



Review of the *spoon tarsus* subgroup of Hawaiian *Drosophila* (Drosophilidae: Diptera), with a description of one new species

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Abstract

The spoon tarsus species subgroup is revised and this clade is placed in the *modified tarsus* group of Hawaiian *Drosophila*. The species boundaries in this group are discussed in light of diagnostic secondary sexual characters of males. *Drosophila septuosa* Hardy is regarded as a junior synonym of *Drosophila percnosoma* Hardy. A new species, *Drosophila kikalaelele* Lapoint, Magnacca & O'Grady is described. *Drosophila fastigata* Hardy, a species endemic to O'ahu, is added to the species subgroup, bringing the total number of known species to 12. An updated key to species is provided to the spoon tarsus subgroup.

Key words:

Introduction

The Hawaiian Drosophilidae is an impressive example of an adaptive radiation, with an estimated 1,000 species filling diverse ecological niches (Heed 1968; Kambysellis *et al.* 1995; Magnacca, Foote & O'Grady 2008; Montgomery 1975) exhibiting an impressive array of behaviors (Spieth 1966). Males of many species display extreme sexual dimorphism in wing, foreleg, and mouthpart characters. These characters, in combination with the elaborate mating displays, have led many researchers to propose that sexual selection may play a role in the rapid diversification observed in this group (Kaneshiro 1988; Spieth 1966; Carson 1997).

The Hawaiian Drosophilidae are placed in two genera, *Drosophila* and *Scaptomyza*. The Hawaiian *Drosophila* lineage has been divided into a number of species groups and subgroups based on taxonomic (Hardy 1965), chromosomal (Carson & Stalker 1968), ecological (Heed 1968), and phylogenetic (Throckmorton 1966; Thomas & Hunt 1993; Kambysellis *et al.* 1995; Baker and DeSalle 1997; Remsen & DeSalle 1998; Bonacum 2001; Remsen & O'Grady 2002) analyses (Fig. 1). The *haleakalae* species group (*sensu* Hardy *et al.* 2001) is basal within the Hawaiian *Drosophila* lineage. Throckmorton suggested that the *ciliated tarsus* species group, characterized by having elongate setulae on the foretarsi of males, is also a more basal member of this group, although more recent molecular phylogenetic analyses have contradicted this placement and consider these species to be a subgroup within the *modified tarsus* species group (Bonacum 2001). A large assemblage of species belonging to the *modified mouthpart* and *picture wing* species groups form a poorly supported clade that is sister to two species groups, *antopocerus* and *modified tarsus*. The latter two groups together form what is referred to as the “leaf breeder clade” as the majority of species in this group utilizes decaying leaves as a larval substrate. The *modified tarsus* species group is divided into four subgroups, *split*, *bristle*, *ciliated* and *spoon tarsus*, based on sexually dimorphic characters on male forelegs

(Throckmorton 1966). Members of the *bristle* and *ciliated tarsus* subgroups have strong bristles on the apical portion of the basitarsus. Species placed in the *split tarsus* subgroup have only four tarsal segments (the remainder of species in Drosophilidae have five) and the second tarsal segment inserts medially into the first (rather than apically as in all other drosophilids). The *spoon tarsus* species have the second tarsal segment of the forelegs shortened and anteriorly concave, similar to a spoon. The *ciliated tarsus* subgroup is characterized primarily by lacking the modifications of the other subgroups, possessing only thin, elongate hairs that are commonly found on the tarsi of many Hawaiian *Drosophila*. While the *split* and *spoon tarsus* subgroups are monophyletic (Bonacum 2001), the *bristle tarsus* subgroup, along with the *ciliated tarsus* species subgroup, forms a paraphyletic grade at the base of the modified tarsus group. Two species of each of the latter were included in Bonacum's (2001) phylogenetic analysis, and were not sister to each other.

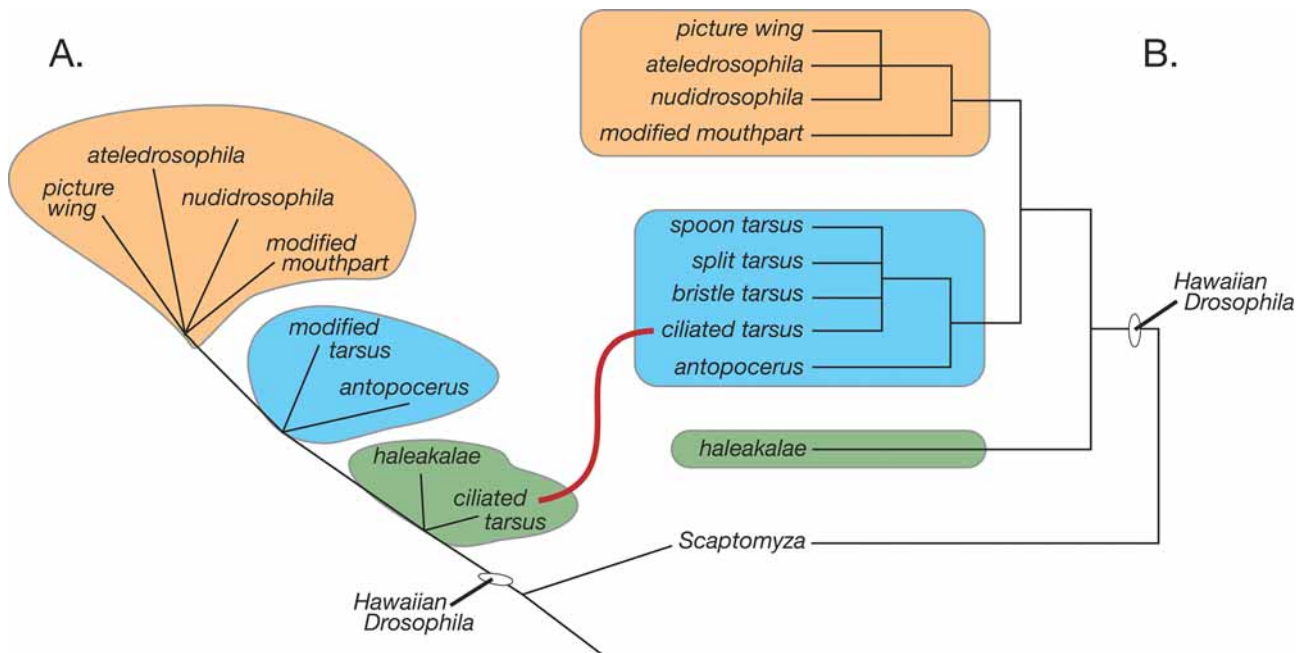


FIGURE 1. The phylogenetic relationships between the major Hawaiian *Drosophila* groups. a) phylogeny of species groups based on internal morphology (Throckmorton 1966), b) phylogeny of species groups based on molecular data (Bonacum 2001).

Grimshaw (1901) described the first *spoon tarsus* species, *Drosophila sordidapex*, from the island of Hawai'i. Later Hardy (1965) described nine new species in this subgroup when he revised the Hawaiian Drosophilidae: *D. conformis* (Hawai'i), *D. contorta* (Maui), *D. dasyncnemias* (Hawai'i), *D. incognita* (Hawai'i), *D. mimiconformis* (Maui Nui), *D. neutralis* (Hawai'i), *D. percinosoma* (Hawai'i), *D. septuosa* (Hawai'i), and *D. waddingtoni* (Hawai'i, Maui Nui). *Drosophila atroscutellata* from Kaua'i was added a year later (Hardy 1966). The *spoon tarsus* species are commonly found in association with the decaying leaves of Araliaceae (especially *Cheirodendron trigynum* and *Tetraplasandra oahuensis*) and Aquifoliaceae (*Ilex anomala*) (Magnacca *et al.* 2008). These taxa can be quite abundant during times of the year when there is a large amount of leaf material on the ground (Mangan 1978), and are readily attracted to fermented banana and mushroom baits. Characters diagnostic for species identification include the presence or absence of dense setae on the posterior surface of the fore tibia of the males, coloration of the face, thorax, legs and abdominal tergites, and position and intensity of infuscation on the apical portion of the wing. Other characters include degree of curving of the basitarsus (*D. contorta*) and the presence of long setae on the basitarsus (*D. incognita*).

