

# The *Campsicnemus macula* Parent complex in Hawai‘i (Diptera: Dolichopodidae): examples of volcanoes acting as islands?<sup>1</sup>

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**Abstract.** The *Campsicnemus macula* complex in the Hawaiian Islands is reviewed and found to contain seven species including *Campsicnemus conanti*, n. sp. from the island of Hawai‘i, which is described and illustrated here. Distributions in Hawai‘i are plotted revealing cases of one-species per volcano in the complex.

## INTRODUCTION

The long-legged fly genus *Campsicnemus* Haliday is one of the most speciose Diptera genera in Hawaii with an estimated 250–300 species. Goodman *et al.* (2014) conducted a molecular analysis of 70 species of *Campsicnemus* from the Hawaiian Islands and included another 14 from French Polynesia, Europe, and North America. The resulting phylogeny showed support for a number of clades of endemic Hawaiian species and is a useful template for further taxonomic and systematic studies on the group in the Pacific. One group that was not studied in detail I am calling the *macula* complex, in which species are characterized by having a cluster of setae on the male mid tibia, an infuscated crossvein dm-m, and sometimes a hyaline area posterior to this crossvein. Only one species was included in the Goodman *et al.* (2014) analysis (*C. halonae* Evenhuis from O‘ahu). Wing Interference Patterns were examined and corroborate the placement of species in this complex that possess conspicuous infuscation as well as those species where the infuscation on dm-m is not as discernable by showing that all species possess a blue streak or blue patch directly posterior to crossvein dm-m. In examining species fitting these characters, one new species was discovered, *Campsicnemus conanti* n. sp., which is described and illustrated. Plotting distributions against volcanoes on the various islands, it was found that there is at least one species per volcano (Table 1) and may be predictive of where other species in the complex may be found with future surveys (e.g., no species of the *macula* complex are yet known from Kaua‘i, the Ko‘olau Volcano on O‘ahu, Lāna‘i, West Maui, or from the Kohala volcano on Hawai‘i Island). In addition to describing and illustrating each species, a key is given to identify the species in this complex.

## MATERIAL AND METHODS

Material derives from collections deposited in the Bishop Museum, Honolulu, Hawai‘i, USA (BPM). Morphological terminology follows Evenhuis (2016) with wing venation following Grichanov & Brooks (2017). Confocal images were accomplished by using a Leica M165C stereo dissecting scope via the Leica Microsystems LAS Multifocus soft-

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ware (v. 5.0.1.2) and using Zerene Stacker<sup>®</sup> software (v. 1.04) (Zerene Systems, LLC, Richmond, Washington, USA) to align and stack-focus each final image. Minor enhancement of Wing Interference Patterns were accomplished in Photoshop CC by increasing contrast and saturation to better visualize color patterns.

## 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).

### *Campsicnemus macula* group

The group is characterized by the presence of a cluster or row of hairs and/or stiff setae on a swollen or bowed area in the subbasal or medial portion of the male mid tibia in combination with infuscation of crossvein dm-m and (often) a hyaline area immediately posterior to crossvein dm-m. In cases where the crossvein dm-m infuscation is not clear, a characteristic blue to blue-green patch or streak posterior to the crossvein can be seen in Wing Interference Pattern images. With the new species described herein, seven species are currently recognized in this complex.

**Included species** (types seen of all nominal species): *Campsicnemus bicrenatus* Hardy & Kohn, 1964 (Moloka'i); *C. biseta* Hardy & Kohn, 1964 (Moloka'i); *C. conanti* Evenhuis, n. sp. (Hawai'i); *C. fusticulus* Hardy & Kohn, 1964 (W. Hawai'i); *C. halonae* Evenhuis, 1996 (O'ahu); *C. macula* Parent, 1940 (E. Maui); *C. mediofloccus* Hardy & Kohn, 1964 (E. Maui).

#### KEY TO SPECIES IN THE *C. MACULA* COMPLEX IN THE HAWAIIAN ISLANDS (based primarily on males)

1. Cluster of setae on male mid tibia on swollen area at basal one-third (Figs. 2, 4, 5) ... **2**  
- Cluster of setae on male mid tibia not as above ..... **4**
2. Wing with hyaline spot posterior to crossvein dm-m (Figs. 10, 11 ) ..... **3**  
- Wing without hyaline spot posterior to crossvein dm-m ... (Moloka'i) .....  
..... *biseta* Hardy & Kohn
3. Mid tibia cluster with stiff erect setae (Fig. 5); Wing Interference Pattern generally magenta with blue and indigo in cell r2+3 (Fig. 17) ... (O'ahu) ... *halonae* Evenhuis  
- Mid tibia cluster with downcurved finer setae (Fig. 4); Wing Interference Pattern yellowish bronze with orange and magenta in cell r2+3 (Fig. 16) ... (West Hawai'i) ...  
..... *fusticulus* Hardy & Kohn
4. Cluster of setae on male mid tibia restricted to small patch at or below middle (Figs. 1, 7); wing without hyaline spot posterior to crossvein dm-m ..... **5**  
- Cluster of setae on male mid tibia a long row extending from upper fourth to just below middle (Figs. 3, 6); wing with hyaline spot posterior to crossvein dm-m ..... **6**
5. Cluster of setae black, thick, curved (Fig. 1) ... (Moloka'i) ... *bicrenatus* Hardy & Kohn  
- Cluster of setae brown, finer, woolly-like (Fig. 7) ... (Maui) ... *mediofloccus* Hardy & Kohn

