

# Malaysian and Bruneian micro-caddisflies in the tribes Stactobiini and Orthotrichiini (Trichoptera: Hydroptilidae: Hydroptilinae)

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Thirty-eight new species of micro-caddisflies (Trichoptera: Hydroptilidae) are described from Malaysia and Brunei in the tribes Stactobiini and Orthotrichiini. Thirteen species are referred to the genus *Chrysotrichia* Schmid, two to *Plethus* Hagen, 13 to *Scelotrichia* Ulmer, five to *Stactobia* McLachlan and five to *Orthotrichia* Eaton. *Chrysotrichia monga* Olah, described from Vietnam, is now recorded from West Malaysia. A checklist of these species is appended for West Malaysia, East Malaysia (Sabah and Sarawak) and Brunei.

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## Introduction

A recent paper (Wells & Huisman 1992) on Malaysian and Bruneian micro-caddisflies (Trichoptera: Hydroptilidae) dealt with species in the tribe Hydroptilini, and recorded a total of 28 species in six genera. Now a further 38 species are added to the Malaysian fauna in two more tribes of the same subfamily, Hydroptilinae. In the tribe Stactobiini, 13 species are newly described in the genus *Chrysotrichia* Schmid, 1958, two in *Plethus* Hagen, 1887, five in *Stactobia* McLachlan, 1880, and 13 in *Scelotrichia* Ulmer, 1951; in the tribe Orthotrichiini, five new species are described in the genus *Orthotrichia* Eaton, 1873. New records are given for a species in *Chrysotrichia* previously known only from Vietnam (Olah 1989).

For generic placement of several of the new Stactobiini species, reliance is placed on the form of the tentorium and metascutellum, and the general structure of the male genitalia. Differences in tibial spur formulae, although considered diagnostic in the past, are unreliable, and wings are highly variable in shape and venation as illustrated by Schmid (1959) for *Stactobia*, and shown here for *Scelotrichia*.

Four *Stactobia* species are accommodated in two existing species groups in the genus, but the fifth species is unusual and stands apart. Many of the *Chrysotrichia* species, too, differ from established species in general form of male genitalia, and for the first time, species groupings are proposed for this genus. Sets of species are less obvious among *Scelotrichia* because the character states do not assort clearly.

The adult collections studied resulted mainly from sweep netting and hand picking. Few specimens were taken at light. For species in *Orthotrichia* this probably indicates their rarity, however, Stactobiini species simply may not be attracted to light since they are frequently seen moving around during the day and are probably diurnal.

Considerable effort was expended in the field to collect immatures at most localities but rarely with much success. Among the material collected, few immatures could be associated with adults. Cased larvae and pupae, associated by the metamorphotype method (Wiggins, 1977), are described and illustrated for five species and conform with other known congeners.

Several of the species considered here may be relatively widespread in the region, but generally members of these two tribes appear to be quite restricted in their distribution. A check-list of West and East Malaysian and Bruneian micro-caddisfly species in the two tribes is appended although it is ment as only a preliminary list for the Malay Peninsula and Borneo. The fauna of this area is undoubtedly far more extensive, and, as indicated by this study, significant to our understanding of the evolution of the Stactobiini.

Phylogenetic and biogeographical studies of these Stactobiini genera are apposite, but given their broader distribution beyond SE Asia, and that problems with the Neotropical members are presently under review, such analyses are beyond the scope of this paper.

For the present, too, no distribution maps are given for Malaysia as the known distributions of the species included here are so fragmentary that maps would only be misleading. We hope that publication of this work will encourage further studies on the aquatic fauna of Malaysia.

### Methods and depositories

Most of the specimens examined in this study were collected by sweep netting or by hand picking, others were taken at lights. Specimens were prepared for study using the methods of Wells (1990a). Males and females were collected, but since Stactobiine females are very conservative and generally could not be associated with certainty, only males are included.

Depositories of material mentioned in the following text are abbreviated as follows:

- ANIC - Australian National Insect Collection, Canberra.
- BMNH - Natural History Museum, London.
- BPBM - B.P. Bishop Museum, Honolulu, Hawaii.
- NHMH - Hungarian Natural History Museum, Budapest.
- NMV - Museum of Victoria, Melbourne.
- NTM - Museum and Art Galleries of the Northern Territory, Darwin.
- RMNH - National Museum of Natural History, Leiden.
- USNM - National Museum of Natural History, Washington, DC.
- ZMA - Zoological Museum, University of Amsterdam.

### Systematics

#### Tribe Stactobiini Botosaneanu, 1956

Stactobiinae Botosaneanu, 1956: 382. Type genus: *Stactobia* McLachlan, 1880; Marshall, 1979: 163.

In terms of genus- and species-group representation in the tribe Stactobiini, the

Malay Archipelago and mainland eastern Asia are beginning to show interesting patterns. The genera that are well represented on the mainland and Sri Lanka include *Chrysotrichia*, *Plethus*, *Scelotrichia*, and *Stactobia*. Two other genera are represented by one species each: *Parastactobia* Schmid, 1958, occurs in Sri Lanka and *Catoxyethira* Ulmer, 1912, in Vietnam (Olah, 1989). Among these genera, *Stactobia* is diverse in the Palaearctic, Africa and southern Asia but only five new species, three from East and two from West Malaysia, are described here. Representation of *Stactobia* appears to decrease eastwards to Bali (Wells, 1993).

*Plethus* is not very species rich (Marshall, 1979). It is known only from S and SE Asia and is unknown east of Bali or N Sulawesi; only two new species are recorded here, both from the Malay Peninsula. The even rarer genera, *Parastactobia* and *Catoxyethira*, have not been found in Malaysia.

A different picture is emerging for the other two genera, *Chrysotrichia* and *Scelotrichia*; both are well represented in Malaysia. Their high diversity, and particularly the representation of separate lineages within *Chrysotrichia*, suggest that the western part of the Malay Archipelago is their centre of origin.

#### Genus *Chrysotrichia* Schmid, 1958

*Chrysotrichia* Schmid, 1958: 54. Type species: *Chrysotrichia hatnagola* Schmid, 1958, by original designation.

Seven species in *Chrysotrichia* have been recorded from Sri Lanka and Pakistan (Schmid, 1958, 1960; Chantaramongkol & Malicky, 1986), two from Vietnam (Olah, 1989), three each from N Sulawesi and New Guinea (Wells, 1990a, 1990b) and one from Australia (Wells, 1991). Thirteen species have now been found in Malaysia; 12 are newly described.

*Chrysotrichia* species from Sri Lanka, Pakistan and Vietnam appear to form a relatively uniform group, here designated the *hatnagola*-group, with the length of abdominal segment IX less than 1.5 times its width, sometimes reduced considerably, with a mid-ventral subgenital plate or process, and often with setate processes lateral to the inferior appendages. Malaysian *hatnagola*-group species include *C. monga* Olah, 1989, described from Vietnam, *C. pisau* spec. nov., which is similar to another Vietnamese species *C. choliona* Olah, 1989, and *C. gajah* spec. nov., which resembles *C. badhami* Schmid, 1960, from Pakistan. Three other species are also placed in this group, two of which show extreme elongation of their inferior appendages.

Species from New Guinea and Australia are distinct in having the length of segment IX reduced, the subgenital plate unspecialised, and no lateral processes. One Sulawesi species, *C. berduri* Wells, 1990a, is closely similar to these and its specific epithet is used for the group. A single new Malaysian species, *C. tanduk*, conforms with these species in form of male genitalia, but based on the tibial spurs would key out to *Stactobiella* Martynov, 1924 (unknown from the region), or *Catoxyethira* (African, and once recorded from Vietnam (Olah, 1989)). Since the general form of the male genitalia shows little resemblance to species in *Stactobiella* or *Catoxyethira*, and because the validity of *Stactobiella* is currently under review (S. Harris, personal communication) this species is referred to *Chrysotrichia*, and placed in the *berduri*-group.

With the exception of *C. tanduk* spec. nov., the above mentioned species have a

tibial spur formula of 0,2,4, which is also shared by two species with abdominal segment IX extraordinarily long and bearing a pair of dorsal spines, with forceps-like inferior appendages and an elongate-triangular subgenital plate. These are designated the *coodei*-group.

Four further species are difficult to place. Their metascutellum shape conforms with species in *Chrysotrichia*, *Catoxyethira*, or *Stactobiella*. One has some features of male genitalia resembling a *Catoxyethira* but for the present it is retained in *Chrysotrichia* as it differs in general form of genitalia. Another new species, *C. menara*, is unique in having fused inferior appendages and a pair of spines arising from an internal dorsal apodeme on the anterior margin of segment IX.

The remaining new species, *C. matakail* and *C. paruparu*, also have atypical spur formulae. *C. matakail* spec. nov. is similar in general appearance to species in *Stactobiella* with which it shares the spur formula of 1,3,4. However, with recognition of the variability in spur count and given that *Stactobiella* has not previously been recorded in SE Asia, coupled with the dubious validity of the *Chrysotrichia*-*Stactobiella* separation (see Wells, 1990a), it seems more appropriate to refer this species to *Chrysotrichia*. Yet another variation in spur formula occurs in *C. paruparu* spec. nov.: 0,3,4. For the present these two species are not placed in species groups.

As mentioned in the discussion of *Stactobiini* genera, the abundance of *Chrysotrichia* species in Malaysia may indicate that the genus originated in this region. Dispersal of only limited forms to peripheral regions would account for the more uniform nature of the species elsewhere.

### *Chrysotrichia bintik* spec. nov.

(figs 1-3)

**Material.**— Holotype, ♂ (RMNH), East Malaysia, Sabah, Long Pa Sia, confluence Sg. Pa Sia - Sg. Matang, 04° 24'N 115° 43'E, 1000 m, 1.iv.1987, J. Huisman & J. van Tol. Paratypes: 3 ♂♂ (RMNH), Brunei, Sg. Temburong, 140 m, 4.iv.1990, M.J.E. Coode.

**Male.**— Antennae 18-segmented. Tibial spurs 0,2,4. Wings (fig. 1) modified. Anterior wing with median patch of black scales (androconia) on proximal half; wing length 1.3 mm. Posterior wing strongly constricted medially, distally forming a slender filament. Genitalia, see figs 2, 3. Abdominal segment IX short, a digitiform process, with two apical setae, at apico-lateral angles of tergite. Dorsal plate membranous, slender, tapered and slightly fluted distally. On each side of the dorsal plate, a curved sclerotised spine, strongly hooked at mid-length. Aedeagus trilobed apically, lateral lobes membranous. No subgenital plate evident. Inferior appendages probably represented by the small, tapered mid-ventral spines.

**Remarks.**— *Chrysotrichia bintik* conforms in general features with congeners, but has highly distinctive wings, i.e. with patches of androconia, which occur also in *C. tigacabanga* Wells, 1990a, from Sulawesi and in a Balinese species (Wells, 1993). Based on genitalia, the two species are placed in different groups. The material was collected at light, along 15 m wide, shallow rivers with clear, tannin-stained water.

**Distribution.**— Malaysia (Sabah, West Malaysia); Brunei.

**Etymology.**— Malay - *bintik* - spot, for the rounded spot of scales on the anterior wing.

***Chrysotrichia tajam* spec. nov.**  
(figs 4-5)

**Material.**— Holotype, ♂ (NTM), East Malaysia, Sabah, Tenom, stream behind Hotel Tenom, 30.vi.1988, A. Wells. Paratypes: 3 ♂♂ (RMNH), same data as holotype; 6 ♂♂ (NTM), same locality and collector, 2.vii.1988; 2 ♂♂ (NTM), East Malaysia, Sabah, Sapong, 1.vi.1988, A. Wells.

**Male.**— Antennae 18-segmented. Tibial spurs 0,2,4. Anterior wing without scales, length 1.3 mm. Genitalia, see figs 4, 5. Abdominal segment IX short. Dorsal plate membranous, rounded distally. Lateral process consisting of a long, slender dorsal and an upturned ventral spine. Aedeagus simple, tapered apically. Subgenital plate not evident. Inferior appendages elongate, slender, basally a small sclerotised lobe on each side - in lateral view, this appears as a sclerotised strip, with a short, ventrally-directed spine.

**Remarks.**— In form of inferior appendages this species groups with *C. angkup* spec. nov., *C. hermani* spec. nov., and *C. coodei* spec. nov., but the latter two are distinctive in having abdominal segment IX elongate.

**Distribution.**— Malaysia (Sabah, East Malaysia).

**Etymology.**— Malay - *tajam* - sharp, being descriptive of the genital structures.

***Chrysotrichia angkup* spec. nov.**  
(figs 6-7)

**Material.**— Holotype, ♂ (NTM), West Malaysia, Kepong, Forest Research Institute of Malaya, on falls, 27.vii.1988, A. Wells, net. Paratypes, 1♂ (RMNH), same data as holotype; 1♂ (NTM), West Malaysia, Cameron Highlands, "40 mile", between Tanah Rata and Tapah, 19.vi.1988, A. Wells, net.

**Male.**— Antennae 18-segmented. Tibial spurs 0,2,4. Wings unmodified. Anterior wing length 1.2 mm. Genitalia, see figs 6, 7. Abdominal segment IX short, a digitiform process with two apical setae at apico-lateral angles. Dorsal plate short relative to inferior appendages, membranous, bifid distally, lobes apically acute; lateral process a simple curved spine. Aedeagus straight, slender, tapered to acute apex. Subgenital plate membranous, obovate. Inferior appendages slender, elongate, in form of a pair of forceps with small setate processes baso-laterally.

**Remarks.**— The forceps-like inferior appendages of *C. angkup* resemble those of species in the *coodei*-group, however, in form of abdominal segment IX, this species groups with *hatnagola* species.

**Distribution.**— West Malaysia.

**Etymology.**— Malay - *angkup* - forceps, for the shape of the inferior appendages.

***Chrysotrichia monga* Olah, 1989**  
(fig. 8)

*Chrysotrichia monga* Olah, 1989: 265. Holotype: (NHMH), ♂, Vietnam, Cucphuong.

**Material.**— 1 ♂ (NTM), West Malaysia, Genting Highlands, Gombak, tributary of Sg. Gombak above University of Malaya field station, 8.vi.1988, A. Wells.

