

The Indo-Australian species of the braconine wasp genus *Zaglyptogastra* Ashmead

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An illustrated key to the eight species of *Zaglyptogastra* Ashmead known to occur in the Indo-Australian Region is provided. Three species are described as new: *aswada* from Sumatra, *maiada* from Malaysia, and *novaguinensis* from Papua New Guinea. *Z. griseiseta* (Enderlein) comb. nov. (= *Megagonia griseiseta* Enderlein) is treated as a junior synonym of *Z. corruscator* (Cameron and Strand). The type specimen of *Iphiaulax ingratellus* Cameron has been re-discovered and this species is transferred to *Zaglyptogastra* for the first time.

KEYWORDS: Hymenoptera, Braconidae, Braconinae, *Zaglyptogastra*, Indo-Australian regions, specific key, new species.

Introduction

Zaglyptogastra Ashmead is a moderately large genus of parasitic wasps with the majority of its species occurring in the Afrotropical Region and a smaller number from the Indo-Australian Region. The genus was originally described on the basis of a single species, *Z. abbotti* Ashmead, from Thailand; however, despite being one of the easiest of all braconid genera to recognize no other species were referred to it until its type was re-examined by Quicke (1981). Many species have subsequently been transferred to it from other genera (Quicke, 1983, 1984a, 1988a) including two other species from the Indo-Australian Region. Another Indo-Australian species is transferred to *Zaglyptogastra* below, and four new species are described, bringing the total number of species known from that region to eight.

No attempt has been made to provide a comprehensive treatment of the genus. The species, particularly those from the Afrotropical Region, were until recently split between a number of other genera, some synonyms of *Zaglyptogastra*, others not. Because of the failure of most previous workers to distinguish members of this genus correctly, previously published keys are virtually useless. A revision of the African species of *Zaglyptogastra* is provided in a companion paper (Quicke, submitted).

Biology

At present, host data are available for only one species of *Zaglyptogastra*, a member of the *Z. cristata* (Szépligeti) group having been reared as a larval parasitoid of the lamiine cerambycid beetle, *Dirphya princeps* Jordan, boring in twigs of coffee (Quicke, 1983, submitted). The arched ovipositor is apparently adapted for manoeuvring

through the host's larval tunnels (Quicke, submitted) and it is obviously unsuited for boring through hard substrata of any sort. It can therefore be assumed that access to host tunnels is probably invariably via frass holes such as those made periodically by *Dirphya* larvae (Crowe, 1962).

Most *Zaglyptogastra* species are large, conspicuously coloured insects and many of them belong to fairly clearly defined homeochromatic associations (Quicke, 1986). Many species of *Zaglyptogastra* have conspicuously pale-tipped ovipositor sheaths as a result of white or buff-coloured setae. The relationship between relative ovipositor length and the portion of the length of the ovipositor sheath with pale setosity was examined for a number of Braconinae genera by Quicke (1984b). Members of the genera *Zaglyptogastra* and *Bathyaulax* Szépligeti were found to be somewhat anomalous in having a relatively larger portion of the ovipositor sheath pale-coloured than similarly sized members of other genera. Quicke (1984b) proposed that the pale-tipped sheaths might serve some visual feedback function, and it was therefore postulated that *Zaglyptogastra* may flex its metasoma more during oviposition than some other genera, thereby bringing more of the sheath into view.

Relatively few specimens of *Zaglyptogastra* have been collected in the Indo-Australian region, whereas they appear to be quite common in Africa. Thus the present paper is based on only 29 specimens spread among eight species. It seems quite likely that this may reflect the fact that much of the Afrotropical material has been collected in arid or semi-arid habitats where bushes and small trees predominate, whereas in the Indo-Australian region the specimens have mainly been collected in denser forest. Given that the hosts of *Zaglyptogastra* species may well be largely confined to growing twigs, they are perhaps more likely to occur in the canopy of tropical wet forest than near to the ground. More material, and probably many more species, may therefore be discovered when research extends more into the canopy.

We employed a computerized system for key construction (the DELTA package; see Materials and methods) which facilitates the updating of keys when new taxa need to be incorporated. Further, DELTA is particularly helpful when the taxa being investigated display a high level of homoplasy and thus do not separate easily into clearly defined species groups, as is the case with the Indo-Australian *Zaglyptogastra* dealt with here.

Terminology and measurements

Terminology follows that of van Achterberg (1979, 1988) except that ovipositor length is taken as that protruding beyond the apex of the metasoma when the ovipositor is directed posteriorly, as it is in most set specimens. Sculpture is described using the terminology of Harris (1979).

Materials and methods

The key to species presented below was created using the DELTA system for processing taxonomic data (Dallwitz and Paine, 1986; Partridge, Dallwitz and Watson, 1988). The options employed were RBASE=2.0, ABASE=2.0, REUSE=1.8, VARYWT=0.8 and number of confirmatory characters=4. Parameter values were chosen on the basis that with only eight taxa the branching pattern of the key (and hence the average path length required to identify a taxon) was not of major importance. Differential character weighting was achieved using the CHARACTER RELIABILITIES statement in the file TOKEY; the default value is 5 (range 0–10). The data

files SPECS, CHARS, ITEMS and TOKEY used in generating the key are given in the Appendix.

Institutions and collections

The following abbreviations are used for collections and museums holding specimens referred to in this study.

AM	Australian Museum, Sydney
BMNH	British Museum (Natural History), London
BMH	Bishop Museum, Honolulu
MCZ	Museum of Comparative Zoology, Cambridge, Massachusetts
MNB	Museum für Naturkunde, Berlin
PASW	Polish Academy of Science, Warsaw
QC	Quicke Collection, Sheffield
RNHL	Rijksmuseum van Natuurlijke Historie, Leiden
USNM	The National Museum of Natural History, Washington D.C.

Zaglyptogastra Ashmead

Zaglyptogastra Ashmead, 1900: 137. Type-species: *Zaglyptogastra abbotti* Ashmead (monobasic).

Eumorpha Szépligeti, 1908: 35. Type-species: *Eumorpha nigripennis* Szépligeti (monobasic).

Holcobracon Cameron, 1909a: 19 (not Cameron, 1905). Type-species: *Holcobracon erythraspis* Cameron (monobasic).

Callidia Schulz, 1910: 68 (replacement name for *Eumorpha* Ashmead not Hubner, 1806, Frieze, 1899).

Megagonia Szépligeti, 1906: 582. Type-species: *Megagonia seminigra* Szépligeti (designated by Viereck, 1914).

Holconotus Fahringer, 1928: 19 (not Schmidt-Goebel, 1846, Agassiz, 1854 or Foerster, 1862). Replacement name for *Holcobracon* Cameron, 1909.

Holcosomius Fahringer, 1935: 634. Replacement name for *Holconotus* Fahringer, 1928.

Diagnosis

Females of *Zaglyptogastra* species may be distinguished from all other parasitic Hymenoptera by the combination of the form of the ovipositor which is formed into four (occasionally three in some Afrotropical species) arch-like sections apically (Figs 26–28) and the 1st subdiscal cell of the fore wing which is more or less straight-sided and has the posterior of vein 3-CU1 at least as wide as vein CU1b (Figs 9 and 10). Males can be distinguished from those of all other genera of Braconinae most certainly by dissection, as they possess a unique sclerotized pair of sublateral, elongate, anterior, internal protuberances of the 8th abdominal (7th metasomal) tergite.

Description

Female. Antennae longer than the fore wing. Terminal flagellomeres pointed, sometimes acuminate. Median flagellomeres usually wider than long. Scapus longer ventrally than dorsally in lateral aspect. Clypeus with a weak to moderately developed transverse median carina situated approximately at the middle in frontal aspect. Face usually extensively sculptured. Eyes glabrous, not markedly smaller than in males. Frons broadly, moderately depressed, with a weak, mid-longitudinal sulcus.

Mesosoma largely smooth and shiny. Notauli weak. Scutellar sulcus narrow, usually crenulate. Mesopleural suture smooth. Precoxal suture absent. Median area of metanotum produced into a distinct carina mid-anteriorly. Propodeal spiracle elliptical, approximately twice as tall as long.

