

***Emoloana*, a New Genus for the Endemic Grass-Feeding Hawaiian Delphacidae (Homoptera Fulgoroidea)**

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Abstract: The endemic Hawaiian grass-feeding species of Delphacidae previously regarded as congeners of *Kelisia* Fieber are transferred to *Emoloana* n.gen. in the tribe Delphacini: *E. emoloa* (Muir) n. comb., *E. eragrosticola* (Muir) n. comb., *E. swezeyi* (Kirkaldy) n.comb., and *E. sporobolicola* (Kirkaldy) n. comb. with the subspecies *E. sporobolicola immaculata* (Muir) n.comb.; 2 new species are described: *E. menehune* n.sp. from Kauai, and *E. pohakua* n.sp. from Hawaii Island. The new genus is endemic to the Hawaiian Islands and comprises 3 morphological groups: the *E. emoloa*-group with *E. emoloa* on Oahu, *E. eragrosticola* on Oahu, Maui, and Hawaii Island, and *E. pohakua* on Hawaii Island; the *E. swezeyi*-group with *E. swezeyi* on Oahu and *E. menehune* on Kauai; the *E. sporobolicola* s.l.-group distributed on all major Hawaiian Islands. The origin of *Emoloana* and relationships among species cannot be determined because of lack of knowledge about the morphology of potentially related taxa. A baseline for future genetic and biosystematic research on this group is discussed.

Keywords: neotype- and lectotype fixation, taxonomy, systematics, intraspecific variation, Hawaiian Islands

Introduction

On the Hawaiian Islands, the planthopper family Delphacidae has radiated extensively after the colonization of apparently only a few founder species and became one of the most speciose taxa of the Hawaiian fauna. The Hawaiian delphacid fauna represents the richest concentration of endemic species in this family on oceanic islands. 143 species and subspecies are endemic to Hawaii (Zimmerman, 1948, 1952; Beardsley, 1960). The systematics of the Hawaiian delphacids, however, is still largely unclear. The most recent review of this group was published by Zimmerman (1948) who generally adopted the generic concepts of Kirkaldy (e.g., 1902, 1910), Muir (e.g., 1916, 1917, 1919, 1921, 1922), and Swezey (1907). Zimmerman grouped the endemic Hawaiian delphacid species in 9 genera, 8 of which were considered autochthonous (see also Muir, 1916) and placed in the tribe Alohini Muir, a group later regarded as polyphyletic and within the tribe Delphacini Muir (Asche, 1985). Zimmerman's remaining genus, *Kelisia* Fieber, was broadly defined, believed to be cosmopolitan and regarded as representative of the tribe Delphacini. Four species and one subspecies of the Hawaiian delphacids were assigned to *Kelisia* by Kirkaldy (1910), and Muir (1917, 1919, 1921): *K. emoloa* Muir from Oahu, *K. eragrosticola* Muir from Maui and Oahu, *K. sporobolicola* Kirkaldy from Oahu, Kauai, Maui, and Hawaii, *K. sporobolicola immaculata* Muir from Hawaii, and *K. swezeyi* Kirkaldy from Oahu and Kauai. These species differ from the "alohine" Hawaiian delphacids not only by morphological characters such as the shape of the post-tibial spur and distinguished shape and color patterns of the antennae, but especially by their host plants. The "alohine" endemic Hawaiian delphacids

feed and reproduce mostly on dicotyledonous shrubs and trees (see e.g., Giffard, 1917; Wilson et al., 1994), whereas the Hawaiian “*Kelisia*” species are associated with grasses and sedges, the usual host plant associations of Delphacidae elsewhere. These grass-feeding species resemble each other morphologically, and it seems likely that they have derived from a single primary colonizer species. The placement of these species in *Kelisia* does not correspond to recent concepts of delphacid taxa (Asche, 1985, 1990). Muir (1917: 310) noted some morphological differences between the Hawaiian species and the type species of *Kelisia* (*K. guttula* Germar), but did not recognize the striking differences in genital characters and the post-tibial spur. Zimmerman (1948: 242) was evidently skeptical about the generic assignment of the Hawaiian species and stated that “...the generic differences need amplification and strengthening.” In recent phylogenetically-based systematics (Wagner 1963; Asche 1985), the genus *Kelisia* is considered a member of a rather plesiomorphic monophyletic subfamily (Kelisiinae Wagner), which is geographically confined to the Holarctic. The Hawaiian “*Kelisia*” do not share apomorphies of either *Kelisia*, or Kelisiinae (e.g., subanal processes in the male genitalia). Their morphology places them in the tribe Delphacini of the Delphacinae, and within this tribe in an apparently monophyletic subgroup displaying advanced oviduct-glands (see Asche, 1985; for morphology of oviduct-glands see Strübing, 1956a, b). The unique morphological features of these Hawaiian grass-feeding delphacid species warrants the establishment of a new genus of Delphacini.

The material examined is deposited in the following institutions and collections: AH = Private collection of M. Asche and H. Hoch, Berlin, FRG; BMNH = The Natural History Museum, London, UK; BPBM = Bishop Museum, Honolulu, Hawaii, USA; HDOA = Hawaii State Department of Agriculture; UHMH = University of Hawaii at Manoa, Entomology, Honolulu, Hawaii, USA.

Taxonomy

Emoloana Asche, new genus

Type species. *Kelisia emoloa* Muir, 1917, Oahu, here designated.

Description. Small, predominantly brachypterous Delphacidae; body length of macropterous form (measured from apex of vertex to tip of abdomen) in males 1.7–2.7 mm, in females 2.0–3.5 mm; length of macropterous form (measured from apex of vertex to tip of tegmina) in males 3.25–3.4 mm, in females 3.7–3.8 mm. Coloration: ground color of body and legs ranging from light stramineous to ochraceous and light brown; head in most species with darker areas on frons, post- and anteclypeus, lateral parts including genae; frons in some taxa with lighter spots marking the former position of larval sensory pits; carinae concolorous or lighter, in some taxa contrasted creamy-white; 1st antennal segment posteriorly dark or at least with a dark stripe, anteriorly or anterodorsally respectively, 2 mostly distinct dark longitudinal stripes enclosing a contrasted lighter area which is normally light yellow to creamy-white; 2nd antennal segment anteriorly with 2 dark longitudinal stripes (continuing from the 1st segment), which in most species fade to the distal darker end of the segment; lateral portions of pro- and mesonotum often darker than the dorsal area; tegmina of brachypterous form semihyaline, pale yellowish, veins concolorous or slightly darker yellow, claval apex with a brown mark; tegmina of macropterous form hyaline, veins basad of nodal line concolorous to light yellow, distad of nodal line brown, claval apex with a brown mark, with or without a broad brownish suffusion from the inner tip of tegmen to the middle of the nodal line; tegmina of both forms usually with brownish granules on the veins; femora on underside and anterodorsally with 2–3 longitudinal brown stripes, in some individuals very faintly developed; pro- and mesotibiae either with a dorsal longitudinal

brown stripe, or with 1–2 ring-like brown marks; abdominal tergites in most taxa sublaterally with a ring- or u-shaped callous which is generally lighter than the surrounding area, in some taxa 1–3 small brown spots transversely arranged on the tergites; ovipositor of female genitalia usually darker than tergite IX, anal style whitish to pale yellow; in males genital segment often with brown dorso- and ventrolateral patches, anal segment and parameres brown, anal style light yellow. Head including compound eyes 2.5–3.2 x wider than thorax at base, generally narrower than the pronotum (0.8–0.9:1); carinae of head and thorax distinct, mostly prominent. Vertex in most taxa apically slightly prominent, in midline as long as wide or longer than wide at base, lateral margins parallel or slightly converging to apex; posterior compartments large, in midline distinctly larger than anterior compartment (1.4–2.3:1), anterior compartment fully on dorsal side. Frons mostly high and narrow, 1.45–1.9 x higher than wide (widest at level or slightly below level of ocelli), and about 1.2–1.5 x higher than post- and anteclypeus together; lateral margins slightly convex or almost parallel to each other; median carina simple, not forked to apex, broadly rounded and distinctly prominent; frontal area on each side of median carina shallowly concave. Postclypeus with surface vaulted, median carina broadly rounded, continuing onto anteclypeus. Rostrum reaching anterior margin of the posttrochanters. Antennae with 1st segment 1.35–1.6 x longer than broad, slightly compressed with posterior side almost plain or in some individuals shallowly concave; 2nd segment subcylindrical, distally slightly wider than at base, 1.5–1.8 x longer than 1st; number and arrangement of sensory fields: 16–7 (for general explanation of formula see Asche, 1985). Genae with oblique carina from lateral angle of frontoclypeal suture to anteroventral corner of the antennal bases. Ocelli and 1–3 blemmata present although in some individuals faint; compound eyes well developed. Pro- and mesonotum tricarinate with lateral carinae slightly diverging, almost straight, attaining the posterior margin; pronotum in midline as long as vertex or slightly smaller, posterior margin shallowly concave; mesonotum in midline 1.1–1.6 x longer than pronotum. Tegmina in brachypterous form reaching to 5th–7th abdominal segment; in macropterous form tegmina exceeding the abdomen with about half of their length; veins usually with fine hairs in distinct callous-like bases; hind wings and tegulae of brachypterous form vestigial. Posttibia ca. 1.3–1.5 x longer than posttarsal segments together, laterally with 2, distally with 5 (2 short inner and 3 longer outer) spines; 1st posttarsal segment ca. 1.4–1.8 x longer than 2nd and 3rd posttarsal segment together, and ca. 1.6–1.75 x longer than post-tibial spur; 1st posttarsal segment distally usually with 7 (2+5) spines, 2nd posttarsal segment distally with 4 spines in a transverse row; post-tibial spur tectiform, subtriangular in cross-section, inner margin with 15–25 minute teeth, terminal tooth obsolete or missing. Abdominal tergites medially ridged, sublaterally each with a round callous-like area; laterotergites with lateral margin shallowly sinuate, slightly narrowing to caudal end. Male drumming organ: 2nd sternite with a pair of long, filiformous apodemes erected dorsocaudad, almost reaching tergites.

Male genitalia. Genital segment in caudal aspect circular to ovate, mostly slightly wider than high; in lateral aspect subquadrate to irregularly trapezoidal, ventrally ca. 3 x longer than dorsally; laterocaudal margins distinctly projected caudad and broadly rounded; ventrocaudal margin quarter- to semicircularly excavated; diaphragm against the lateral margins distinctly sunk cephalad, dorsal margin of diaphragm concave, centrally between dorsal margin and opening for parameres a narrow, semicone-shaped projection; opening for the parameres flat ovate to flat mushroom-shaped. Anal segment short, ring-like, ventrocaudally closed by a transverse sclerotized bridge, in repose almost fully retreated into the genital segment; each ventrocaudal corner produced into a spinose process which is terminally either bluntly pointed, or truncate; anal style small. Parameres with broad basal halves almost parallel to each other, then with distal half tapering to apex and distinctly

diverging. Aedeagus subtubular, especially distally compressed; shaft either comparatively stout and almost straight until distal third, or elongate, slender, and curved dorsad; phallotreme slit-like, subapically orientated on the ventrocaudal margin of the shaft, in distal half with 2–3 rows of numerous small teeth, number of teeth and arrangement of rows specifically variable; suspensorium dorsally with a tongue-like bridge connected with the ventral base of the anal segment, ventrally ring-like, embracing the base of the aedeagal shaft; connective slightly sinuate or elongate and bent cephalad.

Female genitalia. Ovipositor stout, not surpassing the anal segment, median gonapophyses IX dorsally in distal half with a row of 25–30 small, saw-like teeth; valvifers VIII with inner anterior corner hook- or lobe-like expanded mediad, the range of morphological variation of the valvifers VIII within the genus is shown in Figs. 157–168; without genital scale; anal style very small. Oviduct glands of the advanced type (see Strübing, 1956 a, b); in one species, *E. sporobolicola* s.l. from Maui, a whitish lacquer-like secretion was found.

Diagnosis. *Emoloana* can be recognized by the mostly ochraceous coloration of body and legs, the proportions of head and thorax, the proportions and shape of the antennae with the 1st segment posteriorly plain or shallowly concave, the antennal color patterns with longitudinal brown stripes which continue onto the 2nd antennal segment and enclose a contrasted lighter area, and the post-tibial spur with numerous minute teeth on inner margin. The male genitalia are distinguished by the genital segment with the margin laterocaudally produced and broadly rounded, by the short and caudoventrally closed anal segment with its apically bluntly pointed or truncate spinose processes, by apically tapering and diverging parameres, and by the subtubular aedeagus with its subapical, slit-like phallotreme and characteristic rows of fine teeth.

Geographical Distribution. Endemic in the Hawaiian Islands: Kauai, Oahu, Molokai, Maui, Hawaii.

Remarks. Although Muir (1917) expressed his doubts concerning the endemism of the Hawaiian “*Kelisia*” species, I prefer to follow Zimmerman (1948: 242) who regarded them as endemic, since there is no evidence that they were introduced. This supposition is supported by the isolation of *Emoloana* within the Delphacini and by its degree of speciation on the Hawaiian Islands resulting in at least 6 species not found elsewhere. Its morphological characteristics do not suggest close relationships with Hawaiian or other Pacific island taxa, nor with taxa of adjacent continental Old and New World regions. The color pattern of the antennae is considered apomorphic for the genus *Emoloana*. The genital structures are comparatively simple and are similar in some respects to those of some other genera, such as the Holarctic *Nothodelphax* Fennah. A phylogenetic analysis of the tribe Delphacini is needed before the systematic position of *Emoloana* can be determined.

Key to the Species of *Emoloana*

(modified and extended from Zimmerman’s key to the Hawaiian *Kelisia* species (1948))

- 1 Tegmina of brachypters short, not reaching the posterior margin of the 5th abdominal tergites, posterior margin truncate or only weakly rounded (Figs. 1, 16, 35). Male genitalia with shaft of aedeagus nearly straight, not abruptly bent dorsad (e.g., Figs. 11, 26, 46). Female genitalia with valvifers VIII bearing a hook-shaped projection at base (e.g., Figs. 15, 34, 53). ***emoloa*-group** 2
- Tegmina of brachypters reaching or exceeding the posterior margin of the 5th abdomi-

- nal tergites, hind margin evenly rounded (e.g., Figs. 54, 82). Male genitalia with shaft of aedeagus elongate and strongly bent dorsad (e.g., Figs. 63, 114). Female genitalia with valvifers VIII rounded at base, without a hook-shaped projection (e.g., Figs. 66, 128) 4
- 2(1) Anterolateral areas of vertex and frons dark brown, conspicuously contrasted with light colored carinae (Figs. 18, 19). Male genitalia with phallotreme of aedeagus subapical, ventrocaudally exposed (e.g., Figs. 28, 31) *eragrosticola* (Muir)
- Vertex and frons nearly uniformly pale without dark portions (e.g., Figs. 3, 4, 37, 38). Male genitalia with phallotreme of aedeagus subapical on the right side (e.g., Figs. 12, 47) 3
- 3(2) Vertex anteriorly slightly pointed, postclypeus pale (Fig. 4). Legs pale, protibia dorsally with a dark longitudinal stripe (Fig. 1). Male genitalia with paired ventrocaudal processes of the anal segment moderately long and slightly diverging (Fig. 9); apex of aedeagus in lateral view ovately or club-like dilated (Figs. 11, 12) *emoloo* (Muir)
- Vertex anteriorly rounded, postclypeus darkened (Fig. 35). Pro- and metatibia each with two dark, ring-like marks (Fig. 35). Male genitalia with paired processes of the anal segment short and almost parallel to each other (Fig. 43); apex of aedeagus in lateral view almost triangular (e.g., Figs. 46, 48) *pohakua*, n.sp.
- 4(1) Male genitalia with paired ventrocaudal processes of the anal segment pointed apically (e.g., Figs. 61, 75). *swezeyi*-group 5
- Male genitalia with paired ventrocaudal processes of the anal segment truncate apically (Fig. 118). *sporobolico*-group *sporobolico* (Kirkaldy)
- 5(4) Tegmina of brachypters elongate, reaching or slightly surpassing the 7th abdominal tergites (Fig. 54). In females the anal angles of the 9th tergite and in males dorsal portions of the genital segment adjacent to the anal segment conspicuously dark (Figs. 54, 65). Pro- and mesotibia each with two ring-like dark marks (Fig. 54) *swezeyi* (Kirkaldy)
- Tegmina of brachypters shorter, usually only reaching the anterior margin of the 6th abdominal tergites (Fig. 67). Anal angles of the female's 9th tergite and of the male genitalia concolorous with the rest of the abdomen, no dark markings (Figs. 67, 80). Protibia (sometimes also mesotibia) dorsally with dark longitudinal stripe instead of ring-like marks (Fig. 67) *menehune*, n.sp.

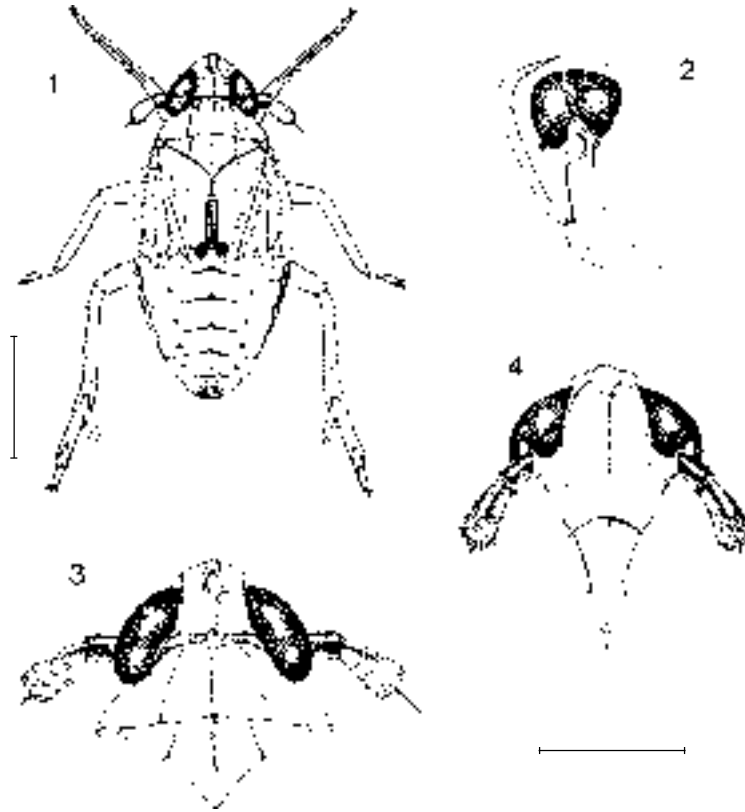
1. *Emoloana emoloo*-group (*E. emoloo*, *E. eragrosticola*, *E. pohakua* n.sp.)