Here, we describe one new species in this group, *Drosophila kikalaeleele* from Hawai'i, and place a second, already described taxon, *D. fastigata* Hardy from O'ahu, in the spoon tarsus subgroup due to its

enlarged second tarsal segment and the high morphological similarity of the basitarsus to that of *D. atroscutellata*. In addition, *D. septuosa* is regarded as a junior synonym of *D. percnosoma*. This brings the total number of spoon tarsus species to 12.

Material examined

Holotypes, paratypes, and series of other specimens are housed in the B. P. Bishop Museum (BPBM), the Natural History Museum (London) (BMNH), and University of Hawai‘i Insect Museum (UHIM). Recent collections (O’Grady, Magnacca, Lapoint, Bennett) were also examined for these descriptions. It is not possible to reliably identify spoon tarsus females to species so all descriptions included here refer only to male characters.

Collector abbreviations are: AB = A. Busck; AC = Andrew Christie; CDS = Chelsea D. Specht; CH = Cheryl Hayashi; CPH = C. P. Hoyt; DO = Deodoro Oliveira; DEH = D. Elmo Hardy; DF = David Foote; EHB = E. H. Bryan; EMC = Elysse M. Craddock; FEC = Francis E. Clayton; GMB = Gordon M. Bennett; GS = Gregor Schuurmann; HLC = Hampton L. Carson; HTS = Herman T. Speith; JBS = Julian B. Stark; JEG = John E. Gatesy; JWB = John W. Beardsley; KNM = Karl N. Magnacca; KRG = Kari Roesch Goodman; KTK, Kevin T. Kaneshiro; KYK = Kenneth Y. Kaneshiro; LHT = Lynn H. Throckmorton; MD = M. Dennis; MG = Mark Giannullo; MPK = Michael P. Kambyzellis; MRW = Marshall R. Wheeler; MT = M. Tamashiro; OHS = Otto H. Swezey; PMO = Patrick M. O’Grady; RN = R. Namba; RHR = Richard H. Richardson; RTL = Richard T. Lapoint; SH = Sara Hotchkiss, SLM = Stephen L. Montgomery; TL = T. Lyttle; WBH = William B. Heed; WCM = W. C. Mitchell; WMG = W. M. Giffard; YK = Y. Kondoh.

O’Grady field notes are decimal numbers prefaced with an O (e.g., O38.3); alcohol and DNA stocks maintained in the O’Grady Lab are six digit numbers prefaced with an O (e.g., O201595); frozen material maintained in the American Museum of Natural History’s Ambrose Monell Cryo Collection are six digit numbers prefaced by AMCC.

Key to males in the spoon tarsus subgroup

1. Front tibia densely setose on posterior surface with setae equal to or longer than tibial spur (Fig. 2b) 2
 - Front tibia not densely setose on posterior surface, setae present less than length of tibial spur (Fig. 2a) 4
2. Thorax entirely yellow, tinged with brown on dorsum; abdomen reddish brown on dorsum, yellow on sides and venter (Maui) *D. contorta*
 - Thorax brown to black; abdomen mostly dark brown to black 3
3. Fifth and sixth abdominal tergites yellow; wings hyaline; thorax dark brown to black; femora tinged with brown (Hawai‘i, Maui Nui)..... *D. waddingtoni*
 - Abdomen entirely dark brown to black; wings subhyaline with brownish infuscation extending through apical third of cell R_1 , across cell R_{2+3} , and through anterior ~1/2 of cell R_{4+5} (Fig. 3d); thorax brown; legs entirely yellow, coxae and apical tarsal segments yellow brown (Hawai‘i) *D. dasyncnemina*
4. Spoon reduced, segment not concave (Fig. 2a) 5
 - Spoon well developed, distinctly concave 6
5. Wing with apical spot extending from cell R_{2+3} to cell M_1 (Fig. 3a); thorax pale yellow (Kaua‘i)..... *D. atroscutellata*
 - Wings hyaline; thorax brown to dark brown (O‘ahu)..... *D. fastigata*
6. Front tibia setose on posterior surface without setae longer than tibial spur (Fig. 2e). Wings slightly darkened; thorax dark brown to black; femora, abdomen black (Hawai‘i) *D. percnosoma*
 - Coloration not as above; other characters variable 7
7. Anteroapical wing spot dark brown, distinct, covering apical 1/2 of cell R_{2+3} and extending halfway into cells R_1 and R_{4+5} (Fig. 3b: sometimes reduced to stripes along veins R_{2+3} and R_{4+5}) 8
 - Wings with spot absent or not as above, broader and more diffuse 9
8. Anal plate black (Hawai‘i)..... *D. kikalaeleele*
 - Anal plate yellow (Hawai‘i) *D. sordidapex*

9. Wings lacking distinct brown markings 10
 - Wings subhyaline with distinct brownish infuscation extending through apical 1/3 of cell R₁, across cell R₂₊₃, and through anterior ~1/2 of cell R₄₊₅ (Fig. 3c) 11
 10. Wings subhyaline, faintly infuscated with brown, but lacking distinct markings (Hawai'i) *D. neutralis*
 - Wings completely hyaline (Maui Nui) *D. mimiconformis*
 11. Front basitarsus with ~7 long setae on apical half of anterior margin (Fig. 2d); dark brown to black thorax; sixth and part of fifth tergites yellow (Hawai'i) *D. incognita*
 - Front basitarsus with few weak setae; sixth tergum black, nearly as long as fifth tergum; Anal plate yellow (Hawai'i) *D. conformis*

***Drosophila atroscutellata* Hardy**

Figures 2a and 3a

Drosophila atroscutellata Hardy, 1966: 200

Diagnosis. The spoon structure of *Drosophila atroscutellata* males is highly reduced relative to the other taxa in this subgroup. The forebasitarsi is slightly extended apically and densely setose with 7 bristles that start at the apex and extend 2/3 of the length of the segment. The second tarsal segment on the forelegs of the male is barely wider than the third tarsal segment, about as long and lacking concavity. Legs mostly yellow, with a dark brown margin at the apical end of the middle tibia (see Fig. 2a). Thorax light yellow except for the dark brown scutellum. The wings are hyaline except for a dark apical spot extending from the anterior portion of vein R₂₊₃ to halfway through cell M₁ (see Fig. 3a).

Types. KAUA'I: Holotype ♂ (BPBM 11258), Halemanu Valley, 1220m, 28.viii.1964, HTS. Allotype ♀ (BPBM 11258a), same collection as holotype. Type locality reported as "Malemanu Valley" by Evenhuis (1982).

Material Examined. KAUA'I: 8 ♂ have been studied from the BPBM: ♂, Kōke'e, 3600 ft, vii.1963, HLC, FEC & MRW; 2 ♂, Kōke'e, 3600 ft., vi.1964, HLC, FEC & MRW; 2 ♂, Halemanu Valley, 4000 ft, vi.1964, FEC, MRW, DEH & HTS; 3 ♂, Nu'alolo Trail, 3800 ft., v.2007, KNM. Over 40 ♂ and 25 ♀ in the UHIM were also examined from the following localities: 4 ♂ and 4 ♀, from Kōke'e, 3600', iii.1964, MRW; ♂, Kōke'e, 3600', iv.1964, DEH; 15 ♂, Kōke'e, 3600', vi. 1964, DEH, HTS, HLC; ♂ and 2 ♀, Kōke'e, 3600', vi.1966, DEH; 4 ♂, Halemanu Valley, 4000', iii.1964, MRW; 16 ♂ and 14 ♀, Halemanu Valley, 4000', vi.1964, DEH, HTS, HLC; 3 ♂ and 5 ♀, Halemanu Valley, 4000', viii.1964, DEH, HTS.

Distribution. This species is endemic to wet forest habitat on Kaua'i.

Chromosomes. The metaphase complement of this species is 5 rods and 1 dot (Clayton 1968; Yoon & Richardson 1978).

Illustrations. Foreleg (Hardy 1966: 201, figs. 3c, d); mouthparts (Hardy 1966: 201, fig. 3a); wing (Hardy 1966: 201, fig. 3b); middle tibia (Hardy 1966: 201, fig. 3e); male genitalia, ventral and lateral (Hardy 1966: 201, figs. 3f, g); female genitalia, lateral (Hardy 1966: 201, fig. 3h).

Discussion. *Drosophila atroscutellata* is the only spoon tarsus species recorded from Kaua'i. It is considered the most basal member of the group because of its highly reduced spoon.