6. Outer surface of male mid tibia with row of minute setae between mesal row and anterior row (Fig. 3); male mid femur with two rows of ventral setae; wing with  $R_{4+5}$  upcurved at wing margin (Fig. 9); WIP with cell r2+3 bronze-colored (Fig. 15) ... (Hawai'i) ..... *conanti* Evenhuis, n. sp.
- Outer surface of male mid tibia with bare area between mesal and anterior rows of setae (Fig. 6); male mid femur with single row of ventral setae; wing with  $R_{4+5}$  slightly downcurved toward wing margin (Fig. 13); WIP with cell r2+3 yellowish orange (Fig. 16) ... (East Maui) ..... *macula* Parent

*Campsicnemus bicrenatus* Hardy & Kohn  
(Figs. 1, 13)

*Campsicnemus bicrenatus* Hardy & Kohn, 1964: 45.

**Types.** Holotype ♂ (BPBM 000004087) from HAWAIIAN ISLANDS: **Moloka'i:** Pu'u Ali'i, Jul 1953, M. Tamashiro (BPBM). *Other material examined:* **Moloka'i:** 1♀, Pu'u Ali'i, Jul 1953, D.E. Hardy (= "allotype" of *C. biseta*) (BPBM).

**Diagnosis.** Most similar to *C. medioflocus* in both having a small patch of setae on the male mid tibia and the wing not having a hyaline area posterior to crossvein dm-m, but can be separated from it by the cluster of setae being thick, black and curved (these setae brown, finer and wooly-like in *C. medioflocus*). The WIP of the two also differ slightly with *C. bicrenatus* having cell r2+3 predominantly yellowish bronze (cell r2+3 is magenta basally, yellowish orange medially and blueish apically in *C. medioflocus*).

**Description**

**Male.** Body length: 1.65 mm. Wing length: 2.2 mm. *Head.* Black, face gray pollinose, subshining in some portions; oc and vt black, about one-half length of antennal arista; face constricted at middle, almost holoptic, eyes separated below antennae by width of 1–2 ommatidia; palp small, brown; proboscis brown, extending below eye in lateral view; antennal segments yellow; arista subequal to head height.

*Thorax.* Mesoscutum, scutellum, and pleura dark brown throughout; thoracic setae black: 3 + 1 dc; 2 np; 2 ph; 1 pa; 1 sc; ac absent.

*Legs.* CI white, smoky brownish basally; CII and CII brown; F and Ti yellowish except as noted, remainder of legs brownish; FI with small brownish patch of color dorsally in middle; FIII with dark brown band subapically. foreleg without MSSC; FII with row of ventral setae; FIII with single strong black seta subapically; TiII (Fig. 1) with large slightly swollen area on apical two-thirds bearing cluster of strong black apically curved setae (MSSC), 3 erect black setae on basal one-third; remainder of mid and hind legs normal, without MSSC.

*Wing.* subhyaline to pale smoky; faint infuscation on crossvein dm-m; WIP (Fig. 13) with cell r1 blue-green basally grading to indigo apically; yellowish bronze color in cell r2+3; cell r4+5 predominantly blue-green; cell m2 blue-green with streak of blue posterior to crossvein dm-m; anal lobe with magenta basally, surrounded by orange-bronze grading to blue-green along wing margin.

*Abdomen.* Dark brown to black with short black hairs dorsally on each tergite, a few longer hairs laterally. Hypopygium brown with paler brown cerci, not dissected.

**Female.** As in male except for lack of MSSC; legs normal, without modifications.



**Figures 1–7.** *Campsicnemus* male mid tibiae. 1. *C. bicrenatus*; 2. *C. biseta*; 3. *C. conanti*, n. sp.; 4. *C. fusticulus*; 5. *C. halonae*; 6. *C. macula*; 7. *C. mediofloccus*.

