TAXONOMIC STUDY OF THE PLANTHOPPER FAMILY CIXIIDAE IN THE UNITED STATES (HOMOPTERA: FULGOROIDEA)

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ABSTRACT

This study completes the first taxonomic revision of the planthopper family Cixiidae in continental United States. Thirteen genera and 172 species are recognized. A key to all 13 genera is presented. Four genera, *Cixius* Latreille, *Myndus* Stål, *Oecleus* Stål, and *Oliarus* Stål, were recently revised by the author, and appropriate references are made to these other studies. Species of the remaining 9 genera are treated here. New genera and new species: *Stegocixius lochites* (Calif.) and *Asotocixius diopter* (Ariz.). New species: *Bothriocera tex* (Texas), *B. omani* (Fla.), *B. datuna* (Ala.), *B. turcafa* (Fla.); *Microledrida olor* (Texas); *Pintalia vibex* (Fla.), *P. gurneyi* (Va.). New synonymy: *Nymphocixia vanduzeei* Muir and *N. vanduzeei* var. *floridensis* Caldwell are reduced to syns. of *N. unipunctata* Van Duzee. *Pintalia dorsalis* (Van Duzee) and *P. dorsivittatus* (Van Duzee) are reduced to syns. of *P. delicata* (Fowler). Lectotypes are selected for *Pintalia delicata* (Fowler) and *Microledrida asperata* Fowler. The distribution of the family is nationwide with the greatest number of genera and species occurring in the Southwest. Plant associations are recorded. All critical diagnostic features are illustrated, and many new distributional records are included.

INTRODUCTION

The Cixiidae comprise one of the larger and more successful families of the Fulgoroidea and occur in both temperate and tropical portions of the world. The nymphs feed on the rootlets of various plants in a cryptic or subterranean situation, and the adults feed on the exposed parts of the same or different plants.

Recent field observations made by economic entomologists and experimental data compiled by plant pathologists appear to show

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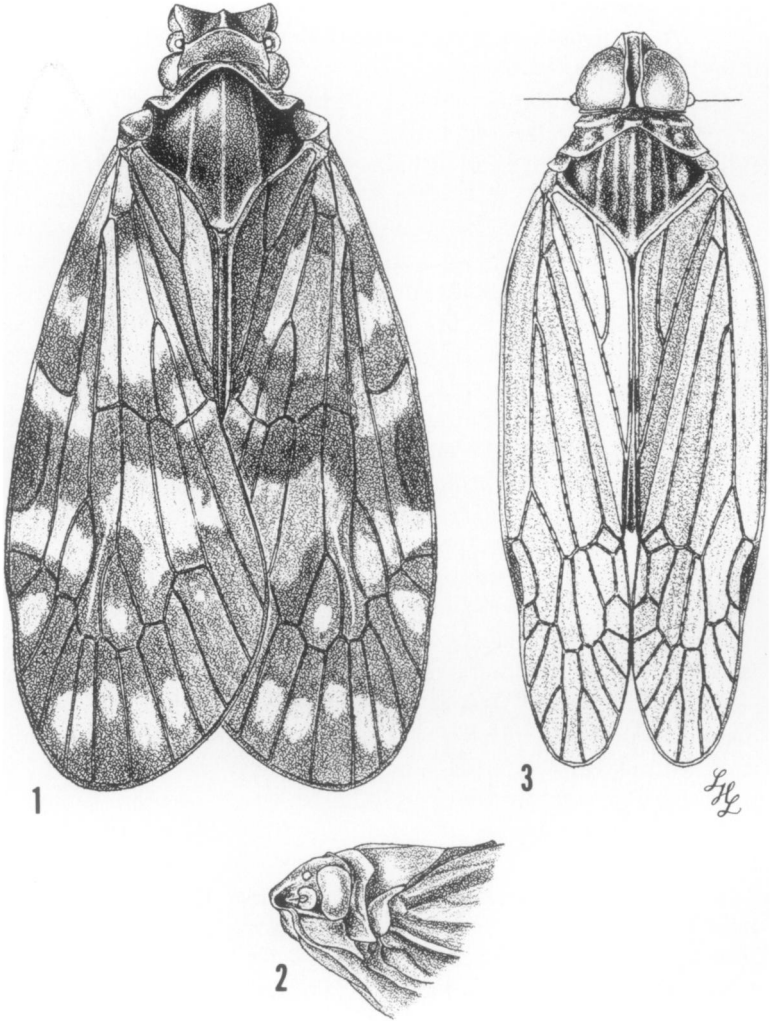
that the involvement of cixiid planthoppers in the transmission of the causative agents of plant diseases may be greater than previously appreciated. Even though most of the evidence to date is preliminary, the general economic implication of cixiids as feeders on cultivated and native plants pointed out the need for a better taxonomic understanding of the family than had been available in the past. This study of the continental United States cixiid fauna was initiated to fulfill this need.

At no time in the past has the cixiid fauna of the United States been studied as a whole. Muir (1925:104-110) published a pilot key to the world genera of the Cixiidae known to him; but he did not include all of the North American genera, provided no illustrations, and gave no indication that he had actually seen all of the taxa he treated. Van Duzee (1923a:32-35) keyed 4 genera and 12 species as found in or likely to be found in Connecticut; he provided no illustrations, and his generic treatment was better than his treatment of species. Metcalf (1923:160-163), working often from inadequate descriptions alone, provided a good key to the genera but less useful keys to species for the cixiids of eastern North America. His paper was well illustrated, and the accuracy of his drawings is generally good. Dozier (1928:54-82) discussed the cixiids of Mississippi and provided some good biological observations. Osborn (1938:298-310) provided keys to 4 genera and 21 species as found in or likely to be found in Ohio; he provided the first illustrations of the concealed male genitalia of some of the species. Beirne (1950), in a preliminary report, recorded two genera in the Canadian fauna; his key to species employed imprecise characters and repeated some of the errors of the past. The value of the studies of all the previous workers is flawed, especially at the species level, by numerous misdeterminations, wrong names, and imprecise definitions. In fairness to all of them, the data presented in their contributions reflected the best knowledge of their day. Metcalf (1936:3-4) provided a complete historical review of the Cixiidae in his world catalogue, and this information is not repeated here.

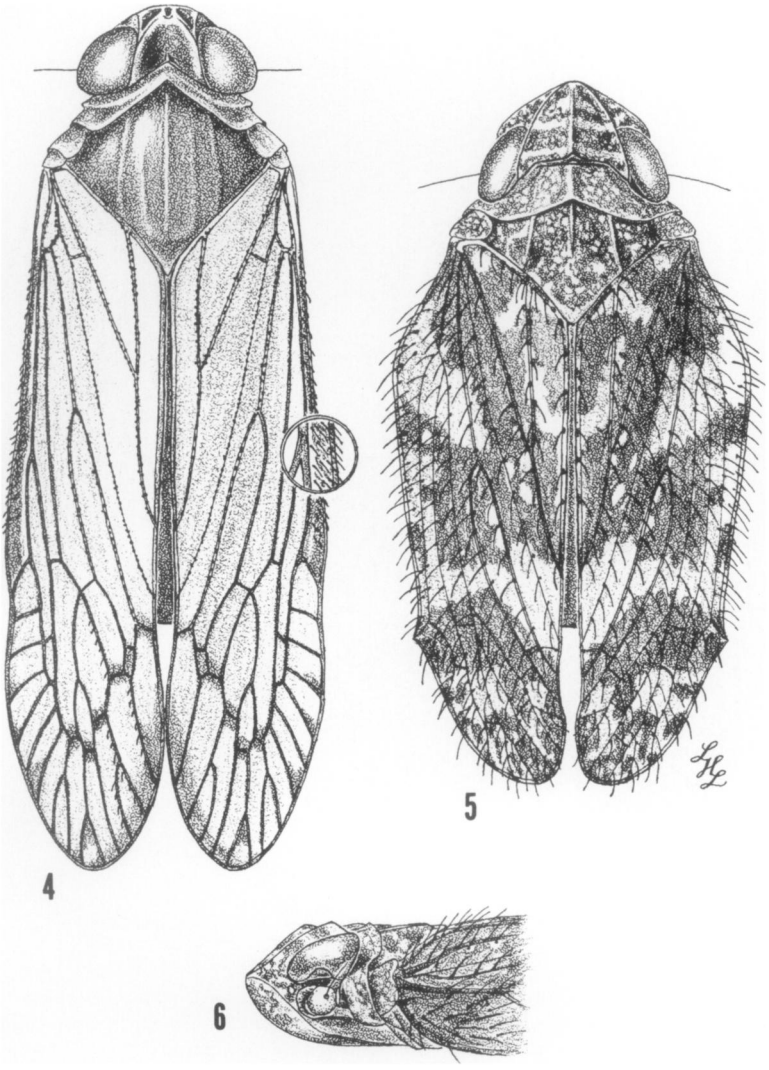
During the course of this research, I was able to restudy all extant holotypes, select lectotypes, or rarely designate neotypes for all of our native species of Cixiidae. The family Cixiidae is now known to

include 13 genera and 172 species in the continental United States. No special attempt was made to include the Canadian fauna, but there are no genera or species found in Canada that are not also found in the United States.

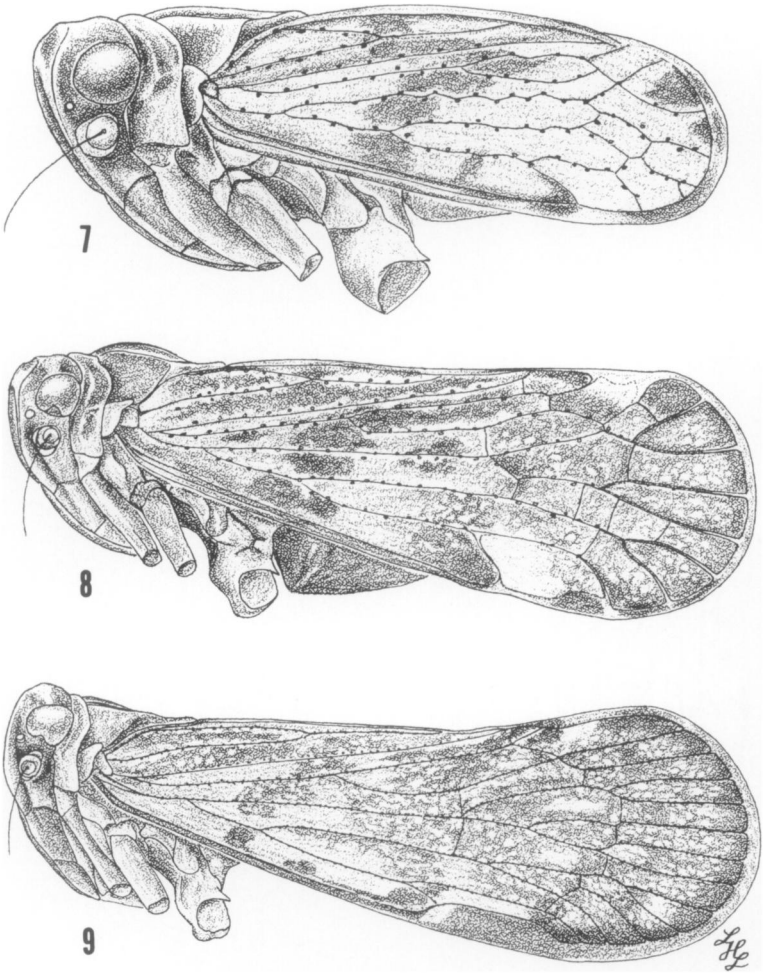
Description of family. — The members of the family Cixiidae may be characterized as small to rather large (3.2-11.0 mm) fulgoroids with the head usually narrower than the pronotum; anterior portion of the head not greatly prolonged; sides of the crown slightly to strongly elevated; longitudinal midline of crown often partly carinate; crown and frons at times separated by carina; frons and clypeus together more or less oval or suboval; frons usually longer than wide, its longitudinal midline usually at least partly carinate; clypeus usually triangular; surface of frons and clypeus often at right angle to sides of head; median or third ocellus present (except *Microledrida*) on longitudinal midline of frons in basal half; lateral ocelli anterior to antennae, antennae arising below eyes (except *Bothriocera*) on sides of head; second segment of antenna enlarged and bearing papillose sensoria; third segment essentially filamentous; pronotum often short, collar-like, and declivent laterally; mesonotum large and well developed with its discal portion bearing 3-5 longitudinal carinae; legs relatively simple; hind tibiae with cluster of spines at apex and with or without lateral spines on its long axis before the apex; second hind tarsal segment with row of spines across its apex; tegulae present and distinct. Forewings usually at least partly transparent and long, each with claval suture reaching commissural margin, veins often with setae-bearing pustules, typically with four or more subapical cells and greater number of apical cells from stigmal area around apex to tip of clavus. Male genitalia: pygofer usually longest on ventral margin and without obvious processes or appendages, median lobe present on ventral margin of pygofer between styles; styles paired, often capitate distally, sometimes asymmetrical; anal tube or flap usually elongated, sometimes asymmetrical with modified apical portion; aedeagus asymmetrical, often strongly so, consisting of basal shaft and variably developed apical flagellum, either or both shaft and flagellum elaborated with processes or appendages.



FIGURES 1-3. Habitus drawings in dorsal view. 1, *Bothriocera cognita* Caldwell, male from Wetaug, Ill. 2, same, lateral view of head. 3, *Oecleus borealis* Van Duzee, female from Annapolis, Md.

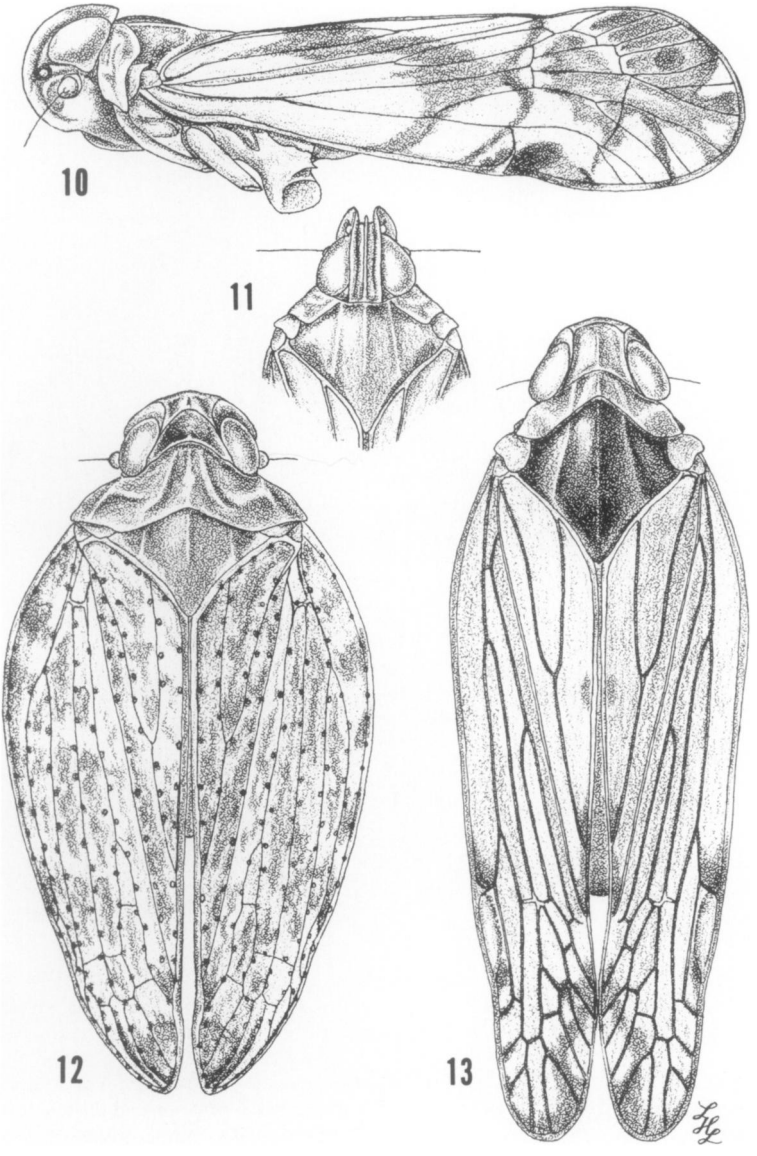


FIGURES 4-6. Habitus drawings in dorsal view. 4, *Oliaronus tontonus* Ball, female from Florence, Ariz. 5, *Microledrida fuscata* Van Duzee, female from San Diego Co., Cal. 6, same, lateral view of head.



FIGURES 7-9. Habitus drawings in lateral view. 7, *Monorachis sordulentus* Uhler, shortwinged male from Thomasville, Ga. 8, same, longwinged female from Gulfport, Miss. 9, *Pintalia vibex* n. sp., female from New Bern, N.C.

