

# New species of *Apsilochorema* (Trichoptera: Hydrobiosidae) from Sabah, East Malaysia

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Key words: Trichoptera; Hydrobiosidae; *Apsilochorema*; taxonomy; Sabah; East Malaysia.

Four new species of the genus *Apsilochorema* are described from submontane to montane areas in Sabah (Borneo), East Malaysia.

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## Introduction

The genera *Hydrobiosis* and *Psilochorema* were first described by Mac Lachlan (1868), who included them in the Hydropsychidae. Ulmer (1905) transferred them, along with *Atopsyche* Banks, to the new subfamily Hydrobiosinae of the Rhyacophilidae. Schmid (1970) elevated the subfamily to family status and recently (Schmid 1989) argued that it may be more closely related to certain Hydropsychoidea than to Rhyacophiloidea.

Schmid's monumental 1989 treatise should be consulted for a comprehensive review of the Hydrobiosidae, now represented by 50 extant genera found mainly in the southern hemisphere, excluding Africa. The majority of genera are endemic to New Zealand (10 genera), Australia and Tasmania (14 genera) in the Australasian Region or to southern Chile and Argentina (22 genera) in the Neotropical Region. Two additional genera are endemic to respectively New Caledonia and New Guinea. Only one genus, *Atopsyche*, is widely distributed in the New World, occurring throughout the mountainous areas of South and Central America, northward to the southwestern United States. Similarly, only *Apsilochorema* Ulmer, 1907 (type species *Psilochorema indicum* Ulmer, 1905: 38-40) occurs widely in the Oriental Region and adjacent areas of the Old World (Schmid, 1989, fig. 253). Records extend from northern Iran and parts of the Soviet Union, through northern India and China to Taiwan, Korea and Japan, and southward through southeast Asia and the East Indies to New Guinea, eastern Australia and Tasmania. The genus is also known from Sri Lanka and Vanuatu (formerly New Hebrides), Fiji, and New Caledonia in the southwestern Pacific. However, while the genus has many species (41), it is poorly represented in both Malaysia and Indonesia with only one species, *A. gisba* (Mosely, 1953; as *Bachorema*), known from Sulawesi, two from Sumatra, *A. anosoana* and *A. nosoan-hama* both Malicky, 1978, one from Java, *A. mancum* Ulmer, 1951, one from Borneo, *A. moselyellum* Kimmins, 1955, and one from West Malaysia, *A. malayanum* Banks, 1931. This low diversity probably is explained best by the fact that the southeast Asian archipelago has been grossly undercollected. Little is known of the biology of *Apsilochorema* species, except that they usually are associated with montane streams in forested areas. It is interesting to note, that *Atopsyche* and *Apsilochorema*, the genera

with the most species in the family are the only ones widely distributed in the tropical and warm temperate parts of the collective range of the family.

The author made numerous collecting trips while spending June 1986-May 1987 in Sabah and Sarawak as well as subsequent collections since then. Altogether some 200 sites were visited. Habitats from which collections were made ranged from lowland to montane (50-3300 m) primary forest. *Apsilochorema* species were found only at eleven sites, all above 950 m elevation. *Apsilochorema moselyellum* was not amongst them, but four new species were collected and are described in this paper. 16 female specimens were collected, but these could not be associated with the males and, therefore, only their distributional records are included in this paper. Collections were made with light traps and specimens were preserved in 70% alcohol. Genitalia were cleared in 10% KOH solution, examined, and illustrated using standard trichopterological practices. Terminology used in the text follows that of Schmid (1989) and that work should be consulted for a detailed diagnosis of the genus. However, Schmid did not include complete citations for species described before 1960, because these were included in Fischer's Tricopteronum Catalogus (1960, 1971). Since scientists in southeast Asia might not have access to Fischer's catalog, a list of all described *Apsilochorema* species is given in table 1, including full citations and distributions\*. Type material of species described in the present paper is deposited in the National Museum of Natural History, Leiden, The Netherlands (RMNH), Instituut voor Taxonomische Zoologie, Universiteit van Amsterdam, The Netherlands (ITZ), and in the collection of the author (AC).

### Descriptions

#### *Apsilochorema cabang* spec. nov.

(figs. 1, 2)

Material.— Holotype, ♂, East Malaysia: Sabah: Kinabalu National Park, Marei-Parei, 06°04'30"N 116°31'E, 1670 m, 8.iii.1987, J. Huisman (RMNH).

Remarks.— This species is closely related to *A. moselyellum* and *A. segitiga* spec. nov, but differs in its bifid filipodes and the longer, more curved, and more apically placed second segment of the inferior appendage.

