

A Revision of the Psychodidae of the Hawaiian Islands (Diptera)

By LARRY W. QUATE

UNIVERSITY OF NEBRASKA, LINCOLN, NEBRASKA

A revision of the Psychodidae of the Hawaiian Islands was undertaken to provide a more detailed picture of the psychodid fauna and to clarify the identity of the species upon which biological information is available. The present study has brought out that the existing lists of Hawaiian Diptera (Bryan, 1934; Hardy, 1952) are incomplete and list less than half of the species present. The biological studies of Hawaiian aquatic insects by Williams (1943) give informative accounts of several psychodids, but, with the exception of *Telmatoscopus albipunctatus*, the identity of the species with which he was dealing has been uncertain. Furthermore, there is reason to doubt if many of the references to *Psychoda alternata* and *P. inornata* are based upon correctly determined specimens, since many specimens which I have examined were incorrectly identified. *Psychoda alternata* has been confused with *P. pseudalternata* and the name *P. inornata* applied to several undescribed species. It is hoped that this revision will give a clearer understanding of the species which Williams studied and thus make possible more accurate cataloguing of his information.

There are but three genera of the family Psychodidae represented in the Hawaiian Islands, *Trichomyia*, *Telmatoscopus*, and *Psychoda*. *Trichomyia* is an archaic genus with relatively few species scattered over the world. *Telmatoscopus* and *Psychoda* are among the larger genera of psychodids and are also widely distributed throughout the world. Absent from the Hawaiian fauna are any members of *Pericoma* and *Phlebotomus* which are on the same level in the number of species they contain as *Telmatoscopus* and *Psychoda*.

Of the fourteen recognized species present seven are restricted in distribution to the Islands. At least two other undescribed species are also endemic (inadequate series precludes their naming at this time). Of the remaining seven, two species, *Telmatoscopus albipunctatus* and *Psychoda alternata*, are cosmopolitan in distribution. *Psychoda inornata* is a common species in North America and Europe and may be more widely distributed than the records indicate. Two species are known only from the Hawaiian Islands and the American mainland; the remaining two have been found in the Islands and Australia and New Zealand.

The type localities of two species herein described as new are found in California and in Florida and the West Indies. These species were discovered during a current study of North American psychodids, which is not yet ready for publication. The series upon which I prefer to base the original descriptions are from North America. Hence the apparent inconsistency of describing Nearctic species in a work concerned with the Hawaiian fauna.

Most of the specimens studied were received from Dr. D. Elmo Hardy of the University of Hawaii. Mr. C. E. Pemberton loaned the psychodid

collection of the Hawaiian Sugar Planters' Association, which contained many of the specimens Williams used in his aquatic studies. Mr. W. F. Rapp, Jr. made available the psychodids which Dr. W. W. Wirth had collected in the Islands. I am indebted to these gentlemen for providing me with this material.

Nearly all the specimens examined during this study were whole mounts on microscope slides. All measurements were taken from these slides. The specimens were cleared in 5% sodium hydroxide, washed in distilled water, dehydrated in methyl cellosolve, and mounted in euparal (diaphane). All locality records are based on slide-mounted specimens, with the exception of *Telmatoscopus albipunctatus*, which is a large and conspicuous species. It is felt by this author that positive identification of most species of the Psychodidae cannot be made on either pinned or alcohol material.

Certain terms employed may not be clear to all users of this revision. Those terms which might lead to confusion are defined. The *teeth* of the labellum are modified setae found on the apical margin of the flattened labellum of most species of the genus *Psychoda*. They are parallel-sided or nearly so, and blunt at the apex. They should not be confused with spines or setae which taper from the base to an acute apex. The *sensory filaments* are lightly sclerotized structures found on the unmodified flagellar segments. They are usually Y-shaped in the genus *Psychoda*, but U-shaped, a single rod, or other shapes in different groups. The filaments are paired and arise from the apical portion of the flagellar node. The terminology of the wing venation is after Tonnoir (1935) employing the Comstock-Needham terminology. The anterior fork is bifurcation R_{2+3} and the posterior fork bifurcation M_{1+2} .

Few terms are used in describing the male and female genitalia, since I rely mainly on the illustrations of these structures to convey the impression of their characteristics. The female *subgenital plate* is the ninth sternite situated ventrad of the ovipositors or *cerci*. The appendages of the male genitalia are termed the *surstyli* and *coxites*. After rotating through 180° the surstyli are the ventral appendages and usually bear at their tips one or more spatulate or otherwise modified bristles, termed *tenaculae*. The coxites are the dorsal appendages after rotation and are composed of a proximal *basistyle* and apical *dististyle*. The *aedeagus* originates within the eighth segment and passes posteriorly at the level of the base of the coxites. It is highly variable in structure and may be a simple shaft or an asymmetrical, multipartite structure. The *ninth tergite* is a broad, quadrate plate ventrad to the coxites and aedeagus. The surstyli arise from its posterior lateral corners.

Key to Genera

1. R_5 present, hence two longitudinal veins between bifurcations R_{2+3} and M_{1+2} ; palpus with 4 segments..... 2
- R_5 absent, hence one longitudinal vein between bifurcations R_{2+3} and M_{1+2} ; palpus with 3 segments..... *Trichomyia*
2. Antenna with flagellar segments equal in size, apical segment not reduced, bearing long, slender apiculis..... *Telmatoscopus*, *T. albipunctatus*
- Antenna with one to three apical segments reduced in size, reduced segments about one-half size of preceding segments, without apiculis..... *Psychoda*

Genus *Trichomyia* Curtis

Trichomyia Curtis, 1839, Brit. Ent., 16(186):745.

Adult characters. *Eyes* round, without eye bridge, interocular suture absent; labellum bulbous, without teeth; palpus with three segments. *Antenna* with 16 segments; flagellar segments pyriform, elongate pyriform or cylindrical, never nodose; apical flagellar segment very small, knob-like; sensory filaments simple, rod-shaped. *Wing* broadly rounded at apex; Rs 3-branched, R_3 absent, hence 1 longitudinal vein between bifurcations R_{2+3} and M_{1+2} ; Sc forked, usually ending in C and R_1 .

Type of genus: *Trichomyia urbica* Curtis (by monotypy).

The genus *Trichomyia* is the only representative of the subfamily Trichomyiinae in the Hawaiian Islands. This primitive genus is a small, widely distributed group not clearly associated with any single zoogeographic region.

This group is easily separated from other psychodid groups in that the radial sector is three-branched producing but one longitudinal vein between the forks of R_{2+3} and M_{1+2} . Also, the round eyes without median eye bridges are distinctive.

Key to Species of *Trichomyia*

1. Aedeagus of male genitalia enlarged distally, not strongly curved; spermathecal ducts of female longer than basal mid-piece of subgenital plate; R_{2+3} broken a short distance before base.....*hawaiiensis* n.sp.
- Aedeagus of male genitalia slender distally, strongly curved; spermathecal ducts of female shorter than basal mid-piece of subgenital plate; R_{2+3} may be weakened at base, but not broken before base.....*oahuensis* n.sp.

Trichomyia hawaiiensis new species (Figs. 9a-d)

Male. *Head:* eyes separated by distance equal to 11 facet diameters at level of antenna; labrum as long as first palpal segment; palpus as figured, 3-segmented, first segment with pit on inner margin, tuft of hairs arising from pit, ratio of segments 8:4:5. *Antenna* (terminal segments lacking) sensory filaments about 1½ times as long as segments bearing them, moderately sinuous, flagellar segments elongate pyriform, 2.4 times as long as wide. *Wing* as figured; R_{2+3} broken short distance from base, R_{4+5} with base lacking. *Genitalia* as figured.

Measurements: holotype, wing length 1.8 mm.; wing width 0.7 mm. Paratypes, wing length 1.5-1.7 mm.; wing width 0.6-0.7 mm.

Female. Similar to male. Flagellar segments 2.7 times as long as wide. *Genitalia* as figured.

Measurements: allotype, wing length 1.9 mm.; wing width 0.7 mm. Paratypes, wing length 1.7-2.0 mm.; wing width 0.6-0.7 mm.

Type data: holotype ♂ and allotype ♀, Upper Olaa Forest, Hawaii, August, 1952 (D. E. Hardy). Paratypes, 11 ♂, 7 ♀, same data; 4 ♂, same (W. C. Mitchell). Holotype and allotype to be deposited at U. S. National Museum, Washington, D. C. Paratypes to be deposited at Bishop Museum, University of Hawaii, and Hawaiian Sugar Planters' Association, Honolulu; American Museum of Natural History, New York; University of Nebraska, Lincoln; and California Academy of Sciences, San Francisco.

Trichomyia oahuensis new species (Figs. 6-8)

Trichomyia sp. Williams, 1943, Proc. Haw. Ent. Soc., 11:325; Hardy, 1952, *ibid.*, 14:445.

Male. Vestiture golden in color. *Head:* eyes separated by distance equal to 11 facet diameters at level of antenna; labrum shorter than first palpal segment; palpus 3-segmented, first segment with pit on inner margin, tuft of hairs arising from floor of pit, second and third segments about $2/3$ size of first, ratio of segments 9:6:7. *Antenna* with 16 segments, about $5/6$ times length of wing; sensory filaments $1\frac{1}{2}$ times length of segment bearing them, moderately sinuous, flagellar segments elongate pyriform, 3.1 times as long as greatest width; apical segment very small, round. *Wing* without scales at base; R_{2+3} unbroken, M_{1+2} with base lacking. *Genitalia* as figured.