***Drosophila conformis* Hardy**

Figures 2c and 3c

Drosophila conformis Hardy, 1965: 319–320

Diagnosis. Tibia lacking profuse setae equal to, or longer than, the tibial spur. Legs are completely yellow, except for last tarsal segment being brown (see Fig. 2c). The thorax ranges from light to dark brown. The

wings have a diffuse brown marking apically, which extends from cell R_1 to halfway through cell R_{4+5} (see Fig. 3c). The abdomen is completely black.

Types. HAWAII: Holotype ♂ (BPBM 6330) Upper Ōla‘a Forest, vii.1953, DEH. Allotype ♀ (BPBM 6330a) same collection as holotype (Evenhuis 1982).

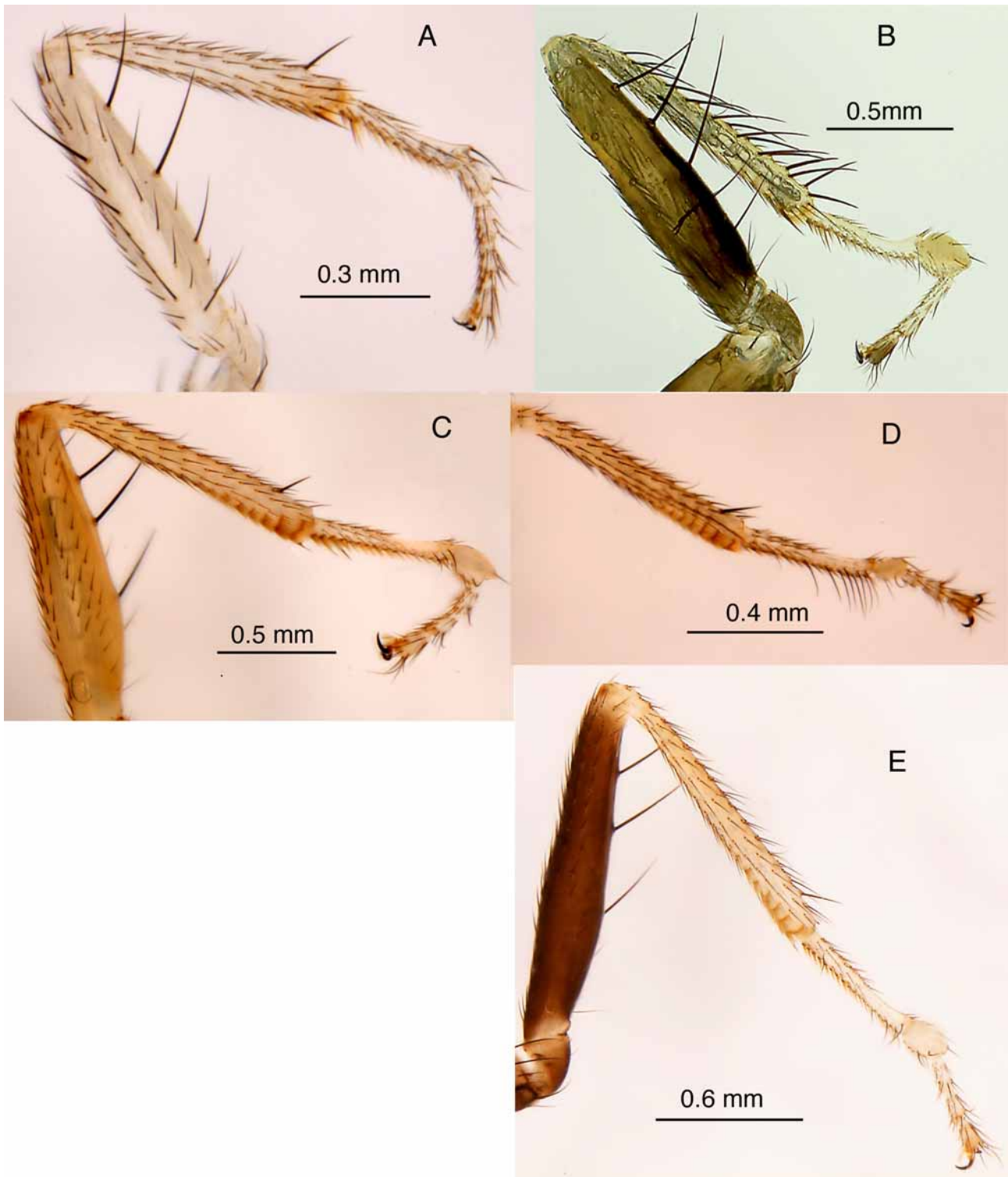


FIGURE 2. Fore-legs of selected males a) *D. atroscutellata*, b) *D. dasyncnemia*, c) *D. conformis*, d) *D. incognita*, and e) *D. percnosoma*.

Material Examined. HAWAII: 16♂ have been studied from the BPBM: 4♂, Kīlauea, viii.1958, JWB; ♂, Kīlauea Field Station, 3900 ft., vi.2006, KNM; ♂, Manukā vii.2006, KNM; ♂, Stainback Highway, Tom's Trail, 3200', x.2006, KNM, RTL, GMB; 2♂, Pu'u Huluhulu, x.2006, KNM, RTL, GMB; 2♂, Laupāhoehoe, 3800', x.2006, KNM, RTL, GMB; 5♂, Ōla'a, Tr 18, ii.2006, KNM. 22♂ deposited in the UHIM have been examined from the following localities: 3♂, Kīlauea, viii.1958, JWB; 9♂, Upper Ōla'a, viii.1952, DEH; ♂, Nāpau Crater, Kīlauea, vii.1953, DEH; ♂, Nāpau Crater, Kīlauea, vii.1953, DEH; 6♂, Keanakolu, vi.1966, WBH; 2♂, Hōnaunau Forest Reserve, ii.1966, WBH. The following material is present at AMNH: ♂, Stainback Highway, 7–8.ii.1999, O49.2, PMO, SLM; 2♂, Volcanoes National Park, Ōla'a Forest, near Pole 44, O112.2, 20.x.2000, PMO; ♂, Volcanoes National Park, Kīpuka Puauulu, O127.5, 29.vii.2001, PMO; 2♂, Volcanoes National Park, Ōla'a Forest, near Pole 44, O128.4, 29.vii.2001, PMO, CDS; 18♂, Volcanoes National Park, Ōla'a Forest, near Pole 44, O132.5, AMCC105703, 2.viii.2001, PMO, CDS; 48♂, Volcanoes National Park, Ōla'a Forest, near Pole 44, O140.7, AMCC105686, 12.iv.2002, PMO, CDS. The following material is in the Essig Museum of Entomology at UC Berkeley: 3♂, Volcanoes National Park, Ōla'a Forest, near pole 48, O247.2; O201320; 6–7.vii.2004, PMO, MG, CDS.

Distribution. This species is endemic to the Big Island of Hawai'i.

Behavior. Shelly (1987; 1990).

Ecology. This species has been reared from leaves of *Ilex anomala* (Aquifoliaceae) (Heed 1968).

Illustrations. Morphological structures of this species are depicted in multiple publications including: foreleg (Hardy 1965: 220, figs. 66a, b); phallus (Kaneshiro 1976: 267, fig. 5d); terminalia, male, lateral (Hardy 1965: 220, fig. 66c).

Molecular Biology. DNA sequences (O'Grady & DeSalle 2008).

Drosophila contorta Hardy

Drosophila contorta Hardy, 1965: 226–227

Diagnosis. Elongate setae present on the posterior surface of fore tibia. The front basitarsus of the males is curved and the face is distinctly concave. The spoon is as long as the third tarsal segments, nearly as wide and distinctly concave. The coloration of the species is very light. The wings are subhyaline (see Fig. 3e for example).

Types. MAUI: Holotype ♂ (BPBM 6333) Waikamoi, 1220 m, vii.1956, DEH. Locality recorded as “Waiakamoi” on type label (Evenhuis 1982).

Material Examined. MAUI: The following material is present at AMNH: ♂, Makawao Forest Reserve, Pig Hunter's Trail, O153.K, AMCC105817, 23.iv.2002, PMO, DO.

Distribution. This species is endemic to Maui.

Illustrations. Foreleg (Hardy 1965: 227, fig. 69b); head (Hardy 1965: 227, fig. 69a).

