

STEPHANIDAE (HYMENOPTERA) OF AMERICA NORTH OF MEXICO

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Abstract.—Eight species of the family Stephanidae are found in Canada and the continental United States. Two new species are described, *Megischus annectens* Aguiar, n.sp., and *Megischus brevicaudatus* Aguiar, n.sp., from the western U.S.A. *Megischus bicolor* Westwood is redescribed, and regional color forms are not recognized as formal subspecies. A key to species is provided. Data on geographical distribution, flight period, and biological associations are summarized.

Key Words: Hymenoptera, Stephanidae, *Schlettererius* Ashmead, *Megischus* Brullé, new species, Nearctic

The family Stephanidae is a basal group of apocritan Hymenoptera that are idiobiont parasitoids of the larvae of wood-boring Coleoptera (Cerambycidae, Buprestidae) and Hymenoptera (Siricidae). The family is fairly small, encompassing only 290 described species around the world. Our objective here is to discuss the taxonomy of stephanids from the United States and Canada, an area last treated by Townes (1949). We include a review and update of the species covered by Townes as well as the description of two new species.

The first Nearctic species of stephanid to be described was *Megischus bicolor* Westwood (1841). Cresson (1872, 1880) later described two additional species, one of which, *Stephanus cinctipes* Cresson, was designated as the type species of *Schlettererius* Ashmead (Ashmead 1900a). Three species described by Schletterer (1889) and Davis (1897) are synonyms of *M. bicolor*. Townes (1949) described two species and recorded the Cuban species *Megischus brunneus* Cresson for the first time in the

U.S.A. In total, Townes recognized six Nearctic species and divided *M. bicolor* into two subspecies. Carlson (1979) did not recognize of the validity of these subspecies.

MATERIAL AND METHODS

A total of 833 specimens were studied from North American and European museums. The Mexican fauna of Stephanidae is both more diverse in species, and the species are more variable in structure and color. Therefore we have deferred a consideration of the specimens found in Mexico until they can be considered in the context of the full diversity of that fauna. Morphological terminology and generic concepts generally follow Aguiar (1998). Measurements of total length are made from the base of the anterior tubercle on the head to the apex of the abdomen. The ratio of pronotal length to width compares the maximum length to minimum width (Fig. 1). The terms semiannular and preannular refer to differentiated parts of the pronotum (Elliott 1922). The semiannular (Fig. 3, sa) is the

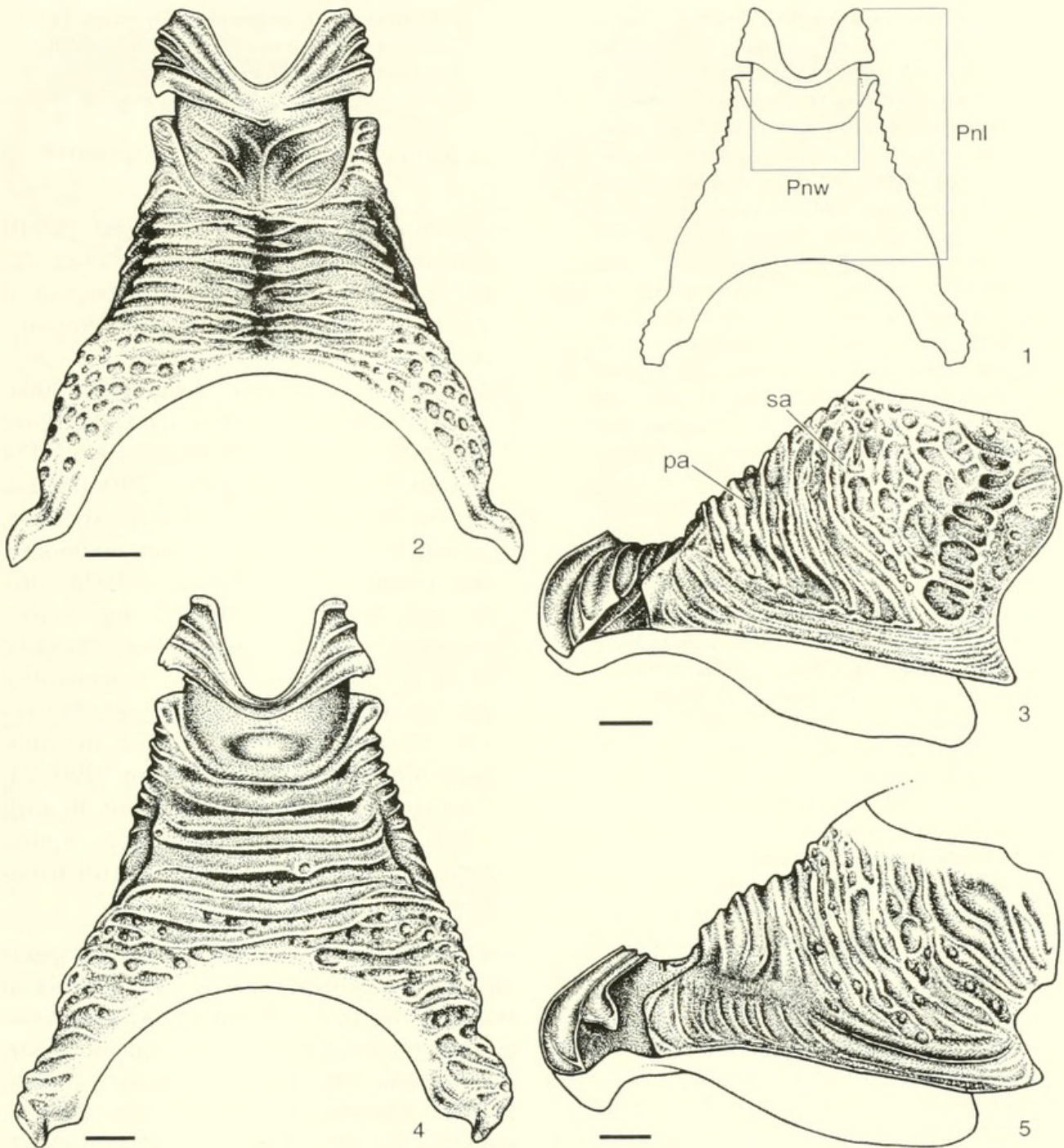
large, inflated posterior part of the pronotum. The preannular (Fig. 3, pa) is the short transverse area between the pronotal fold and the semiannular. The scientific and common names of plants follow the Plants Database of the U.S. Department of Agriculture (plants.usda.gov). The graphs of phenology display the number of specimens for each week of the year as well as the number of collecting events from which specimens are derived. A collecting event is defined as the unique combination of time, place, collector, and method of collection.

Specimens were kindly loaned by the following institutions and individuals alphabetized by codens used in the text: ABSC, Archbold Biological Station Collection, Lake Placid, FL; AEIC, American Entomological Institute, Gainesville, FL; AMNH, American Museum of Natural History, New York, NY; ANSP, Academy of Natural Sciences, Philadelphia, PA; CDAE, California State Collection of Arthropods, Sacramento, CA; CHAH, Henry A. Hespenheide collection, Los Angeles, CA; CIDA, Alberston College of Idaho, Caldwell, ID; CMNH, Carnegie Museum of Natural History, Pittsburgh, PA; CNCI, Canadian National Collection of Insects, Ottawa, Ontario; CSUC, Colorado State University, Ft. Collins, CO; EDNC, North Carolina Department of Agriculture, Raleigh, NC; EMEC, University of California, Berkeley; EMUS, Utah State University, Logan, UT; FCDA, Fresno County Department of Agriculture, Fresno, CA; FMNH, Field Museum of Natural History, Chicago, IL; FSCA, Florida State Collection of Arthropods, Gainesville, FL; IRCW, University of Wisconsin, Madison, WI; ISUI, Iowa State University, Ames, IA; LACM, Natural History Museum, Los Angeles, CA; LSUC, Louisiana State University, Baton Rouge, LA; MCPM, Milwaukee Public Museum, Milwaukee, WI; MEMU, Mississippi State University, Mississippi State, MS; MTEC, Montana State University, Bozeman, MT; NCSU, North Carolina State

University, Raleigh, NC; NHMW, Naturhistorisches Museum, Vienna, Austria; ODAC, Oregon Department of Agriculture, Salem, OR; OSEC, Oklahoma State University, Stillwater, OK; OSUC, Ohio State University, Columbus, OH; PMNH, Peabody Museum of Natural History, New Haven, CT; PPCD, West Virginia Department of Agriculture, Charlestown, WV; PSUC, Pennsylvania State University, University Park, PA; ROME, Royal Ontario Museum, Toronto, Ontario; RUIC, Rutgers State University, New Brunswick, NJ; RWSC, Robert W. Surdick collection; SEMC, University of Kansas, Lawrence, KS; SFVS, San Fernando Valley State University, Northridge, CA; TAMU, Texas A&M University, College Station, TX; UADE, University of Arkansas, Fayetteville, AR; UAIC, University of Arizona, Tucson, AZ; UCDC, University of California, Davis; UCFC, University of Central Florida, Orlando, FL; UCMC, University of Colorado, Boulder, CO; UCMS, University of Connecticut, Storrs, CT; UCRC, University of California, Riverside; UGCA, University of Georgia, Athens, GA; ULKY, University of Louisville, Louisville, KY; UMMZ, University of Michigan, Ann Arbor, MI; UMRM, University of Missouri, Columbia, MO; UNSM, University of Nebraska State Museum, Lincoln, NE; USNM, National Museum of Natural History, Smithsonian Institution, Washington, DC; WFBM, University of Idaho, Moscow, ID; ZSMC, Zoologische Staatssammlung, Munich, Germany.

