

ADDITIONAL NEW GENERA AND SPECIES OF MICROVELIINAE (HETEROPTERA: VELIIDAE) FROM NEW GUINEA AND ADJACENT REGIONS

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Two new genera and 17 new species of Microveliinae are described from New Guinea and Australia. The new genera and their constituent species are as follows: *Papuavelia* gen. n. containing type species *siculifera* sp. n. from central Irian Jaya, Indonesia; *Phoreticovelina* gen. n. containing type species *Phoreticovelina rotunda* sp. n. from southwestern Papua New Guinea and northeastern Australia, plus *Phoreticovelina nigra* sp. n. from Biak, Salawati and Waigeo islands, Irian Jaya, Indonesia, *Phoreticovelina disparata* sp. n. from Queensland, Australia, and *Phoreticovelina notophora* (Esaki) new combination from Palau. The following new species are described in existing genera: *Aegilipsicola iriana* sp. n. from central Irian Jaya; *Aegilipsicola robinae* sp. n. from central Irian Jaya; *Tanyvelia bosavi* sp. n. from southern Papua New Guinea; *Tarsovelia kikori* sp. n. from southern Papua New Guinea; *Tarsovelia bosavi* sp. n. from southern Papua New Guinea, *Tarsovelia reclusa* sp. n. from southern Irian Jaya; *Tarsovelia ziwa* sp. n. from northern Irian Jaya; *Neusterensifer lubu* sp. n. from southern Papua New Guinea; *Neusterensifer kutubu* sp. n. from southern Papua New Guinea; *Neusterensifer acuminata* sp. n. from northern Papua New Guinea; *Neusterensifer pseudocyclops* sp. n. from southwestern Papua New Guinea; *Neusterensifer etna* sp. n. from southwestern Irian Jaya; *Neusterensifer iriana* sp. n. from central Irian Jaya. New distributional records are provided for *Tarsovelia dani* Polhemus & Polhemus. Habitus figures of the above new genera are provided, accompanied by illustrations of key characters for all new species and distribution maps.

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Key words. – Veliidae; Microveliinae; New Guinea; taxonomy; new genera; new species; keys; distribution.

The island of New Guinea contains a remarkable and highly endemic assemblage of genera and species in the subfamily Microveliinae, many of which are still undescribed. The current paper builds on a previous contribution by Polhemus & Polhemus (1994) which provided descriptions for four of the more distinctive genera within this regional biota. Additional collecting since that time has brought further new genera and new species to our attention, as well providing additional distributional information for previously described species.

In the following key to the pleustonic genera of Microveliinae, the monotypic tribe Velohebrini Stys is excluded. The single species, with flagelliform antennae, is presumably terrestrial.

The holotypes of the new species described herein

are deposited in the Bishop Museum, Honolulu (BPBM), the National Museum of Natural History, Smithsonian Institution (USNM), the Naturhistorisches Museum Wien (NHMW), the Indonesian Institute of Sciences (LIPI), or the Australian National Insect Collection, Canberra (ANIC); paratypes are held in these collections, the J. T. Polhemus collection, Englewood, Colorado (JTPC), and the Zoological Museum, University of Copenhagen (ZMUC).

All measurements are given in millimeters. CL numbers following certain localities refer to a coding system used by the authors to cross-reference specimens and collection data. The notation 'PTFI' refers to the P. T. Freeport Indonesia mining company, which provided logistical support to reach certain remote sites associated with their geological exploration activities.

Revised key to genera of New Guinea
Microveliinae (Tribe Microveliini)

1. Body dorsoventrally flattened, strongly sexually dimorphic, males much smaller than females; dorsum of female thorax and basal abdomen depressed, often with patches of waxy secretion laterally on thorax (fig. 8). Middle claws and downcurving arolium modified into thin narrow blades (fig. 10b).....*Phoreticovelia* gen.n.
 – Body not dorsoventrally flattened, not strongly sexually dimorphic, males only slightly smaller than females; dorsum of female thorax and basal abdomen not depressed, without patches of waxy secretion. Claws and arolia may or may not be modified2
2. Large species, length of males 3.25–3.50 mm, of females 3.80–4.10 mm. Middle and hind tarsi with both arolia and both claws modified into leaf-like blades (fig. 3). Males with abdominal sternites II–V tumid medially, produced ventrally, sternite VIII with a large dagger-like structure directed anteriorly, acuminate distally (figs. 2, 4)*Papuavelia* gen.n.
 – Smaller species, length of males not exceeding 3.0 mm, females not exceeding 3.2 mm. Tarsi with arolia and claws not modified into leaf-like blades. Male abdominal sternites sometimes modified, but not as above.....3
3. Middle tarsi subequal in length to middle tibia; light markings on hemelytra restricted to basal angles; fore femur of male at least slightly modified for phoresy.....
*Tarsovelia* Polhemus & Polhemus
 – Middle tarsi distinctly shorter than middle tibia; light markings on hemelytra may be restricted to basal angles, or may occur also on distal portions; fore femur may or may not be modified for phoresy4
4. Claws extremely long (fig. 18), more than twice tarsal width; light hemelytral markings entirely bright greyish to light bluish pruinose; gula long, rostral cavity demarcated by strongly raised carina*Aegilipsicola* Polhemus & Polhemus
 – Claws relatively short, slightly longer than tarsal width; light hemelytral markings not bright pruinose; gula short, rostral cavity not demarcated by strongly raised carina.....5
5. Antennae extremely long, at least $\frac{3}{4}$ of body length; comb on fore tibia $\frac{3}{4}$ the length of the tibia; only micropterous morph known.....
*Tanyvelia* Polhemus & Polhemus
 – Antennae not extremely long, distinctly less than $\frac{3}{4}$ of body length; comb on fore tibia less than $\frac{3}{4}$ length of tibia (except in *Neusterensifer compacta*), if comb on fore tibia $\frac{3}{4}$ length of tibia then male

- proctiger bearing elongate process and female abdominal tergites VII and VIII forming an anal plate (see below); only apterous and macropterous morphs known, latter with large hemelytral light markings basally, and often occurring in all closed cells6
6. Female abdominal tergites VII–VIII deflected ventrad forming an anal plate; male genitalia highly modified, bearing a long sinuate anteriorly directed sword-like process (figs. 43–53).....
*Neusterensifer* Polhemus & Polhemus
 – Female abdominal tergites VII–VIII not deflected ventrad, not forming an anal plate; male genitalia may be modified, but without a long sword-like process.....*Microvelia* Westwood

Papuavelia gen. n.

Type-species: *Papuavelia siculifera* sp. n.

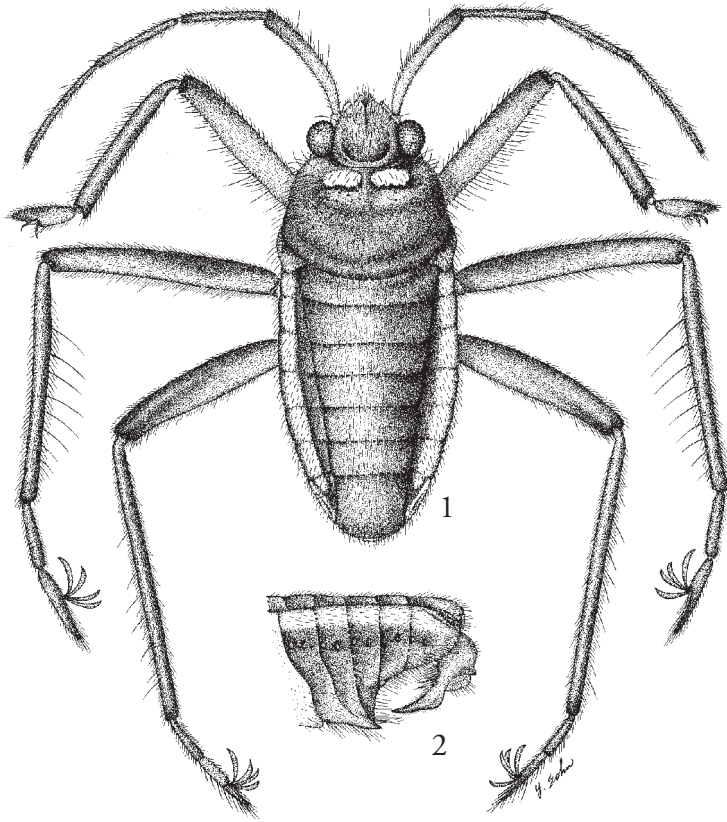
Description

Size. – Apterous form, length of males 3.25–3.40 mm., females 3.80–4.10 mm; general body characteristics and size not sexually dimorphic, males and females similar.

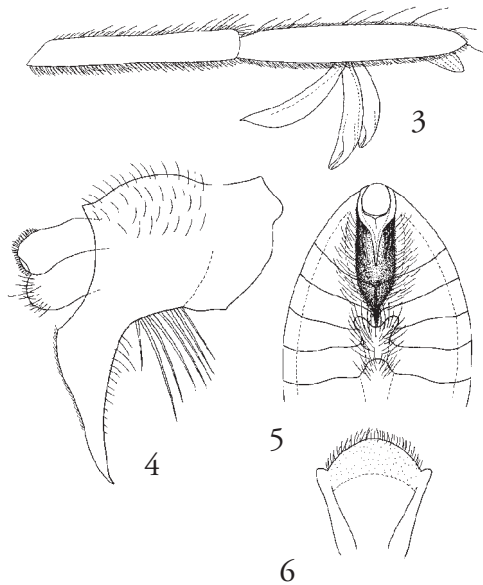
Colour. – Ground colour blackish brown, tinged with orange brown, with silvery pubescent markings on pronotum behind eyes, on abdominal tergite I laterally; anterior pronotal lobe yellowish, sharply demarcated from dark lateral collar and posterior lobe.

Structural characters. – Apterous form, shape oval-elongate (fig. 1). Eyes globose, exerted but not beyond anterolateral pronotal angles, separated by about $1\frac{1}{2}$ times the width of an eye, appressed to anterior pronotal margin, with long ocular setae. Head declivant anteriorly, posterior margin sloping caudo-dorsally, with usual three pairs of facial trichobothria plus scattered long setae; gular region short, plainly visible, rostral cavity closed posteriorly. Rostrum reaching to middle of mesosternum, segment I short, enclosed in rostral cavity, segments I and IV subequal in length and about three times longer than II, segment III about 8 times as long as II. Antennae slender, very long, about $\frac{5}{6}$ of body length.

Pronotum slightly raised medially, without median carina; collar weakly formed, absent medially, evident behind eyes laterally; anterior and posterior lobes set off by a transverse row of large foveae, evanescent laterally; entire pronotum with scattered stiff erect dark setae in males, absent dorsally in females, suggesting phoresy; with silvery seate behind eyes; posterior lobe with numerous small foveae, humeri not prominent, broadly rounded posteriorly, not modified, covering metanotum. Thoracic venter not diagnostic, with weakly formed tubercles on either side of mesosternal midline on posterior margin opposing an unmodified



Figs. 1-6. *Papuavelia siculifera*, gen. n., sp. n. — 1. Male, dorsal habitus; 2. Male terminal abdomen, lateral view; 3. Male middle tarsus; 4. Male abdominal segment VIII, proctiger, and pygophore, lateral view; 5. Male abdomen, ventral view; 6. Male proctiger.



metasternum. Metasternal scent gland opening (omphalium) small but visible, marked by a small tubercle; scent channels prominent, curving slightly anterad to base of metacetabulae. Wing pads absent.

Abdomen with silvery setae laterally on tergite I; without longitudinal carinae on tergites. Abdominal sternites set off from laterosternites by hair-free glabrous oval lacunae; male ventrites II-IV gibbouse, ventrite VII medially depressed.

Legs stout, long, middle and hind legs of about equal length; anterior femur set beneath with short light setae, unmodified in males; anterior tibia of male with a comb of minute black setae occupying $\frac{1}{2}$ of tibial length; middle and hind femora set ventrally with long slender setae; all tarsi long (fig. 1), claws, both up- and down curving arolia large, evident, modified into leaf-like structures (fig. 3).

Male genital segments moderately large, bent ventrad at a sharp angle, ventrite VIII modified into an anteriorly directed dagger-like structure, acuminate distally, medially with long divergent setae (figs. 4, 5); pygophore unmodified; parameres small, triangular symmetrical, hidden; proctiger modified, explanate

laterally, with two (1+1) postero-laterally directed 'wings' distally (fig. 6). Female with tergite VIII on same plane as VII, truncate posteriorly; first gonocoxae large, exposed, plate-like; tergite X (proctiger) of both sexes rounded, protruding posteriorly.

Macropterous form with wings exceeding tip of abdomen, bearing 5 closed cells, consisting of 2 basal cells, 2 central cells, and a single distal cell; coloration of wings uniformly dark brown, lacking pale spots or stripes.

Remarks

Comparative notes. – *Papuavelia* is the largest known microveliine in New Guinea, and differs from all other microveliine genera by possessing four long leaf-like structures subapically on the middle and hind tarsi (fig. 1), those of the claws cleft distally (fig. 3). In the nymphs studied, the downcurving arolium is not modified. In addition, antennal segment one is relatively stout, longer than the width of the head through eyes, and extends anteriorly for 9/10 of its length beyond the apex of the head (fig. 1).

This genus drops from Andersen's (1982: 419) key at couplet 12. A number of described microveliine genera have three leaf-like structures on the middle tarsi, but not four as in *Papuavelia*, which is also unique in possessing leaf-like structures on the posterior tarsi.

The single known species of *Papuavelia* also has the abdominal venter highly modified, with ventrite VIII bearing an anteriorly directed acuminate protuberance (fig. 2).

Etymology. – The generic name *Papuavelia* is derived from Papua, the former name for the island of New Guinea, and *Velia*, the nominate genus of the family. Gender feminine.

Distribution. – New Guinea (fig. 7).

Papuavelia siculifera sp. n. (figs. 1–7)

Type material. – Holotype, apterous male: INDONESIA, Irian Jaya Prov., New Guinea, Wabu River below PTFI Bilogai exploration camp, 2105 m. (6900 ft.), water temp. 17° C., 1 April 1997, 08:30–14:00 hrs. 3°44.69' S, 137° 01.75' E., CL 7083, D. A. and J. T. Polhemus (LIPI). – Paratypes: INDONESIA, Irian Jaya Prov., New Guinea: 1 macropterous male, 26 apterous males, 29 apterous females, 24 immatures, same data as holotype (JTPC, USNM, LIPI); 3 apterous males, 4 apterous females, rocky rainforest tributary to upper Ziwa River at PTFI Wapoga Alpha drilling camp, 1050 m. (3500 ft.), water temp. 20° C., 18 April 1998, 10:00–17:00 hrs.; 19 April 1998, 14:00–18:00 hrs. 3°08.69' S, 136°34.42' E., CL 7100, D. A. Polhemus (USNM, LIPI); 7 apterous males,

7 apterous females, Tarmulu, 4°25' S, 140°17' W, 1500 m., 6 Sept. 1993, Balke and Riedel (USNM, BPBM, JTPC, NHMW).

Description

Size. – Apterous male, length 3.25–3.40 mm (\bar{x} =3.34, n=8); width 1.25–1.40 mm (\bar{x} =1.31, n=8). Apterous female, length 3.80–4.10 mm (\bar{x} =4.01, n=8); width 1.50–1.70 mm, (\bar{x} =1.60, n=8). Macropterous male, length 4.10 mm (n=1); width 1.60 mm (n=1).

Colour. – Apterous male: ground dark brown, anterior pronotum, connexival margins, and venter marked with yellowish brown. Head uniformly dark blackish brown. Pronotum dark blackish brown; posterior margin narrowly lighter brown; anterior lobe transversely yellowish brown, this coloration extending onto propleura; small patches of silvery hairs present behind eyes. Wing pads blackish brown. Abdomen brown, anterior margins of tergites black; lateral portions of tergite I with large patches of silvery hairs; outer portions of connexiva broadly orange brown; ventrites IV–VII extensively marked with orange brown. Legs yellow, upper surfaces marked with brown, this dorsal brown coloration patchy on femora, becoming uniform on tibia and tarsi.

Structural characters. – Apterous male: head of moderate length, declivant anteriorly; length 0.56, width 0.85; width of eye/interocular space, 0.22/0.42. Pronotum long, posterior margin evenly curving, not angulate, humeri obscure; length (midline): width, 0.65 : 1.19.

Abdominal venter bearing numerous long, fine, erect pale setae centrally; ventrites I–III raised centrally to form prominent setiferous tumescences, the tip of the tumescence on ventrite III posteriorly produced and angulate, projecting over and completely covering medial section of ventrite IV, and bearing two (1+1) small brushes of black setae at apex to either side of midline; medial section of ventrite IV with an angulate projection, this projection lying under the posteriorly directed extension of ventrite III, and covering the medial section of ventrite V; ventrite V with a pair (1+1) of small raised tumescences centrally to either side of midline, these tumescences rising to contact the tip of the posteriorly directed projection arising from ventrite III; ventrite VI with a weak longitudinal depression along midline; ventrite VII broadly depressed and concave centrally; first genital segment (segment VIII) curved downward into a vertical orientation, posteroventral margin bearing an anteriorly-directed, glabrous, angulate projection, this projection setting into the medial concavities on ventrites VI and VII.

Legs clothed with numerous short, appressed, pale setae, intermixed on ventral surface of fore femur with numerous long, erect, pale, pilose setae, and on all

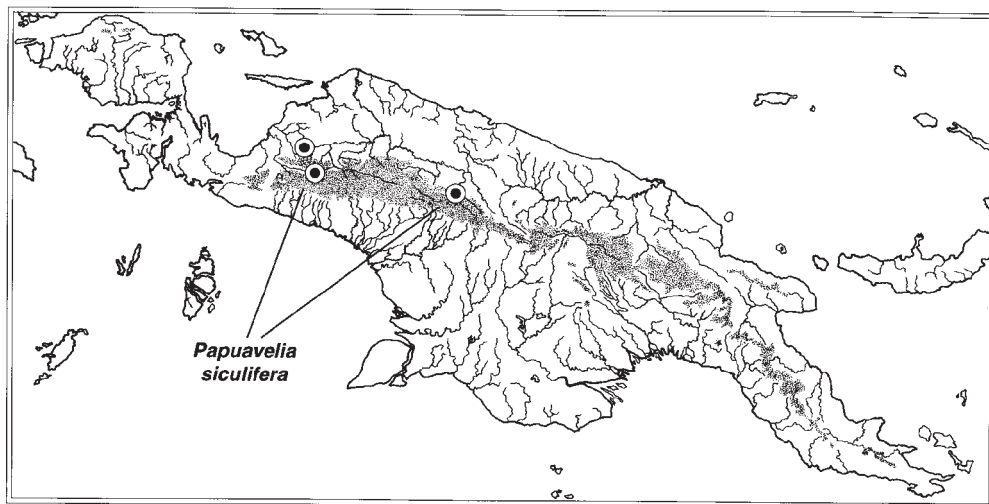


Fig. 7. Distribution of *Papuavelia siculifera*, gen. n., sp. n. in New Guinea.

other segments with scattered moderately long, semi-erect dark setae; all legs unarmed, lacking setal tufts or other modifications. Antennae thickly clothed with short inconspicuous setae, segment I also bearing 3–4 long, spine-like black setae.