Emoloana emoloo (Muir), **new combination** (Figs. 1–15, 157)

Kelisia emoloo Muir, 1917: 311

Supplementary Description. Comparatively large *Emoloana* species, only brachypterous individuals known; body length: male 2.2–2.3 mm (2.28 ± 0.05 mm; n = 4); female 2.8–3.4 mm (3.06 ± 0.23 mm; n = 7). Habitus see Fig. 1. Coloration: nearly uniformly stramineous to light ochraceous or brown; antennal segments as in generic description, anterior area between brown stripes creamy-white; postclypeus pale ochraceous, not darker than frons; protibia (in some individuals also mesotibia) dorsally with a longitudinal brown stripe; tegmina and abdominal tergites as in generic description. Head (Fig. 2–4) including com-

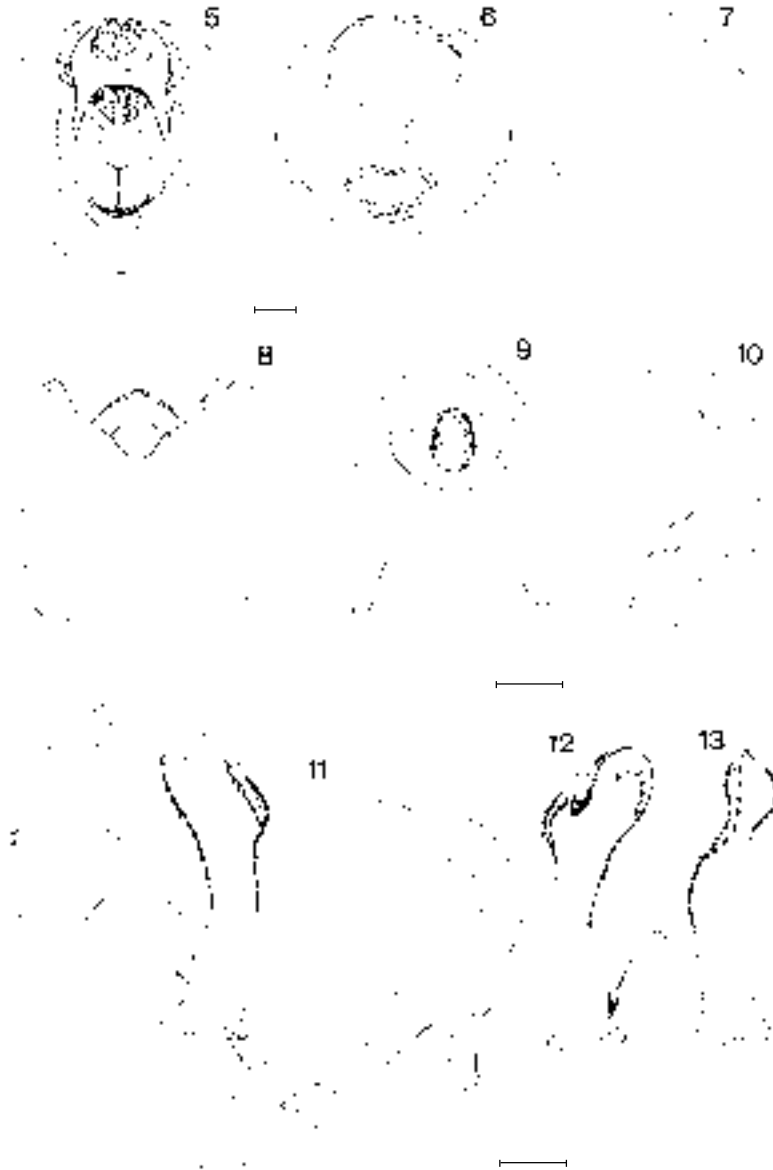
Figures 1–4. *Emoloana emoloa* (Muir): 1, habitus from dorsal, ♀ 1, Oahu: Waialae Ridge; scale: 1.0 mm. 2–4, head, ♂ 1, Oahu: Koko Head: 2, left lateral view; 3, same, dorsal view; 4, same, frontal view. Scale: 0.5 mm.



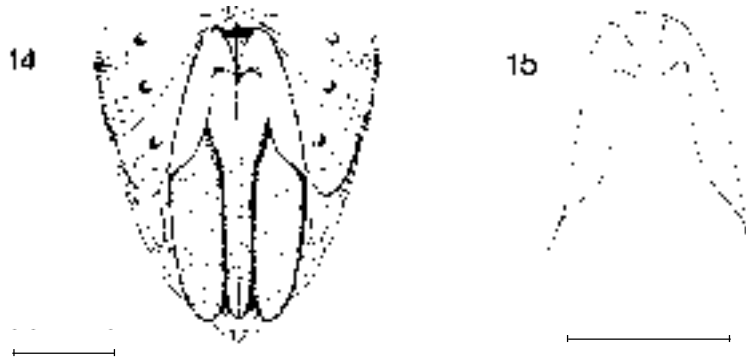
pound eyes ca. 2.5 x wider than vertex at base and ca. 0.8 x smaller than the pronotum. Vertex (Fig. 3) anteriorly slightly projected, more prominent in females than males; females with midline ca. 1.1 x longer than wide at base, males about as long as wide; posterior compartments in midline ca. twice as long as the anterior one. Frons (Fig. 4) ca. 1.8 x higher than wide and ca. 1.4 x higher than post- and anteclypeus together. Second antennal segment ca. 1.5 x longer than 1st. Pronotum in midline about as long as vertex (males) or slightly shorter than vertex (females); mesonotum in midline slightly longer than pronotum (1.4–1.6:1). Tegmina strongly reduced, posterior margin subtruncate and slightly rounded, not surpassing the 5th abdominal tergite. Posttibia 1.4 x longer than posttarsal segments together, spines as in generic description; 1st posttarsal segment 1.5 x longer than 2nd and 3rd together, and 1.6 x longer than the post-tibial spur, distally with 7 (2–5) or 8 (2+6) spines; post-tibial spur with 20–25 minute teeth on inner margin, terminal tooth obsolete or missing.

Male genitalia. Figs. 5–13. Genital segment (Figs. 5–8) in shape and proportions as in generic description; diaphragm with dorsal margin flat v- or u-shaped; opening for parameres flat mushroom-shaped. Anal segment (Figs. 9, 11) with ventrocaudal processes moderately

Figures 5–13. *Emoloana emoloa* (Muir): ♂ genitalia, ♂ 1, Oahu: Koko Head: 5, genitalia in repose, ventrocaudal view; 6, genital segment, caudal view; 7, same, left lateral view; 8, same, ventral view; 9, anal segment, caudal view; 10, left paramere, left lateral view; 11, genitalia without genital segment, left lateral view; 12, aedeagus, right lateral view; 13, same, ventral view. Scale: 0.1 mm.



Figures 14–15. *Emoloana emoloa* (Muir): ♀ genitalia, ♀ 2, Oahu: Koko Head: 14, abdomen, ventral view; 15, valvifers VIII, ventral (= maximum) view. Scale: 0.5 mm.



long, bluntly pointed apically, in caudal aspect diverging, in lateral aspect slightly curved ventrad. Parameres (Figs. 10, 11) as in generic description, diverging, from a broad base continuously narrowing to a blunt apex, in lateral aspect distal half bent dorsad, in caudal aspect both forming a broad “U”. Aedeagus (Figs. 11–13) with shaft almost straight, distal half slightly curved dorsad and gently twisted to the left side; apical third dilated, forming a compressed, apically broadly rounded, club-like structure; phallotreme slit-like, slightly subapically, exposed to the right side; in distal half of the shaft a row of 12–17 teeth extending from right dorsal margin to dorsal apex, apically on the left flanked by a parallel row of ca. 7 teeth, apically on the right side with a strongly curved row of ca. 6–7 teeth; ventral side subapically of the phallotreme velum-like expanded, and bearing 2 almost parallel rows of teeth, the left one with 8–9, the right one with 7–13 teeth; connective medially slightly projected caudad.

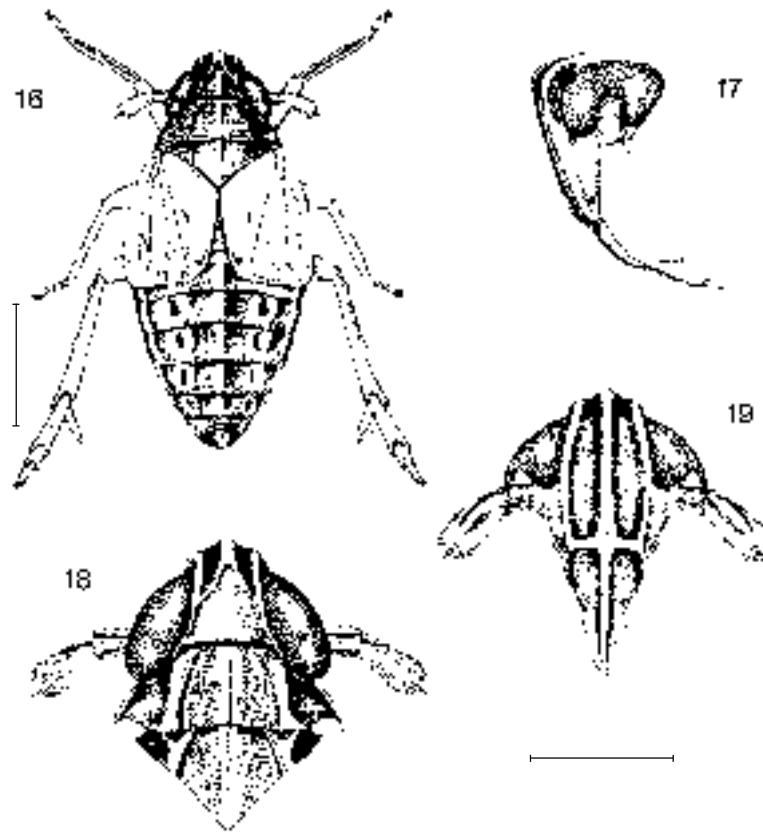
Female genitalia. Fig. 14, 15, 157. Generally as in generic description. Valvifers VIII (Fig. 15) at base with inner margin produced into a hook-like, apically pointed process directed mediocaudad.

Diagnosis. *Emoloana emoloa* is characterized by the nearly uniform coloration, longitudinal brown stripes on the dorsal side of the protibiae rather than ring-like marks on pro- and mesotibiae, structures of the male genitalia such as diverging and bluntly pointed spinose processes of the anal segment and a distally club-like expanded aedeagus with a nearly straight shaft and phallotreme exposed on the right side, and, in the female genitalia, by comparatively long and apically pointed hook-shaped projections of the bases of valvifers VIII.

Type data. Holotype ♂ (BPBM No. 5051) and allotype ♀, examined: **HAWAIIAN IS: OAHU**, Palolo Valley, 29.VII.1916, P.H. Timberlake. Holotype and allotype in BPBM.

Non-type material. **OAHU:** 3♂, 3♀, 2 nymphs (5th instar), Koko Head, 25 ft., on *Eragrostis* sp., F. Muir and W.M. Giffard, 15.XII.1918 (W.M. Giffard collection). 3♀, Waialae Ridge, on *Eragrostis variabilis*, April 22, 1917, W.M. Giffard, with identification label “*Kelisia emoloa* Muir ♀, Timberlake det.”. 1♀, *ibid.*, Waialae Iki, 21.III.1920, O.H. Swezey, on *Eragrostis*. 1♀, *ibid.*, Kuliouou, 3.V.1920, E.H. Bryan Jr., with identification label “*Kelisia emoloa* Muir, O.H.S. det.”; 2♂, 2♀ same data, 1♂, 2♀, 5.III.1920, *ibid.*, O.H. Swezey, on *Eragrostis*. 3♂, 2♀, 1 nymph, *ibid.*, Niu, O.H. S.(wezey). 2♂, *ibid.*, Waimanalo, 6.II.1920, on *Eragrostis*, O.H. Swezey. 2♂, 3♀, 1 nymph, *ibid.*, Kaneohe,

Figures 16–19. *Emoloana eragrosticola* (Muir): 16, habitus from dorsal, paratype ♀ 1, Maui: Iao Valley; scale: 1.0 mm. 17–19, head, paratype ♂ 1, Maui, *ibid.*: 17, left lateral view; 18, dorsal view; 19, frontal view. Scale: 0.5 mm.



14.III.1920, on *Eragrostis*, O.H. Swezey. 1 ♀, *ibid.*, Waianae Mts., 27.I.1924, on *Eragrostis*, O.H. Swezey. In BMNH, BPBM, HDOA, UHMH.

Host plant. *Eragrostis variabilis* Gaud. (In Hawaiian language: “Emoloa”) (Muir, 1917, 1919; Giffard, 1917, 1922; Swezey, 1921; Zimmerman, 1948)

Geographical Distribution. HAWAIIAN IS: OAHU.

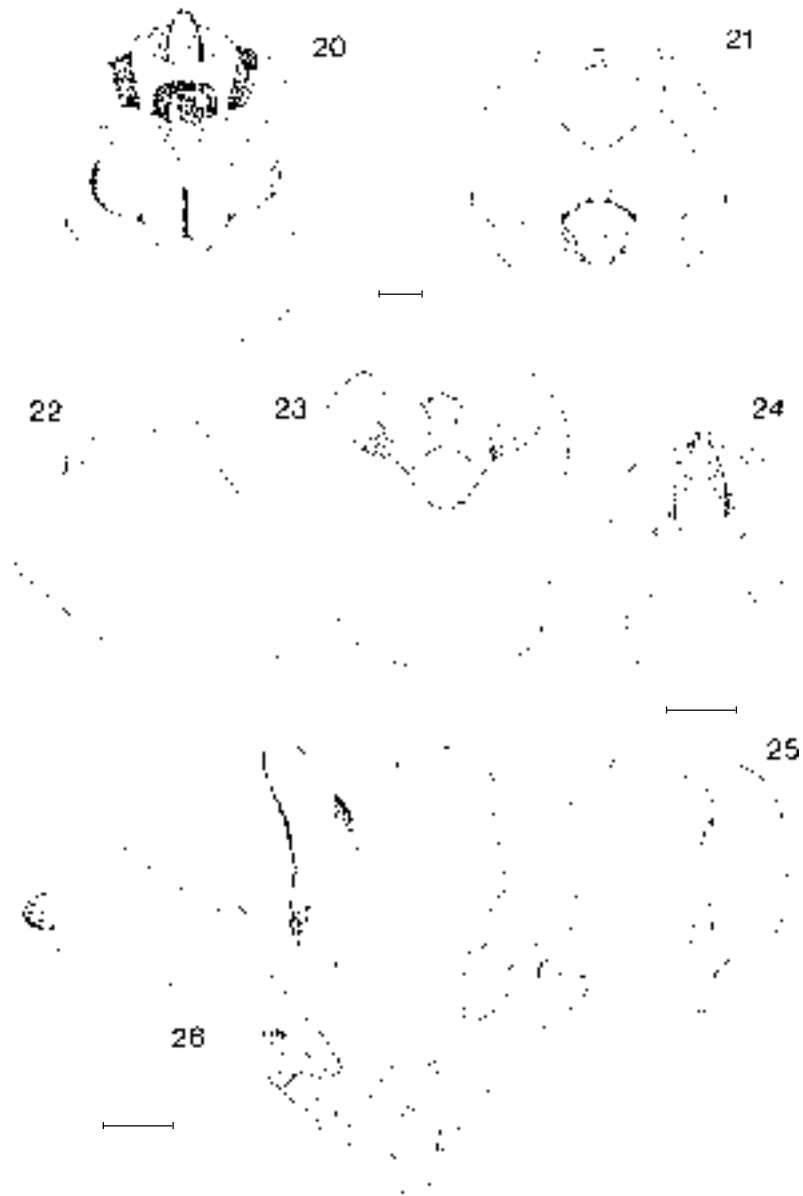
Remarks. Within the *Emoloana emoloa*-group, *E. emoloa* most closely resembles *E. eragrosticola* from Maui.

***Emoloana eragrosticola* (Muir), new combination** (Figs. 16–34, 158)

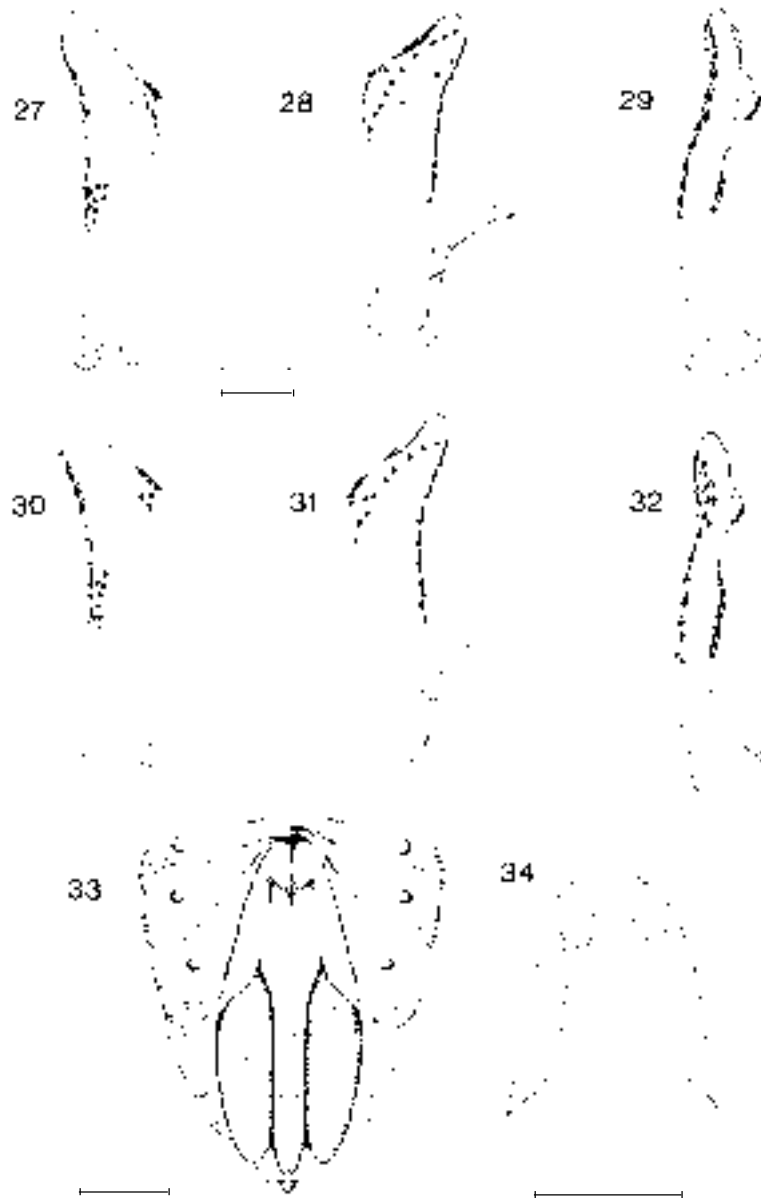
Kelisia eragrosticola Muir, 1919: 85.

