

PSOCOPTERA OF THE TONGAN ARCHIPELAGO

By I. W. B. Thornton¹

Abstract. Thirty-five species of psocopterans are recorded as a result of collecting on the Tongan islands of Vava'u, Tongatapu and Eua. Of these, 8 are newly described. The relationships of the Tongan species are discussed, and a comparison is made between the psocopteran faunas on Tonga and Fiji.

The Tongan islands form the northern part of a typical island arc-trench system (the Tonga-Kermadec arc) associated with the underthrusting of the Australian plate by the Pacific plate. This arc was probably continuous with the more northerly Solomons–New Hebrides arc and originated in Eocene times at about the time that Australia began to rift from Antarctica (Packham 1973, Gill & Gorton 1973). In the Miocene the arc fractured, and the northern part of the system experienced a change in polarity, the trenches being reversed to the southern sides of the arcs. Probably contemporaneously there began some spreading in the Fiji Plateau area, and a splitting along the length of the Tonga-Kermadec arc occurred at the end of the Miocene, leaving the Lau-Colville ridge as a “third arc” (Karig 1970) and creating an active inter-arc basin, the Lau-Havre Trough. The activity of this dilational basin may have resulted in a movement of the Tongan arc-trench system eastwards. Gill & Gorton (1973) propose that the separation of Fiji from Tonga occurred during the last 5.5-million years, whereas the Fiji-New Hebrides separation may be older.

The Tongan Archipelago is now a double line of islands running approximately N–S, those on the west consisting of active volcanoes associated with subduction. The whole archipelago comprises only 697 km² of land. The eastern line of islands, the Vava'u, Ha'apai, and Nomuka groups, Tongatapu and Eua, are covered with coralline limestone, but on Eua pre-Upper Eocene volcanic rocks are exposed, which may date from the inception of the arc (Ewart & Bryan 1973). The pre-Eocene volcanic basement of Eua, and presumably of the other eastern islands, was followed by a sedimentary sequence, with uplift in the late Miocene to early Pliocene and further volcanism in the Late Tertiary to Quaternary (Chase 1971, Packham 1973).

From what is now known of the geology of the region, it seems unlikely that there was subaerial land in the Tonga region before the Pliocene.

This is the first report of Psocoptera from the Tongan Archipelago.

In January 1973 I collected for psocopterans on Tongatapu (5 collecting days), Eua (3 days) and the Vava'u group (4 days), and found a total of 35 species (18 genera; 10 families). Eua (87 km²) reaches 329 m, 'Uta Vava'u (90 km²) 198 m, Pangai

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Motu of the Vava'u group (9 km²) 88 m, and Tongatapu (257 km²) 82 m. Of the 35 species, 8 are described below for the first time; the majority of the remainder consists of 18 species widely distributed in the Pacific, and 9 species are otherwise known only from Fiji. The relationships of the Tongan species and a comparison of the Tonga fauna with that of Fiji, which is now fairly well known (Thornton 1981a), will be discussed in the final section of this paper.

In the systematic section, the following abbreviations are used: AMS—Australian Museum, Sydney; BISHOP—Bishop Museum, Honolulu; I.O.:D—ratio of interocular distance to diameter of eye as measured by Badonnel and described in Ball (1943); FW—fore wing length; HW—hind wing length; F—hind femur length; T—hind tibia length; t₁—length of basal hind tarsal segment; t₂—length of 2nd hind tarsal segment; t₃—length of 3rd hind tarsal segment; ct—number of ctenidia on basal hind tarsal segment; f₁—length of basal flagellar segment; f₂—length of 2nd flagellar segment. Lengths are in millimetres.

Unless otherwise indicated, all specimens were collected by me (IWB.T).

SYSTEMATICS

Family LEPIDOPSOCIDAE Pearman, 1936

Genus **Echmepteryx** Aaron

Echmepteryx Aaron, 1886: 17. Type-species: *Amphientomum hageni* Packard.

Echmepteryx (Thylacopsis) lunulata Thornton, Lee & Chui

Echmepteryx (Thylacopsis) lunulata Thornton, Lee & Chui, 1972: 64–66.—Thornton & Woo, 1973: 6.

Specimens examined. TONGATAPU: 1 ♀, Fatai, *ex* mango tree, 5.I.1973; 1 ♀, Matalikufiri, mango, 5.I.1973. EUA: 1 ♀, Ohonua, nr shore, *Citrus*, 11.I.1973; 1 ♂, 2 ♀, Ha'atu'a, 150 m, mango, 12.I.1973. VAVA'U: 1 ♀, 'Uta Vava'u I, nr Longomapu, 250 m, 7.I.1973.

This species, occurring also in the Chagos Archipelago in the Indian Ocean and in the Pacific on the Bonins, Marianas, Carolines, Marshalls, and Galapagos groups, is present also in Fiji, chiefly on introduced plants. It also occurs in Hawaii (Thornton 1981b). The differences between *E. lunulata* and other similar species from Australia, Africa and Jamaica are discussed by Thornton (1981a).

Echmepteryx (Thylacopsis) madagascariensis (Kolbe)

Thylax madagascariensis Kolbe, 1885: 184.

Echmepteryx (Thylacopsis) albidus (Badonnel): Smithers, 1965: 75.

Echmepteryx albida (Badonnel): Turner, 1975: 537.

For additional synonymy see Thornton & Woo, 1973: 7.

Specimens examined. TONGATAPU: 15 ♀, Pea, dead banana leaves, 5.I.1973. EUA: 1 ♀, Ohonua, nr shore, *Citrus*, 11.I.1973; 5 ♀, Ha'atu'a, 140 m, 12.I.1973. VAVA'U: 3 ♀, 'Uta Vava'u I, Neiafutahi village, palm-thatched "fale," 6.I.1973; 2 ♀, 'Uta Vava'u

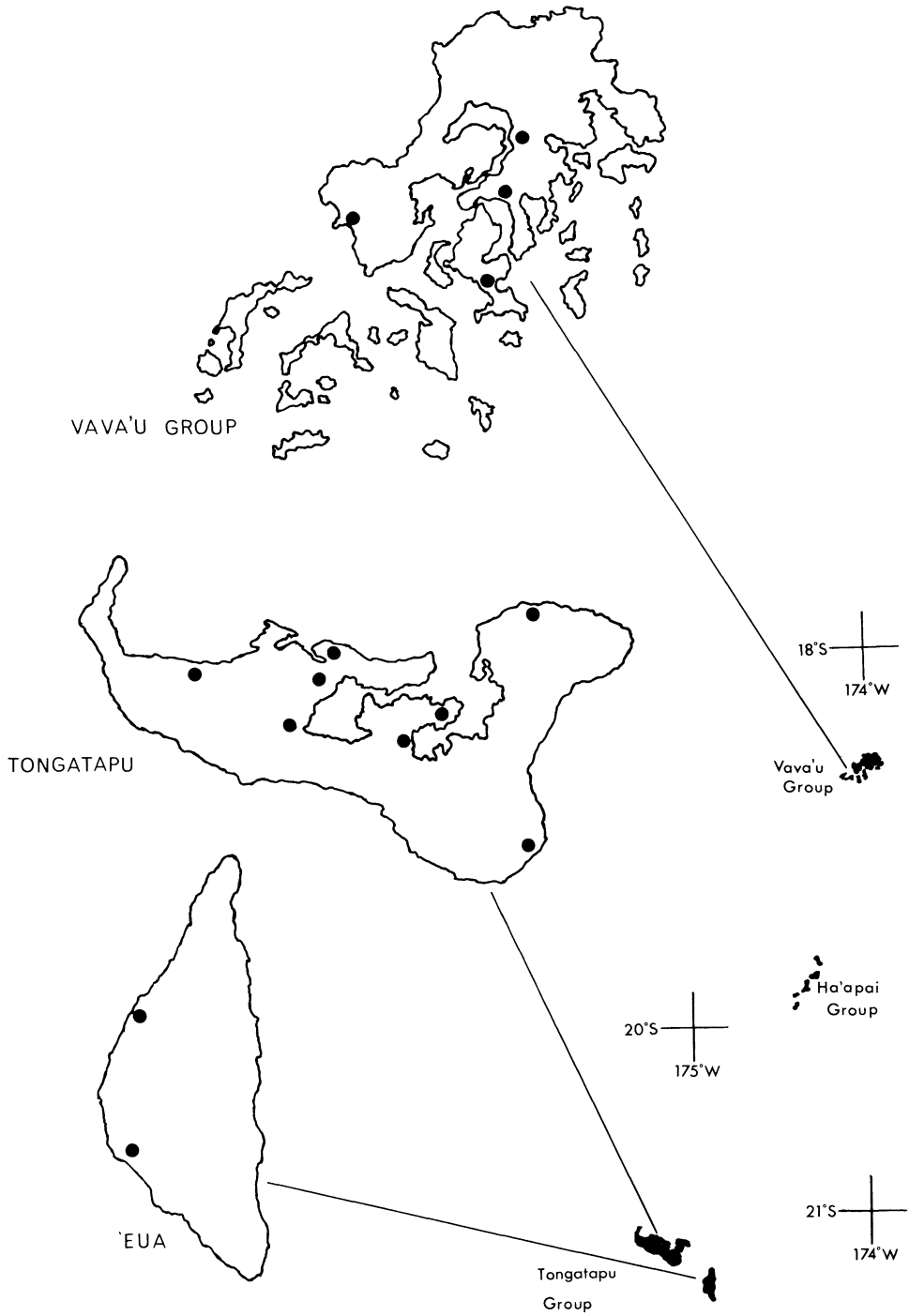


FIG. 1. The eastern Tongan islands showing sites at which Psocoptera were collected.

I, Ene'io Beach, 7.I.1973; 4 ♀, 'Uta Vava'u I, Ene'io Beach, 7.I.1973; 4 ♀, 'Uta Vava'u I, Neiafutahi village, dead banana leaves, 9.I.1973.

This species of ephemeral habitats occurs in Fiji and is widespread in the tropics, having been collected in West Africa, Madagascar, Seychelles, Chagos Archipelago, Hong Kong, Bonins, northern and southern Marianas, Australia, Galapagos, Chile and Jamaica. I have also collected it in Hawaii (Thornton 1981b).

Genus *Lepidopsocus* Enderlein

Lepidopsocus Enderlein, 1903a: 328. Type-species: *Lepidopsocus nepticulides* Enderlein.

Lepidopsocus dindus Thornton

Lepidopsocus dindus Thornton, 1981a: 14–15.

Specimens examined. VAVA'U: 3 ♀, 'Uta Vava'u I, Neiafutahi village, 6.I.1973.

This species was described from Fiji.

Lepidopsocus euaensis Thornton, new species

FIG. 2–5

♀. *Coloration* (freshly killed, in alcohol). Head light buff, patterned with brown as in FIG. 2. Maxillary palps dark brown apart from apical segment brown. Prothoracic dorsum light brown with brown posterior margin. Legs: coxa brown, trochanter and basal ¼ of femur pale buff, rest of femur brown, tibia pale buff with a subbasal and a subapical brown band, tarsal segments brown apart from basal segment fading to light brown apically. Fore wings pale brown with brown clouds as in FIG. 3. Hind wing as in FIG. 4. Abdomen buff.

Morphology. I.O.:D = 1.5:1. Flagellum broken, segments at least 3× as long as broad, at least 28 segments. Thoracic terga waxy. Fore wing with small narrow lanceolate and asymmetrical scales on small bosses, and large stout sharply pointed setae on large bosses (FIG. 3, paratype). Claw with distinct small subapical tooth. Basal hind tarsal segment with 18 ctenidia, rasp of Pearman's organ present. Coxal interlocking device on middle legs, peg on left. Epiproct semicircular, setose; paraproct with long curved spine, field of 5 trichobothria and 2 setae not in rosette sockets. Gonapophyses as usual for the genus (FIG. 5).

Dimensions. B 1.90, FW 2.29, HW 1.84, F 0.54, T 0.92, t₁ 0.34, t₂ 0.07, t₃ 0.07, f₁ 0.043, f₂ 0.04.

♂. Unknown.

Holotype ♀, EUA: above Ana'ahu, 230 m, 12.I.1973, IWBT (BISHOP 11,789). Paratypes: 2 ♀, EUA: Ha'atu'a, 130 m, mango, 12.I.1973, IWBT (AMS).

Other specimen examined. EUA: 1N, same data as holotype.

In head pattern *L. euaensis* is quite distinctive and differs from any of the Tongan or Fijian species of *Lepidopsocus*.

Lepidopsocus fasciatus Thornton

Lepidopsocus fasciatus Thornton, 1981a: 15–17.