Antennal formula I : II : III : IV; 0.94 : 0.62 : 0.70 : 0.87.

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg, 1.30 : 1.25 : 0.50 : 0.0; of middle leg, 1.75 : 1.80 : 0.50 : 0.50; of hind leg, 1.50 : 2.07 : 0.37 : 0.50.

Paramere small, triangular, hidden; proctiger modified, explanate laterally, with two (1+1) postero-laterally directed projections distally (fig. 6).

Apterous female.- Similar to male in general structure and coloration, but larger. Connexiva vertical, convergent posteriorly, evenly tapering toward tip of abdomen, posterolateral angles bearing tufts of black setae; abdominal venter unmodified.

Macropterous male.- Similar to apterous form in general structure in coloration, but with following differences: pronotum enlarged, humeri produced, raised, rounded, posterior lobe expanded, roughly triangular, extending backward to cover all of meso- and metanotum, hind margins tapering evenly to rounded apex; pronotal coloration dark brown, narrowly emarginate with pale brown along posterior margin, posterior lobe with irregularly set with coarse punctations, bearing numerous moderately long, semi-erect gold setae; wings fully developed, reaching beyond tip of abdomen, veins strongly raised, enclosing 5 cells, consisting of 2 basal cells, 2 central cells, and 1 distal cell; coloration of wings uniformly dark brown, without pale markings, basal section of costal margin set

with short, stiff, semi-erect gold setae.

Remarks

Comparative notes. – Easily recognized among the Papuan Microveliinae by its large size, four leaf-like structures on each of the middle and hind tarsi (fig. 3), and by the straight, symmetrical, anteriorly directed, dagger-like process (fig. 4) arising from the anteroventral margin of the male first genital segment (abdominal segment VIII).

Biological notes. – The type series was taken from a small, clear tributary to the upper Wabu River, in an area of montane forest disturbed by native Irianese people for the planting of sweet potato gardens. In general appearance on the water, individuals of *Papuavelia* superficially resemble *Rhagovelia*, skating quickly and erratically, and appear to prefer shaded situations next to vertical or undercut stream banks, where they often aggregate. On a tributary to the upper Ziwa River, to the northwest of the Bilogai type locality, individuals were taken in a zone of crashing cascades, where they occurred in a protected, rock-walled backwater behind a large boulder. As a result of their preference for such sheltered sites, *Papuavelia* tend to be found intermittently along any given stream, often in company with *Tarsovelia* species, which also frequent the same types of dark, protected spots.

Etymology. – The name 'siculifera', meaning 'one who carries a dagger', is derived from *sicu* (L., a dagger) and *fera* (L., to carry), and refers to the dagger-shaped process arising from the male genital segments.

Distribution. – West Central New Guinea (fig. 7).

Phoreticovelina gen.n.

Type-species: *Phoreticovelina rotunda* sp. n.

Description

Size. – Apterous form, length of males 0.93–1.26 mm., females 1.58–2.12 mm; macropterous males, length 1.14–1.55 mm, macropterous females, length 2.02–2.16 mm (for *P. notophora* only); general body characteristics and size strikingly sexually dimorphic, males and females very dissimilar, males much smaller than females, without the depressed dorsum of the females.

Colour. – Ground colour black to orange brown, sometimes sparingly marked with silvery pubescence; anterior pronotal lobe broadly brown to orange brown, continuous streak extending laterally at least to lateral margins of head, sometimes to middle of eyes, shorter in winged forms. Legs, antennae concolourous with body.

Structural characteristics. – Strongly sexually dimorphic, females modified, large (fig. 8), males normal and much smaller than females. Both apterous and macropterous forms known. Eyes globose in female, less so in males, exerted but not nearly to anterolateral pronotal angles, separated by more than twice the width of an eye; not touching in females, but appressed to anterior pronotal margin in males; with short ocular setae. Head porrect, of moderate length, not recessed into pronotum, posterior margin slightly declivant, with usual three pairs of facial trichobothria; gular region short, but visible, rostral cavity partly open posteriorly, with raised carinate bucculae. Rostrum reaching to middle of mesosternum, segment I of moderate length, enclosed in rostral cavity, I and IV subequal in length and about three times longer than II, segment III about six times as long as II. Antennae moderately stout, short, less than 1/2 of body length.

Pronotum short, scarcely more than half of eye length, declivant behind in females, without median carina; collar not evident; posterior lobes lacking; anterior lobe without evident median foveae; lateral transition between pronotum and propleura abrupt, propleura length about equal to eye. Apterous female with mesonotum modified, depressed medially and narrowly along antero-lateral margin; laterally slightly raised, sometimes sculptured anterolaterally, humeri not formed. Male mesonotum normal, lateral margins almost parallel, about three times as long as pronotum, humeri not formed. Metanotum almost as long as mesonotum, sutures obscure medially in female. Thoracic venter not diagnostic, without tubercles on mesosternum or metasternum. Metasternal scent gland opening (omphalium) not visible; scent channels prominent, curving slightly anterad to base of metacetaebulae.

Dorsum of two species (*rotunda*, *disparata*) with

silvery setae on abdominal tergites, and sometimes on the thorax, of both males and females, more extensive in males; apterous form without paired longitudinal carinae on abdominal tergites. Abdominal sternites set off from laterosternites by small hair-free glabrous oval lacunae.

Macropterous forms with two basal closed cells in dark hemelytra, veins of distal two cells only weakly expressed, fifth distal cell not evident; without distinct light markings, either completely dark or with light areas basally and distally; without paired longitudinal carinae on abdominal tergites; pronotum long, evenly rounded posteriorly, not modified for phoresy.

Legs moderately stout, short; anterior femur set beneath with short light setae, slightly modified in males, slightly curved and flattened beneath on basal half; anterior tibia of male slightly bent, flattened and expanded distally, with a comb of minute black setae occupying 1/5 to 1/3 of tibial length, distal pad well developed, projecting; all femora set ventrally with slender setae; middle tibia with a row of 9 or 10 long slender evenly spaced setae beginning before middle, decreasing in length distally; all tarsi moderately long, middle tarsal segments long and about of equal length, almost as long as tibia, claws moderately long; both up- and down curving arolia long, slender in males; middle claws and down curving arolium modified into thin narrow blades, narrower in males, apparently to aid in rowing (fig. 10).

Male abdominal ventrites not modified; genital segments small, not modified, symmetrical; proctiger unmodified; parameres vestigial or absent, not visible at 80X. Female tergite VIII on same plane as VII.

Remarks

Comparative notes. – *Phoreticovelina* gen. n. is easily separated from other veliid genera by the rotund, flattened body of the apterous female, in which the mesonotum, metanotum and anterior abdominal tergites are medially depressed (fig. 8). The sexes are strongly dimorphic, with the males much smaller than females and lacking the striking dorsoventral flattening. The claws and ventral arolium of middle and hind tarsi are modified, blade-like, and thin (being thinner in males), the arolium being almost transparent and apparently modified for rowing (fig. 10b). These structures also have an unusual folding mechanism, not yet fully investigated, which allows them to lie with their tips rotated inward against the ventral surface of the tarsus when completely retracted (fig. 10a). The male fore femur is slightly bent, and flattened beneath; the fore tibia is bent distally, with a tibial comb about 1/5 to 1/3 of the tibial length, and a prominent distal spur in the shape of a pad (fig. 9).

Etymology. – The generic name *Phoreticovelina* is derived from *phoretos* (Gr.), borne, carried, referring

to the habit of males riding on the backs of females, and *Velia*, the nominate genus of the family. Gender feminine.

Distribution. – Australia (northern Queensland); New Guinea (figs. 11, 12); Palau.

Key to species of *Phoreticovelina*

1. Dorsum without distinct patches of silvery setae 2
– Dorsum with distinct patches of silvery setae .. 3
2. Male and female with propleura, mesonotum and abdominal tergites dark *nigra* sp. n.
– Male and female with at least propleura and laterotergites yellowish to brown, usually also parts of mesonotum and abdominal tergites
..... *notophora* (Esaki)
3. Ground colour orange brown; silvery setae present on most of male mesonotum (except sometimes medially), all of male abdominal tergites III–IV, and laterally on female tergites II–VII ...
..... *rotunda* sp. n.
– Ground colour blackish; silvery setae present on most of male mesonotum (including .medially), male abdominal tergites III–V, and on female laterotergite III and tergites VI–VII
..... *disparata* sp. n.

Phoreticovelina rotunda sp. n. (figs. 8–9, 10a, 11, 12)

Type material. – Holotype, apterous female: PAPUA NEW GUINEA, Western Prov., Aramia River near Balimo, CL 1773, 2 Sept. 1983, J. T. & D. A. Polhemus (BPBM). – Paratypes: PAPUA NEW GUINEA, Western Prov.: 6 apterous males, 13 apterous females, same data as holotype (BPBM, JTPC, USNM). AUSTRALIA, Queensland: 10 apterous males, 14 apterous females, Claudie River near Portland Roads, Iron Range, CL 1752, 24 Aug. 1983, J. T. & D. A. Polhemus (JTPC, ZMUC); 3 apterous males, 3 apterous females, Wenlock River at Peninsula Development Road (Moreton), CL 1756, 26 Aug. 1983, J. T. & D. A. Polhemus (JTPC).

Description

Size. – Apterous male, length 1.07–1.12 mm (\bar{x} =1.09, n =10); width 0.47–0.51 mm (\bar{x} =0.50, n =10). Apterous female, length 1.79–1.93 mm (\bar{x} =1.85, n =10); width 0.86–0.98 mm (\bar{x} =0.93, n =10).

Colour. – Apterous female: Ground colour orange brown, tinged with blackish brown ventrally, mostly blackish brown dorsally, except meso- and metanotum laterally, connexiva, and abdominal tergites VI–VIII orange brown; entire dorsum and laterotergites

covered with short dark setae, intermixed with medium length, slender, semi-erect silvery setae on mesonotum, abdominal tergites II–VII laterally, connexiva III–VI; venter with appressed golden pubescence. Head yellowish brown, vertex embrowned; rostrum shining yellowish brown, piceous distally. Pronotum dark brown laterally, mostly orange brown medially behind posterior margin of head. Antennae orange brown. Legs orange brown above, ventrally mostly yellowish brown, tarsi distally darkened; coxae and trochanters pale yellowish white.

Colour. – Apterous male: Coloration similar to female except less extensively marked with dark brown, but with more extensive patches of silvery setae, covering most of mesonotum (except sometimes medially), abdominal tergite II medially, all of tergites III, IV.

Structural characters (See generic description; only additional details here). – Apterous female: head with impressed median line; length 0.30; width of eye: interocular space, 0.12:0.28. Pronotum very short, about half of eye length; length:width, 0.09 : 0.51. Mesonotum depressed medially, tumid laterally; length:width, 0.28 : 0.77. Metanotum length:width, 0.14 : 0.84. Abdominal tergites faintly shining medially; tergites I, III–VI approximately the same length (0.09–0.12), II, VII longer (0.14).

Mesonotum, metanotum, abdominal tergites I–IV broadly depressed medially, forming a large, longitudinally ovate concavity; mesonotum often with a large ovate or irregularly shaped pad of wax-like substance on either side of midline. Legs and antennae thickly clothed with short to moderate length setae, with scattered longer setae.

Antennal formula I : II : III : IV; 0.16 : 0.16 : 0.16 : 0.26.

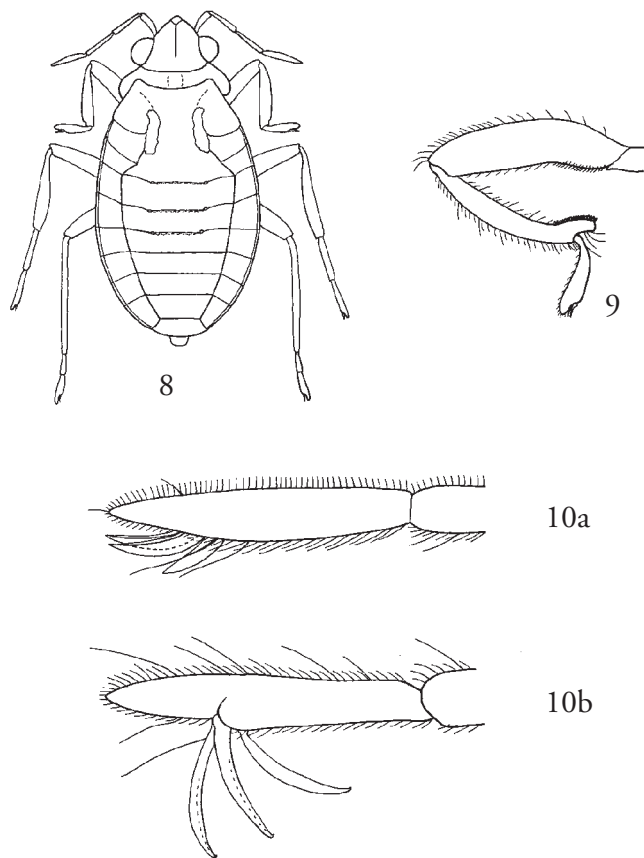
Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg, 0.42 : 0.33 : 0.19 : 0.0; of middle leg, 0.56 : 0.49 : 0.23 : 0.23; of hind leg, 0.56 : 0.58 : 0.09 : 0.19.

Apterous male: Similar to female in general structure and colour, but much smaller; head with only weakly impressed median line. Middle and hind legs unarmed except hind tibia with a distal spur of stiff setae; fore femur very slightly curved, thickened, flattened beneath, slightly tumid basally and distally; fore tibia with grasping comb small, extending 1/5 the length of the tibia, distal spur prominent, projecting (fig. 9).

Antennal formula I : II : III : IV; 0.12 : 0.09 : 0.12 : 0.19.

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg, 0.33 : 0.28 : 0.12 : 0.0; of middle leg, 0.42 : 0.33 : 0.14 : 0.16; of hind leg, 0.40 : 0.47 : 0.07 : 0.14.

Proctiger unmodified. Parameres vestigial or absent.



Figs. 8-10.

Phoreticovelina, gen. n., structural details – 8. *Phoreticovelina rotunda* sp. n., female, dorsal habitus, showing locations of waxy secretions; 9. *Phoreticovelina rotunda* sp. n., male foreleg; 10 a–b. *Phoreticovelina* female pretarsus – a. *Phoreticovelina rotunda* sp. n., showing claws and arolium in fully folded position; b. *Phoreticovelina notophora* Easki, showing claws and arolium in fully extended position.

Remarks

Comparative notes. – Easily separated from *P. nigra* by the brown to orange brown ground colour and the silvery setae on the dorsum of both sexes.

Biological notes. – The Aramia River at the type locality was a wide, deep, slowly flowing river in an area of lowland swamps, with clear, brownish tinted water. The type series of *P. rotunda* was found on calm water next to a cut clay bank.

Etymology. – The name *rotunda* refers to the shape of the rotund female of this species.

Distribution. – Southern New Guinea, Northeastern Australia (figs. 11, 12).

***Phoreticovelina nigra* sp. n.**
(fig. 12)

Type material. – Holotype, apterous female: INDONESIA, Irian Jaya Prov., Biak Is., waterfall and swift limestone stream at Wapsdori, E. of Wardo, 60 m el., CL 2619, 27 Sept. 1991, J. T. & D. A. Polhemus (LIPI). – Paratypes: INDONESIA, Irian Jaya Prov.: 7 apterous males, 1 macropterous male, 11 apterous females, Biak

Is., same data as holotype (JTTC, USNM, LIPI); 6 apterous males, 5 apterous females, Salawati Island, Wajar River, Wagom Mts., 0–30 m el., CL 2623, 30 Sept. 1991, J. T. & D. A. Polhemus (BPBM, JTTC, USNM, LIPI); 23 apterous males, 25 apterous females, Waigeo Island, Warrobiay River, nr. entrance to Majalibit Bay, 0–5 m. (0–15 ft.), water temp. 27° C., 30 April 1999, 09:00–15:00 hrs., 0°17'27.4" S, 130°56'12.8" E, CL 7118, D. A. Polhemus (USNM, LIPI).

Description

Size. – Apterous male, length 0.93-1.02 mm (\bar{x} =0.99, n=10); width 0.44-0.51 mm (\bar{x} =0.47, n=10). Macropterous male, 1.35 mm (n=1); width 0.70 mm (n=1). Apterous female, length 1.58-1.70 mm (\bar{x} =1.65, n=10); width 0.84-0.93 mm, (\bar{x} =0.89, n=10).

Colour. – Apterous female: Ground colour black, tinged with blackish brown; black dorsally and ventrally, except abdominal sternite VII posteriorly, sternite VIII orange brown; entire dorsum and laterotergites covered with short dark setae, intermixed with slightly longer dark setae; venter with appressed golden pubescence. Head black, frons embrowned; ros-

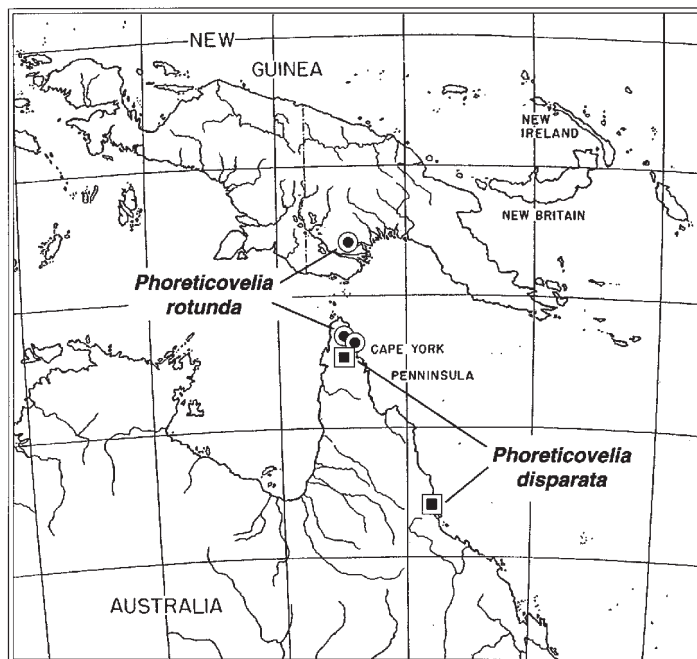


Fig. 11.
Distribution of *Phoreticovelia* species
in New Guinea and Australia.

trium shining yellowish brown, darker distally. Pronotum black laterally, mostly orange brown medially behind posterior margin of head. Antennae brown. Legs orange brown above, ventrally mostly yellowish brown, tarsi distally darkened; coxae and trochanters pale yellowish brown. Apterous male: Coloration similar to female except dorsum tinged with dark brown.

Structural characters (See generic description; only additional details here). – Apterous female: head with impressed median line; length 0.30; width of eye: interocular space, 0.12:0.28. Pronotum very short, about half of eye length; length:width, 0.09 : 0.47. Mesonotum depressed medially, tumid laterally; length:width, 0.30 : 0.74. Metanotum length:width, 0.14 : 0.79. Abdominal tergites faintly shining medially; tergites I–VIII approximately the same length (0.09–0.12).

