

## The *Amblysilopus pulvillatus* Species Group (Diptera: Dolichopodidae: Sciapodinae), a Radiation in the Western Pacific<sup>1</sup>

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**Abstract.** The *Amblysilopus pulvillatus* species group (Diptera: Dolichopodidae: Sciapodinae) comprises nine species from western Pacific archipelagoes comprising Fiji: *A. pulvillatus* (Bezzi), *A. volivoli* n. sp., *A. bezzii* n. sp., *A. waiseai* n. sp., & *A. maulevu* n. sp.; Vanuatu: *A. ambrym* n. sp. and *A. lenakel* n. sp.; Tonga: *A. eupulvillatus* (Parent); and Samoa: *A. upolu* n. sp. All species have the male secondary sexual character of a modified tarsus I, with the anterior claw enlarged, the posterior claw reduced or absent, and the pulvilli usually enlarged. As well, the phallus is unusually broad and both sexes have a white basoventrally seta on femur I. A species cladogram is presented. The *pulvillatus* group evolved in Fiji and Vanuatu, probably when the two ancestral archipelagoes were almost adjacent as part of the Vitiaz Arc, some 6–8 Mya. Species in *pulvillatus* group now show a vicariant distribution, a result of the breakup and rifting of the Vitiaz Arc, although the Samoan and Tongan species may be the result of dispersal.

### INTRODUCTION

In 1928, both Parent and Bezzi described a new species of Sciapodinae from Tonga and Fiji, respectively. Each species had the leg I pulvilli and one claw greatly enlarged, a tarsal modification so impressive that they independently gave their species similar names, *Condylostylus eupulvillatus* Parent and *Condylostylus pulvillatus* Bezzi. Although the two species have since been referred to *Amblysilopus*, they remain valid and are part of a larger group of nine species that occurs from Vanuatu to Samoa. This western Pacific radiation is described below. This paper is the third in a series on the Sciapodinae of Fiji and the western Pacific.

### MATERIALS AND METHODS

This study is based on material from the following collections: Natural History Museum, London (BMNH), Bishop Museum, Honolulu (BPBM), Fiji National Insect Collection (FNIC) (currently held in trust at the Bishop Museum), and the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM), and Zoologische Institut und Zoologisches Museum von Hamburg (ZMUH).

The left lateral view of the hypopygium or male genital capsule is illustrated for all species. In describing the hypopygium, 'dorsal' and 'ventral' refer to morphological position prior to genitalic rotation and flexion. Thus, in figures showing a lateral view of the hypopygium, the top of the page is morphologically ventral, while the bottom is dorsal. Morphological terminology follows Bickel (1994). The CuAx ratio is the length of the m-

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cu crossvein/ distal section CuA. The position of features on elongate structures such as leg segments is given as a fraction of the total length, starting from the base. The relative lengths of the podomeres should be regarded as representative ratios and not measurements. The ratios for each leg are given in the following formula and punctuation: trochanter + femur; tibia; tarsomere 1/ 2/ 3/ 4/ 5. The following abbreviations and terms are used: FSSC = Female secondary sexual character(s), non-genitalic characters found only on the female body; MSSC = Male secondary sexual character(s), non-genitalic characters found only on the male body; I, II, III = pro-, meso-, metathoracic legs, respectively; C = coxa; T = tibia; F = femur; ac = acrostichal setae; ad = anterodorsal; av = anteroventral; dc = dorsocentral setae; dv = dorsoventral; pd = posterodorsal; pv = posteroventral; t = tarsus; t<sub>1-5</sub> = tarsomeres 1 to 5. On the figures, arrows are used to indicate diagnostic features.

## SYSTEMATICS

### Genus *AMBLYSILOPUS* Bigot

*Amblysilopus* is a large and complex genus that acts as a "holding taxon" for many small and often delicate Sciapodinae found primarily in the world's moist tropical zone, with extensions into temperate regions. The Australian fauna comprises 84 described species and is the best documented; and many Australian species groups, such as the *triscuticatus* group, are widespread in the Melanesian archipelago. Although *Amblysilopus* itself is poorly defined and probably polyphyletic, good monophyletic species groups based on male genitalic and secondary sexual characters can be used for systematic study (discussion in Bickel 1994). The *pulvillatus* group is one of these.

#### The *Amblysilopus pulvillatus* group

**Diagnosis.** Vertical seta on male lateral frons curved, almost bent and relatively short, and stronger in females; upper face of males slightly bulging, and flat in females; femur I in both sexes with white ventral seta in basal quarter; leg I male tarsomere 5 with anterior claw enlarged, and pulvilli usually enlarged, and posterior claw reduced in size/ absent; phallus broad near dorsal angle, more than three times width of phallus at apex.

**Remarks.** The *pulvillatus* group comprises the following western Pacific species numbers: Fiji (5 spp.), Vanuatu (2 spp.), Tonga (1 sp.) and Samoa (1 sp.). I have not seen specimens of this group from the rather well-collected New Caledonia (Bickel 2002) or the much more poorly known Solomon Islands.

All species were collected in lowlands below 100 m, in habitats that include coastal forest on stabilized dunes, lowland rainforest, and plantations. Three species, *A. pulvillatus*, *A. bezzii*, and *A. volivoli* are sympatric at Sigatoka Sand Dunes, and the first two species are often abundant in Malaise trap catches from this site.

#### KEY TO MALES OF THE *AMBLYSILOPUS PULVILLATUS* SPECIES GROUP

1. It<sub>5</sub> with pulvilli not enlarged, subequal to those of legs II & III; anterior tarsal claw distinctly enlarged, and posterior claw short; hypopygium (Fig. 1a) with L-shaped cercus; coxa I, all femora and tibiae yellow; halter yellow (Vanuatu) ..  
..... **ambrym** Bickel, n. sp.

