plant Pathologist by training having received the Ph.D. Degree at Ohio State University. I think the fact that we are honoring a Plant Pathologist this evening is indicative of the broad interest and support that our Society enjoys.

Our honoree joined the FMC Corporation in 1960 and is currently Research Associate for Pesticides. He is a member of the Southeast Branch of the Entomological Society of America and has been a member of our Society for 17 years. He has served our Society on the local arrangements committee

Fig. 11. Dr. Willard H. Whitcomb (left), Professor of Entomology, University of Florida, was presented the 1983 Achievement Award in Research by D. J. Schuster, Chrm. Honors and Awards Committee. Photograph by Frank W. Mead.

twice in the past and the knowledge and experience he gained was put to good practice as chairman of this year's committee. I think you will agree that the hard work and long hours that our honoree has expended in making arrangements for this meeting have been well spent.

It is a pleasure to present this certificate of appreciation to DR. ROBERT W. METZ.

Last year the Florida Entomological Society established annual achievement awards to be given in the categories of industry, research, and teaching-extension. The committee has identified outstanding individuals in each category and I would like to present them to you now.

Annual Achievement Award for Industry

Our honoree for the achievement award in industry joined American Cyanamid in 1951 and has spent his entire career with the Company.

In 1954 our honoree moved to Florida and has covered the southern U.S. ever since. He has been in charge of Cyanamid's southern field staff since 1971. He has had an active role in research, development and/or technical service for an impressive list of the company's products including fertilizers, plant growth regulators, defoliants, Herbicides, fungicides, nematicides and insecticides. The list includes at least 18 different products.

Our honoree has served as President of the Florida Entomological Society, the Georgia Entomological Society, and the Florida Anti-Mosquito Association. He has also served on many committees in all of these societies and is still active in our society. He usually attends our annual meetings and participates in the business meetings.

Because of his integrity, professionalism, and many contributions to entomology and our society, I am proud to present the Florida Entomological Society Annual Achievement Award in Industry to MR. JOHN B. O'NEIL.

Annual Achievement Award for Research

Our honoree for the Achievement Award for Research began his career in 1947 when he accepted the position of Entomologist with Ministerio de Agricultura y Cria, Maracay, Venezuela. In 1952 he took charge of entomological investigations for Shell Oil Company of Venezuela at Cagua. From 1956 to 1967 he was Professor of Entomology at the University of Arkansas and centered his attention on the beneficial arthropods of cotton. During this period he teamed with the corn breeder J. O. York to select corn lines resistant to the southwestern corn borer. From 1967 to 1969 he was Peach and Pecan Entomologist at Big Bend Horticultural Laboratory, Monticello, Florida. He has been Professor of Entomology at the University of Florida from 1969 until the present. He is a nationally and internationally acknowledged expert in biological control of arthropod pests, spider and ant biology, and pest management and insect ecology, particularly with respect to habitat manipulation.

It is impossible to mention all of the accomplishments of our honoree in the short time we have this evening but I will mention a few. He is author or co-author of 120 technical articles and author of 5 books or book chapters. He has served as visiting professor or researcher in many countries including Mexico, Guadeloupe, Germany, Argentina and Brazil.

Our honoree is a member of 10 professional societies and is a Henry L. Beadl Fellow in Insect Field Ecology for the Tall Timbers Research Foundation. He was Treasurer of the Western Hemisphere Regional Section of the International Organization of Biological Control. He was also co-chairman of a committee which organized the working group for biological control in the Southeastern U.S.

It is with a great deal of pleasure that I present the annual achievement award for research to DR. WILLARD H. WHITCOMB.

Annual Achievement Award for Teaching-Extension

Our honoree for the Achievement Award for Teaching-Extension joined the faculty at Florida A & M University in 1967 and became Chairman of the Department of Entomology and Structural Pest Control in 1975. He still holds that position.

Although our honoree is a recognized expert in the taxonomy of mayflies, we wish tonight to acknowledge his contributions to teaching and extension at Florida A & M. Our honoree has been a major driving force behind the establishment of the strong undergraduate entomology program at Florida A & M. There currently are 14 faculty and teaching staff under his direction. He has taught or is teaching General Entomology, Systematic Entomology, Principles of Animal Taxonomy, and Orientation to Entomology.

Florida A & M is 1 of only 2 universities in the U.S. that offer full 4 year programs for structural pest control majors. Our honoree is President of the Reuben Capelouto Foundation which was organized to promote and support undergraduate degree programs at Florida A & M, especially with respect to structural pest control. In addition, our honoree expanded the annual departmental open house to include a hands-on workshop dealing with pest control. He organizes and coordinates these workshops which have addressed topics ranging from turf to wood-destroying organisms. Par-

Fig. 12. Dr. William L. Peters (left), Chairman of the Department of Entomology and Structural Pest Control, Florida A&M University, was presented the 1983 Achievement Award in Teaching and Extension by D. J. Schuster, Chrm. Honors and Awards Committee. Photograph by Frank W. Mead.

ticipants are provided laboratory space and equipment to gain experience in pest identification. The interest in these workshops has been tremendous with about 230 attending the workshop held this year.