Mesonotum, metanotum, abdominal tergites I–IV broadly depressed medially, forming a large, longitudinally ovate concavity; mesonotum sometimes with a large ovate or irregularly shaped pad of wax-like substance on either side of midline. Legs and antennae thickly clothed with short to moderate length setae, with scattered longer setae.

Antennal formula I : II : III : IV : 0.16 : 0.19 : 0.19 : 0.23.

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg, 0.42 : 0.35 : 0.19 : 0.0; of middle leg, 0.51 : 0.44 : 0.19 : 0.19; of hind leg, 0.47 : 0.58 : 0.09 : 0.16.

Apterous male: Similar to female in general struc-

ture and colour, but much smaller; head with only weakly impressed median line. Middle and hind legs unarmed except hind tibia with a distal spur of stiff setae; fore femur very slightly curved, thickened, flattened beneath, slightly tumid basally and distally; fore tibia with grasping comb extending 1/4 to 1/3 the length of the tibia, weakly developed in some specimens, distal spur prominent, projecting.

Antennal formula I : II : III : IV : 0.12 : 0.14 : 0.12 : 0.19.

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg, 0.30 : 0.23 : 0.12 : 0.0; of middle leg, 0.33 : 0.30 : 0.12 : 0.16; of hind leg, 0.35 : 0.39 : 0.07 : 0.12.

Proctiger unmodified. Parameres vestigial or absent.

Macropterous male: Similar to apterous male, except larger, humeri prominent; hemelytra uniformly dark, reaching beyond tip of abdomen, with two closed cells, veins of distal two cells only weakly expressed, fifth distal cell not evident.

Remarks

Comparative notes. – Easily separated from *P. rotunda* and *P. notophora* by the darker colouration, and from *P. disparata* by the lack of silvery dorsal setae (see key).

Biological notes. – *P. nigra* was found on Biak on calm water at the margin of a swift, clear, moderately deep stream, flowing over limestone bedrock in a small sheer-walled gorge, shaded by disturbed primary rain

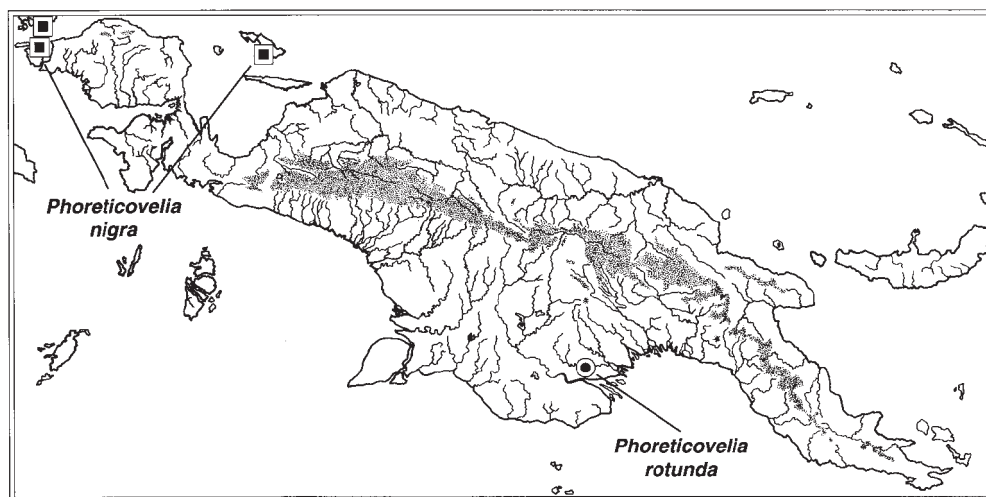


Fig. 12. Distribution of *Phoreticovelia* species in New Guinea.

forest. At the Wajar River on Salawati Island, a clear water stream with a bed of mixed rock types, this species was collected in protected habitats along the banks.

Etymology. – The name *nigra* refers to the dark colour of this species.

Distribution. – Islands off the north and west coast of Irian Jaya (fig. 12).

***Phoreticovelia disparata* sp. n.**
(fig. 11)

Type material. – Holotype, apterous female: AUSTRALIA, Queensland, Upper Mulgrave River at Goldsborough Road bridge, CL 1726, 15 Aug. 1983, J. T. & D. A. Polhemus (ANIC). – Paratypes: AUSTRALIA, Queensland: 273 apterous males, 1 macropterous male, 431 apterous females, same data as holotype (JTPC, USNM, BPBM, LIPI, ANIC, ZMUC); 1 apterous male, Wenlock River at Peninsula Development Road (Moreton), CL 1756, 26 Aug. 1983, J. T. & D. A. Polhemus (JTPC).

Description

Size. – Apterous male, length 1.19–1.26 mm (\bar{x} =1.21, n =10); width 0.47–0.54 mm (\bar{x} =0.52, n =10). Macropterous male, 1.14 mm (n =1); width 0.53 mm (n =1). Apterous female, length 1.94–2.02 mm (\bar{x} =1.99, n =10); width 0.86–1.01 mm, (\bar{x} =0.93, n =10).

Colour. – Apterous female: Ground colour black, tinged with blackish brown; black dorsally and ventrally, except abdominal laterotergites VII – VIII, sternite VIII posteriorly, orange brown; entire dor-

sum and laterotergites covered with short dark setae, intermixed with slightly longer dark setae; laterotergite III, tergite V laterally, tergites VI – VII set with medium length silvery setae; venter with appressed golden pubescence. Head black, frons laterally and basally embrowned; rostrum shining yellowish brown, darker distally. Pronotum black laterally, mostly orange brown medially behind posterior margin of head. Antennae yellowish brown. Legs orange brown above, ventrally mostly yellowish brown, tarsi distally darkened; coxae and trochanters pale yellowish brown. Apterous male: Coloration similar to female except dorsum tinged with dark brown. Mesonotum except laterally, tergites III – IV, tergite V medially, set with medium length silvery setae.

Structural characters (See generic description; only additional details here).- Apterous female: head with impressed median line; length 0.33; width of eye:interocular space, 0.12:0.30. Pronotum very short, about half of eye length; length:width, 0.09 : 0.63. Mesonotum depressed medially, tumid laterally; length:width, 0.30 : 0.77. Metanotum length:width, 0.12 : 0.65. Abdominal tergites faintly shining medially; tergites I-VIII approximately the same length (0.12-0.14).

Mesonotum, metanotum, abdominal tergites I-IV broadly depressed medially, forming a large, longitudinally ovate concavity; mesonotum sometimes with a large ovate or irregularly shaped pad of wax-like substance on either side of midline. Legs and antennae thickly clothed with short to moderate length setae, with scattered longer setae.

Antennal formula I : II : III : IV; 0.16 : 0.19 : 0.21 : 0.30. Proportions of legs as follows: Femur, tibia, tarsal

1, tarsal 2 of fore leg, 0.47 : 0.40 : 0.19 : 0.0; of middle leg, 0.65 : 0.53 : 0.28 : 0.28; of hind leg, 0.56 : 0.60 : 0.09 : 0.19.

Apterous male: Similar to female in general structure and colour, but much smaller; head with only weakly impressed median line. Middle and hind legs unarmed except hind tibia with a distal spur of stiff setae; fore femur very slightly curved, thickened, flattened beneath, slightly tumid; fore tibia curved with grasping comb extending 1/4 to 1/3 the length of the tibia, weakly developed in some specimens, distal spur prominent, projecting.

Antennal formula I:II:III:IV; 0.12:0.14:0.12:0.21.

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg, 0.30 : 0.28 : 0.12 : 0.0; of middle leg, 0.42 : 0.35 : 0.12 : 0.16; of hind leg, 0.40 : 0.49 : 0.07 : 0.14.

Proctiger unmodified. Parameres vestigial or absent.

Macropterous male: Similar to apterous male, except larger, humeri prominent; hemelytra without distinct light spots, uniformly dark except light areas basally and distally, reaching beyond tip of abdomen, with two closed cells, veins of distal two cells only weakly expressed, fifth distal cell not evident.

Remarks

Comparative notes. – Easily separated from *P. rotunda* by the black ground colour, and from *P. nigra* and *P. notophora* by the pattern of silvery dorsal setae.

Biological notes.- *P. disparata* was found in large numbers on calm water at the margins of the upper Mulgrave River, a large clear, moderately shallow stream; the species was especially abundant on the water surface at night.

Etyymology.- The name *disparata* refers to the great disparity in the size of males and females of this species.

Distribution: – Northern Queensland from near Gordonvale northward to the Wenlock River (fig. 11).

Phoreticovelina notophora (Esaki) new combination (fig. 10b)

Microvelina notophora Esaki 1937: 352.

Material examined. – REPUBLIC OF PALAU, Babaldaob Island: 42 apterous males, 1 macropterous male, 38 apterous females, 2 macropterous females, 20 nymphs, upper Tabecheding River, 15 m. (50 ft.), water temp. 26.5° C., 5 August 1999, 7°26'15" N, 134°31'42" E, CL 4208, D. A. and J. T. Polhemus (JTPC, USNM, ZMUC); 7 apterous males, 6 macropterous males, 14 apterous females, 24 macropterous females, 42 nymphs, lower Ngrikill River, sea level, water temp. 25.5° C., 6 August 1999, 7°23'58" N, 134°33'12" E, CL 4209, D. A. and J. T. Polhemus (JTPC, USNM); 14 apterous males, 1 macropterous male, 14 apterous females, 1 macropterous female, 4 nymphs, upper Ngrimel River, 31

m. (100 ft.), water temp. 26° C., 6 August 1999, 7°22'46" N, 134°31'56" E, CL 4210, D. A. and J. T. Polhemus (JTPC, USNM); 3 apterous males, 3 apterous females, 1 nymph, upper Kmekumel River, 52 m. (170 ft.), water temp. 25.5° C., 6 August 1999, 7°23'24" N, 134°32'16" E, CL 4211, D. A. and J. T. Polhemus (JTPC, USNM); 6 apterous males, 8 apterous females, 4 macropterous females, 4 nymphs, waterfall on Kmekumel River, 46 m. (150 ft.), water temp. 26° C., 7 August 1999, 7°23'14" N, 134°32'49" E, CL 4212, D. A. and J. T. Polhemus (JTPC, USNM); 32 apterous males, 31 apterous females, 1 macropterous female, 4 nymphs, Ngrimel River below dam, 6 m. (20 ft.), water temp. 27° C., 10 August 1999, 7°21'20" N, 134°31'41" E, CL 4218, D. A. and J. T. Polhemus (JTPC, USNM); 19 apterous males, 15 apterous females, 7 nymphs, small rocky stream above Ngetkib, west of Palau airport, 46 m. (150 ft.), water temp. 27° C., 10 August 1999, 7°21'52" N, 134°30'45" E, CL 4219, D. A. and J. T. Polhemus (JTPC, USNM).

Description

Size. – Apterous male, length 0.90-0.97 mm (\bar{x} =0.96, n=10); width 0.43-0.47 mm (\bar{x} =0.45, n=10). Macropterous male, length 1.43-1.55 mm (\bar{x} =1.50, n=8); width 0.61-0.68 mm (\bar{x} =0.66, n=8). Apterous female, length 1.91-2.12 mm (\bar{x} =1.99, n=10); width 0.83-0.94 mm (\bar{x} =0.87, n=10). Macropterous female, 2.02 mm-2.16 mm (\bar{x} =2.09, n=10); width 0.86-0.94 mm (\bar{x} =0.90, n=10).

Colour. – Apterous female: Ground colour blackish brown, mostly orange brown ventrally, tinged with orange brown dorsally on meso- and metanotum, connexiva, and abdominal tergites; entire dorsum and laterotergites covered with short dark setae, intermixed with scattered longer setae; without silvery setae; venter with appressed golden pubescence. Head blackish brown, vertex posteriorly embrowned; rostrum shining yellowish brown, piceous distally. Pronotum and propleura yellowish to yellowish brown. Antennae brown. Legs orange brown above, ventrally mostly pale yellowish to yellowish brown, tarsi distally darkened; coxae and trochanters pale yellowish. Apterous male: Coloration similar to female except generally darker dorsally; femora dorsally yellowish basally.

Structural characters (See generic description; only additional details here).- Apterous female: head with impressed median line; length 0.40; width of eye:interocular space, 0.12:0.30. Pronotum very short, about half of eye length; length:width, 0.09 : 0.65. Mesonotum depressed medially, tumid laterally; length:width, 0.21 : 0.72. Metanotum length:width, 0.14 : 0.84. Basal abdominal tergites faintly shining medially; tergites II-VII approximately the same length (0.12-0.14), I longer (0.21).

Pronotum distinctly notched medially. Mesonotum, metanotum, abdominal tergites I-IV broadly depressed medially, forming a large, longitudinally ovate concavity; mesonotum often with a large ovate

or irregularly shaped pad of wax-like substance on either side of midline. Legs and antennae thickly clothed with short to moderate length setae, with scattered longer setae.

Antennal formula I: II: III: IV; 0.20: 0.23: 0.26: 0.28.

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg, 0.53 : 0.42 : 0.23 : 0.0; of middle leg, 0.65 : 0.58 : 0.33 : 0.28; of hind leg, 0.60 : 0.74 : 0.19 : 0.223.

Apterous male: Similar to female in general structure and colour, but much smaller, mesonotum not depressed; head with only weakly impressed median line. Middle and hind legs unarmed except hind tibia with a distal spur of stiff setae; fore femur very slightly curved, thickened, flattened beneath, slightly tumid basally and distally; fore tibia with grasping comb small, extending 1/5 the length of the tibia, distal spur prominent, projecting.

Antennal formula I: II: III: IV; 0.12: 0.12: 0.12: 0.16.

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg, 0.28 : 0.24 : 0.07 : 0.0; of middle leg, 0.35 : 0.33 : 0.12 : 0.16; of hind leg, 0.35 : 0.38 : 0.07 : 0.12.

Proctiger unmodified. Parameres vestigial or absent.

Macropterous male: Similar to apterous male, except larger, humeri prominent; hemelytra without distinct light spots, uniformly dark except lighter basally, reaching beyond tip of abdomen, with four closed cells, fifth distal cell not evident.

Macropterous female: Similar to apterous female, except slightly larger, humeri prominent, without modifications for phoresy. Wings similar to macropterous male.

Remarks

Comparative notes. – The females of this species are less rotund than other species of the genus. The

larger size and extensive brown markings easily separate *P. notophora* from *P. nigra*; these are the only two species lacking dorsal silvery setae. The pronotum of apterous *P. notophora* is more distinctly notched medially than the other species; this notch evidently accommodates the rostrum of the male during phoresy.

Esaki (1937) described this species from ‘Palau-Inseln (Babelthaob und Koror).’ The photograph of the female (Esaki’s fig. 2) clearly shows the depressed mesonotum with the waxy secretions lateral to the midline. The middle leg was figured (fig. 1D) but does not show the blade-like nature of the claws and downcurving arolium, a diagnostic character of the genus *Phoreticovelia*.

Biological notes. – This species is the most common stream dwelling veliid on Palau, commonly skating in swarms on pools or slow moving parts of small to moderate sized streams, usually away from the shoreline.

Distribution: – Palau; Koror and Babeldaub islands.

Tanyvelia Polhemus & Polhemus

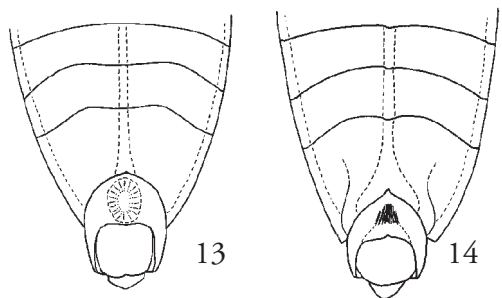
Tanyvelia Polhemus & Polhemus, 1994: 63 (type species *Tanyvelia missim* Polhemus & Polhemus, 1994, monobasic).

Discussion. – For diagnostic structural characters of this genus see discussion in Polhemus & Polhemus (1994).

Revised key to the species of *Tanyvelia*

1. Male abdominal ventrite VII bearing an anteriorly directed triangular medial carina set with an erect tuft of stiff dark setae (fig. 14); male abdominal ventrite VI depressed centrally to form an anteriorly directed triangular sulcus; male abdominal ventrites III–V broadly depressed centrally, forming a broad concavity on underside of abdomen; basal abdominal tergites of both males and females pruinose *T. missim* Polhemus & Polhemus
- Male abdominal ventrite VII lacking an anteriorly directed triangular medial carina, instead bearing a narrow longitudinal medial impression flanked by small patches of semi-erect setae (fig. 13); male abdominal ventrite VI lacking a triangular sulcus medially, bearing only a weakly depressed longitudinal median line; male abdominal ventrites III–V not depressed centrally; basal abdominal tergites of both males and females black, lacking pruinosity *T. bosavi* sp. n.

Figs. 13, 14. *Tanyvelia* species, male terminal abdomen, ventral view. – 13. *Tanyvelia bosavi* sp. n.; 14. *Tanyvelia missim* Polhemus & Polhemus.



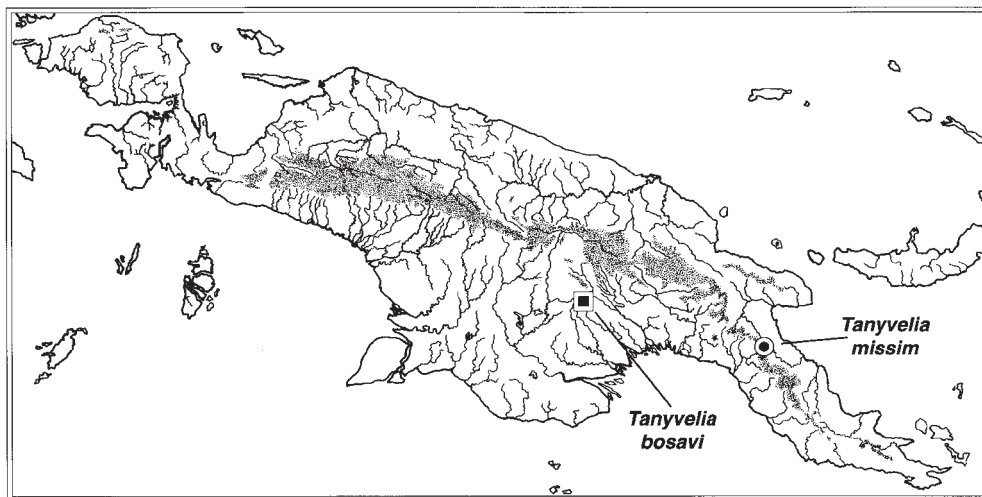


Fig. 15. Distribution of *Tanyvelia* species in New Guinea.