- It<sub>5</sub> with enlarged pulvilli, distinctly larger than pulvilli of legs II and III; other features various ..... 2
- 2. It<sub>5</sub> with pulvilli slightly enlarged, and with anterior claw enlarged and curved around tarsus (Figs 3a, b); coxa I and remainder of legs mostly yellow; cerci elongate and narrow (Figs 1b, c) ..... 3
- It<sub>5</sub> with pulvilli at least half length of tarsomere, anterior claw variously enlarged, but not curving around tarsus; leg color and cercus various ..... 4
- 3. Hypopygium (Fig. 1b): surstylus with strong subapical seta; cercus narrow, digitiform, with rather sparse setae; lateral scutellar setae absent. (Fiji) ..... **maulevu** Bickel, **n. sp.**
- Hypopygium (Fig. 1c): surstylus with short setae; cercus with distinct basal mound; lateral scutellar setae reduced to short weak hairs (Samoa) ..... **upolu** Bickel, **n. sp.**
- 4. Coxa I, all trochanters, femora, tibiae mostly yellow ..... 5
- Coxa I, all trochanters, and at least part of some femora dark brown / black ..... 7
- 5. Leg I basitarsus with some curved ventral setae; It<sub>5</sub> (Fig. 1e) with anterior claw enlarged but shorter than pulvilli, cercus (Fig. 1d) expanded basally and tapering distally, and with abundant strong ventral setae (Fiji) ..... **weisei** Bickel, **n. sp.**
- Leg I basitarsus bare of setae; It<sub>5</sub> with anterior claw enlarged and as long as pulvilli; cercus with distinct basoventral projection ..... 6
- 6. TI with posterior row of fine slanted yellow hairs along entire length; It<sub>5</sub> (Fig. 3d) with pulvilli enlarged, as long as half tarsomere length; hypopygium (Fig. 2e) cercus with short subtriangular jecton, and with ventral lobate projection near base (Vanuatu) ..... **lenakel** Bickel, **n. sp.**
- TI bare of major setae, and without posterior row of hairs; It<sub>5</sub> (Fig. 3e) with pulvilli enlarged, as long as tarsomere, hypopygium (Fig. 2d); cercus elongate, and with ventral setose thumblike projection at 1/3 (Fiji) ..... **bezzii** Bickel, **n. sp.**
- 7. Femur I dark brown to 2/5; distal FI, and all FII and FIII yellow; TI with short dorsal at 1/6, and without fine posterior hairs; It<sub>5</sub> (Fig. 3c) with anterior claw greatly enlarged and curved, and with distinct tooth midway along inner surface; hypopygium (Fig. 2c); cercus elongate and setose, with distinct ventral digitiform projection at 1/3; palp yellowish with black setae (Fiji) ..... **volivoli** Bickel, **n.sp.**
- Femora I and II dark brown to 1/2, and FIII dark brown; TI with major setae, but with posterior row of fine hairs; It<sub>5</sub> with inner surface of enlarged claw smooth; hypopygium various; palp black with black setae ..... 8
- 8. Hypopygium (Fig. 2a) cercus with large clavate ventral projection bearing strong setae, and with two distal digitiform arms; surstylus with strong subapical seta; It<sub>1</sub> covered with short, almost erect setae; It<sub>5</sub> (Fig. 3f) with anterior claw enlarged and posterior claw reduced to short stub (Tonga) ..... **eupulvillatus** Parent
- Hypopygium (Fig. 2b) with clavate cercus, and with only stub of distal digitiform arm; surstylus with only short setae; It<sub>1</sub> covered with short normal vestiture; It<sub>5</sub> (Fig. 3g) with anterior claw enlarged, posterior claw not evident (Fiji) ... **pulvillatus** (Bezzi)

## SPECIES DESCRIPTIONS

All species have the following characters, which will not be repeated in individual descriptions unless needing clarification.

*Head:* vertex and frons shining metallic blue-green; strong postvertical seta and diverging ocellar setae present; vertex well excavated; vertical seta on male lateral frons curved, almost bent and relatively short, and stronger in females; upper face of males slightly bulging, and flat in females; face and clypeus metallic blue green with some grey pruinosity; slightly wider in females than males; clypeus not strongly narrowed; palp usually yellow with black setae; proboscis yellow; antenna brownish to black; scape short; pedicel with short setae; first flagellomere short, subtriangular; arista dorsal, and as long as head height, and simple; ventral postcranium with white setae.

*Thorax:* metallic green with bronze reflections; setae black; 3 irregular pairs of long ac; males with 2 strong posterior dc and 2 or 3 weak hair like dc anterior (MSSC), females with 4 strong dc; lateral scutellar setae reduced to short weak hairs (less than one fifth length of medians), or absent.

*Legs:* femur I with white ventral seta in basal quarter; leg I male tarsomere 5 with anterior claw enlarged; male legs II & III and all female legs with short subequal paired claws.

*Abdomen:* terga 1–6 metallic green bronze, with matt brown areas over tergal overlap, with black marginal setae and short black vestiture; hypandrial arm and phallus both elongate, with phallus extending slightly beyond apex of arm; phallus broad near dorsal angle; epandrial lobe short with strong apical and subapical bristles.

*Amblysilopus ambrym* Bickel n. sp.

(Fig. 1a)

**Description. Male:** length 4.2–4.4 mm; wing: 4.3–4.4 × 1.2 mm.

*Head:* antenna brownish.

*Thorax:* lateral scutellar setae absent.

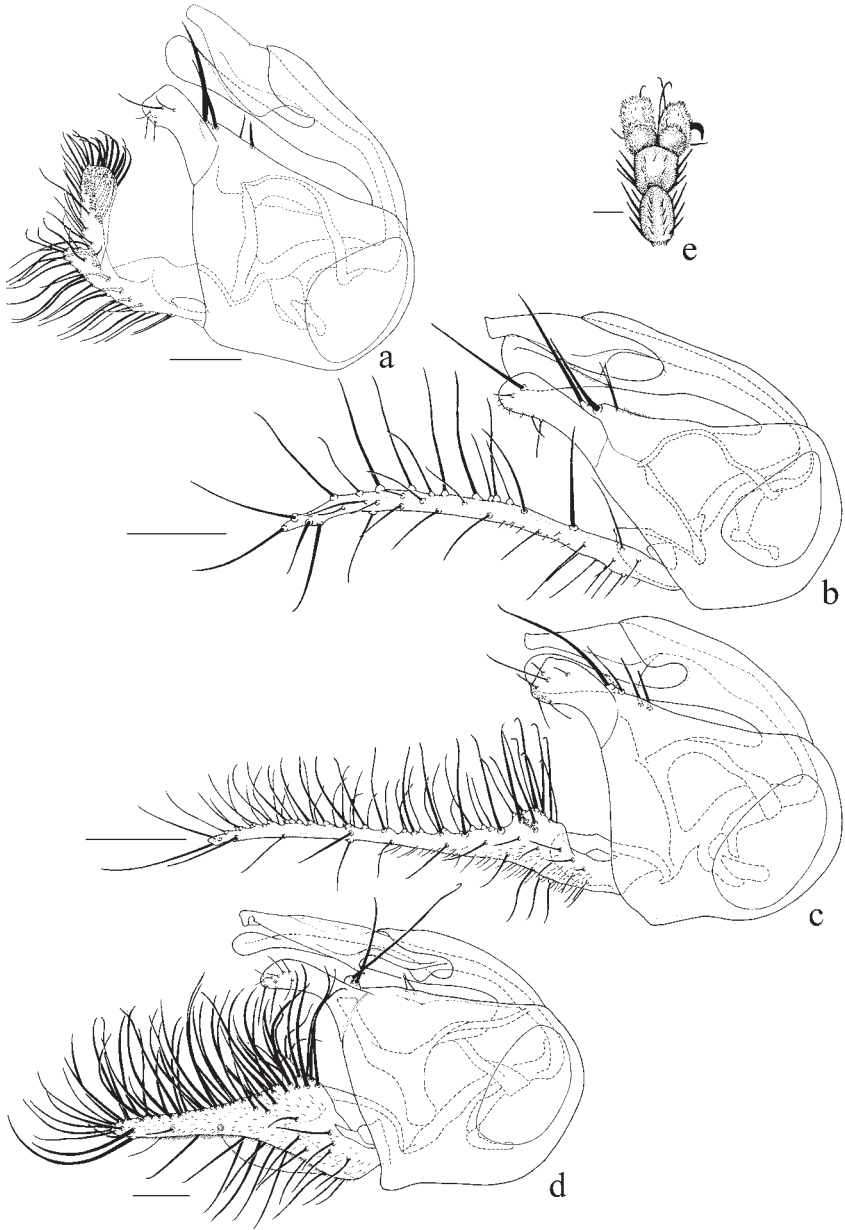
*Legs:* CI, all trochanters, femora, tibiae yellow; tarsi I and II yellow, although distal tarsomeres infuscated; tarsus III brownish; coxae II and III brown; CI and CII with white anterior hairs and a few stronger distal setae; CIII with 2 white lateral setae; I: 5.0; 5.6; 5.0/ 0.8/ 0.5/ 0.4/ 0.5; FI with 3–4 white ventral setae in basal third, with stronger and longer seta at 1/5; TI bare of major setae; It<sub>1</sub> very long, and slightly shorter than TI, and with pale curved ventral seta at 4/5 (MSSC); It<sub>5</sub> with pulvilli normal, not enlarged, and anterior claw slightly enlarged, as long as pulvilli, with posterior claw short (MSSC); II: 5.0; 6.5; 5.0/ 1.5/ 1.0/ 0.5/ 0.4; FII with some short white ventral hairs; TII with short ad only at 1/6, and with subapical ad and av setae; III: 6.2; 9.0; 4.3/ 1.8/ 1.3/ 0.7/ 0.4; FIII with very short white ventral hairs; TIII bare of major setae, but with some short dorsal and anterior setae.

