

Revision of the genus *Trichrysis* Lichtenstein, 1876 from China, with description of three new species (Hymenoptera, Chrysidae)

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<http://zoobank.org/CC65F571-A0EC-405D-A323-12255C696121>

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Abstract

Received 29 November 2015

Accepted 14 March 2016

Published 17 March 2016

Academic editor:

Michael Ohl

Key Words

Chrysidiini

Praestochrysis

new species

new synonym

lectotype designation

The Chinese species of the genus *Trichrysis* Lichtenstein, 1876 are revised for the first time. Thirteen species are recorded, of which three species are new for science, *T. coeruleamaculata* Rosa, Wei & Xu, sp. n., *T. tridensnotata* Rosa, Wei & Xu, sp. n., and *T. yuani* Rosa, Feng & Xu, sp. n.. Two species are revalidated: *T. tonkinensis* (Mocsáry, 1914) and *T. formosana* (Mocsáry, 1912). Two new synonymies are proposed, *T. formosana* (Mocsáry, 1912)=*T. sauteri* (Mocsáry, 1912), syn. n.=*T. taial* (Tsuneki, 1970), syn. n.. The lectotype of *Chrysis pellucida* du Buysson, 1887 is designated.

Introduction

The genus *Trichrysis* Lichtenstein, 1876 belongs to the tribe Chrysidiini (Hymenoptera, Chrysidae). *Trichrysis* has been traditionally considered as a subgenus of *Chrysis* Linnaeus, 1761 (Lichtenstein 1876; Mocsáry 1889; Bischoff 1910, 1913; Trautmann 1927; Balthasar 1953, etc.). Lisenmaier (1959) considered *Trichrysis* and *Chrysidea* Bischoff, 1913 as two subgenera in the genus *Chrysis* Linnaeus, 1761, separated by shape and position of S2 black spots and outer veins of fore wing discoidal cell. Later, Lisenmaier (1968, 1984) moved all the species included in the subgenus *Chrysis* (*Chrysidea*) into the subgenus *Chrysis* (*Trichrysis*) because shape of S2 black spots and wing venations are variable when considering species outside the Palaearctic Region. Bohart and Kimsey (1980) elevated *Trichrysis* to generic rank; Bohart (1987) presented a key to twenty species of this genus and Kimsey and Bohart (1991) gave a checklist

of twenty six known species. Lisenmaier (1994, 1997) moved the *inops* species-group and *lusca* species-group from the subgenus *Praestochrysis* Lisenmaier, 1968 into the subgenus *Trichrysis* based on morphological characteristics and trophic relationships with their hosts, and subdivided the Palaearctic and Oriental *Trichrysis* into three species-groups: *T. cyanea* species-group, *T. lusca* species-group and *T. pumila* species-group; the *T. lusca* species-group includes species with five teeth on apex of T3, while the *T. cyanea* species-group with three teeth on apex of T3. Strumia (2009) described a new species from the Mediterranean region. Rosa and Xu (2015) assigned the *T. pumila* species-group to the genus *Chrysidea*, following Bohart (1988), Kimsey and Bohart (1991). Therefore, thirty three valid species were known in the genus before this study (Kimsey and Bohart 1991; Lisenmaier 1994, 1997; Rosa 2006; Strumia 2009; Madl and Rosa 2012).

In China, eight species were previously recorded (Rosa et al. 2014): *Trichrysis cyanea* (Linnaeus, 1758), *T. im-*

periosa (Smith, 1874), *T. lusca* (Fabricius, 1804), *T. lutzonica* (Mocsáry, 1889), *T. pellucida* (du Buysson, 1887), *T. secernenda* (Mocsáry, 1912), *T. triacantha* (Mocsáry, 1889) and *T. trigona* (Mocsáry, 1889). In this study, thirteen Chinese species of *Trichrysis* are keyed and revised, of which three species are new for science, two species are revalidated, and two synonymies are proposed.

The current species number of *Trichrysis* in the World now increases to thirty eight species.

Materials and methods

All specimens were examined and described under stereomicroscope (Leica MZ125). Photographs of specimens from South China Agricultural University (SCAU) were taken with a digital camera (Cool SNAP) attached to a Zeiss Stemi 2000-CS stereomicroscope. Images were processed using Image-Pro Plus software. Images of types from other museums were taken with Nikon D-80 connected to stereomicroscope Togal SCZ and stacked with software Combine ZP, white balance was calibrated using photo-camera settings to reduce blue effect of fluorescent light of Togal microscope.

