

Key to *Gonatocerus* from the Hawaiian Islands, with Notes on the Species (Hymenoptera: Mymaridae)

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Abstract: The 11 species of *Gonatocerus* (Mymaridae) in the Hawaiian Islands are reviewed and an identification key is given. The Hawaiian fauna consists so far entirely of introduced species, apparently all from the Nearctic region, though further intensive collecting may yield additional species. All of the species occur on one of the islands, Oahu, and at least seven occur on each of Hawaii, Kauai, and Molokai. Most of the species were first collected since the 1960s. Members of the *sulphuripes* and *ater* groups are identified to species but five species in the *membraciphagus* and *litoralis* groups cannot be named for certain, pending revisions of these groups for North America. The named species are: *californicus* Girault, *capitatus* Gahan, *dolichocerus* Ashmead, *mexicanus* Perkins, *ornatus* Gahan, and *pygmaeus* Girault.

Introduction

This is the third of a series of papers treating the Mymaridae of the Hawaiian Islands. A generic key was given in the first paper together with notes on those genera containing only a few species each (Beardsley and Huber, this issue). The second paper treated the genus *Anagrus* (Triapitsyn and Beardsley, this issue).

Gonatocerus is one of the three largest genera of Mymaridae in the Hawaiian Islands with at least 11 species recognizable, representing the four species groups defined by Huber (1988). In contrast to *Polynema*, the most speciose genus of Hawaiian mymarids, *Gonatocerus* consists entirely of exotic species. In contrast to *Anagrus*, which includes several species intentionally introduced and established from Australia or Fiji (Triapitsyn and Beardsley, this issue), the Hawaiian fauna of *Gonatocerus* as presently known consists entirely of species originating from the Nearctic region, most apparently accidental introductions. One species, *G. mexicanus*, was probably introduced deliberately early in the century to control a leafhopper pest (Swezey 1916). At least six species were found at or near Waimanalo, an experimental farm surrounded by disturbed habitat. No *Gonatocerus* species appear to be restricted to native vegetation communities. This would be expected as all these foreign species presumably parasitize introduced hosts occurring on introduced plants.

Many exotic plants in the Hawaiian Islands, their pests, and presumably also some of their parasitoids, came from areas such as the Oriental and Australian regions. Perkins (1906) and his colleagues also deliberately imported many species of potentially beneficial insects from Australia and Fiji to control certain pests. Perkins (1912: 5-6) noted that insect species introduced from "the warmer parts of the American continent readily became established in Hawaii but native insects of California, though they had often been brought here, generally failed to establish themselves". Similarly, the little material introduced intentionally from

Table 1. Distribution and first collection dates for *Gonatocerus* spp. in the Hawaiian Islands.

Species	Island							
	Hawaii	Kauai	Lanai	Maui	Molokai	Nihoa	Oahu	Midway
membraci- phagus group sp.1	VI.1966		III.1966	XI.1994	VI.1994		VII.1955	V.1997
mexicanus		VIII.1961					VIII.1915	
californicus	X.1995	X.1983		IV.1988	X.1987		IX.1988	
capitatus		VIII.1961			VI.1995	IX.1964	XI.1961	
dolichocerus	X.1995	IX.1989		IV.1988	V.1992		III.1979	
pygmaeus	XI.1996	V.1991					VIII.1986	
ornatus				IV.1988	♂ II.1963		VI.1938	
litoralis group sp.1	XI.1996	X.1965					VIII.1965	
sp.2	X.1995	VII.1961			VI.1995	IV.1983	II.1960	XII.1997
sp.3					VI.1995		VI.1965	
sp.4	X.1995			VII.1976	XI.1995		VIII.1962	

Ohio did not become established (Swezey 1936). We therefore expected to find at least some *Gonatocerus* species from regions other than the Nearctic and relatively few from North America. So the strictly Nearctic origin of the Hawaiian species is quite surprising.

The earliest collection date known to us for each *Gonatocerus* species on seven Hawaiian Islands is given in Table I. Except for *G. californicus* and *G. capitatus*, the earliest dates for each species are all from Oahu and the earliest dates overall are 1915 for *G. mexicanus* and 1938 for *G. ornatus*. All but one of the remaining records are post-1960. Two likely explanations for this pattern of collection dates are presented here. Perhaps in the first half of the century there really were only a few *Gonatocerus* species, or none at all, in the islands which would account for Perkins and his colleagues not collecting them. If so, then most of the species arrived since then, perhaps during the 1940's as a result of a greater amount of transport through the Hawaiian Islands during the second world war and faster transport and increased movement of plant material from the Nearctic region since the war. A simpler explanation is that it was not until the 1950's that microhymenoptera again (i.e., since the Perkins era) began to be collected seriously in the islands, mainly by J. Beardsley and C. Yoshimoto, using mass collecting techniques that virtually guarantee that mymarids will be trapped.

All 11 *Gonatocerus* species occur on Oahu. At least seven species occur on each of Hawaii, Kauai and Molokai. The remaining islands have five or fewer species. The lack of early collection records and species from these islands may be due more to relative lack of collecting there than to a real absence of the species. However, we suspect that spread of a given species, once introduced, probably was from Oahu to the other islands.