**Etymology.** Hardy & Kohn (1964) do not give an etymology, but the name appears to be based on the illustration in Hardy & Kohn (1964: fig. 3a) that shows the mid tibia having two rounded projections, thus *bi* (two) + *crenatus* (rounded projections). The illustration however is misleading in a number of points: (1) the orientation gives the impression that the clusters of setae are on the mesal or posterior surface (they are in fact on the anterior (outer) surface); (2) there is actually no upper rounded projection; and (3) the setae in this area are actually 3 long, stiff, and erect (as opposed to a cluster of numerous shorter down-curved setae on a small rounded projection in the illustration).

**Remarks.** The allotype of *C. biseta* Hardy & Kohn was re-examined and found to have the same WIP as the male holotype of *C. bicrenatus* and is here transferred to that species. It is odd that Hardy & Kohn (1964) thought the female was not *C. bicrenatus*, since the “allotype” female of *C. biseta* and the holotype male of *C. bicrenatus* were collected at the same place and time, just different collectors.

*Campsicnemus biseta* Hardy & Kohn

(Figs. 2, 14)

*Campsicnemus biseta* Hardy & Kohn, 1964: 46.

**Types.** Holotype m (BPBM 000004088) from HAWAIIAN ISLANDS: **Molokaʻi:** Hanalililo, 4,000 ft. [1,219 m], 1 Aug 1953, D.E. Hardy.

**Diagnosis.** Easily separated from other species in the complex by the presence of a cluster of setae on a swollen area on the upper third of the male mid tibia combined with the lack of a hyaline in cell m2 posterior to crossvein dm-m.

**Description**

Male. Body length: 1.5 mm. Wing length: 2.0 mm. *Head.* Gray-brown pollinose; oc and vt black, about one-half length of antennal arista; face constricted at middle; palp small, dark brown; proboscis brown, slightly extending below eye in lateral view; antennae with scape and pedicel yellow, postpedicel brown, conical with blunt apex, length about equal to greatest width; arista slightly longer than head height.

*Thorax.* Dorsum of mesoscutum and scutellum gray brown pollinose; upper pleura concolorous with mesoscutum, lower pleura subshining brown; thoracic setae long, strong, black: 3 dc; 2 np; 1 ph; 1 pa; 1 sc; ac absent; halter stem and knob yellowish.

*Legs.* CI yellow, CII and CIII brown, CI with 3–4 strong black setae apically; remainder of legs yellow; FI with 4–5 strong setae basoventrally; TiII (Fig. 2) with slightly swollen area at basal two-fifths bearing cluster of erect setae (MSSC), with mesal row of sparse erect setae; TiIII with two stiff erect black setae, otherwise hindleg unmodified, without MSSC; IIt<sub>1</sub> long, ca. 2× length of IIt<sub>2</sub>; remainder of tarsi without MSSC.

*Wing.* Subhyaline to pale smoky; slight infuscation on crossvein dm-m, without hyaline area immediately posterior to crossvein dm-m; WIP (Fig. 14) with cell r1 blue-green basally, grading to deep blue on apical two-thirds; orange-bronze color in cell r2+3, cell r4+5 predominantly blue-green; cell m2 blue-green with streak of blue posterior to crossvein dm-m, grading to broad area of blue-green apically; anal lobe yellowish basally and blue-green apically, with thin blue apically along wing margin.

*Abdomen.* Tergites I–IV concolorous with mesonotum; sternites brown. Hypopygium gray brown, not dissected.

Female. Unknown.



**Figure 8.** *Campsicnemus conanti*, n. sp. male habitus, lateral view.

**Remarks.** The “allotype” female of this nominal species from Pu‘u Ali‘i was re-examined and the Wing Interference Pattern shows it to belong to *C. bicrenatus* and not *C. biseta*. It is transferred here to *C. bicrenatus*.

**Etymology.** This species is named for the two erect setae on the hind tibia.

***Campsicnemus conanti* Evenhuis, new species**

(Figs. 3, 8, 9, 15)

*Campsicnemus* n. sp. nr. *macula* Parent: Preston *et al.* 2004: 22.

**Types.** *Holotype* ♂ (BPBM ENT 2008008976) and 3♂, 4♀ *paratypes* from HAWAIIAN ISLANDS: **Hawai‘i:** Keanakolu Gulch, 2,000 ft [610 m], 29 Oct 1952, C.P. Hoyt. *Other paratypes:* HAWAIIAN ISLANDS: **Hawai‘i:** 1♂, 1♀, Mauna loa Summit Trail, 7,000 ft [2,134 m], 24 Oct 1971, W.C. Gagné, *pyrethrum* sample #71-51; 1♂, nr. Humu‘ula, 3 Aug 1946, E.C. Zimmerman; 1♂, Humu‘ula, 30 Jul 1935, R.L. Usinger; 1♂, Kona Hema TNC, 14 Apr 2006, R. Peck, Malaise #5; 1♂, Mauna Loa Kipuka Mosaic NAR, Pu‘u Huluhulu, 19°14'11.14"N 155°27'58.85"W, 5 Apr 2004, D.J. Preston, M.K.K. McShane, fogging mossy fallen koa. *Holotype* and *paratypes* in in BPBM.