Specimens examined. TONGATAPU: 2 ♀ (1 typical, 1 dark), Fatai, mango, 5.I.1973; 2 ♀ (typical), Matalukufiri, 5.I.1973; 1 ♀ (typical), Manuka, 10.I.1973; 2 ♀ (1 dark, 1 typical), Kauvai, *Citrus*, 14.I.1973; 2 ♀ (1 dark, 1 typical), Oholei, dead branches, 15.I.1973. EUA: 3 ♀ (1 dark, 2 typical), Ohonua, nr shore, 11.I.1973; 1 ♀ (typical), above Ana'ahu, 230 m, 12.I.1973. VAVA'U: 1 ♀ (dark), 'Uta Vava'u I, Neiafutahi village, 6.I.1973; 5 ♀, 1N (2 ♀, 1N typical, 3 ♀ dark), 'Uta Vava'u I, nr Longomapu, 160 m, 7.I.1973.

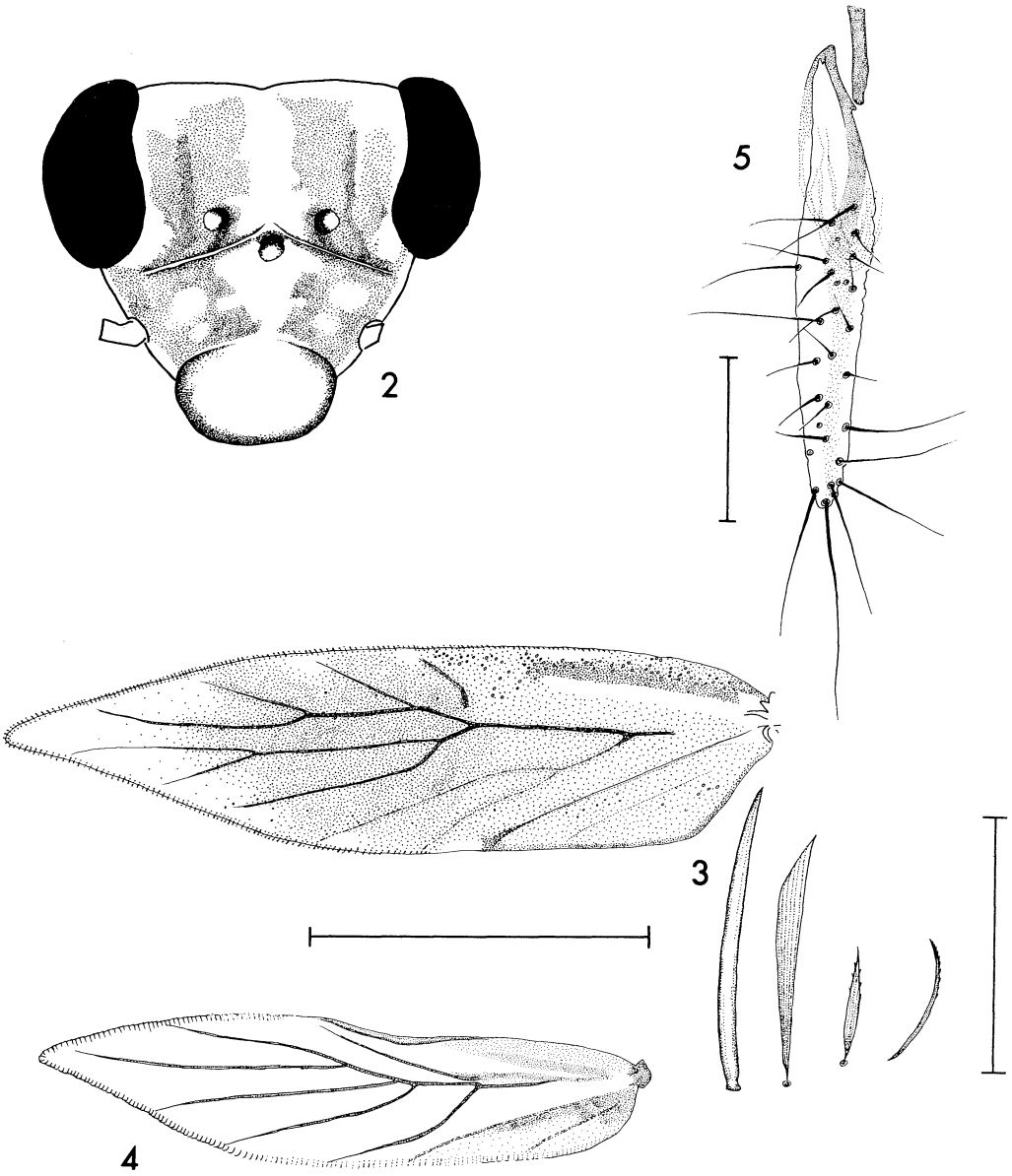


FIG. 2-5. *Lepidopsocus euaensis*, ♀: 2, head pattern; 3, fore wing and (paratype) scales; 4, hind wing; 5, gonapophyses. Head not to scale. Scale for wings 1.0 mm, other scales 0.1 mm.

This dimorphic species also occurs in Fiji and Hawaii (Thornton 1981b). The nymphs are evidently all the same, but the females (male unknown) are of 2 forms, the typical and dark. On Tonga, as in Fiji and Hawaii, both forms were collected on 5 occasions in the same collection.

Lepidopsocus immaculatus Thornton, new species

FIG. 6–10

♂. *Coloration* (freshly killed, in alcohol). Head pale buff, patterned with brown as in FIG. 6. Antennae and maxillary palps pale buff. Thoracic terga pale buff, 2 narrow dark gray stripes down each side of thorax. Legs pale buff, femur with subapical brown patch, tibia with subapical and subbasal brown bands, basal tarsal segment darker basally. Fore wing very pale buff, hind wing hyaline. Abdomen pale buff, short gray-brown transverse bands laterally between basal 4 segments.

Morphology. I.O.:D = 2.0:1. Flagellum with at least 41 segments, segments 4× as long as wide. Thoracic terga waxy. Middle legs with coxal interlocking device, peg on left. Basal hind tarsal segment with 16 ctenidia. Claw with distinct subapical tooth. Fore wing (FIG. 7) with 3 types of scales: setoid, narrow lanceolate, asymmetrical pointed. Hind wing as in FIG. 8. Epiproct semicircular, setose. Paraproct with field of 6 trichobothria and 1 seta not in rosette socket. Phallosome (FIG. 9) inner sclerites with 4 conical pegs.

Dimensions. B 1.5, FW 2.0, HW 1.54, F 0.59, T 0.84, t_1 0.299, t_2 0.069, t_3 0.050, f_1 0.032, t_2 0.035.

♀. *Coloration* (freshly killed, in alcohol). As ♂.

Morphology. I.O.:D = 1.5:1. As ♂ apart from only narrow lanceolate scales remaining on fore wing. Gonapophyses as in FIG. 10.

Dimensions. B 1.9, FW 2.15, HW 1.77, F 0.56, T 0.92, t_1 0.325, t_2 0.063, t_3 0.050, f_1 0.040, f_2 0.040.

Holotype ♂, TONGATAPU: Matalikufiri, beating *Citrus* and mango, 5.I.1973, IWB (BISHOP 11,790). Allotype ♀, same data as holotype (BISHOP). Paratypes: 9♀, 1♂, same data as holotype; 7♀, TONGATAPU: Fatai, mango, 5.I.1973; 2♀, EUA: Ha'atu'a, 130 m, mango, 12.I.1973 (AMS).

In head pattern *L. immaculatus* recalls *L. oweni* Thornton and *L. nausoriensis* Thornton from Fiji, although it differs from both consistently in pattern details. The ornamentation of the phallosome sclerites is also distinctive.

Lepidopsocus maculatus Thornton, Lee & Chui

Lepidopsocus maculatus Thornton, Lee & Chui, 1972: 68–70.—Thornton & Woo, 1973: 8–9.—Thornton, 1981a: 17–19.

Specimens examined. TONGATAPU: 2♀, Fatai, mango, 5.I.1973; 2♀, Pea, *Araucaria*, 5.I.1973; 1♀, Matalikufiri, 5.I.1973; 8♀, 4N, Manuka, 10.I.1973; 2♀, 3N, Kufu'alofa, 13.I.1973; 1♀, Kauvai, *Citrus*, 14.I.1973; 8♀, Oholei area, dead branches, 15.I.1973. EUA: 7♀, 2N, Ohonua, nr shore, 11.I.1973; 7♀, Mata'aha, 230 m, 12.I.1973; 2♀, Ha'atu'a, 230 m, mango, 12.I.1973; 1♀, above Ana'ahu, 330 m, 12.I.1973. VAVA'U: 1♀, 'Uta Vava'u I, nr Longomapu, 140 m, 7.I.1973; 1N, Pangai Motu I, Pangai Motu, 8.I.1973.

This species, known from the southern Marianas and the Galapagos, occurs in Hawaii (Thornton 1981b), as well as in Fiji, where the closely related *L. pseudomaculatus* Thornton also occurs. *L. pseudomaculatus*, which appears to be confined to the highlands of Viti Levu, has not been found in the Tonga group.

Lepidopsocus pretiosus (Banks)

Echmepteryx pretiosa Banks, 1942: 28.—Thornton et al., 1972: 70.

Lepidopsocus pretiosus (Banks): Thornton, 1981a: 28.

Specimen examined. VAVA'U: 1♀, 'Uta Vava'u I, Neiafutahi village, palm-thatched fale, 6.I.1973.

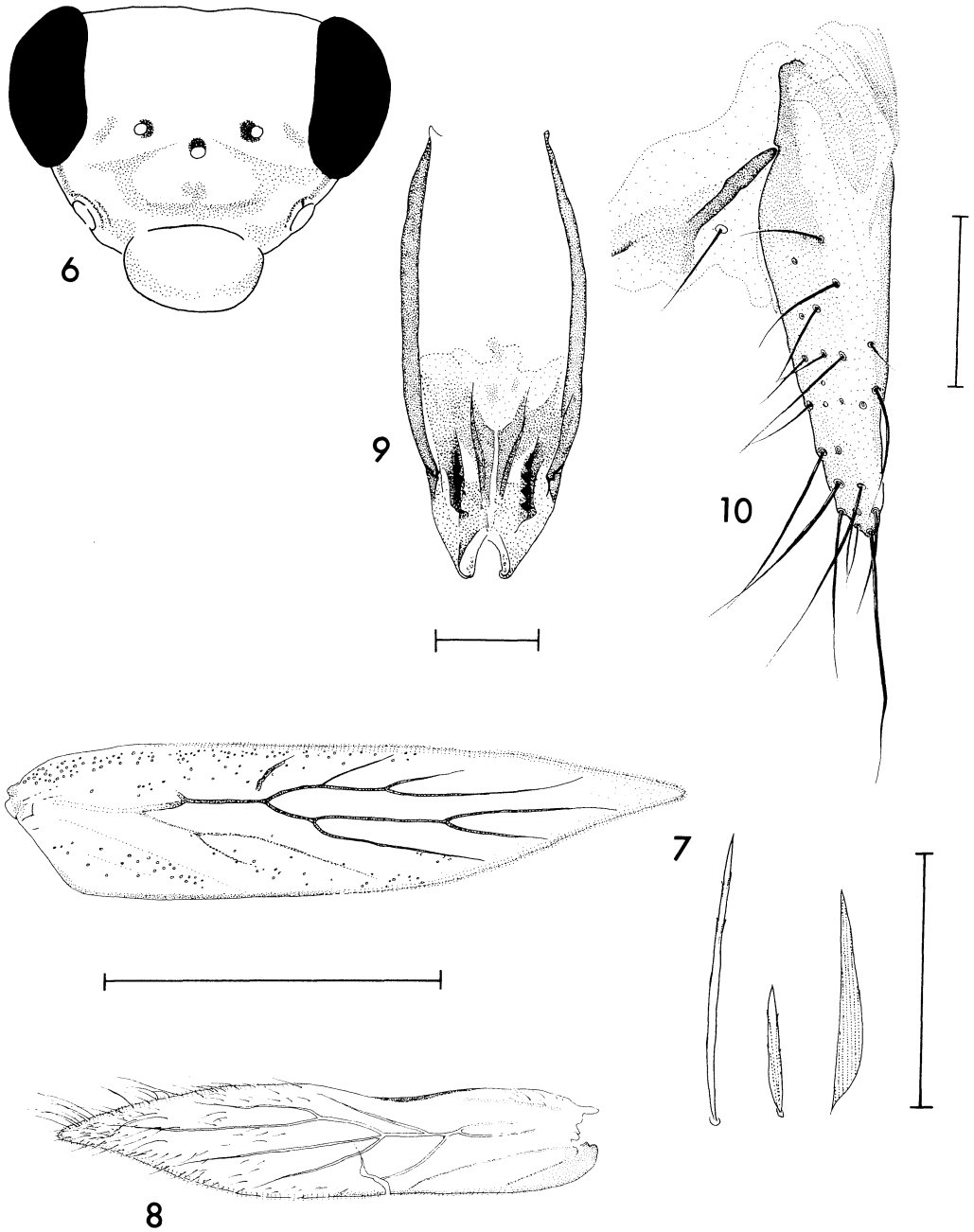


FIG. 6-10. *Lepidopsocus immaculatus*, ♂: 6, head pattern; 7, fore wing and scales; 8, hind wing; 9, phallosome; ♀: 10, gonapophyses. Head not to scale. Scale for wings 1.0 mm, other scales 0.1 mm.