Male.— Forewing colour and venation (fig. 1) as in *A. indicum* Ulmer, 1905, except for absence of hair-like setae in the median cell. Forewing length 5.5 mm. Antero-lateral appendages of sternum V subequal to length of sternum. Genitalia as in figs. 2A-D. Proctiger slightly longer than filipodes, narrowly incised apically to  $\frac{1}{5}$  its length; apical lobes membranous, setose, situated perpendicular to long axis of proctiger. Preanal appendages short, spatulate, setose. Filipodes short, stout, bifid; upper branch longer than lower, both with stout, reddish-brown setae distributed as in fig 2A. Inferior appendages longer than proctiger; first segment broad, gently

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\* The author has assembled a notebook containing complete literature, including illustrations of male genitalia, for all species of *Apsilochorema*. A photocopy of this notebook is available from the author upon request for minimal cost.

tapering towards blunt apex, mesal surface with framework of stout setae as in fig. 2C; in ventral view, gently curved mesally (as in fig. 5C); second segment situated at apical  $\frac{1}{4}$  of first segment, strongly hooked, apex with slight cleft; its length  $\frac{1}{3}$  of first segment. Phallus longer than proctiger; base narrow, rounded; apex globular and laterally flattened, with two internal triangular sclerites; apex of elastic band funnel shaped.

Female and immatures.— Unknown.

Etymology.— Malay - *cabang* - branched, referring to the shape of the filipodes.

Habitat.— Marei-Parei is a spur of Mt. Kinabalu. Vegetation near the type locality was low and open, dominated by *Leptospermum* species and grasses, and on ultra basic soil. The water course next to which specimens were collected was a trickle about 1 m wide, flowing over boulders and sand. The stream channel itself was steep, sloping, and about 10 m wide. On the date of collection, the water was clear, 16°C, pH 6.

### *Apsilochorema kinabalu* spec. nov.

(figs. 3, 4)

Material.— Holotype: ♂, East Malaysia: Sabah: Kinabalu National Park, roadside, 06°00'N 116°32'E, 1500 m, 27.xii.1989, J. Huisman (RMNH). Paratypes: 8 ♂♂, same data as holotype (RMNH); 2 ♂♂, same locality, 15.v.1987, J. Huisman (RMNH); 1 ♂, same locality, 18.xi.1989, J.P. Duffels (ITZ); 1 ♂, Kinabalu National Park, Kiau view trail, 06°00'N 116°32'E, 1500 m, 17.xi.1989, J.P. Duffels (ITZ); 3 ♂♂, Crocker Range, 40 km S of Kota Kinabalu, Sinsuron road, 05°52'N 116°20'E, 1500 m, 19.xii.1989, J. Huisman (AC).

Remarks.— This species closely resembles *A. annandalei* Martynov, 1935, *A. vaneyam* Schmid, 1970b, and *A. tajuk* spec. nov., but it is different in wing venation, shape of the first segment of the inferior appendage, and length and position of the second segment on the first segment.

Male.— Forewing colour and venation (fig. 3) as in *A. moselyellum* except pterostigma with large, dark papillae. Forewing length 6-6.5 mm. Anterolateral appendages of sternum V subequal to length of sternum. Genitalia as in figs. 4A-E. Dorsum of proctiger lightly sclerotised, subequal to filipodes, only very slightly and narrowly incised apically. Apical lobes membranous, setose, situated almost parallel to long axis of proctiger. Preanal appendages short, spatulate, setose. Filipodes long, slender, broadening basally then quickly tapering to downcurved apex; apicomeral surface with bundle of stout orange-brown setae, distributed as in figs. 4A, B. Inferior appendages longer than proctiger; first segment long, broad basally, sharply tapering towards blunt apex, its mesal surface with framework of stout setae as in fig. 4D; in ventral view, slightly sinuate mesally; second segment situated at apical  $\frac{1}{2}$  of first segment, gently curved, apex slightly cleft; its length  $\frac{1}{3}$  of first segment. Phallus equal to proctiger; base slender; apex broad, globular and laterally flattened, with two internal triangular sclerites; apex of elastic band funnel shaped.

Female and immatures.— Unknown.

Etymology.— Named after Mt. Kinabalu, the type locality and, at 4101 m, the highest peak in southeast Asia.

Habitat.— Most specimens were collected at 1500 m in the most frequented area of Kinabalu National Park. The vegetation, wet submontane oak forest, is slightly

disturbed. There is no stream in the direct vicinity of the collection site, but sungai Silau-Silau, a small stream about 5 m wide, runs rapidly over its rocky bed, at a distance of 1-3 km. The habitat of the Crocker Range locality is very similar.

