New Species and a Revised Key to the Hawaiian *Cyrtopeltis* Fieb. with Notes on *Cyrtopeltis* (*Engytatus*) *hawaiiensis* Kirkaldy (Heteroptera : Miridae)

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Carvalho and Usinger (1960) reviewed the Hawaiian *Cyrtopeltis* and added 2 new species. They also clarified some of the confusion surrounding the identity of *C.* (*E.*) *hawaiiensis* and *C.* (*E.*) *confusa* (Perkins), pointing out that some of the specimens they then referred to *C.* (*E.*) *hawaiiensis* from Haleakala, Maui, 6000 ft, and from Molokai did not seem conspecific. They based this on the very different pygophore of the Haleakala specimens and on the anomalous distribution pattern of the Molokai specimens. The matter was left to rest pending additional specimens, unfortunately none have appeared from the localities in question.

This paper is an attempt to furthur clarify the status of *C.* (*E.*) *hawaiiensis* and to add 4 new species, bringing the number of endemic Hawaiian Island species to 8, each of which is restricted to a single island with the exception of *C.* (*E.*) *hawaiiensis*. The Molokai specimens easily fall within the range of variation of the latter and are considered conspecific. The specimens from Haleakala, 6000 ft, are referred to a new species. which is most closely related to *C.* (*E.*) *hawaiiensis*. The other new species added belong in 2 or 3 additional species groups within the subgenus *Engytatus* on the islands.

The very peculiar *C.* (*E.*) *perplexa* sp. n., established for the specimens from Haleakala, 6000 ft, is unique in this subgenus in that it lacks the anterior bifurcation on the pygophore. This species may warrant a new subgenus but for its otherwise close structural affinities with *C.* (*E.*) *hawaiiensis* as further outlined in the species descriptions below.

The ♂ claspers are comparatively uniform and offer little aid in species differentation in the Hawaiian Islands' representatives of *Cyrtopeltis*. Differences in the shape of the pygophore, its bifurcations and its right external wall seem to offer the best criteria for species discrimination.

Table I presents the host associations and distribution of the endemic species. Carvalho and Usinger (*loc. cit.*) pointed out that the "evidence is strong that the endemic *Cyrtopeltis* are host specific and that they are restricted to plant species which are not closely related." In this study the following are evident: (1) that *hawaiiensis* and *perplexa* form a distinct species group on *Dubautia* and *Railliardia* in montane regions of Maui and Molokai; (2) that another distinct species, *sidae* sp. n., with obscure af-

TABLE 1. *Host associations and distribution of endemic* Cyrtopeltis

Species	*Plant Host*	*Plant Family*	*Distribution of Insect*
confusa Perkins[1]	*Cyrtandra cordifolia*	Gesneriaceae	Oahu
cyrtandrae sp. n.	*Cyrtandra* sp.	Gesneriaceae	Oahu
hawaiiensis Kirkaldy[2]	*Dubautia, Railliardia*	Compositae	Maui
	R. menziesii		Maui
	R. platyphylla		Maui
	Dubautia sp.		Molokai
lysimachiae C. & U.	*Lysimachia* sp.	Primulaceae	Kauai
perplexa sp. n.	*Railliardia* sp.	Compositae	Maui
phyllostegiae C. & U.	*Phyllostegia* sp.	Labiatae	Oahu
sidae sp. n.	*Sida* sp.	Malvaceae	Maui
terminalis sp. n.	*Cyrtandra* sp.	Gesneriaceae	Oahu

[1]Zimmerman (1948:188) also records *confusa* from *Gouldia, Straussia,* (both in Rubiaceae) and *Touchardia* (Urticaceae). The first 2 plant genera will probably be found to have been confused with *Cyrtandra.* I have not seen specimens of *confusa* from any of the hosts mentioned by Zimmerman.