This species is widespread in Micronesia and was found in the lowlands of Fiji. It occurs mainly on introduced plants.

Lepidopsocus stradus Thornton, new species

FIG. 11–16

♂. *Coloration* (freshly killed, in alcohol). Head cream, patterned as in FIG. 11, maxillary palps cream; scape and pedicel brown, flagellum light brown. Thorax light brown, legs cream with the following brown: coxa, femur apically, 2 tibial bands, basal tarsal segment basally, remaining tarsal segments. Fore wing (FIG. 12) with extensive brown clouds except basally and apically; hind wing (FIG. 13) hyaline. Abdomen buff.

Morphology. I.O.:D = 2.5:1. B = 1.3 mm. Fore wing as in FIG. 12. Basal hind tarsal segment with 18 ctenidia. Phallosome (FIG. 15) with long internal sclerites bearing minute triangular pegs well spaced, and with a roughened appearance apically. Paraproct with 6 trichobothria and 1 seta without a rosette socket. Broad longitudinal tract of very long stout setae along middle of abdomen ventrally (FIG. 14).

Dimensions. FW 2.08, HW 1.79, F 0.62, T 0.88, t_1 0.37, t_2 0.06, t_3 0.06, f_1 0.032, f_2 0.036.

♀. *Coloration* (freshly killed, in alcohol). As ♂.

Morphology. I.O.:D = 2.0:1. B = 1.5 mm. Sixteen ctenidia on basal hind tarsal segment. No setose abdominal tract. Gonapophyses as in FIG. 16, otherwise as ♂.

Dimensions. FW 2.30, HW 1.76, F 0.60, T 0.83, t_1 0.34, t_2 0.06, t_3 0.06, f_1 0.036, f_2 0.041.

Holotype ♂, EUA: Ha'atu'a, 230 m, mango, 12.I.1973, IWBT (BISHOP 11,791). Allotype ♀, same data as holotype (BISHOP). Paratypes: 7 ♀; 7 ♂, same data as holotype (AMS).

Other specimens examined. TONGATAPU: 1 ♀, Fatai, mango, 5.I.1973; 1 ♀, 1N, Pea, *Araucaria*, 5.I.1973; 3 ♀, 1N, Manuka, 10.I.1973; 4 ♀, Nuku'alofa, *Citrus*, 13.I.1973; 4 ♀, 1 ♂, Oholei area, dead branches, 15.I.1973; 4 ♀, Nuku'alofa area, living branches, 15.I.1973. EUA: 1 ♀, Ohonua, nr shore, *Citrus*, 11.I.1973; 3 ♀, Mata'aha, 230 m, 12.I.1973; 3 ♀, 4 ♂, above Ana'ahu, 330 m, dead banana leaves, 12.I.1973. VAVA'U: 1 ♀, 'Uta Vava'u I, Neiafutahi village, 6.I.1973; 2 ♀, 'Uta Vava'u I, nr Longomapu, 230 m, 7.I.1973; 1 ♀, 1N, Pagai Motu I, Pangai Motu, 8.I.1973; 1 ♀, 'Uta Vava'u I, Neiafutahi village, sea level, 9.I.1973.

In head pattern this species has some features of *L. marmoratus* (Banks) (vertex markings) and some of *L. maculatus* (frons markings), while the fore wing pattern is much more like that of *L. maculatus*. The species differs from *L. maculatus* most noticeably in the length of the phallosome sclerites and the presence in the male of a broad longitudinal tract of very long setae down the middle of the abdomen ventrally, a character that has not been noted, so far as I am aware, in any other lepidopsocid.

Lepidopsocus tibialis Thornton

Lepidopsocus tibialis Thornton, 1981a: 35.

Specimens examined. TONGATAPU: 2 ♀, Nuku'alofa area, living branches, 15.I.1973.

This pale, plain species is easily distinguished by the single dark brown band on the tibia. It was also found in Fiji.

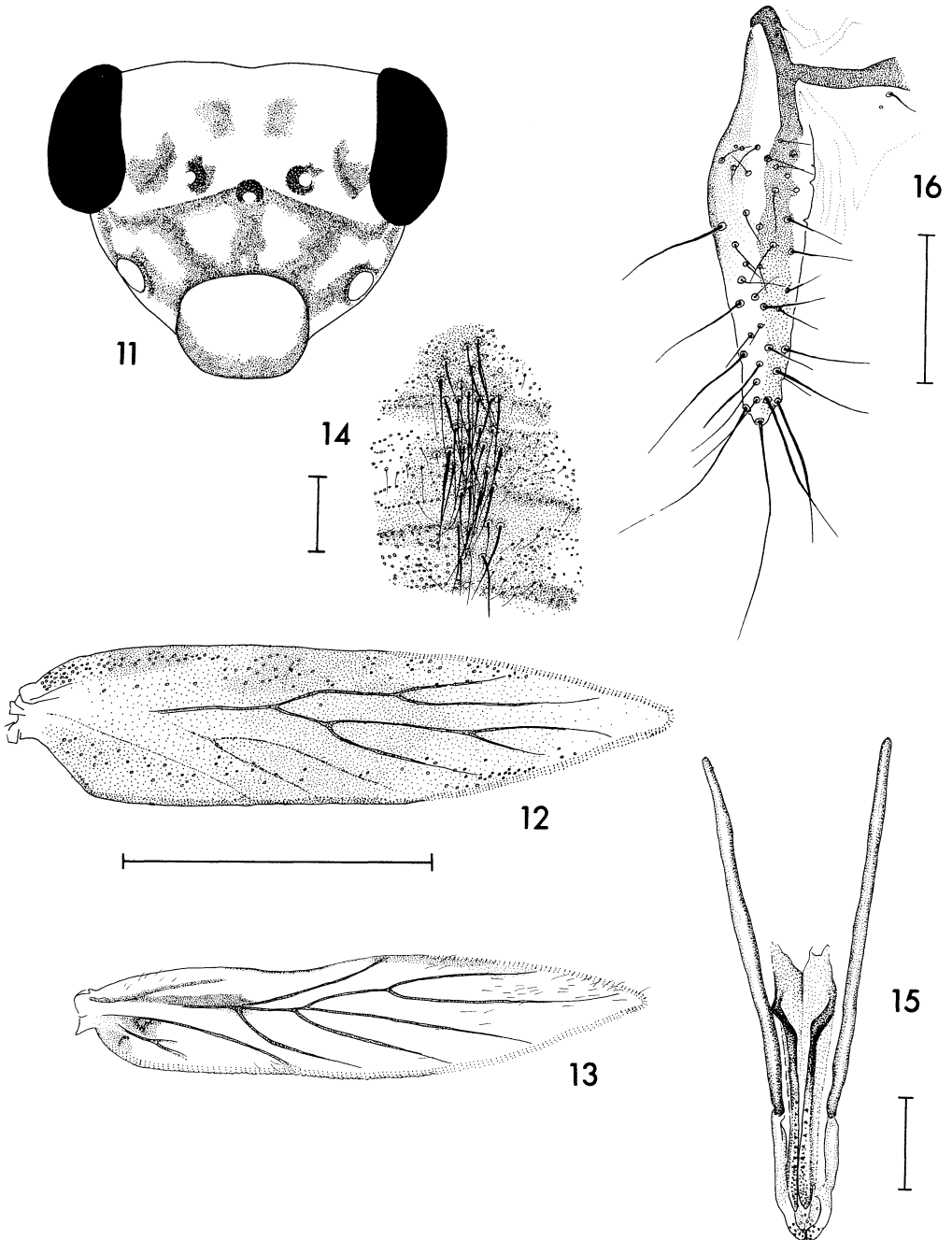


FIG. 11-16. *Lepidopsocus strabus*, ♂: 11, head pattern; 12, fore wing; 13, hind wing; 14, abdomen ventrally; 15, phallosome; ♀: 16, gonapophyses. Head not to scale. Scale for wings 1.0 mm, for genitalia and abdomen 0.1 mm.

Lepidopsocus tongensis Thornton, new species

FIG. 17–20

♀. *Coloration.* Head pale buff, marked with brown as in FIG. 17. Body otherwise pale buff, apart from 2 brown bands on tibia and base of basal tarsal segment brown. Fore wing (FIG. 18) uniformly very pale brown, hind wing (FIG. 19) hyaline.

Morphology. I.O.:D = 1.5:1. B = 1.8 mm. Basal hind tarsal segment with 14 ctenidia. Pearman's organ present and coxal interlocking device (peg on left). Gonapophyses as in FIG. 20. Paraproct with field of 6 trichobothria.

Dimensions. FW 2.15, HW 1.71, F 0.60, T 0.88, t_1 0.33, t_2 0.06, t_3 0.05, f_1 0.032, f_2 0.036.

♂. Unknown.

Holotype ♀, TONGATAPU: Fatai, mango, 5.I.1973, IWBT (BISHOP 11,792). Paratype, 1 ♀, same data as holotype (AMS).

Other specimens examined. VAVA'U: 1 ♀, 'Uta Vava'u I, nr Longomapu, 130 m, 7.I.1973. EUA: 1 ♀, Ha'atu'a, 130 m, mango, 12.I.1973.

The head pattern of this species is quite distinctive. It has not been found in Fiji.

Lepidopsocus torus Thornton

Lepidopsocus torus Thornton, 1981a: 35.

Specimens examined. TONGATAPU: 1 ♀, Fatai, mango, 5.I.1973; 1 ♀, Manuka, 10.I.1973.

This plain, unmarked, pale brown species also occurs in Fiji.

Family PSOQUILLIDAE Pearman, 1936

Genus **Rhyopsocus** Hagen

Rhyopsocus Hagen, 1876: 52.—Roesler, 1944: 130.—Badonnel, 1949: 29.—Mockford & Gurney, 1956: 357.

Type-species: *Rhyopsocus eclipticus* Hagen.

Deipnopsocus Enderlein, 1903b: 358.

Rhyopsocopsis Pearman, 1929: 107.

Rhyopsocus pandanicola Thornton, Lee & Chui

Rhyopsocus pandanicola Thornton, Lee & Chui, 1972: 74–76.

Specimen examined. VAVA'U: 1 ♀, 'Uta Vava'u I, Neiafutahi village, 6.I.1973.

This species, known from the southern Marianas and Marshall Is, has not been found in Fiji. In Micronesia it appears to be associated with *Pandanus*.

Family PACHYTROCTIDAE Pearman, 1936

Genus **Tapinella** Enderlein

Tapinella Enderlein, 1908: 772. Type-species: *Tapinella formosana* Enderlein.

Tapinella levuka Thornton

Tapinella levuka Thornton, 1981a: 38.

Specimens examined. VAVA'U: 2 ♀, 'Uta Vava'u I, Neiafutahi village, 6.I.1973.

T. levuka, a uniformly brown species without darker markings, also occurs on Ovalau, Fiji.

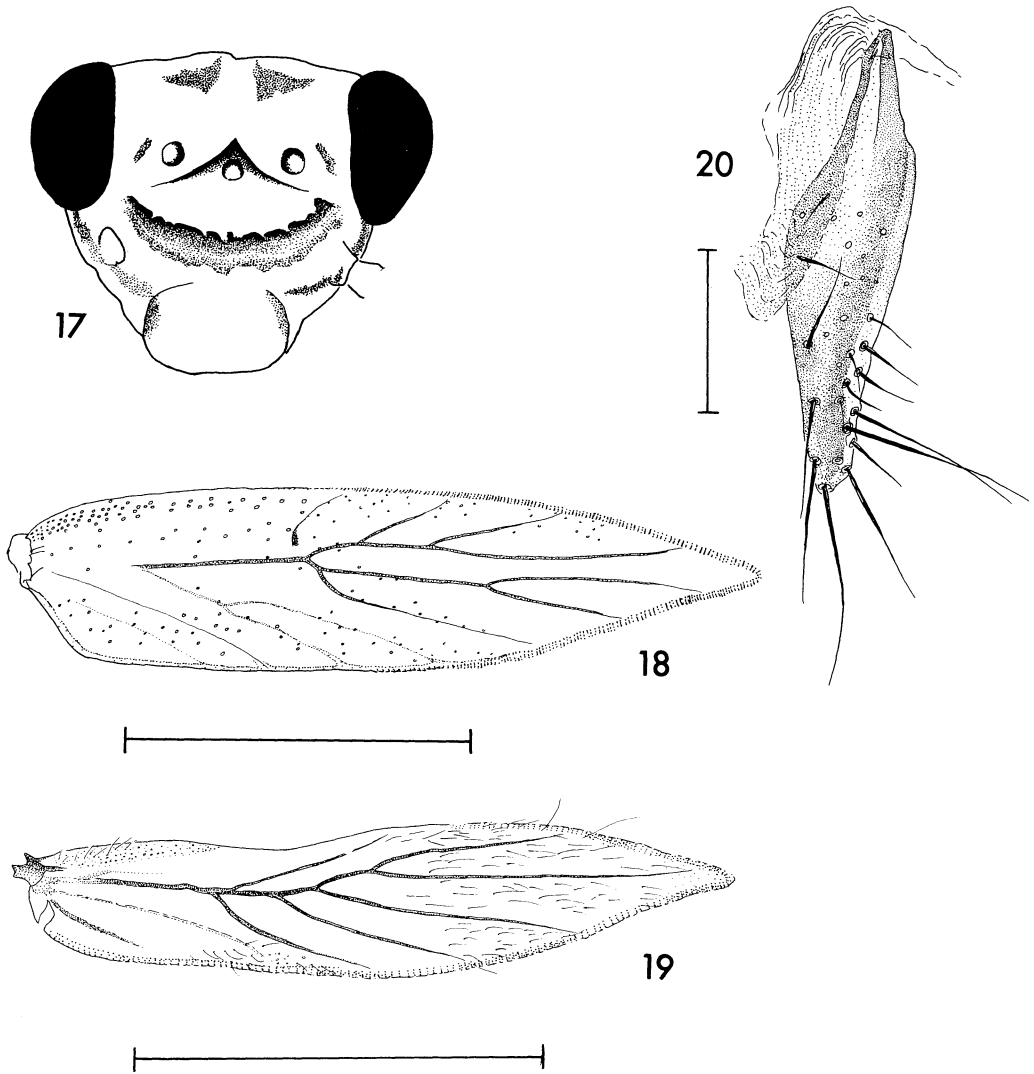


FIG. 17-20. *Lepidopsocus tongensis*, ♀: 17, head pattern; 18, fore wing; 19, hind wing; 20, gonapophyses. Head not to scale. Scales for wings 1.0 mm, scale for genitalia 0.1 mm.