Measurements: holotype, antenna 1.1 mm.; wing length 1.3 mm.; wing width 0.5 mm. Paratype, antenna, 1.1 mm.; wing length 1.4 mm.; wing width 0.5 mm.

Female. Similar to male. *Antenna* $2/3$ times length of wing; flagellar segments 2.9 times as long as wide; wing narrower. *Genitalia* as figured.

Measurements: antenna 1.0 mm.; wing length 1.3 mm.; wing width 0.5 mm.

Type data: holotype ♂, Olympus, Oahu, November 1, 1936, 2,000 ft. (F. X. Williams); allotype ♀, same, November 3, 1936, 1,800 ft. Paratypes, 1 ♂, 1 ♀; same data as allotype. Holotype and allotype to be deposited at U. S. National Museum, Washington, D. C. Paratypes to be deposited at University of Hawaii, Honolulu.

Trichomyia oahuensis and *hawaiiensis* may be separated by the structure of the male and female genitalia. The aedeagus and lateral appendages of the male genitalia differ considerably in the two species. The spermathecal ducts of *T. hawaiiensis* are very long, while those of *T. oahuensis* are moderately short.

In addition to the above two species of *Trichomyia* there is another form which was also collected at Mt. Olympus, Oahu. This form is close to *T. oahuensis*, but differs in the structure of the male genitalia and wing venation. The form is represented by only a few specimens and it is not possible to make a thorough study of it. Therefore, it is felt inadvisable to name and describe this form at the present time.

Genus *Telmatoscopus* Eaton

Telmatoscopus Eaton, 1904, Ent. Mo. Mag., Ser. 2, 15:58.

Adult characters. Medium to large size; vestiture usually dark colored with some color pattern. Eye bridge present; interocular suture often present; labellum bulbous, flattened apically, bearing number of setae on apical surface, but without teeth. *Antenna* with 15 or 16 segments, longer than width of wing; verticils on flagellum well developed, cupuliform; sensory filaments composed of one pair to numerous anterior branches on each flagellar segment, without posterior branches; flagellar segments nodose, basal portion enlarged into node and apical portion a slender internode; apical segments not conspicuously smaller than preceding segments, though internode of sub-apical segment may be shortened; apiculis present. *Wing* with apex rounded or acute; R_5 ending in or beyond apex; R_s 4-branched, hence 2 longitudinal veins between bifurcations R_{2+3} and M_{1+2} ; Sc not forked. Male genitalia with surstyle bearing multiple tenaculæ.

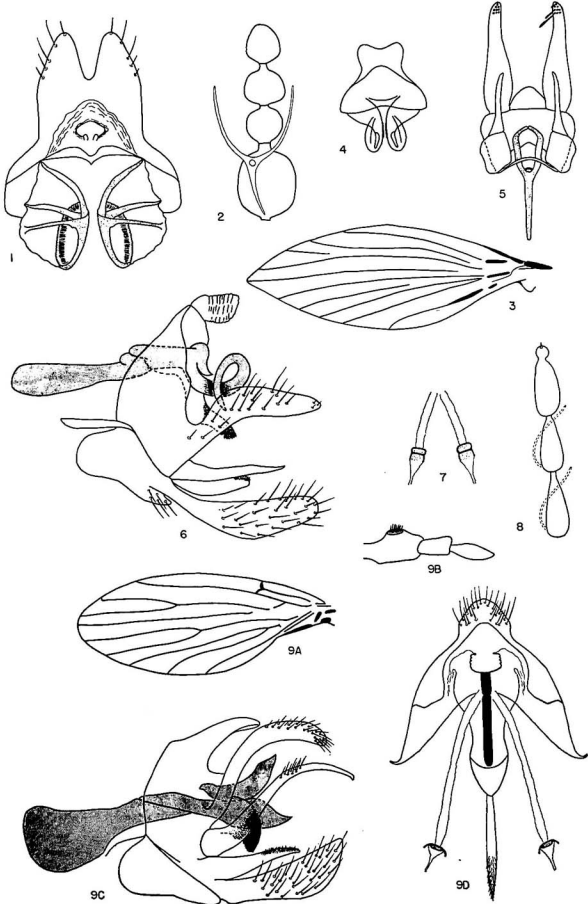
Figures 1-9

Figs. 1-3. *Psychoda insulicola*. Fig. 1. female genitalia, dorsal view. 2. tip of antenna. 3. wing.

Figs. 4-5. *Telmatoscopus albipunctatus*. Fig. 4. female genitalia, dorsal view. 5. male genitalia, dorsal view.

Figs. 6-8. *Trichomyia oahuensis*. Fig. 6. male genitalia, lateral view. 7. female spermatheca. 8. tip of antenna.

Figs. 9a-9d. *Trichomyia hawaiiensis*. Fig. 9a. wing. 9b. male palpus. 9c. male genitalia, lateral view. 9d. female genitalia, dorsal view.



Type of genus: *Pericoma morula* Eaton (by subsequent selection, Tonnoir, 1933:70).

The genus *Telmatoscopus* is predominantly Holarctic in distribution. Twenty-six of the known thirty-six species are found either in North America or Europe. The only element of this psychodid genus found in Hawaii is *T. albipunctatus*, a widely distributed species.

***Telmatoscopus albipunctatus* (Williston) (Figs. 4, 5)**

Psychoda albipunctata Williston, 1893, Ent. News, 4:113; Dyar, 1926, Insec. Ins. Mens., 14:149; del Rosario, 1936, Philip. Jour. Sci., 59:129; Bryan, 1933, Proc. Haw. Ent. Soc., 8:230.

Telmatoscopus albipunctatus, Tonnoir, 1921, Bull. Mus. Nat. Hist., Paris, 27:297; Edwards, 1928, Ent., 61:32; Williams, 1932, Proc. Haw. Ent. Soc., 8:18; Bryan, 1934, *ibid.*, 8:403; Van Zwaluwenberg, 1935, *ibid.*, 9:15; Williams, 1936, *ibid.*, 9:240; 1943, *ibid.*, 11:326; Fullaway and Krauss, 1943, Common Insects of Hawaii, p. 142; Rapp and Rapp, 1946, Jour. N.Y. Ent. Soc., 54:292.

Male. Large species; frons, clypeus, and palpus covered with brown hairs, vertex, antenna, scutum covered with white hairs becoming brown at tips; abdomen clothed with white and brown hairs dorsally, brown hairs ventrally; wings chiefly covered with brown hairs, upper surface with few black hairs on basal half intermixed with brown; white hairs on Sc, R_{2+3} from base to bifurcation, Cu, and apices of veins; white and black patches of hairs at bifurcations R_{2+3} and M_{1+2} ; curved row of white patches distad to black band, median patches faint; lower surface with two small patches of white hair at base; legs covered with brown hairs and brown and white tomentum; apices of femora, apices and bases of tibiae, and apices of first tarsal segments with white tomentose annuli, tibiae with scattered white tomentum, tarsal segments 1 to 3 with conspicuous dense brown hair fringe on posterior border, fringe largest on first tarsal segment.

Head: eyes separated by distance equal to about 1 facet diameter; suture extending from inner eye margin to antennal base with median spur near eye margin; labrum shorter than first palpal segment; palpus long, $\frac{1}{2}$ as long as antenna, ratio of segments 8:22:16:19. **Antenna** $\frac{1}{2}$ - $\frac{2}{3}$ times length of wing; sensory filaments composed of 2 anterior branches extending forward to apex of internode; flagellar segments with slender internodes; segment XIV with long apiculis. **Wing** broad, little more than twice as long as wide; membrane translucent, costal cell lightly infuscated; apex acute; Sc ending at level of base of R_{2+3} ; bifurcation R_{2+3} distad of M_{1+2} by distance equal to width of cell R_3 at point of bifurcation; vein R_5 ending just at apex. **Legs**, tarsal segment 1 to 4 with pair of stout bristles at lateral posterior apices. **Genitalia** as figured; aedeagus terminating in loop.

Measurements: antenna 2.0-2.6 mm.; wing length 2.6-3.8 mm.; wing width 1.2-1.8 mm.

Female. Similar to male. Antennal verticils not as well developed; sensory filaments composed of single anterior branch. **Genitalia** as figured.

Measurements: antenna 2.3-2.6 mm.; wing length 2.8-4.1 mm.; wing width 1.3-2.0 mm.

Type data: syntypes, 2 ♀, Havana, Cuba, January 27, 1869 (University of Kansas).

Other specimens examined: Honolulu, Oahu, January 1, 1953, at light (D. E. Hardy); same, January 18, 1951 (B. L. Defibaugh); same, March 13, 1931, April 13, 1931 (F. X. Williams); same, May 14, 1929, July 3, 1930 (O. H. Swezey); same, December 2, 1932 (F. X. Williams); Hering Valley, Honolulu, December 30, 1930 (F. X. Williams); Manoa Valley, Oahu, April 16, 1905 (O. H. Swezey); Tantalus, Oahu, February 6, 1930, ex.

kukui tree water (F. X. Williams). Waihee, Maui, June, 1952, at light (D. E. Hardy, M. Tamashiro).