**Diagnosis.** This species is most similar to *Campsicnemus macula* from Maui, but can be separated from it by the presence of a row of minute setae on the male mid tibia between the outer and mesal rows (bare area in *C. macula*) and the bronze color in cell r2+3 in the WIP (yellowish orange in *C. macula*).

**Description**

Male (Fig. 8). Body length: 1.7 mm. Wing length: 2.0 mm. *Head.* Gray-brown pollinose; oc and vt black, about one-half length of antennal arista; face constricted at middle; palp small, dark brown; proboscis brown, slightly extending below eye in lateral view; antennae brown; postpedicel acute conical with rounded apex, length about equal to greatest width; arista slightly longer than head height.

*Thorax.* Dorsum of mesoscutum and scutellum gray brown pollinose; upper pleura concolorous with mesoscutum, lower pleura subshining brown; thoracic setae long, strong, black: 3 dc; 2 np; 1 ph; 1 pa; 1 sc; ac absent; halter stem and knob yellowish brown.

*Legs.* CI yellow, CII and CIII brown, CI with 3–4 strong black setae apically; remainder of legs yellow; FI with 4–5 strong setae basoventrally; hindleg unmodified, without MSSC; FII yellow with yellowish brown on apical one-fourth, with two rows of ventral setae: one row of 6 strong setae and one row of 6 shorter setae; TiII (Fig. 3) with anterior surface bearing elongated row of long thick setae, curved apically (MSSC), outer surface with medial row of minute setae in between anterior and mesal rows of minute setae; II<sub>1</sub> long, ca. 2× length of II<sub>2</sub>; remainder of tarsi without MSSC.

*Wing* (Fig. 9). Subhyaline to pale smoky; infuscation on crossvein dm-m and hyaline area immediately posterior to crossvein dm-m; WIP (Fig. 15) with cell r1 deep blue; yellowish bronze color in cell r2+3, cell r4+5 predominantly blue-green; cell m2 blue-green with large spot of blue posterior to crossvein dm-m, continuing as a thin streak medially, then broadening to encompass most of cell apically; anal lobe predominantly blue-green, thin blue basally along wing margin.

*Abdomen.* Tergites I–IV concolorous with mesonotum, with blue-green metallic highlights, tergites V–VI brown, each tergites with short stiff curved black hairs dorsally; sternites brown. Hypopygium gray brown, not dissected.



Figures 9–12. *Campsicnemus* wings. 9. *C. conanti*, n. sp.; 10. *C. fusticulus*; 11. *C. halonae*; 12. *C. macula*.

**Female.** As in male but no MSSC; WIP paler in color.

**Etymology.** The specific name honors the memory of Patrick Conant, long-time colleague and forest neighbor, for his friendship over the years, and his firm devotion to conserving native plants. For many years he had a mossy overgrown welcome mat on the stoop at his Volcano home and we sometimes both sat on the steps above it, sipped beers, and watched *Campsicnemus* frolicking, courting, and mating in the moss with Pentax Papilio II close-up binoculars. Good times. He left us way to soon.

*Campsicnemus fusticulus* Hardy & Kohn

(Figs. 4, 10, 16)

*Campsicnemus fusticulus* Hardy & Kohn, 1964: 94.

**Types.** *Holotype* ♂ (BPBM ENT 0000004115) and 8♂, 1♀ *paratypes* from HAWAIIAN ISLANDS: **Hawai'i:** north slope, Hualālai, 4,000–6,000 ft [1,219–1,829 m], Jul 1953, D.E. Hardy. Other *paratypes*: HAWAIIAN ISLANDS: **Hawai'i:** 1♂, Kīlauea, Kīpuka Ki, 4,250 ft [1,295 m], forest floor, 31 Jan 1945, F.X. Williams; 1♂, Kīlauea, Kīpuka Nene, 3,000 ft [914 m], on ground, 31 Jan 1945, F.X. Williams.

**Diagnosis.** Most similar to *C. halonae* due to both having a cluster of setae on a swollen area in the upper third of the male mid tibia and the presence of a hyaline spot in the wing in cell m2 immediately posterior to crossvein dm-m, but can be easily separate from it by the cluster of hairs consisting of fine downcurved hairs (these setae more thick, erect, and stiff in *C. halonae*) and the Wing Interference Pattern with yellowish bronze color in cell r2+3 (this cell generally magenta with blue and indigo in *C. halonae*).