Our honoree is a member of 10 professional societies in addition to the Florida Entomological Society. He has served our Society as Chairman of the Publicity Committee for 4 Years, as Vice-President, as President and now as Past-President. He spent much time and effort this year working with Dr. F. A. Wood (Dean for Research, IFAS, University of Florida) in convincing him of the national stature of our Society and journal. It is with a great deal of pleasure that I present the annual achievement award for teaching-extension to DR. WILLIAM L. PETERS.

Recognition of the President

Last, but certainly not least, we wish to acknowledge the outstanding job of our outgoing President, Mr. A. C. (Abe) White. Abe has expended much time and effort on behalf of our Society and has insured its continued growth and development. In his presidential address, Abe expressed concern for the recognition and image of Entomology, Entomologists and our Society. The efforts of many people over several years have culminated this year in the attainment of national recognition of our Society and our journal by IFAS. So, on behalf of the Florida Entomological Society it is a

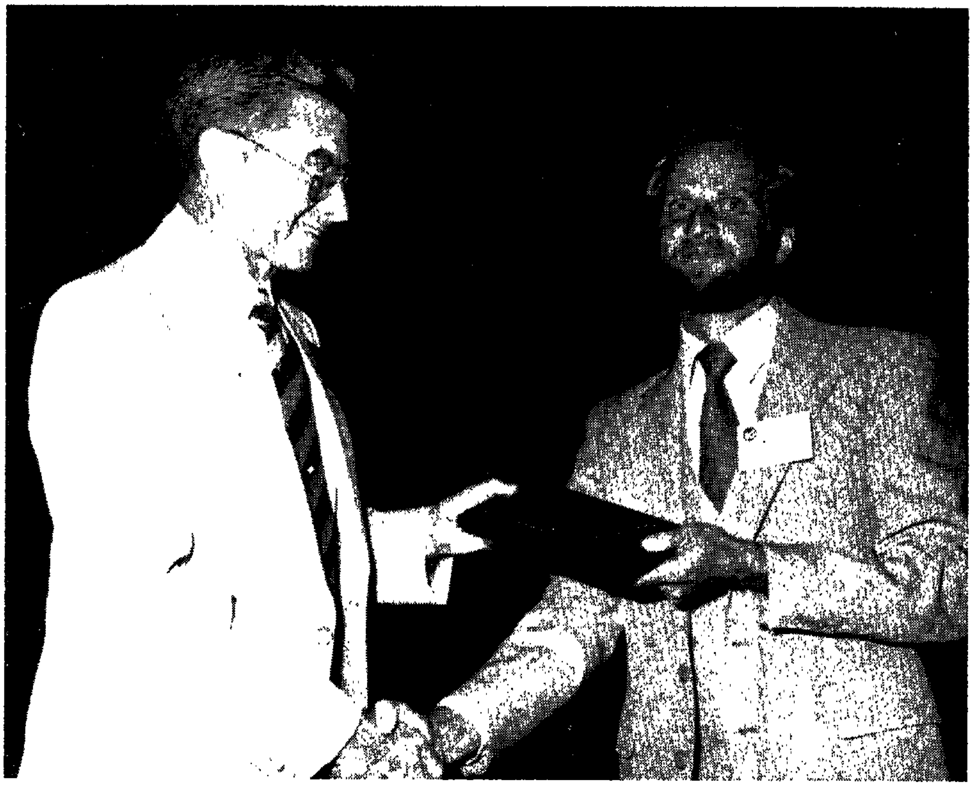


Fig. 13. Mr. A. C. (Abe) White (left), Outgoing-President receives a plaque for a job well done from D. J. Schuster, Chrm. Honors and Awards Committee. Photograph by Frank W. Mead.

pleasure to present this plaque to Abe for a job well done.

Ladies and gentlemen, fellow members, and honored guests, this completes the report of the honors and awards committee.

C. S. LOFGREN
V. H. WADDILL
D. J. SCHUSTER, Chairman

REPORT OF THE RESOLUTIONS COMMITTEE

Resolution No. 1

WHEREAS the Florida Entomological Society meeting at the Sheraton Sand Key Resort, Clearwater, Florida, has found the facilities to be convenient and attractive and the staff to be hospitable and courteous, which has greatly contributed to the success of the meeting,

THEREFORE, BE IT RESOLVED that the Society be instructed to write a letter of appreciation to the Hotel management.