The *ater-* and *sulphuripes-*group species were redescribed by Huber (1988). Two species in each of these groups have been found. The *membraciphagus-* and *litoralis-*group species have not been revised for the Nearctic region. Until they are, not all of the Hawaiian fauna can be confidently named to species. Diagnostic characters are given for all species, mostly summarizing the characters used in the key.

Kirkaldy (1909) mentioned *G. cingulatus* Perkins (1905), as being a Hawaiian species. It is closest to sp. 1, discussed below, but we have not found any specimens from the islands. It is likely that Kirkaldy's mention of this species as occurring in the islands is an inadvertent error, so it is not included in our key.

Methods

About 330 slide-mounted or pinned specimens (260 females and 70 males) from the following institutions were examined.

BPBM - Department of Entomology, Bernice P. Bishop Museum, Honolulu. G. Nishida.

CNCI - Canadian National Collection of Insects, Agriculture and Agri-Food Canada, Ottawa. J.T. Huber.

HDOA - Division of Plant Industry, Hawaii Department of Agriculture, Honolulu. B. Kumashiro.

A variety of collecting techniques, such as yellow pan (water) traps, Malaise traps, yellow sticky traps, sweeping, and pit fall traps were used to collect the specimens. Most were mounted on microscope slides, though some old, air-dried (hence shriveled) point-mounted specimens (HDOA) and fresh, critical point dried specimens (CNCI, BPBM) of a few species were also seen. Members of *Gonatocerus* can often be separated on color characters so it is important to collect specimens directly into ethanol for critical point drying before card or point mounting. Slide mounts can then be made as needed to confirm species identification, using the distribution of sensory ridges on the female antenna and other features as necessary. Males usually can be identified by association, but may not be identifiable, especially in the *litoralis* group, when not associated with females. Unassociated males were examined but not entered into the material examined sections under each species unless we were confident about their specific identity.

Terms used are according to Huber (1988). The only morphological abbreviation used in the text is F for funicular segment.

Hosts

Huber (1986) reported twelve families of hosts for *Gonatocerus* species worldwide. Eight of these are considered to be doubtful or incorrect and only two, Cicadellidae and Membracidae, are frequently parasitized host families. Cicadellidae are the usual hosts for species of the *ater*, *sulphuripes* and *litoralis* groups of *Gonatocerus* whereas Membracidae are the hosts for species of the *membraciphagus* group. In Hawaii, the only definite host records are *Draeculacephala* spp. (Cicadellidae) for *G. mexicanus* and *Spissistilus festinus* (Say) (Membracidae) for *G. ornatus*. Likely hosts for *G. capitatus*, and the *membraciphagus*-group species are the introduced *Circulifer tenellus* (Baker) (Cicadellidae) and *S. festinus*, respectively. Biological studies on all of the *Gonatocerus* species are needed to determine their host ranges, life cycles, and number of generations per year.

Key to *Gonatocerus* species from the Hawaiian Islands

(Both sexes will key to species group and, using size or color, to species of the *sulphuripes* and *ater* groups; females only will key from couplet 7 on, i.e., most species in the *litoralis* group are identifiable using females only.)

- 1 Dorsellum of metanotum biconvex, rhomboidal or triangular; pronotal lobes abutting medially; ocellar triangle with 2 setae between posterior ocelli 2
- Dorsellum of metanotum strap-shaped; pronotal lobes widely separated by membranous median area; ocellar triangle with 3 or 4 setae between posterior ocelli (*litoralis* group) 6
- 2(1) Discal setae of forewing relatively sparse and beginning at apex of venation (Fig. 12); propodeal spiracle huge, larger than mesothoracic spiracle, and somewhat triangular; ovipositor distinctly projecting under mesosoma, extending clearly anterior to gastral petiole *membraciphagus* group
- Discal setae of forewing denser and either present behind venation or beginning at apex of venation (Figs. 8–11); propodeal spiracle normal, the same size as or smaller than mesothoracic spiracle and round; ovipositor not projecting under metasoma, entirely located well behind gastral petiole 3
- 3(2) Propodeum smooth medially; forewing relatively narrow (Figs. 10, 11), at least 3.6 times as long as wide, with rounded apex *sulphuripes* group, 4
- Propodeum with 2 submedian carinae; forewing relatively broad (Figs. 8, 9), at most 3.1 times as long as wide, with somewhat flattened apex *ater* group, 5
- 4(3) Body uniformly dark brown; ovipositor extending beyond apex of gaster for distance equal to at least one-third gastral length and forming large circular loop inside gaster *mexicanus* Perkins
- Head and thorax brown, gaster usually yellowish, mottled with small brown spots; ovipositor barely extending beyond gastral apex and not forming loop inside gaster *californicus* Girault
- 5(3) Large species, at least 1.0 mm long; back of head with strong occipital sulcus constricting gena in lateral view; gaster yellowish with distinct brown bands on terga; forewing with setae behind venation *dolichocerus* Ashmead
- Smaller species, at most 0.9 mm long; back of head without occipital sulcus; gaster uniformly brown; forewing without setae behind venation *capitatus* Gahan
- 6(1) Ocellar triangle with 4 setae between posterior ocelli; only one funicle segment, F8, with 2 sensory ridges (Fig. 1); forewing behind venation with asetose area surrounded by setae *pygmaeus* Girault
- Ocellar triangle with 3 setae between posterior ocelli; at least 2 funicle segments with either 1 or 2 sensory ridges (Figs. 2–6); forewing behind venation more uniformly setose 7
- 7(6) F6 with 2 (sometimes 1) sensory ridges (Figs. 2, 6); either with forewing relatively narrow, at least 4.2 times as long as wide, or legs with distinctive black and white markings 8
- F6 usually without sensory ridges (Figs. 3–5); if F6 with sensory ridges then forewing wider (at least ca. 3.6 times as long as wide); legs without distinctive markings 9
- 8(7) Gaster elongate, with ovipositor more than 1.5 times as long as hind tibia; forewing at most 3.6 times as long as wide; thoracic dorsum dark brown (teneral adults with H-shaped white mark on median part of mesoscutum and scutellum) ... *ornatus* Gahan