KEY TO NEARCTIC SPECIES OF STEPHANIDAE

1. Tergite and sternite of first metasomatic segment distinctly separated, both relatively short (see Fig. 1 in Townes 1949); pronotum short, in lateral view with distinct 90° break in profile immediately in front of mesonotum to form a flat, polished wall; fore wing with vein 1M arched; hind tibia white basally *Schlettererius cinctipes* (Cresson)
- Tergite and sternite of petiole fused, petiole distinctly longer than wide (see Fig. 2 in Townes 1949); pronotum long, evenly subconical; fore wing vein 1M straight; hind



Figs. 1–5. Pronotum. 1, Dorsal measurements: Pnl = length; Pnw = width. 2, *Megischus annectens*, dorsal. 3, Same, left side, pa = preannular, sa = semiannular. 4, *M. brevicaudatus*, dorsal. 5, Same, left side. Scale bars: 0.25 mm. Drawings by Gláucia Marconato.

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|--|---|--|---|
| tibia black or brown basally (<i>Megischus</i> Brullé) | 2 | anteriorly; semiannular weakly swollen; hind tibia moderately constricted medially (Fig. 10) | 4 |
| 2(1). Petiole and pronotum polished; petiole with conspicuous transverse strigation | 3 | – Hind femur polished laterally; pronotum appearing conical in dorsal view, without anterior constriction; semiannular distinctly swollen; hind tibia with distinct nearly semi-circular constriction medially (Fig. 11) . . . | 6 |
| – Petiole and pronotum microreticulate; petiole otherwise smooth, without transverse strigation | 7 | | |
| 3(2). Hind femur matte laterally; pronotum in dorsal view with deep polished constriction, interrupting gradual convergence of sides | | 4(3). Ovipositor sheath with distinct preapical white band; gena usually smooth, some- | |

- times with sparse, shallow foveolae; femoral sulcus distinct on pronotum; petiole relatively long, length $0.62\text{--}0.77 \times$ length of metasoma beyond petiole 5
- Ovipositor sheath uniformly dark; gena usually foveolate, in small specimens foveolae may be sparse, but deep, distinct; femoral sulcus on pronotum absent or inconspicuous; petiole short, length $0.49\text{--}0.62 \times$ length of metasoma beyond petiole (California) *Megischus annectens* Aguiar, n.sp.
- 5(4). Ovipositor longer than body, length $1.08\text{--}1.28 \times$ body length; hind basitarsus brownish-yellow; median femoral tooth inclined towards apex, triangular (Fig. 8); inter- and postfoveolar areas of mesopleuron (see Aguiar 1998) distinctly transversely strigate; length of dilated part of hind tibia $1.5 \times$ length of compressed basal portion; wings weakly infusate; dorsal portion of metapleuron smooth only in narrow central area *Megischus bicolor* Westwood
- Ovipositor shorter than body, length $0.80\text{--}0.99 \times$ body length; hind basitarsus reddish; median femoral tooth long perpendicular, round (Fig. 9); inter- and postfoveolar areas of mesopleuron usually smooth or weakly transversely strigate, only rarely distinctly strigate; length of dilated part of hind tibia $2\text{--}3 \times$ length of compressed basal portion; wings clear; dorsal portion of metapleuron entirely smooth, polished *Megischus brevicaudatus* Aguiar, n.sp.
- 6(3). Ovipositor sheath with preapical white band; pronotum anteriorly with pair of short carinae on each side (Townes 1949: Plate 25, Fig. 6); mesopleuron (Fig. 6) and prosternum with scattered foveolae, generally separated by distance greater than their diameter *Megischus arizonicus* Townes
- Ovipositor sheath uniformly dark; pronotum with four sharp transverse carinae anteriorly (Townes 1949: Plate 25, Fig. 7); mesopleuron (Fig. 7) and prosternum with dense foveolae, each separated by less than their diameter *Megischus brunneus* Cresson
- 7(2). Posterior half of pronotum with fine transverse strigation; mesopleuron rugulose; metapleuron nearly or entirely glabrous; maxillary palp short, reaching approximately to apex of mandible; vein 2-1A darkly pigmented, tubular or nebulous; body dark brown in color *Megischus californicus* Townes
- Posterior half of pronotum microreticulate, without transverse strigation; mesopleuron with large shallow foveolae; metapleuron with dense tuft of setae; length of maxillary

palp subequal to height of head; vein 2-1A very weakly pigmented, nebulous; body light brown in color *Megischus texanus* Townes

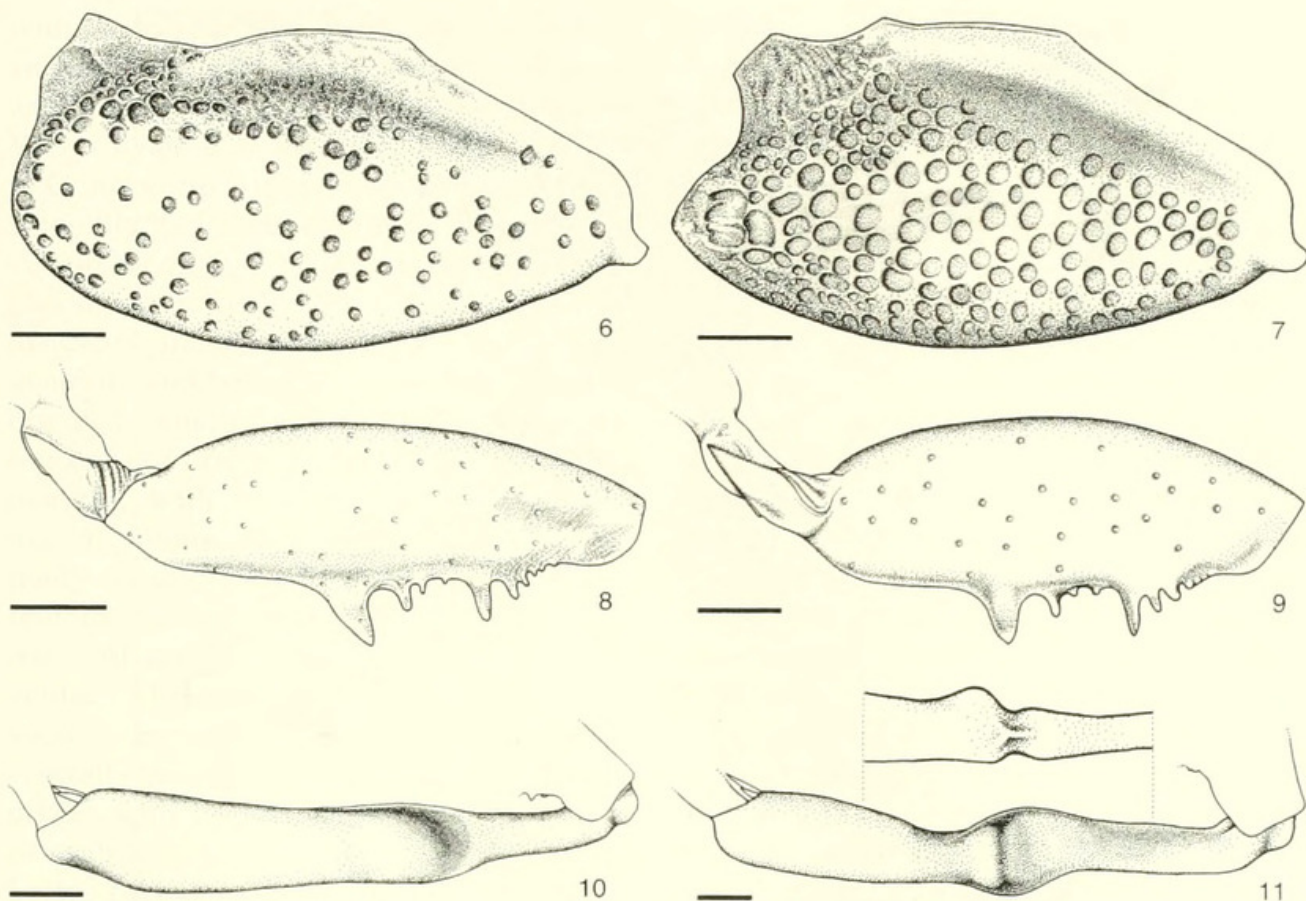
Schlettererius cinctipes (Cresson)
(Figs. 12, 17)