***Apsilochorema segitiga* spec. nov.**  
(fig. 5)

**Material.**— Holotype: ♂, East Malaysia: Sabah: Kinabalu National Park, sungai Tibabar, 06°02'N 116°33'E, 1750 m, 11.viii.1986, J. Huisman (RMNH). Paratype: 1 ♂, same data as holotype (AC).

**Remarks.**— This species is most closely related to *A. cabang* spec. nov. and also resembles *A. moselyellum*. It can be distinguished by its triangular, unbranched filipodes and by the position and length of the second segment of the inferior appendages.

**Male.**— Forewing colour and venation as in *A. cabang* spec. nov. (fig. 1). Forewing length 6.2 mm. Anterolateral appendages of sternum V shorter than sternum. Genitalia as in figs. 5A-E. Proctiger about twice as long as filipodes, narrowly incised apically to  $\frac{1}{4}$  its length. Apical lobes membranous, setose, situated perpendicular to long axis of proctiger. Preanal appendages short, spatulate, setose. Filipodes short, triangular, with stout setae along distal  $\frac{1}{3}$  of ventral edge, distributed as in fig. 5A. Inferior appendages about twice as long as proctiger; first segment broad, slightly tapering towards blunt apex, its mesal surface with framework of stout setae as in fig. 5D; in ventral view, slightly curved mesally; second segment situated at apical  $\frac{1}{3}$  of first segment, sharply hooked, apex entire; its length  $\frac{1}{3}$  of first segment. Phallus subequal to proctiger; base broad, rounded; apex rounded and laterally flattened, with two internal triangular sclerites; apex of elastic band funnel shaped.

**Female and immatures.**— Unknown.

**Etymology.**— Malay - *segitiga* - triangular, referring to the shape of the filipodes.

**Habitat.**— Sungai Tibabar is a small tributary of the Liwagu. At the collecting site, the stream is 4 m wide and shallow, its banks rather steep and covered with open, low, wet montane oak forest. The water flows quietly over pebbles and leaf-litter. On the date of collection, the water was clear, 15°C, pH 6.

***Apsilochorema tajuk* spec. nov.**  
(fig. 6)

**Material.**— Holotype: ♂, East Malaysia: Sabah: 3.5 km SW of Long Pa Sia, sungai Ritan, 04°24'N 115°42'E, 1160 m, 8.iv.1987, J. Huisman (RMNH). Paratypes: 1 ♂, same data as holotype (AC); 1 ♂, same locality, 9.iv.1987, J. Huisman (RMNH).

**Remarks.**— This species is closely related to *A. kinaba* spec. nov., but differs in the length of its filipodes, the distribution of apical setae on the filipodes, and the shape of first segment of the inferior appendages.

**Male.**— Forewing colour and venation as in *A. kinaba* (fig. 3), except for larger width discoidal cell, base F4 wider, and no papillae on pterostigma. Forewing length

5-5.5 mm. Anterolateral appendages of sternum  $V \frac{3}{4}$  of length of sternum. Genitalia as in figs. 6A-E. Proctiger shorter than filipodes, only slightly, narrowly incised apically. Apical lobes membranous, setose, situated at a  $45^\circ$  angle to long axis of proctiger. Preanal appendages short, spatulate, setose. Filipodes long, slender, curving gently through their entire length to slightly broader apex; apicomeral surface with crown of stout orange-brown setae, distributed as in fig. 6A and inset. Inferior appendages slightly longer than proctiger; first segment gradually tapering towards blunt apex, its mesal surface with framework of stout setae as in fig. 6D; in ventral view, gently curved mesally; second segment situated at apical  $\frac{1}{2}$  of first segment, gently curved, apex with slight indentations; its length  $\frac{1}{4}$  of first segment. Phallus slightly longer than proctiger; base narrow, rounded; apex rounded and laterally flattened, with two internal triangular sclerites; apex of elastic band funnel shaped.

Female and immatures.— Unknown.

*Etiymology*.— Malay - *tajuk* - crown, referring to the apical setae of the filipodes.

*Habitat*.— Sungai Ritan runs through wet submontane forest, with abundant epiphytic mosses and ferns. The vegetation reaches the stream, providing much shade. The stream is 3 m wide, its banks steep and 1 m high. The water is fast flowing with riffles, over boulders, pebbles and sand. On the date of collection the water was clear,  $19^\circ\text{C}$ , pH 6.