- Gaster rounded, with ovipositor equal in length to hind tibia; forewing at least 4.2 times as long as wide; thoracic dorsum mainly yellow, but dark anteriorly on lateral part of mesocutum, anteriorly on median part of mesoscutum, and on anterior part of scutellum sp. 1
- 9(7) F5 without sensory ridges (Fig. 4) sp. 3
- F5 with 1 or 2 sensory ridges (Figs. 3, 5) 10
- 10(9) Ovipositor at most about 1.1 times as long as hind tibia sp. 2
- Ovipositor at least 1.5 times as long as hind tibia sp. 4

Taxonomy

Membraciphagus Species Group (Figs. 7, 12)

Only one species of this species group occurs in the Hawaiian Islands. Its presence there was already noted by Huber (1988). It represents the first record for the group outside the Western Hemisphere but until the group is revised we prefer not to name the Hawaiian species.

Diagnosis. This species has an enormous propodeal spiracle, a feature shared by only two other described species of the group, *G. spiracularis* Ogloblin from Argentina (Ogloblin 1935) and *G. jvator* Perkins from Mexico (Perkins 1912). The Hawaiian species most closely resembles *G. spiracularis*; both have two sensory ridges on F7 and F8 (Fig. 7), though at least one specimen of the Hawaiian species also has sensory ridges on F6. *G. jvator*, in contrast, has sensory ridges on F5–F8. The clava and flagellar segments of *G. spiracularis* are relatively longer than in the Hawaiian species. A forewing of *G. membraciphagus* Ogloblin, typical for the group, is illustrated (Fig. 12).