**Description**

**Male.** Body length: 1.7 mm. Wing length: 2.0 mm. *Head.* Dark gray-brown pollinose; oc and vt black, about one-half length of antennal arista; face constricted at middle; palp small, dark brown; proboscis brown, slightly extending below eye in lateral view; anten-



nal scape and pedicel yellow, postpedicel yellowish brown, conical with acute apex, length about 1.3× greatest width; arista slightly longer than head height.

*Thorax.* Dorsum of mesoscutum and scutellum gray brown pollinose; upper pleura concolorous with mesoscutum, lower pleura subshining brown; thoracic setae long, strong, black: 3 dc; 2 np; 1 ph; 1 pa; 1 sc; ac absent; halter stem and knob yellow.

*Legs.* Coxae brown basally, yellow apically; remainder of legs yellow; CI without basal setae; FI with 4–5 strong setae basoventrally; hindleg unmodified, without MSSC; FIII yellow with yellowish brown on apical one-fourth, with one row of 5–6 strong ventral setae; TiII (Fig. 4) with swollen area on basal one-third, bearing long thick downcurved setae on outer surface and smaller setae on inner surface, with 2 stiff setae on outer surface above swollen area (MSSC); IIt<sub>1</sub> long, ca. 1.5× length of IIt<sub>2</sub>; remainder of tarsi without MSSC.

*Wing* (Fig. 10). Subhyaline to pale smoky; infuscation on crossvein dm-m and hyaline area immediately posterior to crossvein dm-m; vein R<sub>4+5</sub> downcurved at wing margin; vein M<sub>4</sub> not reaching wing margin WIP (Fig. 16) with cell r1 magenta at extreme base, then green medially grading to blue apically; cell r2+3 deep indigo basally grading to orange and yellow apically; cell r4+5 predominantly yellow; cell m2 bronze-green with large spot of blue posterior to crossvein dm-m; anal lobe predominantly bronze-yellow, narrow magenta basally along M<sub>4</sub>, thin blue along apical margin.

*Abdomen.* Black; sternites brown. Hypopygium gray brown, not dissected.

Female. As in male but no MSSC.

**Etymology.** This species is derived from the Latin diminutive, *fusticulus*, = ‘small club’; referring to the swollen area of the male mid tibia.

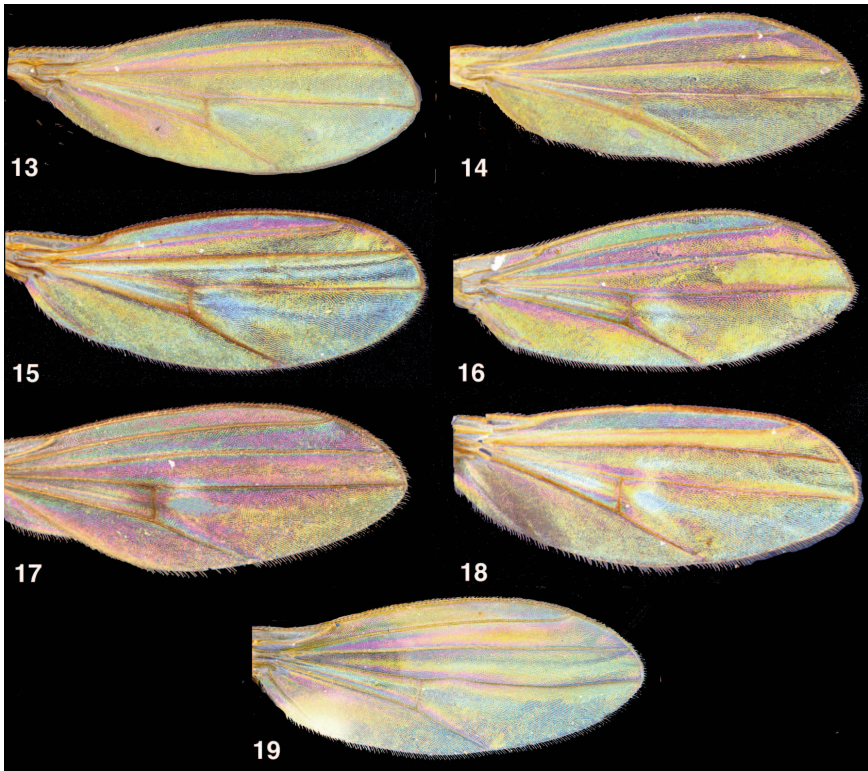
### *Campicnemus halonae* Evenhuis

(Figs. 5, 11, 17)

*Campicnemus halonae* Evenhuis, 1996: 55.