FIGURES 10-13. Habitus drawings. 10, *Nymphocixia unipunctata* Van Duzee, female paratype in lateral view. 11, same, dorsal view of head and thorax. 12, *Stegocixius lochites* n. sp., male holotype in dorsal view. 13, *Platycixius calvus* Van Duzee, female from San Gabriel Canyon, Cal. in dorsal view.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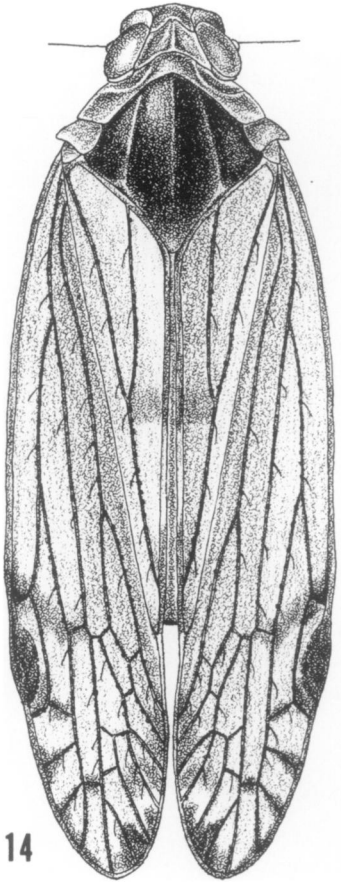
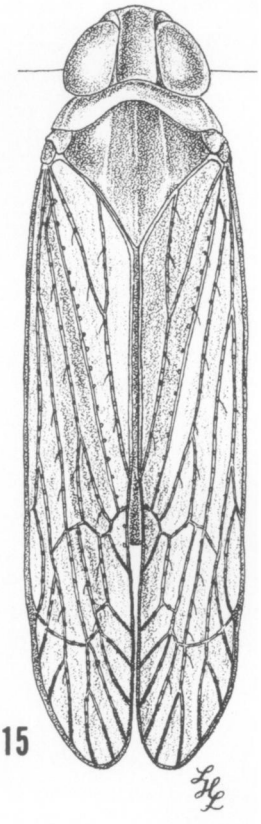




FIGURES 14-15. Habitus drawings in dorsal view. 14, *Asotocixius diopter* n. sp., female from Dixie National Forest, Nev. 15, *Myndus pusillus* Van Duzee, female from Thomasville, Ga.

Diagnosis of family. — The Cixiidae can be distinguished from all other fulgoroid families in our fauna by the following combination of positive and negative characters: head not prolonged to form long cephalic extension; not more than single carina on longitudinal central portion of frons; terminal segment of beak more than twice as long as wide; tegulae present; forewings not broadly overlapping at apex and without numerous crossveins or secondary veinlets in claval and corial areas; second segment of hind tarsus with row of spines at its apex; apex of hind tibia without calcar or moveable spine at its apex; aedeagus asymmetrical and consisting of sclerotized shaft and partly membranous apical flagellum.

Notes on the keys to genera and species. — The characteristics presented in the key to genera can be readily observed as external features of either male or female specimens. The user should note that the spines on the hind tibia before the apex, when present, range in size from relatively large and conspicuous to quite small and inconspicuous, but the spines are never obscure. Frequent reference to habitus illustrations should help to make the task of interpreting generic characteristics relatively easy.

Keys to the species of individual genera are based heavily upon features of the concealed male genitalia. In all cases, references are made to the appropriate illustrations of these structures to facilitate use of the keys. Those genera marked with an asterisk (*) have been previously reported upon: *Oecleus* (Kramer 1977), *Oliarus* (Mead and Kramer 1982), *Cixius* (Kramer 1981) and *Myndus* (Kramer 1979).

KEY TO THE UNITED STATES GENERA OF CIXIIDAE

1. Either antennae arising from elongated cup-like cavities anterior to eyes (fig. 2) or crown much narrowed, almost slitlike, and without strongly elevated lateral margins (fig. 3) 2
   Without either of the above features 3
2. Crown broadly produced in front of eyes, width of anterior coronal margin greater than its median longitudinal length (fig. 1); antennae arising anterior to eyes (fig. 2) ..... *Bothriocera* Burmeister
   Crown narrowly produced in front of eyes, width of anterior coronal margin much less than its median longitudinal length (fig. 3); antennae arising below eyes (Kramer 1977: fig. 3) ..... *Oecleus* Stål*

3. With one or more spines on long axis of hind tibia before apex 4
   Without spines on long axis of hind tibia before apex 10
4. Posterior margin of crown angularly incised (fig. 4); mesonotum with five longitudinal carinae (fig. 4), but intermediate pair sometimes obsolete .. 5
   Posterior margin of crown quadrately or roundly incised; mesonotum with three longitudinal carinae 6
5. Middle portion of costal area of each forewing thickened, dark, and setigerous (fig. 4) ..... *Oliaronus* Ball
   Middle portion of costal area of each forewing hyaline or nearly so, without setigerous punctures (Mead and Kramer 1982: fig. 1) ..... *Oliarus* Stål*
6. Eye elongated, about twice as long as wide (fig. 5); pronotum not strongly narrowed at middle (fig. 5); head porrect in lateral view (fig. 6) ..... *Microledrida* Fowler
   Without all of the above features 7
7. Submacropterous species (fig. 7), forewings just reaching or only slightly exceeding apex of abdomen, hindwings reduced to elongated scales ... *Monorachis* Uhler (in part)
   Macropterous species, forewings extending much beyond apex of abdomen, hindwings fully developed 8
8. Forewings at rest roof-like in position with distal portions clearly separated (Kramer 1981: figs. 1-3); spines on hind tibia conspicuous ..... *Cixius* Latreille*
   Forewings at rest vertical in position with distal portions broadly adpressed; spines on hind tibia less conspicuous 9
9. Mesonotum convex in lateral view (fig. 8); apical cells of forewing comparatively broad (fig. 8); frons with midlength and greatest width subequal ..... *Monorachis* Uhler (in part)
   Mesonotum flat in lateral view (fig. 9); apical cells of forewing almost uniformly slender (fig. 9); frons with midlength exceeding greatest width ..... *Pintalia* Stål
10. Middle portion of pronotum concealed by basal portion of crown (fig. 11); head in lateral view broadly rounded (fig. 10) .... *Nymphocixia* Van Duzee
    Middle portion of pronotum exposed; head in lateral view not broadly rounded 11
11. Pronotum unusually large and concealing all but tips of tegulae (fig. 12) ..... *Stegocixius,* n. g.
    Pronotum not unusually large, most of tegulae exposed 12
12. Carina on longitudinal midline of frons absent ..... *Platycixius* Van Duzee
    Carina on longitudinal midline of frons present 13
13. Crown with distinct carina on both longitudinal midline and between anterior portions of eyes (fig. 14); longitudinal midlength of mesonotum at least 3× longitudinal midlength of crown (fig. 14) (Southwestern) ..... *Asotocixius,* n.g.

Crown without distinct carina on both longitudinal midline and between anterior portions of eyes; longitudinal midlength of mesonotum about 2× or less longitudinal midlength of crown (fig. 15) (widespread) ..... *Myndus* Stål*

Genus BOTHRIOCERA Burmeister

Bothriocera Burmeister 1835:156. Type-species *Bothriocera tinealis* Burmeister 1835:156, by monotypy.

Small to average-sized cixiids (3.9-5.8 mm); head in dorsal view narrower than pronotum, eyes comparatively small, crown broad and subrectangular, strongly produced beyond anterior margin of eyes, its anterior margin concave and as broad or broader than its interocular width at base, lateral and posterior margins of crown carinate, transverse carina between anterior margins of eyes, this carina at middle joins longitudinal carina extending from midline of frons, posterior margin of crown nearly transverse; head in lateral view (fig. 2) with antenna arising from deep elongated depression in front of eye, ocellus prominent and located above antenna in front of eye; head in facial view with sides of frons and clypeus carinate, dorsolateral portions of frons expanded and auriculate, longitudinal midline of frons carinate only on upper half, frontal ocellus prominent, longitudinal midline of clypeus carinate but carina evanescent basally; pronotum reduced to narrow band behind head, its central portion sometimes concealed by posterior margin of head, mesonotum tricarinate, hind tibiae without spines before apex, venation as in fig. 1, veins without setae-bearing pustules. Male genitalia: typical of family, apical flagellum of aedeagus long and well developed, both aedeagal shaft and flagellum elaborated with processes or appendages.

Notes. — *Bothriocera* is primarily a genus of the Neotropics, but ten species do occur in the fauna of the United States. Most of these are found in the eastern portion of our country. Recognition of the genus is easy because the bizarre head of *Bothriocera* is unique among our cixiid genera.

Records of *B. undata* (Fabricius), *B. bicornis* (Fabricius), *B. westwoodi* (Stål), *B. signoreti* Stål, and *B. tinealis* Burmeister for

the United States are based on misdeterminations. All of the above species, with the possible exception of *B. westwoodi,* are Mexican or Neotropical species that do not occur within the geographic boundries of the United States. For comments concerning *B. westwoodi,* see notes under *B. tex* Kramer, n. sp.

Myers (1929:289-292) provided a good description of a bothrioceran nymph. The most remarkable features of the last instar nymph are the fossorial prothoracic legs. He found nymphs in crevices under stones or in depression in the soil itself. In both situations, the nymphs were associated with the rootlets of various plants.

Key to United States Species of *Bothriocera*
Males only

1. Style in lateral view hooked on proximal edge distally (fig. 16); each forewing with row of dark spots in apical cells ..... *tex,* n. sp.
   Style in lateral view not hooked on proximal edge distally (fig. 19); each forewing without row of dark spots in apical cells 2
2. Aedeagus in ventral view with large avicephaliform projection on left side of shaft (figs. 21, 24) 3
   Aedeagus in ventral view with or without projection on left side of shaft; if present, not as above 5
3. Style in lateral view irregularly rounded distally (fig. 19); right apical process of aedeagus slender, elongated, and not hooked apically (fig. 20); aedeagal flagellum with narrow barbed process on distal portion (fig. 21) ..... *knulli* Caldwell
   Style in lateral view triangular distally (fig. 25); right apical process of aedeagus stouter and hooked apically; aedeagal flagellum without such process on distal portion 4
4. Anal tube strongly convex on ventral margin near apex in left lateral view (fig. 22); right apical process of aedeagus usually with two teeth (fig. 23) ..... *cognita* Caldwell
   Anal tube less strongly convex on ventral margin near apex in left lateral view (fig. 25); right apical process of aedeagus usually with five or more teeth (fig. 26) ..... *furcata* Caldwell
5. Anal tube broadened apically in left lateral view (fig. 30) 6
   Anal tube not broadened apically in left lateral view (fig. 36) 7
6. Right apical process of aedeagus completely fused with shaft and not decurved but projecting obliquely cephalad (fig. 29); major flagellar process not expanded subapically (fig. 28) ..... *turcafa,* n. sp.

Right apical process of aedeagus not completely fused with shaft and strongly decurved and projecting ventrad (fig. 31); major flagellar process expanded subapically (fig. 31) ..... *omani,* n. sp.

7. Major flagellar process stout in left lateral view (fig. 33); right apical process uniformly long, slender, and broadly decurved (fig. 34) .... *transversa* Caldwell

Major flagellar process slender in left lateral view (fig. 36); right apical process not as above (fig. 43) 8

8. Flagellum with two major processes reaching or nearly reaching apex (figs. 36, 38); right apical process of aedeagus stout, straight, rounded distally, with short tooth on dorsal distal edge (fig. 37) . . . *maculata* Caldwell

Flagellum with one major process reaching or nearly reaching apex (figs. 40, 43); right apical process of aedeagus not stout, decurved and acute distally, with two or more teeth on decurved portion (fig. 40) 9

9. Anal tube convex on dorsal margin just before apex in left lateral view (fig. 39); style rounded on proximal edge distally (fig. 39) .... *datuna,* n. sp.

Anal tube not convex on dorsal margin just before apex in left lateral view (fig. 42); style obtusely angular on proximal edge distally (fig. 42) .... *drakei* Metcalf

Bothriocera tex Kramer, n. sp.

Figs. 16-18

Salient features. — Length of males 4.2-4.5 mm, females 4.8-5.0 mm. Transverse coronal carina not clearly angled at middle. Ground color of head and pronotum tawny, poorly defined longitudinal brown stripe on each side of longitudinal midline, auriculate portions marginally embrowned, middle portion of face and sides of head below eyes embrowned, tegulae unmarked, mesonotum dark reddish brown, forewings mainly transparent or semitransparent brown, each with pale patch covering middle of clavus and adjacent portions of corium, narrow whitish and oblique linear marking before stigma, few small irregular pale spots on preapical cells, most of each apical cell hyaline except at base, single brown spot in hyaline portion of each apical cell, veins of forewings mainly brown.

Male genitalia. — Genital capsule in ventral view (fig. 18) with median lobe of pygofer well produced, each style with angulation on outer margin in distal half; genital capsule in left lateral view (fig. 16) with posterior margin of pygofer broadly triangular, distal angle of stylar apex well produced, proximal angle of stylar apex shorter and hooked, anal tube narrowest near middle; aedeagus in left lateral view (fig. 16) with long slender process arising near apex, turning dorsad, then ventrad in flagellar mass, flagellum with various angulations on distal portions and dorsal margin, its ventral margin at least partly serrate; aedeagus in right lateral view (fig. 17) with slender and distally hooked process arising at apex on dorsal margin, flagellum with two processes emerging at apex, more dorsal process thinner and longer, basal portion of shorter process evanescent, lower margin of flagellum serrate, upper margin with blunt protrusion near middle and short serrated area near apex.

Types. — Holotype male (USNM 100044) Devils River, Texas, 5 May 1907, F.C. Bishop; allotype female same except 3 May 1907, F.C. Pratt; paratypes, male same as holotype except E.A. Schwartz, two females, same except 5 May 1907, F.C. Pratt.

Specimens studied. — TEXAS, Devils River. Collection dates 3 and 5 May. Total specimens studied 2 males and 3 females.

Notes. — The features used in the key to species differentiate *B. tex* from all of its congeners. Devils River is mainly in Val Verde County, Texas, which borders Mexico on the south. It appears likely that this is where Bishop, Pratt, and Schwartz collected the type series. The plant relationships are unrecorded. The species name, an arbitrary combination of letters, is to be considered as a noun in apposition.

There is some possibility that this new species is *B. westwoodi* (Stål), described from Mexico. But the original description is too vague to establish the matter with certainty, and the type is no longer extant which precludes restudy.

Bothriocera knulli Caldwell

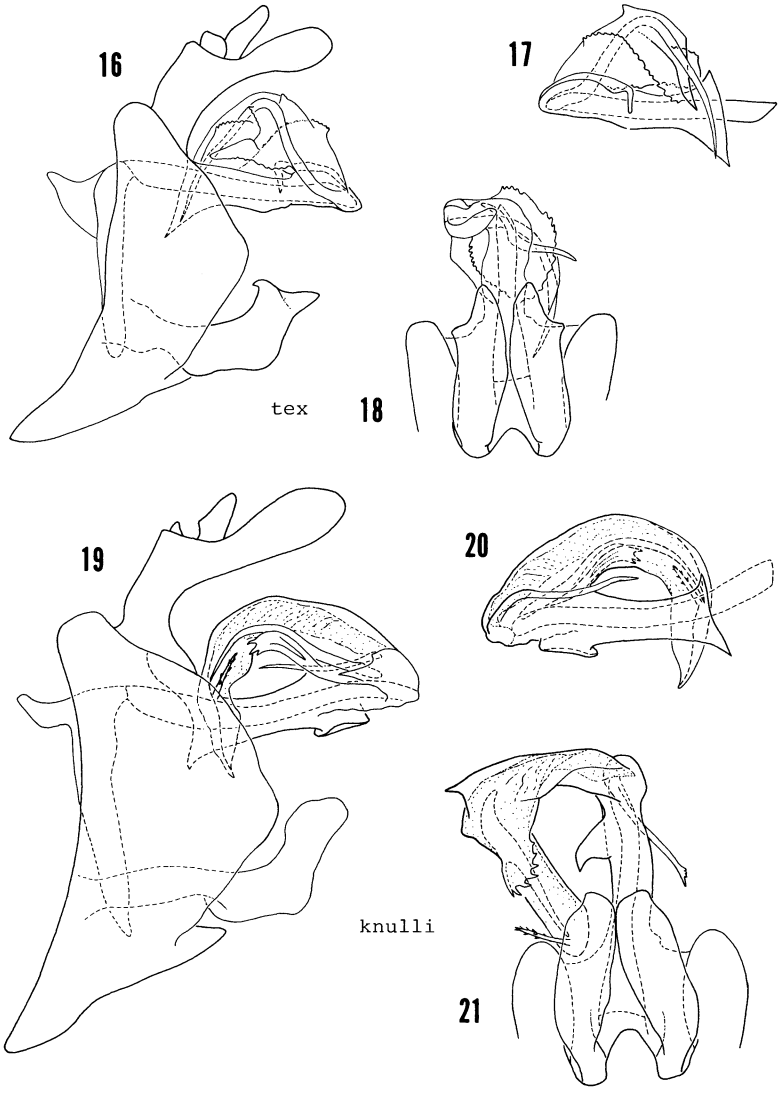
Figs. 19-21

Bothriocera knulli Caldwell 1943:321.

Salient features. — Length of males 4.5-5.0 mm, females 5.2-5.5 mm. Transverse coronal carina angled toward apex at middle. Ground color of head and pronotum stramineous to tawny, without strong markings, apex and sides of clypeus sometimes darkened, tegulae pale, mesonotum yellowish brown to almost fuscus, forewings mainly colorless and transparent or semitransparent whitish, each with inner portion of clavus embrowned, irregular transverse brown patch across middle and subapex, subapical patch usually broader, transverse patches connected by irregular longitudinal embrowned area, irregular brown spots in subcostal area, elongated embrowned area joins subapical transverse patch to posterior margin.

Male genitalia. — Genital capsule in ventral view (fig. 21) with median lobe of pygofer strongly produced, styles uniformly broad, aedeagal shaft with large avicephaliform projection on left margin, flagellum with transverse dentate area near middle and slender barbed process near apex; genital capsule in left lateral view (fig. 19) with posterior margin of pygofer convex, style obliquely upturned distally and subcapitate, anal tube narrowest near middle; aedeagus in left lateral view (fig. 19), with single slender process arising subapically and following curvature of flagellum, base of process concealed by irregular projection, ventral margin of aedeagal shaft with broad and blunt projection subapically, flagellum curved ventrad distally, dentate area near middle of its ventral margin and slender barbed process near its apex; aedeagus in right lateral view (fig. 20) with single slender process arising near apex and directed cephalad on this side.

