

Revision of the *Drosophila mimica* Subgroup, with Descriptions of Ten New Species

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ABSTRACT The *Drosophila mimica* subgroup is revised, including descriptions of 10 new species (*D. acanthos* Kam & Perreira, *D. antecedens* Kam & Perreira, *D. chimera* Kam & Perreira, *D. echinostoma* Kam & Perreira, *D. gagné* Kam & Perreira, *D. inebria* Kam & Perreira, *D. lobatopalpus* Kam & Perreira, *D. ma'ema'e* Kam & Perreira, *D. odontostoma* Kam & Perreira, *D. xenophaga* Kam & Perrierra) and a needed lectotype designation for *Drosophila kauluai* Bryan. We erect seven species complexes; *conjectura*, *flavibasis*, *infuscata*, *involuta*, *kauluai*, *mimica*, and *soanae*, based on a variety of morphological characters, most specifically the chaetotaxy of the labellae and the forelegs of males. A key to all taxa in the *mimica* subgroup is provided. The ecological associations of this species subgroup are also reviewed. We report host use from 13 of the 20 *mimica* subgroup species.

KEY WORDS Hawaiian *Drosophila*, systematics, modified mouthpart species group

TWO MAJOR LINEAGES of Drosophilidae are found in the Hawaiian Islands, one consisting of the endemic members of the genus *Drosophila* and another, which contains several subgenera in the genus *Scaptomyza* (Fig. 1a). Collectively, this group is known as the Hawaiian Drosophilidae and may contain as many as 1,000 species (Kaneshiro 1997). Throckmorton (1966) examined internal morphology of the Hawaiian Drosophilidae in an effort to better understand the phylogenetic relationships within this group. Although the relationships within the genus *Scaptomyza* have not been extensively studied beyond the original species descriptions (Hackman 1959, 1962; Hardy 1965; Hackman 1982), the Hawaiian *Drosophila* are quite well studied. The *haleakalae* species group (Hardy et al. 2001) is basal within the Hawaiian *Drosophila* lineage (Fig. 1a). Although Throckmorton (1966) considered the *ciliated tarsus* species group to be basal within the Hawaiian *Drosophila* lineage, a recent study (Bonacum 2001) places this group in a clade consisting of the *modified tarsus* and *antopocerus* species groups. The *modified mouthparts*, *picture wing*, and *nudidrosophila* species groups form a derived clade in this tree (Fig. 1a).

Despite the recent phylogenetic work on the Hawaiian Drosophilidae, only ≈500 of the estimated 1,000 species have been described (Kaneshiro 1997). Several of the “less conspicuous” species groups require additional taxonomic work before further phylogenetic study can progress. The *modified mouthparts* species group, with ≈80 described species, is one such group. This group is characterized by modifications to

the mediproboscis and labellae of males. This may take the form of elongation and enlargement of the labellar rim (Fig. 2 a and e) to extreme modifications in the shape and degree of sclerotization of the spines on the mouthparts (Fig. 2 b–e). Although several subgroups, such as the *semifuscata* (Hardy and Kaneshiro 1968), *mitchelli* (Hardy and Kaneshiro 1975), and *mimica* (Yoon et al. 1972), have been proposed, a large number of species in this group are unplaced. Furthermore, relationships among the major subgroups of the *modified mouthpart* group are largely unclear. Based on the sequences of several molecular loci, Bonacum (2001) proposed that the *quadrisetae* subgroup is the sister taxon of the *mimica* subgroup (Fig. 1b). The *quadrisetae* and *mimica* subgroups both possess a characteristic tusk-like seta on the mediproboscis and are, therefore, sister taxa. In the *mimica* subgroup, however, this tusk is associated with seven large, distinctly shaped setae. The *quadrisetae* group only has a number of undifferentiated hairs. Within the *mimica* subgroup, the *mimica* complex is the sister group to the remaining taxa. The *conjectura*, *involuta*, *infuscata*, and *flavibasis* complexes from a clade of closely related taxa (Fig. 1b).

Heed (1968, 1971) examined the ecological affiliations of the *modified mouthpart* species group and found that they were quite diverse with respect to host substrate. While most Hawaiian Drosophilidae species groups use a single type of host plant substrate (i.e., fruits, fungi, sap fluxes, bark, stems, leaves), members of the *modified mouthpart* species group were able to exploit them all. This is not to say that these taxa are all generalists. In fact, most members of this group are

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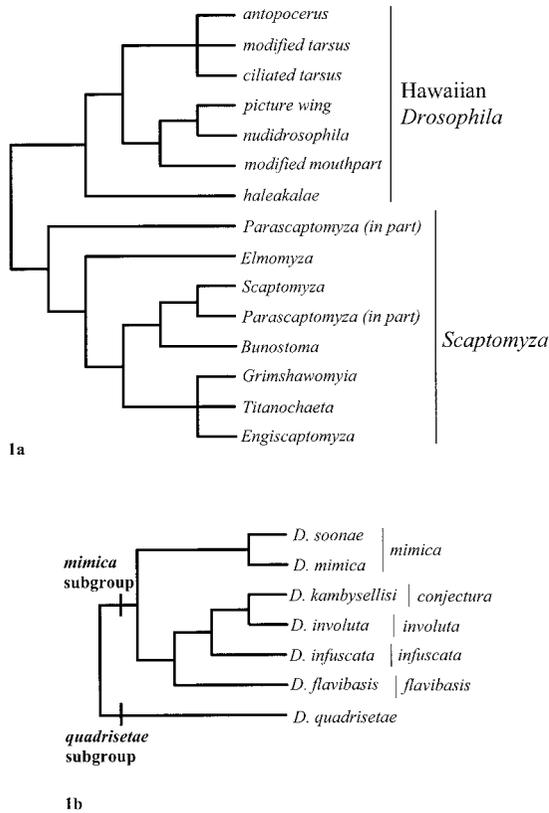


Fig. 1. (a) Phylogenetic relationships within the Hawaiian Drosophilidae (after Throckmorton 1966, Bonacum 2001). (b) Phylogenetic relationships within the *modified mouthpart* species group (after Bonacum, 2001).

quite specialized on a host plant and substrate type (Table 1).

Based on undescribed species present in several museum collections, it is probable that this group will eventually contain upwards of 150 species. Here we focus on the taxonomy of the *mimica* subgroup, which is defined by having a large, tusk-like seta present on the mediproboscis followed by seven distinctly shaped setae (Fig. 3). We describe 10 new species and place them in the *flavibasis*, *infuscata*, *kambysellisi*, *kauluaui*, and *mimica* species complexes (Table 2) based on the work of Kam (1978).

Materials and Methods

Field Collections and Substrate Rearing. Collections were performed as in Carson and Heed (1986), with some modifications for working in Hawai'i. A number of collectors have been involved in obtaining some of the taxa we review here.

CPH, C. P. Hoyt; DEH, D. Elmo Hardy; DG, Don Gubler; DR, Dick Richardson; DS, D. Sargent; FEC, Francis E. Clayton; FXW, F. X. Williams; GBM, G. B. Mainland; HLC, Hampton L. Carson; HTS, Herman T. Spieth; JBS, Julian B. Stark; JPM, John P. Murphy; JSY, Jong Sik Yoon; JWB, Jack W. Beardsley; KYK, Kenneth

Kaneshiro; LHT, Lynn Throckmorton; MDD, Mercedes D. Delfinado; MK, Melanie Kam; MPK, Michael P. Kambysellisi; MRW, Marshall R. Wheeler; NLHK, Noel L. H. Krauss; OHS, Otto H. Swezey; PMO, Patrick M. O'Grady; RI, R. Iwamoto; RW, Rick Warshauer; SLM, Steven L. Montgomery; SR, Susan Rockwood; WBH, William B. Heed; WCM, W. C. Mitchell; WDP, William Perreira.

We followed the methods of Heed (1968) when rearing species from field collected substrates. Briefly, rotting fruits, leaves, and stems of native plants suspected to contain eggs or larvae of Hawaiian Drosophilidae were collected. Different host substrates were placed individually into plastic bags labeled with collection locality information. The tops of the bags were loosely folded to permit ventilation while ensuring that larvae did not escape. Field-collected substrates were transported in an ice chest to the laboratory rearing facility to simulate the cooler temperatures found in the Hawaiian rainforest. Once in the laboratory, substrates were transferred to wide-mouthed gallon jars filled to $\approx 1/4$ volume with moist, sterilized sand. A piece of fabric was placed over the mouth of the jar and held in place with the rubber band. All flies were reared at 20°C with a controlled night-day light schedule. Adults were collected from rearing jars every 2 d, aged for 10 d on Hawaiian *Drosophila media* (Kaneshiro et al. 1977), and then pinned and dissected for identification.

Drosophila specimens are deposited in the collections of the American Museum of Natural History (AMNH), Bernice P. Bishop Museum (BPBM), British Museum, Natural History (BMNH), or the University of Hawai'i at Manoa (UHM). Host plant voucher specimens were collected with the rotting substrates and identified by Gerald Carr and James Jacobi (University of Hawai'i at Manoa, Botany Department). Pressed plant material has been preserved for examination.

Dissections. Specimens used for dissections were obtained as adults from field collections or reared out of substrates collected in the field. Several males were dissected to get a notion for intraspecific versus interspecific morphological differences. Photographs of lateral and ventral views of the mouthparts were taken and used to make line drawings. Mouthparts of males were cleared and mounted as follows: (1) dissect head from the thorax and boil in 10% KOH for 1 min; (2) wash head three times with 70% methanol and place in creosote for several hours to remove any extraneous tissue, (3) dissect mouthparts from head and cut in half longitudinally so that the two labelar lobes were bilaterally symmetrical, (4) remove pseudotracheae and other extraneous tissues from mouthparts, (5) dissect ventral portions from the labelar lobes and mount the four sections (left and right labelar lobes plus left and right ventral lobes) separately in euparal.

Mouthpart Morphology. General nomenclature of mouthpart structures can be found in Ferris (1950). Specific nomenclature used here to refer to the chaetotaxy of the mouthparts was designed for this study. We were most interested in the lateral and ventral

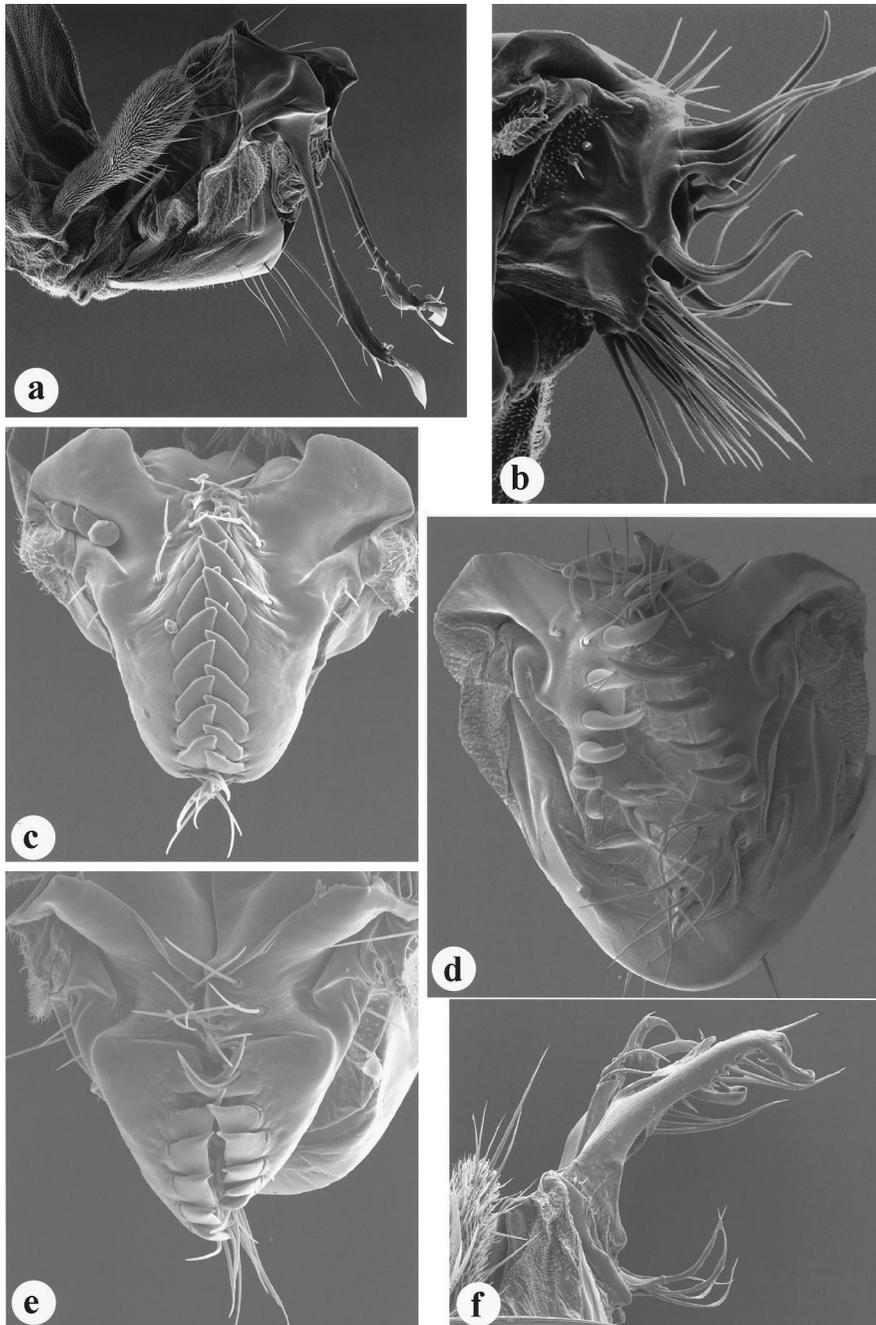


Fig. 2. Morphological diversity in the modified mouthpart species group. (a) *D. adventitia*, (b) *D. hystricosa*, (c) *D. freycinetiae*, (d) "D. astelia," (e) *D. prominens*, (f) *D. aethostoma*.

views of the mediproboscis and labellar lobe (Fig. 3a). The group I setae, numbered I-1-I-10, are on the dorsal-most portion of the mouthparts, and are numbered from the base of the mediproboscis. The first, third, or fourth, and tenth setae are often in a row posterior to the main row of setae. The group II setae, located on the labellar lobe, are ventral to the group I series and are numbered II-1-II-8. Seta II-1 is typi-

cally the largest on the mediproboscis (Fig. 3a). It is wide at the base and characteristically tusk shaped, forming a nearly 90 degree bend toward the dorsum. Often, the bend is elongated and pointed somewhat ventrally. The group III setae are located on the ventral surface of the labellar lobe and are numbered III-1-III-3 (Fig. 3b). The first seta in group III is closest to the junction of the labellar lobes.

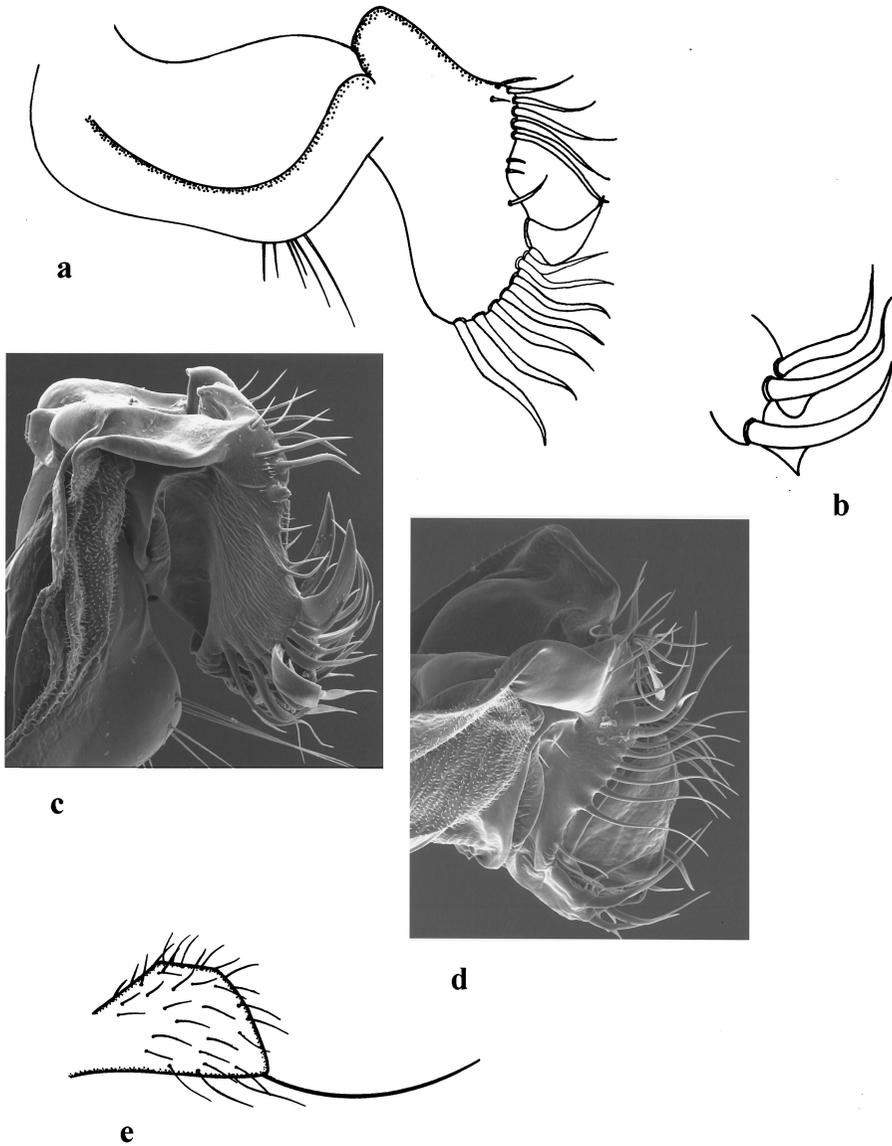


Fig. 3. General morphology of the mouthparts, showing the relative placement of the group I, II and III setae. (a) *D. conjectura*, group I and II setae; (b) *D. conjectura*, group III setae; (c) *D. xenophaga*, group I, II and III setae; (d) *D. involuta*, group I, II and III setae; (e) *D. conjectura*, palp.