Family CAECILIIDAE Pearman, 1936

Genus **Caecilius** Curtis

Caecilius Curtis, 1837: 648 (see Mockford, 1965). Type-species: *Psocus fuscopterus* Latreille.

Caecilius casarum Badonnel

Caecilius casarum Badonnel, 1931: 234.

Caecilius palmarum Mockford & Gurney, 1956: 361.

Specimens examined. VAVA'U: 1♂, 1♀, 'Uta Vava'u I, Neiafutahi village, 6.I.1973.

In Fiji this species occurs only on introduced plants up to 800 m. It is widespread in the tropics, occurring in coastal areas of the American tropics and subtropics, the southern United States, Mozambique, Hong Kong, New Guinea, Micronesia, Samoa, and Easter I. I have also collected it in Hawaii (Thornton 1981b).

Caecilius niunatus Thornton

Caecilius niunatus Thornton, 1981a: 40–43.

Specimens examined. TONGATAPU: 1♂, Fatai, mango, 5.I.1973; 1♂, 4♀, Manuka, 10.I.1973; 1♀, Nuku'alofa area, living branches, 15.I.1973. VAVA'U: 3♂, 9♀, 'Uta Vava'u I, Neiafutahi village, 6.I.1973; 1♂, 2♀, 'Uta Vava'u I, nr Longomapu, 130 m, 7.I.1973. EUA: 1♀, Ha'alu'a, 140 m, mango, 12.I.1973.

This species is also found in Fiji, predominantly in the lowlands on introduced plants.

Family ECTOPSOCIDAE Roesler, 1952

Genus **Ectopsocus** McLachlan

Ectopsocus McLachlan, 1899: 277. Type-species: *Ectopsocus briggsi* McLachlan. For synonymy see Thornton et al., 1972: 101.

Ectopsocus denervus Thornton & Wong

Ectopsocus denervus Thornton & Wong, 1968: 95–98.—Thornton et al., 1972: 104.

Specimens examined. EUA: 1♀, Ha'atu'a, 170 m, mango, 12.I.1973. VAVA'U: 2♂, 'Uta Vava'u I, Neiafutahi village, 6.I.1973; 1♂, same data except 9.I.1973.

This species is characterized by the lack (unusual in *Ectopsocus* species) of vein r_{2+3} in the hind wing. One male taken on 6.I.1973 has normal hind wing venation (i.e., vein r_{2+3} is present); the genitalia are close to those of *denervus* except that the prongs of the inner parameres are somewhat larger than usual. Possibly this specimen represents a separate species, but in the absence of further material it is for the present assigned to *E. denervus*.

The species is known from the Philippines, Micronesia, Fiji and Samoa. In all specimens so far collected (apart from the one mentioned above) vein r_{2+3} of the hind wing is lacking.

Ectopsocus fullawayi Enderlein

Ectopsocus fullawayi Enderlein, 1913: 356.
For synonymy see Thornton et al., 1972: 102.

Specimens examined. TONGATAPU: 1♂, Fatai, mango, 5.I.1973; 2♂, Manuka, 10.I.1973. EUA: 1♀, Ohonua, *Citrus* nr shore, 11.I.1973; 1♂, above Ana'ahu, 230 m, 12.I.1973. VAVA'U: 3♀, 'Uta Vava'u I, Neiafutahi village, *Citrus*, 6,9.I.1973; 1♀, 'Uta Vava'u I, nr Longomapu, 230 m, 7.I.1973.

This is a widespread central Pacific species, occurring in Fiji on the high islands of the western group, the Moala group and the Lau group. It is also present on Wake, Laysan, Hawaii, Samoa, Tubuai, Rapa, the Tuamotu archipelago, Pitcairn, Oeno, Mangareva, Henderson, and Easter I. It has not been collected in Micronesia.

Ectopsocus lambus Thornton, **new species**

FIG. 21–24

♀. *Coloration* (freshly killed, in alcohol). Head brown, epicranial suture dark brown. Frons slightly lighter than rest of head, a distinct pigment margin from below orbit to just posterior to ocelli, ocelli pale. Clypeus with faint striae. Antennal scape, pedicel and f_1 pale brown, rest of flagellum brown. Thorax brown, legs paler. Fore wing (FIG. 21) with distinct dark brown pigment pattern. Hind wing (FIG. 22) with faint clouds. Abdomen brown, narrow pale annuli between segments dorsally.

Morphology. I.O.:D = 3.0:1. B = 1.4 mm. Head waxy. Basal hind tarsal segment with 13 ctenidia, claw without subapical tooth. Rasp of Pearman's organ present. Fore wing margin bare, veins with single row of fine setae, veins *rs* and *m* with point junction. Hind wing bare. Subgenital plate (FIG. 23) bilobed, each lobe with 2 mesial stout long setae and 2 lateral fine shorter ones; a row of 6 long fine setae along apical margin of main plate. Gonapophyses (FIG. 24) ventral valve narrow, outer valve setose apically, dorsal valve fleshy. Paraproct with field of 8–9 trichobothria and row of 4 setae.

♂. Unknown.

Holotype ♀, EUA: nr shore, Ohonua, *Citrus*, 11.I.1973, IWBT (BISHOP 11,793).
1 ♀, paratype, same data (AMS).

This species is superficially similar to *E. perkinsi*, *E. fullawayi* and *E. spilotus*, which also occur in Tonga, and *E. dialeptus* Thornton & Wong from the Kermadecs. *E. lambus* may be readily distinguished from them by the 6 distinct large hyaline areas in the fore wing. On wing and genitalia characters, *E. lambus* appears to be a member of the *perkinsi* group (Thornton & Wong 1968), but without information on the male it is not possible to place the species with certainty.

Ectopsocus perkinsi Banks

Ectopsocus perkinsi Banks, 1931: 438.—Zimmerman, 1948: 235.—Thornton & Wong, 1968: 118–120.

Specimens examined. EUA: 1 ♀, 2 ♂, Ha'atu'a, mango, 12.I.1973. VAVA'U: 1 ♂, 'Uta Vava'u I, Neiafutahi village, sea level, 9.I.1973.

This patterned-wing species is similar to *E. fullawayi*, but its range in the Pacific appears to be more restricted (Hawaii, Fiji, Tonga, Samoa, Tubuai). On Fiji it is less common than *E. fullawayi* but occurs on the western group at elevations up to 1300 m. It is also present on the Lau group.

Ectopsocus spilotus Thornton & Wong

Ectopsocus spilotus Thornton & Wong, 1968: 107.

Specimens examined. TONGATAPU: +10 ♀, +10 ♂, Pea, *Araucaria*, 5.I.1973; 3 ♀, Manuka, 10.I.1973; 8 ♀, 3 ♂, Nuku'alofa, *Citrus*, 13.I.1973; 1 ♂, 'Oholei area, dead branches, 15.I.1973; 3 ♀, 1 ♂, Nuku'alofa area, living branches, 15.I.1973. EUA: 8 ♀, Ohonua, *Citrus* nr shore, 11.I.1973; 2 ♀, Mata'ahu, 170 m, 12.I.1973; 1 ♀, 1 ♂, Ha'atu'a, mango, 160 m, 12.I.1973; VAVA'U: +10 ♂, +10 ♀, 'Uta Vava'u I, Neiafutahi

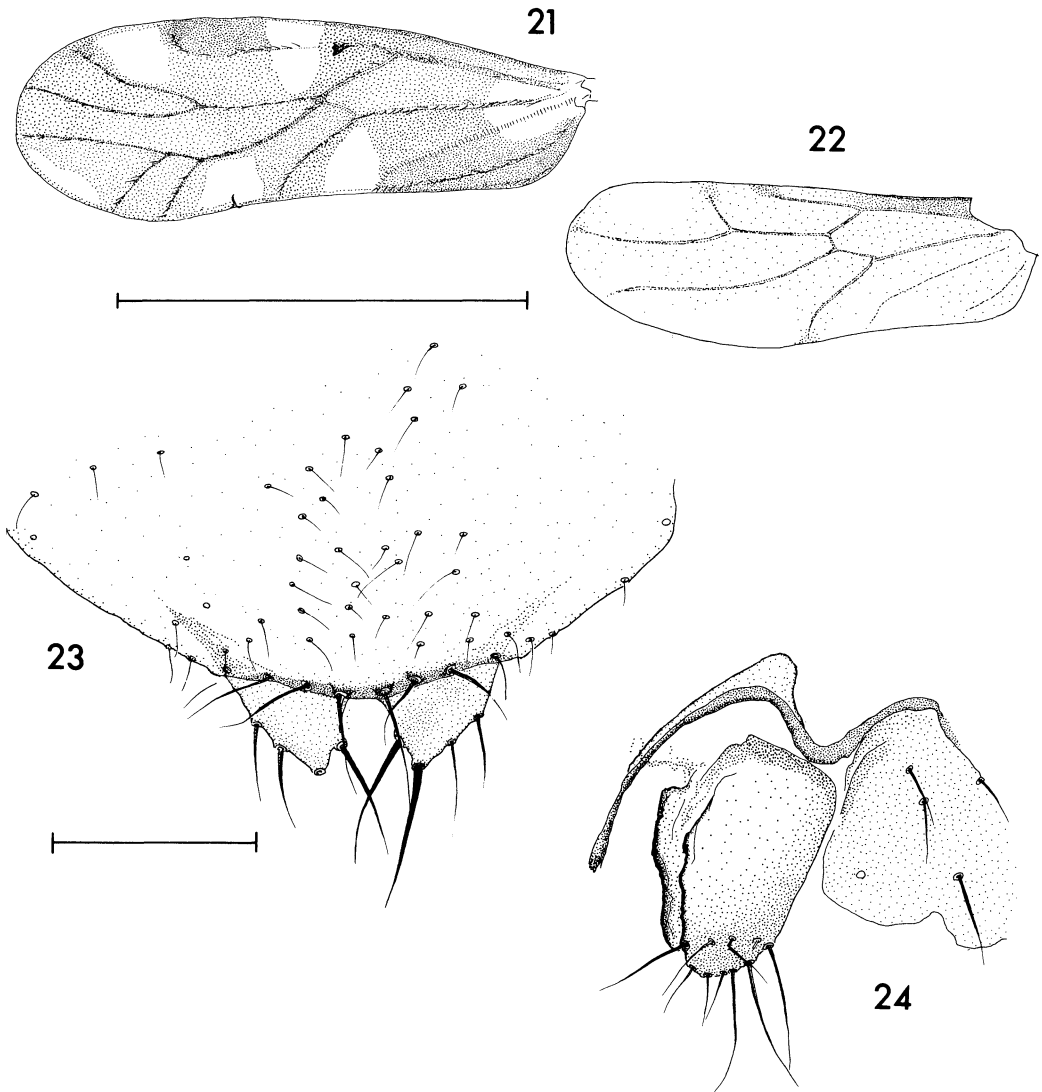


FIG. 21-24. *Ectopsocus lambus*, ♀: **21**, fore wing; **22**, hind wing; **23**, subgenital plate; **24**, gonapophyses. Scale for wings 1.0 mm, for genitalia 0.1 mm.

village, 6.I.1973; 3 ♀, 1 ♂, 'Uta Vava'u I, nr Longomapu, 160 m, 7.I.1973; 2 ♀, 2 ♂, 'Uta Vavau I, Ene'io Beach, 7.I.1973; 6 ♀, Pangai Motu I, Pangai Motu, 8.I.1973; +10 ♀, +10 ♂, 'Uta Vava'u I, Neiafutahi village, sea level, 9.I.1973.

