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Contribution to the genus *Omalus* Panzer, 1801 of China, with descriptions of two new species (Hymenoptera, Chrysididae)

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Abstract

In spite of that Chinese species of the genus *Omalus* Panzer, 1801 were recently revised by Wei *et al.* (2014), the study of more material has revealed the presence of other four species: two of them are new, *O. corrugatus* Rosa, Wei & Xu, **sp. nov.** (China, Guangdong) and *O. hainanensis* Rosa, Wei & Xu, **sp. nov.** (China, Hainan); the other two are newly recorded from China, *O. stella* (Semenov & Nikol'skaya, 1954) and *O. timidus* (Nurse, 1902), **comb. nov.** (from the genus *Holophris* Mocsáry, 1890). An update key to Chinese species and illustrations are provided.

Key words: Chrysididae, Elampini, *Omalus*, *Holophris*, new species, new records, China

Introduction

The genus *Omalus* Panzer, 1801 belongs to the chrysidid tribe Elampini. It includes 30 species (Kimsey & Bohart 1991; Rosa 2005, 2006, 2009; Wei *et al.* 2014). The Chinese species were recently revised by Wei *et al.* (2014), who listed eight species: *Omalus aeneus* (Fabricius, 1787), *O. berezovskii* (Semenov, 1932), *O. helanshanus* Wei, Rosa, Liu & Xu, 2014, *O. imbecillus* (Mocsáry, 1889), *O. potanini* (Semenov, 1932), *O. probiaccinctus* Wei, Rosa, Liu & Xu, 2014, *O. pseudoimbecillus* Wei, Rosa, Liu & Xu, 2014, and *O. tibetanus* Wei, Rosa, Liu & Xu 2014. Additional bibliographical data were reported by Rosa *et al.* (2014).

The examination of more material and type specimens revealed the presence of other four *Omalus* species, of which two are new for science, and two are newly recorded from China; one of the latter is transferred from the genus *Holophris* Mocsáry, 1890. The current number of species in the genus *Omalus* Panzer increase to 33.

Material and methods

All specimens were examined and described under stereomicroscope (Leica MZ125). Photographs of *O. stella* were taken with Nikon D-80 connected to the stereomicroscope Togal SCZ and stacked with the software Combine ZP. The other photographs were taken with a digital camera (CoolSNAP) attached to a Zeiss Stemi 2000-CS stereomicroscope. Images were processed using Image-Pro Plus software.

Morphological terminology follows that of Kimsey & Bohart (1991). Abbreviations used in the descriptions as follows: **F1**, **F2**, **F3**, etc. = flagellomere 1, 2, 3 and so on; **MOD** = midocellus diameter; **MS** = malar space, the shortest distance between base of mandible and lower margin of compound eye; **OOL** = the shortest distance between posterior ocellus and compound eye; **P** = pedicel; **PD** = puncture diameter; **POL** = the shortest distance between posterior ocelli; **T1**, **T2**, **T3**, etc. = metasomal tergum 1, 2, 3 and so on.

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Types and other specimens have been examined from the following institutions:

BMNH	The Natural History Museum, London, UK.
HNHM	Hungarian Natural History Museum, Budapest, Hungary.
SCAU	Hymenopteran Collection, South China Agricultural University, Guangzhou, China.
ZIN	Zoological Institute, St. Petersburg, Russia.

Genus *Omalus* Panzer, 1801

Omalus Panzer, 1801: 13. Type species: *Chrysis aenea* Fabricius, 1787, by monotypy.
Homalus Saunders, 1873: 411. Unjustified emendation of *Omalus* Panzer, 1801.
Omalus Panzer: Linsenmaier 1959: 17 (part., *Omalus* s. str.); Bohart & Campos 1960: 235 (part., *Omalus* s. str.); Bohart & Kimsey 1982: 36 (part., *Omalus* s. str.); Kimsey & Bohart 1991: 243; Rosa 2005: 8; 2006: 100; Wei *et al.* 2014: 30.

Diagnosis. *Omalus* Panzer, 1801 is close to *Holophris* Mocsary, 1890, *Philoctetes* Abeille de Perrin, 1879, and *Pseudomalus* Ashmead, 1902. It can be distinguished from them by the combination of the following characteristics: head lenticular in frontal view; scapal basin deep, smooth and glabrous, rarely with weak striae; MS usually equal to or longer than 1 MOD, and horizontally bisected by curved genal carina; postocular margin angulated; mandible tridentate; pronotum impunctate medially; mesoscutum impunctate, at most with very sparse and tiny punctures, or weakly wrinkled; mesopleuron with single carina or with weak double carinae, but not well developed as in *Holophris*, and usually limited to some large foveae (*O. timidus*); in few cases, large foveae aligned along the omaulus, thus resembling the double omaulus of *Holophris* (e. g. *O. imbecillus* and *O. pseudoimbecillus*); mesoscutellum without anterior foveae or with anterior foveae; transpleural carina reaching apex of propodeal angle; forewing medial cell asetose, medial vein strongly arched and arising before cu-a, stigma short, broad, and apically rounded (the only exception is the *O. aeneus* species-group, whose medial vein is longer and weakly arched); tarsal claw with three to four teeth; T3 with or without semitransparent rim on posterior margin, and sometimes on T2; apex of T3 with or without median notch.

