

First Report of the Genus *Stilbula* Spinola, 1811 (Hymenoptera: Eucharitidae) in Egypt

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Abstract: The genus *Stilbula* Spinola, 1811 (Hymenoptera: Eucharitidae: Eucharitinae) is recorded for the first time for the Egyptian fauna, with one species *S. vitripennis* Masi, 1934. Extreme colour variation among the studied specimens, especially of males, was also documented and illustrated. *Camponotus aegyptiacus* Emery, 1915 (Hymenoptera: Formicidae) represents a new host record for *S. vitripennis*.

Key words: *Stilbula vitripennis*, new host record, new geographical record, colour variation, morphometrics, *Camponotus aegyptiacus*, Giza, Egypt.

Introduction

Stilbula Spinola, 1811 is a genus of the family Eucharitidae consisting of 41 species (HERATY 2017, NOYES 2017). Species are widespread in the Old World (Palearctic, Ethiopian and Indo-Pacific Regions) (HERATY 2002, 2017). Little is known about the biology of this genus (see FAHRINGER & Tölg 1912, FAHRINGER 1922, CLAUSEN 1923, 1940, WHEELER & WHEELER 1924, PARKER 1924, 1932, 1937). One of the most important studies concerning the biology of *Stilbula* was that of CLAUSEN (1923), who provided a detailed information about the biology of *S. tenuicornis*. A summary of what had been known until then was also given by him (CLAUSEN 1940). Within Eucharitini (Eucharitidae: Eucharitinae), the *Stilbula* clade is a distinct group, with all its species parasitising camponotine ants (Formicinae: Camponotini) (CLAUSEN 1940, HERATY 2002). *Stilbula cyniformis* (Rossi) was reared from several different species of *Camponotus* (FAHRINGER & Tölg 1912, FAHRINGER 1922, CLAUSEN 1923, 1941, PARKER 1924, 1932, 1937), whereas both *S. arenae* Girault and *S. polyrhachidia* (Wheeler & Wheeler) were reared from *Polyrhachis* spp. (WHEELER & WHEELER 1924, BOUČEK 1988).

The genus *Stilbula* has been revised and identified by several authors (BOUČEK 1988, HERATY 2002, GIRISH KUMAR 2017). It is relatively easily recognised by its mesoscutellar projection (=frenal projection, see HERATY 2002), which arises from a single basal stalk and then bifurcates into two short processes (Figs. 3, 9, 20). The genus is represented in the Middle East by three species, *S. vitripennis* (Cyprus, Greece, Israel, Turkey) (MASI 1934a, BOUČEK 1951, HERATY 2002), *S. tonyi* Narendran & Kumar, 2004 and *S. yemenica* Narendran & Girish Kumar, 2004 (Yemen) (NARENDRAN & Girish Kumar 2004, HERATY 2017, NOYES 2017).

Here we document the first record of the genus *Stilbula* Spinola (*S. vitripennis* Masi) for Egypt, as well as its extreme variability in colour, especially among males, and provide a new host association with *Camponotus aegyptiacus* Emery, 1915 (Formicinae: Formicinae).

A mesosomal colour pattern of yellow with dark patches is a common colour pattern in some groups of Eucharitidae, and in particular species within the *Eucharis* and *Stilbula* clades which are known to attack Formicinae (HERATY 2002). These patterns of

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colouration can be highly variable in individuals of the same species at a single locality and can range from a mesosoma that is almost completely yellow to completely dark (HERATY 1985, 2002, TORRÉNS et al. 2008, HERATY et al. 2009). This variability was observed in species within the *Stilbula* clade, which are parasitoids of Camponotini (Formicinae), e.g. *Lophyrocera variabilis* Torrén et al., 2008, *Obeza septentrionalis* (Brues) (HERATY 1985, 2002; TORRÉNS et al. 2008, HERATY et al. 2009). In the present study, the highly variable pattern of colour variation is documented among the male specimens of *S. vitripennis*.