Drosophila dasyncnemias Hardy

Figures 2b and 3d

Drosophila dasyncnemias Hardy, 1965: 236–238

Diagnosis. Elongate setae present on the posterior surface of fore tibia. The legs are yellow except for brown coxae and terminal portions of the last tarsi (see Fig. 2b). Wings are lightly infuscated with a brown marking apically, which extends from cell R_1 to halfway through cell R_{4+5} (see Fig. 3d). The thorax is brown, and the abdomen is almost entirely dark brown, with the last tergite being yellow.

Types. HAWAII: Holotype ♂ (BPBM 6337) Upper Ōla'a Forest, viii.1952, DEH (Evenhuis 1982).

Material Examined. HAWAII: 61 ♂ have been deposited in the BPBM: ♂, Kaiwiki, ix.1918, OHS; 2 ♂, Stainback Highway, 3600', x.2006, KNM, RTL, GMB; 2 ♂, Stainback Highway, Tom's Trail, 3200', x.2006, KNM, RTL, GMB; 2 ♂, Kīpuka 9, Kaūmana Trail, x.2006, KNM, RTL, GMB; 5 ♂, Ōla'a Forest, x.2006, KNM, RTL, GMB; 5 ♂, Ōla'a Tr 18, vi.2006, KNM; 10 ♂, Ōla'a Tr 18, ii.2006, KNM; 3 ♂, Kawaihae Uka, Kohalas, x.2006, KNM, RTL, GMB; ♂, Kukuioipa'e, South Kona Forest Reserve, x.2006, KNM, RTL, GMB; 5 ♂, Laupāhoehoe, 3700', x.2006, KNM, RTL, GMB. 30 ♂ from the UHIM have been examined from the following localities: 5 ♂, Upper Ōla'a, vii.1956, DEH, WCM; 3 ♂, Upper Ōla'a, viii.1958, DEH, WCM; 12 ♂, Upper Ōla'a, viii.1952, DEH, WCM; 7 ♂, Kīlauea, viii.1958, JWB; 2 ♂, Volcano, v.1915, AB; ♂, Mud Lane, vi.1964, DEH, LHT. The following material is present at AMNH: 5 ♂, Forest behind Volcano Solid Waste Transfer Station, O40.4, 5.vii.1998, PMO, SLM; 14 ♂, Stainback Highway, 7–8.ii.1999, O49.3, PMO, SLM; 2 ♂, Forest behind Volcano Solid Waste Transfer Station, O51.5, 12–14.iii.1999, PMO, JBS; 5 ♂, Volcanoes National Park, Ōla'a Forest, near Pole 44, O93.6, 7.ix.2000, PMO; 16 ♂, Volcanoes National Park, Ōla'a Forest, near Pole 44, O132.6, 2.vii.2001, PMO, CDS. The following material is in the Essig Museum of Entomology at UC Berkeley: 8 ♂, Volcanoes National Park, Ōla'a Forest, near pole 48, O247.2; O201321; 6–7.vii.2004, PMO, MG, CDS; 5 ♂, Tree Planting Road, O256.8; O201497; 11.vii.2004, PMO, MG; 4 ♂, Puu Makaala Trailhead, O257.1, O201318, 11.vii.2004, PMO, MG; ♂, Kohala Mountains, Top of Waipio Falls, O269.6, O201595, 16.vii.2004, PMO, CDS, GS, SH, MG; 2 ♂, Volcanoes National Park, Upper Ōla'a Forest, end of Wright Road, O272.F, O200625; 20.vii.2004, PMO, MG, GS, AC.

Distribution. This species is endemic to the island of Hawai'i.

Behavior. Speith (1966:272).

Ecology. This species has been reared from leaves of *Cheirodendron trigynum* (Araliaceae) (Heed 1968; Mangan 1978).

Illustrations. Morphological structures of this species are depicted in multiple publications including: foreleg (Hardy 1965: 237, fig. 74a); phallus (Kaneshiro 1976: 267, fig. 5 ♀); terminalia, male, lateral (Hardy 1965: 237, fig. 74c); wing (Hardy 1965: 237, fig. 74b; Edwards et al 2007: fig7).

Molecular Biology. DNA sequences (Baker & DeSalle 1997).

Drosophila fastigata Hardy

Drosophila fastigata Hardy, 1965: 271–273

Diagnosis. Legs entirely yellow. Apex of the basitarsus extends dorsally into a hatchet shaped lobe with two setae. The second tarsal segment is as long as wide and not concave. Wings hyaline, lacking distinct markings (see Fig. 3e for example). Thorax brown tinged with yellow, darker dorsally. Scutellum ranges from dark brown to black. Abdominal tergites are brown, except for last tergite which is yellow.

Types. O'AHU: Holotype ♂ (BPBM 6529) Pūpūkea, vii.1958, DEH (Evenhuis 1982).

Material Examined. O'AHU: 9 ♂ have been studied from the BPBM: ♂, Poamoho Trail, 1700', v.1953, DEH; ♂, Mt. Ka'ala, iv.1929, EHB; 2 ♂, Manoa Cliff Trail Trail, ii.2007, KNM; 5 ♂, Mt. Ka'ala, 3950', v.2007, KNM.

Distribution. This species is endemic to the island of O'ahu.

Ecology. This species has been reared from leaves of *Cheirodendron platyphyllum* (Araliaceae) (Heed 1968).

Illustrations. Foreleg (Hardy 1965: 272, fig. 93a); terminalia, male, lateral (Hardy 1965: 272, figs. 93b, c).

Discussion. *D. fastigata* is the only spoon tarsus species endemic to O'ahu. Due to its morphological similarity to *D. atroscutellata*, this species is included in this group, but is also considered basal due to the reduced spoon.

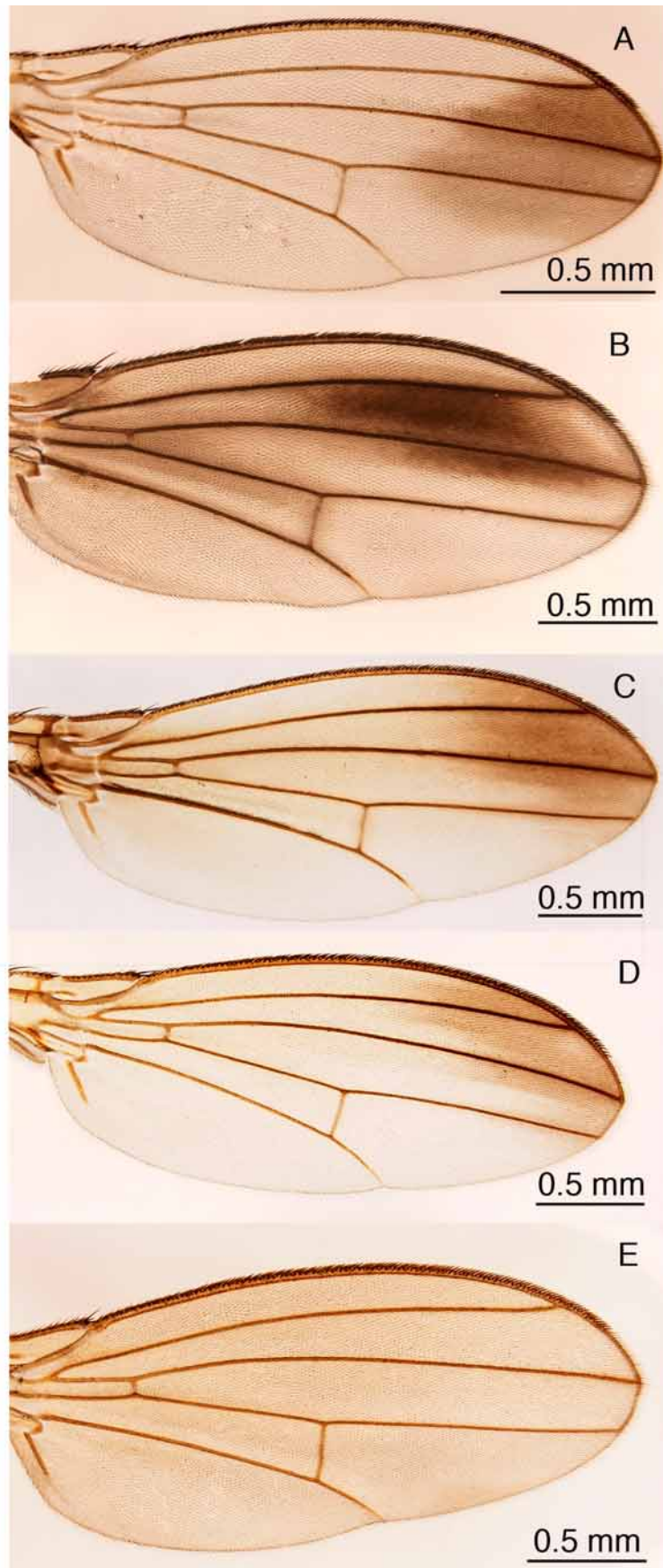


FIGURE 3. Wings of selected species a) *D. atroscutellata*, b) *D. sordidapex*, c) *D. conformis*, d) *D. dasyncemia*, and e) *D. waddingtoni*.

