

NEW SPECIES AND NEW RECORDS OF *ECNOMUS* MCLACHLAN
(TRICHOPTERA: ECNOMIDAE) FROM INDONESIA

DAVID I. CARTWRIGHT

Biology Laboratory, Werribee Treatment Complex, Private Bag 10, Werribee,
Victoria 3030, Australia

Abstract

Cartwright, D.I., 1994. New species and new records of *Ecnomus* McLachlan (Trichoptera: Ecnomidae) from Indonesia. *Memoirs of the Museum of Victoria* 54: 447–459.

Descriptions and keys are provided for males of ten species of *Ecnomus* including five new species from Kalimantan and three from Sulawesi. *Ecnomus forcipatus* Mosely, 1932 and *E. puntung* Cartwright, 1992 are also recorded from South Sulawesi. Females of eight species are figured but only one, *E. puntung*, is associated with certainty with a male. The remainder are designated *Ecnomus* species E to K. *Ecnomus retusus* sp. nov. and *E. gapit* sp. nov. have fork 1 absent in the anterior wing in males; females of *Ecnomus* sp. K also have fork 1 absent. This is the first known documentation of aberrant wing venation in the genus.

Introduction

Twelve species of *Ecnomus* have been described previously from the Indonesian islands of Sumatra, Java and Sulawesi (Mosely, 1932; Ulmer, 1951; Cartwright, 1992). The genus has not been recorded previously from Kalimantan (Indonesian Borneo), but one species has been described from the adjacent Malaysian state, Sarawak (Kimmins, 1955). The biogeography and phylogeny of the genus *Ecnomus* in the south-eastern Asian-Australian region will be considered at a later date when more species have been described, especially from other areas of Indonesia and from Papua New Guinea.

Species are best identified by differences in male and female genitalia, which usually requires clearing the abdomen in potassium hydroxide. Males and females can seldom be associated positively unless collected in copula or bred through from larvae.

Depositories for specimens are abbreviated as follows:

The Natural History Museum, London (BMNH), Museum of Victoria, Melbourne (NMV), National Natuurhistorisch Museum, Leiden (RMNH), Zoologisch Museum, Universiteit van Amsterdam (ZMA). CT- numbers refer to the notebook of the author.

Ecnomus McLachlan

Ecnomus McLachlan, 1864: 30.

Type species. *Philopotamus tenellus* Rambur, 1842 (by original designation).

Diagnosis (revised after Neboiss, 1977). Maxillary palpi with segment 1 short, segments 2, 3 and 4 successively slightly longer than preceding segment, segment 5 about as long as all other segments together. Mesoscutum and scutellum each with a pair of rounded warts. Anterior wings with R1 forked at apex, apical forks 1 (absent in two species), 2, 3, 4 and 5 present, fork 1 short; discoidal, median and thyridial cells present. Posterior wings slightly narrower than anterior wings; forks 2 and 5 present; discoidal cell absent. Tibial spurs 3:4:4.

Remarks. *Ecnomus* females usually have short abdominal segments 9 and 10 but there is at least one exception: *Ecnomus* sp. A from North Sulawesi (Cartwright, 1992).

Checklist of Indonesian species of *Ecnomus*

Ecnomus asciatus Ulmer, 1951
E. bengkak sp. nov.
E. buntak Cartwright, 1992
E. forcipatus Mosely, 1932
E. furcatus Ulmer, 1951
E. gada sp. nov.
E. gapit sp. nov.
E. kelung sp. nov.
E. obtusus Ulmer, 1951
E. pseudotenellus Ulmer, 1951
E. puntung Cartwright, 1992
E. retusus sp. nov.
E. robustior Ulmer, 1951
E. seluk sp. nov.
E. serratus Ulmer, 1951

E. singkarakensis Ulmer, 1951*E. tang* Cartwright, 1992*E. tegap* sp. nov.*E. tipis* Cartwright, 1992*E. tjurupensis* Ulmer, 1951*E. yuleae* sp. nov.

**Key to males of species of *Ecnomus*
from Sulawesi and Kalimantan**

1. Anterior wing with fork 1 absent (Fig. 1) 2
- Anterior wing with fork 1 present 3
- 2(1). Inferior appendages with subapical notch
(Figs 2, 3) *E. retusus* sp. nov.
- Inferior appendages without subapical notch (Figs 4, 5)
..... *E. gapit* sp. nov.
- 3(1). Superior appendages in lateral view very short, length about same as
width, not dilated apically (Cartwright, 1992; Fig. 1)
..... *E. buntak* Cartwright
- Superior appendages in lateral view long, length greater than width,
usually dilated apically (Figs 6, 8) 4
- 4(3). Superior appendages in lateral view with length about $1.3 \times$ width, trunc-
ate apically (Fig. 6) *E. puntung* Cartwright
- Superior appendages in lateral view with length greater than twice width,
rounded apically (Figs 8, 10) 5
- 5(4). Inferior appendages in ventral view short, straight and robust, length
about $3 \times$ width (Fig. 9) *E. tegap* sp. nov.
- Inferior appendages in ventral view long, slender in apical half, usually
with apices inflexed, length greater than $3.5 \times$ width (Figs 11, 13) ...
..... 6
- 6(5). Superior appendages with ventrally directed projection on basiventral
margin (Fig. 10) *E. bengkok* sp. nov.
- Superior appendages without ventrally directed projection on basiventral
margin (Figs 12) 7
- 7(6). Superior appendages in lateral view robust, broadbased, length about 2.5
 \times width (Fig. 12) 8
- Superior appendages in lateral view long, slender, dilated apically, length
greater than $3 \times$ width (Figs 16, 18) 9
- 8(7). Inferior appendages in ventral view dilated apically (Fig. 13)
..... *E. gada* sp. nov.
- Inferior appendages in ventral view tapered apically (Fig. 15)
..... *E. yuleae* sp. nov.
- 9(7). Inferior appendages in lateral view with mesal projection protruding
above dorsal margin; parameres simple (Figs 16, 18) 10
- Inferior appendages in lateral view without mesal projection protruding
above dorsal margin; parameres branched (Fig. 20) 11
- 10(9). Inferior appendages broadest in basal half, slender and inflexed strongly
in distal half (Figs 16, 17) *E. forcipatus* Mosely
- Inferior appendages similar width along whole length, weakly inflexed in
distal half (Figs 18, 19) *E. kehung* sp. nov.