### Unidentified material

The following female *Apsilochorema* specimens could not be associated with males:

*Material*.— East Malaysia: Sabah: Kinabalu National Park: 2 ♀♀, sungai Tibabar,  $06^\circ02'N$   $116^\circ33'E$ , 1750 m, 11.viii.1986, J. Huisman (RMNH); 1 ♀, same locality, 2.x.1986, J. Huisman (RMNH); 2 ♀♀, same locality, 12.i.1987, J. Huisman (AC); 1 ♀, Pakka cave, sungai Kolopis,  $06^\circ04'N$   $116^\circ34'E$ , 2960 m, 14.i.1987, J. Huisman (RMNH); 1 ♀, Gunung Lagadan, sungai Kolopis,  $06^\circ04'N$   $116^\circ34'E$ , 3200 m, 13.i.1987, J. Huisman (AC); 1 ♀, roadside,  $06^\circ00'N$   $116^\circ32'E$ , 1500 m, 27.xii.1989, J. Huisman (RMNH). Crocker Range: 1 ♀, 40 km S of Kota Kinabalu, Sinsurun road.,  $05^\circ52'N$   $116^\circ20'E$ , 1500 m, 19.xii.1989, J. Huisman (AC). Long Pa Sia area: 2 ♀♀, 8.5 km S on trail Long Pa Sia - Long Semado, sungai Malabit,  $04^\circ21'N$   $115^\circ41'E$ , 1180 m, 18.xii.1986, J. Huisman (AC); 1 ♀, same locality, 4.xii.1987, J. Huisman & C. van Achterberg (RMNH); 1 ♀, 10 km S of Long Pa Sia, sungai Rurun,  $04^\circ22'N$   $115^\circ40'30'E$ , 1400 m, 21.xii.1986, J. Huisman (RMNH); 1 ♀, 2 km E of Long Pa Sia, Paya Kalaba, brooklet,  $04^\circ25'N$   $115^\circ44'E$ , 1000 m, 13.iv.1987, J. Huisman & J. van Tol, (RMNH); 2 ♀♀, W of Long Pa Sia, malaise trap 3, 1050 m, 25.xi-8.xii.1987, C. van Achterberg (RMNH).