Tanyvelia bosavi sp. n.
(figs. 13, 15)

Type material. – Holotype, micropterous male: PAPUA NEW GUINEA, Southern Highlands Prov., swift rocky stream in moss forest on N. slope of Mt. Bosavi, 1400 m., water temp. 18° C., 19 March 1995, 11:00-13:30 hrs., D. A. Polhemus (BPBM). – Paratypes: PAPUA NEW GUINEA, Southern Highlands Prov.: 1 micropterous male, 6 micropterous females, same data as holotype (BPBM, USNM, JTPC); 2 micropterous male, 4 micropterous females, crashing stream on N. slope of Mt. Bosavi, 1700 m., water temp. 17° C., 18 March 1995, 11:00-13:30 hrs., D. A. Polhemus (BPBM).

Description

Size. – Micropterous male, length 2.50–2.70 mm (\bar{x} =2.59, n=4); width 0.82–0.95 mm (\bar{x} =0.88, n=4). Micropterous female, length 2.80–3.00 mm (\bar{x} =2.89, n=4); width 0.87–1.02 mm, (\bar{x} =0.97, n=4). Macropterous form unknown.

Colour. – Micropterous male: ground colour black, venter and connexiva tinged with brown. Head black, brown ventrally; rostrum luteous on basal three segments, piceous distally. Pronotum with anterior lobe entirely yellowish including propleura, except narrowly embrowned medially; disc and collar black. Micropterous wing pads black, with patches of silvery setae basally. Abdomen black, lighter ventrally, tergites uniformly black and lacking pruinosity in both males and females; a narrow longitudinal brown line present on tergites III–VI. Antennae brown. Legs yellowish brown to pale brown, distally darker.

Structural characters. – Micropterous male: head of moderate length, declivant anteriorly; length 0.47; width of eye/interocular space, 0.20/0.26. Pronotum length:width, 0.77 : 0.85. Abdominal tergites not shining; tergites, II–VII progressively greater in length (0.12, 0.15, 0.15, 0.19, 0.25, 0.31 respectively). Abdominal venter set with short appressed setae; ventrites III–V not depressed, bearing a narrow, glabrous, longitudinal median line; ventrite VI with similar median line, but this line weakly depressed; ventrite VII with a narrow longitudinal medial depression, bordered by small tufts of semi-erect pale setae (fig. 13). Legs, antennae thickly clothed with short to moderate length semi-erect setae, with a few scattered longer setae. Legs unarmed, tibial comb on fore femur extending for over $\frac{3}{4}$ the length of the femur.

Antennal formula, segments I : II : III : IV; 0.57 : 0.44 : 0.75 : 0.75.

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg, 0.87 : 0.80 : 0.31 : 0.0; of middle leg, 1.10 : 1.12 : 0.12 : 0.27; of hind leg, 1.25 : 1.50 : 0.25 : 0.32.

Paramere slender and acuminate, very similar in shape to that previously illustrated for *T. missim* (Polhemus & Polhemus 1994: fig. 3).

Micropterous female: Similar to male in general structure and coloration, with following exceptions: connexival margins outwardly reflexed adjacent to abdominal tergites I–IV, folded inward over lateral portions of tergites V–VIII; lateral portions of abdominal tergites II and III and infolded portions of connexiva reddish brown.

Remarks

Comparative notes. – *Tanyvelia bosavi* n. sp. is separable from the previously described *Tanyvelia missim* (Polhemus & Polhemus, 1994) by the structure of the male abdominal venter, and the coloration of the abdominal dorsum. In *T. missim*, male abdominal ventrite VII bears an anteriorly directed triangular medial carina set with an erect tuft of stiff dark setae, and male abdominal ventrite VI is depressed centrally to form an anteriorly directed triangular sulcus (fig. 14). In *T. bosavi*, by contrast, male abdominal ventrite VII bears a narrow longitudinal medial impression flanked by small patches of semi-erect setae, and male abdominal ventrite VI lacks a sulcus, bearing only a weakly depressed longitudinal median line (fig. 13). Further, male abdominal ventrites III–V are broadly depressed centrally in *T. missim*, with these linked depressions forming a broad concavity on the underside of the abdomen; such a concavity is lacking in males of *T. bosavi*. Finally, the basal abdominal tergites of both males and females are pruinose in *T. missim*, but uniformly black in *T. bosavi*.

Biological notes. – The type series of *T. bosavi* was taken from a small, clear stream descending through a bed of mossy boulders, and heavily shaded by extremely dense and mossy primary montane rain forest. The insects were taken on pools below small cascades.

Etymology. – The name ‘bosavi’ is a noun in apposition and refers to the Mt. Bosavi type locality.

Distribution: – South Central New Guinea (fig. 15).

Aegilipsicola Polhemus & Polhemus

Aegilipsicola Polhemus & Polhemus, 1994: 60 (type species *Aegilipsicola rapida* Polhemus & Polhemus, 1994, monobasic).

Discussion. – For diagnostic structural characters of this genus see discussion in Polhemus & Polhemus (1994).

Revised key to the species of *Aegilipsicola*

1. Venter of male first genital segment deeply excavate basally, the posterior margin of this depression bordered by 2–3 small sclerotized tubercles (fig. 20); posterolateral apices of female connexiva not produced, rounded or at most gently angulate 2
- Venter of male first genital segment deeply excavate basally, the posterior margin of this depression lacking sclerotized tubercles, but bounded by a narrow, upraised, lip-like carina (fig. 19); posterolateral apices of female connexiva produced and sharply angulate, folded inward over wing tips (fig. 21) *A. iriana* sp. n.
2. Male fore femur with small, compact tuft of dark

setae ventrally on distal third (fig. ..16); legs dark yellowish above; female connexiva with posterolateral angles gently angulate, upright, not folded inward over lateral portions of abdominal tergites VI and VII *A. rapida* Polhemus & Polhemus

- Male fore femur unmodified, lacking a compact tuft of dark setae ventrally (fig. 17); legs mostly brown above; female connexiva with posterolateral angles rounded, folded inward over lateral portions of abdominal tergites VI and VII
..... *A. robiniae* sp. n.

Aegilipsicola iriana sp. n.

(figs. 17, 19, 21, 22)

Type material. – Holotype, macropterous male: INDONESIA, Irian Jaya Prov., Tanime-Eipomek [vicinity of Wamena], 4°30' S, 140°05' W, 2100–2300 m., 24 Sept. 1993, Balke and Riedel (NHMW). – Paratypes: INDONESIA, Irian Jaya Prov., New Guinea: 9 macropterous males, 4 macropterous females, 4 immatures, same data as holotype (USNM, BPBM, JTPC, NHMW); 2 macropterous females, Borme, Tarmlu, ca. 4°24' S, 140°25' W, 1500 m., 6 Sept. 1993, M. Balke (JTPC, NHMW).

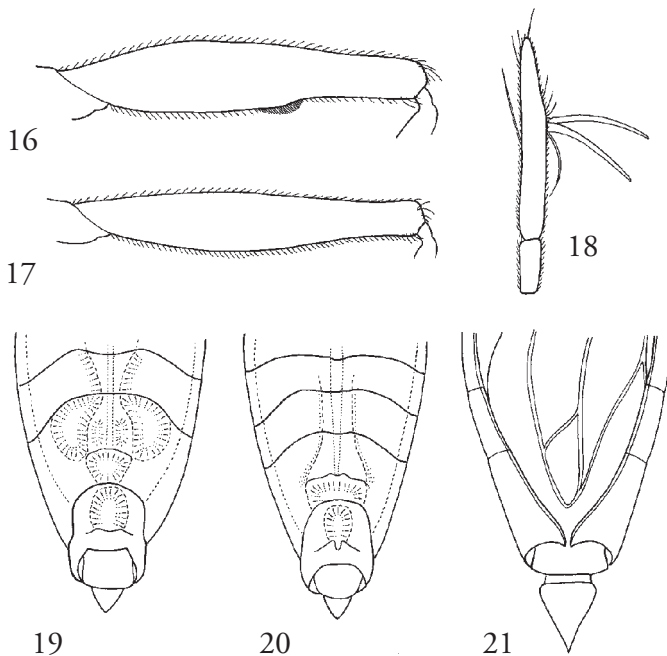
Description

Size. – Macropterous male, length 3.10–3.20 mm (\bar{x} =3.15, n=8); width 1.00–1.06 mm (\bar{x} =1.03, n=8). Macropterous female, length 3.57–3.69 mm (\bar{x} =3.64, n=5); width 1.07–1.12 mm, (\bar{x} =1.11, n=5).

Colour. – Macropterous male: ground colour black, tinged with yellowish brown ventrally. Head black; posterior margin and two (1+1) longitudinal regions lying between eyes and medial furrow brown. Pronotum with anterior lobe narrowly, transversely orange brown on either side of midline, this coloration extending laterally to inner eye margins; lateral portions dark brown but thickly covered with silvery pubescence; posterior lobe black, very narrowly margined with brown. Abdomen greyish black ventrally, central portion brown, acetabulae and first genital segment brownish yellow. Antennae brown, first segment lighter. Legs brown above, brownish yellow below. Hemelytra black, bearing four elongate bluish-grey pruinose streaks at basal angles, confined within the basal cells, plus four additional small pruinose spots on distal third.

Structural characters. – Macropterous male: head of moderate length, declivant anteriorly; length 0.55; width of eye/interocular space, 0.19/0.34. Pronotum long, humeri evident but not raised; length : width, 0.94 : 1.02. Hemelytra long, extending beyond tip of abdomen.

Abdominal venter set with very short appressed fine setae; ventrite VI with a roughly trapezoidal raised area



Figs. 16–21.

Aegilipsicola species, structural characters. — 16. *Aegilipsicola rapida* Polhemus & Polhemus, male foreleg; 17. *Aegilipsicola iriana* sp. n., male foreleg; 18. *Aegilipsicola robiniae* sp. n., male tarsus; 19. *Aegilipsicola iriana* sp. n., male terminal abdomen, ventral view; 20. *Aegilipsicola robiniae* sp. n., male terminal abdomen, ventral view; 21. *Aegilipsicola iriana* sp. n., female terminal abdomen, dorsal view.

centrally, with its broad base directed anterad; ventrite VII with a pair (1+1) of strong depressions laterally on basal half to either side of midline, flanking a roughly trapezoidal raised area centrally, the broad base of this raised trapezoid directed posteriorly, and its central portion broadly depressed, posterior half of ventrite VII broadly depressed centrally; first genital segment (ventrite VIII) deeply excavated ventrally, the posterior margin of this concavity bounded by a thin, raised, plate-like transverse carina (fig. 19). Legs and antennae thickly clothed with short inconspicuous setae, without longer setae. Legs uniformly unarmed, fore femur lacking any raised setal tufts (fig. 17).

Antennal formula I: II: III: IV: 0.52: 0.37: 0.75: 0.75.

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg, 0.80: 0.65: 0.32: 0.0; of middle leg, 1.40: 1.12: 0.07: 0.37; of hind leg, 1.72: 2.12: 0.12: 0.47.

Paramere small and thumb-shaped, very similar in shape to that previously illustrated for *A. rapida* (Polhemus & Polhemus 1994: Fig. 8).

Macropterous female: Similar to male in general structure and coloration, but somewhat larger. Forewing bearing five small pruinose spots on distal third. Connexiva with posterolateral apices sharply angulate, folded inward and touching over distal portion of wings (fig. 21).

Remarks

Comparative notes. — Superficially to the previous-

ly described *Aegilipsicola rapida* (Polhemus & Polhemus, 1994), but separable on the basis of the ventral male abdominal sculpturing (fig. 19), the armature of the male foreleg (fig. 17), and the structure of the female connexival apices (fig. 21). In *A. rapida* the ventral excavation of the male first genital segment is flanked posteriorly by several small tubercles, while in *A. iriana* such tubercles are absent, although a transverse, plate-like carina is present instead. On male abdominal ventrite VI and the basal portion of male abdominal ventrite VII, *A. iriana* bears strongly raised trapezoidal projections centrally, while in *A. rapida* the development of such structures is incipient at best. The male fore femur of *A. rapida* bears a small tuft of raised setae on the distal portion of the ventral surface, while the male fore femur of *A. iriana* is unarmed. The female posterolateral apices of the connexiva in *A. iriana* are sharply angulate and folded inward over the wing tips, meeting above them, while in *A. rapida* the connexival apices are more rounded, lying widely separated and in a vertical orientation. Finally, the dorsal coloration of *A. iriana*, particularly that of the head and legs, is darker than that of *A. rapida*.

Biological notes. — No information is available regarding the habits of this species.

Etymology. — The name 'iriana' refers to the Indonesian province of Irian Jaya, comprising the western half of New Guinea.

Distribution. — West Central New Guinea (fig. 22).

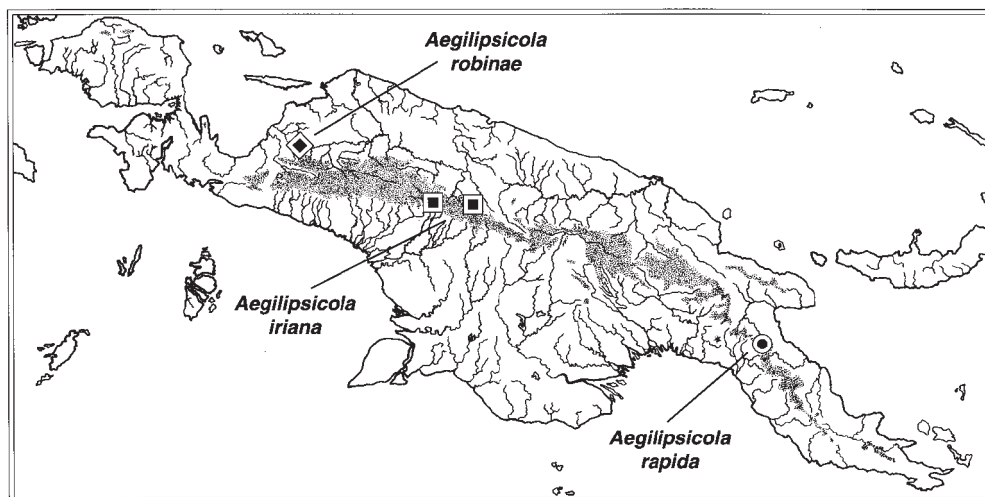


Fig. 22. Distribution of *Aegilipsicola* species in New Guinea.

Aegilipsicola robinae sp. n.
(fig. 18, 20, 22)

Type material. – Holotype, macropterous male: INDONESIA, Irian Jaya Prov., New Guinea, seeping rock face near tributary to upper Ziwa River at PTFI Wapoga Alpha drilling camp, 1050 m. (3500 ft.), water temp. 20° C., 19 April 1998, 14:00–18:00 hrs. 3°08.69' S, 136°34.42' E., CL 7100, D. A. Polhemus (LPI). – Paratypes: INDONESIA, Irian Jaya Prov., New Guinea: 2 macropterous males, 4 micropterous males, 3 micropterous females, 1 immature, same data as holotype (USNM, JTPC, LPI); 1 winged male, seeping rock face along upper Ziwa River at PTFI Wapoga Alpha drilling camp, 1050 m. (3500 ft.), water temp. 19° C., 19 April 1998, 08:00–12:00 hrs. 3°08.69' S, 136°34.42' E., CL 7101, D. A. Polhemus (USNM).

Description

Size. – Macropterous male, length 3.00–3.20 mm (\bar{x} =3.08, n=3); width 1.05–1.10 mm (\bar{x} =1.07, n=3). Micropterous male, length 2.80–3.00 mm (\bar{x} =2.92, n=4); width 0.80–0.80 mm (\bar{x} =0.80, n=4). Micropterous female, length 3.00–3.10 mm (\bar{x} =3.07, n=3); width 0.85–1.00 mm (\bar{x} =0.92, n=3).

Colour. – Macropterous male: ground colour light brown, becoming yellowish ventrally, dorsum of head and pronotum darker brown to black. Head dark brown; posterior margin and two (1+1) longitudinal regions lying between eyes and medial furrow medium brown; entire head covered with scattered, short, recumbent silvery setae. Pronotum with anterior lobe bearing a transverse orange brown spot medially, this

coloration extending laterally to inner eye margins, lateral sections of anterior lobe dark, this coloration largely obscured by thick silvery setae; posterior lobe black, humeri brown; entire pronotal surface covered with scattered, short, recumbent silvery setae, these setae thicker along pronotal midline, forming an obvious longitudinal band; lateral sections of anterior lobe to either side of central orange spot thickly set with longer silvery setae. Abdomen yellowish brown ventrally, lateral areas surrounding spiracles darker brown. Antennae dark brown, first segment lighter basally. Legs light brown above, dark yellowish below, tips of femora and tibiae darker. Hemelytra black, bearing two elongate bluish-grey pruinose streaks at basal angles, confined within the basal and costal cells, plus two additional small pruinose spots on distal third; veins bearing scattered long, erect, pale setae.

Structural characters. – Macropterous male: head of moderate length, declivant anteriorly; length 0.50, width across eyes 0.62; width of eye/interocular space, 0.15/0.35. Pronotum long, humeri evident, moderately raised; length : width, 0.92 : 1.05. Hemelytra long, extending beyond tip of abdomen.

Abdominal venter set with very short, appressed, fine, pale setae; ventrites IV–VI with a weakly suggested longitudinal median sulcus; ventrite VII with a pair (1+1) of dark, moderate sized depressions laterally on basal half to either side of midline, flanking a roughly trapezoidal raised area centrally, the broad base of this raised trapezoid directed posteriorly, and its central portion longitudinally depressed, posterior half of ventrite VII forming a broad, transverse de-

pression; first genital segment (ventrite VIII) deeply excavated ventrally, the posterior margin of this concavity bearing a pair (1+1) of ventrally directed, glabrous tubercles (fig. 20). Legs and antennae thickly clothed with short inconspicuous setae, without longer setae. Legs uniformly unarmed, fore femur lacking any raised setal tufts (fig. 17); grasping comb on ventral surface of fore tibia extending for $\frac{3}{4}$ the length of the tibia.

Antennal formula I : II : III : IV; 0.50 : 0.31 : 0.77 : 0.75.

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg, 0.80 : 0.72 : 0.25 : 0.0; of middle leg, 1.05 : 1.06 : 0.07 : 0.40; of hind leg, 1.55 : 2.00 : 0.8 : 0.46.

Paramere small and thumb-shaped, very similar in shape to that previously illustrated for *A. rapida* (Polhemus & Polhemus 1994: fig. 8).

Micropterous male: Similar to macropterous male in general structure and coloration, but with abdominal tergites exposed, dark brown in colour; lengths of tergites I–VIII; 0.15 : 0.12 : 0.15 : 0.17 : 0.20 : 0.20 : 0.19 : 0.19. Wing pads short, apices rounded, reaching to middle of abdominal tergite II; outer sections pale pruinose bluish grey, inner sections black.

Micropterous female: Similar to micropterous male in general structure and coloration, but somewhat larger. Lengths of abdominal tergites I–VII; 0.24 : 0.22 : 0.22 : 0.20 : 0.25 : 0.27 : 0.25. Connexival vertical on basal segments, gradually folding inward posteriorly to cover lateral portions of abdominal tergites VI and VII, posterolateral apices rounded, not produced or strongly angulate.