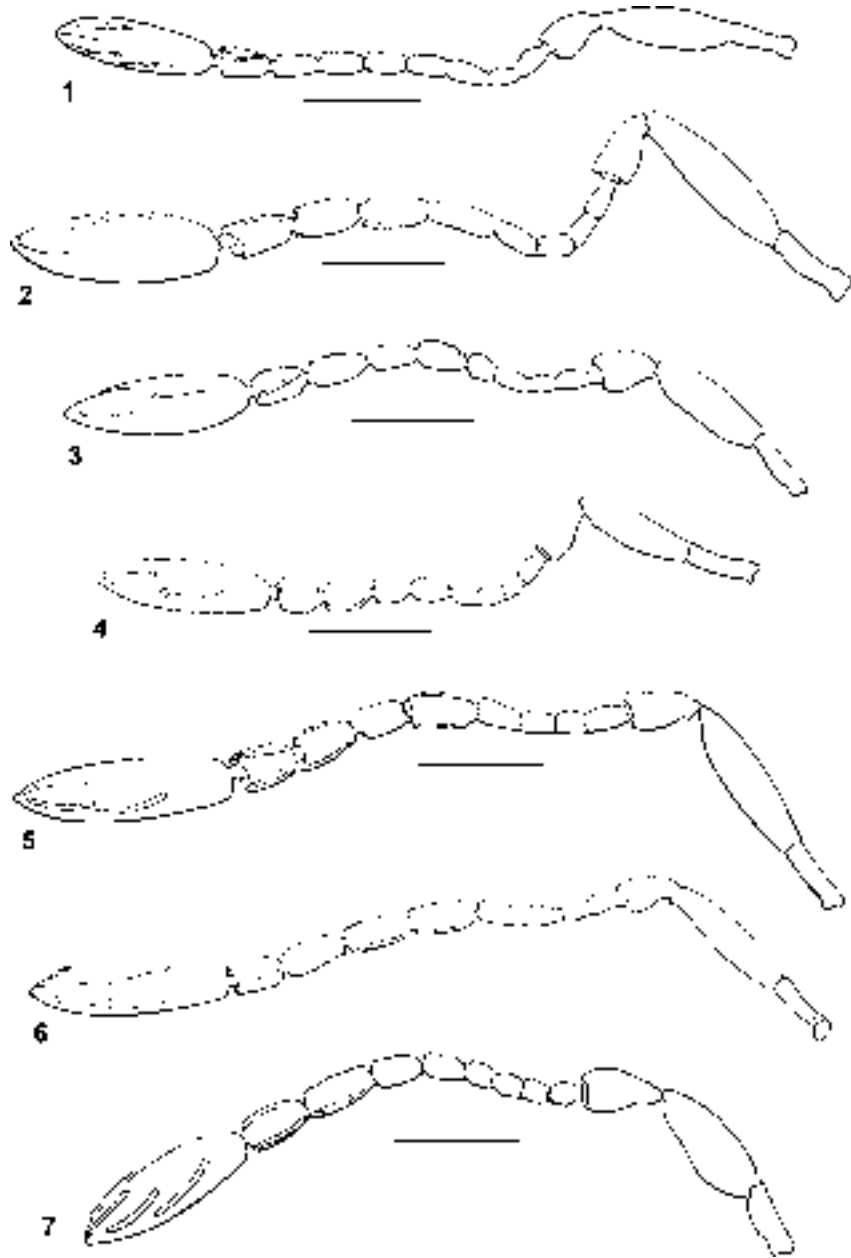
Material examined. Hawaii I.: Kaupulehu Forest Reserve, Kona, 2000', 27.vi.1966, J.W. Beardsley (2 ♀). **Lanai I.:** Lanaihale, 25.iii.1966, J.W. Beardsley (1 ♀), same data, C.M. Yoshimoto (2 ♀). **Maui I.:** Haleakala hwy., 90', 18.xi–2.xii.1995, W.D. Perreira (2 ♀); lower Honea-Piilani road, 10', 23.viii–6.ix.1996, W.D. Perreira (4 ♀). **Midway Is.:** Sand I., Roosevelt and Halsey Drives, 1–17.v.1997, G.M. Nishida (2 ♀) and 15–20.xii.1997, G.M. Nishida and G.A. Samuelson (5 ♀). **Molokai I.:** Mapulehu nr Ililiopae Heiau, 10–40', 20.i.1995, J.W. Beardsley and W.D. Perreira (1 ♀); Kualapuu in coffee field, 750', 21.vii–4.viii.1995 and 19.viii–2.ix.1994, W.D. Perreira (2 ♀); Kapukahehu Beach, vi.1994, J.W. Beardsley and W.D. Perreira (1 ♀); Papio Stream, vi.1994, J.W. Beardsley and W.D. Perreira (1 ♀). **Oahu I.:** Barber's Point, 22.iv.1966, and 29.xii.1965, J.W. Beardsley (3 ♀), and 11.viii.1966, C.M. Yoshimoto (1 ♀); Ewa, iv.1960, (2 ♀) 3.viii.1961, sweeping grass and alfalfa (3 ♀), 29.viii.1962, sweeping alfalfa (2 ♀), 12.iii.1964 (1 ♀), 9.ii.1965 (3 ♀), and 22 and 29.ix.1965 (5 ♀), J.W. Beardsley; Hickam Air Force Base, 19.v.1988, J.W. Beardsley (6 ♀); Waimanalo, University of Hawaii farm, 18.vii.1994, sweeping crops and weeds (2 ♀) and ca. 60', 11–18.x.1994 (1 ♀), J.W. Beardsley and W.D. Perreira; Waipio, 10.vii.1955, ex. alfalfa (3 ♀) and 5.vii.1955 ex. *Erigeron canadensis* (1 ♀), and iii.1960 (1 ♀), J.W. Beardsley; Honolulu, 27.i.1964, ex. membracid, G. Funasaki (2 ♀).

Sulphuripes Species Group

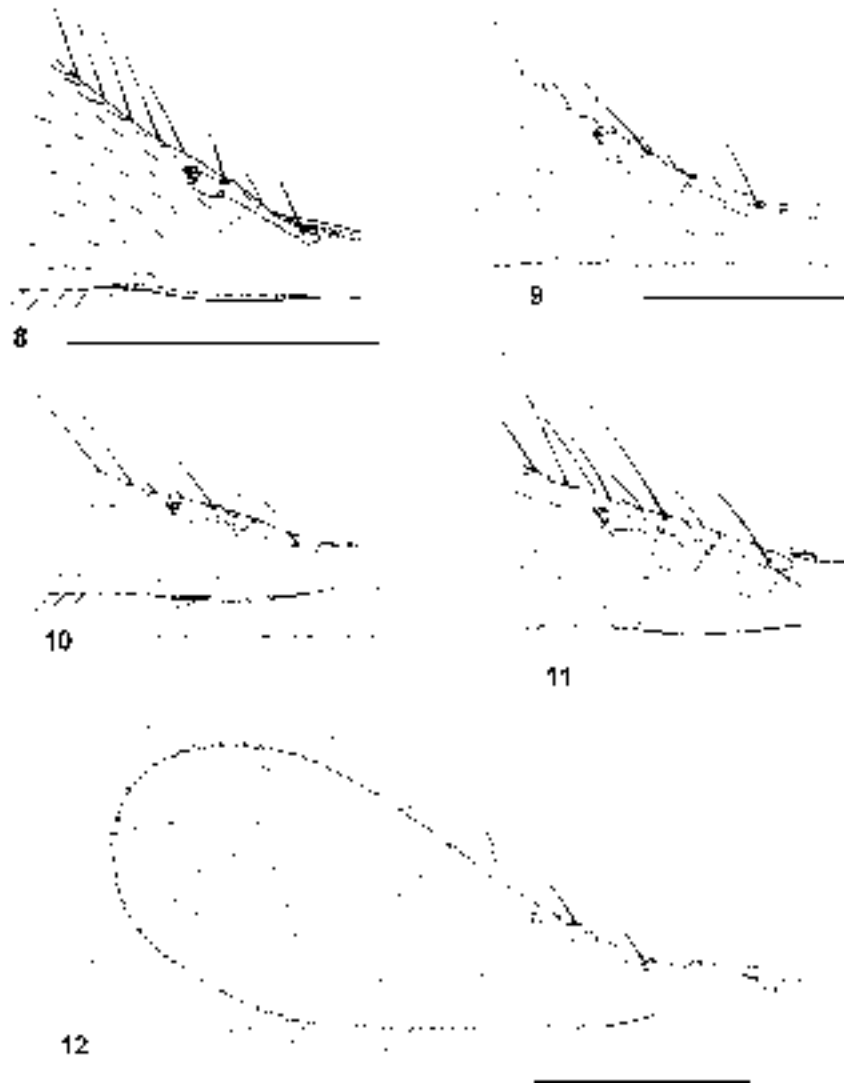
Gonatocerus mexicanus Perkins (Fig. 11)