A Key to Species in the *mimica* Subgroup

- 1. Palps of males notched on dorsal surface *soanae* complex, 7
 Palps of males rounded or pointed at apex, but never notched 2
- 2. Wings with broad, contiguous brown infuscation between the apices of the veins R2+3, R4+5, and M1+2, which extends well into the adjacent cells. Crossvein dm-cu also infuscated. *infuscata* complex, 8
 Wings either hyaline or with infuscations at the apices of veins R2+3 and R4+5, but infuscations never contiguous 3
- 3. Strong pair of nearly cruciate anterior oral vibrissae. Group III setae thin (Fig. 12b). No elongate setae or cilia on forelegs (Fig. 12 g) (Hawai'i) *D. involuta* Hardy
 Anterior oral vibrissae not exceptionally strong, typically no longer than other setae in vibrissal row. Chaetotaxy of labellae and foretarsi not as above 4
- 4. Anterior reclinate setae distinctly anterior to proclinate setae. Infuscations at apices of veins R2+3, R4+5, M1+2, and along crossvein dm-cu well defined; crossvein dm-cu always infuscated (Fig. 20) *mimica* complex, 9

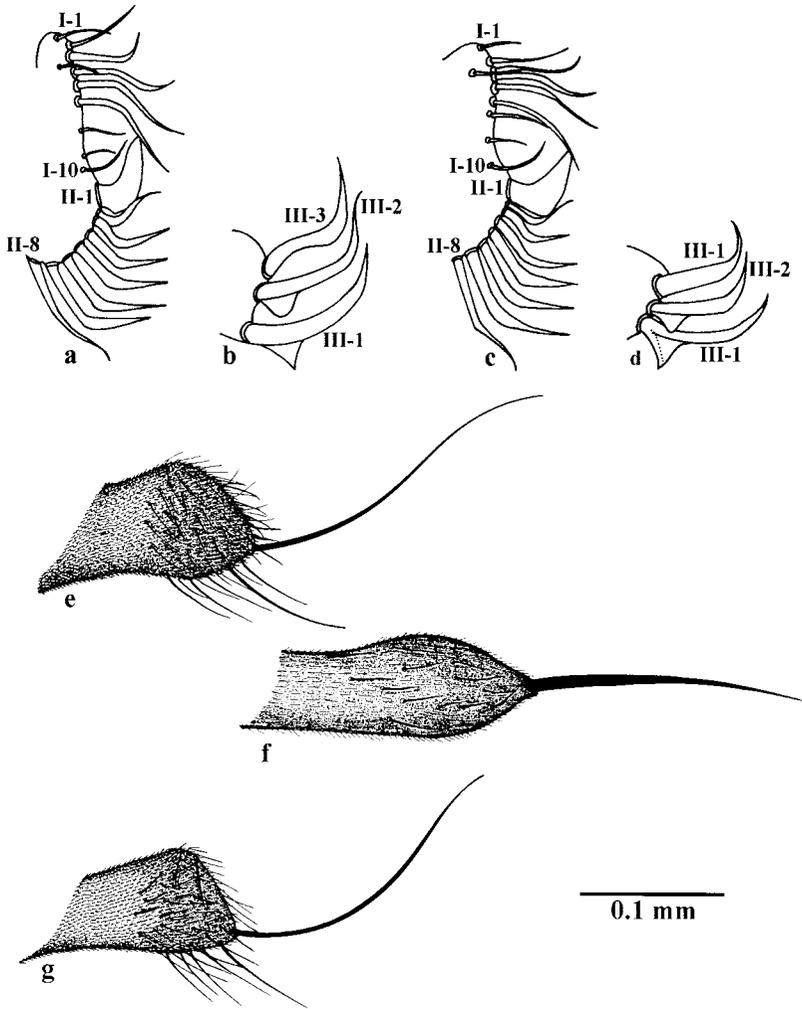


Fig. 4. Labellar setae and palps of the *conjectura* complex. (a) *D. conjectura*, groups I and II; (b) *D. conjectura*, group III; (c) *D. reschae*, groups I and II; (d) *D. reschae*, group III; (e) *D. conjectura* male palps; (f) *D. conjectura* female palps; (g) *D. reschae* male palps.

- Anterior reclinate either posterior or even to proclinate. Other characters not as above 5
- 5. Anterior dorsocentral setae small or rudimentary in males, never >1/2 length of posterior setae. *flavibasis* complex, 11
- Anterior dorsocentral setae well developed, >1/2 length of posterior dorsocentrals 6
- 6. Preapical setae on tibia of male foreleg well developed. Palps rounded at apex, otherwise not as above *kauluai* complex, 14
- Preapical setae on tibia of male foreleg either absent or not strongly developed. Palps somewhat pointed on ventral surface, with one strong seta and a number of additional ventral palpal setae *conjectura* complex, 18
- 7. Palps deeply incised along inner surface (Fig. 21e). Foretibia with short, equal length, row of anterodorsal setae (Fig. 22a). Entire length of foretarsi with two rows of dorsal setae; an-

- terodorsal series $\approx 3\times$ longer than mediadorsal row (Fig. 22a); setae within each row approximately equivalent in length (Hawai'i). *D. soonae* Takada & Yoon
- Incision on inner surface of palps shallow (Fig. 21g). Foretibia with row of elongate setae, becoming longer apically (Fig. 22b). Foretarsi with two rows of dorsal setae. Anterodorsal series $\approx 3\times$ longer at apex than at base of segment. Mediodorsal series approximately equal in length; ≈ 3 setae on basitarsus; single seta on second tarsomere (Fig. 22b) (O'ahu) *D. lobatopalpus* Kam & Perreira
- 8. Wings infuscations limited to crossvein dm-cu and apical 1/3 of wing (Fig. 11a). Infuscations do not extend to crossvein dm-cu (Hawai'i). *D. infuscata* Grimshaw

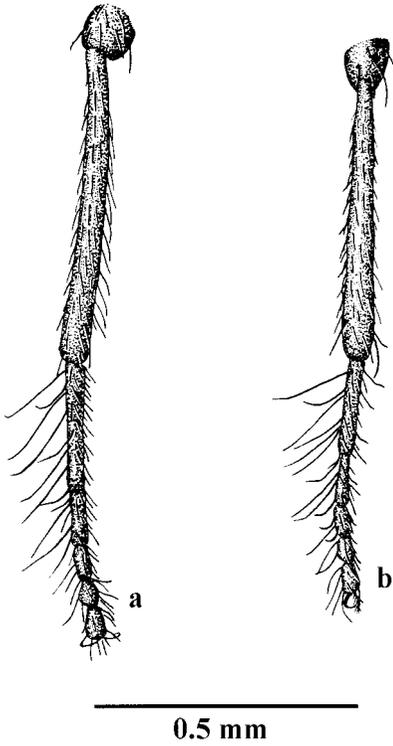


Fig. 5. Forelegs of species in the *conjectura* complex. (a) *D. conjectura*; (b) *D. reschae*.

- Wings more extensively infuscated. Extending from apex of wing along costa, R2+3, and R4+5 to level of crossvein dm-cu (Fig. 11b) (Maui) *D. ma'ema'e* Kam & Perreira
9. Anterior reclinate inserted anterior of proclinate, proclinate orbital setae inserted approximately midway between reclinate setae (Fig. 17a). Palps with one strong apical and two strong subapical setae, in addition to numerous thin setae on venter (Fig. 18a) (Kaua'i) *D. antecedens* Kam & Perreira
- Anterior reclinate inserted anterior to proclinate, but proclinate is not midway between reclinates. Palps with one strong apical and 3–5 strong subapical setae, in addition to numerous thick setae on ventral surface 10
10. Seta I-10 inserted in line with setae I-9 and II-1. Seta I-3 slightly basal, but closely inserted to, seta I-4 (Fig. 17 d) (O'ahu) *D. gagné* Kam & Perreira
- Seta 1–10 inserted basally to line between I-9 and II-1. Seta I-3 distinctly basal to I-4. (Fig. 17f) (Hawai'i) *D. mimica* Hardy
11. Palps of male with two strong, roughly equal length, apical setae; ≈ 6 thick setae, $\approx 2/3$ length of apical setae, present on ventral surface (Fig. 7a) (O'ahu) *D. chimera* Kam & Perreira
- Apical seta of palps always distinctly longer than subapical setae. Palps of male with thin

- cilia, $\approx 1/2$ length of apical seta, present on venter 12
12. Palps of male with one strong apical and two equal length subapical setae, subapical setae $\approx 3/4$ length of apical seta (Fig. 7d). Thin cilia present on dorsal and ventral surfaces \approx one-third length of apical seta. Palps of female with one strong apical seta and numerous strong setae, $\approx 1/4$ length of apical seta, covering both dorsal and ventral surfaces. (Fig. 7e) (Hawai'i) *D. xenophaga* Kam & Perreira
- Palps of male with one strong apical and one strong subapical setae. Subapical seta $\approx 1/2$ length of apical seta. (Fig. 7 b and c) . . . 13
13. Basitarsus of male foreleg short, $\approx 1/4$ length of tibia, and with only ≈ 6 elongate cilia (Fig. 8b) *D. flavibasis* Hardy
- Male basitarsus $\approx 1/3$ length of tibia with ≈ 10 elongate cilia present on the segment (Fig. 8c) (O'ahu) *D. inebria* Kam & Perreira
14. Foretibia with ≈ 7 elongate setae on apex of posteroventral surface. Numerous heavy setae on both anterior and posterior surfaces of foretarsus (Fig. 15d) (O'ahu) *D. kauluai* Bryan
- Tibia with single seta at apex of posteroventral surface 15
15. Elongate setae or cilia present on anterodorsal and posteroventral surfaces of foretarsi (Fig. 15 b and c) 16
- Elongate setae present only on anterodorsal surfaces of foretarsi (Fig. 15 a and e) . . . 17
16. Palps with few thin cilia on apical 1/2, in addition to single prominent apical seta (Fig. 14c) (Maui) *D. badia* Hardy
- Palps with ≈ 3 –4 thick apical setae in addition to several thick cilia on apical 1/2 (Fig. 14d) (Maui) *D. echinostoma* Kam & Perreira
17. Setae on foretarsi approximately equal in length, ≈ 7 present on anterodorsal surface, ≈ 1 –2 setae present on tarsomeres 2 and 3 (Fig. 15a) (Hawai'i, Kona-side) *D. acanthos* Kam & Perreira
- Setae on foretarsus distinctly longer at base, becoming shorter distally, most basal seta $\approx 2\times$ length of seta at apical margin (Fig. 15e). Elongate setae present on all five tarsomeres (Hawai'i, Hilo-side) *D. odontostoma* Kam & Perreira
18. Basitarsus short, $\approx 1/4$ the length of the tibia (Fig. 5b). Seta I-9 placed in line with seta I-10 and setae II-3-7 thin, not clavate (Fig. 4c) (O'ahu) *D. reschae* Hardy & Kaneshiro
- Basitarsus longer, great than 1/4 the length of the tibia. Seta 1–9 placed posterior to seta 1–10; setae 11-3-7 clavate 19
19. Border of follicle imprints broad (Lana'i, Moloka'i) *D. conjectura* Hardy
- Border of follicle imprints broad with a narrow central ridge (Hawai'i) *D. kambysellisi* Hardy & Kaneshiro

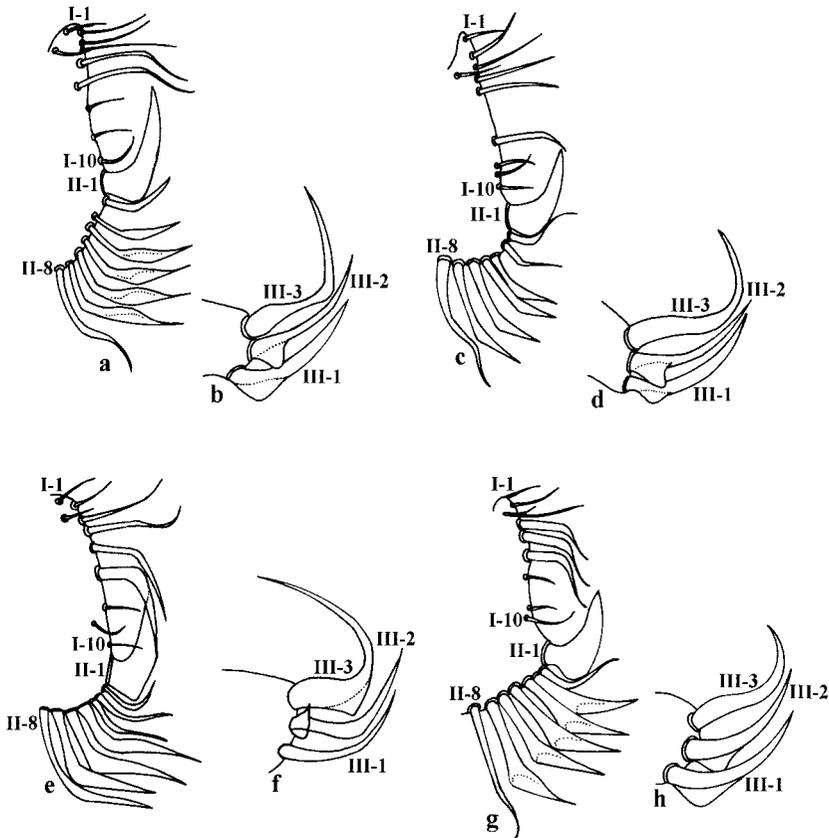


Fig. 6. Labellar setae of *flavibasis* complex males. (a) *D. chimera*, groups I and II; (b) *D. chimera*, group III; (c) *D. flavibasis*, groups I and II; (d) *D. flavibasis*, group III; (e) *D. inebria*, groups I and II; (f) *D. inebria*, group III; (g) *D. xenophaga*, groups I and II; (h) *D. xenophaga*, group III.

The *conjectura* Complex. This complex contains three species, *D. conjectura* Hardy from Moloka'i and Lana'i, *D. kambysellisi* Hardy & Kaneshiro from Hawai'i, and *D. reschae* Hardy & Kaneshiro from O'ahu. *Drosophila kambysellisi* was described by Hardy and Kaneshiro (1969) and is nearly identical to *D. conjectura* in every way except for the chorion structures (M. P. Kambysellis, personal communication). The *conjectura* complex is most closely related to the *mimica* complex and differs by having the anterior reclinate and proclinate orbital setae inserted either alternating or opposite to one another, well developed dorsocentral setae, no infuscation over crossvein dm-cu, and labelar setae II-3-II-7 that are narrow. The species in this complex use the rotting leaves of *Pisonia* sp. (Nyctaginaceae), *Psychotria* sp. (Rubiaceae), and *Passiflora* sp. (Passifloraceae) as host plants.

Drosophila conjectura Hardy
(Figs 4 a, b, e, and f, 5a)

Drosophila conjectura Hardy, 1965: 223.

Head. Male, Female. Hardy (1965) provided a description of this species. Because of the extreme similar-

ity between *D. kambysellisi* and *D. conjectura*, we are including an extensive description of the latter species here. In addition to the characters in the original descriptions, we are focusing on the chaetotaxy of the labellum. The posterior row of group I spines consists of I-1, I-4, I-10 (Fig. 4a). Spines I-2-I-3 and I-5-I-7 lie in a row with their bases near to each other or in contact with the bases of neighboring spines. Spines I-8 and I-9 are separated from the main row as shown in Fig. 4a. Spine II-1 is "foot-shaped" and having its apical portion directed toward the group I spines (Fig. 4a). Spine II-2 is much smaller and narrower than II-1 and follows its outline, II-3-II-7 are somewhat broad along their lengths and have apices which become clavate then taper off to points vertically or in the directions which the apex of II-1 points (Fig. 4a). Spine II-8 is long and eventually tapers to a point. Spines of group IV are narrow, taper apically and point inward toward the lobes of the labellum (Fig. 4b). The body of IV-1 is free of any sclerotized flaps. A rounded sclerotized flap is found at the base of IV-2 and a triangular shaped flap is located at the base of IV-3. Palps of male pointed on ventral margin; one strong apical and one moderately strong, $\approx 1/2$ the length of the apical seta, subapical present (Fig. 4e). Numerous setae

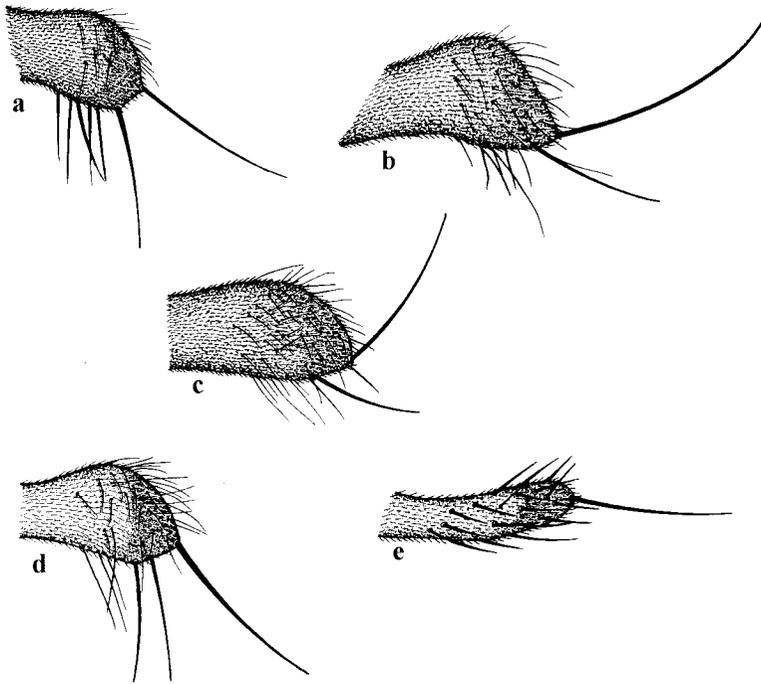


Fig. 7. Palps of species in the *flavibasis* complex. (a) *D. chimera*, male; (b) *D. flavibasis*, male; (c) *D. inebria*, male; (d) *D. xenophaga*, male; (e) *D. xenophaga*, female.

are present on dorsal and ventral margins of palps, ventral setae are longer. Females resemble males in most respects, palps pointed at apex (Fig. 4f) with one strong apical seta. No additional elongate palpal setae are present in females.

Thorax. Foretibia of males with two rows of setae on anterodorsal surface (Fig. 5a).