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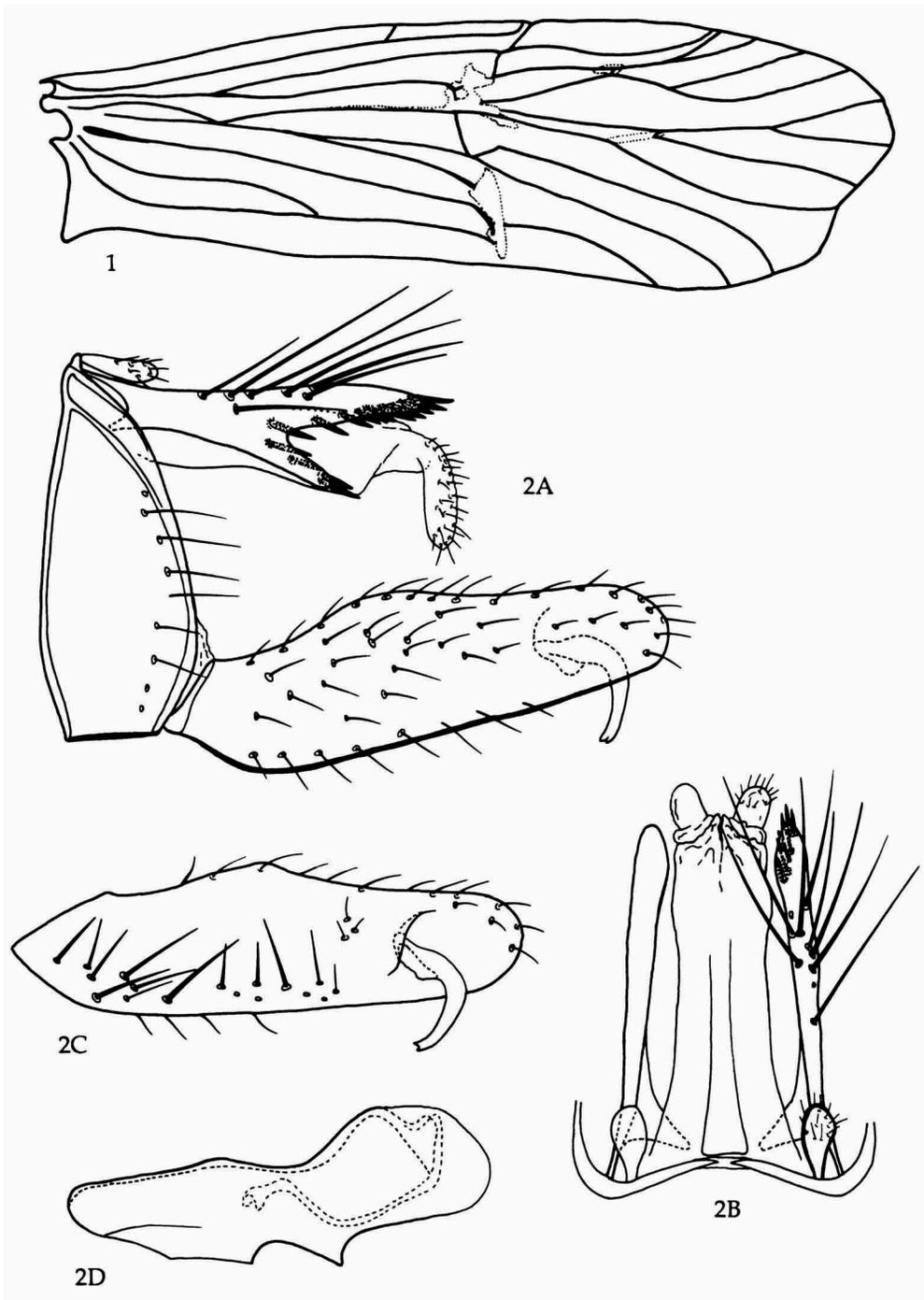
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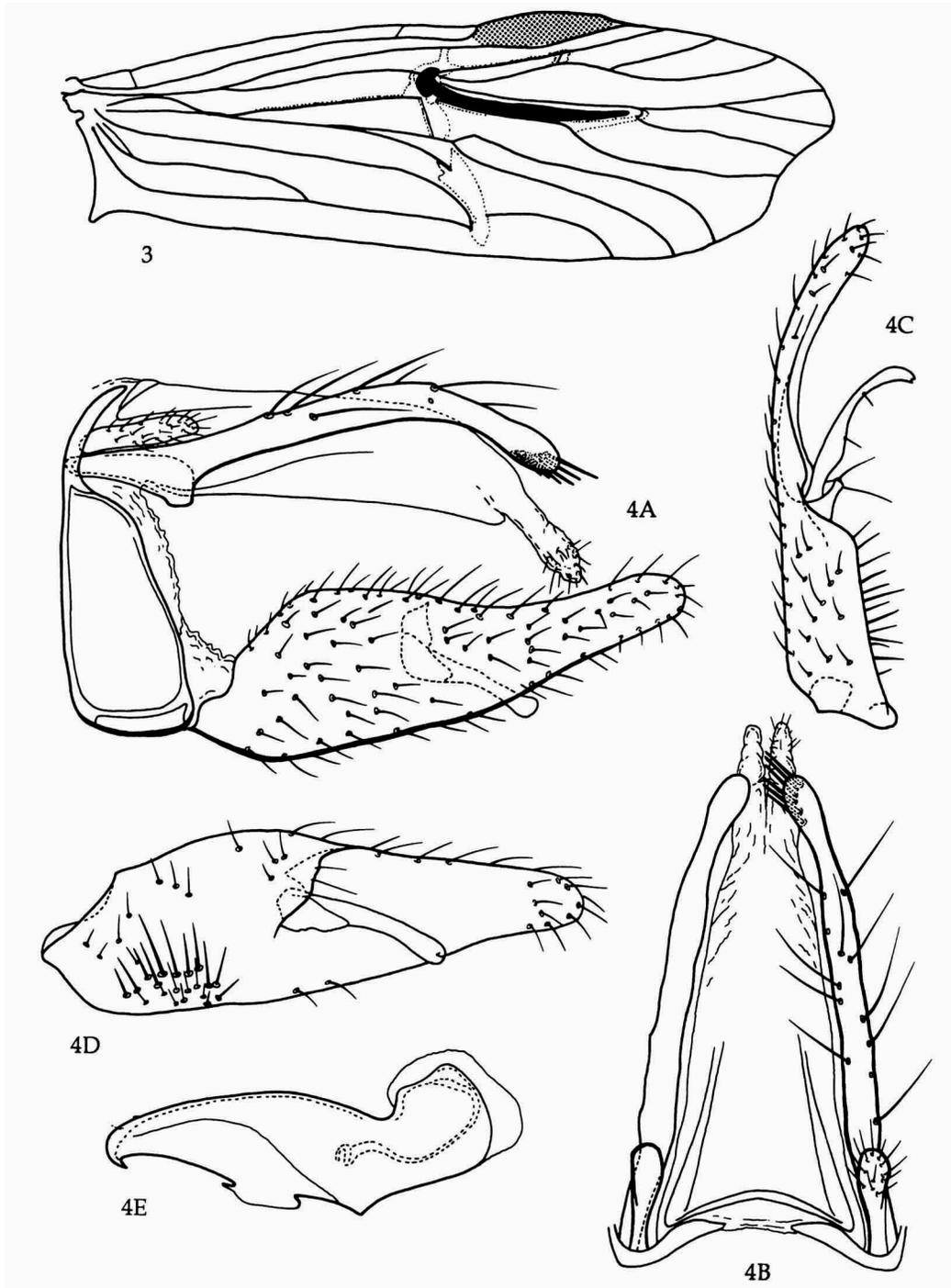
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Table 1. Species of *Apsilochorema* Ulmer (1907).