[2]Perkins (1912:730 stated that this species "will probably be found on *Dodonaea viscosa*" (Sapindaceae) but gives no reasons for this. I have not seen specimens from this host.

finities, occurs on *Sida* in lowland Maui; (3) that the remainder, on an assemblage of plant genera, form a loose aggregate of slender species with subparallel costal margins and are variously infuscate or not dorsally; (4) that 3 species occur on *Cyrtandra* in Oahu, of which *confusa* and *terminalis* sp. n. are larger species with laterally concave pronota and swollen callosities, while the other, *cyrtandrae* sp. n., is a considerably smaller species with the sides of the pronotum straight and the callosities not swollen and occurs sympatrically with *confusa.*

The only other *Cyrtopeltis* known from the islands is the widely distributed *C.* (*E.*) *modesta* (Distant), a pest of tobacco and tomato, which was first introduced from America in 1924 (Swezey, 1925) and is now probably found throughout the islands.

KEY TO HAWAIIAN CYRTOPELTIS (modified from Carvalho & Usinger, 1960)

1. Body generally ovoid; costal margins divergent; pubescence on dorsum, legs and antennae black; postocular space less than 1/2 eye length..... 2
   Body linear; costal margins parallel; pubescence pale to light brown, never black; postocular space greater than 1/2 eye length.....3
2. Pygophore bifurcate (Fig. la); scutellum clothed with black pubescence. Maui:Haleakala, on *Dubautia, Railliardia* sp., *R. menziesii, R. platyphylla*: Molokai, on *Dubautia.....hawaiiensis* Kirkaldy (1902)

Pygophore with a single terminal process (Fig. 2a, b); scutellum subglaborous Maui: Haleakala, 6000 ft, on *Railliardia*.....*perplexa* sp. n.

3. Body totally pale yellow translucent, without any infuscations.....4
   Body with at least apex of cuneus infuscate, usually also infuscate on clavus and antennae.....5
4. Smaller species, body length less than 3.40 mm; callosities not swollen; pronotum not constricted behind the callosities; antenna II longer than antenna III. Maui, on *Sida*.....*sidae* sp. n.
   Larger species, body length exceeding 3.60 mm; callosities swollen, pronotum constricted behind the callosities; antenna II shorter than III. Oahu, on *Cyrtandra*.....*terminalis* sp. n.
5. Body infuscate only on apex of cuneus and areole; antennae totally pale yellow. Oahu, on *Cyrtandra*.....*cyrtandrae* sp. n.
   Body more or less infuscate on clavus and apices of corium and cuneus; antennae brown at least on bases of antennae I and II.....6
6. Eyes very large, each eye equal to or wider than interocular space; tylus dark brown. Kauai, Oahu, Molokai, Maui, Hawaii, on tomato and tobacco .....*modesta* Distant (1884)
   Eyes smaller, distinctly narrower, as seen from above, than interocular space; tylus pale yellow.....7
7. Rostrum exceeding apices of hind coxae; cell in membrane 6 times as long as wide. Oahu, on *Cyrtandra*.....*confusa* Perkins (1911)
   Rostrum not exceeding apices of hind coxae; membranal cell 4 times as long as wide.....8
8. Rostrum short, reaching only to apices of front coxae. Kauai, on *Lysimachia*.....*lysimachiae* Carvalho & Usinger (1960)
   Rostrum longer, reaching nearly to apices of hind coxae. Oahu, on *Phyllostegia*.....*phyllostegiae* Carvalho & Usinger (1960)

All measurements given below are in millimeters.

Cyrtopeltis (**Engytatus**) **hawaiiensis** Kirkaldy (Fig. 1)

Cyrtopeltis hawaiiensis Kirkaldy, 1902 Fauna Hawaiiensis **3**: 138 fig. (note, key)

Engytatus hawaiiensis Zimmerman, 1948 Insects of Hawaii **3**: 188 fig. (note, key)

Cyrtopeltis (*Engytatus*) *hawaiiensis* China & Carvalho, 1952, Ann. Mag. Nat. Hist. **5**(12): 160, 165 (list)

———, Carvalho, 1958 Catalogue of the Miridae of the World. II: 185 (cat.)

