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A New Species of Flightless *Campsicnemus* (Diptera: Dolichopodidae) from the Wai‘anae Range, O‘ahu, Hawaiian Islands[1]

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INTRODUCTION

Flightless forms of otherwise normally alate insects are usually an adaptation to extreme environmental conditions. Islands, whether oceanic or island-ecosystems such as mountain summits or areas isolated from easy dispersal, are the most common places flightless insects may be found. In Hawaii, flightlessness has also developed in response to the lack of predatory ants. Ants have only recently (the last few hundred years) been introduced; thus, the Hawaiian fauna has evolved over millions of years in the absence of these predatory organisms. In the Dolichopodidae, flightlessness is extremely rare. Of the more than 7,700 species of long-legged flies found worldwide (Grichanov & Brooks, 2017), only 16 flightless species are known (0.2%). Within that number, eight, a remarkable 50% of all flightless dolichopodids, are found in the Hawaiian Islands. Bickel (2006) and Evenhuis (1997) summarized the species of flightless dolichopodids and noted that most are found above 1500 m and are found on islands. A seventeenth flightless species, the ninth in Hawai‘i, *Campsicnemus hao,* **n**. **sp**. is described herein. One population of the new species described herein is noteworthy in that it was found at roughly 400 m (one of the lowest elevations recorded for a flightless dolichopodid) in the midst of large populations of introduced ants.

MATERIAL AND METHODS

Specimens examined are housed in the Bishop Museum (BPBM). Morphological terminology follows Evenhuis (1997). Wing Interference Patterns were also investigated and species-specific differences, though slight, were noted [see Shevtsova *et al*. (2011) for details on this relatively new character suite]. Since virtually all the character that define species in *Campsicnemus* Haliday are found on the male, the male is the sex upon which most of the descriptions are based. I here describe the male, but also give the characters of the characters that differ in the female.

TAXONOMY

Campsicnemus Haliday

Campsicnemus Haliday *in* Walker, 1851: 187. Type species: *Dolichopus scambus* Fallén, 1823, by validation of I.C.Z.N., 1958: 351. *Nomen protectum* (see Evenhuis, 2003: 3).

1. Contribution No. 2018-005 the Hawaii Biological Survey.

Campsicnemus hao Evenhuis, **new species**
(Figs. 1–2, 4–6)

Campsicnemus bryophilus (Adachi). Evenhuis, 1997: 19, 20 (misidentification).

Diagnosis. Similar to *Campsicnemus bryophilus* (Adachi) but can be separated from it based on the antennal shape (flagellomere shorter than in *C. bryophilus*), wing shape (more bowed than *C. bryophilus*), wing venation (radial and cubital veins effaced and only evident as row of microtrichiae; these veins present without microtrichiae in *C. bryophilus*); Wing Interference Pattern (without a long blue streak subapically; this blue streak present in *C. bryophilus*), and the different setal number and pattern on the male mid tibia (cf. Figs. 3–4); specifically two different areas are marked in the figures as S1 and S2. S1 points to a row of three peg-like setae in *C. bryophilus*; this same area has only one such seta in *C. hao*; S2 points to a short socketed hair below the patch of peg-like setae in *C. bryophilus*; this hair is absent in *C. hao*.

Description. **Male**. Body length: 1.8–2.5 mm. Wing length: 2.2–2.8 mm.

Head. Black; oc and vt black, about one-half length of antennal arista; face constricted at middle, eyes holoptic, contiguous below antennae for length of 4–6 ommatidia; palp small, dark brown; proboscis brown, extending below eye in lateral view; antennal segments dark brown; postpedicel rounded, length about 1.5 x width; arista slightly longer than head height.

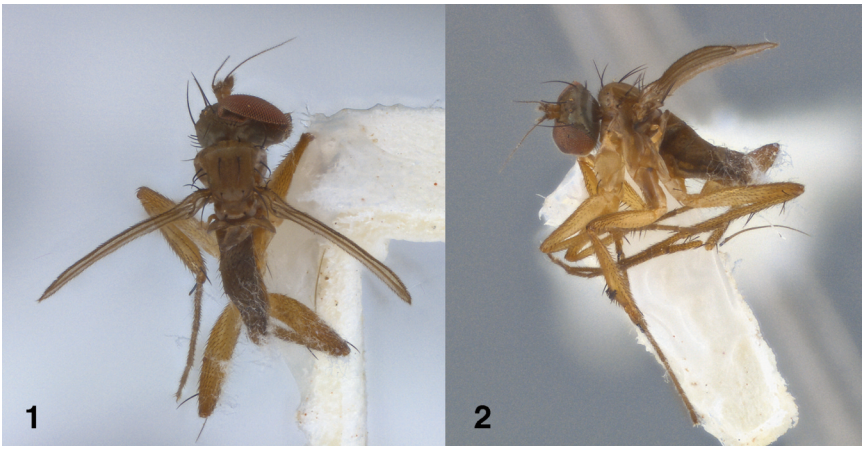
Thorax (Figs. 1, 2). Dorsum of mesoscutum, scutellum, and mediotergite brown with some brassy and green highlights, darker brown anteriorly; upper pleura concolorous with mesoscutum, lower pleura yellowish; thoracic setae long, strong, black: 3 dc; 2 np; 2 ph; 1 pa; 1 sc; ac absent; halter stem and knob pale brownish.