Telmatoscopus albipunctatus is easily recognized due to its large size, color pattern of the vestiture, and the racquet shape of the male aedeagus. There is no other species in the Hawaiian Islands of this size which could be confused with this species.

Williams (1943:326) gives an excellent account of the biology of *T. albipunctatus* and notes that this species breeds in sinks, drains, wet mud, water in tree holes, rain barrels, shallow little pools partly filled with dead leaves and debris, and rinds of kukui tree fruit. Dyar (1926:149) reported that the larvae of *T. albipunctatus* have been found with those of the mosquitoes *Culex quinquefasciatus* and *Aedes aegypti*. Efflatoun (1921, Bull. Soc. ent. d'Egypte, 6:22) gave an account of large numbers of the immature stages of *T. albipunctatus* (= *T. meridionalis* Eaton) living in a water-tank used for macerating bones. These divergent types of larval habitats would indicate a wide range of tolerances on the part of *T. albipunctatus* and help explain the wide occurrence of this species.

Genus *Psychoda* Latreille

Psychoda Latreille, 1796, *Precis caract. gen. ins.*, p. 152.

Adult characters. Small to medium size; vestiture usually uniformly yellowish in color. Eye bridge present; interocular suture present or absent; labellum flattened with number of teeth on apical margin and several spines near lateral margin or bulbous without teeth. *Antenna* with 14 to 16 segments, longer than width of wing; verticils on flagellum well developed, cupuliform; sensory filaments almost always Y-shaped, sometimes with 3 anterior branches; flagellar segments nodose, basal portion enlarged into node and apical portion a slender internode; flagellar segment XII and following segments, if present, reduced in size, about 1/2 size of preceding segments; apiculus absent. *Wing* with apex acute; R_3 ending in apex; R_s 4-branched, hence 2 longitudinal veins between bifurcations R_{2+3} and M_{1+2} ; Sc not forked. Male genitalia usually with surstyle bearing single tenaculum.

Type of genus: *Tipula phalaenoides* Linnaeus (by monotypy).

The genus *Psychoda* contains most of the species of psychodids found in the Hawaiian Islands. Other members of the genus are distributed throughout the world with a goodly number of species in all the zoogeographical regions.

Key to Species of *Psychoda*

1. Bases of veins R_3 and M_2 present or only lacking at bifurcation; hairs originating only on wing veins, not on membrane; labellum flattened, bearing row of blunt teeth on apical margin..... 2
 - Basal third of veins R_3 and M_2 lacking; hairs originating on membrane as well as on veins; labellum bulbous, without blunt teeth..... *insulicola* n.sp.
2. Tips of longitudinal veins with brown spots (may be faint in general specimens); flagellar segments XIII and XIV broadly fused together..... 3
 - Tips of longitudinal veins without markings; terminal flagellar segments clearly separated..... 4
3. Apical portion of female subgenital plate V-shaped; lower process of male aedeagus as large as apical half of main shaft, extending to or beyond apex of main shaft (Fig. 15)..... *alternata* Say
 - Apical portion of female subgenital plate cigar-shaped, not bilobed; lower process of male aedeagus smaller than apical half of main shaft, not extending to apex of shaft (Fig. 11)..... *pseudalternata* Williams

4. Antenna with 14 or 16 segments; bases of R_3 and M_2 present..... 5
 Antenna with 15 segments; bases of R_3 and M_2 lacking..... *wirthi* n.sp.
5. Antenna with 14 segments..... 6
 Antenna with 16 segments..... 8
6. R_{2+3} subequal to length of R_2 ; female subgenital plate with sides of apical half convergent 7
 R_{2+3} noticeably longer than R_2 (6:5); female subgenital plate with sides of apical half parallel..... *inornata* Grimshaw
7. Male with wing broad, 2 times as long as broad; female subgenital plate terminating as pair of small, slender lobes..... *hardyi* n.sp.
 Male wing moderately slender, $2\frac{1}{2}$ times as long as broad; female subgenital plate terminating as pair of broadly rounded lobes..... *lucia* n.sp.
8. Male with surstyle short and stocky, little longer than ninth tergite; female with apical portion of subgenital plate with convergent sides, sides not suddenly narrowing 9
 Male with surstyle relatively long and slender, nearly twice as long as ninth tergite; female with apical portion of subgenital plate with parallel or divergent sides, suddenly narrowing near base or center..... 10
9. Teeth of labellum very short, not as long as wide; male with R_{2+3} considerably shorter than R_2 (5:8); female subgenital plate nearly as long as wide..... *salicornia* n.sp.
 Teeth of labellum normal, considerably longer than wide; male with R_{2+3} subequal to length of R_2 ; female subgenital plate twice as wide as long..... *williamsi* n.sp.
10. Male aedeagus with basal portion anterior to base of style (coxite) lightly sclerotized, apical recurved hook moderately long and very slender; female subgenital plate with large, lateral expansions at base extending forward almost to apex of plate..... *harrisi* Satchell
 Male aedeagus with basal portion normally sclerotized, apical hook short and broad; female subgenital plate without large lateral expansions at base..... *uncinula* n.sp.

Psychoda insulicola new species (Figs. 1-3)

Female. *Head:* eyes separated by distance equal to less than $\frac{1}{2}$ facet diameter; interocular suture present, with median spur projecting posteriorly; labrum longer than first palpal segment; labellum bulbous, bearing number of setae and spines, but without teeth; ratio of palpal segments 10:14:16:18. *Antenna* with 16 segments, nearly $\frac{1}{2}$ times length of wing; sensory filaments composed of 2 anterior and 1 posterior branches; terminal 3 segments reduced in size, clearly separated from each other. *Wing* moderately narrow, 3 times as long as wide; hairs arising from veins and membrane; basal half of R_3 and base of M_2 lacking. *Genitalia* as figured; subgenital plate deeply cleft at apex.

Measurements: holotype, antenna 0.9 mm.; wing length 2.1 mm.; wing width 0.7 mm. Paratypes, wing length 1.9-2.2 mm.; wing width 0.7-0.8 mm.

Male. Unknown.

Type data: holotype ♀, Honolulu, Oahu, June, 1952, light trap (D. E. Hardy). Paratypes, 1 ♀, same data; 6 ♀, same, January 19, 1951 (B. L. Defibaugh); 1 ♀, same, January 24, 1951; 1 ♀, Waimanalo, Oahu, January 31, 1951 (D. E. Hardy); 1 ♀, Manoa Valley, Oahu, March 17, 1949, at light (G. Howe). All types whole mounts on slides. Holotype to be deposited at U. S. National Museum, Washington, D. C. Paratypes at Bishop Museum, University of Hawaii, Hawaiian Sugar Planters' Association collection, Honolulu; California Academy of Sciences, San Francisco; and University of Nebraska, Lincoln.

The characters of *P. insulicola* which make this species distinctive are the bulbous labellum, the absence of the bases of veins R_3 and M_2 and the deeply cleft female subgenital plate.

Psychoda insulicola is noteworthy due to the bulbous labellum and the hairs on the wing membrane as well as the veins. Tonnoir (1922) proposed the subgenus *Trichopsychoda* to include the species of the genus *Psychoda* with the hairy membrane. At a later date (1940, Trans. Soc. Brit. Ent., 7:61) he indicated that he considered the group of generic status. I prefer to include *P. insulicola* in the genus *Psychoda* at this time, although it is divergent from other members of the genus that occur in the Hawaiian Islands and undoubtedly represents at least a separate subgenus.

Psychoda alternata Say (figs. 13-16)

Psychoda alternata Say, 1824, Narrative expedition source St. Peter's River, 2:358; Grimshaw, 1901, Fauna Haw., 3:6; Swezey, 1907, Proc. Haw. Ent. Soc., 1:116; Tonnoir, 1922, Ann. Soc. Ent. Belg., 62:72; Illingworth, 1927, Proc. Haw. Ent. Soc., 6:394; Swezey & Bryan, 1929, *ibid.*, 7:301; Swezey and Williams, 1932, *ibid.*, 8:187; Bryan, 1934, *ibid.*, 8:403, 445; del Rosario, 1936, Philip. Jour. Sci., 59:93; Williams, 1938, Proc. Haw. Ent. Soc., 10:112; 1943, *ibid.*, 11:334; Rapp and Rapp, 1946, Jour. N. Y. Ent. Soc., 54:291. (For complete synonymy see Tonnoir, 1934 and del Rosario, 1936.)