Morphological terminology follows Kimsey and Bohart (1991). Abbreviations used in the descriptions as follows: **BOL**=brow-ocellar line, the shortest distance between mid ocellus and transversal frontal carina; **F1, F2, F3**=flagellomeres 1, 2, 3; **I/w**=length/ width; **MOD**=mid ocellar diameter; **MS**=malar space, the shortest distance between base of mandible and margin of compound eye; **OOL**= oculo-ocellar line, the shortest distance between lateral ocellus and compound eye; **P**=pedicel; **PD**=puncture diameter; **POL**=the shortest distance between posterior ocelli; **S2** black spots=two black spots on metasomal sternite 2; **T1, T2, T3**=metasomal tergites 1, 2, 3; **TFC**=transverse frontal carina.

Types and other specimens are deposited in the following institutions:

BMNH	Natural History Museum, London, UK.
EIHU	Entomology Institute, Hokkaido University, Hokkaido, Japan.
HNHM	Hungarian Natural History Museum, Budapest, Hungary.
HUM	Entomology Institute, Hokkaido University Museum, Japan.
ISEA-PAN	Invertebrate collections of the Institute of Systematics and Evolution of Animals, Polish Academy of Sciences in Krakow, Poland.
LS	The Linnean Society of London, UK.
MNHN	National Museum of Natural History, Paris, France.
MNHU	Museum of Natural History of the Humboldt-Universität, Berlin, Germany.
MSNG	Museum of Natural History "G. Doria", Genoa, Italy.

NHMW	Natural History Museum, Vienna, Austria.
NIAS	Laboratory of Insect Systematics, National Institute of Agro-Environmental Sciences, Kannondai, Tsukuba, Ibaraki, Japan.
NMLS	Natur-Museum Luzern, Switzerland.
OMNH	Osaka Museum of Natural History, Osaka, Japan.
PRC	Paolo Rosa Collection, Bernareggio, Italy.
SCAU	Hymenopteran Collection, South China Agricultural University, Guangzhou, China.
USNM	United States National Museum of Natural History, United States National Entomological Collection, Washington DC, USA.
ZIN	Zoological Institute, St. Petersburg, Russia.

Specimens collected with Malaise traps or conserved in alcohol till they are completely dehydrated may change colours when they were prepared: blue metallic colour turns into dark blue, green turns into blue, yellow turns into greenish and red becomes more yellowish. Specimens collected by net and preserved in other way, usually change their colour less considerably. Most of the examined specimens have been collected on field by net.

Citations and synonyms in text are related to important works and relevant articles for the studied area. The material examined is listed with coordinates and depositories; in case of type specimens and other historical material examined in museums, data reported on different labels are separated from each other by a slash.

Results

Genus *Trichrysis* Lichtenstein, 1876

Chrysis (*Trichrysis*) Linnaeus: Lichtenstein, 1876: 27. Type species: *Sphex cyanea* Linnaeus, 1758: 572.

Chrysis (*Trichrysis*) Linnaeus: Mocsáry 1889: 319; Tsuneki 1947: 55; 1950: 70; 1953a: 25; 1953b: 58; Lisenmaier 1959: 169; 1968: 107; 1994: 192; 1997: 284.

Trichrysis (*Trichrysis*) Lichtenstein: Bohart and Kimsey 1980: 138, 147.

Trichrysis Lichtenstein: Kimsey and Bohart 1991: 568; Rosa 2006: 322; Kurzenko and Lelej 2007: 1006; Ha et al. 2008: 73; Strumia 2009: 589; Madl and Rosa 2012: 125.

Description. Head broader than high. Scapal basin concave, striate or punctate. TFC various, usually single and medially raised, sometimes double, downcurved along eye margin, or with branches upward extended to ocellar area. MS usually about 1 MOD. Pronotum with distinct and complete sublateral carina, sometimes incomplete or weak. Mesopleuron with broad episternal sulcus and scrobal sulcus. Metasoma usually with geminate punctures. T2 usually with median carina. T3 with three or five teeth; lateral teeth in some species can be merely angle-shaped. S2 with black spots usually fused medially, rarely separated by a narrow line, never connected to lateral margins.