Remarks.— A figure of *C. monga* is included here (fig. 8) for comparisons. *C. monga* conforms with the *hatnagola*-group because abdominal segment IX is short and retracted in segment VIII (as does a similar Vietnamese species, *Chrysotrichia choliona* Olah, 1989).

Distribution.— Vietnam; Malaysia (Genting Highlands, West Malaysia).

***Chrysotrichia gajah* spec. nov.**  
(figs 9, 10, 77)

Material.— Holotype, ♂ (NTM), East Malaysia, Sabah, Tenom, Tenom Agricultural Research Station, 30.vi.1988, A. Wells, net. Paratypes, 3 ♂♂ (NTM, RMNH), same data as holotype. Other material.— Pupae, same data as holotype.

Male.— Antennae 18-segmented. Tibial spurs 0,2,4. Wings unmodified. Anterior wing length 1.3-1.4 mm. Genitalia, see figs 9, 10. Abdominal segment IX moderately long, retracted within segment VIII. Dorsal plate short, broad, membranous, apex cleft medially. Aedeagus (fig. 10) tripartite in distal half, forming three slender filaments. Subgenital plate represented by the mid ventral finger-like process. Inferior appendages lobate, broadest in mid-section.

Immatures.— Pupae have been associated. The case (fig. 77) is ovoid, built of concentrically arranged filaments of algae.

Remarks.— This species conforms with the species from Pakistan and Sri Lanka described by Schmid (1958, 1960), particularly in having the subgenital plate prominent and apically-acute. The male resembles *C. badhami* Schmid from Pakistan, differing in having a broad, membranous dorsal plate. The pupal case, however, is similar to that seen in the New Guinean *berduri*-group species, *C. iomara* Wells, 1990b. Cases were picked from small stones in a small, shallow, sand/silt bottomed, open stream.

Distribution.— Malaysia (Sabah, East Malaysia).

Etymology.— Malay - *gajah* - elephant, for the male genitalia in ventral view.

***Chrysotrichia paruparu* spec. nov.**  
(fig. 11)

Material.— Holotype, ♂ (NTM), East Malaysia, Sarawak, Lambir National Park, 11.vii.1988, A. Wells, net. Paratypes: 2 ♂♂ (NTM), same data as holotype; 3 ♂♂ (RMNH), same locality and collector, 14.vii.1988.

Male.— Uniformly black. Antennae 18-segmented. Tibial spurs 0,3,4. Anterior wing length 1.3 mm. Genitalia, see fig. 11. Abdominal segment IX longer than segment VIII. Dorsal plate elongate, rounded apically. Aedeagus simple, slender medially, expanded distally, apex slightly fluted. Subgenital plate small, almond shaped. Inferior appendages fused basally, apices sclerotised, in ventral view close-pressed, subtriangular in lateral view.

Remarks.— Similar to the new *C. gajah* from which it is readily distinguished by having a simple aedeagus, subgenital plate about half length of inferior appendages. It also resembles the new *C. coodei* and *C. hermani* in the somewhat elongate abdominal segment IX.

Distribution.— Malaysia (North Sarawak, East Malaysia).

Etymology.— Malay - *paru-paru* - lungs, for the shape of the inferior appendages.

***Chrysotrichia ganjil* spec. nov.**  
(figs 12-14)

Material.— Holotype, ♂ (NTM), West Malaysia, Genting Highlands, Gombak, tributary of Sg. Gombak above University of Malaya field station, 8.vi.1988, A. Wells, lt.tr. Paratype: 1 ♂ (RMNH), same data as holotype.

Male.— Antennae 18-segmented. Tibial spurs 0,2,4. Wings unmodified. Anterior wing length 1.3 mm. Genitalia, see figs 12-14. Abdominal tergite IX with a pair of long, slender, unequal spines arising basally, left spine bifid distally. Dorsal plate elongate, tapered, cleft apically. Aedeagus (fig. 13) a long slender rod. Subgenital plate not evident. Inferior appendages fused forming elongate sub-triangular plate.

Remarks.— This species resembles species of *Parastactobia* and *Catoxyethira*, but conforms with *Chrysotrichia* in shape of the metascutellum, and tibial spur number. Resemblance between *C. ganjil* and *C. menara* spec. nov., is misleading, because the dorsal spines of *C. ganjil* arise from separate internal apodemes, while those of *C. menara* spec. nov. arise from the anterior margin of segment IX.

Distribution.— Malaysia (Genting Highlands, West Malaysia).

Etymology.— Malay - *ganjil* - unusual, for the general form of the genitalia.

***Chrysotrichia menara* spec. nov.**  
(figs 15-16)

Material.— Holotype, ♂ (NTM), East Malaysia, Sarawak, Lambir National Park, 11.vii.1988, A. Wells, net. Paratypes, 28 ♂♂ (NTM), same data as holotype; 23 ♂♂ (RMNH), same locality and collector, 14.vii.1988.

Male.— Antennae 18-segmented. Tibial spurs 0,2,4. Wings unmodified. Anterior wing length 1.0-1.1 mm. Genitalia, see figs 15, 16. Abdominal segment IX retracted in VIII, paired dorsal spines arising from anterior margin of tergite. Dorsal and subgenital plates not evident (reduced?). Aedeagus simple, slender, apically acute. Inferior appendages fused, forming a plate, broad in basal  $\frac{2}{3}$ , tapered towards apex.

Remarks.— Like *C. ganjil*, this species differs from most other congeners in general appearance of its highly specialised male genitalia. For resemblance to *C. ganjil*, see remarks on that species.

Distribution.— Malaysia (North Sarawak, East Malaysia).

Etymology.— Malay - *menara* - minaret, for the plate formed by the inferior appendages.

***Chrysotrichia tanduk* spec. nov.**  
(fig. 17)

Material.— Holotype, ♂ (NTM), West Malaysia, Genting Highlands, Gombak, tributary Sg. Gomgag above University of Malaya field station, 8.vi.1988, A. Wells.

Male.— Antennae 18-segmented. Tibial spurs 1,3,4. Wings unmodified. Anterior wing length 1.4 mm. Genitalia, see fig. 17. Dorsal plate, membranous, broadly rounded. Aedeagus slender in proximal half, divided into three fine "prongs" distally; central "prong" containing ejaculatory duct, shorter than outer parts. Subgenital plate probably represented by processes dorsal to inferior appendages which curve inwards and have sclerotised apices. Inferior appendages short, subquadrate.

Remarks.— The 1,3,4 tibial spur count of *C. tanduk* suggests placement in *Stactobiella*. However, the form of abdominal segment IX and of male genitalia are typical of the *berduri*-group.

Distribution.— Malaysia (Genting Highlands, West Malaysia).

Etymology.— Malay - *tanduk* - horn, for the shape of the subgenital plate.

***Chrysotrichia pisau* spec. nov.**  
(figs 18-20)

Material.— Holotype, ♂ (NTM), West Malaysia, Cameron Highlands, "40 mile" between Tanah Rata and Tapah, below falls, 19.vi.1988, A. Wells, net.

Male.— Antennae 18-segmented. Tibial Spurs 0,2,4. Anterior wing length 1.2 mm. Genitalia, see figs 18-20. Abdominal segment IX short, a small setate process apico-laterally. Dorsal plate not evident. Aedeagus (fig. 19) simple, slender, straight. Subgenital plate narrowly rounded apically, a pair of short sclerotised processes laterally at base. Inferior appendages slender, rod-like.

Remarks.— Males of *C. pisau* show similarities to *C. bintik*, *C. tajam*, and *C. angkup*, differing in having shorter inferior appendages. General form of male genitalia in *C. pisau* is like *Catoxyethira improcera* Statzner, 1977, from central Africa. The head and thorax of *C. improcera* conform with *Chrysotrichia* but the tibial spur formula is that of *Catoxyethira*, namely 1,3,4. Number of tibial spurs is proving to be an unreliable character in hydroptilids and thus referral of this *Catoxyethira* species to *Chrysotrichia*, where save for spur formula (1,3,4), it clusters with the *hatnagola*-group, may be more appropriate.

Distribution.— Malaysia (Cameron Highlands, West Malaysia).

Etymology.— Malay - *pisau* - knife, for the shape of the aedeagus.

***Chrysotrichia hermani* spec. nov.**  
(figs 21-24)

Material.— Holotype, ♂ (RMNH), East Malaysia, Sabah, Long Pa Sia, confluence Sg. Ritan, Sg. Rurun, 1040 m, 1.i.1989, J. Huisman. Paratype: 1♂ (RMNH), same data as holotype.

Male.— Antennae 18-segmented, flagellar segments with length about 2 times width. Tibial spur formula 0,2,4. Anterior wing (fig. 24) with an elongate "sail" along R in distal third; length 1.5-1.7 mm. Hind wing with a patch of dark hair medially in fringe on costal margin. Genitalia, see figs 21-23. Abdominal segment VIII stout, conical. Abdominal segment IX narrow, elongate, a pair of short spines dorsally just posterior to middle, anterior apodemes as long as segment. Dorsal plate not evident.

Aedeagus (fig. 22) divided into three straps in distal half. Subgenital plate elongate-triangular, as long as inferior appendages. Inferior appendages slender, apices inturned.

Remarks.— *C. hermani* and *C. coodei* spec. nov., form a distinctive group based on the unusually long abdominal segment IX relative to segment VIII, and the presence of paired dorsal spines medially. *C. hermani* shows similarity to *C. coodei* from which it is distinguished by the longer dorsal spines on segment IX. The specimens were collected along a 6 m wide stream; the clear water flowed swiftly over the boulders and pebbles.

Distribution.— Malaysia (Sabah, East Malaysia).

Etymology.— Named after ethologist Herman in den Bosch (Leiden) who accompanied one of us in the field.

***Chrysotrichia coodei* spec. nov.**  
(figs 25-26)

Material.— Holotype, ♂ (RMNH), Brunei, Sg. Temburong, 140 m, 4.iv.1990, M.J.E. Coode.

Male.— Antennae 18-segmented. Tibial spurs 0,2,4. Wings unmodified. Anterior wing length 1.5 mm. Genitalia, see figs 25, 26. Abdominal segment VIII tubular, about as wide as long. Abdominal segment IX elongate, slender, greatly exceeding length of segment VIII. A pair of dark spines dorsally at about  $\frac{2}{3}$  length, spines about half length of inferior appendages. Dorsal plate not evident. Aedeagus slender, divided into three narrow blades in distal third. Subgenital plate as long as inferior appendages, tapered distally, a pair of sclerotised spurs subapically. Inferior appendages in form of slender forceps with inturned apices.

Remarks.— *C. coodei* is distinguished from *C. hermani* by the shorter spines on segment IX.

Distribution.— Brunei.

Etymology.— Named after Mark Coode, who collected many hydroptilids for us.

***Chrysotrichia matakail* spec. nov.**  
(fig. 27)

Material.— Holotype, ♂ (NTM), West Malaysia, Kepong, Forest Research Institute of Malaya, 27.vii.1988, A. Wells, net. Paratypes: 14 ♂♂ (NTM, RMNH), same data as holotype; 1 ♂ (NTM), West Malaysia, Genting Highlands, Gombak, tributary of Sg. Gombok above University of Malaya field station, 8.vi.1988, A. Wells.

Male.— Antennae 18-segmented. Tibial spurs 1,3,4. Anterior wing length 1.4-1.5 mm. Genitalia, see fig. 27. Dorsal plate rounded. Aedeagus relatively stout, a pair of short flanges subapically. Subgenital plate short, apically excavated. Inferior appendages irregularly-shaped, with a series of lobes and spurs.

Remarks.— In tibial spur number of 1,3,4, and metascutellum short and wide, *C. matakail* would also agree with the diagnosis for *Stactobiella*, however, as mentioned above, the integrity of *Stactobiella* is under scrutiny. Thus, for the present, although it stands alone in form of its male genitalia with robust inferior appendages, this

species is referred to *Chrysotrichia*.

Distribution.— Malaysia (Genting Highlands and Selangor, West Malaysia).

Etymology.— Malay - *mata kail* - fishhook, for the shape of the inferior appendages.

### Genus *Plethus* Hagen, 1887

*Plethus* Hagen, 1887: 643. Type species: *Hydroptila cursitans* Hagen, 1887; by monotypy.

*Plethotrichia* Ulmer, 1951: 65. Type species: *Plethotrichia baliana* Ulmer, 1951; by original designation and monotypy. [Synonymised by Marshall, 1979].

The genus *Plethus* is not rich in species, and its adults are relatively uniform in appearance. They are probably diurnal as none were collected at lights in this study. Larvae have been found on rock surfaces in small soaks or seepages, as well as just below the water surface on rocks in swift flowing streams. As noted by Marshall (1979), *Plethus* larvae are conservative morphologically. Like *Stactobia*, they have small tergites on the abdominal segments. However, they are distinguished from *Stactobia* by poorer development of tergites on the posterior abdominal segments, and absence of sculpturing, serrations and/or pegs on tergites VIII-X. The two new species described here have quite different case forms, one with an upper dome-shaped valve over a short flat "under-strap", in profile quite flat, the other having an upper cylinder and flat basal flanges, giving a higher profile.

### *Plethus bishopi* spec. nov.

(figs 28-29, 74-76)

Material.— Holotype, ♂ (NTM), West Malaysia, Genting Highlands, Gombak, tributary of Sg. Gombak above University of Malaya field station, 10.vi.1988, A. Wells, net. Paratypes: 4 ♂♂ (NTM), same data as holotype; 23 ♂♂ (NTM), same locality and collector, 8.vii.1988; 12 ♂♂ (RMNH), same locality and collector, 10.vi.1988; 6 ♂♂ (NTM), West Malaysia, Bukit Rengit, 21.vii.1988, A. Wells. Other material.— 42 ♂♂, larvae, pupae (NTM), West Malaysia, Cameron Highlands, "40 mile", between Tanah Rata and Tapah, 19.vi.1988, A. Wells; larvae, pupae (NTM), same data as for holotype.

Male.— Uniformly black, hairy. Antennae 18-segmented. Tibial spurs 0,2,3. Anterior wing length 1.3-1.5 mm. Genitalia, see figs 28, 29. Dorsal plate membranous, rounded apically. Aedeagus (fig. 29) stout, simple. Subgenital plate short, sclerotised. Inferior appendages rod-shaped in ventral view, tapered apically, each with a darkly sclerotised process dorsally.