Types. — Holotype male, Gillespie Co., Texas, 23 June 1940, D.J. & J.N. Knull, Caldwell coll'n, in United States National Museum. There is a second male with identical data and also labeled holotype in the Ohio State University collection. Caldwell (1943:318) noted that all types of new species were in his collection unless otherwise stated in the text. Inasmuch as the male holotype was not originally stated to be in the Ohio State University collection, the specimen so labeled must be con-



FIGURES 16-21. Male genitalia. 16-18, *Bothriocera tex* n. sp., from holotype. 19-21, *Bothriocera knulli* Caldwell, from paratype. 16, 19, complete left lateral view of genital capsule. 17, 20, aedeagus in right lateral view. 18, 21, apex of pygofer, styles, and aedeagus in ventral view.

sidered to be only one of the original 24 paratypes with data identical to that of the holotype.

Specimens studied. — ARIZONA, Patagonia Mts.; TEXAS, Devils River, Kerrville, county only — Gillespie. Collection dates 2 May to 20 July. Total specimens studied 24 males and 11 females.

Notes. — The avicephaliform projection on the left margin of the aedeagal shaft in ventral view and the slender, barbed process on the distal portion of the aedeagal flagellum provide the distinctive features of *knulli*. *B. knulli* is a species of our southwestern states; however, its plant associations are yet to be reported.

Bothriocera cognita Caldwell

Figs. 1-2, 22-24

Bothriocera cognita Caldwell 1943:322.

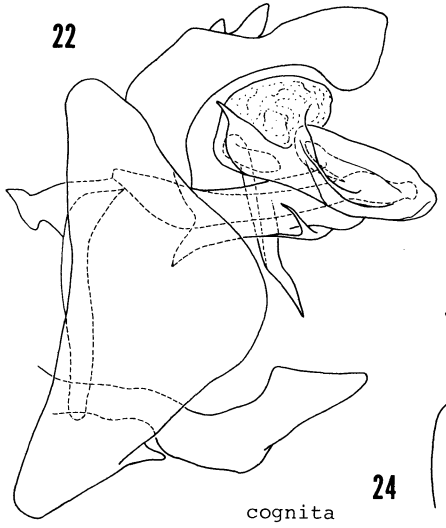
Salient features. — Length of males 4.8-5.5 mm, females 5.0-5.8 mm. Transverse coronal carina usually bluntly angled toward apex at middle. Ground color of head and pronotum light to dark tawny, middle portion of dorsal surface of head variably darkened, face except lateral margins strongly darkened, pronotum variably embrowned, tegulae usually dark, mesonotum reddish brown to nearly black; forewings colorless, transparent or semitransparent whitish and patterned with brown, each with clavus entirely brown, irregular transverse brown patch across middle and subapex, these patches narrowly blending in area of outer subapical cells, few irregular brown spots in subcostal area, distal portions of apical cells at least partly embrowned.

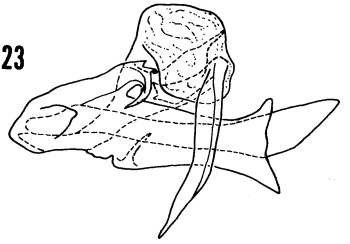
Male genitalia. — Genital capsule in ventral view (fig. 24) with median lobe of pygofer produced, styles stout and elongated, avicephaliform projection on left side of aedeagal shaft; genital capsule in left lateral view (fig. 22) with posterior margin of pygofer roundly produced, style obliquely upturned distally, its apical portion triangular, anal tube with large round convexity on ventral margin at apex; aedeagus in left lateral view (fig. 22) with slender and elongated toothlike projection near middle of ventral margin, distally-stout process arising near apex of shaft and closely associated with flagellum, this process apically prolonged and narrowed; aedeagus in right lateral view (fig. 23) with apical appendage extended cephalad, its distal portion hooked with hook bearing 2 to 4 teeth, slender and elongate process emerging from flagellar apex.

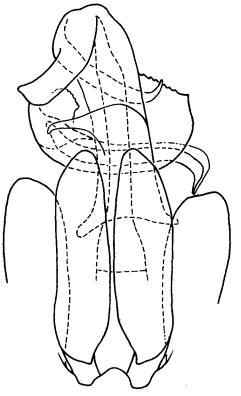
Type. — Holotype male, Kosciusko, Mississippi, 9 June 1933, D.W. Grimes in collection of Ohio State University, Columbus.

Specimens studied. — ALABAMA, Auburn; DELAWARE, Dover, Gumboro; FLORIDA, Estero, Gainesville; ILLINOIS, Wetaug in Pulaski Co.; MARYLAND, Oxon Hill; MISSISSIPPI, Kosciusko; NEW JERSEY, Lake Pine; PENN-

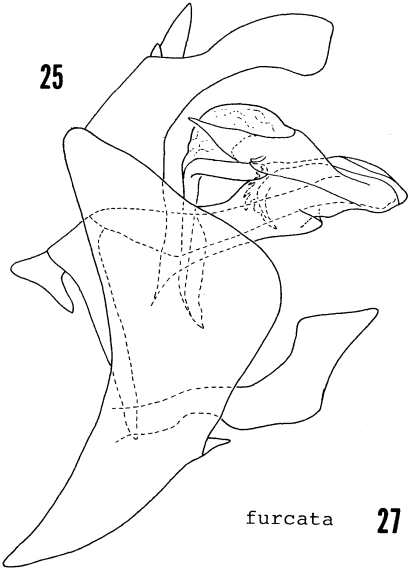
FIGURES 22-27. Male genitalia. 22-24, *Bothriocera cognita* Caldwell, from Wetaug, Ill. 25-27, *Bothriocera furcata* Caldwell, from Sanford, Fla. 22, 25, complete left lateral view of genital capsule. 23, 26, aedeagus in right lateral view. 24, 27, apex of pygofer, styles, and aedeagus in ventral view.

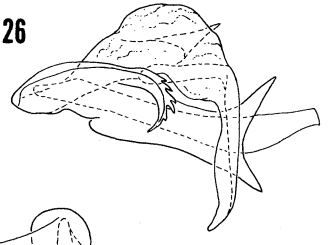


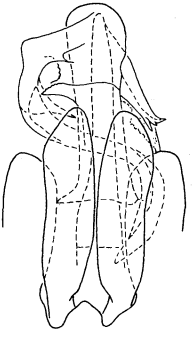




cognita







furcata

SYLVANIA, Philadelphia; TEXAS, Tyler; VIRGINIA, Dyke, Westmoreland State Park. Collection dates 14 May to 27 August. Total specimens studied 22 males and 18 females.

Notes. — The avicephaliform projection on the left side of the aedeagal shaft in ventral view and the large round convexity on the ventroapical portion of the anal tube in lateral view distinguish *B. cognita.* It is closely related to *B. furcata;* the two species can be separated by the features used in couplet 4 of the key to species of *Bothriocera.*

B. cognita is a species of our southeastern states; it is known from Florida north to southern New Jersey and west to southern Illinois and eastern Texas. The holotype was collected on *Salix.* Some of the Florida specimens were taken on *Cephalanthus occidentalis* L., buttonbush. Others were attracted to black light traps. Dozier (1928:57), using the name *B. bicornis,* recorded this species as occurring on young *Quercus, Spartina,* and *Juncus.*

Bothriocera furcata Caldwell

Figs. 25-27

Bothriocera furcata Caldwell 1943:321.

Salient features. — Length of males 4.6-5.1 mm, females 5.2-5.5 mm. Transverse coronal carina usually angled toward apex at middle. Ground color of head and pronotum light to dark tawny, middle portion of dorsal surface of head varying from unmarked to almost blackish, face with middle portion, especially frons, darkened, pronotum unmarked or variably embrowned, mesonotum varying from dark yellowish brown to almost fuscus; forewings colorless, transparent or semitransparent whitish and clouded with brown in same pattern as *B. cognita.*

Male genitalia. — Genital capsule in ventral view (fig. 27) with median lobe of pygofer produced, styles stout and elongated, avicephaliform process on left side of aedeagal shaft; genital capsule in left lateral view (fig. 25) with posterior margin of pygofer roundly produced, style obliquely upturned distally, its apical portion triangular, anal tube with round convexity on ventral margin at apex; aedeagus in left lateral view (fig. 25) with projection near middle of ventral margin, stout process arising near aedeagal apex, closely associated with flagellum, its apical portion narrowed and prolonged, long decurved process on or near ventral margin of flagellum; aedeagus in right lateral view (fig. 26) with apical appendage extending cephalad, its distal portion hooked with 5-7 teeth, rarely 4, elongated process exiting at flagellar apex.

Type. — Holotype male, Sanford, Florida, 8 July 1931, at light, collector not recorded, in collection of Ohio State University, Columbus.

Specimens studied. — FLORIDA, Clermont, Daytona, Enterprise, Gainesville, Hampton, Jacksonville, Sanford, counties only — Lake, Levy, State Parks — Golden Head Branch, Highlands; GEORGIA, Thomasville; MISSISSIPPI, Biloxi, Leland, Pascagoula, Vicksburg, Woodville; VIRGINIA, Lake Drummond in Dismal Swamp. Collection dates 20 March to 1 October. Total specimens studied 36 males and 35 females.

Notes. — The avicephaliform projection on the left side of the aedeagal shaft in ventral view and the round convexity on the ventroapical portion of the anal tube in lateral view distinguish *B. furcata* from all of its congeners except *B. cognita.* These two species are very similar but can be separated in couplet 4 of the key to species of *Bothriocera.*

Like *B. cognita, B. furcata* is found in the Southeast; but it appears to be more southern in distribution than that species. The records show a range from Florida north to southern Virginia and west to Mississippi. The holotype was taken at lights; a few other Florida specimens were taken in Steiner traps or were collected on *Vaccinium,* blueberry; and *Saururus,* lizardtail.

Bothriocera turcafa Kramer, n. sp. Figs. 28-29

Salient features. — Length of male 4.8 mm, female unknown. Transverse coronal carina weakly angled toward apex at middle. Coloration of head, thorax, and forewings falling within range described for *B. cognita.*

Male genitalia. — Except for the aedeagus, structures not different from those of *B. furcata.* Aedeagus in left lateral view (fig. 28) with dorsal margin of shaft with large acute projection on distal half, projection directed obliquely cephalad; flagellum with two processes, longer one originating in basal half, following curvature of flagellum and projecting beyond flagellar apex, shorter process dorsad of longer one and about half as long, tapered to sharply acute apex; aedeagus in ventral view with short irregular projection on left margin; aedeagus in right lateral view (fig. 29) with projection on dorsal margin of shaft bearing minute teeth at apex and single one on dorsal margin, minutely serrated ridge on central longitudinal portion of flagellum.

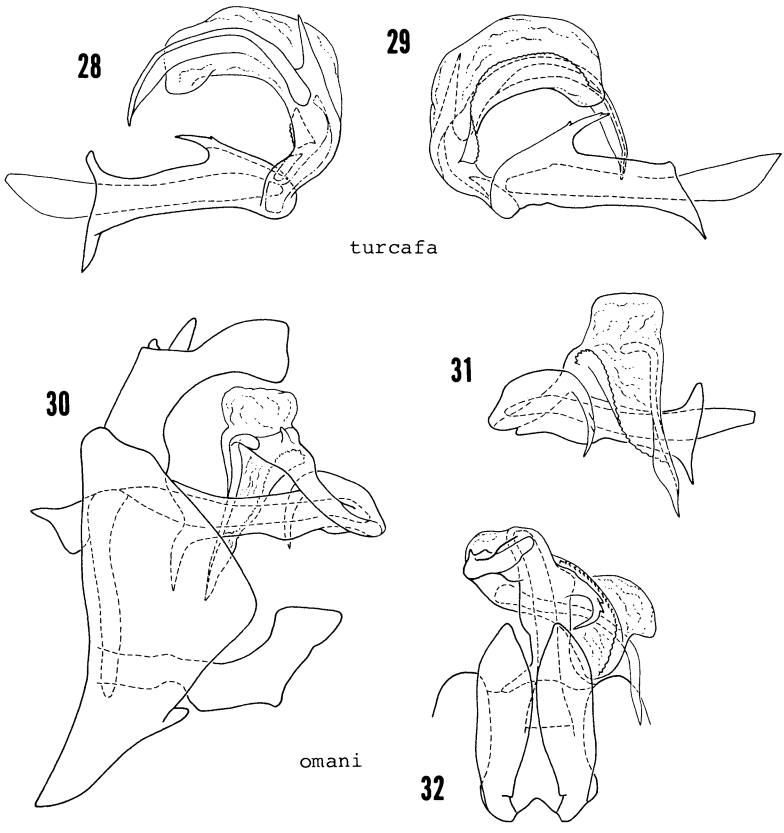
Type. — Holotype male (USNM 100045), Highlands Hammock State Park, Florida, H.W. Weems, Jr., 15 July 1956, J.S. Caldwell coll'n.

Specimens studied. — Known only from holotype.

Notes. — The acute projection on the dorsal margin of the aedeagal shaft is unique among the species of *Bothriocera* found in our fauna. *B. turcafa* is known from only one locality in Florida and is without ecological data. The species name, an arbitrary combination of letters, is to be considered as a noun in apposition.

Bothriocera omani Kramer, n. sp. Figs. 30-32

Salient features. — Length of males 3.9-4.2 mm, females 4.5-4.8 mm. Transverse coronal carina broadly angled or rounded toward apex at middle. Ground color of head and pronotum tawny to pale tawny, usually without definite darker markings, middle portion of dorsal surface of head and frons sometimes shade darker, mesonotum tawny to honey brown; forewings colorless transparent or semitransparent whitish and clouded with pale brown in pattern similar to that of *B. cognita,* except each clavus usually only embrowned partly or entirely along inner margin, rarely claval areas completely pale.



FIGURES 28-32. Male genitalia. 28-29, *Bothriocera turcafa* n. sp., from holotype. 30-32, *Bothriocera omani* n. sp., from holotype. 28, aedeagus in left lateral view. 29, 31, aedeagus in right lateral view. 30, complete left lateral view of genital capsule. 32, apex of pygofer, styles, and aedeagus in ventral view.

Male genitalia. — Genital capsule in ventral view (fig. 32) with median lobe of pygofer subtriangularly produced, styles elongated and broad, aedeagal shaft with bulge on left margin; genital capsule in left lateral view (fig. 30) with posterior margin of pygofer triangularly produced, style obliquely upturned distally, its distal portion subtriangular, anal tube widened at apex; aedeagus in left lateral view (fig. 30) with slight convexity on ventral margin in distal half, process arising near apex,

irregularly broadening distally with short blunt tooth near dorsal margin in distal half, long slender extension at extreme apex; aedeagus in right lateral view (fig. 31) with apical process having long distally-toothed hook, ventral margin of flagellum finely serrated, process emerging from flagellar mass subapically expanded.

Type. — Holotype male (USNM 100046), Alachua Co., Florida, 27 August 1954, H.V. Weems, taken at light, J.S. Caldwell coll'n.

Specimens studied. — FLORIDA, Sanford, county only — Alachua, Levy; SOUTH CAROLINA, Charleston, county only — Aiken; VIRGINIA, Back Bay. Collection dates 18 May to 10 October. Total specimens studied 7 males and 18 females.

Notes. — The features noted in the key to species of *Bothriocera* differentiate *B. omani* from its congeners. A useful supplementary feature is the pale claval area of each forewing. The clavi are usually embrowned, at least in part, along their inner margins. This species is known from Florida north to southern Virginia, but its plant relationships are yet to be discovered. It is named for Dr. Paul W. Oman whose generic classification of the North American Cicadellidae is a taxonomic keystone.

Bothriocera transversa Caldwell

Figs. 33-35

Bothriocera transversa Caldwell 1943:321.

Salient features. — Length of males 4.6-5.3 mm, females 5.0-5.8 mm. Transverse coronal carina usually angled toward apex at middle. Ground color of head and pronotum tawny, middle portion of dorsal surface of head tinted variably with brown to nearly black, face similarly darkened except for lateral edges, pronotum and tegulae undarkened to infuscated, mesonotum dark reddish brown to almost black; forewings marked like those of *B. cognita* except transverse patches across middle and subapex broader and usually darker.

Male genitalia. — Genital capsule in ventral view (fig. 35) with median lobe of pygofer slender, styles broad and elongated, large subquadrate projection distally on left side of aedeagal shaft; genital capsule in left lateral view (fig. 33) with posterior margin of pygofer bluntly produced, style obliquely upturned distally, its distal portion capitate, anal tube narrowed in distal half, its apex usually slightly decurved; aedeagus in left lateral view (fig. 33) with shaft stout and broad finlike projection in distal half, slender process arising near apex and directed into flagellar mass distally, large sclerotized area near middle of flagellum, its narrowed apex directed ventrocephalad with elongated slender process on its dorsal margin; aedeagus in right lateral view (fig. 34) with slender process arising at or near apex, its form that of irregular inverted "U", apex of apical process from left side emerging near middle of ventral flagellar margin.

Types. — Holotype male and four paratype males, Bonefish Key, Florida, 2 February 1940, J.S. Caldwell in collection of United States National Museum.

Specimens studied. — FLORIDA, Biscayne Bay, Bonefish Key, Cape Sable, Everglades National Park, Key Largo, Matheson Hammock, Miami, Paradise Key,

Vaca Key, county only — Dade, Monroe. Collection dates 2 February to 18 December. Total specimens studied 29 males and 18 females.

