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Journal of Natural History

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/tnah20>

Systematics of the Australasian endemic wasp genus *Syngaster* Brullé (Hymenoptera: Braconidae: Doryctinae)

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Published online: 21 Feb 2007.

To cite this article: M. Iqbal, A. D. Austin & S. A. Belokobylskij (2006) Systematics of the Australasian endemic wasp genus *Syngaster* Brullé (Hymenoptera: Braconidae: Doryctinae), *Journal of Natural History*, 40:13-14, 819-853, DOI: [10.1080/00222930600790653](https://doi.org/10.1080/00222930600790653)

To link to this article: <http://dx.doi.org/10.1080/00222930600790653>

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Systematics of the Australasian endemic wasp genus *Syngaster* Brullé (Hymenoptera: Braconidae: Doryctinae)

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(Accepted 28 April 2006)

Abstract

The braconid genus *Syngaster* Brullé is revised and nine species are recognized, six of which are new: *S. lepidus* Brullé, *S. quadricolor* (Cameron), *S. variegatus* (Szépligeti), *S. crypticus* sp. nov., *S. hirtus* sp. nov., *S. neoguineensis* sp. nov., *S. polychromus* sp. nov., *S. stevensi* sp. nov., and *S. tricolor* sp. nov. Host data are only available for *S. lepidus* which is a parasitoid of cerambycid larvae, notably *Phoracantha* spp. associated with temperate, subtropical and Mediterranean eucalypt forests in eastern and southern Australia. Other than *S. lepidus*, *S. polychromus* is the only other species known from Australia (south-east Queensland), the remaining seven species all being restricted to mainland New Guinea. Preliminary phylogenetic analysis indicates the genus comprises two species groups with *S. lepidus* and *S. quadricolor* forming a polytomy with these. The two Australian species (*S. lepidus* and *S. polychromus*) are not monophyletic, nor are the two species that lack an occipital carina (*S. tricolor* and *S. cryptus*).

Keywords: *Braconidae*, *Doryctinae*, *Phoracantha*, *Syngaster*

Introduction

Until recently, the fauna of Doryctinae for the Australasian region was very poorly known. However, a major generic revision by Belokobils kij et al. (2004) more than doubled the number of known genera to 49 (12 of which were new), and increased the number of species to 110 (an increase of 47%). Significantly, 21 genera appear to be endemic, the highest proportion of any biogeographic region. Among these taxa, the Siragrini are particularly important with five of its six genera being endemic to Australasia. Apart from *Pseudodoryctes* Szépligeti that is restricted to Africa, the other genera either occur broadly throughout Australasia (*Pseudosyngaster* Belokobils kij, Iqbal and Austin), are restricted to New Guinea (*Siragra* Cameron) or to mainland Australia (*Arkoola* Belokobils kij, Iqbal and Austin and *Gurburra* Belokobils kij, Iqbal and Austin), or are shared between Australia and

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Published 26 July 2006

ISSN 0022-2933 print/ISSN 1464-5262 online © 2006 Taylor & Francis
DOI: 10.1080/00222930600790653

New Guinea (*Syngaster* Brullé). Species in the latter genus stand out as being among the most distinctive doryctines within the region due to their vivid, contrasting colour pattern, their moderately large body size, and the distinct lobe and double carinae on the dorsal rim of the antennal scape.

First described for *S. lepidus* Brullé for a specimen collected in about 1840 from Tasmania (Brullé 1946), *Syngaster* remained largely unstudied except for anecdotal reports on additional specimens as they came to hand or listing of the type species (e.g. Viereck 1914; Turner 1918; Parrott 1953). Fahringer (1942) and van Achterberg (1980) correctly recognized two additional species, *Epitonychus variegatus* Szépligeti and *Hecabolus quadricolor* Cameron, respectively, as members of the genus, while Cameron (1912) and Austin et al. (1994) provided redescriptions of *S. lepidus* and Belokobylskij et al. (2004) provided a redescription of the genus.

Interestingly, Quicke et al. (1992) postulated that the type species, *S. lepidus*, is part of a mimicry complex comprising species from three braconid subfamilies that parasitize the eucalypt wood-boring beetle genus *Phoracantha* (Coleoptera: Cerambycidae). This group of wasps all have a striking orange-red head, black body and vivid white propodeum and/or anterior metasoma. However, despite this intriguing biological phenomenon, the species was known from very few specimens until Austin et al. (1994) showed that the species was relatively common and widespread in southeastern Australia. More recently, Belokobylskij et al. (2004) have presented a detailed diagnosis for *Syngaster* as part of a synopsis of doryctine genera of Australasia, which also includes a comprehensive key to genera for the region. During this work a number of new taxa, mostly from New Guinea, were uncovered in collections that are the focus of this paper.

The taxonomy of *Syngaster* is here revised as part of a broader study aimed at dealing with the endemic doryctine genera of Australasia. A revised diagnosis of the genus is presented along with descriptions of six new species. In addition, we also undertake a preliminary analysis of relationships among species, present a key to species, and discuss the distribution and biology of the genus.

Materials and methods

Images were taken using an Olympus SZX12 stereomicroscope fitted with an Olympus DP11 digital microscope camera at the Olympus Imaging Unit, The University of Adelaide. Terminology used for morphology follows Sharkey and Wharton (1997).

The following abbreviations are used in the text: AEIC, American Entomological Institute, Gainesville; ANIC, Australian National Insect Collection, Canberra; BMNH, The Natural History Museum, London; FCTH, Forestry Commission of Tasmania, Hobart; HNHM, Hungarian Natural History Museum, Budapest; MNHN, Museum National d'Histoire Naturelle, Paris; NSWA, New South Wales Department of Agriculture Collection, Orange; QMBA, Queensland Museum, Brisbane; UQIC, University of Queensland, St Lucia; USNM, National Museum of Natural History, Washington, DC; WAMP, Western Australian Museum, Perth; WINC, Waite Insect and Nematode Collection, Adelaide; ZMAN, Zoologisch Museum, Amsterdam.

Phylogenetic analysis

The phylogenetic analyses were undertaken using PAUP* (phylogenetic analysis using parsimony) version 4.0 (Swofford 2001) for Power Macintosh and PC, while MacClade

3.07 (Maddison and Maddison 1997) was employed to input the data matrix in spreadsheet format and to trace character distribution on trees. AutoDecay 2.9.8 (Eriksson 1997) was used to calculate decay values or Bremer support (Bremer 1994) and the resulting trees were viewed and printed using TreeView 1.4 (Page 1997).

Where possible, characters were divided into binary states to avoid hierarchical linkage and the problem of scoring of non-applicable states (Pleijel 1995; Wilkinson 1995). For quantitative data, segment coding was adopted. The values of measurements were arranged in ascending order and then one standard deviation value was added to the minimum mean value in Table I. All taxa equal to or less than the added value were coded with the one state. This process was continued until the last mean value was assigned to a segment.

For parsimony analyses only the “heuristic” search option of PAUP* was employed. “Random” addition sequence with 100 replications and TBR branch swapping were used in all analyses. Characters were treated as unordered and weighted equally, irrespective of the number of states, with the exception of the morphometric characters that were down-weighted according to the number of states. For example, for a five-state character the base weight of 12 was divided by four, and treated as either ordered or unordered. Bootstrap analysis (Felsenstein 1985) and Bremer support (Bremer 1994) were used as a measure of tree fitness. Bootstraps were calculated using 100 replicates. Fourteen taxa and 30 characters were used in the analysis as listed below. The in-group comprised the nine species of *Syngaster* plus representatives of the other four genera that comprise the tribe Siragrini (=Syngastrini) [i.e. *Arkoola elongata* Belokobylskij et al., *Gurburra australica* Belokobylskij et al., *Pseudosyngaster annulicornis* (Brullé), *Siragra nitida* Cameron (Belokobylskij et al. 2004)]. Trees were rooted using *Jarra painei* Austin and Dangerfield, a member of the tribe Doryctini. The characters and states employed in the analysis were as follows:

1. Carina on apical lobe of scape: (0) separated; (1) fused.
2. Protuberance above clypeus: (0) present; (1) absent.
3. Occipital carina development: (0) present; (1) absent.
4. Notauli shape: (0) deep; (1) shallow.
5. Anterior mesonotum shape: (0) subvertical above pronotum; (1) gently curved above pronotum.
6. Prepectal carina development: (0) present; (1) absent.
7. Metapleural-propodeal suture: (0) present, (1) absent.
8. Angle of metapleural-propodeal surfaces: (0) present, (1) absent.
9. Propodeal bridge development: (0) present; (1) absent.
10. Propodeal colour: (0) milk white; (1) any other.
11. Propodeal aerola development: (0) present; (1) absent.
12. Anteroventral corner of hind coxa: (0) present; (1) absent.
13. Hind basitarsus: tarsal segments 2–5: (0) ≤ 0.84 ; (1) 0.85–1.03; (2) 1.04–1.22; (3) 1.23–1.41; (4) ≥ 1.42 .
14. Vein 3Rsa: vein 2RS: (0) ≤ 0.67 ; (1) 0.68–0.84; (2) 0.85–1.01; (3) 1.02–1.18; (4) ≥ 1.19 .
15. Colour of first metasomal tergite: (0) at least some part white or yellow on dorsal side; (1) other colour.
16. Sculpturing of first metasomal tergite: (0) striate at least in apical one-third; (1) not striate.
17. Suture of second metasomal tergite: (0) sinuate; (1) straight.

Table I. Data matrix for phylogenetic analysis.