Gonatocerus mexicanus Perkins 1912: 21; Swezey, 1916: 146, 223; Timberlake 1924: 448; Swezey 1929: 290; Zimmerman 1948: 23; Swezey, 1954: 194; Beardsley, 1966: 166;

Figs. 1–7. Female antennae. Figs. 1–6. *Gonatocerus litoralis* group species. 1, *G. pygmaeus* from Oahu, Waimanalo; 2, *G. sp. 1* from Kauai, Kokee; 3, *G. sp. 2* from Oahu, Barber's Point; 4, *G. sp. 3* from Molokai, Kalaniana'ole; 5, *G. sp. 4* from Oahu, Ewa; 6, *G. ornatus* from Oahu, Waimanalo; Fig. 7. *Gonatocerus membraciphagus* group species from Oahu, Hickam Air Force Base. Scale lines = 0.1 mm.



Figs. 8–12. Forewings. Figs. 8–11. Forewing base (from specimens collected in Nearctic region). 8, *capitatus*; 9, *dolichocerus*; 10, *californicus*; 11, *mexicanus*. Fig. 12. Entire forewing, paratype of *G. membraciphagus* from Argentina. Scale lines = 0.2 mm.



Napompeth and Nishida, 1972: 246; Huber 1988: 42.

G. mexicanus was first collected in the Hawaiian Islands in 1915. Possibly it was an accidental introduction though more likely it was introduced from Mexico by Koebele around 1907, but no vouchers were kept (Swezey 1916). The Nihoa record for this species (Beardsley 1966: 166) is a misidentification—the species actually is *G. capitatus*.

Diagnosis. Females of *G. mexicanus* are easily recognized by the ovipositor which forms a large coil inside the gaster and is exerted about one-fourth of its length beyond the gastral apex. Both sexes are distinguished from *G. californicus*, so far the only other *sulphuripes*-group species found in the Hawaiian Islands, by their uniformly brown color.

Material examined. Kauai I. Kokee, 4–6.viii.1961, Maa, Miyatake and Yoshimoto (1 ♀). **Oahu I.** Pearl City, iii.1970, T. Nishida, ex. eggs of *Draeculacephala* (3 ♀, 2 ♂); Ewa, 22.xii.1965, J.W. Beardsley (1 ♀); Honolulu, 31.vii.1970, J.W. Beardsley, ex. eggs of *Draeculacephala mollipes* (3 ♀, 1 ♂); Waimanalo, 6.ix.1988 (1 ♀), 12.i.1966, sweeping weeds and crops, J.W. Beardsley, (2 ♀), and HITAHR Experiment Station, 4.vi.1991, sweeping weeds, crops, and low bushes, J.W. Beardsley (1 ♀, 1 ♂).

Host. *Draeculacephala minerva* (Ball) and *D. mollipes* Say (Cicadellidae) (but see Napompeth and Nishida, 1972, for host taxonomy).

Gonatocerus californicus Girault (Fig. 10)

Gonatocerus californicus Girault 1911: 271; Huber, 1988: 35.

Diagnosis. Head and thorax brown, contrasting distinctly with the yellowish gaster, which bears more or less distinct brown spots in females and bands in males. This is a smaller species than *G. mexicanus* with a shorter ovipositor at most barely exerted beyond the gaster.