Male. Vestiture white to pale yellow; wing vestiture very light brown, with indistinct white band at base and at middle, apices of longitudinal veins with brown spots ringed by white areas. (General or denuded specimens show only brown spots at apices of veins.) **Head:** eyes separated by distance equal to 1 to 3 facet diameters; interocular suture usually absent; labrum longer than first palpal segment; labellum flattened, bearing 4 (sometimes 5) long and 1 short teeth and 3 spines; third palpal segment moderately expanded, larger in diameter than other segments, ratio of segments 9:10:9:13. **Antenna** with 15 segments, 5/9 times length of wing; sensory filaments composed of 2 anterior and 1 posterior branches, branches short; terminal two segments reduced in size, flagellar segments XI and XII fused together, XII smaller than XI; XIII free, very small. **Wing** $2\frac{1}{2}$ times as long as wide; bifurcation R_{2+3} at middle of wing; bifurcation M_{1+2} mesad of R_{2+3} by distance equal to 2 to 3 times width of cell R_3 at level of bifurcation; ratio of $R_{2+3}:R_2:R_3 = 10:10:15$. **Genitalia** as figured, surstyle long and slender, nearly twice as long as 9th tergite.

Measurements: antenna 1.0-1.2 mm.; wing length 1.2-2.3 mm.; wing width 0.5-0.9 mm.

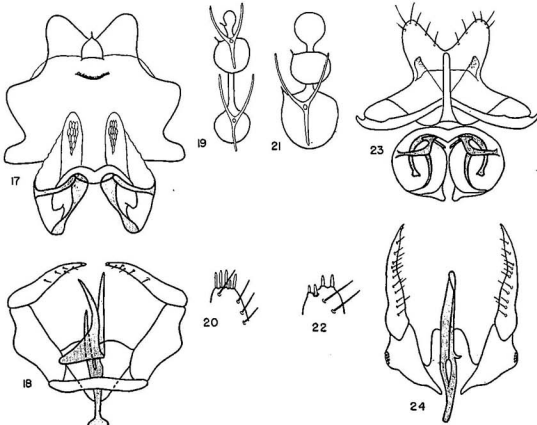
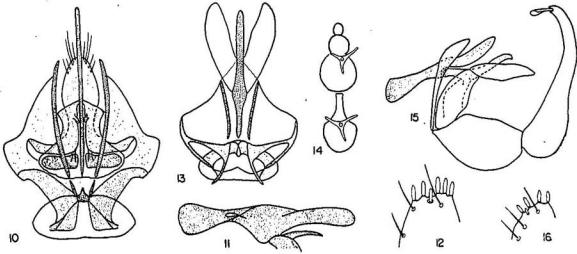
Female. Similar to male. Antenna shorter, $\frac{1}{3}$ - $\frac{1}{2}$ times length of wing. Genitalia as figured, subgenital plate V-shaped.

Measurements: antenna 0.8-1.2 mm.; wing length 1.4-3.0 mm.; wing width 0.7-1.3 mm.

Type data: Philadelphia, Pennsylvania. (Probably destroyed.)

Specimens examined: Honolulu, Oahu, January, 1953, at light (D. E. Hardy); same, January 18, 1951, January 19, 1951, light trap (B. L. Defibaugh); same, June 16, 1936 (F. X. Williams); Waialae, Oahu, December 10, 1946, chicken manure (L. Kartman); Waianae Mts., Oahu (low), 1945, light trap (M. Y. Webb). Waihee, Maui, June, 1952, light trap. Hilo, Hawaii, November, 1945, light trap (W. W. Wirth); Pahala, Hawaii, March 9, 1907.

Psychoda alternata is a common and abundant species. Specimens were very numerous in all light trap collections from Honolulu. It also is frequently taken in large numbers by light traps in the United States.



Figures 10-16

Figs. 10-12. *Psychoda pseudalternata*. Fig. 10. female genitalia, dorsal view. 11. aedeagus of male genitalia, lateral view. 12. labellum.

Figs. 13-16. *P. alternata*. Fig. 13. female genitalia, dorsal view. 14. tip of antenna. 15. male genitalia, lateral view. 16. labellum.

Figures 17-24

Figs. 17-20. *Psychoda inornata*. Fig. 17. female genitalia, dorsal view. 18. male genitalia, dorsal view. 19. tip of antenna. 20. labellum of female.

Figs. 21-24. *P. wirthi*. Fig. 21. tip of antenna. 22. labellum. 23. female genitalia, dorsal view. 24. male genitalia, dorsal view.

In North America there are several species in the *alternata* complex. Tonnoir (1922:73) identified the name *P. alternata* with that species possessing the V-shaped female subgenital plate, which concept I accept. Del Rosario (1936) illustrated a species of the *alternata* complex with a U-shaped subgenital plate, which has been named *lativentris* Berdén.

Psychoda pseudalternata Williams (Figs. 10-12)

Psychoda pseudalternata Bryan, 1940, Proc. Haw. Ent. Soc., 10:370 (*nomen nudum*).

"*Psychoda pseudalternata* Tonnoir (unpublished)," Williams, 1943, Proc. Haw. Ent. Soc., 11:336 (*nomen nudum*).

Psychoda pseudalternata Williams, 1946, Proc. Haw. Ent. Soc., 12:637; Rapp and Rapp, 1946, Jour. N. Y. Ent. Soc., 54:292; Hardy, 1952, Proc. Haw. Ent. Soc., 15:445.

Male. Vestiture white to pale yellow; wing vestiture very light brown, with indistinct white band at base and at middle, apices of longitudinal veins with brown spots ringed by white areas (teneral or denuded specimens show only brown spots at apices of veins). **Head:** eyes separated by distance equal to 2 to 3 facet diameters; interocular suture usually absent; labrum longer than first palpal segment; labellum flattened, bearing 5 long and 1 short teeth and 3 spines; second and third palpal segments expanded, larger in diameter than other segments, ratio of segments 10:10:10:14. **Antenna** with 15 segments, 2/5 times length of wing; sensory filaments composed of 2 anterior and 1 posterior branches, branches short; terminal two segments reduced in size; flagellar segments XI and XII fused together; XII smaller than XI; XIII free, very small. **Wing** about 2½ times as long as wide; bifurcation R_{2+3} near middle of wing; bifurcation M_{1+2} mesad of R_{2+3} by distance equal to 1 to 2 times width of cell R_3 at level of bifurcation, ratio of $R_{2+3}:R_2:R_3 = 10:9:15$. **Genitalia** as figured; surstyle long and slender, nearly twice as long as ninth tergite.

Measurements: antenna 0.7-0.8 mm.; wing length 1.6-1.7 mm.; wing width 0.7-0.8 mm.

Female. Similar to male. Genitalia as figured; apical portion of subgenital plate rod-shaped, arising from basal band.

Measurements: antenna 0.7-1.0 mm.; wing length 1.7-2.4 mm.; wing width 0.7-1.1 mm.

Type data: ♂, Canberra, A. C. T., Australia (Bishop Museum).

Specimens examined: Honolulu, Oahu, January 19, 1951, light trap (B. L. Defibaugh); same, April 18, 1935 (F. X. Williams); Hering Valley, Honolulu, November 8, 1933 (F. X. Williams); Lanikai, Oahu, December 17, 1945, light trap (W. W. Wirth); Mt. Kaala, Oahu, November 6, 1945, 4,000 ft. (W. W. Wirth).

Psychoda pseudalternata and *P. alternata* are closely allied species and are readily distinguished from other Hawaiian species by the brown spots at the tips of the longitudinal wing veins and the fifteen-segmented antenna. The rod-like structure of the terminal part of the female subgenital plate easily distinguishes the female of *P. pseudalternata* from the female of *P. alternata* with its V-shaped subgenital plate. The males of these two species are less readily distinguished. Apparently, the only important difference lies in the form of the aedeagus. In *P. pseudalternata* the lower process of the aedeagus is much smaller in diameter than the upper shaft, is sharply pointed, and terminates one-third the length of the main shaft from its apex. The lower shaft of *P. alternata* is nearly equal in diameter to the main shaft, is rounded apically, and terminates on the same level as the main shaft.

The status of the name *Psychoda pseudalternata* is reviewed by Hardy (1952:446), who pointed out that the name has appeared in the literature twice (Bryan, 1940:370; Williams, 1943:336) as a *nomen nudum* with the authorship being incorrectly accredited to Tonnoir. Tonnoir never published the name. In 1946 Williams validated the name by a description; hence, authorship should be accredited to Williams and priority is effective as of May, 1946.

This is one of the more abundant species of Hawaii, specimens being numerous in nearly all light trap collections from Honolulu which I have examined. *Psychoda pseudalternata* and *P. alternata* constituted the bulk of such collections.

The fact that *P. pseudalternata* and *P. alternata* share so many characters in common makes it natural to assume that these two species arose from a common ancestor. During a part of their evolutionary history, these two species must have been allopatric in distribution. At the present time the two species are sympatrically distributed at least in Hawaii, both species having been taken in the same collections from Honolulu. Outside of Hawaii *P. pseudalternata* is known only from Australia, while *P. alternata* is almost world-wide in distribution. *Psychoda pseudalternata* is probably the native species and *P. alternata* the introduced species due to the wider distribution of the latter.

Psychoda wirthi new species (Figs. 21-24)

Male. *Head:* eyes separated by distance equal to 1 facet diameter; interocular suture absent; labrum longer than first palpal segment; labellum flattened, bearing 4 long teeth and 2 spines; palpal segments subequal in diameter, ratio of segments 10:10:10:13. *Antenna* with 15 segments, $\frac{2}{3}$ length of wing; sensory filaments composed of 2 anterior and 1 posterior branches; apical two segments reduced in size, about $\frac{1}{2}$ size of preceding segments. *Wing* about $2\frac{1}{3}$ times as long as wide; bifurcation little distad of middle of wing; bases of R_3 and M_2 lacking. *Genitalia* as figured; aedeagus rod-like; surstyle long and slender, twice as long as ninth tergite.