———, Carvalho & Usinger, 1960 Proc. Hawaiian Entomol. Soc. **17**: 249 fig. (note, key)

♂: Body ovoid; costal margins divergent; dark yellow with a brownish annulation near base of antenna I and another on base of antenna II; pubescence black on dorsum, femora, and tibia, pale elsewhere. Body

length 3.08–4.15; width 0.94–1.26. *Head*: Length 0.31–0.51; width 0.53–0.58; vertex width 0.26–0.31; black pubescence only near base of vertex; subvertical in front; eyes brown; postocular space less than 1/2 eye length. *Antennae*: I, 0.23–0.37, yellow with a brownish annulation near base, pale, sparse pubescence below annulation, black pubescence above; II, 0.55–1.04, yellow with a brown annulation near base; III, 0.53–1.02, sordid yellow; IV, 0.33–0.50, sordid yellow. *Pronotum*: Length 0.38–0.53; width 0.76–0.93; trapezoidal, not constricted behind callosities; propleura glaborous. *Rostrum*: Length 0.90–1.16; reaching bases of mesocoxae; yellow and darkening on apical segment. *Legs*: Pale yellow with darker apical tarsal segment; darker pubescence on femora and tibia; tarsal spines black. *Abdomen*: Pale yellowish; pubescence entirely pale; pygophore as illustrated (Fig. la, b).

♀: Differing from ♂ as follows: Body length 2.74–3.90; width 0.96–1.26; brown antennal annulations generally paler. *Head*: Length 0.31–0.51; width 0.53–0.60; vertex width 0.29–0.37. *Antennae*: I, 0.22–0.30; II, 0.49–0.81; III, 0.46–0.78; IV, 0.31–0.43. *Pronotum*: Length 0.40–0.50; width 0.70–0.95. *Rostrum*: Length 0.99–1.08; reaching apex of mesosternum.

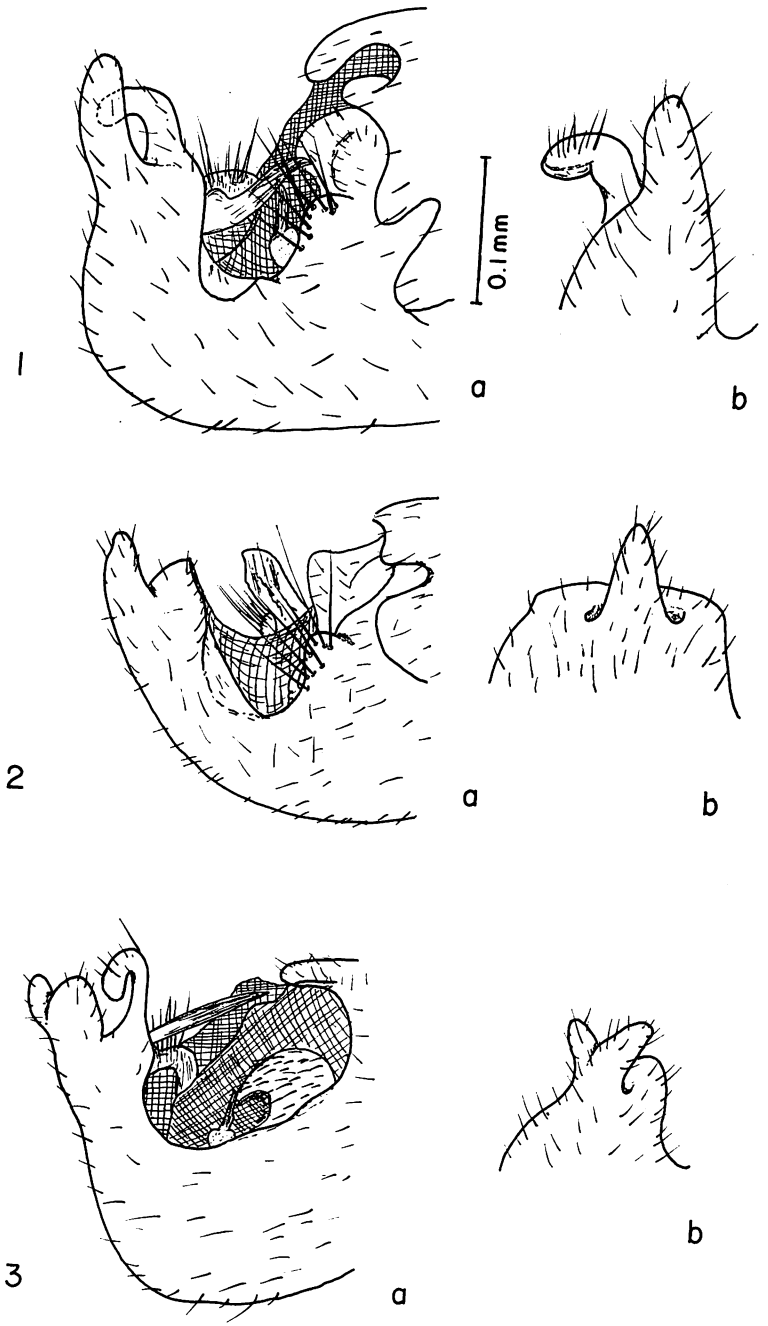
Plant hosts: *Dubautia* sp., *Railliardia menziesii*, *R. platyphylla*, and *R.* sp.