Occurring also in the Marshalls, Gilberts, Hawaii, Fiji and Samoa, this is quite a common species in Tonga. On Viti Levu, Fiji, it was collected at 1300 m.

Family PERIPSOCIDAE Pearman, 1936
Genus **Peripsocus** Hagen

Peripsocus Hagen, 1866: 203. Type-species: *Psocus phaeopterus* Stephens.

Peripsocopsis Tillyard, 1923: 193.

Peripsocus ferrugineus Thornton & Wong

Peripsocus ferrugineus Thornton & Wong, 1968: 91–93.—Thornton et al., 1972: 107.

Specimens examined. TONGATAPU: 1 ♀, Manuka, 10.I.1973; 1 ♀, Nuku'alofa, *Citrus*, 13.I.1973. EUA: 1 ♀, Ha'atu'a, 170 m, mango, 12.I.1973. VAVA'U: 1 ♀, 'Uta Vava'u I, nr Longomapu, 160 m, 7.I.1973; 1 ♀, Pangai Motu I, Pangai Motu, 8.I.1973.

Similar to *Peripsocus maoricus* (Tillyard) from New Zealand, *P. ferrugineus* lacks the cloudy area in the center of the wing. It occurs also on the southern Marianas, Carolines (including atolls), Hawaii, Fiji, and Samoa.

Peripsocus pauliani Badonnel

Peripsocus pauliani Badonnel, 1949: 42.—Thornton & Wong, 1968: 20–22.—Thornton et al., 1972: 107–108.—Thornton & Woo, 1973: 32–33.

Specimens examined. TONGATAPU: 2 ♀, Nuku'alofa, *Citrus*, 13.I.1973. EUA: 1 ♀, Ohonua, *Citrus* nr shore, 11.I.1973; VAVA'U: 3 ♀, 'Uta Vava'u I, Neiafutahi village, 6.I.1973.

Evidently a widespread species, *P. pauliani* is known from Africa (Ivory Coast), Hong Kong, Malaya, Philippines, Volcanos, southern Marianas, Carolines, Marshalls, Fiji, and the Galapagos Is. Males have not been found; the species is probably parthenogenetic.

Peripsocus similis Enderlein

Peripsocus similis Enderlein, 1903a: 290 (nec Badonnel, 1955).

For full synonymy see Thornton & Wong, 1968: 22.

Specimens examined. TONGATAPU: 1 ♀, Fatai, mango, 5.I.1973; 2 ♀, Manuka, 10.I.1973; 2 ♀, Nuku'alofa, *Citrus*, 13.I.1973.

Known also from Singapore, Hong Kong, Hawaii and Fiji, this species is also probably parthenogenetic; males are unknown.

Family PSEUDOCAECILIIDAE Pearman, 1936

Genus **Heterocaecilius** Lee & Thornton

Heterocaecilius Lee & Thornton, 1967: 13. Type-species not designated (Article 42c, International Code Zool. Nomencl.).

Although *Heterocaecilius* was erected as a "holding genus," 9 Fijian species can be grouped into a taxonomic unit, the *greenwoodi* group; these differ from other species placed in *Heterocaecilius* (Lee & Thornton 1967, Thornton 1978).

Heterocaecilius apicalis Thornton

Heterocaecilius apicalis Thornton, 1981a: 53–54.

Specimens examined. TONGATAPU: 1 ♀, Metalikufiri, beating introduced shrubs and trees, 5.I.1973. EUA: 3 ♂, 4 ♀, Ha'atu'a, 170 m, mango, 12.I.1973. VAVA'U: 1 ♂, 2 ♀, 'Uta Vava'u I, Neiafutahi village, *Citrus*, 6.I.1973.

On Fiji this plain species occurs both on introduced and native vegetation, up to 800 m. It is a member of the *greenwoodi* group.

Heterocaecilius phimus Thornton, **new species**

FIG. 25–33

♂. *Coloration* (freshly killed, in alcohol). Head (FIG. 25) with epicranium brown, suture black; frons and vertex including ocellar protuberance cream, boundary between this area and brown epicranium distinct, passing from ventral border of orbit to a point dorsal to ocellar protuberance; ocelli pale with grayish crescents; clypeus with a distinct broad brown band transversely between antennal sockets, anterior part of clypeus, genae and maxillary palps cream; scape, pedicel and basal flagellar segment pale brown, rest of flagellum brown; setae on head black, in dark sockets. Thoracic terga brown, conspicuous black setae on pro- and mesothorax, pleura light brown. Legs: coxa brown, fading to pale buff distally; trochanter and femur very pale buff; tibia and tarsal segments light brown. Fore wing (FIG. 26) patterned with brown clouds. Hind wing hyaline. Abdomen cream.

Morphology. I.O.:D = 2.0:1. B = 1.7 mm. In fore wing setae on veins very long and stiff, stalk of vein r_3 slightly longer than vein r_{4+5} , a small distinct field of sense papillae at base of anal cell. Basal hind tarsal segment with 16 ctenidia. Pearman's organ with rasp and "mirror." Posterior border of 9th tergite only slightly produced posteriorly, the pair of very shallow lobes slightly rugose (FIG. 27). Penis frame (FIG. 28) enclosing 3 pairs of rods, 2 pairs very well sclerotized, fusion of inner parameres serrate. Hypandrium (FIG. 29) trilobed; median lobe subtriangular, setose, outer lobes each with a prominent pointed spine and an apical field of smaller pointed spines. Paraproct with a field of 10 trichobothria; epiproct (FIG. 30) with extensive median rugose field.

♀. *Coloration* (freshly killed, in alcohol). As ♂, fore wing pattern (FIG. 31) more sharply defined and perostigma unpigmented.

Morphology. I.O.:D = 3.0:1. B = 2.0 mm. No basal field of papillae in fore wing. Basal hind tarsal segment with 17 ctenidia. Ninth tergite posterior border not rugose. Epiproct semicircular, setose, no rugose field. Paraproct with field of 10 trichobothria. Subgenital plate (FIG. 32) with pair of triangular lobes covered with fine fringing spines, each lobe with a stout subapical and subbasal seta on its mesial face. Gonapophyses (FIG. 33): outer valve with 6 stout setae, a fairly large bare lobe (folded anteriorly in preparation); dorsal valve lobed, spine projecting as far as apex of lobe, mesial face of valve finely spinous basal to spine; ventral valve lobed.

Holotype ♂, EUA: Ha'atu'a, 170 m, mango, 12.I.1973, IWBT (BISHOP 11,794). Allotype ♀, same data as holotype (BISHOP). Paratypes: 7 ♂, 11 ♀, same data as holotype (AMS).

Other specimens examined. TONGATAPU: 1 ♂, Manuka, 10.I.1973. VAVA'U: 2 ♀, 'Uta Vava'u I, Neiafutahi village, 6.I.1973; 1 ♀, 'Uta Vava'u I, nr Longomapu, 170 m, 7.I.1973; 3 ♀, Pangai Motu I, Pangai Motu, 8.I.1973. EUA: 2 ♂, Mata'aha, 160 m, 12.I.1973.

Heterocaecilius phimus, which is quite a common Tongan species, is readily distinguishable from other Tongan and Fijian pseudocaeciliids on head and fore wing pattern. In genitalic characters it is similar to *H. albicrus* Thornton, *H. apicalis* and *H. pictus* Thornton, being closest to *H. apicalis*, which also occurs in Tonga. It differs from

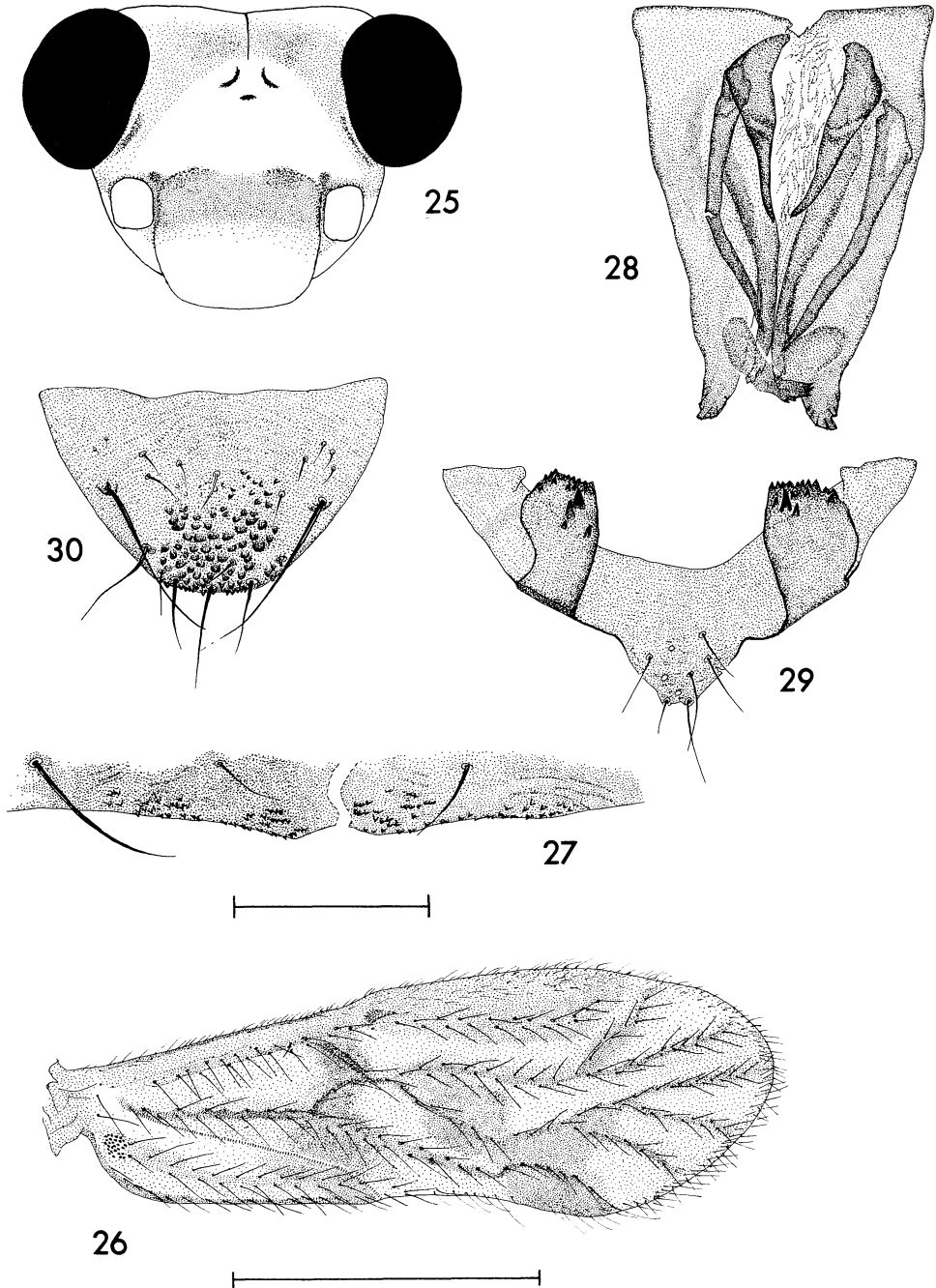


FIG. 25-30. *Heterocaecilius phimus*, ♂: 25, head pattern; 26, fore wing; 27, 9th tergite; 28, phallosome; 29, hypandrium; 30, epiproct. Head not to scale. Scale for wing 1.0 mm, for genitalia 0.1 mm.

this species quite distinctly in shape and number of phallosome sclerites and ornamentation of 9th tergite of the male. It is another member of the *greenwoodi* group of species.

Genus **Lobocaecilius** Lee & Thornton

Lobocaecilius Lee & Thornton, 1967: 12–13. Type-species: *Lobocaecilius cynara* Lee & Thornton.

Lobocaecilius nigrens Lee & Thornton

Lobocaecilius nigrens Lee & Thornton, 1967: 100–103.

Specimens examined. TONGATAPU: 1 ♀, Fatai, mango, 5.I.1973; 1 ♀, Pea, *Araucaria*, 5.I.1973. VAVA'U: 2 ♀, 'Uta Vava'u I, nr Longomapu, 170 m, 7.I.1973.

This species occurs in Fiji together with *Lobocaecilius vanuensis* Lee & Thornton. *L. nigrens* differs from *vanuensis*, known only from the female, in that the apical lobe of the subgenital plate is distinctly bilobed. In Fiji it occurs on the high islands and also the Lau group.