Materials and Methods

Specimens were collected from Dreamland (6th October City) [29.9754° N, 31.0392° E] by sweep netting over a nest of *Camponotus aegyptiacus* in June 2017. Morphological and body sculpture terminology are based on HERATY (1994, 2002) and GIBSON (1997). Measurements were made with the use of an ocular micrometer. Specimens were photographed using a Canon EOS 70D camera attached to a Leica MZ125 stereomicroscope. Individual source images were then stacked using HeliconFocus v6.22 (HeliconSoft Ltd) extended depth of field software. Further image processing

was done using the software Adobe Photoshop Cs5.1 (ver. 12.1 x32) and Adobe Photoshop Lightroom 5.2 Final (64 bit). Measurements and abbreviations were adopted from GRAHAM (1969) and HERATY (2002) and some from BAUR et al. (2014). In females, values in parentheses are those taken either from the original description of MASI (1934a) or measured from syntype photos whenever possible. Measurements of the new material are based on 21 females and 38 males. Photos of female syntypes deposited in the Museo Civico di Storia Naturale di Genova (MCSG) were provided by Gerard Delvare (CIRAD, Montpellier, France). Identification of the ant species was done by Dr. Mustafa Sharaf (King Saud University, KSA).

Specimens are deposited in the Efflatoun Bey Collection, Entomology Department, Faculty of Science, Cairo University, Giza, Egypt (EFC) and Biological Control Department Collection, Plant Protection Institute, Giza, Egypt.

Abbreviations: EYB = greatest breadth of eye from lateral view. EYH = greatest length of eye height from lateral view. F. B = breadth of second flagellomere taken across its apex. F. L = length of second flagellomere. Frp. B = breadth of frenal process. Frp. L = length of frenal process taking along the longitudinal midline from base at point of attachment to mesoscutellum to its apex. HDH = distance

Table 1. Main morphological characteristics of *Stilbula vitripennis* Masi, 1934.

Body region	Original description (MASI 1934a)	Syntype, present condition	Freshly collected specimens
Head	Green	Dark green with metallic luster (Figs. 10, 11)	Dark metallic green, in some specimens lower face lateral to clypeus shiny yellow (Figs. 2, 5).
Antenna	Yellowish	Reddish brown (Fig. 10)	With scape, pedicel, anellus and last three antennal articles yellowish, rest of antenna dark brown to black (Figs. 4, 5)
Mesosoma	Scapulae (except laterally), mesoscutellum and axillae cupreous or cupro-violet; outer margin of scapulae, tegula are ochraceous yellow	All dark brown, except lateral margins of scapulae and upper part of metapleuron that are pale brown in colour (Figs. 9, 12)	Mesosoma clear yellow, with dark metallic green markings in the following parts: a median quadrate marking at anterior margin of mesoscutum, a median oval one on lateral lobe of mesoscutum, posterior margin of mesoscutellar disc (at point of attachment to frenal process), middle area of mesepisternum surrounding middle coxae, in some specimens apex of lateral frenal processes dark brown (Figs. 1, 3)
Wings	Milky, with yellowish-grey veins, except at base ferruginous.	Hyaline with yellowish veins (Fig. 12)	Hyaline, with yellowish veins, Stv somewhat pale brownish (Fig. 7)
Legs	Yellow	Yellow to orange, except dark brown, with faint metallic coxae (Figs 11, 12)	Yellow, with dark metallic green coxae.
Metasoma	Green	Dark reddish brown, with evenly brown posterior margins (Fig. 13)	Gaster with a mixture of brown and yellow, Gt1 (= first gastral tergite) mostly dark brown, all tergites with a median longitudinal black line extending along length, somewhat broader on Gt1 (Figs. 1, 8)
Petiole	Whitish	Brown (Fig. 13)	Pale yellow to white (Fig. 1)

between lower margin of clypeus and the dorsal margin of ocellus. IOD = interocular distance. MSP = distance between mouth margin and lower edge of eye from lateral view. OOL = distance between inner edge of posterior ocellus and outer edge of eye. Pet. B = metasomal petiole breadth. Pet. L = metasomal petiole length. POL = distance between inner edges of posterior ocelli. Scp. B = scape breadth at widest part. Scp. L = scape length excluding radicle from outer aspect. Stv = stigma vein of fore wing. W. B = wing breadth from broadest part. W. L = wing length from apex of humeral plate to wing apex.