Measurements: holotype, antenna 0.9 mm.; wing length 1.3 mm.; wing width 0.6 mm.

Female. Similar to male. Interocular suture present (sometimes absent). Antenna $\frac{1}{2}$ as long as wing. *Genitalia* as figured; subgenital plate with divergent sides, apical indentation V-shaped; genital digit very long, originating at base of plate.

Measurements: allotype, antenna 0.9 mm.; wing length 1.8 mm.; wing width 0.7 mm.

Type data: holotype δ , allotype φ , Honolulu, Oahu, June, 1952, light trap (D. E. Hardy). Paratypes, 4 φ , same data, 1 δ , same, January, 1953; 1 φ , same, January 19, 1951 (B. L. Defibaugh); 1 δ , same, January 24, 1951; 2 δ , 2 φ , same, October, 1952, light trap (D. E. Hardy). 1 φ , Waihee, Maui, June, 1952, at light (D. E. Hardy and M. Tamashiro); 2 φ , same, light trap. 1 φ , Hilo, Hawaii, November, 1945, light trap (W. W. Wirth). All types whole mounts on slides. Holotype and allotype to be deposited at U. S. National Museum, Washington, D. C. Paratypes to be deposited at Bishop Museum, University of Hawaii, Hawaiian Sugar Planters' Association, Honolulu; University of Nebraska, Lincoln; and California Academy of Sciences, San Francisco.

Psychoda wirthi is separable from other Hawaiian psychodids on the basis of the fifteen-segmented antenna, the divergent-sided female subgenital plate, and the absence of the bases of veins R_3 and M_2 . Also,

this is the only species in which the genital digit of the female originates at the base of the subgenital plate, rather than near the center.

It is with pleasure that I take the opportunity to name this species in honor of my friend, Dr. Willis W. Wirth of the U. S. Department of Agriculture.

***Psychoda inornata* Grimshaw (Figs. 17-20)**

Psychoda inornata Grimshaw, 1901, Fauna Haw., 3:6; Swezey, 1907, Proc.

Haw. Ent. Soc., 1:116; Bryan, 1934, *ibid.*, 8:403; Rapp and Rapp, 1946, Jour. N. Y. Ent. Soc., 54:291; Hardy, 1952, Proc. Haw. Ent. Soc., 14:445.

Psychoda severini Tonnoir, 1922, Ann. Soc. ent. Belg., 62:78.

New synonymy.

Male. Vestiture dull golden. *Head:* eyes separated by distance equal to 1 facet diameter; interocular suture absent or faint; labrum longer than first palpal segment; labellum with 1 short and 3 long teeth and 2 spines; palpal segments approximately equal in diameter, ratio of segments 10:10:10:14. *Antenna* with 14 segments, $\frac{3}{4}$ as long as wing; sensory filaments composed of 2 anterior and 1 posterior branches; apical segments reduced in size, internode bearing tubercle near base of node. *Wing* $2\frac{1}{2}$ times as long as wide; bifurcation R_{2+3} little beyond middle of wing; bifurcation M_{1+2} mesad of bifurcation R_{2+3} by distance equal to 5 times width of cell R_3 at level of bifurcation; ratio of $R_{2+3}:R_2:R_3 = 12:10:14$. *Genitalia* as figured; surstyle long and slender, twice as long as ninth tergite.

Measurements: antenna 0.9-1.5 mm.; wing length 1.5-2.2 mm.; wing width 0.5-0.9 mm.

Female. Similar to male. Eyes separated by distance equal to 2 facet diameters, interocular suture often present; labellum with 1 short and 4 long teeth and 4 spines; antenna little more than $\frac{1}{2}$ as long as wing; ratio of $R_{2+3}:R_2:R_3 = 10:6:10$.

Measurements: antenna 0.8-1.5 mm.; wing length 1.4-2.8 mm.; wing width 0.5-1.0 mm.

Type data: ♀, Kona, Hawaii, August, 1892, 4000 ft. [British Museum (Natural History)].

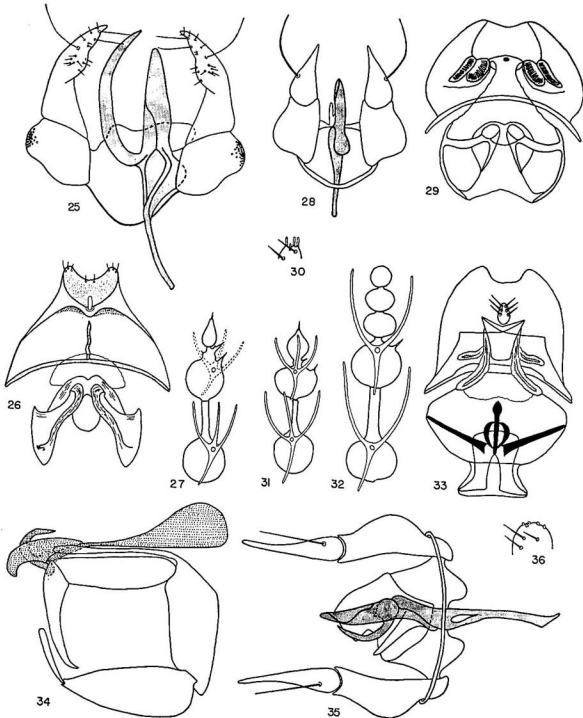
Specimens examined: 1 ♀, Honolulu, Oahu, April, 1951, bait trap (D. E. Hardy); 3 ♀, Paliku, Haleakala Crater, Maui, June, 1952 (M. Tamashiro); 2 ♀, Makawao, Maui, June, 1952, at light (D. E. Hardy and M. Tamashiro).

The behavior of *P. inornata* in the Hawaiian Islands appears to differ from its actions in North America. I have examined specimens from 17 states ranging from New York to California, British Columbia, and Alaska. Many of these records were based on light trap collections and specimens were often numerous in the collections. In other words, *P. inornata* is a common, abundant species in North America. Yet of the approximately 1000 specimens of psychodids which I examined from Hawaii, only 6 specimens of *P. inornata* were present and only two of these were taken at light. The point I wish to make is that apparently differences are present between populations in the Hawaiian Islands and those of the mainland.

Dr. Paul Freeman examined the type of *inornata* and on the basis of his examination of the wing and antenna it became evident that *inornata* and *severini* were possibly synonymous. Dr. Geoffrey Satchell later confirmed this synonymy by a critical examination of the type after it had been boiled and cleared.

Psychoda hardyi* new species (Figs. 25-27).Psychoda* sp. 2 Williams, 1943, Proc. Haw. Ent. Soc., 11:337.

Male. Vestiture chiefly dark gray, vestiture of antenna and legs dark brown. **Head:** eyes separated by distance equal to 1 facet diameter; interocular suture absent; labrum longer than first palpal segment; labellum flattened, bearing 3 long and 1 short teeth and 2 spines; first palpal segment with small, rounded tubercle on medial, apical margin, terminal segment more slender than other segments, ratio of segments 10:10:10:14.

**Figures 25-36**

Figs. 25-27. *Psychoda hardyi*. Fig. 25. male genitalia, dorsal view. 26. female genitalia, dorsal view. 27. tip of male antenna.

Figs. 28-31. *P. lucia*. Fig. 28. male genitalia, dorsal view. 29. female genitalia, dorsal view. 30. labellum. 31. tip of male antenna.

Figs. 32-36. *P. salicornia*. Fig. 32. tip of antenna. 33. female genitalia, dorsal view. 34. male genitalia, lateral view. 35. male genitalia, dorsal view. 36. labellum.

Antenna with 14 segments, $\frac{2}{3}$ times length of wing; sensory filaments composed of 3 anterior and 1 posterior branches; apical segment reduced in size; internode with long, spine-bearing tubercle and short, spine-bearing tubercle. *Wing* broad, little more than twice as long as wide; bifurcation R_{2+3} little before middle of wing; bifurcation M_{1+2} mesad of R_{2+3} by distance equal to twice width of cell R_3 at level of bifurcation; ratio of $R_{2+3}:R_2:R_3 = 10:10:13$. *Genitalia* as figured; surstyle long and slender, twice as long as ninth tergite.

Measurements: holotype, antenna 1.1 mm.; wing length 1.5 mm.; wing width 0.8 mm.

Female. Similar to male. Vestiture of antenna and legs brown. Eyes separated by distance equal to nearly 2 facet diameters. Antenna little more than $\frac{1}{2}$ as long as wing. Wing $2\frac{1}{2}$ times as long as wide. *Genitalia* as figured; subgenital plate with deep apical concavity.

Measurements: allotype, antenna 1.1 mm.; wing length 2.0 mm.; wing width 0.9 mm. Paratypes, wing length 1.5-2.0 mm.; wing width 0.6-0.9 mm.