Genus **Pseudocaecilius** Enderlein

Pseudocaecilius Enderlein, 1903a: 261 (see Lee & Thornton, 1967: 9–10). Type-species: *Pseudocaecilius elutus* Enderlein.

Pseudocaecilius criniger (Perkins)

Elipsocus criniger Perkins, 1899: 85.

Pseudocaecilius elutus Enderlein, 1903a: 261.

For full synonymy see Thornton & Woo, 1973: 34.

Specimens examined. VAVA'U: 1 ♀, 'Uta Vava'u I, Neiafutahi village, 6.I.1973.

The type-species of *Pseudocaecilius*, *P. criniger*, has a wide distribution which includes tropical Africa, S Africa, Mozambique, Madagascar, India, the Malay Peninsula, southern China, Taiwan, the Philippines, Java, Bonins, Marianas, Carolines, Hawaiian Is, Fiji, Tonga, Galapagos and possibly the southern United States and Puerto Rico.

Family PHILOTARSIDAE Pearman, 1936

Genus **Aaroniella** Mockford

Aaroniella Mockford, 1951: 102. Type-species: *Elipsocus maculosus* Aaron.

Aaroniella pterosoma Thornton females collected in the New Hebrides, Fiji and Tonga are similar to the holotype of *Aaroniella guttulata*, which I have dissected (Thornton 1981a). In the Harvard collection there is a male collected with the female holotype of *A. guttulata* in Luzon, Philippines. I give below a description of this male, for comparison with the male of *A. pterosoma* described below.

Description of Luzon ♂ of Aaroniella guttulata. Morphology: I.O.:D = 1.8:1. Hind tarsal segments with 13:0:0 ctenidia. Claw with subapical tooth, Pearman's organ complete. Vein cu_2 of fore wing (FIG. 34) bare. Ciliation of hind wing veins: r_1 10, rs 3, r_{2+3} 5, r_{4+5} 5+, m 10 +, cu_1 0. Hypandrium (FIG. 39) with lateral incisions. Penis frame (FIG. 38) with a pair of slightly curved, closely apposed rod sclerites. Paraproct with a circular field of 20 trichobothria and 1 seta without a basal rosette.

In Tonga and the New Hebrides I have collected males of *A. pterosoma*, and, accordingly, provide a further description below.

Aaroniella pterosoma Thornton

FIG. 35–36, 40–41, 44–45

Aaroniella pterosoma Thornton 1981a: 64–65.

Further description

♂. *Coloration* (freshly killed, in alcohol). Head buff with brown markings similar to those of *A. gressitti*. Gena brown round antennal socket, brown band on ventral and posterior border. Eyes black, ocelli pale with black inner margins. Antenna light brown, flagellar segments with white apices. Thorax, including legs, brown. Fore wing (FIG. 36) with obvious transverse fascia, somewhat interrupted. Hind wing hyaline. Abdomen buff.

Morphology. I.O.:D = 3.0:1. Antennal apex attenuated with single apical seta. Hind tarsal segments with 13:0:0 ctenidia. Claw with subapical tooth, Pearman's organ complete. Vein cu_2 in fore wing (FIG. 36) bare. Ciliation of hind wing veins: r_1 11, rs 6, r_{2+3} 6, r_{4+5} 14, m 10, cu_1 0. Hypandrium (FIG. 41) with lateral incisions. Penis frame (FIG. 40) with a pair of featherlike sclerites. Paraproct with a circular field of 17 trichobothria and 1 seta without rosette socket.

♀. *Coloration* (freshly killed, in alcohol). As ♂, but pale area in pterostigma a little larger, and spots on apical veins rather more distinct (FIG. 35).

Morphology. I.O.:D = 3.5:1. Ciliation of hind wing veins: r_1 9, rs 5, r_{2+3} 4, r_{4+5} 15, m 10, m_1 0. Hind tarsal segments with 14:0:0 ctenidia. Subgenital plate (FIG. 45) and gonapophyses (FIG. 44) very similar to that of *A. guttulata* (see Thornton 1981a). Paraproct with field of 15 trichobothria and 1 seta without basal rosette.

Specimens on which further description based. ♂, ♀, EUA: Mata'aho, 170 m, 12.I.1973, IWBT (BISHOP).

Other specimens. TONGATAPU: 2 ♀, Manuka, 10.I.1973; 2 ♀, Nuku'alofa, *Citrus*, 13.I.1973. EUA: 1 ♀, Ha'atu'a, 170 m, mango, 12.I.1973.

Distribution elsewhere. FIJI (see Thornton 1981a). NEW HEBRIDES: 2 ♂, 5 ♀, Erromango I, Dillon's Bay, 27.IX.1976; 2 ♂, 1 ♀, Erromango I, nr air strip, 29.IX.1976; 4 ♀, Tanna I, Bethel, 24–26.IX.1976; 1 ♀, Tanna I, Isangel, 25.IX.1976; all collected IWBT and C. N. Smithers.

A. pterosoma differs from *A. guttulata* in the form of the sclerites within the penis frame. *A. guttulata* has a pair of closely apposed, simple, slightly curved sclerites, while *A. pterosoma* has a pair of featherlike structures.

A. pterosoma is also closely similar to *A. gressitti* Thornton, Lee & Chui from Micronesia (not Truk) and Manus I in the Bismarcks, and *Aaroniella trukensis* Thornton, Lee & Chui from Truk and the Solomons. It may be distinguished from both species by the apical sclerite of the subgenital plate, which, as in *A. guttulata*, is as wide as long, narrowing apically, and bears 2–3 setae. Sclerites within the phallosome are absent in *A. gressitti* and, in *A. trukensis*, the pair of "sclerites" are of a rather different form from those of either *A. guttulata* or *A. pterosoma*. *Philotarsus samoanus* Karny from Samoa, known only from the male, is clearly an *Aaroniella* (flagellar segments with white apices and fore wing vein setae sited on brown spots) and in general fore wing pattern (FIG. 37, from holotype) resembles the 4 species mentioned above. I have dissected the type of *samoanus* in the British Museum (Natural History). The phallosome differs from the other 4

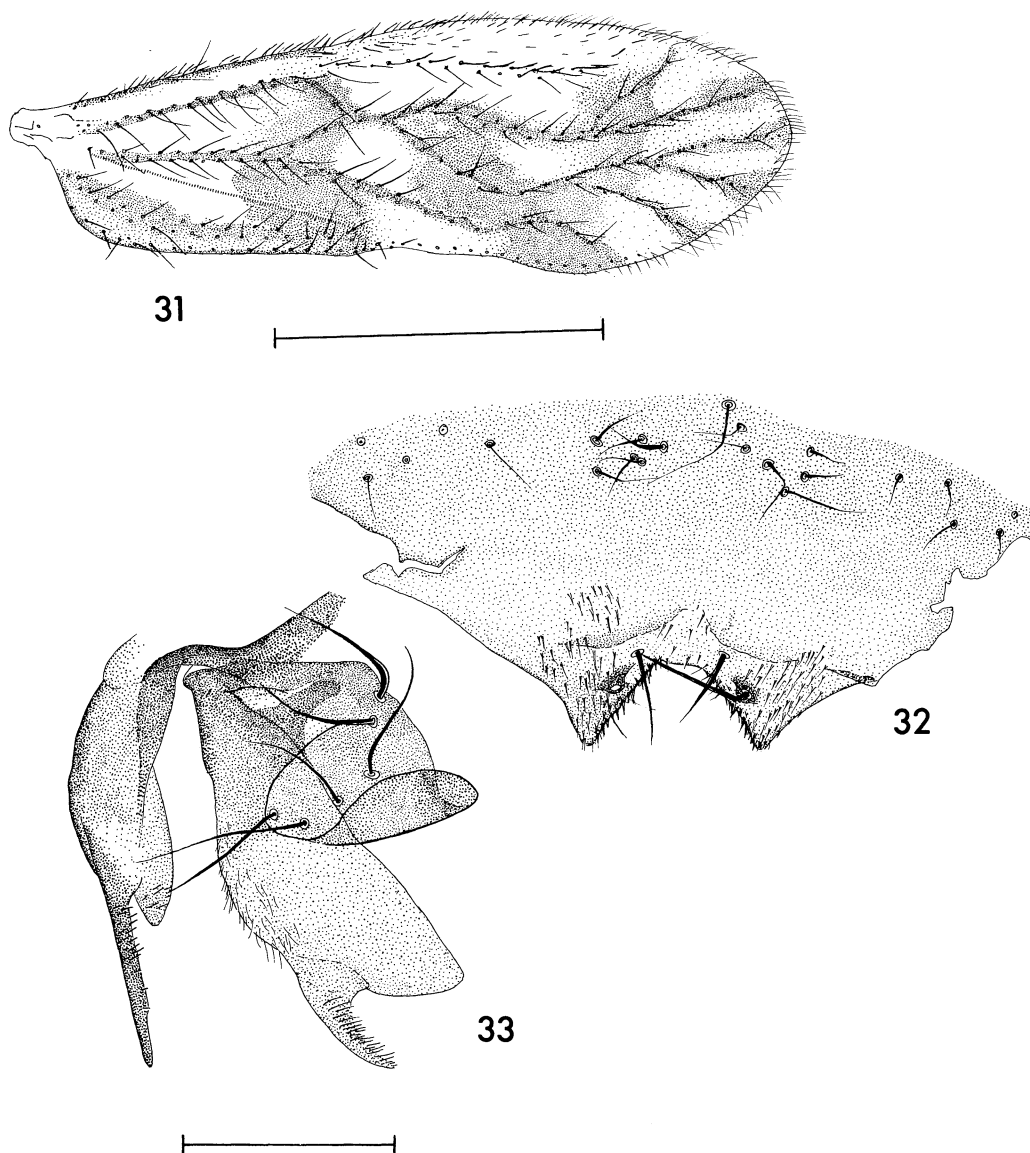
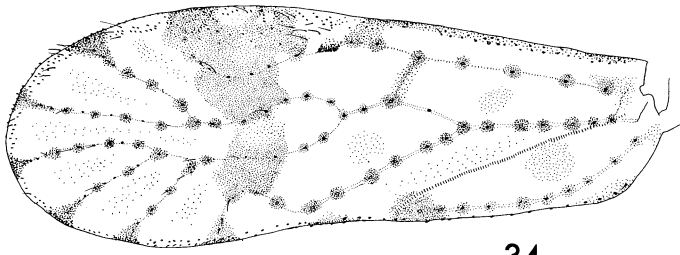


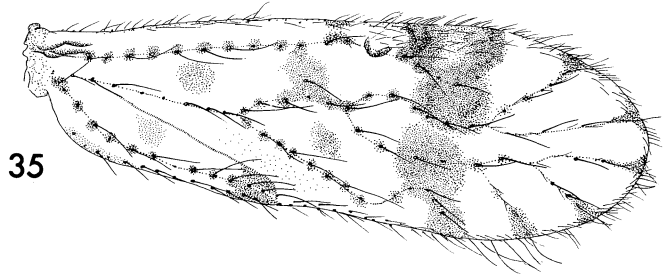
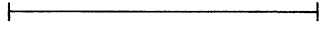
FIG. 31-33. *Heterocaecilius phimus*, ♀: **31**, fore wing; **32**, subgenital plate; **33**, gonapophyses. Scale for wing 1.0 mm, for genitalia 0.1 mm.

species in the "radula," which does not consist of a pair of sclerites (FIG. 42) but differs from the *A. gressitti* condition. The hypandrium (FIG. 43) is laterally incised.

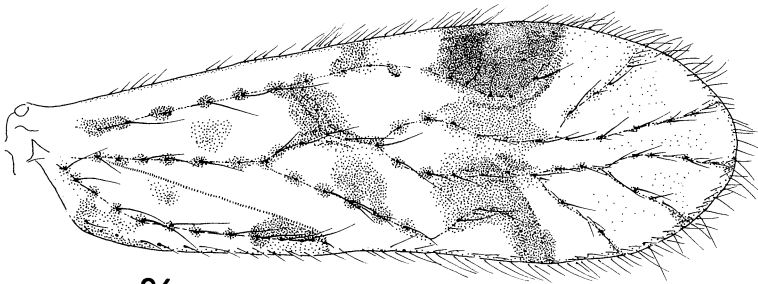
The 5 species, *A. gressitti* (Carolines except Truk, Manus I), *A. trukensis* (Truk, Solomons), *A. guttulata* (Philippines), *A. pterosoma* (New Hebrides, Fiji, Tonga) and *A. samoana* (Samoa) are clearly closely related on fore wing pattern, but differ in details



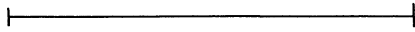
34



35



36



37

FIG. 34-37. Fore wings: **34**, *Aaroniella guttulata* ♂ from Luzon; **35**, *A. pterosoma*, ♀; **36**, *A. pterosoma*, ♂; **37**, *A. samoana*, holotype ♂. FIG. 34, 35 to common 1.0 mm scale; FIG. 36 scale 1.0 mm, FIG. 37 not to scale.