Remarks

Comparative notes. – This species is separable from the previously described *Aegilipsicola rapida* (Polhemus & Polhemus, 1994) by the simple, unmodified male fore femur, which lacks a small tuft of raised black setae on the ventral surface (similar to fig. 17), by the pattern of ventral abdominal sculpturing (fig. 20), and by the infolding of the female connexival angles over the lateral portions of abdominal tergites VI and VII. The structure of these infolded female connexival angles also serves to separate *A. robiniae* from *A. iriana* n. sp.; in the latter species they are produced and angulate (fig. 21), while in *A. robiniae* they are rounded. Another spot character separating *A. robiniae* from *A. iriana* is the degree of development of a line of shining gold setae along the longitudinal midline of the pronotum; this medial setal line is pronounced and obvious in *A. robiniae*, but subtle and discontinuous in *A. iriana*. Finally, the pale, pruinose wing markings in *A. robiniae* are more extensive than in either *A. rapida* or *A. iriana*; in both of these latter two species the markings consist of 6 or 7 discrete pruinose spots, with 2 or 3 in the basal half

of the wing and 4 in the distal half of the wing, near the tip, while in *A. robiniae* 2 basal spots are present, the largest of which, lying along the costal margin, extends into the outer distal half of the wing (except for a narrow interruption at a cross vein) and only 2 additional distal spots are present, creating a 4 spot pattern. The overall effect is to produce a much more extensive area of pale, pruinose coloration along the costal margin, making *A. robiniae* easily distinguishable from its congeners on the basis of colour alone.

Biological notes. – The type series of *A. robiniae* was taken from a vertical seeping rock face, heavily shaded by primary montane rain forest, along the headwaters of a small tributary to the upper Ziwa River. The insects were found in areas of shallow, laminar flow and ran quickly across the wet surface.

Etymology. – The name 'robiniae' refers to Robin Polhemus, the wife of the first author, to whom we dedicate this small, beautiful species.

Distribution. – Northwestern New Guinea (fig. 22).

Tarsovelia Polhemus & Polhemus

Tarsovelia Polhemus & Polhemus, 1994: 63 (type species *Tarsovelia alta* Polhemus & Polhemus, 1994, by original designation).

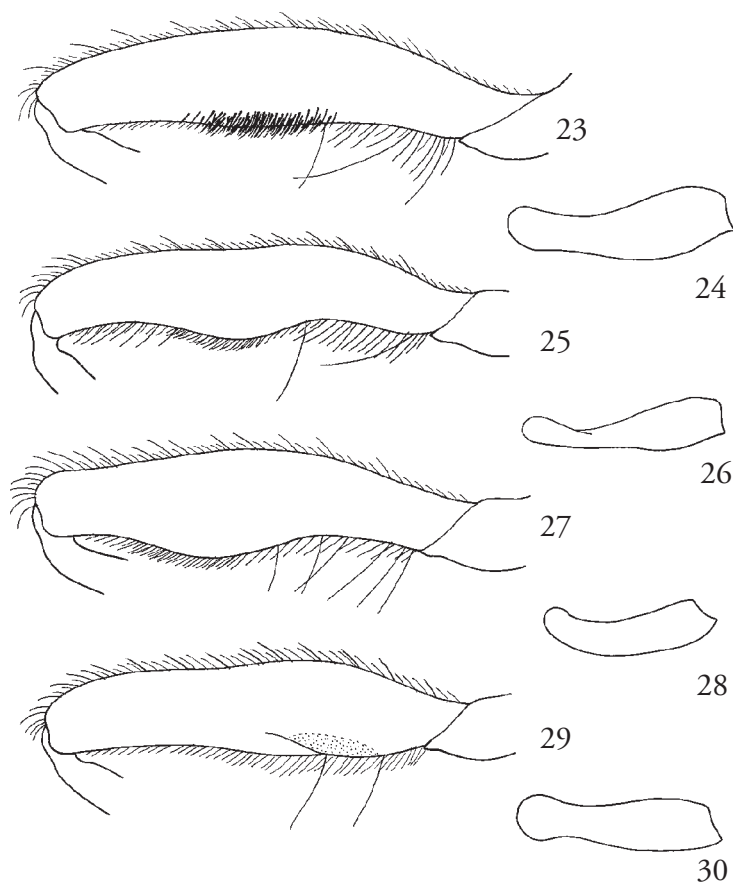
Discussion. – For diagnostic structural characters of this genus see discussion in Polhemus & Polhemus (1994).

Revised key to the species of *Tarsovelia*

Discussion. – Females of *Tarsovelia* are often confusingly similar, and for the most part lack good specific characters. For this reason, the key below treats males only; females are best determined by association with sympatrically collected males.

Males

1. Fore femur with either a patch of short, stiff, pale hairs or a patch of short, dense, dark hairs on ventral surface (figs. 23, 25, 27) 2
 - Fore femur lacking patch of short, stiff hairs or short, dense, dark hairs on ventral surface (fig. 29) 6
2. Fore femur with a patch of short, dense, dark hairs near central portion of ventral margin (fig. 23) *T. bosavi* sp. n.
 - Fore femur with a patch of pale, short, stiff hairs on ventral surface (figs. 25, 27) 3
3. Fore femur slender basally, slightly expanded distally, bearing a patch of short, stiff, pale hairs in the central section of the ventral face 4
 - Fore femur slightly expanded basally, slender and gently arcuate distally, bearing a patch of short, stiff, pale hairs basally on ventral face; abdominal



Figs. 23–30. *Tarsovelia* species, structural characters. – 23. *Tarsovelia bosavi* sp. n., male foreleg; 24. *Tarsovelia bosavi* sp. n., male paramere; 25. *Tarsovelia kikori* sp. n., male foreleg; 26. *Tarsovelia kikori* sp. n., male paramere; 27. *Tarsovelia ziwa* sp. n., male foreleg; 28. *Tarsovelia ziwa* sp. n., male paramere; 29. *Tarsovelia reclusa* sp. n., male foreleg; 30. *Tarsovelia reclusa* sp. n., male paramere.

- venter orange brown *T. dani* Polhemus & Polhemus
- 4. Fore femur with patch of short, stiff, pale hairs extending inward from the middle of the ventral face to the beginning of the narrowed basal section *T. arfak* Polhemus & Polhemus
- Fore femur with patch of short, stiff, pale hairs extending distally from middle of ventral face toward tip of femur 5
- 5. Hair patch on ventral face of fore femur with short setae, these setae not becoming longer distally (fig. 25); abdominal venter reddish to yellowish brown *T. kikori* sp. n.
- Hair patch on ventral face of fore femur with setae becoming longer distally (fig. 27); abdominal venter black *T. ziwa* sp. n.
- 6. Fore femur with a small, carinate ridge centrally on ventral face (fig. 29) *T. reclusa* sp. n.
- Fore femur lacking a small, carinate ridge on central section of ventral face *T. alta* Polhemus & Polhemus

***Tarsovelia kikori* sp. n.**
(figs. 25, 26, 31)

Type material. – Holotype, macropterous male: PAPUA NEW GUINEA, Gulf Prov., Lubu River above Omo, 50 m., water temp. 19° C., 1 March 1995, 09:00-12:00 hrs., D. A. Polhemus (BPBM). – Paratypes: PAPUA NEW GUINEA, Gulf Prov. 11 macropterous males, 5 macropterous females, same data as holotype (BPBM, JTPC, USNM).

Description

Size. – Macropterous male, length 2.45-2.60 mm (\bar{x} =2.54, n=4); width 1.00-1.05 mm (\bar{x} =1.02, n=4). Macropterous female, length 3.00-3.02 mm (\bar{x} =3.01, n=2); width 1.19-1.20 mm (\bar{x} =1.19, n=2). Micropterous forms unknown.

Colour. – Macropterous male: ground colour black to dark brownish black, venter slightly lighter. Head

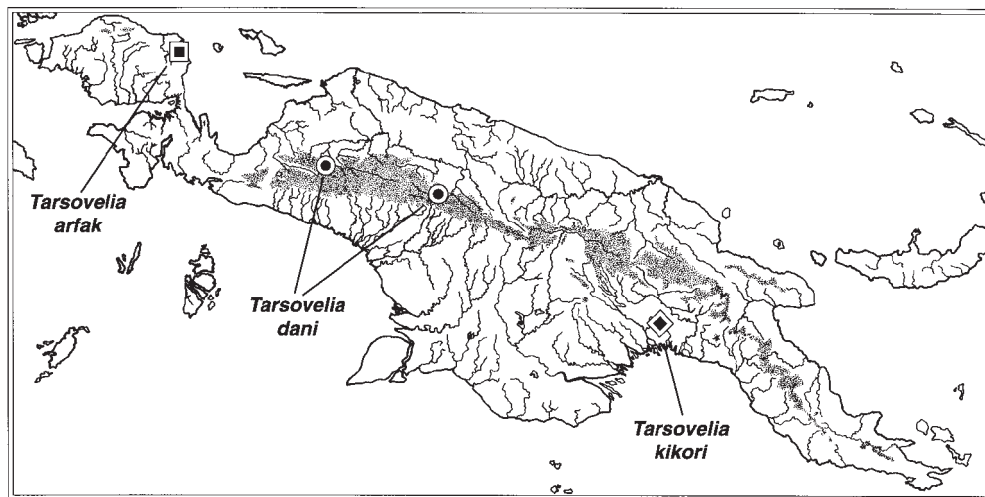


Fig. 31. Distribution of *Tarsovelia* species in New Guinea.

dark brownish black, lighter beneath; rostrum luteous medially, piceous distally. Pronotum with anterior transverse band orange brown, not extending onto propleura; disc black, humeri medium brown. Wings dark brown, basal angles yellowish white, this white coloration extending posteriorly past the apex of the pronotum; interior section of central cell and raised patch on distal subcosta black. Abdomen black, embrowned ventrally, posterior margin light brown. Antennae medium brown. Coxae, trochanters, and basal $\frac{3}{4}$ of fore femur yellow to yellowish brown, remaining leg segments dark brown.

Structural characters. – Macropterous male: head of moderate length, declivant anteriorly; length 0.32; width of eye/interocular space, 0.13/0.27. Pronotum long, apex rounded, length:width, 0.87 : 1.05; humeri, prominent, raised. Abdominal tergites not visible.

Abdominal venter not modified, set with short appressed setae.

Legs and antennae thickly clothed with short appressed gold setae, intermixed with scattered slender erect dark setae; fore femur lacking patches of dark setae ventrally, but ventral surface thickly set with numerous long, erect, pale setae. Legs unarmed; fore femur expanded on distal half (fig. 25).

Antennal formula I : II : III : IV; 0.27 : 0.32 : 0.32 : 0.40.

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg, 0.75 : 0.70 : 0.27 : 0.0; of middle leg, 1.15 : 0.95 : 0.50 : 0.37; of hind leg, 0.81 : 1.00 : 0.20 : 0.25.

Paramere slender, tip rounded, slightly expanded (fig. 26).

Macropterous female: Similar to male in general structure and coloration, but somewhat larger; anterior lobe of pronotum with two (1+1) tufts of stiff erect black setae to either side of midline, similar setae also present on propleura; fore femur tapering evenly, not expanded as in male.

Remarks

Comparative notes. – *Tarsovelia kikori* sp. n. may be separated from previously described species of *Tarsovelia* by the shape and setiferation of the male fore femur. This species is similar to *T. ziwa*, but has the expanded portion of the male ventral fore femur lying more medially; the raised hair patch in *T. kikori* does not extend as far distally as in *T. ziwa*, and the hairs do not become longer distally as in *T. ziwa* (fig. 27). The parameres are also different, with that of *T. kikori* being more elongate and slender, and with a rounded, slightly expanded tip (fig. 25). Finally, the ventral coloration of *T. kikori* is reddish to yellowish brown, while that of *T. ziwa* is black.

Biological notes. – The Lubu River at the type locality was a large, swift, cold-water river emerging from caves in a limestone plateau via a set of high waterfalls. The type series of *T. kikori* was taken downstream of the falls, on shallow, shaded side pools amid cobble bars adjacent to the main channel.

Etymology. – The name 'kikori' is a noun in apposition referring to the Kikori River basin of southern New Guinea, from which the type series came.

Distribution. – Southern New Guinea (fig. 31).

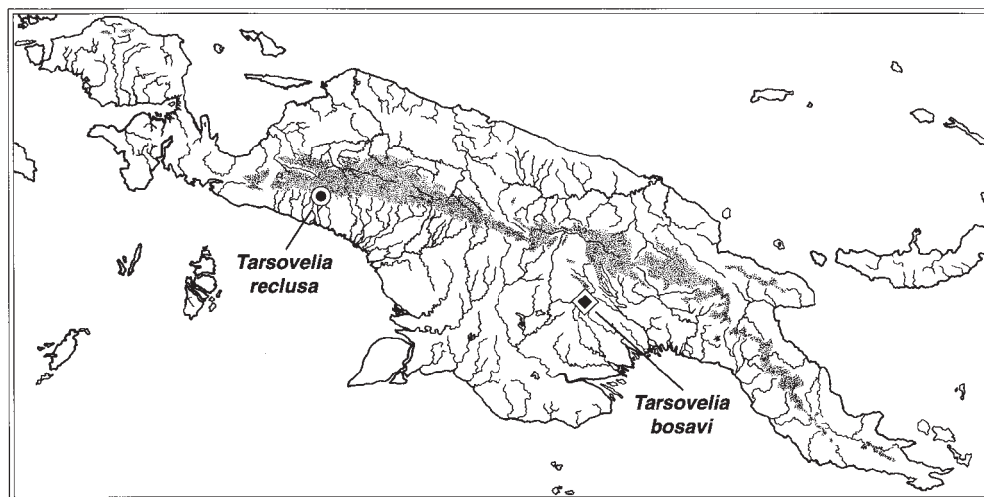


Fig. 32. Distribution of *Tarsovelia* species in New Guinea.

Tarsovelia bosavi sp. n.
(figs. 23, 24, 32)

Type material. – Holotype, macropterous male: PAPUA NEW GUINEA, Southern Highlands Prov., swift rocky stream in moss forest on N. slope of Mt. Bosavi, 1400 m., water temp. 18° C., 19 March 1995, 11:00-13:30 hrs., D. A. Polhemus (BPBM). – Paratypes: PAPUA NEW GUINEA, Southern Highlands Prov.: 42 macropterous males, 14 macropterous females, same data as holotype (BPBM, USNM, JTPC); 50 macropterous males, 20 macropterous females, crashing stream on N. slope of Mt. Bosavi, 1700 m., water temp. 17° C., 18 March 1995, 11:00-13:30 hrs., D. A. Polhemus (BPBM).

Description

Size. – Macropterous male, length 2.75-2.90 mm (\bar{x} =2.82, n=3); width 1.05-1.15 mm (\bar{x} =1.10, n=3). Macropterous female, length 3.10-3.25 mm (\bar{x} =3.19, n=5); width 1.20-1.25 mm, (\bar{x} =1.21, n=5). Micropterous forms unknown.

Colour. – Macropterous male: ground colour black to dark brownish black, venter reddish brown. Head dark brownish black, reddish brown beneath; rostrum luteous medially, piceous distally. Pronotum with anterior transverse band orange brown, this coloration extending broadly onto the propleura; pronotal disc black and humeri medium black. Wings dark brown, basal angles white, these white areas extending posteriorly past the apex of the pronotum and bearing stiff, erect, black setae along the veins. Abdomen reddish brown, with irregular dark brown

markings surrounding spiracles and intersegmental sutures. Antennae dark blackish brown. Coxae, trochanters, and basal 4/5 of fore femur yellow to yellowish brown, remaining leg segments dark brown above, dark yellowish below.

Structural characters. – Macropterous male: head of moderate length, declivant anteriorly; length 0.45, width 0.62; width of eye/interocular space, 0.15/0.36. Pronotum long, apex rounded, length:width, 1.00 : 1.12; humeri, prominent, raised. Abdominal tergites not visible.

Abdominal venter not modified, set with short appressed setae.

Legs and antennae thickly clothed with short appressed gold setae, intermixed with scattered slender erect dark setae, fore femur ventrally with numerous long, erect, pale setae; fore femur excavate ventrally on basal half, this depressed area flanked distally near middle of ventral surface by a raised tumescence bearing a patch of short, stiff, black setae (fig. 23); fore tibia bowed, straight on basal 3/4, then angled downward at approximately 15° on distal section bearing grasping comb; middle and hind legs unarmed.

Antennal formula I:II:III:IV;0.30:0.32:0.45:0.45.

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg, 0.77 : 0.77 : 0.27 : 0.0; of middle leg, 1.06 : 1.02 : 0.52 : 0.40; of hind leg, 1.00 : 1.20 : 0.25 : 0.30.

Paramere stout basally, narrowing slightly then weakly expanded to a rounded tip (fig. 24).

Macropterous female: Similar to male in general structure and coloration, but larger; anterior lobe of pronotum with two (1+1) tufts of stiff erect black se-

tae to either side of midline, similar setae also present on propleura and basally on veins of forewings, the latter contrasting with the white patches at the wing bases; fore femur straight, tapering evenly, not modified as in male.

Remarks

Comparative notes. – *Tarsovelia bosavi* sp. n. is most similar to *T. arfak* from the Vogelkop area of northwestern New Guinea, but may be separated from that species by the modifications of the forelegs. In *T. bosavi* the fore femur is depressed on the basal half ventrally, then expands medially to form a low tumescent swelling bearing a patch of stiff, dense, dark setae (fig. 23). In *T. arfak*, by contrast, the basoventral depression of the femur is less extensive, and the medial section ventrally bears a dense patch of pale setae (Polhemus & Polhemus 1994, fig. 11). The fore tibia of *T. bosavi* is angled on its distal 1/4, the portion bearing the grasping comb, while in *T. arfak* the entire fore tibia is relatively straight. In *T. bosavi* the orange brown coloration on the anterior lobe of the pronotum extends laterally onto the propleural area, while in *T. arfak* this pale coloration is confined to a medial spot separated from the propleura by dark areas laterally. In addition, the presence of stiff, erect black setae in the pale areas at the wing bases is a useful spot character for recognition of *T. bosavi*.

Biological notes. – The type series was taken from pools on a small, heavily shaded stream flowing through a bed of mossy boulders. For additional notes see discussion under *Tanyvelia bosavi*.

Etymology. – The name 'bosavi' is a noun in apposition referring to the Mt. Bosavi type locality.

Distribution: – Southern New Guinea (fig. 32).

Tarsovelia reclusa sp. n. (figs. 29, 30, 32)

Type material. – Holotype, macropterous male: INDONESIA, Irian Jaya Prov., New Guinea, small swift trib. to West Branch of Otomona River at Aroanop, 1220 m. (4000 ft.), water temp. 18° C., 25 January 1997, 06:10–09:00 hrs. 4°09.35 S, 136°58.66 E., CL 7062, D. A. Polhemus (LIP). – Paratypes: INDONESIA, Irian Jaya Prov., New Guinea: 3 macropterous males, 1 macropterous female, same data as holotype (BPBM, JTPC, USNM).

Description

Size. – Macropterous male, length 2.85–3.05 mm (\bar{x} =2.97, n =3); width 1.10–1.15 mm (\bar{x} =1.12, n =3). Macropterous female, length 3.50 mm (n =1); width 1.20 mm, (n =1). Micropterous forms unknown.