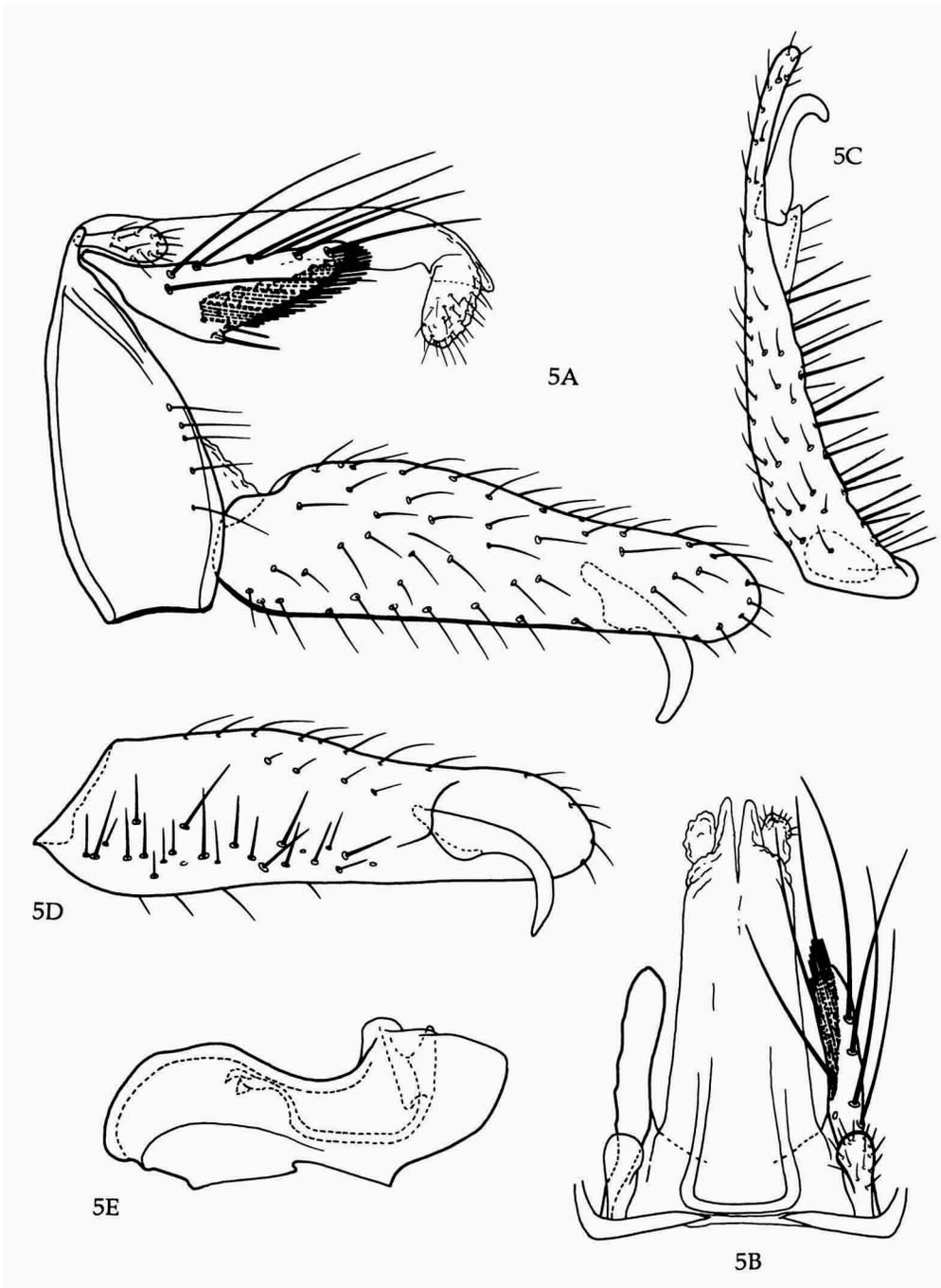
Species	References	Distribution
<i>A. anosoana</i>	Malicky, 1978: 161, fig. 2	Sumatra
<i>A. annandalei</i>	Martynov, 1935; Schmid, 1970a: 261, figs. 1, 2, 6, 7	India
<i>A. banksi</i>	(Mosely, 1941); Ross, 1951a: 179, figs. 1, 3	Fiji
<i>A. burgersi</i>	Ulmer, 1938: 398; Neboiss, 1986: 12	New Guinea
<i>A. cabang</i>	present paper: 128, figs. 1, 2	Sabah
<i>A. caledonicum</i>	Schmid, 1989: 137, Pl. XV, figs. 7, 16, 17	New Caledonia
<i>A. cheesmanae</i>	Kimmins, 1958: 244, figs. 5, 6	Vanuatu
<i>A. chelicium</i>	Schmid, 1989: 138, Pl. XV, figs. 12, 21	Australia
<i>A. clavator</i>	Schmid, 1989: 138, Pl. XV, figs. 8, 18	New Guinea
<i>A. clavigerum</i>	Schmid, 1989: 138, Pl. XV, figs. 4, 13	New Guinea
<i>A. coreanum</i>	Botosaneanu, 1970: 288, Pl. X	Korea (N)
<i>A. dakchinam</i>	Schmid, 1970a: 270, figs. 26, 27	India
<i>A. diffine</i>	Banks, 1920; Schmid, 1958: 37, figs. 4-7	Sri Lanka
<i>A. excisum</i>	(Ulmer, 1927): 174	Formosa
<i>A. extensum</i>	Schmid, 1989: 138, Pl. XV, fig. 11, 20	New Guinea
<i>A. falciferum</i>	Schmid, 1989: 139, fig. 245, Pl. XV, fig. 6, 15	New Guinea
<i>A. gisba</i>	(Mosely, 1953): 494; Neboiss, 1986: 11	Australia, Tasmania, Sulawesi
<i>A. hrasvam</i>	Schmid, 1970a: 270, figs. 3, 23-25	India
<i>A. indicum</i>	Ulmer, 1905; Schmid, 1989: 147, figs. 246-8, Pl. XV, figs. 1-2.	Afghanistan, Pakistan, Punjab, USSR
<i>A. iranicum</i>	Schmid, 1959a: 411, figs. 2-4	Iran
<i>A. kinabalu</i>	present paper: 129, figs. 3, 4	Sabah