Fore wing—Marginal cell long, vein SR1 reaching the wing margin at least 0·8 of the distance between the apex of the pterostigma and the wing tip (Figs 1–5). Second submarginal cell long, more or less parallel-sided. Vein r–m usually with both a distinct anterior and posterior bulla. Vein 1–M more or less straight (Fig. 6). Vein 1–SR+M usually strongly angled posteriorly shortly after arising from 1–M, sometimes more or less evenly curved, rarely (one African species, *Z. afer* (Szépligeti)) straight. Vein cu—a interstitial or distinctly postfurcal with vein 1–M (Figs 9 and 10). Vein 3–CU1 usually distinctly thickened posteriorly.

Hind wing—Vein 1r–m usually at least as long as vein SC+R1 but shorter in one Afrotropical species, *Z. tacita* (Cameron). Apex of vein C+SC+R with more than one especially thickened bristle.

Basal metasomal tergites usually strongly sculptured (Fig. 25) though virtually smooth in *Z. novaguinensis* sp. nov. (Fig. 18). First tergite without dorsal carinae, with or without dorsolateral carinae. Second tergite with a poorly to well-defined, raised mid-basal triangular area which usually has similar sculpture to the remainder of the tergite. Tergites 2–6 with well-defined anterolateral areas defined posteriorly on each side by a groove (Figs 19–24). Tergites 3–6 usually with well-developed, transverse, subposterior grooves (absent in *Z. novaguinensis* sp. nov. and in the Madagascan species, *Z. gaullei* (Granger)). Hypopygium acutely pointed in lateral aspect. Ovipositor usually rather longer than the metasoma, the apical part formed into a series of arch-like regions (normally with 4 arches (Figs 26–28) but with only 3 in some African species (e.g. *Z. afer*, *Z. nigripennis* (Szépligeti), and *Z. spathulata* (Szépligeti)). Ovipositor without a pre-apical dorsal nodus and usually with apicoventral serrations reduced or absent (Figs 26 and 28) but conspicuous in *Z. maiada* sp. nov. and in a few African species (e.g. *Z. spathulata*).

Males. Difficult to recognize and easily confused with those of *Craspedolcus* Enderlein and some other genera. Similar to females, eyes not particularly larger. Genitalia described and illustrated by Quicke (1988b). With a pair of large, intersegmental tergal glands between the 7th and 8th abdominal tergites and with a pair of long, sclerotized (possibly gland-associated), sublateral, internal anterior projections of the 8th abdominal tergite (Quicke, in press). Rectum fused to the 8th abdominal tergite (Quicke, 1988c). Rectal pads very elongate, more than 3 times longer than wide.

Key to the Indo-Australian species of *Zaglyptogastra* (females only)

- 1(0) Pterostigma more than 2·8 times longer than wide (Figs 2–5, 7 and 8); metasomal tergites 2 and 3 largely strongly sculptured, scabrous, rugose, or striate (Fig. 25); base of hind wing with a moderate-sized to large glabrous area (Figs 12 and 13); fore wing vein 1–SR+M moderately to strongly curved (Figs 2–5, 7 and 8) 2
- Pterostigma less than 2·8 times longer than wide (Figs 1 and 6); metasomal tergites 2 and 3 smooth except for middle of 2nd tergite and 2nd suture (Fig. 18); base of hind wing evenly setose (Fig. 11); fore wing vein 1–SR+M straight (Figs 1 and 6) *novaguinensis* sp. nov.
- 2(1) Hind legs entirely black; metasomal tergites entirely black 3
- Hind legs entirely yellow-brown; metasomal tergites entirely brown or yellow to orange 7
- 3(2) Fore wing pterostigma entirely yellowish except for extreme apex (Figs 2, 4, 5 and 8); ovipositor sheath hairs short (Fig. 14); fore wing vein cu—a postfurcal with 1–M (Fig. 9). 4

- Fore wing pterostigma at least apical 0.35 brown or black (Figs 3 and 7); ovipositor sheath hairs long (Fig. 15); fore wing vein cu – a more or less interstitial with 1 – M (Fig. 10) *plumiset*
- 4(3) Metasomal tergite 5 largely smooth except for fine punctures (Fig. 21); propodeum sparsely setose anteromedially (Fig. 16); metasomal tergite 4 largely striate (Fig. 20); ovipositor sheath hairs black except for apical 0.25 at most of sheath 5
- Metasomal tergite 5 largely scabrous or rugulose (Fig. 24); propodeum densely setose anteromedially (Fig. 17); metasomal tergite 4 largely rugulose to rugose (Fig. 23); ovipositor sheath hairs white or distinctly greyish or yellowish on apical half of sheath 6
- 5(4) Ovipositor apex dorsoventrally compressed (Fig. 26); head (excluding stemmaticum) extensive yellowish with piceous-black on frons and occiput; fore wing 15 mm long or more *corruscator*
- Ovipositor apex laterally compressed (see Figs 27 and 28); head (excluding stemmaticum) entirely yellow or rufous; fore wing 12–15 mm long *aswada* sp. nov.
- 6(4) Scapus entirely black; length of hind wing vein 1r – m: SC + R1 greater than 1.45: 1; fore wing 2nd but not 3rd submarginal cells yellow basally (see Figs 3 and 4); hairs on inner side of hind tibia and tarsus black or brown *vitalisi*
- Scapus brown or yellow-brown dorsally; length of hind wing vein 1r – m: SC + R1 ranging between 1.17: 1 and 1.45: 1; fore wing 2nd and 3rd submarginal cells brown basally (Fig. 2); hairs on inner side of hind tibia and tarsus white *ingratella*
- 7(2) Scapus entirely black; metasomal tergite 5 largely striate (Fig. 19) *maiada* sp. nov.
- Scapus brown or yellow-brown dorsally; metasomal tergite 5 largely smooth except for fine punctures (Fig. 22) *abbotti*

Zaglyptogastra abbotti Ashmead

Zaglyptogastra abbotti Ashmead, 1900: 137 (in key only; description in Ashmead, 1906: 197).

Material examined

HOLOTYPE ♀ (USNM): 'Trong, Lower Siam, Dr W. L. Abbott'.

Additional specimens examined. One ♀ (RNHL): 'Dr B. Hagen, Tandjong Morawa. Serdang (N. O. Sumatra)'; 4♀ (BMNH): (1) 'Sarawak: 4th Div. Gn. Mulu, RGS Exp. 27.vi.–19.vii, 1978 H. Vallack'; (2) 'B. N. Borneo. Mt Kinabalu, Kiau, 3000 ft. April 5th 1929'; (3) 'Matang. Sarawak 9.3.1912'; (4) 'Borneo. Sarawak Trusan Jan. 1915 Prof: H. W. Smith'; 1♂ (BMNH): 'B. N. Borneo. Mt. Kinabalu, Kiau, 3000 ft. April 4th 1929'; 1♀ (MCZ): 'Rawa Takbok W. Java VII', 'East Preanger', 'Sternitzky collection'.