Colour. – Macropterous male: ground colour dull black to dark brownish black, venter orange brown

centrally. Head dark brownish black, lighter beneath, eyes red; rostrum luteous medially, piceous distally. Pronotum with anterior transverse band orange brown, separated from similar coloration on propleura by a diffuse, infuscated band along pronotal margin; disc black, humeral margins medium brown. Wings dark brown, basal angles yellowish white, this white coloration extending posteriorly past the apex of the pronotum. Abdomen orange brown, black laterally adjacent to spiracles. Antennae dark brown, basal section of segment I yellowish brown. Coxae, trochanters, fore femur and ventral faces of middle and hind femora yellow to yellowish brown, remaining portions of legs dark brown.

Structural characters. – Macropterous male: head of moderate length, declivant anteriorly; length 0.47; width of eye/interocular space, 0.16/0.31. Pronotum long, apex rounded, length:width, 1.00 : 1.07; humeri, prominent, raised. Abdominal tergites not visible.

Abdominal venter not modified, set with short appressed setae.

Legs and antennae thickly clothed with short appressed gold setae, intermixed with scattered slender erect dark setae; fore femur lacking patches of dark setae ventrally, but ventral surface thickly set with numerous long, erect, pale setae. Legs unarmed; fore femur not expanded, ventral face centrally bearing a raised carinate ridge flanked by an elongate depression (fig. 29).

Antennal formula I : II : III : IV : 0.31 : 0.31 : 0.42 : 0.46.

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg, 0.65 : 0.62 : 0.27 : 0.0; of middle leg, 1.00 : 1.00 : 0.56 : 0.39; of hind leg, 0.87 : 1.00 : 0.25 : 0.30.

Paramere nearly straight, narrowing centrally, then weakly expanded to a rounded tip (fig. 30).

Macropterous female: Similar to male in general structure and coloration, but somewhat larger; posterior apex of pronotum angulate; fore femur lacking small carinate ridge ventrally.

Remarks

Comparative notes. – *Tarsovelia reclusa* sp. n. runs in the key of Polhemus & Polhemus (1994) to *T. alta*, but may be separated from that species by the armature of the male fore femur. The ventral face of the fore femur in *T. reclusa* bears a low, carinate ridge flanked by a parallel depression (fig. 29), a structure difficult to see except in oblique light; the ventral face of the fore femur in *T. alta*, by contrast, is unmodified. The parameres are also differently shaped, that of *T. alta* being elongate and tapering (Polhemus & Polhemus 1994, fig. 15), while that of *T. reclusa* is stouter and has the tip more highly expanded (fig. 30).

Biological notes. – The type series of *T. reclusa* was

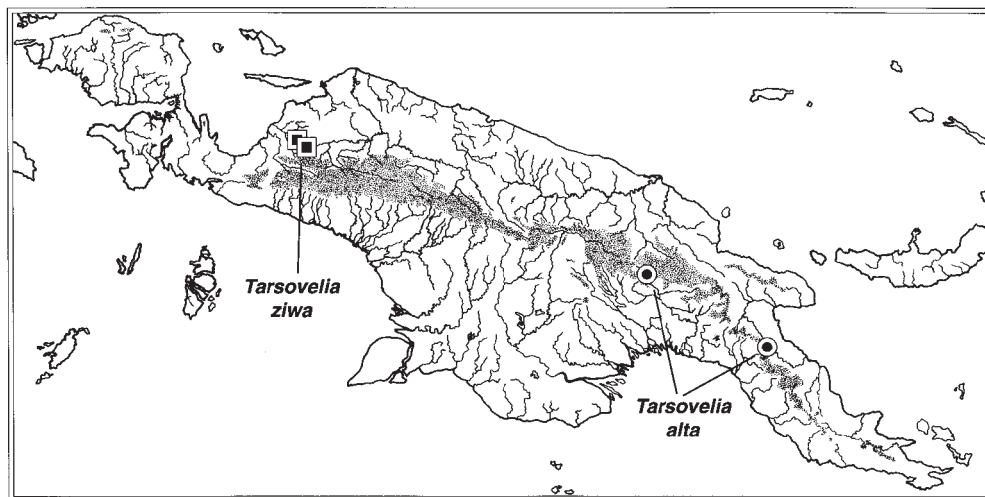


Fig. 33. Distribution of *Tarsovelia* species in New Guinea.

taken along the margins of a swift, cold, rocky tributary to the Otomona River, flowing in an incised channel cut into an open, grassy valley floor. The insects were found in a few dark, protected spots under overhanging banks, but were not abundant.

Etyymology. – The name ‘reclusa’ refers to the secretive habits of this species.

Distribution. – Southern New Guinea (fig. 32).

Tarsovelia ziwa sp. n.
(figs. 27, 28, 33)

Type material. – Holotype, macropterous male: INDONESIA, Irian Jaya Prov., New Guinea, swift tributary to upper Ziwa River at PTFI Wapoga Alpha drilling camp, 1050 m. (3500 ft.), water temp. 20° C., 19 April 1998, 12:30–13:30 hrs. 3°08.69' S, 136°34.42' E, CL 7102, D. A. Polhemus (LIPI). – Paratypes: INDONESIA, Irian Jaya Prov., New Guinea: 27 macropterous males, 6 macropterous females, same data as holotype (BPBM, JTPC, USNM, LIPI); 17 macropterous males, 11 macropterous females, rocky tributary to Logari River, approx. 0.5 km. W. of PTFI Landing Site 21, 295 m. (970 ft.), water temp. 25° C., 6 April 1998, 12:30–14:30 hrs. 3°00.45' S, 136°33.23' E, CL 7091, D. A. Polhemus (USNM, JTPC, LIPI); 46 macropterous males, 27 macropterous females, rocky rainforest tributary to upper Ziwa River at PTFI Wapoga Alpha drilling camp, 1050 m. (3500 ft.), water temp. 20° C., 18 April 1998, 10:00–17:00 hrs.; 19 April 1998, 14:00–18:00 hrs. 3°08.69' S, 136°34.42' E, CL 7100, D. A. Polhemus (USNM, LIPI); 15 macropterous males, 7 macropterous females, up-

per Ziwa River at PTFI Wapoga Alpha drilling camp, 1050 m. (3500 ft.), water temp. 19° C., 19 April 1998, 08:00–12:00 hrs. 3°08.69' S, 136°34.42' E, CL 7101, D. A. Polhemus (USNM, LIPI).

Description

Size. – Macropterous male, length 2.90–3.00 mm (\bar{x} =2.95, n=4); width 1.10–1.15 mm (\bar{x} =1.12, n=4). Macropterous female, length 3.25–3.40 mm (\bar{x} =3.30, n=3); width 1.25–1.33 mm (\bar{x} =1.29, n=3). Micropterous forms unknown.

Colour. – Macropterous male: ground colour, including venter, dull black to dark brownish black. Head dark brownish black, eyes red; rostrum luteous, piceous medially and distally. Pronotum small transverse orange brown medially along anterior margin, not extending laterally beyond eyes; disc and humeri dark brownish black. Wings dark brown, basal angles yellowish white, this white coloration extending posteriorly past the apex of the pronotum. Abdomen dark brownish black. Antennae dark brown, basal section of segment I orange brown. Coxae, trochanters, basal $\frac{3}{4}$ of fore femur and basal $\frac{1}{3}$ of middle and hind femora yellowish brown, remaining portions of legs dark brown.

Structural characters. – Macropterous male: head of moderate length, declivant anteriorly; length 0.42, width across eyes 0.62; width of eye/interocular space, 0.15/0.35. Pronotum long, apex rounded, length:width, 1.10 : 0.94; humeri, prominent, raised. Veins at wing bases set with scattered long, fine, erect, brown setae. Abdominal tergites not visible.

Abdominal venter not modified, set with short ap-

pressed pale setae.

Legs and antennae thickly clothed with short appressed gold setae, intermixed with scattered slender erect dark setae; fore femur expanded on distal 2/3, bearing a raised patch of short, stiff, pale setae extending apically from center of ventral face (fig. 27).

Antennal formula I: II: III: IV; 0.31 : 0.32 : 0.36 : 0.40.

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg, 0.72 : 0.62 : 0.31 : 0.0; of middle leg, 1.00 : 1.00 : 0.55 : 0.32; of hind leg, 0.84 : 1.06 : 0.24 : 0.26.

Paramere curving, tip not expanded (fig. 28).

Macropterous female: Similar to male in general structure and coloration, but somewhat larger; posterior apex of pronotum angulate; fore femur lacking small carinate ridge ventrally. Paired (1+1) tufts of long, erect, black setae present along transverse sulcus between anterior and posterior lobes of pronotum to either side of midline; similar setae also present on propleurae and at posterior margin of corium adjacent to basal section of wing membrane; veins at wing bases bearing scattered long, fine, erect, brown setae.

Remarks

Comparative notes. – *Tarsovelia ziwa* sp. n. is a dark colored species similar in general aspect to *T. arfak* Polhemus & Polhemus, but differing in the structure of the male fore femur. In both species this leg segment is narrowed on the basal one third and expanded distally, and bears a brush of short, dense hairs on the ventral margin, but this brush is located more basally in *T. arfak*, in the area adjacent to the narrowed basal section (Polhemus & Polhemus, 1994, fig. 11), while in *T. ziwa* it lies on the distal half of the femur (fig. 27). *Tarsovelia ziwa* is also similar in many aspects to *T. kikori* sp. n. (see notes under that species). The paramere of *T. ziwa* is also quite distinctive, being broadly curved and not expanded at the tip (fig. 28).

Biological notes. – The type series of *T. ziwa* was taken along the margins of a very swift, cold, clear tributary to the upper Ziwa River, partially shaded by primary montane rain forest. The insects would aggregate in sheltered spots in the lee of large boulders, under logs, or in small, shaded backwater eddies out of the main current. This species was also found along the margins of the main Ziwa River itself, a powerful, rocky stream flowing in a mostly unshaded bed. Along this river they skated on sheltered side pools out of the main flow, rowing swiftly using their elongate middle tarsi. Lower in the same catchment, on a tributary to the Logari River, a series of *T. ziwa* was taken from beneath an overhanging rock along the edge of a small, gravel-bottomed stream pool.

Etymology. – The name 'ziwa' is a noun in apposition and refers to the Ziwa River type locality.

Distribution. – Northwestern New Guinea (fig. 33).

Tarsovelia dani Polhemus & Polhemus

Tarsovelia dani Polhemus & Polhemus 1994: 65.

Material examined. – INDONESIA, Irian Jaya Prov., New Guinea: 10 macropterous males, 10 macropterous females, trib. to Wabu River below PTFI Bilogai exploration camp, 2105 m. (6900 ft.), water temp. 17° C., 1 April 1997, 08:30–14:00 hrs. 3°44.69' S, 137° 01.75' E., CL 7083, D. A. and J. T. Polhemus (JTPC, USNM, LIPI); 11 macropterous males, 9 macropterous females, Tanime-Eipomek [vicinity of Wamena], 4°30' S, 140°05' W, 2100–2300 m., 24 Sept. 1993, Balke and Riedel (NHMW).

Neusterensifer Polhemus & Polhemus, emended

Neusterensifer Polhemus & Polhemus, 1994: 67 (type species *Neusterensifer compacta* Polhemus & Polhemus, 1994, by original designation).

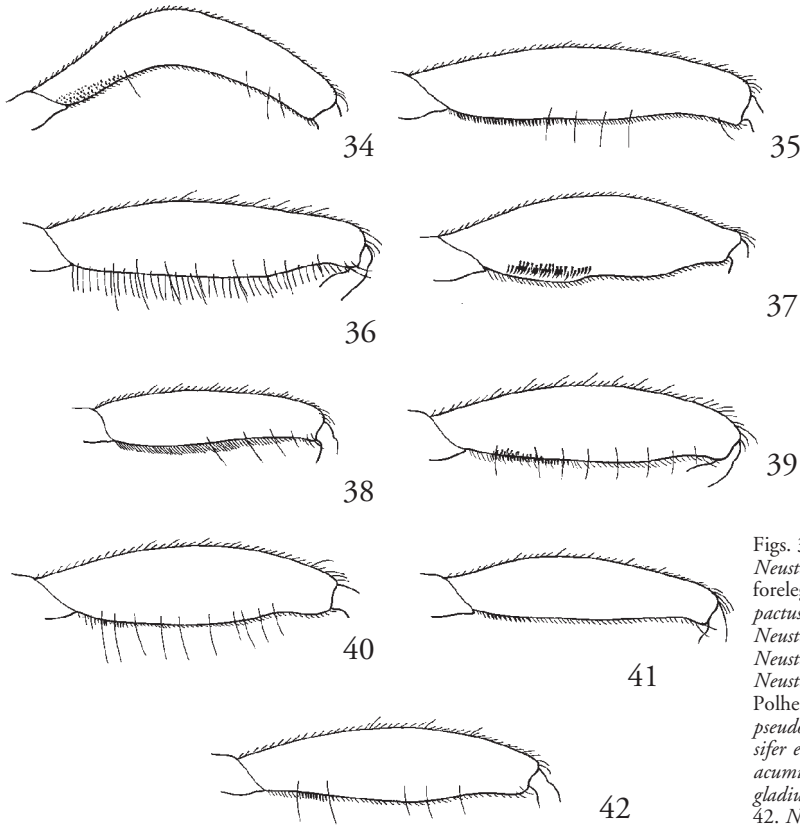
Neusterensifer Polhemus & Polhemus, corrected here; see below.

Discussion. – For diagnostic structural characters of this genus see discussion in Polhemus & Polhemus (1994).

The derivation of the generic name, *Neusterensifer*, was given in the original description as; neuster, bearer, plus ensifer, sword. Through a lapsus the name was consistently spelled Neusterinsifer, which must be corrected to *Neusterensifer*.

Revised key to species of *Neusterensifer*

1. Male process on proctiger bifurcate, short (fig. 43); female abdomen strongly narrowed posteriorly, boat shaped
..... *nabire* Polhemus & Polhemus
– Male process on proctiger not bifurcate, longer (figs. 44–53); female abdomen not strongly narrowed posteriorly, not boat shaped 2
2. Process on male proctiger relatively short, sharp and triangular (figs. 45, 47) 3
– Process on male proctiger long and narrow, or very long and sinuate, not short, sharp and triangular (figs. 44, 46, 48–53) 4
3. Abdominal ventrite VII strongly excavate across its entire ventral surface; patches of silvery setae present along entire posterior margins of tergites V and VI in males, and tergites IV – VI in females; female connexival segment VII bearing a small tubercle *pseudocyclops* sp. n.
– Abdominal ventrite VII excavate only on posterior half; silvery setae absent medially on abdominal tergites IV–VI in both sexes, present only as paired lateral patches; female connexival segment VII lacking a small tubercle
..... *cyclops* Polhemus & Polhemus
4. Process of male proctiger very long, slender and sinuate, tip hooked or acuminate (figs. 46, 48, 50, 52, 53); female abdominal tergite VII with a



Figs. 34–42. *Neusterensifer* species, male forelegs. – 34. *Neusterensifer compactus* Polhemus & Polhemus; 35. *Neusterensifer kutubu* sp. n.; 36. *Neusterensifer lubu* sp. n.; 37. *Neusterensifer sepik* Polhemus & Polhemus; 38. *Neusterensifer pseudocyclops* sp. n.; 39. *Neusterensifer etna* sp. n.; 40. *Neusterensifer acuminata* sp. n.; 41. *Neusterensifer gladius* Polhemus & Polhemus; 42. *Neusterensifer iriana* sp. n.

- prominent transverse fold, posterior portion bent sharply downward in relation to basal section 5
- Process of male proctiger moderately long, narrow or broad, but not sinuate medially, tip blunt or acuminate, but never hooked (figs. 44, 49, 51); female abdominal tergite VII flat, entire tergite lying in same plane, posterior portion not folded downward (although entire tergite may be angled downward or vertically) 9
- 5. Medial sulcus on male abdominal ventrites V–VII bordered by prominent black setiferous tumescences on abdominal ventrite VI or VII 6
- Medial sulcus on male abdominal ventrites V–VII not bordered by prominent black setiferous tumescences on abdominal ventrites VI or VII, instead bearing angulate, non-setiferous tumescences on abdominal tergite VII 8
- 6. Medial sulcus on male abdominal ventrites V–VII bordered by prominent black setiferous tumescences on abdominal ventrite VII 6

-*gladius* Polhemus & Polhemus
- Medial sulcus on male abdominal ventrites V–VII bordered by prominent black setiferous tumescences on abdominal ventrite VI 7
- 7. Body length 3.00 mm or greater; tip of process on male proctiger coming to a slender, curving point (fig. 52); female abdominal tergite VII lacking long erect dark setae *N. iriana* sp. n.
- Body length 2.50 mm or less; tip of process on male proctiger rounded and blunt (fig. 46); female abdominal tergite VII bearing numerous long erect dark setae *N. etna* sp. n.
- 8. Process on male proctiger weakly sinuate medially (fig. 53); black spinules on basal portion of male fore femur arrayed in more or less a single row, forming a small, relatively inconspicuous patch (fig. 40); female with prominent transverse patches of silvery setae along posterior margins of abdominal tergites II–VI *acuminata* sp. n.
- Process on male proctiger strongly sinuate medially (fig. 50); black spinules on basal portion of male fore femur arrayed in several rows, forming

- a large and obvious patch (fig. 35); female lacking transverse patches of silvery setae along posterior margins of abdominal tergites II–VI
 *kutubu* sp. n.
9. Male fore femur lacking a patch of black denticles or spinules basally on ventral face (fig. 36); female connexival segment VII bearing a small, upwardly directed tubercle at posterolateral angle
 *lubu* sp. n.
- Male fore femur bearing a patch of black denticles or spinules basally on ventral face; female connexival segment VII lacking a small tubercle
 10
10. Process of male proctiger long, slender, narrowly rounded distally (fig. 44); male fore femur strongly bowed, bearing small black denticles basally (fig. 34); caudal extreme of female connexival segment VII forming an obtuse angle
 *compactus* Polhemus & Polhemus
- Process of male proctiger long, broad (fig. 49); male fore femur not bowed, with a patch of black spinules basally (fig. 37); caudal extreme of female connexival segment VII slightly produced posteriorly, forming an acute angle
 *sepik* Polhemus & Polhemus

Neusterensifer lubu sp. n.
 (figs. 36, 51, 54)

Type material. – Holotype, apterous male: PAPUA NEW GUINEA, Gulf Prov., Lubu River above Omo, 50 m., water temp. 19° C., 1 March 1995, 09:00-12:00 hrs., D. A. Polhemus (BPBM). – Paratypes: PAPUA NEW GUINEA, Gulf Prov. 13 apterous males, 5 apterous females, same data as holotype (BPBM, JTPC, USNM).

Description

Size. – Apterous male, length 2.35-2.37 mm (\bar{x} =2.36, n=3); width 0.77-0.87 mm (\bar{x} =0.82, n=3). Apterous female, length 2.31-2.44 mm (\bar{x} =2.37, n=2); width 1.00-1.00 mm, (\bar{x} =1.00, n=2).