Legs. CI, CIII yellowish white, CI with two strong black setae apically, numerous smaller curved stiff setae; CII brown; remainder of legs yellowish brown; foreleg and hindleg unmodified, without MSSC; FII with row of 4–6 strong black setae ventrally on subbasal one-third, smaller setae in same row extending to apex; patch of 5–6 smaller black setae lateroventrally on subapical one-fourth; TiII (Fig. 4) swollen, widest subapically, apical one-fourth bearing dense patch short stiff peg-like black setae and longer hairs anterolaterally, paired rows of short black hairs on basal one-half, single thick strong long black chaeta at apical one-third, row of stiff setae laterally on basal half (all MSSC), smaller black setae and hairs along entire ventral surface, single strong black seta mesoapically. IIt_1 short, one-third length of IIt_2, dark brown, with thick apical black spur, semi-spatulate; IIt_2 ca. 1.5 x length of IIt_3; remainder of tarsi without MSSC.

Wing (Fig. 5, 6). Long, thin, bowed; pale smoky hyaline; anal field and venation absent; radial and cubital veins effaced and evident only as row of microtrichiae; medial vein present; Wing Interference Pattern (Fig. 6) with pale yellow area apically.

Abdomen. Brown, with short stiff curved black hairs dorsally on each tergite, uniformly distributed, a few longer hairs laterally, lateral hairs longest on tergite I; sternites brown. Hypopygium brown, not dissected.

Female. As in male except for lack of MSSC; antennal postpedicel subtriangular, length slightly shorter than width.

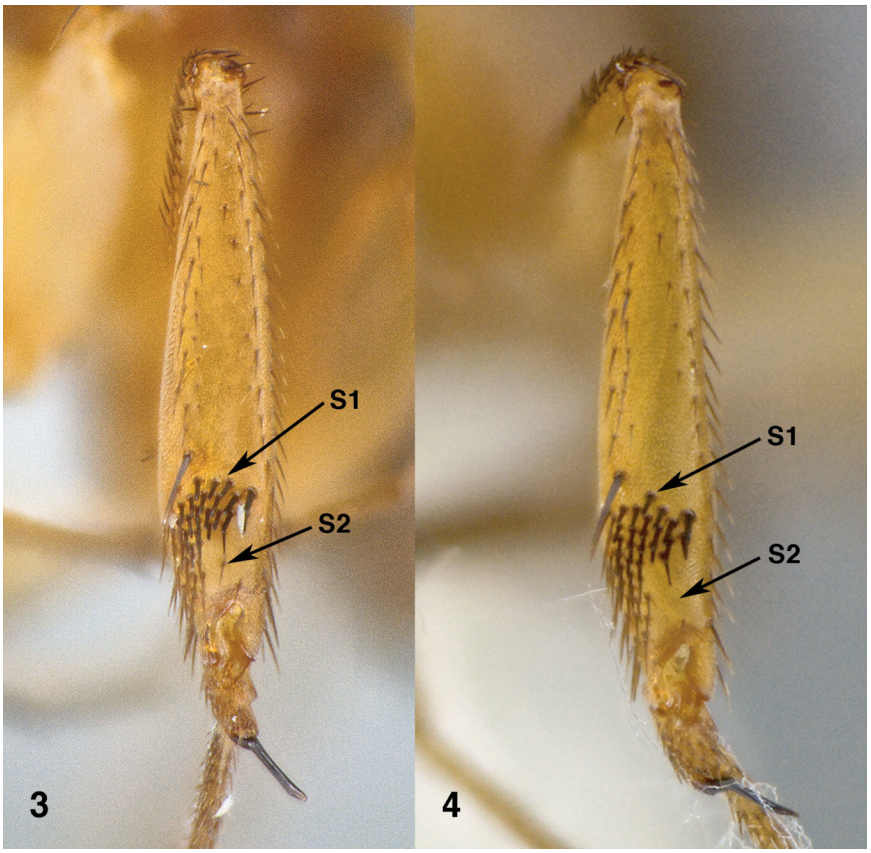


Figs. 1–2. *Campsicnemus hao*, n. sp., male holotype **1.** Dorsal view. **2.** Lateral view, male holotype.