- 11(9). Inferior appendages in lateral view slender, tapering slightly apically (Cartwright, 1992; Fig. 7) *E. tipis* Cartwright
- Inferior appendages in lateral view robust, broadest near middle, tapering slightly apically (Fig. 20) 12
- 12(11). Inferior appendages in ventral view with digitiform mesal projection (Cartwright, 1992; Fig. 6) *E. tang* Cartwright
- Inferior appendages in ventral view without digitiform mesal projection (Fig. 21). *E. seluk* sp. nov.

Ecnomus retusus sp. nov.

Figures 1–3

Type material. Holotype male, East Kalimantan, Mahakam River, 250 km W of Samarinda, 10 Mar 1991, C. Yule (NMV T-14304).

Paratypes: 2 males, same data as holotype (genitalia prep. CT-193 figured, NMV); 1 male, Long Hubungan, Mahakam River, 250 km W of Samarinda, 10 Mar 1991, C. Yule (NMV); 1 male, Camp Prampus, Kelian River trib. of Mahakam River, 250 km W of Samarinda, light trap, 31 Mar 1991, C. Yule (NMV).

Description. Male. Wings fawn to pale brown with paler irrorations, venation characteristic of genus except fork 1 absent on anterior wing (Fig. 1). Ventrolateral processes of segment 10 very long, slender with 3 small setae apically. Superior appendages in lateral view long and slender, length about $4 \times$ width, narrowed in the middle (Fig. 2), with field of mesally-directed spiny setae apically; inferior appendages in ventral view long and slender, length about $4 \times$ width, with a small incision subapically (Fig. 3), in lateral view long and straight, length about $3.5 \times$ width; in lateral view parameres robust, dilated or bulbous apically (Fig. 2); phallus with single spine subapically (Figs 2, 3).

Female unknown.

Length of forewing: male 3.3–3.7 mm.

Etymology. Latin, notched at the apex, referring to the shape of the inferior appendages.

Distribution. East Kalimantan (Indonesia).

Remarks. *Ecnomus retusus* and *E. gapit* sp. nov. are the only known species of *Ecnomus* lacking fork 1 in the anterior wing. *Ecnomus retusus* has a distinctive subapical notch on the inferior appendages. The phallus has a single large spine embedded subapically, which has also been recorded in the Australian species *E. wellsae* Cartwright.

Ecnomus gapit sp. nov.

Figures 4, 5

Type material. Holotype male, East Kalimantan, Kelian River trib. of Mahakam River, 250 km W of Samarinda, light trap, 4 Sep 1992, C. Yule (NMV T-14309; specimen CT-216 figured).

Description. Male. Wings fawn with some paler irrorations, venation characteristic of genus except fork 1 absent on anterior wing as for *E. retusus*. Ventrolateral processes of segment 10 very short, rounded with 3 short setae apically. Superior appendages in lateral view robust, length about twice width, narrowed near middle (Fig. 4), apices with dense field of mesally directed spiny setae; inferior appendages in ventral view slender, broadest near base, apices inflexed (Fig. 5), and dorsoventrally flattened, in lateral view straight, slender, tapering apically; parameres in lateral view straight and slender; phallus with acute apex (Fig. 4).

Female unknown.

Length of forewing: male 3.9 mm.

Etymology. Indonesian, meaning tweezers or pineers, referring to the shape of the inferior appendages.

Distribution. East Kalimantan (Indonesia).

Remarks. *Ecnomus gapit* is known from only one male specimen which, like *E. retusus*, lacks fork 1 in the anterior wings. It can be distinguished by the dorsoventrally flattened apices on the inferior appendages.

Ecnomus puntung Cartwright

Figures 6, 7, 22, 23

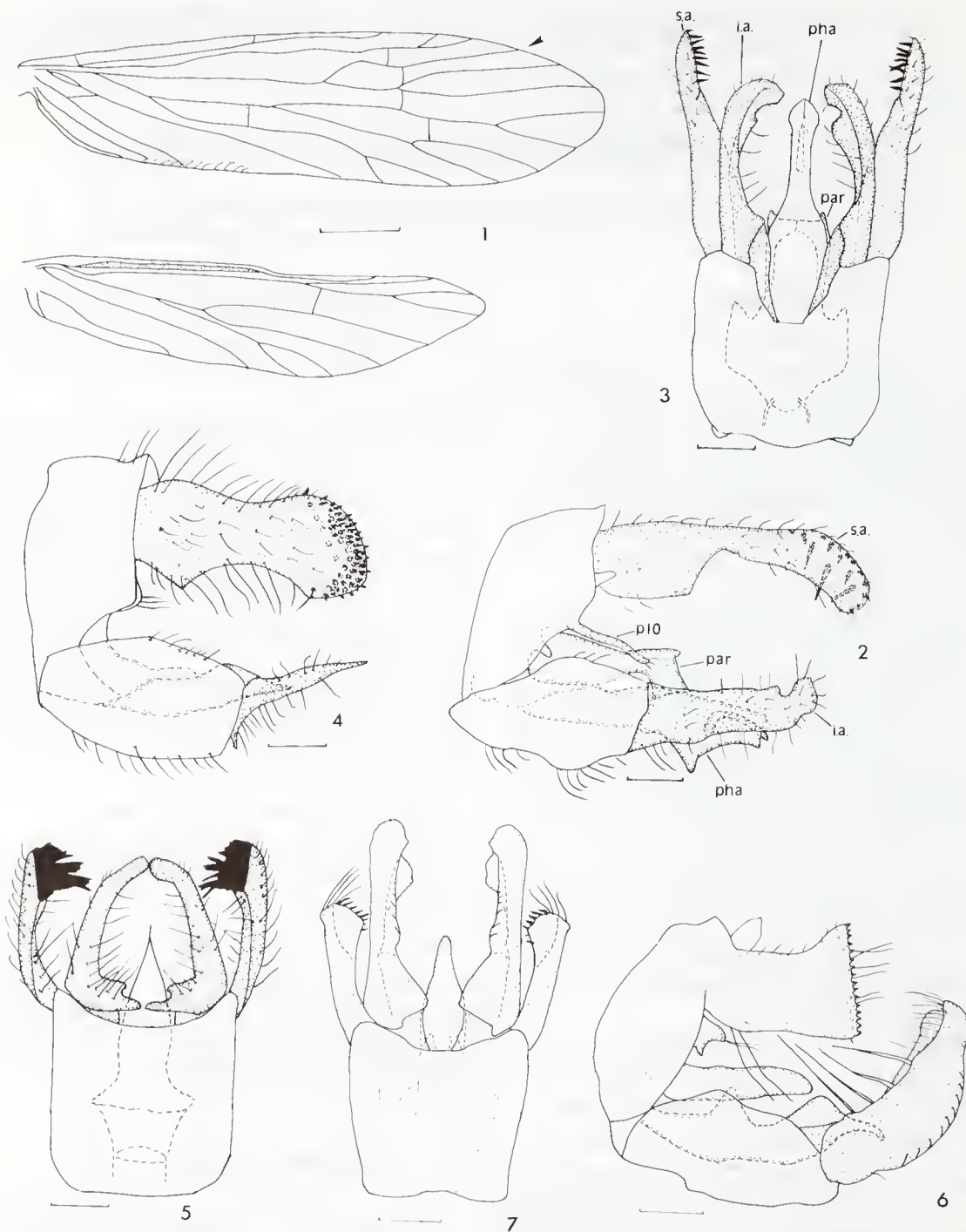
Ecnomus puntung Cartwright 1992: 102, figs 3–4.