Specimens examined: Maui, Haleakala: 2 ♂, 1 ♀, summit, vi–17–1927, *Railliardia* (Swezey); 4 ♂, 2 ♀, viii-17-1929 (Swezey); 1 ♂, 6 ♀, north of Puu Nianiau, about 5800 ft, vii–18–1919, on *Railliardia* tree (Timberlake); 3 ♂, 5 ♀, edge of crater, 8000 ft, vii–17–1919, Ex *Railliardia menziesii* (Timberlake); 2 ♂, east of crater, 8000 ft, vii–21–1919 (Timberlake), 1 ♂, Elevation ab. 6200 ft, vii–10–1919, Ex. *Railliardia platyphylla* (Timberlake); 1 ♂, Gulch area, Puu Nianiau, El. ab. 6200 ft, vii–16–1919 (Timberlake); 4 ♂, 6 ♀, West Rim, 9700 ft, iv–25–1945, *Dubautia* (Zimmerman); 2 ♂, 6 ♀, White Hill, x–23–1948, *Railliardia*, (Zimmerman); 5 ♂, 2 ♀, ix–1–1956, *Railliardia* (Beardsley). Molokai: 1 ♂, 1 ♀, Puu Kole Kole, iii–23–1929, *Dubautia* (Swezey). Several nymphs are also present in the above collections.

The only related species is *perplexa* sp. n.; both have the black pubescence and the tuft of setae on the right outer wall of the pygophore (Figs. 1a, 2a). The 2 may be separated as outlined in the key.

There is considerable variability in dimensions in the specimens before me but the ♂ pygophore is very uniform in conformation. The 2 specimens from Molokai fall in the range of variability of the Maui population, thus posing an interesting anomaly in the distribution pattern of the endemic species of *Cyrtopeltis* in that *hawaiiensis* is still the only species known from more than 1 island.

Types of the species described below are deposited in the B. P. Bishop Museum, Honolulu. Paratypes, where available are deposited in the



FIGS. 1–3. *Male pygophores*: a, *right lateral*; b, *terminal*. 1, Cyrtopeltis (Engytatus) hawaiiensis Kirkaldy; 2, C. (E.) perplexa sp. n.; 3, C. (E.) sidae sp. n.

California Academy of Sciences, San Francisco, the California Insect Survey, Berkeley and in the author's collection.

Cyrtopeltis (Engytatus) perplexa sp. n. (Fig. 2)

Male: Agreeing with *hawaiiensis* in body shape, color, and pubescence, but has an almost glabrous scutellum and a non-bifurcate pygophore. Body length 3.66, width 1.02. *Head*: Length 0.40; width 0.55; vertex width 0.31; subvertical in front; postocular length less than 1/2 eye length. *Antennae*: I, 0.30; II, 0.79; III and IV broken. *Pronotum*: Length 0.46; width 0.85; trapezoidal; callosities not swollen; not constricted behind the callosities. *Rostrum*: Tip obscured by glue but reaching at least to middle of mesosternum. Pygophore as illustrated (Fig. 2a, b).