Notes. — The large subquadrate projection on the left distal margin of the aedeagal shaft in ventral view, the shape of the sclerotized area on the flagellum in left lateral view, and the slender apical process in the form of an inverted "U" in right lateral view provide the identifying characters of *B. transversa.* This species, generally darker than its congeners, is known only from Florida, where it has been collected on *Chrysobalanus icaco* L. or cocoplum, *Cestrum nocturnum* L. or night jessamine, *Cocos nucifera* L. or coconut palm, *Borrichia arborescens* or tree seaox-eye. Other plant associations include *Solanum, Flavaria,* and *Pittosporum.* Some specimens were also taken in Steiner traps.

Bothriocera maculata Caldwell

Figs. 36-38

Bothriocera maculata Caldwell 1943:325.

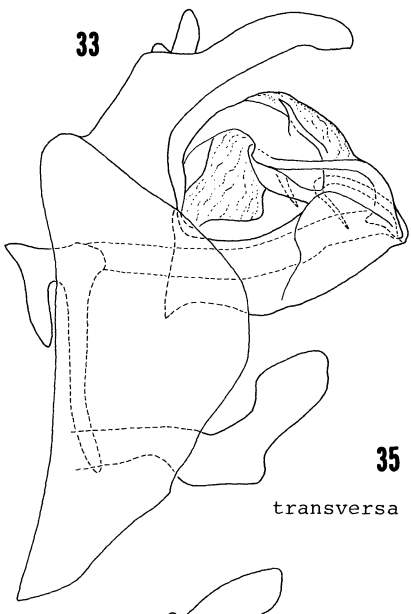
Salient features. — Length of males 4.2-5.0 mm, females 4.4-5.2 mm. Transverse coronal carina usually angled toward apex at middle. Ground color of head and pronotum tawny, middle portion of dorsal surface of head darkened with shades of brown to nearly black, face similarly darkened except for lateral margins, pronotum and tegulae embrowned or not, mesonotum dark yellowish brown to dark reddish brown; forewings generally similar to those of *B. coghita* except for slight differences in markings as follows; each clavus only embrowned along inner margin, transverse patches across middle and subapex diffuse and less intense.

Male genitalia. — Genital capsule in ventral view (fig. 38) with median lobe of pygofer bluntly triangular, styles elongated and broad, flagellum arising on left side and crossing shaft on dorsal margin; genital capsule in left lateral view (fig. 36) with posterior margin of pygofer bluntly triangular, style obliquely upturned distally, anal tube narrowest at middle; aedeagus in left lateral view (fig. 36) with finlike expansion on ventral margin in distal half, indistinct processes within aedeagal flagellum; aedeagus in right lateral view (fig. 37) with stout process arising at or near apex of dorsal margin and directed cephalad, partly fused with shaft, its apex broadly rounded with distinct tooth on dorsodistal edge, flagellum with both right and left edges thickened to form elongated processes.

Types. — Holotype male and six male paratypes, Dade Co., Florida, 12 May 1939, D.J. and J.N. Knull in collection of United States National Museum.

Specimens studied. — FLORIDA, Andytown, Archbold Biological Station, Belle Glade, Childs, Crescent City, Daytona, Dunedin, Estero, Everglades National Park,

FIGURES 33-38. Male genitalia. 33-35, *Bothriocera transversa* Caldwell, from Monroe Co., Fla. 36-38, *Bothriocera maculata* Caldwell, from Archbold Biological Station, Fla. 33, 36, complete left lateral view of genital capsule. 34, 37, aedeagus in right lateral view. 35, 38, apex of pygofer, styles, and aedeagus in ventral view.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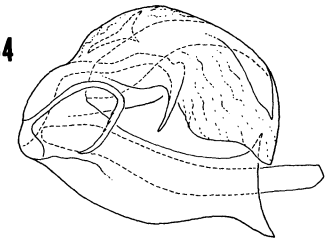
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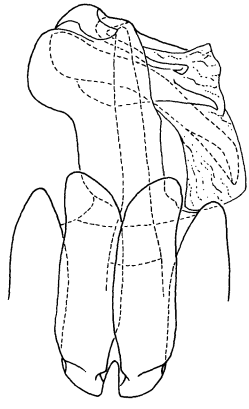
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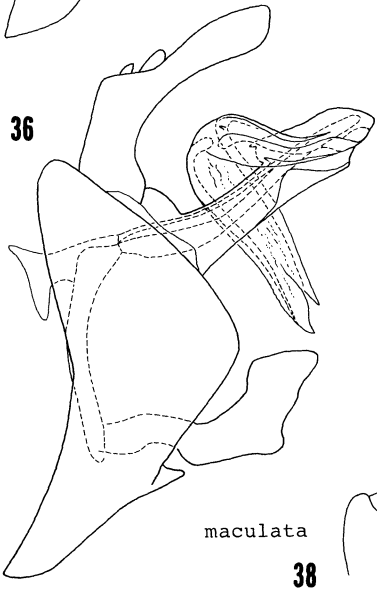
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maculata
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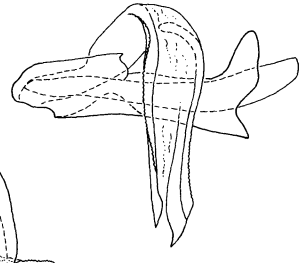
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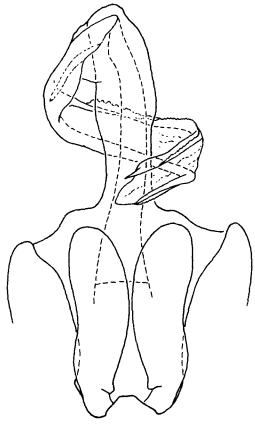


Ft. Myers, Gainesville, Hialeah, Homestead, Jacksonville, Key Largo, Marco, Matheson Hammock, Miami, Naples, New Smyrna, Ochopee, Ormond Beach, Palm Beach, Paradise Key, Polk City, St. John's Bluff, St. Petersburg, Sanford, Siesta Key, Stuart, Vero Beach, county only — Alachua, Broward, Collier, Dade, Levy, Martin; LOUISIANA, Franklin, New Orleans; MARYLAND, Piney Point; MISSISSIPPI, Pascagoula; NORTH CAROLINA, Ashe Island in Onslow Co., Wilmington; TEXAS, Anahuac; VIRGINIA, Cape Henry. Collection dates 14 March to 29 September. Total specimens studied 137 males and 126 females.

Notes. — *B. maculata* can be recognized by the stout process arising on or near the apicodorsal margin of the aedeagal shaft in right lateral view. The apex of this process is rounded with a small but distinct tooth on the dorsodistal edge. None of our other species of *Bothriocera* have a process with this form. *B. maculata* is most common in Florida but has a coastal distribution which extends as far north as Maryland in the East and Texas in the West. Specimens have been taken on *Spartina patens* (Ait.) Muhl. or saltmeadow cordgrass; *Spartina cynosuroides* (L.) Roth. or big cordgrass; *Eupatorium capillifolium* (Lam.) Small or dog-fennel; and *Juncus roemerianus* Scheele, a rush.

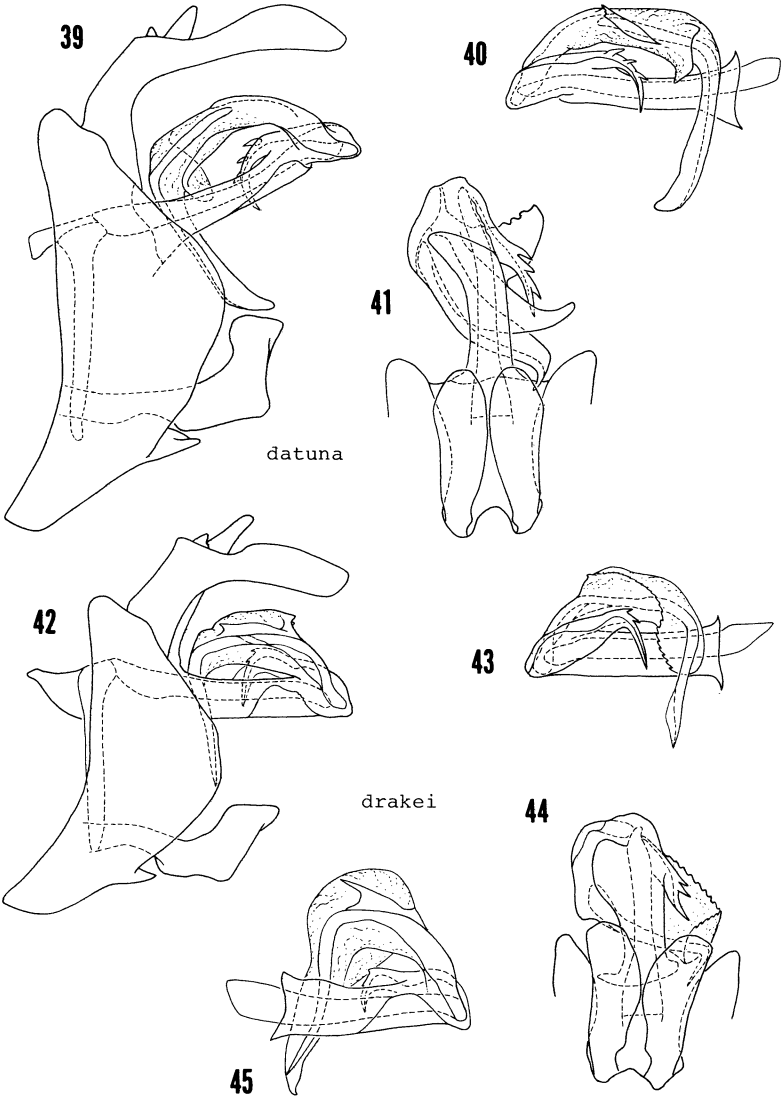
Bothriocera datuna Kramer, n. sp.

Figs. 39-41

Salient features. — Length of males 4.6-5.0 mm, females 4.5-5.2 mm. Transverse coronal carina broadly angled toward apex at middle. Ground color of head and pronotum tawny, middle portion of dorsal surface of head varying from unmarked to slightly darkened, face darker with its lateral edges pale, pronotum and tegulae either slightly darkened or not, mesonotum varying from dark yellowish brown to dark reddish brown, forewings generally similar to those of *B. cognita* except for differences in markings as follows: each clavus varying from only partly to entirely embrowned, fewer dark areas on costal margins, transverse patch across middle more solidly colored than one across subapex, transverse subapical patch diffuse.

Male genitalia. — Genital capsule in ventral view (fig. 41) with median lobe of pygofer well produced, styles elongated and stout, aedeagal flagellum arising near apex of left margin and crossing shaft on dorsal margin; genital capsule in left lateral view (fig. 39) with posterior margin of pygofer bluntly produced, style obliquely upturned distally, its proximal apical margin rounded, its distal apical margin produced, anal tube narrowed at middle, its dorsal margin convex on distal half; aedeagus in left lateral view (fig. 39) with flagellum arising near apex of shaft, directed cephalad, then ventrad on right side of shaft; aedeagus in right lateral view (fig. 40) with process arising near apex on dorsal margin and directed cephalad, its distal portion toothed and decurved, flagellum with oblique fin near middle, angular

FIGURES 39-45. Male genitalia. 39-41, *Bothriocera datuna* n. sp., from holotype. 42-44, *Bothriocera drakei* Metcalf, from Sanford, Fla. 45, same, from Hyattsville, Md. 39, 42, complete left lateral view of genital capsule. 40, 43, aedeagus in right lateral view. 41, 44 apex of pygofer, styles, and aedeagus in ventral view. 45, aedeagus in left lateral view.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datuna
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43
drakei
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45

projection beyond middle of ventral margin, distal portion of flagellum narrowed and elongated.

Types. — Holotype male (USNM 100047) and allotype female Columbia, Alabama, 9 August 1912, collector not recorded.

Specimens studied. — ALABAMA, Columbia; FLORIDA, Gainesville, Homestead, Ocala, Paradise Key, Royal Palm Park, Sanford, county only — Alachua, Lake; LOUISIANA, Opelousas. Collection dates 22 February to 11 October. Total specimens studied 21 males and 39 females.

Notes. — In addition to the features used in the key to species of *Bothriocera, B. datuna* can often be recognized by the form of the transverse patches on the forewings. The transverse patch across the middle of each forewing tends to be more solidly colored than the diffuse and less well defined transverse patch across the subapex. This is a species of our Gulf Coast states and is known to occur from Florida west to Louisiana. Plant relationships are unrecorded. The specific name, an arbitrary combination of letters, is to be considered as a noun in apposition.

Bothriocera drakei Metcalf

Figs. 42-45

Bothriocera drakei Metcalf 1923:179.
Bothriocera tinealis floridana Dozier 1928:56.

Salient features. — Length of males 4.1-4.8 mm, females 4.5-5.0 mm. Transverse coronal carina broadly angled toward apex at middle. Ground color of head and pronotum light tawny, either unmarked or vaguely darkened on middle portions of dorsal surface of head and face, pronotum and tegulae pale, mesonotum tan to dark yellowish brown; forewings with pattern generally similar to that of *B. cognita* except as follows: each clavus usually entirely pale or only slightly darkened at apex, transverse patches across middle and subapex highly variable, ranging from tan to medium brown and moderately distinct to almost entirely pale with only a few vague spots representing transverse subapical patch.

Male genitalia. — Genital capsule in ventral view (fig. 44) with medium lobe of pygofer produced, styles elongated and moderately broad; genital capsule in left lateral view (fig. 42) with posterior margin of pygofer convex, style obliquely upturned distally and bluntly triangulate at extreme apex, anal tube narrowest near middle; aedeagus in left lateral view (figs. 42, 45) with long slender process arising near apex of shaft, following curvature of flagellum, and crossing shaft distally, acute projection on flagellum above and near middle of process, blunt and finlike projection on ventrodistal margin of aedeagal shaft; aedeagus in right lateral view (fig. 43) with process arising near or at apex and directed cephalad, its distal portion hooked with 1-6 teeth, usually 2, flagellum finely serrated on ventral margin.

Types. — Holotype male, Gainesville, Florida, 4 July 1918, C.J. Drake. Allotype female with same data, except 7 July 1918. Both of these types are on indefinite loan to the United States National Museum from North Carolina State University, Raleigh.

Specimens studied. — DELAWARE, Dover; FLORIDA, Bradenton, Childs, Clermont, Crescent City, Estero, Gainesville, New Smyrna, Sanford, Seven Oaks,

Vero, Windmere, State Parks — Gold Head, Highlands Hammock, Torreya; LOUISIANA, Cameron; MARYLAND, Hyattsville; NEW YORK, Babylon, Montauk (both on Long Island); NORTH CAROLINA, Southern Pines; OHIO, Licking County. Collection dates 19 March to 22 October. Total specimens studied 85 males and 62 females.

Notes. — The data presented in the key to species of *Bothriocera* provide the basis for separating *B. drakei* from its congeners in our fauna. There is a fair amount of intraspecific color variation; most specimens from Florida, where it is common, are unaccountably lighter in color than those from other parts of its range. *B. drakei* provides the northernmost records for the genus; these are Central Ohio and Long Island, New York. Osborn (1938:306) previously recorded this species from Ohio as *B. tinealis* Burmeister. Wild ferns are apparently the food plants of *B. drakei;* specimens at hand were collected on wild ferns in both Florida and Long Island, New York. There are no other recorded plant associations.

Checklist of United States species of *Bothriocera* with state records

1. *cognita* Caldwell 1943:322. Ala., Del., Fla., Ill., Md., Miss., N.J., Pa., Tex., Va.
2. *datuna* Kramer, n. sp. Ala., Fla., La.
3. *drakei* Metcalf 1923:79. Del., Fla., La., Md., N.Y., N.C., Ohio.
   = *tinealis floridana* Dozier 1928:56.
4. *furcata* Caldwell 1943:321. Fla., Ga., Miss., Va.
5. *knulli* Caldwell 1943:321. Ariz., Tex.
6. *maculata* Caldwell 1943:325. Fla., La., Md., Miss., N.C., Tex., Va.
7. *omani* Kramer, n. sp. Fla., S.C., Va.
9. *tex* Kramer, n. sp. Tex.
9. *transversa* Caldwell 1943:321. Fla.
10. *turcafa* Kramer, n. sp. Fla.

Genus OLIARONUS Ball

Oliaronus Ball 1934:268. Type-species *Oliaronus tontonus* Ball 1934:268, by monotypy.

Large robust cixiids (7.0-11.0), head in dorsal view only slightly narrower than pronotum, eyes large, crown with lateral margins carinate and slightly elevated, longitudinal midline usually weakly carinate on basal half, V-shaped transverse carina between anterior portions of eyes, apex of this carina directed anteriorly and transverse at middle, here connected to upper portion of frons by two short and flat carinae, three shallow foveae resulting, middle one smaller than lateral pair, posterior margin of crown acutely in-

cised; head in lateral view bluntly rounded at extreme apex; head in facial view with face longer than broad, its longitudinal midline weakly carinate, lateral margins of frons sharply carinate, frontal ocellus distinct, clypeus triangular; pronotum narrow, posterior margin acutely incised, with transverse carina laterally following curvature of posterior margin of each eye, tegulae well developed, mesonotum large with greatest length and width subequal, discal portion with five carina, intermediate pair sometimes obsolete, hind tibia with three spines before apex, venation as in fig. 4, middle portions of costal areas thickened, dark, and setigerous, cells behind stigmal areas transverse or obliquely transverse, veins with minute setae-bearing pustules. Male genitalia; characteristic of family, both aedeagal shaft and apical flagellum elaborated with processes.

Notes. — *Oliaronus* is closely related to *Oliarus;* they share the acutely angular incision on the posterior margin of the crown and spines on the hind tibiae before the apex. In typical examples of both genera, the mesonotum bears five carinae; but the intermediate pair of mesonotal carinae is sometimes obsolete in examples from either genus. The two are easily separated by the features used in couplet 5 of the key to genera. *Oliaronus* includes a single species known only from our southwestern state of Arizona.