Measurements. $N = 7\delta$. TL = 3.3 mm (2.9–3.6); WL = 7.2 mm (6.3–7.6); TL/WL = 0.5 (0.4–0.5); HW = 2.5 mm (2.2–2.7); HW/TL = 0.8 (0.7–0.8); CI = 5.4 (5.0–5.6); 4V = 1.4 (1.3–1.5); 5X = 1.4 (1.3–1.5); 4C = 0.4 (0.4–0.5); M = 0.4 (0.4–0.5).

Type Material. MOLOKA'I: HOLOTYPE δ , BPBM 6332, Maunawainui Valley, vii.1952, DEH (Evenhuis 1982). A single paratype at UHM has been examined. 1 δ , same data as holotype, microvial with mouthparts on a separate pin.

Material Examined. LANA'I: 2 δ , Lana'ihale, 3,300 feet, 19.viii.1965, KYK; 6 δ , North end, Lanaihale, 3,300 feet, 14.iv.1966, G46B, KYK; 3 δ , Kaiholena Gulch, 29.xi.1967, K94, HLC; 22 δ , 54 δ , Kaiholena Gulch, 26.ii.1977, reared ex: *Pisonia umbellifera* (G. Forster) Seem. Leaves, MK. MOLOKA'I: 21 δ , East fork of the east fork of Kawela Gulch, Moloka'i Ranch, 30.viii.1978, SLM.

Distribution and Ecology. This species was originally described from Moloka'i and can also be found on Lana'i. *Drosophila conjectura* has been reared from the rotting leaves of *Pisonia umbellifera* and *P. sandwicensis* Hillebr. (Nyctaginaceae) on Lana'i (Heed 1968, Kam 1978).

Diagnosis. *Drosophila conjectura* can be differentiated from *D. reschae* by having a longer basitarsus,

$\approx 1/3$ the length of the tibia, and by having spine I-8 inserted $1/2$ the distance from spines I-7 and I-9, rather than closer to I-7. The egg chorion structures, in particular that of the follicle imprints, are the only characters differentiating this species from *D. kambysellisi*.

Discussion. Labellar chaetotaxy is the most reliable character differentiating *D. conjectura* from *D. reschae*. Examining the labellae and ovipositor morphology of *D. kambysellisi* and *D. conjectura* indicates that these two taxa are identical for these and all other characters. However, as is often the case in Hawaiian *Drosophila* taxonomy, allopatric populations occurring on different islands, or even separate volcanoes on the same island, are often valid species, in spite of few or no external morphological differences. Michael Kambysellis (personal communication) reports differences in the morphology of the egg chorion of *D. conjectura* and *D. kambysellisi*, suggesting that the Hawai'i and Maui Nui populations of these taxa are actually morphocryptic sibling species. Nucleotide sequences, more detailed morphological analyses, or mating behavior will be required to generate additional characters separating these species.

Drosophila kambysellisi
Hardy & Kaneshiro

Drosophila kambysellisi Hardy & Kaneshiro, 1969: 44.

Description. *Male, Female.* This species follows the description of *D. conjectura*, above, except as noted in the diagnosis.

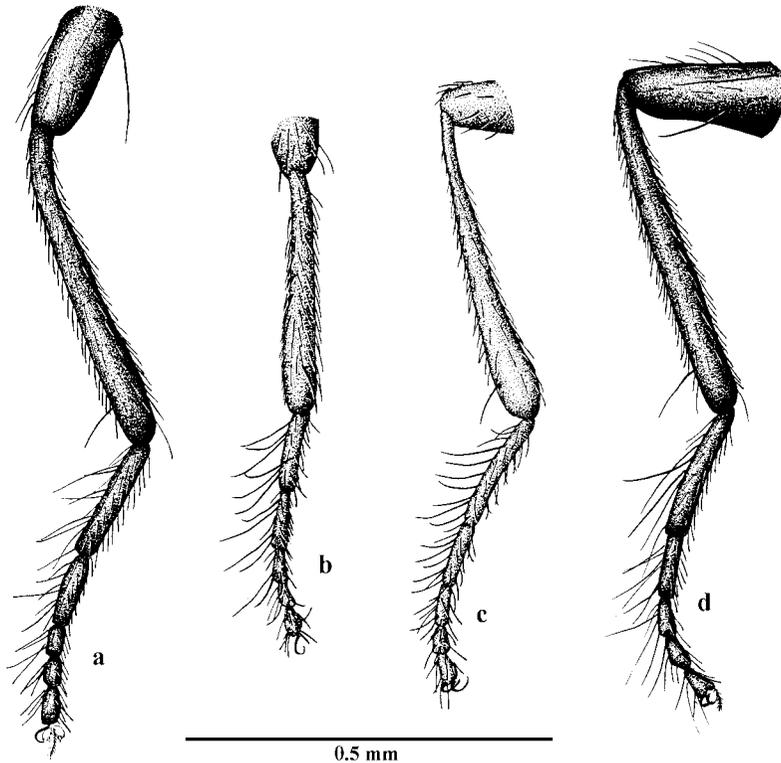


Fig. 8. Forelegs of *flavibasis* complex males. (a) *D. chimera*; (b) *D. flavibasis*; (c) *D. inebria*; (d) *D. xenophaga*.

Type Material. HAWAII: HOLOTYPE ♂, BPBM 9235, Kilauea (Volcano), Bird Park, 21.v.1968, MPK, axillary cell of left wing notched; right wing with three small holes (Evenhuis 1982). The following paratypes are in the collection at UHM. 4♂ Bird Park, Kilauea, vii.1963, WBH; 3♂, Bird Park, Kilauea, 21.v.1968; MPK; 1♂, Olaa B, Kipuka, no date given, LHT. A small series is also present at BPBM (18770—18773). 1♂, 3♀, Bird Park, Kilauea, 15.ix.1964, ex: *Psychotria* leaves, HTS.

Material Examined. HAWAII: The following specimens are present at UHM. 1♀, Upper Olaa Forest, viii.1952, WCM; 3♂, Bird Park, Kilauea, 5.xii.1963, MRW; 2♂, Bird Park, Kilauea, 16.i.1964, dissections of mouthparts on slide 15, MRW; 1♀, Bird Park, Kilauea, 12.vii.1964, LHT; 3♂, 1♀, Bird Park, Kilauea, 16.vii.1964, LHT; 1♂, 2♀, Bird Park, Kilauea, 15.ix.1964, reared ex: *Psychotria* leaves, HTS; 1♂, Bird Park, Kilauea, S29, 5.xi.1964, HTS; 1♂, 3♀, Bird Park, Kilauea, HTS19.3, vii.1965, HTS; 1♂, Bird Park, Kilauea, 5.viii.1965, DEH; 11♀, Bird Park, Kilauea, 14.iii.1966, reared ex: *Pisonia brunoniana* Endl. (label reads *Heimerliodendron brunonionum*), WBH; 5♂, 3♀, Bird Park, Kilauea, 17.iii.1968, L39, reared ex: *Pisonia brunoniana* (label reads *Pisonia brunonianas*), RI; 3♂, Bird Park, Kilauea, 1.iv.1968, L49, MPK; 3♂, Bird Park, Kilauea, 17.iv.1968, L53, reared ex: *Pisonia* leaves, RI; 10♂, Bird Park, Kilauea, 18.vi.1969, SR; 1♂, Bird Park, Kilauea, Site 30 d, 29.vii.1969; DR; 6♂, Bird Park, Kilauea, Site 31 d, 29.vii.1969; DR; 1♂, Papa, South

Kona, N72, 2.iii.1973, SLM; 3♂, Bird Park, Kilauea, viii.1974, T14, JY; 5♂, Manuka Forest Reserve, South Kona, UU12Q, 27.vi.1976, SLM; 28♂, 1♀, Upper Olaa Forest, U13, 19.vii.1976, dissections of mouthparts on slides 72 a-b and 76a-b, KYK; 8♂, 2♀, Pu'u Waawaa, 3,800 feet, 1.vii.1977, sweeping in *Pisonia* grove, SLM; 1♂, Greenwell Ranch, Y56, 12-14.iii.1989, dissection of mouthparts on slide 8a-b, KYK; 9♂, 4♀, Bird Park, Kilauea, T169Y15, no date or collector given; 1♂, 1♀, Papa, South Kona, S107Y12, no date or collector given; 1♂, Y56 wild collection, no collector, date or locality given. A number of specimens are also present at AMNH: 5♂, 5♀, Palumbo Property, Papa, South Kona, 2,200 feet, O39.6, 4.vii.1998, PMO and SLM.

Distribution and Ecology. This species is endemic to the Big Island. *Drosophila kambysellisi* has been reared from the rotting leaves of *P. brunoniana* (Nyctaginaceae), as well as from some unidentified species of *Pisonia* and *Psychotria* (Rubiaceae).

Diagnosis. This species is identical to *D. conjectura* Hardy in all characters except for the morphology of egg chorionic structures, and in particular the border of follicle imprints. In *D. kambysellisi* the follicle imprint borders are broad with a distinct narrow central ridge, while in *D. conjectura* the central ridge is missing or severely disrupted (M. P. Kambysellis, personal communication).

Discussion. This species was originally described based on comparison with sympatric populations of *D. mimica*. Differences between *D. kambysellisi* and *D.*

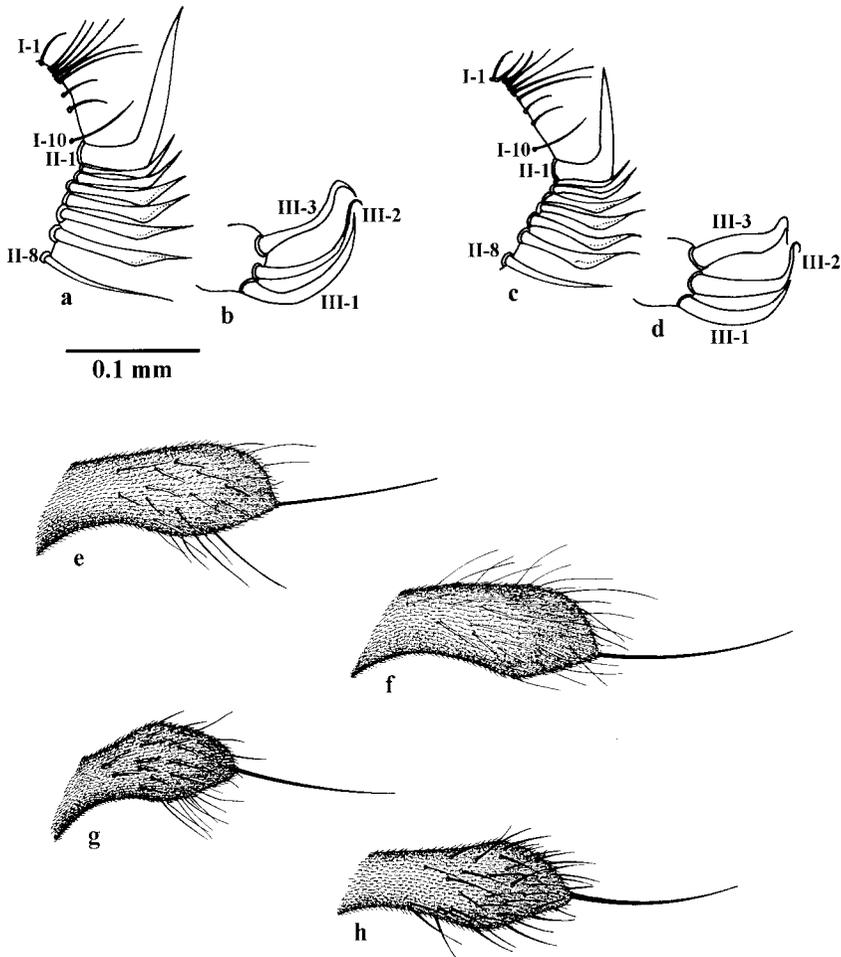


Fig. 9. Labellar setae and palps of species in the *infuscata* complex. (a) *D. infuscata*, groups I and II; (b) *D. infuscata*, group III; (c) *D. ma'ema'e*, groups I and II; (d) *D. ma'ema'e*, group III; (e) *D. infuscata*, male palps; (f) *D. infuscata*, female palps; (g) *D. ma'ema'e*, male palps; (h) *D. ma'ema'e*, female palps.

mimica are quite clear (Hardy and Kaneshiro 1969) and suggest that these taxa are not siblings. In the Hawaiian *Drosophila* species, egg chorion structure provides reliable morphological characters for differentiating cryptic taxa (Kaneshiro and Kambysellis 1999). *Drosophila conjectura*, above, is the closest relative of *D. kambysellisi*.

Drosophila reschae Hardy & Kaneshiro
(Figs. 4 c, d, and g, 5b)

Drosophila reschae Hardy & Kaneshiro, 1975: 63.

Description. *Male, Female.* Refer to Hardy and Kaneshiro (1975) for a full description of this species. Additional characters are described above.

Measurements. $N = 1\delta$. TL = 2.7 mm; WL = 5.9 mm; TL/WL = 0.5; HW = 1.9 mm; HW/TL = 0.7; CI = 4.7; 4V = 1.5; 5X = 1.6; 4C = 0.5; M = 0.4.

Type Material. O'AHU. HOLOTYPE δ , BPBM 9624, Puu Pane, Waialua, 1.iii.1970, SLM. Head in

microvial mounted below specimen, mouthparts on slide 9624 (Evenhuis 1982). ALLOTYPE ♀ , BPBM 9624a, same collection as holotype. Two paratypes at UHM have also been examined. 1 δ , same collection as holotype, mouthparts on slide 19a-c, 1 δ , Wailua, 24.v.1970, head in vial beneath specimen, mouthparts on slide 16a-c.

Material Examined. O'AHU: Additional material is also present at UHM. 1 δ , Pupukea, 4.v.1964, mouthparts in vial beneath specimen, no collector given; 1 δ , Pupukea, viii.1963, mouthparts in vial beneath specimen, DG.

Distribution. This species is known only from O'ahu.

Diagnosis. *Drosophila reschae* is very similar in general morphology to *D. conjectura*. These species can be distinguished by having a relatively short basitarsus, $\approx 1/4$ the length of the tibia (Fig. 5b). The labellar chaetotaxy is also diagnostic. Specifically, *D. reschae* has seta I-9 placed in line with seta I-10 and setae

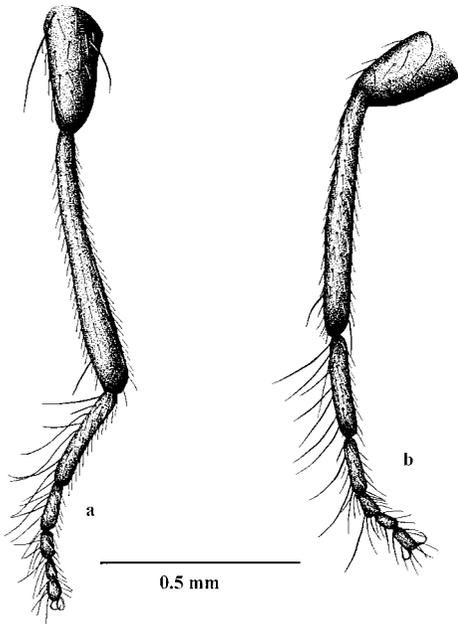


Fig. 10. Forelegs of *infuscata* complex males. (a) *D. infuscata*; (b) *D. ma'ema'e*.

II-3-II-7 thin, not clavate (Fig. 4c). Palps of males pointed along ventral margin (Fig. 4g); with one strong apical seta; one subapical seta, \approx one-third the length of apical seta; and numerous setae on dorsal and ventral surfaces; ventral setae are longer than dorsal (Fig. 4g).

Discussion. Some specimens which we are describing as *D. gagné* Kam & Perreira were originally designated as paratypes of *D. reschae*. *Drosophila reschae* is clearly distinct, based on the characters described above and in Hardy and Kaneshiro (1975). We have examined about two dozen females from the paratype series, both at UHM and BPBM (19337-19339) of *D. reschae* and are uncertain as to their placement. They may actually represent two closely related species and their identity should be considered uncertain.

The flavibasis Complex. This complex contains four species, *D. flavibasis* Hardy from Kaua'i, *D. chimera* Kam & Perreira and *D. inebria* Kam & Perreira from O'ahu, and *D. xenophaga* Kam & Perreira from the Big Island. Based on the morphology of males, this complex is probably most closely related to the *conjectura* and *mimica* complexes. General characters of the *flavibasis* complex are: head mostly yellow-brown; lower reclinate inserted posterior to or opposite proclinate, never distinctly anterior; thorax either with mesonotum reddish-brown and pleurae yellow or entirely brown; two strong humeral setae and one additional cilia present on humerus; anterior pair of dorsocentral setae small or rudimentary in males, never $>1/2$ length of posterior pair; legs entirely yellow, with ornate ciliation restricted to the foretarsi; wings predominantly hyaline, with faint brown infuscations evident only along the dm-cu crossvein and at apices of

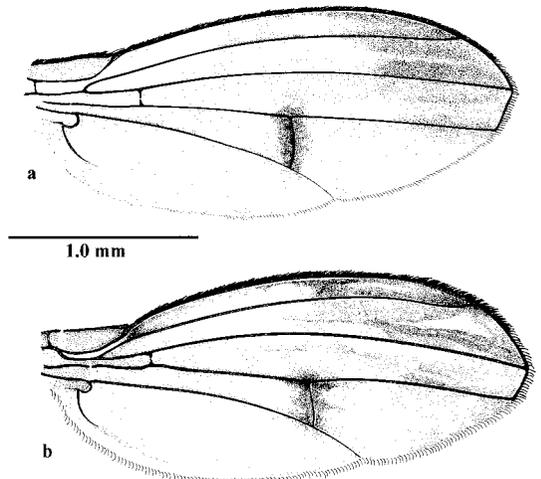


Fig. 11. Wings of species in the *infuscata* complex. (a) *D. infuscata*; (b) *D. ma'ema'e*.

R2+3, R4+5, and M1+2 when viewed in indirect light. Mouthpart chaetotaxy is also important in differentiating among the species and species complexes in the *mimica* subgroup. The *flavibasis* complex is characterized by having the base of setae I-7 set apart from that of I-6. Seta II-1 is tusk-shaped. Seta II-2 is narrow and tends to follow the shape of II-1. Setae II-3-II-7 are particularly clavate in this complex. Group III setae are elongate, with projections at the bases of III-2 and III-3. Palpi tend to be broad in males.