Female: Differing from ♂ as follows: Body length 3.39; width 1.21. *Head*: Length 0.38; width 0.55; vertex width 0.33. *Antennae*: I, 0.26; brown annulation more obscure; II, 0.65, brown annulation also more obscure; III, 0.59; IV, broken. *Pronotum*: Length 0.47; width 0.91. *Rostrum*: Length 0.99; reaching apex of mesosternum.

Host plant: *Railliardia* sp.

Holotype ♂, allotype ♀, Haleakala, Maui, 6000 ft, 6–15–27, O. H. Swezey, Collector, on *Railliardia*.

In spite of the paucity of material, it seems advisable to name this species because of the anomalous nature of the pygophore. This is the only known instance in the subgenus *Engytatus* where the anterior bifurcation on the pygophore is absent. But in spite of this curious condition, this species has obvious affinities with *hawaiiensis* and otherwise agrees quite closely with that species as noted above. Furthur field work is obviously necessary to evaluate more correctly the systematic position of this oddity.

For the species described below, the first measurement is that of the corresponding holotype or allotype and following in brackets is the variation, if any, of the paratypes.

Cyrtopeltis (Engytatus) sidae sp. n. (Fig. 3)

Male: Totally pale yellow translucent; pubescence totally pale. Body length 3.34 (3.34–3.39); width 1.06 (1.01–1.06). *Head*: Length 0.32 (0.31–0.36); width 0.45 (0.45–0.46); vertex width 0.25 (0.25–0.26); vertical in front; postocular length equal to eye length; eyes black. *Antennae*: I, 0.25 (0.25–0.27); II, 0.70 (0.70–0.86); III, 0.76 (0.76–0.80), sordid yellow on apical half; IV, 0.42 (0.41–0.43), sordid yellow. *Pronotum*: Length 0.42 (0.42–0.43); width 0.77 (0.76–0.77); trapezoidal; callosities not swollen; not constricted behind the callosities. *Rostrum*: Length 1.05 (1.05–1.13); reaching middle of mesocoxae; darker at apex. Legs and abdomen pale yellow; pygophore with posterior bifurcation terminally dichotomous. (Fig. 3a, b).

Female: Differing from ♂ as follows: Body length 3.33 (3.23–3.39); width 1.00 (1.00–1.06). *Head*: Length 0.38 (0.38–0.39); width 0.49 (0.46–0.49); vertex width 0.29. *Antennae*: I, 0.26 (0.24–0.26); II, 0.65 (0.61–0.65); III, 0.77 (0.68–0.77), pale yellow; IV, 0.42 (0.41–0.42). *Pronotum*: Length 0.46 (0.42–0.46); width 0.87 (0.75–0.87). *Rostrum*: Length 1.09 (1.09–1.12). Apical tarsal segments brown.

Host plant: *Sida* sp.

Holotype ♂, allotype ♀, paratypes 20♂, 14♀, 5 mi. Kula side, Ulupalakua, Maui, iii–5–65, Collected on *Sida*, J. W. Beardsley, Collector.

This species may have affinities with *C.* (*E.*) *cyrtandrae* sp. n. in having the totally pale pubescence, smaller body size and similar pronotal shape, but the lack of infuscations and the unique pygophore with the terminally swollen anterior bifurcation and the terminally dichotomous posterior bifurcation clearly set it apart.

Cyrtopeltis (**Engytatus**) **cyrtandrae** sp. n. (Fig. 4)

Male: Elongate narrow, costal margins subparallel; pale yellow translucent with apices of cuneus and areole infuscate; pubescence pale inconspicuous. Body length 3.28 (3.24–3.28); width 0.80 (0.75–0.85). *Head*: Length 0.46 (0.45–0.46); width 0.42 (0.42–0.43); vertex width 0.24 (0.24–0.25); postocular space subequal to eye length; eyes reddish. *Pronotum*: Length 0.43 (0.43–0.52); width 0.72 (0.71–0.73); elongate narrow but not constricted across middle; callosities only slighlty swollen; a longitudinal median impression from base of collar to base of callosities. *Rostrum*: Length 1.32 (1.31–1.38); reaching bases of hind coxae. *Legs*: Hind tarsi extremely long, subequal to length of antennae II; apical tarsal segments darker at apices. Pygophore as illustrated (Fig. 4a, b).