Stephanus cinctipes Cresson 1880: XVIII (original description); Cresson 1887: 52 (keyed); Schletterer 1889: 156 (repeat of Cresson (1880), distribution, keyed); Ashmead 1900b: 597 (listed).

Schlettererius cinctipes: Ashmead 1900a: 150 (generic transfer, keyed); Dalla Torre 1902: 5 (listed); Enderlein 1905: 474 (listed); Enderlein 1906: 290 (listed, keyed); Viereck 1914: 132 (type species); Elliott 1922: 714 (description, taxonomic discussion, keyed); Leonard 1928: 961 (listed); Townes 1949: 362, fig. 1 (description, distribution, ecology, keyed); Kirk, 1975: 59, 60 (hosts, seasonality); Meyer et al. 1978: 326 (biology, behavior); Carlson 1979: 741 (listed, distribution, biology, ecology); Mason 1990: 94, 95 (wing venation nomenclature, figure); Madl 1991: 120 (redescription, figure, keyed); Smith 1997: 377, 378 (distribution, rearing records, keyed).

Distribution.—We have seen 227 specimens from southern British Columbia, Washington, Idaho, Montana, South Dakota, Oregon, Utah, California, and southeastern Arizona, Fig. 12 (AEIC, CNCI, FSAC, IRCW, AMNH, UCRC, ANSP, EMUS, ROME, WFBM, EMEC, CIDA, UCDC, LACM, MTEC, ODAC, FCDA, CDAE, USNM). A single specimen in the USNM was collected in northern Virginia by D. R. Smith (Smith 1997). This specimen was from a Malaise trap in a suburban yard and may have emerged from wood from the western U.S. or Canada. Most likely it is not yet an indication of an expansion of its range to the East. It was also introduced into Australia (Victoria, New South Wales, Tasmania).

Biological associations.—Kirk (1975) reared this species from ponderosa pine (*Pi-*



Figs. 6–11. Mesopleuron, left. 6, *Megischus arizonicus*. 7, *M. brunneus*. 8–9, Hind left femur, lateral. 8, *M. bicolor*. 9, *M. brevicaudatus*. 10–11, Hind left tibia, lateral. 10, *M. bicolor*. 11, *M. arizonicus* (detail shows posterior view). Scale bars: 0.5 mm. Drawings by Gláucia Marconato.

nus ponderosa P. & C. Lawson), Engelmann spruce (*Picea engelmannii* Parry ex Engelm.), and white fir (*Abies concolor* Lindl. ex Hildebr.) infested by species of *Sirex* Linnaeus, *Urocerus* Geoffroy, and *Xeris* Costa (Hymenoptera: Siricidae); and it has also been reared from Douglas-fir, *Pseudotsuga menziesii* (Mirbel) Franco. According to Townes (1949), *S. cinctipes* has a range similar to that of Douglas-fir and seems to be most common in forests of this tree.

Taylor (1967) established a laboratory culture of *Schlettererius cinctipes* on *Sirex noctilio* Fabricius from adults collected in California. Additional material was later imported from Arizona and New Mexico, and the parasitoid was established in Tasmania (Taylor 1976). However, *Sirex noctilio* does not occur within the natural range of *S. cinctipes* (Carlson 1979). Meyer et al. (1978) suggested that *Monochamus orego-*

nensis (LeConte) (Coleoptera: Cerambycidae) may also serve as a host. Collection dates for populations in the U.S.A. and Canada extend from June 1 to August 29 (Townes 1949, see Fig. 17).

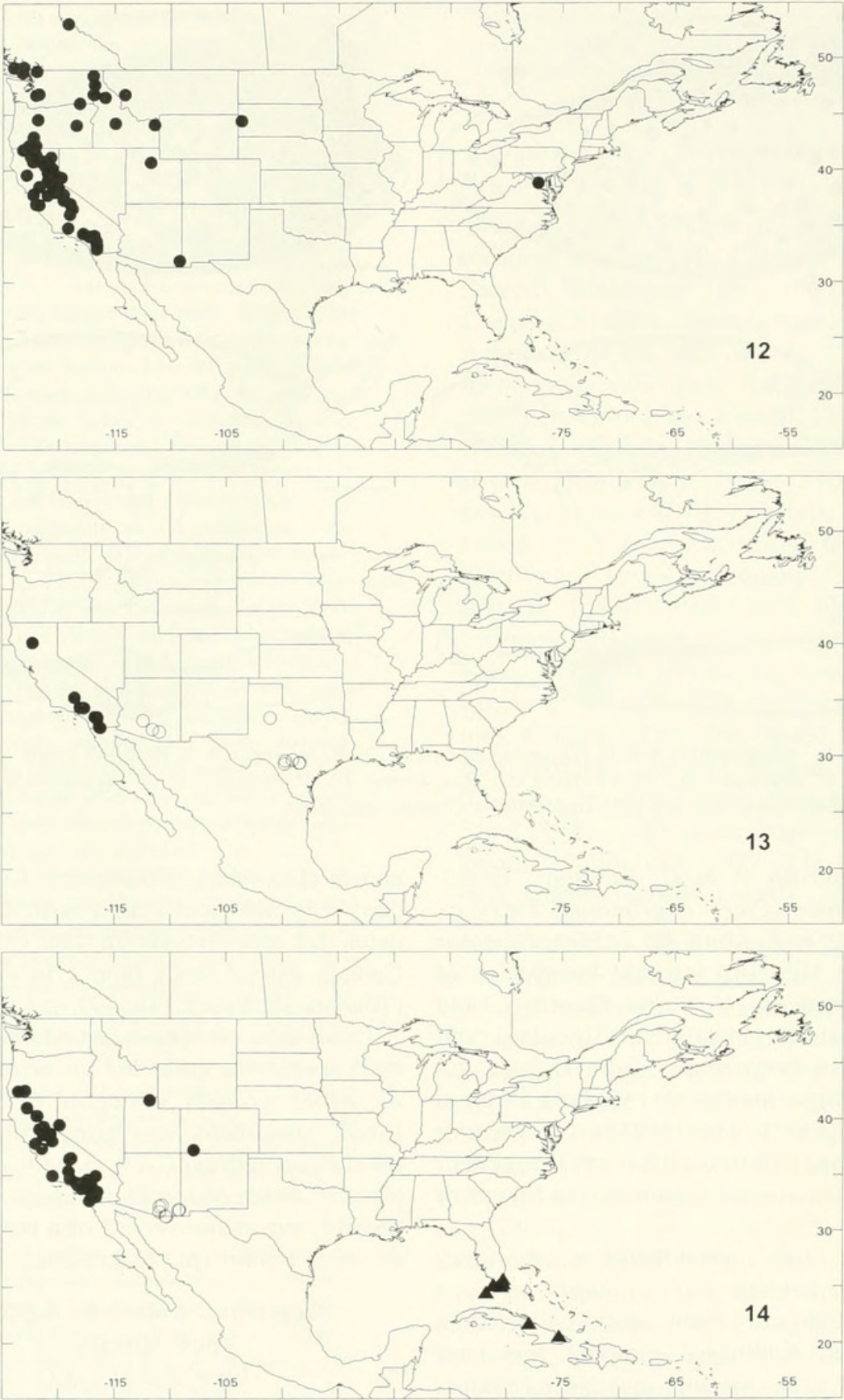
Label data on specimens additionally record specimens collected on or near grand fir, *Abies grandis* (Douglas ex D. Don) Lindl; specimens emerging from Jeffrey pine, *Pinus jeffreyi* Grev. et Balf., and sugar pine, *P. lambertiana* Douglas; as well as a possibly erroneous record of a rearing from thistle, *Cirsium* sp. (Asteraceae).