Supplementary Description. Comparatively large *Emoloana* species, in this study only brachypterous individuals examined; body length: male 2.4–2.7 mm (2.55 ± 0.06 mm; n = 35); female 3.0–3.5 mm (3.18 ± 0.14 mm; n = 47). Habitus see Fig. 16. Coloration: body

Figures 20–26. *Emoloana eragrosticola* (Muir), ♂ genitalia, ♂ 1, Hawaii I.: Pohakuloa: 20, genitalia in repose, ventrocaudal view; 21, genital segment, caudal view; 22, same, left lateral view; 23, same, ventral view; 24, anal segment, caudal view; 25, left paramere, left lateral view; 26, genitalia without genital segment, left lateral view. Scale: 0.1 mm.



Figures 27–34. *Emoloana eragrosticola* (Muir): 27–32, ♂ genitalia; 27–29, ♂ 1, 30–32, ♂ 2; Hawaii: Pohakuloa: 27, 30, aedeagus, left lateral view; 28, 31, same, right lateral view; 29, 32, same, ventral view. Scale: 0.1 mm. 33–34, ♀ genitalia, paratype ♀ 2, Maui: Iao Valley: 33, abdomen, ventral view; 34, valvifers VIII, ventral (= maximum) view. Scale: 0.5 mm.



generally stramineous to orange, partly brown; anterolateral area of vertex and lateral transition to frons brown to dark brown, distinctly contrasted with creamy white vertical and frontal carinae, carinae of thorax and clypeus centered in a creamy white stripe, lateral and median frontal carinae bordered brown; lateral margins of abdomen, sublateral u-shaped or ring-like markings and median ridge whitish; enclosed area between the brown stripes on anterior side of antennae whitish; tibiae and femora of all legs with 1–3 longitudinal stripes of which usually the dorsal one of the protibiae is most pronounced; genital segment of male dorso- and ventrolaterally with a brown mark. Head (Figs. 17–19) including compound eyes ca. 2.7 x wider than vertex at base, and 0.9 x narrower than pronotum. Vertex (Fig. 18) with apex medially distinctly produced, ca. 1.6 x longer in midline than wide at base, posterior compartment in midline about twice as long as anterior one. Frons (Fig. 19) about twice as high as wide and 1.3 x higher than post- and anteclypeus together, lateral margins slightly convex, in lower half almost parallel-sided. Second antennal segment ca. 1.8 x longer than 1st. Pronotum in midline shorter than vertex (0.9:1), carinae straight, prominent, attaining the posterior margin, lateral ones diverging, posterior margin very shallowly concave. Mesonotum medially ca. 1.4 x longer than pronotum, carinae distinct. Tegmina strongly reduced with posterior margin truncate, not exceeding the 5th abdominal tergite. Posttibia ca. 1.5 x longer than posttarsal segments together; 1st posttarsal segment ca. 1.4 x longer than 2nd and 3rd together, and ca. 1.7 x longer than the post-tibial spur; spines of posttibia and posttarsi as in generic description; post-tibial spur with 18–22 minute teeth on inner margin, terminal tooth obsolete.

Male genitalia. Figs. 20–32. Genital segment (Figs. 20–23) as in generic description, in lateral aspect subtriangular to high trapezoidal; diaphragm with dorsal margin flat v-shaped; opening for parameres flat ovate to mushroom-shaped. Anal segment (Figs. 24, 26) with ventrocaudal spinose processes moderately long, apically truncate, in lateral aspect straight and from their base slightly directed ventrocephalad, in caudal aspect distant and parallel to each other. Parameres (Figs. 25, 26) with a broad basal half, both of which are parallel to each other in caudal aspect; distal half tapering, finger-shaped with blunt apex, in caudal aspect strongly diverging, in lateral aspect almost rectangularly bent dorsad. Aedeagus (Figs. 26–32) especially in distal part compressed, shaft in basal half straight, then slightly bent dorsad; apical third triangularly dilated, apex rounded; phallotreme slightly exposed on the right side near apex; dorsolaterally on left side at about midlength of shaft a group of 7–8 teeth; dorsally a row of 12–14 teeth ascending from midlength of shaft to apex, on the right side in apical part usually flanked by a short, parallel row of 3–4 teeth, subapically on the ventral side below the phallotreme a velum-like protuberance bearing 3–4 saw-like teeth; on the right side in apical third below the phallotreme an oblique row of 8–12 teeth almost parallel to the outer margin of aedeagal apex; in some individuals on the right apical side a few additional, irregular teeth; intraspecific variation of number and arrangement of aedeagal teeth shown in Figs. 27–32. Connective medially slightly bent caudad.

Female genitalia. Figs. 33, 34, 158. As in generic description. Valvifers VIII (Fig. 34) at base projected in a hook-like, mediocaudad directed process with bluntly rounded apex.

Diagnosis. *Emoloana eragrosticola* can be distinguished from its congeners by the following combination of characters: comparatively narrow and apically projected vertex; dark brown anterolateral areas of vertex and upper frons which contrast conspicuously with the whitish carinae; in the male genitalia ventrocaudal spinose processes of anal segment apically truncate, straight, and parallel to each other; aedeagus with shaft comparatively slender and apically only little curved dorsad, subapically on the right side bearing a velum-like, toothed protuberance; in the female genitalia valvifers VIII at base with a hook-like but terminally bluntly rounded projection. It differs from *E. emoloa* by the darker, much more contrasted coloration, and genitalic characters.

Type data. Neotype ♂ (BPBM No. 5052), here selected from surviving paratypes: HAWAIIAN IS: **Maui**, Iao Valley, 18.V.1918, Giffard and Fullaway. Neotype in BPBM. Paratypes: 39♂, (1♂: only abdomen), 48♀, 2 specimens without abdomen, 16 nymphs (4th and 5th instar), same data as neotype. Paratypes in BMNH, BPBM, HDOA, UHMH.

Non-type material. **Maui:** 5♂, 6♀, same data as neotype; 2♂, 1♀, 1 nymph, *ibid.*, 9.II.1930, O.H. Swezey, on *Eragrostis* sp.; 8♂, 6♀, 2 nymphs (5th instar), *ibid.*, 1700 ft., 25.II.1920, on *Eragrostis variabilis*, no collector's name given, with remark: "these specimens belong to slide No. 6". 2♀, Haleakala, 1919, Timberlake. **Oahu:** 1♂, Kolokole Pass, 23.X.1927, on *Eragrostis* sp., O.H. Swezey. 1♀, *ibid.*, 10.IV.1927, on *Eragrostis* sp., O.H. Swezey. **Hawaii:** 3♂, 5♀, 1 nymph (5th instar), Pohakuloa, 1800 m, 2.V.1966, J.W. Beardsley. 1♀, Hale Pohaku, 8500 ft., 18.VI.1966, on "bunchgrass" (*Eragrostis* sp.?), J.W. Beardsley. In BMNH, BPBM, HDOA, UHMH.

Host plant. *Eragrostis variabilis* Gaud. (Muir, 1919; Giffard, 1922; Swezey, 1936; Zimmerman, 1948)

Geographical Distribution. HAWAIIAN IS: MAUI, OAHU, HAWAII (new island record).

Remarks. Both the holotype male and allotype female from Maui (type-locality: Iao Valley) designated by Muir (1919) are missing in the collections of the BPBM ("missing off the pins and have been since 1960", G. Nishida, Bishop Museum, Honolulu, personal communication). Since this species belongs to a taxonomically difficult group of closely related species of the Hawaiian Islands, the selection of a neotype from the remaining paratype series with same locality data as published for the type is necessary and is in accordance with article 75, recommendation 75 A of the International Code of Zoological Nomenclature.

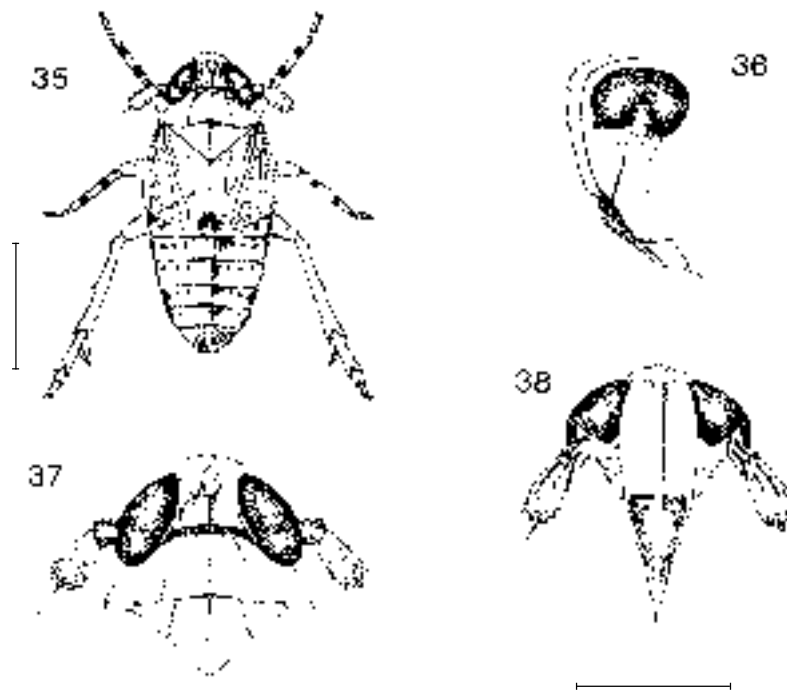
Muir (1919) referred to a macropterous female of this species (also mentioned by Zimmerman, 1948); however, no conspecific macropterous individuals could be traced for this study.

On Hawaii Island, *E. eragrosticola* occurs sympatrically with *E. pohakua* n.sp. (see below) and *E. sporobolicola* (ssp. *immaculata*). Locally, populations of these three species occupy the same habitat.

***Emoloana pohakua* Ashe, new species** (Figs. 35–53, 159)

Description. Small *Emoloana* species, only brachypterous form known; body length: male 1.9–2.0 mm (1.91 ± 0.03 mm; $n = 9$); female 2.2–2.5 mm (2.33 ± 0.07 mm; $n = 17$). Habitus see Fig. 35. Coloration: ground color stramineous to pale ochraceous, males slightly darker and with more contrasting color patterns than females; postclypeus brown, generally darker than frons, median carina creamy white; color patterns of antennal segments as in generic description, anteriorly enclosed area between the brown stripes pale yellow. Pro- and metatibiae each with 2 ring-like brown markings; abdominal tergites in midline with a whitish carina and sublaterally on each side with a row of callous-like creamy white markings which are centered by a brownish pit and flanked by irregular brown markings; laterotergites anteriorly brown, posteriorly stramineous; tegmina pale yellow with veins concolorous; genital segment of males dorso- and ventrolaterally with brown patches. Head (Figs. 36–38) including compound eyes ca. 2.9 times wider than vertex at base and slightly narrower than pronotum (ca. 0.85:1). Vertex (Fig. 37) in midline as long as wide at base, lateral margins slightly concave; carinae well developed but not sharp-edged; posterior compartments large, medially about 1.4 times longer than anterior one; transition to frons smoothly rounded, beset with fine hairs. Frons (Fig. 38) ca. 1.4 times higher than wide and

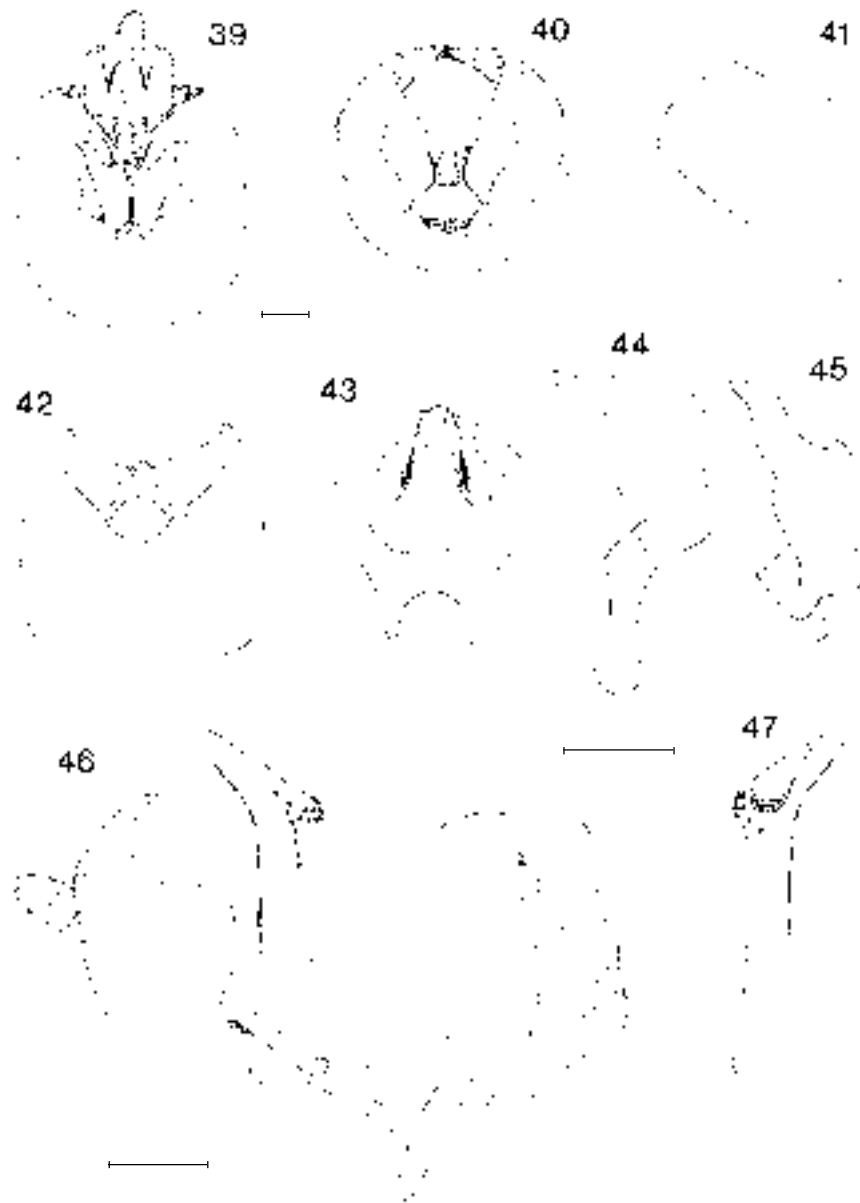
Figures 35–38. *Emoloana pohakua* Asche, n.sp.: 35, habitus from dorsal, paratype ♀ 1, Hawaii I.: Hale Pohaku; scale: 1.0 mm. 36–38, head, paratype ♂ 4, ibid.: 36, left lateral view; 37, dorsal view; 38, frontal view. Scale: 0.5 mm.



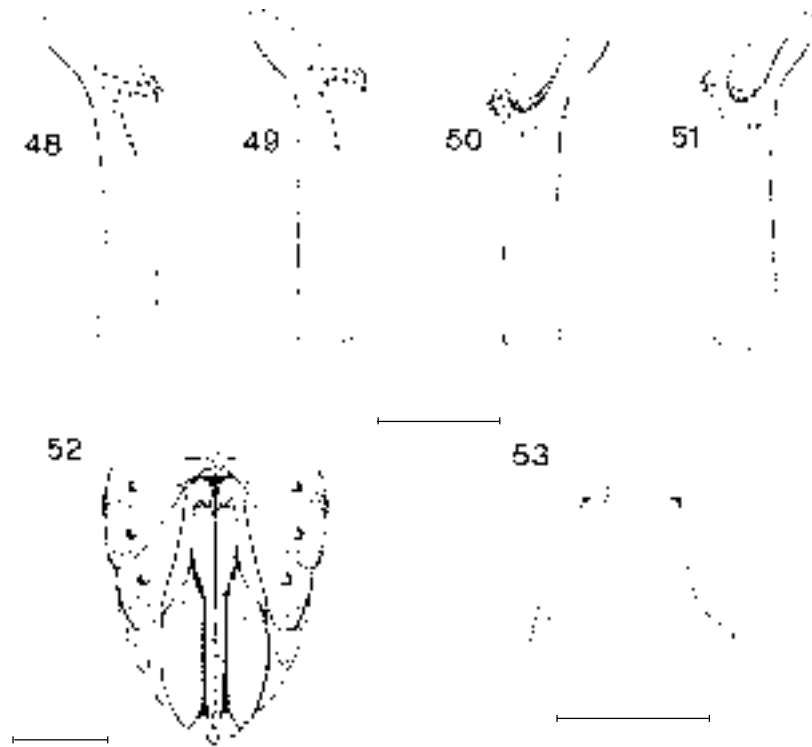
1.2 times wider than post- and anteclypeus together. 2nd antennal segment ca. twice as long as 1st. Pronotum in midline slightly shorter than vertex (0.9:1), posterior margin very shallow angulately excavated; mesonotum in midline slightly longer than pronotum (1.1–1.2:1), carinae straight, distinct but not very prominent. Tegmina strongly reduced, posterior margin obliquely truncate, in both sexes not exceeding the 5th abdominal tergite; wings and tegulae vestigial. Posttibia ca. 1.5 times longer than posttarsal segments together; 1st posttarsal segment ca. 1.8 times longer than 2nd and 3rd tarsal segment together and ca. 1.7 times longer than the post-tibial spur; spines of posttibia and posttarsi as in generic description; post-tibial spur with 15–18 minute teeth on inner margin, terminal tooth obsolete.