Ecnomus sp. C (female) 1992: 107, figs 13–14.

Material examined. Holotype male, Sulawesi Utara, Dumoga Bone National Park, Edwards Camp near Tumpah River, 650 m, 00°35' 123°51'E, MV light, 22 May 1985, A. Wells (NMV T-10727).

Paratypes. 20 males, same data as holotype (NMV, RMNH, ZMA).

Additional material. Sulawesi Tenggara, many males.



Figures 1–7: *Ecnomus* spp. Males. 1–3, *Ecnomus retusus* sp. nov.; 1, wings; 2, genitalia, lateral view; 3, genitalia, ventral view; 4, 5, *Ecnomus gapit* sp. nov., genitalia; 4, lateral view; 5, ventral view; 6, 7, *Ecnomus puntung* Cartwright, genitalia; 6, lateral view; 7, ventral view. Abbreviation: i.a., inferior appendages; par, parameres; pha, phallus; p10, ventrolateral processes of segment 10; s.a., superior appendages. Scale lines: 0.5 mm (Fig. 1), 0.1 mm (Figs 2–7).

females, many sites, Oct-Nov 1989, R. de Jong and J. Huisman (RMNH). List of localities available from author.

Description (revised after Cartwright, 1992). Wings fawn to pale brown with paler irroration.

Male. Ventrolateral processes of segment 10 short, bilobed with 3 short setae apically. Superior appendages in lateral view short and broad, length about $1.3 \times$ width, apices dilated and truncate (Fig. 6), with field of mesally-directed spiny setae; inferior appendages in ventral view length about $3 \times$ width, broadest near base, with broad mesal lobe dorsally (Fig. 7), in lateral view length about $3 \times$ width, broadest in middle, with several long hair-like setae dorsally (Fig. 6) and series of grooves ventrally (Figs 6, 7); parameres straight and robust; phallus extended into long, slender apical projection (Fig. 6).

Female. Ventral plates with shallow concavity near mesal margin in middle, length about $1.5 \times$ width, apices smoothly rounded (Figs 22, 23).

Length of forewing: male 3.7–4.4 mm; female 3.5–4.5 mm.

Distribution. North and South Sulawesi (Indonesia).

Remarks. *Ecnomus puntung* is the commonest species of *Ecnomus* collected from Sulawesi. The male can be readily distinguished by the truncate superior appendages. The female has a distinctive concavity on each ventral plate.

Ecnomus tegap sp. nov.

Figures 8, 9

Type material. Holotype male, East Kalimantan, Mahakam River, 250 km W of Samarinda, 10 Mar 1991, C. Yule (NMV T-14310).

Paratypes: male, same data as holotype (genitalia prep. CT-194 figured; NMV); 2 males, Long Hubungan, Mahakam River, 250 km W of Samarinda, 10 Mar 1991, C. Yule (NMV).

Description. Male. Wings fawn with some paler irroration, venation characteristic of genus. Ventrolateral processes of segment 10 long, slender with 3 small setae apically. Superior appendages in lateral view long and robust, length about twice width, tapering slightly apically, with small digitiform projection mesally (Fig. 8), field of mesally-directed spiny setae apically; inferior appendages in ventral view straight, robust, subrectangular, length about $3 \times$ width (Fig. 9), in lateral view robust, length about twice width, with broad projection apically; para-

meres absent; phallus with small digitiform projection dorsally (Fig. 8).

Female unknown.

Length of forewing: male 3.4–3.7 mm.

Etymology. Indonesian, *tegap* meaning robust, referring to the shape of the inferior appendages.

Distribution. East Kalimantan (Indonesia).

Remarks. *Ecnomus tegap* can be distinguished from other Indonesian species by the robust appearance of both the superior and inferior appendages.

Ecnomus bengkok sp. nov.

Figures 10, 11

Type material. Holotype male, Sulawesi Tenggara, N slope Gunung Watuwila, 250 m, light, 19 Oct. 1989, R. de Jong and J. Huisman, (RMNH JS 8918). Mokowu camp, Sg. Mokowu (genitalia prep. CT-206 figured, RMNH).

Description. Male. Wings pale fawn. Ventrolateral processes of segment 10 straight with 3 small setae apically. Superior appendages in lateral view long, length about $3 \times$ width, a digitiform process present on ventral margin near base (Fig. 10), with a field of mesally directed spiny setae apically; inferior appendages in ventral view long and slender, length about $6 \times$ width, apices slightly inflexed and with bifid appearance especially in apical view (Fig. 11), in lateral view long and straight, length about $4 \times$ width; in lateral view parameres simple, straight and robust; phallus with upper apical angle extended into a slender point (Fig. 10).