Megischus annectens Aguiar, new species

(Figs. 2–3, 13, 17)

Etymology.—From the Latin to link, to join; in reference to the intermediate taxonomic status of this species.

Description of ♀.—Reddish black, including ovipositor sheaths. Gena ventrally



Figs. 12–14. Geographic distribution. Only localities recorded more precisely than counties are illustrated. Maps drawn with units of latitude and longitude of equal size. 12, *Schlettererius cinctipes*. 13, *Megischus annectens* (solid circles) and *M. brevicaudatus* (open circles). 14, *M. californicus* (closed circles), *M. arizonicus* (open circles), *M. brunneus* (triangles).

with yellowish spot. Fore- and midtibiae, and hind tarsus reddish. Fore- and midtarsi, and hind second trochanter reddish brown. Wings hyaline or weakly infusate.

Gena centrally produced into round, smoothly polished callosity, distinctly foveolate ventrally. Vertex laterally and temples areolate rugose. Pronotum (Figs. 2–3) distinctly transversely rugose, rugae finer ventrally and becoming more longitudinally oriented; anteriorly with deep, transversely rugose constriction. Preannular smoothly merging with semiannular, with shallow medial longitudinal sulcus dorsally (normally visible only with tangential light); femoral sulcus inconspicuous or absent. Apex of scutellum with mesal line of foveolae. Mesopleuron distinctly rugose-foveolate, especially anteriorly. Metapleuron centrally distinctly areolate rugose, sparsely pilose, with 1–2 long hairs within each cell of sculpture; dorsally polished smooth centrally, rugulose anteriorly and posteriorly; with narrow channel originating from pleuropodopodeal fovea, running alongside line of fusion of metapleuron and propodeum, ending at posterior margin. Interfoveolar area of mesopleuron distinctly transversely strigate; postfoveolar area polished smooth or with very weak strigation. Propodeal sculpture varying from areolate rugose to densely foveolate, otherwise polished smooth; with distinct longitudinal or, rarely, transverse rugulae near petiolar foramen and sometimes along midline. Posterior spiracular plate indistinct; area behind spiracle areolate rugose. Hind femur and tibia distinctly microreticulate. Basal tooth long, distinctly inclined toward apex, blunt apically, with 1–2 subapical hairs; apical tooth distinctly smaller, blunt apically. Metasomatic T2–T8 microreticulate, becoming more distinct toward T8. Pygidial sulcus Y-shaped, i.e., extended basally along dorsal midline of T8.

Total length 13.8–20.5 mm; ovipositor length/total length 1.00–1.16; ovipositor length/length of metasoma beyond petiole 2.40–2.71; ovipositor length/petiole length

4.29–5.58; ovipositor length/length mesosoma 3.66–4.31; length of petiole/length of metasoma beyond petiole 0.49–0.62; length/minimum width of pronotum 2.41–2.85 (N = 6 for all measurements).

Description of ♂.—Similar to ♀; gena with weaker sculpture, not as distinctly projected; dorsal longitudinal sulcus on pronotum less conspicuous; scutellum without mesal line of foveolae; metapleural channel inconspicuous. Color usually as in ♀, but often much lighter; head and pronotum light reddish brown; fore- and hind tibiae and tarsi sometimes yellowish brown; hind tibia and petiole light reddish brown or yellowish brown; very small specimens sometimes entirely yellowish brown, including wing veins.

Diagnosis.—*Megischus annectens* may be distinguished from the similar species *M. bicolor* and *M. brevicaudatus* by the following combination of characters: gena and temple distinctly foveolate; pronotum without femoral sulcus, with a dorsal longitudinal sulcus, preannular smoothly merging with semiannular; metapleural channel present; propodeum areolate rugose; ovipositor sheaths without preapical white band.

Biological associations.—Collected on site dominated by birchleaf mountain mahogany, *Cercocarpus montanus* Raf. var. *glaber* (S. Wats.) F. L. Marting (Rosaceae, recorded on label as *Cercocarpus betuloides* Nutt.); collected on site dominated by oak. Emerged from coastal sage scrub oak, *Quercus dumosa* Nutt. (Fagaceae).

Material examined.—Holotype ♀. CALIFORNIA: Jacumba [San Diego Co.]; 3-VII-1956; D. J. and J. N. Knull; OSUC 0020401 (OSUC). Paratypes. Same data as holotype, except collected 26-V-1960, OSUC 0020301, ♂; 23-VI-1954, OSUC 0020521, ♀; 27-VI-1952, OSUC 0020295, ♂; 27-VI-1958, OSUC 0020519, ♂; 27-VI-1958, OSUC 0020522, ♂; 3-VII-1956, OSUC 0020300, ♂; 3-VII-1956, OSUC 0020302, ♂ (all OSUC). CALIFORNIA: Riverside Co., Pinyon Flats; 21-V-1962; D. S. Verity; *Megischus bicolor sickmanni*,

det. R. R. Snelling; OSUC 0020215; ♂ (FSCA). Pinyon Flats; 23-VII-1962; R. L. Westcott; OSUC 0020534; ♂ (ODAC). Piñon Flats; 30-VI-1958; G. H. Nelson; OSUC 0020548; ♂ (UCDC). Santa Rosa Mountains, Hwy. 74, elev. 3,500'; collected 2-IV-1978, emerged 1-13-V-1979; D. S. Verity; ex *Quercus dumosa*; OSUC 0020404; ♂ (CHAH). Santa Rosa Mountains, Hwy. 74, elev. 3,500'; 2-IV-1978; Emg.?; D. S. Verity; reared ex *Quercus dumosa* (*Acmaeodera*?); OSUC 0020405; ♂ (CHAH). San Bernardino Co., Wrightwood, 1 mile E; 10-VII-1965; D. S. Verity; OSUC 0020403; ♀ (CHAH). San Diego Co., Boulevard; 20-V-1984; B. K. Dozier; collected on *Cercocarpus betuloides*; OSUC 0020402; ♀ (FSCA). South Indian Canyon; 8-VII-1948; G. A. Marsh; *Megischus* n. sp. Townes 1956; OSUC 0020399; ♀ (AEIC). Tehama Co., Red Bluff; 17-IX-1970; D. L. Wilson; oak foothills; *Megischus bicolor sickmanni*, det. M. Wasbauer, 1975; OSUC 0020400; ♀ (CDAE). CALIFORNIA: Anza; VI-1955; Simonds; *Megischus bicolor sickmanni* det. Marsh; OSUC 0020044; ♂ (UCDC).

Other material.—The following specimens are all small males. We believe that they belong to this new species, but we have not designated them as paratypes because their small size and associated loss of characters reduces our confidence in their correct identification. CALIFORNIA: Kern Co., 18 mi S Bodefish; 21-VIII-1967; reared *Chryso'nus nauseosus*; F. M. Beer; OSUC 0020068; ♂ (CHAH). [probably rubber rabbitbrush, *Ericameria nauseosa* (Pallas ex Pursh) Nesom & Baird (Asteraceae)]. CALIFORNIA: Santa Rosa Mountains; 25-VI-1946; D. J. and J. N. Knull; *Megischus bicolor sickmanni*, Townes 1947; OSUC 0020307; ♂ (OSUC); 15-VI-1948; *Megischus bicolor bicolor*, Townes 1949; OSUC 0020294; ♂ (OSUC). CALIFORNIA: Jacumba; 16-VI-1954; D. J. and J. N. Knull; OSUC 0020299; ♂ (OSUC); 3-VI-1956; OSUC 0020303; ♂ (OSUC).

Megischus arizonicus Townes
(Figs. 6, 11, 14)

Megischus arizonicus Townes 1949: 364, 368, fig. 6 (original description, pronotum figured, distribution, keyed); Carlson 1979: 741 (listed, distribution); Gauld 1995: 184 (listed, distribution south of U.S.A.).

Distribution.—Southeastern Arizona, Fig. 14 (15 specimens: AEIC, AMNH, CNCI, EMEC, FSCA, OSUC, UAIC, UCDC, UCRC, USNM).