*Wing:* hyaline; dm-cu slight flexed, and joining vein M and CuAx<sub>1</sub> at angle; CuAx ratio 2.1; lower calypter yellow with fan of yellowish setae; halter yellow with pale yellow club.

*Abdomen:* hypopygium (Fig. 1a) brown with brownish cercus; epandrium subrectangular with strong and weaker ventral setae; surstylus lobate with setae as figured; cercus L-shaped, with short distal projection at bend, and setose, especially medially and apically.

**Female:** similar to male, except lack MSSC, and as noted: vertex and frons metallic blue-green, with some grey pruinosity; vertical seta strong and curved; face flat; antenna brownish, not distinctly black; 3 pairs of long ac; 4 strong dc present; leg coloration and podomere rations similar; FI also with only short ventral hairs and single strong longer white av seta at 1/5; TI with ad seta at 1/5, and without posterior row of fine hairs; It<sub>1</sub> without curved seta; It<sub>5</sub> with 2 short subequal claws; TIII with ad seta at 1/6.

**Types.** Holotype ♂ (BPBM 16,670), paratypes 2♂, 2♀, VANUATU: **Malakula:** Lakatoro, 29.ix.1967, Malaise trap, J. & M. Sedlacek; paratypes, 2♂ same data but 22–30.ix.1967; 1♂, same but ii.1973 (BPBM), paratypes 1♂, 1♀, Atchin Island, vii.1929, L.E. Cheesman; 1♂, Malua Bay, vii.1929, L.E. Cheesman (BMNH). Holotype in BPBM.



**Figure 1.** Male hypopygium, left lateral: **a**, *Amblypsilopus ambrym*. **b**, *A. maulevu*. **c**, *A. upolu*. **d**, *A. waisei*. **e**, male tarsomeres 3–5, leg I, *A. waisei*. Scale line = 0.1 mm.

**Additional Material.** VANUATU: **Ambrym:** 2♂, 1♀, (no locale), 22.viii–4.ix.1967, Sedlacek (BPBM). **Pentacost:** 1♂, Batnavni, 0–100 m, 3.ix.1979, on *Acacia simplex*, Gagné (BPBM).

**Remarks.** *Amblypsilopus ambrym* is known from the Vanuatu islands of Ambrym, Malakula, and Pentacost.

**Etymology.** The specific epithet *ambrym* is a place name of indigenous origin and is treated here as a noun in apposition.

***Amblypsilopus waiseai* Bickel n. sp.**

(Fig. 1d, e)

**Description. Male:** length 5.2 mm; wing: 4.7 × 1.4 mm.

**Head:** antenna black.

**Thorax:** lateral scutellar setae absent.

**Legs:** (leg II absent on specimen) CI, all trochanters, femora and tibiae I and III yellow; tarsi I yellow, although distal tarsomeres infuscated; tarsus III brownish; coxae II and III brown; CI and CII with white anterior hairs and a few stronger distal setae; CIII with group of 5 white lateral setae; I: 6.0; 5.3; 4.3/ 1.2/ 0.8/ 0.4/ 0.4; FI with 2 long subequal white ventral setae, at 1/4 and 1/3; TI with short black dorsal seta at 1/5; It<sub>1</sub> with black curved ventral setae at 1/5 and 1/3, and with 3 shorter curved ventral distad (MSSC); It<sub>5</sub> (Fig. 1e) with pulvilli much larger than those on leg III, and anterior claw enlarged, with posterior claw short (MSSC); leg II missing; III: 7.5; 11.5; 5.8/ 2.5/ 1.6/ 0.8/ 0.4; FIII ventrally bare; TIII with ad seta at 1/6, and some short dorsal and anterior setae.

**Wing:** hyaline; dm-cu slightly curved, and joining vein M and CuAx<sub>1</sub> at angle; CuAx ratio 2.5; lower calypter yellow with fan of yellowish setae; halter yellow with pale yellow club.

**Abdomen:** hypopygium (Fig. 1d) dark brown with dark brown cercus; epandrium subrectangular with 2 weak ventral setae; phallus not as wide as in other species; surstylus lobate with setae as figured; cercus expanded basally and tapering distally, with abundant strong ventral setae.

**Female:** unknown.

**Types.** Holotype ♂, FIJI: **Viti Levu:** 2 km SE Nabukavesi Village (Ocean Pacific Resort) 18.172°S 178.258°E, 40 m, coastal lowland moist forest, 2–11.xi.2005, I. Buaserau (FBA 511521). Holotype to be deposited in FNIC.

**Remarks.** *Amblypsilopus waiseai* is known from the coastal forest on the southern margin of Viti Levu. Male leg I has the anterior claw is distinctly enlarged, and the pulvilli also enlarged. The male phallus in this species is not as broad as in other species of the group.

**Etymology.** *Amblypsilopus waiseai* is named in honor of Waisea Naisilisili, who lives near the collection site and who assisted with survey work at the Wildlife Conservation Society, Suva.

***Amblypsilopus maulevu* Bickel n. sp.**

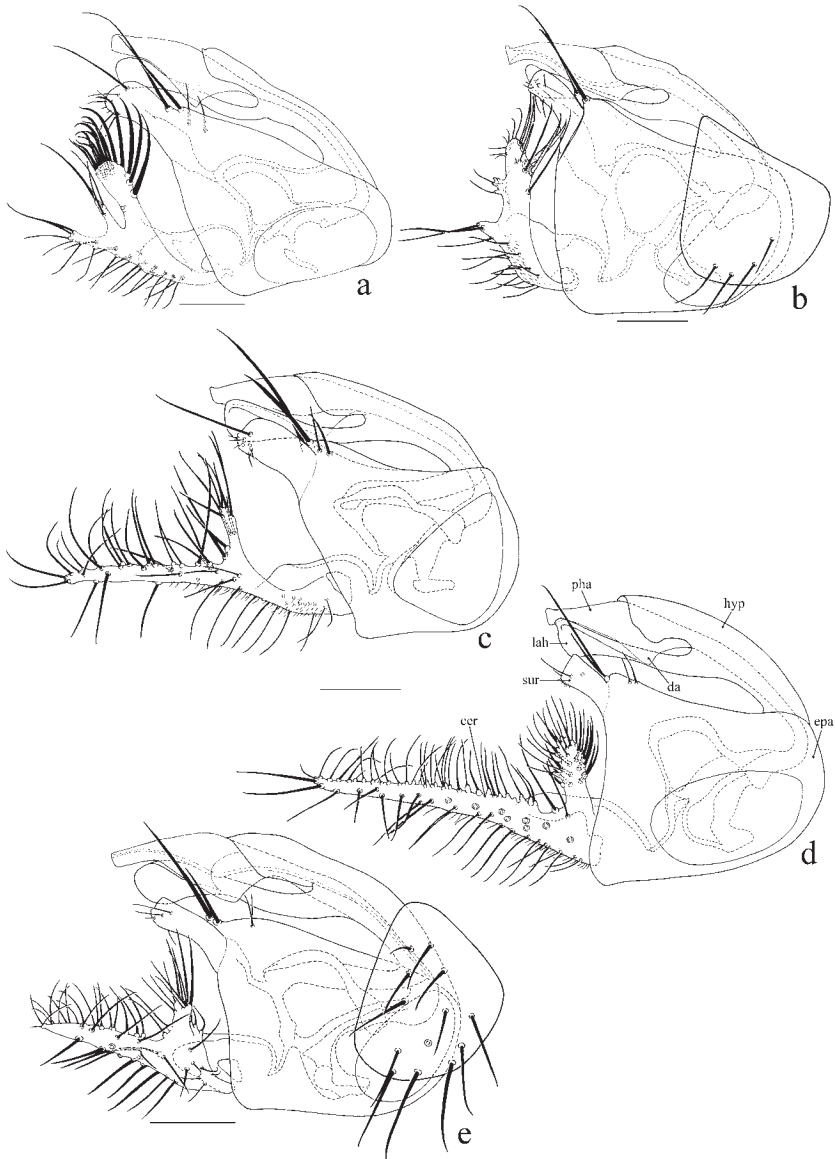
(Figs. 1b, 3a, b)