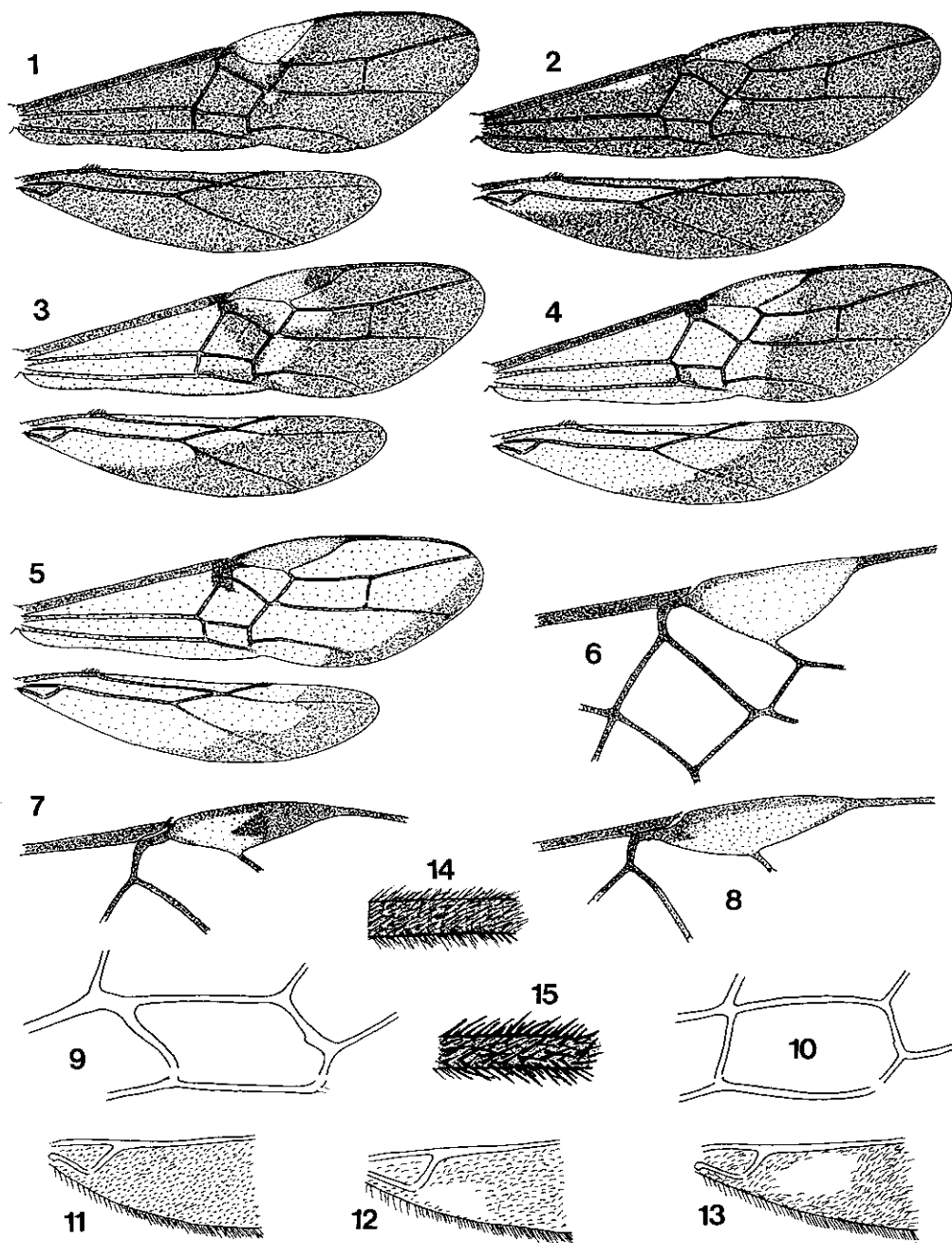
Description

Females. Length of body 16.5–19.0 mm, of fore wing 15.4–17.2 mm and of ovipositor 15.5–18.0 mm.

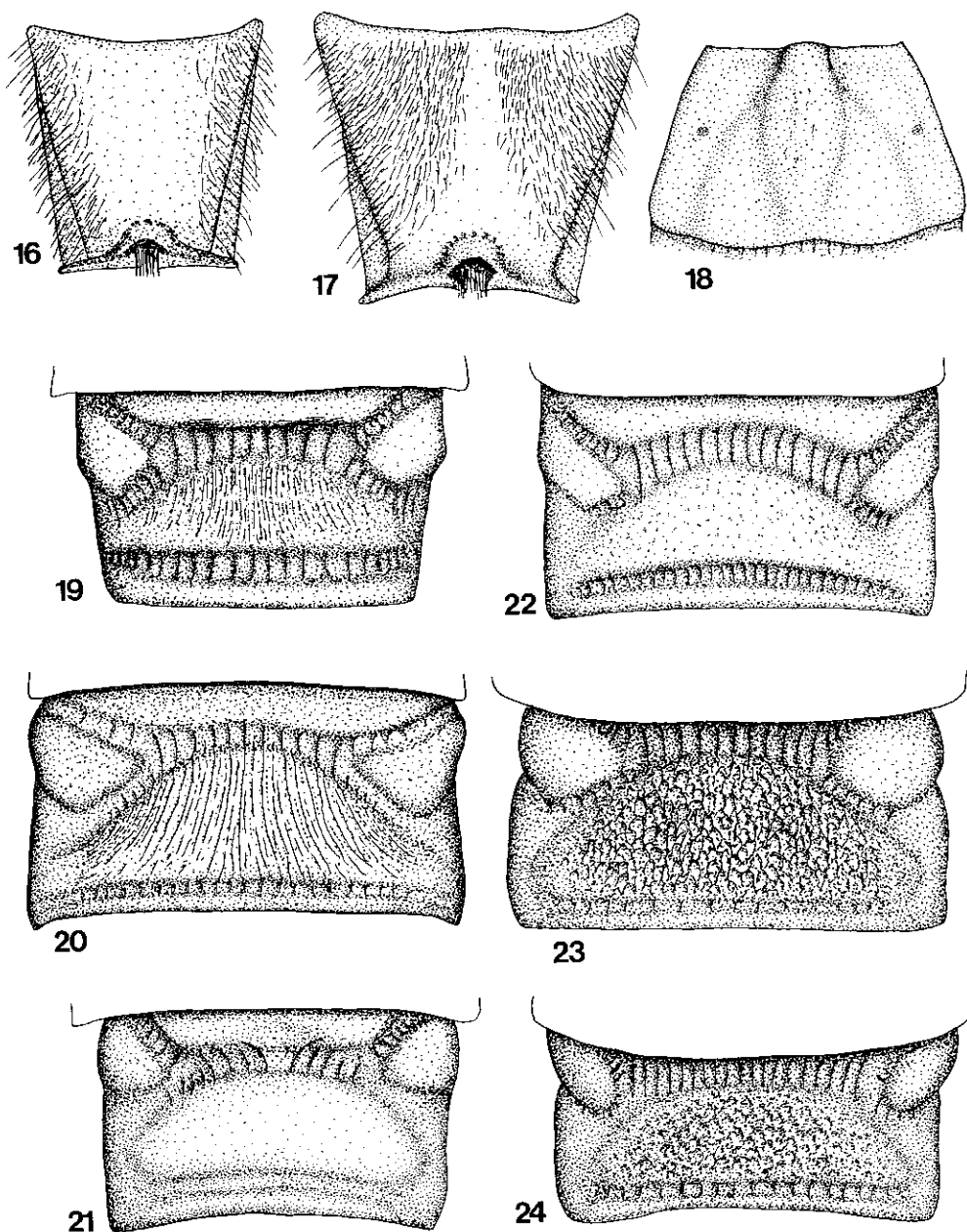
Antennae (broken). First flagellomere 1.5 times longer than the second or third. Inter-tentorial distance: tentorio-ocular distance ranging between 1.25 and 1.42: 1.0. Head widest across eyes. Shortest distance between eyes: width of head = 1: 1.88–1.98. POL: transverse diameter of posterior ocellus: shortest distance between posterior ocellus and eye = 1.0: 1.0–1.14: 2.13–2.67.

Mesosoma approximately 1.71–1.93 times longer than deep. Propodeum sparsely setose anteromedially.