Distribution. The species of *Omalus* occur in all zoogeographic regions except Australia. There are 33 valid species: 22 are found in the Palaearctic, two in both the Palaearctic and the Oriental, one in both the Holarctic and the Oriental, two in the Oriental, three in the Nearctic, two in the Afrotropical, and one in the Neotropical Regions. In this paper, four species are reported, including two new species, and two new records from China.

Key to Chinese species of the genus *Omalus*

1.	T3 with wide semitransparent rim (≥ 1 MOD)	2
-	T3 without semitransparent rim or with narrow semitransparent rim (≤0.5 MOD)	5
2.	Mesoscutum weakly wrinkled; notauli distinct and complete	*O. corrugatus* **sp. nov.**
-	Mesoscutum polished without wrinkles; notauli indistinct or absent	3
3.	Tarsal claw with four teeth	*O. timidus* (Nurse)
-	Tarsal claw with three teeth	4
4.	Mesoscutellum evenly punctate and with two anterior foveae; metanotum gibbous with round and subequally spaced punctures	*O. hainanensis* **sp. nov.**
-	Mesoscutellum largely polished and without anterior foveae; metanotum prominent with irregular and large punctures without interspaces	*O. potanini* (Semenov)
5.	Tarsal claw with four teeth	6
-	Tarsal claw with three teeth.	8
6.	Mesoscutum weakly wrinkled.	*O. probiaccinctus* Wei, Rosa, Liu & Xu
-	Mesoscutum polished, at most punctate	7
7.	Body light metallic green with golden reflections; medial vein short and strongly arched	*O. stella* (Semenov & Nikol'skaya)
-	Female body metallic blue sometimes with violet reflections and male body metallic blue to green, often dorsally blackish; medial vein longer and gently curved	*O. aeneus* (Fabricius)
8.	Notauli distinct and deep.	9
-	Notauli indistinct and shallow, impressed as fine lines	10
9.	Pronotum with scattered and shallow punctures medially; metasoma pear-shaped; T2 distinctly wider than T1; T3 with median notch V-shaped	*O. berezovskii* (Semenov)

- Pronotum almost impunctate medially; metasoma distinctly elongate; T2 not wider than T1; T3 with median notch shallowly indented ..... *O. tibetanus* Wei, Rosa, Liu & Xu

10. Mesoscutellum without anterior foveae ..... *O. helanshanus* Wei, Rosa, Liu & Xu
- Mesoscutellum with two anterior foveae 11

11. Tegula fully metallic blue; mesopleuron without striae among punctures; propodeal angle indistinct . *O. imbecillus* (Mocsáry)
- Tegula transparent brown, with faint metallic reflections anteriorly; mesopleuron with striae among punctures; propodeal angle distinct and stout ..... *O. pseudoimbecillus* Wei, Rosa, Liu & Xu

***Omalus corrugatus* Rosa, Wei & Xu, sp. nov.**
(Figs 1A–1F)

Material examined. Holotype: ♀, CHINA: Guangdong, Guangzhou, Liuxihe National Forest Park (23°44'31"N 113°47'0"E), 29–31.VIII.2004, leg. Z-f Xu (SCAU).

Diagnosis. *Omalus corrugatus* **sp. nov.** resembles *O. timidus* (Nurse, 1902) for body colouration; however it can be easily separated from the latter by weakly wrinkled mesoscutum.

Description. *Female*. Holotype. Body length 2.9 mm (Fig. 1A). Fore wing length 2 mm. OOL = 1.4 MOD; POL = 2.4 MOD; MS = 1.2 MOD; relative length of P:F1:F2:F3 = 1:1:0.8:0.6.

Head. Head with shallow punctures and weak wrinkles on frons and vertex (Fig. 1B). In lateral view, the longest distance between genal carina and lower margin of eye is 0.9 MOD. Genal carina bisecting MS, its end almost jointing lower margin of eye (0.2 MOD). Scapal basin deep, smooth and glabrous. Ocellar triangle isosceles. Occipital area beneath ocellar area weakly wrinkled. Postocellar line interrupted medially. Gena without punctures, with fine and oblique wrinkles.

Mesosoma. Pronotum weakly wrinkled, with row of large deep pits on anterior margin, with shallow, spare and small punctures on posterior margin, deeper and denser punctures (0–0.5 PD) on lateral margins (Fig. 1C). Mesoscutum with wrinkles (Fig. 1C). Notauli distinct and complete, with deep and elongated notauli pits (Fig. 1C). Parapsidal furrow indistinct. Lateral field of mesoscutum with row of large punctures along tegula margin. Mesoscutellum with two enlarged anterior foveae, distinctly separated by 1.5 MOD; with weakly wrinkled subtriangular antero-median area; rest of mesoscutellum with large, round and subequal punctures, and wrinkled interspaces on posterior margin (Fig. 1D). Metanotum evenly with larger, deeper and irregular areolate punctures (Fig. 1D). Mesopleuron and metapleuron fully with large and deep punctures, without elongated punctures or other elongated sculptures on ventral margin. Tarsal claw with three teeth.