**Description. Male:** length 3.3 mm; wing: 2.7 × 0.9 mm.

**Head:** antenna black.

**Thorax:** lateral scutellar setae absent.

**Legs:** CI brown at very base, but otherwise yellow; coxae and trochanters II and III dark brown; trochanter I, all femora, tibiae and tarsi yellow, but with distal tarsomeres infuscated; CI and CII with white anterior hairs and a few stronger distal setae; CIII with white lateral seta; I: 3.5; 3.4; 2.8/ 0.7/ 0.4/ 0.3/ 0.5; FI with some white ventral hairs to 1/2, and with single strong longer white av seta at



**Figure 2.** Male hypopygium, left lateral: **a**, *Amblypsilopus eupulvillatus*. **b**, *A. pulvillatus*. **c**, *A. volivoli*. **d**, *A. bezzii*. **e**, *A. lenakel*. Legend: cer, cercus; da, dorsal angle of phallus; epa, epandrium; hyp, hypandrium; lah, lateral arm of hypandrium; pha, phallus; sur, surstylus. Scale line = 0.1 mm.

1/5; TI bare of major setae;  $It_{4-5}$  with some long dorsal, anterior and posterior setae (MSSC);  $It_5$  (Fig 3a, b) slightly flattened, with ventral pad-like surface, both pulvilli slightly enlarged, and with anterior claw only greatly enlarged and curved around tarsus, with smooth inner margin, and with short appressed posterior claw (MSSC); II: 4.0; 4.5; 3.8/ 1.2/ 0.8/ 0.3/ 0.3; FII with 4–5 short black ventral setae in distal third; TII with ad seta only at 1/6 and with subapical ad and av setae; III: 5.0; 6.3; 2.7/ 1.4/ 1.0/ 0.5/ 0.3; FIII with very short white ventral hairs; TIII with ad at 1/5, with some short dorsal setae spaced along length.

*Wing*: hyaline; dm-cu slight flexed, and joining vein M and  $CuAx_1$  at angle;  $CuAx$  ratio 1.9; lower calypter yellow with fan of white setae; halter with brownish stalk and pale yellow club.

*Abdomen*: hypopygium (Fig. 1b) brown with yellowish cercus; epandrium subtriangular with 2 strong adjacent ventral setae; surstylus lobate with strong subapical seta; cercus narrow, digitiform, with rather sparse setae as figured.

**Female**: unknown.

**Types**. Holotype ♂ (BPBM 16,671), paratype ♂, FIJI: **Vanua Balavu**: Maulevu, 0–10 m, 14.ii.1970, N.L.H. Krauss (BPBM). Holotype in BPBM.

**Remarks**. *Amblypsilopus maulevu* is known only from Vanua Balavu, the largest island in the northern Lau group, Fiji.

**Etymology**. The specific epithet *maulevu* is a place name of indigenous origin and is treated here as a noun in apposition.

***Amblypsilopus upolu* Bickel, n. sp.**

(Fig. 1c)

**Description. Male**: length 3.4 mm; wing:  $3.0 \times 1.2$  mm.

*Head*: antenna black.

*Thorax*: lateral scutellar setae reduced to short weak hairs.

*Legs*: CI with very base brown/ metallic green, but otherwise yellow; CII and CIII dark brown; trochanters, femora and remainder of legs yellow although distalmost tarsomeres infuscated; CI and CII with white anterior hairs and a few stronger distal setae; CIII with white lateral seta; all femora with weak white ventral hairs; I: 4.2; 3.8; 3.0/ 0.7/ 0.4/ 0.3/ 0.5; FI with white ventral hairs, and with strong ventral at 1/6; TI bare of major setae, but with some short subapical setae;  $It_{2-5}$  with some dorsal, anterior and posterior setae (MSSC);  $It_5$  slightly flattened, with ventral pad-like surface, both pulvilli slightly enlarged, and with anterior claw only greatly enlarged and curved around tarsus, and with short posterior claw (MSSC); II: 4.6; 5.0; 4.0/ 1.3/ 0.8/ 0.3/ 0.3; TII with ad seta at 1/6, and short pd setae at 1/3, and 2/5, and with strong subapical ad and av setae; III: 5.3; 7.5; 3.1/ 1.7/ 1.2/ 0.6/ 0.4; TIII with strong dorsal at 1/8, with some short dorsal setae spaced along length.

*Wing*: hyaline;  $CuAx$  ratio 1.85; lower calypter brownish with fan of black setae; halter yellow.

*Abdomen*: hypopygium (Fig. 1c) brown with yellowish cercus; epandrium subrectangular with 2 strong ventral setae; surstylus lobate with setae as figured; cercus narrow, digitiform and setose, and with distinct basal mound with cluster of setae as figured.