Drosophila chimera Kam Perreira, sp. nov.
(Figs. 6 a and b, 7a, 8a)

Drosophila reschae Hardy & Kaneshiro, 1975: 63.

Head. *Male, Female Unknown.* This species largely follows the description of *D. flavibasis* (Hardy 1965). Several differences are noted here. Setae I-1-I-7 form evenly spaced clump; distance which separates them from I-8 is greater than that which separates first seven setae from one another (Fig. 6a). Setae I-1 and I-5 located in row basal to main row of spines on mediproboscis. Setae I-8, I-9, and I-10 are roughly evenly spaced and approximately as far from one another as I-8 from I-1-I-7 (Fig. 6a). Seta II-1 large, tusk-shaped, and smooth. Seta II-2 tusk-shaped, but much smaller and narrower. Setae II-1 and II-2 closely inserted, forming a series distinct from II-3-II-8 (Fig. 6a). Setae II-3-II-7 dorsally directed and somewhat broad and flat just before tapering to point at apices. Seta II-8 tapers to point and is narrower and more elongate than setae II-3-II-7. Apices of group III setae directed dorsally, toward junction of labellar lobes (Fig. 6b). Rounded sclerotized projections arise from baso-ventral surfaces of III-2 and III-3. Palpi are broad at apex with two roughly equal length apical setae (Fig. 7a). A series of ≈ 5 setae present on ventral surface and a number of thin, hair-like cilia are present on dorsum.

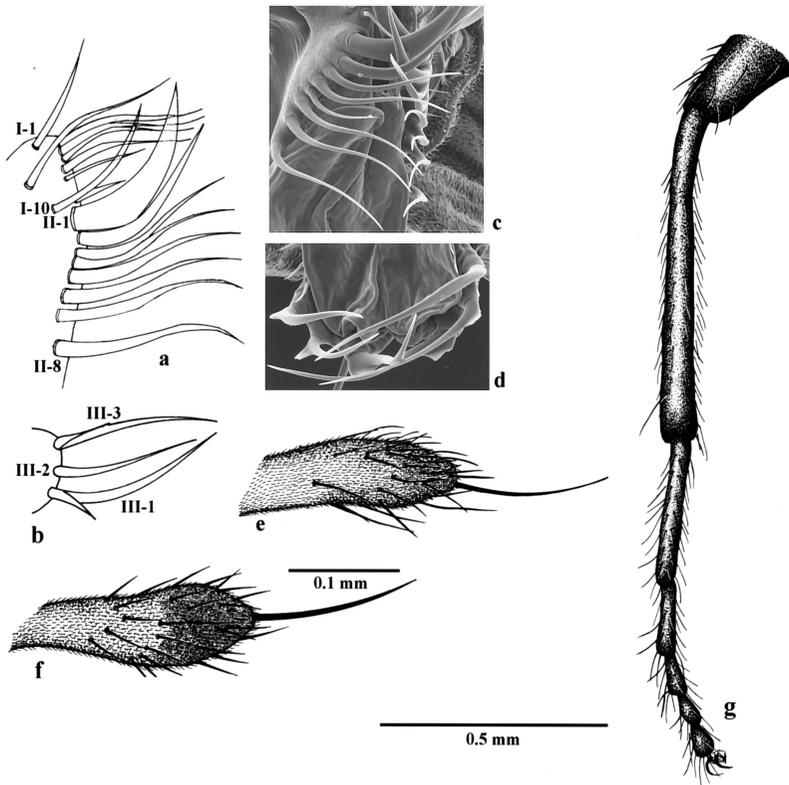


Fig. 12. Morphology of *D. involuta*. (a) Group I and II setae; (b) Group III setae; (c) Detail of group II setae; (d) Detail of group III setae; (e) Palps of male; (f) Palps of female; (g) Foreleg of male.

Thorax. An evenly spaced series of anterodorsal cilia are present on the first, second and third tarsal segments. Cilia on tarsomeres 4 and 5 are limited to basal 1/2 of segments (Fig. 8a).

Measurements. $N = 1\sigma$. TL = 3.2 mm; WL = 6.5 mm; TL/WL = 0.5; HW = 2.3 mm; HW/TL = 0.7; CI = 5.1; 4V = 1.5.

Type Material. O'AHU: HOLOTYPE σ , BPBM 16425, Palikea, Waianae Mountains, 11.v.1966, reared from *Clermontia* sp. leaves, G56A, mouthparts on slide 30, WBH (described as a paratype of *D. reschae*). A paratype is at UHM: 1 σ , Palikea, Waianae Mountains, 29.vi.1966, G86B, mouthparts on slide 26a–c, KYK.

Distribution and Ecology. This species is endemic to O'ahu. *Drosophila chimera* has been reared from rotting leaves of *Clermontia* sp. (Campanulaceae).

Etymology. The species name refers to fact that this taxon is similar in appearance to several *modified mouthpart* species, causing it to be placed within the paratype series of *D. reschae*.

Diagnosis. *Drosophila chimera* differs from the other species in this complex in the chaetotaxy of the mouthparts (Fig. 6 a and b), palps (Fig. 7a), and the ciliation of the male foretibia (Fig. 8a).

Discussion. *Drosophila chimera* is superficially similar to *D. reschae* from O'ahu. Specimens of *D. chimera* were originally designated as paratypes of *D. reschae*, but examination of the mouthparts of these taxa

clearly demonstrates that they are distinct (Fig. 4 a and b, versus 6 a and b).

Drosophila flavibasis Hardy (Figs. 6 c and d, 7b, 8b)

Drosophila flavibasis Hardy, 1965: 273.

Head. Male, Female. Hardy (1965) described the external morphology of *D. flavibasis*. Here we describe several characters of the male mouthparts that distinguish it from other species in the *flavibasis* complex. Setae I-1–I-6 form well-defined clump; greatest distance between I-6 and I-7 twice that as among first six group I setae (Fig. 6c). Setae I-1 and I-3 located basal to main series of setae on mediproboscis. Seta I-7 larger and thicker than setae I-8–I-10 and directed ventrally at apex. Setae II-1 tusk-shaped, smooth, and directed dorsally at apex (Fig. 6c). Seta II-2 closely inserted to II-1 and tusk-shaped, but smaller and narrower. Setae II-3–II-7 elongate and slightly spatulate before tapering to point at apices. Seta II-8 narrower than spines II-3–I-7, tapers to a point. The group III setae are bent dorsally, toward junction of labellar lobes (Fig. 6d). Rounded, sclerotized projections originate at baso-ventral surfaces of III-2 and III-3. Palps broad, somewhat pointed along ventral margin of apex. Palps setose, with two long apical seta (Fig. 7b).

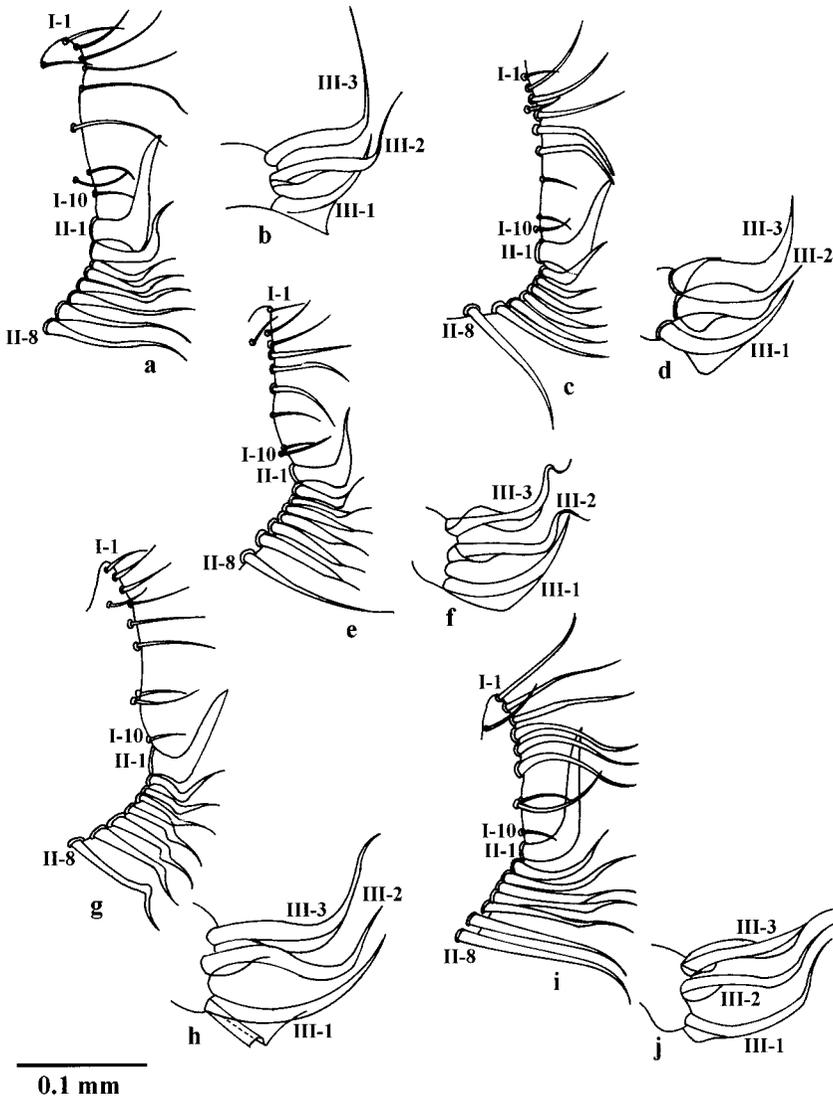


Fig. 13. Labellar setae of *kauluai* complex males. (a) *D. acanthos*, groups I and II; (b) *D. acanthos*, group III; (c) *D. badia*, groups I and II; (d) *D. badia*, group III; (e) *D. echinostoma*, groups I and II; (f) *D. echinostoma*, group III; (g) *D. kauluai*, groups I and II; (h) *D. kauluai*, group III; (i) *D. odontostoma*, groups I and II; (j) *D. odontostoma*, group III.

Smaller seta 1/2 length of longer. Numerous thin cilia present on the dorsal and ventral margins of the palps (Fig. 7b).

Thorax. A series of anterodorsal cilia are present on the foretarsus of males (Fig. 8b).

Measurements. $N = 3\delta$. TL = 3.1 mm (3.0–3.2); WL = 6.8 mm (6.5–7.0); TL/WL = 0.5; HW = 2.4 mm (2.3–2.5); HW/TL = 0.8; CI = 5.0 (5.0–5.1); 4V = 1.4 (1.4–1.5); 5X = 1.3 (1.1–1.5); 4C = 0.5; M = 0.4.

Type Material. KAUA'I: HOLOTYPE δ , BPBM 6358, Halemanu Swamp, viii.1953, DEH. Left foreleg beyond the tarsus missing; posteroapical portion of wing torn off (Evenhuis 1982). ALLOTYPE δ , BPBM 6358a, same collection as holotype. Several paratypes

from UHM have also been studied. 3 δ , Nualolo Valley, 3,400 feet, vii.1952, mouthparts of one individual are located in a microvial beneath the specimen, DEH.

Material Examined. KAUA'I: Several specimens are present at UHM. 9 δ , Kokee, 3,600 feet, 29C.16, MRW and FEC; 7 δ , Halemanu Valley, 4,000 feet, 24.vi.1964, DEH; 3 δ , Halemanu Valley, 4,000 feet, 10.ix.1965, no collector given; 1 δ , Mohihi Stream, Kokee, 18.vii.1966, KYK; 1 δ , Halemanu, 3,400 feet, L43, 22.iii.1968, HLC; 5 δ , Makanalua Valley, 1,950 feet, 23.iii.1973, mouthparts of one specimen on slide 14 a–d, KYK; 13 δ , Powerline Road, Kapa'a, 1,150 feet, 2.vi.1977, mouthparts of one specimen on slide 25a–c, reared ex: *Pisonia umbellifera* leaves, MK.

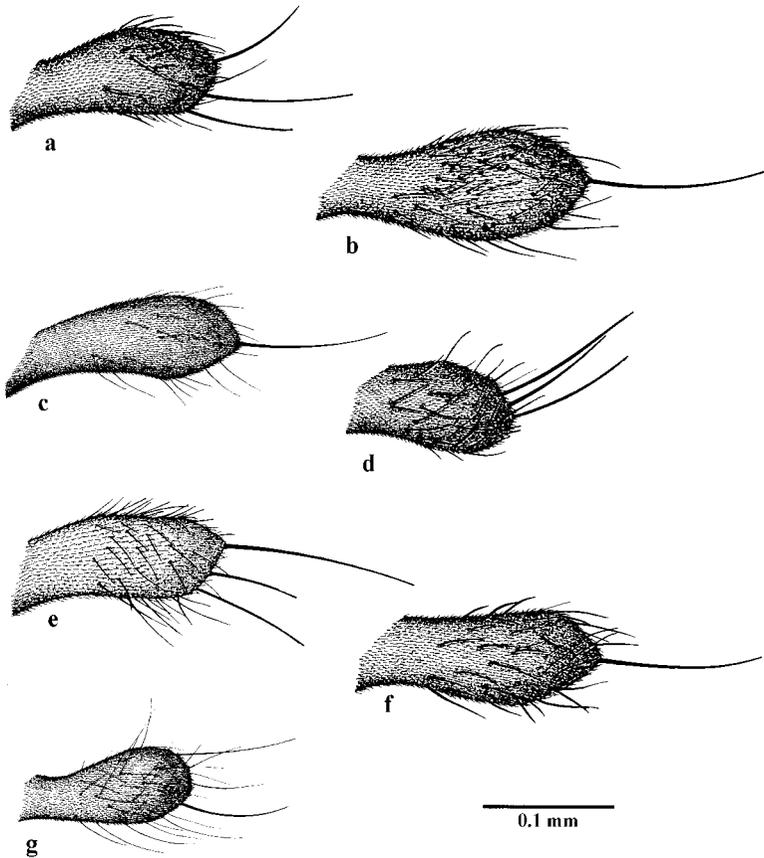


Fig. 14. Palps of species in the *kauluai* complex. (a) *D. acanthos*, male; (b) *D. acanthos*, female; (c) *D. badia*, male; (d) *D. echinostoma*, male; (e) *D. kauluai*, male; (f) *D. kauluai*, female; (g) *D. odontostoma*, male.

Distribution and Ecology. This species is endemic to Kaua'i and has been reared from the decaying leaves of *Pisonia umbellifera*, a native member of the Nyctaginaceae. Other incidental hosts (Kam 1978) include the decaying leaves and fruits of the introduced New Zealand laurel, *Corynocarpus laevigatus* J. R. Forster & G. Forster (Cornycarpacae).

Diagnosis. This species is most closely related to *D. chimera* and *D. inebria*. It differs by having the anterior dorsocentral setae $\approx 2/5$ – $1/2$ length of posterior dorsocentrals, a single strong apical seta, ≈ 2 times longer than the subapical seta, on its palps (Fig. 7b) and by the chaetotaxy of the labellae (Fig. 6 c and d), most specifically the arrangement of setae I-1–I-6 and the more pointed apices of spines II-4–II-7.

Discussion. Specimens of *D. antecedens* Kam & Perreira were included as paratypes of *D. flavibasis* by Hardy (1965). The similarities between these two taxa are superficial, many morphological characters, including the placement of the orbital setae (Fig. 17a), chaetotaxy of the foreleg of males (Fig. 8b versus 19a), chaetotaxy of the labellum (Fig. 6 c and d versus 17 b and c), extent of maculations on the wing, and the shape of the palpi (Fig. 7b versus 18 a and b), indicate that they are distinct species.

***Drosophila inebria* Kam & Perreira, sp. nov.**
(Figs. 6 e and f, 7c, 8c)

Head. *Male, Female Unknown.* This species closely follows the description of *D. flavibasis* (Hardy 1965) except as follows. Group I setae evenly spaced, not forming distinct clump (Fig. 6e). Setae I-1, I-3, and I-9 basal to main series of setae on mediproboscis. Setae I-6 and I-7 tusk-shaped, distinctly curved ventrally. Seta I-7 $\approx 1/2$ width of seta II-1. Seta II-1 large, tusk-shaped, dorsally directed, with distinct ventral projection at bend (Fig. 6e). Setae II-2–II-4 narrow, elongate, and not widened before apex. Setae II-5–II-8 elongate, becoming clavate before tapering to point at apex. Seta II-8 tall, narrow. Group III setae similar to those of *D. chimera* (Fig. 6f). Palps similar to *D. flavibasis*, but more rounded at apex (Fig. 7c). Subapical palpal seta $\approx 1/2$ length of palpal seta. Thin cilia present on dorsal and ventral margins of palps, slightly longer on venter.

Thorax. With a complete series of anterodorsal cilia on foretarsus. Basitarsus somewhat long, $\approx 2\times$ length of second tarsomere (Fig. 8c).

Type Material. O'AHU: HOLOTYPE δ , BPBM 16428, Pupukea, no date recorded, mouthparts on slide

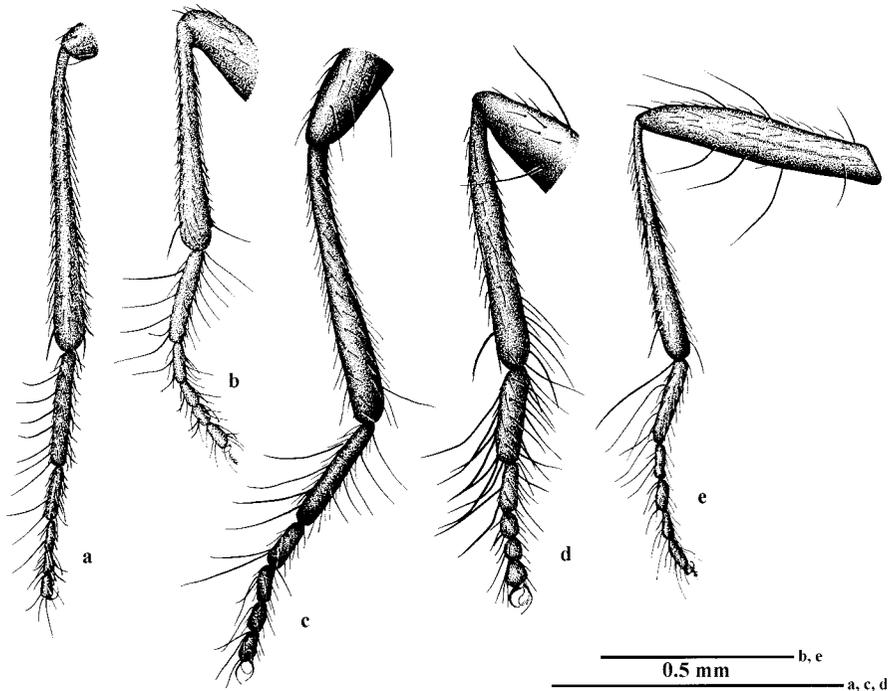


Fig. 15. Forelegs of *flavibasis* complex males. (a) *D. acanthos*; (b) *D. badia*; (c) *D. echinostoma*; (d) *D. kaului*; (e) *D. odontostoma*.