Metasoma. T1 impunctate. T2 and T3 almost impunctate, with fine and spare dots close to lateral margins. T1 without semitransparent rim. T2 with narrow semitransparent rim (0.8 MOD). T3 with wider semitransparent rim (1 MOD). Apex of T3 with distinct median notch (Fig. 1F).

Colouration. Antenna black, with scape and pedicel metallic blue. Head black, with face metallic blue. Mesosoma bluish-purple, with median area of pronotum, mesoscutum and metanotum black. Tegula blackish-brown. Leg metallic bluish-green, with tarsi brown. Metasoma black with feeble metallic blue reflections on anterio-lateral corners of T1 and lateral margins of T2 and T3.

Male. Unknown.

Distribution. China (Guangdong).

Etymology. The specific name *corrugatus* is the past participle of the Latin verb *corrugo* (nominative masculine singular) and refers to the sculpture of mesosoma.

***Omalus hainanensis* Rosa, Wei & Xu, sp. nov.**
(Figs 2A–2F)

Material examined. Holotype: ♀, CHINA: Hainan, Bawangling National Nature Reserve (19°7'31"N 109°14'6"E, 7–11.VII.2006, leg. J-x Liu & L-q Weng (SCAU). Paratypes: 2♀, CHINA: Hainan, Diaoluoshan National Nature Reserve (18°39'32"N 109°54'56"E), 7–8.V.2008, leg. H-y Chen (SCAU).

Diagnosis. *Omalus hainanensis* **sp. nov.** is similar to *O. corrugatus* **sp. nov.** and *O. timidus* (Nurse, 1902) for body colouration; however it can be separated from *O. corrugatus* **sp. nov.** by impunctate mesoscutum (weakly wrinkled in *O. corrugatus* **sp. nov.**); and from *O. timidus* by tarsal claw with three teeth (four teeth in *O. timidus*).

Omalus hainanensis **sp. nov.** is also similar to *O. potanini* (Semenov, 1932) and can be separated by elongated anterior foveae on mesoscutellum (without anterior foveae in *O. potanini*) and by the evenly punctate mesoscutellum (widely polished in *O. potanini*).

Description. *Female*. Holotype. Body length 4.1 mm (Fig. 2A). Fore wing length 2.4 mm. OOL = 1.7 MOD; POL = 2.2 MOD; MS = 1 MOD; relative length of P:F1:F2:F3 = 1:1:0.5:0.5.

Head. Head with shallow punctures on face and vertex, with interspaces wrinkled among punctures (Fig. 2B); punctures aligned and laterally touching. In lateral view, the longest distance between genal carina and lower margin of eye is 1.5 MOD. Genal carina bisecting MS. Scapal basin deep, polished and glabrous. Ocellar triangle isosceles. Postocellar line absent. Gena with fine and oblique wrinkles, without punctures. Occipital area beneath ocellar area smooth and impunctate.