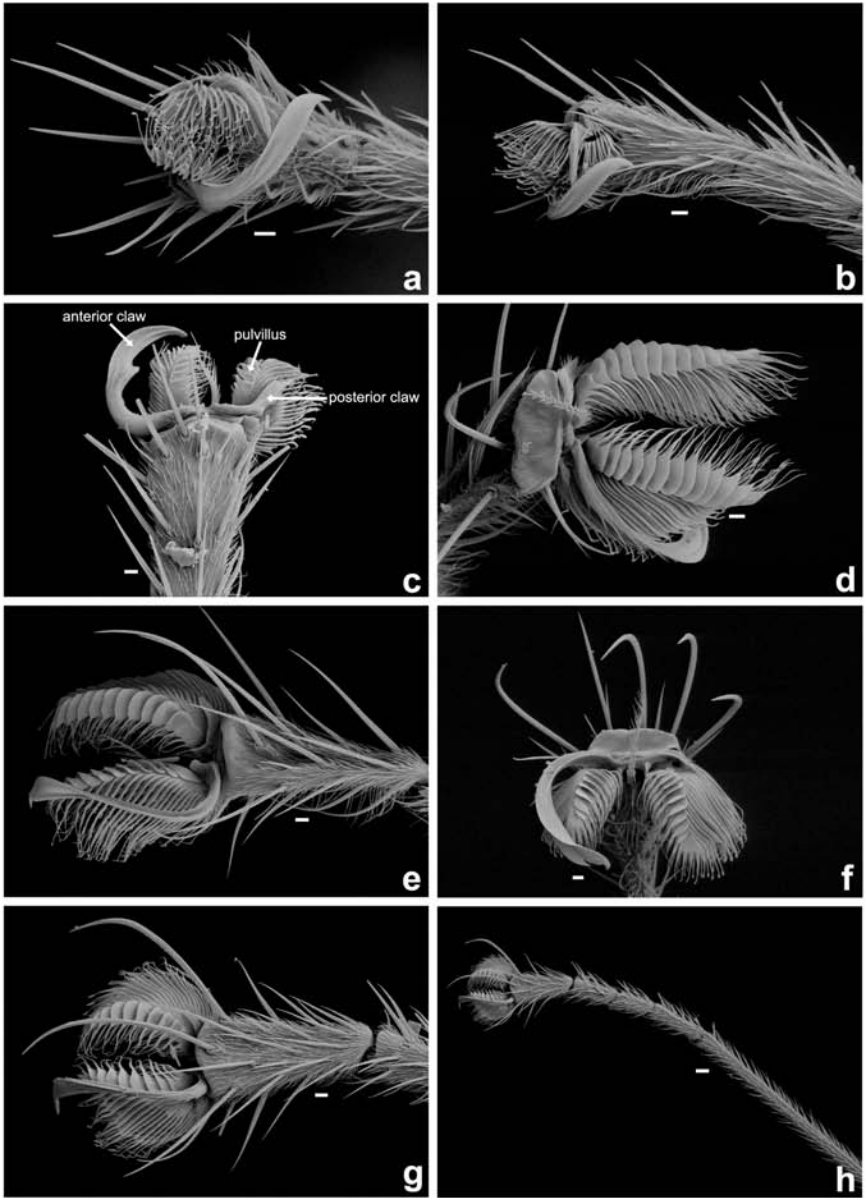
**Female**: unknown.

**Types**. Holotype ♂ (16,672), SAMOA: **Upolu**: Apia, 16.x.1968, B. Hocking (ex collection C.E.Dyde). Holotype in BPBM.

**Remarks**. *Amblypsilopus upolu* is known only from the Samoan island of Upolu.

**Etymology**. The specific epithet *upolu* is a place name of indigenous origin and is treated here as a noun in apposition.





**Figure 3.** SEMs of male tarsomere 5, leg I: **a**, *Amblypsilopus maulevu*, ventral; **b**, same but posterior. **c**, *A. volivoli*, dorsal. **d**, *A. lenakel*, dorsal. **e**, *A. bezzii*, dorsal. **f**, *A. eupulvillatus*, basal. **g**, *A. pulvillatus*, dorsal. SEM of male tarsus I: **h**, *A. pulvillatus*, dorsal. Scale line = 10  $\mu$ m.

*Amblysilopus volivoli* Bickel n. sp.

(Figs. 2c, 3c)

**Description. Male:** length 4.4–4.5 mm; wing: 4.0 × 1.3 mm.*Head:* antenna black.*Thorax:* lateral scutellar setae absent.

*Legs:* coxae and trochanters black with dusting of grey pruinosity; FI black to 2/5; distal FI, all FII and FIII, basal TIII, and tarsi I and II yellow; distal TIII and tarsus III dark brown; CI and CII with white anterior hairs and a few stronger distal setae; CIII with white lateral seta and some shorter white hairs; I: 3.8; 3.6; 3.4/ 0.6/ 0.3/ 0.2/ 0.6; FI with some white ventral hairs to 1/2, and with strong longer white av seta at 1/4; TI with short dorsal at 1/6, and short subapical setae; It<sub>2-5</sub> with some dorsal, anterior and posterior setae (MSSC); It<sub>5</sub> (Fig. 3c) slightly flattened with fine ventral hair s; both pulvilli enlarged, but less than half length of tarsomere 5, with distinctive plate like structure; anterior claw only greatly enlarged and curved, and with distinct tooth midway along inner surface, and posterior claw reduced to stub (MSSC); II: 4.5; 5.7; 5.5/ 1.3/ 1.0/ 0.3/ 0.3; FII with some short white ventral hairs; TII with ad-pd setal pair at 1/6 and short pd seta at 3/5, and with strong subapical ad and av setae; III: 5.0; 8.5; 4.3/ 1.7/ 1.2/ 0.7/ 0.4; FIII with white ventral hairs in basal half; TIII with strong ad seta at 1/8, with some short dorsal setae spaced along length.

*Wing:* hyaline; dm-cu slight flexed, and joining vein M and CuAx<sub>1</sub> at angle; CuAx ratio 2.0; lower calypter brownish with fan of black setae; halter with brownish stalk and pale yellow club.

*Abdomen:* hypopygium (Fig. 2c) brown with brownish cercus; epandrium subrectangular with 2 ventral setae near epandrial lobe; surstylus lobate with strong subapical seta; cercus elongate and setose, and with distinct ventral digitiform projection at 1/3, with setae as figured.

**Female:** unknown.

**Types.** Holotype ♂, FIJI: **Viti Levu:** Sigatoka Prov., Sigatoka Sand Dunes NP, Malaise, coastal forest, 55 m, 1–13.xii.2002, T. Ratawa (FBA 025514); paratypes, 1 ♂, same but 12.ii–12.iii.2003 (FBA 024557); 1 ♂, same but 11.vi–9.vii.2003 (FBA 030974); 1 ♂, same but 31.i–12.ii.2003 (FBA 024954); 1 ♂, same but 0.8 km SSW of Volivoli Village, 25 m, 27.viii–13.ix.2004, G. Niusoria (FBA 503336) (BPBM). Holotype will be deposited in FNIC.

**Additional Material.** FIJI: **Taveuni:** 3 ♂, 1 ♀, Cakaudrove Prov., 3.2 km NW Lavena Village, Mt. Koronibuanibua, 235 m, 16.855°S 179.892°W, 5–17.vi.2004, Malaise trap, lowland rainforest Schlinger & Tokota'a (FBA 123540, 123550) (BPBM).

**Remarks.** *Amblysilopus volivoli* is known from coastal dune forest in southern Viti Levu, and from lowland rainforest on Taveuni. On the Sigatoka Sand Dunes it is sympatric with two other species in the *pulvillatus* group, *A. bezzii* and *A. pulvillatus* itself.

**Etymology.** The specific epithet *volivoli* is a place name of indigenous origin and a noun in apposition.

*Amblysilopus bezzii* Bickel n. sp.

(Figs. 2d, 3e)

**Description. Male:** length 3.2–3.4 mm; wing: 3.7 × 1.1 mm.*Head:* antenna black.*Thorax:* scutellar setae reduced to short weak hairs.