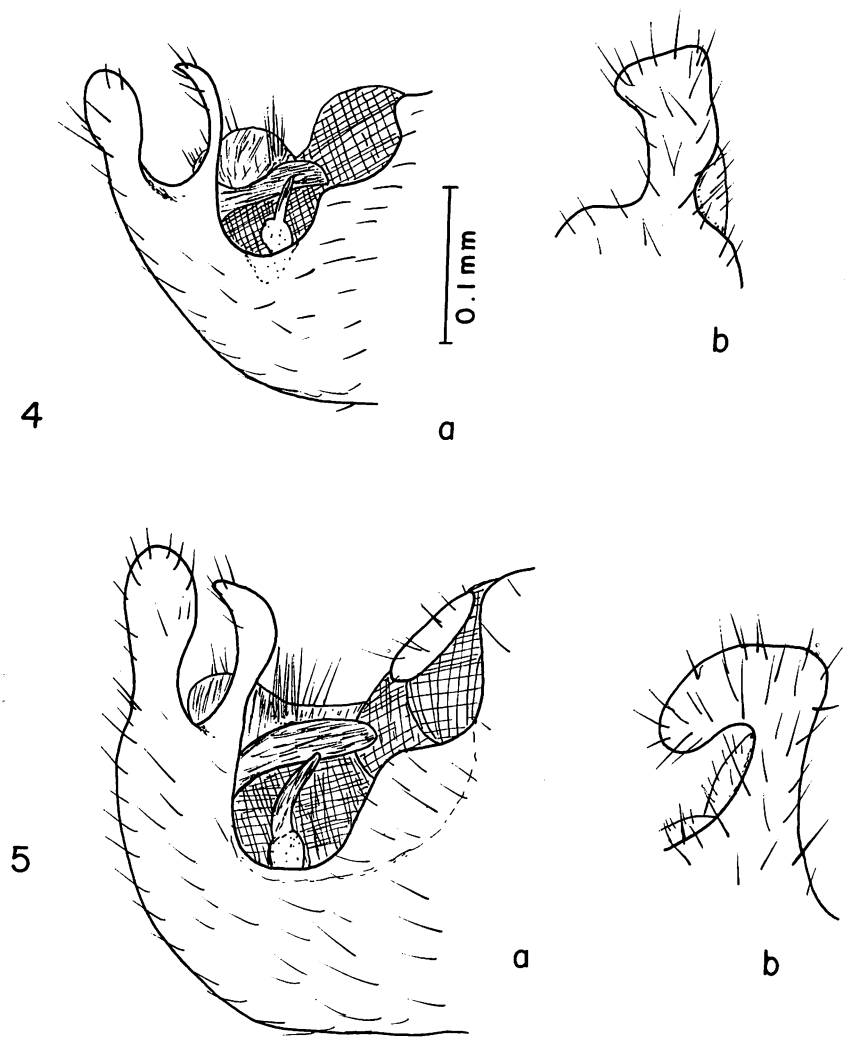
Female: Differing from ♂ as follows: Body length 3.13; width 0.80. *Head*: Length 0.49; width 0.43; vertex width 0.25. *Antennae*: I, 0.27 (0.26–0.27); II, 0.59 (0.59–0.68); III, 0.51; IV, 0.34. *Pronotum*: Length 0.51; width 0.71. *Rostrum*: Length 1.40; reaching middle of hind coxae.

Host plant: *Cyrtandra* sp.

Holotype ♂, allotype ♀, paratypes 8♂, 2♀, Kukuiala, Oahu, iv–11–1936, *Cyrtandra*, R. L. Usinger, Collector; 1♂ paratype, Pukaloa Valley, Oahu, iii–22–36, *Cyrtandra*, R. L. Usinger, Collector.