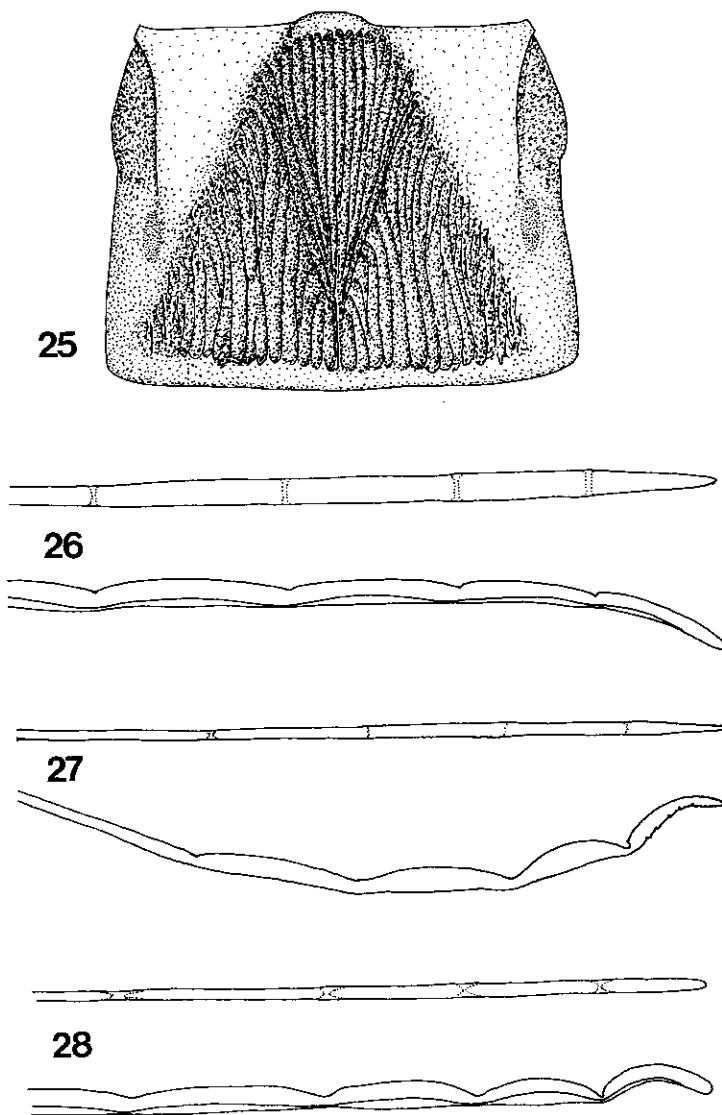
Pterostigma 3.7 times longer than wide. Lengths of fore wing veins SR1: 3 – SR: r = 5.5–5.8: 4.5–5.0: 1.0. Fore wing vein 1 – SR + M moderately to strongly curved (Fig. 8) and 1.16–1.32 times length of 1 – M. Lengths of fore wing veins 2 – SR: 3 – SR: r – m = 1.0–1.04: 2.31–2.80: 1–1.2. Fore wing vein cu – a postfurcal with 1 – M. Hind wing



FIGS 1-15. Figs 1-13. Features of the right wings: 1, *Z. novaguinensis* sp. nov.; 2, *Z. ingratellus*; 3, *Z. plumiseta*; 4, *Z. aswada* sp. nov.; 5, *Z. maiada* sp. nov.; 6, *Z. novaguinensis* sp. nov.; 7, *Z. plumiseta*; 8, *Z. abbotti*; 9, *Z. maiada* sp. nov.; 10, *Z. plumiseta*; 11, *Z. novaguinensis* sp. nov.; 12, *Z. maiada* sp. nov.; 13, *Z. aswada* sp. nov. Figs 14 and 15. Medial length of ovipositor sheath showing relative length and thickness of setosity: 14, *Z. vitalisi*; 15, *Z. plumiseta*.



FIGS 16-24. Figs 16 and 17. Propodeum showing distribution of setosity: 16, *Z. aswada* sp. nov.; 17, *Z. vitalisi*. Fig. 18. Second metasomal tergite: 18, *Z. novaguinensis* sp. nov. Fig. 19. Fifth metasomal tergite: 19, *Z. maiada* sp. nov. Figs 20 and 21, Fourth and 5th metasomal tergites respectively: both *Z. corruscator*. Fig. 22. Fifth metasomal tergite: *Z. abbotti*. Figs 23 and 24. Fourth and 5th metasomal tergites respectively: both *Z. vitalisi*.



FIGS 25–28. Fig. 25. Second metasomal tergite: *Z. corruscator*. Figs 26–28. Dorsal and lateral aspects of apical part of ovipositor: 26, *Z. corruscator*; 27, *Z. maiada* sp. nov.; 28, *Z. vitalisi*.

vein 1r–m 1.28 times longer than SC + R1. Apex of vein C + SC + R with 7–8 well-spaced, thickened bristles. Base of hind wing with a moderate-sized to large glabrous area.

Length of fore femur:tibia:tarsus = 1.0:1.06–1.16:1.45–1.52. Fore basitarsus 5.75–7.0 times longer than maximally deep. Length of hind femur:tibia:basitarsus = 1.43–1.56:2.35–2.50:1.0. Hind basitarsus 10.8 times longer than deep.

First metasomal tergite approximately 1.25–1.33 times longer than wide. Second metasomal tergite approximately 1.23–1.68 times wider than long. Second and third metasomal tergites largely sculptured, striate. Fourth metasomal tergite (except for

transverse grooves) largely striate. Fifth metasomal tergite (except for transverse grooves) largely smooth except for fine punctures. Ovipositor ranging between 0.95 and 1.16 times the length of the fore wing. Ovipositor apex intermediately compressed. Ovipositor sheath hairs short.

Yellow or rufous except for the following: antennae piceous or black but scapus entirely brown or yellow-brown dorsally. Wings largely yellow, marked with grey-brown narrowly at the apex and with a dark brown mark around the parastigma (see Fig. 5). Fore wing pterostigma entirely yellow except for external apex. Ovipositor sheath setosity entirely black.

***Zaglyptogastra aswada* sp. nov.**

Material examined

HOLOTYPE ♀ (BMNH): 'Dr B. Hagen Tandjong Morawa, Serdang (N. O. Sumatra)'.

Description

Female. Length of body 17.0 mm, of fore wing 14.7 mm and of ovipositor 15.9 mm. Antennae (missing).

Inter-tentorial distance : tentorio-ocular distance = 1 : 1.0. Head widest across eyes. Shortest distance between eyes : width of head = 1 : 1.9. POL : diameter of posterior ocellus : shortest distance between posterior ocellus and eyes = 1.0 : 2.0 : 3.0.

Mesosoma approximately 1.92 times longer than deep. Propodeum sparsely setose anteromedially (Fig. 16).

Pterostigma 4.23 longer than wide. Lengths of fore wing veins SR1 : 3 - SR : r = 6.0 : 5.2 : 1.0. Fore wing vein 1 - SR + M moderately to strongly curved and approximately 1.43 times length of 1 - M. Lengths of fore wing veins 2 - SR : 3 - SR : r - m = 1 : 2.27 : 1.18. Fore wing vein cu - a postfurcal with 1 - M. Hind wing vein 1r - m 1.22 times longer than SC + R1. Apex of vein C + SC + R with 7 well-spaced, thickened bristles. Base of hind wing with a moderate-sized to large glabrous area (Fig. 13).

Length of fore femur : tibia : tarsus = 1 : 1.26 : 1.35. Fore basitarsus 6.42 times longer than maximally deep. Length of hind femur : tibia : basitarsus = 1.82 : 2.91 : 1.0. Hind basitarsus 6.2 times longer than deep.

First metasomal tergite approximately 1.40 times longer than wide. Second metasomal tergite approximately 1.18 times wider than long. Second and third metasomal tergites largely sculptured, scabrous, rugose or striate. Fourth metasomal tergite (except for transverse grooves) largely striate. Fifth metasomal tergite (except for transverse grooves) largely smooth except for fine punctures. Ovipositor 1.08 times the length of the fore wing. Ovipositor apex laterally compressed. Ovipositor sheath hairs short.

Scapus entirely black. Head (excluding stemmaticum) entirely yellow or rufous. Fore wing pterostigma entirely yellowish except for extreme apex (Fig. 4). Hind legs entirely black. Metasomal tergites entirely black. Ovipositor sheath hairs black except for apical 0.25 at most of sheath.

***Zaglyptogastra corruscator* (Cameron and Strand) comb. nov.**

Iphiaulax corruscator Cameron and Strand in Strand, 1912: 54.