49a-d, HLC. TL = 3.4 mm; WL = 6.6 mm; TL/WL = 0.5; HW = 2.6 mm; HW/TL = 0.8; CI = 5.0; 4V = 1.2; 5X = 1.2; 4C = 0.4; M = 0.3.

Distribution. *Drosophila inebria* is found only on O'ahu and is known only from the holotype male.

Etymology. This species is named "*inebria*" because of the confusion concerning the origin of the type of this species.

Diagnosis. *Drosophila inebria* is very closely related to *D. chimera*. It can be differentiated from this species by differences in the chaetotaxy of the labellae (Fig. 6 e and f), palps (Fig. 7c), and foretarsi (Fig. 8c).

Discussion. Because of insufficient label data, it is unclear whether this species was collected as an adult, reared from some substrate, or is the F1 of some unknown female. We are currently unable to associate this species with either a female or a substrate and further collections will be needed before we can do so.

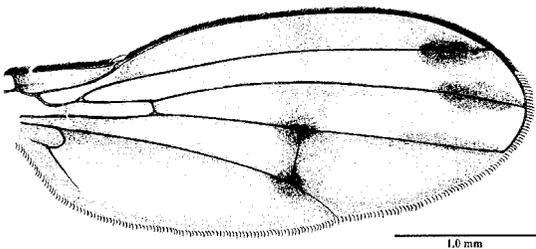


Fig. 16. Wing of *Drosophila kaului*.

***Drosophila xenophaga* Kam & Perreira, sp. nov.**

(Figs. 6 g and h, 7d and e, 8d)

Head. *Male, Female.* Vertex brown, dusted with silver-gray pollen. Front and genae yellow. Eyes reddish brown. Anterior reclinate seta arises opposite, or slightly anterior, to proclinate. Anterior reclinate $\approx 1/2$ length of proclinate. Posterior reclinate is $\approx 4\times$ length of anterior reclinate. Antennae predominately brown with some yellow on first segment. Three ventral and seven dorsal rays present on arista, in addition to apical fork. Prominent facial carina, $\approx 5\times$ as long as wide, present. Anterior most setae of oral vibrissae thin, poorly developed in male, well-developed in female. Setae II-18 form distinct clump (i.e., distance between I-8 and I-9 is greater than that among setae II-18; Fig. 6g). Setae I-1, I-3, and I-10 located in row basal to main series of setae on mediproboscis (Fig. 6g). Setae I-5-I-7 well-developed, $\approx 1/3$ thickness of seta II-1, and directed ventrally. Seta II-1 tusk-shaped, dorsally directed, with a ventral projection on bend (Fig. 6g). Setae II-3-II-7 widen considerably before tapering at apices. Setae II-1-II-7 have their apices directed vertically, toward group I setae. Seta II-8 approximately equal in length as II-7, but much narrower and curvate before tapering to point. Group III setae elongate, with apices pointed dorsally, toward junction of labellar lobes (Fig. 6h). Sclerotized projections originate on the baso-ventral surfaces of III-2-III-3. Palpi of male broad, somewhat pointed on ventral margin (Fig. 7d), with three distinct setae, one

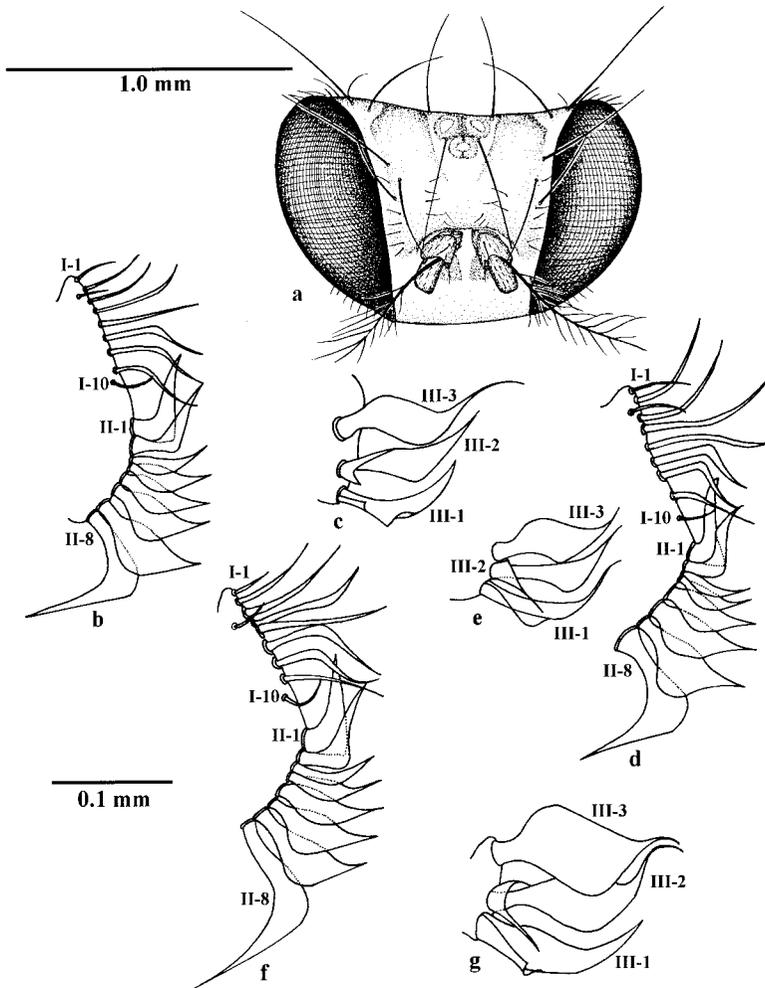


Fig. 17. Head and labellar structures in the *mimica* complex. (a) *D. antecedens*, head; (b) *D. antecedens*, groups I and II; (c) *D. antecedens*, group III; (d) *D. gagné*, groups I and II; (e) *D. gagné*, group III; (f) *D. mimica*, groups I and II; (g) *D. mimica*, group III.

apical and two subapical. Subapical palpal setae roughly equal in length, $\approx 4/5$ length of apical palpal seta. Thin cilia present on palps of male, slightly longer on venter. Palps of female narrow and rounded at apex, with only a single strong seta at apex (Fig. 7e) and numerous short setae on ventral and dorsal margins.

Thorax. Predominately brown. Mesonotum brown, covered lightly with silver-gray pollen. Anterior pair of dorsocentral setae short, $\approx 1/3$ length of the posterior dorsocentrals, in male. Anterior dorsocentrals in female well developed, $\approx 9/10$ length of posterior dorsocentrals. Pleura brown or brown with occasional yellow. Halteres yellow. Legs entirely yellow. Long cilia present along the foretarsus or males (Fig. 8d), absent in females.

Wings. Mostly hyaline with very faint brown infuscation along dm-cu crossvein.

Type Material. HAWAII: HOLOTYPE ♂, BPBM 16432, forest above Paauilo, 29.viii.1966, reared from

leaves of *Passiflora* sp., J28, RI TL = 3.1 mm; WL = 6.5 mm; TL/WL = 0.5; HW = 2.3 mm; HW/TL = 0.7; CI = 5.8; 4V = 1.4; 5X = 1.5; 4C = 0.4; M = 0.4. ALLOTYPE ♀, BPBM 16432, same data as holotype. TL = 3.6 mm; WL = 7.4 mm; TL/WL = 0.5; HW = 2.5 mm; HW/TL = 0.7; CI = 5.0; 4V = 1.4; 5X = 1.5; 4C = 0.5; M = 0.4. A large series of paratypes is also present at UHM. 7♂, 3♀, forest above Paauilo, 3,000 feet, 28–29.viii.1963, DEH, LHT and DG; 2♂, 7♀, forest above Paauilo, 2,700 feet, LHT; 5♂, 3♀, forest above Paauilo, 3,000 feet, 19.vi.1964, DEH and LHT; 14♂, 29♀, from the same collection as the holotype; Sinkhole, Hualalai, Kona, 5,600 feet, K3, 7.vii.1967, KYK; 1♂, Keaau Forest Reserve, 2,200 feet, 13.iv.1973, reared from leaves of *Charpentiera* sp. (Amaranthaceae), R96, HLC; Hualalai Ranch, 4,600 feet, 21.v.1976, slide 13 a-d, KYK.

Distribution and Ecology. This species is endemic to the Big Island of Hawai'i. *Drosophila xenophaga* has been reared from the rotting leaves of an endemic

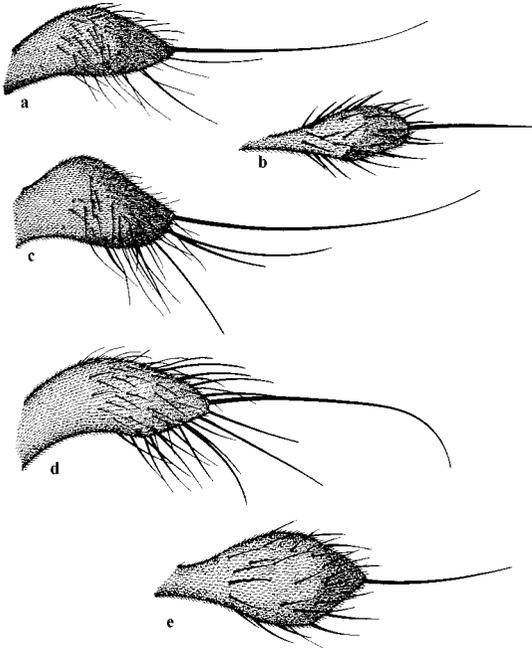


Fig. 18. Palps of species in the *mimica* complex. (a) *D. antecedens*, male; (b) *D. antecedens*, female; (c) *D. gagné*, male; (d) *D. mimica*, male; (e) *D. mimica*, female.

species of *Charpentiera* (Amaranthaceae) as well as an exotic species of the banana poka, *Passiflora mollissima* (Kunth) L. H. Bailey. (Kam 1978).

Etymology. Greek, from *xeno* (foreign or alien) and *phagos* (one that eats). This name is given to this species in consideration of the large series of specimens that were reared from the leaves of the introduced passion-fruit vine.

Diagnosis. *Drosophila xenophaga* is differentiated from other species in the *flavibasis* complex by the arrangement of setae on the labellum (Figs. 6 g and h), the palps (Fig. 7 d and e) and the foretarsi (Fig. 8d).

The infuscata Complex. This complex contains three species, *D. infuscata* Grimshaw from the Big Island, *D. ma'ema'e* Kam & Perreira from Maui, and an undescribed species from O'ahu. Species in this complex are characterized by an infuscation over the dm-cu crossvein and a contiguous brown infuscation between the apices of the wing veins extending well into the adjacent cells (Fig. 11 a and b) in combination with a light brown to brownish yellow mesomotum and a yellow pleura. The chaetotaxy of the labellum is also characteristic of this group. Group I setae all thin and elongate, roughly equal in thickness; setae I-1-I-7 are in a single row and inserted very close to one another; setae I-8 and I-9 $\approx 1/2$ length of other setae in this series; seta I-10 placed in a row basal to the other setae in this series, close to the base of seta II-1. Group II setae are as follows: seta II-1 strongly elongated, angular, and tusk-shaped; seta II-2 narrow and closely follows the curvature of II-1; seta II-3 taller, slightly wider, and less curved than the II-2; setae II-4-II-7 taller, straighter and more clavate apically than setae

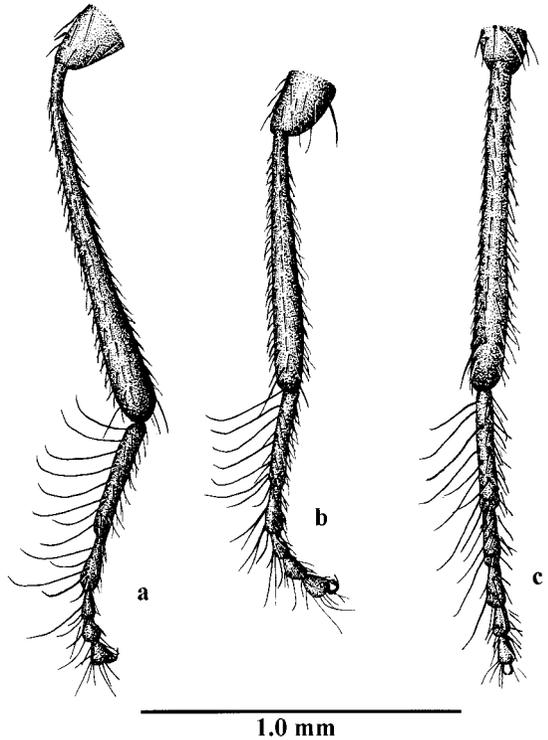


Fig. 19. Forelegs of *mimica* complex males. (a) *D. antecedens*; (b) *D. gagné*; (c) *D. mimica*.

II-2 and II-3; seta II-8 elongate and gently curved, its base distinct from that of II-7. The group III setae are long, narrow, and curve as they taper toward the apices. Sclerotized projections on the bases of group III setae are absent in this complex. Ecologically, this group is unique within the *mimica* subgroup in that it uses bark and stems of native host plants rather than leaves or fruit.

Drosophila infuscata Grimshaw
(Figs. 9 a, b, e, and f; 10a, 11a)

Drosophila infuscata Grimshaw, 1901: 63.

Drosophila infuscata Hardy, 1965: 324.

Head. Male, female. Hardy (1965) described this species. Here we add some characteristics of the chaetotaxy of male labellae. **Head.** Setae I-1-I-7 thin and

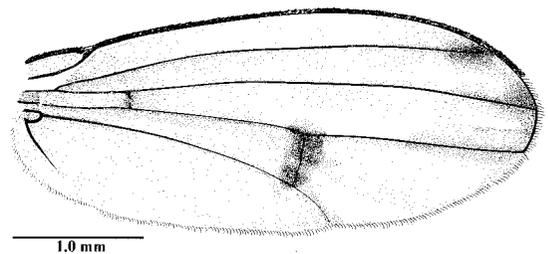


Fig. 20. Wing of *Drosophila mimica*.

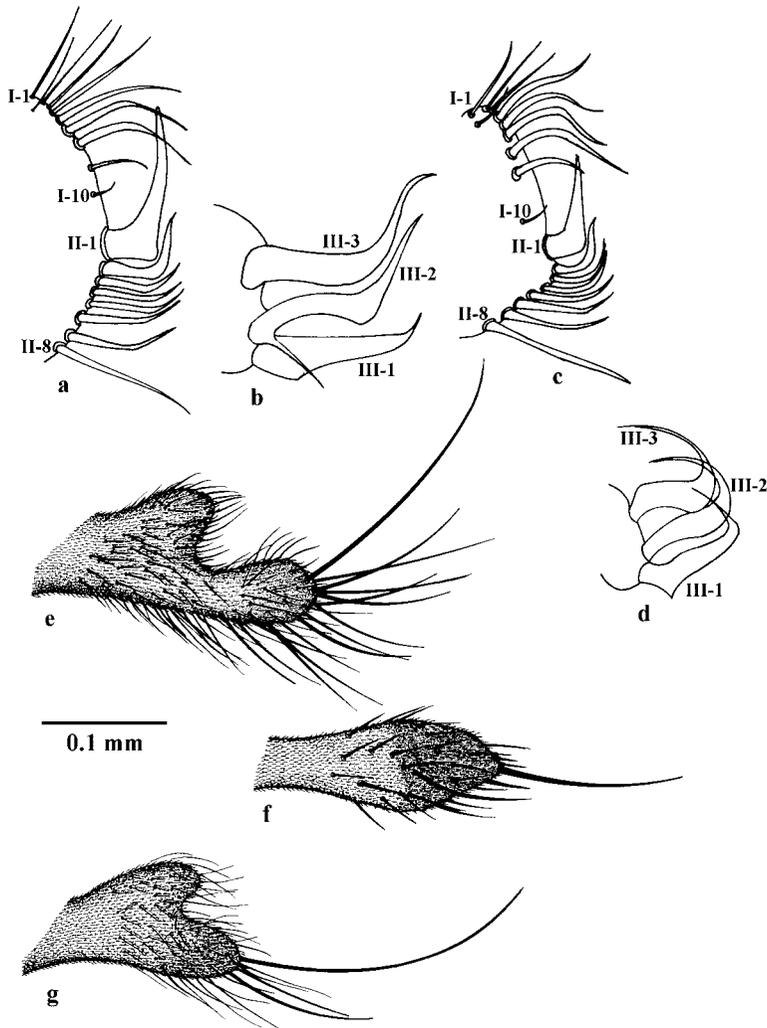


Fig. 21. Labellar setae and palps of species in the *infuscata* complex. (a) *D. soonae*, groups I and II; (b) *D. soonae*, group III; (c) *D. lobatopalpus*, groups I and II; (d) *D. lobatopalpus*, group III; (e) *D. soonae*, male palps; (f) *D. soonae*, female palps; (g) *D. lobatopalpus*, male palps.

closely inserted, forming a distinct clump of setae. Setae I-8, I-9, and I-10 more or less evenly spaced (Fig. 9a). Seta I-10 $\approx 1\frac{1}{2}$ times longer than I-8 or I-9. Seta II-1 large, tusk-shaped, and directed dorsally with no ventral projection at bend. Setae II-2–II-7 rather weakly dorsally directed and clavate just before their apices (Fig. 9a). Seta II-8 thinner, not clavate, and straight, not directed dorsally. Setae III-1–III-3 not clavate and only weakly directed dorsally toward junction of labellar plates (Fig. 9b). Palpi of male somewhat pointed at apex with a single apical palpal seta (Fig. 9e). Roughly three dorsal and six ventral cilia present on margin. Palps of female similar to those of male but with thinner, more numerous cilia present, especially on ventral margin (Fig. 9f).