Material examined. Hawaii I. Volcano Village, along Wright road, 3860', 20.x–3.xi.1995, W.D. Perreira (1 ♀); Whittington Beach Park at Honu'apo Bay, 3', 20.x–3.xi.1995, W.D. Perreira (1 ♀). **Kauai I.** Moloaa, 3.v.1991, J.W. Beardsley, *Casuarina* belt above seacliff, sweeping low vegetation (1 ♀, 2 ♂); Opaekaa Falls lookout and Wailua Falls, 13 and 15.x.1983, D.M. LaSalle (6 ♀). **Maui I.** Kula, ii and iv–vi, 1988, J.W. Beardsley (3 ♀) and Kula Research Center, 1.iv.1988, J.W. Beardsley (1 ♀); Pulehu, 1.iv.1988, J.W. Beardsley (1 ♀). **Molokai I.** Kaluakoi, and Kaluakoi and Palaau St. Park, 1500', 13.v.1994, J.W. Beardsley and W.D. Perreira (4 ♀, 3 ♂); Kamalo Bridge, 3', 16–20.ix.1994, W.D. Perreira (1 ♀); Kamakou Preserve 1200–1300 m, 7.x.1987, N. Reimer and J. Strazanac (1 ♀). **Oahu I.** Barber's Point, 3–10', 16.xi.1995, J.W. Beardsley and W.D. Perreira (1 ♀); Lualualei Gulch Stream, 7.ii.1996, G. Nishida (2 ♀); Honolulu, Lyon arboretum, 19–21.v.1989, L. Masner, disturbed forest (1 ♀); Waimanalo, 6.ix.1988, J.W. Beardsley (1 ♀, 1 ♂), University of Hawaii farm, 60', 10.x.1994, J.W. Beardsley (1 ♀), and 60–80', 5.vi.1995, sweeping crops and weeds, J.W. Beardsley and W.D. Perreira (6 ♀, 5 ♂).

Ater Species Group

Gonatocerus capitatus Gahan (Fig. 8)

Gonatocerus capitatus Gahan, 1932: 754.

G. mexicanus, Beardsley 1966: 166, misidentification.

Diagnosis. This species superficially resembles a *litoralis*-group species, being relatively small and generally pale brown. These features separated it from *G. dolichocerus*, the only

other *ater*-group species so far found in the Hawaiian Islands, which is much larger and has a black head and mesosoma and yellowish or whitish gaster with distinct black bands on each tergum. *G. capitatus* females also lack sensory ridges on F5 (2 present on F5 in *G. dolichocerus*).

Material examined. Kauai I.: Kokee, 4–6.viii.1961, Maa, Miyataki and Yoshimoto (1 ♀, 1♂). **Molokai I.:** Kalanianaʻole Colony, 3–6', 9.vi.1995, sweeping *Atriplex* and *Chenopodium*, J.W. Beardsley and W.D. Perreira (1 ♀), and vi, 7–21.vii and 4–18.viii.1995, W.D. Perreira (7 ♀, 3♂). **Nihoa I.:** 24.ix.1964, J.W. Beardsley (2 ♀, 1♂); Miller Peak, 100', 22.vi.1990, J. Strazanac, low shrubs (3 ♀, 4♂); 100m, 25.iv.1983, on blooming *Euphorbia celastroides*, and Miller Valley, 50m, 29.iv.1983, sweeping *Chenopodium oahuense* and *Solanum nelson*, W.C. Gagne (4 ♀, 1♂). **Oahu I.:** Barber's Point, 22.iv.1966, J.W. Beardsley (1♂) and 11.viii.1966, C.M. Yoshimoto (5 ♀); Ewa, 9.xi.1961, J.W. Beardsley (1 ♀); 22 and 29.ix.1965, J.W. Beardsley (1 ♀, 1♂).

Host. *G. capitatus* was collected on *Atriplex semibaccata* R. Br. and *Chenopodium oahuensis* (Meyen) Aellen in association with beet leafhopper, *Circulifer tenellus*, on Nihoa and Molokai. This cicadellid is an important host of *G. capitatus* in North America (Huber 1988) and is likely also the host in the Hawaiian Islands.

Gonatocerus dolichocerus Ashmead (Fig. 9)

Gonatocerus dolichocerus Ashmead, 1887: 192; Huber, 1988: 72.

G. marilandicus Girault 1917: 115; Asquith and Messing 1993: 15.

Diagnosis. This is the largest species of *Gonatocerus* so far found in the Hawaiian Islands. Color, size, presence of sensory ridges on F5 in females (absent in *G. capitatus*) and presence of setae behind the venation (absent in *capitatus*) distinguish it from *G. capitatus* as discussed under that species.