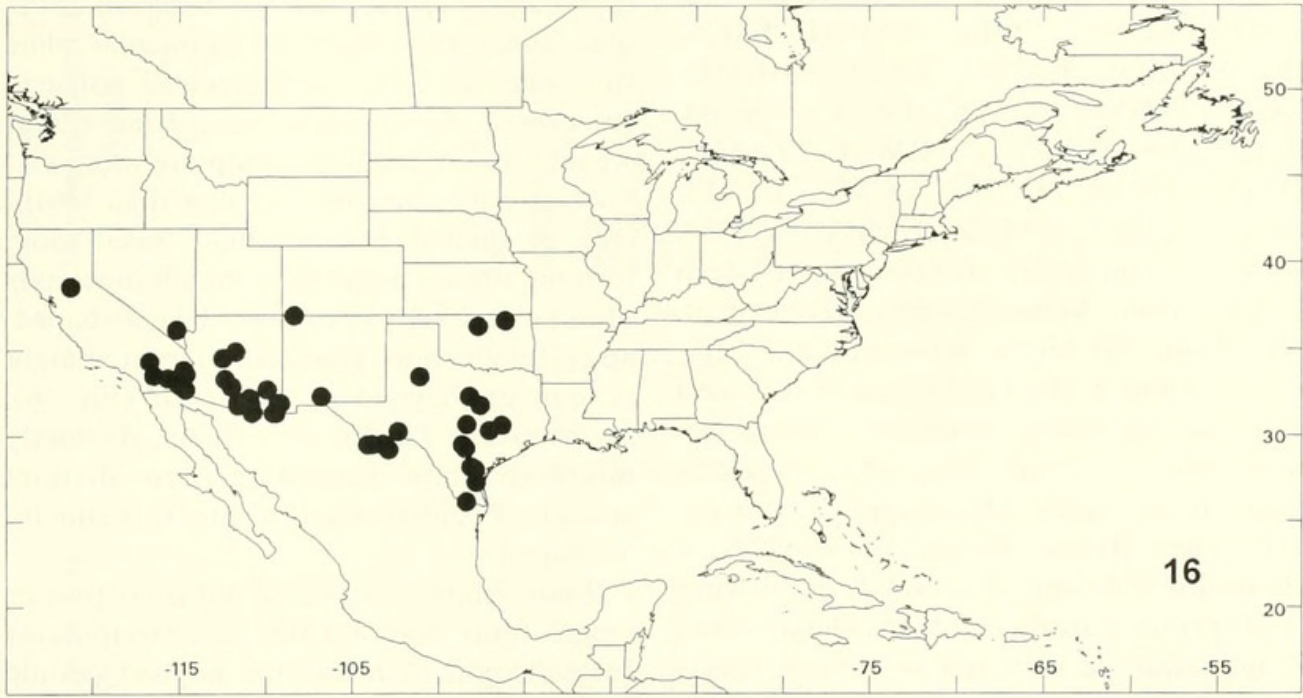
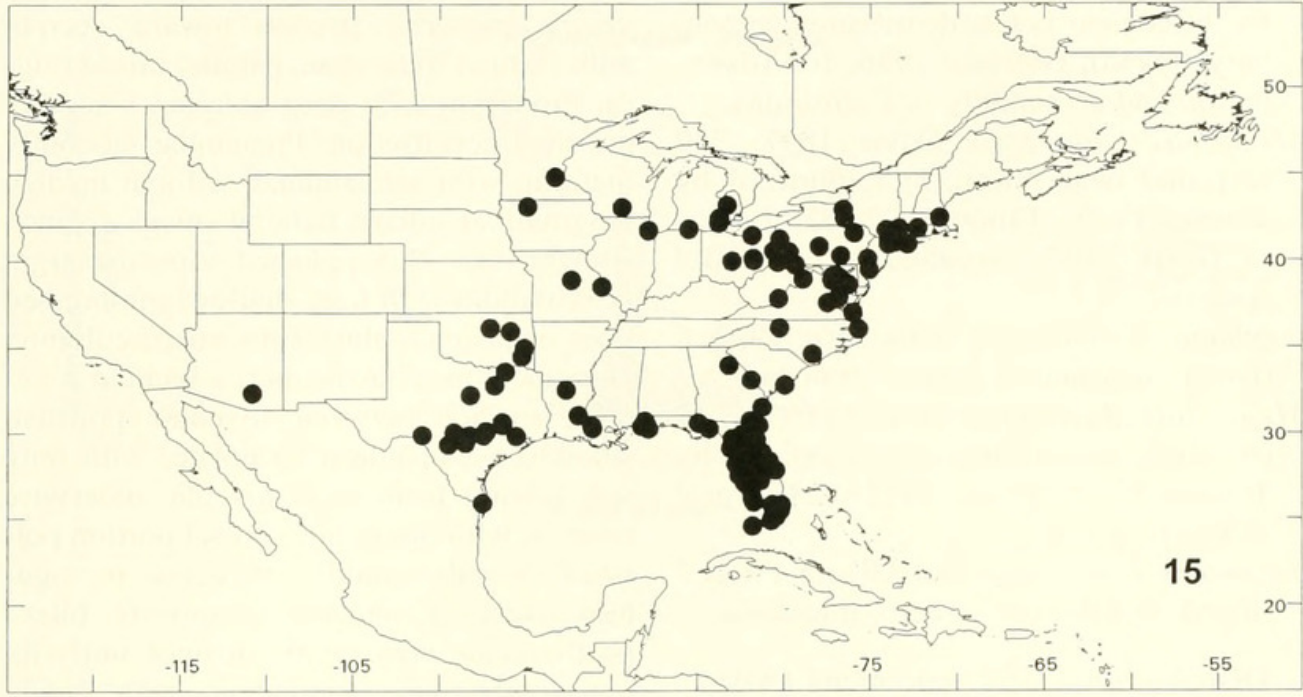
Biological associations.—Townes (1949) recorded the holotype from "white oak" in Arizona. The species with the common name "white oak," *Quercus alba* L., does not occur in that state. The record perhaps refers to Arizona white oak, *Quercus arizonicus* Sarg. (Fagaceae).

Comments.—A distinct species in the U.S.A., further characterized by the absence or only short basal extension of the pygidial sulcus, while the sulcus is distinctly Y-shaped in *M. bicolor* and *M. annectens*; metasomatic T2 polished smooth, but matte in *M. bicolor*, *M. brevicaudatus*, *M. annectens*.

Megischus bicolor (Westwood)
(Figs. 8, 10, 15, 17)

Stephanus bicolor Westwood 1841: 538 (original description); Westwood 1843: 276 (complementary description, distribution); Schletterer 1889: 90, 154 (redescription, distribution, figure, keyed); Dalla Torre 1902: 6 (listed, distribution); Enderlein 1905: 475 (listed, distribution); Kieffer 1908: 4 (listed, distribution); Elliott 1922: 716, 732 (description, distribution, keyed).

Megischus bicolor: Townes 1949: 364, 366, figs. 2, 5 (redescription, generic transfer, distribution, pronotum and habitus figured, keyed, division into subspecies); Carlson 1979: 741 (listed, distribution, synonymy); Aguiar and Sharkov 1997: 422 (collection with blue pan traps);



Figs. 15–16. Geographic distribution. Only localities recorded more precisely than counties are illustrated. Maps drawn with units of latitude and longitude of equal size. 15, *Megischus bicolor*. 16, *M. texanus*.

<p>Smith 1997: 377 (distribution, rearing records, seasonality, keyed).</p> <p><i>Megischus bicolor bicolor</i>: Townes 1949: 364, 367 (diagnosis, distribution, synonymy, keyed).</p> <p><i>Stephanus sickmanni</i> Schletterer 1889: 90, 152 (original description, distribution, figure, keyed, transferred as subspecies of <i>M. bicolor</i> by Townes 1949); Enderlein</p>	<p>1905: 475 (listed, distribution); Kieffer 1908: 4 (listed, distribution, figure); Elliott 1922: 716, 727 (description, distribution, keyed).</p> <p><i>Stephanus sickmanni</i>: Dalla Torre 1902: 9 (listed, distribution, incorrect subsequent spelling).</p> <p><i>Megischus bicolor sickmanni</i>: Townes 1949: 364, 367 (diagnosis, generic trans-</p>
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fer, biological notes, distribution, synonymy, keyed); Halstead 1986: 103 (distribution and seasonality in California).

Megischus canadensis Davis 1897: 349 (original description, synonymized by Townes 1949); Elliott 1922: 827 (repeat of Davis 1897, classified as "doubtful species").

Stephanus Canadensis: Dalla Torre 1902: 6 (listed, distribution, generic transfer).