Male genitalia. Figs. 39–51. Genital segment (Figs. 39–42) in shape and proportions as in generic description, in lateral aspect trapezoidal; diaphragm with dorsal margin deeply v-shaped, central semiconical projection comparatively flat; opening for parameres almost flat ovate. Anal segment (Figs. 43, 46) ventrocaudal processes short, apically pointed, nearly parallel to each other. Parameres (Figs. 44–46) moderately long, not exceeding the upper level of the diaphragm, broadest at basal half, then diverging, medially with a short, rounded edge, apex short and blunt. Aedeagus (Figs. 46–51) subcylindrical, compressed (especially towards apex); basal two-thirds of shaft almost straight, apical third of shaft forming a long triangle which is gently curved dorsad with apex bluntly pointed; phallotreme subapically on the right side; on the dorsal side a row of 6–10 saw-like teeth extending from the lower

Figures 39–47. *Emoloana pohakua* Asche, n.sp., ♂ genitalia, paratype ♂ 1, Hawaii I.: Hale Pohaku: 39, genitalia in repose, ventrocaudal view; 40, genital segment, caudal view; 41, same, left lateral view; 42, same, ventral view; 43, anal segment, caudal view; 44, left paramere, left lateral view; 45, same, ventrocaudal view; 46, genitalia without genital segment, left lateral view; 47, aedeagus, right lateral view. Scale: 0.1 mm.



Figures 48–53. *Emoloana pohakua* Asche, n.sp., 48–51, ♂ genitalia, variation of the aedeagus, 48, 50: paratype ♂ 2; 49, 51: paratype ♂ 3, both Hawaii I.: Hale Pohaku: 48, 49, left lateral; 50, 51, right lateral. Scale: 0.1 mm. 52–53, ♀ genitalia, paratype ♀ 2, ibid.: 52, abdomen, ventral view; 53, valvifers VIII, ventral (= maximum) view. Scale: 0.5 mm.



third of shaft up to the subapical area; subapically on the left side an oblique row of about 4–5 teeth joining a field of 15–20 teeth which are in some individuals arranged in 2 nearly parallel, horizontal rows and extend over the ventral aspect to the right side; in some individuals 1–3 additional small teeth are present below the phallotreme; for intraspecific variation in number and arrangement of aedeagal teeth see Figs. 48–51. Connective in lateral aspect slightly s-shaped.

Female genitalia. Figs. 52, 53, 159. Generally as in generic description. Valvifers VIII (Fig. 53) with inner base lobate forming a hook-like structure.

Diagnosis. Smallest species within the *Emoloana emoloa*-group; readily recognizable by the extremely short and obliquely truncate tegmina, the color patterns of the legs (pro- and mesotibiae with 2 ring-like marks instead of longitudinal stripes) as well as by the genitalic characters: in the male genitalia anal segment with comparatively short, apically pointed spinose processes, aedeagus in distal third triangularly with characteristic pattern of teeth; in the female genitalia with recurrent projections at base of the valvifers VIII lobe-like rounded.

Type data. Holotype ♂ (BPBM No. 15317), HAWAIIAN IS: HAWAII, Hale Pohaku, 8500 ft., on “bunchgrass”, 18.VI.1966 (J.W. Beardsley). Paratypes: 8♂, 11♀, same data as holotype. 5♀, Pohakuloa, 1800 m, 2.V.1966, J.W. Beardsley; 1♀, same data except for 17.VI.1966, on *Chenopodium oahuense* (?). Holotype and paratypes in BPBM.

Non-type material. 1 nymph (5th instar), same data as holotype; in BPBM.

Host plant. Collected on Poaceae: “bunchgrass”, possibly *Eragrostis* sp.. The host plant record *Chenopodium oahuense* (Chenopodiaceae) as indicated on a label attached to a specimen from Pohakuloa seems doubtful, and is probably accidental.

Geographical Distribution. HAWAIIAN IS: HAWAII.

Remarks. Within the *Emoloana emoloa*-group, *E. pohakua* does not show any obvious morphological affinities either to *E. emoloa*, or to *E. eragrosticola*. However, the triangular apex of the aedeagus, resembles more closely that of *E. eragrosticola* than the club-like aedeagal apex of *E. emoloa*.

At the type-locality, *Emoloana pohakua* occurs syntopically with *E. eragrosticola* and *E. sporobolicola* (ssp. *immaculata*).

Etymology. The species is named for the type-locality, Hale Pohaku.

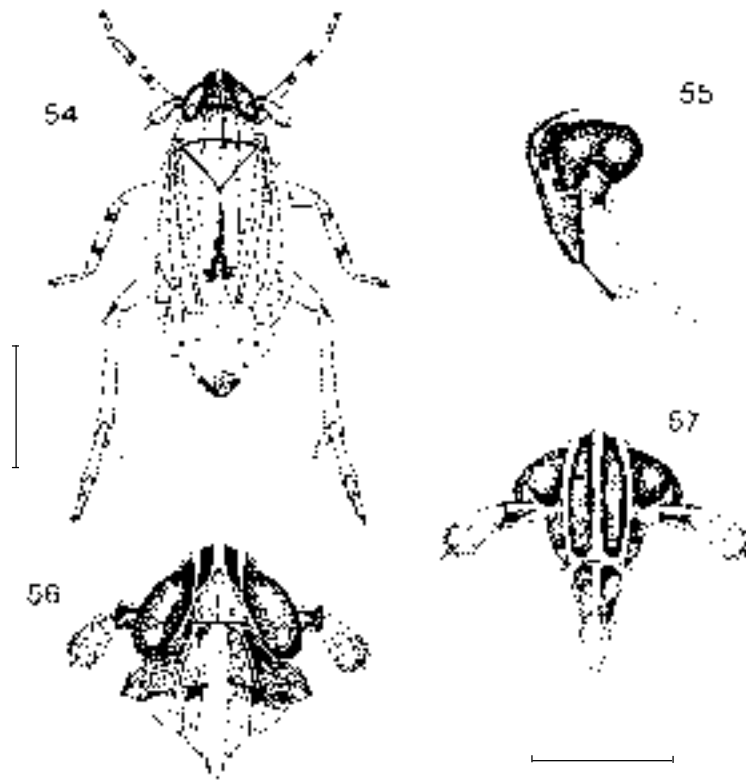
2. *E. swezeyi*-group (*E. swezeyi*, *E. menehune* n.sp.)

Emoloana swezeyi (Kirkaldy), **new combination** (Figs. 54–66, 160)

Kelisia swezeyi Kirkaldy, 1910: 578.

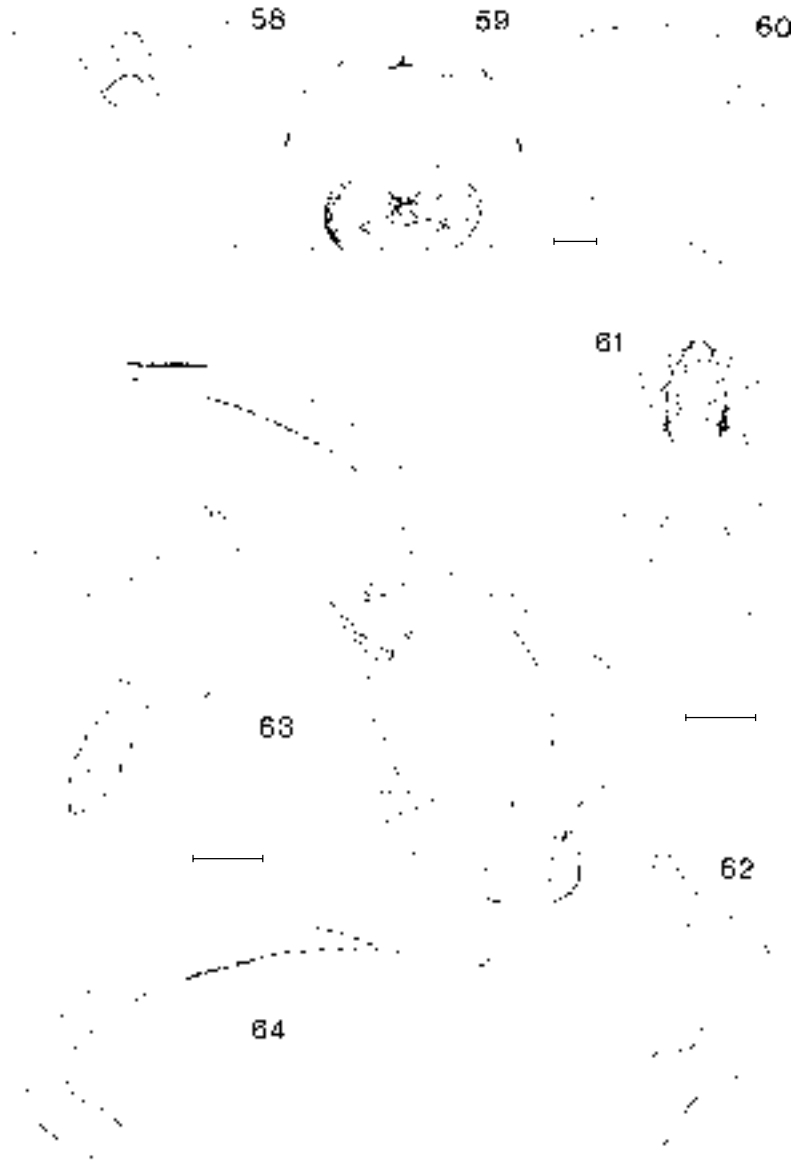
Supplementary Description. Medium-sized *Emoloana* species, in this study only brachypterous individuals were examined; body length: male 2.2–2.5 mm (2.31 ± 0.08 mm; n = 27 mm); female 2.5–3.2 mm (2.66 ± 0.16 mm; n = 25). Habitus see Fig. 54. Coloration: ground color of body and legs stramineous to pale yellow-orange, carinae generally lighter; anterolateral area of vertex and the lateral transition onto frons dark brown, conspicuously contrasted with the whitish carinae in this area (as in *E. eragrosticola*); frons diffusely light brown with creamy-white carinae bordered chestnut-brown, in lower part of frons sometimes 2 whitish spots on each side marking the former position of larval sensory pits; genae and area anterad of compound eyes in some individuals (especially males) diffusely brown; antennal segments anteriorly with enclosed area between the longitudinal brown stripes whitish or pale yellow (less distinct in males); pro- and mesotibia with 2 ring-like brown marks; laterotergites anteriorly brown; male genitalia with the dorsolateral angle of the genital segment with a distinct brown spot, female genitalia with the apex of tergite IX with a conspicuous brown mark extending from the ventral to the laterodorsal portion and which contrasts with the yellow-orange ground color of this tergite (see Fig. 54). Head (Figs. 55–57) including compound eyes ca. 2.7–2.8 x wider than vertex at base and ca. 0.8 x narrower than the pronotum. Vertex (Fig. 56) in males ca. 1.1–1.2 x, in females ca. 1.4 x longer than wide at base; apex—especially in females—distinctly medially projected; posterior compartments in midline ca. 2.3 x longer than the anterior one. Frons (Fig. 57) ca. 1.7–1.8 x higher than wide and ca. 1.2 x higher than post- and anteclypeus together. 2nd antennal segment ca. 1.5–1.6 x longer than 1st. Pronotum medially slightly shorter than vertex (0.8:1), mesonotum medially ca. 1.6 times longer than pronotum, lateral carinae almost parallel to each other. Tegmina reduced, attaining the 7th abdominal tergite. Posttibia ca. 1.4 x longer than posttarsal segments together; 1st posttarsal segment ca. 1.4 x longer than 2nd and 3rd together, and ca. 1.55 x longer than the post-tibial spur; spines of posttibiae and posttarsi as in generic description; post-tibial spur with 18–25 minute teeth on inner margin, terminal tooth obsolete.

Figures 54–57. *Emoloana swezeyi* (Kirkaldy): 54, habitus from dorsal, ♀ 1, Oahu, Koolau Mts., Rooke Valley; scale: 1.0 mm. 55–57, head, ♂ 1, ibid.: 55, left lateral view; 56, dorsal view; 57, frontal view. Scale: 0.5 mm.



Male genitalia. Figs. 58–64. Genital segment (Figs. 58–60) in caudal aspect subquadrate to ovate, in lateral aspect trapezoidal, dorsocaudally at level of the dark mark slightly impressed; diaphragm with dorsal margin deeply u- or v-shaped, centrally with a comparatively narrow, conically-shaped projection. Anal segment (Figs. 61, 63) with ventrocaudal spinose processes comparatively long, apically bluntly pointed (not truncate), in lateral aspect straight, in caudal aspect parallel to each other. Parameres (Figs. 62, 63) in basal half rather broad and parallel to each other, distal halves abruptly diverging and slightly bent dorsad, tapering, apex bluntly rounded or subtruncate. Aedeagus (Figs. 63, 64) rather long and slender, apically tapering to a compressed, spear-like tip; shaft in basal fifth of its length abruptly bent dorsad, then to apex only gently curved; phallotreme slit-like, subapically on the ventrocaudal margin, slightly exposed to the left side; a row of 15–18 fine teeth leading from midlength of shaft on the left dorsal side obliquely to the subapical region of the right side ending at level of the phallotreme, where it meets with another shorter row of ca. 4–6 teeth, both rows together forming an acute angle subapically on the right side. Connective elongate, curved cephalad.

Figures 58–64. *Emoloana swezeyi* (Kirkaldy), ♂ genitalia, ♂ 2, Oahu, Koolau Mts., Rooke Valley: 58, genital segment, ventral view; 59, same, caudal view; 60, same, left lateral view; 61, anal segment, caudal view; 62, left paramere, left lateral view; 63, genitalia without genital segment, left lateral view; 64, aedeagus, right lateral view. Scale: 0.1 mm.



Figures 65–66. *Emoloana swezeyi* (Kirkaldy), ♀ genitalia, ♀ 2, Oahu, Koolau Mts., Rooke Valley: 65, abdomen, ventral view; 66, valvifers VIII, ventral (= maximum) view. Scale: 0.5 mm.



Female genitalia. Figs. 65, 66, 160. As in generic description. Valvifer VIII (Fig. 66) anteriorly with a short and rounded lobe-like projection directed mediad.

Diagnosis. *Emoloana swezeyi* can readily be distinguished from its congeners by the tegmina, which extend to the 7th abdominal segment and by conspicuous dark marks dorsocaudally on the male genital segment and on the apex of female tergite IX. It differs from *E. menehune* n.sp. from Kauai in details of color patterns of the legs and abdomen as well as in genital structures (see below).

Type-data. Neotype ♂ (BPBM No. 15327), here designated: HAWAIIAN IS: OAHU, SE Koolau Mts., Rooke Valley, VII.1917, ex ramus of *Eragrostis variabilis*, J.C. Bridwell. Neotype in BPBM.

Non-type material. 1♂, 3♀, 3 nymphs (5th instar), HAWAIIAN IS: OAHU, same data as neotype. 21♂, 16♀, 2 nymphs (5th instar), same data as neotype except for 1. VII.1917. 1♂, 2♀, SE Koolau Mts., II.1917, J.C. Bridwell. 3♀, 1 nymph (5th instar), Nuuanu Pali, 28.VI.1917, J.C. Bridwell; 2♀, ibid., 5.XI.1916 and 12.XI.1916, on “Pili grass”, D.T. Fullaway; 3♀, 2 nymphs (5th instar), ibid., 14.I.1917, on “Pili grass”, W.M. Giffard; 1♂, 2♀, 1 nymph (5th instar), ibid., W.M. Giffard; 9♂, 2♀, ibid. 19.X.1919, W.M. Giffard; 1♀, ibid., 29.X.1916, W.M. Giffard; 1♂, 1♀, ibid., 19.XI.1916, on *Eragrostis*, W.M. Giffard and D.T. Fullaway; 1♂, 2♀, 1 nymph, ibid., 8.X.1916, on *Eragrostis variabilis*, Timberlake; 4♂, 6♀, ibid., 8.X.1916, O.H. Swezey; 1♀, ibid., 2.II.1952, O.H. Swezey. 4♂ (1♂: Giffard-collection, slide No. 62), 9♀, Manoa Cliff Trail, 1400 ft., 26.X.1919, on *Eragrostis variabilis*, W.M. Giffard. 1♂, 1♀, Manoa Cliff, 25.II.1917, on *Eragrostis variabilis*, Timberlake. 2♂, 3♀, Mt. Tantalus, 1500 ft., 27.VIII.1918, on *Eragrostis variabilis*, W.M. Giffard; 1♂, ibid., 22.XII.1918, on *Eragrostis* sp., W.M. Giffard. 1♀, Puu Kaua, 6.XI.1932, on *Eragrostis* sp., O.H. Swezey. 2♂, Palehua, 3.IV.1927, on *Eragrostis* sp., O.H. Swezey. 1♀, Castle Trail, on *Eragrostis*, 22.VIII.1920 (no further data). 2♂, 1♀, Waianae Mts., Mt. Kaala, 22.VII.1917, J.C. Bridwell. 1♂, South Waianae Mts., 9.XI.1919, O.H. Swezey. Specimens in BMNH, BPBM, HDOA, UHMH.

Host plant. *Eragrostis*-species, e.g. *Eragrostis variabilis* (see Giffard, 1917, 1922; Muir, 1921, 1922; Zimmerman, 1948), *Gahnia* sp. (“coarse sedge”, see Zimmerman, 1948).

Geographical Distribution. HAWAIIAN IS: OAHU. The records of “*Kelisia swezeyi*” from Kauai (Giffard, 1922; Muir, 1921, 1922; Swezey, 1921; Zimmerman, 1948) refer to

Emoloana menehune n.sp., described below.

Remarks. In the original description of *Kelisia swezeyi*, Kirkaldy (1910: 579) mentioned the locality “Oahu, Kalihi” and collecting-data “March, Swezey” of a single male specimen but provided no information about type-fixation and depository (see also Zimmerman, 1948: 245). All available material in the BMNH, BPBM, HDOA and UHMH was examined. However, a labeled type or any specimen bearing labels conforming to the type-data was not found. The corresponding specimen of Kirkaldy is presumed lost. In order to clarify the taxonomic situation in a difficult group of closely related species, I designate a neotype in accordance to Art. 75 of the International Code of Zoological Nomenclature.