Zaglyptogastra corruscator Quicke, 1988a: 78.

Megagonia griseiseta Enderlein, (1918) 1920: 59 syn. nov.

Zaglyptogastra griseiseta comb. nov.

Material examined

HOLOTYPE ♀ of *corruscator* (MNB): 'Iphiaulax corruscator Strand det., Cam et Strand', 'Iphiaulax corruscator Cam. Type', 'Type' and 'Java Hffg. S.'.

HOLOTYPE ♀ of *griseiseta* (PASW): 'Soekaranda Januar 1894 Dohrn.', 'Megagonia griseiseta Enderlein ♀ Dr Enderlein det. 1919'.

Additional specimen examined. Metatype ♀ (RNHL): 'Sumatra Laut Tado. 20 Jan. 1949 R Siraaïman leg'.

Description

Female. Length of body 19.0 mm, of fore wing 16.5 mm and of ovipositor 18.0 mm.

Antennae (broken). First flagellomere 1.21 times longer than the second or third. Inter-tentorial distance: tentorio-ocular distance = 1.19:1.0. Head widest across eyes. Shortest distance between eyes: width of head = 1:1.81. POL:diameter of posterior ocellus: shortest distance between posterior ocellus and eyes = 1.17:1.3:17.

Mesosoma approximately 2.14 times longer than deep. Propodeum sparsely setose anteromedially.

Pterostigma 3.57 times longer than wide. Lengths of fore wing veins SR1:3—SR:r = 6.3:6.0:1.0. Fore wing vein 1—SR+M moderately to strongly curved and approximately 1.35 times length of 1—M. Lengths of fore wing veins 2—SR:3—SR:r—m = 1:3:1.0. Fore wing vein cu—a postfurcal with 1—M. Hind wing vein 1r—m 1.29 times longer than SC+R1. Apex of vein C+SC+R with 6 well-spaced, thickened bristles. Base of hind wing with a moderate-sized to large glabrous area.

Length of fore femur:tibia:tarsus = 1:1.13:1.50. Fore basitarsus 5.71 times longer than maximally deep. Length of hind femur:tibia:basitarsus = 2.14:2.82:1.0. Hind basitarsus 6.8 times longer than deep.

First metasomal tergite approximately 2.12 times longer than wide. Second metasomal tergite approximately 1.37 times wider than long. Second to fourth metasomal tergites largely longitudinally striate (Figs 20 and 25). Fifth metasomal tergite (except for transverse peribasal groove) largely smooth except for fine punctures (Fig. 21). Ovipositor 1.09 times the length of the fore wing. Ovipositor apex dorsoventally compressed (Fig. 25). Ovipositor sheath hairs short.

Antennae entirely black. Head yellow with a large piceous-black mark on the frons, stemmaticum and occiput. Mesosoma, fore and middle legs brownish-orange but with the mesoscutum, mesopleuron, metapleuron and propodeum often with darker brown or piceous markings. Fore wing yellow with approximately the distal third brown; pterostigma entirely yellowish except for extreme apex. Hind legs entirely black (see Fig. 4). Metasomal tergites and sclerotized parts of the sternites entirely black. Ovipositor sheath hairs black except for approximately the apical 0.25 of sheath where they are more or less greyish.

Zaglyptogstra ingratella (Cameron), comb. nov.

Iphiaulax ingratellus Cameron, 1909b: 148.

Material examined

HOLOTYPE ♀ (BMNH): 'Iphiaulax ingratellus Cam. type, Borneo', 'Cotype', 'Sadong, Aug. 1903', 'P. Cameron Coll 1914-110' and 'Br. 6'.

Additional specimens examined. One ♀ (BMNH): 'Brunei: Labi Mixed dipterocarp forest. 200 m. viii-ix 1979. Gauld'.

Description

Female. Length of body 18.0–19.5 mm, of fore wing 16.3–17.6 mm, and of ovipositor 21.5–27.0 mm. Antennae broken in both specimens.

Inter-tentorial distance: tentorio-ocular distance = 1.27–1.33:1.0. Head widest across eyes. Shortest distance between eyes: width of head = 1.0:1.93–1.96. POL: transverse diameter of posterior ocellus: shortest distance between posterior ocellus and eye = 1.0:1.0–1.50:2.83–3.75.

Mesosoma approximately 1.87–2.08 times longer than deep. Propodeum densely setose anteromedially.

Pterostigma 4.66 times longer than wide. Lengths of fore wing veins $SR1:r = 5.42-5.92:4.83-5.17:1.0$. Fore wing vein $1-SR+M$ moderately to strongly curved and approximately 1.42–1.52 times length of $1-M$. Lengths of fore wing veins $2-SR:3-SR:r-m = 1.0-1.04:2.52-3.05:1.0$. Fore wing vein $cu-a$ postfurcal with $1-M$. Hind wing vein $1r-m$ 1.27–1.38 times longer than $SC+R1$. Apex of vein $C+SC+R$ with 5 well-spaced, thickened bristles. Base of hind wing with a moderate-sized to large glabrous area.

Length of fore femur:tibia:tarsus = 1.0:1.07–1.18:1.41–1.43. basitarsus 5.0–6.7 times longer than maximally deep. Length of hind femur:tibia:basitarsus = 1.62–1.74:2.36–2.39:1.0. Hind basitarsus 8.3–8.8 times longer than deep.

First metasomal tergite approximately 1.47–1.59 times longer than wide. Second metasomal tergite approximately 1.11–1.33 times wider than long. Second and third metasomal tergites largely sculptured, scabrous, rugose or striate. Fourth metasomal tergite (except for transverse grooves) largely rugulose to rugose. Fifth metasomal tergite (except for transverse grooves) largely scabrous or rugulose. Ovipositor 1.31–1.40 times the length of the fore wing. Ovipositor apex laterally compressed. Ovipositor sheath hairs short.

Flagellum black. Scapus brown or yellow-brown dorsally. Head, mesosoma, fore and middle legs entirely yellow-orange to rufous. Wings largely dark brown but the hind wing in particular more yellowish basally; pterostigma entirely yellowish except for extreme apex (Fig. 2). Hind legs entirely black; hairs on inner side of the tibia and tarsus white. Metasomal tergites and sclerotized parts of the sternites black. Ovipositor sheath hairs usually conspicuously white or at least distinctly greyish or yellowish on apical half of sheath.

Notes

The location of the holotype of this species was previously unknown (Shenefelt, 1978); it was found in a drawer of putative Cameron type specimens. The specimen bears a cotype label but agrees well with Cameron's original description. Unfortunately, the ovipositor sheaths of this specimen are missing.

Zaglyptogastra maiada sp. nov.*Material examined*

HOLOTYPE ♀ (BMNH): 'Fed Malay States: 1909 C. J. Brooks B. M. 1931–570'.

Description

Female. Length of body 17.0 mm, of fore wing 16.2 mm, and of ovipositor 14.5 mm. Antennae (missing).

Inter-tentorial distance:tentorio-ocular distance=1.38:1.0. Head widest across eyes. Shortest distance between eyes:width of head=1.0:1.83. POL:diameter of posterior ocellus:shortest distance between posterior ocellus and eyes=1.0:1.40:2.60.

Mesosoma approximately 2.64 times longer than deep. Propodeum sparsely setose anteromedially.

Pterostigma 4 times longer than wide. Lengths of fore wing veins SR1:3-SR:r=5.91:5.45:1.0. Fore wing vein 1-SR+M moderately to strongly curved and approximately 1.33 times length of 1-M. Lengths of fore wing veins 2-SR:3-SR:r-m=1.17:2.42:1.0. Fore wing vein cu-a postfurcal with 1-M (Fig. 9). Hind wing vein 1r-m 1.29 times longer than SC+R1. Apex of vein C+SC+R with 7 well-spaced, thickened bristles. Base of hind wing with a moderate-sized to large glabrous area (Fig. 12).

Fore legs (broken). Length of hind femur:tibia:basitarsus=1.62:2.46:1.0. Hind basitarsus 6.5 times longer than deep.