Megischus floridanus Davis 1897: 349 (original description, synonymized by Townes 1949). Elliott 1922: 828 (repeat of Davis 1897).

Stephanus Floridanus: Dalla Torre 1902: 7 (listed, distribution, generic transfer).

Distribution.—368 specimens (ABSC, AEIC, AMNH, ANSP, CMNH, CNCI, CSUC, EDNC, EMEC, FMNH, FSCA, IRCW, ISUI, LACM, LSUC, MEMU, NCSU, NHMW, OSEC, OSUC, PMNH, PPCD, PSUC, RUIC, RWSC, TAMU, UADE, UCDC, UCFC, UCMC, UCMS, UGCA, ULKY, UMMZ, UMRM, UNSM, ZSMC). Generally limited to eastern U.S.A., from Massachusetts, Connecticut, New York, Michigan, Wisconsin and Minnesota south to the Gulf Coast states, west to Iowa, Missouri, Oklahoma, Texas and southeastern Arizona (Fig. 15). No specimens found from Mississippi, Kentucky, Tennessee, Rhode Island, Vermont, New Hampshire, Maine. Recorded in Townes (1949) from Canada (southern Ontario) and Kansas, but we have not seen these specimens. Most material recorded by Townes from the western U.S.A. is now placed in *M. annectens* and *M. brevicaudatus*.

Description of ♀.—Head, prothorax, mesothorax varying from bright red to dark brown, red color sometimes extending onto propodeum, mesopleuron, legs; remaining mesosoma, metasoma dark brown; gena with yellowish spot near base of mandible; legs sometimes with yellow markings, tarsi usually yellowish brown.

Gena polished smooth or with few, very small foveolae. Temples, central portion of

vertex, posterior portion toward occiput with distinct transverse, parallel raised ridges. Pronotum with deep anterior, smoothly polished constriction. Preannular smoothly merging with semiannular, without median longitudinal sulcus; femoral sulcus distinct, straight, smoothly polished. Apical margin of scutellum with fine, shallowly impressed lines or distinct, alutaceous microsculpture. Mesopleuron with distinct, separated foveolae, surface between foveolae polished smooth. Metapleuron foveolate, with long seta arising from each foveola, otherwise covered with dense pile; dorsal portion polished smooth centrally, foveolate or rugulose anteriorly, punctate posteriorly. Inter-, postfoveolar areas with distinct uniform, transverse strigae. Propodeum with widely separated foveolae, surface between foveolae alutaceous. Posterior spiracular plate foveolate, area between foveolae polished smooth or finely alutaceous. Hind femur weakly microreticulate, sculpture more distinctly visible apically, weaker than sculpture on dilated part of tibia. Basal tooth forming obtuse angle with longitudinal axis of femur, laterally compressed, keel-shaped; apical tooth short, rounded; margin straight or convex beyond apical tooth (Fig. 8). Metasomatic T2–T8 very finely, distinctly microreticulate, becoming more distinct apically. Pygidial sulcus normally distinctly Y-shaped.

Total length 11.1–27.2 mm; ovipositor length/total length 1.08–1.28; ovipositor length/length of metasoma beyond petiole 2.94–3.31; ovipositor length/petiole length 3.94–4.97; ovipositor length/length mesosoma 3.90–5.00; length of petiole/length of metasoma beyond petiole 0.63–0.77; length/minimum width of pronotum 2.72–3.34 (N = 10 for all measurements).

Diagnosis.—Closely related to *M. brevicaudatus*, from which it may be most easily separated by having a longer ovipositor (length 1.08–1.28 × body length), yellowish brown hind tarsi, and the oblique basal and short apical tooth on the hind femur (Fig. 8). Additional differences include the

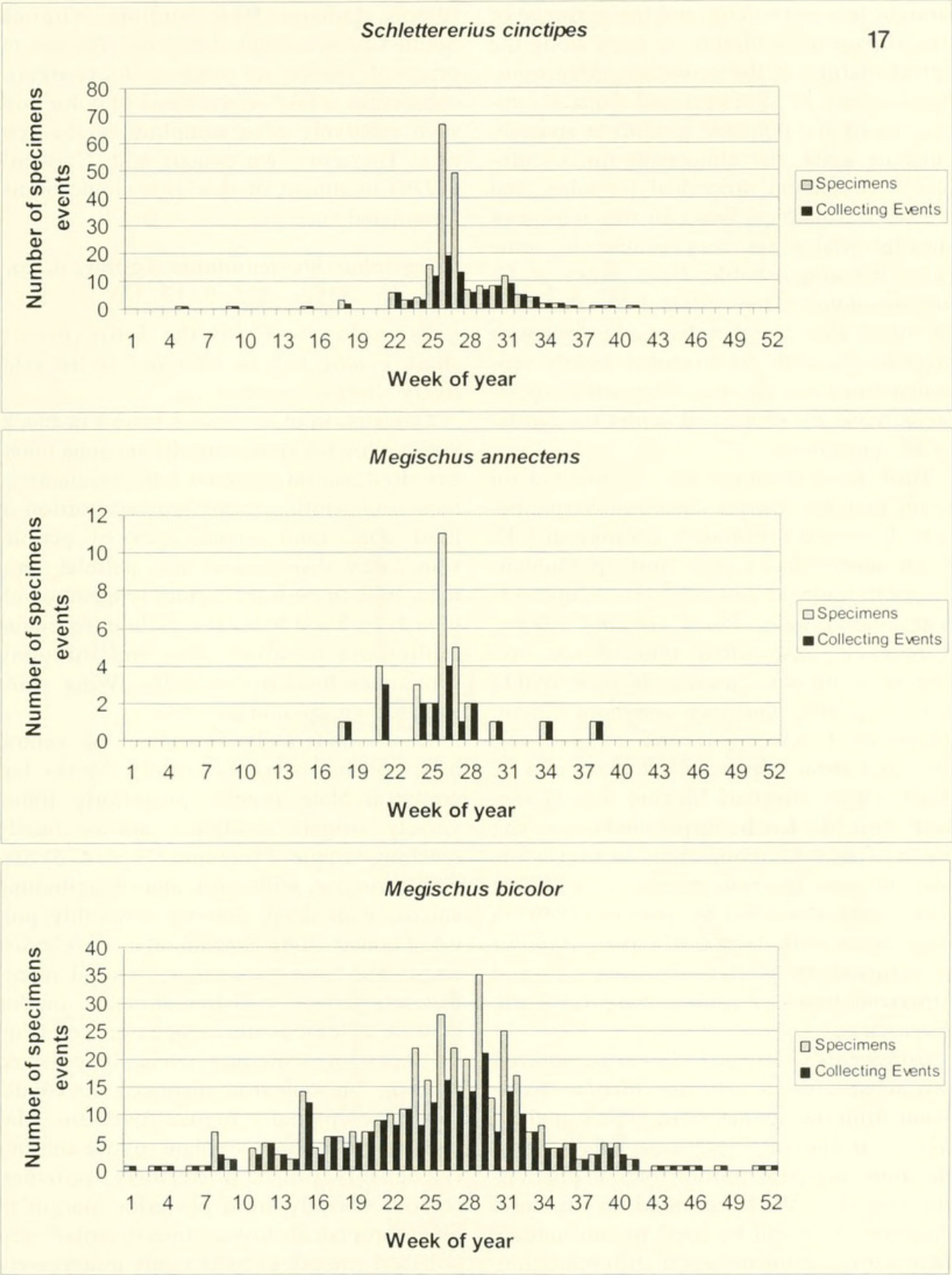


Fig. 17. Seasonal flight periods as indicated by total number of specimens collected and number of independent collecting events. Collecting events are unique combinations of localities, dates, collectors, and methods. Only specimens or events with the date recorded as a single day are illustrated.

straight femoral sulcus, and the presence of fine alutaceous sculpture or lines along the apical margin of the scutellum. *Megischus bicolor* may be distinguished from *M. annectens* by the polished smooth or sparsely punctate gena, the alutaceous microsculpture between the propodeal foveolae, and the white subapical band on the ovipositor sheaths. Males are very similar, in some cases indistinguishable, from males of *M. brevicaudatus*. They differ from males of *M. annectens* by the distinctly foveolate propodeum, with the foveolae widely separated from one another. Very small specimens have the propodeal sculpture similar to *M. annectens*.