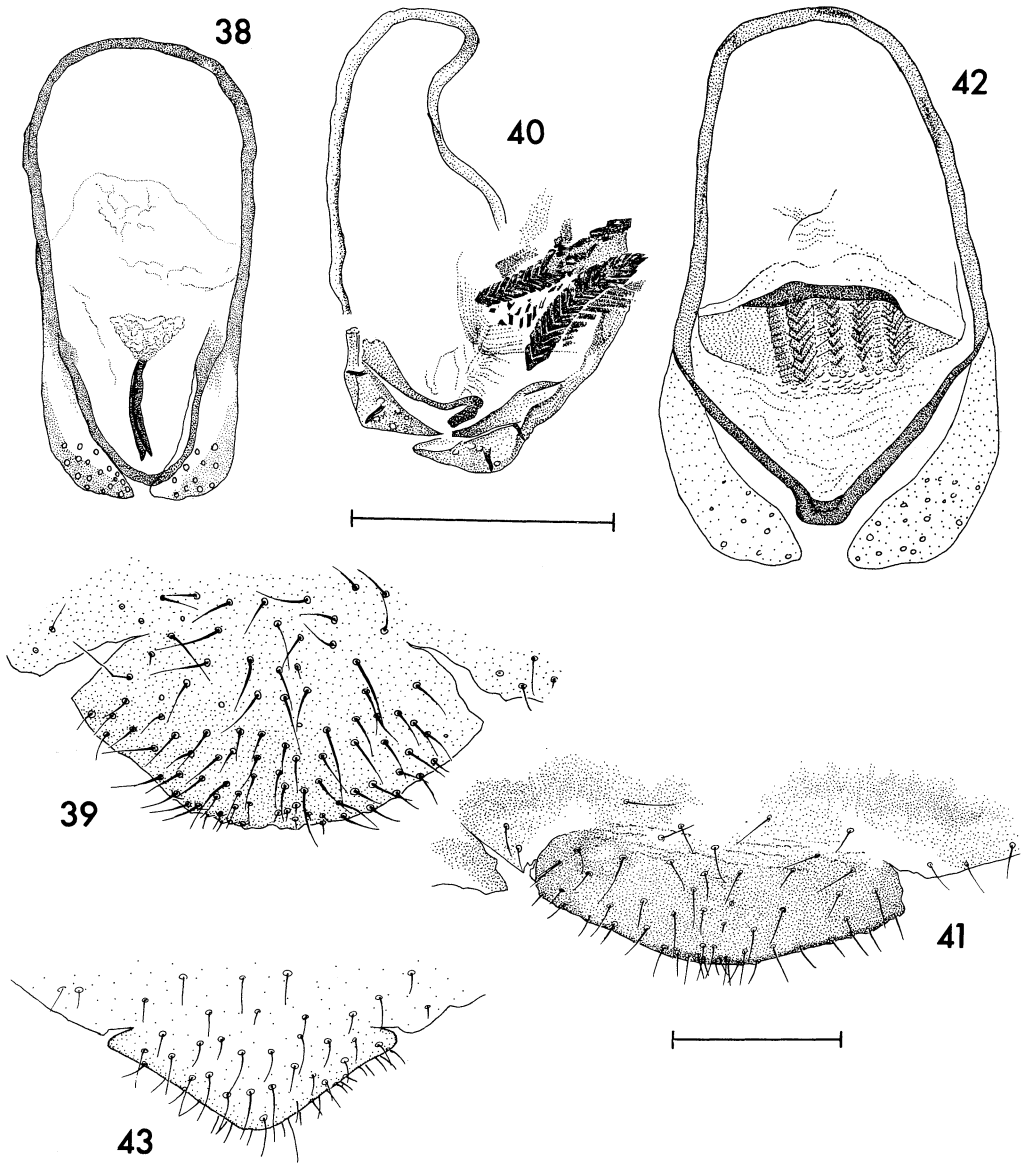


FIG. 38–43. 38–39. *Aaroniella guttulata* ♂ from Luzon: 38, phallosome; 39, hypandrium. 40–41. *Aaroniella pterosoma*, ♂: 40, phallosome; 41, hypandrium. 42–43. *Aaroniella samoana*, holotype ♂: 42, phallosome; 43, hypandrium. FIG. 38, 39, 41 to common 0.1 mm scale; FIG. 40 to scale 0.1 mm; FIG. 42, 43 not to scale.

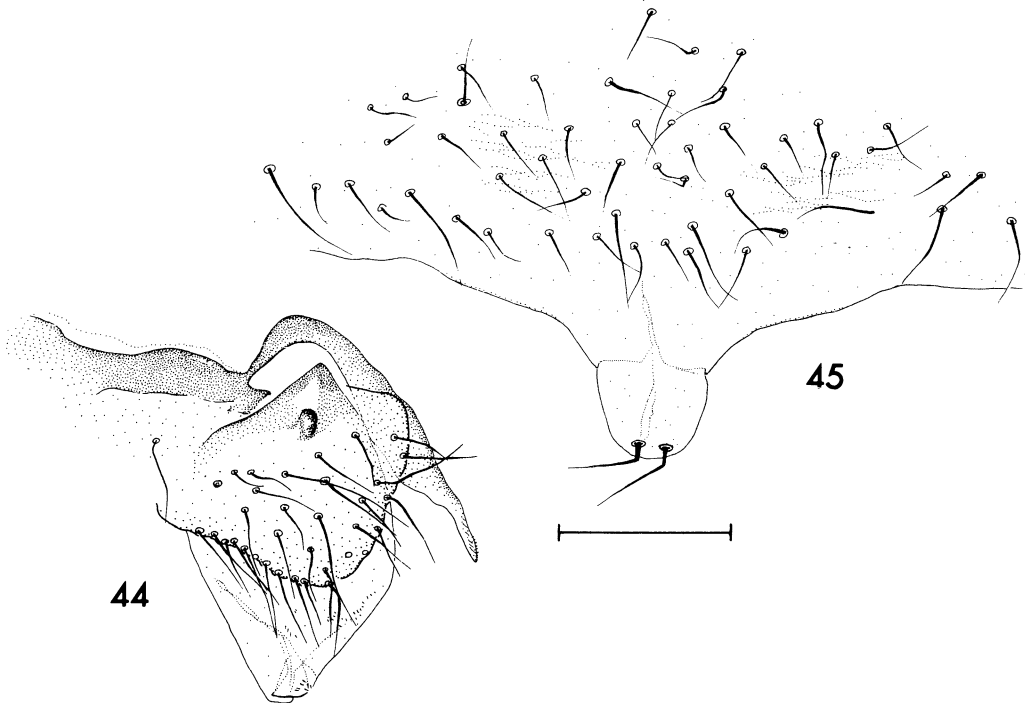


FIG. 44–45. *Aaroniella pterosoma*, ♀: **44**, gonapophyses; **45**, subgenital plate. Common scale 0.1 mm.

of subgenital plate and radula structure. It is noteworthy that there is evidently species replacement, no 2 of these closely related forms being sympatric.

Genus *Haplophallus* Thornton

Haplophallus Thornton, 1959: 336. Type-species: *Haplophallus orientalis* Thornton.

Haplophallus trepticus Thornton & Smithers

Haplophallus trepticus Thornton & Smithers, 1974: 183–184.

Specimens examined. TONGATAPU: 2♀,1♂, Fatai, mango, 5.I.1973; 1♀, Matalikufiri, *Citrus*, 5.I.1973; 3♀,3♂, Manuka, 10.I.1973; 6♀,11♂,1N, Nuku'alofa, *Citrus*, 13.I.1973; 1♀, Kauvai, *Citrus* nr royal residence, 14.I.1973; 1♂, Nuku'alofa area, living branches, 15.I.1973. EUA: 11♀,8♂, Ohonua area, nr shore, 11.I.1973; +10♀,+10♂, Mata'aho, 170 m, 12.I.1973; 10♀,1♂, Ha'atu'a, 160 m, 12.I.1973; 2♀,1♂, above Ana'ahu, 230 m, 12.I.1973. VAVA'U: +10♀,+10♂, 'Uta Vava'u I, Neiafutahi village, *Citrus*, 6.I.1973; 1♀, 'Uta Vava'u I, nr Longomapu, 170 m, 7.I.1973; 1♀, 'Uta Vava'u I, Eneio Beach, 7.I.1973; 1♀, Pangai Motu I, Pangai Motu, 8.I.1973.

This species' range includes New Caledonia, Solomons, New Hebrides, Fiji (including the Lau group), Tonga and Samoa. In Fiji it occurs at elevations of 1100 m.

Family PSOCIDAE Stephens, 1892
Genus **Ptycta** Enderlein

Ptycta Enderlein, 1925: 102. Type-species: *Psocus haleakalae* Perkins.

Ptycta bebea Thornton

Ptycta bebea Thornton, 1981a: 66–67.

Specimens examined. TONGATAPU: 1♂, Fatai, mango, 5.I.1973; 1♀, 2♂, Manuka, 10.I.1973; 4♀, 4♂, Nuku'alofa, *Citrus*, 13.I.1973. VAVA'U: 1♂, 1♀, 'Uta Vava'u I, nr Neiafutahi village, 9.I.1973.

This rather small psocid, known also from the high islands of Fiji, is characterized by the fore wing pattern of numerous fairly small patches of pigment and a narrow transverse band across the clypeus anteriorly. Unlike other Fijian species, veins *rs* and *m* in the fore wing are united for a short distance, as is usual in the genus. The species is very similar to *Ptycta angulata* Thornton, Lee & Chui from the southern Marianas and eastern Carolines and Marshalls, differing in wing pattern and shape of penis frame.

Ptycta insularum Thornton, new species

FIG. 46–52

♀. *Coloration* (after 4 years in alcohol). Head pale buff, light brown markings as in FIG. 46. Maxillary palps pale buff, brown towards apex of apical segment. Antenna: scape and pedicel pale buff, basal flagellar segment pale buff darkening to dark brown at apex, remaining segments dark brown. Thoracic dorsa largely pale cream, antedorsum and mesothoracic dorsa dark brown on anterior surfaces, scutella pale cream. Thoracic pleura brown apart from mesothoracic episternum buff with 2 faint brown patches. Legs: coxa brown, trochanter, femur and tibia cream, femur with subapical light brown patch, tibia dark brown at extreme apex, tarsal segments dark brown. Fore wing hyaline, marked with brown as in FIG. 47; hind wing hyaline. Abdomen cream, sparse gray-brown granulations.

Morphology. I.O.:D = 2.0:1, B = 3.1 mm. Antedorsum polished on anterior face. Basal hind tarsal segment with 25 ctenidia. Pearman's organ with rasp and "mirror." Epiproct squarish, with 7 stout setae posteriorly, paraproct with field of 27 trichobothria and 1 seta without basal rosette. Subgenital plate as in FIG. 48. Gonapophyses as in FIG. 49.

♂. *Coloration* (after 4 years in alcohol). As ♀.

Morphology. I.O.:D = 1.0:1, B = 2.5 mm. Antedorsum polished over anterior face. Basal hind tarsal segment with 28 ctenidia. Epiproct with 7 large setae and basal low finely spinous lobe (FIG. 50), paraproct with field of 35 trichobothria. Hypandrium (FIG. 51) with toothed tongue, teeth more prominent on 1 side. Phallosome (FIG. 52) with finely spinous apical knob.

Holotype ♀, TONGATAPU: Nuku'alofa area, 13.I.1973, IWBT (BISHOP 11,795). Allotype ♂, same data as holotype (BISHOP). Paratypes: 9♂, 7♀, same data as holotype (AMS).