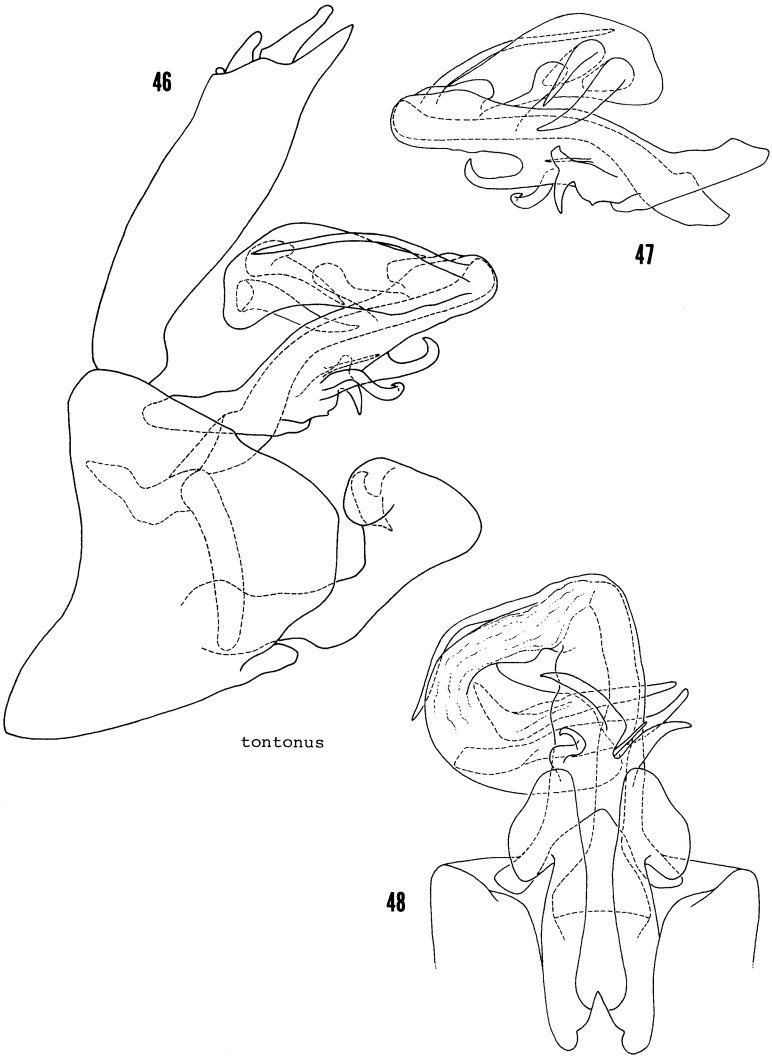
Oliaronus tontonus Ball

Figs. 4, 46-48

Oliaronus tontonus Ball 1934:268.

Salient features. — Length of males 7.0-9.0 mm, females 9.7-11.0 mm. Ground color of head and pronotum tawny, anterior foveae on head blackened, portion of crown between eyes darkened with shades of reddish brown, face yellowish to reddish brown except at margins near middle, pronotum and tegulae variably shaded with dark brown, mesonotum medium to dark reddish brown, its lateral portions usually distinctly darker, sometimes nearly black, forewings mainly hyaline or subhyaline, either with or without irregular brown clouding in claval areas, coria, and subapical cells, apical margins variably embrowned, distal crossveins usually margined with dark brown, veins medium to dark brown with minute pustules and setae similarly colored.

Male genitalia. — Genital capsule in ventral view (fig. 48) with median lobe of pygofer triangularly produced, styles elongated and expanded on outer margin distally, aedeagal shaft with four processes visible on or directed toward right margin, two processes visible on or directed toward left margin, flagellum curved



FIGURES 46-48. Male genitalia of *Oliaronus tontonus* Ball, from Santa Rita Mts., Ariz., 46, complete left lateral view of genital capsule. 47, aedeagus in right lateral view. 48, apex of pygofer, styles, and aedeagus in ventral view.

left, then looping right above aedeagal shaft, upper margin of flagellum with long slender process approximating its curvature; genital capsule in left lateral view (fig. 46) with posterior margin of pygofer broadly produced, style apically capitate, with lobe on dorsal margin and hooklike process on inner margin, anal tube elongated, its extreme apical portion narrowed to sharp apex; aedeagus in left lateral view (fig. 46) with three processes visible near middle of ventral margin, longer two recurved and directed caudad, shorter one straight and directed ventrad, flagellum with long slender process arising near apex and directed cephalad; aedeagus in right lateral view (fig. 47) with same three processes visible on ventral margin as on left side with basalmost process broadly forked distally and needlelike process just above it. Flagellum with pair of stout processes arising on distal half, these directed latero-ventrad.

Types. — Holotype female, allotype male, and 10 paratypes, Eloy, Arizona, 5 August 1932, E.D. Ball in collection of United States National Museum.

Specimen studied. — ARIZONA, Baboquivari Mts., Benson, Bowie, Cline, Devils Canyon, Douglas, Eloy, Huachuca Mts., Santa Rita Mts., Tucson. Collection dates 16 June to 25 August. Total specimens studied 11 males and 19 females.

Notes. — The thickened, dark, and setigerous middle portion of the costal areas of the forewings and the transverse or obliquely transverse cells behind the stigmal areas of the forewings provide the unique features of *O. tontonus*. The setae on the darkened middle portion of each forewing are often abraded so that these areas appear as merely dark and finely pustulate. This species is known only from Arizona, where the original series was taken on mesquite.

Genus MICROLEDRIDA Fowler

Microledrida Fowler 1904:99. Type-species *Microledrida asperata* Fowler 1904:99, by monotypy.

Generally small cixiids (3.2-4.0 mm); head in dorsal view about as wide as pronotum, eyes longer than wide, crown broad and subtriangular, its longitudinal midline and sides elevated and carinate, carinae converge at apex, posterior margin of crown broadly incised; head in lateral view (fig. 6) comparatively flat and subtriangular, extreme apex angular; head in facial view with sides of frons carinate, its longitudinal midline with flattened and obscure carina, frons with greatest width clearly exceeding length on longitudinal midline, frontal ocellus absent, clypeus triangular and carinate on lateral margins; pronotum with elevated carina on longitudinal midline, mesonotum tricarinate, hind tibiae with one or two distinct spines before apex, venation of forewings as in fig. 5, veins with dark setae-bearing pustules. Male genitalia: apical

flagellum of aedeagus greatly reduced, shaft elaborated with processes.

Notes. — *Microledrida* is a Neotropical genus that reaches its northern range in our states bordering Mexico. I have seen examples of the genus from Puerto Rico and the Dominican Republic in the West Indies and from southern Mexico and Guatemala in continental America. Three species occur within the United States.

The opportunity is taken here to clarify the exact identity of the type-species of the genus. Some of the specimens found in collections from various localities in Texas were misdetermined as this species. Lectotype male of *Microledrida asperata* Fowler here selected with labels: "Chilpancingo, Guerrero, 4600 ft., Aug., H.H. Smith" and "B.C.A. Homopt. I., *Macroledrida* (sic) *asperata* Fowl." and (handwritten) "*Microledrida asperata* Fowler, Type." The lectotype is in the British Museum (Nat. Hist.). Figs. 49-51 were prepared from the lectotype, *M. asperata* is not known to occur within the United States.

Key to United States Species of *Microledrida*

1. Face with middle portion transversely pale, upper and lower portions darker; anal tube in left lateral view distally narrowed, broadly arched, decurved, and tapered to slender apex (fig. 52) ..... *olor,* n. sp.
   Face entirely darkly mottled, shaded with brownish, or all pale; anal tube not as above 2
2. Anal tube in left lateral view comparatively short, its apical portion broadly blunt (fig. 55); aedeagus in lateral view with distally projecting process on ventral margin (figs. 55, 56) ..... *flava* Metcalf
   Anal tube in left lateral view elongated, its apical portion irregularly oval (figs. 58, 61); aedeagus in lateral view without distally projecting process on ventral margin (figs. 59, 62) ..... *fuscata* Van Duzee

Microledrida olor Kramer, n. sp. Figs. 52-54

Salient features. — Length of male 3.2 mm, female 3.6 mm. Ground color of head and thorax yellowish white, crown with pair of vague transverse orange bands, bands broken on midline, lateral margins of crown narrowly dark brown but pale prebasally, portion of head anterior to eyes irregularly marked with brown, upper portion of frons and all of clypeus mottled with brown, pronotum lightly and irregularly shaded on discal portion, its lateral portions and tegulae largely pale, mesonotum similarly shaded, forewings semitransparent and milky white, forewings with pustules and setae mainly dark, large brown cloud covering most of portions

touching mesonotum, few other small indistinct brownish clouds distad, coloration of female darker and more distinct than that of male.

Male genitalia. — Genital capsule in ventral view (fig. 54) with median lobe of pygofer broadly triangular, distal portions of styles bluntly subtriangular, large hooked process on left side of shaft; genital capsule in left lateral view (fig. 52) with posterior margin of pygofer triangularly produced, style recurved and enlarged distally, anal tube broad basally, strongly narrowed and decurved distally, and tapered to slender apex; aedeagus in left lateral view (fig. 52) with two long processes originating near apex and directed cephalad or ventrocephalad, irregular hooked projection from side of shaft in basal half; aedeagus in right lateral view (fig. 53) similar to left lateral view but lacking irregular projection from side of shaft.

Types. — Holotype male (USNM 100048) and allotype female, Brownsville, Texas, 3 January 1932, E.D. Ball.

Specimens studied. — Known only from types.

Notes. — The transversely pale middle portion of the face, the large and irregular hooked process on the left margin of the aedeagal shaft, and the outline of the male anal tube provide the set of features which distinguishes *M. olor.* This species is known only from southernmost Texas, without recorded plant association. The specific name, a Latin noun in apposition, means swan. This is an allusion to the shape of the male anal tube in lateral aspect.

Microledrida flava Metcalf

Figs. 55-57

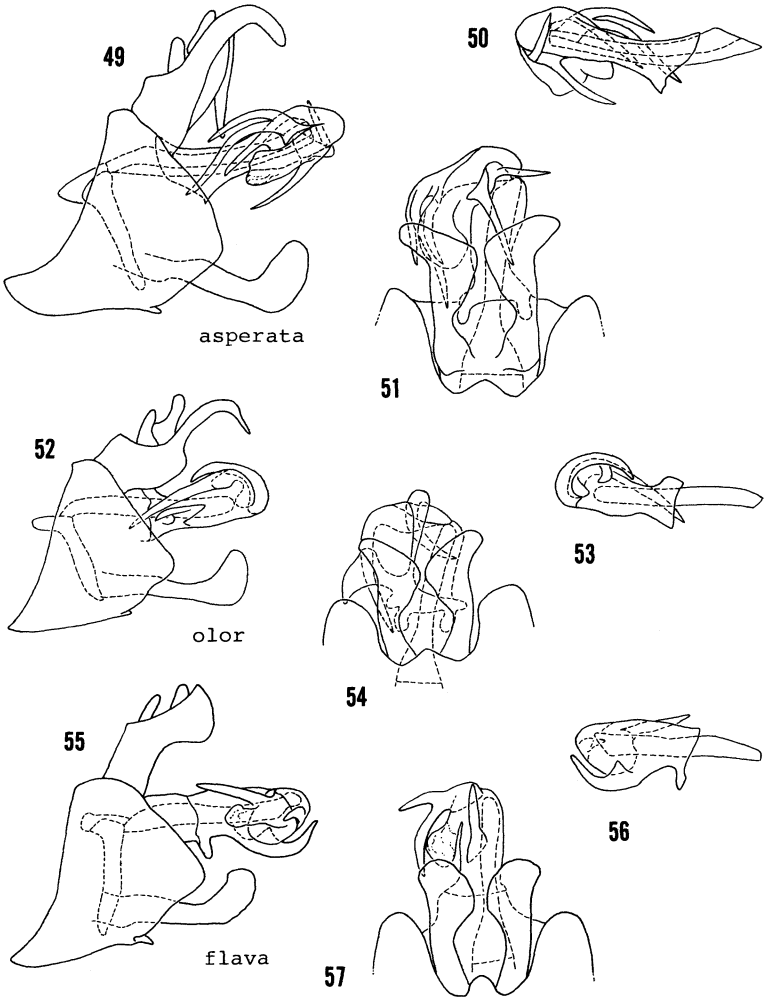
Microledrida flava Metcalf 1923:183.

Salient features. — Length of males 3.2-3.5 mm, females 3.4-3.8 mm. Ground color of head and thorax pale brownish yellow, crown vaguely shaded with orange anteriorly, clypeus and basal portion of frons variably tinted with orange or orange-brown, pro- and mesonotum mainly pale, discal portions sometimes darker, forewings transparent, sometimes slightly milky, pustules dark with setae and veins pale, crossveins at level of stigma often distinctly embrowned, coloration of females not different from that of males.

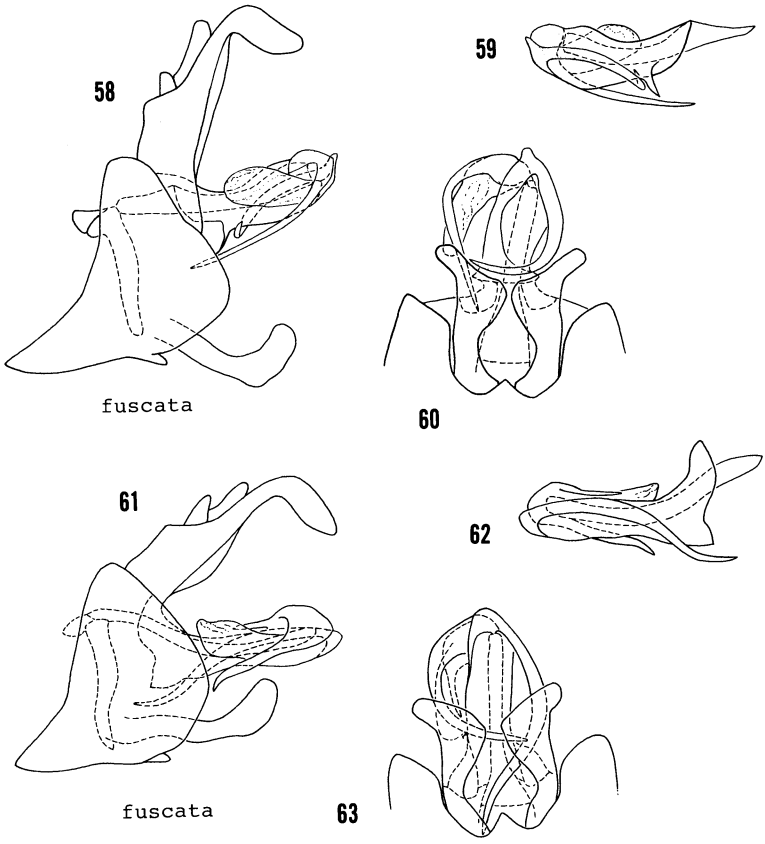
Male genitalia. — Genital capsule in ventral view (fig. 57) with median lobe of pygofer produced, styles irregularly oval distally, aedeagus with forked process on left margin near apex and single process directed caudad on midline; genital capsule in left lateral view (fig. 55) with posterior margin of pygofer bluntly triangular, style upcurved distally, anal tube comparatively short and broadly blunt on apical margin; aedeagus in left lateral view (fig. 55) with blunt projection near middle of ventral margin, curved process originating from ventral margin and projecting to aedeagal apex, straight process originating near apex dorsally and directed obliquely cephalad; aedeagus in right lateral view (fig. 56) without processes originating on this side.

Type. — Holotype male, Brownsville, Texas, 21 November 1911, Palm Jungle sweeping, collector not recorded, in collection of Illinois State Natural History Survey, Urbana.

Specimens studied. — TEXAS, Brownsville, Corpus Christi, Los Borrigos,



FIGURES 49-57. Male genitalia. 49-51, *Microledrida asperata* Fowler, from lectotype. 52-54, *Microledrida olor* n. sp., from holotype, 55-57, *Microledrida flava* Metcalf, from Brownsville, Texas. 49, 52, 55, complete left lateral view of genital capsule. 50, 53, 56, aedeagus in right lateral view. 51, 54, 57, apex of pygofer, styles, and aedeagus in ventral view.



FIGURES 58-63. Male genitalia. 58-60, *Microledrida fuscata* Van Duzee, from San Diego Co., Cal. 61-63, same, from Brownsville, Texas. 58, 61, complete left lateral view of genital capsule. 59, 62, aedeagus in right lateral view. 60, 63, apex of pygofer, styles and aedeagus in ventral view.

Olmito. Collection dates 4 January to 21 July. Total specimens studied 26 males and 8 females.

Notes. — *M. flava* resembles the paler forms of *M. fuscata,* and it is generally lighter in color than that species. Two features of the concealed male genitalia immediately separate *M. flava* from all of its congeners; these are the short and apically blunt anal tube and the curved process that originates on the ventral margin of the shaft and projects to the apex. This species is known only from southeastern Texas, where a few of the specimens studied were taken on Easter lilies, eggplant, and cotton.

Microledrida fuscata Van Duzee

Figs 5-6, 58-63

Microledrida fuscata Van Duzee 1914:38.

Salient features. — Length of males 3.2-3.6 mm, females 3.6-4.0 mm. Ground color of head and thorax brownish yellow, crown and portions anterior to eyes unmarked or irregularly darkened with various shades of brown to sometimes nearly black, at times darkened areas appear as poorly defined transverse bands on crown, coronal midline and lateral margins pale or variably darkened, clypeus dark reddish brown to almost black, frons pale and unmarked to mottled with dark shades of brown, pro- and mesonotum unmarked or variably mottled with dark shades of brown to nearly black, forewings milky subhyaline, markings vague to distinct with large dark brown cloud on portions touching mesonotum, smaller clouds near middle and subapex, clouds blend in heavily marked specimens, veins brown, pustules and setae dark brown.