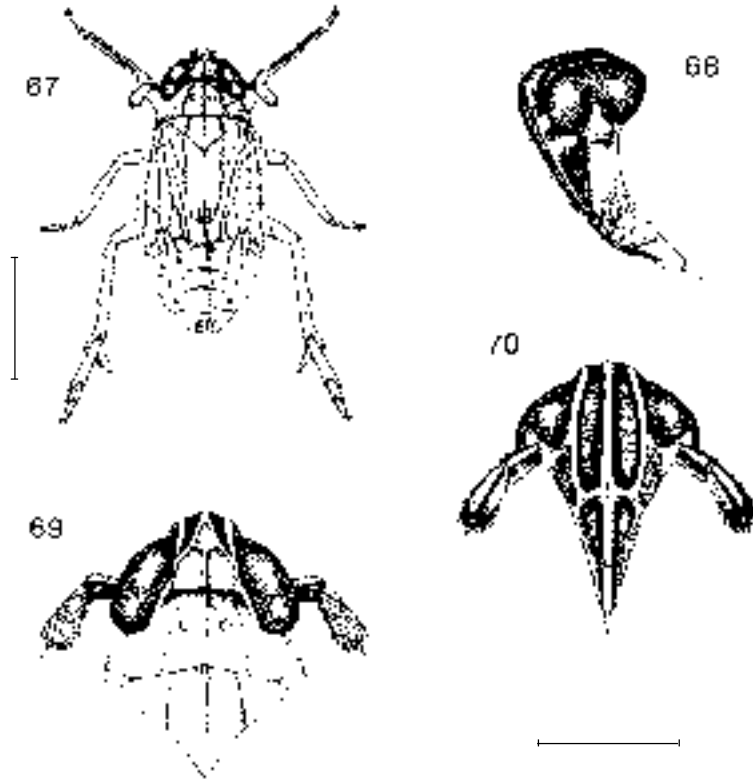
Emoloana swezeyi and *E. menehune* n.sp. form a morphological group characterized by a slender and elongate aedeagus with a spear-like apex. Zimmerman (1948) mentioned the existence of macropterous females of this species; however, these could not be found in the collections cited above.

***Emoloana menehune* Ashe, new species** (Figs. 67–81, 161)

Description. Small to medium-sized *Emoloana* species, only brachypterous individuals known; body length: male 2.2–2.3 mm (2.28 ± 0.04 mm; $n = 5$); female 2.5–2.7 mm (2.55 ± 0.1 mm; $n = 4$). Habitus see Fig. 67. Coloration: stramineous to pale ochraceous; antero-lateral angles of vertex and lateral transition to frons chestnut- to blackish brown (resembling the color pattern of *E. swezeyi* and *E. eragrosticola*); frons brown with darker margins along carinae; carinae of frons, post- and anteclypeus, pro- and mesonotum pale yellow or whitish; genae and parts anterad and above compound eyes mostly brown; both antennal segments posteriorly dark brown, anterodorsally with 2 longitudinal brown stripes enclosing a creamy-white area; femora usually with 2 diffusely brown stripes; protibia (in some individuals also mesotibia) dorsally with a brown longitudinal stripe, no ring-like brown markings; abdominal tergites each with a transverse row of 2–3 small brown spots; laterotergites brown, lighter to the caudal end; genital segment of males and tergite XI of females apicodorsally concolorous, without a conspicuous dark mark; male genital segment ventrolaterally brownish. Head (Figs. 68–70) including compound eyes ca. 3.0 x (males)–3.2 x (females) wider than vertex at base and ca. 0.9 x narrower than pronotum. Vertex (Fig. 69) medially 1.2–1.3 x longer than wide at base, apex slightly produced (in females more so than in males); posterior compartments in midline ca. 2 x longer than the anterior one. Frons (Fig. 70) ca. 1.7 x higher than wide and ca. 1.2 x higher than post- and anteclypeus together. Second antennal segment ca. 1.6 x longer than 1st. Pronotum in midline slightly smaller than vertex (ca. 0.8–0.9: 1), posterior margin very shallowly excavated; mesonotum medially ca. 1.6 x longer than pronotum. Tegmina reduced, distally rounded, reaching the 6th abdominal tergite. Posttibia ca. 1.3 x longer than posttarsal segments together; 1st posttarsal segment ca. 1.5 x longer than 2nd and 3rd segment together and ca. 1.7 x longer than the post-tibial spur; spines of posttibiae and posttarsi as in generic description; post-tibial spur with 20–25 minute teeth on inner margin, terminal tooth obsolete.

Male genitalia. Figs. 71–79. Genital segment (Figs. 71–73) in caudal aspect flat ovate: width to height ca 0.9:1; in lateral aspect trapezoidal; in some individuals, a short triangular protuberance in the center of the semicircular excavation of the ventrocaudal margin; diaphragm with dorsal margin deeply v- or u-shaped, centrally forming a narrow conically-shaped projection; opening for parameres flat ovate to mushroom-shaped. Anal segment (Figs. 74, 75) with ventrocaudal spinose processes moderately long, apically tapering, in lateral aspect slightly curved ventrocephalad, in caudal aspect in comparatively wide dis-

Figures 67–70. *Emoloana menehune* Ashe, n.sp.: 67, habitus from dorsal, paratype ♀ 1, Kauai: Olokele Canyon; scale: 1.0 mm. 68–70, head, paratype ♂ 2, ibid., Halemanu; 68, left lateral view; 69, dorsal view; 70, frontal view. Scale: 0.5 mm.

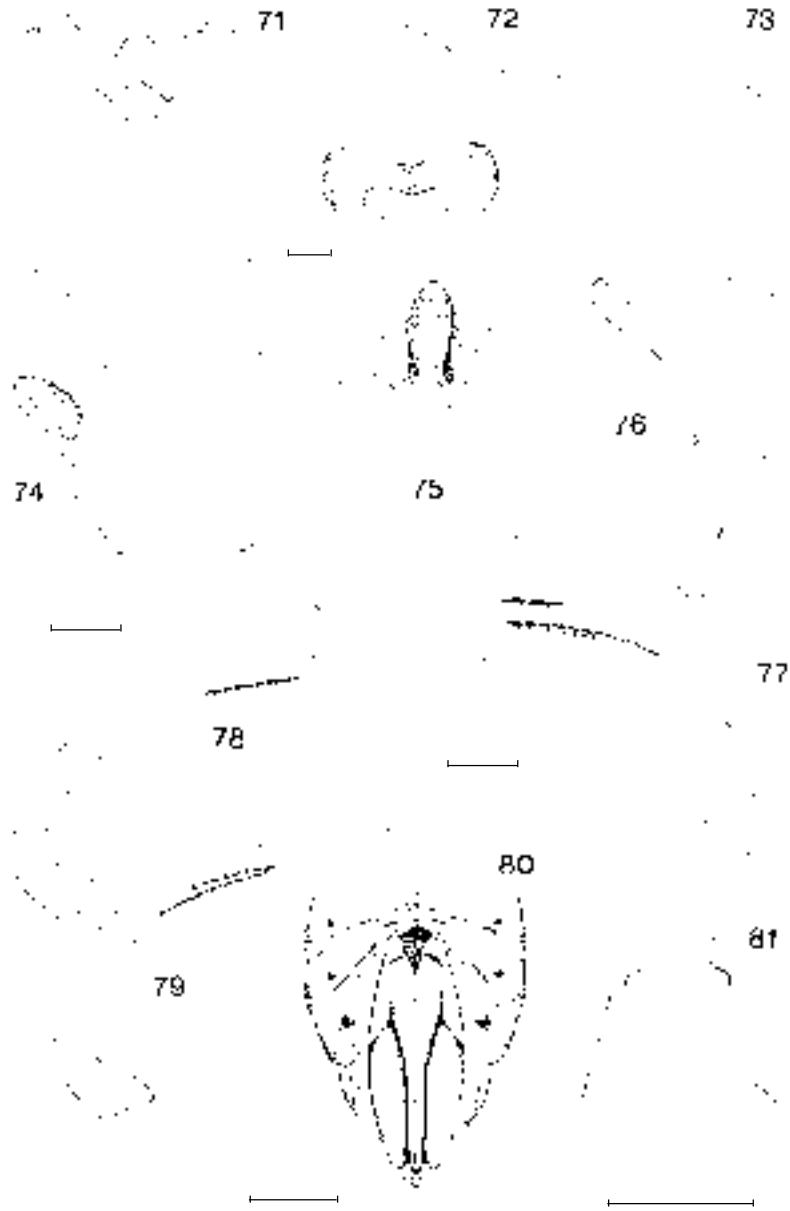


tance to each other, slightly diverging. Parameres (Fig. 76) each with basal half broad and close to each other, apical half diverging, almost straight, tapering to apex, apex nearly truncate. Aedeagus (Figs. 77–79) very long and slender, especially in compressed apical part, shaft shortly distad of base abruptly curved dorsad, apically prolonged into a very slender spear-like tip which varies individually in its length; phallotreme slit-like, subapically on ventrocaudal margin at level of about 2/5 of the aedeagal length measured from apex, slightly exposed on left; on the left dorsal margin from midlength of shaft to level of phallotreme a long row of ca. 11–15 small teeth; on the right dorsal margin about at level of phallotreme a shorter row of ca. 7–8 teeth, both rows slightly oblique, forming an acute angle on dorsal side. Connective elongate, slightly curved cephalad.

Female genitalia. Figs. 80, 81, 161. Generally as in generic description. Valvifer VIII (Fig. 81) at base with a small subtriangular lobe-like projection directed mediad.

Diagnosis. *Emoloana menehune* n.sp. closely resembles *E. swezeyi* in general appearance, coloration of the head, and in the comparatively long and distally rounded tegmina in the brachypterous form, but differs in the following characters: legs without ring-like brown marks on pro- and mesotibia, but with a longitudinal brown stripe instead; dorsolateral angle

Figures 71–81. *Emoloana menehune* Asche, n.sp.: 71–79, ♂ genitalia; 71–78, paratype ♂ 1, Kauai: Halemanu; 79, paratype ♂ 3, ibid., Nualoa; 71, genital segment, ventral view; 72, same, caudal view; 73, same, left lateral view; 74, anal segment, left lateral view; 75, same, caudal view; 76, left paramere, left lateral view; 77, 79, aedeagus, left lateral view; 78, same right lateral view. Scale: 0.1 mm. 80–81, ♀ genitalia, paratype ♀ 1, Kauai, Halemanu: 80, abdomen, ventral view; 81, valvifers VIII, ventral (= maximum) view. Scale: 0.5 mm.



of male genital segment and tip of female tergite IX without a conspicuous dark marking, but concolorous instead; spinose processes of anal segment in caudal aspect comparatively widely separated from each other and slightly diverging instead of comparatively close and parallel to each other; spear-like apex of aedeagus longer, both rows of teeth located more or less on the left and right dorsal margin, instead of both rows obliquely uniting to an acute angle on the right side; left row with fewer teeth (11–15 instead of 15–18), right row with more teeth (7–8 instead of 4–6).

Type data. Holotype ♂ (BPBM No. 15316), HAWAIIAN IS.: **Kauai**, Halemanu, 29.VIII.1921, on *Eragrostis* sp., O.H. Swezey. Holotype in BPBM. Paratypes: 2♂, 2♀, same data as holotype; 1♂, same data but 29.VII.1921. 4♂, 3♀, Olokele Canyon, 5.IX.1920, on *Eragrostis* sp., O.H. Swezey. 2♂, Nualolo, 16.VIII.1925, on *Eragrostis* sp., O.H. Swezey. Paratypes in BPBM, HDOA, UHMH.

Non-type material. Kauai: 1 nymph (5th instar), same data as holotype. 1 nymph (5th instar), Olokele Canyon, 5.IX.1920, on *Eragrostis* sp., O.H. Swezey. In BPBM and UHMH.

Host plant. *Eragrostis*-species.

Geographical Distribution. HAWAIIAN IS: KAUAI (some specimens previously reported as “*Kelisia swezeyi*” by Giffard, 1922; Muir, 1921, 1922; Swezey, 1921; Zimmerman, 1948).

Remarks. *Emoloana menehue* n.sp. is apparently closely related to *E. swezeyi*; the rather slender and very elongate aedeagus could be considered as a synapomorphous character if a sturdier and less elongate aedeagal model within the genus (e.g. as in *E. sporobolicola*, see below) can be accepted as plesiomorphic. Older records of “*Kelisia swezeyi*” from Kauai probably are of *E. menehune*. *Emoloana menehune* appears to be a geographical vicariant of *E. swezeyi*, which is confined to Oahu.

Etymology. The name of this species refers to the dwarfish Hawaiian fairy folk or “Menehune”.

3. *Emoloana sporobolicola*-group (*E. sporobolicola* sensu lato)

Emoloana sporobolicola (Kirkaldy), **new combination** (Figs. 82–156, 162–168)

Kelisia sporobolicola Kirkaldy, 1910: 198.

Supplementary Description. Small to medium-sized *Emoloana* species, usually brachypterous, only a few macropterous individuals known; body length variable within and among populations of different islands (Table 1). Habitus see Figs. 82, 83, 98, 104, 121.

Coloration very variable:

a) *Lectotype and paralectotypes from Oahu, Honolulu:* ground color of body and legs pale stramineous to ochraceous (color probably somewhat faded in these specimens); vertex and thorax slightly lighter than frons; frons pale ochraceous to light brownish, carinae yellowish, frons and anterolateral area on each side of median carina with 9 small light yellow spots (marking the former positions of larval sensory pits); post- and anteclypeus ochraceous; genae and area in front and above compound eyes brown with several yellow marks; 1st antennal segment posteriorly brown, dorsally and anteriorly with 2 diffusely brown longitudinal stripes enclosing a yellowish area, 2nd antennal segment terminally darker, longitudinal stripes very faint or missing; pro- and mesonotum laterally darker; tegmina semihyaline, pale yellow, veins almost concolorous with distinct brown granules, claval apex with brown spot; femora with about 2 faint longitudinal brownish stripes on underside, pro- and mesotibia each with 2 very faint brown ring-like marks, metatibia with a small brown spot on dorsolateral base; abdominal tergites sublaterally with a light yellow

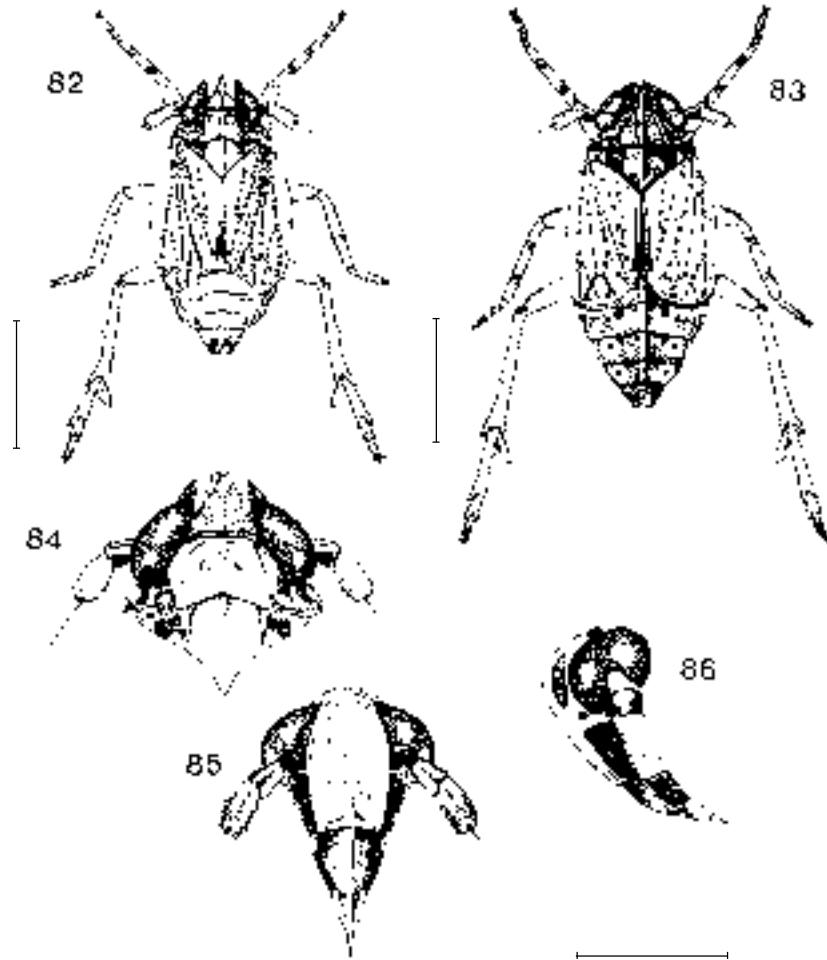
Table 1. *Emoloana sporobolicola* (Kirkaldy), variation in body length; measurements in mm ($\bar{X} \pm \text{SD}$).