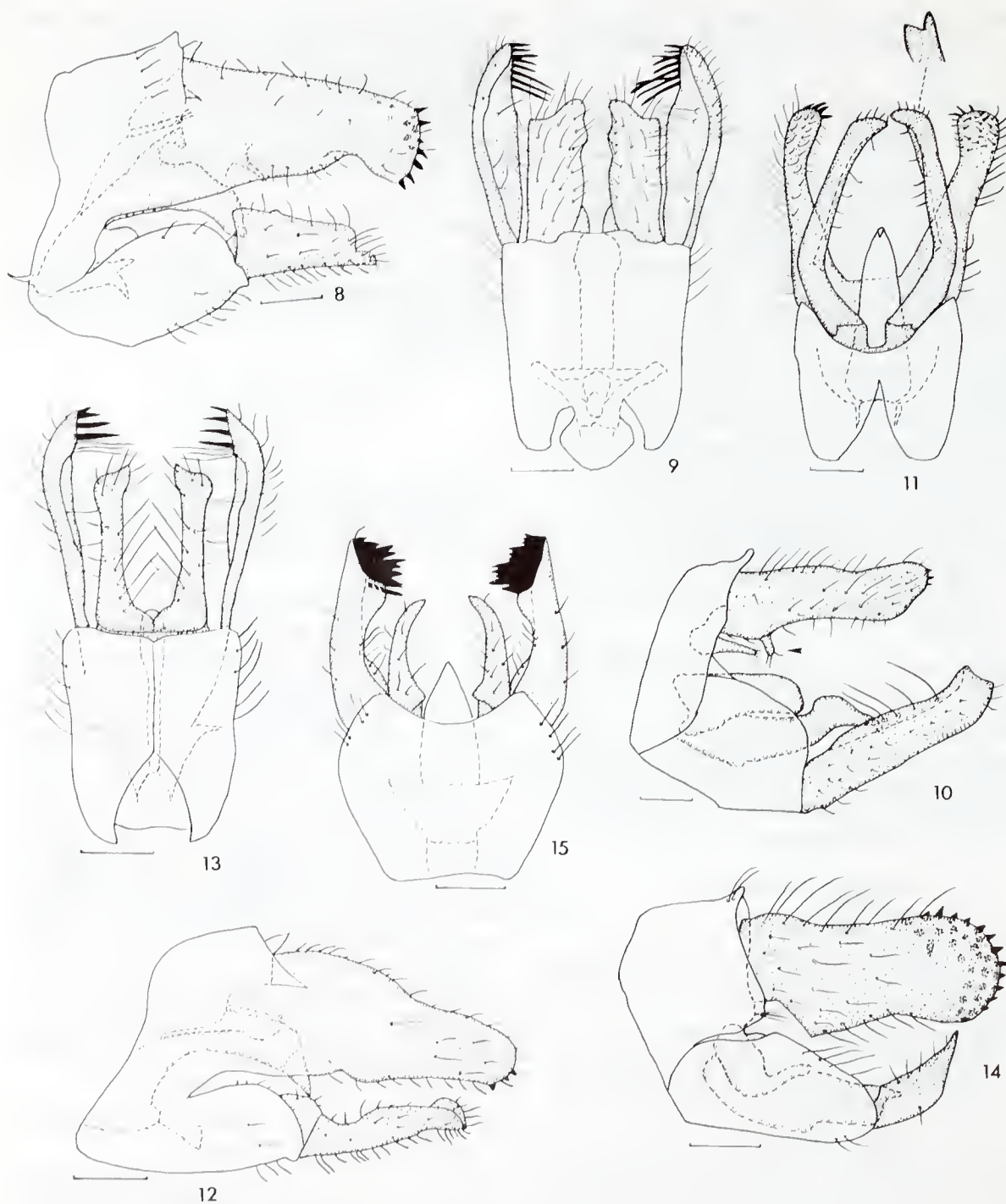
Female unknown.

Length of forewing: male 3.8 mm.

Etymology. Indonesian, *bengkok* meaning somewhat bent or crooked, referring to the shape of the inferior appendages.

Distribution. South Sulawesi (Indonesia), known from type locality only.

Remarks. The single male specimen resembles two Australian species, *E. turgidus* Neboiss and *E. dignatus* Cartwright, and *E. penjabi* Schmid from Pakistan, in having a ventral projection on the superior appendages. It can be distinguished from these three species by the lack of a small projection on the inferior appendages as in the two Australian species and the robust superior and inferior appendages compared with *E. penjabi*.



Figures 8–15: *Ecnomus* spp. Male, genitalia. 8, 9, *Ecnomus tegap* sp. nov. 8, lateral view; 9, ventral view; 10, 11, *Ecnomus bengkok* sp. nov.; 10, lateral view; 11, ventral view; 12, 13, *Ecnomus gada* sp. nov. 12, lateral view; 13, ventral view; 14, 15, *Ecnomus yuleae* sp. nov.; 14, lateral view; 15, ventral view. All scale lines 0.1 mm.

Ecnomus gada sp. nov.

Figures 12, 13

Type material. Holotype male, East Kalimantan, Long Hubungan, Mahakam River, 250 km W of Samarinda, 10 Mar 1991, C. Yule (NMV T-14314).

Paratypes: 2 males, same data as holotype (NMV); male, East Kalimantan, Mahakam River, 250 km W of Samarinda, 10 Mar 1991, C. Yule (genitalia prep. CT-192 figured, NMV); male, East Kalimantan, Kelian River trib. of Mahakam River, 250 km W of Samarinda, light trap, 30 Jun 1992, C. Yule (NMV).

Description. Male. Wings fawn with some paler irrorations. Ventrolateral processes of segment 10 long, slender, with 3 small setae apically. Superior appendages in lateral view long and robust, length about twice width, tapered slightly apically (Fig. 12), with a field of spiny setae apically; inferior appendages in ventral view long and slender, length about $3.5 \times$ width, slightly dilated subapically (Fig. 13), in lateral view straight and slender, length about $4 \times$ width; parameres absent; phallus slightly swollen distally, tapered apically (Fig. 12).

Female unknown.

Length of forewing: male 2.8–3.1 mm.

Etymology. Indonesian, *gada* meaning club, referring to the shape of the inferior appendages.

Distribution. East Kalimantan (Indonesia).

Remarks. *Ecnomus gada* can be distinguished from other Indonesian species by the robust superior appendages, slender inferior appendages and lack of parameres.

Ecnomus yuleae sp. nov.

Figures 14, 15

Type material. Holotype male, East Kalimantan, Kelian River trib. of Mahakam River, 250 km W of Samarinda, Light trap, 30 Jun 92, C. Yule (NMV T-14319, specimen CT-218 figured).

Description. Male. Wings fawn with some paler irrorations. Vento-lateral processes of segment 10 reduced to inconspicuous swellings with 3 small setae apically. Superior appendages in lateral view robust, length about $2.5 \times$ width (Fig. 14), apices with dense field of mesally directed spiny setae; inferior appendages laterally compressed, in ventral view slender, length about $3.5 \times$ width, broadest near base (Fig. 15), in lateral view broadest near middle, tapered apically; parameres in lateral view short and slender;

phallus with apex extended into a short projection (Fig. 14).

Female unknown.

Length of forewing: male 3.3 mm.

Etymology. The species is named for Cathy Yule (collector).

Distribution. East Kalimantan (Indonesia).

Remarks. The single male specimen can be distinguished from other Indonesian species by the simple, laterally compressed inferior appendages and robust superior appendages.

Ecnomus forcipatus Mosely

Figures 16, 17

Ecnomus forcipatus Mosely 1932: 4, figs 11-13.