	Character																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
<i>Jarra painei</i>	1	1	0	0	0	0	0	1	1	1	0	1	0	0	1	0	1	1	1	–	1	0	0	1	1	2	0	0	0	0
<i>Siragra nitida</i>	0	1	1	0	1	1	0	0	0	1	0	1	0	3	1	1	0	1	1	–	1	2	1	3	2	4	1	0	–	2
<i>Gurburra australica</i>	0	1	0	0	0	0	0	0	1	1	1	0	4	0	1	1	1	1	1	–	1	3	3	0	1	3	2	4	1	4
<i>Arkoola elongata</i>	0	1	0	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	–	1	2	2	0	3	2	0	3	0	2
<i>Pseudosyngaster annulicornis</i>	0	1	0	0	0	0	0	0	1	1	1	1	3	1	1	1	1	1	1	–	1	2	2	0	0	2	0	0	0	0
																								1	1		1	1		1
																														2
																														3
<i>Syngaster crypticus</i>	0	1	1	0	0	0	0	1	1	1	1	1	2	2	0	0	1	0	0	1	1	2	0	1	1	1	1	2	–	0
<i>Syngaster hirtus</i>	0	1	0	1	0	0	0	1	1	1	1	0	2	0	0	0	1	0	0	1	1	1	0	3	1	1	0	0	1	2
																														1
																														2
<i>Syngaster lepidus</i>	0	1	0	0	0	0	0	0	1	0	1	1	0	0	0	1	1	1	0	0	1	0	0	2	1	1	0	0	2	0
																								2			1			1
																														2
																														3
<i>Syngaster neoguineensis</i>	0	1	0	1	0	0	1	1	1	1	1	1	2	2	0	1	1	1	0	1	0	2	0	1	2	0	0	0	1	1
<i>Syngaster polychromus</i>	0	0	0	0	0	0	1	1	1	0	1	1	1	1	0	1	1	1	0	1	0	0	2	1	1	1	0	0	1	1
<i>Syngaster quadricolor</i>	0	1	0	0	0	0	0	0	1	1	1	1	0	?	0	1	1	0	0	1	1	?	?	1	0	1	0	3	–	3
<i>Syngaster stevensi</i>	0	1	0	0	0	0	0	1	1	1	1	1	0	0	0	1	1	1	0	1	0	1	0	0	0	0	1	1	–	1
<i>Syngaster tricolor</i>	0	1	1	1	0	0	1	1	1	1	1	1	2	1	0	1	1	1	0	1	0	2	2	1	1	1	1	1	0	2
<i>Syngaster variegatus</i>	0	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1	1	2

18. Sculpturing of second metasomal tergite: (0) striate, at least to some part laterally; (1) other sculpturing.
19. Basal area of second metasomal tergite: (0) present; (1) absent.
20. Shape of basal area of second metasomal tergite: (0) short and wide; (1) long and semicircular.
21. Posterior area of metasomal tergites 3–6: (0) with white bands; (1) without white bands.
22. Forewing length: width: (0) ≤ 3.57 ; (1) 3.58–4.04; (2) 4.05–4.51; (3) ≥ 4.52 .
23. Hindwing length: width: (0) ≤ 4.67 ; (1) 4.68–5.34; (2) 5.35–6.01; (3) ≥ 6.02 .
24. Face height: eye height: (0) ≤ 1.08 ; (1) 1.09–1.16; (2) 1.17–1.24; (3) ≥ 1.25 .
25. Mesosoma length: width: (0) ≤ 1.99 ; (1) 2–2.22; (2) 2.23–2.45; (3) ≥ 2.46 .
26. Second metasomal tergite length: third metasomal tergite length: (0) ≤ 0.74 ; (1) 0.75–0.91; (2) 0.92–1.08; (3) 1.09–1.25; (4) ≥ 1.26 .
27. First metasomal tergite length: maximum width: (0) ≤ 1.34 ; (1) 1.35–1.78; (2) ≥ 1.79 .
28. Metasoma length: head and mesosoma length: (0) ≤ 1.03 ; (1) 1.04–1.16; (2) 1.17–1.29; (3) 1.3–1.42; (4) ≥ 1.43 .
29. Tip of ovipositor sheaths: (0) straight, (1) slightly clavate, (2) broadly clavate.
30. Body size: (0) ≤ 7.22 mm; (1) 7.23–9.24 mm; (2) 9.25–11.26 mm; (3) 11.27–13.28 mm; (4) ≥ 13.29 mm.

Syngaster Brullé

Syngaster Brullé 1846, p 454. Type species: *Syngaster lepidus* Brullé by monotypy (Viereck 1914); Turner 1918, p 57; Shenefelt and Marsh 1976, p 1332; Quicke et al. 1992, p 1021; Belokobylskij et al. 2004, p 100.

Epitonychus Szépligeti 1902, p 25. Type species: *Epitonychus variegatus* Szépligeti (synonymy by Fahringer 1942).

Diagnosis

Head subcubical. Ocelli small and in almost equilateral triangle. Antennal sockets situated very close together, sometimes almost fused along internal margins. Occipital carina usually present, sometimes absent. Eyes glabrous. Postgenal bridge narrow. Maxillary palps six-segmented; labial palps four-segmented, third segment not shortened. Antennal scape long and narrow, with distinct constriction basally, with distinct apical lobe dorsally margined by two strong and widely separated lateral carinae, lower carina posteriorly not fused with upper. First flagellar segment weakly curved or straight, usually longer or sometimes shorter than second. Mesonotum high, rounded in lateral view and raised above pronotum. Notauli complete, usually shallow, sometimes deep. Prepectal carina present, postpectal carina absent, Sternaulus distinct and rather deep, almost straight. Propodeum without marginate areas, propodeal tubercles and propodeal bridge absent. Fore wing marginal cell slightly shortened, 2RS and r-m present, second submarginal cell short, 1m-cu almost interstitial, 1cu-a interstitial or postfurcal, first subdiscal cell closed distally, 3CU arising from posterior one-third to one-quarter along distal margin of first subdiscal cell. Hind wing subbasal cell short, m-cu present, basal cell wide distally, RS arising from R, marginal cell without r. Fore tibia with strong spines arranged almost in single row. Hind coxa usually angulate basoventrally but without tooth. Hind basitarsus 0.8–0.9 times as long as segments 2–5 combined. First metasomal tergite with small dorsope. Acrosternite 0.15–0.2

times as long as tergite. Second tergite with deep, curved basal furrow separating basal semicircular area, female with second suture distinct, almost straight or weakly curved laterally. Third tergite with distinct transverse, weakly curved furrow in basal one-third. Ovipositor longer than metasoma, usually almost as long as body.

Taxonomic comments

Syngaster annulicornis Brullé was excluded from the genus by Belokobylskij et al. (2004) and proposed as the type species of *Pseudosyngaster* Belokobylskij, Iqbal and Austin. The latter genus differs from *Syngaster* primarily in the second metasomal tergite lacking a semicircular basal area, the metapleuron being coarsely rugose-reticulate, and the metasoma lacking any white coloration. The placement of *Syngaster* as a junior synonym of *Odontobracon* Cameron by Szépligeti (1904) was not accepted by subsequent authors. *Odontobracon* is restricted to the New World, belongs to a different tribe, and is morphologically very different from *Syngaster* (Marsh 1988).

Hosts and biology

Host data are known only for *S. lepidus* which has been extensively reared from the larvae of *Phoracantha* spp. as a solitary idiobiont ectoparasitoid, as well as from the genera *Coptocerus* and *Epithora* (Cerambycidae) (Austin et al. 1994; Belokobylskij et al. 2004). *Syngaster lepidus* has been introduced into South Africa and California as a biological control agent against *Phoracantha* attacking plantation and ornamental eucalypt trees. This species apparently did not establish in South Africa, but has in California where it is exerting some pressure, along with other introduced parasitoids, on *Phoracantha* populations (Austin et al. 1994; Millar et al. 2002a, 2002b).

As outlined by Quicke et al. (1992), *S. lepidus* is part of a mimicry complex comprising species from three braconid subfamilies that parasitize the eucalypt wood-boring beetle genus *Phoracantha* in Australia. These wasps all have the same striking orange-red, black and white colour pattern. What is unclear is whether the other species of *Syngaster* that have a similar colour pattern (namely *S. crypticus*, *S. polychromus*, *S. stevensi*, *S. tricolor*, and *S. variegates*) are also part of this mimicry complex and are parasitoids of *Phoracantha* spp. or related cerambycids.

Phylogenetic results

Parsimony analysis with morphometric characters treated as unordered generated three equally shortest trees of length 564 steps. The strict consensus tree (Figure 1) shows *Syngaster* is monophyletic (node 2) and sister to *G. australica*, with the other three taxa (*S. nitida*, *A. elongata*, and *P. annulicornis*) forming a monophyletic group (node 1) below them. Monophyly of *Syngaster* is supported by three character states in this analysis: (1) at least part of first metasomal tergite white or yellow (character 15), (2) basal area of the second metasomal tergite present (character 19), and (3) face height to eye height >1.09 (character 24). This is one of only two relatively well-supported nodes in the tree with a decay index of nine and bootstrap value of 60. Within *Syngaster* two groups of species are recognized but with *S. lepidus* (Australia) and *S. quadricolor* (New Guinea) falling outside these and being unresolved with respect to each other. Four species from New Guinea form one clade (node 4) that is supported by two morphometric characters (characters 22 and

Figure 1. Strict consensus of three most parsimonious trees of length 564 steps (CI=0.55, RI=0.56, RC=0.31). Bootstrap values greater than 50 are given below the line; Bremer support values are given above the line; numbers in circles refer to nodes discussed in the text.

28). The other clade (node 3), which has the highest decay index and bootstrap values, includes two species from New Guinea and one from Queensland (*S. polychromus*). This group is supported by two character states; absences of the metapleural-propodeal suture (character 7) and the ratio of veins 3Rsa to 2RS being 0.68–1.01 (character 14). Surprisingly, species that lack an occipital carina (character 3), *S. tricolor* and *S. crypticus*, are

not sister taxa. In fact, constraint of this character state to form a monophyletic group required an additional 19 steps to find the most parsimonious tree.

Analysis of the data matrix with morphometric characters treated as ordered generated nine shortest trees of length 646, but with less resolution compared with the tree derived from unordered morphometric characters. However, the same general relationships among the species were recovered, including a sister group relationship between *S. crypticus* and *S. hirtus*, and the monophyly of the species at node 3. The only difference between the two analyses is that the position of *S. stevensi* switches from clade 4 to clade 3 with the ordered data.

The preliminary nature of these results preclude any detailed biogeographic analysis but some assessment of the data may be useful. Interestingly, the two Australian species, *S. lepidus* and *S. polychromus*, are not sister taxa, nor are the New Guinean species monophyletic, although six are contained within two distinct groups. Given that New Guinea was connected to north Queensland during the Pleistocene and in earlier times (Hope 1994), it is likely that the genus speciated on one side or the other of Torres Strait, and dispersed within New Guinea and southwards into eastern and southern Australia. Also, given that the majority of species have been rarely collected, it is likely that a number of additional taxa will eventually be discovered both in Australia and New Guinea.