Biological associations.—Collected on scrub hickory, *Carya floridana* Sarg.; pecan, *Carya illinoensis* (Wangenh.) K. Koch; unspecified *Carya* Nutt. sp. (Juglandaceae); juniper, *Juniperus* L. (Cupressaceae); pond pine, *Pinus serotina* Michx. (Pinaceae); unspecified pine, *Pinus* sp.; swamp white oak, *Quercus bicolor* Willd.; sand live oak, *Quercus geminata* Small; unspecified oak, *Quercus* (Fagaceae). Emerged from papaya, *Carica papaya* L. (Caricaceae); shagbark hickory, *Carya ovata* (P. Mill.) K. Koch; unspecified *Carya* sp.; beech, *Fagus* L. (Fagaceae); swamp white oak; bur oak, *Quercus macrocarpa* Michx. (Fagaceae). Recorded by Townes (1949) in association with bigtooth aspen, *Populus grandidentata* Michx. (Salicaceae) and American beech, *Fagus grandifolia* Ehrh. (Fagaceae).

Comments.—Townes (1949) recognized two subspecies: *M. bicolor bicolor* Westwood from the southeastern U.S.A. and *M. bicolor sickmanni* (Schletterer) throughout the more northern portion of the distribution (Fig. 15). We have found no structural characters that can be used to substantiate their formal nomenclatural differentiation. The two color forms overlap but little in their geographic distribution, but significant gaps in our knowledge remain. For example, we have not seen specimens from Tennessee, Kentucky, Mississippi, and most of

Illinois, Indiana, West Virginia, Virginia, South Carolina, and Alabama. We see no practical reason to continue to recognize subspecies solely on the basis of color with such relatively poor sampling of the species. Therefore, we concur with Carlson's (1979) treatment of this as a single undifferentiated species.

***Megischus brevicaudatus* Aguiar, n. sp.**
(Figs. 4, 5, 9, 13, 18)

Etymology.—From the Latin *brevis*, short; *cauda*, tail; in reference to the relatively short ovipositor.

Description of ♀.—Dark brown or black, with yellowish spot ventrally on gena under eye. Reddish on pronotal lobe, trochanters, fore- and midtibiae, compressed portion of hind tibia, hind tarsus, apex of petiole; sometimes also reddish near petiolar foramen, base of petiole. Lighter reddish to yellowish on basal half of flagellum; fore- and midfemora basally; fore- and midtarsi; sometimes hind trochantellus. Wing veins dark brown, membrane clear.

Gena moderately foveolate on ventral half, polished smooth dorsally. Vertex laterally areolate rugose, posteriorly transversely strigate, sculpture not or barely reaching temple. Pronotum (Figs. 4–5) distinctly rugose, without median longitudinal sulcus, with deep, anterior, smoothly polished constriction. Semiannular weakly distinguished from preannular; femoral sulcus distinct, narrow, polished smooth, sinuous or with at least posterior apex curved (Fig. 5). Apex of scutellum normally polished smooth. Mesopleuron distinctly foveolate, sometimes partially rugose foveolate. Metapleuron distinctly areolate rugose centrally, densely pilose posteriorly, polished smooth dorsally from posterior margin to pleuropropodeal fovea. Interfoveolar area polished smooth to moderately transversely strigate; postfoveolar area polished smooth or with very weak strigation; very rarely both areas distinctly transversely strigate. Propodeum deeply foveolate, area between foveolae distinctly, finely alutaceous;

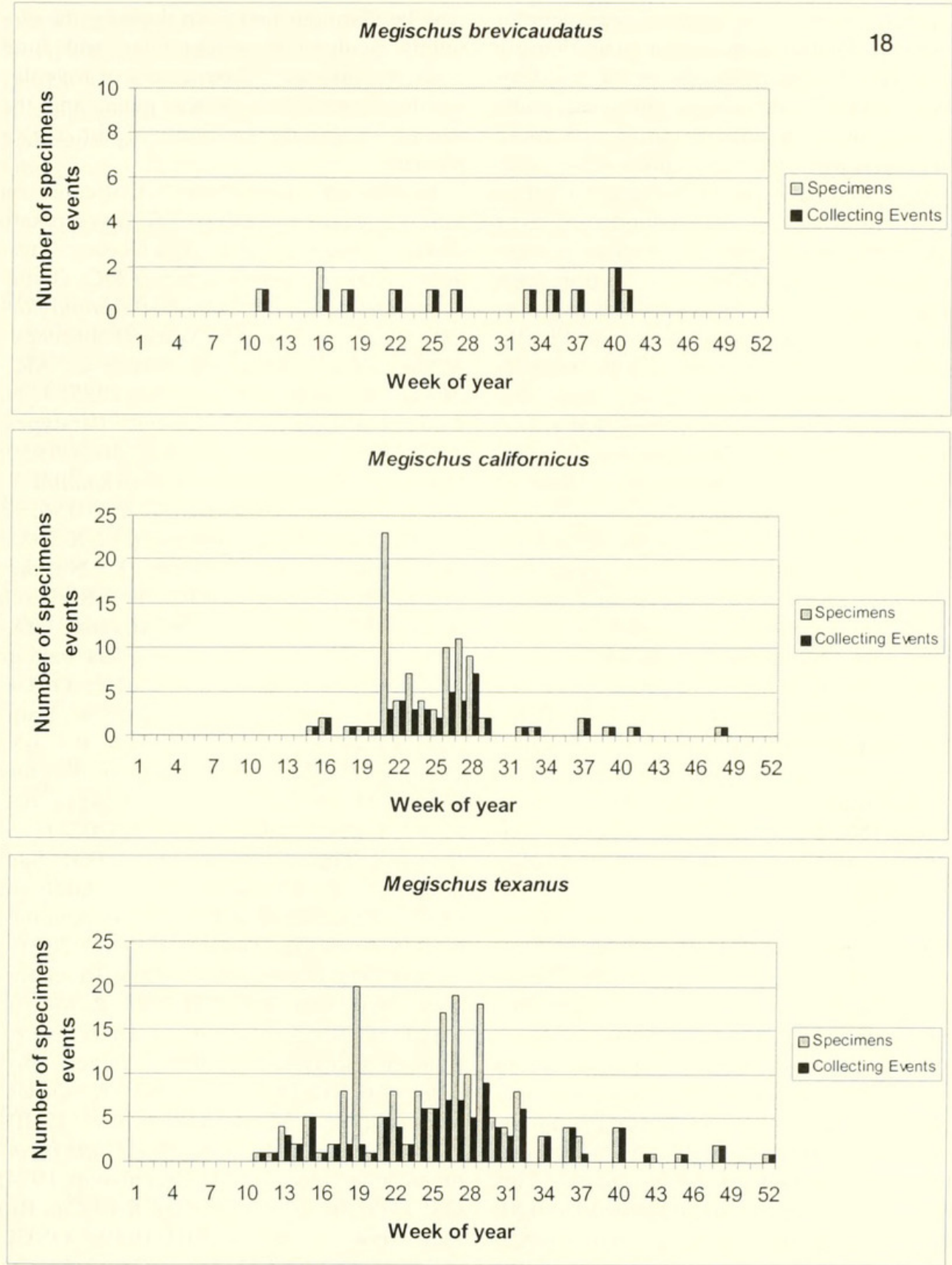


Fig. 18. Seasonal flight periods as indicated by total number of specimens collected and number of independent collecting events. Collecting events are unique combinations of localities, dates, collectors, and methods. Only specimens or events with the date recorded as a single day are illustrated.

coarsely transversely rugose near petiolar foramen. Posterior spiracular plate densely foveolate, foveolae contiguous or fused together. Hind femur weakly microreticulate, nearly smooth basally, progressively more distinct toward apex, sculpture much less distinct than that on dilated part of tibia. Basal tooth nearly perpendicular to long axis of femur, elongate in lateral view, rarely triangular, rounded in cross-section, apex blunt; apical tooth long, acute; margin of femur concave beyond apical tooth (Fig. 9). Metasomatic T2—T8 very finely microreticulate, sculpture progressively more distinctly developed apically. Pygidial sulcus distinctly V-shaped, without basal extension; T8 sometimes depressed at base of "V" formed by sulcus.

Total length 17.6–22.8 mm; ovipositor length/total length 0.80–0.99; ovipositor length/length of metasoma beyond petiole 2.09–2.66; ovipositor length/petiole length 3.26–3.96; ovipositor length/length mesosoma 2.89–3.68; length of petiole/length of metasoma beyond petiole 0.62–0.73; length/minimum width of pronotum 2.17–3.15 (N = 11 for all measurements).

Description of ♂.—Generally similar to female, but diagnostic characters less conspicuous because of significantly smaller body size.