Material examined. Hawaii I.: Hamakua coast at Maulua Gulch, 120', 20.x–3.xi.1995, W.D. Perreira (1♂); Whittington Beach Park at Honu'apo Bay, 3', 20.x–3.xi.1995, W.D. Perreira (2 ♀). **Kauai I.:** Moloaa, 19.ix.1989, sweeping young corn plants (2 ♀) and 3.v.1991, *Casuarina* belt above seacliff, sweeping low vegetation (3 ♀), J.W. Beardsley. **Maui I.:** Kula, iv–vi.1988, J.W. Beardsley, (2♀); near Oopuola Str., ca. 800', 18.xi–2.xii.1995, W.D. Perreira (1 ♀, 1♂); Pulehu, 1.vi.1988, J.W. Beardsley (1 ♀). **Molokai I.:** Kualapuu in coffee field, 750', 19.viii–2.ix.1994, W.D. Perreira (2 ♀); Mapulehu, 6.v.1992, J.W. Beardsley (1♂); Mapulehu nr Ililiopae Heiau, 10–40', 9.vi.1995, sweeping weeds and grasses J.W. Beardsley and W.D. Perreira (1 ♀, 1♂) and v.1995. W.D. Perreira (1♂); Palaau State Park, vi.1994, and 1500', 13.v.1994, J.W. Beardsley and W.D. Perreira (2 ♀, 2♂); Papio Stream, vi.1994, J.W. Beardsley and W.D. Perreira (1 ♀). **Oahu I.:** Barber's Point near lighthouse, 5', 29.i.–11.ii.1995 W.D. Perreira and T. Mitomi (4 ♀, 1♂); Honolulu, 16.ii.1979, ex. ova in citrus and 15.iii.1979, ex. lemon tree, K. Murai (2 ♀, 8♂); Honolulu, 1–25.v.1985 (5 ♀, 2♂), 2065 Lanihuli Dr., 28.i.–28.ii.1985, (12 ♀, 11♂), and 3050 Maile Way, behind Gilmore Hall, 6–20.i.1986 (5 ♀, 2♂), L. LeBeck; Waimanolo, 10.v.1994, on soybean rust, R. Heu and E. Killgore (1 ♀, 1♂) and 6.ix.1988, J.W. Beardsley (3 ♀); Waimanalo, University of Hawaii farm, 60–80', 5.vi.1995 and 10.x.1994, J.W. Beardsley and W.D. Perreira, sweeping weeds and crops (7 ♀, 4♂).

Litoralis Species Group

Gonatocerus pygmaeus Girault (Fig. 1)

Gonatocerus pygmaeus Girault, 1911: 269.

Diagnosis. This is the only Hawaiian species with 4 setae between the posterior ocelli and, within the *litoralis* group, the only one with a distinct bare area surrounded by setae behind the venation.

Material examined. Hawaii I.: Kauhiula at edge of Hilo Bay, 60–80', 20.x–3.xi.1996, W.D. Perreira (1 ♀). **Kauai I.:** Moloaa, 3.v.1991, J.W. Beardsley, *Casuarina* belt above seacliff, sweeping low vegetation (1 ♀). **Oahu I.:** Hickam Air Force Base, 19.v.1988, J.W. Beardsley (1 ♀); Waimanalo, 2.viii.1988, J.W. Beardsley (5 ♀); Waimanalo, University of Hawaii farm, 5.vi.1995, 5–12.vi.1995, 20–22.ii.1996, J.W. Beardsley and W.D. Perreira, sweeping weeds and crops and yellow pitfall trap (4 ♀); Waimanalo Experimental Station, 21–28.viii.1986, L. LeBeck (5 ♀).

Gonatocerus ornatus Gahan (Fig. 6)

Gonatocerus ornatus Gahan, 1918: 23; Fullaway, 1943: 262; Zimmerman, 1948: 89.

Diagnosis. This species is distinguished from other members of the group by its uniformly very dark brown body and pale legs with femora and tibiae broadly and distinctly black medially, relatively long gaster and ovipositor, and the four apical funicular segments each with 2 sensory ridges (Fig 6).

Material examined. Maui I.: Kula, iv–vi.1988, J.W. Beardsley (1 ♀). **Molokai I.:** Kaunakakai, 14.ii.1963, J.W. Beardsley (1 ♂). **Oahu I.:** Barber's Point, 3–10', 16.xi.1995, J.W. Beardsley and W.D. Perreira (2 ♀, 1 ♂); Ewa, 24.xi, iii.1965, 22.xii.1965, J.W. Beardsley (6 ♀) and iii.1990, T.H. (1 ♂); Honolulu, i.1942, M. Chong, ii.1942, D.T. Fullaway, ex. *Stictocephala festina* on *Crotolaria* (9 ♀, 6 ♂), x.1943, ex bean, D.T. Fullaway (2 ♀, 1 ♂), and 23.vi.1938, collected on hand in car at P.O., O.H. Swezey (1 ♀); Honolulu, University of Hawaii Campus, Gilmore Hall, 27.iv.1986, L. LeBeck (1 ♀); Waimanalo, 18.viii.1965, J.W. Beardsley (1 ♀); Waimanalo Experimental Station, 21–28.viii.1986, L. LeBeck (1 ♀); Waimanalo, University of Hawaii Farm, 18.vii.1994, J.W. Beardsley and W.D. Perreira, sweeping weeds and crops (1 ♀, 1 ♂) and HITAHR Experimental Station, 4.vi.1991, J.W. Beardsley (1 ♂).

Host. Threecornered alfalfa treehopper, *Spissistilus festina*.

***Gonatocerus* sp. 1** (Fig. 2)

Diagnosis. This species keys more or less to *G. aureus* Girault or *G. illinoisensis* Girault in Girault (1929). It has almost the same distribution of sensory ridges on the funicular segments as *G. ornatus* except that F5 and F6 have one sensory ridge, instead of two as in the latter (Fig. 2). It is distinguished from *ornatus* by its distinctly patterned yellow and brown thorax, lighter gaster, much narrower forewing, lack of distinct sculpture on the posterior scutellum, and much shorter ovipositor.