Male genitalia. — Genital capsule in ventral view (figs. 60, 63) with median lobe of pygofer triangularly produced, distal portions of styles narrowed, aedeagus with process on both right and left side at apex, lengths and curvatures of processes variable; genital capsule in left lateral view (figs. 58, 61) with posterior margin of pygofer produced, style upturned distally, anal tube elongated, narrowed in distal half, and decurved in distal fourth; aedeagus in left lateral view (figs. 58, 61) with slender process originating apically on ventral margin, directed basally, barely discernable transparent flap arising just above process, ventral margin of shaft with variable projection in basal half; aedeagus in right lateral view (figs. 59, 62) with only one process originating on this side, process arising near apex and directed basally.

Types. — Lectotype male here selected with labels: "San Diego Co., Cal., 3-11-14, E.P. Van Duzee" and (red label) "Lectotype *fuscata*" and (yellow label)" E.P. Van Duzee Collection." Allolectotype female with same data as lectotype is also here selected. Both of these specimens are in the California Academy of Sciences collection and were previously labeled by Van Duzee, but the selections were never published.

Specimens studied. — ARIZONA, Black River, Bradshaw Mts., Cline, Kaibab, Yarnell Heights; CALIFORNIA, San Diego Co.; TEXAS, Brownsville, Fabens, Catarina, Laredo, Pharr, Presidio. San Antonio. Collection dates 1 January to 10 October. Total specimens studied 57 males and 46 females.

Notes. — The shape of the male anal tube in lateral view provides the features that distinguish *M. fuscata* from its congeners in the United States. There is a fair amount of variation in the curvatures of the apical processes of the aedeagus. The extremes of this variation can be seen in fig. 60 and 63. In coloration, specimens from southern California are generally darker, those from Arizona paler, and those from Texas somewhat intermediate between the other two. However, there are no consistent morphological features to separate the three populations; thus no subdivision of the species is in order.

Van Duzee's original series was beaten from *"Heteromeles* (Christmas berry)" in Alpine, San Diego Co., California. A few of the specimens taken in Texas were

associated with beets, cotton, and narrowleaf globemallow. The distribution of *M. fuscata* extends from Brownsville, Texas in the east to San Diego Co., California in the west.

Checklist of United States species of *Microledrida* with state records

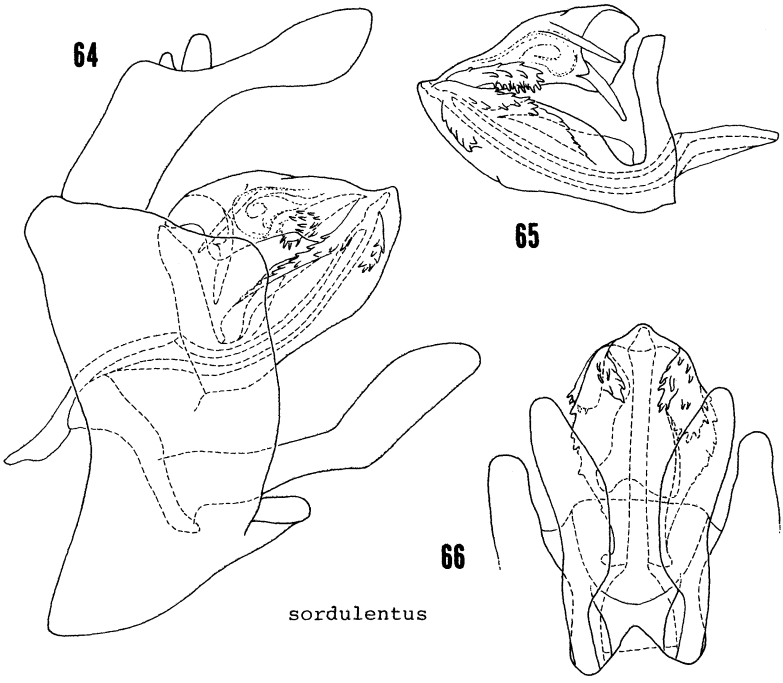
1. *flava* Metcalf 1923:183. Tex.
2. *fuscata* Van Duzee 1914:38. Ariz., Cal., Tex.
3. *olor* Kramer, n. sp. Tex.

Genus MONORACHIS Uhler

Monorachis Uhler 1901:509. Type-species *Monorachis sordulentus* Uhler 1901:510, by monotypy.

Small to average-sized cixiids (3.1-5.9 mm); head in dorsal view slightly narrower than pronotum, eyes comparatively small, crown basally lunulate, distally weakly foveolate, wider than long, its edges carinate, longitudinal midline weakly carinate, posterior margin broadly incised; head in lateral view bluntly angular at apex; head in facial view with sides and longitudinal midline of frons and clypeus carinate, frontal ocellus small, frons broadly oval with greatest width and length subequal, its lateral edges flared; pronotum posteriorly incised with transverse carina on discal portion approximating outline of posterior incision of crown, mesonotum tricarinate, hind tibiae with 2 or 3 spines before apex, venation of forewings as in figs. 7-8, at times with few extra veinlets, 5 to 7 veins reaching hind margin, veins with dark pustules. Male genitalia: typical of family, aedeagus with long and well developed apical flagellum.

Notes. — This genus contains but one species redescribed below. Van Duzee (1917:734) with a question mark listed *Metabrixia aspersa* Fowler, a Mexican species not known to occur in the United States, as a syn. of *Monorachis sordulentus.* I have examined a male from Fowler's original series on loan from the British Museum (Nat. Hist.) and concluded that it is a distinct species and probably belongs in the genus *Pintalia* as it was placed in the world catalogue by Metcalf (1936:28). Dozier (1928:68) incorrectly applied this name as *Cotyleceps aspersa* (Fowler) to the species elsewhere described in this study as *Pintalia vibex,* n. sp.



FIGURES 64-66. Male genitalia of *Monorachis sordulentus* Uhler, from St. Louis, Mo. 64, complete left lateral view of genital capsule. 65, aedeagus in right lateral view. 66, apex of pygofer, styles, and aedeagus in ventral view.

Monorachis sordulentus Uhler

Figs. 7-8, 64-66

Monorachis sordulentus Uhler 1901:510.

Salient features. — Length of males (submacropterous) 3.1-3.4 mm, females (macropterous) 5.2-5.9 mm. Ground color of head and thorax tawny, intercarinal portions variably embrowned or darkened; forewings of submacropterous males (fig. 7) varying from hyaline with only vague traces of brownish clouding to mostly dark with irregular brown clouding proximally, mesally, and distally; forewings of macropterous females (fig. 8) almost entirely various shades of transparent brown; in both males and females, veins of forewings bear dark pustules; in well-marked males and females, following portions pale: irregular patch just beyond claval apex and on stigmal area, portions of veins reaching posterior margin, and all or most of entire margin.

Male genitalia. — Genital capsule in ventral view (fig. 66) with median lobe of pygofer triangularly produced, styles slender and narrowest near bases, aedeagus broadly oval with irregular teeth and serrations distally; genital capsule in left lateral view (fig. 64) with posterior margin of pygofer produced (usually slightly more triangularly than shown), style irregularly oval distally, anal tube constricted near middle; aedeagus in left lateral view (fig. 64) with teeth and serrations laterally near apex, on dorsal margin of shaft, on venter of flagellum near base; aedeagus in right lateral view (fig. 65) with serrated areas laterally near apex and middle, dorsal margin and submargin of shaft irregularly toothed, anterior process toothed, flagellum with pair of simple processes distally.

Type. — Holotype female, Lake Worth, Florida, Mrs. Annie Trumbull Slosson, in collection of American Museum of Natural History, New York City. Since the original description, the head and left forewing have been lost from the submacropterous holotype.

Specimens studied. — FLORIDA, Dade County, Flamingo Prairie in Everglades Nat. Park, Lake Worth; GEORGIA, Thomasville; ILLINOIS, Vienna; KANSAS, Topeka; LOUISIANA, Baton Rouge; MISSISSIPPI, Gulfport; MISSOURI, St. Louis: NORTH CAROLINA, Ashe Island in Onslow Co.; SOUTH CAROLINA, Orangeburg; TENNESSEE, Reelfoot Lake. Collection dates 25 March to 18 August. Total specimens studied 8 males and 8 females.

Notes. — *M. sordulentus* is the only United States species of Cixiidae known to have both longwinged and shortwinged forms. Except for the holotype, all of the females studied were of the form with long wings. All of the males studied were shortwinged except for one example from Baton Rouge, Louisiana. The longwinged forms of *M. sordulentus* resemble species of *Pintalia* but can be easily separated from them by the features presented in couplet 9 of the key to genera. Except for two males collected on savanna grass at Vienna, Illinois, the plant relationships are unrecorded. This is a species of our southeastern states and is known to occur from Florida north to North Carolina and west to eastern Kansas and Louisiana.

Genus PINTALIA Stål

Pintalia Stål 1862:4 Type-species *Pintalia lateralis* Stål, by subsequent designation of Muir 1925:103.

Cotyleceps Uhler 1895:63. Type-species *Cotyleceps decorata* Uhler, by monotypy.

Metabrixia Fowler 1904:86. Type-species *Metabrixia delicata* Fowler, by subsequent designation of Muir 1925:102.

Ciocixius Metcalf 1923:183. Type-species *Cixius dorsivittatus* Van Duzee, by monotypy.

Moderate-sized to large cixiids (5.2-7.2 mm); head in dorsal view not as wide as pronotum, eyes of average size, crown wider than long with transverse carina near middle and at apex, longitudinal carina on midline usually not strongly developed, lateral margins

carinate and elevated, posterior margin of crown broadly incised; head in lateral view bluntly angular at apex; head in facial view with sides and longitudinal midline of frons and clypeus carinate, frontal ocellus well developed, frons elongated with greatest width much less than greatest length, its lateral edges flared; pronotum narrow and posteriorly incised, with transverse carina on discal portion approximating outline of hind margin of head, mesonotum tricarinate, hind tibia with 1 or 2 small to minute spines before apex, venation of forewings as in fig. 9, apical cells with widths about equal, 10 to 12 veins reaching hind margin of wing, veins with fine granules or pustules. Male genitalia: typical of family, aedeagus with long and well developed apical flagellum.

Notes. — *Pintalia* is largely a genus of the Neotropics; many species occur in the faunas of Mexico and the West Indies. There is no comprehensive study of the species south of the United States, but the Mexican fauna was treated in part by Caldwell (1944). Only three species are known to occur in our fauna, and these are keyed below.

KEY TO UNITED STATES SPECIES OF *Pintalia*

1. Aedeagus in ventral view with two sharp spines on each side of shaft (fig. 69); subcostal cell of forewing transparent brownish and either with or without 1 to 3 irregular pale milky spots ..... *delicata* (Fowler)
   Aedeagus in ventral view without spines as above (fig. 72); subcostal cell of forewing hyaline or milky hyaline with 1 to 4 irregular brownish spots 2
2. Aedeagus in lateral view with tapered, curved, subtriangular projection near middle of dorsal margin (figs. 70-71) (widespread in the Southeast) .... *vibex,* n. sp.
   Aedeagus in lateral view with dentate convexity near middle of dorsal margin (figs. 73-74) (known only from Virginia) ..... *gurneyi,* n. sp.

Pintalia delicata (Fowler) Figs. 67-69

Metabrixia delicata Fowler 1904:86, pl. 9, fig. 23.
Cixius dorsalis Van Duzee 1908:491. N. Syn.
Cixius dorsivittatus Van Duzee 1909:188 (new name for *C. dorsalis* Van Duzee 1908, not *C. dorsalis* Stephens 1829). N. Syn.

Salient features. — Length of males 5.2-6.6 mm, females 5.5-7.0 mm. Ground color of head and thorax dark tawny to brownish, intercarinal portions of face often

variably darker, crown and middle portions of pronotum and mesonotum typically pale and contrasting sharply with dark brown to almost black lateral portions of pro- and mesonotum, at times intercarinal portions of crown and thorax tinted variably with brownish; forewings with commissural margins pale to claval apices, remainder mainly smoky transparent brown, color darkest in and near claval areas and apical portions, veins dark, usually with few irregular small pale spots in apical and subapical cells and subcostal cells, distal margins of forewings and portions of veins touching them often pale.

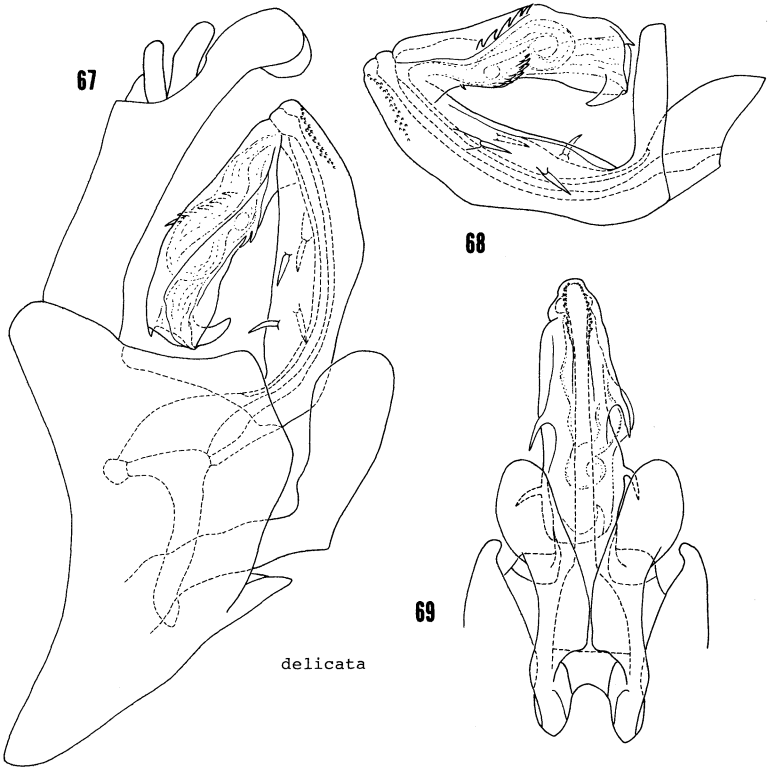
Male genitalia. — Genital capsule in ventral view (fig. 69) with median lobe of pygofer roundly produced, styles broadest distally, aedeagus with two spines on each side of shaft; genital capsule in left lateral view (fig. 67) with posterior margin of pygofer produced, its dorsal margin usually concave, style enlarged distally, anal tube elongated and depressed at apex, portion of right margin visible apically; aedeagus in left lateral view (fig. 67) elongate, ventral margin of shaft somewhat irregular, finely serrated strip near ventral margin distally, two spines near dorsal margin, flagellum almost as long as shaft, with apical hook and oblique serrations near middle and smaller ones on ventral margin; aedeagus in right lateral view (fig. 68) similar to left lateral view.

Types. — Lectotype male here selected for *Metabrixia delicata* Fowler with labels: "Chilpancingo, Guerrero, 4600 ft., June, H.H. Smith" and "B.C.A. Homopt. I, *Metabrixia delicata* Fowler" and (handwritten) *"Metabrixia delicata* Fowler, type." The lectotype represents part of the series before Fowler at the time of the original description and is located in the British Museum (Nat. Hist.). Other localities, all Mexican, mentioned in the original description include Presidio and Teapa in Tabasco. The male genitalia of the lectotype agree well with figs. 67-69.

The holotype female of *Cixius dorsalis* Van Duzee was taken by Mrs. Annie T. Slosson at Biscayne Bay, Florida without additional data. This holotype is in the collection of the American Museum of Natural History, New York City; and since the original description, the left forewing has been lost.

Specimens studied. — ARIZONA, Douglas, Portal, Willcox; FLORIDA, Belle Glade, Biscayne Bay, Gainesville, Jacksonville, Jay, Key Largo, Key West, Marathon, Mayport, Miami, New Smyrna, Pensacola, Sanford; GEORGIA, Savannah; LOUISIANA, Burnside, Gueydan, New Iberia, New Orleans, Tallulah; MARYLAND, Bowie; MISSISSIPPI, Ocean Springs; NORTH CAROLINA, Ashe Island in Onslow County; TEXAS, Boca Chica, Brownsville, Houston, Sinton Welder Wildlife Range, Victoria, Weslaco, county only — Bexar, Cameron. Collection dates 22 March to 15 October. Total specimens studied 72 males and 105 females.

Notes. — *P. delicata* can be recognized by the features presented in the key to species. It appears to be the most common species of *Pintalia* in most of Mexico. Caldwell (1944:155) listed 10 Mexican states and Guatemala as localities from which he had seen specimens. He did not include any United States records. Within our territory, it is known in the West from Arizona and in the East from Texas to Florida and north along the coastal states to Maryland. Dozier (1928:68) reported *Sagittaria latifolia* Willd., common arrowhead, as the food plant of specimens he collected in



FIGURES 67-69. Male genitalia of *Pintalia delicata* (Fowler), from Ashe Island, Onslow Co., N.C. 67, complete left lateral view of genital capsule. 68, aedeagus in right lateral view. 69, apex of pygofer, styles, and aedeagus in ventral view.

low, moist places in deciduous woods in Mississippi. Other than by general sweeping of vegetation, most of the specimens examined during this study were taken without recorded plant associations.