Island/ locality	Brachypterous form				Macropterous form			
	Males	n	Females	n	Males	n	Females	n
Kauai								
Mana	1.7–1.75 (1.71 ± 0.025)	4	2.0–2.25 (2.08 ± 0.09)	11				
Oahu								
Honolulu								
a) types	2.2	1	2.3	2				
b) non-types	2.0–2.2	4	2.3–2.4	5				
Oahu								
Barber's Point	2.0–2.2 (2.05 ± 0.05)	17	2.2–2.5 (2.37 ± 0.08)	20				
Oahu								
Black Pt., Kahala	1.9–2.15 (2.00 ± 0.08)	17	2.2–2.5 (2.33 ± 0.08)	24				
Oahu								
Waianae Coast	2.4 (2.6 ± 0.09)	1	2.5–2.7	9				
Oahu								
Palolo	2.3	1	2.7	1		3.7	1	
Molokai								
Waikolu						4.2	1	
Molokai								
Moamami			2.4	1				
Maui								
Haleakala	2.4–2.5	3	2.7–2.8	3				
Hawaii								
Kilauea	2.6	6						
Hawaii								
Ahumoa Crater	2.0–2.1	2	2.35–2.6	3	3.25–3.4	2		
Hawaii								
Kona Coast			2.35	2				
Hawaii								
Puako (Kohala)	2.1	2	2.3–2.4	2				

ring- or u-shaped area, each tergite transversely with 2–3 small brownish marks; genital segment of male dorso- and ventrolaterally diffusely brown; tergite IX of female ochraceous, ovipositor brownish; sternites individually varying from nearly uniformly stramineous to dark brown (see Figs. 149, 150). The Oahu-populations from Honolulu (non-types), Barber's Point, Black Point, and Waianae Coast correspond largely to this color pattern.

b) *Specimens from Oahu, Palolo*: ground color of body and legs orange-brown; frons in males and macropterous females almost chestnut-brown; brachypterous females light brown,

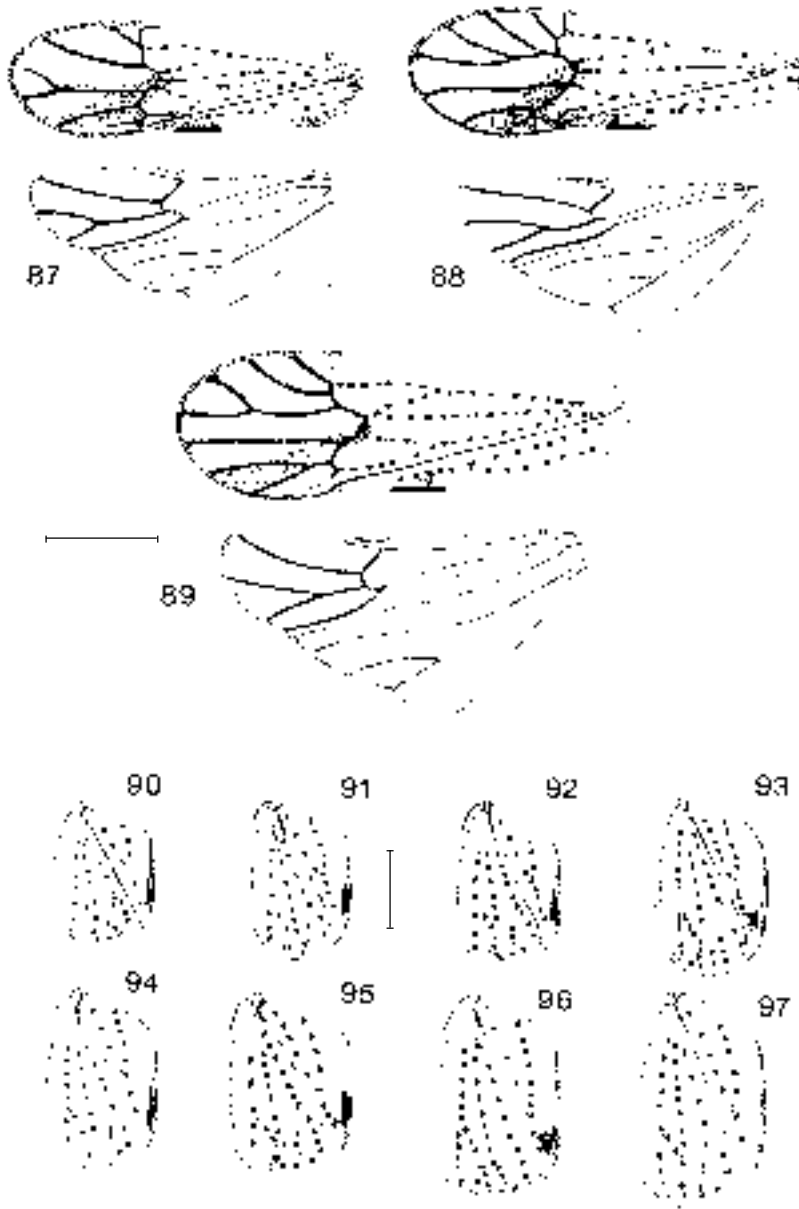
Figures 82–86. *Emoloana sporobolicola* (Kirkaldy)-group: 82–83, habitus from dorsal; 82, ♀ from Oahu: Barber's Point; 83, ♀ from Hawaii I.: Ahumoa Crater; scale: 1.0 mm. 84–86, head, ♂ from Oahu: Barber's Point: 84, dorsal view; 85, frontal view; 86, left lateral view. Scale: 0.5 mm.



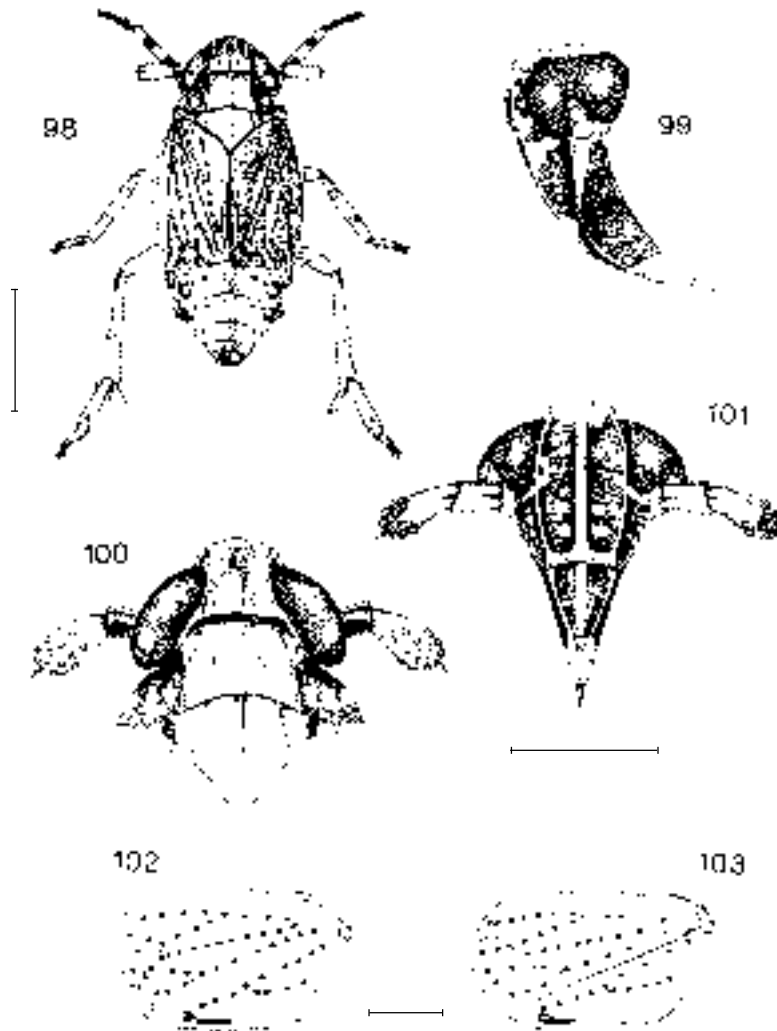
with contrasted creamy-white carinae, marks indicating former larval sensory pits rather faint; post- and anteclypeus as well as genae and area in front and above compound-eyes brown with creamy-white marks; macropterous females with tegmina and wings hyaline, tegminal veins light yellow and distad of nodal line brown, a brown suffusion from inner distal angle to mid of nodal line; hind wings with terminal M- and Cu- branches brown; abdominal sternites of females uniformly stramineous (Fig. 127). Coloration patterns otherwise as in types from Honolulu.

c) Specimens from Kauai, Mana: body pigmentation rather uniformly ochraceous except for post- and anteclypeus as well as lateral parts of head light brown; marks indicating

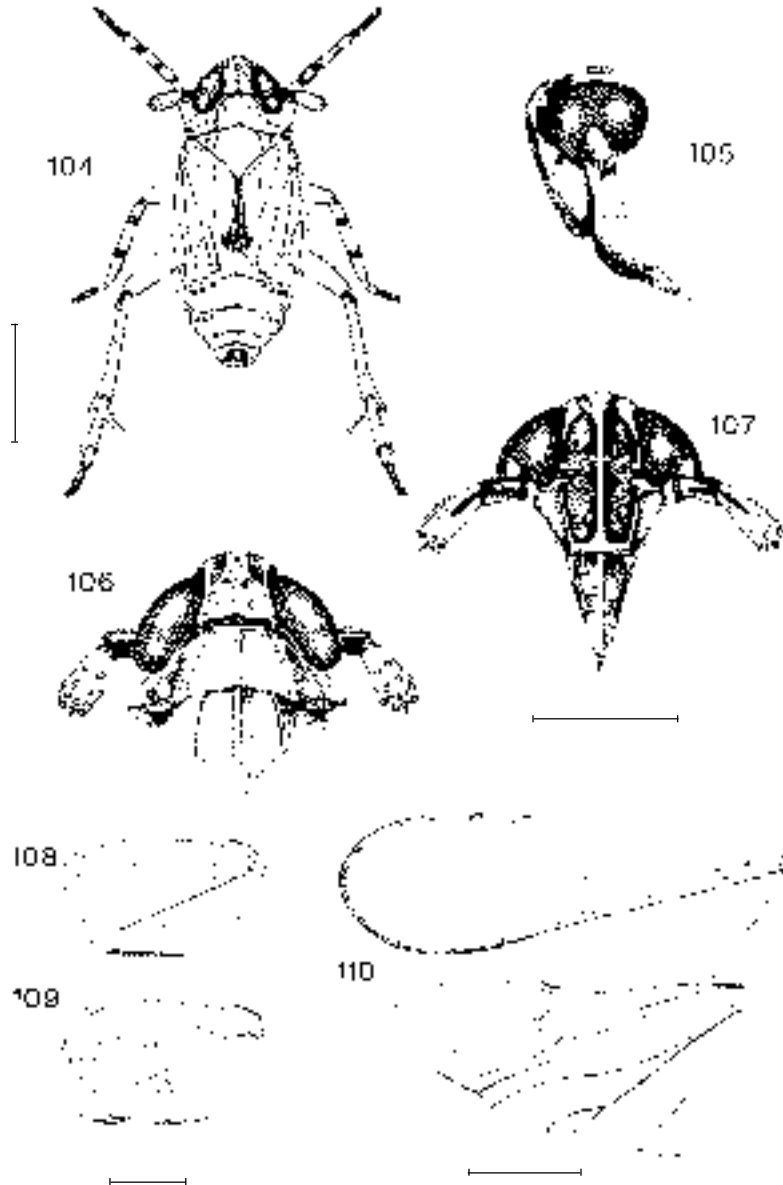
Figures 87–97. *Emoloana sporobolicola* (Kirkaldy)-group, tegmina and hind wings: 87, macropterous ♂ from Hawaii I.: Ahumoa Crater; 88, another macropterous ♂, *ibid.*; 89, macropterous ♀ from Molokai: above Waikolu Valley. Scale: 1.0 mm. 90–97, variation of size and venation of tegmina in the brachypterous form; 90–93, males; 94–97, females; 90, 94, Kauai: Mana; 91, 95, Oahu: Barber's Point; 92, 96, Oahu: Honolulu; 93, 97, Hawaii I.: Kohala Mts.. Scale: 0.5 mm.



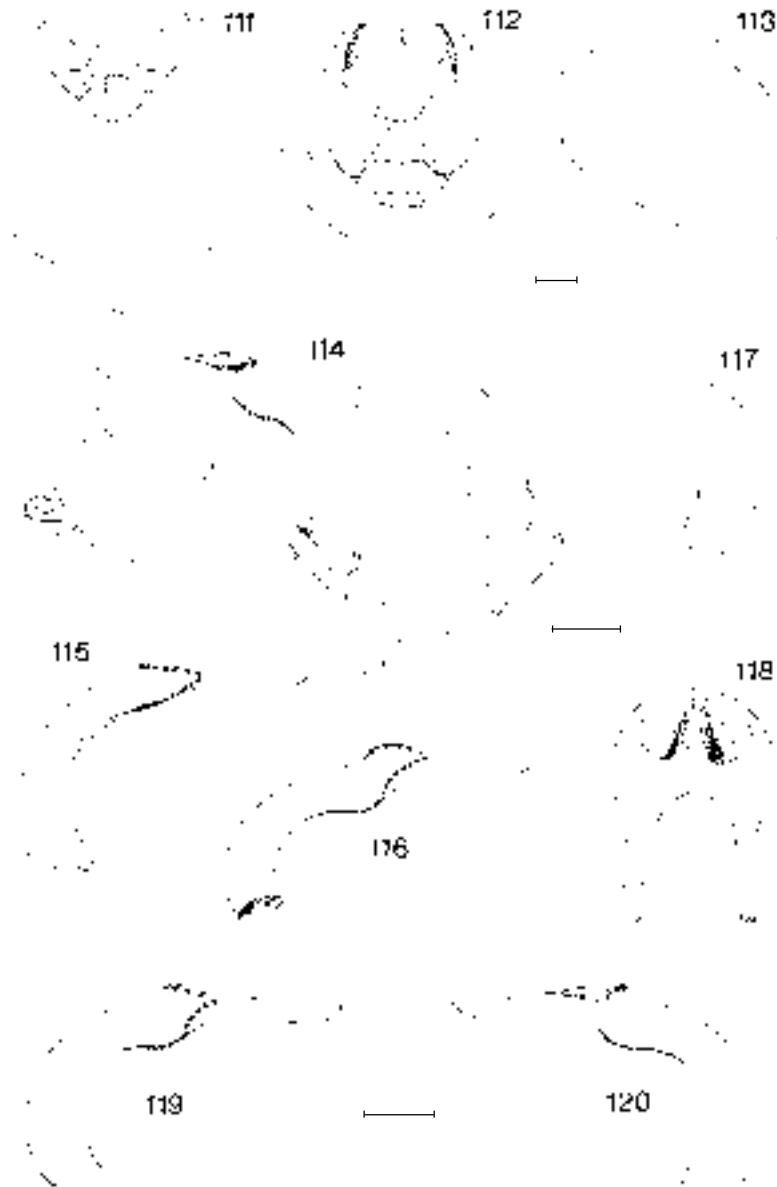
Figures 98–103. *Emoloana sporobolicola* (Kirkaldy)-group, specimens from Maui: Haleakala, Halemanu Trail: 98, habitus from dorsal, ♀; scale: 1.0 mm. 99–101, head, ♂; 99, left lateral view; 100, dorsal view; 101, frontal view. Scale: 0.5 mm. 102, brachypterous tegmen of ♂; 103, same of ♀. Scale: 0.5 mm.



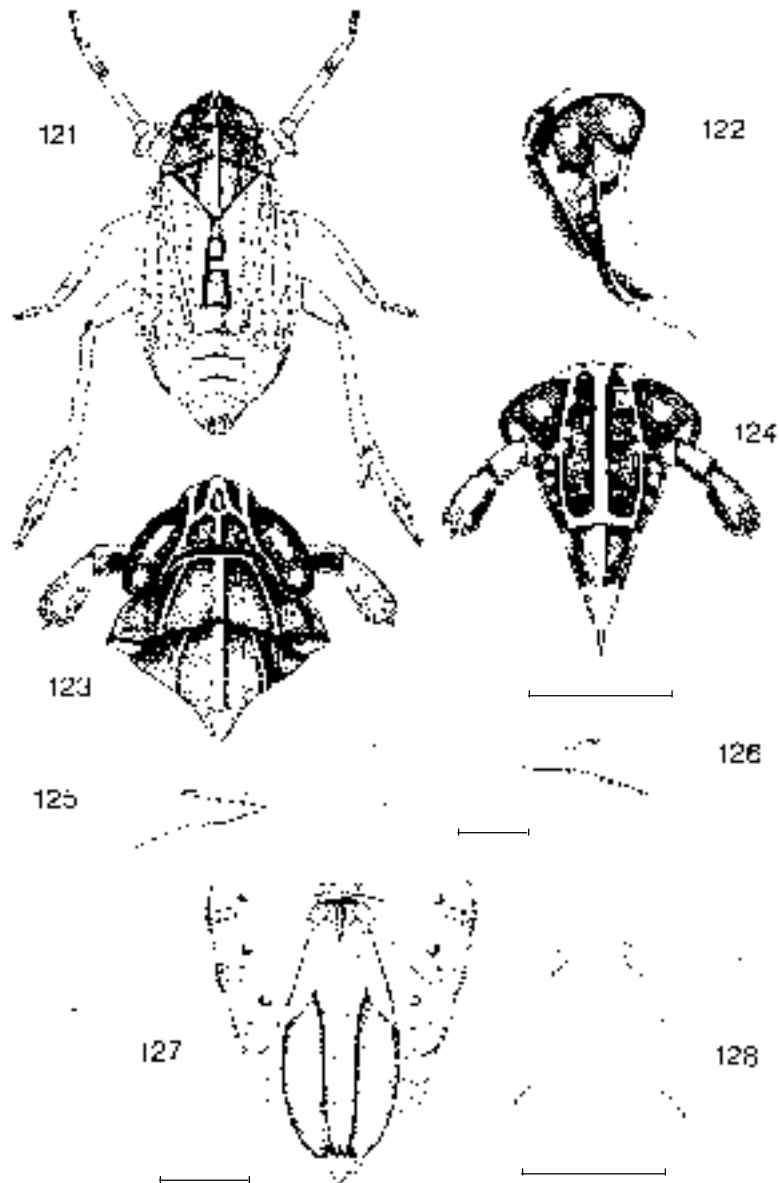
Figures 104–110. *Emoloana sporobolicola* (Kirkaldy)-group: subspecies *E. spor. immaculata* (Muir): 104, habitus from dorsal, ♀ from Hawaii I.: Kilauea; scale: 1.0 mm. 105–107, head, paratype ♂, ibid.; 105, left lateral view; 106, dorsal view; 107, frontal view; scale: 0.5 mm. 108, brachypterous tegmen, paratype ♂, ibid.; 109, same, paratype ♀, ibid.; scale: 0.5 mm. 110, left tegmen and hind wing, macropterous ♀ from Hawaii I.: Pohakuloa. Scale: 1.0 mm.