Types. *Holotype* ♂ (BPBM Type 17,482) and 2♂,2♀ *paratypes* from HAWAIIAN ISLANDS: **O'ahu**: Mt. Ka'ala, [c. 1225 m], summit bog, leaf litter, 13 Jan 1993, S. Montgomery (BPBM). *Other paratypes*: **O'ahu**: 1♂,1♀, Lualualei Naval Magazine Annex, Halona Valley, 1404 ft [c. 425 m], N21.42472° W158.10368°, 18–21 Sep 2017, C. Campora, N. Evenhuis, C. Imada, pitfall trap, station #10. Holotype (pinned) and paratypes (pinned and in fluid) in BPBM.

Remarks. The discovery of a male and female of this flightless species in a pitfall trap in Halona Valley, Lualualei Naval Magazine Annex, O'ahu is noteworthy. In 1993, specimens of this flightless species were collected by Steve Montgomery and published (Evenhuis 1997) in a review of flightless dolichopodids on the Hawaiian Islands. After examination at that time, the specimens were identified as *Campsicnemus bryophilus* (Adachi), which occurs on Moloka'i. It was surmised that in order for a flightless fly to have such a disparate distribution (Moloka'i and O'ahu), the fly must have moved from one island to the other when the two were connected; the plausibility of that connection was made using data from Carson & Clague (1995). However, the hypothesis was extremely weak since the flies would have to have made that migration roughly 1.5 mya when the two islands were connected and maintain their conspecific status for 1.5 million years without contact outside of the gene pool of each disparate population after the island connection disappeared and have remained isolated since. After the 1997 review paper was published and no further specimens were observed despite frequent trips to the same site, it was thought possible that they might have been mislabeled specimens and no further thought was given to them.

Recently, when two specimens were found in one of the pitfall traps in a relatively low-elevational and much drier site in Halona Valley, O'ahu, they were re-examined and seen to be the same species as those collected at the high elevations in Wai'anae range on O'ahu (both the Ka'ala summit bog site and the Halona Valley site). I then re-examined the Moloka'i specimens of *Campsicnemus bryophilus* and compared them with the O'ahu specimens. More than 25 years have elapsed since I first described *C. bryophilus* and I



Figs. 3–4. Mid tibiae of *Campsicnemus*, lateral view of left leg. **3.** *C. bryophilus*. **4.** *C. hao*, n. sp. Numbered arrows point to differences in setation (see text for discussion).

have obtained much more knowledge on specific differences in *Campsicnemus* during that time. More characters were examined and it was found that the O‘ahu specimens do indeed belong to a separate and new species.

The differences in antennal flagellomere shape, leg setal pattern, Wing Interference Pattern, and venation are consistent between the two populations with no variation within each population, thus I feel confident that the two are separate species, the speciation having occurred at some point during that 1.5 million-year old migration event from one island to the other and then remaining isolated since.

Molecular analysis on the O‘ahu species could help determine if *C. bryophilus* and *C. hao*, n. sp. share a common winged or wingless ancestor. The molecular analysis conducted by Goodman *et al*. (2014) did not have available fresh specimens of the Wai‘anae specimens for analysis. In that study, *C. bryophilus* was found to be the sister of another flightless species from Maui, *C. aeptus* Hardy & Kohn.

Figs. 5–7. Wings of *Campsicnemus*. **5**. *C. hao*, bright field image showing venation; arrow points to microtrichiae on cubital vein. **6.** *C. hao*, Wing Interference Pattern. **7.** *C. bryophilus* Wing Interference Pattern; arrow points to blue streak.

The area in which the two specimens were collected in Halona Valley was observed to be replete with primarily two species of ants; the yellow crazy ant, *Anoplolepis gracilipes* (Smith) and the Papuan thief ant, *Solenopsis papuana* (Emery). How these flightless flies survived in the midst of these ants is unknown. The flightless flies in Hawai‘i are normally found at higher elevations in Hawai‘i where ants do not occur.

Etymology. The specific name derives from the Hawaiian, *ha‘o* = unusual, surprising; referring to the unusual finding of a flightless dipteran at such a low elevation.

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sorted the pitfall trapped material that led to the discovery of the flightless population of the Halona specimens. Dan Bickel kindly reviewed the manuscript and provided useful comments and corrections that helped improve the paper.

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