Resolution No. 2

WHEREAS Rita Garvey, Clearwater City Commissioner, willingly gave of her time and efforts to give the welcome to the Society for the City of Clearwater, which effectively opened the 66th Annual Meeting of the Florida Entomological Society, THEREFORE, BE IT RESOLVED that the Society be instructed to write a letter of appreciation to her.

Resolution No. 3

WHEREAS the Local Arrangements Committee has provided excellent organization and facilities for the 66th Annual Meeting of the Society,

AND WHEREAS the speakers who submitted papers, including student and professional scientists in academia, business, industry and government, have taken time and effort to share with us their work and ideas,

AND WHEREAS Dr. James E. Lloyd, with support from colleagues and Administration, has created another excellent and stimulating Behavioral Ecology Symposium, which attracts national and international scientists and attention to the Society,

AND WHEREAS the committee supervising the Graduate Student Paper Competition has created another excellent program directing attention to the research of our student entomologists,

THEREFORE BE IT RESOLVED that the Society commend and express its appreciation to those individuals who helped make the meeting a success.

Resolution No. 4

WHEREAS President A. C. (Abe) White and other Executive Committee members have served the Society in many ways this past year,

AND WHEREAS Carol Musgrave Sutherland, Editor of *The Florida Entomologist*, has continued to maintain the high standards that sustain the journal's national and international reputation,

AND WHEREAS members of the other committees have contributed their time and efforts to the Society this past year,

THEREFORE BE IT RESOLVED that the Society commend these individuals and express its appreciation for their services to the Society and to the Science of Entomology.

J. A. REINERT
F. SLANSKY, JR., Chairperson

REPORT OF THE AD HOC COMMITTEE ON BY-LAWS

The Ad Hoc Committee on By-Laws was reactivated by President White to address the problem on the nomination and election of officers. After much consultation and discussion with members the following motion was made by Harold Denmark at the final business meeting and voted on by the members:

> "The Nominating Committee shall consist of three members. The Chairperson, *immediate* Past-President of the Society, will appoint the other two members. All will serve for one year. This committee shall prepare a list of candidates comprising one nominee for President, one nominee for President-Elect, two or more nominees for Vice-President and Secretary, one or more nominees for Treasurer to serve for three years, and two members-at-large, one of whom shall be elected each year to serve for two years. The Committee shall secure the consent of each candidate before presentation. These names shall be mailed out to the membership not less than 30 days before the Annual Meeting. The election results will be announced at the Annual Meeting".

Motion seconded by Wojick; motion carried.

G. R. BUCKINGHAM
D. H. HABECK
F. A. JOHNSON
H. A. DENMARK, Chairman

Report of the Joint Meeting/Caribbean Conference Committee

Several months ago, I was approached by the Florida Entomological Society about chairing a committee to explore the possibility of holding the 1985 meetings of the FES somewhere in the Caribbean. Over the past several weeks, my committee has begun to investigate this possibility, and we are ready to propose the following:

> That the Florida Entomological Society does, in fact, plan a 1985 meeting somewhere in the Caribbean and that my committee be given the sanction (moral and financial) to plan the site and logistical details for such a meeting.

This motion was made and passed by a vote of 37 to 3 during the Final Business Meeting of the 1983 annual FES meetinigs.

R. Baranowski
F. Bennett
C. Barfield, Chairman

Report of the Nominating Committee

With approval by the Executive Committee, a straw ballot was mailed to all members on July 1, 1983. The straw ballot included the following nominations for 1983-1984: for President-Elect M. Lewis Wright, Jr. and write in candidate; for Vice-President John A. Mulrennan, Jr. and James A. Reinert; for Secretary David F. Williams and write in candidate; for Member at Large (2 years) Emil A. Moherek and Robert W. Metz; and for Honorary Membership Louis C. Kuitert. Based on the straw ballot those candidates receiving the most votes are: M. Lewis Wright for President-Elect, James A. Reinert for Vice-President, David F. Williams for Secretary, Robert W. Metz for Member at Large (2 years) and Louis C. Kuitert approved for Honorary Membership. Therefore the Nominating Committee would like to nominate the following slate of officers for 1983-1984: for President-Elect M. Lewis Wright, Jr., for Vice-President James A. Reinert, for Secretary David F. Williams, and for Member at Large (2 years) Robert W. Metz. Based on constitutional decreed, we recommend Clayton W. McCoy to be installed as President. Further, we nominate Louis C. Kuitert to be an Honorary Member.