Biology. Species of *Trichrysis* are known to be parasitoids of sphecid or crabronid wasps (Dufour and Perris 1840; García Mercet 1911; Alfken 1915; Enslin 1921; Trautmann 1927; Grandi 1931, 1936; Danks 1971; Groot 1971; Lomholdt 1975; Morgan 1984; Kimsey and Bohart

1991; Asís et al. 1994; Kunz 1994; Strumia 1997; Rosa 2006). Recently Pärn et al. (2014) included also some Pompilidae species as potential hosts for *Trichrysis*.

Distribution. Palaearctic, Afrotropical, Oriental and Australian Regions.

Key to Chinese species of *Trichrysis* Lichtenstein

The key is mostly based on females. Males from China are known only for six species (*T. cyanea*, *T. formosana*, *T. lusca*, *T. secernenda*, *T. triacantha*, and *T. yuani* sp. n.), and are recognizable by subtruncate apex of T3, shorter apical teeth and usually darker colouration dorsally.

- 1 Apex of T3 with five teeth (*T. lusca* species-group)..... 2
- Apex of T3 with three teeth (*T. cyanea* species-group)..... 3
- 2 Vertex, pronotum, mesoscutum, mesoscutellum, metanotum, mesopleuron, T1 and T2 laterally metallic coppery, in contrast with metallic blue body colouration (Figs 31–36); F1 only partially metallic green to blue (Fig. 34); S2 black spots fused medially (Fig. 98); pit row of T3 with deep and mostly fused pits (Fig. 36)..... *T. imperiosa* (Smith)
- Body metallic green to blue; T2 with greenish to golden or golden-red spot laterally (Figs 37–42); F1 fully metallic green to blue (Fig. 40); S2 black spots fused medially or separated by narrow metallic line (Fig. 99); pit row of T3 with smaller and well defined pits (Fig. 42) *T. lusca* (Fabricius)
- 3 S2 black spots ovoid, separated medially by narrow metallic line (Figs 60, 102) *T. secernenda* (Mocsáry)
- S2 black spots fully or partially fused 4
- 4 Tegula brown, without metallic reflection; if with feeble metallic reflection, then apex of T3 with blunt lateral teeth (Figs 12, 18, 54, 93) 5
- Tegula entirely with metallic reflection; if with feeble metallic reflection, then apex of T3 with sharp lateral teeth (Figs 5, 23, 47, 73–75, 81, 87) 8
- 5 Body robust, 7.0–10.0 mm in length; pit row of T3 with large and deep pits, sometimes fused (Figs 54, 93); median tooth prominent and elongate, lateral tooth blunted (Figs 54, 93) 6
- Body slender, 4.0–7.0 mm in length; pit row of T3 with smaller shallow and separated pits (Figs 12, 65); median tooth small and short in *T. cyanea* (Figs 12, 18), lateral tooth sharp in *T. tonkinensis* (Fig. 65) 7
- 6 Body length 9.0–10.0 mm; in lateral view, distance from anterior margin of pit row to apical margin of median tooth >3 MOD (Fig. 49); in dorsal view, T3 with median tooth sharp (Fig. 54); S2 black spots see Fig. 101; body usually dark blue to violet (Fig. 49), occasionally dark green *T. pellucida* (du Buysson)
- Body length 7.0–7.5 mm; in lateral view, distance from anterior margin of pit row to apical margin of median tooth=2 MOD (Fig. 88); in dorsal view, T3 with median tooth blunt (Fig. 93); S2 black spots see Fig. 107; body light blue (Fig. 88) *T. yuani* sp. n.
- 7 Body usually dark green or blue, sometimes with blackish areas dorsally on mesosoma and metasoma, especially in males; Chinese specimens frequently blue with dark blue areas dorsally (Figs 7–18); T2 and T3 usually without median carina; T3 with blunt lateral tooth (Fig. 12); S2 black spots see Fig. 97; T3 in male with short and blunt median tooth (Fig. 18) *T. cyanea* (Linnaeus)
- Body colour usually metallic green or light greenish-blue, with characteristic olive green to blackish mat areas on inter-spaces between punctures on pronotum, mesoscutum and on mesoscutellum antero-medially (Figs 61–66); T2 and T3 with median carina (Fig. 65); T3 with sharp lateral tooth (Fig. 65); S2 black spots see Figs 66, 103; male unknown *T. tonkinensis* (Mocsáry)
- 8 T3 with convex interval between median tooth and lateral tooth (Figs 71, 73–75) *T. triacantha* (Mocsáry)
- T3 with straight to concave interval between median tooth and lateral tooth 9
- 9 S2 black spots subtrapezoid (Figs 100, 105) 10
- S2 black spots subtriangular (Figs 96, 106) 12
- 10 Body metallic blue without contrasting colour pattern (Figs 76–81); interval between median tooth and lateral tooth deeply concave (Fig. 81) *T. tridensnotata* sp. n.
- Body metallic green-blue, with contrasting greenish to golden stripes laterally on metasoma; interval between median tooth and lateral tooth straight 11
- 11 TFC without upward branches directed to ocellar area (Fig. 20); in lateral view, median bridge of pit row distinctly depressed, leaving apical tooth hook-like (Fig. 24) *T. formosana* (Mocsáry)
- TFC with two upward branches directed to ocellar area (Fig. 44); in lateral view, median bridge of pit row straight, at most slightly depressed (Fig. 43) *T. luzonica* (Mocsáry)