The general conformation of the pygophore suggests closest affinities to *C.* (*E.*) *phyllostegiae* Carvalho & Usinger and *C.* (*E.*) *lysimachiae* Carvalho & Usinger but this species is infuscate at most, only on the apex of the cuneus and areole. It occurs sympatrically with *C.* (*E.*) *confusa*, but differs in being much paler and noticeably smaller; less than 3.30 mm long, contrasting with *confusa* which is greater than 3.50 mm long. Both species have the hind tarsi comparatively long.

The series from Kukuiala also bears a label stating "ex *Straussia*" but Dr. Usinger informs me, in conversation, that this was based on a sight



FIGS. 4–5. *Male pygophores*: a, *right lateral*; b, *terminal*. 4, Cyrtopeltis (Engytatus) cyrtandrae sp. n.; 5, C. (E.) terminalis sp. n.

identification which later proved incorrect.

Cyrtopeltis (Engytatus) terminalis sp. n. (Fig. 5)

Male: Elongate narrow, costal margins subparallel; pale yellow translucent without infuscations; pubescence pale inconspicuous. Body length 4.00 (3.65–4.14); width 0.81 (0.81–1.06). *Head*: Length 0.46 (0.46–0.48); width 0.47 (0.47–0.48); vertex width 0.30 (0.29–0.31); acute in front, tylus protuberent; eyes reddish; postocular space subequal to eye

length. *Antennae*: I, 0.35 (0.35–0.42); II, 1.36 (1.06–1.36); III, 1.40 (1.21–1.40), longer than II; IV, broken (0.44–0.55 in paratypes). *Pronotum*: Length 0.55 (0.48–0.60); width 0.76 (0.72–0.77); elongate narrow; callosities swollen; constricted laterally behind callosities; a longitudinal median impression from base of collar to middle of disc. *Rostrum*: Length 1.38 (1.38–1.60); reaching middle of mesocoxae. *Legs*: Entirely pale. *Pygophore*: Posterior bifurcation terminally hooked to the left. (Fig. 5a, b).

Female: Differing from ♂ as follows: Body length 4.45 (4.45–4.50); width 1.06. *Head*: Length 0.48 width 0.49; vertex width 0.33. *Antennae*: I, 0.38; II, 1.04; III, 1.15; IV, 0.50. *Pronotum*: Length 0.59 (0.59–0.60); width 0.82. *Rostrum*: Length 1.47; reaching middle of hind coxae.

Host plant: *Cyrtandra* sp.

Holotype ♂, allotype ♀, 1♂ paratype, Haleauau, Oahu, iii–8–36, *Cyrtandra*, A. Suehiro, Collector. Other paratypes: 2♂, Hawaiian Ids., Oahu, S. E. Koolau Mts., June 17, 1917, Pauoau, Ex *Cyrtandra*, J. C. Bridwell, Collector; 1♂, same data except, Cooke Trail; 2♂, 1♀, same data except, Mt. Kaala, July 22, 1917; 1♂, Nuuanu, Oahu, i–14–17, D. T. Fullaway.

This species and *C. (E.) sidae* sp. n. are the only Hawaiian species which are totally pale yellow translucent, but the latter is a much smaller species (less than 3.40 mm), whereas *terminalis* is longer than 3.65 mm, the pronotum is differently shaped and antenna III is shorter than II. This species is most closely related to *C. (E.) confusa*, both being quite similar in shape of the pronotum and in size. But *confusa* is dorsally infuscate and has the posterior bifurcation of the pygophore swollen and club-shaped and not apically twisted to the left as in *terminalis* (Fig. 5b).

Undoubtedly, host association will be found to be an isolating mechanism for the group of *Cyrtopeltis* species occuring on *Cyrtandra*. St. John (1966), in his monograph of this plant genus, recorded 118 species of *Cyrtandra* from Oahu alone and states (*pg.* 11) that "most of them are narrowly precinctive, growing in only one or in a few adjacent valleys, often only on one side of one mountain range." If the speciation of the host is in any way indicative, we can expect that many more species of *Cyrtopeltis* remain to be discovered on these plants.

ACKNOWLEDGEMENT

I would like to thank Prof. R. L. Usinger, University of California, Berkeley for suggesting and encouraging this study, for reviewing the manuscript, for making his collection available and for obtaining additional material from the Bishop Museum, Honolulu.

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