<i>A. malayanum</i>	Banks, 1931: 403; Ross, 1956: 114, fig. 288	W. Malaysia
<i>A. malickyi</i>	Schmid, 1989: 139, Pl. XV, fig. 10	Thailand
<i>A. mancum</i>	Ulmer, 1951: 49, figs. 9, 10	Java
<i>A. monicae</i>	Schmid, 1989: 139, Pl. XV, figs. 9, 19	New Guinea
<i>A. moselyellum</i>	Kimmins, 1955: 375, figs. 1-5	Sarawak
<i>A. moselyi</i>	Ross, 1951: 181, fig. 4	Fiji
<i>A. natibhinnam</i>	Schmid, 1970a: 268, figs. 20-22	India
<i>A. nigrum</i>	(Navas, 1932): 932, fig. 49	Tonkin
<i>A. nosoanhama</i>	Malicky, 1978: 162, fig. 2	Sumatra
<i>A. obliquum</i>	(Mosely, 1953): 494, fig. 334	Australia, Tasmania
<i>A. oxypages</i>	Neboiss, 1984: 178, fig. 1-3	New Guinea
<i>A. rossi</i>	Kimmins, 1957: 291, figs. 1, 2	Guadacanal
<i>A. segitiga</i>	present paper: 130, fig. 5	Sabah
<i>A. sutshanum</i>	Martynov, 1934: 72, 326, figs. 39, 40	Ussuri, Japan
<i>A. japonicum</i>	Tsuda, 1942: 243, figs. 3, 4	Japan
<i>A. tajuk</i>	present paper: 130, fig. 6	Sabah
<i>A. tanum</i>	Schmid, 1970a: 262, figs. 11, 12	India
<i>A. tigmatjanam</i>	Schmid, 1970a: 266, fig. 4, 13, 14	India, Nepal
<i>A. turanicum</i>	Martynov, 1934: 71, fig. 38a-d	Bukhara, Uzbekistan
<i>A. unciferum</i>	Schmid, 1989: 140, Pl. XV, figs. 5, 14	New Guinea
<i>A. unculatum</i>	Schmid, 1970a: 268, figs. 17-19	China; Fou Kien
<i>A. urdalum</i>	Neboiss, 1962: 528, figs. 4-12	Australia
<i>A. utchtchunam</i>	Schmid, 1970a: 267, figs. 15, 16	India
<i>A. vaneyam</i>	Schmid, 1970a: 262, figs. 8-10	India
<i>A. zimmermani</i>	Ross, 1951: 179, figs. 1, 3	Fiji