**Types.** *Holotype* ♂ (BPBM ENT0000015717) from HAWAIIAN ISLANDS: **O‘ahu:** Waianae Mts., Lualualei Naval Magazine, Halona Valley, 450 m, 22 Nov 1995, N.L. Evenhuis, yellow pans. *Paratypes:* 10♂♀, same data except, 9 May 1994, F.G. Howarth, at light; 10, 23 May 1994, G.M. Nishida; 1♂, 7 Dec 1995, D.J. Preston; 2♂, 3 Jan 1996, D.J. Preston & G.M. Nishida, Malaise trap; 4♂♀, 1,420 ft [432 m], 18–19 Jan 1996, D.J. Preston & G.M. Nishida, yellow pans; 1♂, 1,620 ft [493 m], 18–19 Jan 1996, D.J. Preston & G.M. Nishida; 15♂♀, Palikea Peak, 3,100 ft [945 m], 3 May 1995, D.A. Polhemus, running on leaves; 8♂♀, Pu‘u Kaua summit, 3,100 ft [945 m], 4 May 1995, D.A. Polhemus, sweeping understory. *Other material examined:* HAWAIIAN ISLANDS: **O‘ahu:** 1♂, 2♀, Mana Kapu, 29 Mar 1968, J.A. Tenorio & D. Ashdown; 4♂♀, Halona Valley, *Sapindus* grove, 16 Mar–19 Apr 1996; 1♂, Halona Valley, Pohakea Spring, 14 Mar 1996, G.M. Nishida, G.A. Samuelson; 1♂, Pu‘u Hāpapa, 2600 ft [792 m], 24 Feb 2010, K.N. Magnacca (all in BPBM).

**Diagnosis.** Most similar to *C. fusticulus* due to both having a cluster of setae on a swollen area in the upper third of the male mid tibia and the presence of a hyaline spot in the wing in cell m2 immediately posterior to crossvein dm-m, but can be easily separate from it by the thick, stiff, erect cluster of setae (these setae finer and downcurved in *C. fusticulus*) and the Wing Interference Pattern generally magenta with blue and indigo in cell r2+3 (this cell with yellowish bronze color in *C. fusticulus*).



Figures 13–19. *Campsicnemus* Wing Interference Patterns. 13. *C. bicrenatus*; 14. *C. biseta*; 15. *C. conanti*, n. sp.; 16. *C. fusticulus*; 17. *C. halonae*; 18. *C. macula*; 19. *C. mediofloccus*

### Description

Male. Body length: 1.68–1.76 mm. Wing length: 1.84–2.0 mm. *Head*. Black, face gray pollinose, subshining in some portions; oc and vt black, about one-half length of antennal arista; face constricted at middle, almost holoptic, eyes separated below antennae by width of 1–2 ommatidia; palp small, brown; antennal segments yellow; arista subequal to head height.

*Thorax*. Mesoscutum, scutellum, and pleura dark brown throughout; thoracic setae black: 3 + 1 dc; 2 np; 2 ph; 1 pa; 1 sc; ac absent.

*Legs*. CI white, smoky brownish black on basal 1/5; CII brown, slightly paler than surrounding pleura; CIII yellowish; F and Ti yellowish except as noted, remainder of legs brownish; FI with small brownish patch of color dorsally in middle; FIII with dark brown band subapically. foreleg without MSSC; FII with long black seta on apical 1/3, 4–5 smaller black setae apically (MSSC); FIII with single strong black seta subapically; TiII (Fig. 5) with small bulbous swollen area subbasally bearing 4–5 strong black apically curved setae (MSSC), smaller black setae and hairs along entire length, 2 strong black

setae near middle and single apical black seta; remainder of mid and hind legs normal, without MSSC.

*Wing* (Fig. 11) subhyaline to pale smoky; spot of smoky black color on crossvein dm-m; hyaline area just distal to crossvein dm-m; WIP (Fig. 17) generally magenta colored; cell r1 with dark blue-green subbasally, light magenta apically; cell r2+3 indigo; cell r4+5 magenta and orange colored; cell m2 dark magenta basally with blue spot immediately posterior to crossvein dm-m, magenta color grading to blue-green and bronze-yellow apically; anal lobe magenta with orange along wing margin.

*Abdomen*. Dark brown with short black hairs dorsally on each tergite, a few longer hairs laterally; tergal interstices white. Hypopygium brown with paler brown cerci, not dissected.

Female. As in male except for lack of MSSC; legs normal, without modifications.

**Remarks.** This species has been observed running on leaves on low-growing vegetation and on leaf litter on open ground.

**Etymology.** This species is named for the Wai'anae valley where it was first discovered.

### *Campsicnemus macula* Parent

(Figs. 6, 12, 18)

*Campsicnemus macula* Parent, 1940: 229.