Diagnosis.—*Megischus brevicaudatus* may be separated from the closely related *M. bicolor* by the distinctly shorter ovipositor, reddish hind tarsi, V-shaped pygidial sulcus, perpendicular basal tooth, and presence of a distinct concavity on the femur beyond its apical tooth in the former species. The reddish color, especially on the hind tarsi, is the only stable diagnostic feature found for male *M. brevicaudatus*. This new species may be distinguished from *M. annectens* by the lack of a median longitudinal sulcus dorsally on the pronotum, the V-shaped pygidial sulcus, and the presence of a white preapical band on the ovipositor sheaths. Some species in Central and South America also have the deep constriction in the pronotum. *Megischus brevicaudatus*

may be distinguished from these by the distinctly sculptured semiannular and hind coxa, the presence of punctures or foveolae on the ventral half of the gena, and the densely foveolate sculpture of the mesopleuron.

Biological associations.—Collected on ash, *Fraxinus* L. (Oleaceae); sweetpotato cactus, *Cereus* P.Mill. (Cactaceae); mesquite, *Prosopis juliflora* (Sw.) DC. (Fabaceae); and blue paloverde, *Parkinsonia florida* (Benth. ex Gray) S. Wats. (Fabaceae).

Material examined.—Holotype ♀: ARIZONA: Chiricahua Mts., 2-VI-1935, J. N. Knull; OSUC 0020309 (OSUC). Paratypes. ARIZONA: *Pima Co.*, Tucson; 10-X-1959; F. Werner; *Megischus bicolor sickmanni* ♀, det. F. Werner, 1960; OSUC 0020156; ♀ (UAIC). Tucson, vic. Ina/Oracle; 7-X-1985; on *Cereus* bloom; 2200 h; L. Nutting; OSUC 0020154; ♂ (UAIC). IBP Research Area, Silver Bell, 10 mi W Marana; 1-IX-1972; D. S. Chandler; *Megischus bicolor sickmanni* det. D. S. Chandler; OSUC 0020123; ♀ (UCDC). *Maricopa Co.*, Rainbow Valley Rd., 2–5 mi S Gila R.; 3-V-1990; ex flowers of *Cercidium floridum* Benth.; *Megischus arizonicus* Townes, det. J. R. Wiley, 1995; OSUC 0020211; ♀ (FSCA). TEXAS: *Bexar Co.*, Fort Sam Houston; 15-IX-1953; B. J. Adelson; OSUC 0020157; ♀ (UCMS). San Antonio; 6-X-1968; W. H. Tyson; OSUC 0020119; ♀ (LACM). *Dickens Co.*, White River Reserve, Fert. Bait, 7-11-VII-1988, R. Morris; OSUC 0020363; ♀ (UGCA). *Hidalgo Co.*, Bentsen Rio Grande Valley S. P. near Mission; 10-VII-1981; C. Porter; OSUC 0020180; ♀ (FSCA). *Karnes Co.*; 12-III-1934; C. E. Heard; 5443; *Megischus bicolor sickmanni* det. H. M. Greenbaum 1974; OSUC 0020153; ♂ (TAMU). *Real Co.*, Rio Frio, Hwy. 90; 14-VIII-1959; OSUC 0020314; ♀ (CNCI). *Starr Co.*, Salineño, along Rio Grande; spring 1992; reared from dead ash limbs; E. G. Riley; OSUC 0020202; ♂ (TAMU). *Uvalde Co.*, 10 mi N of Uvalde; 19-VI-1968; G. H. Nelson; on dead limbs; on *Prosopis juliflora* (Sw.) DC;

OSUC 0020209; ♂ (FSCA). *Val Verde Co.*, Devil's River, Dolan Falls area, elev. 360 m; 18-V-1993; Gelhaus No. 589, Nelson, Koenig; OSUC 0020311; ♀ (ANSP). One additional non-type female without locality labels from UAIC.

Megischus brunneus Cresson

(Figs. 7, 14)

Megischus brunneus Cresson 1865: 84 (original description); Townes 1949: 364, 369 (generic transfer, redescription, distribution, figure, keyed); Carlson 1979: 141 (listed, generic transfer, distribution); Gauld, 1995: 184 (listed, distribution south of U.S.A.).

Stephanus brunneus: Dalla Torre 1902: 6 (listed, generic transfer, distribution, unjustified emendation).

Stephanus brunneus: Enderlein 1905: 475 (listed, distribution); Kieffer 1908: 4 (listed, distribution); Elliott 1922: 716, 718, 725 (description, keyed); Orfila 1951: 273 (generic transfer, keyed).

Distribution.—Seven specimens from southernmost Florida (Monroe, Dade counties: AEIC, FSCA, USNM); extralimital material from Cuba, Fig. 14.

Biological associations.—Collected on dead white mangrove, *Laguncularia racemosa* (Linnaeus) Gaertn. f. (Combretaceae); “at” American sycamore, *Platanus occidentalis* L. (Platanaceae); resting on dead fig, *Ficus* L. (Moraceae). Recorded in literature in association with buttonwood (Townes 1949), possibly *Conocarpus erectus* L. (Combretaceae); and “diseased Jalia” (Cresson 1865).

Megischus californicus Townes

(Figs. 14, 18)

Megischus californicus Townes 1949: 364, fig. 3, ♂, ♀. (original description, protonum figured, keyed); Carlson 1979: 741 (listed, distribution); Halstead 1986: 101 (distribution, seasonality in California, cited as *californica*).

Distribution.—Oregon, California, Nevada, Utah, Colorado (56 specimens: AEIC, CDAE, CNCI, EMEC, EMUS, LACM, ODAC, OSUC, UCDC, UCRC, USNM).

Biological associations.—Emerged from buckbrush, *Ceanothus cuneatus* (Hook.) Nutt. (Rhamnaceae); interior live oak, *Quercus wislizeni* A. DC.; and an unspecified oak, *Quercus* L. (Fagaceae). Collected on mule's fat, *Baccharis salicifolia* (Ruiz & Pavón) Pers. (cited as *B. glutinosa*) (Asteraceae); *Ceanothus cuneatus*, and *Ceanothus* L.

Megischus texanus Cresson

(Figs. 16, 18)

Megischus texanus Cresson 1872: 190, ♀ (original description); Elliott 1922: 761 (possible placement in *Hemistephanus* Enderlein); Townes 1949: 364 (figure, description, distribution); Carlson 1979: 741 (listed, distribution); Halstead 1986: 103 (distribution, seasonality in California; biology); Gauld 1995: 184 (distribution south of U.S.A.).

Stephanus texanus: Dalla Torre 1902: 9 (generic transfer, distribution); Elliott 1922: 716, 730 (description, distribution, keyed).

Stephanus (Hemistephanus) texanus: Roman 1917: 14 (keyed, subgeneric assignment).

Hemistephanus texanus: Elliott 1922: 755 (generic transfer, similar to *Parastephanellus pictipes* Roman).

Distribution.—California, Nevada, Arizona, New Mexico, Colorado, Oklahoma, Texas, Louisiana, Fig. 16 (124 specimens: AEIC, AMNH, ANSP, CHAH, CNCI, CSUC, EMEC, EMUS, FCDA, LACM, LSUC, MCPM, ODAC, OSUC, SEMC, SFVS, TAMU, UAIC, UCDC, UCRC, UGCA, USNM, WFBM).

Biological associations.—Reared as a larval parasitoid of *Acmaeoderopsis junki* (Thery) (Coleoptera: Buprestidae). Emerged from paloverde species, *Parkinsonia* Linnaeus, (Fabaceae; recorded on label as *Cerci-*

dium Tulasne); blue paloverde, *P. florida* (Benth. ex Gray); desert ironwood, *Olneya tesota* Gray (Fabaceae); mesquite, *Prosopis* Linnaeus (Fabaceae), interior live oak, *Q. wislizeni*. Collected on paloverde; pine, *Pinus* Linnaeus (Pinaceae), mesquite; oak; and sumac, *Rhus* Linnaeus (Anacardiaceae). Collected on site dominated by pine.

Comments.—Small specimens of *M. texanus* do not have the sculpture and color patterns typical of the species. They tend to be darker and have coarser pronotal sculpture, and they may easily be mistaken for *M. californicus*. The relative length of the maxillary palp and the pilosity on the metapleuron are stable, size-independent characters not mentioned in Townes (1949). *Megischus texanus* may be distinguished from *M. californicus* by having the maxillary palp as long as the height of the head and the presence of a dense tuft of hairs centrally on the metapleuron.

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