Key to species of *Syngaster*

1. Occipital carina absent (Figure 7c) 2
- Occipital carina distinct and almost complete (Figure 2h) 3
2. Metapleuron and propodeum fused, not separated by distinct suture; mesosoma pale red-brown (Figure 7d); scape entirely yellow-brown (Figure 7d); legs yellow-brown, hind tibia in apical two-thirds and hind tarsus dark red-brown to black; metasomal tergites 3–6 with wide milk-white bands posteriorly (Figure 7e); hind coxa with rather distinct ventroanterior corner; body length 9.7 mm *S. tricolor* sp. nov.
- Metapleuron and propodeum separated by distinct punctate suture; mesosoma black (Figure 2a); scape black, pale apically (Figure 2a); legs entirely black; metasomal tergites 3–6 without white bands posteriorly (Figure 2a, c); hind coxa without ventroanterior corner; body length 5.2 mm *S. crypticus* sp. nov.
3. Propodeum mostly milk-white (Figure 5b) (Australia) 4
- Propodeum red-yellow or sometimes darker (Figure 6d) (New Guinea) 5
4. Metapleuron separated from propodeum by distinct punctate suture (Figure 5a) along which these sclerites meet at an angle (i.e. propodeal and metapleural surfaces not continuously rounded); first metasomal tergite 1.2–1.5 times as long as its apical width (Figure 5a); mid and hind coxae black, rarely mid coxa red-brown; metasoma behind first tergite entirely black, sometimes apically brown; mesosoma (except propodeum) black; face without median protuberance above clypeus (seen laterally); body length 6.0–12.5 mm *S. lepidus* Brullé
- Metapleuron and propodeum fused, not separated by distinct suture, surfaces continuously rounded (Figure 6a); first metasomal tergite almost as long as its apical width; mid and hind coxae milk-white; metasoma behind first tergite mostly milk-white, with black basal stripes on all tergites (Figure 6a); mesosoma (except propodeum) light red-brown, propleuron yellow (Figure 5h); face with distinct

Figure 2. (a–c) *Syngaster crypticus* sp. nov., male: (a) body (dorsolateral view); (b) head and pronotum (lateral view); (c) propodeum and metasomal tergites 1–4 (lateral view). (d–g) *Syngaster hirtus* sp. nov., female: (d) head and mesosoma (dorsal view); (e) head and mesosoma (lateral view); (f) propodeum and metasomal tergites 1–2 (dorsal view); (g) head (anterior view); (h) *Syngaster lepidus* Brullé, female, head and pronotum (dorsal view). Scale bars: 2 mm (a, e, f, h); 1 mm (b–d, g).

- median protuberance above clypeus (seen laterally); body length 8.2–8.5 mm
. *S. polychromus* sp. nov.
5. First metasomal tergite striate at least in apical one-third (Figure 2f) 6
– First metasomal tergite entirely or mostly (except sculptured apical quarter) smooth, sometimes partly puncturate or fine rugulose (Figure 6d) 7
6. First metasomal tergite in apical two-thirds and second tergite (except smooth basal area) distinctly striate (Figure 2f); basal area of second tergite long, separated by distinctly convexly curved furrow (Figure 2f); temple 1.1 times eye length (seen dorsally); propodeum red-brown, first metasomal tergite yellow in basal one-third and on sides, black in medio-apical two-thirds (Figure 2f); body length 11–12 mm *S. hirtus* sp. nov.
– First metasomal tergite striate only in apical one-third, second tergite mostly smooth (Figure 7h); basal area of second tergite shortened, separated by weakly convexly curved furrow (Figure 7h); temple 0.7 times eye length (seen dorsally); propodeum red-brown with dark posterior margin (Figure 7g), first metasomal tergite white with black patch in medio-apical one-third (Figure 7h); body length 9.3 mm *S. variegatus* (Szépligeti)
7. Metasomal tergites 3–6 with milk-white bell-shaped posterior area (Figure 7a); body length 8.25 mm *stevensi* sp. nov.
– Metasomal tergites without bell-shaped posterior area (Figure 5f); body length greater than 9 mm 8
8. Notauli in anterior half of mesoscutum deep and weakly crenulate; metapleuron and propodeum separated by distinct suture (Figure 6b); first metasomal tergite rugulose-punctate in apical two-thirds, smooth in basal one-third (Figure 6d), second tergite striate but puncturate medially (Figure 6d); propodeum dark brown, first metasomal tergite yellow with small black medio-apical spot (Figure 6d); body length 13 mm *S. quadricolor* (Cameron)
– Notauli in anterior half of mesoscutum shallow and smooth; metapleuron and propodeum fused, not separated by distinct suture (Figure 5f); first and second metasomal tergites smooth (Figure 5e); propodeum red-brown, first metasomal tergite dark brown with white basal area and sides (Figure 5e, f); body length 9.5 mm *S. neoguineensis* sp. nov.

Treatment of species

Syngaster crypticus sp. nov.

(Figures 2a–c, 4a)

Male

Length. 5.2 mm.

Colour. Head pale yellow. Antenna dark brown to black. Palps yellow-brown. Mesosoma black. Legs dark brown. Wings faintly infusate, pterostigma dark brown. First tergite of

metasoma milky white, second tergite white in basal half, apical half and basal area dark brown, rest of tergites dark brown, third to sixth tergites with wide milk-white bands posteriorly.

Head. Width 1.3 times its median length, 1.1 times width of mesoscutum. Head behind eyes weakly convex. Transverse diameter of eye 0.9 times as long as temple in dorsal view. Ocelli medium size, in triangle with base 1.2 times its sides, POL 1.2 times OD, 0.2 times OOL. Frons short and weakly convex. Diameter of antennal sockets two times distance from socket to border of eye. Eyes glabrous, 1.2 times as high as broad. Malar space height 0.59 times height of eye, 1.3 times basal width of mandible. Face width 1.1 times height of eye and 1.2 times height of face and clypeus combined. Clypeus with narrow lower flange, clypeal suture distinct laterally, almost absent dorsally. Hypoclypeal depression round, its width 0.9 times distance from edge of depression to eye, 0.4 times width of face. Occipital carina absent. Hypostomal keel wide. Head below eyes convexly narrowed. Maxillary palps about 1.7 times as long as height of head. Antennal flagellum slender (missing apically, only 40 segments present), first segment length four times width. Maximum length of scape including lobe 3.2 times maximum width.

Mesosoma. Length 2.16 times its height. Pronotum short. Mesoscutum highly and almost perpendicularly raised above pronotum. Notauli deep, narrow, and crenulated. Prescutellar depression rather short, more or less deep, smooth, with four strong carinae, 0.2 times as long as scutellum. Scutellum slightly convex, its maximum width almost equal to median length. Metanotum with very small median tooth. Subalar depression shallow and wide, rugose-reticulate. Sternaulus very shallow, straight, smooth, running along entire lower length of mesopleura. Metapleural lobe short and wide. Metapleuron separated from propodeum by distinct punctate suture; propodeal and metapleural surfaces continuously rounded, not distinctly angled along suture. Propodeum with lateral tubercles, distinctly roundly narrowed from base to apex (lateral view). Fore tibia with very small spines arranged almost in single row. Tarsal segment of middle leg not elongate, basitarsus 3.6 times as long as wide, 2.2 times as long as second segment, fourth segment subsquare. Hind coxa without basoventral tooth, 1.55 times as long as wide. Hind femur 3.9 times as long as wide. Inner spur of hind tibia 0.9 times as long as outer spur, 0.1 times as long as basitarsus. Hind tarsus 1.1 times as long as hind tibia, hind basitarsus 1.15 times as long as second to fifth segments combined, second tarsal segment of hind leg 0.27 times as long as basitarsus, 0.9 times as long as fifth segment (without pretarsus).

Wings. Length of fore wing 4.14 times its maximum width. Pterostigma 4.5 times as long as wide, 0.45 times as long as R1. 3RSa 1.2 times r, 0.17 times 3RSb, 0.66 times 2RS. Second submarginal cell two times as long as wide, 0.65 times as long as first subdiscal cell. Hind wing about 4.2 times as long as wide, C+Sc+R 0.9 times SC+R.

Metasoma. Metasoma 1.31 times as long as head and mesosoma combined. First tergite distinctly and almost linearly widened basally, weakly convex and weakly narrowed apically, with short wide basolateral processes, with very small dorsope and small spiracular tubercles, length of tergite 1.74 times its maximum submedian width, 1.82 times its apical width, apical width 0.9 times its maximum submedian width, 1.4 times its minimum width. Second tergite with wide and distinctly convex medially basal semicircular area, separated by deep crenulate furrow, median length of area 0.64 times maximum length of tergite,

maximum length 0.9 times its basal width, 0.83 times length of third tergite, second suture distinctly undulate. Third tergite with curved transverse crenulate furrow in basal one-third.

Sculpture and pubescence. Vertex, frons, and temple entirely smooth. Vertex with rather long semi-erect and sparse hairs. Face smooth with sparse puncturation. Sides of pronotum, mesoscutum and scutellum puncturate, but mesopleuron smooth over most part. Metapleuron almost smooth anteriorly, rugulose-striate posteriorly. Propodeum almost entirely smooth medially, with sparse puncturation laterally. Mesoscutum entirely with dense short semi-erect hairs. Hind coxa rugulose. Hind femur almost smooth with sparse puncturation. Hind tibia dorsally with very short, dense semi-erect hairs. First metasomal tergite striate in apical two-thirds, smooth in basal one-third. Second tergite striate except for smooth basal area. Remainder of metasoma smooth.

Female

Unknown.

Material examined

Holotype: male, Papua New Guinea, 5°25'S, 144°04'E, Jimi Valley, Baiyer River, 1750 m, 7–26 February 1979, J. Sedlacek (AEIC).

Comments

This is a distinctive species and easily identified based on the absence of an occipital carina, black mesosoma, white first metasomal tergite and lateral parts of the second tergite, and the unusual convex, semicircular area on the second tergite. The species name “*crypticus*” refers to the unusual loss of the occipital carina and therefore the possible cryptic position of this species relative to the other members of the genus.

***Syngaster hirtus* sp. nov.**

(Figures 2d–g, 4a)

Female

Length. 11–12 mm.

Colour. Head red-yellow. Scape dark red-brown, flagellum dark brown, almost black. Palps yellow. Mesosoma light red-brown. Legs brown-yellow, hind femur and tarsus darker. First metasomal tergite yellow in basal one-third and on sides, black in medio-apical two-thirds. Rest of tergites black, third to sixth tergites with rather narrow submedian transverse yellow stripes.

Head. Width 1.2 times its median length, 1.1 times width of mesoscutum. Head behind eyes weakly convex. Transverse diameter of eye 0.9 times as long as temple in dorsal view. Ocelli medium size, in triangle with base 1.2 times its sides, POL 1.1 times OD, 0.25 times OOL. Frons short and weakly convex. Diameter of antennal sockets 1.8 times distance

from socket to border of eye. Eyes glabrous, 1.3 times as high as broad. Malar space height 0.54 times height of eye, almost equal to basal width of mandible. Face width 1.3 times height of eye and almost equal to height of face and clypeus combined. Clypeus without distinct lower flange, clypeal suture distinct laterally, almost absent dorsally. Hypoclypeal depression round, its width 0.7 times distance from edge of depression to eye, 0.4 times width of face. Occipital carina complete, curved ventrally and fused with hypostomal carina. Hypostomal keel wide. Head below eyes distinctly and convexly narrowed. Maxillary palps about 1.5 times as long as height of head. Antennal flagellum slender, 59–64-segmented, first segment length four times width. Scape more or less distinctly compressed, its maximum length including lobe three times maximum width.