Pintalia vibex, Kramer, n. sp. Figs. 9, 70-72

Salient features. — Length of males 5.8-7.2 mm, females 6.8-7.8 mm. Ground color of head and thorax dark tawny, intercarinal portions of face variably darker,

sides of head embrowned to partly blackened, pro- and mesonotum with sides infuscated, middle portions usually paler; forewings with commissural margins either pale to claval apices or not, rest of each forewing mainly transparent smoky brown interrupted with pale areas, brown color ranging from vague light mottling to almost solid clouds, subcostal cell pale with 1 to 4 irregular brown spots, veins mainly brownish, in well-marked specimens three more or less distinct pale spots in basal half, one in clavus, others in corium, distal margin of forewing sometimes pale.

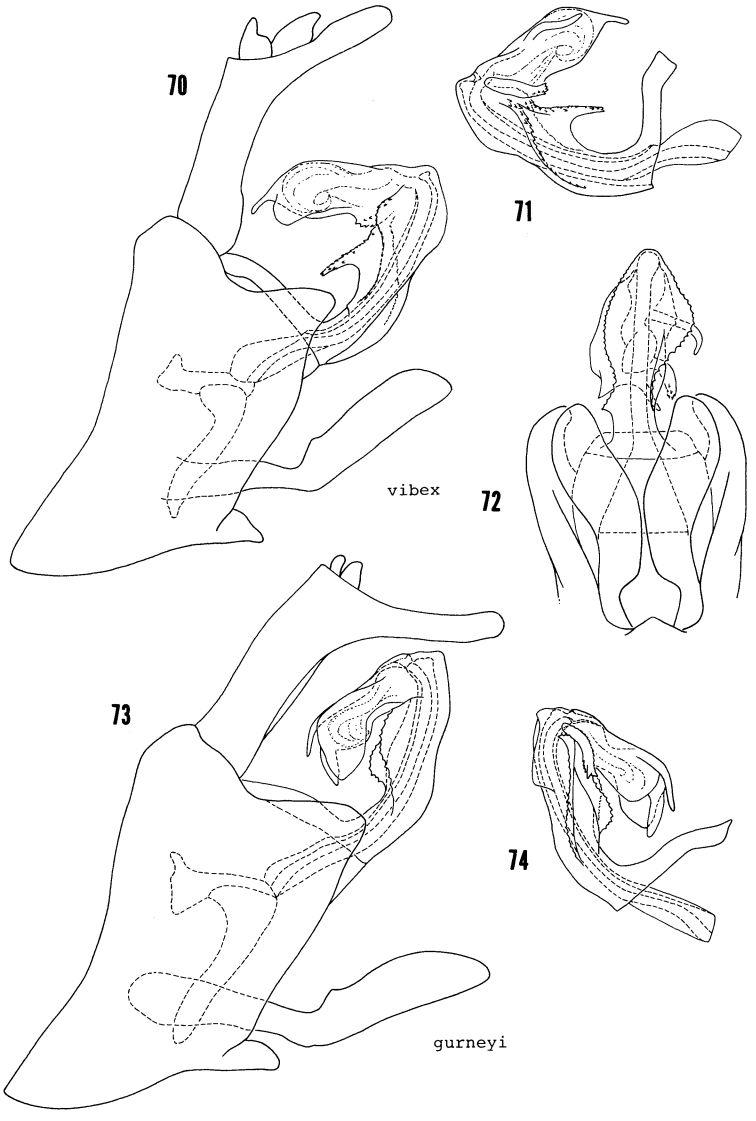
Male genitalia. — Genital capsule in ventral view (fig. 72) with median lobe of pygofer triangularly produced, styles broadened distally, lateral margins of aedeagus serrated; genital capsule in left lateral view (fig. 70) with dorsal margin of pygofer indented and posterior margin oblique, slightly convex, style enlarged distally, anal tube elongated with distal portion narrowed; aedeagus in left lateral view (fig. 70) with ventral margin convex near apex, dorsal margin with finely serrated convexity near apex, tapered and finely toothed projection near middle of dorsal margin, flagellum about as long as shaft, its basoventral margin convex and partly toothed, its apex slender with broad subapical fin; aedeagus in right lateral view (fig. 71) similar to left lateral view but shaft with oblique and dentate ridge originating near dorsal margin in distal half, and short apical process bearing fine dentation, flagellum with simple process originating near dorsal margin in distal half.

Type. — Holotype male (USNM 100049), La Belle, Florida, 16 July 1939, P.W. Oman.

Specimens studied. — ALABAMA, Coleta; ARKANSAS, Little Rock; FLORIDA, Enterprise, Gainesville, La Belle, Parker Island, Plant City, Sanford; ILLINOIS, Charleston, Mason, Wetaug; INDIANA, Rush County; KANSAS, Oswego; LOUISIANA, Tallulah; MARYLAND, Bowie, Breton Bay, Chesapeake Beach, Glen Echo, Oxon Hill, Piney Point; MISSISSIPPI, Leland; NORTH CAROLINA, New Bern; SOUTH CAROLINA, Charleston, Swansea; VIRGINIA, Alexandria, Exmore, Falls Church, Lake Drummond, Mount Vernon, Vienna. Collection dates 5 March to 18 November. Total specimens studied 68 males and 70 females.

Notes. — The tapered, curved, and subtriangular projection on the dorsal margin of the aedeagus as seen in lateral view immediately distinguishes this species from its congeners. This is the species misidentified by Dozier (1928:68) as *Cotyleceps aspersa* (Fowler) and by Caldwell (1944:154) as *Pintalia dorsovittata* (sic) (Van Duzee). *P. vibex,* a southeastern species, occurs from Florida north to Maryland and west to Kansas and Louisiana. Exact plant relationships are unrecorded, but Dozier (1928:69) found it in low, moist, deciduous woods. The few specimens I have seen with recorded ecological data support his findings. Some of the specimens seen during this study were taken from vegetation along streams or in swampy areas. The specific name, a Latin noun in apposition, means mark or weal.

FIGURES 70-74. Male genitalia. 70-72, *Pintalia vibex* n. sp., from holotype. 73-74, *Pintalia gurneyi* n. sp., from holotype. 70, 73, complete left lateral view of genital capsule. 71, 74, aedeagus in right lateral view. 72, apex of pygofer, styles, and aedeagus in ventral view.


70
71
vibex
72
73
74
gurneyi

Pintalia gurneyi Kramer, n. sp. Figs. 73-74

Salient features. — Length of male 6.5 mm, female unknown. Ground color of head and thorax dark tawny, intercarinal portions of face and sides of head darkened with shades of brown to nearly black, dark patch on middle half of crown near base, lateral portions of pro- and mesonotum dark brown to nearly black; forewings transparent with commissural margins pale to claval apices, rest of each forewing lightly mottled with brown but leaving some clear areas, basal portion of clavus and portions of apical cells clouded with brown, subcostal cell with three large and somewhat irregular dark brown spots.

Male genitalia. — Genital capsule in ventral view not separable from that of *P. vibex;* genital capsule in left lateral view (fig. 73) with dorsal margin of pygofer indented and posterior margin nearly straight, style suboval distally, distal portion of anal tube narrowed and angled with basal portion; aedeagus in left lateral view (fig. 73) elongated with ventral margin of shaft slightly irregular, dentate convexity near middle of dorsal margin, flagellum not as long as shaft but with two apical projections; aedeagus in right lateral view (fig. 74) similar to left lateral view but with broad fin near apex, oblique dentate strip originating near apex on dorsal margin, and short dentate apical process.

Type. — Holotype male (USNM 100050), Dismal Swamp, Lake Drummond, Nansemond County, Virginia, 8-9 June 1974, D. and M. Davis.

Specimens studied. — Known only from holotype.

Notes. — *P. gurneyi* is most similar to *P. vibex;* the two species are readily separated by the features used in the key to species. Even though this species is known only from the Dismal Swamp in southern Virginia, it seems probable that it will be found elsewhere in our eastern states in the future. Gurney (1963:62) discussed the faunistic affinities of the Dismal Swamp insects. On the basis of information compiled from the literature, he found no insects unique to Dismal Swamp. This new species is named for Dr. Ashley B. Gurney, a respected colleague and friend.

Checklist of United States species of *Pintalia* with state records

1. *delicata* (Fowler) 1904:86. Ariz., Fla., Ga., La., Md., Miss., N.C., Tex.
   = *dorsalis* (Van Duzee) 1908:491. N. Syn.
   = *dorsivittatus* (Van Duzee) 1909:188. N. Syn.
2. *gurneyi* Kramer, n. sp. Va.
3. *vibex* Kramer, n. sp. Ala., Ark., Fla., Ill., Ind., Kans., La., Md., Miss., N.C., S.C., Va.

Genus NYMPHOCIXIA Van Duzee

Nymphocixia Van Duzee 1923:189. Type-species *Nymphocixia unipunctata* Van Duzee 1923:189, by monotypy.

Average-sized cixiids (4.8-5.8 mm); head in dorsal view much narrower than pronotum, eyes large, crown narrow with its lateral margins strongly elevated and carinate, especially distally, carina on longitudinal midline of crown continuous with that of frons, posterior portion of crown concealing middle portion of pronotum (fig. 11); head in lateral view (fig. 10) almost semicircular, lateral edges of frons and crown forming continuous line; head in facial view with sides of frons foliaceous and carinate, longitudinal midline carinate, frons narrowing apically with length exceeding width, frontal ocellus small but distinct, clypeus triangular; pronotum divided by hind margin of crown, mesonotum tricarinate, hind tibiae without spines before apex, venation of forewings as in fig. 10, veins with minute setae-bearing pustules. Male genitalia: typical of family, aedeagus with prominent apical flagellum and additional processes.

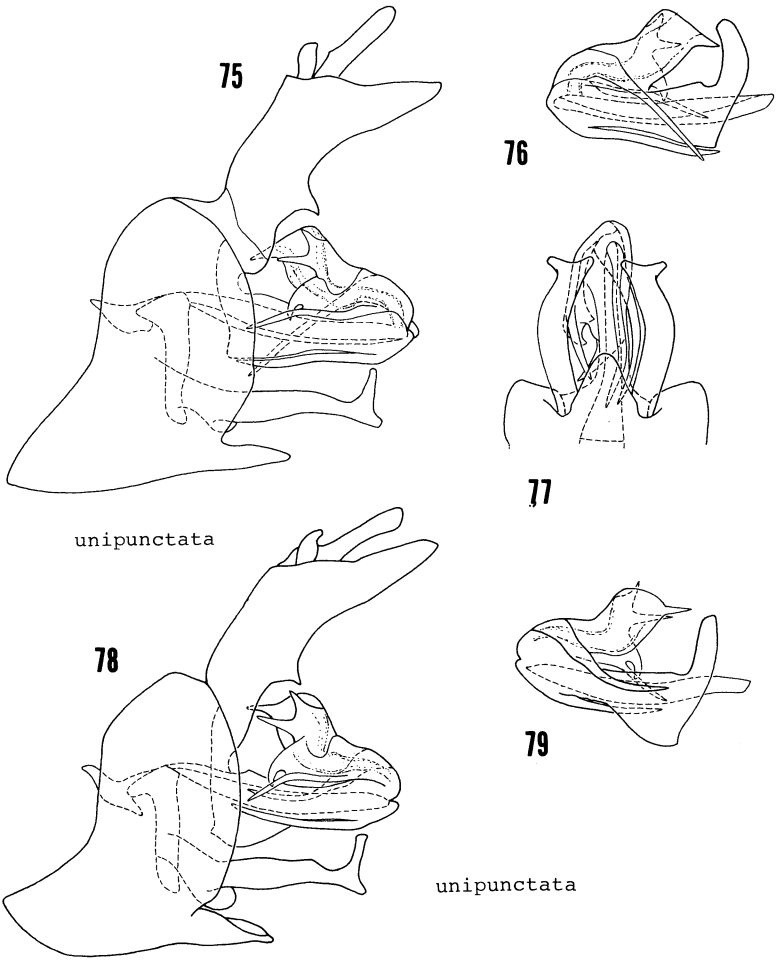
Notes. — *Nymphocixia* is primarily a genus of the American tropics; I have seen examples of the genus from the West Indies, Central America, and northern South America. Only one widespread Neotropical species is known to occur in our fauna.

Nymphocixia unipunctata Van Duzee

Figs. 10-11, 75-79

Nymphocixia unipunctata Van Duzee 1923:189.
Nymphocixia vanduzeei Muir 1930:13. N. Syn.
Nymphocixia vanduzeei var. *floridensis* Caldwell 1944a:254. N. Syn.

Salient features. — Length of males 4.8-5.2 mm, females 5.4-5.8 mm. Ground color of head and pronotum whitish to pale tawny, foliaceous edges of crown and frons narrowly darkened, in well-marked specimens edges of longitudinal carina on midline of frons darkened, sides of clypeus and portions of head below eyes with darkened patches, mesonotum pale orange-brown in males and dark reddish brown in females with extreme apex irregularly pale, lateral pair of mesonotal carina darkened in males, forewings largely transparent with transverse and longitudinal color pattern in various shades of brown as in fig. 10. Intensity of color pattern variable in both males and females, females almost always darker than males and usually with sharper markings, setae on forewings pale.



FIGURES 75-79. Male genitalia. 75-77, *Nymphocixia unipunctata* Van Duzee, from paratype. 78-79, same, from Plantation Key, Fla. 75, 78, complete left lateral view of genital capsule. 76, 79, aedeagus in right lateral view. 77, apex of pygofer, styles, and aedeagus in ventral view.

Male genitalia. — Genital capsule in ventral view (fig. 77) with median lobe of pygofer bluntly triangular, styles bowed outward with their apical portions broadly forked; genital capsule in left lateral view (fig. 75, 78) with posterior margin of pygofer broadly rounded, style slender and produced subapically on dorsal margin, anal tube narrowed distally and with large tooth in basal half of ventral margin; aedeagus in left lateral view (figs. 75, 78) with two long slender processes originating at or near apex, both directed cephalad, one on dorsal margin, other on ventral margin, flagellum with broad hook on ventral margin near middle, left apical portion of flagellum forked, right apical portion of flagellum blunt distally but produced as slender tooth on proximal edge; aedeagus in right lateral view (figs. 76, 79) similar to left lateral view but with elongated and slender process originating near base of flagellum and directed cephalad or ventrocephalad.

Types. — Holotype male of *N. unipunctata* Van Duzee, Espiritu Santo Island, Gulf of California, 1 June 1921, E.P. Van Duzee, Cal. Acad. Sci. No. 1080. Two additional males and five females, including the allotype, Cal. Acad. No. 1081, with identical data were also seen. All of these specimens are in the California Academy of Sciences, San Francisco.

Holotype male of *N. vanduzeei* Muir, Cartagena, Colombia, 30 June 1905, C. Gogzo, in collection of the Zoological Museum, Hamburg University, Federal Republic of Germany.

Holotype female of *N. vanduzeei* var. *floridensis* Caldwell, Manatee County, Cortes Beach, Florida, 4 January 1925, T.H. Hubbell in collection of Ohio State University, Columbus.

Specimens studied. — FLORIDA, Cortes Beach in Manatee County, Key Largo, Plantation Key. Collection dates 4 January to 18 July. Total specimens studied 7 males and 4 females.

Notes. — The shape of the head in lateral view and the concealed central portion of the pronotum differentiate *N. unipunctata* from all of our other native cixiids. Florida provides the only state record; specimens collected in the Florida Keys were taken on *Rhizophora mangle* L., American or red mangrove; and on *Laguncularia racemosa* (L.) Gaertn., white mangrove. Van Duzee's original series was also associated with mangrove having been taken on *Avicennia nitida* Jacq. = *A. germinans* (L.) L., black mangrove, in the Gulf of California. The data at hand indicate that *N. unipunctata* is a widespread Neotropical maritime species associated with mangroves.

The synonymy proposed above is based on a study of the appropriate holotypes. Figures 75-77 were prepared from a paratype with data identical to that of the holotype of *N. unipunctata* and figs. 78-79 from a specimen taken at Plantation Key, Florida. The concealed male structures of *N. vanduzeei* Muir were studied and agreed well with those of the Florida specimen except the apex of the flagellum was found to be flatter and the apical process on the right side of the aedeagus straighter; both of these features are more like those found in the paratype of *N. unipunctata.* Compared with the Florida specimen, the paratype has the basoventral portion of the aedeagus in right lateral aspect less flared and the anal tube shorter. None of these differences are evaluated as more than intraspecific variation. *N. vanduzeei* var. *floridensis* Caldwell, based on a single female, was differentiated on the basis of

its darker color; Caldwell was apparently not aware that females are almost always darker than males.

Genus STEGOCIXIUS Kramer, new genus

Type-species *Stegocixius lochites* Kramer, new species.