Immatures.— Larvae conform with those described by Ulmer (1957) for *P. acutus* and *P. cruciatus* Ulmer, 1951. Pupae and mature larvae have more or less cylindrical secretion cases (figs 74-76), slightly ridged along the mid dorsal line and sharply drawn into acute ends, the base flush with broad lateral flanges that may be smooth or roughened by *aufwuchs*.

Remarks.— Males are similar to *Plethus acutus* (Ulmer, 1951), but differ in the shape of their inferior appendages, and in having the dorsal processes above the inferior appendages. Cases of *P. bishopi* have more strongly attenuated ends than those of *P. acutus* or *P. cruciatus*. Adults were seen by day, scurrying about on rocks beside flowing water. Immatures were collected from rocks, boulders and bedrock in moder-

ately fast flowing, small to medium sized streams with low, open riparian vegetation.

Distribution.— Malaysia (West Malaysia).

Etymology.— The species is named for John Bishop, friend and erstwhile colleague of A. Wells, who first collected Trichoptera from Sungai Gombak, and who published the first work on macro-invertebrates of a SE Asian tropical stream (Bishop, 1973).

### ***Plethus segitiga* spec. nov.**

(figs 30-32, 78)

Material.— Holotype, ♂ (NTM), West Malaysia, Kepong, Forest Research Institute of Malaya, 27.vii.1988, net, A. Wells. Other material: larvae, pupae (NTM), West Malaysia, W Pahang, Genting Highlands, Genting Tea Estate, 11.vi.1988, A. Wells.

Male.— Jet black. Antennae 18-segmented. Tibial spurs 0,2,3. Anterior wing length 1.5 mm. Genitalia, see figs 30-32. Dorsal plate difficult to discern, probably the ringed membrane in the dorsal concavity between the lobes of segment IX. Aedeagus (fig. 32) with a pair of small sub-apical spurs. Subgenital plate seen as a sclerotised internal structure. Inferior appendages stout, sub-triangular.

Immatures.— Larvae with small dorsal sclerites, on abdominal segments II-VII, each sclerite surrounding a row of 4 round chloride epithelia. Pupae show no particular distinguishing features. Case (fig. 78) broad, ovoid, pale, in the form of a smooth dome over an elongate tube; at pupation, the tube is sealed to a peak at each end.

Remarks.— Males of *P. segitiga* resemble *P. kala* Schmid, 1960, from Pakistan, differing in having fewer sclerotised spurs or spines on the aedeagus and more triangular inferior appendages. The specimen was netted from riparian vegetation beside falls in a swiftly flowing stream. Immatures were picked from just below the water line of rocks in fast flowing water. The cases of this species differ considerably from those of *P. bishopi* in being dome-shaped as in many *Stactobia* although lacking the fluting on the dome seen in *Stactobia*.

Distribution.— Malaysia (Selangor district and Genting Highlands, West Malaysia).

Etymology.— Malay - *segitiga* - triangular, for the shape of the inferior appendages.

### **Genus *Stactobia* McLachlan, 1880**

*Stactobia* McLachlan, 1880: 505. Type species: *Hydroptila fuscicornis* Schneider, 1880; by subsequent designation by Mosely (1933). (See Marshall, 1979, for full list of synonymies).

Three of the new *Stactobia* species are uniform in appearance of male genitalia and are referred to Schmid's (1959) *nielsenii*-group, which includes species from northern Iran, Pakistan, southern Yemen and Indonesia (Java). Another is referred to the southern Asian *martyanovii*-group (Schmid, 1959). The fifth species lacks the ventral process on sternite VII, and has relatively simple genitalia. The form of the metascutellum as well as tibial spur count and probably the shape of the aedeagus, place this species in *Stactobia*, although the general appearance of male genitalia more closely resembles *Chrysotrichia*. For the present it is not placed in any species group.

**Stactobia kudung spec. nov.**

(fig. 33)

Material.— Holotype, ♂ (NTM), West Malaysia, Cameron Highlands, "40 mile" falls, between Tanah Rata and Tapah, 19.vi.1988, A. Wells, net. Paratypes: 16 ♂♂ (NTM, RMNH), same data as holotype.

Male.— Dark brown to black. Antennae 18-segmented. Tibial spurs 1,2,4. Anterior wing length 1.4-1.5 mm. Genitalia, see fig. 33. A long straight mid-ventral process on abdominal segment VII. Dorsal plate broad, membranous, margins studded with tiny setules. Aedeagus broad, rounded apically, a pair of stout, blade-like spines arising at distal third, one almost reaching apex, other shorter. Subgenital plate a small median structure. Inferior appendages reduced to small, apically-truncate, ventral lobes with sclerotised processes dorsally.

Remarks.— This species, in the *martynov*-group (Schmid, 1960), is similar to *S. wimmeri* Malicky, 1988, from East Turkey, differing mainly in the truncated inferior appendages, and different shaped spines on the aedeagus. Adults were collected by dabbling them with a finger dipped in alcohol as they scurried around on rocks and boulders beside fast flowing water in a stream with open riparian vegetation.

Distribution.— Malaysia (Cameron Highlands, West Malaysia).

Etymology.— Malay - *kudung* - truncate, for the shape of the inferior appendages.

**Stactobia tonyi spec. nov.**

(figs 34-35)

Material.— Holotype, ♂ (NTM), East Malaysia, Sabah, Tenom, stream behind Hotel Tenom, 30.vi.1988, A. Wells, net. Paratypes: 3 ♂♂ (NTM, RMNH), same data as holotype.

Male.— Antennae 18-segmented. Spurs 1,2,4. Anterior wing length 1.1 mm. Genitalia, see figs 34, 35. Abdominal sternite VII with a slender mesal process tipped with small tubercles. Dorsal plate rectangular, membranous but strengthened by sclerotised straps, a pair of lateral spines at about  $\frac{2}{3}$  length. Aedeagus (fig. 35) expanded distally, a set of unequal sized spines and sclerotised plates apically. Subgenital plate not evident. Inferior appendages lobulate and membranous in basal  $\frac{2}{3}$ , forming slender, curved processes distally.

Remarks.— In the *nielseni*-group, and in general arrangement of genitalic parts most closely allied to *S. takuk* spec. nov., and *S. rahang* spec. nov.

Distribution.— Malaysia (Sabah, East Malaysia).

Etymology.— Named after Tony Lamb, a dear host and friend of both authors.

**Stactobia gerutu spec. nov.**

(figs 36-37)

Material.— Holotype, ♂ (NTM), East Malaysia, Sabah, Sapong Falls 10 km S of Tenom, 1.vii.1988, A. Wells, net. Paratypes: 4 ♂♂ (NTM), same data as holotype; 6 ♂♂ (NTM, RMNH), East Malaysia, Tenom Agricultural Research Station, 30.vi.1988, A. Wells, net.

Male.— Brown, wings scaly. Antennae 17-segmented. Tibial spurs 1,2,4. Anterior wing length 1.1-1.2 mm. Genitalia, see figs. 36, 37. Abdominal segment VII without mid-ventral process. Dorsal plate extending well beyond inferior appendages, truncate apically. Aedeagus (fig. 37) with small spinules towards apex, a pair of strong, sclerotised spines arising at about half length. Subgenital plate not evident. Inferior appendages in ventral view pale and sub-quadrate anteriorly, a dark spine extending from inner apical angle.

Remarks.— This species differs from congeners in lacking the long ventral process on segment VII. The genitalia are simple in other respects and, save for the shape of the metascutellum, the species more closely resembles *Chrysotrichia*. Adults were netted from riparian vegetation beside small streams.

Distribution.— Malaysia (Sabah, East Malaysia).

Etymology.— Malay - *gerutu* - prickly, for the appearance of the aedeagus.

***Stactobia rahang* spec. nov.**  
(figs 38, 79, 80, 82, 83)

Material.— Holotype, ♂ (NTM), West Malaysia, Genting Highlands, Gombak, stream 1.5 km below University of Malaya field station, at fall, 9.vi.1988, A. Wells, net. Other Material: larvae and pupae (NTM), same data as for holotype.

Male.— Dark brown. Antennae 18-segmented. Anterior wing length 1.4 mm. Tibial spurs 1,2,4. Genitalia, see fig. 38. Abdominal segment VII with a long mid-ventral process. Dorsal plate triangular, membranous, slightly cleft apically. Aedeagus apically acute, constricted medially, a ring of spines arising basad of constriction. Subgenital plate not evident. Inferior appendages rod-like, tapered distally. A small membranous plate mid-ventrally.

Immatures.— Larvae (figs 79, 80, 82, 83) have characteristic abdominal tergites, including a strongly modified tergite IX which overhangs segment X (figs 82, 83); tergites II-VI each with row of four circular chloride epithelia centrally. Case (figs 79, 80) with ventral valve elongate, narrow, forming a median tube with the broader dorsal plate extended to form a flat ovoid platform, notched at each end, built of secretion incorporating sparse sand grains and small flecks of carbon or detritus.

Remarks.— Another *nielseni*-group species, resembling *S. takuk* spec. nov., but differing in many aspects, including shape of the aedeagus and absence of lateral processes. Cases of this species closely resemble three of the six cases illustrated for *Plethus cruciatus* Ulmer (1957, figs 239-241). The other three cases shown for the same species are similar to cases of *Plethus bishopi*, so they may have been misidentified.

Distribution.— Malaysia (Genting Highlands, West Malaysia).

Etymology.— Malay - *rahang* - jaw, for the shape of the inferior appendages.

***Stactobia takuk* spec. nov.**  
(figs 39, 81, 84)

Material.— Holotype, ♂ (NTM), East Malaysia, Sarawak, Bako National Park, Sg. Delima, 9.vii.1988, A. Wells, net. Paratypes: 6 ♂♂ (NTM), same data as holotype; 1 ♂ (NTM), same locality and collector,

7.vii.1988; 5 ♂♂ (RMNH), same locality and collector, 8.vii.1988; 1 ♂ (NTM), East Malaysia, Sarawak, Lambir National Park, E of Miri, 11.vii.1988, A. Wells; 1 ♂ (NTM), East Malaysia, Sabah, Tenom, 30.vi.1988, A. Wells. Other Material: larvae and pupae (NTM), same data as for holotype.

**Male.**— Uniformly black, wings scaly. Antennae 18-segmented. Tibial spurs 1,2,4. Anterior wing length 1.2 mm. Genitalia, see fig. 39. Abdominal segment VII with elongate mid-ventral process. Dorsal plate triangular, membranous. Aedeagus dilated distally, apex notched. Subgenital plate not evident. Inferior appendages with straight inner margins in ventral view, outer margins rounded. A bifid spiny process laterally.

**Immatures.**— Case (fig. 81) dome-shaped, rounded with fluting around margins. Prior to pupation, the narrow bridge-like ventral valve is extended to form a sealed "hour glass-shaped" chamber. Larva with short rectangular tergites on all abdominal segments, expanded to form large plates on segments VIII-X; chloride epithelia poorly developed (fig. 84).

**Remarks.**— This is one of the *nielseni*-group species. Adults were collected by sweeping riparian vegetation above small falls. The type locality is a small fall, dropping about two metres to mangrove mudflats that are inundated at high tide. The larvae of *Stactobia rahang* have rows of three or four chloride epithelia on their abdominal tergites. Curiously, larvae of this species collected from where they may well be subjected to slightly higher salinities than usual, show poor development of chloride epithelia. Unfortunately, no larvae were collected from the other localities, so whether or not the lack of chloride epithelia is a general condition for the species or adaptive for local conditions is unknown.

**Distribution.**— Malaysia (Sarawak and Sabah, East Malaysia).

**Etymology.**— Malay - *takuk* - notch, for the shape of the apex of the aedeagus.

### Genus *Scelotrichia* Ulmer, 1951

*Scelotrichia* Ulmer, 1951: 73. Type species: *Scelotrichia saranganica* Ulmer, 1951; by original designation, and monotypy. (See Wells (1990a) for a full list of synonymies).

Like *Chrysotrichia*, the genus *Scelotrichia* is relatively species rich in Malaysia; their general form is conservative compared to those from New Guinea. Due to the dense vestiture, distinguishing between species is usually exceedingly difficult unless the specimens are macerated and cleared for study. Some species have a moth-like clothing of hairs, and some males have their wings distorted by patches of scales (androconia), or by costal folds containing specialised scales, presumably involved in scent production and dispersion. Some of the variety of wing forms is illustrated in figs 40-46.

Particular patterns of wing scales, general form of male genitalia and tibial spur formula seem not to be correlated in any way. Yet one might expect to be able to detect trends in the development of the quite elaborate costal folds. Even the loss of the foretibial spur, or its replacement with a knob, which separates the species into two groups, might be expected to be a natural division, reflected in an associated suite of character states. Yet no clear pattern in the distribution of these features and the occurrence of particular patterns in the male genitalia can be detected. This suggests that these characters are all very labile.

**Scelotrichia pucat spec. nov.**

(figs 42, 47, 48)

Material.— Holotype, ♂ (NTM), East Malaysia, Sabah, Kundassang, Mesilau East River, 26.vi.1988, A. Wells, net. Paratypes: 5 ♂♂ (NTM, RMNH), same data as holotype.

Male.— Jet black. Antennae 18-segmented, tips pale. Tibial spurs 1,2,4; spur on foretibia reduced to a small knob. Anterior wing (fig. 42) distorted, with a large proximal patch of scales (androconia); length 2.5 mm. Antennae 18-segmented. Genitalia, see figs 47, 48. Dorsal plate forming a short sheath around aedeagus. Aedeagus divided distally, two slender processes extending beyond ejaculatory duct. Subgenital plate not evident. Inferior appendages fused to sternite IX basally, distally forming curved lobes projecting beyond the obliquely truncate lobes of sternite IX, rows of pale teeth on inner margins; a pair of small spurs on the inner distal margins of the divided portion of sternite IX.

Remarks.— Males of *S. pucat* are similar to those of *S. kait* spec. nov., particularly in the strongly distorted, scaly wings. Features such as the longer and pale tooth row at the base of inferior appendages, and absence of large sclerotised hooks above the inferior appendages, distinguish the two.

Distribution.— Malaysia (Sabah, East Malaysia).

Etymology.— Malay - *pucat* - pale, for the colour of the teeth rows on the inferior appendages.