Measurements. $N = 2\delta$. TL = 3.8 mm; WL = 7.6 mm (7.5–7.6); TL/WL = 0.5; HW = 2.9 mm (2.8–2.9); HW/TL = 0.8 (0.7–0.8); CI = 5.0; 4V = 1.4 (1.3–1.4); 5X = 1.3; 4C = 0.5; M = 0.4.

Type Material. HAWAII: HOLOTYPE δ , BMNH (not examined). Two homotypes are at UHM. 2 δ , Kaiholena, Kohala Mountains, 2,300 feet, viii.1952, DEH. Two topotypes from BPBM (18747) were examined. 1 δ , 1 δ (mounted on minutens on the same pin), Ola'a, vii.1903, no collector listed.

Material Examined. HAWAII: The following material is present at UHM: 1 δ , Kilauea, 13.x.1929, sweeping ferns, OHS; 1 δ , Kaiholena Ridge, 2,300 feet, viii.1952, DEH; 1 δ , Kaiholena, 2,200 feet, viii.1952, DEH; 1 δ , 2 δ , Kaiholena, Ditch Trail, Kohala Mountains, 2,000 feet, vii.1958, DEH; 2 δ , 1 δ , Pawaina, 3,000 feet, 13.vii.1965; C129.3, RSF; 1 δ , Ranger Cabin, Kilauea, G70, 3.vi.1966, WBH; 1 δ , Saddle Road, 2,275 feet, reared ex: *Freycinetia* branch, G69A, WBH; 2 δ , 1 δ , Saddle Road, 2,275 feet, G92A, 6.vii.1966, reared ex: *Clermontia* stems, WBH; 6 δ , 4 δ , Honaunau Forest, 2,100 feet, J6G, 19.vii.1966; HLC; 1 δ , 1 δ , Honaunau Forest Reserve, 2,100 feet, J6C7, 20.vii.1966, reared ex:

Table 1. Host plants of species in the *mimica* subgroup

Species	Host plant	Substrate type	Reference
<i>D. antecessens</i>	Corynocarpaceae: <i>Cornycarpus laevigata</i>	Fruits	3,5,6
<i>D. chimera</i>	Campanulaceae: <i>Clermontia</i> sp.	Leaves	5,6
<i>D. conjectura</i>	Nyctaginaceae: <i>P. brunoniana</i> , <i>umbillifera</i>	Leaves	3,4,6
<i>D. flavibasis</i>	Corynocarpaceae: <i>Cornycarpus laevigata</i>	Leaves	5
	Nyctaginaceae: <i>P. umbillifera</i>	Leaves	5
<i>D. gagné</i>	Sapindaceae: <i>Sapindus oahuensis</i> S. <i>saponaria</i>	Fruits	5,6
<i>D. infuscata</i>	Campanulaceae: <i>Clermontia</i> sp.	Stems, bark	3,4
	Oleaceae: <i>Nestegis sandwicensis</i>	Stems, bark	3,4
	Pandanaceae: <i>Freycinetia arborea</i>	Stems, bark	3,4
<i>D. involuta</i>	Campanulaceae: <i>Clermontia</i> sp.	Fruits	3
	Fabaceae: <i>Canavalia hawaiiensis</i>	Flowers	6
<i>D. kambysellisi</i>	Campanulaceae: <i>Clermontia</i> sp.	Leaves	5
	Nyctaginaceae: <i>P. sandwicensis</i>	Leaves	5
	Passifloriaceae: <i>Passiflora</i> sp.	Leaves	5
	Piperaceae: <i>Peperomia</i> sp.	Leaves	5
	Rubiaceae: <i>Psychotria</i> sp.	Leaves	5
<i>D. kauluai</i>	Apocynaceae: <i>Pteralyxia</i> sp.	Fruits	6
	Sapotaceae: <i>Pouteria</i> sp.	Fruits	2
<i>D. lobatopalpus</i>	Sapindaceae: <i>Sapindus</i> sp.	Flux/dirt	6
<i>D. ma'ema'e</i>	Pandanaceae: <i>Freycinetia arborea</i>	Stems, bark	6
<i>D. mimica</i>	Basidiomycetes: bracket fungus	Fruiting body	2
	Nyctaginaceae: <i>Pisonia</i> sp.	Leaves	2
	Piperaceae: <i>Peperomia</i> sp.	Leaves	1
	Sapindaceae: <i>Sapindus saponaria</i>	Fruit	3,6
<i>D. xenophaga</i>	Amaranthaceae: <i>Charpentiera</i> sp.	Leaves	6
	Passifloriaceae: <i>Passiflora</i> sp.	Leaves	5,6

1, Bryan (1934); 2, Spieth (1966); 3, Heed (1968); 4, Heed (1971); 5, Kam (1978); 6, this study.

Freycinetia stems, HLC; 19♂, 13♀, Honaunau Forest Reserve, 19–20.vii.1966, cytological vouchers (J6G22–25), HLC; 2♂, 1♀, Pu'u Laalau, Kohala Mountains, 4,000 feet, J29B65, 29–31.viii.1966, KYK;

1♀, Pawaina, Kona, 7.vii.1967, K4, KYK; 2♂, Stainback Highway, 2,100 feet, K62, 2.x.1967, HLC; 1♀, Pu'u Huluhulu, Volcano National Park, L21, 20.xii.1967, HLC; 7♂, West of Pu'u Ohu, South Kohala Mountains, 3,650 feet, L77G11, 4–5.vi.1968, HLC; 1♀, Kehena Ditch, South Kohala, N17, 22–24.vii.1969, WBH; 2♂, Kilauea, 28.i.1969, MDD; 1♀, Kohala Ditch Trail, Honokane Nui Valley, 1,100 feet, 10.vii.1970, KYK; 1♂, 1♀, Hinakapoula, Hualalai, reared ex: *Freycinetia* stem or leaf, 20.xii.1970, no collector given; 2♂, 3♀, Papa, South Kona, N72, leaf axil dieback, 2.iii.1973, SLM and WBH. Several specimens at BPBM (18748–18750)

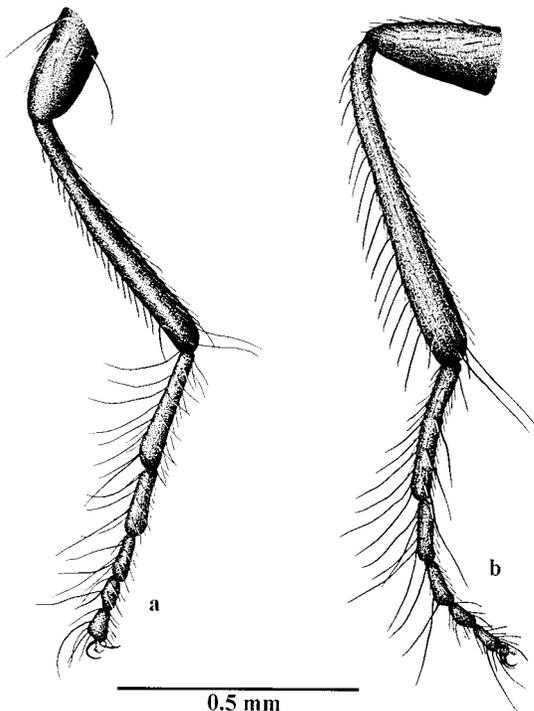


Fig. 22. Forelegs of *soonae* complex males. (a) *D. soonae*; (b) *D. lobatopalpus*.

Table 2. Taxonomic relationships within the *mimica* subgroup

Species complex	Species	Distribution
<i>conjectura</i>	<i>conjectura</i>	Lana'i, Moloka'i
	<i>kambysellisi</i>	Hawai'i
	<i>reschae</i>	O'ahu
<i>flavibasis</i>	<i>chimera</i>	O'ahu
	<i>flavibasis</i>	Kaua'i
	<i>inebria</i>	O'ahu
	<i>xenophaga</i>	Hawai'i
<i>infuscata</i>	<i>infuscata</i>	Hawai'i
	<i>ma'ema'e</i>	Maui
	Q	O'ahu
<i>involuta</i>	<i>involuta</i>	Hawai'i
<i>kauluai</i>	<i>acanthos</i>	Hawai'i
	<i>badia</i>	Maui
	<i>echinostoma</i>	Maui
	<i>kauluai</i>	O'ahu
	<i>odontostoma</i>	Hawai'i
<i>mimica</i>	<i>antecessens</i>	Kaua'i
	<i>gagné</i>	O'ahu
	<i>mimica</i>	Hawai'i
<i>soonae</i>	<i>soonae</i>	Hawai'i
	<i>lobatopalpus</i>	O'ahu

were also examined: 1♂, Glenwood, 3.ii.1919, OHS; 2♂, Kaiholena, Kohala Mts., 2,000 feet, viii.1952; DEH.

Distribution and Ecology. *Drosophila infuscata* is known from the Big Island. This species has been reared from the stems and bark of several plant families (Heed 1968; 1971) including *Clermontia* sp. (Campanulaceae), *Freycinetia arborea* Gaud. (Pandanaeae), and *Nestegis sandwicensis* (A. Gray) Degener, I, Degener, and L. Johnson (Oleaceae).

Diagnosis. *Drosophila infuscata* males differ from those of *D. ma'ema'e* by having the curvature of the apices of spines II-4-II-7 less directed dorsally (Fig. 9a), possessing thinner, less numerous cilia on the anterodorsal margin of the foretarsi (Fig. 10a), and by the less extensive brown infuscations on the wings (Fig. 11a). Females can be differentiated by having fewer ventral cilia on the palps (Fig. 9f).

Drosophila ma'ema'e Kam & Peirerra, sp. nov.

(Figs. 9 c, d, g, and h, 10b, 11b)

Head. *Male, Female.* This species fits with the description of *D. infuscata*, except in the characters listed in the diagnosis and as follows. *Head.* Vertex brown, with silvery-gray pollen. Eyes red to reddish-brown. Gena yellow. First two antennal segments yellow with slight brown discoloration. ≈5-9 dorsal and 2-3 ventral rays present, in addition to apical fork. Face yellow, covered with silvery pollen, which is white in appearance. Carina low, indistinct. Relative placement of anterior reclinate and proclinate setae varies from slightly anterior to slightly posterior to one another. Anterior-most setae of oral vibrissae poorly to moderately developed, never extending >1/4 width of face.

Thorax. Mesonotum and scutellum light brown to brownish-yellow, covered with layer of silver gray pollen. Between six and eight rows of acrostichal setulae present. Two strong pairs of dorsocentral setae and a prominent pair of humeral setae present. Pleurae yellow. Halteres clear yellow or yellow tinged with brown. Legs entirely yellow. Foretarsi with long cilia (Fig. 10b).

Wings. Infuscated with brown along crossvein dm-cu and in much of the apical cells of the wing. Remaining portions of wing hyaline (Fig. 11b).

Abdomen. Predominantly brown to black on dorsum except for yellow first tergite.

Measurements. $N = 5♀$. TL = 3.7 mm (3.6-3.8); WL = 7.2 mm (7.1-7.3); TL/WL = 0.5; HW = 2.6 mm (2.6-2.7); HW/TL = 0.7; CI = 4.4 (4.3-4.5); 4V = 1.4 (1.2-1.4); 5X = 1.0 (0.9-1.1); 4C = 0.5 (0.5-0.6); M = 0.4 (0.3-0.4).

Type Material. MAUI, HOLOTYPE ♂, BPBM 16430, Pohakea Gulch, 29.iv.1972, reared ex. *Freycinetia arborea*, KYK. TL = 3.3 mm; WL = 6.2 mm; TL/WL = 0.5; HW = 2.6 mm; HW/TL = 0.8; CI = 4.6; 4V = 1.2; 5X = 1.1; 4C = 0.5; M = 0.4. ALLOTYPE ♀, BPBM 16430a, same collection as holotype. TL = 3.8 mm; WL = 7.3 mm; TL/WL = 0.5; HW = 2.7 mm; HW/TL = 0.7; CI = 4.3; 4V = 1.2; 5X = 0.9; 4C = 0.5;

M = 0.3. A number of paratypes are present at UHM. 1♂, 5♀, UHM, same collection as holotype.

Distribution and Ecology. This species is endemic to Maui. *Drosophila ma'ema'e* has been reared from the stems of *Freycinetia arborea* (Pandanaeae).

Etymology. We dedicate this species to the late Mae Mull, a conservationist and friend. In the Hawaiian language "ma'ema'e" means clean and attractive.

Diagnosis. *Drosophila ma'ema'e* bears considerable resemblance to *D. infuscata* from Hawai'i. Males of *D. ma'ema'e* can be separated from those of *D. infuscata* by having setae II-4-II-7 more clavate and dorsally directed (Fig. 9c), more numerous and curvate cilia on the foretarsi (Fig. 10b), and wings which are more extensively infuscated (Fig. 11b). Females of *D. ma'ema'e* can only be distinguished by having more cilia on the ventral margin of the palps (Fig. 9h).

Drosophila sp. Q. A single female which strongly resembles *D. infuscata* and *D. ma'ema'e* is on hand from Pupukea, O'ahu. Numerous collecting trips to this area have failed to yield additional specimens and, without a complete examination of the chaetotaxy of male mouthparts and forelegs, the identity of this species will remain uncertain. This specimen possibly represents a third species of the *infuscata* complex. 1♀, Pupukea, O'ahu, 2.i.1964, MRW.

The involuta Complex. This complex contains a single species, *D. involuta* Hardy, from the Big Island. Kam (1978) placed it with the *infuscata* complex but, since it is quite distinct morphologically, we are removing it and placing it in a separate complex. The *involuta* complex most closely resembles species of the *mimica* complex in external morphology and may be confused with these taxa in those localities where the two occur sympatrically. Distinguishing characteristics include the strong development of at least one pair of anterior oral vibrissae, absence of strong cilia on the foretarsi, two well-developed pairs of dorsocentral setae, and the chaetotaxy of the labellum.

Drosophila involuta Hardy

(Fig. 12 a-e)

Drosophila involuta Hardy, 1965: 329.

Head. *Male, Female.* Hardy (1965) described this species. We include several additional characters here. Occiput and vertex brown. Vertex covered with silvery-gray pollen. Eyes brownish-red. Remainder of head yellow, or predominately yellow. Anterior reclinate setae arise opposite to and at the base of the proclimates. First and second antennal segments tinged with brown. Arista with six dorsal and three ventral rays, in addition to the apical fork. One pair of setae along anterior-most portion of oral vibrissae strongly developed, so much so that opposite setae nearly meet or crossover at center of face in some specimens. Group I setae narrow, erect, and of similar shape and curvature. Setae I-1, I-5, and I-9 are located in a row basal to other series of group I setae. Seta II-1 is relatively narrow, tusk-shaped (Fig. 10a). Setae II-

2-II-8 simple (not clavate or convex), narrow, elongate, and tapering at the apices. The apical portions of II-4-II-8 pointed in ventrally, in direction of group III setae (Fig. 10a). Bases of setae II-2-II-6 contact laterally, each spine having its base in contact with base of spine which immediately precedes it and with base of one which immediately follows it. Group III setae narrow, elongate, and taper ventrally, in the direction of labellar lobes, at apices (Fig. 12b). Setae III-1 and III-2 may or may not have sclerotized flaps on basoventral portions. Sclerotized flap always present on basoventral portion of seta III-3. Palpi rounded at apex and with single prominent apical seta (Fig. 12c and d) in males and females.

Thorax. Mesonotum and scutellum yellowish-brown to dark brown, covered lightly with gray pollen. Two well developed pairs of dorsocentral setae and 6-8 rows of acrostichal setulae present. Pleura yellow. Single pair of humeral setae, accompanied by a strong setae, are present. Halteres clear yellow to light brown. Predominately yellow legs with some brown marks on the tarsi. Foreleg lacks elongate cilia (Fig. 12e). Several short setae, which form irregular rows, present on foretarsi. Mid- and hind legs lack ornamentation.

Wings. Crossvein dm-cu infuscated with brown. Very faint markings at the apices of veins R2+3, R4+5, and M1+2 are also present. Remainder of wing hyaline.

Abdomen. Apical half of first tergite and all sternites yellow. Posterior half of the first tergite, all remaining tergites, and pleurites are dark brown to black.

Type Material. HAWAII: HOLOTYPE ♂, BPBM 6382, near Pawaina, Kona, 914 m, vii.1953, DEH. Left foreleg glued to point; abdomen beyond third segment missing; genitalia in microvial mounted below specimen (Evenhuis 1982).

Material Examined. HAWAII: A large series is present at UHM. 4♂, forest above Honokaa, 2,000 feet, 27.vii.1963, LHT; 5♂, 1♀, Paauiilo, forest above experimental station, 2,900 feet, 28.viii.1963, LHT; 1♂, Pu'u Hualalai, G90A, 1.vii.1966, reared ex: *Clermontia* fruits, WBH; 1♂, Hoopuloa, South Kona, 2,000 feet, 9.ix.1981, reared ex: *Canavalia* flower, SLM; 2♂, Greenwell Ranch, Y56, 12-14.iii.1989, KYK; 56♂, 55♀, Y56, no other information given. One specimen is present at BPBM (18758). 1♀, forest above Honokaa, 2,000 feet, 27.vii.1963, DG.

Distribution and Ecology. This species is known only from the Big Island where one male specimen has been reared from the flowers of *Canavalia hawaiiensis* Degener, I., Degener, and J. Sauer (Fabaceae) and another (Heed 1968) from the fruits of the genus *Clermontia* (Campanulaceae).

Diagnosis. *Drosophila involuta* can be readily differentiated from other members of the *mimica* subgroup because, although it possesses the characteristic tusk-like setae II-1 on its labellae (Fig. 12a and b), it lacks elongate cilia on the foretarsi of males (Fig. 12e).

The kauluai Complex. This complex contains five species, *D. acanthos* Kam & Perreira and *D. odontostoma* Kam & Perreira from the Big Island, *D. badia*

Hardy and *D. echinostoma* Kam & Perreira from Maui, and *D. kauluai* Bryan from O'ahu. The *kauluai* complex is most easily differentiated from the other complexes in the *mimica* subgroup by the ornamentation on the forelegs of males.