Drosophila incognita Hardy

Figure 2d

Drosophila incognita Hardy, 1965: 319–320

Diagnosis. The anteroapical portion of the forebasistarsus of males have 6 to 8 long setae (see Fig. 2d). The thorax is dark brown. The apical wing spot is similar to that of *D. conformis* but darker (see Fig. 3c for example). The lateral portion of most of the abdomen and the entire final tergite is yellow.

Types. HAWAII: Holotype ♂ (BPBM 6377) Upper Ōla‘a Forest, viii.1952, DEH (Evenhuis 1982).

Material Examined. HAWAII: ♂ has been studied from the BPBM: Ōla‘a Trail 18, vi.2006, KNM. 6 ♂ have been studied from the UHIM: 2 ♂, Upper Ōla‘a Forest, vii.1956, DEH; ♂, Kīlauea, viii.1958, JWB; 2 ♂, Upper Ōla‘a Forest, viii.1952, DEH; ♂, Kaiholena, Kohala Mountains, viii.1952, DEH. The following material is present at AMNH: ♂, Volcanoes National Park, Ōla‘a Forest, near Pole 44, O132.7, AMCC105701, 2.viii.2001, PMO, CDS. The following material is in the Essig Museum of Entomology at UC Berkeley: ♂, Tree Planting Road, O256.8; O201315; 11.vii.2004, PMO, MG.

Illustrations. Morphological structures of this species are depicted in multiple publications including: foreleg (Hardy 1965: 320, fig. 118a); phallus (Kaneshiro 1976: 267, fig. 5c); terminalia, male, lateral (Hardy 1965: 320, fig. 118c); wing (Hardy 1965: 320, fig. 118c)

Discussion. This species is morphologically very close to *D. conformis* and the defining features are the long setae on the basitarsus.

Drosophila kikalaeleele, Lapoint, Magnacca & O’Grady new species

Diagnosis: This species is very similar to *D. sordidapex* in overall morphology, notably the discrete marking at the apical portion of the wing, and is inferred to be the sister species. *Drosophila kikalaeleele* is differentiated by the last two tergites being completely yellow on an otherwise completely brown to black abdomen, and by having the anal plate black.

Male Description. Body length: 2.5 to 3 mm. Wing length: 3 mm. **Head.** Lower portion of frons yellow. Ocellar triangle black. Vertex ranges from brown to black. Face ranges from light to dark brown. Gena yellow. Ocellar and vertical setae ~ as long as antennal arista. Anterior reclinate slightly shorter than proclinate. Clypeus, labella and palpi yellow. Several weak black setae on apical portion of palpi. Labellum fringed with weak yellow setae. Mouthparts not ornate. First and second antennal segments yellow. Third antennal segment completely dark brown to black. 6 dorsal rays, 2 ventral rays and apical fork on arista.

Thorax. Thorax dorsally light brown with four rufous stripes running anterior to posterior. Scutellum entirely yellow. The anepisternum dark brown, otherwise lateral portion of thorax yellow tinged with light brown. Posterior dorsocentral setae 1/3 longer than anterior dorsocentral setae. Apical scutellar setae ~2/3 as long as the basal scutellar setae. Haltere completely yellow.

Legs. Basitarsi lack setae apically; second tarsal segment concave and 1/3 longer than third tarsal segment. Fore and mid legs entirely yellow except for slight darkening of fifth tarsal segment and middle tibia. Mid leg yellow except for brown tibia. Short setae 1/2 as long as preapical bristle on tibia.

Wings. Discretely edged wing spot darkens apical half of cell R_{2+3} , lower apical margin of cell R_1 and upper apical margin of cell R_{4+5} . Remainder of wing hyaline. Costal fringe extends halfway between apical margin of cell R_{2+3} (see Fig. 3b).

Abdomen. Dorsal tergites dark brown to black with yellow on posterior margins of each tergite, except for yellow to light brown fifth and sixth tergites. Sternites yellow. Anal plate dark black. Genitalia identical to *D. sordidapex*.

Type Material. Holotype ♂ (BPBM 16909), South Kona Forest Reserve, x.2006, RTL, KNM, GMB.

Material Examined. HAWAII: 2 ♂ have been deposited into the BPBM: ♂, Ōla‘a Trail 18, vi.2006, KNM; ♂ South Kona Forest Reserve, x.2006, RTL, KNM, GMB. 30 ♂ have been deposited in the UHIM from the following localities: 19 ♂, Hualālai, vii.1970, WBH, MD, TL; 3 ♂, Hualālai, 3400’, xii.1969, KYK; ♂, Kīpuka No 9, Saddle Rd, vi.1969, WBH; 4 ♂, Kīpuka No 14, 5100’, Saddle Road, vii.1969, WBH; ♂, Pu‘u Huluhulu, vii.1969, RHR; ♂, Greenwell Ranch, Pauahi, vi.1974; ♂, Upper Ōla‘a Forest Reserve, x.1988, KYK.

Distribution and Ecology. Reared from *Ilex* leaves by W. B. Heed. Collected at Hualālai, Pu‘u Huluhulu, the Saddle Road Kīpukas and the Ōla‘a Forest.

Etymology: A combination of the Hawaiian words ‘ele‘ele = black and kikala = buttock, posterior.

Relationships. Based on overall morphology, especially wing patterning, this species is close to *D. sordidapex*.

***Drosophila mimiconformis* Hardy**

Drosophila mimiconformis Hardy, 1965: 367–369

Diagnosis. The labella, palpi and frons are all yellow. The fore-tibia of the males lacks numerous vertical setae present on other species (see Fig. 2c). The wings are completely hyaline (see Fig. 3e). The thorax ranges in color from light to dark brown. The legs are entirely yellow. The abdomen is completely black.

Types. MOLOKA‘I: Holotype ♂ (BPBM 6401) Maunawainui Valley, vii.1952, DEH (Evenhuis 1982).

Material Examined. MOLOKA‘I: 2 ♂ has been studied from BPBM: ♂, Maunawainui Valley, vii.1952, DEH; ♂, East Kawela Gulch, ii.2007, KNM. 26 ♂ have been deposited in the UHIM from the following localities: ♂, Hanalilolilo, viii.1953, MT; 15 ♂, Maunawainui Valley, vii.1952, DEH; 2 ♂, Pu‘u Ali‘i, vii.1953, DEH, MT; 4 ♂, Pu‘u Kolekole, v.1965, DEH; 3 ♂, Pu‘u Kolekole, vi.1964, DEH; 2 ♂, South of Hanalilolilo, vii.1964, DEH.

Distribution. This species is endemic to Maui Nui (Moloka‘i, Maui, Lana‘i).

Ecology. This species has been reared from leaves of *Cheirodendron trigynum* (Araliaceae) on Maui and Moloka‘i; leaves of *Tetraplasandra* sp (Araliaceae) on Moloka‘i; leaves of *Ilex anomala* on Maui (Aquifoliaceae) (Heed 1968).

Illustrations. Morphological structures of this species are depicted in multiple publications including: foreleg (Hardy 1965: 368, fig. 140a); phallus (Kaneshiro 1976: 267, fig. 5a); terminalia, male, lateral (Hardy 1965: 368, fig. 140b).

Discussion. *D. mimiconformis* is the only species endemic to the island of Moloka‘i. It is very similar to *D. conformis* of the island of Hawai‘i, but can be easily distinguished by location of collection and a lack of pigmentation in the apical portion of the wing.

***Drosophila neutralis* Hardy**

Drosophila neutralis Hardy, 1965: 383–385

Diagnosis. The labella, palpi and frons are all brown. Dense setae on the posterior portion of the tibia of the fore legs of the males are prone, not erect, and never longer than the tibial spur (see Fig. 2c for example). Legs are completely yellow, except for the last tarsal segments which are brown. The apical portion of the wings are hyaline (see Fig. 3e for example). Abdomen is mostly dark brown, except for the last two tergites and the sides of first tergite which are yellow.