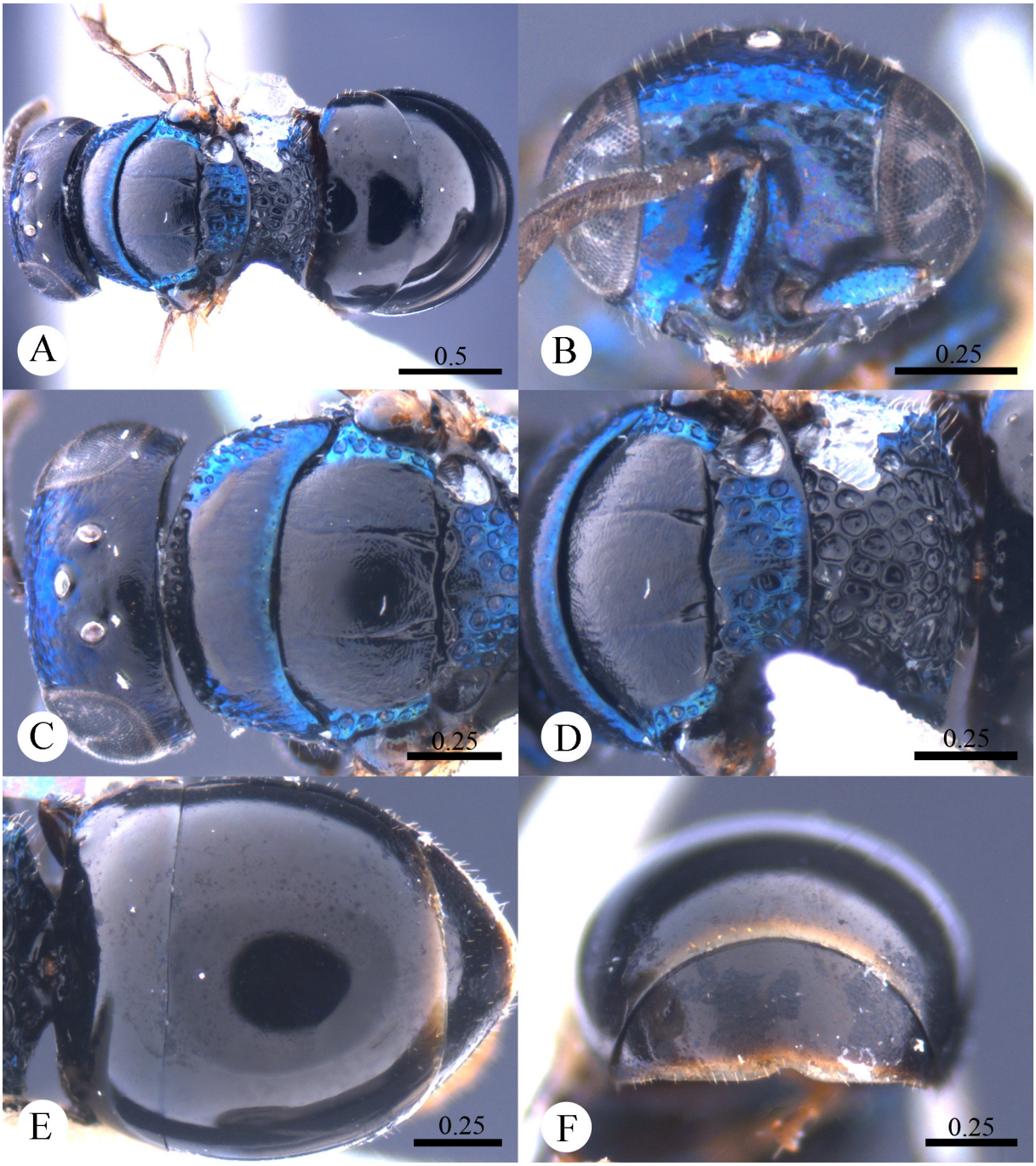

FIGURE 1. *Omalus corrugatus* **sp. nov.**, ♀, holotype, Guanzhou. **A.** Habitus, dorsal view; **B.** Head, frontal view; **C.** Head, pronotum and mesoscutum, dorsal view; **D.** Mesoscutum, mesoscutellum, and metanotum, dorsal view; **E.** Metasoma, dorsal view; **F.** T3, posterior view. Scale bar: mm.