*Legs:* CI with very base brown/ metallic green, but otherwise yellow; CII and CIII dark brown; trochanters, femora and remainder of legs yellow although distalmost tarsomeres infuscated; CI and CII with white anterior hairs and some stronger white distal setae; CIII with white lateral seta, subtended by white hairs; I: 4.4; 4.3; 3.2/ 0.6/ 0.4/ 0.4/ 0.7; FI with short 5–6 short white ventral hairs to 1/2, and with single strong longer white av seta at 1/6; TI bare of major setae, and without posterior row of fine hairs; It<sub>1-4</sub> with short hairs; It<sub>5</sub> (Fig. 3e) with some long dorsal, anterior and posterior

or setae;  $It_{4-5}$  slightly flattened with fine ventral hair; pulvilli enlarged, as long as  $It_5$ , and with distinctive plate like structure; anterior claw only enlarged and longer than pulvilli, and posterior claw reduced to stub (MSSC); II: 4.5; 5.7; 4.6/ 1.3/ 1.0/ 0.4/ 0.3; FII with some white ventral hairs; TII with ad seta at 1/6, and with strong subapical ad and av setae; III: 5.6; 8.0; 3.6/ 15/ 1.1/ 0.6/ 0.4; TIII bare of major setae but with some short dorsal setae spaced along length.

*Wing*: hyaline; dm-cu slight flexed, and joining vein M and  $CuAx_1$  at angle;  $CuAx$  ratio 2.1; lower calypter yellow with fan of yellowish setae; halter with yellowish stalk and pale yellow club.

*Abdomen*: hypopygium (Fig. 2d) brown with brownish cercus; epandrium subrectangular with 2 subequal ventral setae; surstylus lobate with short setae; cercus elongate and setose, and with setose with ventral thumblike projection at 1/3.

**Female**: similar to male, except lack MSSC, and as noted: antenna brownish, not distinctly black; leg coloration and podomere ratios similar; FI also with single strong longer white av seta at 1/6; TI with ad seta at 1/5, and without posterior row of fine hairs;  $It_{1-4}$  with normal vestiture;  $It_5$  unmodified; lower calypter also with fan of yellowish setae; TIII with black ad seta at 1/6.

**Types**. Holotype ♂, paratypes, 4♂, FIJI: **Viti Levu**: Sigatoka Sand Dunes NP, Malaise, coastal forest, 55 m, 22.xii.2002–3.i.2003, T. Ratawa (holotype, FBA 045658, paratypes FBA 045654–045657); paratypes: 12♂, 1♀, same but 14.xii–22.xii.2002 (FBA 001353, 0016004); 2♂, same but 24.xi–15.xii.2003 (FBA 062508–062509), 1♂, 1♀ same but 12.ii–12.iii.2003 (FBA 024558–024559); 1♂, same but 6–17.iv.2004 (FBA 063833) (BPBM). Holotype will be deposited in FNIC.

**Additional Material**. FIJI: **Ovalau**: 1♂, Levuka, 0–100 m, xi.1975, N.L.H. Krauss; 1♂, 6♀, Vatukalo, 0–20 m, 30.xii.1969, Krauss. **Taveuni**: 1♂, Waiyevo, 0–100 m, i.1972, Krauss (BPBM).

**Remarks**. *Amblypsilopus bezzii* is known from lowland sites along the southern coast of Viti Levu, Ovalau, and Taveuni.

**Etymology**. The specific epithet *bezzii* is a patronym in honor of the Italian dipterist Mario Bezzi for his 1928 monograph *Diptera Brachycera and Athericera of the Fiji Islands*.

### *Amblypsilopus lenakel* Bickel n. sp.

(Figs. 2e, 3d)

**Description**. **Male**: length 3.9–4.0 mm (2.7 mm from Epi); wing: 3.6 × 1.3 mm (2.9 × 0.8 mm from Epi).

*Head*: antenna black.

*Thorax*: lateral scutellar setae as short weak hairs.

*Legs*: CI, all trochanters, femora, tibiae and tarsi yellow, although distal tarsomeres infuscated; coxae II and III dark brown; CI and CII with white anterior hairs and a few stronger distal setae; CIII with white lateral seta; I: 4.7; 4.3; 3.3/ 0.6/ 0.4/ 0.3/ 0.5; FI with short 5–6 short white ventral hairs to 1/2, and with single strong longer white av seta at 1/8; TI bare of major setae, but with posterior row of fine slanted yellow hairs along entire length (MSSC);  $It_{1-4}$  with short erect hairs;  $It_5$  (Fig. 3d) with some long dorsal, anterior and posterior setae, and slightly flattened, but without ventral pile; pulvilli enlarged, slightly longer than half tarsomere length, and with distinctive plate like structure; anterior claw only greatly enlarged and curved, not toothed, and posterior claw reduced to stub (MSSC); II: 4.7; 5.8; 4.7/ 1.3/ 1.1/ 0.3/ 0.3; FII with some short white ventral hairs; TII with offset ad–pd setal pair at 1/6, short pd and short anterior at 3/5 and with subapical ad and av setae; III: 6.4; 8.3; 3.5/ 1.8/ 1.0/ 0.7/ 0.4; FIII with very short white ventral hairs; TIII with ad at 1/6, with some short dorsal setae spaced along length.

*Wing*: hyaline; dm-cu slight flexed, and joining vein M and  $CuAx_1$  at angle;  $CuAx$  ratio 2.1; lower calypter yellow with fan of yellowish setae; halter yellow with pale yellow club.

*Abdomen*: hypopygium (Fig. 2e) brown with brownish cercus; epandrium subrectangular with 2 adjoined ventral setae; surstylus lobate with setae as figured; cercus short subtriangular, and with ventral lobate projection at 1/3, and with setae as figured.

**Female:** similar to male, except lack MSSC, and as noted: antenna brownish, not distinctly black; leg coloration and podomere ratios similar; FI also with short 5–6 short white ventral hairs to 1/2, and with single strong longer white av seta at 1/8; TI with ad seta at 1/5, and without posterior row of fine hairs;  $It_{1-4}$  with normal vestiture;  $It_5$  unmodified; lower calypter also with fan of yellowish setae.

**Types.** Holotype ♂ (16,673), paratypes 2♂, 2♀, VANUATU: **Tanna:** Lenakel, 0–200 m, i.1981, N.L.H. Krauss (BPBM Acc. # 1981.131). paratypes: 2♂, 1♀, same but ii.1981; 1♂, 3♀, same but iii.1980; 2♂, same but xi.1978, 1♂, 3♀, same but iii.1970, 1♂, same but i.1973 (BPBM).

**Additional Material.** VANUATU: **Ambrym:** 0–100 m, xii.1984, Krauss (BPBM); Olal Catholic Mission, 2.i.1989, Lachlan (AMS). **Anatom:** (♀ only), Anelgaohat, 0–200 m, i.1986, Krauss (BPBM). **Efate:** Port Vila, ii.1959, Krauss. **Epi:** Lowekewou, 0–100 m, 31.viii.1979, Gagné, et al. (BPBM); **Erromango:** Dillon Bay, 0–100 m, ii.1981, xii.1985, Krauss (BPBM); **Tanna:** White Grass, 0–100 m, xii.1985, Krauss; Port Resolution, 0–100 m, 6.iii.1970, Krauss; Yanema, 6.iii.1970, Krauss; 2 km S of Ipeukeul, 300 m, 23.viii.1979, Gagné (BPBM).

**Remarks.** *Amblysilopus lenakel* is known from the Vanuatu islands of Tanna, Ambrym, Epi, Erromango, and Efate. The specimens from Epi are distinctly smaller (wing length 2.9 mm) than those from Tanna (wing length 3.6 mm) but in all other respects are similar.

**Etymology.** The specific epithet *lenakel* is a place name of indigenous origin and is treated here as a noun in apposition.

### *Amblysilopus eupulvillatus* (Parent)

(Figs 2a, 3f)

*Condylostylus eupulvillatus* Parent, 1928: 194.