Type material. Holotype male, Taiping, Perak, F.M.S., (West Malaysia), Apr 1912, J. Henderson (BMNH).

Paratype male, same data as holotype (BMNH). Types not seen.

Material examined. Sulawesi Tenggara, 1 male, Desa Aopa, 50 m, at light, 27 Oct 1989, R. de Jong and J. Huisman (RMNH JS 8928), (genitalia prep. CT-207 figured, RMNH).

Description (revised after Mosely, 1932). Male. Wings pale fawn. Ventrolateral processes of segment 10 straight, with 3 small setae apically. Superior appendages in lateral view long, straight, length about $4.5 \times$ width (Fig. 16), with a field of mesally directed spiny setae apically; inferior appendages hairy, in ventral view, slender, apices inflexed, broadened into a swelling basally (Fig. 17), in lateral view broad basally, slender and upturned in apical half, with small rounded knob on dorsal margin; parameres robust, dilated and downturned apically; phallus mostly hidden between parameres (Fig. 16).

Female unknown.

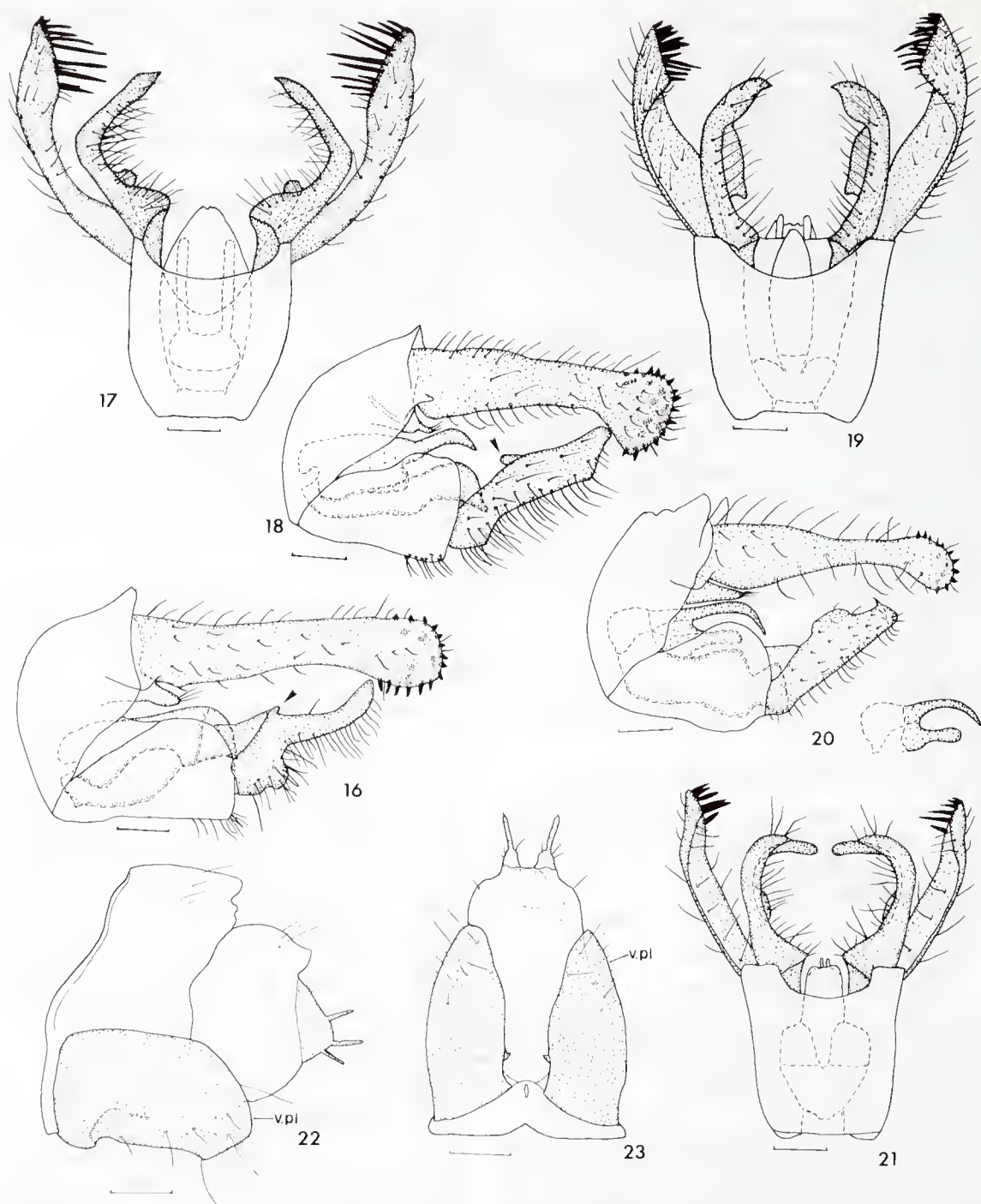
Length of forewing: male 3.8–4.0 mm.

Distribution. South Sulawesi (Indonesia) and Perak (West Malaysia).

Remarks. *Ecnomus forcipatus* was described originally from the Malay Peninsula (Mosely, 1932), and can be distinguished from other Indonesian species by the strongly inflexed apical half of the inferior appendages and the projection on the dorsal margin.

Ecnomus kelung sp. nov.

Figures 18, 19



Figures 16–23: *Ecnomus* spp. genitalia. 16, 17, *Ecnomus forcipatus* Mosely, male; 16, lateral view; 17, ventral view; 18, 19, *Ecnomus kehung* sp. nov., male; 18, lateral view; 19, ventral view; 20, 21, *Ecnomus seluk* sp. nov., male; 20, lateral view and parameres lateral view; 21, ventral view; 22, 23, *Ecnomus puntung* Cartwright, female; 22, lateral view; 23, ventral view. Abbreviation: v. pl., ventral plate. All scale lines 0.1 mm.

Type material. Holotype male, Sulawesi Tenggara, Pulau Kabaena, Batuawu, at light, 11 Nov 1989, R. de Jong and J. Huisman (RMNH JS 8945), Sg. Lebo-komea.

Paratypes: 3 males, same data as holotype (genitalia prep. CT-209 figured, RMNH); 4 males, Sulawesi Tenggara, Moramo Sg., Moramo, 200 m, at light, 16 Nov 1989, R. de Jong and J. Huisman, RMNH JS 8947 (RMNH).