Mesosoma. Length two times its height. Pronotum very short, with distinct submedian pronotal keel. Mesoscutum highly and almost perpendicularly raised above pronotum, its median lobe weakly protruding forward. Notauli shallow, narrow, and smooth. Prescutellar depression rather short, more or less deep, smooth, with five strong carinae, 0.3 times as long as scutellum. Scutellum flat, its maximum width 1.5 times median length. Metanotum with very small median tooth. Subalar depression shallow and wide, rugose-reticulate. Sternaulus very shallow, straight, smooth, running along anterior two-thirds of lower length of mesopleuron; metapleural lobe short and wide. Metapleuron separated from propodeum by distinct punctate suture; propodeal and metapleural surfaces continuously rounded, not distinctly angled along suture. Propodeum without lateral tubercles, distinctly roundly narrowed from base to apex (lateral view). Fore tibia with very small spines arranged almost in single row. Tarsal segment of middle leg not elongate, basitarsus 3.7 times as long as wide, 2.3 times as long as second segment, fourth segment subsquare. Hind coxa without basoventral tooth, but with distinct basoventral corner, 1.6 times as long as wide. Hind femur 3.4 times as long as wide. Inner spur of hind tibia 1.6 times as long as outer spur, 0.1 times as long as basitarsus. Hind tarsus 1.1 times as long as hind tibia, hind basitarsus 1.1 times as long as second to fifth segments combined, second tarsal segment of hind leg 0.3 times as long as basitarsus, 0.9 times as long as fifth segment (without pretarsus).

Wings. Length of fore wing 3.6 times its maximum width. Pterostigma 4.6 times as long as wide, 0.8 times as long as R1. 3RSa 1.4 times r, 0.19 times 3RSb, 0.63 times 2RS. Second submarginal cell 1.8 times as long as wide, 0.86 times as long as first subdiscal cell. Hind wing about 4.35 times as long as wide, C+Sc+R 1.2 times SC+R.

Metasoma. Metasoma 1.1–1.3 times as long as head and mesosoma combined. First tergite distinctly and almost linearly widened basally, weakly convex and weakly narrowed apically, with short wide basolateral processes, with very small dorsope, without spiracular tubercles, length of tergite 1.3 times its maximum submedian width, 1.45 times its apical width, apical width 0.9 times its maximum submedian width, 1.4 times its minimum width. Second tergite with wide and distinctly convex medially basal semicircular area, separated by deep crenulate furrow, median length of area 0.6 times maximum length of tergite, maximum length 0.6 times its basal width, 0.8 times length of third tergite, second suture distinctly undulate. Third tergite with distinct straight transverse crenulate furrow in basal one-third. Ovipositor sheaths almost as long as body, two times as long as metasoma, 2.8 times as long as mesosoma; tip of sheaths slightly clavate in shape.

Sculpture and pubescence. Vertex, frons, and temple entirely smooth. Vertex with rather long semi-erect sparse hairs. Face densely and rather coarsely transversally striate entirely. Sides of pronotum smooth. Mesoscutum and scutellum smooth, mesoscutum with two distinct striae medio-posteriorly. Mesopleuron smooth in most part. Metapleuron sparsely and distinctly punctulate, almost smooth anteriorly, rugulose-striate posteriorly. Propodeum almost entirely smooth with sparse puncturation. Mesoscutum entirely with dense short semi-erect hairs. Hind coxa almost entirely smooth. Hind femur almost smooth. Hind tibia dorsally with very short dense semi-erect hairs. First metasomal tergite striate in apical two-thirds, smooth in basal one-third. Basal area of second tergite sparsely punctulate, almost smooth basally, rest of tergite striate. Third and fourth tergites striate in basolateral two-thirds. Rest of metasoma smooth.

Male

Unknown.

Material examined

Holotype: female, Papua New Guinea, 10°03'S, 149°27'E, Amazon Bay Area, Keria, 1650 ft, 29 June to 22 July 1962, W. W. Brandt (ANIC). Paratype: one female, 6°44'S, 147°33'E, Basu River, 60 km E of Lae, 13 January to 10 March 1979, J. Sedlacek (AEIC).

Comments

This species is easily identified from all other *Syngaster* based on its yellow-brown or reddish brown head, mesosoma, and legs; the black apical area of the first metasomal tergite, the mostly sculptured second tergite, and having coarsely crenulated broad grooves on the remaining tergites. This is also the largest species of *Syngaster*, its length only rarely attained by a few large specimens of *S. lepidus*. The species name "*hirtus*", refers to the dense, short, semi-erect hairs on the mesoscutum.

***Syngaster lepidus* Brullé**

(Figures 2h, 3a–e, 4b, 5a, b)

Syngaster lepidus Brullé 1846, p 459; Cameron 1912, p 197; Belokobylskij et al. 2004, p 100; Shenefelt and Marsh 1976, p 1332; Austin et al. 1994, p 160 (lectotype designation).

Vipio gestroi Mantero 1897, p 119; Parrott 1953, p 209 (synonym by Fahringer 1942).

Iphiaulax rubriceps Froggatt 1916, p 564 (synonym by Austin et al. 1994).

Iphiaulax rubricepsis Shenefelt 1978, p 1792 (replacement name for *I. rubriceps*).

Female

Length. 8.0–12.5 mm.

Colour. Head red-brown. Mesosoma usually all black, sometimes with posterior scutellum and metanotum dark red-brown. Palps pale brown, slightly darker basally. Scape black except for outer distal flange which is dark red-brown; rest of antenna black. Metapleuron and propodeum milk white; posterior margin of propodeum black. Legs usually all black, sometimes partially or almost completely red-brown. Wings evenly and darkly infusate.

Figure 3. *Syngaster lepidus* Brullé, female. (a) Fore wing; (b) hind wing; (c) head (anterior view); (d) fore tibia (lateral view); (e) propodeum and metasomal tergites 1–3. Scale bars: 2 mm (a, b); 1 mm (c–e). After Austin et al. (1994).

First metasomal tergite milk white. Second to sixth tergites black, sometimes with red-brown or golden brown transverse stripes. Seventh tergite yellow-brown or red-brown.

Head. Width 1.25 times its median length, 1.1 times width of mesoscutum. Head behind eyes weakly convex. Transverse diameter of eye virtually equal to length of temple in dorsal view. Ocelli medium size, in triangle with base 1.2 times its sides, POL 1.1 times OD, 0.2 times OOL. Frons short with narrow indistinct depression. Diameter of antennal sockets 2.0 times distance from socket to border of eye. Eyes glabrous, 1.3 times as high as broad. Malar space height 0.6 times height of eye, 1.1 times basal width of mandible. Face flat, width 1.2 times height of eye and almost equal to height of face and clypeus combined. Clypeus with lower flange, clypeal suture distinct. Hypoclypeal depression round, its width 0.75 times distance from edge of depression to eye, 0.5 times width of face. Occipital carina complete, curved ventrally and fused with hypostomal carina. Hypostomal keel wide. Head below eyes convexly narrowed. Maxillary palps about 1.4 times as long as height of head. Antennal flagellum slender, 58–65-segmented, first segment length 3.3 times width. Scape more or less compressed, its maximum length including lobe 2.7 times maximum width.

Mesosoma. Length two times its height. Pronotum very short, with distinct submedian pronotal keel. Mesoscutum highly and almost perpendicularly raised above pronotum, its median lobe weakly protruding forward. Notauli deep, narrow, complete, and crenulated. Prescutellar depression rather short, more or less deep, smooth, with seven strong carinae, 0.3 times as long as scutellum. Scutellum flat, its maximum width about 1.1 times median

Figure 4. (a) Distribution map of *Syngaster* species in New Guinea: (▲) *S. crypticus*; (◆) *S. hirtus*; (+) *S. neoguineensis*; (★) *S. quadricolor*; (■) *S. stevensi*; (●) *S. tricolor*; (*) *S. variegatus*. (b) Distribution map of *Syngaster* species in Australia: (●) *S. lepidus*; arrow, *S. polychromus*. Map for *S. lepidus* modified from Austin et al. (1994).

Figure 5. (a, b) *Syngaster lepidus* Brullé, female: (a) Propodeum and metasomal tergites 1–3 (dorsal view); (b) propodeum and first metasomal tergite (dorsal view). (c–f) *Syngaster neoguineensis* sp. nov., female: (c) head (dorsal view); (d) head (frontal view); (e) metasomal tergites 1–4 (dorsal view); (f) propodeum and metasoma (lateral view). (g, h) *Syngaster polychromus* sp. nov., female: (g) head (anterior view); (h) head, mesosoma and anterior metasoma (lateral view). Scale bars: 1 mm (a, c, d, g); 2 mm (b, e, f, h).

Figure 6. (a) *Syngaster polychromus* sp. nov., female, propodeum and metasoma (lateral view). (b–e) *Syngaster quadricolor* (Cameron), female: (b) head and mesosoma (lateral view); (c) head (anterior view); (d) propodeum and first tergite to third tergite (dorsal view); (e) body (lateral view). (f–h) *Syngaster stevensi* sp. nov., male: (f) head (dorso-lateral view); (g) head (frontal view); (h) propodeum and metasomal tergites 1–2 (lateral view). Scale bars: 2 mm (a, c); 1 mm (b, d–h).

Figure 7. (a) *Syngaster stevensi* sp. nov., male, metasomal tergites 3–6 (dorsal view). (b–e) *Syngaster tricolor* sp. nov., female: (b) head (frontal view); (c) head (dorso-lateral view); (d) head and mesosoma (dorsal view); (e) metasoma (dorsal view). (f–h) *Syngaster variegatus* (Szépligeti), female: (f) head (anterior view); (g) head, mesosoma and first metasomal tergite (lateral view); (h) metasomal tergites 1–4 (dorso-lateral view). Scale bars: 1 mm (a–c, f–h); 2 mm (d, e).

length. Metanotum with very small median tooth. Subalar depression shallow and wide, rugose-reticulate. Sternaulus very shallow, straight, smooth, running along entire lower length of mesopleuron. Metapleuron separated from propodeum by distinct punctate suture along which these sclerites meet at an angle (i.e. propodeal and metapleural surfaces not continuously rounded). Propodeum without lateral tubercles, distinctly roundly narrowed from base to apex (lateral view). Fore tibia with very small spines arranged almost in single row. Basitarsal segment of middle leg elongate, nearly seven times as long as wide, 2.0 times as long as second segment; remaining segments shortened, with fourth segment subsquare. Hind coxa without basoventral tooth, 1.45 times as long as wide. Hind femur 3.6 times as long as wide. Inner spur of hind tibia 1.3 times as long as outer spur, 0.13 times as long as basitarsus. Hind tarsus 0.9 times as long as hind tibia, hind basitarsus 0.94 times as long as second to fifth segments combined, second tarsal segment 0.38 times as long as basitarsus, 1.4 times as long as fifth segment (without pretarsus).