H. V. Weems, Jr.
R. Lipsey
W. L. Peters, Chairman

A. Selhime moved that the nominations be closed and that the slate be elected; motion seconded by H. Denmark; motion carried. The new President, Clayton W. McCoy was escorted to the podium by A. Selhime and H. Denmark. President McCoy recognized the fine job that A. C. White did the past year as President and also the outstanding job that M. L. Wright did in putting the program together. McCoy announced the appointment of an Ad Hoc Committee to search for a new Business Manager consisting of the following members:

J. A. Mulrennan, Jr., Chairman
W. L. Peters
A. C. White
N. C. Leppla
M. L. Wright
R. F. Brooks

Wright extended his sincere appreciation to all individuals who helped to make this program one of the best.

The final door prize was won by L. Stange. Other door prizes were won by D. Williams and R. Patterson. There being no further business, the 66th Annual Meeting was adjourned at 12:35 p.m. 12 August, 1983.

EXECUTIVE COMMITTEE MEETINGS 1982-83

17 November 1982, Gainesville, Division of Plant Industry
2 February 1983, Gainesville, Division of Plant Industry
9 June 1983, Gainesville, Division of Plant Industry
9 August 1983, Clearwater Beach, The Sheraton (Hotel)

DAVID F. WILLIAMS, Secretary


ENTOMOLOGICAL
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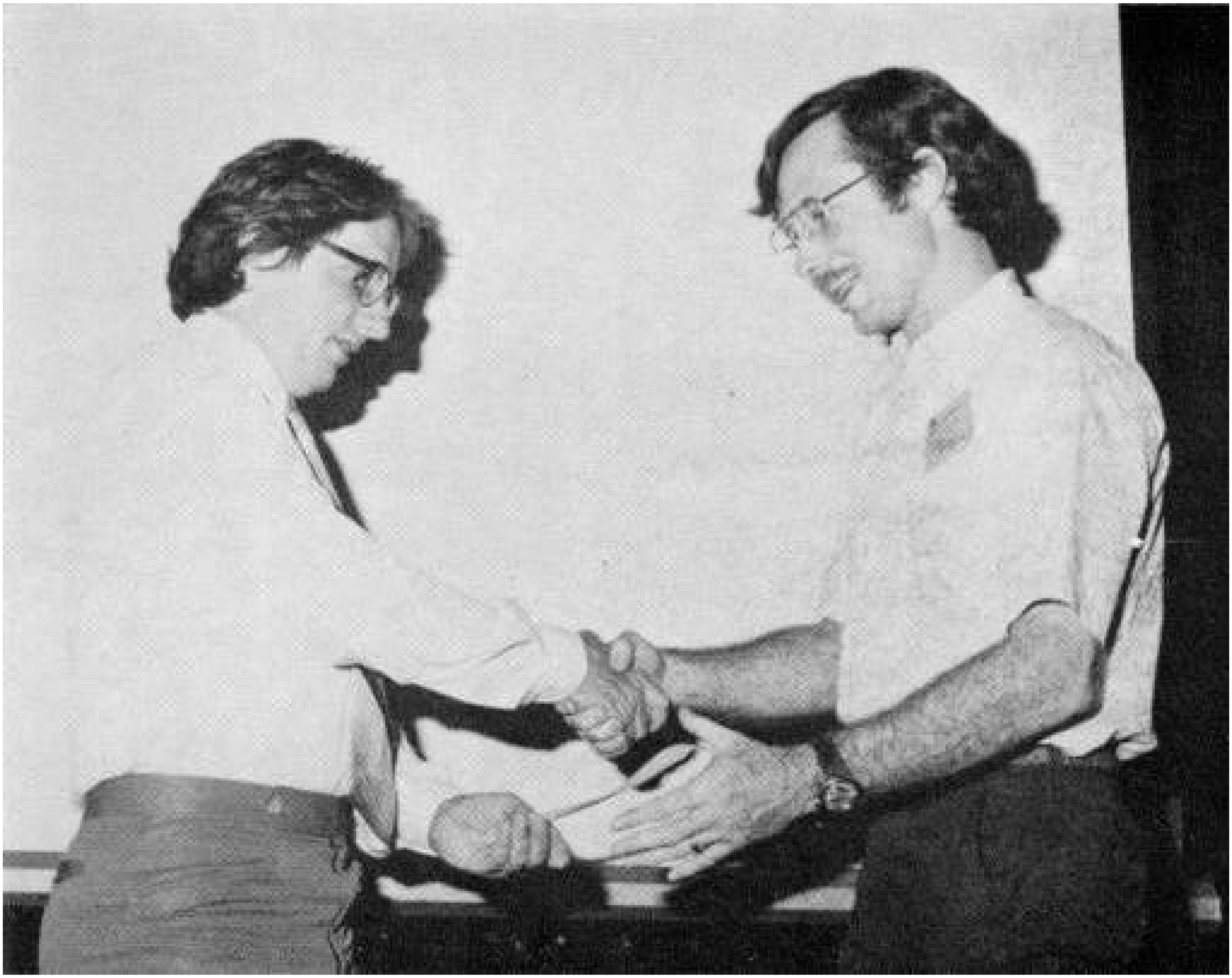