First metasomal tergite approximately 1.42 times longer than wide. Second metasomal tergite approximately 1.57 times wider than long. Second and third metasomal tergites largely sculptured, scabrous, rugose or striate. Fourth and fifth metasomal tergites (except for transverse grooves) largely striate (Fig. 19). Ovipositor 0.89 times the length of the fore wing. Ovipositor apex intermediately compressed (Fig. 27). Ovipositor sheath hairs short.

Antennae black. Head (excluding stemmaticum), mesosoma, legs and metasoma entirely orange-yellow to pale rufous brown. Fore wing very largely yellow, narrowly marked with grey-brown apically; pterostigma entirely yellowish except for extreme apex (Fig. 5). Ovipositor sheath hairs entirely black or dark brown, not conspicuously paler apically.

Zaglyptogastra novaguinensis sp. nov.

Material examined

HOLOTYPE ♀ (AM): 'Papua New Guinea, Wau, Morobe District 1158 m. 26 Nov. 1972, G. A. Holloway'.

Description

Female. Length of body 11.8 mm, of fore wing 12 mm, of ovipositor 10.7 mm and of antennae 13.5 mm.

Antennae with 92 flagellomeres. Terminal flagellomere tapering towards the apex, approximately 2.7 times longer than basally wide. First flagellomere 1.64 times longer than the second or third. Inter-tentorial distance:tentorio-ocular distance=1.45:1.0. Head widest across eyes. Shortest distance between eyes:width of head=1.94:1.0. POL:diameter of posterior ocellus:shortest distance between posterior ocellus and eyes=1.0:1.13:3.50.

Mesosoma approximately 2.08 times longer than deep. Propodeum sparsely setose anteromedially.

Pterostigma 2.25 times longer than wide (Fig. 6). Lengths of fore wing veins SR1:3-SR:r=6.33:4.67:1.0. Fore wing vein 1-SR+M straight and approximately 1.40 times length of 1-M (Fig. 6). Lengths of fore wing veins 2-SR:3-SR:r-m=1.1:2.1:1.0. Fore wing vein cu-a more or less interstitial with 1-M (Fig. 6). Hind wing vein 1r-m 1.1 times longer than SC+R1. Apex of vein C+SC+R with 7 well-spaced, thickened bristles. Base of hind wing evenly setose, without a glabrous area (Fig. 11).

Length of fore femur:tibia:tarsus = 1.0:1.15:1.51. Fore basitarsus 7.40 times longer than maximally deep. Length of hind femur:tibia:basitarsus = 1.78:2.78:1.0. Hind basitarsus 6.8 times longer than deep.

First metasomal tergite approximately 1.59 times longer than wide. Second metasomal tergite approximately 1.53 times wider than long (Fig. 18). Second and third metasomal tergites smooth except for middle of the 2nd tergite and the 2nd suture (Fig. 18). Fourth and fifth metasomal tergites largely smooth except for fine punctures. Ovipositor 0.89 times the length of the fore wing. Ovipositor apex intermediately compressed. Ovipositor sheath hairs short.

Antennae entirely black. Head entirely black. Mesosoma and first three segments of metasomal tergites orange to pale brownish-red; posterior metasomal tergites black. Wings largely brown; pterostigma largely yellowish (Fig. 1). Legs yellow-brown except for hind tarsus and apex of tibia which are black. Ovipositor sheath hairs black except for those at extreme apex.

Zaglyptogastra plumiseta (Enderlein) comb. nov.

Megagonia plumiseta Enderlein, 1920: 59.

Material examined

LECTOTYPE ♀ (PASW): 'Sumatra Soekaranda Dr H. Dohrn S.', '*Megagonia plumiseta* type End., Dr Enderlein det. 1919'.

Paralectotype ♀ (PASW): same data as lectotype.

Additional specimens examined. Six ♀ (BMNH): (1) 'Singapore 10 2.viii. 1967 C. G. Roche'; (2) 'Malaysia Selangor, Pansoon Ulu Langat. x. 1979. I. Gauld.'; (3) 'Malay States: Bukit Kutu. 3300 ft. A. R. Sanderson.'; (4) 'Singapore 5 4.viii.1967 C. G. Roche'; (5) '8792 Malay Peninsula 16.7. 32 Sungkai G. H. Corbett.'; (6) 'Malay Pen.: SE Pahang Rompin Mining Co. Liman 27. XI. 1960'; 1♀ (BMH): 'P. Peutiang Udjang Kulon, W. Java 2. VIII. 1955 Leg: O. H. R. Wegner'.

Description

Females. Length of body 10–13 mm, of fore wing 8.4–11.2 mm and of ovipositor 8.3–11.4 mm.

Antennae (broken). First flagellomere 1.56–1.73 times longer than the second or third. Inter-tentorial distance:tentorio-ocular distance = 1.12–1.17:1.0. Head widest across eyes. Shortest distance between eyes:width of head = 1.0:1.90–2.06. POL:transverse diameter of posterior ocellus:shortest distance between posterior ocellus and eyes = 1.0:1.25:2.25–2.63.

Mesosoma 2.06–2.22 times longer than deep. Propodeum sparsely setose anteromedially.

Pterostigma 3.5 times longer than wide (Fig. 7). Lengths of fore wing veins SR1:3–SR:r = 5.50–6.0:5.38–5.71:1.0. Fore wing vein 1–SR+M moderately to strongly curved (Fig. 7); approximately 1.28–1.44 times length of 1–M. Lengths of fore wing veins 2–SR:3–SR:r–m = 1.06–1.38:2.63–3.08:1.0. Fore wing vein cu–a more or less interstitial with 1–M (Fig. 10). Hind wing vein 1r–m 1.09–1.16 longer than SC+R1. Apex of vein C+SR+R with 5–8 well-spaced, thickened bristles. Base of hind wing with a moderate-sized to large glabrous area.

Length of fore femur:tibia:tarsus = 1.0:1.14–1.16:1.48–1.54. Fore basitarsus 6.50–6.75 times longer than maximally deep. Length of hind femur:tibia:basitarsus = 1.55–1.79:2.34–2.7:1.0. Hind basitarsus 6.44–6.85 times longer than deep.

First metasomal tergite approximately 1.38–1.68 times longer than wide. Second metasomal tergite approximately 1.15–1.33 times wider than long. Second and third metasomal tergites largely striate to striate-rugose. Fourth and fifth metasomal tergites (except for transverse grooves) largely striate. Ovipositor ranging between 0.93 and 1.07 times the length of the fore wing. Ovipositor apex laterally compressed. Ovipositor sheath hairs especially long and thick (Fig. 15).

Antennae entirely black. Head extensively yellowish-orange with piceous-black on stemmaticum and usually also on frons and occiput. Mesosoma, fore and middle legs brownish-orange to rufous. Fore wing yellow basally, somewhat variably patterned with brown apically (Fig. 3); pterostigma at least with apical 0.35 brown or black (Fig. 7). Hind legs, metasomal tergites and sclerotized parts of sternites black. Ovipositor sheath hairs black except for apical 0.1 at most of sheath where they may occasionally be marginally paler.

Zaglyptogastra vitalisi (Turner)

Eumorpha vitalisi Turner, 1919: 430.

Calliidia vitalisi: Shenefelt, 1978: 1655.

Zaglyptogastra vitalisi: Quicke, 1984a: 341.

Material examined

HOLOTYPE ♀ (BMNH): 'Trong. Lower Siam Dr W. L. Abbott'.

Additional specimens examined. Four ♀ (BMNH). (1)–(3) 'Laos: Wapikhamthong Province, Khong Sedone, Wapi 15.VI.1967'; (4) 'Laos: Sedone Prov. Paksa 15.VII.1967'.

Description

Females. Length of body 16.1–18.0 mm, of fore wing 14.5–16.5 mm, of ovipositor 19.0–22.0 mm, and of antennae (only intact in one specimen) 17.8 mm.