Other specimens examined. TONGATAPU: 1N, Fatai, mango, 5.I.1973; 7♀, 3♂, Manuka, 10.I.1973; 8♀, 10♂, 2N, Nuku'alofa area, 13.I.1973. EUA: 2♀, Ohonua, nr shore, *Citrus*, 11.I.1973; 1♀, 1N, Mata'aho, 170 m, 12.I.1973; 1♀, above Ana'ahu, 230 m, 12.I.1973; 1♀ (teneral), Ha'atu'a, 170 m, mango, 12.I.1973. VAVA'U: 4♀, 3♂, 'Uta Vava'u I, nr Neiafutahi village, *Citrus*, 6.I.1973; 2♀, 2♂, 'Uta Vava'u I, nr Lon-

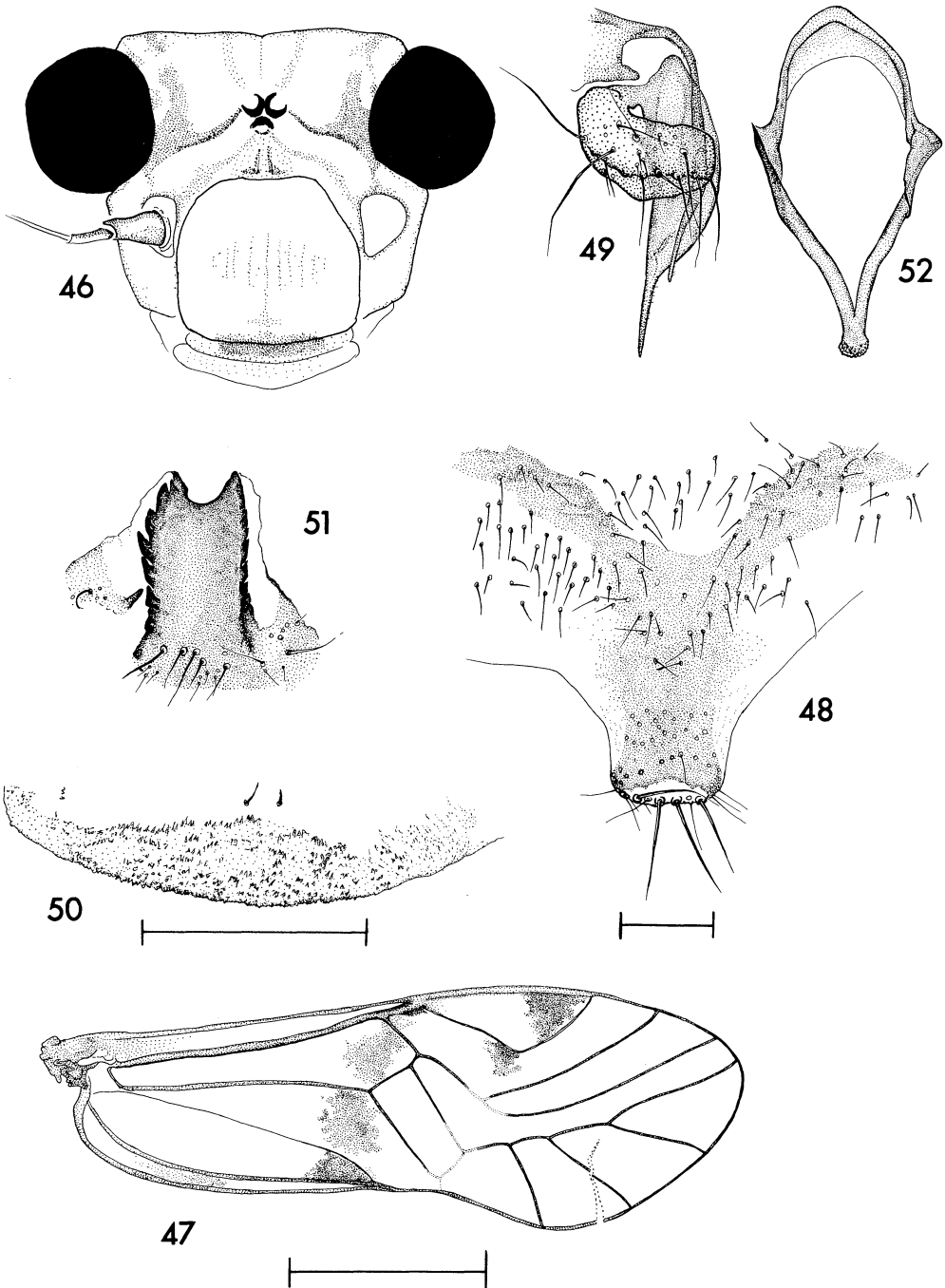


FIG. 46-52. *Ptycta insularum*. ♀: 46, head pattern; 47, fore wing; 48, subgenital plate; 49, gonopophyses. ♂: 50, base of epiproct; 51, hypandrial tongue; 52, phallosome. Head not to scale; fore wing to scale of 1.0 mm; FIG. 50 to 0.1 mm; other figures to common scale of 0.1 mm.

gomapu, 170 m, 7.I.1973; 1♂, Pangai Motu I, Pangai Motu, 8.I.1973; 4♀, 2♂, 9N, 'Uta Vava'u I, nr Neiafutahi, 9.I.1973.

P. insularum, like the *vitiensis* group of 8 species on Fiji, has veins *rs* and *m* in the fore wing connected by a crossvein rather than a fusion (96 wings crossvein, 3 point junction, 0 fusion). In genitalic characteristics it is most similar to *P. vitiensis* (Karny). Evidently it is the only representative of the *vitiensis* group on Tonga, and it has not been collected in Fiji.

Family MYOPSOCIDAE Enderlein, 1903

Genus *Phlotodes* Enderlein

Phlotodes Enderlein, 1910: 67. Type-species: *Myopsocus kolbei* Enderlein.

***Phlotodes amicus* Thornton, new species**

FIG. 53–55

♀. *Coloration* (freshly killed, in alcohol). Pale buff, apart from coxa brown, femur brown with pale subbasal band, apex of tibia brown, very faint head pattern with clypeal striae just discernible. Eyes black, ocelli with dark centripetal margins. Fore wing with pale brown pigment pattern (FIG. 53), hind wing hyaline.

Morphology. I.O.:D = 2.5:1. B = 2.5 mm. Basal hind tarsal segment with 20 ctenidia. Epiproct trapezoid, sparsely setose; paraproct with field of 20 trichobothria. Subgenital plate (FIG. 54) apical lobe somewhat clubbed, bearing 9 setae, 2 apical ones about 2× as long as shortest ones. Gonapophyses as in FIG. 55.

♂. Unknown.

Holotype ♀, TONGATAPU: Fatai, ex mango, 5.I.1973, IWB T (BISHOP 11,796).

This species is described from a singleton because it is closely similar to *Ph. punctatus* Thornton, Lee & Chui, known from Micronesia, and *Ph. punctatoides* Thornton, which occurs in Fiji and Tonga. In all 3 species the apical lobe of the subgenital plate bears more than 2 setae. In *Ph. punctatoides* the setae are all more or less the same length, while in *Ph. punctatus* and *Ph. amicus* 2 apical setae are decidedly longer than the others, in *Ph. punctatus* about 3× as long, and in *Ph. amicus* about 2× as long. *Ph. amicus* is also more similar to *Ph. punctatus* in fore wing pattern than is *Ph. punctatoides*.

***Phlotodes graptus* Thornton**

Phlotodes graptus Thornton, 1981a: 87, 89–90.

Specimen examined. EUA: 1N, Ohonua, nr shore, 11.I.1973.

This nymph has the V-shaped clypeal pigment pattern which is characteristic of *Ph. graptus*, known from Viti Levu, Fiji. However, confirmation of the presence of the species in Tonga will only be possible when adults are discovered.

***Phlotodes punctatoides* Thornton**

Phlotodes punctatoides Thornton, 1981a: 91, 93–95.

Specimens examined. EUA: 1♂, nr Ohonua, 11.I.1973. TONGATAPU: 1♂, Govt. Experimental Farm, collection 6986, malaise trap, 12.IV.1975, W. H. Pierce; 1♂, same data except collection 6449, 12.X.1974.

Ph. punctatoides occurs on Viti Levu, Vanua Levu and the Lau group in Fiji, as well

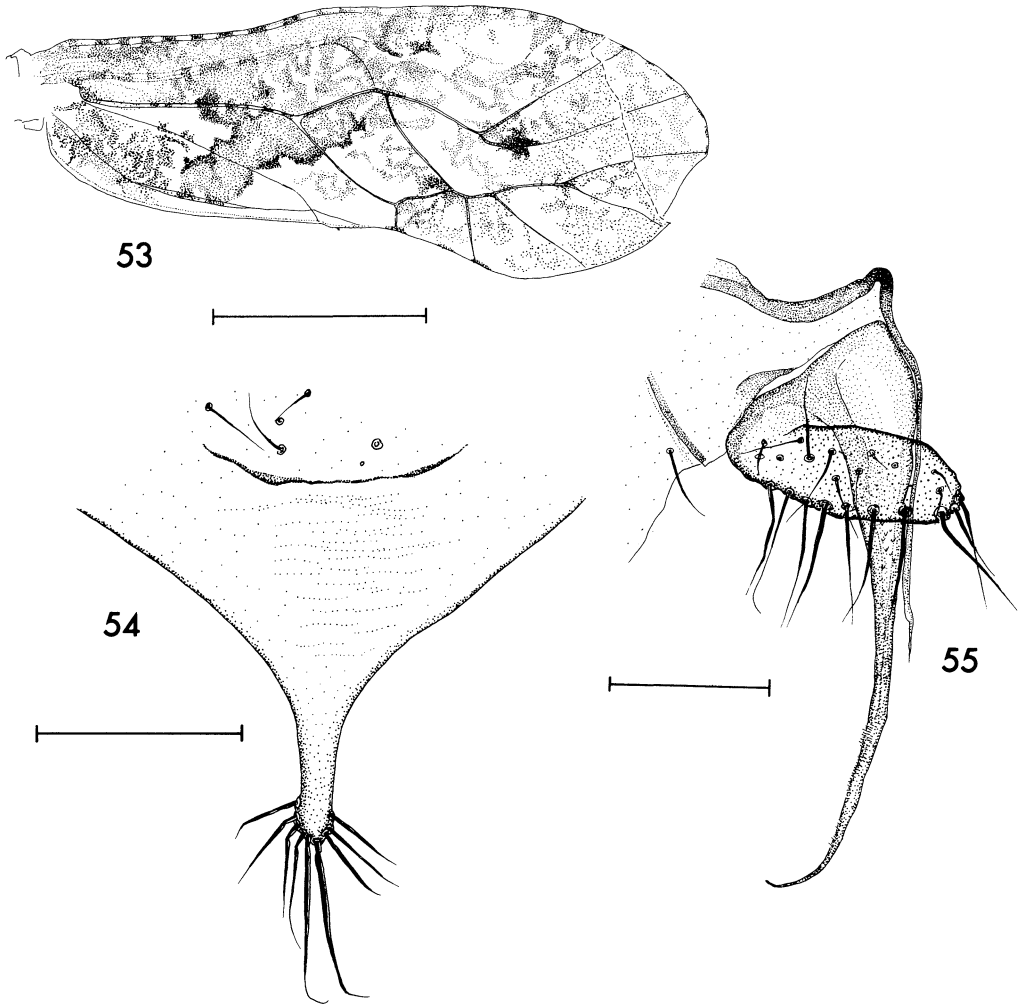


FIG. 53-55. *Phlotodes amicus*, ♀: **53**, fore wing; **54**, subgenital plate; **55**, gonapophyses. Wing scale 1.0 mm; scales for genitalia 0.1 mm.

as Tonga. It is similar to *Ph. punctatus* from Micronesia and to *Ph. amicus* known only from Tonga. The 3 species differ in details of fore wing pattern.

DISCUSSION

The known psocopteran faunas of Fiji and Tonga are compared in TABLE 1. Half of the Tongan fauna (17 of 35 species) is widespread in the Pacific, compared to only $\frac{1}{3}$ (26 of 81 species) of the much larger Fijian fauna. Whereas $\frac{3}{4}$ of the Tongan species (26 of 35) occur in Fiji, only $\frac{1}{3}$ of the Fijian species (26 of 81) are present in

TABLE 1. Comparison of known psocopteran faunas of Fiji and Tonga.

GENUS	NO. OF SPP. PRESENT IN FIJI, ABSENT IN TONGA	NO. OF SPP. PRESENT IN FIJI AND TONGA	NO. OF SPP. PRESENT IN TONGA ABSENT IN FIJI
Cyrtophania	2(2)*	—	—
Echmepteryx	1	2(2)	—
Lepidopsocus	14(?1)	6(4)	4
Nepticulomima	1	—	—
Rhyopsocus	—	—	1(1)
Tapinella	1	1	—
Caecilius	2?(1?)	2(1)	—
Ectopsocus	4?(3?)	4(4)	1
Peripsocus	—	3(3)	—
Heterocaecilius	9	1	1
Lobocaecilius	1	1	—
Pseudocaecilius	1(1)	1(1)	—
Pseudoscottiella	1	—	—
Aaroniella	—	1(1)	—
Haplophallus	—	1(1)	—
Ptycta	8	1	1
Myopsocus	2?(1?)	—	—
Phlotodes	8(1)	2	1
	55(10)	26(17)	9(1)

* () = no. occurring elsewhere in Pacific.

Tonga. The Tongan fauna can thus be regarded largely as an extension of that of Fiji.

In Tonga there is some small extension of the endemic Fijian groups of *Phlotodes*, *Heterocaecilius* and *Lobocaecilius* (*Ph. punctatoides*, *Ph. graptus*, *H. apicalis* and *L. nigrens*), and a considerable extension of the Fijian *Lepidopsocus* fauna (7 species). In a few cases divergence of species of Fijian groups has occurred, resulting in endemic Tongan species (*Ptycta insularum*, *Phlotodes amicus*, *Heterocaecilius phimus*; four species of *Lepidopsocus* and *Ectopsocus lambus* may also fall into this category), but the majority of the Tongan fauna consists of species widespread in the Pacific or occurring also in Fiji. The widespread Pacific species are almost all associated with lowland habitats and Pacific food plants and have possibly been carried about by canoe since man arrived in the Pacific.

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