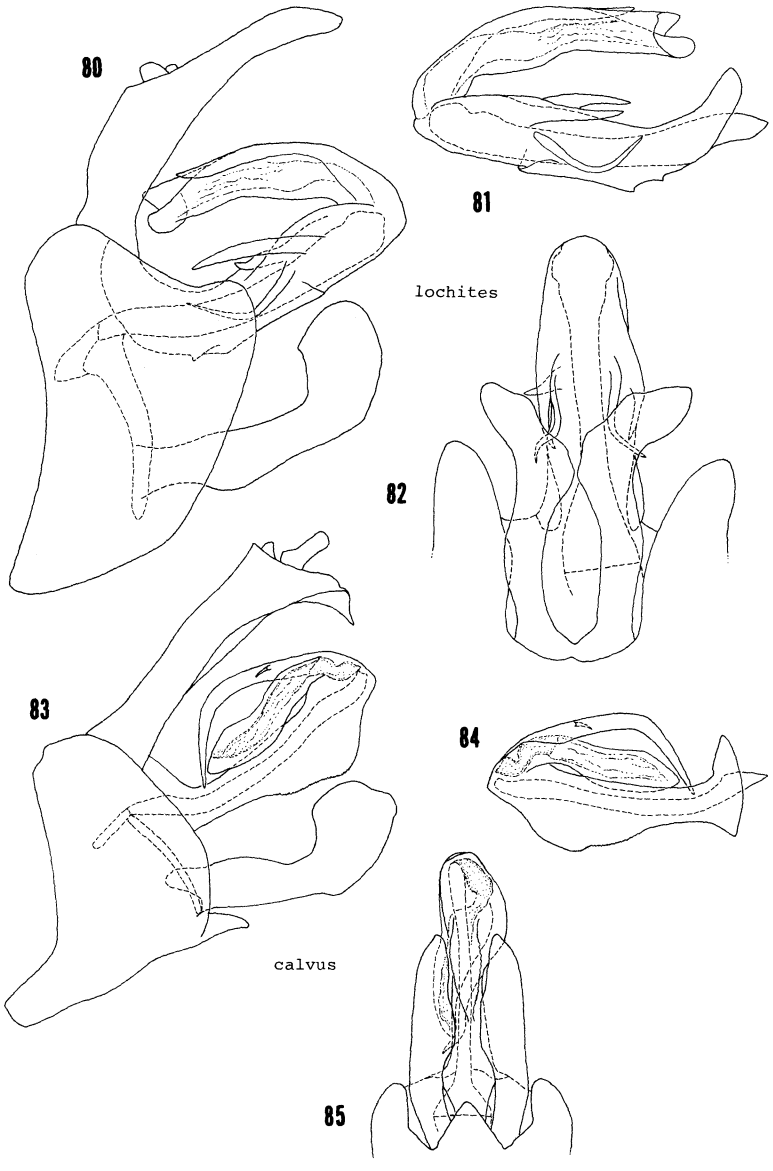
Cixiids of moderate size (5.0 mm); head in dorsal view about two-thirds as wide as pronotum, eyes not large, crown basally lunulate with margins of lunulate portion carinate, crown distally with flattened ridges delimiting shallow foveae, posterior margin of crown broadly incised; head in lateral view blunt at apex; head in facial view with sides and midline of frons and clypeus carinate, frons broadest near base and tapered toward apex, frontal ocellus obscure, clypeus triangular; pronotum unusually large, tricarinate on discal portion with additional transverse ridges laterally, posterior lateral portions covering most of tegulae, mesonotum tricarinate, hind tibiae without spines before apex, venation as in fig. 12, veins with distinct dark pustules bearing setae. Male genitalia: characteristic of family with long apical flagellum and processes on shaft.

Notes. — *Stegocixius* resembles some of the western species of *Cixius* in general habitus, but it can be easily distinguished from that genus and from all other genera in our fauna by the unusually large pronotum and lack of spines on the hind tibia before the apex. The genus is based on one species known from the San Francisco Bay area of California.

Stegocixius lochites Kramer, n. sp. Figs. 12, 80-82

Salient features. — Length of male 5.0 mm, female unknown. Ground color of head and thorax tawny, intercarinal portions of crown, foveae, and small spot at apex of frontal carina dark brown, sides of head darkened, intercarinal areas of pronotum and mesonotum darkened with shades of brown, forewings transparent but milky whitish with vague brownish clouding between light brown veins, pustules

FIGURES 80-85. Male genitalia. 80-82, *Stegocixius lochites* n. sp., from holotype. 83-85, *Platycixius calvus* Van Duzee, from Santa Paula, Ventura Co., Cal. 80, 83, complete left lateral view of genital capsule. 81, 84, aedeagus in right lateral view. 82, 85, apex of pygofer, styles, and aedeagus in ventral view.


80
81
lochites
82
83
84
calvus
85

brown, poorly defined brownish cloud at each claval apex, subcostal area, and apex of wing, veins in apical cloud of each forewing in part dark brown.

Male genitalia. — Genital capsule in ventral view (fig. 82) with median lobe of pygofer weakly produced, styles long, their distal portions directed obliquely laterad with inner distal margins irregular, aedeagus with 3 processes on left side and 2 processes on right side; genital capsule in left lateral view (fig. 80) with dorsal margin of pygofer indented near apex, hind margin oblique, style stout and upturned distally with small tooth on proximal margin before apex, anal tube distinctly narrowed in distal half; aedeagus in left lateral view (fig. 80), shaft with 3 processes, all directed cephalad, shortest process originating near middle of dorsal margin, stoutest process originating near dorsal margin in distal half, and most slender process originating near middle on side of shaft, flagellum long with elongated process following its dorsal margin; aedeagus in right lateral view (fig. 81) with 2 processes originating on this side, both directed cephalad, more slender process originating near middle of shaft, stouter process on or near dorsal margin in distal half, apex of flagellum asymmetrical.

Type. — Holotype male (USNM 100051), Dillon Beach, Marin county, California, 26 October 1969, M. Wasbauer, collector.

Specimens studied. — Known only from holotype.

Notes. — The nearly hidden tegulae, the large pronotum, and the absence of spines on the hind tibiae distinguish *S. lochites* from all other cixiids in our fauna. Nothing is known about the plant relationships of this California species. The specific name, a Greek noun in apposition, means ambusher.

Genus PLATYCIXIUS Van Duzee

Platycixius Van Duzee 1914:37. Type-species *Platycixius calvus* Van Duzee 1914:38, by monotypy.

Comparatively large cixiids (6.0-7.3 mm); head in dorsal view slightly more than four-fifths as wide as pronotum, eyes longer than wide, crown flat, its longitudinal midline at least partly carinate, lateral margins carinate and slightly elevated, anterior margin carinate with weakly defined transverse fovea at middle between crown and upper portion of frons, posterior margin of crown broadly incised; head in lateral view slightly flattened and bluntly angular at extreme apex; head in facial view with greatest width of frons exceeding median longitudinal length, its sides sharply carinate and longitudinal midline not carinate, frontal ocellus small but distinct, clypeus triangular, its lateral edges bluntly carinate; pronotum not greatly narrowed at middle, its middle portion tricarinate, extreme lateral portions longitudinally bicarinate, tegulae prominent, mesonotum large, longer than wide,

and tricarinate, hind tibiae without spines before apex, venation as in fig. 13, apical cells on costal margin wider than long, apical cells on anal margin longer than wide, veins with few scattered pale pustules sometimes bearing pale setae. Male genitalia: typical of family, apical flagellum more than half length of shaft, but with scattered and inconspicuous white hairs on genital capsule.

Notes. — *Platycixius* is superficially similar to *Cixius,* but it can be immediately separated from that genus and from all other genera in our fauna by the complete absence of the median longitudinal carina on the midline of the frons. The genus is based on a single species known from our western states.

Platycixius calvus Van Duzee

Figs. 13, 83-85

Platycixius calvus Van Duzee 1914:38.

Salient features. — Length of male 6.0 mm, females 6.5-7.3 mm. Ground color of head and pronotum tawny, dorsal surface of head sometimes shade darker, face pale except for variable embrowning on middle portion of base of frons and darkening sublaterally on clypeus; pronotum irregularly tinted with brownish, tegulae mainly pale, mesonotum black, forewings mainly hyaline or subhyaline, each with distal portions partly or entirely clouded with brown, clavus with small darkened area at middle of commissural margin and at apex, stigma usually creamy in color, veins medium to dark brown.

Male genitalia. — Genital capsule in ventral view (fig. 85) with median lobe of pygofer triangularly produced, styles elongated; genital capsule in left lateral view (fig. 83) with posterior margin of pygofer not strongly produced, style capitate in apical portion, anal tube slender and elongated, its extreme apex asymmetrical, right apical margin longer than left apical margin; aedeagus in left lateral view (fig. 83) with ventral margin of shaft strongly convex on distal half, long process arising at apex of shaft, directed cephalad, then ventrad, tapering to acute apex, with small slender tooth at midlength, flagellum simple but long; aedeagus in right lateral view (fig. 84) with basal portions of apical process and flagellum closely allied.

Type. — Holotype female, San Diego County, California, 12 April 1914, E.P. Van Duzee in collection of California Academy of Sciences, San Francisco.

Specimens studied. — ARIZONA, Huachuca Mts.; CALIFORNIA, San Gabriel Canyon, Santa Paula, Victorville, Weldon, county only — San Diego. Collection dates 14 April to 14 October. Total specimens studied 1 male and 5 females.

Notes. — As previously noted, *P. calvus* can be recognized by and distinguished from all other cixiids in our fauna by the absence of the carina on the longitudinal midline of the frons. There are other good characters which differentiate this species as well; these can be found in the description above. *P. calvus* is known from only a few specimens, singly collected, in southern California and Arizona; two of these were taken on *Yucca.*

Genus ASOTOCIXIUS Kramer, new genus

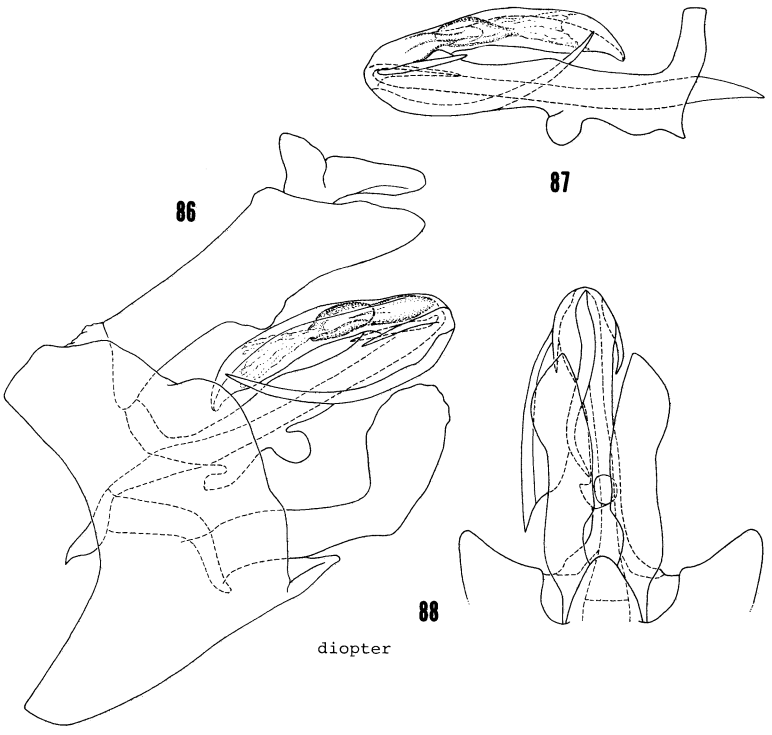
Type-species *Asotocixius diopter* Kramer, new species

Comparatively large cixiids (6.0-9.0 mm), head in dorsal view about two-thirds as wide as pronotum, eyes longer than wide, crown with lateral margins carinate and slightly elevated, longitudinal midline carinate in basal half, distally-angled transverse carina between anterior portions of eyes, crown and frons separated by broad and flat carina, posterior margin of crown broadly incised; head in lateral view with extreme apex bluntly angular; head in facial view with greatest width of frons exceeding median longitudinal length, its midline and lateral margins carinate, frontal ocellus distinct, clypeus triangular, its lateral margins at least in part bluntly carinate; pronotum not greatly narrowed at middle, its middle portion tricarinate, extreme lateral portions longitudinally bicarinate, tegulae well developed, mesonotum large, longer than wide, and tricarinate, hind tibiae without spines before apex, venation as in fig. 14, apical cells on costal margin wider than long, apical cells on anal margin longer than wide, veins with setae-bearing pustules in females, veins with only very few scattered pale pustules in males. Male genitalia: typical of family, aedeagal flagellum more than half length of shaft, but with scattered and inconspicuous white hairs on genital capsule.

Notes. — *Asotocixius* greatly resembles *Platycixius* in venation of the forewings and general habitus, but it is less depressed than that genus and retains the median longitudinal carina on the frons, which is absent in *Platycixius*. *Asotocixius* contains but one species found in our western states.

Asotocixius diopter Kramer, n. sp. Figs. 14, 86-88

Salient features. — Length of male 6.0 mm, females 6.5-9.0 mm. Ground color of head and pronotum tawny, intercarinal portions of dorsal surface of head variably embrowned or blackened, intercarinal portions of face embrowned or blackened except on lateral margins, pronotum and tegulae lightly to heavily embrowned, mesonotum black, forewings mainly hyaline or nearly so, sometimes with few small indistinct brownish clouds in apical cells and near each stigma, stigma usually dark, veins pale to dark brown.



FIGURES 86-88. Male genitalia of *Asotocixius diopter* n. sp., from holotype. 86, complete left lateral view of genital capsule. 87, aedeagus in right lateral view. 88, apex of pygofer, styles, and aedeagus in ventral view.

Male genitalia. — Genital capsule in ventral view (fig. 88) with median lobe of pygofer triangularly produced, styles elongated; genital capsule in left lateral view (fig. 86) with posterior margin of pygofer irregular, style capitate at apex, anal tube stout with blunt projection near middle of ventral margin; aedeagus in left lateral view (fig. 86) with irregularly rounded protuberance on ventral margin of shaft in basal half, two processes, directed cephalad, arising near apex of aedeagus, upper process much shorter and straighter, lower process more than twice length of upper process, bowed with its apex directed cephalodorsad, both processes sharply acute at apex; aedeagus in right lateral view (fig. 87) with only one process arising on this side, its form and position like that of upper process on left side of shaft.

Type. — Holotype male (USNM 100052), Huachuca Mts., Arizona, 31 October 1937, P.W. Oman.

Specimens studied. — ARIZONA, Huachuca Mts.; CALIFORNIA, Cajon Pass in San Bernadino County; NEVADA, Dixie National Forest, county only — Esmeralda. Collection dates 1 July to 31 October. Total specimens studied 1 male and 3 females.

Notes. — The lack of spines on the hind tibia before the apex, the shapes of the apical cells of the forewings, the large mesonotum, and the carinate longitudinal midline of the frons together distinguish *A. diopter* from all other cixiids found in our fauna. It is known only from singly collected specimens taken in Arizona, Nevada, and California. Except for one female collected on a Joshua tree at Cajon Pass, California, the plant associations are not known. The specific name, a Greek noun in apposition, means scout or spy.

Distributional Comments Concerning the Cixiidae in North America

Three genera, widespread from a world viewpoint, are *Cixius, Oliarus,* and *Myndus.* These three dominate in the United States by providing 110 of the 172 recorded cixiid species. *C. meridionalis* Beirne is found in Alaska above the Arctic Circle and is the northernmost member of the family in North America. Even though all three genera occur in Canada, only *Cixius* and *Oliarus* dominate there.

Five genera, *Oecleus, Bothriocera, Pintalia, Microledrida,* and *Nymphocixia,* are shared with the Neotropical Region. These five genera provide 57 of the 172 recorded cixiid species in the United States. Collectively, they are richer in species in the Neotropical Region than in the Nearctic Region. These genera are essentially tropical elements whose northern ranges include the warmer parts of the United States.

Five genera, *Monorachis, Platycixius, Oliaronus, Stegocixius* and *Asotocixius,* are known only from the United States. All are monotypic and thus provide only 5 of the 172 recorded United States cixiids. Their distribution is generally restricted to the southern half of the United States, where they are uncommon to rare.

In summary, the cixiid fauna of the United States is a composite of widespread (64%), tropical (33%), and endemic (3%) generic elements.

Species of the family Cixiidae are known to occur in all the states of continental United States. Figure 89 shows an outline map of the

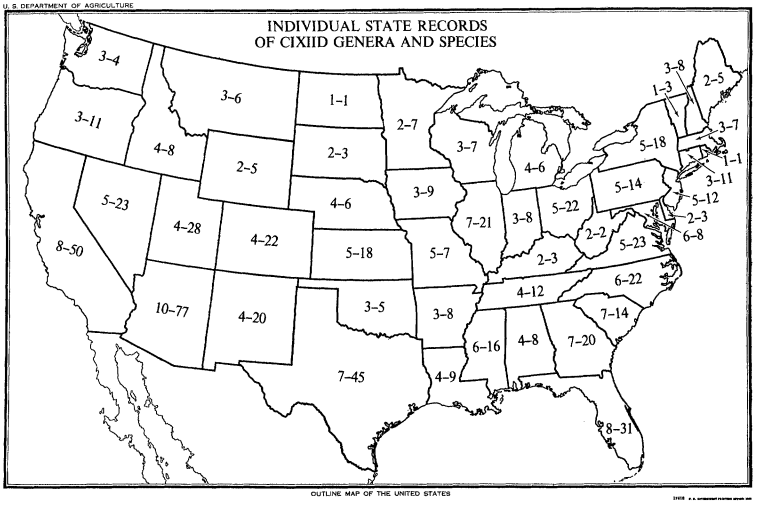


FIGURE 89. Distributional records for the family Cixiidae in continental United States. The first number is the total number of genera, and the second number is the total number of species presently known from any single state.

United States on which are recorded the composite numbers of genera and species taken within each state and seen during the course of this study. Even though we know that not all states have been equally well collected and that these numbers will change, several useful observations regarding distribution can be made on the basis of these data at hand. The greatest per state concentration of genera and species occurs in Arizona, followed by California and Texas. In a comparison of eastern and western states, Connecticut and Oregon have the same number of genera and species as do Virginia and Nevada. If the numbers of genera and species per state are averaged on transects across our southern, middle, and northern states, we find that the southern transect averages 6 genera and 31 species, the middle one 5 genera and 17 species, and the northern one 3 genera and 7 species.

From the foregoing information we can draw several conclusions. Firstly, the hot and dry Southwest is where the cixiids achieve their greatest diversity of genera and species. Secondly, certain states of the eastern deciduous forest and the western Cordilleran

forest on the same latitude have the same numbers of genera and species. Thirdly, the generic and specific diversity of the cixiid fauna decline markedly from south to north; this is not unexpected and is a pattern one might project for a phytophagus insect family whose greatest diversity is to be found in the tropics.

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