Description. Male. Wings pale fawn. Ventrolateral processes of segment 10 short, broadbased, with 3 small setae apically. Superior appendages in lateral view long and slender, length about $3 \times$ width, apices dilated (Fig. 18), and with field of mesally directed spiny setae; inferior appendages hairy, in ventral view, slender, length about $4 \times$ width, with broad dorsal lobe near middle, apices pointed, slightly inflexed and with spatulate appearance (Fig. 19), in lateral view slightly upturned, length about $4.5 \times$ width, with small dorsal projection near middle; in lateral view parameres long, slender, downcurved apically with ventral lobe; phallus slightly dilated subapically with acute apex (Fig. 18).

Female unknown.

Length of forewing: male 3.2–3.9 mm.

Etymology. Indonesian, *kelung* meaning bent or hollow, referring to the shape of the inferior appendages.

Distribution. South Sulawesi (Indonesia).

Remarks. *Ecnomus kelung* males resemble *E. tang* Cartwright and *E. tipis* Cartwright from N Sulawesi, *E. forcipatus* Mosely from the Malay Peninsula and E Kalimantan, and *E. seluk* sp. nov., in all genitalic structures, but is distinguished by the spatulate shape of the inferior appendages.

Ecnomus seluk sp. nov.

Figures 20, 21

Type material. Holotype male, Sulawesi Tenggara, Moramo, Sg. Moramo, 200 m, at light, 16 Nov 1989, R. de Jong and J. Huisman (RMNH JS 8947).

Paratypes: 3 males, same data as holotype (genitalia prep. CT-201 figured, RMNH).

Description. Male. Wings pale fawn. Ventrolateral processes of segment 10 long, straight, with 3 small setae apically. Superior appendages in lateral view long and slender, length about $4 \times$ width, apices slightly dilated (Fig. 20), and with field of mesally directed spiny setae; inferior appendages hairy, in ventral view slender,

broadest near base, apices inflexed (Fig. 21), in lateral view straight and robust, length about $3 \times$ width, with broad dorsal lobe near middle and small apical projection; in lateral view parameres branched, with dorsal branch long and slender, downcurved apically, ventral branch straight and robust; phallus swollen subapically (Fig. 20), with two small processes apically (Fig. 21).

Female unknown.

Length of forewing: male 3.0–3.4 mm.

Etymology. Indonesian, *seluk* meaning curve or bend, referring to the shape of the inferior appendages.

Distribution. South Sulawesi (Indonesia).

Remarks. *Ecnomus seluk* males resemble *E. tang* Cartwright, *E. tipis* Cartwright, *E. kelung* and *E. forcipatus* Mosely in all genitalic structures, but can be separated by the shape of the dorsal lobe on the inferior appendages and the form of the parameres.

Ecnomus sp. E (female)

Figures 24, 25

Material examined. Sulawesi Tenggara, 9 females, Pulau Kabaena, Batuawu, at light, 11 Nov 1989, R. de Jong and J. Huisman (RMNH JS 8945), Sg. Lebo-komea (genitalia prep. CT-208 figured; RMNH); 2 females, Moramo, Sg. Sena, 50 m, at light, 15 Nov 1989, R. de Jong and J. Huisman (RMNH JS 8946); 1 female, Moramo, Sg. Moramo, 200 m, at light, 16 Nov 1989, R. de Jong and J. Huisman, (RMNH JS 8947).

Description. Female. Wings fawn to pale brown with paler irrorations. Ventral plates with length about twice width, tapered apically, apices acute (Figs 24, 25).

Length of forewing: female 3.6–4.1 mm.

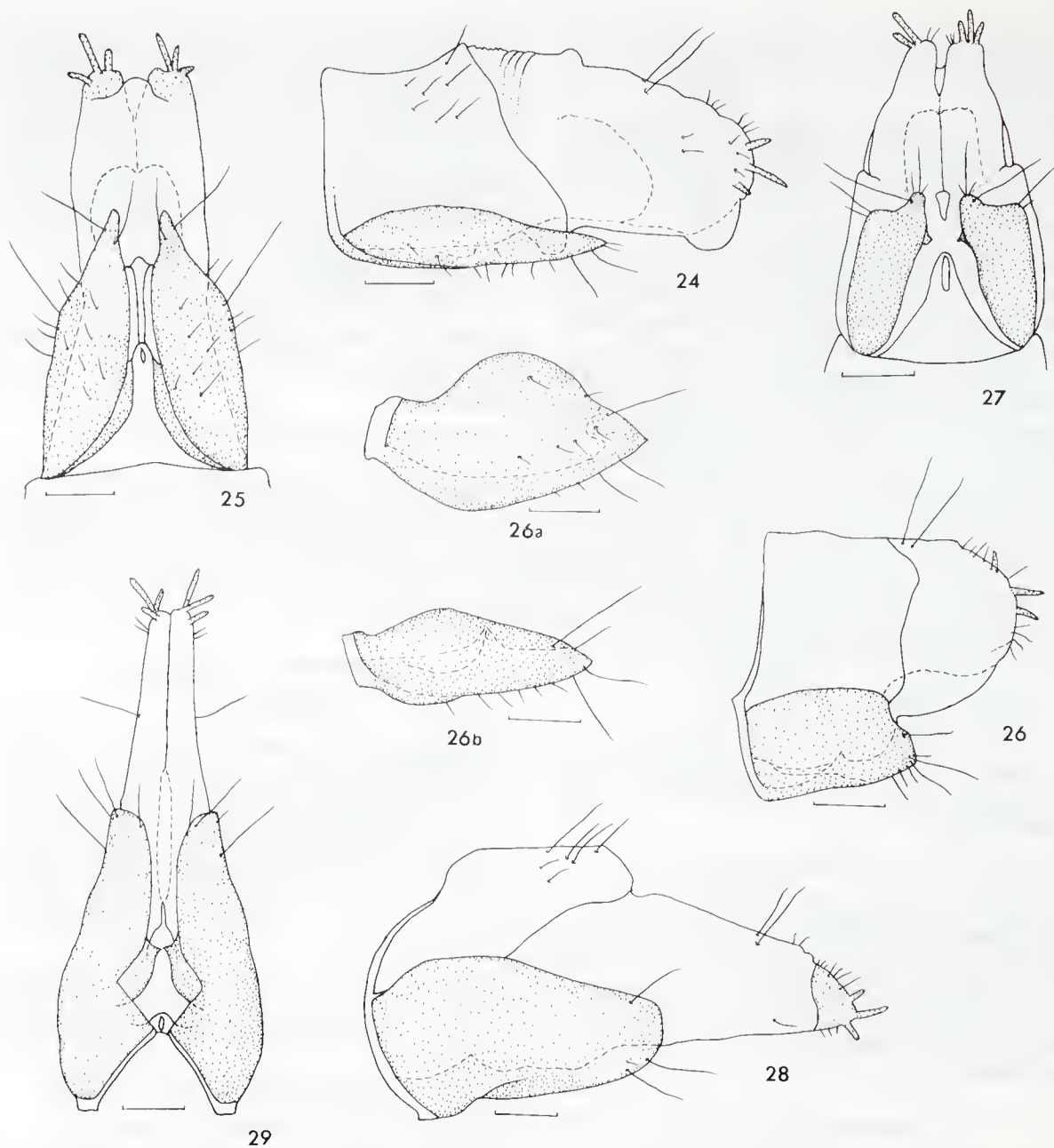
Distribution. South Sulawesi (Indonesia).