Colour. – Apterous male: Ground colour dark brown, marked with yellowish brown on anterior pronotum, connexival margins, and venter; entire dorsum and laterotergites covered with fine appressed golden pubescence, sparsely intermixed with scattered medium length, slender, semi-erect brown setae; patches of short, shining, silvery pubescence present laterally on all abdominal tergites, along the posterior margins of abdominal tergites IV and V, along anterior margin of pronotum, and on sides of thorax and abdomen. Head brown, yellowish brown beneath; rostrum shining yellowish brown, fuscous medially, piceous distally. Pronotum dark brown, with an elongate transverse orange brown spot medially behind anterior margin; disc dark brown. Ab-

domen dark brown, lighter ventrally, connexiva entirely orange brown. Antennae brown. Legs yellowish brown above, femora, tibiae and tarsi distally darkened; coxae and trochanters pale yellowish white.

Structural characters. – Apterous male: head of moderate length, declivant anteriorly, with weak impressed median line; length 0.42; width of eye/interoocular space, 0.17/0.27. Pronotum long, covering mesonotum, thickly set with obscure foveae, humeri depressed; length:width, 0.37 : 0.81. Metanotum length:width, 0.25 : 0.62. Abdominal tergites dull, without shining areas; lengths of tergites II–VIII, respectively: 0.20 : 0.19 : 0.15 : 0.12 : 0.12 : 0.31 : 0.25.

Abdominal venter set with short appressed setae, and scattered longer setae; central sections of ventrites II–VI broadly depressed, forming a large, longitudinally ovate concavity on underside of abdomen; ventrite VI posteriorly angulate along central portion of posterior margin, this angulation bearing two (1+1) raised patches of dense dark setae to either side of midline; ventrite VII also posteriorly angulate medially, this angulation projecting over base of ventrite VIII. Legs and antennae thickly clothed with short to moderate length setae, with scattered longer setae. Middle and hind legs unarmed; fore femur bearing a thick fringe of long, erect, pale setae ventrally, fore tibia with grasping comb extending ½ the length of the tibia (fig. 36).

Antennal formula I : II : III : IV : 0.32 : 0.25 : 0.50 : 0.57.

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg, 0.62 : 0.52 : 0.27 : 0.0; of middle leg, 0.87 : 0.82 : 0.15 : 0.27; of hind leg, 0.97 : 1.12 : 0.15 : 0.30.

Proctiger produced anteriorly into a short, blade-like process (fig. 51). Parameres vestigial or absent.

Micropterous female: Similar to male in general structure and Colour, but somewhat larger; connexiva angling outward, posterolateral margins produced into small, tuberculate, vertically oriented processes, lacking tufts of long setae.

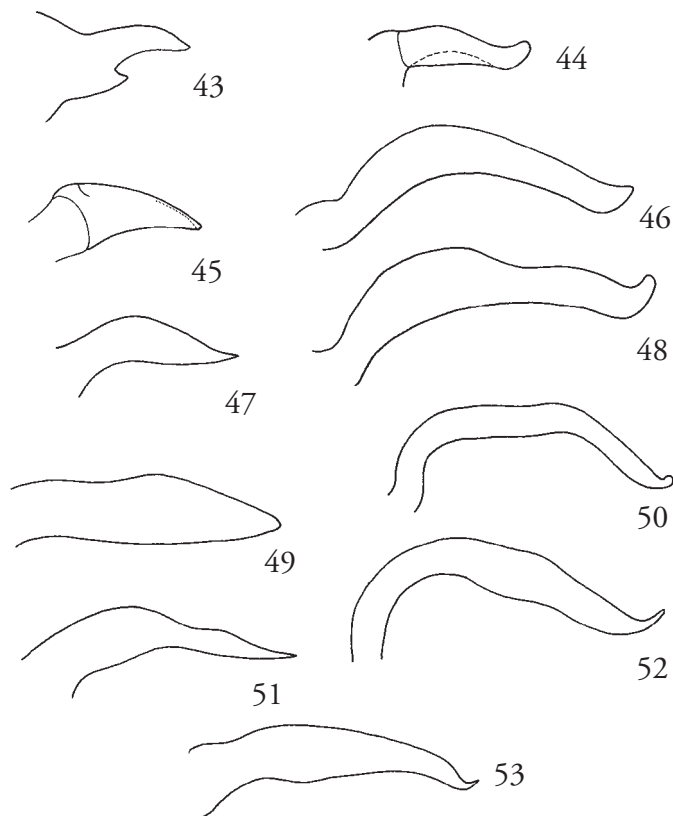
Remarks

Comparative notes. – Recognized by the brown ground colour, the lack of long erect setae on the dorsum, the short, blade-like process on the male proctiger (fig. 51), the thick fringe of erect pale setae ventrally on the male foreleg (fig. 36), and the small, tuberculate processes at the posterolateral angles of the female connexiva.

Biological notes. – The type series was taken on shallow, shaded side pools amid cobble bars adjacent to the main Lubu River channel. For additional notes on this locality see discussion under *Tarsovelia kikori*.

Etymology. – The name *lubu* is a noun in apposition referring to the Lubu River type locality.

Distribution. – Southern New Guinea (fig. 54).



Figs. 43–53.

Neusterensifer species, ventral process of male proctiger. – 43. *Neusterensifer nabire* Polhemus & Polhemus; 44. *Neusterensifer compactus* Polhemus & Polhemus; 45. *Neusterensifer cyclops* Polhemus & Polhemus; 46. *Neusterensifer etna* sp. n.; 47. *Neusterensifer pseudocyclops* sp. n.; 48. *Neusterensifer gladius* Polhemus & Polhemus; 49. *Neusterensifer sepik* Polhemus & Polhemus; 50. *Neusterensifer kutubu* sp. n.; 51. *Neusterensifer lubu* sp. n.; 52. *Neusterensifer iriana* sp. n.; 53. *Neusterensifer acuminata* sp. n.

Neusterensifer kutubu sp. n.
(figs. 35, 50, 55)

Type material. – Holotype, apterous male: PAPUA NEW GUINEA, Southern Highlands Prov., branch of upper Kara Creek (trib. to Digimu River), 3.5 km. S. of Moro oil camp, on road to Ridge camp, 900 m., water temp. 20° C., 13 March 1995, 08:40–11:30 hrs., D. A. Polhemus (BPBM). – Paratypes: PAPUA NEW GUINEA, Southern Highlands Prov.: 34 apterous males, 21 apterous females, same data as holotype (BPBM, JTPC, USNM).

Description

Size. – Apterous male, length 2.27–2.40 mm (\bar{x} =2.35, n=3); width 1.00–1.00 mm (\bar{x} =1.00, n=3). Apterous female, length 2.50–2.69 mm (\bar{x} =2.60, n=3); width 1.05–1.15 mm. (\bar{x} =1.08, n=3).

Colour. – Apterous male: Ground colour greyish black, marked with yellowish brown on anterior pronotum, connexival margins, and venter; entire dorsum and laterotergites covered with fine appressed golden pubescence thickly intermixed with scattered

long, erect, slender, brown setae, patches of short, shining, silvery pubescence present laterally on abdominal tergites, along anterior margin of pronotum, and on sides of thorax and abdomen. Head greyish black, orange brown beneath; rostrum shining yellowish brown, fuscous medially, piceous distally. Pronotum greyish black, with an elongate transverse orange brown spot medially behind anterior margin; disc greyish black. Abdomen greyish black, lighter ventrally, connexiva margined with orange brown. Antennae brown. Legs brown above, yellowish brown below, distally darkened; femora darker posteriorly; coxae and trochanters luteous.

Structural characters. – Apterous male: head of moderate length, declivant anteriorly, with weak impressed median line; length 0.37; width of eye/interocular space, 0.18/0.27. Pronotum long, covering mesonotum, thickly set with obscure foveae, humeri depressed; length:width, 0.32 : 1.00. Metanotum length:width, 0.30 : 0.75. Abdominal tergites dull, without shining areas; lengths of tergites II–VIII, respectively: 0.27 : 0.15 : 0.12 : 0.12 : 0.20 : 0.30 : 0.30.

Abdominal venter set with short, appressed setae,

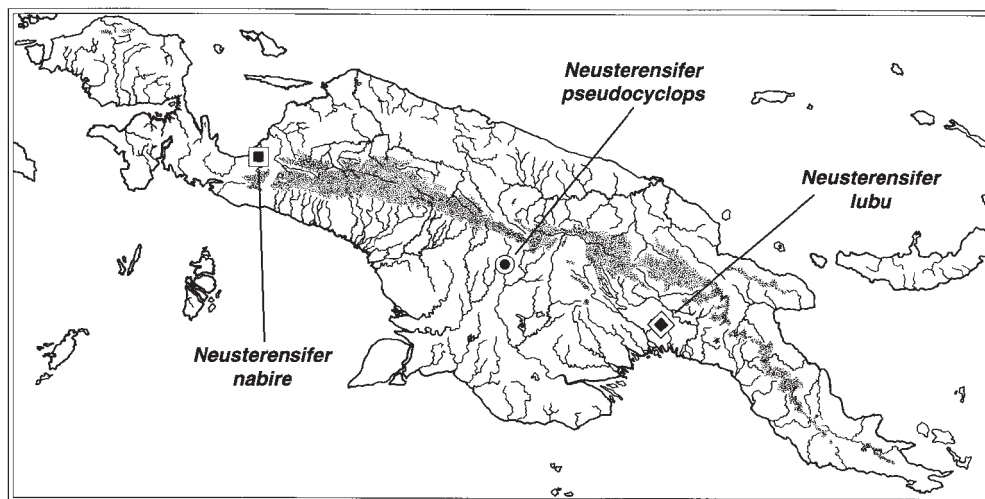


Fig. 54. Distribution of *Neusterensifer* species in New Guinea.

intermixed with longer, pale setae; ventrite VII bearing two (1+1) tuberculate processes on posterior margin, flanking a large central depression, this depression longitudinally glabrous centrally, continuing anterad onto ventrites V and VI. Legs and antennae thickly clothed with short to moderate length setae, intermixed with scattered longer setae. Middle and hind legs unarmed; foreleg bearing an elongate patch of short, spine-like black setae on basal $\frac{1}{3}$ of ventral surface, tibial comb extending for only $\frac{2}{5}$ the length of the tibia (fig. 35).

Antennal formula I: II: III: IV; 0.37: 0.27: 0.37: 0.50.

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg, 0.62: 0.60: 0.25: 0.0; of middle leg, 0.85: 0.82: 0.12: 0.27; of hind leg, 1.00: 1.25: 0.20: 0.27.

Proctiger produced anteriorly into an elongate, sinuate process ending in a slightly hooked and knobbed tip (fig. 50). Parameres vestigial or absent.

Apterous female: Similar to male in general structure and coloration, but somewhat larger; connexiva angled outward, posterolateral angles unmodified, bearing tufts of long, slender setae; abdominal ventrites V–VII bearing an impressed longitudinal glabrous line medially.

Macropterous forms: unknown.

Remarks

Comparative notes. – *Neusterensifer kutubu* belongs to a group of species including *N. gladius* Polhemus & Polhemus from northern Irian Jaya and *N. acuminata* n. sp. from the Madang area of Papua New Guinea, all of which have patches of black spinules

basoventrally on the male fore femur and very long, sinuate processes on the male proctiger. Among these species, *N. kutubu* is distinguished by the shape of the process on the male proctiger, which has an acuminate tip and a strong, sinuate twist in its middle section (fig. 50), the blackish grey ground colour and highly pilose dorsum in both sexes, and the absence of transverse bands of silvery setae along the posterior margins of the female abdominal tergites.

Biological notes. – The type locality was a clear, shallow creek shaded by tall primary montane rain forest. The type series of *N. kutubu* was taken from protected areas of slow water along the stream margins.

Etymology. – The name *kutubu*, a noun in apposition, refers to the Lake Kutubu drainage basin from which the type series was collected.

Distribution. – South Central New Guinea (fig. 55).

Neusterensifer pseudocyclops sp. n. (figs. 38, 47, 54)

Type material. – Holotype, apterous male: PAPUA NEW GUINEA, Western Prov., 10 km. S. of Ningerum on Ok Tedi Rd., CL 1779, 4 Sept. 1983 (BPBM). Paratypes: PAPUA NEW GUINEA, Western Prov.: 2 apterous males, 2 apterous females, same data as holotype (JTPC).

Description

Size. – Apterous male, length 2.00 mm (\bar{x} =2.00, n =1); width 0.80 mm (\bar{x} =0.80, n =1). Apterous female, length 2.20 mm (\bar{x} =2.20, n =1); width 1.00

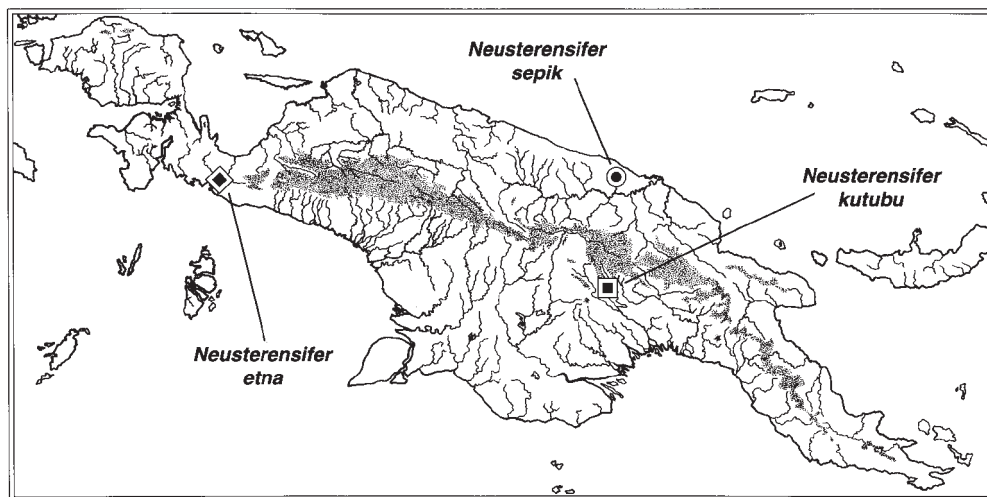


Fig. 55. Distribution of *Neusterensifer* species in New Guinea.

mm, (\bar{x} =1.00, n=1).

Colour. – Apterous male: Ground colour dark brown, marked with yellowish brown on anterior pronotum, connexiva, and venter; entire dorsum and laterotergites covered with fine appressed golden pubescence intermixed with scattered stiff, erect, dark setae; patches of shining, recumbent, silvery setae present laterally on all abdominal tergites, and also extending across entire widths of tergites IV–VI along posterior margins, similar silvery setae also present along anterior margin of pronotum and on sides of thorax and abdomen. Head dark brown, yellowish brown beneath; rostrum shining yellowish brown, fuscous medially, piceous distally. Pronotum dark brown, with an elongate transverse yellowish brown spot medially behind anterior margin; disc dark brown. Abdomen dark brown, lighter ventrally, connexiva yellowish brown. Antennae brown. Legs brown above, yellowish brown below, distally darkened; femora darker posteriorly; coxae and trochanters uniformly yellowish.

Structural characters. – Apterous male: head of moderate length, declivant anteriorly, with weak impressed median line; length 0.32, width across eyes 0.60; width of eye/interocular space, 0.15/0.30. Pronotum long, covering mesonotum, thickly set with obscure foveae, humeri depressed; length:width, 0.31 : 0.82. Metanotum length:width, 0.25 : 0.67. Abdominal tergites dull, without shining areas; lengths of tergites II–VIII, respectively: 0.15 : 0.12 : 0.10 : 0.10 : 0.10 : 0.20 : 0.27.

Abdominal venter set with very short, appressed se-

tae; ventrite VI bearing two large (1+1) tuberculate processes on posterior margin, these processes terminating in small, brushy tufts of short, dark setae; central section of ventrite VI between tubercles strongly depressed to form a large central sulcus, this sulcus bearing small pruinose areas along its midline and continuing anteriorly onto ventrite V and posteriorly onto ventrite VII, forming a large, deep concavity centrally along entire length of latter segment. Legs and antennae thickly clothed with short to moderate length setae, intermixed with scattered longer setae. Middle and hind legs unarmed; fore femur and tibia relatively straight and unmodified, lacking tumescences, depressions, or raised and modified hair patches (fig. 38), tibial comb extending for only ½ the length of the tibia.

Antennal formula I : II : III : IV : 0.32 : 0.25 : 0.34 : 0.50.

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg, 0.50 : 0.50 : 0.20 : 0.0; of middle leg, 0.75 : 0.67 : 0.12 : 0.25; of hind leg, 0.77 : 0.92 : 0.14 : 0.25.

Proctiger produced anteriorly into a short, tapering process with a carinate dorsolateral margin, ending in a sharp point (fig. 47). Parameres vestigial or absent.

Apterous female: Similar to male in general structure and coloration, but somewhat larger; connexiva angled outward, bearing small tubercles at posterolateral angles of segment VII; abdominal tergites IV–VI almost entirely covered with shining, recumbent, silvery setae; abdominal ventrites V–VII bearing an impressed longitudinal glabrous line medially.

Macropterous forms: unknown.

Remarks

Comparative notes. – *Neusterensifer pseudocyclops* is closest to *N. cyclops*, differing primarily in the morphology of the male abdominal terminalia. In *N. pseudocyclops* abdominal ventrite VI has a deeper median sulcus, larger, higher tubercles lateral to the sulcus, and each tubercle bears a smaller tuft of setae; ventrite VII is completely excavated (vs. only the posterior half in *cyclops*); the process of the proctiger ('sword') is of a slightly different shape, and lacks the ventral spur and associated short ridge found in *cyclops*, having the dorsolateral margin carinate instead (fig. 47). In addition, the silvery patches of setae occupy the entire posterior margins of tergites V and VI in males, and tergites IV – VI in females, while they are absent medially in *cyclops*. Finally, *pseudocyclops* females have a distinct tubercle on the posterolateral margin of connexival segment VII, lacking in *cyclops* females. These tubercles on the connexival apices are similar to those seen in *N. lubu*, but in that species the female bears transverse bands of silvery setae along the posterior margins of abdominal tergites IV and V only, and the structure of the process on the male proctiger is different (compare figs. 47, 51).

Biological notes. – The type series came from protected areas along the margins of a shallow, shaded rainforest stream with a gravel bottom, swift current, and low, overhanging banks.

Etymology. – The name *pseudocyclops* (L.), refers to the superficial similarity of this species to the previously described *Neusterensifer cyclops*.

Distribution. – Southern New Guinea (fig. 54).