Wings. Length of fore wing 3.5 times its maximum width. Pterostigma 3.9 times as long as wide, 0.78 times as long as R1. 3RSa 2.0 times r, 0.2 times 3RSb, 0.8 times 2RS. Second submarginal cell 2.1 times as long as wide, 0.6 times as long as first subdiscal cell. Hind wing about 4.8 times as long as wide; C+Sc+R almost equal to SC+R.

Metasoma. Metasoma 1–1.1 times as long as head and mesosoma combined. First tergite distinctly and almost linearly widened basally, but weakly narrowed apically, with short and wide basolateral processes, with very small dorsope, without spiracular tubercles, length of tergite almost equal to its maximum submedian width, 1.25 times its apical width. Second tergite with wide and distinctly convex medially basal semicircular area, separated by deep crenulate furrow, median length of area 0.7 times maximum length of tergite, maximum length 0.7 times its basal width, 0.76 times length of third tergite, second suture weakly undulate. Third tergite with distinct straight transverse crenulate furrow in basal one-third. Ovipositor sheaths about as long as body, 1.8 times as long as metasoma, 2.7 times as long as mesosoma; tip of sheaths strongly and broadly clavate.

Sculpture and pubescence. Vertex, frons, and temple entirely smooth. Vertex, temples, and face with rather long semi-erect sparse hairs. Face mostly smooth except for scattered tiny punctures. Pronotum rugulose in dorsal part, punctate along ventral margin. Mesoscutum and scutellum smooth. Mesosoma except for median mesopleuron entirely with semi-erect hairs. Mesopleuron smooth in most part. Metapleuron sparsely and distinctly punctulate, smooth anteriorly. Propodeum entirely punctulate to reticulate-punctate, sometimes smoother along anterior and posterior margins. Hind coxa almost entirely smooth, dorsally with very short, dense semi-erect hairs. Hind femur almost smooth. First tergite sparsely punctulate to more extensively punctate but with broad smooth areas between. Second and third tergites virtually smooth except for punctate transverse grooves. Remaining tergites smooth.

Male

As for female except as follows: length 6.0–10.0. Metasoma elongate, up to two times as long as head and mesosoma combined. First metasomal tergite with lateral margins parallel, about 1.8 times as long as wide. Second tergite with median area defined by

striate-punctate sculpturing. Fourth and fifth tergites with crescent-shaped area anteriorly indicated by faint line which is often finely scrobiculate. Body with slightly longer pilosity which is denser along ventro-lateral pronotum.

Material examined

Lectotype: *Syngaster lepidus*, female (designated by Austin et al. 1994) (in poor condition: part of head, side of the mesosoma, right fore leg, both median and left hind legs, right hind wing, left fore wing and metasoma behind third tergite missing), “Nmuseum Paris, Tasmanie, Craunster 2900-40”, “2900/40”, “♀ *Syngaster lepidus* Brullé, C. van Achterberg, 1970, Lectotype” (MNHN). Lectotype of *Iphiaulax rubriceps* Froggatt, female, “NSW, Uralla, parasite of *Phoracantha*, WWF” (NSWA).

Other material. **Queensland:** one female, Brisbane, January 1973, J. Sedlacek (AEIC); two females, Brisbane, 22–26 January 1990, R. Wharton (USNM); one female, one male, Brisbane, 4 September 1911, H. Hacker (QMBA); one female, Brisbane, 13 April 1912, H. Hacker (QMBA); one female, 17 Mile Rocks, Brisbane, 24 February 1964 (UQIC); one female, Dunk Island, August 1927, H. Hacker (QMBA); one female, Highvale, November, year and collector missing (AEIC); one male, Lake Broadwater near Dalby, 1 May 1987, G. and A. Daniels (UQIC); one male, Lamington National Park, 22 July 1963, M. Koplick (UQIC); two males, Mackay, 1909 (BMNH); two females, Mt Tambourine, 27 October 1912, H. Hacker (QMBA); one male, Dunwich, Stradbroke Is, 2 May 1971, D. Murray (UQIC); two females, Stradbroke Island, 3 December 1912, H. Hacker (QMBA); one female, Stradbroke Island, 5 December 1913, H. Hacker (QMBA); one female, Mt Walker, November to December, year and collector missing (AEIC). **New South Wales:** one female, Mt Canobolas, 29 October 1957, E. F. Riek (ANIC); one male, Mt Kaputra, 30 October 1967, G. W. Frazier (ANIC); one female, Lisarow, 11 July 1954, K. M. Moore (USNM); one female, Lisarow, 25 July 1954, K. M. Moore (USNM); two females, four males, Ourimbah State Forest, Scaddens Ridge Wyong, 1 July 1986 (AEIC, WINC); five females, one male, Wyong, September 1968, D. U. U. Webb (USNM). **Australian Capital Territory:** three female, six males, Black Mountain, 12–15 February 1991, R. Paiva (WINC); one female, five males, Black Mountain, 25 January to 7 February 1991, R. Paiva (WINC; USNM); two males, Black Mountain, 15 January 1991, R. Paiva (AEIC; USNM); one female, Blundells, 6 January 1961, E. F. Riek (ANIC); one female, two males, Canberra, 4–10 January 1999, R. Wharton (USNM). **Victoria:** one male, Healesville, 3 January 1927, F. E. Wilson (QMBA); 11 females, 10 males, Morwell, 24 May 1991, Qiao Wang (USNM; WINC); one female, multiple locations, October 1991, Qiao Wang (WINC); one male, locality missing, 1912, C. French (BMNH); one female, no data, 7 February 1907 (BMNH). **South Australia:** one female, one male, Bundaleer, 27 October 1959, F. D. M. (WINC); two females, Mt Crawford, 10 July 1986, no collector (WINC); one female, Kangaroo Island, 26 December 1989 to 3 January 1990, R. Wharton (USNM); one female, Nundoo, December 1961, H. G. G. (UQIC); four females, Wirrabara, November 1987, Riverside (USNM). **Tasmania:** one female, Woodsdale, 15 July 1985, R. Bashford (FCTH); one female, Woodsdale, 16 August 1984, R. Bashford (FCTH). **Western Australia:** one female, 41 miles W Caiguna, 25 October 1969, H. Evans and R. W. Matthews (USNM); one female, Perth, 1917 (WAMP); one female, Caversham, November 1915 (WAMP); one female, Yanchep, 16 October 1969, H. Evans and R. W. Matthews (USNM).

Comments

Syngaster lepidus is the most widely distributed (Figure 4b) and commonly collected species in the genus and, along with *S. polychromus*, is the only species recorded from Australia. These two species are also the only members of the genus that have a white propodeum. However, they differ in many respects and are not closely related to each other. Most importantly they differ in the metapleural–propodeal suture which is present and distinctly punctate in *S. lepidus* and absent in *S. polychromus*. *Syngaster lepidus* also has the mid and hind coxae black (rather than white), lacks a median protuberance above clypeus, and has a much larger body. Compared with all other species, it also has a distinctly clavate tip to the ovipositor sheaths. N.B. The distribution map for *S. lepidus* (Figure 4b) includes locality data for the material examined and listed above, as well as additional material from several collections referred to in Austin et al. (1994) which we did not need to re-borrow for the current study.

***Syngaster neoguineensis* sp. nov.**

(Figures 4a, 5c–f)

*Female**Length.* 8–8.75 mm.

Colour. Head and mesosoma pale red-brown with dark patches behind eyes in holotype. Scape red-brown. Palps yellow. Legs pale red-brown with hind tarsus dark brown. First metasomal tergite dark brown with white basal and lateral margins, second tergite dark brown, remaining tergites dark brown with rather narrow submedian transverse white stripe.

Head. Width 1.3 times its median length, almost equal to width of mesoscutum. Head behind eyes weakly convex. Transverse diameter of eye almost equal to temple length in dorsal view. Ocelli medium size, in triangle with base 1.2 times its sides, POL almost equal to OD, 0.3 times OOL. Frons short and weakly convex. Diameter of antennal sockets two times distance from socket to border of eye. Eye glabrous, 1.2 times as high as broad. Malar space height 0.47 times height of eye, almost equal to basal width of mandible. Face width 1.1 times height of eye and 1.2 times height of face and clypeus combined. Clypeus without distinct lower flange, clypeal suture distinct. Hypoclypeal depression round, its width 0.9 times distance from edge of depression to eye, 0.4 times width of face. Occipital carina complete, curving ventrally and fused with hypostomal carina. Hypostomal keel wide. Head below eyes convexly narrowed. Maxillary palps about 1.8 times as long as height of head. Antennal flagellum slender (missing apically, only 25 segments present), first segment length 3.7 times width. Scape more or less compressed, its maximum length including lobe 2.6 times maximum width.

Mesosoma. Length 2.35 times its height. Pronotum short. Mesoscutum highly and almost perpendicularly raised above pronotum, its median lobe weakly protruding forwards. Notauli shallow and smooth in anterior half. Prescutellar depression rather short, more or less deep, smooth, with four strong carinae, 0.2 times as long as scutellum. Scutellum flat, its maximum width 1.1 times median length. Metanotum with very small median tooth. Subalar depression shallow and wide, rugose-reticulate. Sternaulus very shallow, straight,

smooth, running along entire lower length of mesopleuron. Metapleural lobe short. Metapleuron and propodeum fused and surfaces evenly rounded (i.e. propodeal–metapleural suture absent). Propodeum with lateral tubercles, distinctly roundly narrowed from base to apex (lateral view). Fore tibia with small spines arranged almost in single row. Tarsal segment of middle leg not elongate, basitarsus 4.6 times as long as wide, 2.5 times as long as second segment, fourth segment subsquare. Hind coxa without basoventral tooth, 1.6 times as long as wide. Hind femur 8.1 times as long as wide. Inner spur of hind tibia 1.1 times as long as outer spur, 0.12 times as long as basitarsus. Hind tarsus 1.15 times as long as hind tibia, hind basitarsus 1.15 times as long as second to fifth segments combined, second tarsal segment of 0.37 times as long as basitarsus, 1.8 times as long as fifth segment (without pretarsus).