**Description. Male:** length 4.1 mm; wing: 3.7 × 1.2 mm.

**Head:** palp brown with black setae; antenna black.

**Thorax:** lateral scutellar setae as short weak hairs.

**Legs:** all coxae, trochanters, FI and FII to 5/6 and all FIII dark brown; distal sixth of FI and FII, and all tibiae and tarsi yellowish, with distal tarsomeres infuscated; CI and CII with whitish pruinosity, white anterior hairs and a few stronger white distal setae; CIII with group of white lateral seta; I: 4.6; 4.5; 4.0/ 0.4/ 0.3/ 0.4/ 0.5; FI with some white ventral hairs to 1/2, and with single longer white ventral seta at 1/5; TI bare of major setae, but with pv row of short pale slanted weak setae (MSSC);  $It_1$  covered with short, almost erect setae (MSSC);  $It_4$  with some longer dorsal setae and fine whitish erect ventral pile (MSSC);  $It_5$  (Fig. 3f) with some long dorsal, anterior and posterior setae;  $It_{4-5}$  slightly flattened with fine ventral hair; both pulvilli enlarged, as long as tarsomere 5, and with distinctive plate like structure; anterior claw only greatly enlarged and longer than pulvilli, and posterior claw reduced to stub (MSSC); II: 4.7; 6.4; 4.7/ 1.4/ 0.8/ 0.4/ 0.4; FII with some short white ventral hairs; TII with ad seta at 1/6, short pd at 3/5 and short anterior at 2/3, and with subapical ad and av setae; III: 6.2; 8.5; 3.4/ 1.7/ 1.2/ 0.7/ 0.4; FIII with very short white ventral hairs; TIII bare of major setae.

**Wing:** with faint smoky wash; dm-cu slight flexed, and joining vein M and  $CuAx_1$  at angle;  $CuAx$  ratio 1.8; lower calypter brown with fan of brown setae; halter brownish.

**Abdomen:** hypopygium (Fig. 2a) brown with brown cercus; epandrium subtriangular with 2 long ventral setae; surstylus lobate with strong subapical seta; cercus with large clavate ventral projection bearing strong setae, and with two shorter distal digitiform arms, with setae as figured.

**Female:** similar to male, except lack MSSC, and as noted: coxa I, trochanters, femora, tibiae, and basal tarsomeres distinctly yellow; FI also with short 5–6 short white ventral hairs and with longer white seta at 1/6; TI with ad seta at 1/5, and without posterior row of fine hairs;  $It_{1-4}$  with normal vestiture;  $It_5$  unmodified; TIII with ad at 1/6; lower calypter also with fan of yellowish setae; halter yellow.

**Types.** Parent described *Condylostylus eupulvillatus* from Tonga (ZMUH, types de-destroyed). Bickel (1994) designated a male neotype, from Tonga, Tongatapu, Nukualofa, 25.x.1945, D.G. Hall (USNM).

**Additional Material.** TONGA: **Tongatapu:** 13♂, 3♀: Nukualofa, 0–100 m, x.1968, ii, iii, viii, x, xi, 1969, ii.1972, Krauss; Haatafu, 0–50 m, 29.x.1969, Krauss; Kolovai, 0–20 m, 29.i.1979, Krauss (BPBM).

**Remarks.** *Amblysilopus eupulvillatus* is known only from the low coralline island of Tongatapu, Tonga. All associated females have a distinctly different leg color to males, with coxa I and the remainder of the legs yellow.

### *Amblysilopus pulvillatus* (Bezzi)

(Figs. 2b, 3g, 3h)

*Condylostylus pulvillatus* Bezzi, 1928: 68.

**Description. Male:** length 3.3–3.4 mm; wing:  $3.6 \times 1.3$  mm.

**Head:** palp brown with black setae; antenna black.

**Thorax:** lateral scutellar setae absent.

**Legs:** all coxae, trochanters, FI and FII to 4/5 and all FIII dark brown; distal fifth of FI and FII, and TI, TII, and tarsi I and II yellow, with distal tarsomeres infuscated; TIII yellowish, becoming infuscated distally, with all tarsus III dark brown; CI and CII with white anterior hairs and a few stronger distal setae; CIII with white lateral seta and some weaker whitish setae; I: 4.3; 3.8; 3.0/ 0.6/ 0.4/ 0.5/ 0.7; FI with short 5–6 short white ventral hairs to 1/2, and with single longer white av seta at 1/6; TI bare of major setae, but with posterior row of fine slanted yellow hairs along entire length (MSSC); It<sub>1–4</sub> (Fig. 3h) with short vestiture; It<sub>4–5</sub> slightly flattened with fine ventral hair; It<sub>5</sub> (Fig. 3g) with some long dorsal, anterior and posterior setae; both pulvilli enlarged, as long as tarsomere 5, and with distinctive plate like structure; anterior claw only greatly enlarged and longer than pulvilli, and posterior claw totally absent (MSSC); II: 4.4; 5.2; 3.6/ 1.4/ 0.8/ 0.3/ 0.3; FII with some short white ventral hairs; TII with off-set ad–pd setal pair at 1/6, short anterior at 3/5 and with subapical ad and av setae; III: 5.5; 7.5; 3.3/ 1.6/ 1.0/ 0.6/ 0.4; FIII with very short white ventral hairs; TIII bare of major setae.

**Wing:** slightly smoky; dm-cu slight flexed, and joining vein M and CuAx<sub>1</sub> at angle; CuAx ratio 2.0; lower calypter brown with fan of mostly yellowish setae mixed with some black setae; halter with brownish stalk and with yellow club.

**Abdomen:** terga 1–6 metallic green bronze, with matt brown areas over tergal overlap, with black marginal setae and short black vestiture; hypopygium (Fig. 2b) brown with brown cercus; epandrium subrectangular without ventral setae; surstylus lobate; cercus clavate and bearing strong setae, and with two short stubs of digitiform arms.

**Female:** similar to male, except lack MSSC, and as noted: coxa I, trochanters, femora, tibiae, and basal tarsomeres distinctly yellow; FI also with 5–6 short white ventral hairs and with longer white seta at 1/6; TI with ad seta at 1/5, and without posterior row of fine hairs; It<sub>1–4</sub> with normal vestiture; It<sub>5</sub> unmodified; TIII with ad at 1/6; wing hyaline; lower calypter also with mixed yellowish and black setae; halter entirely pale yellow.

**Types.** Bezzi described *Condylostylus pulvillatus* from a pair taken at Rarawai, Vanua Levu (BMNH, examined). The figure (Bezzi's fig. 21) associated with the description mistakenly shows tarsus I with two enlarged claws, whereas only one claw (anterior) is enlarged, as noted in Bezzi's text.

**Additional Material.** FIJI: **Viti Levu:** Sigatoka Prov., Sigatoka Sand Dunes NP, Malaise, coastal forest, 55 m, T. Ratawa & G. Niusoria: 22.ix–8.x.2002 (FBA 001207), 14.xii–22.xii.2002 (FBA 001374), 1.xii–13.xii.2002 (FBA 025517), 11.vi–9.vii.2003 (FBA 030973), 15.xii.2003–13.iii.2004 (FBA 061088) (BPBM).

**Remarks.** *Amblysilopus pulvillatus* is known from the southern coast of Viti Levu near Sigatoka, and near Labasa, Vanua Levu. All associated females have a distinctly different leg color to males, with coxa I and the remainder of the legs yellow.