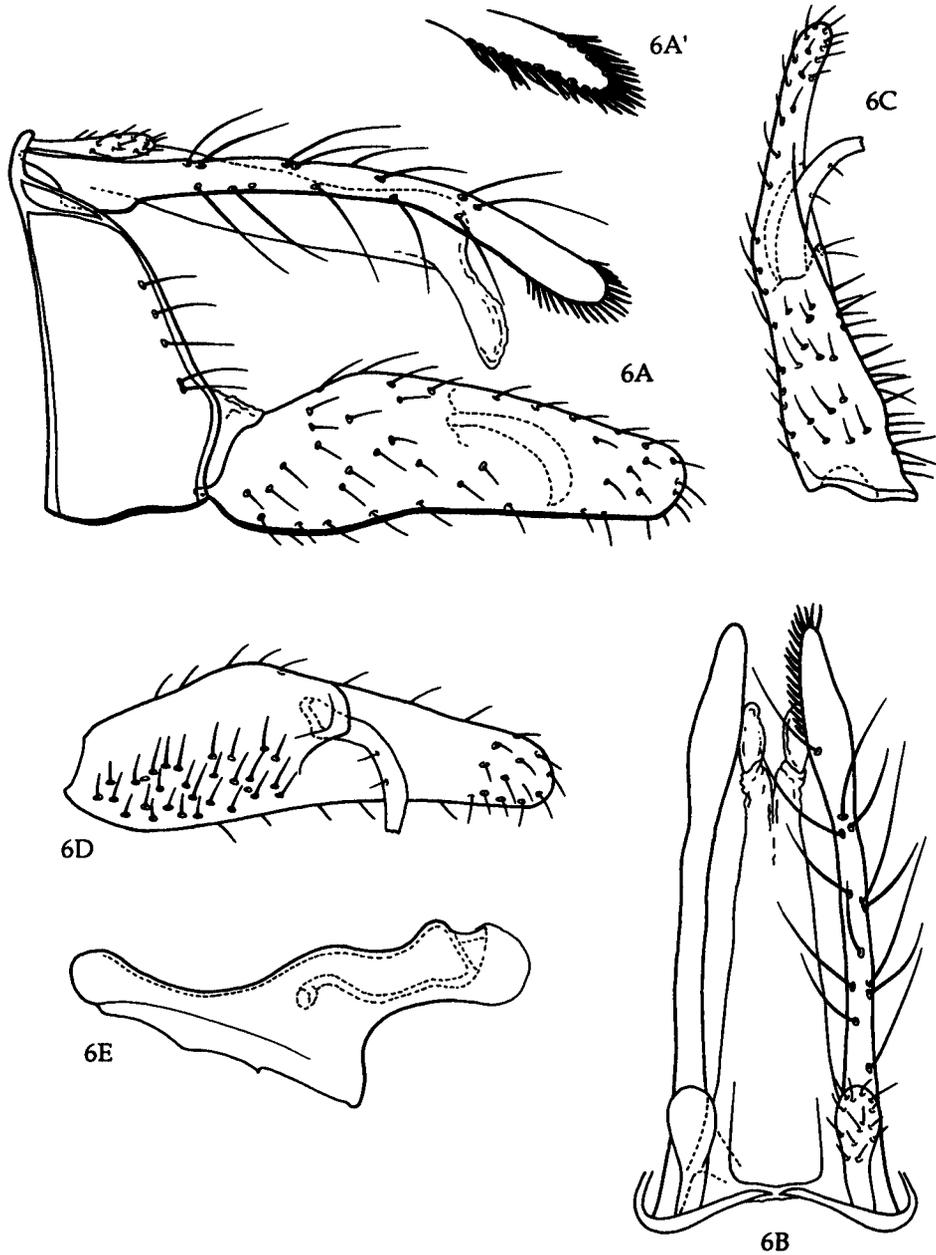
Figs. 1, 2A-D. *Apsilochorema cabang* spec. nov. 1, male anterior wing. 2A-D, male genitalia: A, lateral; B, dorsal; C, inferior appendage, mesal; D, phallus, lateral.



Figs. 3, 4A-E. *Apsilochorema kinabalu* spec. nov. 3, male anterior wing. 4A-E, male genitalia: A, lateral; B, dorsal; C, inferior appendage, ventral; D, inferior appendage, mesal; E, phallus, lateral.



Figs. 5A-E *Apsilochorema segitiga* spec. nov., male genitalia: A, lateral; B, dorsal; C, inferior appendage, ventral; D, inferior appendage, mesal; E, phallus, lateral.



Figs. 6A-E. *Apsilochorema tajuk* spec. nov., male genitalia: A, lateral; A', apex of filipode, mesal; B, dorsal; C, inferior appendage, ventral; D, inferior appendage, mesal; E, phallus, lateral.