Results

Stilbula Spinola, 1811

Stilbula Spinola, 1811: 150. Type species:

Ichneumon cyniformis Rossi, by monotypy.

Stilbula vitripennis Masi, 1934a: 10-11. Type data: Cyprus. Type deposition: Naturhistorisches Museum Wien.

Female: freshly collected specimens (Figs. 1-8); syntype (Figs. 9-13).

Morphometric variation: Body length: 3.0-5.5mm; fore wing length: 2.5-4.0mm. **Ratios:** IOD/EYH 1.7-2.4; EYB/HDH 1.5-2.1; OOL/POL 0.3-0.5; MSP/EYH 0.4-0.5 (0.6); Scp. L/Scp. B 1.0-1.1; F2. L/F2. B 2.0-2.5; F2. L/F3. L 1.2-1.6; penultimate F. L/penultimate F. B 1.1-1.3; last F. L/last F. B 1.0-1.5; Frp. L/Frp. B 2.5-4.0; Pet. L/Pet. B 2.5-4.0; W. L/W. B 2.0

Colour variation (female): Colour variation was detected between the specimens described by MASI (1934a), syntype present condition (Figs. 9-13), and freshly collected specimens (Figs. 1-8) (Table 1).

Male (Figs. 14-21):

Morphometric variation: Body length: 4.0-5.0mm; fore wing length: 3.0-4.0mm. **Ratios:** IOD/EYH 2.0-2.2; EYH/HDH 1.5-1.6; OOL/POL 0.4-0.7; Msp (Malar space)/EYH 0.26-0.3; Scp. L/Scp. B 1.0; F2. L/F2. B 2.4-2.8 (2.2); F2. L/F3. L 1.0-1.5; penultimate F. L/penultimate F. B 1.4-1.8 (1.8); last F. L/last F. B 1.6-2.0 (2.7); Frp. L/Frp. B 2.4-3.0; Pet. L/Pet. B 7.5-9.2; W. L/W. B 2.4-3.5

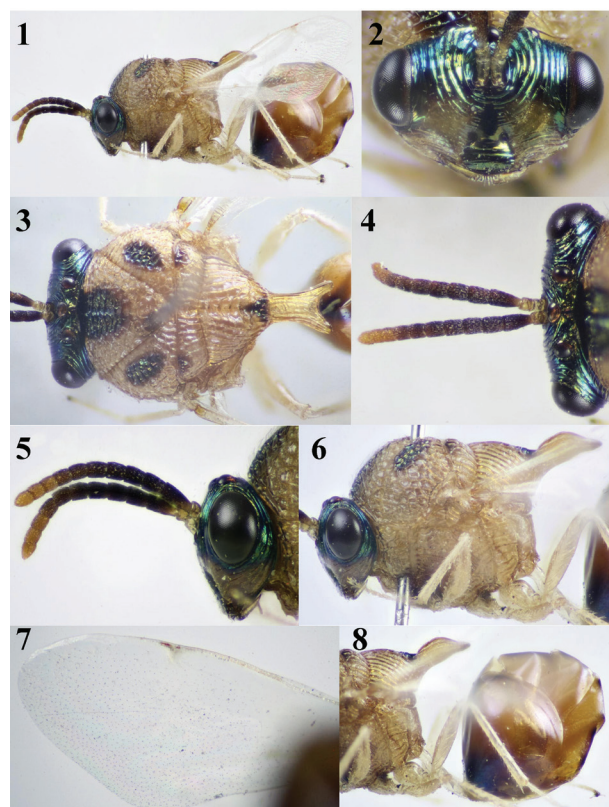
Generally differs from female in the following: supra-clypeal area smooth (Fig. 14) to weakly and partly transversely striated (Fig. 15) (smooth and shiny in female (Fig. 2)); labrum with 8 (Fig. 16) to 11 (Fig. 17) digits (female labrum with 7-8 digits); mandibles in all specimens as in female, with 2/2 teeth but slightly shorter and thickened, in one specimen mandibles 2/3 (Fig. 18) (in female thin, always with 2 teeth); antenna with all flagellomeres

distinctly elongate and cylindrical (as in Fig. 19) (in female funicular segments not elongate; Figs. 4, 5), with 9 funicular segments and densely setose as in female; axilla foveolate (Fig. 20) (in female, axilla longitudinally strigate; Fig. 3). Hind wing with 4-6 hamuli (5-6 in female).