Types. HAWAII: Holotype ♂ (BPBM 6409) Kīlauea, viii.1958, JWB (Evenhuis 1982).

Material Examined. HAWAII: 32 ♂ have been studied in the BPBM from the following localities: 3 ♂, 29 mi. Ōla‘a, viii.1925, WMG; ♂, Stainback Highway, 3600', x.2006, KNM, RTL, GMB; 2 ♂, Stainback Highway, Tom's Trail, 3200', x.2006, KNM, RTL, GMB; 5 ♂, Hionamo Stream, Ka‘ū Forest, x.2006, KNM, RTL, GMB; 3 ♂, Ōla‘a Forest, x.2006, KNM, RTL, GMB; 2 ♂, Ōla‘a Forest, Tr 18, ii.2007, KNM; 4 ♂, Ōla‘a Forest, Tr 18 vi.2006, KNM; 4 ♂, HAVO escape road, 3900', vi.2006, KNM; ♂, HAVO Kīpuka Puauulu, 4000', vi.2006, KNM; ♂, Pu‘u Huluhulu, x.2006, KNM, RTL, GMB; ♂, Kukuiopa‘e, South Kona, x.2006, KNM, RTL, GMB; 5 ♂, Laupāhoehoe, 3700', x.2006, KNM, RTL, GMB. Over 50 ♂ have been deposited in the UHIM from the following localities: 20 ♂, Upper Ōla‘a Forest, viii.1952, DEH; 6 ♂, Upper Ōla‘a Forest, vii.1953, DEH; 8 ♂, Upper Ōla‘a Forest, vii.1956, DEH; ♂, Nāpau Crater, Kīlauea, vii.1952, DEH; ♂, Pauahi 4300', Kīlauea, vii.1952, DEH; 10 ♂, Kīlauea, viii.1958, JWB; 6 ♂, Fern Forest, Upper Ōla‘a Forest, iii.1966, KYK; 2 ♂, Kīlauea, viii.1966, KYK. The following material is present at AMNH: ♂, Forest behind Volcano Solid Waste Transfer Station, O40.2, 5.vii.1998, PMO, SLM; 2 ♂, Forest behind Volcano Solid Waste Transfer Station, O51.4, 12–14.iii.1999, PMO, JBS; ♂, Volcanoes National Park, Ōla‘a Forest, near Pole 44, O128.5, 29.vii.2001, PMO, CDS. The following material is in the Essig Museum of Entomology at UC Berkeley: ♂, Tree Planting Road, O256.8; O201316; 11.vii.2004, PMO, MG; ♂, Kohala Mountains, Top of Waipio Falls, O269.6, O200623, 16.vii.2004, PMO, CDS, GS, SH, MG.

Distribution. This species is endemic to the Big Island of Hawai‘i.

Ecology. This species has been reared from the bark of *Tetraplasandra oahuensis* (Araliaceae); the leaves and bark of *Cheirodendron trigynum* (Araliaceae) (Heed 1968; Magnacca et al 2008; Mangan 1978).

Illustrations. Morphological structures of this species are depicted in multiple publications including: foreleg (Hardy 1965: 384, fig. 148b); phallus (Kaneshiro 1976: 267, fig. 5h); terminalia, male, lateral (Hardy 1965: 384, fig. 148c).

Chromosomes. The metaphase complement of this species is 5 rods and 1 dot (Yoon & Richardson 1978).

Drosophila percnosoma Hardy

Figure 2e

Drosophila percnosoma Hardy, 1965: 410–412

Drosophila septuosa Hardy, 1965:410–412, *syn. nov.*

Diagnosis. A large (~ 4 mm) species. The mouthparts and palpi are dark brown to black, along with the other features of the head. Tibia densely setose on posterior surface without setae longer than the tibial spur (see Fig. 2e). Femora are dark brown while the rest of the leg is yellow. The thorax is a dark brown to black. The wings are subhyaline with a faint infuscation of brown at the apical portion of the wing (see Fig. 3e). The abdomen is dark brown to black.

Types. HAWAII: Holotype ♂ (BPBM 6419) Upper Ōla‘a Forest, viii.1958, DEH. Allotype ♀ (BPBM 6419a) same collection as holotype (Evenhuis 1982).

***D. septuosa* Type:** Holotype ♂ (BPBM 6443) Kīlauea, viii.1958, JWB (Evenhuis 1982).

Material Examined. HAWAII: 27 ♂ have been studied from the BPBM from the following localities: ♂, Glenwood, iii.1919, OHS; 1 ♂ 29 mi Ōla‘a, viii.1925, WMG; 3 ♂, Stainback Highway, Tom's Trail, 3200', x.2006, KNM, RTL, GMB; 5 ♂, Hionamo Stream, Ka‘ū Forest, x.2006, KNM, RTL, GMB; ♂, Kīpuka 9, Kaūmana Trail, x.2006, KNM, RTL, GMB; 4 ♂, Ōla‘a Forest, x.2006, KNM, RTL, GMB; 4 ♂, from Pu‘u Huluhulu, x.2006, KNM, RTL, GMB; 5 ♂, Laupāhoehoe, 3700', x.2006, KNM, RTL, GMB; 3 ♂, Ōla‘a Forest, Tr 18 ii.2006, KNM. Over 70 ♂ have been deposited in the UHIM from the following localities: 4 ♂, Upper Ōla‘a Forest, viii.1952, WCM; 15 ♂, Kīlauea, viii.1958, JWB; 24 ♂, Upper Ōla‘a Forest, viii.1952, DEH, WCM; 3 ♂, Kahuku Ranch, vii.1953, DEH; ♂, Upper Ōla‘a Forest, vii.1953, DEH, WCM; 2 ♂, Upper Ōla‘a Forest, viii.1956, DEH; ♂, Keauhou Ranch, Kīlauea, viii.1953, DEH; ♂, Pauahi 4300', Kīlauea,

vii.1952, DEH; 7 ♂, Lower Ōla‘a Forest, vii.1964, LHT; 2 ♂, Upper Ōla‘a Forest, vii.1964, LHT; 4 ♂, Upper Ōla‘a Forest, ix.1964, HTS; 4 ♂, Upper Ōla‘a Forest, vi.1966, WBH; 2 ♂, Upper Ōla‘a Forest, vii.1963, WBH; 3 ♂, Nāpau Crater, Kīlauea, vii.1956, DEH; ♂, Upper Ōla‘a Forest, vii.1956, DEH. The following material is present at AMNH: 8 ♂, Forest behind Volcano Solid Waste Transfer Station, O40.3, 5.vii.1998, PMO, SLM; 10 ♂, Stainback Highway, 7–8.ii.1999, O49.1, PMO, SLM; 6 ♂, Forest behind Volcano Solid Waste Transfer Station, O51.1, 12–14.iii.1999, PMO, JBS; 5 ♂, Volcanoes National Park, Ōla‘a Forest, near Pole 44, O93.5, 7.ix.2000, PMO; 2 ♂, Volcanoes National Park, Ōla‘a Forest, near Pole 44, O112.3, 20.x.2000, PMO; 3 ♂, Volcanoes National Park, Kīpuka Puauulu, O127.3, 29.vii.2001, PMO; 2 ♂, Volcanoes National Park, Ōla‘a Forest, near Pole 44, O128.3, 29.vii.2001, PMO, CDS; 44 ♂, Volcanoes National Park, Ōla‘a Forest, near Pole 44, O132.4, AMCC105700, 2.vi.2001, PMO, CDS; 49 ♂, Volcanoes National Park, Ōla‘a Forest, near Pole 44, O140.8, AMCC105685, 12.iv.2002, PMO, CDS. The following material is in the Essig Museum of Entomology at UC Berkeley: 12 ♂, Volcanoes National Park, Ōla‘a Forest, near pole 48, O247.2; O201444; 6–7.vii.2004, PMO, MG, CDS; 4 ♂, Tree Planting Road, O256.8; O201317; 11.vii.2004, PMO, MG; 3 ♂, Puu Makaala Trailhead, O257.1, O201500, 11.vii.2004, PMO, MG; 2 ♂, Volcanoes National Park, Upper Ōla‘a Forest, end of Wright Road, O272.F, O200640; 20.vii.2004, PMO, MG, GS, AC; 24 ♂, Volcanoes National Park, Ōla‘a Forest, near pole 44, O307.6, O201114; 8.viii.2005; PMO, GMB, CH, JEG.