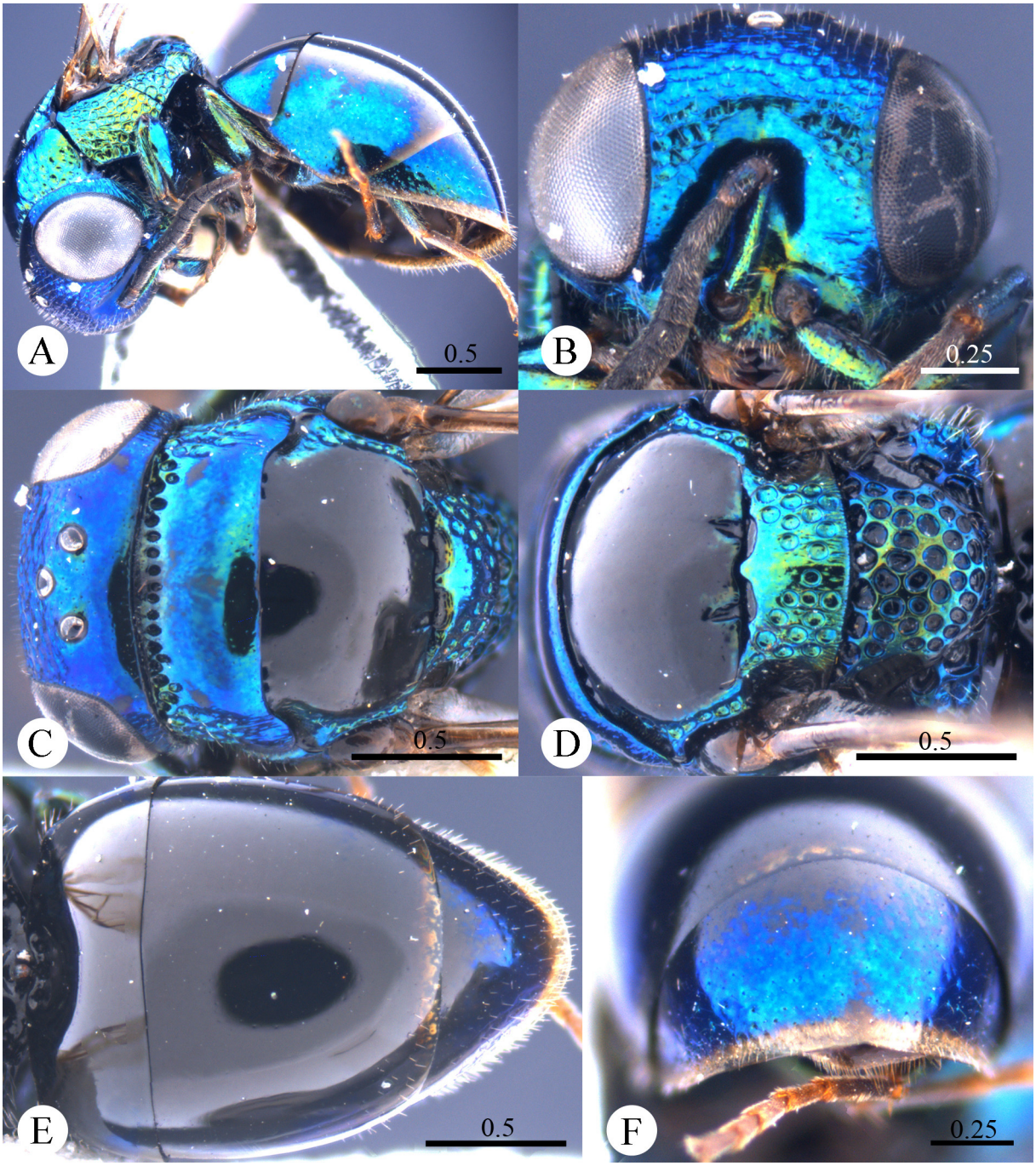

FIGURE 2. *Omalus hainanensis* **sp. nov.**, ♀, holotype, Hainan. **A.** Habitus, lateral view; **B.** Head, frontal view; **C.** Head, pronotum and mesoscutum, dorsal view; **D.** Mesoscutum, mesoscutellum, and metanotum, dorsal view; **E.** Metasoma, dorsal view; **F.** T3, posterior view. Scale bar: mm.

Mesosoma. Pronotum nearly impunctate, with row of large and deep pits on anterior margin, with shallow, spare and small punctures on posterior margin, deeper and denser (0–0.5 PD) punctures on lateral margins. Mesoscutum impunctate (Fig. 2C). Notauli pits deep and elongated (1.2 MOD). Notauli indistinct (Fig. 2D). Parapsidal furrows indistinct. Lateral field of mesoscutum with row of large punctures along tegula margin. Mesoscutellum with two enlarged anterior foveae (3 MOD), close to each other and separated by 0.5 MOD; with smooth and small subtriangular antero-median area; rest of mesoscutellum with large, round and subequal punctures, and wrinkled interspaces on posterior margin (Fig. 2D). Metanotum evenly with larger, deeper and round punctures subequally interspaced, with distinct smooth intervals bearing some shallow dots (Fig. 2D); bottom of punctures blackish contrasting with metallic green to blue interspaces. Mesopleuron and metapleuron

with large, deep and round punctures, punctures transversally corrugated and aligned with wrinkled intervals; diameter of punctures increasing from alar fovea to omaulus. Tarsal claw with three teeth.

Metasoma. T1 impunctate. T2 almost impunctate, with fine and spare dots close to lateral margins. T3 with more incised dots laterally. T1 without semitransparent rim. T2 and T3 with wide semitransparent rims (1 MOD). Apex of T3 without distinct median notch (Fig. 2F).

Colouration. Antenna black, with scape and pedicel metallic bluish. Head entirely metallic blue. Mesoscutum black; rest of mesosoma greenish-blue, with blackish punctures on metanotum (Fig. 2D). Tegula brown, without metallic reflection. Leg metallic bluish-green, with tarsi brown. T1 and T2 black, without metallic reflection. T3 mostly metallic green to blue.

Male. Unknown.

Distribution. China (Hainan).

Etymology. The species is named after the type locality.

Omalus stella (Semenov & Nikol'skaya, 1954)

(Figs 3A–3F)

Ellampus stella Semenov & Nikol'skaya, 1954: 93. Lectotype ♀ (designation by Kimsey 1986), Tajikistan: Stalinabad [Dushanbe] (ZIN).
Omalus stella: Kimsey & Bohart 1991: 249.

Material examined. CHINA: 1♀, [oasis Sa-zhou] = Xinjiang, Chanji, [Gashunskaya Gobi], 28.VII.1895, leg. P.K. Kozlov (ZIN).

Diagnosis. *Omalus stella* (Semenov & Nikol'skaya) is similar to *O. timidus* (Nurse, 1902) for tarsal claw with four teeth. However it can be separated from the latter by the following characteristics: pronotum flat laterally (deeply impressed in *O. timidus*); notauli distinct and complete (indistinct in *O. timidus*); semitransparent rim narrow (< 1MOD) and apical margin widely interrupted (semitransparent rim ≥ 1 MOD and continuous in *O. timidus*).

Redescription. *Female.* Body length 3.5–4.2 mm (Fig. 3A). Fore wing length 2.5–3.0 mm. OOL = 1.8 MOD; POL = 2.0 MOD; MS = 0.9 MOD.

Head. Frons and vertex with large punctures (Fig. 3B); from ocellar area to occipital area smooth, with sparse and shallow pits. Scapal basin deep and polished. In lateral view, the longest distance between genal carina and lower margin of eye is 1.2 MOD. Genal carina bisecting MS. Gena with spare dots and wrinkles. Ocellar triangle isosceles. Postocellar line indistinct.