Wings. Length of fore wing 4.1 times its maximum width. Pterostigma 3.75 times as long as wide, 0.6 times as long as R1. 3RSa 2.5 times r, 0.24 times 3RSb, almost equal to 2RS. Second submarginal cell 1.92 times as long as wide, 0.62 times as long as first subdiscal cell. Hind wing about 4.4 times as long as wide; C+Sc+R 1.6 times SC+R.

Metasoma. Metasoma 0.9–1.1 times as long as head and mesosoma combined. First tergite almost linearly widened basally, weakly narrowed apically, with short wide basolateral processes, with very small dorsope and spiracular tubercles present, length of tergite almost equal to its maximum submedian width, 1.1 times its apical width; apical width 0.9 times its maximum submedian width, 1.1 times its minimum width. Second tergite with wide distinctly convex medially basal semicircular area, separated by deep crenulate furrow, median length of area 0.66 times maximum length of tergite, maximum length 0.52 times its basal width, 0.7 times length of third tergite, second suture weakly undulate. Third tergite with distinct straight transverse crenulate furrow in basal half. Ovipositor sheaths almost equal to body length, 2.1 times as long as metasoma, 2.7 times as long as mesosoma; tip of sheaths slightly clavate.

Sculpture and pubescence. Vertex, frons, and temple entirely smooth. Vertex with rather long semi-erect sparse hairs. Face densely and rather coarsely transversally striate. Sides of pronotum rugulose. Mesoscutum and scutellum smooth. Mesopleuron smooth in most part. Metapleuron sparsely and distinctly punctulate anteriorly, almost smooth posteriorly. Propodeum almost entirely smooth. Mesoscutum entirely with semi-erect hairs. Hind coxa almost entirely with sparse puncturation. Hind femur almost smooth. Hind tibia dorsally with short, dense semi-erect hairs. First and second metasomal tergites smooth with sparse puncturation, third tergite smooth with sparse puncturation in basolateral one-third, rest of metasoma smooth.

Male

Unknown.

Material examined

Holotype: female, Papua New Guinea, 6°13'S, 146°01'E, Kassam Pass, 1300 m, 10–23 January 1979, J. Sedlacek (AEIC). Paratype: one female, 7°20'S, 146°43'E, Wau, October 1969, P. Shanahan (AEIC).

Comments

This species can be easily separated from all other species of *Syngaster* by the uniform pale red-brown colour of the head, mesosoma and legs, the white metasomal sternites, and white band on tergites 3–5. This species is named after the island of New Guinea where most species in the genus have been collected.

Syngaster polychromus sp. nov.

(Figures 4b, 5g, h, 6a)

Female

Length. 8.2–8.5 mm.

Colour. Head and pronotum yellow. Scape dark red-brown. Palps yellow. Mesoscutum and scutellum light red-brown. Propodeum milk white with apical margin dark brown. Fore legs yellow with fifth tarsal segment dark brown, mid legs yellow with coxa milk white, tibia light brown, trochanter and tarsal segments dark brown, hind legs dark brown with milk white coxa. First metasomal tergite milk white with dark brown basal and apical margins. Second tergite dark brown with white medio-lateral triangle. Remaining tergites dark brown with rather narrow submedian transverse white stripes.

Head. Width 1.1 times its median length, 1.1 times width of mesoscutum. Head behind eyes weakly convex. Transverse diameter of eye 1.1 times as long as temple in dorsal view. Ocelli medium size, in triangle with base 1.2 times its sides, POL 1.1 times OD, 0.2 times OOL. Frons short and weakly convex. Diameter of antennal sockets 1.8 times distance from socket to border of eye. Eyes glabrous, 1.4 times as high as broad. Malar space height 0.46 times height of eye, almost equal to basal width of mandible. Face width 1.1 times height of eye and almost equal to height of face and clypeus combined. Clypeus without distinct lower flange, clypeal suture distinct. Hypoclypeal depression round, its width 0.8 times distance from edge of depression to eye, 0.4 times width of face. Occipital carina complete, curved ventrally and fused with hypostomal carina. Hypostomal keel wide. Head below eyes convexly narrowed. Maxillary palps about 1.6 times as long as height of head. Antennal flagellum slender, 51–55-segmented, first segment length three times width. Scape more or less compressed, its maximum length including lobe 2.5 times maximum width.

Mesosoma. Length two times its height. Pronotum very short, with distinct submedian pronotal keel. Mesoscutum highly and almost perpendicularly raised above pronotum, its median lobe weakly protruding forward. Notauli deep, narrow, complete, and crenulated. Prescutellar depression rather short, more or less deep, smooth, with five strong carinae, 0.3 times as long as scutellum. Scutellum flat, its maximum width 1.1 times median length. Metanotum with very small median tooth. Subalar depression shallow and wide, rugose-reticulate. Sternaulus very shallow, straight, smooth, running along entire lower length of mesopleuron. Metapleural lobe short and wide. Metapleuron and propodeum fused and surfaces evenly rounded (i.e. propodeal–metapleural suture absent). Propodeum without lateral tubercles, distinctly roundly narrowed from base to apex (lateral view). Fore tibia with very small spines arranged almost in single row. Tarsal segment of middle leg not elongate, basitarsus 3.8 times as long as wide, 2.1 times

as long as second segment, fourth segment subsquare. Hind coxa without basoventral tooth, 1.4 times as long as wide. Hind femur 3.4 times as long as wide. Inner spur of hind tibia 1.3 times as long as outer spur, 0.13 times as long as basitarsus. Hind tarsus 0.9 times as long as hind tibia, hind basitarsus 0.95 times as long as second to fifth segments combined, second tarsal segment 0.37 times as long as basitarsus, 1.2 times as long as fifth segment (without pretarsus).

Wings. Length of fore wing 3.57 times its maximum width. Pterostigma 3.7 times as long as wide, 0.82 times as long as R1. 3RSa 1.8 times r, 0.18 times 3RSb, 0.8 times 2RS. Second submarginal cell 1.9 times as long as wide, 0.8 times as long as first subdiscal cell. Hind wing about 5.8 times as long as wide; C+Sc+R almost equal to SC+R.

Metasoma. Metasoma 1–1.1 times as long as head and mesosoma combined. First tergite distinctly and almost linearly widened basally, but weakly narrowed apically, with short and wide basolateral processes, with very small dorsope, without spiracular tubercles, length of tergite almost equal to its maximum submedian width, 1.1 times its apical width; apical width 0.9 times its maximum submedian width, 1.2 times its minimum width. Second tergite with wide and distinctly convex medially basal semicircular area, separated by deep crenulate furrow, median length of area 0.7 times maximum length of tergite, maximum length 0.7 times its basal width, 0.76 times length of third tergite, second suture weakly undulate. Third tergite with distinct straight transverse crenulate furrow in basal one-third. Ovipositor sheaths 0.7–0.75 times as long as body, 1.1 times as long as metasoma, 1.4–1.5 times as long as mesosoma; tip of sheaths slightly clavate.

Sculpture and pubescence. Vertex, frons, and temple entirely smooth. Vertex with rather long semi-erect sparse hairs. Face densely and rather coarsely transversally striate. Sides of pronotum rugulose. Mesoscutum and scutellum smooth. Mesopleuron smooth in most part. Metapleuron sparsely and distinctly punctulate, striate anteriorly, almost smooth posteriorly. Propodeum almost entirely with deep and sparse puncturation, with distinct median carina in basal two-thirds, smooth in apical one-third. Mesoscutum entirely with semi-erect hairs. Hind coxa almost entirely smooth. Hind femur almost smooth. Hind tibia dorsally with very short, dense semi-erect hairs. First tergite with sparse puncturation. Basal area of second tergite densely punctulate, rest of tergite almost smooth. Third tergite in basolateral one-third puncturate. Remaining tergites smooth.

Male

Unknown.

Material examined

Holotype: female, Queensland, 27°20'S, 152°46'E, Mt Glorious, 10 January, without year and collector (AEIC). Paratype: one female, same data as holotype (AEIC).

Comments

This species is the only species, other than *S. lepidus*, to have a vivid white propodeum, and to be found on the Australian mainland. *Syngaster polychromus* is particularly distinctive and

can be separated from all other species based on having the mid and hind coxae white, the metapleuron and propodeum fused and not separated by a distinct suture, the metasoma behind first tergite being mostly white with a black basal band on each tergite, and the face with a distinct median protuberance above the clypeus. This species is named after its distinctive colour pattern.

***Syngaster quadricolor* (Cameron)**

(Figures 4a, 6b–e)

Hecabolus quadricolor Cameron 1911, p 243; Shenefelt and Marsh 1976, p 1356.

Syngaster quadricolor Cameron: van Achterberg 1980, p 213.

Female

Length. 13.0 mm.

Colour. Head red-yellow. Frons in most part and face black. Scape dark red-brown. Palps yellow. Mesosoma light red-brown. Metapleuron and propodeum black. Fore and middle legs brown-yellow, but middle coxa almost black, hind leg dark red-brown, hind coxa and trochanters almost black, hind femur and tarsus lighter. First metasomal tergite yellow, with small black medio-apical spot, remaining tergites black, third to sixth tergites with rather narrow submedian transverse yellow stripes.

Head. Width 1.4 times its median length, 1.1 times width of mesoscutum. Head behind eyes weakly convex in anterior half, roundly narrowed in posterior half. Transverse diameter of eye 1.1 times as long as temple in dorsal view. Ocelli medium size, in triangle with base 1.2 times its sides, POL 0.7 times OD, 0.2 times OOL. Frons short and weakly convex. Diameter of antennal sockets 1.8 times distance from socket to border of eye. Eyes glabrous, 1.2 times as high as broad. Malar space height 0.55 times height of eye, almost equal to basal width of mandible. Face width 1.1 times height of eye and almost equal to height of face and clypeus combined. Clypeus without distinct lower flange, clypeal suture distinct laterally, almost absent dorsally. Hypoclypeal depression round, its width 0.6 times distance from edge of depression to eye, 0.4 times width of face. Occipital carina complete, curved ventrally and fused with hypostomal carina. Hypostomal flange wide. Head below eyes distinctly and convexo-roundly narrowed. Maxillary palps about 1.5 times as long as height of head. Antennal scape more or less distinctly compressed, its maximum length including lobe 2.3 times maximum width (antennal flagella missing).