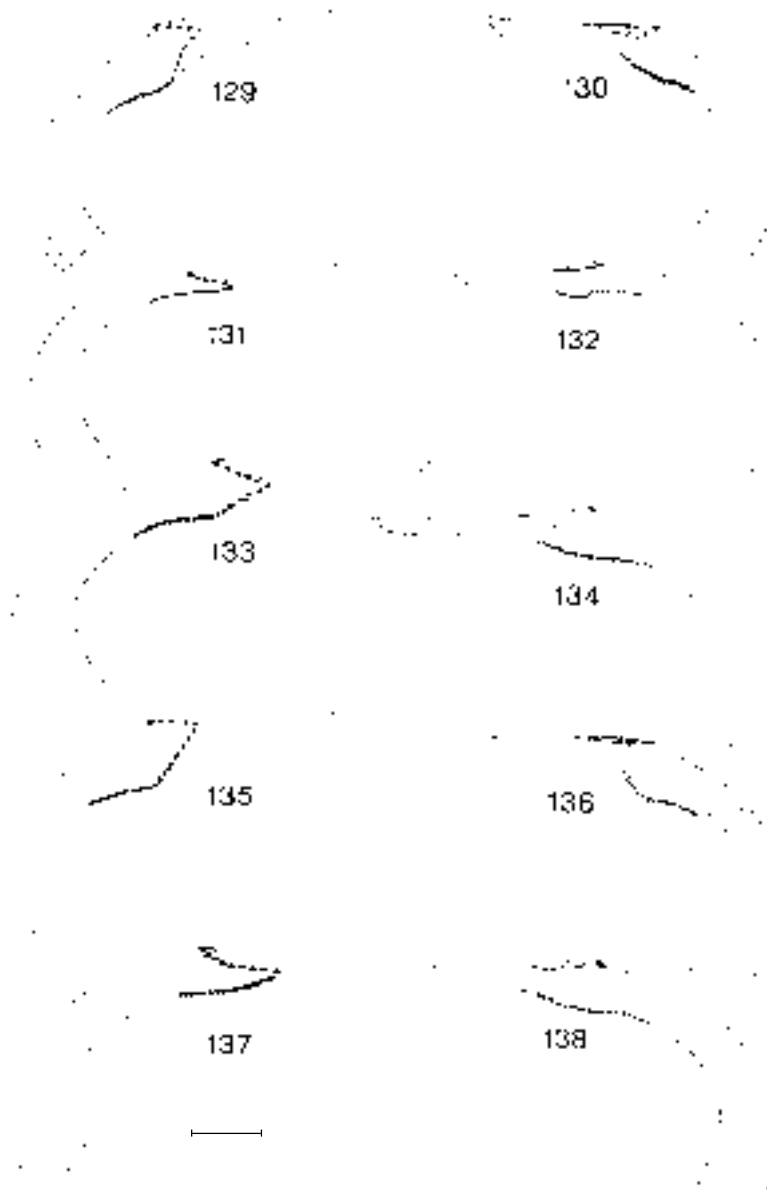
Figures 111–120. *Emoloana sporobolicola* (Kirkaldy)-group, male genitalia, 111–118, specimen from Oahu: Kaena Point: 111, genital segment, ventral view; 112, same, caudal view; 113, same left lateral view; 114, genitalia without genital segment, left lateral view; 115, aedeagus, right lateral view; 116, same, against 115 slightly twisted to left; 117, left paramere, left lateral view; 118, anal segment, caudal view; 119–120, specimen from Oahu: Mokapu: 119, aedeagus, right lateral view; 120, same, left lateral view. Scale: 0.1 mm.



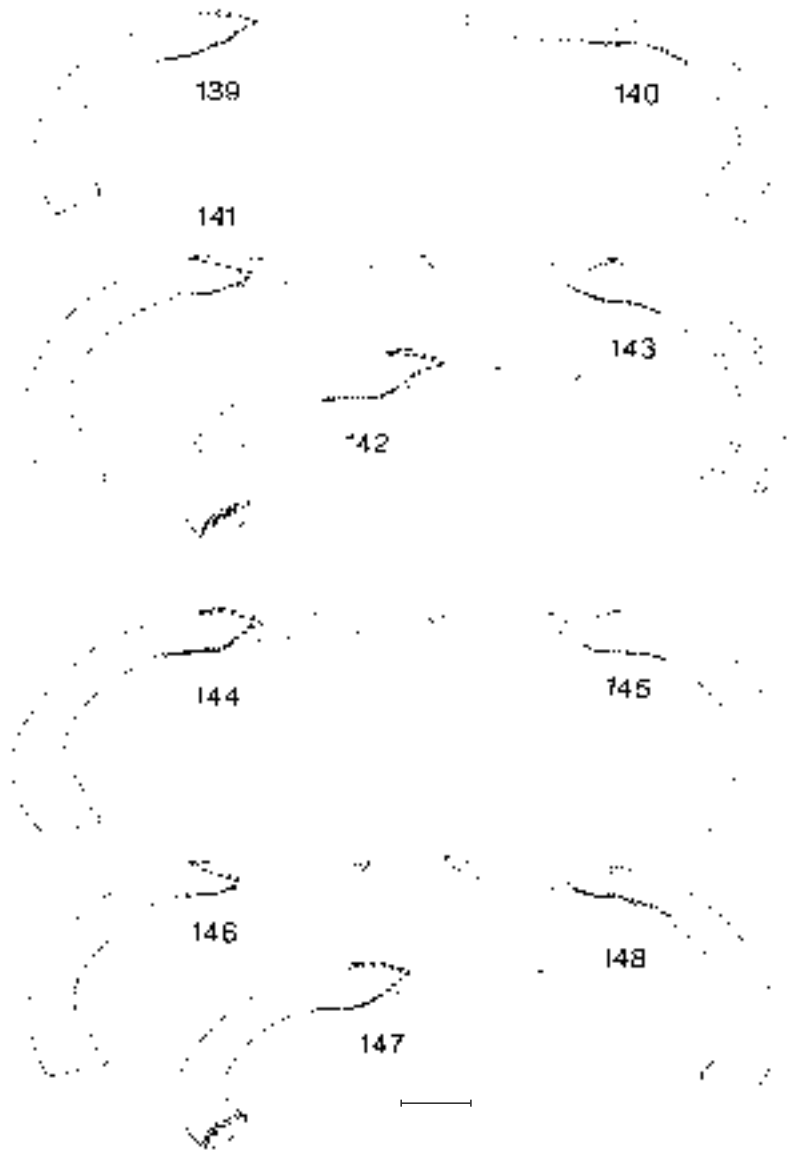
Figures 121–128. *Emoloana sporobolicola* (Kirkaldy)-group, specimens from Oahu: Palolo Valley: 121, habitus from dorsal, ♀; scale: 1.0 mm. 122–124, head, ♂; 122, left lateral view; 123, dorsal view; 124, frontal view; scale 0.5 mm. 125, aedeagus, right lateral view; 126, same, left lateral view; scale: 0.1 mm. 127–128, female genitalia; 127, abdomen, ventral view; 128, valvifers VIII, ventral (= maximum) view; scale: 0.5 mm.



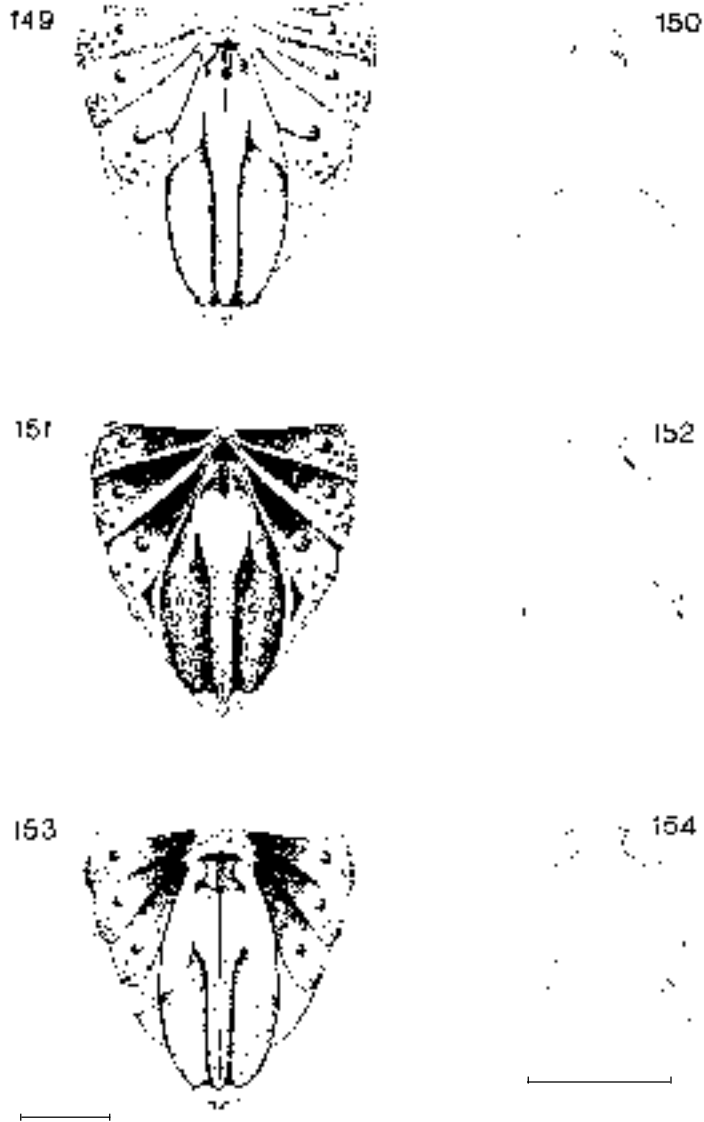
Figures 129–138. *Emoloana sporobolicola* (Kirkaldy)-group: variation of the aedeagus (left column = right lateral view; right column = left lateral view); 129–130, Kauai: Mana; 131–132, Maui: Haleakala, Puu Nianiau; 133–134: Maui: Haleakala, Halemanu Trail; 135–136: Hawaii I.: Kohala Mts.; 137–138: Hawaii I.: Kilauea. Scale: 0.1 mm.



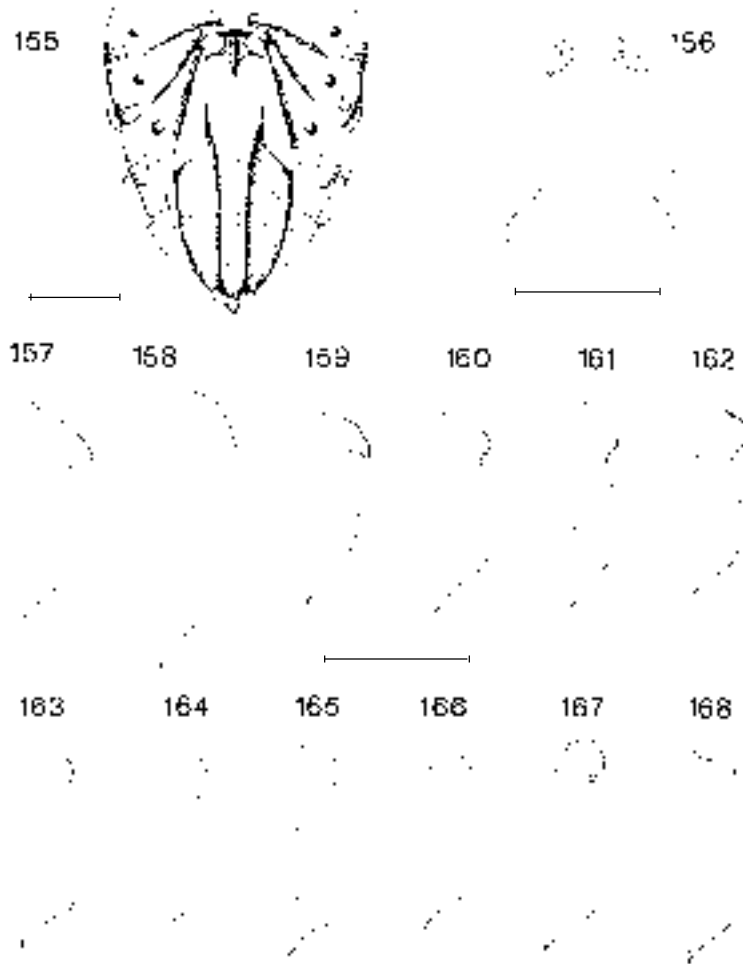
Figures 139–148. *Emoloana sporobolicola* (Kirkaldy)-group: variation of the aedeagus (left column = right lateral view; right column = left lateral view); 139–140, Hawaii I.: Ahumoa Crater; 141, 142, 143, Hawaii I.: Kilauea, paratype of *E. spor. immaculata* (Muir); 142 is against 141 slightly twisted to left; 144–145: Hawaii I.: Pohakuloa, *E. spor. immaculata* (Muir); 146, 147, 148, Hawaii I.: Hale Pohaku, *E. spor. immaculata* (Muir); 147 is against 146 slightly twisted to left. Scale: 0.1 mm.



Figures 149–154. *Emoloana sporobolicola* (Kirkaldy)-group: variation of the female genitalia; 149, 151, 153: abdomen; ventral view; 150, 152, 154: valvifers VIII, ventral (= maximum) view; 149–150, Oahu: Waianae coast; 151–152, Oahu: Black Point; 153–154, Maui: Haleakala, Halemanu Trail. Scale: 0.5 mm.



Figures 155–168. *Emoloana* species: variation of the female genitalia; 155, *E. sporobolicola immaculata* (Muir), paratype, Hawaii I.: Kilauea: abdomen, ventral view; 156, same specimen, valvifers VIII, ventral (= maximum) view. 157–168, variation of valvifer VIII, ventral (= maximum view): 157, *E. emoloa* (Muir), Oahu: Koko Head; 158, *E. eragrosticola* (Muir), Maui: Iao Valley, paratype; 159, *E. pohakua* Asche, n.sp., Hawaii I.: Hale Pohaku, paratype; 160, *E. swezeyi* (Kirkaldy), Oahu: Rooke Valley; 161, *E. menehune* Asche, n.sp., Kauai: Halemanu, paratype. 162–168, *E. sporobolicola* (Kirkaldy)-group: 162, Oahu: Palolo Valley; 163, Oahu: Waianae coast; 164, Oahu: Black Point; 165, Molokai: Waikolu Valley, macropterous specimen; 166, Molokai: Moamami District, brachypterous specimen; 167, Maui: Haleakala, Halemanu Trail; 168, Hawaii I.: Kilauea, paratype of *E. spor. immaculata* (Muir). Scale: 0.5 mm.



former larval sensory pits rather faint; longitudinal stripes of antennal segments diffuse except for the dark brown posterior aspect of the 1st antennal segment. Coloration patterns otherwise as in types from Honolulu.

d) *Specimens from Maui, Haleakala*: generally light ochraceous; anterior compartment and anterolateral area of vertex, frons and lateral parts of head diffusely dirty brown; post- and anteclypeus dark brown; carinae and frontal spots yellowish; antennal stripe-pattern on 1st segment distinct, on 2nd segment diffuse; ring-like marks of pro- and mesotibiae very faint, mostly only the distal mark visible; abdominal sternites of females (Fig. 153) dark as in population from Black Point in Oahu. Coloration patterns otherwise as in types and other populations from Honolulu.

e) *Specimens from Hawaii, Ahumoa Crater*: generally darker than specimens from other localities, ground color of body and legs light brown; frons medium brown, margins and median carina bordered dark brown, marks indicating former larval sensory pits indistinct; post- and anteclypeus as well as lateral parts of head dark brown; stripes of antennal segments dark brown, on 1st segment posterior mark and upper anterior stripe dorsally united, stripes on 2nd segment distinct but terminally fused; area enclosed between anterior stripes contrasted creamy-white; lateral parts of pronotum brown with whitish callous-like spots; in macropterous males lateral parts of pro- and mesonotum blackish brown; tegmina and hind wings of macropterous males as in macropterous female from Oahu (Palolo). Coloration patterns otherwise as in types and other populations from Honolulu.

f) *Specimens from Hawaii, Kilauea, "immaculata"*: rather uniformly stramineous to pale ochraceous, post- and anteclypeus slightly darker; tegmina in brachypterous form semihyaline, in macropterous form hyaline, veins concolorous to light yellowish, granules missing or, if present, not centered in a brown spot, brown mark of claval apex faint or missing; abdominal sternites of females (Fig. 155) with some brownish suffusions at the posterior margins. Coloration patterns otherwise as in types and other populations from Honolulu.

All other specimens examined fall into the range of these color patterns or mediate between them.

Head (Figs. 84–86, 99–101, 105–107, 122–124) including compound eyes 2.85–3.0 x wider than vertex at base and 0.8–0.9 x narrower than pronotum. Vertex (Figs. 84, 100, 106, 123) medially slightly produced but rounded, in midline ca. 1.05–1.1 x longer than wide at base; posterior compartments in midline ca. 1.55–1.75 x longer than the anterior one. Frons (Figs. 85, 101, 107, 124) ca. 1.65–1.9 x higher than wide and ca. 1.4–1.5 x higher than post- and anteclypeus together; median carina prominent but obsolete to vertex. Ocelli in some individuals rather faint. 2nd antennal segment about 1.6–1.7 x longer than 1st. Pronotum in midline about as long as vertex or slightly shorter, lateral areas with 3–5 callous-like marks; mesonotum ca. 1.45–1.6 x longer than pronotum. Tegmina of brachypterous form in males reaching to the end of the 5th or the anterior portion of the 6th abdominal tergite, in females nearly reaching to the end of the 6th abdominal segment; the range of intraspecific variation in shape and venation show Figs. 90–97, 102, 103, 108, 109; in macropterous form tegmina distinctly surpassing the tip of abdomen, the intraspecific variation show Figs 87–89, 110; veins with distinct granules except for the "*immaculata*"-populations from Hawaii Island (Figs. 104, 108–110); tegmina in macropterous form distad of nodal line with irregular venation patterns (possibly indicating a secondary macroptery). Posttibia ca. 1.3–1.35 x longer than the posttarsal segments together. 1st posttarsal segment 1.35–1.45 x longer than 2nd and 3rd segment together and 1.6–1.75 x longer than the post-tibial spur; spines of posttibiae and posttarsi as in generic description; post-tibial spur with ca. 15–21 minute teeth on inner margin.

Male genitalia. Figs. 111–120, 125, 126, 129–148. Genital segment (Figs. 111–113) in

shape and proportions as in generic description; diaphragm with dorsal margin flat u- or v-shaped; opening for parameres flat ovate to flat mushroom-shaped. Anal segment (Figs. 114, 118) with ventrocaudal spinose processes comparatively long, straight, apically truncate, truncate area of tip often concave; processes in caudal aspect slightly diverging. Parameres (Figs. 114, 117) with broad base, narrowing to apex, diverging and slightly bent dorsad, tip broadly rounded or truncate. Aedeagus (Figs. 114–116, 119, 120, 125, 126, 129–148) comparatively stout, subtubular, especially in apical half compressed; almost evenly curved dorsad, in apical third slightly dilated with phallotreme subapically on the ventrocaudal margin, phallotreme in most individuals exposed on the left side; apical third of aedeagus blade-like; an oblique row of 15–20 small teeth at midlength of shaft extending from the left dorsal margin to the middle of the right side, dorsal margin of shaft expanded and velum-like; the right side with an oblique row of 4–9 small teeth extending from the posterior end of the phallotreme at the ventrocaudal margin of shaft to the middle of the right side joining the first row, both rows meet at an acute angle. The range of intraspecific variation of the aedeagus within and among populations is illustrated in Figs. 129–148.

Female genitalia. Figs. 127, 128, 149–156, 162–168. As in generic description. Valvifer VIII with inner margin lobate at base. The range of variation is illustrated in Figs. 128, 150, 152, 154, 156.