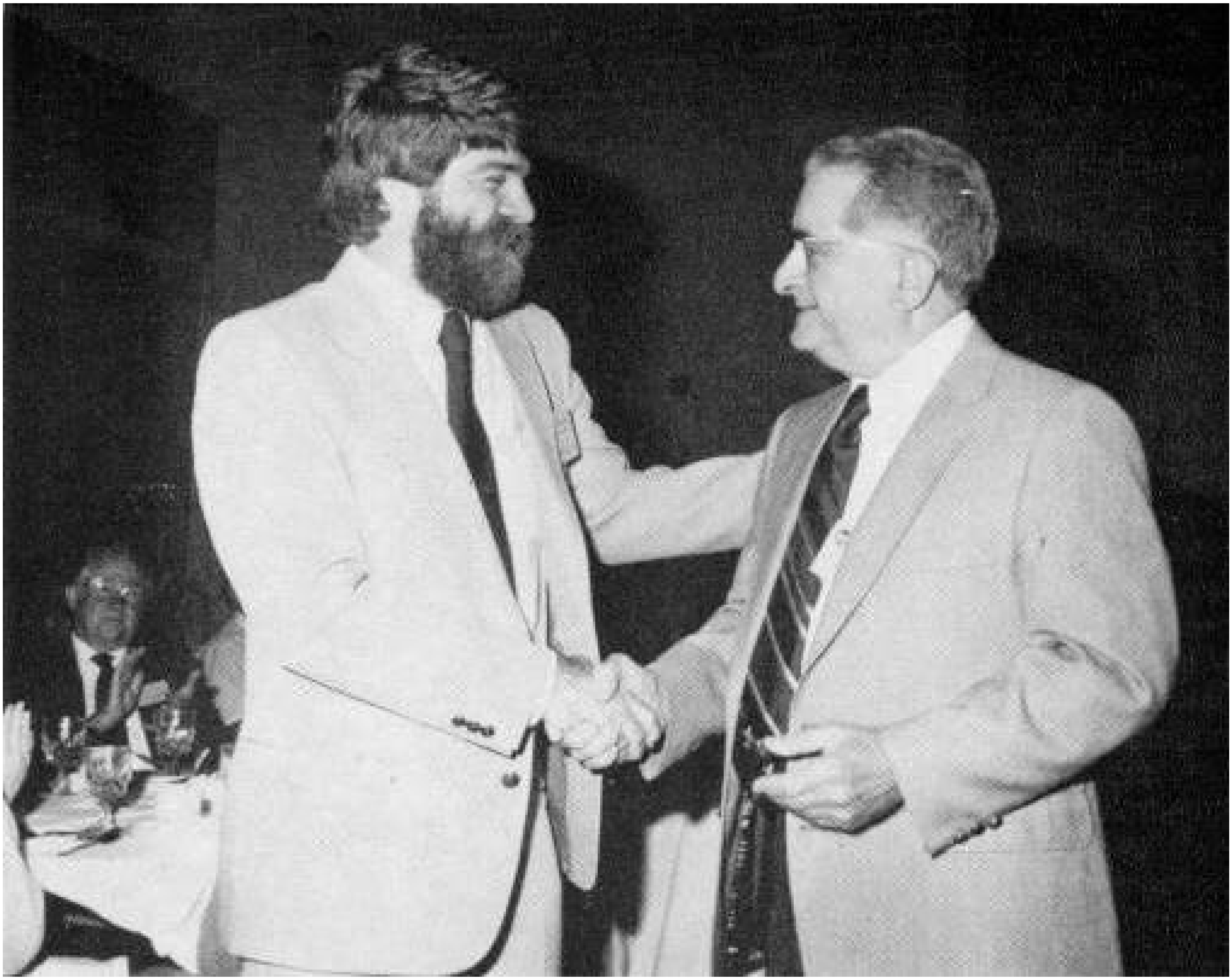

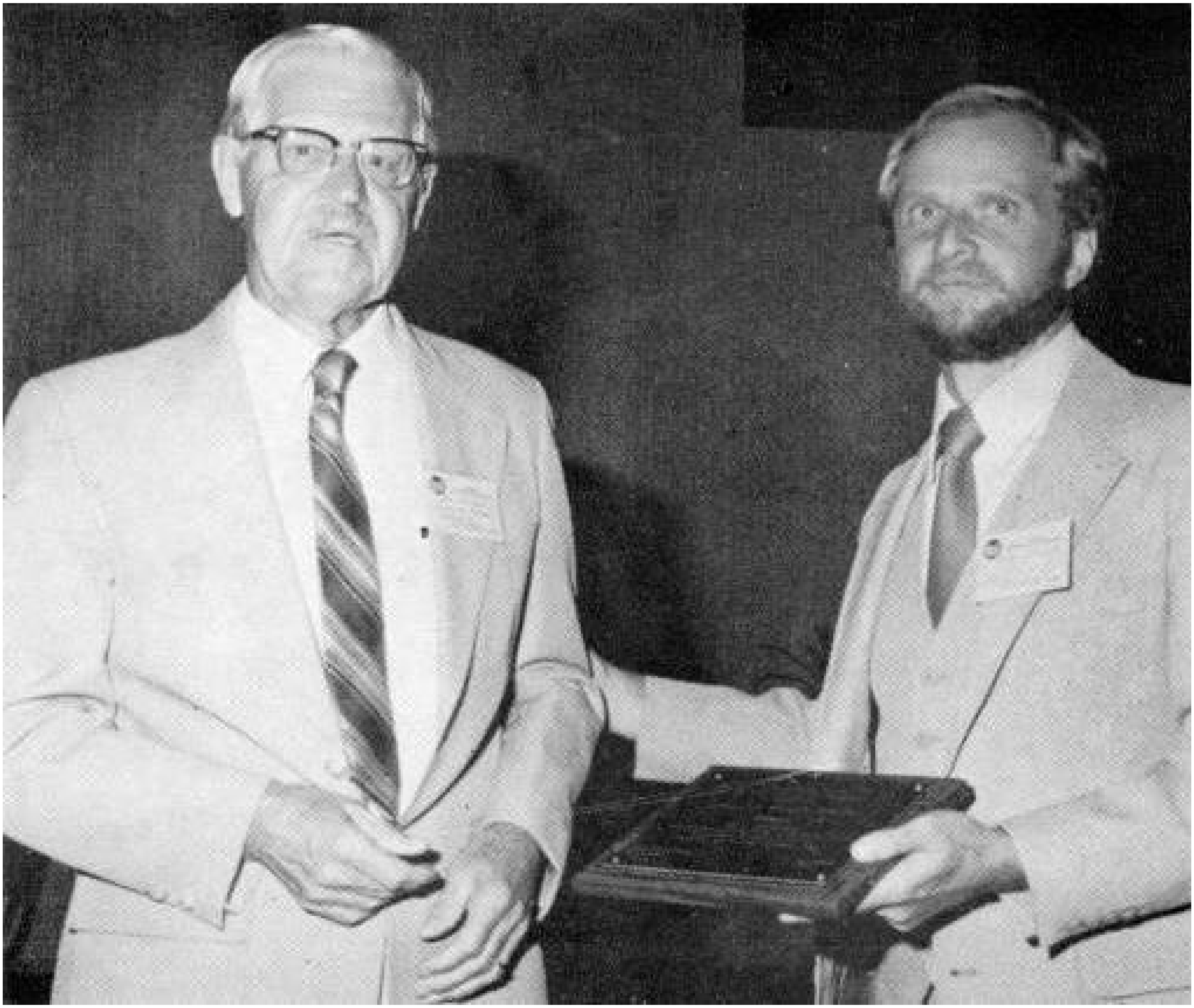

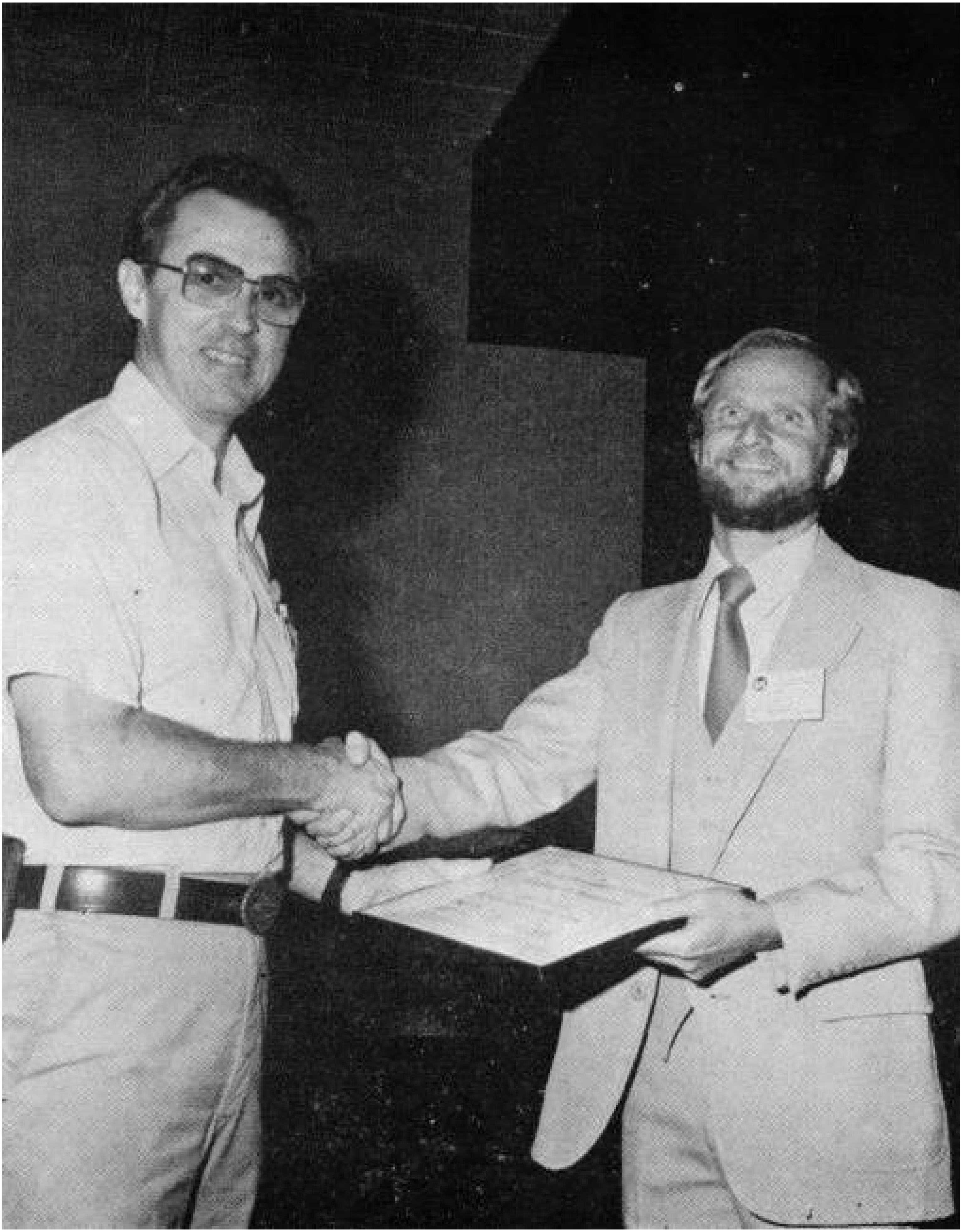

NEW SOCIETY ADDRESS

Effective 5 December 1983, the Business Manager/Treasurer of the Florida Entomological Society will be ANN C. KNAPP. The new business address for the Society will be: P.O. BOX 7326, WINTER HAVEN, FL 33883-7326.

FES PLANS 1985 MEETING IN JAMAICA

The Florida Entomological Society is planning to hold its 1985 meetings, Aug. 5-8, Sheraton Hotel, Ocho Rios, Jamaica. Meeting emphasis will be both on general entomology and interdisciplinary crop protection. Scientists from the USA, Latin America and the Caribbean will attend. Persons interested in attending or desiring additional information should contact DR. CARL S. BARFIELD, Prog. Chm., Dept. Entomology & Nematology, 3103 McCarty Hall, University of Florida, Gainesville, FL 32611; (904)-392-7089.