Type data: holotype δ , Honolulu, Oahu, January 24, 1951, light trap (B. L. Defibaugh); allotype φ , Waimanalo, Oahu, January 31, 1951, ex rotten cucumber (T. Nishida). Paratypes, 1 δ , same data as holotype; 6 δ , same data as allotype; 1 φ , Honolulu, January 18, 1951, light trap (B. L. Defibaugh); 1 δ , 6 φ , same, January 19, 1951; 4 δ , 2 φ , same, June, 1952, light trap (D. E. Hardy). 1 φ , Hilo, Hawaii, November, 1945, light trap (W. W. Wirth). All types whole mounts on slides. Holotype and allotype to be deposited at U. S. National Museum, Washington, D. C. Paratypes to be deposited at Bishop Museum, University of Hawaii, Hawaiian Sugar Planters' Association collection, Honolulu; University of Nebraska, Lincoln; and California Academy of Sciences, San Francisco.

Other specimens examined: Honolulu, Oahu, ex rotten vegetation (D. E. Hardy); Waimanalo, April, 1952, ex rotten tomatoes (T. Nishida). Kukuiala Valley, Oahu, September 16, 1933, ex rotten *Alacryon* fruit (O. H. Swezey) (det. *Psychoda inornata* Grim. by Bryan); Kipapa, Oahu, August, 1945, (W. W. Wirth); Waihee, Maui, June, 1952, at light (D. E. Hardy & M. Tamashiro).

Psychoda hardyi is easily recognized by the three anterior branches of the sensory filaments, the broad wings of the male and the female subgenital plate in combination with the fourteen-segmented antennae. The subgenital plate tapers from its base to apex and terminates in a pair of small lobes separated by a marked concavity. The characters of the male genitalia are distinctive, but the differences between this and other species are more subtle.

Williams' drawings of *Psychoda* sp. 2 (1943:338) agree well with *P. hardyi* and undoubtedly the two belong to the same species. The illustration of the male genitalia of *Psychoda* sp. 2 doesn't show all of the aedeagus, but the illustrated parts more closely resemble *P. hardyi* than any other known Hawaiian species.

I take pleasure in naming this species in honor of my friend, Dr. D. Elmo Hardy, who furnished many of the specimens studied for this revision.

Psychoda lucia new species (Figs. 28-31)

Male. *Head:* eyes separated by distance equal to less than $\frac{1}{2}$ facet diameter; interocular suture absent; labrum longer than first palpal segment; flagellum with 3 long and 1 short teeth and 2 spines; third palpal segment expanded, larger in diameter than other segments, ratio of segments 10:10:10:14. *Antenna* with 14 segments, about $\frac{2}{3}$ as

long as wing; sensory filaments composed of 3 anterior and 1 posterior branches; apical segment reduced in size, internode expanded on one side at base. *Wing* nearly $2\frac{1}{2}$ times as long as wide; bifurcation R_{2+3} little mesad of middle of wing; bifurcation M_{2+3} mesad of R_{2+3} by distance equal to twice width of cell R_3 at level of bifurcation; ratio of $R_{2+3}:R_2:R_3 = 10:9:13$. *Genitalia* as figured; dististyle enlarged basally, bearing 1 very long hair $\frac{1}{3}$ distance from base; surstyle long and slender, twice as long as ninth tergite.

Measurements: holotype, antenna 0.9 mm.; wing length 1.3 mm.; wing width 0.5 mm.

Female. Similar to male. Eyes separated by distance equal to 2 facet diameters; antenna about $\frac{2}{3}$ times length of wing. *Genitalia* as figured; subgenital plate broad with marked apical concavity; rosette-like structure internally at base of each apical lobe.

Measurements: allotype, antenna 0.8 mm.; wing length 1.3 mm. Paratypes, wing length 1.2-1.4 mm.; wing width 0.4-0.5 mm.

Type data: holotype δ , and allotype φ , Gastries, St. Lucia, West Indies, September 10 to 22, 1919 (J. C. Bradley). Paratypes, 6 φ , same data; 1 δ , 1 φ , Morrison Field, West Palm Beach, Florida, September 20, 1942 (D. E. Hardy); 1 φ , same, September 22, 1942; 1 φ , same, October 2, 1942; 1 δ , 1 φ , same, December 5, 1942; 2 δ , same, January 15, 1943; 1 φ , Miami, Florida, October, 1943 (W. W. Wirth). All types whole mounts on slides. Holotype, allotype and paratypes to be returned to Cornell University, Ithaca, New York. Paratypes to be deposited at U. S. National Museum, Washington, D. C.; American Museum of Natural History, N. Y.; University of Nebraska, Lincoln; California Academy of Sciences, San Francisco; and Bishop Museum, Honolulu.

Other specimens examined: Honolulu, Oahu, January 2, 1951, January, 1953, at light (D. E. Hardy); same, January 2, 1951, January 18, 1951, January 19, 1951, light trap (B. L. Defibaugh).

Psychoda lucia is separable from other Hawaiian species by the fourteen-segmented antenna, the three anterior branches of the sensory filaments, the broad, bilobed subgenital plate of the female, and the structure of the male genitalia, especially the short, thick, and laterally expanded basistyle.

The apparent discontinuous distribution of *P. lucia*, being known only from the West Indies, Florida, and Hawaii, may raise the question as to whether we are dealing with but a single species. This point was in the author's mind when he was studying the species. No significant differences were discerned between the specimens from the West Indies and Florida and those from Hawaii. *Telmatoscopus albipunctatus* has a similar distribution, but also has been reported from various points in the southern United States, and other tropical and subtropical regions of the world. However, *T. albipunctatus* is a large, conspicuous psychodid, while *P. lucia* is a small, unicolorous species. It is conceivable that *P. lucia* may have a distribution similar to that of *T. albipunctatus* but has been overlooked or simply disregarded because of its small size and unobtrusiveness, whereas *T. albipunctatus* would be more readily collected due to its attractive appearance.

Psychoda salicornia new species (Figs. 32-36)

Male. Vestiture brown; wing with dark brown scales on lower surface sparsely scattered over basal half; costa with long, dense brush of hairs arising from basal angle and lying flat on lower surface. *Head:* eyes separated by distance equal to $1\frac{1}{2}$ facet diameters; interocular suture present; frons with faint suture from anterior median eye margin to antennal base, clear spot adjacent and posterior to antennal base, disc

covered with hair, median band extending posteriorly almost to interocular suture; labrum longer than first palpal segment; labellum with 5 very short teeth and 3 spines; palpal segments of nearly equal diameter, ratio of segments 9:14:15:18. *Antenna* with 16 segments, approximately $\frac{3}{4}$ times length of wing; sensory filaments composed of 2 anterior and 1 posterior branches; flagellar segment I with clavate node $1\frac{1}{2}$ times length of internode; nodes of segments II to VIII similar, but progressively becoming globular, remaining nodes globular; flagellar segment XI with short internode; XII, XIII, and XIV clearly separated from each other; XII and XIII equal in size; XIV somewhat smaller than two preceding segments. *Thorax*: anepisternum of mesothorax a large, ovoid plate, outer surface covered with setae and few, scattered hairs on posterior third, internal surface with small black, rod-like structures. *Wing* $2\frac{1}{3}$ times as long as wide; costa thickened, with strong angle immediately beyond distal node; bifurcation R_{2+3} mesad of middle of wing; bifurcation M_{1+2} mesad of R_{2+3} by distance equal to twice width of cell R_3 at level of bifurcation; ratio of R_{2+3} : R_2 : R_3 = 10:16:22. *Genitalia* as figured; surstyle short, enlarged basally; little longer than ninth tergite; aedeagus with basal fan-shaped enlargement laterally flattened, terminating as stout, downward curving hook, flanked by slender, acute, upward curving hook.

Measurements: holotype, antenna 1.6 mm.; wing length 2.1 mm.; wing width 0.9 mm. Paratypes, antenna 1.5 mm.; wing length 1.9-2.2 mm.; wing width 0.8-1.0 mm.

Female. Similar to male. Antenna shorter, nearly $\frac{1}{2}$ as long as wing; anepisternum of mesothorax normal; wing narrower, $2\frac{1}{2}$ times as long as wide, without scales or costal brush of hairs; ratio of R_{2+3} : R_2 : R_3 = 10:10:16. *Genitalia* as figured.

Measurements: allotype, antenna 1.3 mm.; wing length 2.3 mm.; wing width 0.9 mm. Paratypes, antenna 1.4-1.5 mm.; wing length 2.0-2.6 mm.; wing width 0.8-1.1 mm.

Type data: holotype δ , and allotype φ , Alviso, Santa Clara Co., California, September 9, 1949, salt marsh (L. W. Quate). Paratypes, 4 δ , 3 φ , same data; 5 δ , 6 φ , Milpitas, Santa Clara Co., California, October 21, 1950, light trap (W. Graef); 1 φ , Alum Rock Park, Santa Clara Co., California, February 23, 1950 (L. W. Quate); 12 δ , 2 φ , Alameda, Alameda Co., California, November 4, 1949 (L. W. Quate); 4 δ , 3 φ , Inverness, Marin Co., California, September 25, 1950 (L. W. Quate); 1 φ , Sausalito, Marin Co., California, October 24, 1941 (C. T. Dodds). All types whole mounts on slides. Holotype and allotype to be deposited at the California Academy of Sciences, San Francisco. Paratypes to be deposited at the U. S. National Museum, Washington, D. C.; American Museum of Natural History, New York; University of Nebraska, Lincoln; California Insect Survey, Berkeley; and Bishop Museum, Honolulu.