Maui: 10 ♂ have been studied from UHIM from Waikamoi Forest, v.1966, WBH.

Distribution. This species is endemic to the Big Island of Hawai‘i.

Behavior. Bell and Kipp (1994).

Chromosomes. The metaphase complement of this species is 5 rods and 1 dot (Clayton 1968).

Ecology. This species has been reared from leaves of *Cheirodendron trigynum* and *Tetraplasandra oahuensis* (Araliaceae); leaves of *Clermontia* sp (Campanulaceae) (Heed 1968; Magnacca et al 2008; Mangan 1978).

Illustrations. Morphological structures of this species are depicted in multiple publications including: foreleg (Hardy 1965: 411, figs. 163a, b); terminalia, male, lateral (Hardy 1965: 411, fig. 163c) *as septuosa*: foreleg (Hardy 1965: 462, fig. 187d); phallus (Kaneshiro 1976: 267, fig. 5g); terminalia, male, lateral (Hardy 1965: 462, fig. 187c).

Chromosomes. The metaphase complement of this species is 5 rods and 1 dot (Yoon & Richardson 1978).

Molecular Biology. DNA sequences (O’Grady & DeSalle 2008).

Discussion. Based on our morphological analysis, *Drosophila septuosa* (Hardy 1965) is synonymous with *Drosophila percnosoma* (Hardy 1965). The descriptions of both species by Hardy are very similar, with only minor differences between species, all well within normal variation for the group. We have examined both holotypes in the BPBM as well as the above series and compared both to the description found that all the characters used by Hardy to describe each species describe both holotypes and their respective series. On closer inspection the minor character differences Hardy utilizes in his descriptions are not present in one of the two holotypes. *Drosophila percnosoma* is chosen because of its page priority in the original description and greater usage in the literature: 7 for *D. percnosoma* (Bell & Kipp 1994; Clayton 1968; Hardy 1965; Heed 1968; Magnacca et al 2008; Mangan 1978; O’Grady & DeSalle 2008) and 5 for *D. septuosa* (Hardy 1965; Heed 1968; Kaneshiro 1976; Magnacca et al 2008; Yoon & Richardson 1978). We have identified 10 individuals from UHIM that were reared from *Pittosporum* leaves by W. B. Heed in 1966 from Waikamoi Forest on Maui, but this is the only instance of *D. percnosoma* being found off of the island of Hawai‘i.

Drosophila sordidapex Grimshaw

Figure 3b

Drosophila sordidapex Grimshaw, 1901: 63

Diagnosis. The palpi and mouthparts are light brown. The thorax is yellow to light brown and the legs are completely yellow. The wing possesses a distinct marking that completely darkens the apical half of cell R_{2+3} , the posterior apical margin of cell R_1 and anterior apical margin of cell R_{4+5} . Unlike other species, this spot is much darker and is not diffuse, with defined margins (see Fig. 3b), although in some specimens (including the holotype), it may be distinctly following the veins with a small clear area in the middle of cell R_{2+3} . The abdomen is dark brown to black dorsally with yellow sides except for the completely yellow last tergite.

Types. **HAWAII:** Holotype ♂ (BMNH) Ōla‘a Forest, vii. 1895. [probably collected by R. C. L. Perkins].

Material Examined. **HAWAII:** 11 ♂ have been deposited in the BPBM from the following localities: ♂, Stainback Highway, Tom's Trail, 3200', x.2006, KNM, RTL, GMB; 4 ♂, Kahuku, Pu‘u Akihi Gulch, i.2006, KNM; ♂, HAVO escape road, 3900', vi.2006, KNM; ♂, Hionamoa Stream, Ka‘ū Forest, x.2006, KNM, RTL, GMB; ♂, Ōla‘a Forest, x.2006, KNM, RTL, GMB; ♂, Kukuiope‘e, South Kona Forest Reserve, x.2006, KNM, RTL, GMB; 2 ♂, Laupāhoehoe, 3700', x.2006, KNM, RTL, GMB. Over 50 ♂ have been deposited in the UHIM from the following localities: 23 ♂, Keanakolu, x.1952, DEH; 13 ♂, Upper Ōla‘a Forest, viii.1952, DEH; 5 ♂, Upper Ōla‘a Forest, viii.1953, DEH; 5 ♂, Upper Ōla‘a Forest, vii.1963, WBH; 3 ♂, Upper Ōla‘a Forest, vii.1964, LHT; 7 ♂, Upper Ōla‘a Forest, vii.1956 DEH; 4 ♂, Pu‘u Hualalai, vi.1966, WBH; 3 ♂, Kaiholeua, Kohala Mountains, viii.1952, DEH; ♂, Forest above Pa‘auilo, vii.1953, DEH; ♂, Keauhou Ranch, Kīlauea, vii.1953, DEH; ♂, Honaunau Forest, vii.1966 KYK. The following material is present at AMNH: ♂, Neuneu Road, Kaloko Mauka, North Kona, O38.6, 3.vii.1998, PMO, SLM; 5 ♂, Volcanoes National Park, Ōla‘a Forest, near Pole 44, O117.4, 23.ii.2001, PMO; 2 ♂, Volcanoes National Park, Ōla‘a Forest, transect 16, O120.2, 25.ii.2001, PMO, DF; ♂, Volcanoes National Park, Ōla‘a Forest, near Pole 44, O132.8, AMCC105696, 2.vi.2001, PMO, CDS; 5 ♂, Volcanoes National Park, Ōla‘a Forest, near Pole 44, O140.8, AMCC105684, 12.iv.2002, PMO, CDS. The following material is in the Essig Museum of Entomology at UC Berkeley: ♂, Volcanoes National Park, Ōla‘a Forest, near pole 48, O247.H; O201459; 6–7.vii.2004, PMO, MG, CDS.

Distribution. This species is endemic to the Big Island of Hawai‘i.

Behavior: Speith (1966: 274).

Ecology. This species has been reared from leaves of *Cheirodendron trigynum* (Araliaceae); leaves of *Ilex anomala* (Aquifoliaceae) (Heed 1968).

Illustrations. Morphological structures of this species are depicted in multiple publications including: foreleg (Hardy 1965: 470, fig. 190a); phallus (Kaneshiro 1976: 267, fig. 5b); terminalia, male, lateral (Hardy 1965: 470, fig. 190c); wing (Hardy 1965: 470, fig. 190b).

Drosophila waddingtoni Hardy

Figure 3e

Drosophila disticha Hardy, 1965: 249–252

Drosophila waddingtoni Basden, 1976: 185

Diagnosis. Dense setae are present on the posterior surface of the tibia equal to, or longer than, the tibial spur (see Fig. 2b for example). The legs are yellow, except for brown front coxae and femora. The second tarsal segment is the widest of the group, being 1/3 wider than long. The wings are without any noticeable pigmentation (see Fig. 3e). The thorax is dark brown to black, and the abdomen is mostly dark brown with the last tergum yellow, and the preceding tergites marked with yellow laterally.

Types: MAUI: Holotype ♂ (BPBM 6344) Waikamoi, 1220 m, vii.1956, DEH. Locality recorded as “Waiakamoi” on type label (Evenhuis 1982).

Synonym. *disticha* Hardy 1965: 249 preoccupied

Material Examined. HAWAII: 11 ♂ have been studied from the BPBM from the following localities: 3 ♂, Keanakolu, x.1952, DEH, CPH; 3 ♂, Kīlauea, xi.1919, WMG; 5 ♂, from Kawaihae Uka, Kohalas, x.2006, KNM, RTL, GMB. 30 ♂ have been deposited in the UHIM from the following localities: 7 ♂, Kīlauea, viii.1958, JWB; 5 ♂, Upper Ōla‘a Forest, vii.1953, DEH; 3 ♂, Upper Ōla‘a Forest, viii.1952, DEH; 4 ♂, Upper Ōla‘a Forest, vii.1956, DEH; 4 ♂, Kūlani 5200', vii.1952, WCM; 2 ♂, Keanakolu, x.1952, DEH, CPH; 5 ♂, Kīpuka Kī, vii.1966, KYK. The following material is present at AMNH: ♂, Volcanoes National Park, Kīpuka Puauulu, O127.4, 29.vii.2001, PMO; 65 ♂, Volcanoes National Park, Ōla‘a Forest, near Pole 44, O132.3, AMCC105705, 2.viii.2001, PMO, CDS; 40 ♂, Volcanoes National Park, Ōla‘a Forest, near Pole 44, O140.C, AMCC105687, 12.iv.2002, PMO, CDS. The following material is in the Essig Museum of Entomology at UC Berkeley: 2 ♂, Puu Makaala Trailhead, O257.1, O201319, 11.vii.2004, PMO, MG; ♂, Volcanoes National Park, Upper Ōla‘a Forest, end of Wright Road, O272.F, O200624; 20.vii.2004, PMO, MG, GS, AC.