Mesosoma. Pronotum nearly impunctate, with row of large and deep pits on anterior margin, with shallow and spare punctures on posterior margin, deeper and denser punctures on lateral margins. Mesoscutum impunctate with shallow, spare and small dots (Fig. 3C). Notauli pits deep and elongated (about 2 MOD). Notauli distinct and complete. Parapsidal furrows deep and distinct, extending over half length of mesoscutum. Lateral field of mesoscutum with row of large punctures along tegula margin. Mesoscutellum with two narrow and enlarged anterior foveae (1.5 MOD), separated by 1 MOD, with smooth subtriangular antero-median area; rest of mesoscutellum with large, round and subequal punctures (Fig. 3C). Metanotum evenly with larger, deeper and round punctures interspaced subequally, with distinct smooth intervals. Mesopleuron and metapleuron with large, deep and round punctures, without wrinkled interspaces or striae (Fig. 3 D). Tarsal claw with four teeth.

Metasoma. T1 almost impunctate, with fine and sparse dots close to lateral margins. T2 and T3 with fine and sparse dots, and denser on lateral margins. T1 without semitransparent rim. T2 with narrow semitransparent rim (0.5 MOD). T3 with narrow semitransparent rim (0.5 MOD), largely interrupted apico-medially (Fig. 3F).

Colouration. Antenna black, with scape and pedicel metallic green. Body metallic green with golden reflections. Tegula metallic green. Legs metallic green, with tarsi light brown to testaceous.

Male. Not available in this study, males from other localities do not differ from female.

Distribution. China (Xinjiang); Tajikistan (Semenov & Nikol'skaya 1954).

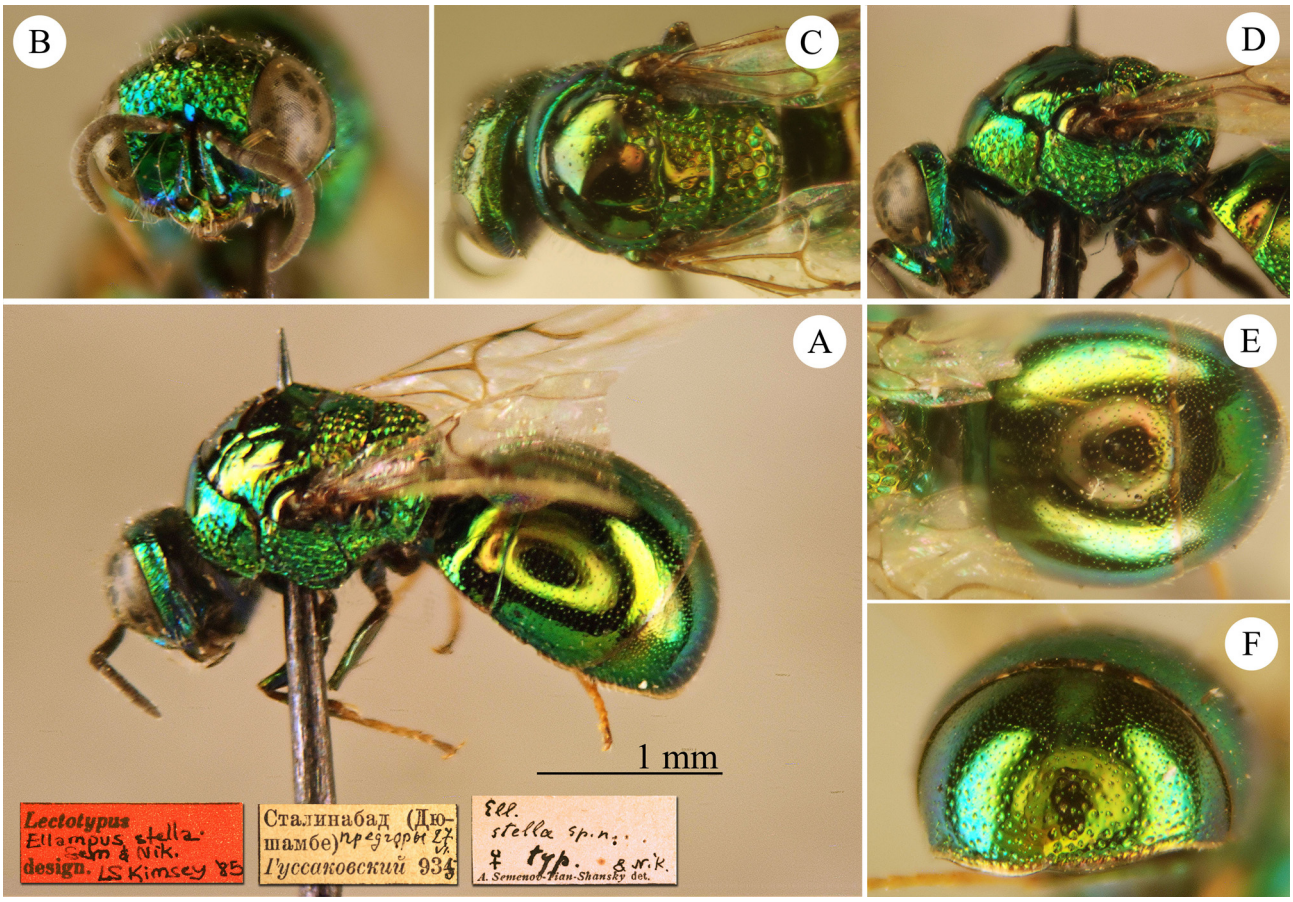

FIGURE 3. *Omalus stella* (Semenov & Nikol'skaya), ♀, lectotype, Tajikistan. **A.** Habitus, lateral view; **B.** Head, frontal view; **C.** Head and mesosoma, dorsal view; **D.** Head and mesosoma, lateral view; **E.** Metasoma, dorsal view; **F.** T3, posterior view.