Diagnosis. *Emoloana sporobolicola* is distinguished by the presence of light spots on the frons, lateral parts of the head and pronotum indicating the former positions of larval sensory pits, and by characters of the male and female genitalia: anal segment of males with elongate processes, slightly diverging and apically truncate, sometimes concave; aedeagus with a long, compressed, blade-like apex, with the phallotreme mostly on the left side, and with a characteristic number and arrangement of aedeagal teeth; females with valvifers VIII rounded at base, with a small lobate projection. Within the genus, *E. sporobolicola* most closely resembles the species of the *E. swezeyi*-group, but differs by the shorter tegmina in the brachypterous form, by the flat instead of deeply excavated dorsal margin of the diaphragm, by the shape of the male anal segment, especially by the apically truncate instead of pointed apex, and by the shorter, more robust, and more evenly curved aedeagus with the phallotreme exposed on the left.

Type data. Lectotype ♂ (BPBM No. 1734), here designated: HAWAIIAN IS: OAHU, bearing the labels “Honolulu, XI.1903, R.C.L.P.” (Perkins), selected from 3 specimens placed in the type collection of the BPBM by Zimmerman (see Zimmerman, 1948: 244) and that were registered with the type-number BPBM No.1734. The remaining 2 ♀ are here designated as paralectotypes.

Non-type material. OAHU: 4♂, 5♀, 3 nymphs (4th instar), 5 nymphs (5th instar), Honolulu, ft. “KD”, no collecting date given, Kirkaldy. 1♂, 3♀, Waimanalo, 7.VIII.1927, E.H. Bryan Jr.; 4♂ (1♂ macropterous), 4♀, 13.III.1921, O.H. Swezey; 1♂, *ibid.*, beach area, 2.III.1979, K.T. Takayanagi; 3♂, 5♀, 14 nymphs, *ibid.*, 7.II.1907, no further data. 1♂, 2♀, 4 nymphs (5th instar), Mokapu, no collecting date given, on “Bermuda grass” on sandy beach, E.H. Bryan Jr. 1♀, Kailua, 4.III.1928, E.H. Bryan Jr. 1♀, Maunaula, 20.XII.1919, E.H. Bryan, labelled “*Kelisia sporobolicola*, det. O.H. Swezey”. 3♀, 1 nymph (5th instar), Makapuu Point, 25.I.1920, on *Sporobolus* sp., O.H. Swezey. 1♂, 5♀, 3 nymphs (5th instar), III.1907, R.C.L. Perkins. 3♀, 3 nymphs (5th instar), Waianae coast, 29.XII.1906, “(unreadable), with the specimen called `maritima` *K. sporobolicola*. R.C.L.P.” (Perkins) (handwritten). 2♂, Kaena Point, 15.X.1937, on *Sporobolus* sp., O.H. Swezey. 5♂, 6♀, 1 nymph (5th instar), Barber’s Point, 29.VI.1919, E.H. Bryan Jr; 12♂, 6♀, 3 nymphs (5th instar), *ibid.*, O.H. Swezey, no further data; 2♂, *ibid.*, 1.VII.1923, O.H. Swezey. 12♂ (1♂: slide No. 55, dissection by F. Muir), 20♀, 4 nymphs (5th instar), Black Point, Kahala, 30.I.1917, W.M. Giffard, on *Sporobolus* sp.; 1♂, 1♀, 3 nymphs (5th instar), *ibid.*, on

Sporobolus sp., W.M. Giffard; 13♂, 11♀, 1 nymph (4th instar), 8 nymphs (5th instar), *ibid.*, 16.XI.1919, on *Sporobolus* sp., W.M. Giffard. 1♂, 2♀ (1♀ macropterous), 2 nymphs (5th instar), Palolo, 20.X.1918, on *Gahnia* sp., O.H. Swezey. 1♂ (macropterous), Makua, 1.I.1927, O.H. Swezey. 1♂, Diamond Head, 0 ft., 18.II.1917, D.T. Fullaway. **Kauai:** 8♂, 14♀, 1 nymph (5th instar), Mana, 4.IX.1920, on *Sporobolus* sp., O.H. Swezey. 2♂, Puu Ka Pele, 4.IX.1920, on *Eragrostis* sp., O.H. Swezey. 1♀, Kawaikoa Str., 12.VI.1955, on *Acacia koa* (most likely accidentally collected on this plant!), D.T. Rainwater. **Molokai:** 1♀, Moomomi Dunes, 15 m, 8.III.1974, W.C. Gagné. 1♀ (macropterous), above Waikolu Valley, 1400 m, 29.IV.1955, C.R. Joyce. **MAUI:** 1♂, 3♀, Haleakala, 6200 ft., 10.X.1919, on *Deschampsia australis*, Timberlake; 2♂, *ibid.*, near Laleini, 6800 ft., III.1919, on *Deschampsia australis*, Timberlake (W.M. Giffard-collection); 1♂, 3♀, 3 nymphs, *ibid.*, 11.X.1919, Timberlake; 10♂, 5♀, 4 nymphs, *ibid.*, gulch near Puu Nianiau, ca. 6200 ft., 20.VII.1919, on *Deschampsia australis*, no collector indicated (labels in Timberlake's handwriting); 1♀, *ibid.*, Keaum. (sic ?) Pali, 5200–5800 ft., 19.X.1919, Walker; 1♀, *ibid.*, “crest of crater at out trail”, 8000 ft., 17.X.1919, Timberlake; 2♂, 2♀, 1 nymph (5th instar), *ibid.*, Halemau Trail, ca. 8000 ft., on *Deschampsia* sp., 14.VI.1989, M. Asche and H. Hoch. **Hawaii:** 6♂, Kilauea, VIII.1921, F. Muir; 1♂ (slide No. 53, dissection by F. Muir), *ibid.*, 4000 ft., 20.IX.1919, on *Vincentia angustifolia*, W.M. Giffard. 2♀, Kona coast (no date and collector given). 13♂, 7♀, Puako, 12.V.1905, on *Sporobolus virginicus*, O.H. Swezey. 1♀, Hale Pohaku, 8500 ft., on “bunch grass”, 18.VI.1966, J.W. Beardsley. 1♀, Kilauea Iki, Rim Trail, 3800 ft., 23.VI.1966, J.W. Beardsley. 4♂ (2♂ macropterous), 3♀, Ahumoa Crater, 6500 ft., 21.VI.1966, 3 specimens collected on *Sophora* sp. (probably accidentally), J.W. Beardsley. In AH, BMNH, BPBM, HDOA, UHMH, .

Host plants. *Sporobolus virginicus*, *Eragrostis atropioides*, *Deschampsia australis*, *Vincentia angustifolia*, *Gahnia* sp. (Giffard, 1917, 1922; Muir, 1921; Zimmerman, 1948). The host plant-records *Acacia koa* and *Sophora* are doubtful.

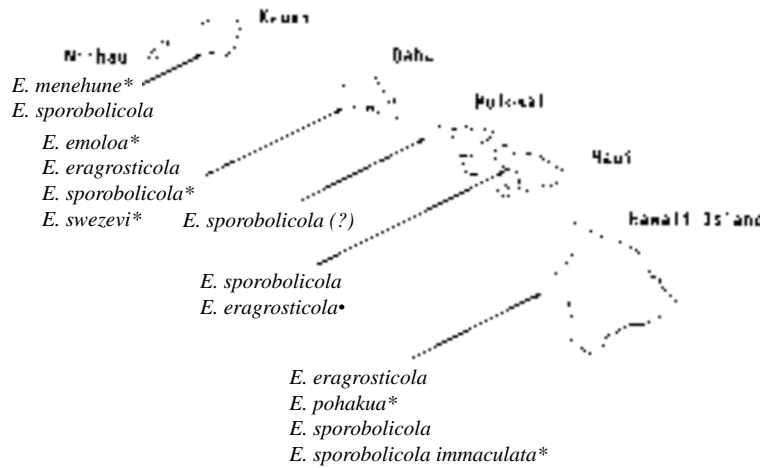
Geographical Distribution. HAWAIIAN IS: KAUAI, OAHU, MOLOKAI (new island record), MAUI, HAWAII. The record of *Kelisia sporobolicola* from Laysan Island as listed in the Hawaiian Terrestrial Arthropod Checklist (Nishida, 1994) is based on an error and subsequently deleted from the database (G. Nishida, Bishop Museum, Honolulu, personal communication).

Emoloana sporobolicola immaculata (Muir), new combination (Figs. 104–110, 141–148, 155, 156, 168)

Kelisia sporobolicola var. *immaculata* Muir, 1921: 509

Diagnosis. In size, coloration, and structures of the male and female genitalia well within the morphological range of *Emoloana sporobolicola* (see above). It differs only by the lack of dark granules in the tegmina, both in the brachypterous and macropterous form. The granules, if present, are concolorous with the veins. Body length: brachypters, from Kilauea: males 2.2–2.5 mm (2.37 ± 0.07 ; n=30), females 2.55–2.85 mm (2.66 ± 0.08 , n=20); from Hale Pohaku: males 2.2–2.25 mm (n=2), females 2.4–2.5 mm (n=3); macropters, from Pohakuloa: female 3.8 mm (n=1).

Type data. Holotype ♂ (BPBM No. 5053) and allotype ♀, examined, HAWAIIAN IS: **HAWAII**, Kilauea, Steam Crack, 3800 ft., 6.IX.1919, on *Deschampsia australis*, W.M. Giffard. Holotype and allotype in BPBM. Paratypes examined: 25♂, 8♀, same data as holotype; 2♂, 2♀, Kilauea, 4000 ft., 8.IX.1919, on *Deschampsia australis*, W.M. Giffard; 7♂, 3♀, *ibid.*, Crater Trail, 6.VIII.1919, on *Deschampsia australis*, no collector's name given but labels in Timberlake's handwriting). In BMNH, BPBM, HDOA, UHMH.

Figure 169. Geographical distribution of the *Emoloana*-species in the Hawaiian Islands.

*type locality is on the island

Non-type material. HAWAII: 1 nymph (4th instar), 2 nymphs (5th instar), same data as holotype. 41♂ (2♂ : slide No. 54 and 54A, dissection by F. Muir ?), 17♀, 3 nymphs (3rd instar), 1 nymph (4th instar), 6 nymphs (5th instar), Kilauea, 4000 ft., 28.VIII.1919, W.M. Giffard. 1♂, 1 nymph (5th instar), Kilauea, Crater Road, 3800 ft., 11.IX.1919, W.M. Giffard; 2♀, *ibid.*, 6.VIII.1919, on *Deschampsia australis*, no collector's name given (Timberlake's handwriting). 3♂, 3♀, Kilauea, VIII.1921, F. Muir. 2♂, 3♀, Hale Pohaku, 8500 ft., on "bunch grass", 18.VI.1966, J.W. Beardsley. 1♂ (macropterous), Pohakuloa, 1800 m, 2.V.1966, J.W. Beardsley. 1♂, 1♀, Ahumoia Crater, 21.VI.1966, on *Sophora* sp. (apparently accidentally on this plant), J.W. Beardsley. In BMNH, BPBM, UHMH.

Host plants. *Deschampsia australis* (Giffard, 1922; Zimmerman, 1948), ?*Vincentia angustifolia* (see Zimmerman, 1948), ?*Sophora* sp. (doubtful record).

Geographical Distribution. HAWAIIAN IS: HAWAII.

Remarks on *Emoloana sporobolicola* (Kirkaldy) sensu lato. *Emoloana sporobolicola* s.l. is represented on all major Hawaiian Islands (except Niihau, Lanai, and Kahoolawe), and is the most widely distributed species in the genus. Remarkably, this taxon displays a fairly large range of variation in morphology (e.g., body size, tegmina, male genitalia) and coloration within the same and among different populations of the same and different islands. It also shows the widest range of host plant records: it has been associated with at least 5 grass species (*Deschampsia australis*, *Eragrostis atropioides*, *Gahnia* sp., *Sporobolus virginicus*, *Vincentia angustifolia*). Ecologically, it appears to be rather diverse, as it occurs from comparatively dry lowland biotopes as in Oahu to moist montane biotopes such as in the Haleakala Canyon rim on Maui or in the Kilauea region on Hawaii Island. Whether *E. sporobolicola* represents a single widely distributed species, or whether it consists of a group of sibling species cannot be decided on mere morphological grounds (see Discussion). Therefore, for the time being, I suggest maintaining the subspecific status of "*Emoloana sporobolicola immaculata*".

Discussion

The genus *Emoloana* exhibits a notable degree of differentiation, especially in genital characters. Based on the morphological data presented here, *Emoloana* contains at least six species (and 1 subspecies) which can be assigned to three groups: 1) the *E. emoloa*-group with 3 species—*E. emoloa* from Oahu, *E. eragrosticola* from Maui, Oahu, and Hawaii, and *E. pohakua* from Hawaii, 2) the *E. swezeyi*-group with 2 species—*E. swezeyi* from Oahu and *E. menehune* from Kauai, and 3) the *E. sporobolicola*-group with 1 (?) very variable species, *E. sporobolicola*, reported from nearly all the Hawaiian Islands and a subspecies *E. sporobolicola immaculata* from Hawaii. The *E. emoloa*-group is represented on Oahu, Maui, and Hawaii, the *E. swezeyi*-group is confined to Kauai and Oahu, and the *E. sporobolicola*-group is distributed over nearly all the high Hawaiian Islands. Geographically arranged, the *Emoloana* species show the following distribution pattern (species name asterisked if the type locality is on the corresponding island; see Fig. 169): Kauai has 2 species of 2 morphological groups (*E. menehune*; *E. sporobolicola*), Oahu 4 species of all 3 morphological groups (*E. emoloa*, *E. eragrosticola*; *E. swezeyi*; *E. sporobolicola*), Molokai 1 (?) species of 1 morphological group (*E. sporobolicola* s.l.), Maui 2 species of 2 morphological groups (*E. eragrosticola*; *E. sporobolicola*), and Hawaii Island at least 3 species of 2 morphological groups (*E. eragrosticola*, *E. pohakua*; *E. sporobolicola* s.l. incl. subspecies *immaculata*).

The origin and phylogenetic relationships of these morphological groups are difficult to judge. Similarities in morphology and color patterns coupled with the isolated geographic position of the archipelago suggests that a single ancestral *Emoloana* species colonized the Hawaiian Islands. The genus *Emoloana* appears to be confined to the Hawaiian Islands, and as no close relatives were found elsewhere, the geographic origin of the ancestral population is obscure. It is conceivable that after their first arrival on the Hawaiian Islands, due to character release and founder effects (as studied in the Hawaiian *Drosophila* species, see e.g., Carson and Templeton, 1984; Kaneshiro, 1989; Templeton, 1980), descendants of the founder species have evolved in different directions leading to a mosaic-like mixture of characters. Muir (1919) considered the genitalia of *E. eragrosticola* as the “transmission from *K. swezeyi* and *K. sporobolicola* to *K. emoloa*”, probably assuming a morphological transition from the slender, elongate and strongly curved *E. swezeyi*-aedeagus (which he regarded as „primitive“?) over a shorter and less curved *E. sporobolicola*-aedeagus to the straight aedeagus of *E. eragrosticola* and *E. emoloa*. Alternatively, if we regard a species of the *E. emoloa*-group (e.g., the comparatively widespread *E. eragrosticola*) as most „primitive“, then phylogenetic reasoning supports the opposite conclusion: a straight aedeagus with a terminally dilated area around the phallotreme may be taken as plesiomorphic. From this model a stepwise prolongation of the aedeagal shaft with development of a blade-like apex and the dislocation of the phallotreme to a subapical position may have derived, first leading to a configuration as present in *E. sporobolicola*, and from this leading to the *E. swezeyi*-group. Finally, if *E. sporobolicola* represents the morphological configuration of the ancestral species, then we may regard a curved but comparatively short aedeagus with a blade-like apex and an oblique and a marginal row of small teeth as plesiomorphic. From this model both of the other groups would have derived: the *E. swezeyi*-group by the prolongation and stronger basal bending of an otherwise similar aedeagus, and the *E. emoloa*-group by the reduction of the terminal blade-like apex, the straightening of the shaft, and the dilation of the phallotreme bearing area. None of the three alternatives is entirely convincing. However, the third hypothesis which posits *E. sporobolicola* as the most plesiomorphic species, is not unlikely as the apically truncate processes of the anal segment is probably an apomorphic character.

It is remarkable that nearly all individuals of Hawaiian *Emoloana* are brachypterous and thus limited in their dispersal capability. This group of insects would therefore be ideal for

testing the “habitat dimensionality-flight capability hypothesis” sensu Denno (e.g., Denno et al., 1989; Denno, 1993) as all *Emoloana* species are bound to low profile habitats, which is in contrast to the normally arboreal habitats of the mostly macropterous Hawaiian “alohine” delphacids.

A phylogenetic analysis of *Emoloana* seems appropriate only if all the species can be regarded as biologically well defined. The *E. sporobolicola*-group is very problematic. Two models could explain the rather high morphological variation within this group: 1) this taxon may represent a single polymorphic, relatively euryoecious and widely distributed species; however, 2) it is equally conceivable that *E. sporobolicola* s.l. represents a group of closely related, but biologically well separated species that, at least on Hawaii Island, occur sympatrically and even syntopically (e.g., in the Kilauea-region “*E. sporobolicola*” and “*E. sporobolicola immaculata*” occur at the same locality and on the same host plant). Also local hybridization between morphologically and ecologically similar taxa cannot be excluded if reproductive barriers are still low. Based on morphology alone, the degree of speciation and direction of evolution within *Emoloana* cannot be determined. Clarification within the *E. sporobolicola*-group and in its congeners requires genetic and biosystematic study including the analysis of the species-specific communication signals. Recent biosystematic studies of Asian, European, and North American Delphacidae (e.g., *Nilaparvata* Stål (e.g., Claridge et al., 1985) *Muellerianella* Wagner (e.g., Booji, 1982; Drosopoulos, 1977, 1985), *Javesella* Fennah (e.g., Strübing and Hasse, 1975; de Vrijer, 1984, 1986), *Ribautodelphax* (e.g., den Bieman, 1986, 1988; de Winter, 1992, de Winter and Rollenhagen, 1990), and *Prokelisia* Osborn (Heady and Denno, 1991)), have revealed a high potential of newly developed methodologies for clarifying specific status and phylogenetic relationships in closely related taxa.

The morphological results presented here are considered preliminary to understand the only endemic Hawaiian delphacids associated with native grasses, and are meant as an encouragement for further genetic and biosystematic research.

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