Other specimens examined: Honolulu, Oahu, February, 1946, June, 1945, light trap (W. W. Wirth).

Psychoda salicornia resembles *Psychoda williamsi* and *P. cinerea* in the general facies of the male genitalia and the sixteen-segmented antenna with the three terminal segments separated. However, *P. salicornia* is differentiated from these species by the very short teeth on the labellum, the costal brush of hairs and the scales on the lower surface of the male wing, and the characters of the male and female genitalia as illustrated.

In California the pickle weed, *Salicornia ambigua*, typical of the salt marshes along the coast, characterizes the habitat in which this psychodid is found. The adults are found abundantly on the stems and branches of the pickle weed. When disturbed they quickly seek shelter in the lowermost parts of the plants. Although searches were made for this species in the spring and early summer, specimens were collected only in the fall and winter months. As the only Hawaiian record is based on light trap collections, it is unknown whether *P. salicornia* exists under the same ecological condition in Hawaii as it does on the mainland.

Psychoda williamsi* new species (Figs. 44-45)Psychoda* sp. 1 Williams, 1943, Proc. Haw. Ent. Soc., 11:336

Male. Vestiture brown. **Head:** eyes separated by distance equal to 1 facet diameter, interocular suture absent; labrum little longer than first palpal segment; labellum flattened, bearing 4 long and 1 short teeth and 4 spines; palpal segments similar in diameter, ratio of segments 10:14:16:18. **Antenna** with 16 segments, about $\frac{2}{3}$ length of wing; sensory filaments composed of 2 anterior and 1 posterior branches; terminal 3 segments reduced in size, clearly separated from each other. **Wing** $2\frac{1}{2}$ times as long as broad; dense tuft of brown hairs sub-basally on costa; bifurcation R_{2+3} at middle of wing; bifurcation M_{1+2} mesad of R_{2+3} by distance equal to 3 times width of cell R_3 at level of bifurcation; ratio of $R_{2+3}:R_2:R_3 = 10:10:13$. **Genitalia** as figured; surstyle short and stocky.

Measurements: holotype, antenna 1.3 mm.; wing length 1.9 mm.; wing width 0.8 mm. Paratypes, antenna 1.1-1.3 mm.; wing length 1.5-1.9 mm.; wing width 0.6-0.8 mm.

Female. Similar to male. Eyes separated by distance equal to 2 facet diameters. Antenna $5/9$ times length of wing. **Genitalia** as figured; subgenital plate broad, apex with weak concavity.

Measurements: allotype, antenna 1.1 mm.; wing length 1.9 mm.; wing width 0.8 mm. Paratypes, antenna 0.9-1.2 mm.; wing length 1.6-2.1 mm.; wing width 0.7-0.8 mm.

Type data: holotype δ , Palikea, Oahu, March 14, 1937; wet scum on tank (F. X. Williams); allotype f , same, March, 4, 1936. Paratypes, 1 f , same data as holotype; 1 δ , same data as allotype; 1 δ , 2 f , same, February 26, 1937; 1 δ , Honolulu, January 4, 1940, *Melaleuca* stump sap (F. X. Williams); 3 f , Honolulu, January 18, 1951, light trap (B. L. Defibaugh); 1 δ , 2 f , same, January 19, 1951; 1 f , same, June, 1952 (D. E. Hardy); 2 δ , 1 f , Mt. Olympus, Oahu, October 26, 1936, decaying *Freycinetia* (F. X. Williams); 1 f , Mt. Olympus, December 1, 1933, wet uluhi fern trash (F. X. Williams); 2 δ , 2 f , Lanikai, Oahu, December 17, 1945, light trap (W. W. Wirth); 1 f , behind Tantalus, Oahu, January 23, 1937, 1700 ft. (F. X. Williams); 1 δ , Manoa, Oahu, August 2, 1936, *Freycinetia* interleaf bases (F. X. Williams); 1 δ , Palolo, Oahu, January 29, 1922 (J. F. Illingworth). All types whole mounts on slides. Holotype and allotype to be deposited at U. S. National Museum, Washington, D. C. Paratypes to be deposited at Bishop Museum, University of Hawaii, Hawaiian Sugar Planters' Association collection, Honolulu; University of Nebraska, Lincoln; California Academy of Sciences, San Francisco.

Other specimens examined: Hilo, Hawaii, November, 1945, light trap (W. W. Wirth). Waihee, Maui, June, 1952, light trap.

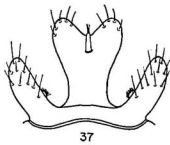
Psychoda williamsi is separable from other Hawaiian species by the short, thickened surstyle of the male genitalia, the relatively broad subgenital plate of the female, and the sixteen-segmented antenna. This species is very similar to *Psychoda cinerea* Banks, a common species in the United States. The chief difference between these two species lies in the structure of the male aedeagus. The aedeagus of *P. cinerea* is broad

Figures 37-45

Figs. 37-39. *Psychoda harrisi*. Fig. 37. female genitalia, dorsal view. 38. tip of antenna. 39. male genitalia, dorsal view.

Figs. 40-43. *P. uncinula*. Fig. 40. female genitalia, dorsal view. 41. tip of antenna. 42. labellum. 43. male genitalia, dorsal view.

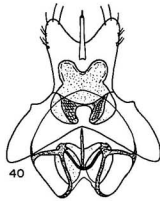
Figs. 44-45. *P. williamsi*. Fig. 44. female genitalia, dorsal view. 45. male genitalia, dorsal view.



37



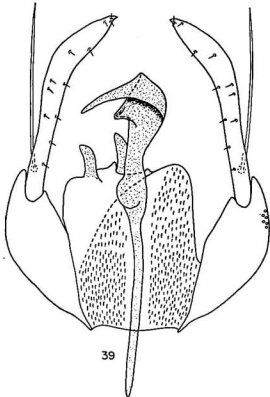
38



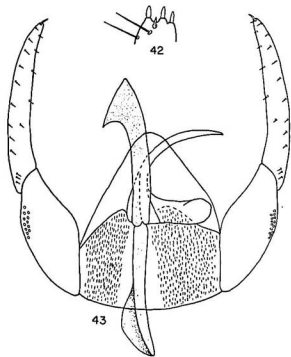
40



41



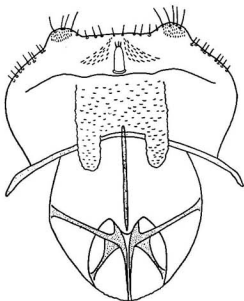
39



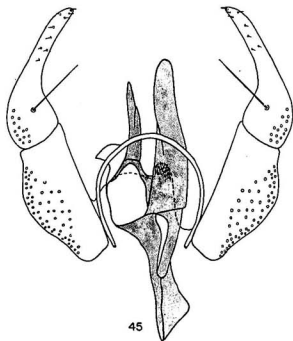
43



42



44



45

and terminates in a sharp point, while that of *P. williamsi* is relatively narrow and is rounded apically. This is observable only in a dorsal view of the aedeagus. Also, there is a rounded, setose lobe below the aedeagus of *P. williamsi*, but this lobe is broadly truncate and bare in *P. cinerea*. The apical concavity of the female subgenital plate of *P. williamsi* is somewhat deeper than that of *P. cinerea*.

The close similarity of *P. williamsi* and *P. cinerea* has resulted in the erroneous recording of the latter species from Hawaii. Hardy (1952:445) recorded *P. cinerea* (Quate's identification) from the Hawaiian Islands, but in reality the reported species is *P. williamsi*. Insofar as is known, *P. cinerea* does not occur in Hawaii.

Psychoda williamsi is undoubtedly the same species as *Psychoda* sp. 1 Williams (1943:336), of which Williams illustrates the wing, surstyle and coxites. The short, swollen surstyle and rather long, slender dististyle as illustrated by Williams are identical to those structures of *P. williamsi*.

I take pleasure in naming this psychodid species in honor of Dr. F. X. Williams, who was the first to seriously investigate the biologies of the Hawaiian Psychodidae.

Psychoda harrisi Satchell (Figs. 37-39)

Psychoda harrisi Satchell, 1950, Trans. R. ent. Soc. London, 101:171.

Male. Vestiture gray. **Head:** eyes nearly touching; interocular suture absent; labrum longer than first palpal segment; labellum flattened, bearing 3 long and 1 short teeth and 2 spines; second and third palpal segments relatively short and thick, 3 times as long as broad, ratio of segments 8:10:10:12. **Antenna** with 16 segments, 4/5 times length of wing sensory filaments composed of 2 anterior and 1 posterior branches; terminal three segments reduced in size, separated from each other, flagellar segments XII and XIII subequal in size, XIV smaller than XIII. **Wing** about 2 times as long as broad; bifurcation R_{2+3} little distad of middle of wing; bifurcation M_{1+2} mesad of R_{2+3} by distance equal to 2 times width of cell R_3 at level of bifurcation; ratio of $R_{2+3}:R_2:R_3 = 10:10:14$. **Genitalia** as figured; dististyle elongate, incurving distally, aedeagus terminating in ventrally curved hook.