**Scelotrichia kait spec. nov.**

(fig. 49)

Material.— Holotype, ♂ (NTM), East Malaysia, Sabah, Kundassang, Mesilau East River, 26.vi.1988, A. Wells, net.

Male.— Jet black. Antennae 18-segmented. Tibial spurs 1,2,4; spur on fore leg reduced to a small knob. Anterior wing distorted, with a large patch of androconia proximally; length 2.5 mm. Genitalia, see fig. 49. Dorsal plate forming a sheath around aedeagus, curving ventrally to form a pair of stout, sclerotised hooks. Aedeagus as for *S. pucat*. Subgenital plate not evident. Inferior appendages forceps-like, basally with short rows of black teeth on inner margin. Sternite IX not separated mid-ventrally.

Remarks.— See remarks for *S. pucat*.

Distribution.— Malaysia (Sabah, East Malaysia).

Etymology.— Malay - *kait* - hook, for the stout hooks of the dorsal plate.

**Scelotrichia rienki spec. nov.**

(fig. 50)

Material.— Holotype, ♂ (NTM), West Malaysia, Templer's Park, 20 km NW of Kuala Lumpur, 28.vii.1988, A. Wells, net. Paratypes: 1 ♂ (NTM), same data as holotype; 3 ♂♂ (RMNH), same locality and collector, 29.vii.1988; 1 ♂ (NTM), West Malaysia, Kepong, Forest Research Institute of Malaya, 25.vii.1988, A. Wells, net.

Male.— Antennae 18-segmented. Tibial spurs, 1,2,4; foretibial spur reduced to small knob. Wings narrow, unmodified. Anterior wing length 1.5-1.9 mm. Genitalia, see fig. 50. Dorsal plate membranous, broadly rounded apically. Aedeagus expanded in distal half, apically with a pair of slender outer spines, and a pair of shorter inner blade-like processes. Subgenital plate may be represented by membrane between structures derived in part from inferior appendages. Inferior appendages separated mid ventrally by a deep cleft, basal third of which is lined with small dark teeth. Median ventral process extended well forward to rounded area bordered anteriorly by short setae on sternite VII.

Remarks.— This species is distinguished by absence of scales, ridges or folds on the wings, and by the form of the apex of the aedeagus.

Distribution.— Malaysia (Selangor district, West Malaysia).

Etymology.— Named after Rienk de Jong.

**Scelotrichia rumpu spec. nov.**

(figs 40, 51-52)

Material.— Holotype; ♂ (NTM), East Malaysia, Sarawak, Lambir National Park, 5.vii.1988, A. Wells, net. Paratype: 1 ♂ (NTM), same data as holotype.

Male.— Black, covered with scales. Antennae 18-segmented. Tibial spurs 1,2,4; spur on foretibia a small knob. Anterior wing (fig. 40) with two separate costal folds, one broader than other, both containing androconia and together extending along proximal half of margin; anterior wing length 1.3-1.5 mm. Genitalia, see figs 51, 52. Dorsal plate, short, membranous, covered with tiny spinules. Aedeagus deeply divided distally into two sets of four spines. Subgenital plate not evident. Inferior appendages short, tipped by a small dark spur, lined in anterior third by pale teeth. Mid ventral rounded plate mesial on sternite VIII.

Remarks.— This species is easily distinguished from congeners by the form of the aedeagus; it groups with the set of species having a small knob on the foretibia.

Distribution.— Malaysia (Northwest Sarawak, East Malaysia).

Etymology.— Malay - *rumpu* - grass, for the shape of the aedeagus.

**Scelotrichia bilah spec. nov.**

(figs 53-54)

Material.— Holotype, ♂ (RMNH), East Malaysia, Sabah, Long Pa Sia area, Sg. Ritan, 04° 24'N 115° 42'E, 1160 m, 9.iv.1987, J. Huisman & J. van Tol.

Male.— Antennae 18-segmented. Tibial spurs 1,2,4; foretibial spur a small knob. Anterior wing with scattered tear-drop shaped scales and small medial costal fold; length 1.7 mm. Genitalia, see figs 53, 54. Abdominal segment IX forming broadly rounded lateral lobes. Dorsal plate reduced to curved, sclerotised lateral spines. Aedeagus stout, distally forming four blade-like spines. Subgenital plate not evident. Inferior appendages discrete in distal half, stout throughout length, apices convergent, sclerotised, acuminate, without teeth on inner margins.

Remarks.— Compared with other congeners, this species shows less development of the inferior appendages, which reach just into the posterior margin of sternite VIII. In this respect it aligns with *S. dasar* spec. nov. At the collecting site the river was 3 m wide, with clear water, flowing rapidly over boulders and leaf litter.

Distribution.— Malaysia (Sabah, East Malaysia).

Etymology.— Malay - *bilah* - blade, for the four blades on the apex of the aedeagus.

***Scelotrichia buluhalus* spec. nov.**

(figs 44, 55-56)

Material.— Holotype, ♂ (RMNH), East Malaysia, Sabah, 60 km W Lahad Datu, DVFC [= Danum Valley Field Centre] nr bridge, 04° 58'N 117° 48'E, 150 m, 21.iii.1987, J. Huisman. Paratypes: 1 ♂ (RMNH), Brunei, Sg. Temburong, 140 m, 4.iv.1990, M.J.E. Coode; 1 ♂ (RMNH), same locality, same collector, 8.iv.1990.

Male.— Moth-like in appearance with wings and body densely clothed in scales. Antennae damaged, segments elongate. Tibial spurs 1,2,4; foretibial spur reduced to a knob. Anterior wing (fig. 44) broad; length 2.4-2.7 mm. Genitalia, see figs 55,56. Dorsal plate short, ruggedly sclerotised. Aedeagus short, rod-shaped, slightly expanded medially, apex simple, blunt. Subgenital plate not evident. Inferior appendages deeply separated, stout, apices broadly rounded in ventral view, tapered slightly in lateral view, without teeth on inner margins.

Remarks.— This species has undistinguished male genitalia, but with its fluffy, moth-like appearance, is probably the most easily recognised of all Malaysian species. In general features of male genitalia *S. buluhalus* resembles *S. kipas* spec. nov., however, it has a foretibial knob which the latter lacks. Collected along 15 m wide rivers, with clear water flowing over sandy substrates.

Distribution.— Malaysia (Sabah, East Malaysia); Brunei.

Etymology.— Malay - *bulu halus* - fluff, for the general appearance of this species.

***Scelotrichia dasar* spec. nov.**

(figs 43, 57)

Material.— Holotype, ♂ (NTM), West Malaysia, Templer's Park, 29.vii.1988, A. Wells, net. Paratypes: 3 ♂♂ (NTM, RMNH), same locality and collector as holotype, 28.vii.1988.

Male.— On dorsal head, tufts of scales (androconia) below post-occipital caps. Antennae 17-segmented, width of segments exceeds length. Tibial spurs 0,2,4. Wings (fig. 43) narrow, with scattered scales. Anterior wing length 1.3 mm. Genitalia, see fig. 57. Dorsal plate membranous, quadrate. Aedeagus elongate, a long lateral spur distally. Subgenital plate not evident. Inferior appendages lobulate, elongate, inserted on sternite VIII.

Remarks.— The male genitalia of *S. dasar* may represent an early stage in the development of the typical *Scelotrichia* genitalia. The inferior appendages are separate and lobate in ventral view, although fused dorsally to sternites VIII and IX; their bases have moved only towards the anterior margin of sternite VIII, not as far as VII

as in other species, and segments VIII and IX are not strongly modified. The arrangement of the inferior appendages closely resembles that of some species of *Stactobia*, e.g. *S. beatensis* Mosely, 1934. *S. dasar* probably groups with *S. lampai* spec. nov., although that species is more specialised.

Distribution.— Malaysia (NW of Kuala Lumpur, West Malaysia).

Etymology.— Malay - *dasar* - basic, for the basic form of the genitalia.

***Scelotrichia kipas* spec. nov.**

(figs 45, 58-59)

Material.— Holotype, ♂ (NTM), East Malaysia, Sabah, Tenom, 1.vii.1988, A. Wells.

Male.— Antennae damaged, segments quadrate. Tibial spurs, 0,2,4. Wings (fig. 45) unmodified. Anterior wing length 1.3 mm. Genitalia, see figs 58, 59. Abdominal segment IX not produced apico-laterally. Dorsal plate membranous, rounded. Aedeagus elongate, slender, fanned apically. Subgenital plate not evident. Inferior appendages deeply divided, stout, with rounded apices, on inner mesal margins a pale spur.

Remarks.— The unmodified form of *S. kipas*' wings, resembles *S. rienki*, but this species shows closer similarity to *S. thingana* Olah, 1989, from Vietnam, from which it differs in shape of inferior appendages and aedeagus.

Distribution.— Malaysia (Sabah, East Malaysia).

Etymology.— Malay - *kipas* - fan, for the shape of the apex of the aedeagus.

***Scelotrichia ceesi* spec. nov.**

(figs 46, 60-61)

Material.— Holotype, ♂ (RMNH), East Malaysia, Sabah, 8.5 km S Long Pa Sia, Sg. Malabit, 04° 21'N 115° 41'E, 1180 m, 4.xii.1987, J. Huisman & C. v. Achterberg. Paratypes: 3 ♂♂ (RMNH), same data as holotype.

Male.— Antennae damaged, segments slightly longer than wide. Tibial spurs 0,2,4. Anterior wing (fig. 46) with narrow costal band of adpressed scales extending more than half length; length 2.2 mm. Genitalia, see figs 60, 61. Dorsal plate tapered distally, apex deeply cleft medially. Aedeagus stout, not clearly divided distally in ventral view, but curved and spiny in lateral view. Subgenital plate not evident. Inferior appendages short, irregular in shape, with mesal spine subapically.

Remarks.— Based on the spur formula this species groups with the new *S. lampai*, *S. jari*, and *S. paku*, but their male genitalia are clearly distinct. Collected at light along a 10 m wide stream where tannin-stained water flowed over boulders and pebbles.

Distribution.— Malaysia (Sabah, East Malaysia).

Etymology.— Named after Cees van Achterberg.

***Scelotrichia lampai* spec. nov.**

(fig. 62)

Material.— Holotype, ♂ (NTM), West Malaysia, Selangor district, Templer's Park, 20 km NW Kuala Lumpur, 29.vii.1988, A. Wells, net. Paratypes: 1 ♂ (RMNH), same data as holotype; 6 ♂♂ (NTM), same

locality and collector, 28.vii.1988; 2 ♂♂ (NTM), West Malaysia, Maxwell's Hill, 17.vii.1988, A. Wells.

Male.— Antennae 18-segmented, segments longer than wide. Tibial spurs 0,2,4; without knob on foretibia. Anterior wing with a short costal fold containing androconia; length 1.5-1.7 mm. Genitalia, see fig. 62. Dorsal plate concave apically. Aedeagus slender, apically a pair of short fine setae and a pair of longer, stouter processes. Subgenital plate may be fused with the membranous structure situated above the inferior appendages and partly sheathing the aedeagus. Inferior appendages short, stout, rounded apically; at base of cleft between inferior appendages, a pair of small sclerotised knobs.

Remarks.— This species groups with *S. kipas*, *S. buluhalus*, and *S. dasar* based on the general form of the aedeagus, but is distinguished from them by the costal fold in the forewing which places it with the new *S. rumput*, *S. jari*, and *S. bilah*.

Distribution.— Malaysia (West Malaysia).

Etymology.— Malay - *lampai* - slender, for the general appearance of the male genitalia.

***Scelotrichia jari* spec. nov.**  
(figs 41, 63)

Material.— Holotype, ♂ (NTM), West Malaysia, Genting Highlands, tributary Sg. Gombak, 9.vi.1988, A. Wells, net. Paratypes: 3 ♂♂ (NTM), West Malaysia, Maxwell's Hill, 17.vii.1988, A. Wells, net; 3 ♂♂ (NTM), East Malaysia, Sabah, Tenom, 30.vi.1988, A. Wells.

Male.— Antennae 17-18-segmented. Tibial spurs 0,2,4. Anterior wing (fig. 41) with short, stout costal fold proximally, containing broad, tear-drop shaped scales; wing length 1.5 mm. Genitalia, see fig. 63. Dorsal plate broadly truncate, with paired wing-like apico-lateral processes. Aedeagus stout, divided irregularly towards apex. Subgenital plate not evident. Inferior appendages stout basally, narrowed to finger-like processes distally, separated to mesal glandular region on abdominal sternite VII, inner margin without teeth.

Remarks.— One of the group lacking foretibial spurs, but easily distinguished by the clearly separated and elongate inferior appendages with finger-like apical process.

Distribution.— Malaysia (West and East Malaysia).

Etymology.— Malay - *jari* - finger, for the shape of the inferior appendages.

***Scelotrichia gerigi* spec. nov.**  
(fig. 64)

Material.— Holotype, ♂ (RMNH), East Malaysia, Sabah, 8.5 km S Long Pa Sia, Sg. Malabit, 04° 21'N 115° 41'E, 1180 m, 4.xii.1987, J. Huisman & C. v. Achterberg. Paratype: 1 ♂ (RMNH), same data as for holotype.

Male.— Antennae damaged, segments elongate. Tibial spurs 0,2,4. Anterior wing with strip of scales extending along  $\frac{2}{3}$  of costal margin; wing length 2.2-2.3 mm.

Genitalia, see fig. 64. Dorsal plate membranous, deeply concave apically. Aedeagus stout, apex trifurcate. Subgenital plate not evident. Inferior appendages serrate on inner distal margin, each with a sclerotised spur distad of their point of separation; basal gland almost at anterior margin of sternite VII.

Remarks.— In lacking the foretibial spur or knob this species groups with *S. lampai*, *S. jari* and *S. paku* spec. nov. It is distinguished by the mesal spurs on the inferior appendages.

Distribution.— Malaysia (Sabah, East Malaysia).

Etymology.— Malay - *gerigi* - jagged, for the shape of the inferior appendages.

### **Scelotrichia paku** spec. nov.

(figs 65-66)

Material.— Holotype, ♂ (RMNH), East Malaysia, Sabah, 2 km SW Long Pa Sia, confluence Sg. Ritan, Sg. Rurun, 04° 21'N 115° 42'E, 1040 m, 29.ix.1989, J. Huisman.