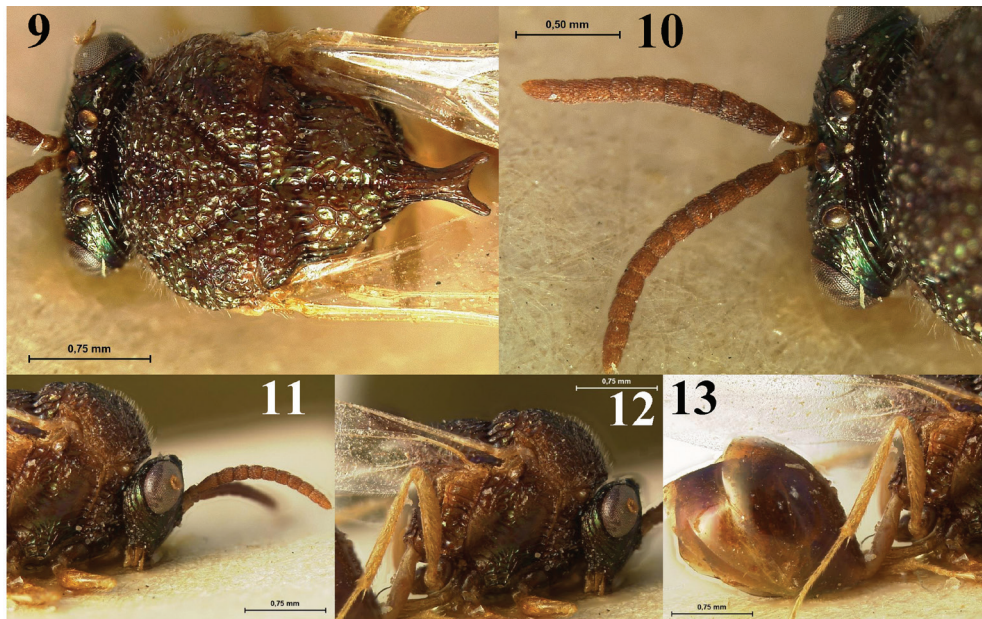
Male genitalia of typical form, with elongate parameres that appear very close apically (Fig. 21a), digitus long plate-like (dorsoventrally flattened and rounded apically), with a row of about 7 apical short, triangular, sharp teeth, outwardly directed (Fig. 21b).

Variation among freshly collected male specimens (Figs. 22-26): Variability in colour, particularly of mesosoma, extreme among male specimens of *S. vitripennis* (Figs. 22-26). Antennae from entirely clear yellow (Fig. 19) to dark reddish brown (Fig. 23). Body colour (excluding head) from entirely clear yellow (including antennae), with weak (Fig. 22a) to strong brownish markings on mesosoma (Fig. 22b), to a mixture of yellow and dark metallic green on mesosoma (Fig. 23) with reddish metasoma. There was a considerable variation in colour pattern of mesosoma (Figs. 24-26).

Differences in some body structures were



Figs. 1-8. *Stilbula vitripennis* female: 1. Lateral habitus. 2. Frontal view of head. 3. Dorsal view of head and mesosoma. 4. Dorsal view of head. 5. Lateral view of head. 6. Lateral view of head and mesosoma. 7. Fore wing. 8. Lateral view of mesosoma (part) and metasoma.



Figs. 9-13. *Stilbula vitripennis* syntype female: 9. Dorsal view of head and mesosoma. 10. Dorsal view of head. 11. Lateral view of head and mesosoma (part). 12. Lateral view of head and mesosoma. 13. Lateral view of metasoma.

also noticed: supraclypeal area smooth (Fig. 14), to weakly transversely carinate (Fig. 15); wings in some specimens with no setae apparent, while in others with dense microtrichea; petiole in all studied specimens with no swelling along its whole length, but in few specimens a very small, hardly seen swelling frenal projection stalk heavily carinate along its whole length in some specimens (Fig. 24), but only laterally in others, longitudinally foveate medially (fig. 25); scutellum foveolate in most males, longitudinally striated in few male specimens (Fig. 26).