***Omalus timidus* (Nurse, 1902), comb. nov.**
(Figs 4A–4F)

Ellampus timidus Nurse, 1902: 305. Lectotype ♂ (designated by Kimsey 1986), Pakistan: Peshin (BMNH).
Ellampus timidus: Bingham 1903: 420, 1908: 347; Bischoff 1913: 9.
Ellampus hypocrita du Buysson: Nurse 1904: 19 (synonym in error).
Holophris timidus: Kimsey & Bohart 1991: 226.

Material examined. CHINA: 1♀, Guangdong, Nankunshan Provincial Nature Reserve (23°39'28"N 113°55'23"E), 4–6.VI.2011, leg. Z-f Xu (SCAU). 1♀: PAKISTAN: Quetta, Collect. Bingham, *Elampus timidus* Nurse ♀, *timidus* Nurse, Bingham typ., paralectotypus ♀, *Elampus timidus* Nurse (L.D. French), id. nr. 135047 HNHM Hym. coll. (HNHM).

Diagnosis. Chinese specimens of *Omalus timidus* (Nurse), **comb. nov.** are similar to *O. corrugatus* **sp. nov.** and *O. hainanensis* **sp. nov.** by body colouration; but it can be separated from both of them by tarsal claw with four teeth. Moreover, it can be separated from *O. corrugatus* **sp. nov.** by impunctate mesoscutum (weakly wrinkled in *O. corrugatus*).

Redescription. *Female* (from Guangdong). Body length 4.0 mm (Fig. 4A). Fore wing length 2.7 mm. OOL = 1.6 MOD; POL = 1.8 MOD; MS = 1.2 MOD; relative length of P:F1:F2:F3 = 1:1:0.6:0.5.

Head. Frons and vertex with small punctures and fine wrinkled interspaces (Fig. 4B); from ocellar area to occipital area impunctate, with sparse and shallow pits. Scapal basin deep and polished. In lateral view, the longest distance between genal carina and lower margin of eye is 0.9 MOD. Genal carina bisecting MS and closing to lower margin of eye (0.5 MOD). Gena polished with spare dots and wrinkles towards MS. Ocellar triangle isosceles. Postocellar line indistinct.

Mesosoma. Pronotum nearly impunctate, with row of large and deep pits on anterior margin, with shallow and spare punctures on posterior margin, deeper and denser punctures on lateral margins. Mesoscutum impunctate, with shallow, spare and small dots (Fig. 4C). Notauli pits deep and elongated (about 1.5 MOD). Notauli indistinct. Parapsidal furrows deep and distinct, extending half length of mesoscutum. Lateral field of mesoscutum with row of large punctures along tegula margin. Mesoscutellum with two enlarged anterior foveae (2.5 MOD), separated by 0.8 MOD, with narrow, smooth subtriangular antero-median area; rest of mesoscutellum with large, round and subequal punctures, and longitudinally wrinkled interspaces on posterior margin (Fig. 4D). Metanotum evenly with larger, deeper and round punctures interspaced subequally, with distinct smooth intervals bearing some shallow dots. Mesopleuron and metapleuron with large, deep and round punctures, and with narrow wrinkled interspaces, without distinct striae. Tarsal claw with four teeth.