Male.— Large. Antennae 19-segmented. Tibial spurs 0,2,4. Anterior wing with scales along Sc; wing length 2.6 mm. Genitalia, see figs 65, 66. Dorsal plate membranous, subquadrate, with sclerotised, blade-like spines laterally. Aedeagus with acute spike apically. Subgenital plate not evident. Inferior appendages strongly modified, mid-ventrally forming a broad plate, apico-laterally slender, tapered.

Remarks.— Grouped with *S. lampai*, *S. jari* and *S. gerigi*, based on the absence of foretibial knob; readily recognised by the broad, plate-like lateral spines.

Distribution.— Malaysia (Sabah, East Malaysia).

Etymology.— Malay - *paku* - spike, for the apex of the aedeagus.

## Tribe Orthotrichiini Nielsen, 1948

Orthotrichiinae Nielsen, 1948: 186; Marshall, 1979: 212-213. Type genus: *Orthotrichia* Eaton, 1873.

The tribe Orthotrichiini comprises two genera, *Orthotrichia* and *Ithytrichia* Eaton, 1873. Probably only *Orthotrichia* occurs in SE Asia. On the basis of larval form, Marshall (1979) transferred one of Ulmer's (1951) Indonesian (Java) species to *Ithytrichia*, but at the same time she expressed doubt about its true identity, as the adult specimen is in a poor state. Other species of *Ithytrichia* are Holarctic, so, given that in all the recent collecting in SE Asia no members have been found, it seems highly probable that the genus is really absent from the region.

*Orthotrichia* is sparsely represented in SE Asia, in comparison with New Guinea or northern Australia. Twelve species are known from Indonesia [five from Bali, Sumatra, Java, (Ulmer 1951); seven from N Sulawesi (Wells 1990a)].

## Genus *Orthotrichia* Eaton, 1873

*Orthotrichia* Eaton, 1873: 141. Type species: *Hydroptila angustella* McLachlan, 1880, by original designation.

The five new species described here in *Orthotrichia* are unremarkable. Two have strongly asymmetrical inferior appendages, a feature that has probably arisen repeatedly in the genus. A more significant character is the shape of anterior apodemes of abdominal segment IX, which varies considerably. This character has never been studied carefully in the genus, but would undoubtedly be rewarding for phylogenetic studies.

Wells (1990a) referred the Sulawesi *Orthotrichia* to Marshall's *kokodana*-group, and since the five Malaysian species do not differ significantly from the Sulawesi species they are placed in the same group.

*Orthotrichia runching* spec. nov.  
(fig. 67)

Material.— Holotype, ♂ (RMNH), East Malaysia, Sabah, 12 km NNE Ranau, Poring Hot Springs, Sg. Kipogoh, 06° 03'N 116° 42'E, 550 m, 9.xii.1986, J. Huisman.

Male.— Antennae 22-segmented. Anterior wing length 1.8 mm. Abdominal segment IX truncate anteriorly, a stout spine extending from right margin. Genitalia, see fig. 67. Dorsal plate elongate, membranous with left margin lightly sclerotised, a spur at apex. Aedeagus elongate, slender. Inferior appendages slightly unequal sized, lobes sub-triangular; dorsal process in form of two setate, digitiform lobes, anterior apodeme short.

Remarks.— In general appearance similar to the sympatric *O. sinit* spec. nov., from which it differs in the shape of inferior appendages and in having a single apical spine on the dorsal plate, rather than two spines sub-apically.

Distribution.— Malaysia (Sabah, East Malaysia).

Etymology.— Malay - *runching* - pointed, for the apical spine on the dorsal plate.

*Orthotrichia newi* spec. nov.  
(figs 68, 69)

Material.— Holotype, ♂ (NTM), East Malaysia, Sabah, Tenom, 30.vi.1988, A. Wells.

Male.— Antennae 25-segmented, flagellar segments elongate. Anterior wing length 1.8 mm. Genitalia, see figs 68, 69. Abdominal segment IX relatively narrow, a long slender spine arising internally from right anterior angle of segment, projecting posteriorly. Dorsal plate, broad, membranous, almost truncate apically, a short narrow spine dorsally on left. Aedeagus slightly twisted distally. Inferior appendages irregular in shape, dorsal process asymmetrical, arising on right. Paramere short, slender.

Remarks.— The male of this species is distinguished by its unique asymmetrical inferior appendages.

Distribution.— Malaysia (Sabah, East Malaysia).

Etymology.— Named for Tim New.

**Orthotrichia jani spec. nov.**

(fig. 70)

Material.— Holotype, ♂ (RMNH), East Malaysia, Sabah, Long Pa Sia area, Sg. Ritan, 04° 24'N 115° 42'E, 1160 m, 8.vi.1988, J. Huisman & J. van Tol.

Male.— Antennae damaged, in excess of 24 segments, flagellar segments elongate. Anterior wing length 2.0 mm. Genitalia, see fig. 70. Abdominal segment IX rounded anteriorly and at postero-lateral angles. Dorsal plate with spines at apico-lateral angles: left short and straight, right horn-like, curving anteriorly. Aedeagus slender, straight. Inferior appendages, irregular, fused; dorsal process small, undivided.

Remarks.— This is another species with asymmetric inferior appendages, distinguished from *O. newi* by a ventrally curving spine on the right apico-lateral angle of the dorsal plate.

Distribution.— Malaysia (Sabah, East Malaysia).

Etymology.— Named after Jan van Tol.

**Orthotrichia lebar spec. nov.**

(figs 71-72)

Material.— Holotype, ♂ (NTM), East Malaysia, Sarawak, Bako National Park, Sungai Delima, 9.vii.1988, A. Wells.

Male.— Antennae 24-segmented, length flagellar segments 2 times width. Anterior wing length 1.7 mm. Genitalia, see figs 71, 72. Abdominal segment IX almost entirely retracted into VIII, narrow, angular anteriorly. Dorsal plate membranous, narrow, rounded. Aedeagus slender, straight. Inferior appendages symmetrical, width about twice length, each with a apico-lateral long seta, apical margin truncate. Paramere long, slender.

Remarks.— Resembling *O. jembatana* Wells, 1990, from N Sulawesi, from which it is distinguished by the truncate apical margins of inferior appendages and rounded dorsal plate.

Distribution.— Malaysia (Sarawak, East Malaysia).

Etymology.— Malay - *lebar* - wide, for the shape of the inferior appendages.

**Orthotrichia sinit spec. nov.**

(fig. 73)

Material.— Holotype, ♂ (RMNH), East Malaysia, Sabah, 12 km NNE Ranau, Poring Hot Springs, Sg. Kipogoh, 06° 03'N 116° 42'E, 550 m, 9.xii.1986, J. Huisman.

Male.— Antennae 21-segmented. Anterior wing length 1.4-1.5 mm. Genitalia, see fig. 73. Abdominal segment IX broad, not retracted in VIII. Dorsal plate tapered distally to rounded apex, a pair of short dark spines sub-apically, a broad blunt spine lying along right lateral margin. Aedeagus slender, straight. Inferior appendages symmetrical, discrete ventral lobes with sclerotised patches on inner distal margins,

setate lobes. Paramere a straight, strong spine.

Remarks.— This species is distinguished by a pair of short sclerotised sub-apical spines on the dorsal plate. Collected at light along a 1 m wide streamlet on a steep slope, in dense forest.

Distribution.— Malaysia (Sabah, East Malaysia).

Etymology.— Named after the Gabriel Sinit family.

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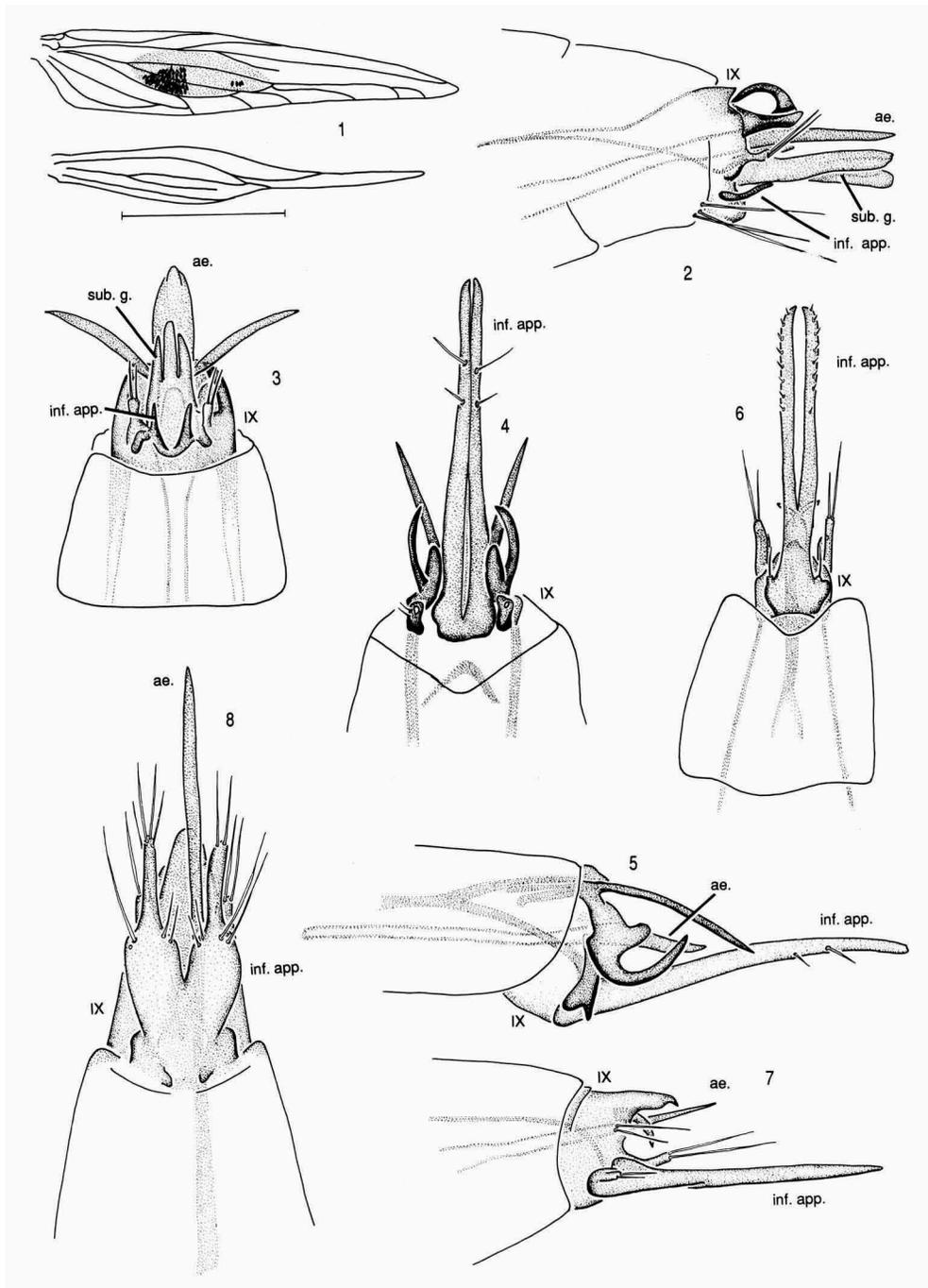
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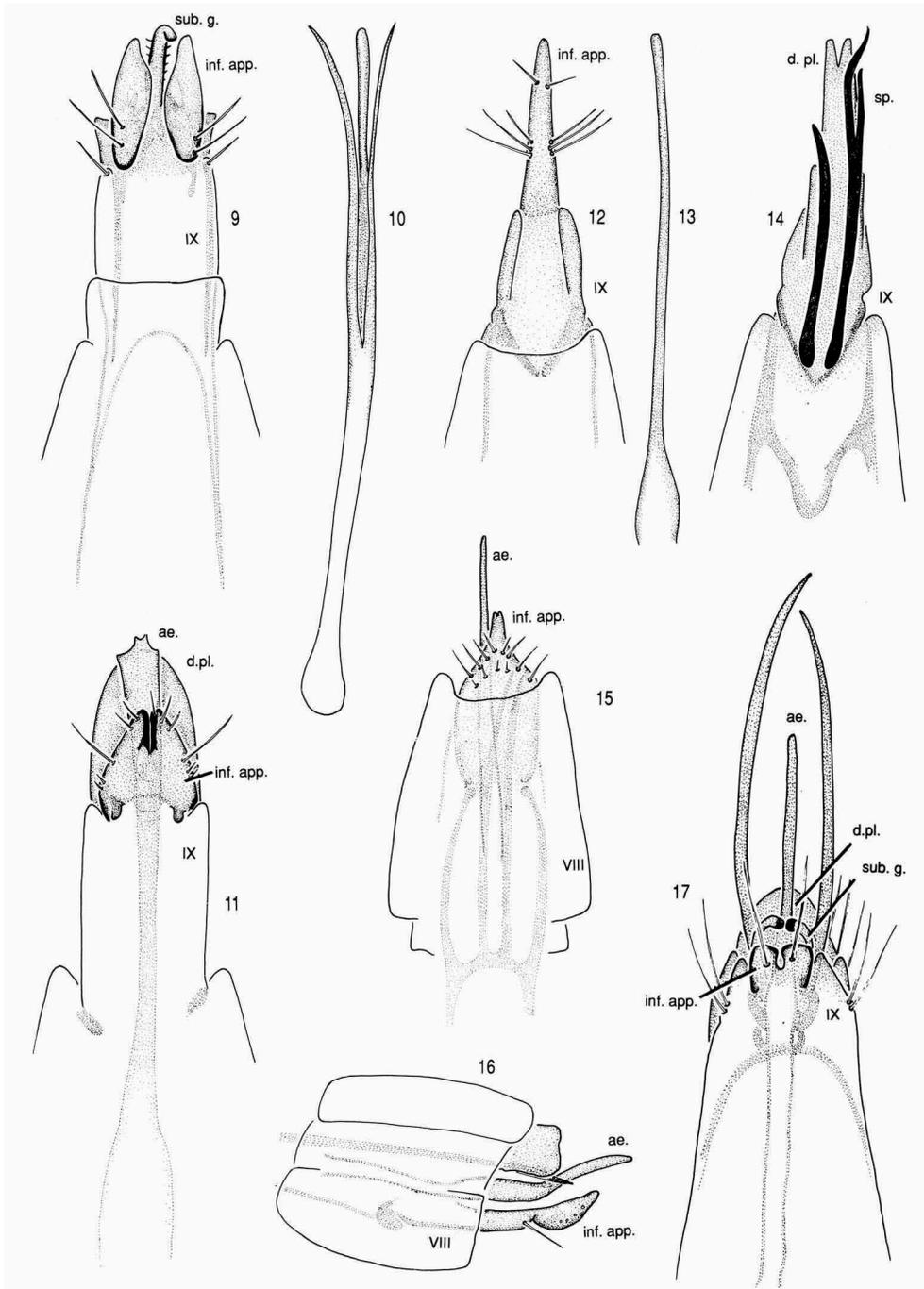
## Appendix