Drosophila acanthos Kam & Perreira, sp. nov.

(Figs. 13a and b, 14a and b, 15a)

Head. *Male, Female.* Frons brown anteriorly, lighter on lateral margins; darker brown posteriorly. Frons covered with heavy gray pollen posterior to level of proclinate orbital, less densely pollinose on orbital plate and ocellar triangle. Orbital plate and ocellar triangle dark brown to black. Antennae brown, darker on dorsal surfaces. Arista with seven dorsal and two ventral branches in addition to terminal fork. Central region of face yellow; duller and darker brown along lateral and ventral margins. Carina distinctly raised $\approx 2\times$ the width at ventral margin. Clypeus pollinose brown. Vibrissae with a row of ≈ 8 equal length setae. Group I setae are thin and hair-like (Fig. 13a). Seta I-4 inserted apically on mediproboscis, about 3-4 times the distance from I-1 to I-2. Setae I-1, I-7, and I-9 are in a series basal to the other group I setae (Fig. 13a). Seta II-1 tusk-like and directed strongly toward dorsal margin of labellum, a distinct ventral projection is present at the bend in this seta (Fig. 13b). Seta II-2 also distinctly directed dorsally. Setae II-3-II-5 slightly bent dorsally and somewhat flattened at point of bend. Setae II-6-II-8 are more or less straight, with no distinct dorsal or ventral bend. Setae II-1-II-8 form a single, closely inserted series, all setae touch at bases. Group III setae all distinctly directed dorsally, toward junction of labellar plates (Fig. 13b). Setae III-2 and III-3 with prominent, sclerotized flaps or projections at bases. Palps rounded at the apex. Males with three strong apical setae on plaps, shorter setae are 3/4-4/5 length of longest (Fig. 14a). Female with a single apical setae on palps (Fig. 14b). Additional cilia are also present on ventral and dorsal margins of palps, but these are much shorter and thinner than palpal setae.

Thorax. Mesonotum unicolorous brown. Foretibia with a series of short cilia along anterodorsal margin. Basitarsus with ≈ 7 evenly spaced cilia in this series (Fig. 15a). First tarsomere with two apical cilia. Second tarsomere with a single elongate cilia on the apex of the segment.

Wings. Wings with slight infuscation, most readily observed in indirect light, on crossvein dm-cu and at the apices of the long veins.

Abdomen. Mostly dark brown to black. Tergites 1-2 are lighter brown. Some light brown areas on lateral margin of tergites 3-6 also present.

Measurements. $N = 3\sigma$. TL = 3.7 mm (3.5-3.9); WL = 7.3 mm (7.2-7.4); TL/WL = 0.5; HW = 2.7 mm (2.6-2.9); HW/TL = 0.7; CI = 5.4 (5.0-5.9); 4V = 1.4 (1.3-1.4); 5X = 1.4 (1.3-1.4); 4C = 0.4 (0.4-0.5); M = 0.4. $N = 3\phi$. TL = 3.9 mm (3.7-4.3); WL = 7.9 mm (7.5-8.6); TL/WL = 0.5; HW = 2.8 mm (2.5-3.1); HW/TL = 0.7; CI = 5.3 (5.0-5.7); 4V = 1.5 (1.4-1.6); 5X = 1.3 (1.2-1.4); 4C = 0.5 (0.4-0.5); M = 0.4.

Type Material. HAWAII: HOLOTYPE ♂, BPBM 16423, Papa, South Kona, next to Hoomau Ranch, S107Y12, slide 51a-e, 1974, JSY. TL = 3.9 mm; WL = 7.4 mm; TL/WL = 0.5; HW = 2.9 mm; HW/TL = 0.7; CI = 5.9; 4V = 1.4; 5X = 1.3; 4C = 0.4; M = 0.4. ALLOTYPE ♀, BPBM 16423a, same collection as holotype. TL = 4.3 mm; WL = 8.6 mm; TL/WL = 0.5; HW = 3.1 mm; HW/TL = 0.7; CI = 5.7; 4V = 1.4; 5X = 1.2; 4C = 0.4; M = 0.4. A number of paratypes have been designated. 5♂, 1♀, same collection as holotype. 1♀, Papa, South Kona, 2.iii.1973, SLM.

Distribution. This species is known only from the Big Island.

Diagnosis. This species is most closely related to *D. kauluui* and *D. echinostoma*. *Drosophila acanthos* can be differentiated from these other species by having cilia which are shorter and less numerous on the foretibia (Fig. 15a).

***Drosophila badia* Hardy**
(Figs. 13 c and d, 14c, 15b)

Drosophila badia Hardy, 1965: 166.

Head. Male, Female. Hardy (1965) described this species. We add additional characters of the male mouthparts. Seta I-1 short (Fig. 13c). Setae I-1-I3 in single row. Seta I-4 short and inserted anterior to row I-1-I-3, approximately halfway between I-3 and I-5 (Fig. 13c). Setae I-6 and I-7 strong and bent ventrally. Seta I-10 inserted midway between I-9 and II-1 (Fig. 13c). Group III setae thick (Fig. 13d). Palps of male with single apical seta and ≈8 thin setae on the venter (Fig. 14c).

Type Material. MAUI: HOLOTYPE ♂, BPBM 6303, Waikamoi, 1,220 m, vii.1956, DEH. Locality incorrectly spelled Waiakamoi on label (Evenhuis 1982).

Material Examined. MAUI. The following specimens are present in the UHM collection. 1♂, Waikamoi, 4,300 feet, 9.vii.1964, C104, head in vial beneath specimen, mouthparts on slide 26, HLC; 1♂, Waikamoi, 11.vii.1964, mouthparts on slide 79a-c, LHT; 1♂, Waikamoi, 9.ix.1965, mouthparts on slide 35 a-c, KYK; 1♂, Waikamoi, 14.iv.1967, mouthparts on slide 82 a-b; JPM; 1♂, no collection information available, entire specimen in vial.

Distribution. This species is known from Maui.

Diagnosis. The forelegs and labellar setae of males of *D. badia* suggest that this species is closely related to *D. kauluui* and *D. echinostoma*. It can be differentiated by having only a few, thin setae on the palps (Fig. 14c) of males and by having seta I-10 inserted midway between setae I-9 and II-1 (Fig. 13c). Legs as in Fig. 15b.

***Drosophila echinostoma* Kam & Perreira, sp. nov.**
(Figs. 13 e and f, 14d, 15c)

Head. Male, Female Unknown. Face mostly yellow, some light brown pigment at lower margin. Frons yellow-brown along anterior margin; dark brown to

black above; entirely covered with dense gray pollen. Ocellar triangle dusky black. Gena yellow and broad, ≈1/5 width of eye at widest point. Eyes dark red. Group I setae are thin, hair-like, and not directed dorsally or ventrally (Fig. 13e). Setae I-4 and I-9 inserted basally relative to other group I setae. Setae I-1-I-7 form cluster, distance between seta I-7 and I-8 is ≈2× greater than distance among setae I-1-I-7. Setae I-8 and I-9 closely inserted, bases nearly touching. Seta I-10 short, ≈1/2 length of other group I setae, and placed closely to seta II-1. Seta II-1 is thick, tusk-shaped and dorsally directed, with a slight ventral projection at the bend (Fig. 13e). Setae II-2 and II-3 are also slightly bent dorsally. Setae II-4-II-8 are more or less straight, not directed toward venter or dorsum. Setae II-1-II-7 are closely inserted, the base of each touches the base of the next, seta II-8 is separate from the other setae in group II. Seta II-8 is longer, ≈1/3 times the length of other group II setae. Group III setae are flattened, clavate and directed dorsally, toward the junction of the labellar lobes (Fig. 13f). Seta III-1 very wide at the base. Setae III-2 and III-3 curvate. Palps of male short, ≈1 1/2 times longer than broad, and with three apical setae (Fig. 14d). Some thin cilia are also present on the dorsal surface of the palps.

Thorax. Mesonotum unicolorous dark brown, covered with gray pollen. Scutellum with slight lightening at apex. Acrostichal setulae in about six regular rows. Halteres yellow-brown. Legs mostly yellow, with slightly brown patches on coxae. Foretibia with distinctive preapical cilia on anterodorsal and posteroventral surfaces (Fig. 15c). Forebasitarsus with ≈4 anterodorsal and five posteroventral cilia extending along the length of the segment. Second tarsomere with two apical cilia, both slightly longer than the segment. Tarsomeres 3, 4, and 5 also with 1-2 elongate cilia (Fig. 15c).

Wings. Faint brown infuscations at the tips of the long veins and over crossvein dm-cu. Paratype has an incomplete supernumerary crossvein anterior to crossvein dm-cu.

Abdomen. Mostly shining black on dorsum. Tergites five and six are reddish in color.

Measurements. $N = 2♂$. TL = 3.4 mm (3.1-3.4); WL = 7.7 mm (6.8-8.6); TL/WL = 0.5 (0.4-0.5); HW = 3.0 mm (2.8-3.2); HW/TL = 0.8 (0.7-0.8); CI = 5.3 (5.0-5.6); 4V = 1.4; 5X = 1.4 (1.3-1.4); 4C = 0.5 (0.4-0.5); M = 0.4.

Type Material. MAUI. HOLOTYPE ♂, BPBM 16426, Waikamoi, 4,000 feet, vii.1956, slide 27a-b, DEH. TL = 3.1 mm; WL = 6.8 mm; TL/WL = 0.5; HW = 2.3 mm; HW/TL = 0.7; CI = 5.0; 4V = 1.4; 5X = 1.3; 4C = 0.5; M = 0.4. A single paratype is designated. 1♂, Waikamoi, 7.i.1966, head mounted on separate point, slide 80a-c, DS.

Distribution. This species is known from Maui.

Diagnosis. *Drosophila echinostoma* is distinguished from other species in the *mimica* subgroup by having anterodorsal and posteroventral cilia on the foretarsi of males.

Drosophila kauluai Bryan
(Figs. 13 g and h, 14 e and f, 15d, 16)

Drosophila kauluai Bryan, 1934: 439.

Drosophila kauluai Hardy, 1965: 335.

Head. *Male, Female.* Bryan (1934) and Hardy (1965) describe most of the morphological characters of this species. We add only details of the mouthparts of males. *Head.* Group I setae very similar in arrangement to *D. echinostoma*. Setae I-3 and I-9 inserted basally relative to the other group I setae. Setae I-1-I-7 form a cluster of setae, distinct from the closely placed setae I-8 and I-9. Seta I-10 placed close to II-1. Group II setae wavy at apices. Seta II-2 bent sharply dorsally, following curvature of seta II-1. Group III setae with sclerotized flaps, extended to 1/2–2/3 length of setae in III-1 and III-3.

Measurements. $N = 1\delta$. TL = 4.3 mm; WL = 7.7 mm; TL/WL = 0.6; HW = 3.2 mm; HW/TL = 0.7; CI = 5.0; 4V = 1.2; 5X = 1.3; 4C = 0.4; M = 0.4.

Type Material. O'AHU: SYNTYPES: 1♂, 3♀ BPBM 816 (mounted with minutens on the same wooden point). Two pupal cases are also pinned on the point, all are in excellent condition (Evenhuis 1982). The male is being designated as a LECTOTYPE. The paratype series is as follows: one ♂, Pacific Heights, no date given, OHS, UHM; 3♀ (mounted on minutens on the same pin, with two pupal cases), Pacific Heights, no date given, OHS, BPBM 18767; 2♂, 2♀ (mounted on minutens on the same pin, with two pupal cases), Pacific Heights, no date given, OHS, BPBM 18768.

Material Examined. O'AHU: Several specimens are present at UHM. 2♂, 4♀, Makaleha Valley, 2.i.1931, *Sideroxylon*, one female with aberrant crossvein, OHS; 1♂, MT, Kaala Trail, 1,800 feet, 30.viii.1936, FXW; 1♂, MT, Kaala, iv.1949, GBM; 1♂, MT, Kaala Trail, 2,500 feet, 20.v.1956, no collector given; 1♂, Pupukea, 0.v.1964, DG; 1♂, Pupukea, 14.vi.1964, MRW; 2♂, Pupukea, 11.vii.1964, MRW; 1♂, Pu'u Pane, Waialea, P10Q, 3.i.1970, SLM; 3♂, 8♀, East Makaleha Valley, P2, 8.ii.1970, reared ex: *Pouteria* fruits, no collector given; 1♂, Pia Nui, 5.vi.1970, no collector given; 1♀, Pu'u Pane, 25.vi.1970, reared ex: *Pteralyxia* fruit, SLM; 2♂, Wiliwilinui Ridge, P34, 27.vi.1970, SLM; 1♂, Makaha, 2,000 feet, 18.x.1975, SLM. One specimen is also present at BPBM (18769). 1♂, MT, Kaala, 3.iv.1957, CPH.

Distribution and Ecology. This species is known from O'ahu where it has been reared from the fruits of *Pouteria* (Sapotaceae), the kaulu (Bryan 1934), and *Pteralyxia* (Apocynaceae).

Diagnosis. This species can be differentiated from closely related forms by the distinctive chaetotaxy of the forelegs. Tibia with two rows of posteroventral cilia, each series with ≈ 4 cilia. A single thick setae, $\approx 1/2$ the length of the basitarsus, is also present in the preapical position on the anterodorsal surface of the tibia. Foretibia with a dense series of thin cilia extending along the posteroventral surface from the base of the first tarsomere to the third tarsomere. A series of thick setae are also present on the anterodorsal

surface of the foretarsus from the base of the first tarsomere to the apex of tarsomere 2.

Drosophila odontostoma Kam & Perreira, sp. nov.
(Figs. 13 i and j, 14g, 15e)

Head. *Male, Female Unknown.* Ocellar triangle and orbital plate pollinose dark brown, remainder of frons yellow, covered with light pollen. Proclinate inserted opposite and slightly posterior to anterior reclinate. Arista with six dorsal and two ventral branches, in addition to apical fork. Antennae yellow-brown, darker on dorsoapical surfaces of third segment. Gena yellow and broad, $\approx 1/5$ width of eye at widest point. Eye dark red. Face pollinose, dark gray. About five weak setae in vibrissal row. Seta I-1 long. Setae I-1-I-3, I-5-I-7 in a single row. Seta I-4 inserted distinctly posterior to this series (Fig. 11i). Setae I-5-I-7 elongate and wavy, directed toward venter, but not distinctly bent. Setae I-9 inserted even with and directly posterior to I-8, seta I-10 closer to II-1 than I-9 (Fig. 13i). Group III setae thin (Fig. 13j). Palps of male with two apical setae in addition to numerous thin setae on dorsal and ventral surfaces (Fig. 14g).

Thorax. Mesonotum and pleurae unicolorous dark brown. Scutellum broadly lightened to yellow brown at apex. Acrostichal setulae in 6–8 rows. Legs with four setae on anterodorsal surface of basitarsus, becoming shorter distally (Fig. 15e). No setae present on posteroventral surface.

Wings. Subhyaline, with distinct infuscations over both crossveins and at apices of long veins.

Abdomen. Unicolorous, entirely dark brown to black.

Type Material. HAWAII: HOLOTYPE ♂, BPBM 16431, Pihea-Maulua boundary, Keanakolu Road, 6,500 feet, K14, 12.vii.1967, head reattached with glue, mouthparts on slide 64 a–d, WBH.

Distribution. This species is known from the Big Island.

Diagnosis. *Drosophila odontostoma* can be differentiated from other closely related taxa by having two apical palpal setae and palps covered with thin setae (Fig. 14g). Seta I-9 inserted even with and posterior to setae I-8 (Fig. 13i).

The mimica Complex. This species complex contains three species, *D. antecessens* Kam & Perreira, *D. gagné* Kam & Perreira, and *D. mimica* Hardy. This group is most closely related to species of the *conjectura* and *flavibasis* complexes, especially in morphology and coloration.

Although slightly larger in size, males of the *mimica* complex are very similar to those of the *conjectura* complex. There are, however, several diagnostic characters for the *mimica* complex: anterior reclinate setae always placed distinctly anterior to proclimates; anterior-most pair of dorsoapical setae rudimentary; infuscations at apices of veins R2+3, R4+5, M1+2, and along the dm-cu crossvein well defined; crossvein dm-cu always infuscated; labellar setae II-3-II-7 greatly flattened; group III setae broad, tapering

sharply at apices; sclerotized flaps present at bases of setae III-1-III-2; distal portion of palps is narrow.

Species within the *mimica* complex are very close morphologically. *Drosophila antecessens* is distinguished by the placement of the anterior reclinate and the posterior reclinate setae. The chaetotaxy of the mouthparts is the only morphological means of separating specimens of *D. gagné* from those of *D. mimica*. Ecologically, members of the *mimica* complex are quite diverse. They have been reared from rotting leaves, fruits and fungus.

***Drosophila antecessens* Kam & Perreira, sp. nov.**
(Figs. 17 a-c, 18 a and b, 19a)

Drosophila flavibasis Hardy, 1965: 273.

Drosophila mimica Hardy, 1965: 365.

Head. *Male, Female.* *Drosophila antecessens* fits so closely with the description of *D. mimica* that Hardy (1965) concluded that two "*D. mimica*-like" males from Kaua'i (among those we are describing here as *D. antecessens*) "fit *mimica* in all details." However, Hardy did not designate these as members of the type series. Characters that define *D. antecessens* are included in the diagnosis and below. Placement of orbital setae in females is similar to that of males. Palps of males sharply pointed, with a single strong seta at apex and ≈ 10 thinner setae along ventral margin. Female palps rounded at apex, with one strong apical setae and thick, dense setae on dorsal and ventral surfaces.

Thorax. Tibia three times longer than basitarsus. About eight elongate setae present on basitarsus, five on second tarsomere, and 1-2 setae on remaining tarsal segments.

Wings. With faint infuscations over crossvein dm-cu and at apices of long veins.