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POSITION ANNOUNCEMENT

JOB DESCRIPTION: Two (2) post-doctoral positions are available for persons interested in work on the design and implementation of pest management programs in tropical ecosystems. Primary research will be on major pests of maize and beans in Honduras. Research will be conducted at the Pan American School of Agriculture and at three (3) outlying areas in Honduras.

REQUIREMENTS: Ph.D. in entomology, plant pathology, or related crop protection discipline. Candidates must be able to demonstrate research capabilities in vita materials. Fluency in Spanish is required. Candidates must have interest in applied research work in tropics and be willing to reside in Honduras.

SALARY: Negotiable and dependent upon qualifications.

BENEFITS: Successful applicants will be provided housing, basic medical care, transportation and other fringe benefits.

TO APPLY: Interested persons should send curriculum vita, three (3) letters of recommendation, and a statement of interests and objectives to either of the following:

Dr. Keith Andrews	Dr. C. S. Barfield
Escuela Agricola Panamericana	Dept. Entomology
Apartado Postal 93	Bldg. 803
Tegucigalpa, Honduras	Univ. of Florida
CENTRAL AMERICA	Gainesville, FL 32611
	(904) 392-7089

JOB DURATION: Successful applicants will be hired for a two (2) year period beginning in 1984. Exact starting date in 1984 is somewhat negotiable, although persons hired should probably be available in the first quarter.