Antennae with approximately 125 flagellomeres. Terminal flagellomere tapering towards the apex, approximately 2.3 times longer than basally wide. First flagellomere 1.38–2.10 times longer than the second or third. Inter-tentorial distance: tentorio-ocular distance = 1.18–1.50:1.0. Head widest across eyes. Shortest distance between eyes: width of head = 1.0:1.89–1.93. POL:diameter of posterior ocellus:shortest distance between posterior ocellus and eyes = 1.0–1.08:1:2.75–2.77.

Mesosoma approximately 1.65–1.84 times longer than deep. Propodeum densely setose antero-medially (Fig. 17).

Pterostigma 3.66 times longer than wide. Fore wing vein SR1:3–SR:r = 5.15–5.62:4.0–4.08:1.0. Fore wing vein 1–SR+M moderately to strongly curved and approximately 1.38–1.52 times length of 1–M. Fore wing vein 2–SR:3–SR:r–m = 1.05–1.09:2.32–2.41:1.0. Fore wing vein cu–a postfurcal with 1–M. Hind wing vein 1r–m 1.26–1.37 times longer than SC+R1. Apex of vein C+SC+R with 5 well-spaced, thickened bristles. Base of hind wing with a moderate-sized to large glabrous area.

Length of fore femur:tibia:tarsus = 1.0:1.04–1.16:1.50–1.52. Fore basitarsus 6.8 times longer than maximally deep. Length of hind femur:tibia:basitarsus = 1.37–1.47:2.18–2.44:1.0. Hind basitarsus 8.17–8.70 times longer than deep.

First metasomal tergite approximately 1.15–1.42 times longer than wide. Second metasomal tergite approximately 1.56–1.59 times wider than long. Second and third metasomal tergites largely sculptured, scabrous, rugose or striate. Fourth metasomal

tergite (except for transverse grooves) largely rugulose to rugose (Fig. 23). Fifth metasomal tergite (except for transverse grooves) largely scabrous or rugulose (Fig. 24). Ovipositor ranging between 1.31 and 1.45 times the length of the fore wing. Ovipositor apex laterally compressed (Fig. 28). Ovipositor sheath hairs short (Fig. 14).

Antennae entirely black. Head, mesosoma, front and middle legs entirely yellow or rufous. Wings largely yellow but with approximately the apical quarter brown (see Fig. 4); pterostigma entirely yellowish except for extreme apex. Hind legs entirely black, hairs and inner side of hind tibia and tarsus black or brown. Metasomal tergites and sclerotized parts of sternites entirely black. Ovipositor sheath hairs white or distinctly greyish on apical half of sheath.

Acknowledgements

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Appendix

The following are the data and instruction files SPECS, CHARS, ITEMS and TOKEY input into the DELTA computerized key construction package.

File SPECS

*SHOW: Indo-Australian *Zaglyptogastra*—specs file
 *NUMBER OF CHARACTERS 21
 *MAXIMUM NUMBER OF STATES 3
 *MAXIMUM NUMBER OF ITEMS 8
 *CHARACTER TYPES 4,OM 5,RN 10,OM 20,OM 21,RN
 *NUMBERS OF STATES 2,3 4,3 10,3 12,3 14,3 16–17,3 20,3
 *IMPLICIT VALUES
 *DEPENDENT CHARACTERS

File CHARS

*SHOW: Indo-Australian *Zaglyptogastra*—character list
 *CHARACTER LIST

- 1.01 #1. scapus <colour>/
- 1.02 1. entirely black/
- 1.03 2. brown or yellow–brown dorsally/
- 2.01 #2. head (excluding stemmaticum) <colour>/
- 2.02 1. entirely yellow or rufous/
- 2.03 2. extensive yellowish with piceous-black on frons and occiput/
- 2.04 3. entirely black/
- 3.01 #3. propodeum/
- 3.02 1. sparsely setose antero-medially/
- 3.03 2. densely setose antero-medially/

- 4.01 #4. fore wing <colour>/
- 4.02 1. 2nd and 3rd submarginal cells yellow basally/
- 4.03 2. 2nd but not 3rd submarginal cells yellow basally/
- 4.04 3. 2nd and 3rd submarginal cells brown basally/
- 5.01 #5. fore wing/
- 5.02 mm long/
- 6.01 #6. pterostigma <colour>/
- 6.02 1. entirely yellowish except for extreme apex/
- 6.03 2. at least apical 0.35 brown or black/
- 7.01 #7. pterostigma <shape>/
- 7.02 1. more than $2.8 \times$ longer than wide/
- 7.03 2. less than $2.8 \times$ longer than wide/
- 8.01 #8. fore wing vein 1-SR+M <shape>/
- 8.02 1. moderately to strongly curved/
- 8.03 2. straight/
- 9.01 #9. fore wing vein cu-a/
- 9.02 1. postfurcal with 1-M/
- 9.03 2. more or less interstitial with 1-M/
- 10.01 #10. length of hind wing vein 1r-m:SC+R1/
- 10.02 1. greater than 1.45:1/
- 10.03 2. ranging between 1.17:1 and 1.45:1/
- 10.04 3. less than 1.17:1/
- 11.01 #11. base of hind wing <setosity>/
- 11.02 1. with a moderate-sized to large glabrous area/
- 11.03 2. evenly setose/
- 12.01 #12. hind legs <colour>/
- 12.02 1. entirely black/
- 12.03 2. entirely yellow-brown/
- 12.04 3. yellow-brown except tarsus and apex of tibia, black/
- 13.01 #13. hairs on inner side of hind tibia and tarsus <colour>/
- 13.02 1. black or brown/
- 13.03 2. white/
- 14.01 #14. metasomal tergites <colour>/
- 14.02 1. entirely black/
- 14.03 2. entirely brown or yellow to orange/
- 14.04 3. the first three segments yellow-brown and posterior segments black/
- 15.01 #15. metasomal tergites 2 and 3/
- 15.02 1. largely strongly sculptured, scabrous, rugose, or striate/
- 15.03 2. smooth except for middle of 2nd tergite and 2nd suture/
- 16.01 #16. metasomal tergite 4 <except for transverse grooves>/
- 16.02 1. largely rugulose to rugose/
- 16.03 2. largely striate/
- 16.04 3. entirely smooth/

- 17.01 #17. metasomal tergite 5 <except for transverse grooves>/
- 17.02 1. largely smooth except for fine punctures/
- 17.03 2. largely striate/
- 17.04 3. largely scabrous or rugulose/
- 18.01 #18. ovipositor sheath hairs/
- 18.02 1. short/
- 18.03 2. long/
- 19.01 #19. ovipositor sheath hairs <colour>/
- 19.02 1. black except for apical 0.25 at most of sheath/
- 19.03 2. white or distinctly greyish or yellowish on apical half of sheath/
- 20.01 #20. ovipositor apex/
- 20.02 1. dorso-ventrally compressed/
- 20.03 2. intermediate/
- 20.04 3. laterally compressed/
- 21.01 #21. length of ovipositor:fore wing/