**Types.** Lectotype ♂ (BPBM ENT 0000004060) from HAWAIIAN ISLANDS: **Maui** (E): Haleakalā, 3,500 ft [1,067 m], 20 Dec 1936, F.X. Williams (lectotype designated by Evenhuis (2007: 28) (all in BPBM). *Other material examined.* HAWAIIAN ISLANDS. **Maui** (E): 2♂, Manawainui Valley, 1,908 m, 19 Jul 2006, R. Peck; 2♂, 1♀, same data except 1,795 m, 7 Jun 2006; 4♂, 4♀, same data except 2,115 m, 29 Jun 2006 (all in BPBM).

**Diagnosis.** This species is most similar to *Campsicnemus conanti*, n. sp. from Hawai'i Island, but can be separated from it by the absence of a row of minute setae on the male mid tibia between the outer and mesal rows (present in *C. conanti*, n. sp); the single row of ventral setae on the male mid femur (two rows in *C. conanti*, n. sp), and the yellowish orange color in cell r2+3 in the WIP (bronze in *C. conanti*, n. sp).

### **Description**

Male. Body length: 1.7 mm. Wing length: 2.0 mm. *Head*. Gray-brown pollinose; oc and vt black, about one-half length of antennal arista; face constricted at middle; palp small, dark brown; proboscis brown, slightly extending below eye in lateral view; antennae with scape and pedicel yellowish; postpedicel brown, conical with blunt apex, length about equal to greatest width; arista slightly longer than head height.

*Thorax*. Dorsum of mesoscutum and scutellum coppery, gray pollinose; pleura subshining brown; thoracic setae long, strong, black: 3 dc; 2 np; 1 ph; 1 pa; 1 sc; ac absent; halter stem and knob yellowish.

*Legs*. CI and CIII dark brown, CII brown basally, yellowish apically; remainder of legs yellow; FII with row of 6 ventral setae; TiII (Fig. 6) with anterior surface bearing elongated row of long thick setae, curved apically (MSSC), outer surface bare, without medial row of minute setae in between anterior and mesal rows of minute setae; II<sub>1</sub> long, ca. 2× length of II<sub>2</sub>; remainder of tarsi without MSSC.

*Wing* (Fig. 12). Subhyaline to pale smoky; infuscation on crossvein dm-m and hyaline area immediately posterior to crossvein dm-m; WIP (Fig. 18) with cell r1 blue-green basally grading to indigo apically; golden yellow color in cell r2+3, cell r4+5 predominantly blue-green with elongated spot of blue medially; cell m2 with large spot of blue posterior to crossvein dm-m, continuing as a broad streak medially, then broadening to encompass most of cell apically, cell with orange-bronze color above and below blue spot; anal lobe magenta basally, yellowish and blue-green apically, thin blue basally along wing margin.

*Abdomen*. Black; sternites dark brown. Hypopygium gray brown, not dissected.

**Female**. As in male but no MSSC; WIP paler in color.

**Remarks**. Parent's type series consisted of an unspecified number of males from Palikea in the Wai'anae mountains of O'ahu collected on 15 November and from Haleakalā on Maui collected at 2,000 feet [610 m] elevation on 20 December 1936. Two specimens labeled as cotypes from Haleakalā were found in MNHN; one male from Haleakalā was located in BPBM (transferred from the HSPA collection). Hardy & Kohn (1964: 116) stated "Type in the Hawaiian Sugar Planters' Association collection". Evenhuis (2007) described the condition of the lectotype as "missing the head and the fore leg beyond the tibia; the right wing is torn at the humeral crossvein".

**Etymology**. This species name derived from the Latin *macula* = spot or mark; referring to the dark infuscation on the dm-m crossvein and the hyaline area posterior to it.

***Campsicnemus mediofloccus* Hardy & Kohn**  
(Figs. 7, 19)

*Campsicnemus mediofloccus* Hardy & Kohn, 1964: 117.

**Types**. Holotype ♂ (BPBM 0000004129) from Hawaiian Islands: **Maui**: Haleakalā Crater: Palikū, Jun 1952, D.E. Hardy.

**Diagnosis**. Most similar to *C. bicrenatus* in both having a small patch of setae on the male mid tibia and the wing not having a hyaline area posterior to crossvein dm-m, but can be separated from it by the cluster of setae being brown, fine and wooly-like (these setae thick, black and curved in *C. bicrenatus*). The WIP of the two also differ slightly with *C. bicrenatus* having cell r2+3 magenta basally, yellowish orange medially and blueish apically (cell r2+3 is predominantly yellowish bronze in *C. bicrenatus*).

**Description**

**Male**. Body length: 1.7 mm. Wing length: 2.0 mm. *Head*. Gray-brown pollinose; oc and vt black, about one-half length of antennal arista; face constricted at middle; palp small, dark brown; proboscis brown, slightly extending below eye in lateral view; antennal scape and pedicel yellow; postpedicel brown, conical with blunt apex, length about equal to greatest width; arista slightly longer than head height.