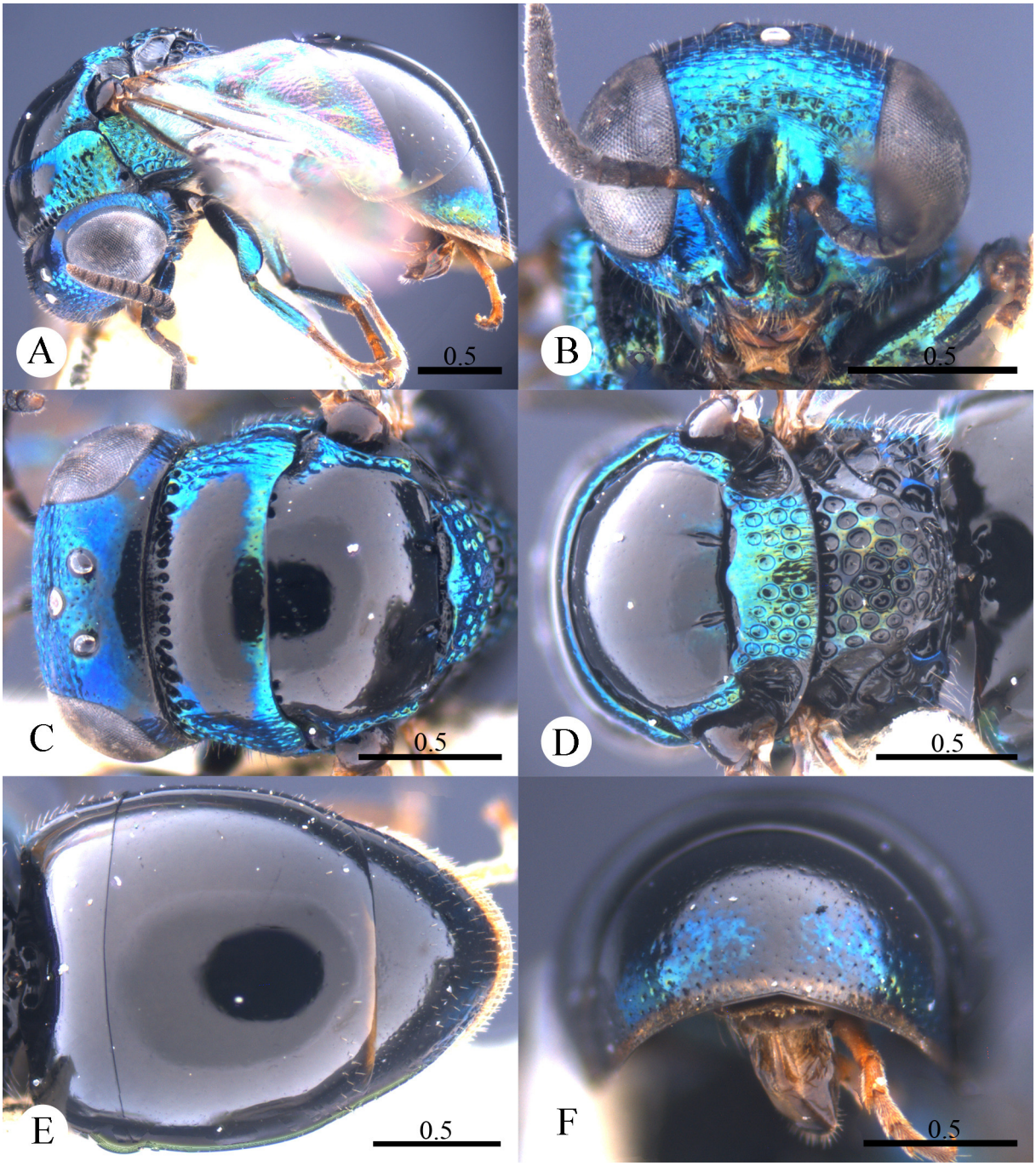

FIGURE 4. *Omalus timidus* (Nurse), **comb. nov.** ♀, Guangdong. **A.** Habitus, lateral view; **B.** Head, frontal view; **C.** Head, pronotum and mesoscutum, dorsal view; **D.** Mesoscutum, mesoscutellum, and metanotum, dorsal view. **E.** Metasoma, dorsal view; **F.** T3, posterior view. Scale bar: mm.

Metasoma. T1 impunctate. T2 and T3 almost impunctate, with fine and sparse dots close to lateral margins. T1 without semitransparent rim. T2 with narrow semitransparent rim (0.5 MOD) only apico-medially. T3 with wider semitransparent rim (1 MOD). Apex of T3 without distinct median notch (Fig. 4F).

Colouration. Antenna black, with scape metallic blue. Head metallic blue to green. The median area of pronotum and mesoscutum black, without metallic reflections; metanotum black, with some metallic reflection; the rest of mesosoma metallic blue. Tegula brown without metallic reflection. Legs metallic bluish-green, with tarsi light brown to testaceous. Metasoma blackish, with greenish-blue metallic reflections on T1 and T2, and T3 laterally; with brown semitransparent rims on T2 and T3.

Male. Unknown.

Distribution. China (Guangdong); Pakistan; India (Bingham 1908).

Remarks. The Chinese specimen shows some dissimilarities comparing with the type: head in frontal view with some striae (without striae in the type); pedicel not metallic blue (metallic blue in the type); POL 1.8 MOD (2.5 MOD in the type); metasoma almost entirely black, with metallic reflections laterally (entirely metallic, dorsally dark blue to violet and laterally blue in the type).

Kimsey & Bohart (1991) included *Ellampus timidus* into the genus *Holophris*. We here transfer *E. timidus* into *Omalus* because it does not share the main diagnostic characteristics of *Holophris*, such as double omaulus, double genal carinae and transpleural carina not reaching apex of propodeal angle. In particular, row of large and aligned punctures on mesopleuron may resemble the double omaulus of *Holophris*. For this characteristics, and other similar morphological characteristics (e. g. the anterior foveae on mesoscutellum and shorten metanotum), *O. timidus*, *O. corrugatus* **sp. nov.** and *O. hainanensis* **sp. nov.** are closely related to *O. imbecillus* and *O. pseudoimbecillus*, and apparently form a distinct species group.

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