File ITEMS*SHOW: Indo-Australian *Zaglyptogastra*—items***ITEM DESCRIPTIONS**

- 1.01 #abbotti <Ashmead>/
- 1.02 1,2 2,1 3,1 4,1 5,15.4–17.2 6,1 7,1 8,1 9,1 10,2 11,1
- 1.03 12,2 13,1 14,2 15,1 16,2 17,1 18,1 19,1 20,2 21,0.95–1.15
- 2.01 #aswada <sp. n.>/
- 2.02 1,1 2,1 3,1 4,2 5,14.7 6,1 7,1 8,1 9,1 10,2 11,1 12,1
- 2.03 13,1 14,1 15,1 16,2 17,1 18,1 19,1 20,3 21,1.06
- 3.01 #corruscator <Cameron & Strand>/
- 3.02 1,1 2,2 3,1 4,2 5,16.5 6,1 7,1 8,1 9,1 10,2 11,1 12,1
- 3.03 13,1 14,1 15,1 16,2 17,1 18,1 19,1 20,1 21,1.08
- 4.01 #ingratella <Cameron>/
- 4.02 1,2 2,1 3,2 4,3 5,16.3–17.6 6,1 7,1 8,1 9,1 10,2 11,1
- 4.03 12,1 13,2 14,1 15,1 16,1 17,3 18,1 19,2 20,3 21,1.26–1.33
- 5.01 #maiada <sp. nov.>/
- 5.02 1,1 2,1 3,1 4,1 5,16.2 6,1 7,1 8,1 9,1 10,2 11,1 12,2
- 5.03 13,1 14,2 15,1 16,2 17,2 18,1 19,1 20,2 21,0.87
- 6.01 #novaguinensis <sp. nov.>/
- 6.02 1,1 2,3 3,1 4,3 5,12.7 6,1 7,2 8,2 9,2 10,3 11,2 12,3
- 6.03 13,1 14,3 15,2 16,3 17,1 18,1 19,1 20,2 21,0.77
- 7.01 #plumiseta <Enderlein>/
- 7.02 1,1 2,2 3,1 4,V 5,8.4–11.2 6,2 7,1 8,1 9,2 10,3 11,1 12,1
- 7.03 13,1 14,1 15,1 16,2 17,2 18,2 19,1 20,3 21,0.97–1.09
- 8.01 #vitalisi <Turner>/
- 8.02 1,1 2,1 3,2 4,2 5,14.5–16.5 6,1 7,1 8,1 9,1 10,1 11,1
- 8.03 12,1 13,1 14,1 15,1 16,1 17,3 18,1 19,2 20,3 21,1.2–1.37

File TOKEY

- *SHOW: Translate into KEY format
- *HEADING: Indo-Australian *Zaglyptogastra*
- *LISTING FILE TOKEY.LST
- *INPUT FILE SPECS
- *TRANSLATE INTO KEY FORMAT
- *COMMENT: not reordered: EXCLUDE CHARACTERS
- *OMIT TYPESETTING MARKS
- *CHARACTER RELIABILITIES 1-5,5 6,9 7,10 8-10,5 11,7 12,9 13,5 14,9 15,10
16-17,5 18,9 19,3 20,6 21,4
- *KEY STATES 5,~12.5/12-15/15~21,~1/0.95-1.2/1.15~
- *KEY OUTPUT FILE KCHARS
- *INPUT FILE CHARS
- *KEY OUTPUT FILE KITEMS
- *INPUT FILE ITEMS

References

- ACHTERBERG, C. VAN, 1979, A revision of the subfamily Zelinae auct. (Hymenoptera, Braconidae), *Tijdschrift voor Entomologie*, **122**, 241-479.
- ACHTERBERG, C. VAN, 1988, Revision of the subfamily Blacinae Foerster (Hymenoptera, Braconidae), *Zoologische Verhandelingen*, **249**, 1-423.
- ASHMEAD, W. H., 1900, Classification of the Ichneumon flies, or the superfamily Ichneumonoidea, *Proceedings of the United States National Museum*, **23**, 1-220.
- ASHMEAD, W. H., 1906, Descriptions of new Hymenoptera from Japan, *Proceedings of the United States National Museum*, **30**, 169-201.
- CAMERON, P., 1909a, On some African species of Braconinae in the Royal Berlin Zoological Museum, *Archiv für Mathematik og Naturvidenskab*, **30**, 1-27.
- CAMERON, P., 1909b, On some new Bornean species of Braconidae, *Societas Entomologica*, **24**, 148-149.
- CROWE, T. J., 1962, The biology and control of *Dirphya nigricornis* Olivier, a pest of coffee in Kenya (Coleoptera: Cerambycidae), *Journal of the Entomological Society of South Africa*, **25**, 304-312.
- DALLWITZ, M. J. and PAINE, T. A., 1986, *User's Guide to the DELTA System. A general system for processing taxonomic descriptions*, 3rd edn. (Canberra: CSIRO, Division of Entomology Report), 13.
- ENDERLEIN, G. (1918) 1920, Zur Kenntniss ausser europaischer Braconiden, *Archiv für Naturgeschichte*, **84** (A), 51-224.
- FAHRINGER, J., 1928, *Opuscula braconologica*. 2. Aethiopische Region, Lieferung 1-3, 1-224.
- FAHRINGER, J., 1935, *Opuscula braconologica*. 2. Aethiopische Region. Lieferung 6-8, 385-635.
- HARRIS, R. A., 1979, A glossary of surface sculpture, *Occasional Papers of the Bureau of Entomology of the California Department of Agriculture*, **28**, 1-31.
- PARTRIDGE, T. R., DALLWITZ, M. J. and WATSON, L., 1988, *A Primer for the DELTA System on MS-DOS and VMS*, 2nd edn. (Canberra: CSIRO, Division of Entomology Reports), 38.
- QUICKE, D. L. J., 1981, A reclassification of some Oriental and Ethiopian species of Braconinae (Hymenoptera: Braconidae), *Oriental Insects*, **14**, 493-498.
- QUICKE, D. L. J., 1983, Reclassification of twenty species of tropical, Old World Braconinae described by Cameron, Strand and Szepligeti (Hymenoptera: Braconidae), *Entomologist's monthly magazine*, **119**, 81-84.
- QUICKE, D. L. J., 1984a, Further reclassification of Afrotropical and Indo-Australian Braconinae (Hymenoptera: Braconidae), *Oriental Insects*, **18**, 339-353.
- QUICKE, D. L. J., 1984b, Evidence for the function of white-tipped ovipositor sheaths in Braconinae (Hymenoptera: Braconidae), *Proceedings and Transactions of the British Entomological and Natural History Society*, **17**, 71-79.

- QUICKE, D. L. J., 1986, Preliminary notes on homeochromatic associations within the between the Afrotropical Braconinae (Hym., Braconidae) and Lamiinae (Col., Cerambycidae). *Entomologist's Monthly Magazine*, **122**, 97–110.
- QUICKE, D. L. J., 1988a, Reclassification of twenty-four species of Old World Braconinae (Hym., Braconidae). *Entomologist's Monthly Magazine*, **124**, 77–80.
- QUICKE, D. L. J., 1988b, Inter-generic variation in the male genitalia of the Braconinae (Insecta, Hymenoptera, Braconidae). *Zoologica Scripta*, **17**, 399–409.
- QUICKE, D. L. J., 1988c, The higher classification, zoogeography and biology of the Braconinae, in V. K. Gupta (ed.), *Advances in Parasitic Hymenoptera Research* (Leiden: E. J. Brill), pp. 117–138.
- QUICKE, D. L. J., 1990, Tergal and inter-tergal glands of male braconine wasps (Insecta, Hymenoptera, Braconidae). *Zoologica Scripta* (In press).
- SCHULZ, W. A. (1909) 1911, Zweihundert alte Hymenopteren, *Zoologischer Annalen*, **4**, 1–220.
- SHENEFELT, R. D., 1978, *Hymenopterorum Catalogus* (nov. ed). Part 15: Braconidae, vol. 10 (The Hague: Junk), pp. 1425–1865.
- STRAND, E., 1912, Über exotische Schulpfwespen (nebst Bemerkungen über KIEFFER'S Bearb. der Evaniiden im, 'Tierreich'). *Archiv für Naturgeschichte*, **78** (A), 24–75.
- SZÉPLIGETI, G. V., 1906, Braconiden aus der Sammlung des ungarischen National-Museums, *Annales historico-naturales Musei nationalis hungarici*, **4**, 547–618.
- SZÉPLIGETI, G. V., 1908, Braconidae und Ichneumonidae, in Sjostedt, Y. (ed.) *Wissenschaftliche Ergebnisse schwedischer zoologische Expedition Uppsala, Kilimanjaro-Meru*, **2**, 25–95.
- TURNER, R. E., 1919, On Indo-Chinese Hymenoptera collected by R. Vitalis de Salvaza. I, *Annals and Magazine of Natural History: including Zoology, Botany, Geology*, (9) **3**, 425–433.
- VIERECK, H. L., 1914, Type species of the genera of ichneumon flies, *Bulletin of the United States National Museum*, **83**, 1–186.