Material examined: 21♀, 38♂, Egypt: Dreamland (El-Wahat Road, 6th October, Giza) [29.9754° N, 31.0392° E], 1.vi-17.vii.2017, sweep net (leg. S. Shaari) (8-10 AM).

Host records: Males and females were observed hovering close to the entrance of a nest of *Camponotus aegyptiacus* Emery, 1915 (Formicidae: Formicinae) and some individuals were observed carried out of the nest by the ants.

Remarks: *Stilbula cyniformis* (Rossi) and its proposed subspecies *S. cyniformis tenuicornis* (Ashmead), are known to parasitise species of *Camponotus* (see CLAUSEN 1923, PARKER 1924). *S. vitripennis* is newly recorded here parasitising ants of the genus *Camponotus*.

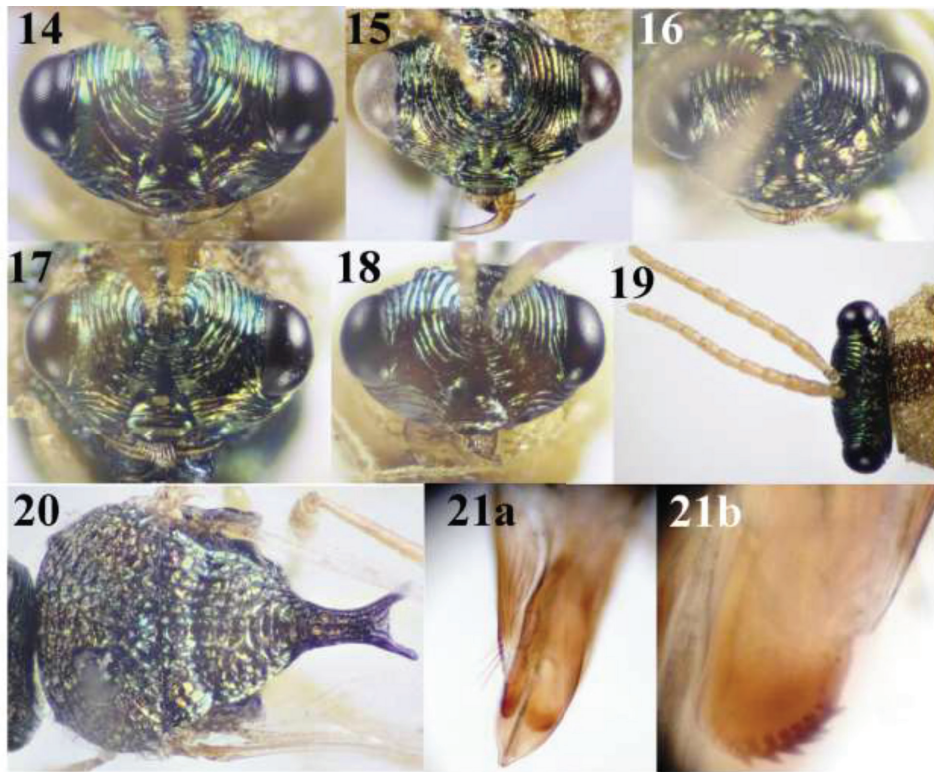
Distribution: Cyprus (MASI 1934a), Greece (BOUČEK 1952), Israel (BOUČEK 1956), Rhodes (MASI 1934b), Turkey (BOUČEK 1951); Egypt (**new record**).