*Thorax*. Dorsum of mesoscutum and scutellum gray brown pollinose; upper pleura concolorous with mesoscutum, lower pleura subshining brown; thoracic setae long, strong, black: 3 dc; 2 np; 1 ph; 1 pa; 1 sc; ac absent; halter stem and knob yellowish brown.

*Legs*. CI yellow, CII and CIII brown, CI with 3–4 strong black setae apically; remainder of legs yellow; FI with 4–5 strong setae basoventrally; hindleg unmodified, without

MSSC; FII yellow with yellowish brown on apical one-fourth, with two rows of ventral setae: one row of 6 strong setae and one row of 6 shorter setae; TiII (Fig. 7) with anterior surface bearing elongated row of long thick setae, curved apically (MSSC), outer surface with medial row of minute setae in between anterior and mesal rows of minute setae; II<sub>1</sub> long, ca. 2× length of II<sub>2</sub>; remainder of tarsi without MSSC.

*Wing.* Subhyaline to pale smoky; infuscation on crossvein dm-m and hyaline area immediately posterior to crossvein dm-m; WIP (Fig. 19) with cell r1 deep blue; yellowish bronze color in cell r2+3, cell r4+5 predominantly blue-green; cell m2 blue-green with large spot of blue posterior to crossvein dm-m, continuing as a thin streak medially, then broadening to encompass most of cell apically; anal lobe predominantly blue-green, thin blue basally along wing margin.

*Abdomen.* Tergites I–IV concolorous with mesonotum, with blue-green metallic highlights, tergites V–VI brown, each tergites with short stiff curved black hairs dorsally; sternites brown. Hypopygium gray brown, not dissected.

**Female.** Unknown.

**Etymology.** This species names derives from the Latin *medio* = middle, + *floccus* = tuft or lock of wool; referring to the dense fluffy-looking patch of hairs on the middle of the male mid tibia.

**VOLCANOES ACTING AS ISLANDS**

Plotting distributions of each species in the *C. macula* complex (see Table 1) shows that there is at least one species per volcano, where the volcanoes are acting like an “island”, where species are possibly showing signs of allopatry in some cases. Table 1 show the current distribution of species in the *macula* complex against a list of the volcanoes in the main Hawaiian Islands, in chronological order with the oldest volcano (Kaua‘i) on the left and younger volcanoes to the right. All the species except *C. conanti* and *C. fusticulus* are found on one volcano only.

**Table 1. Volcanic Distribution of Species in the *C. macula* complex.**

[Volcano ages from Clague & Dalrymple (1989)]

Species	Kauai	Waianae	Koolau	West Molokai	East Molokai	Lānai	West Maui	East Maui	Kohala	Mauna Kea	Mauna Loa	Hualalai	Kīlauea
Age (Ma)	5.1	3.7	2.6	1.9	1.76	1.3	1.32	0.75	0.43	0.47	0.4	0.35	0.1
bicrenatus					x								
biseta					x								
conanti										x	x		x
fusticulus												x	
halonae		x											
macula								x					
medifloccus								x					

To maintain the single-volcano hypothesis for species in this group some species occurrences need some clarification: *Campsicnemus conanti*, n. sp. (Mauna Loa, Mauna Kea and Kīlauea) and *C. fusticulus* (Hualālai and Kīlauea) are found on more than one volcano. It is assumed due to the relatively young age of these volcanoes (the youngest emerged volcanoes in the Hawaiian Islands), these two species have had no obstacles over their relatively young age in the *macula* complex to prevent them from spreading. Over time, it hypothesized here that populations would settle into occupying a single volcano.

Given what appears to be a single volcano for most species, it is possible that we can predict that other species should be found within the current island range of the species group. Since no species in the *macula* complex have been found on Kauaʻi, it may be that *C. halonae* (found only in the Waiʻanae volcano on West Oʻahu) is the founding member of this lineage. The phylogenetic study in Goodman *et al.* (2014) estimated the age of the lineage containing *C. halonae* to be 1.5 Ma, yet the Waiʻanae volcano is 3.7 Ma, so *C. halonae* appeared more than 2 million years after the Waiʻanae volcano emerged. Other younger volcanos that provide similar habitats, vegetation, and temperature regimes thus could be predicted to harbor additional species of this complex. [Note: the West Molokai volcano (Mauna Loa\*) has eroded considerably and all of West Molokaʻi has undergone degradation of habitat from overgrazing and agriculture activity; thus, it would not be able to support any members of this complex; and no species of *Campsicnemus* have ever been collected from this arid western half of Molokaʻi.] Further collecting in the Koʻolaus on Oʻahu, Lānaʻi, West Maui, and the Kohalas on Hawaiʻi Island may discover further species of this complex.

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\* There are two volcanoes in Hawaiʻi named Mauna Loa: one on West Molokaʻi and one on Hawaiʻi Island.

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