**PHYLOGENETIC ANALYSIS AND BIOGEOGRAPHY OF THE  
*AMBLYPSILOPUS PULVILLATUS* GROUP**

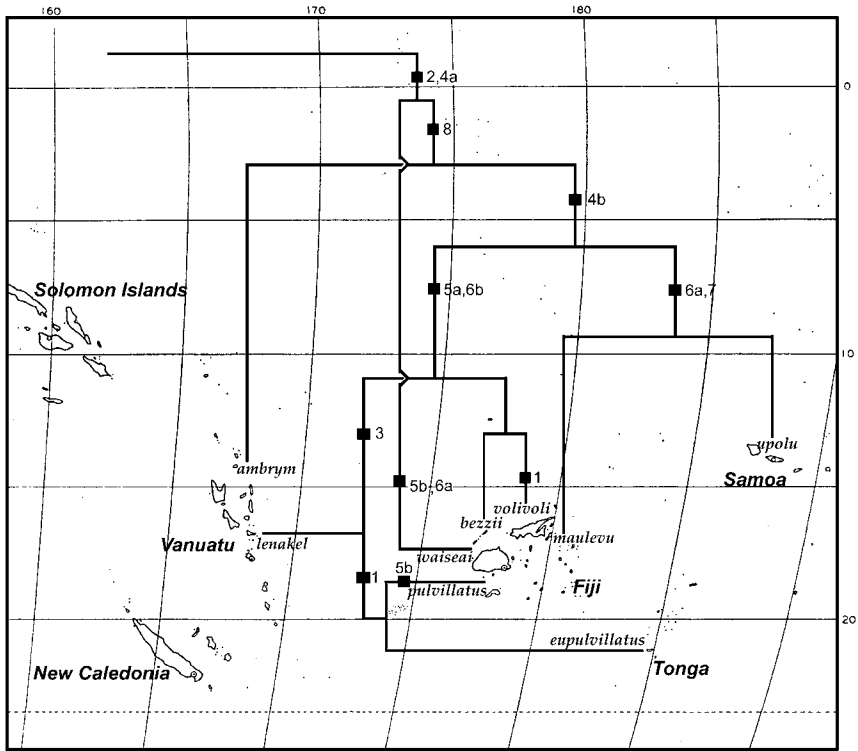
The phylogenetic relationships among species in the *pulvillatus* group is proposed in Fig.4, using the character states discussed below. Most of the characters used in the analysis are the same characters used to define the species, male secondary sexual characters (MSSC) and genitalic structure. These characters are purportedly used for mate recognition, and are often developed *de novo* from other states, which for practical purposes in the absence of a definable sister taxon, are here considered unmodified.

The principal MSSC in the *pulvillatus* group is the modification of the fifth tarsal segment of male leg I, a suite of three sets of characters (4, 5, and 6 below): enlargement of the anterior claw, the enlargement of the pulvilli, and the reduction/ loss of the posterior claw. These characters are not necessarily independent of each other, and multiple character states as listed for some characters do not necessarily represent a progression series.

The characters are presented in the following format: character state: plesiomorphic/ apomorphic.

1. Male leg color: coxa I and all femora yellow / coxa I black and femora at least partially black. Most *Amblypsilopus* species have yellow legs in both sexes. In some cases leg color dimorphism is developed in males and is regarded as a MSSC. All male of species with black coxa I and mostly black femora have conspecific females with coxa I and all femora yellow.
2. Femur I ventral setation: ventrally bare or with scattered pale hairs / with ventral white seta in basal quarter, both sexes. This white basoventral seta on femur I is a diagnostic synapomorphy in both sexes of all *pulvillatus* group species. Other *Amblypsilopus* species I have seen have various ventral setation on femur I.
3. Male tibia I: posteriorly bare / with row of fine hairs along length (MSSC).
4. Male anterior claw on leg I: unmodified, subequal to claws on other legs/ a. slightly enlarged with respect to posterior claw/ b. greatly enlarged, more than half length of tarsomere 5.
5. Male posterior claw on leg I: unmodified, subequal to claws on other legs/ a. reduced in size to short basal plate / b. totally absent.
6. Male pulvilli on leg I: unmodified, subequal to claws on other legs/ a. slightly enlarged with respect to pulvilli on other legs/ b. greatly enlarged, more than half length of tarsomere 5.
7. Male cercus: lobate with projections/ elongate and digitiform, without projections.
8. Male phallus dorsal angle: not more than 2 times as wide as apex of phallus/ wide, more than 3 times as wide as apex of phallus (e.g. Fig. 2d). The phallus on almost all Sciapodinae has a distinct dorsal angular projection just beyond mid length which usually not greatly produced, whereas in all members of the *pulvillatus* group except *A. waiseai* it is remarkably wide, and I regard this as derived.

The *pulvillatus* group is defined by strong apomorphy 2, the white basoventral seta on FI, and 4a, the enlargement of the anterior claw. The sister taxon to this group is probably some undescribed assemblage of species from Melanesia, as the genus is rich in the Papuan– Melanesian region. *Amblypsilopus waiseai* from Viti Levu, has an unmodified phallus, whereas all other members of the group have a broad phallus, and has only slight modification of the male tarsus I. *A. ambrym* from Vanuatu has a broad phallus but also



**Figure 4.** Cladogram and distribution map of the *Amblysilopus pulvillatus* group. Black squares indicate apomorphies and numbers refer to characters discussed in the text.

has only slight modification of the male tarsus I. A sister pair from single sites on Samoa, *A. upolu*, and the northern Lau island of Vanua Balavu, *A. maulevu*, have similar digitiform cerci and leg I modifications. This pair suggests possible dispersal from a common ancestor. The main *pulvillatus* group assemblage all have the male tarsus I strongly modified. Apomorphy 1, the black male coxa I and femora, is shown as appearing twice, in *A. volivoli* and in the pair *A. eupulvillatus* + *A. pulvillatus*, as I regard character 3, the posterior row of hairs on male tibia I to be a more robust character that unites the clade *A. lenakel* + *A. eupulvillatus* + *A. pulvillatus*.

The distribution of *pulvillatus* group species (Fig. 4) suggests a primary Fiji–Vanuatu radiation. The two most plesiomorphic species are *Amblysilopus ambrym* from Vanuatu and *A. waiseai* from Fiji, while *A. lenakel*, the second Vanuatu species, branched within a predominately Fijian radiation. This suggests physical proximity of Fiji and Vanuatu, as was the case some 6–8 Mya when as part of the old Vitiaz Arc, Viti Levu (Fiji) and Malakula (Vanuatu) were within 100 km of each other (Dickinson 2002). Since that time, Fiji has rifted and rotated and is now some 800 km away from Vanuatu. The Tongan species *A. eupulvillatus*, the sister species of the Fijian *A. pulvillatus*, could have evolved in the southern part of the ancestral Vitiaz Arc thus be a vicariant species, or it might have



dispersed from Fiji. The Samoan *A. upolu*, to the east of the Tongan Trench and away from the Vitiaz complex, is likely to have dispersed to Samoa from a common ancestor with its Lauan sister species, *A. maulevu*.

In summary, the *pulvillatus* group evolved in Fiji and Vanuatu, probably when the two archipelagoes were in close proximity as part of the Vitiaz Arc, some 6–8 Mya. This radiation possibly involved species on the ancestral Lau and Tonga ridges. As the result of the breakup and rifting of the old Vitiaz Arc, species now show a vicariant distribution, although the Samoan and Tongan species may be the result of dispersal.

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