Neusterensifer acuminata sp. n.
(fig. 40, 53, 56)

Type material. – Holotype, apterous male: PAPUA NEW GUINEA, Madang Prov., rocky stream at Kau Wildlife Area, N. of Madang, 30 m., 26 March 1994, water temp. 28° C., 16:00–17:30 hrs., D. A. Polhemus (BPBM). – Paratypes: PAPUA NEW GUINEA, Madang Prov.: 3 apterous males, 5 apterous females, same data as holotype (JTPC); 4 apterous males, 3 apterous females, Gum River nr. Ohu, 11 km. W. of Madang, 80 m., 27 March 1994, water temp. 28° C., 10:00–14:00 hrs., CL 7035, D. A. Polhemus (BPBM, USNM); 6 apterous males, 2 apterous females, Hul Stream, trib. to Gum River, nr. Ohu, approx. 13 km. SW of Madang, 50 m., 14 August 1994, S. E. Miller (BPBM, USNM).

Description

Size. – Apterous male, length 2.20–2.25 mm (\bar{x} =2.23, n=3); width 0.90–1.00 mm (\bar{x} =0.93, n=3). Apterous female, length 2.40–2.50 mm (\bar{x} =2.47, n=3); width 1.00–1.05 mm, (\bar{x} =1.02, n=3).

Colour. – Apterous male: Ground colour dark brown, marked with orange brown on anterior pronotum, connexival margins, and abdominal venter; entire dorsum and laterotergites covered with fine appressed golden pubescence intermixed with scattered long, slender, erect brown setae, patches of short, shining, silvery pubescence present laterally on all abdominal tergites, centrally as small patches on abdominal tergites III and IV, along anterior margin of pronotum, and on sides of thorax and abdomen. Head dark brown above, orange brown beneath; rostrum shining golden brown, fuscous medially, piceous distally. Pronotum dark brown, anterior lobe with an elongate transverse orange brown spot medially behind anterior margin, posterior lobe dark brown. Abdomen dark brown, lighter ventromedially, connexiva broadly margined with orange brown. Antennae brown, segment I yellowish at extreme base. Legs brown above, yellowish brown below, distally darkened, coxae and trochanters uniformly yellowish.

Structural characters. – Apterous male: head of moderate length, declivant anteriorly, with weak impressed median line; length 0.35, width across eyes 0.57; width of eye/interocular space, 0.17/0.30. Pronotum long, covering mesonotum, thickly set with obscure foveae, humeri depressed; length:width, 0.36 : 0.92. Metanotum length:width, 0.25 : 0.70. Abdominal tergites dull, without shining areas; lengths of tergites II–VIII, respectively: 0.15 : 0.10 : 0.07 : 0.07 : 0.07 : 0.30 : 0.32.

Abdominal venter set with short, appressed setae, intermixed with longer, pale setae; ventrites V–VII bearing a longitudinal medial depression, this depression glabrous along its central midline on ventrites V and VI, and flanked by low, angulate tumescences on ventrites VI and VII. Legs and antennae thickly clothed with short to moderate length setae, intermixed with scattered longer setae, particularly on ventral margins of fore and middle femora. Middle and hind legs unarmed; foreleg bearing an elongate patch of short, spine-like black setae on basal 1/3 of ventral surface (fig. 40); tibial comb extending for less than 1/2 the length of the fore tibia.

Antennal formula I : II : III : IV; 0.32 : 0.25 : 0.37 : 0.49.

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg, 0.60 : 0.55 : 0.25 : 0.0; of middle leg, 0.75 : 0.75 : 0.12 : 0.27; of hind leg, 0.82 : 1.06 : 0.12 : 0.22.

Proctiger produced anteriorly into an elongate, tapering process ending in an acute tip (fig. 53). Parameres vestigial or absent.

Apterous female: Similar to male in general structure and coloration, but somewhat larger; connexiva angled outward, posterolateral apices forming small, posteriorly directed, angulate points, set with sparse tufts of long, dark setae; abdominal ventrites V–VII bearing an

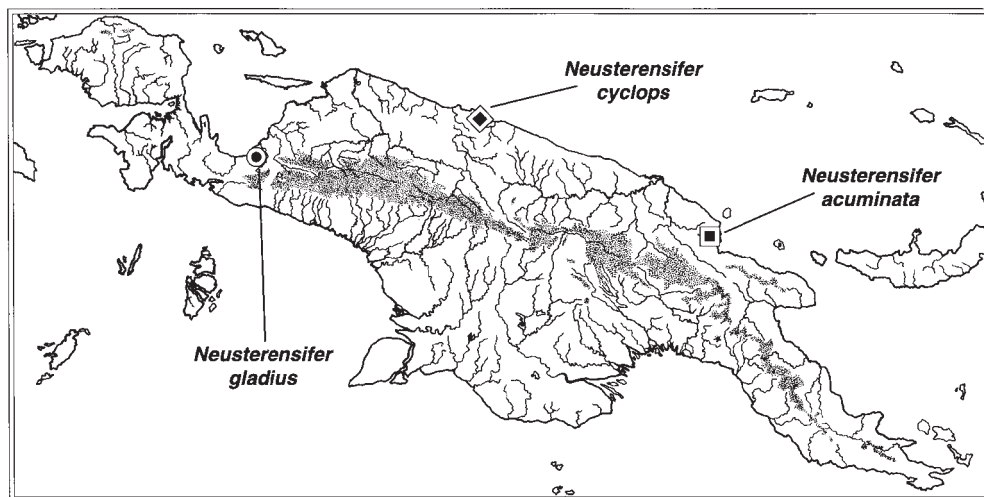


Fig. 56. Distribution of *Neusterensifer* species in New Guinea.

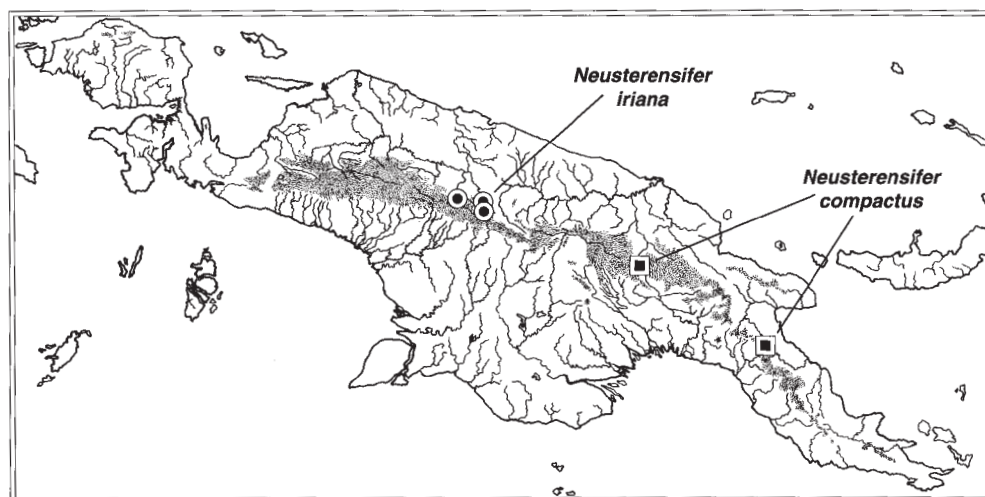


Fig. 57. Distribution of *Neusterensifer* species in New Guinea.

impressed longitudinal glabrous line medially.

Macropterous forms: unknown.

Remarks

Comparative notes. – *Neusterensifer acuminata* n. sp. is most similar in general structure to *N. gladius* Polhemus & Polhemus from northern Irian Jaya, both species possessing elongate processes on the male

proctiger and patches of black setae ventrally on the base of the male fore femur. *Neusterensifer acuminata* is much smaller in size, however (body length under 2.50 mm in both sexes), and has the process on the male proctiger progressively tapering to an acuminate tip (fig. 53), instead of widening medially and then slightly hooking at the tip as in *N. gladius* (fig. 46). In addition, males of *N. acuminata* have the medial sul-

cus on abdominal ventrites V–VII bordered by only slightly raised tumescences, while in *N. gladius* this sulcus is bordered by a pair (1+1) of prominent, setiferous tumescences on abdominal ventrite VI. Females of *N. acuminata* have transverse patches of silvery setae extending across the entire posterior halves of abdominal tergites II–V, while such setae are present only as small medial tufts on the posterior margins of abdominal tergites III and IV in *N. gladius*.

Biological notes. – The Kau River at the type locality was a small, heavily shaded stream flowing over bedrock and cobbles. The type series of *N. acuminata* was taken from small, still pools amid shaded bedrock exposures adjacent to the main stream channel.

Etymology. – The name *acuminata* (L.), refers to the shape of the process on the male proctiger.

Distribution. – Northeastern New Guinea (fig. 56).

Neusterensifer etna sp. n.
(figs. 39, 46, 55)

Type material. – Holotype, apterous male: INDONESIA, Irian Jaya Prov., New Guinea: small stream along N. side of PTFI Etna Bay exploration camp, 0–60 m. (0–200 ft.), 3°58.10' S, 134° 57.68' E, water temp. 25–27° C., 28 March 1997, 09:30–11:00 hrs., CL 7077, D. A. & J. T. Polhemus (LIPI). – Paratypes: INDONESIA, Irian Jaya Prov., New Guinea: 13 apterous males, 25 apterous females, same data as holotype (JTPC, USNM, LIPI); 48 apterous males, 46 apterous females, rocky stream at PTFI Helipad 60, 90 m. (300 ft.), 3°56.92' S, 134° 59.04' E, water temp. 24.5° C., 30 March 1997, 08:00–09:45 hrs., CL 7080, D. A. & J. T. Polhemus (JTPC, USNM, LIPI).

Description

Size. – Apterous male, length 2.20–2.25 mm (\bar{x} =2.24, n=4); width 0.90–1.00 mm (\bar{x} =0.96, n=4). Apterous female, length 2.25–2.50 mm (\bar{x} =2.37, n=5); width 1.00–1.10 mm, (\bar{x} =1.05, n=5).

Colour. – Apterous male: Ground colour dark blackish brown, marked with orange brown on anterior pronotum, connexival margins, and abdominal venter; entire dorsum and laterotergites covered with fine appressed golden pubescence intermixed with scattered long, slender, erect brown setae, patches of short, shining, silvery pubescence present laterally on metanotum and abdominal tergites II, III, and V–VIII, on anterior section of pronotum, and on sides of thorax and abdomen. Head dark brown above, orange brown beneath; rostrum shining golden brown, fuscous medially, piceous distally. Pronotum dark brown, anterior lobe with an elongate transverse orange brown spot medially behind anterior margin, posterior lobe dark brown. Abdomen dark brown, lighter ventromedially, connexiva broadly

marginated with orange brown. Antennae brown, segment I yellowish at extreme base. Legs brown above on distal halves of segments, yellowish brown below, coxae and trochanters uniformly yellowish.

Structural characters. – Apterous male: head of moderate length, declivant anteriorly, with weak impressed median line; length 0.35, width across eyes 0.60; width of eye/interocular space, 0.15/0.30. Pronotum long, covering mesonotum, thickly set with obscure foveae, humeri depressed; length:width, 0.31 : 0.87. Metanotum length:width, 0.26 : 0.67. Abdominal tergites dull, without shining areas; lengths of tergites II–VIII, respectively: 0.10 : 0.09: 0.10 : 0.07 : 0.07 : 0.26 : 0.27.

Abdominal venter set with short, fine, appressed setae, intermixed with longer, pale setae; ventrites V–VII bearing a longitudinal medial depression, this depression glabrous along its central midline on ventrites V and VI, and flanked by a pair (1+1) if low, dark, setiferous tumescences on ventrite VI, and by a pair (1+1) of angulate, posteriorly diverging tumescences on ventrite VII, creating a triangular depression on posterior half of ventrite VII with apex directed anteriorly. Legs and antennae thickly clothed with short to moderate length setae, intermixed with scattered longer setae, particularly on ventral margins of fore and middle femora. Middle and hind legs unarmed; foreleg bearing an elongate patch of short, spine-like black setae on basal 1/5 of ventral surface (fig. 39); tibial comb extending for approximately 2/5 the length of the fore tibia.

Antennal formula I:II:III:IV; 0.31 : 0.25 : 0.37 : 0.50.

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg, 0.60 : 0.52 : 0.25 : 0.0; of middle leg, 0.75 : 1.07 : 0.14 : 0.27; of hind leg, 0.81 : 1.04 : 0.19 : 0.26.

Proctiger produced anteriorly into an elongate and sinuate process, central section slightly thickened, tip rounded (fig. 46). Parameres vestigial or absent.

Apterous female: Similar to male in general structure and coloration, but somewhat larger; connexiva angled outward adjacent to abdominal tergites I–V, convergent adjacent to posterior margin of tergite VI, basal section of connexival segment VI with margins produced into small, posteriorly directed, angulate points, set with sparse tufts of long, dark setae; posterior margin of tergite VI and entirety of tergite VII set with numerous long, slender, erect black setae; silvery setae present laterally on mesonotum and all abdominal tergites, forming transverse bands along posterior margins of tergites II–IV, covering entirety of abdominal tergite VII; posterior 1/3 of abdominal tergite VII flexed sharply downward; abdominal ventrites V–VII bearing an impressed longitudinal glabrous line medially.

Macropterous forms: unknown.

Remarks

Comparative notes. – *Neusterensifer etna* n. sp. is similar in general appearance to *N. gladius* Polhemus & Polhemus, but may be easily separated by the different shape of the process on the male proctiger (compare figs. 46, 48), the presence of dark, setiferous tumescences on male abdominal ventrite VI (versus tergite VII in *N. gladius*), the presence of small tubercles on female connexival segment VI, the absence of a transverse band of silvery setae along the posterior margin of female abdominal tergite V, and the presence of numerous erect black setae on female abdominal tergite VII.

Biological notes. – The type series was taken along the margins of small, rocky streams draining to the head of Etna Bay, a deep, fjord-like arm of the sea cutting into the mountainous coast of southern Irian Jaya. The insects were found in sheltered areas along vegetated banks adjacent to stream pools, or on small pools formed amid rocks and cobbles away from the main stream flow.

Etymology. – The name *etna* is a noun in apposition and refers to the Etna Bay type locality.

Distribution. – Southwestern New Guinea (fig. 55).

Neusterensifer iriana sp. n. (figs. 42, 52, 57)

Type material. – Holotype, apterous male: INDONESIA, Irian Jaya Prov., New Guinea, Bime, 1400 m., 4°30' S, 140°12' E, 11 September 1993, Balke and Reidel (NHMW). – Paratypes: INDONESIA, Irian Jaya Prov., New Guinea: 7 apterous males, 5 apterous females, same data as holotype (NHMW, JTPC, USNM); 2 apterous males, 1 apterous female, Tarmulu, 1500 m., 4°25' S, 140°17' E, 6 September 1993, Balke and Reidel (NHMW, USNM); 3 apterous males, 5 apterous females, Okloma, 1700 m., 4°17' S, 139°55' E, 30 September 1993, Balke and Reidel (NHMW, USNM).

Description

Size. – Apterous male, length 2.80–2.90 mm (\bar{x} =2.85, n=3); width 1.10–1.15 mm (\bar{x} =1.12, n=3). Apterous female, length 3.00–3.15 mm (\bar{x} =3.03, n=5); width 1.00–1.15 mm. (\bar{x} =1.10, n=5).

Colour. – Apterous male: Ground colour dark blackish brown, marked with orange brown on anterior pronotum, connexival margins, and abdominal venter; entire dorsum and laterotergites thickly covered with fine appressed golden pubescence intermixed with scattered long, slender, erect brown setae; short, shining, silvery pubescence present as large patches laterally on abdominal tergites II, III and VII, as small patches laterally on metanotum and abdominal tergites IV–VI and VIII, thickly on anterior section of pronotum, and on sides of thorax and ab-

domen. Head dark brown above, orange brown beneath; rostrum shining golden brown, fuscous medially, piceous distally. Pronotum dark brown, anterior lobe with an elongate transverse orange brown spot medially behind anterior margin, posterior lobe dark brown. Abdomen dark brown, lighter ventromedially, connexiva broadly margined with orange brown. Antennae brown, segment I yellowish at extreme base. Legs brown above, yellowish brown below, distally darkened, coxae and trochanters uniformly yellowish.

Structural characters. – Apterous male: head of moderate length, declivant anteriorly, with weak impressed median line; length 0.50, width across eyes 0.70; width of eye/interocular space, 0.17/0.34. Pronotum long, covering mesonotum, thickly set with obscure foveae, humeri depressed; length:width, 0.50 : 1.00. Metanotum length:width, 0.31 : 0.82. Abdominal tergites dull, without shining areas; lengths of tergites II–VIII, respectively: 0.19 : 0.16 : 0.12 : 0.12 : 0.12 : 0.31 : 0.43.

Abdominal venter set with short, appressed setae, intermixed with longer, pale setae; ventrites V–VII bearing a longitudinal medial depression, this depression glabrous along its central midline on ventrites V and VI, and flanked by a pair (1+1) if low, dark, setiferous tumescences on ventrite VI, central section of ventrite VII broadly depressed, not bordered by tumescences. Legs and antennae thickly clothed with short to moderate length setae, intermixed with scattered longer setae, particularly on ventral margins of fore and middle femora. Middle and hind legs unarmed; foreleg bearing an elongate patch of short, spine-like black setae on basal 1/6 of ventral surface (fig. 42); tibial comb extending for approximately 1/2 the length of the fore tibia.

Antennal formula I : II : III : IV : 0.45 : 0.30 : 0.50 : 0.59.

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg, 0.80 : 0.75 : 0.30 : 0.0; of middle leg, 1.00 : 1.00 : 0.20 : 0.30; of hind leg, 1.12 : 1.39 : 0.20 : 0.32.

Proctiger produced anteriorly into an elongate, tapering process ending in an acute tip (fig. 52). Parameres vestigial or absent.

Apterous female: Similar to male in general structure and coloration, but somewhat larger; connexiva angled outward adjacent to basal abdominal tergites, curving inward adjacent to posterior margin of tergite VI, connexival margins thickly set with long, stout black setae, lacking tubercles, posterolateral apices forming small, posteriorly directed, angulate points, set with sparse tufts of long, dark setae; abdominal tergites with silvery setae present as large lateral patches on tergites I and II, as a small central patch on tergite III, as a diffuse complete transverse band across the posterior margin of tergite IV, as small lat-

eral patches on tergite V, and as sparse patches laterally and along posterior margin on tergite VII, tergite VI dull and hair free except for transverse band of long, erect black setae across posterior margin; tergite VII folded sharply downward on posterior $\frac{1}{3}$; abdominal ventrites V–VII bearing an impressed longitudinal glabrous line medially.

Macropterous forms: unknown.

Remarks

Comparative notes. – *Neusterensifer iriana* n. sp. is similar to *N. gladius* Polhemus & Polhemus and *N. etna* sp. n., but may be recognized by its large size (body length exceeding 2.75 mm in both sexes), the shape of the process on the male proctiger (fig. 52), the presence of black, setiferous tumescences on male abdominal ventrite VI coupled with the absence of tumescences or other raised structures on ventrite VII, the setiferous female connexival margins that lack tubercles, and the absence of a complete transverse band of silvery setae across the posterior margin of female abdominal tergite III.

Biological notes. – Nothing is known concerning the habits of this species.

Etymology. – The name *iriana* refers to the Indonesian province of Irian Jaya, encompassing the western portion of New Guinea.

Distribution: – North Central New Guinea (fig. 57).

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