Remarks. *Ecnomus* sp. E has ventral plates similar to those of *Ecnomus* sp. B from North Sulawesi but with apices more acute.

Ecnomus sp. F (female)

Figures 26, 27

Material examined. Sulawesi Tenggara, 6 females, Moramo, Sg. Moramo, 200 m, at light, 16 Nov 1989, R. de Jong and J. Huisman (RMNH JS 8947), (genitalia prep. CT-203 figured, CT-204 partly figured; RMNH); 1 female, Desa Aopa, 50 m, at light, 27 Oct 1989, R. de Jong and J. Huisman (RMNH JS 8928), (genitalia prep. CT-210 partly figured; RMNH).



Figures 24–29: *Ecnomus* spp., female genitalia. 24, 25, *Ecnomus* sp. E; 24, lateral view; 25 ventral view; 26, 27, *Ecnomus* sp. F; 26, lateral view; 26a, b, variations in form of ventral plate in lateral view; 27, ventral view; 28, 29, *Ecnomus* sp. G; 28, lateral view; 29 ventral view. All scale lines 0.1 mm.

Description. Female. Wings fawn to pale brown with paler irrorations. Ventral plates with shape variable, from sub-rectangular (Figs 26a, 26b) to more elongate, narrowed apically (Figs 26, 27).

Length of forewing: female 3.3–4.3 mm.

Distribution. South Sulawesi (Indonesia).

Remarks. *Ecnomus* sp. F is somewhat variable in the shape of the ventral plates, but is similar to *Ecnomus* sp. D from North Sulawesi, although lacking the strong ridge on the mesal margin of the ventral plates.

Ecnomus sp. G (female)

Figures 28, 29

Material examined. Sulawesi Tenggara, 45 females, Moramo, Sg. Moramo, 200 m, at light, 16 Nov 1989, R. de Jong and J. Huisman (RMNH JS 8947), (genitalia prep. CT-202 figured; RMNH); 1 female, Moramo, Sg. Moramo, 175 m, at light, 17 Nov 1989, R. de Jong and J. Huisman, (RMNH JS 8949); 1 female, Desa Aopa, 50 m, at light, 27 Oct 1989, R. de Jong and J. Huisman, (RMNH JS 8928); 1 female, Pulau Kabaena, 1 km S Tangkeno, Sg. Lantanol, 550 m, UV-light, 9 Nov 1989, R. de Jong and J. Huisman, (RMNH JS 8940-42).

Description. Female. Wings fawn to pale brown with paler irrorations. Ventral plates with length about twice width, rounded apically, segment 9 laterally compressed (Figs 28, 29).

Length of forewing: female 3.5–4.4 mm.

Distribution. South Sulawesi (Indonesia).

Remarks. *Ecnomus* sp. G has similar genitalic characters to *Ecnomus* sp. B from North Sulawesi, but the apices of the ventral plates are more rounded and slightly truncated.

Ecnomus sp. H (female)

Figures 30, 31

Material examined. East Kalimantan, 5 females, Mahakam River, 250 km W of Samarinda, 10 Mar 1991, C. Yule (genitalia prep. CT-195 figured; NMV); 28 females, Long Hubungan, Mahakam River, 250 km W of Samarinda, 10 Mar 1991, C. Yule (NMV).

Description. Female. Wings fawn to pale brown with paler irrorations. Ventral plates with length about 1.5 × width, tapered apically, apices rounded in lateral view (Figs 30, 31).

Length of forewing: female 3.0–3.7 mm.

Distribution. East Kalimantan (Indonesia).

Remarks. *Ecnomus* sp. H females can be separ-

ated from other Kalimantan females by the lack of poekets on the ventral plates as in *Ecnomus* sp. K and *Ecnomus* sp. J, and the apices of the ventral plates are less truncated than in *Ecnomus* sp. I.

Ecnomus sp. I (female)

Figures 32, 33

Material examined. East Kalimantan, 1 female, Long Hubungan, Mahakam River, 250 km W of Samarinda, 10 Mar 1991, C. Yule (genitalia prep. CT-198 figured; NMV).

Description. Female. Wings pale brown. Ventral plates with length about equal to width, subquadrate, truncate apically (Figs 32, 33).

Length of forewing: female 4.4 mm.

Distribution. East Kalimantan (Indonesia).

Remarks. *Ecnomus* sp. I can be distinguished from other females by the quadrate ventral plates in lateral and ventral views.

Ecnomus sp. J (female)

Figures 34, 35

Material examined. East Kalimantan, 1 female, Mahakam River, 250 km W of Samarinda, 10 Mar 1991, C. Yule (genitalia prep. CT-213 figured; NMV).

Description. Female. Wings pale brown with some paler irrorations. Ventral plates with length about same as width, apices rounded in lateral view, with shallow mesally facing poeket near mid-mesal margin, shallow groove basal to poeket and shallow concavity laterad to poeket (Figs 34, 35).

Length of forewing: female 4.5 mm.