Mesosoma. Length 1.8 times its height. Pronotum very short, with distinct submedian pronotal keel. Mesoscutum high and almost perpendicularly raised above pronotum, its median lobe weakly protruding forward. Notauli deep, narrow, complete, and strongly crenulated. Prescutellar depression rather short, more or less deep, smooth, with five strong carinae, 0.3 times as long as scutellum. Scutellum flat, its maximum width 1.2 times median length. Metanotum with very small median tooth. Subalar depression shallow and wide, rugose-reticulate. Sternaulus very shallow, straight, smooth, running ventrally along anterior two-thirds of mesopleuron; metapleural lobe short and wide. Metapleuron separated from propodeum by distinct punctate suture along which these sclerites meet at an angle (i.e. propodeal and metapleural surfaces not continuously rounded).

Propodeum without lateral tubercles, distinctly roundly narrowed from base to apex (lateral view). Fore tibia with very small spines arranged almost in single row. Tarsal segment of middle leg elongate, basitarsus 2.5 times as long as wide, 1.8 times as long as second segment, fourth segment subsquare. Hind coxa without basoventral tooth, but with distinct basoventral corner, 1.5 times as long as wide. Hind femur 3.3 times as long as wide. Inner spur of hind tibia 1.6 times as long as outer spur, 0.2 times as long as basitarsus. Hind tarsus 1.1 times as long as hind tibia, 0.8 times as long as segments 2–5 combined, second segment 0.4 times as long as basitarsus, 0.9 times as long as fifth segment (without pretarsus).

Wings. Missing.

Metasoma. Metasoma 1.4 times as long as head and mesosoma combined. First tergite distinctly and almost linearly widened basally, then weakly and roundly widened, but weakly narrowed apically; with short and wide basolateral processes, with very small dorsope, without spiracular tubercles, length of tergite 1.3 times its maximum submedian width, 1.45 times its apical width, apical width 0.9 times its maximum submedian width, 1.4 times its minimum width. Second tergite with wide and distinctly convex medially basal semicircular area, separated by deep crenulate furrow, median length of area 0.6 times maximum length of tergite, maximum length 0.7 times its basal width, 0.8 times length of third tergite, second suture weakly and distinctly undulate. Third tergite with distinct straight transverse crenulate furrow in basal one-third. Ovipositor almost as long as body, 3.3 times as long as metasoma, 1.7 times as long as mesosoma (ovipositor sheaths missing).

Sculpture and pubescence. Vertex, frons, and temple entirely smooth. Vertex with rather long semi-erect sparse hairs laterally, broad median area glabrous. Entire face densely and rather coarsely transversely striate. Sides of pronotum widely and distinctly rugulose. Mesoscutum and scutellum smooth. Mesoscutum with two distinct striae medio-posteriorly. Mesopleuron smooth in most part. Metapleuron sparsely and distinctly punctulate, almost smooth anteriorly, rugulose-striate posteriorly. Propodeum almost entirely with deep and rather sparse puncturation, with distinct median carina in basal two-thirds. Mesoscutum entirely with dense short semi-erect hairs. Hind coxa almost entirely smooth. Hind femur almost smooth. Hind tibia dorsally with very short, dense semi-erect hairs. First tergite rugulose-punctulate in apical two-thirds, smooth in basal one-third. Basal area of second tergite sparsely punctulate, almost smooth basally, rest of tergite striate, but punctulate medially. Third and fourth tergites in basolateral two-thirds striate. Remaining tergites smooth.

Male

Unknown.

Material examined

Holotype: female, Irian Jaya (without wings and flagellum), “Z. Nieaw, Lorentz 1909–10, Heuvel Bivak, XI.09, 750 m” [5°23'S 138°04'E], “*Hecabolus quadricolor* Cam. type”, “*Hecabolus quadricolor* Cam., C. van Achterberg, 1980, Holotype” (ZMAN).

Comments

This species has not been collected since the holotype in 1909. It can be separated from other members of the genus by its dark brown propodeum, the yellow first metasomal tergite which has a small black apical patch, and the notauli which are deep and weakly crenulated.

Syngaster stevensi sp. nov.

(Figures 4a, 6f–h, 7a)

Male

Length. 8.25 mm.

Colour. Head brown-yellow with dark brown band on face. Antennae dark brown to black. Palps pale yellow. Mesosoma red-brown except dorsal propodeum which is dark brown to black. Fore and mid legs brown-yellow, hind legs dark brown with coxae black. Wings faintly infusate, pterostigma dark brown. First tergite of metasoma milky white with dark brown medio-dorsal patch in posterior half, rest of tergites black, tergites 3–6 with wide milk-white bell-shaped posterior area.

Head. Width 1.5 times its median length, 1.1 times width of mesoscutum. Head behind eyes weakly convex. Transverse diameter of eye 1.1 times as long as temple in dorsal view. Ocelli medium size, in triangle with base 1.1 times its sides, POL 1.1 times OD, 0.13 times OOL. Frons short and weakly convex. Diameter of antennal sockets two times distance from socket to border of eye. Eyes glabrous, 1.26 times as high as broad. Malar space height 0.47 times height of eye, almost equal to basal width of mandible. Face width almost equal to height of eye and 1.2 times height of face and clypeus combined. Clypeus with narrow lower flange, clypeal suture distinct laterally, almost absent dorsally. Hypoclypeal depression round, its width 0.73 times distance from edge of depression to eye, 0.4 times width of face. Occipital carina present. Hypostomal keel wide. Head below eyes convexly narrowed. Maxillary palps about 1.7 times as long as height of head. Antennal flagellum slender, 50-segmented, first segment length 3.75 times width. Scape with maximum length including lobe 3.3 times maximum width.

Mesosoma. Length 1.76 times its height. Pronotum short. Mesoscutum highly and almost perpendicularly raised above pronotum. Notauli deep and crenulated. Prescutellar depression rather short, more or less deep, smooth, with three strong carinae, 0.3 times as long as scutellum. Scutellum slightly convex, its maximum width 1.16 times median length. Metanotum with very small median tooth. Subalar depression shallow and wide. Sternaulus shallow, straight, smooth, running along entire lower length of mesopleuron. Metapleural lobe wide. Metapleuron separated from propodeum by distinct punctate suture; propodeal and metapleural surfaces continuously rounded, not angled along suture line. Propodeum with lateral tubercles, distinctly roundly narrowed from base to apex (lateral view). Fore tibia with very small spines arranged almost in single row. Tarsal segment of middle leg not elongate; basitarsus 2.8 times as long as wide, 2.8 times as long as second segment, fourth segment subsquare. Hind coxa without basoventral tooth, 1.33 times as long as wide. Hind femur 4.3 times as long as wide. Inner spur of hind tibia 1.3 times as long as outer spur, 0.2 times as long as basitarsus. Hind tarsus 0.95 times as long as

hind tibia, basitarsus 0.8 times as long as second to fifth segments combined, second segment 0.3 times as long as basitarsus, 0.75 times as long as fifth segment (without pretarsus).

Wings. Length of fore wing 3.61 times its maximum width. Pterostigma 4.2 times as long as wide, 0.7 times as long as R1. 3RSa two times r, 0.18 times 3RSb, 0.66 times 2RS. Second submarginal cell 1.86 times as long as wide, 0.6 times as long as first subdiscal cell. Hind wing about four times as long as wide, C+Sc+R almost equal to SC+R.

Metasoma. Metasoma 1.2 times as long as head and mesosoma combined. First tergite distinctly and almost linearly widened basally, weakly narrowed apically, with short and wide basolateral processes, with very small dorsope, without spiracular tubercles, length of tergite 1.4 times its maximum width, 1.7 times its apical width, apical width 0.8 times its maximum width. Second tergite with wide and convex medially basal semicircular area, separated by deep crenulate furrow, median length of area 0.66 times maximum length of tergite, maximum length 0.8 times its basal width, 0.57 times length of third tergite, second suture weakly and distinctly undulate. Third tergite with straight transverse crenulate furrow in basal one-third. Remaining tergites smooth and lacking any surface features except for unusual colour pattern.

Sculpture and pubescence. Vertex, frons, and temple entirely smooth. Vertex with rather long semi-erect sparse hairs. Face rugulose with sparse puncturation. Sides of pronotum, mesoscutum, and scutellum puncturate. Mesopleuron smooth in most part. Metapleuron rugulose. Propodeum almost entirely smooth medially, with sparse puncturation laterally. Mesoscutum entirely with dense short semi-erect hairs. Hind coxa rugulose. Hind femur almost smooth with puncturation. Hind tibia with very short, dense, and semi-erect hairs. First metasomal tergite smooth with sparse puncturation, rest of metasoma almost smooth.

Female

Unknown.

Material examined

Holotype: male, Papua New Guinea, 5°32'S, 144°09'E, Baiyer River, 1100 m, 25 January to 6 February 1979, J. Sedlacek (AEIC).

Comments

This is a very distinct species based on the black patch on the first metasomal tergite, and the bell-shaped pale white area on the posterior of metasomal tergites 3–6. There is a possibility that it represents the male of one of the species already described from New Guinea, if the metasomal colour pattern (Figure 7a) is sexually dimorphic and does not occur in the female sex. However, this character is so unusual that we have elected to describe the species as new so that it can be more easily recognized in the future. It is named after Nick Stevens in thanks for his help with this revision of *Syngaster*.

Syngaster tricolor sp. nov.

(Figures 4a, 7a–e)

*Female**Length.* 9.7 mm.

Colour. Head and mesosoma pale red-brown. Two basal segments of antenna yellow-brown, most part of flagellum dark brown. Palps brown-yellow. Legs yellow-brown. Hind tibia in apical two-thirds and hind tarsus dark red-brown to black. Wings faintly infusate, pterostigma dark brown. First tergite of metasoma milky white, rest of tergites dark brown, third to sixth tergites with wide milk-white bands posteriorly. Ovipositor sheath dark brown.

Head. Width 1.2 times its median length, 1.1 times width of mesoscutum. Head behind eyes weakly convex. Transverse diameter of eye 1.3 times as long as temple in dorsal view. Ocelli medium size, in triangle with base 1.3 times its sides, POL 1.2 times OD, 0.2 times OOL. Frons short and weakly convex. Diameter of antennal sockets two times distance from socket to border of eye. Eyes glabrous, 1.1 times as high as broad. Malar space height 0.5 times height of eye, almost equal to basal width of mandible. Face width 1.1 times height of eye and almost equal to height of face and clypeus combined. Clypeus with narrow lower flange, clypeal suture distinct. Hypoclypeal depression round, its width 0.8 times distance from edge of depression to eye, 0.4 times width of face. Occipital carina absent. Hypostomal keel wide. Head below eyes convexly narrowed. Maxillary palps about 1.5 times as long as height of head. Antennal flagellum slender (missing apically, only 35 segments present), first segment length three times width. Scape length including lobe 2.7 times maximum width.