### Check-list of Stactobiini and Orthotrichiini (Hydroptilidae) from Malaysia and Brunei.

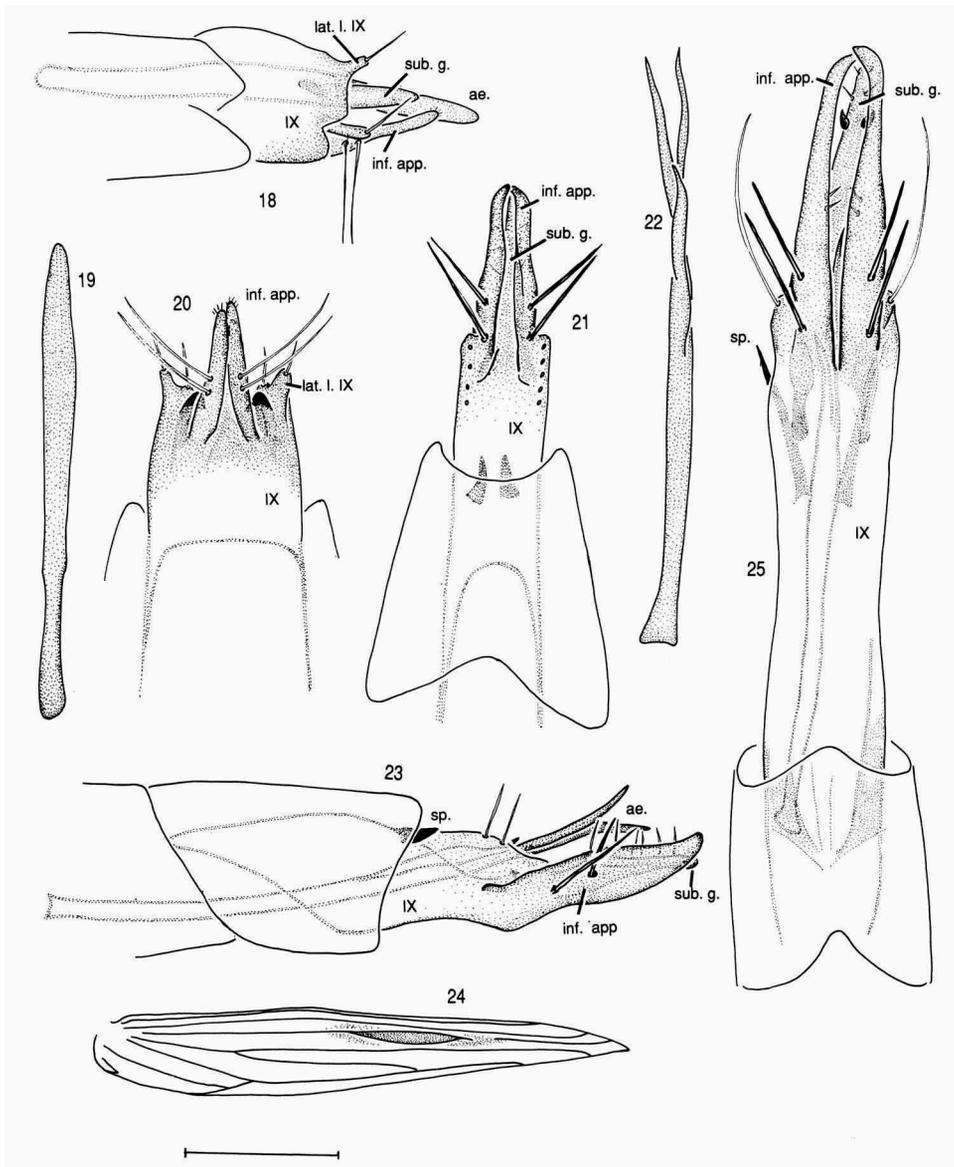
West Malaysia			
Stactobiini	<i>Chrysotrichia</i>	<i>ankup</i> spec. nov. <i>matakail</i> spec. nov. <i>monga</i> Olah <i>pisau</i> spec. nov. <i>tanduk</i> spec. nov.	<i>kait</i> spec. nov. <i>kipas</i> spec. nov. <i>paku</i> spec. nov. <i>pucat</i> spec. nov. <i>gerutu</i> spec. nov. <i>takuk</i> spec. nov. <i>tonyi</i> spec. nov.
	<i>Plethus</i>	<i>bishopi</i> spec. nov. <i>segitiga</i> spec. nov.	Orthotrichiini
	<i>Scelotrichia</i>	<i>dasar</i> spec. nov. <i>jari</i> spec. nov. <i>lampai</i> spec. nov. <i>rienki</i> spec. nov.	<i>Orthotrichia</i>
	<i>Stactobia</i>	<i>kudung</i> spec. nov. <i>rahang</i> spec. nov.	<i>jani</i> spec. nov. <i>newi</i> spec. nov. <i>runching</i> spec. nov. <i>sinit</i> spec. nov.
			Sarawak
			Stactobiini
			<i>Chrysotrichia</i>
			<i>menara</i> spec. nov. <i>paruparu</i> spec. nov.
Stactobiini	<i>Chrysotrichia</i>	<i>bintik</i> spec. nov. <i>gajah</i> spec. nov. <i>ganjil</i> spec. nov. <i>hermani</i> spec. nov. <i>tajam</i> spec. nov.	<i>Scelotrichia</i>
	<i>Scelotrichia</i>	<i>bilah</i> spec. nov. <i>buluhalus</i> spec. nov. <i>ceesi</i> spec. nov. <i>gerigi</i> spec. nov. <i>jari</i> spec. nov.	<i>Stactobia</i>
			Orthotrichiini
			<i>Orthotrichia</i>
			<i>lebar</i> spec. nov.
			Brunei
			Stactobiini
			<i>Chrysotrichia</i>
			<i>bintik</i> spec. nov. <i>coodei</i> spec. nov.
			<i>Scelotrichia</i>
			<i>buluhalus</i> spec. nov.



Figs 1-3, *Chrysotrichia bintik* spec. nov. 1, wings; 2, 3 male genitalia, lateral and ventral views. Figs 4, 5, *Chrysotrichia tajam* spec. nov., male genitalia, ventral and lateral views. Figs 6, 7, *Chrysotrichia angkup* spec. nov., male genitalia, ventral and lateral views. Fig. 8, *Chrysotrichia monga* Olah, male genitalia, ventral view. Abbreviations: ae, aedeagus; inf. app., inferior appendages; sub. g., subgenital plate; IX, abdominal segment nine. Scale bar = 0.5 mm.



**Figs 9, 10, *Chrysotrichia gajah* spec. nov. 9, male genitalia, ventral view; 10, aedeagus. Fig. 11, *Chrysotrichia paruparu* spec. nov., male genitalia, ventral view. Figs 12-14, *Chrysotrichia ganjil* spec. nov. 12, male genitalia, ventral view; 13, aedeagus; 14, male genitalia, dorsal view. Figs 15, 16, *Chrysotrichia menara* spec. nov., male genitalia, ventral and lateral views. Fig. 17, *Chrysotrichia tanduk* spec. nov., male genitalia, ventral view. Abbreviations: ae, aedeagus; d. pl., dorsal plate; inf. app., inferior appendages; sp., spine; sub. g., subgenital plate; IX, abdominal segment nine.**



Figs 18-20, *Chrysotrichia pisau* spec. nov. 18, male genitalia, lateral view; 19, aedeagus; 20, male genitalia, ventral view. Figs 21-24, *Chrysotrichia hermani* spec. nov. 21, male genitalia, ventral view; 22, aedeagus; 23, male genitalia, lateral view; 24, forewing. Fig. 25, *Chrysotrichia coodei* spec. nov., male genitalia, ventral view. Abbreviations: ae, aedeagus; inf. app., inferior appendages; lat. l. IX, lateral lobes of abdominal segment IX; sp., spine; sub. g., subgenital plate; IX, abdominal segment nine. Scale bar = 0.5 mm.

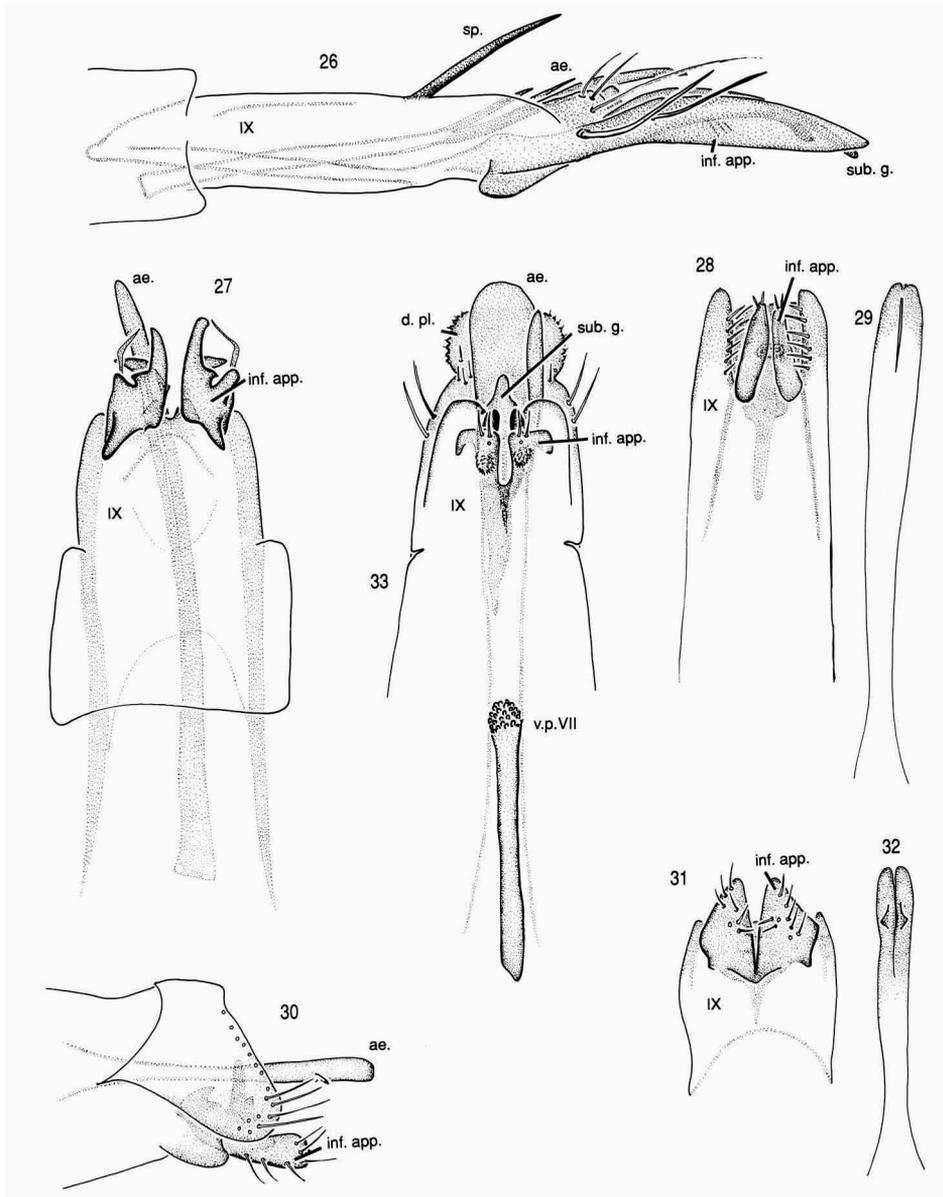
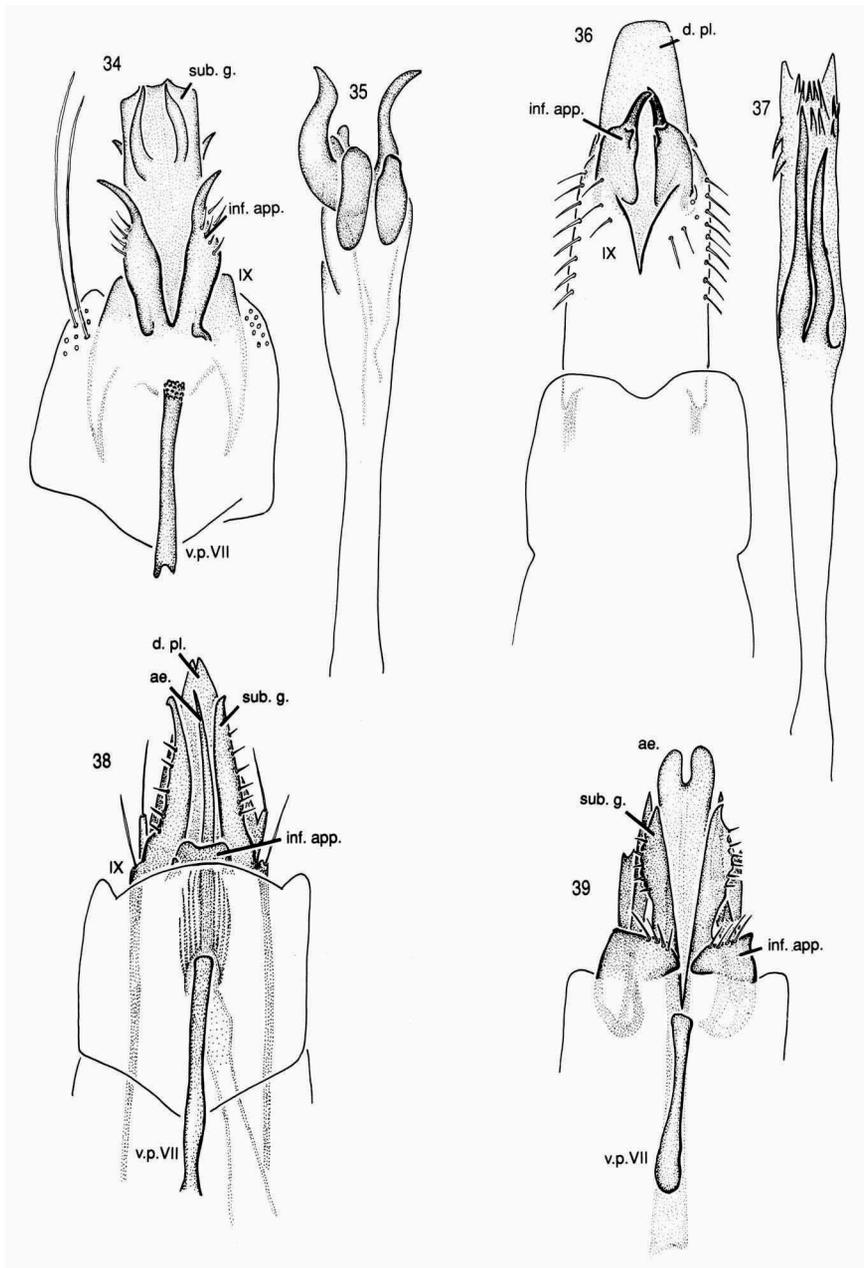
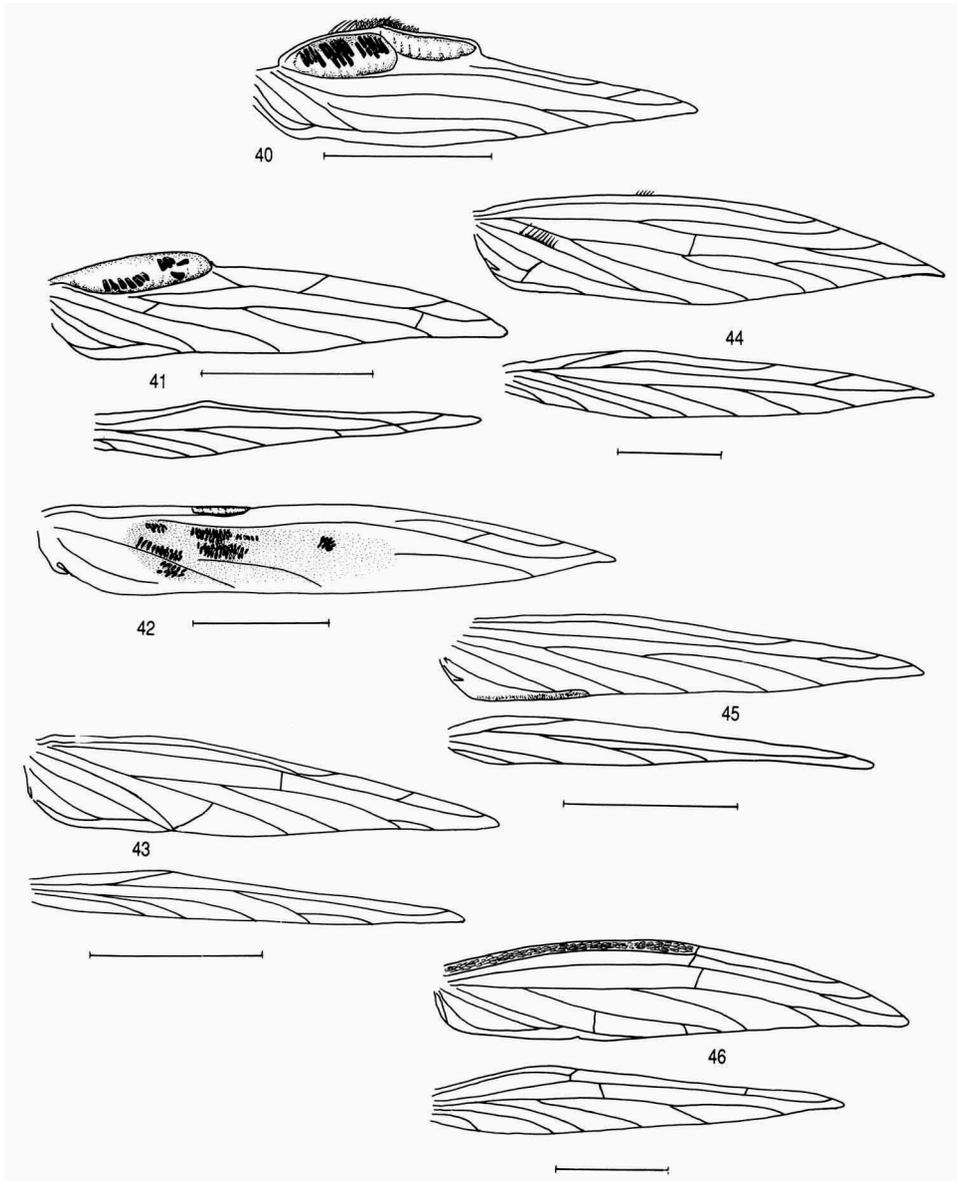