G. cingulatus Perkins has a somewhat similar color pattern (Perkins 1905) but the accompanying illustration shows the ovipositor to be distinctly exerted beyond the gaster so sp. 1 is probably not that species. The single specimen from the island of Hawaii does not have quite the same color pattern as the remainder and may actually be misplaced here.

Material examined. Hawaii I.: Kohala Mt. road at mile post 10, ca. 3480', 20.x–3.xi.1995, W.D. Perreira (1 ♀); **Kauai I.:** Kokee, 13–17.ix.1965, J.W. Beardsley (1 ♀); **Oahu I.:** University of Hawaii Manoa Campus, ca. 80', 3.vi.1995, J.W. Beardsley (1 ♀); Waimanalo, HITAHR Experimental Station, 4.vi.1991, sweeping weeds and low bushes, J.W. Beardsley (1 ♀).

***Gonatocerus* sp. 2** (Fig. 3)

Diagnosis. This apparently fairly common species is distinguished by the rather uniform light brown color of the mesosoma, and lack of sensory ridges on F6 but their presence on F5 (Fig. 3). The female ovipositor is 1.0–1.1 times the hind tibial length (n=24). The forewing width varies somewhat and it is possible that it represents a complex of species.

Species 2, as defined here, occurs on Nihoa, Kauai, Oahu, Midway, and Molokai, apparently mainly in dry, lowland sites (Oahu, Molokai) that suggests it may be associated with the beet leafhopper, but also at higher elevations on the island of Hawaii.

Unfortunately, the number and distribution of sensory ridges is not perfectly constant within a species and it is difficult to determine to what extent the differences may be due to inter-specific versus intraspecific variation. Thus, specimens of species 2, 3 and 4 are somewhat problematic and may be incorrectly grouped here.

Material examined. **Hawaii I.:** Kohala Mt. road nr. Koiaie Preserve, ca. 3400', 20.x–3.xi.1995, W.D. Perreira (3 ♀). **Kauai I.** Kokee, viii.1961, J. W. Beardsley (1 ♀) and 4–6.viii.1961, Maa, Miyataki and Yoshimoto (1 ♀). **Midway Is.:** Sand I., Roosevelt and Halsey Drives, 15–20.xii.1997, G.M. Nishida and G.A. Samuelson (1 ♀). **Molokai I.:** Kalaniana'ole Colony, 3', vi, 7–21.vii, and 4–18.viii.1995, W.D. Perreira (10 ♀); near Kamalo Bridge, 3', 21.vii–4.viii.1995, W.D. Perreira (1 ♀). **Nihoa I.:** 29.iv.1983, W. Gagne (1 ♀) and 100', 22.vi.1990, J. Strazanac (1 ♀). **Oahu I.:** Barber's Point, 3–10', 14.xi.1966, J.W. Beardsley and W.D. Perreira (5 ♀); Ewa, 9.ii.1966, J.W. Beardsley (2 ♀); Hickam Air Force Base, 19.v.1988, J.W. Beardsley (1 ♀); Koko Head, 6.v.1966, J.W. Beardsley (1 ♀).

***Gonatocerus* sp. 3** (Fig. 4)

Diagnosis. This species lacks sensory ridges on both F5 and F6 (Fig. 4) but is otherwise similar in color to sp. 2.

Material examined. **Molokai I.:** Kalaniana'ole Colony, 5', 9.vi.1995, J.W. Beardsley and W.D. Perreira, sweeping *Atriplex* and *Chenopodium* (2 ♀) and vi.1995, W.D. Perreira (1 ♀). **Oahu I.** Ewa, 30.vi.1962 and 29.xi.1965, J.W. Beardsley (2 ♀).

***Gonatocerus* sp. 4** (Fig. 5)

Diagnosis. This species is similar to sp. 2 in the distribution of sensory ridges on the funicle (Fig. 5), but differs in the color of the scutellum, which is only partly brown, and in the relatively long ovipositor, which is 1.5–1.8 times as long as the hind tibia (n=21).

Material examined. **Hawaii I.:** Kipahoe, along Hawaii belt road nr mp 92, ca. 1600', 20.x–3.xi.1995, W.D. Perreira (4 ♀). **Maui I.** Lower Honea-Piilani road, 10', 23.viii–6.ix.1996, W.D. Perreira (1 ♀); near Wailena Gulch, ca. 600', 23.viii–6.ix.1996, W.D. Perreira (3 ♀); no locality, 2.vii.1976, J. Ah Sam (1 ♀). **Oahu I.:** Barber's Point, 22.iv.1966, J.W. Beardsley (2 ♀); Ewa, 23.ix.1965, J.W. Beardsley (2 ♀); University of Hawaii Farms at Waimanalo, ca. 60–80', 5.vi.1995, sweeping crops and weeds, J.W. Beardsley and W.D. Perreira (1 ♀) and 15–22.v.1996, W.D. Perreira (3 ♀).

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