Mesosoma. Length 2.16 times its height. Pronotum short. Mesoscutum highly and almost perpendicularly raised above pronotum. Notauli shallow, narrow, and smooth. Prescutellar depression rather short, more or less deep, smooth, with five strong carinae, 0.2 times as long as scutellum. Scutellum slightly convex, its maximum width almost equal to median length. Metanotum with very small median tooth. Subalar depression shallow and wide, rugose-reticulate. Sternaulus very shallow, straight, smooth, running along anterior two-thirds of lower length of mesopleuron. Metapleural lobe short and wide. Metapleuron and propodeum fused and surfaces evenly rounded (i.e. propodeal–metapleural suture absent). Propodeum with lateral tubercles, distinctly roundly narrowed from base to apex (lateral view). Fore tibia with very small spines arranged almost in single row. Tarsal segment of middle leg not elongate, basitarsus 4.5 times as long as wide, 2.4 times as long as second segment, fourth segment subsquare. Hind coxa without basoventral tooth, but with distinct basoventral corner, 1.5 times as long as wide. Hind femur 3.5 times as long as wide. Inner spur of hind tibia 0.86 times as long as outer spur, 0.1 times as long as basitarsus. Hind tarsus 1.1 times as long as hind tibia, basitarsus 1.2 times as long as second to fifth segments combined, second tarsal segment of hind leg 0.36 times as long as basitarsus, 1.8 times as long as fifth segment (without pretarsus).

Wings. Length of fore wing 4.5 times its maximum width. Pterostigma four times as long as wide, 0.8 times as long as R1. 3RSa 1.8 times r, 0.17 times 3RSb, 0.46 times 2RS. Second

submarginal cell 1.3 times as long as wide, 0.63 times as long as first subdiscal cell. Hind wing about five times as long as wide, C+Sc+R 1.17 times SC+R.

Metasoma. Metasoma 1.23 times as long as head and mesosoma combined. First tergite distinctly and almost linearly widened basally, then weakly and roundly convex, but weakly narrowed apically; with short and wide basolateral processes, with very small dorsope, with spiracular tubercles; length of tergite 1.3 times its maximum submedian width, 1.53 times its apical width, apical width 0.9 times its maximum submedian width, 1.4 times its minimum width. Second tergite with wide and distinctly convex medially basal semicircular area, separated by deep crenulate furrow, median length of area 0.55 times maximum length of tergite, maximum length 0.8 times its basal width, 0.88 times length of third tergite, second suture weakly and distinctly undulate. Third tergite with distinct straight transverse crenulate furrow in basal one-third. Ovipositor sheaths 1.3 times body length, 2.43 times as long as metasoma, 3.9 times as long as mesosoma; tip of ovipositor straight, not clavate.

Sculpture and pubescence. Vertex, frons, and temple entirely smooth. Vertex with rather short semi-erect sparse hairs. Face smooth with sparse puncturation. Sides of pronotum, mesoscutum, and scutellum smooth. Mesopleuron smooth in most part. Metapleuron almost smooth anteriorly, rugulose-striate posteriorly. Propodeum almost entirely smooth with sparse puncturation. Mesoscutum entirely with dense short semi-erect hairs. Hind coxae rugulose. Hind femur almost smooth. Hind tibia dorsally with very short, dense semi-erect hairs. Metasomal tergites mostly smooth.

Male

Unknown.

Material examined

Holotype: female, Papua New Guinea, 6°13'S, 146°01'E, Kassam Pass, 1300 m, 10–23 January 1979, J. Sedlacek (AEIC).

Comments

Like other *Syngaster*, this is a distinctive species based on the lack of an occipital carina, and its yellow-brown colour pattern, namely mesosoma yellow-brown with distal mid and hind legs darker; first metasomal tergite white, and white bands on tergites 3–6. This species is named after its distinctive colour pattern.

***Syngaster variegatus* (Szépligeti)**

(Figures 4a, 7f–h)

Epitonychus variegatus Szépligeti 1902, p 58.

Syngaster variegatus: Fahringer 1942, p 46; Shenefelt and Marsh 1976, p 1333.

Female

Length. 9.5 mm.

Colour. Head and mesosoma light reddish brown. Antennae black, two basal segments dark reddish brown. Palps yellow. Legs light reddish brown, hind leg on internal and external margins distinctly darkened. Fore wing strongly infusate. Pterostigma dark brown. Metasoma black, first tergite at most part and transverse stripes on the posterior margins of third and fourth tergites yellowish white.

Head. Width about 1.5 times its median length. Temple behind eyes weakly roundly narrowed. Transverse diameter of eye 1.4 times as long as temple in dorsal view. Ocelli small, in almost equilateral triangle; POL 0.6 times OD, 0.2 times OO. Frons rather short and weakly convex. Antennal sockets fused at their internal borders. Diameter of socket about three times distance from socket to border of eye. Eyes glabrous, 1.2 times as high as broad. Malar space height 0.4 times height of eye, 0.8 times basal width of mandible. Face width 0.9 times height of eye and almost equal to height of face and clypeus combined. Clypeus with narrow lower flange, clypeal suture distinct laterally, shallow and indistinct dorsally. Hypoclypeal depression subround, its width 0.8 times distance from edge of depression to eye, 0.45 times width of face. Occipital carina present, very shortly interrupted dorsally, obliterated below near mandibles. Hypostomal keel wide (very difficult to see on either specimen). Head below eyes convexly narrowed. Maxillary palps about 1.7 times as long as height of head. Antennal flagellum slender, weakly setiform (broken, only 47 segments present), first flagellar segment length 2.5 times width. Scape with weak constriction basally, its maximum length including lobe 2.1 times maximum width.

Mesosoma. Length 1.9 times its height. Pronotum rather short. Mesoscutum highly and almost perpendicularly raised above pronotum. Notauli deep, narrow, and finely crenulated. Prescutellar depression rather short, more or less deep, smooth, with three distinct carinae, 0.3 times as long as scutellum. Scutellum almost flat, its maximum width almost equal to median length. Metanotum with very small median tooth. Subalar depression rather deep and wide, rugose below. Sternaulus indistinct, slightly deeper medially than anteriorly, absent posteriorly, almost straight, smooth, running along entire lower length of mesopleuron. Metapleural lobe rather long and narrow. Metapleuron separated from propodeum by distinct punctate suture; propodeal and metapleural surfaces continuously rounded, not angled along suture line. Propodeum without lateral tubercles, distinctly roundly narrowed from base to apex in lateral view. Fore tibia with very small spines arranged almost in single row (16 small spines arranged in along anterior surface of fore tibia; some paired). Tarsal segments of middle leg considerably shorter compared with tarsal segments of fore and hind legs, basitarsus 3.6 times as long as wide, 2.2 times as long as second segment, fourth segment subsquare. Hind coxa without basoventral tooth, 1.6 times as long as wide. Hind femur 3.1 times as long as wide. Inner spur of hind tibia 0.9 times as long as outer spur, 0.15 times as long as basitarsus. Hind tarsus 1.1 times as long as hind tibia, basitarsus 0.9 times as long as second to fifth segments combined, second segment 0.4 times as long as basitarsus, 0.85 times as long as fifth segment (without pretarsus).

Wings. Length of fore wing 3.6 times its maximum width. Pterostigma about six times as long as wide, 0.7 times as long as R1. 3RSa 1.7 times r, 0.17 times 3RSb, 0.63 times 2RS. Second submarginal cell 1.8 times as long as wide, 0.6 times as long as first subdiscal cell. Hind wing 4.6 times as long as wide, C+Sc+R 0.8 times SC+R.

Metasoma. Metasoma 1.1–1.3 times as long as head and mesosoma combined. First tergite rather weakly convex, weakly narrowed apically, without distinct basolateral processes, with very small dorsope, with small spiracular tubercles in basal one-third, length of tergite about 1.3 times its maximum submedian width, 1.35 times its apical width, apical width 0.9 times its maximum submedian width, 1.3 times its minimum width. Second tergite with wide distinctly convex medially basal semicircular area, separated by deep crenulate furrow, median length of area 0.4 times maximum length of tergite, maximum length 0.5 times its basal width, 0.55 times length of third tergite, second suture strongly and distinctly undulate. Third tergite with distinct straight transverse crenulate furrow in basal one-quarter. Ovipositor sheaths almost as long as body, two times as long as metasoma, 2.8 times as long as mesosoma; tip of sheaths slightly clavate.

Sculpture and pubescence. Vertex, frons, and temple entirely smooth. Vertex with rather long semi-erect sparse hairs. Face smooth with sparse puncturation. Sides of pronotum smooth. Mesoscutum, scutellum, and mesopleuron smooth in most part. Metapleuron almost entirely smooth, with sparse puncturation. Propodeum with sparse puncturation, smooth partly. Mesoscutum entirely with dense short semi-erect hairs. Hind coxa rugulose, hind femur almost smooth with sparse puncturation. Hind tibia dorsally with short, very dense semi-erect hairs mixed with sparse long hairs. First metasomal tergite striate in medio-apical half, the rest with sparse puncturation. Basal area of second tergite smooth, the rest striate with puncturation laterally and widely smooth medially. Third and fourth tergite in basolateral one-third or two-thirds striate. Rest of metasoma smooth.

Male

Unknown.

Material examined

Holotype: female, Papua New Guinea, “N. Guinea, Biró, 1899”, “Sattelberg, Huon Gulf.”, “*variegatus*, det. Szépligeti”, “Type *Epitonychus variegatus* Szépl., det. P. Marsh, 66”, “Holotypus ♀ *Epitonychus variegatus* Szépl. 1902, Papp’69”, “Hym. Typ. No 1643, Mus. Budapest” (HNHM).

Other material. Papua New Guinea, one female, Wau, October 1970, P. Shanahan (AEIC).

Comments

The specimen of *S. variegatus* identified in AEIC has allowed us to more accurately diagnosis this species. The head and mesosoma are characteristically red-brown, the first metasomal tergite is white with a distinct black apical patch, and tergites 3–6 have pale white bands similar to *S. tricolor*.

Acknowledgements

We wish to thank the curators of the various collections listed above for the loan of specimens; Nick Stevens and Joanne Kent for technical assistance; John Jennings for commenting on a draft of the manuscript; the Centre for Electron Microscopy and Micro

Analysis, The University of Adelaide for allowing us to use their facilities; CABI Publishing for allowing us to reproduce Figures 3 and 4b; and the Australian Biological Resources Study and Australian Research Council for providing funding for this study.

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