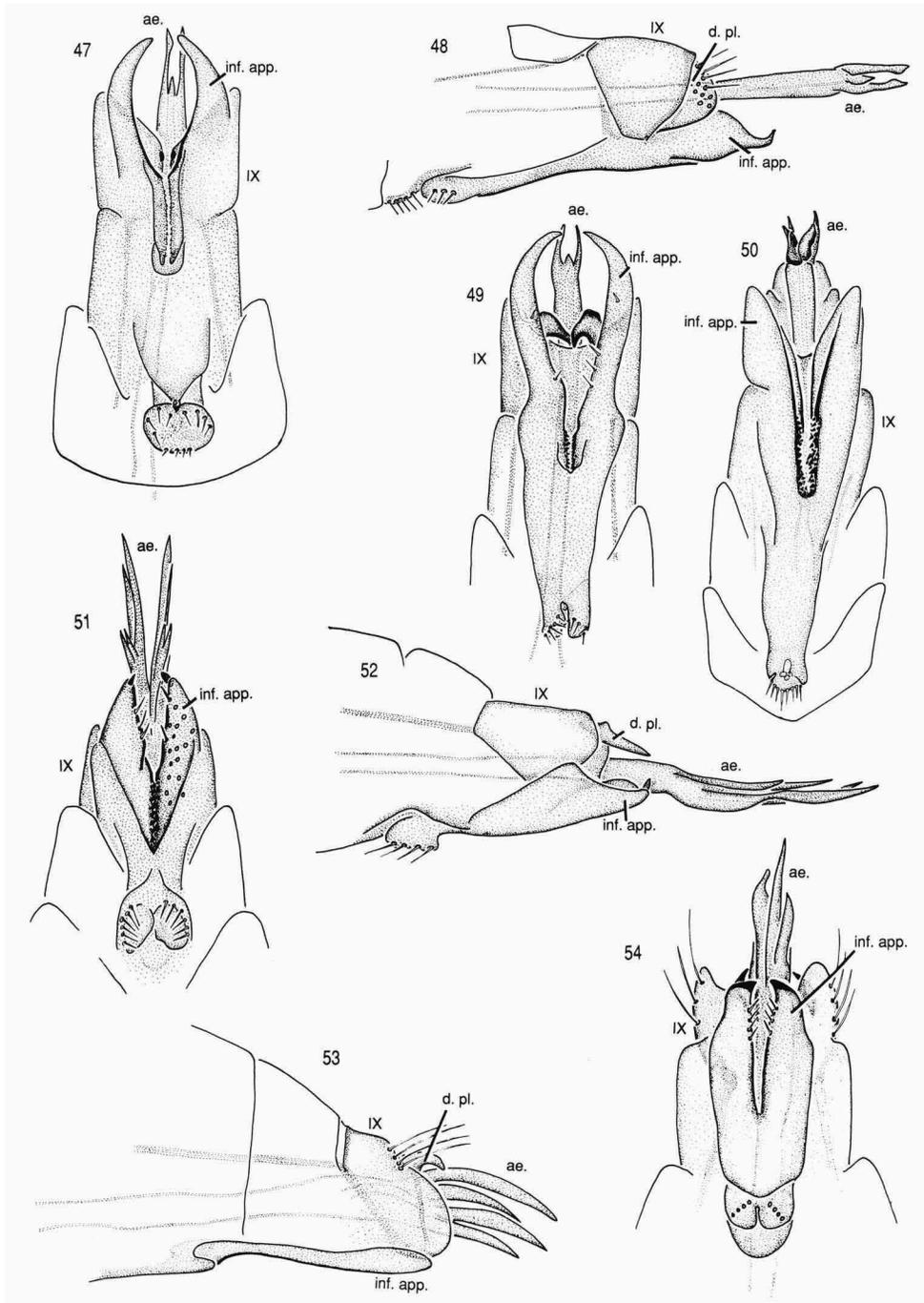
Fig. 26, *Chrysotrichia coodei* spec. nov., male genitalia, lateral view. Fig. 27, *Chrysotrichia matakail* spec. nov., male genitalia, ventral view. Figs 28, 29, *Plethus bishopi* spec. nov., 28, male genitalia, ventral view; 29, aedeagus. Figs 30-32, *Plethus segitiga* spec. nov. 30, 31, male genitalia, lateral and ventral views; 32, aedeagus. Fig. 33, *Stactobia kudung* spec. nov., male genitalia, ventral view. Abbreviations: ae, aedeagus; d. pl., dorsal plate; inf. app., inferior appendages; sp., spine; sub. g., subgenital plate; v. pr. VII, ventral process of abdominal segment seven; IX, abdominal segment nine.



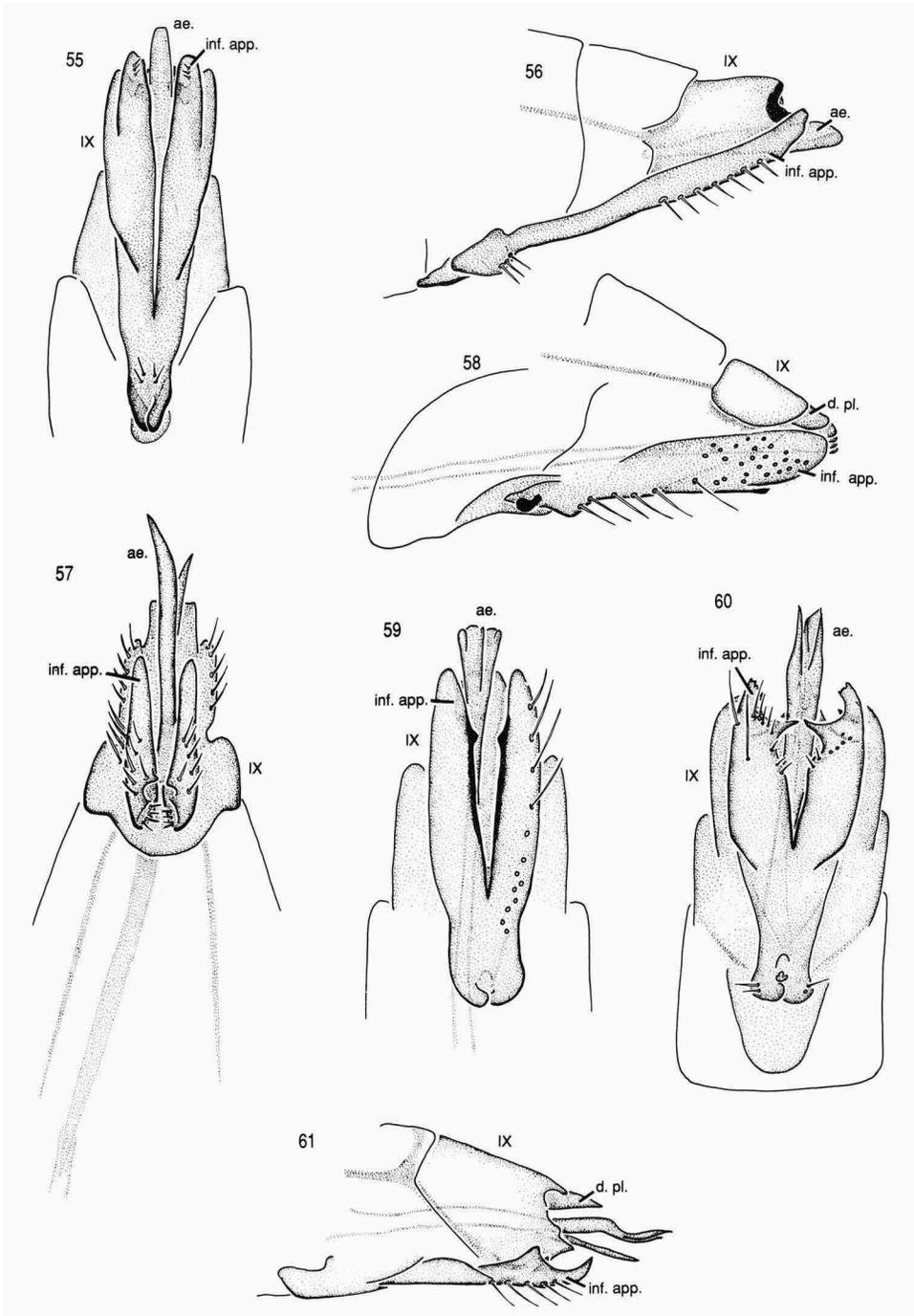
Figs 34, 35, *Stactobia tonyi* spec. nov. 34, male genitalia, ventral view; 35, aedeagus. Figs 36, 37, *Stactobia gerutu* spec. nov. 36, male genitalia, ventral view; 36, aedeagus. Fig. 38, *Stactobia rahang* spec. nov., male genitalia, ventral view. Fig. 39, *Stactobia taduk* spec. nov., male genitalia, ventral view. Abbreviations as for figs 26-33.



Figs 40-46, *Scelotrichia* species, wings. 40, *S. rumput* spec. nov.; 41, *S. jari* spec. nov.; 42, *S. pucat* spec. nov.; 43, *S. dasar* spec. nov.; 44, *S. bubuhalus* spec. nov.; 45, *S. kipas* spec. nov.; 46, *S. ceesi* spec. nov. Scale bars = 0.5 mm.