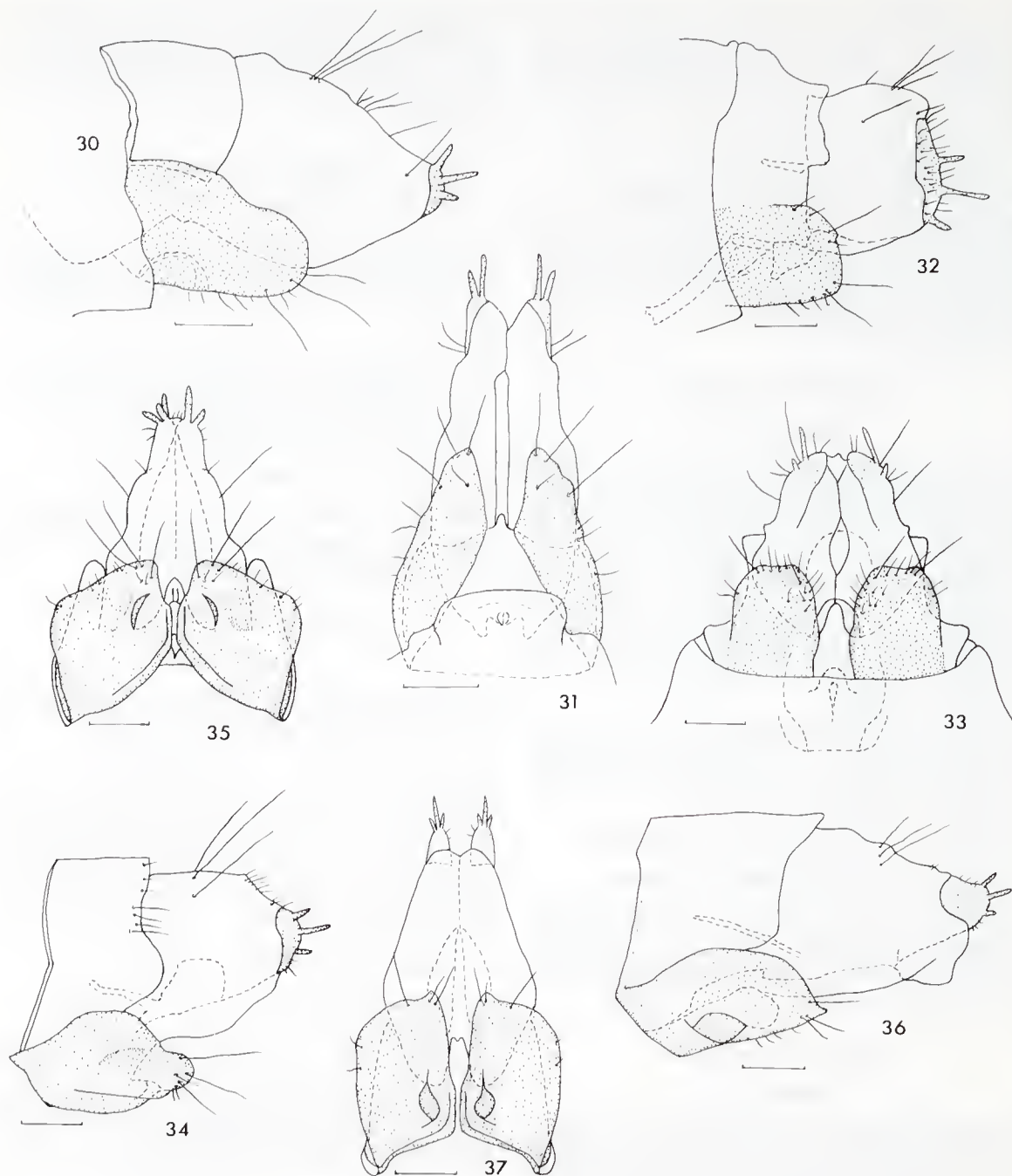
Distribution. East Kalimantan (Indonesia).

Remarks. The single female specimen is similar to *Ecnomus* sp. K from East Kalimantan in having a mesally facing poeket on the ventral plates. The poeket is shallower and situated closer to the apex than in *Ecnomus* sp. K.

Ecnomus sp. K (female)

Figures 36, 37

Material examined. East Kalimantan, 1 female, Mahakam River, 250 km W of Samarinda, 10 Mar 1991, C. Yule (NMV); 7 females, Long Hubungan, Mahakam River, 250 km W of Samarinda, 10 Mar 1991, C. Yule (genitalia prep. CT-197 figured; NMV); 3 females, Camp Prampus, Kelian River trib. of Mahakam River, 250 km W of Samarinda, Light trap, 31 Mar 1991, C. Yule (NMV).



Figures 30–37: *Ecnomus* spp., female genitalia. 30, 31, *Ecnomus* sp. H: 30, lateral view; 31, ventral view; 32, 33, *Ecnomus* sp. I: 32, lateral view; 33, ventral view; 34, 35, *Ecnomus* sp. J: 34, lateral view; 35, ventral view; 36, 37, *Ecnomus* sp. K: 36, lateral view; 37, ventral view. All scale lines 0.1 mm.

Description. Female. Wings fawn to pale brown with paler irrorations, venation characteristic of genus except fork 1 absent on anterior wing. Ventral plates with length about twice width, subrectangular with small apical projections and mesally facing pocket near meso-basal angle (Figs 36, 37).

Length of forewing: female 3.5–3.8 mm.

Distribution. East Kalimantan (Indonesia).

Remarks. *Ecnomus* sp. K females are similar to *Ecnomus* sp. J in having mesally facing pockets on the ventral plates. Cartwright (1990) reported that a group of Australian species have laterally facing pockets. Although *Ecnomus* sp. K has aberrant wing venation it cannot be positively associated with either *Ecnomus retusus* or *E. gapit*.

Acknowledgements

I thank Dr Arturs Neboiss for providing access to specimens collected by Cathy Yule, R. de Jong and J. Huisman, and Dr Alice Wells and Dr Arturs Neboiss for comments on a draft of this manuscript.

References

- Cartwright, D.I., 1990. The Australian species of *Ecnomus* McLachlan (Trichoptera: Ecnomidae). *Memoirs of the Museum of Victoria* 51: 1–48.
- Cartwright, D.I., 1992. Descriptions of four new species of *Ecnomus* McLachlan (Trichoptera: Ecnomidae) from North Sulawesi. *Bulletin Zoologisch Museum Universiteit van Amsterdam* 13: 101–108.
- Kimmins, D.E., 1955. Results of the Oxford University expedition to Sarawak, 1932. Order Trichoptera. *Journal of the Sarawak Museum* 6: 374–442.
- McLachlan, R., 1864. On the trichopterous genus *Polycentropus* and the allied genera. *Entomologist's Monthly Magazine* 1: 25–31.
- Mosely, M.E., 1932. New exotic species of the genus *Ecnomus* (Trichoptera). *Transactions of Entomological Society London* 80: 1–17.
- Neboiss, A., 1977. A taxonomic and zoogeographic study of Tasmanian caddis-flies (Insecta: Trichoptera). *Memoirs of the National Museum Victoria* 38: 1–208.
- Ulmer, G., 1951. Köcherfliegen (Trichopteren) von den Sunda-Inseln (Teil 1). *Archiv für Hydrobiologie. Supplement* 19: 1–528.