Measurements: antenna 1.2 mm.; wing length 1.5 mm.; wing width 0.7 mm.

Female. Similar to male. Eyes separated by distance equal to 2 facet diameters. Antenna 5/9 times length of wing. Genitalia as figured; subgenital plate with pair of large, basal lobes, apical portion slender basally and widening distally.

Measurements: wing length 1.6-1.9 mm.; wing width 0.7-0.9 mm.

Type data: New Zealand (Cawthron Institute, Nelson, New Zealand).

Specimens examined: Honolulu, Oahu, January 18, 1951, January 19, 1951; light trap (B. L. Defibaugh); same, January 29, 1951, June, 1952, December, 1950, at light (D. E. Hardy). Waihee, Maui, June, 1952, light trap.

The "fleur-de-lis" shape of the female subgenital plate makes the females of *P. harrisi* readily separable from other Hawaiian psychodids. The elongate, incurving dististyle and the beak-like apex of the aedeagus of the male genitalia, in combination with the sixteen-segmented antenna, separates the males of this species from other species.

Dr. Satchell examined specimens of *P. harrisi* from Hawaii and stated that they were almost identical to specimens from New Zealand. The only difference he detected was a slight variation in the aedeagus of the male.

***Psychoda uncinula* new species (Figs. 40-43)**

Male. Vestiture chiefly gray, vestiture of legs and antenna dark gray. *Head:* eyes separated by distance equal to less than 1 facet diameter; interocular suture absent; labrum little longer than first palpal segment; labellum flattened, bearing 3 (sometimes 4) teeth and 2 spines; palpal segments subequal in diameter, ratio of segments 10:12:12:16. *Antenna* with 16 segments, 4/5 times length of wing; sensory filaments with 2 anterior and 1 posterior branches; terminal 3 segments reduced in size, separated from each other, flagellar segment XIV about 1/2 size of XIII. *Wing* about 2 1/2 times as long as broad; bifurcation R_{2+3} at middle of wing; bifurcation M_{1+2} mesad of R_{2+3} by distance equal to 3 times width of cell R_3 at level of bifurcation; ratio of $R_{2+3}:R_2:R_3 = 10:10:14$. *Genitalia* as figured; aedeagus moderately broad, laterally flattened, apex blunt with recurved dorsal barb; surstyle long and slender, twice as long as ninth tergite.

Measurements: holotype (antenna lacking); wing length 1.6 mm.; wing width 0.7 mm. Paratypes, antenna 1.2-1.5 mm.; wing length 1.6-2.1 mm.; wing width 0.7-0.9 mm.

Female. Similar to male. Eyes separated by distance equal to 1 facet diameter; antenna about 1/2 as long as wing. *Genitalia* as figured; subgenital plate with apical portion parallel-sided, apex with well defined, V-shaped indentation.

Measurements: allotype, antenna 1.0 mm.; wing length 1.9 mm.; wing width 0.8 mm. Paratypes, antenna 0.9-1.3 mm.; wing length 1.5-2.5 mm.; wing width 0.7-0.9 mm.

Type data: holotype ♂, Honolulu, Oahu, January 19, 1951, light trap (B. L. Defibaugh); allotype ♀, same, June, 1952, light trap (D. E. Hardy). Paratypes, 1 ♂, 1 ♀, same data as holotype; 1 ♀, same data as allotype; 2 ♂, 1 ♀, same, January 24, 1951; 1 ♂, Mt. Tantalus, Oahu, January, 1953 (D. E. Hardy); 2 ♂, 5 ♀, Tantalus, Oahu, November 12, 1950 (D. E. Hardy); 1 ♀, same, January 23, 1937, 1700 ft. (F. X. Williams); 2 ♂, 1 ♀, Mt. Kaala, Oahu, November 6, 1945, 4,000 ft. (W. W. Wirth). 1 ♀, Paliku, Haleakala Crater, Maui, June, 1952 (M. Tamashiro); 1 ♀, Makawao, Maui, June, 1952 (D. E. Hardy & M. Tamashiro); 1 ♂, Keanakolu, Hawaii, October, 1952 (D. E. Hardy). All types whole mounts on slides. Holotype and allotype to be deposited at U. S. National Museum, Washington, D. C. Paratypes to be deposited at Bishop Museum, University of Hawaii, Hawaiian Sugar Planters' Association collection, Honolulu; University of Nebraska, Lincoln; California Academy of Sciences, San Francisco.

Other specimens examined: Mt. Tantalus, Oahu, October 25, 1945, rocky ledges, ferns, etc. (W. W. Wirth); Pupukea, Oahu, December 13, 1952, 1500 ft. (D. E. Hardy).

Psychoda uncinula is separable from other Hawaiian species of *Psychoda* with sixteen-segmented antennae by the parallel-sided female subgenital plate and the barbed aedeagus of the male. This species is most closely related to *P. harrisi*. The females of the two species are easily distinguished, but the males may be confused. However, the barb at the tip of the aedeagus of *P. uncinula* is dorsal in position and quickly tapers to an acute apex, while the recurved hook of the aedeagus of *P. harrisi* is ventral in position, slender and attenuate.

Psychoda uncinula has been erroneously identified as *P. phalaenoides* Linnaeus by W. F. Rapp, Jr. Thus, the latter species has been incorrectly reported from the Hawaiian Islands (Wirth, 1947). Specimens collected on Mt. Tantalus by Dr. Wirth, upon which the record was based, were obtained from Mr. Rapp and determined by the writer to belong to the species described above as *P. uncinula*. This species differs markedly from *P. phalaenoides* in the structure of the male and female genitalia and in

the possession of a sixteen-segmented antenna. *Psychoda phalaenoides* has but fifteen segments in the antenna.

Check List of Hawaiian Psychodidae

Species	Distribution
Trichomyia	
1. <i>hawaiiensis</i> Quate	Hawaii
2. <i>oahuensis</i> Quate	Oahu
Telmatoscopus	
3. <i>albipunctatus</i> Williston	Oahu, Maui Tropicopolitan
Psychoda	
4. <i>insulicola</i> Quate	Oahu
5. <i>alternata</i> Say.....	Oahu, Maui, Hawaii
6. <i>pseudalternata</i> Williams	Cosmopolitan Oahu
7. <i>wirthi</i> Quate	Australia Oahu, Maui, Hawaii
8. <i>inornata</i> Grimshaw	Oahu, Maui, Hawaii
9. <i>hardyi</i> Quate	U.S., Quebec, B.C., Alaska, England, Europe Oahu, Maui, Hawaii
10. <i>Lucia</i> Quate	Oahu
11. <i>salicornia</i> Quate	Florida, West Indies Oahu
12. <i>williamsi</i> Quate	California Oahu, Maui, Hawaii
13. <i>harrisi</i> Satchell	Oahu, Maui
14. <i>uncinula</i> Quate	New Zealand Oahu, Maui, Hawaii

BIBLIOGRAPHY

- Bryan, E. H., Jr. 1934. A review of the Hawaiian Diptera, with descriptions of new species. Proc. Haw. Ent. Soc., 8:399-468.
- Edwards, F. W. 1928. Two widely-spread moth-flies. Entomologist, 61:32.
- Hardy, D. E. 1952. Additions and corrections to Bryan's check list of the Hawaiian Diptera. Proc. Haw. Ent. Soc., 14:445-446 (Psychodidae).
- Rapp, W. F., Jr., and Rapp, J. L. C. 1946. Check-list of Psychodidae of the Philippine and Hawaiian Islands. Jour. N. Y. Ent. Soc., 54:291-292.
- del Rosario, F. 1936. The American species of *Psychoda* (Diptera: Psychodidae). Phil. Jour. Sci., 59:85-148.
- Satchell, G. H. 1950. The New Zealand Psychodidae: a study based upon the collection and manuscript notes of the late Dr. A. L. Tonnoir. Trans. R. Ent. Soc. London, 101:147-178.
- Swezey, Mrs. O. H. 1907. Notes on moth flies (Psychodidae, Diptera). Proc. Haw. Ent. Soc., 1:116-118.
- Tonnoir, A. L. 1922. Synopsis des espèces européennes du genre *Psychoda* (Diptères). Ann. Soc. Ent. Belg., 62:49-88.
- 1933. Descriptions of remarkable Indian Psychodidae and their early stages, with a theory of the evolution of the ventral suckers of dipterous larvae. Rec. Ind. Mus., 35:53-75.
- 1934. Notes synonymiques sur quelques *Psychodidae* (Diptera). Bull. Ann. Soc. Ent. Belg., 74:69-82.
- 1935. The Australian species of the genus *Phlebotomus*. Bull. Ent. Res., 26:137-147.
- Williams, F. X. 1943. Biological studies in Hawaiian water-loving insects—Part III Diptera or flies—C, Tipulidae and Psychodidae. Proc. Haw. Ent. Soc., 11:313-338.
- 1946. *Psychoda pseudalternata* n.sp. (Diptera: Psychodidae). *Ibid.*, 12:637.
- Wirth, W. W. 1947. Notes and exhibitions. *Ibid.*, 13:7.