Figs 47, 48, *Scelotrichia pucat* spec. nov., male genitalia, ventral and dorsal views. Fig. 49, *Scelotrichia kait* spec. nov., male genitalia, ventral view. Fig. 50, *Scelotrichia rienki* spec. nov., male genitalia, ventral view. Figs 51, 52, *Scelotrichia rumput* spec. nov., male genitalia, ventral and lateral views. Figs 53, 54, *Scelotrichia bilah* spec. nov., male genitalia, lateral and ventral views. Abbreviations as for figs 9-17.



Figs 55, 56, *Scelotrichia buluhalus* spec. nov., male genitalia, ventral and lateral views. Fig. 57, *Scelotrichia dasar* spec. nov., male genitalia, ventral view. Figs 58, 59, *Scelotrichia kipas* spec. nov., male genitalia, lateral and ventral views. Figs 60, 61, *Scelotrichia cesi* spec. nov., male genitalia, ventral and lateral views. Abbreviations as for figs 9-17.

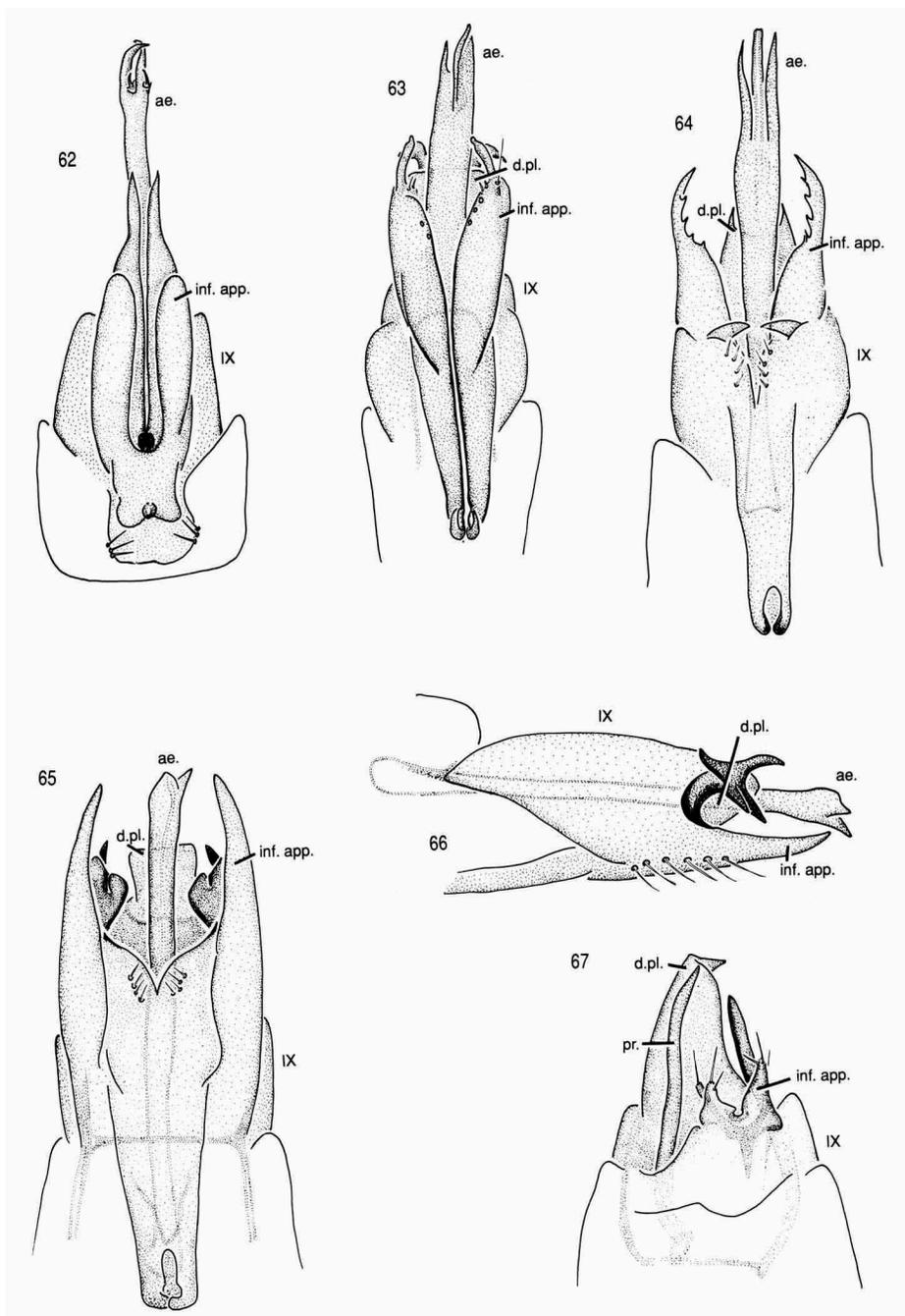
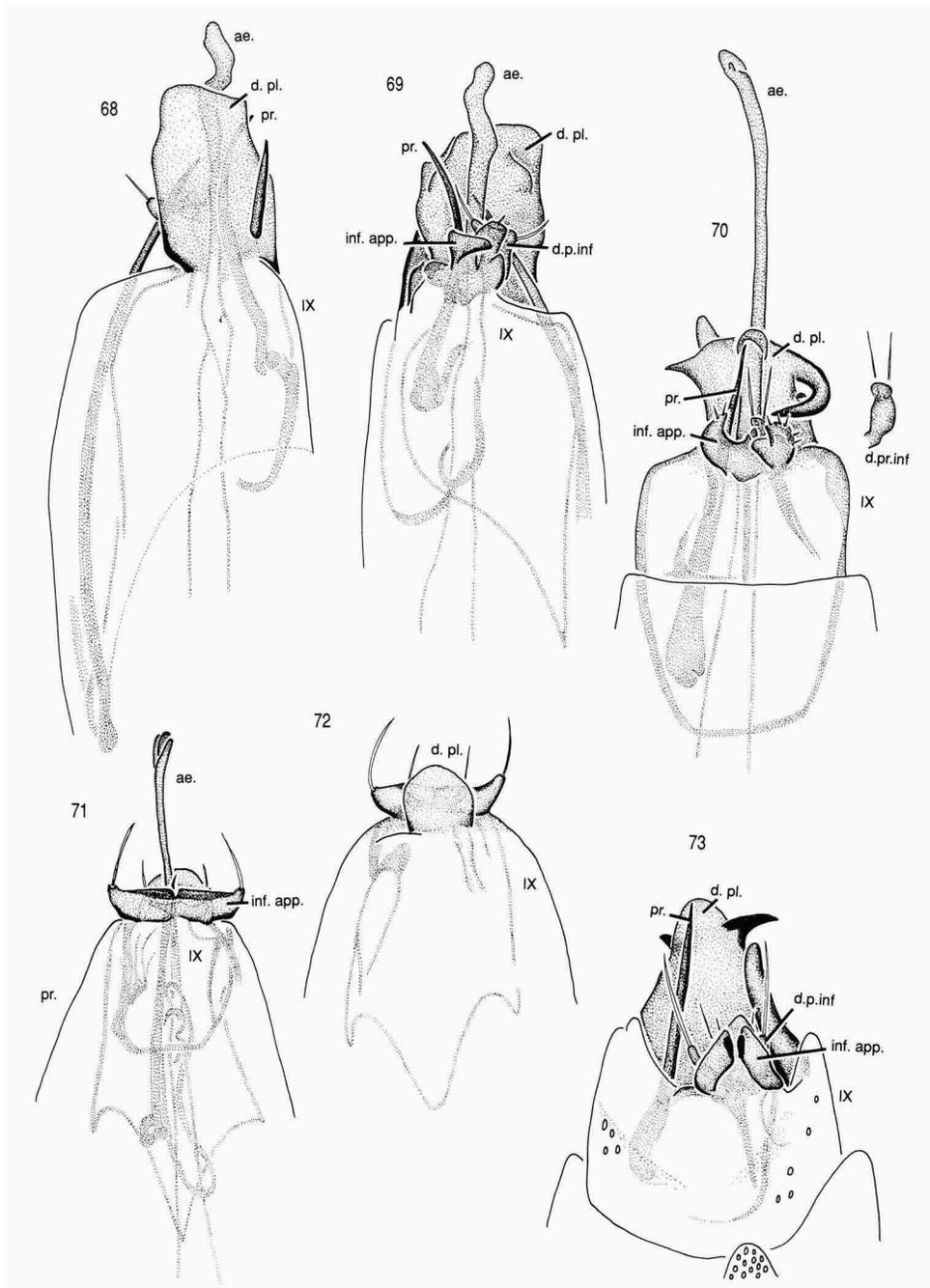
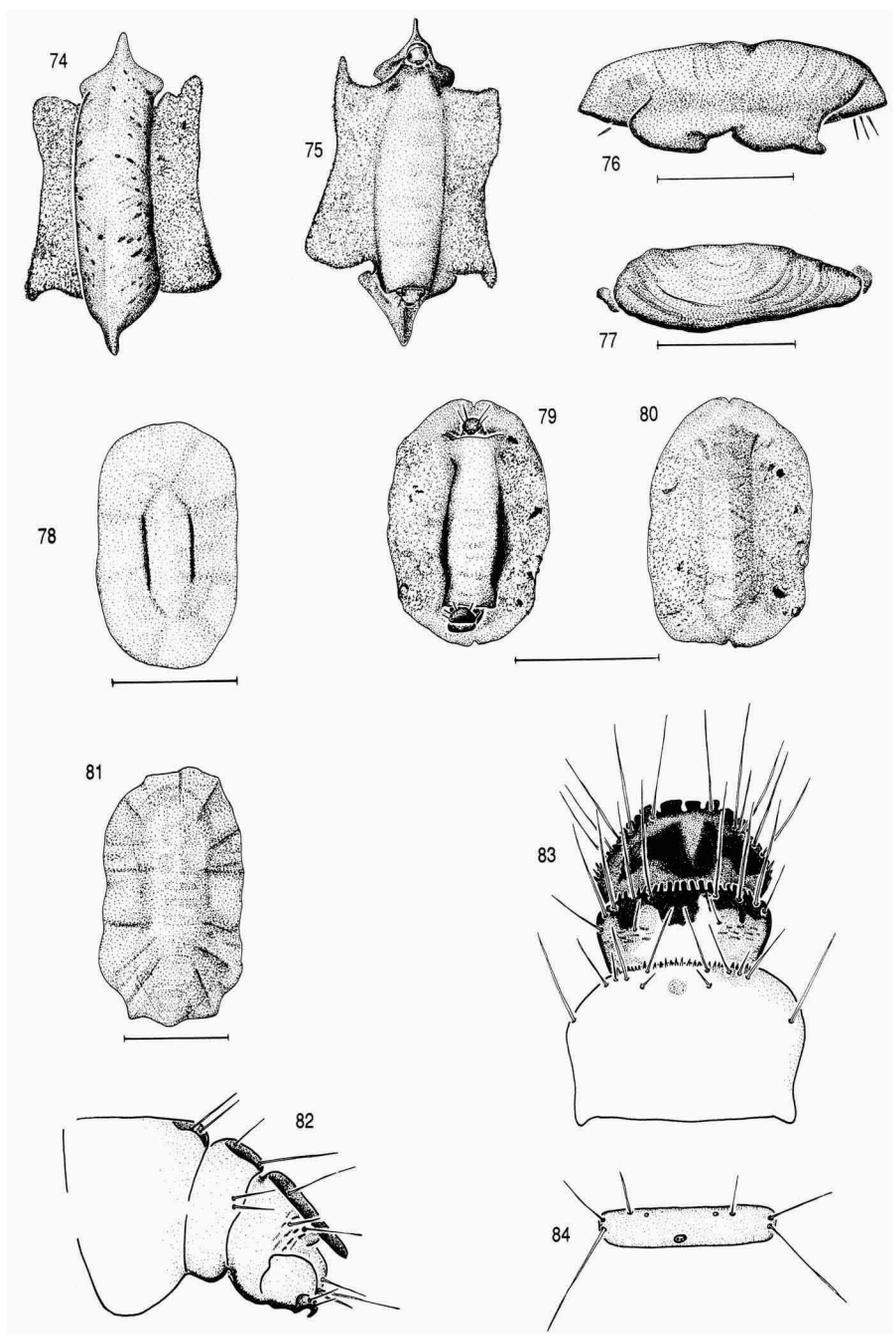


Fig. 62, *Scelotrichia lampai* spec. nov., male genitalia, ventral view. Fig. 63, *Scelotrichia jari* spec. nov., male genitalia, ventral view. Fig. 64, *Scelotrichia gerigi* spec. nov., male genitalia, ventral view. Figs 65, 66, *Scelotrichia paku* spec. nov., male genitalia, ventral and lateral views. Fig. 67, *Orthotrichia runching* spec. nov., male genitalia, ventral view. Abbreviations: ae, aedeagus; d. pl., dorsal plate; inf. app., inferior appendages; pr., paramere; sub. g., subgenital plate; IX, abdominal segment nine.



Figs 68, 69, *Orthotrichia newi* spec. nov., male genitalia, dorsal and ventral views. Fig. 70, *Orthotrichia jani* spec. nov., male genitalia, ventral view. Figs 71, 72, *Orthotrichia kudung* spec. nov., male genitalia, ventral and lateral views. Fig. 73, *Orthotrichia sinit* spec. nov., male genitalia, ventral view. Abbreviations: ae, aedeagus; d. pl., dorsal plate; d. pr. inf., dorsal process of inferior appendages; inf. app., inferior appendages; pr., paramere; sub. g., subgenital plate; IX, abdominal segment.



Figs 74-76, *Plethus bishopi* spec. nov., larval case, dorsal, ventral and lateral views. Fig. 77, *Chrysotrichia gajah* spec. nov., pupal case. Fig. 78, *Plethus segitiga* spec. nov., pupal case. Figs 79, 80, *Stactobia rahang* spec. nov., larval case, ventral and dorsal views. Fig. 81, *Stactobia takuk* spec. nov., larval case, dorsal view. Figs 82, 83, *Stactobia rahang* spec. nov., posterior larval abdomen, lateral and dorsal views. Fig. 84, *Stactobia takuk* spec. nov., larval tergite. Scale bars = 1 mm.