LANA‘I: Over 60 ♂ have been deposited in the UHIM from the following localities: ♂, Lāna‘ihale, vi.1953, DEH; 12 ♂, Lāna‘ihale 3300', iii.1965, KYK; 46 ♂, Lāna‘ihale 3000', vii.1956, DEH; 4 ♂, Lāna‘ihale 3300', viii.1964, HLC.

MAUI: Over 180 ♂ have been deposited in the UHIM from the following localities: 2 ♂, Pu‘u Kukui, vi.1953, DEH; 2 ♂, Pu‘u Kukui, iv.1954, DEH; ♂, Haelaau, xii.1928, OHS; ♂, Kula Pipeline, vi.1927, OHS; 16 ♂, Kula Pipeline, vii.1956, DEH; ♂, Waikamoi, i.1926, OHS; 59 ♂, Waikamoi, vii.1956, RN; 13 ♂, Waikamoi, viii.1958, DEH; 88 ♂, Waikamoi, vii.1964, HLC; 2 ♂, Waikamoi, vii.1956, DEH; ♂, Waikamoi, iii.1966, WBH. The following material is present at AMNH: 9 ♂, Upper Waikamoi Forest Reserve, 5500 ft., O41.4, 6.vii.1998, PMO, SLM; 10 ♂, 2 ♀, Waikamoi Forest Reserve, Heed Trail, O50.A, 8.iii.1999, PMO, EMC, MPK; 3 ♂, Waikamoi Forest Reserve, Heed Trail, O55.B, 16–18.iii.1999, PMO, JBS; ♂, Makawao Forest Reserve, Pig Hunter’s Trail, O56.1, 18.vii.1999, PMO, JBS; 20 ♂, Waikamoi Forest Reserve, Heed Trail, O71.A, 2.vi.1999, PMO; 3 ♂, Hanaula, O72.9; 15–16.vi.1999, PMO, KYK, KTK, YK; 6 ♂, 2 ♀, Waikamoi Forest Reserve, Heed Trail, O73.C, 22.vii.1999, PMO, EMC, MPK; 2 ♂, Waikamoi Forest Reserve, Heed Trail, O74.I, 4.ii.2000, PMO; 10 ♂, Makawao Forest Reserve, Pig Hunter’s Trail, O153.8, AMCC105805, 23.iv.2002, PMO, DO; 4 ♂, Waikamoi Forest Reserve, Heed Trail, O154.H, 23.iv.2002, PMO, DO. The following material is in the Essig Museum of Entomology at UC Berkeley: ♂, Waikamoi Forest Reserve, Flume stream, O300.8, O201347, 4.viii.2005, PMO, GMB, CH, JEG; 4 ♂, Waikamoi Forest Reserve, Heed Trail, O301.A, O201362, 4.viii.2005, PMO, GMB, CH, JEG; 10 ♂, Waikamoi Forest Reserve, Heed Trail, O303.5, O201407, 4.viii.2005, PMO, GMB, CH, JEG; 6 ♂, Waikamoi Forest Reserve, Carson Trail, O305.5, 6.viii.2005, PMO, GMB; 12 ♂, Waikamoi Forest Reserve, Heed Trail, O398.1, O200786, 31.vii.2007; PMO, KNM, RTL, GMB, KRG.

MOLOKA‘I: 23 ♂ have been deposited in the BPBM from the following localities: 3 ♂, Kamakou Preserve, forest near Hanalilolilo Lookout, O376.C, O201865, 19.ii.2007, PMO, KNM, RTL, GMB; 13 ♂ Kamakou Preserve, Puu Kolekole, O377.6, O201874, 19.ii.2007, PMO, KNM, RTL, GMB, ♂ Kamakou Preserve, makai of Puu Kolekole Cabin, O378.4, 201890, 19.ii.2007, PMO, RTL, GMB; ♂ Kamakou Preserve, Tunnel on trail to Puu Kolekole, O379.1, O201894, 19.ii.2007, PMO, KNM, RTL, GMB; 11 ♂, Pepe‘opae, vii.1959, DEH; 4 ♂, Maunawainui Valley, vii.1952, DEH. Over 50 ♂ have been deposited in the UHIM from the following localities: 16 ♂, Pu‘u Kolekole, vii.1952, DEH, MT; 16 ♂, Pu‘u Kolekole, vii.1953, DEH, MT; 4 ♂, Pu‘u Kolekole, iii.1963, DEH; 1 ♂, Pepe‘opae, vii.1959, DEH; 4 ♂, Maunawainui Valley, vii.1952, DEH. The following material is present at AMNH: 46 ♂, Kamakou Preserve, Puu Kolekole, O35.1, 1.vii.1998, PMO, SLM; 83 ♂, Kamakou Preserve, Puu Kolekole, O58.5, 19–21.iii.1999, PMO, JBS; 37 ♂, Kamakou Preserve, Puu Kolekole, O101.C, 26–27.vii.1999, PMO, EMC, MPK; 26 ♂, 55 ♀, Kamakou Preserve, Puu Kolekole, O146.2, AMCC105707, 15–16.iv.2002, PMO, CDS, DO; 1 ♂, 13 ♀, Kamakou Preserve, Pepeopae Boardwalk Trail, O150.2, AMCC105755, 16.iv.2002, PMO, CDS, DO; 2 ♂, 7f, Kamakou Preserve, forest

near Hanalilolilo Lookout, O151.C, AMCC105765, 17.iv.2002, PMO, CDS, DO. The following material is in the Essig Museum of Entomology at UC Berkeley: 35 ♂, Kamakou Preserve, Puu Kolekole, 3854 ft., O283.1, O201705, 28–29.vii.2004, PMO, CDS.

Distribution. This species is endemic to Maui Nui and the Big Island of Hawai‘i.

Behavior. Speith (1966: 273); Grossfield (1968); Kambysellis and Heed (1971).

Chromosomes. The metaphase complement of this species is 5 rods and 1 dot (Clayton 1969; Yoon & Richardson 1978).

Ecology. Nutritional requirements (Robertson et al 1968); This species has been reared from leaves of *Cheirodendron trigynum* (Araliaceae) from Hawai‘i, Maui, Moloka‘i and Lana‘i; leaves of *Tetraplasandra* sp (Araliaceae) from Hawai‘i; leaves and stems of *Clermontia* sp (Campanulaceae) from Hawai‘i and Lana‘i; leaves of *Myrsine lessertiana* (Myrsinaceae) from Moloka‘i; leaves of *Pittosporum* sp (Pittosporaceae) from Moloka‘i (Heed 1968; Magnacca et al 2008; Mangan 1978).

Illustrations. Morphological structures of this species are depicted in multiple publications including: egg (Kambysellis and Heed 1971: 34, fig. 2.3; 36, figs. 4.1, 4.2); foreleg (Hardy 1965: 250, fig. 82a); ovary (Kambysellis and Heed 1971: 35, fig. 3.1); phallus (Kaneshiro 1976: 267, fig. 5e); terminalia, female, lateral (Hardy 1965: 250, fig. 82b); terminalia, male, lateral (Hardy 1965: 250, fig. 82c); Takada 1966: 318, fig. 1.8).

Molecular Biology. DNA sequences (Kambysellis & Craddock 1997; O’Grady & DeSalle 2008; O’Grady & Zilversmit 2004).

Discussion. *Drosophila waddingtoni* has the widest range of any spoon tarsus group species and is found throughout Hawai‘i and Maui Nui. Several individuals from Maui have been collected that grade in coloration of the tibia from yellow (normal) to dark brown.

Acknowledgments

The authors are very grateful to Neal Evenhuis for granting us access to the collections at the BPBM, as well as to Daniel Rubinoff for access to the UHIM. We would especially like to thank Luc Leblanc for all of his help. Travel was partially funded by the U.C. Berkeley Walker Grant.

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