Discussion

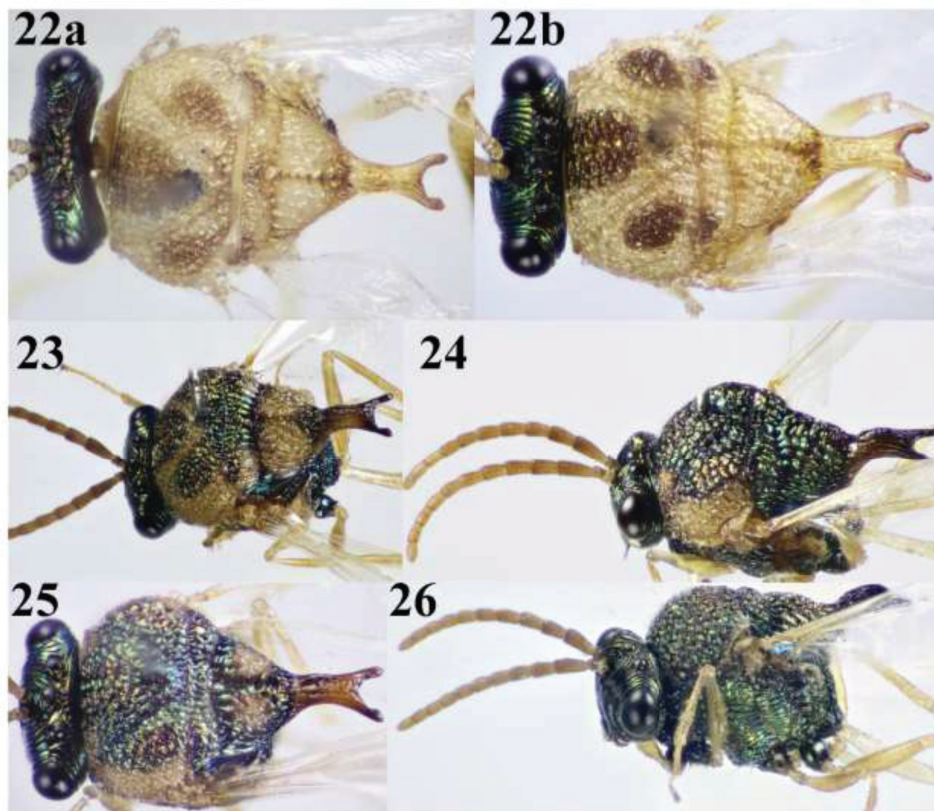
In the present study, *Stilbula vitripennis* is recorded for the first time for the fauna of Egypt, with *Camponotus aegyptiacus* as the first host record for this species. Males and females were observed hovering close to the entrance of *C. aegyptiacus* nest and some individuals were carried out by the ants out of the nest.

Although collected from a single locality, we found considerable variation in different aspects of the studied specimens, especially colour. Unfortunately, colour has been lost in the syntypes (see Figs. 9-13) and there is almost no match between the syntype and the material collected later. It appears that the colour has deteriorated over time. Variation of mesosomal colour is quite extensive among the recently collected specimens, especially in males, ranging from yellow to a mixture of yellow and dark metallic green, to entirely dark metallic green (Figs. 22-26).

Presumed conspecificity is based upon a lack of good morphological differences between the studied specimens and because they were all collected from the same site under the same conditions. This is in addition to their agreement with the colour variation observed in a number of previously studied eucharitine species (HERATY 1985, TORRÉNS et al. 2008), also found among species attacking Camponotini: e.g. *Obeza septentrionalis* (Brues) (see HERATY 1985) and *Lophyrocera variabilis* Torrén et al. (TORRÉNS et al. 2008).



Figs. 14-21. *Stilbula vitripennis* male: 14-18. Frontal view of heads. 19. Dorsal view of head. 20. Dorsal view of mesosoma. 21a. Ventral view of male genitalia. 21b. Male genitalia (digitus).



Figs. 22-26: *Stilbula vitripennis* male head and mesosoma (showing colour variation): 22a, 22b, 25. Dorsal view. 23. Dorso-lateral view. 24, 26. Lateral view.

Other variation, especially among male specimens, is also found in body size and in wing setation, number of digits of labrum, mandibular teeth, sculpturing of the supraclypeal area and mesoscutellum, as well as the frenal process of mesoscutellum. These differences in other eucharitine species are attributed to different geographical localities, however, this is not the case here, since all specimens were collected from the same place, under the same conditions.

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