INSECT PHOTO SALON

The American Mosquito Control Association will hold its Annual Insect Photo Salon in conjuction with its annual meeting in Toronto, CANADA from 18-22 March 1984. The salon is sanctioned by the Photographic Society of America and will be conducted according to PSA standards. The competition is open to all photographers. Only 2x2 slides of insects and/or their arthropod allies can be submitted. Entries are limited to 4 slides per photographer. The entry fee is $3.00 (U.S.). Entry forms and complete details can be obtained from: DR. C. LAMAR MEEK, Chairman, AMCA Photo Salon, Dept of Entomology, Louisiana State University, Baton Rouge, LA 70803.

BOOK REVIEW

HOW TO WRITE AND PUBLISH A SCIENTIFIC PAPER, Second Edition. Robert A. Day. ISI Press—A subsidiary of the Institute for Scientific Information. 3501 Market Street, University City Science Center, Philadelphia, PA 19104. 181 p. $17.95 hardcover, $11.95 softcover.

Most books about scientific writing are on writing as such and are very general. Day, in contrast, concentrates on preparing articles for primary, refereed journals, and how to get articles published. The first edition was highly successful, which was particularly gratifying to me since Day's book is the first I've seen whose approach to teaching scientific writing and whose emphases are the same as in my course on the subject. Such instruction could be subtitled "103 tricks of the trade for slipping a manuscript past an editor".

I wish Day did not say ". . . the goal of research is publication", however much I agree that research must be published and that the scientist ". . . becomes known by publications". Philosophical differences aside, Day presents a "how to" book that can be used as a reference text: How to Prepare the Title, How to list the Authors, How to list the Addresses, How to Write the Introduction, and on through 10 more to How to Deal with Editors and How to Deal with Printers.

He does not start at the beginning. Our goal is to help young scientists convert notebooks of raw data into a publishable manuscript. The first step is to organize the data, and some courses on "writing" cover virtually nothing else. One might conclude from reading Day that the article can be written first and *then* the tables and graphs prepared. But that is only a matter of the order in which chapters are arranged. The reason I would not require my students to buy the first edition as the course textbook is the many errors of omission. The 2nd edition is no improvement. Like many books about writing, Day's repeatedly identifies problems in scientific writing for which no solutions are offered. He does not explain why the errors arise and how to recognize and repair them or how to avoid them. There is about a page of examples of wildly dangling gerunds and participles with no explantation of how to avoid or correct them. There are 5 examples of titles with syntactical errors with only 1 example of how to correct such a title. Lists are offered (The Ten Commandments of Good Writing, The Ten Commandments of Good Speaking) that are wholly cast sarcastically in the form of bad examples. Day thinks this is humorous. It most certainly is not constructive. This attitude seems to assume the readers are already erudite and practiced writers and that Day can write for their amusement, not their instruction.

This is a shame because when he sets himself to be wholly instructive a superb job is done. His exposition on Tense in Scientific Writing is surely the best I have seen, and fine discussions are presented on the Review Process, and Ethics, Rights, and Permissions, among others. Day's experience as an editor shows to excellent advantage in these sections.

After the section on writing and publishing primary articles (1st 17 chapters) several chapters cover specific topics such as How to Present a Paper Orally, How to Write a Thesis, How to Write a Book Review, and the like. These are brief chapters with considerable rumination and philosophizing and a handful of useful suggestions. Overall, they are weak. The new chapter on The Electronic Manuscript says only that word processors are the coming thing, and they have advantages. Its inclusion gives no improvement over the 1st edition.

In brief, Day is too brief. Nevertheless, his book is the most useful of its genre. Get it and use it. It will help you grease your MS so it will slide past the crustiest old editor.—S. H. KERR, Dept. of Entomology and Nematology, University of Florida, Gainesville, FL 32611 USA.

TRICHOPTERA OF THE AREA PLATENSE: Oliver S. Flint. 1982. Biología Acuática, published by the Instituto de Limnologia, La Plata, Argentina. 70 p., 71 fig. $8.00.

Dr. Flint has prepared a systematic analysis of the caddisflies of the Area Platense, Argentina, including keys and descriptions of the thirty-one species occurring in the area. The paper has keys to the 6 families and the 11 genera as well as brief descriptions of the habitats, comments on distribution, and methods for collecting and preserving the immature and adult stages.

The booklet comprises the second issue of the journal "Biología Acuática". Those persons wanting to learn more about the journal or to order Dr. Flint's paper should write to Analía C. Paggi, Instituto de Limnología, Casilla de Correo 55, 1923 Berisso, Argentina.—LEWIS BERNER, Department of Zoology, University of Florida, Gainesville 32611 USA.

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