Measurements. $N = 11\delta$. TL = 3.7 mm (3.2-4.0); WL = 7.4 mm (6.3-8.0); TL/WL = 0.5; HW = 2.8 mm (2.4-3.1); HW/TL = 0.8 (0.7-0.8); CI = 5.0 (4.6-5.0); 4V = 1.4 (1.1-1.5); 5X = 1.2 (1.1-1.3); 4C = 0.4 (0.4-0.5); M = 0.4 (0.3-0.4). $N = 10\eta$. TL = 4.4 mm (3.9-4.6); WL = 8.4 mm (7.6-8.8); TL/WL = 0.5 (0.5-0.6); HW = 3.1 mm (2.7-3.3); HW/TL = 0.7; CI = 5.3 (4.9-6.3); 4V = 1.2 (1.1-1.4); 5X = 1.1 (1.0-1.5); 4C = 0.4 (0.3-0.4); M = 0.3 (0.3-0.5).

Type Material. KAUA'I: HOLOTYPE δ , BPBM 16424, Mahanaloa Valley, 1,950 feet, 23.iii.1973, "R93," KYK. TL = 3.5 mm; WL = 7.1 mm; TL/WL = 0.5; HW = 2.6; HW/TL = 0.7; CI = 4.6; 4V = 1.4; 5X = 1.2; 4C = 0.5; M = 0.4. ALLOTYPE η , BPBM 16424a, Mahanaloa Valley, Milolii, 2,100 feet, 19.viii.1974, "T1Y1," SLM and RW. TL = 4.6 mm; WL = 8.9 mm; TL/WL = 0.5; HW = 3.3; HW/TL = 0.7; CI = 5.0; 4V = 1.2; 5X = 1.1; 4C = 0.4; M = 0.3. Twenty-four paratypes are designated. 2 δ , Waipio Falls, viii.1953, DEH; mouthparts on slides 9 and 77 a-b, (originally designated as paratypes of *D. flavibasis*); 1 δ , 1 η Halemanu Valley, 4,000 feet, 24-28.vi.1964, FEC and DEH; 3 η , Halemanu, 20.viii.1966, "reared ex. New Zealand Laurel fruits, (J7AIP)," WBH; 1 δ , Milolii, 22.viii.1970,

SLM; 3 δ , same data as holotype; 8 δ , 5 η , same data as allotype.

Distribution and Ecology. This species is endemic to Kaua'i. The fruits of introduced New Zealand Laurel, *Corynocarpus laevigatus* (Corynocarpaceae), are the only known host for this species.

Etymology. Latin, one that goes before, in reference to the relative positioning of the anterior reclinate bristle before the proclinate.

Diagnosis. *Drosophila antecessens* can be distinguished from closely related species by having the anterior reclinate setae positioned distinctly in front of the proclimates, which are located approximately midway between the two reclinate setae (Fig. 17a). The chaetotaxy of the labellum is also characteristic; seta I-10 is found placed posterior to setae I-9 rather than in a line with setae I-9 and II-1 (Fig. 17b). There is also a short, sclerotized flap or collar on seta III-2 (Fig. 17c).

Discussion. Heed (1968) referred to this species as *D. mimica* from Kaua'i.

***Drosophila gagné* Kam & Perreira, sp. nov.**
(Figs. 17 d and e, 18c, 19b)

Drosophila reschae Hardy & Kaneshiro, 1975: 63.

Description. *Male, Female Not Associated.* *Drosophila gagné* fits the description of *D. mimica*, except as above.

Measurements. $N = 3\delta$. TL = 3.5 mm (3.3-3.6); WL = 7.0 mm (6.9-7.0); TL/WL = 0.5; HW = 2.8 mm (2.7-2.9); HW/TL = 0.8; CI = 5.0; 4V = 1.3 (1.2-1.4); 5X = 1.1 (1.1-1.2); 4C = 0.5 (0.4-0.5); M = 0.4.

Type Material. O'AHU: HOLOTYPE δ , BPBM 16427, Pu'u Pane, Waialua, 1.iii.1970, "P10Q," SLM. TL = 3.3 mm; WL = 6.9 mm; TL/WL = 0.5; HW = 2.7; HW/TL = 0.8; CI = 5.0; 4V = 1.3; 5X = 1.1; 4C = 0.5; M = 0.4. The holotype was originally designated as a paratype of *D. reschae*. Mouthpart dissections (slide $\delta 31$) indicate that this is a distinct species. Two paratypes at UHM have also been designated. 2 δ , Pu'u Pane, MT, Kaala, 1,800 feet, 17.iv.1977, "reared ex. *Sapindus saponaria* L. fruits," SLM.

Distribution and Ecology. This species is found on O'ahu and has been reared from the fruits of *Sapindus oahuensis* Hillebr. ex. Radlk and *S. saponaria* (Sapindaceae)

Etymology. This species is named in honor of the late Wayne C. Gagné, friend and colleague, who made significant contributions to Hawaiian entomology and conservation biology.

Diagnosis. *Drosophila gagné* can be distinguished from other members of the *mimica* complex by the chaetotaxy of the labellum and in the relative placement of the orbital setae. The anterior reclinate is inserted slightly anterior to the base of the proclinate. Setae I-10 originates in line with setae I-9 and II-1, setae I-3-I-4, in conjunction with the relative shapes and sizes labellar setae, are characteristic (Fig. 17 d and e). Palps pointed and symmetrical, with a single

apical setae and 3–4 shorter, weaker setae present on ventral margin.

Discussion. Yoon et al. (1972) used an O'ahu species designated as "*mimica-like-a*" to conduct cytogenetic comparisons with *D. mimica*. We have been unable to locate and examine Yoon's voucher specimens so it is not possible to determine whether *D. gagné* was examined in their study.

Drosophila mimica Hardy
(Figs. 17 f and g, 18d, 19c, 20a)

Drosophila mimica Hardy, 1965: 365.

Head. *Male, Female.* This species was described by Hardy (1965). We add several characters to that description. Seta I-3 inserted slightly ventral to I-4 (Fig. 17f). Setae I-6–I-9 evenly spaced, no gap between I-8 and I-9. Seta II-1 tapers to a sharp point. Group II setae II-1–II-7 broadly expanded ventrally; seta II-8 sharply pointed ventrally (Fig. 17f). Group III distinct; seta III-2 with ventrally elongate, pointed sclerotized flap; seta III-3 broadly expanded, flattened and blade like, width at midpoint $\approx 4\times$ that at base (Fig. 17g).

Abdomen. *Drosophila mimica* females average 14 ovarioles per ovary (Kambysellis and Heed 1971). Ovipositor with about five peg like ovisensilla on ventral margin of apex, thinner ovisensilla extend anteriorly. A number of sharply pointed ovisensilla are present on dorsolateral surface (Kambysellis 1993).

Measurements. $N = 10\delta$. TL = 4.2 mm (3.7–4.6); WL = 9.0 mm (8.1–9.6); TL/WL = 0.5; HW = 3.1 mm (2.8–3.3); HW/TL = 0.7 (0.7–0.8); CI = 5.3 (4.7–6.4); 4V = 1.2 (1.1–1.4); 5X = 1.1 (1.0–1.3); 4C = 0.4 (0.4–0.5); M = 0.3 (0.3–0.4). $N = 10\eta$. TL = 4.5 mm (3.1–5.1); WL = 9.2 mm (7.8–10.1); TL/WL = 0.5 (0.4–0.5); HW = 3.2 mm (2.6–3.5); HW/TL = 0.7 (0.7–0.8); CI = 4.8 (4.3–5.6); 4V = 1.2 (1.1–1.3); 5X = 1.1 (0.9–1.3); 4C = 0.5 (0.4–0.5); M = 0.3 (0.3–0.4).

Type Material. HAWAII: HOLOTYPE δ , BPBM δ 400, Mauna Loa Truck Trail, 1,220 m, viii.1952, DEH. Left foreleg missing beyond coxa (Evenhuis 1982). ALLOTYPE η , BPBM 6400a, same collection as holotype. A large series of paratypes is present at UHM. 1 δ , 1 η , Kilauea, 18–19.iv.1944, NHLK; 1 η , Bird Park, vi.1951, JWB; 18 δ , 17 η , same collection as holotype; 6 δ , 5 η , Bird Park, Kilauea, viii.1952, DEH; 2 δ , 1 η , Upper Olaa Forest, viii.1952, WHM; 4 δ , 4 η , Bird Park, Kilauea, vii.1953, DEH. Three paratypes from BPBM (18892–18994) were also studied. 1 η , same collection as the holotype; 1 δ , Mauna Loa Truck Trail, xi.1956, WCM; 1 η , Bird Park, Kilauea, 5.xii.1963, DEH.

Material Examined. HAWAII: A large series of specimens is present at UHM. 1 η , Kipuka Ki, National Park, 29.i.1963, DEH; 2 δ , 3 η , Bird Park, vi.1963, LHT; 3 δ , Forest above experiment station, Paauilo, 2,900–3,000 feet, viii.1963, LHT; 1 δ , 2 η , Bird Park, Kilauea, vii.1963, LHT; 2 δ , Forest above Honokaa, 2,000 feet, 27.vii.1963, DG; 10 δ , Bird Park, Kilauea, 5.xii.1963, MRW; 2 δ , Bird Park, Kilauea, 12–16.vii.1964, LHT; 1 δ , Kipuka Ki, 7.ix.1964, S14.1, reared ex: gill-type fungi, HTS; 1 δ , Bird Park, Kilauea, 5.xi.1964, HTS; 2 δ ,

Kipuka Ki, 14–15.iv.1966, G50A2, reared ex: *Sapindus* (soapberry) fruits, WBH; 1 δ , Kipuka Ki, 28.vii.1966, J15B, reared ex: *Peperomia* leaves, KYK; 25 δ , 29 η , Bird Park, Kilauea, 16.iii.1968, L39, reared ex: *Sapindus* fruits, RI; 1 δ , Bird Park, Kilauea, 1.iv.1968, L49, MPK; 1 δ , Bird Park, Kilauea, 29.i.1969, MDD; 1 δ , Pu'u Waawaa, 4,000 feet, 1.vii.1974, SLM; 5 δ , 2 η , Po-hakaloa, 27.ix.1971, MDD; 34 δ , 16 η , Kipuka Ki, 7.iv.1972, MDD; 1 δ , Kipuka 10, Saddle Road, i.iii.1973, SLM; 12 δ , 26 η , Bird Park, Kilauea, 8.iv–2.v.1973, N79, reared ex: *Sapindus* (soapberry) fruits, WBH; Bird Park, Kilauea, S78, 24.iv.1974, HTS; 2 δ , Kilauea Forest, Volcano, 3.vi.1974, HTS; 8 δ , Greenwell Ranch, Pauahi, 27.vi.1974, KYK; 1 δ , Kipuka Ki, 25.vii.1975, HTS; 1 η , Hualalai Ranch, 4,600 feet, 21.v.1976, U5, KYK; 3 δ , 5 η , Bird Park, v.1987, reared ex: *Sapindus* (soapberry) fruits, WDP; 6 δ , 3 η , Greenwell Ranch, 12–14.iii.1989, Y56, F1 from wild collected female, KYK; two pupae labeled "F1 pupae, *mimica*, Bird Park;" specimen in microvial labeled "*mimica* 11." One specimen is also present in the BPBM collection (18895). 1 δ , Bird Park, Kilauea, 5.xii.1963, MRW. A number of specimens are located at AMNH: 1 δ , 12 η , Bird Park, Hawai'i Volcanoes National Park, O76.2, 16.ii.2000, PMO; 36 δ , 13 η , Kipuka Ki, Hawai'i Volcanoes National Park, O78.1, PMO; 42 δ , 47 η , Bird Park, Hawai'i Volcanoes National Park, O92.2, 7.ix.2000, PMO; 1 δ , 1 η , Upper Bird Park, Hawai'i Volcanoes National Park, O95.1, 8.ix.2000, PMO; 20 δ , 13 η , Bird Park, Hawai'i Volcanoes National Park, O96.2, 8.ix.2000, PMO; 35 δ , 17 η , Bird Park, Hawai'i Volcanoes National Park, O1063, 19.x.2000, PMO; 24 δ , 22 δ , Kipuka Ki, Hawai'i Volcanoes National Park, 4,600 feet, O108.1, 19.x.2000, PMO.

Distribution and Ecology. This species is known from the Big Island. Hosts of *D. mimica* include fruits of *S. saponaria*, rotting leaves of *Peperomia* sp. (Piperaceae), and a "gill-type" fungus.

Diagnosis. *Drosophila mimica* can be differentiated from closely related taxa by having anterior reclinate setae inserted anterior to proclimates, palps densely setose on dorsal and ventral surface of apical 1/3, and by having group III setae III-3 very broad.

The *soonae* Complex. This species complex contains two species, *D. soonae* Takada & Yoon and *D. lobatopalpus* Kam & Perreira. The *soonae* complex is characterized by having males with broadly flattened, heavily setose palps with a single large notch on the inner surface, giving a "hook-like" appearance. This complex can be further differentiated from other members of the *mimica* subgroup by having completely hyaline wings and bright yellow to yellowish-brown bodies and by lacking gray pollen on the vertex and mesonotum. The ecology of this group is poorly understood. A single specimen of *D. lobatopalpus* has been reared from the soil beneath a *Sapindus* flux.

Drosophila lobatopalpus Kam & Perreira, sp. nov.
(Figs. 21 c, d, and g, 22b)

Head. *Male, Female Unknown.* Predominately yellow. Front and frontal portion of vertex below pitilinal

suture yellow; brown discoloration covers portion of vertex above ptilinal suture, extending to occiput. Proclinate setae $\approx 1\frac{1}{2}$ times long longer than anterior reclinate, inserted slightly anterior to anterior reclinate setae. Eyes red. Carina narrow, gently sloping; extends from middle of face dorsally to bases of antennae. Antennae tinged brown on first and second segments. Arista with five dorsal and three ventral rays in addition to apical fork. Basal area of face weakly concave, rounded to form shallow depression. Anterior oral vibrissae poorly developed. Group I and II setae very similar to those of *D. soonae*. Setae I-6-8 distinctly curvate, seta I-10 $\approx 1/3$ length of seta I-9, seta II-1 not elongate. Sclerotized flap on seta III-1 is triangular; flap of seta III-2 not acute. Palps of males densely setose, with $\approx 3-4$ strong setae and ≈ 10 thinner setae present on ventral margin. Notch in palp shallow.

Thorax. Entirely yellow. Anterior dorsocentral setae $\approx 1/4$ length of posterior dorsocentrals. Eight rows of acrostichal bristles present. Halteres yellow. Tibia and tarsi of the foreleg are heavily ornamented with setae and long cilia (Fig. 22b). Single row of downward curved setae present on anterodorsal surface of foretibia. Two cilia, equal in length to tarsal cilia, arise on posterolateral margin of apex of tibia. Tarsus equal in length to tibia; basitarsus approximately equal to $1/2$ tibia length. Mid and hind legs yellow, not ornate.

Wings. Very faint, indiscrete brown infuscation along the dm-cu crossvein can be seen under indirect light.

Abdomen. Similar to *D. soonae*.

Type Material. O'AHU: HOLOTYPE δ , BPBM 16429, Pu'u Pane, 18.vi.1970, reared ex: dirt beneath rotting *Sapindus* flux, SLM. The mouthparts are dissected on slide 27a-d. TL = 3.3; WL = 7.0; TL/WL = 0.5; HW = 2.4; HW/TL = 0.7; CI = 5.0; 4V = 1.4; 5X = 1.2; 4C = 0.5; M = 0.4.

Distribution and Ecology. This species known only from the holotype male collected on O'ahu. A single specimen of *D. lobatopalpus* has been reared from the dirt beneath a fluxing *Sapindus* tree.

Etymology. We name this species "*lobatopalpus*" for the rounded, lobe-like projection on the palps of males.

Diagnosis. *Drosophila lobatopalpus* is differentiated from closely related taxa by having a row of strong setae on the foretibia (Fig. 22b). The palps of *D. lobatopalpus* are notched on the inner margin, although not as deeply as *D. soonae* (Fig. 21g). Group III setae are strongly curvate; seta III-2 without spur-like projection at base (Fig. 21d).

Drosophila soonae Takada & Yoon

Drosophila soonae Takada & Yoon, 1989: 114.

Head. *Male, Female.* Takada and Yoon (1989) described this species. We add here some additional descriptions of the mouthpart morphology of males. Group I and II setae similar to *D. lobatopalpus*. Setae I-5-I-8 less curvate, seta II-1 more elongate relative to

the other group II setae (Fig. 21a). Seta I-10 significantly shorter than I-9. Sclerotized flap on spine III-1 broad, rounded (Fig. 21b). Flap of III-2 pointed, spine-like. Palps of males densely setose with acute notch on inner surface (Fig. 21e). Palps of female not ornate (Fig. 21f).

Measurements. $N = 11\delta$. TL = 4.6 mm (3.7-4.8); WL = 9.4 mm (9.1-9.8); TL/WL = 0.5 (0.4-0.5); HW = 3.4 mm (3.1-3.5); HW/TL = 0.7 (0.7-0.9); CI = 5.2 (4.8-5.5); 4V = 1.1 (1.0-1.2); 5X = 1.0 (1.0-1.1); 4C = 0.4; M = 0.3. $N = 7\eta$. TL = 4.7 mm (4.3-4.9); WL = 9.0 mm (8.8-9.2); TL/WL = 0.5; HW = 3.2 mm (3.0-3.5); HW/TL = 0.7; CI = 5.0 (4.6-5.4); 4V = 1.2 (1.1-1.2); 5X = 0.9 (0.8-1.0); 4C = 0.4 (0.4-0.5); M = 0.3.

Type Material. The types for this species are deposited in the National *Drosophila* Species Stock Center and have not been examined. A series of specimens are present at AMNH: 17 δ , Kealakekua Ranch, Pawaina, Kona, 3,000 feet, HLC.

Material Examined. HAWAII: 1 δ , Keauhou, 2,200 feet, 18.viii.1964, HLC; 2 δ , Greenwell Ranch, Kona, 3,000 feet, 13.vii.1965, DEH; 13 δ , 9 η , Pawaina, 3,000 feet, 15.vii.1965, HLC; 1 δ , 1 η , south slope of Hualalai, Kona, 2,500 feet, 5.vii.1967, K2B4, KYK; 10 δ , 7 η , Greenwell Ranch, 12-14.iii.1989, Y56, F1 offspring, KYK.

Distribution. This species is known from the Big Island.

Diagnosis. This species is closely related to *D. lobatopalpus* but is differentiated by being conspicuously larger, in the ciliation of the foretarsi (Fig. 21a), by the sizes, shapes and placement of the labelar setae, and by having the lobe of the palpus more "hooked-shaped."

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