- 12 Scapal basin punctate (Fig. 2); punctuation of mesosoma with wide and punctate interspaces (Fig. 3); metasoma with punctate interspaces (Fig. 4); T2 with two large dark blue areas fused medially along longitudinal carina (Fig. 5); S2 with two large black spots as in Figs 6, 96 *T. coeruleamaculata* sp. n.
- Scapal basin striate medially and punctate laterally (Fig. 83); punctuation of mesosoma almost without interspaces, with exception of mesoscutum laterally, or with wrinkled interspaces (Fig. 84); metasoma without interspaces or with wrinkled interspaces (Fig. 85); T2 with two small dark blue areas separated from longitudinal carina (Fig. 87); S2 with two small black spots as in Fig. 106 *T. trigona* (Mocsáry)

Trichrysis coeruleamaculata Rosa, Wei & Xu, sp. n.

<http://zoobank.org/9E74BB03-B89B-4923-83A5-6EC68506AB54>

Figs 1–6, 96

Material examined. Holotype, ♀: CHINA: Fujian, Fuzhou, Jingshan ($26^{\circ}17'12''N$ $118^{\circ}58'52''E$), 21.VIII.2004, leg. C-m. Liu (SCAU).

Diagnosis. *Trichrysis coeruleamaculata* sp. n. is similar to *T. trigona* (Mocsáry, 1889) and *T. hexapholis* Bohart, 1987, from Sri Lanka. It can be separated from *T. trigona* by the following characteristics: body punctuation with large interspaces, 0.2–1.0 PD; scapal basin punctate; pit row with large pits; pit row sunken with deep pits, and post pit row area impunctate; T1 and T3 each with two dark blue spots, T2 dark blue dorsally; tegula brown or with feeble metallic reflections; S2 with large black spots as in Fig. 96. It can be separated from *T. hexapholis* by blue colouration without bright purple and gold markings; TFC straight and not as inverted V.

Description. Female. Holotype. Body length 8.0 mm. **Head.** Scapal basin deep and punctate. TFC single and straight (Fig. 2). Frons slightly raised between TFC and scapal basin. Relative length of P:F1:F2:F3=1.0:1.3:0.7:0.6; F1 l/w=2.9; OOL=1.2 MOD; BOL=1.7 MOD; POL=2.0 MOD; MS=1.2 MOD; clypeus incised medially.

Mesosoma. Pronotal groove deep, almost extending to posterior margin of pronotum (Fig. 3); sublateral carina incomplete, well developed only anteriorly. Punctuation on pronotum, mesoscutum and mesoscutellum with large interspaces between punctures, 0.2–1.0 PD (Fig. 3); interspaces shining and punctate. Episternal sulcus and scrobal sulcus with large areolate punctures.

Metasoma. Metasoma with large geminate punctures and punctate interspaces (Fig. 4). T2 with weak median carina (Fig. 4). T3 prepit bulge slightly convex; pit row distinct, with large pits; post pit row area flat and impunctate (Fig. 5). Apex of T3 with three sharp teeth (Fig. 5); interval between median tooth and lateral tooth concave. S2 black spots subtriangular, elongated longitudinally and fused medially (Figs 6, 96).

Colouration. Body metallic blue (Fig. 1), with dark blue spots on vertex, pronotum, mesoscutum, mesoscutellum, and metanotum medially; with two dark blue, large and symmetrical spots on T1, T2 and T3, respectively (Fig. 4); with green reflections on face, lateral fields of mesoscutum. Scape, pedicel and only base of F1 metallic bluish-green, rest of flagellum black. Tegula brown, with

weak metallic reflections. Legs metallic bluish-green, with tarsi brown.

Male. Unknown.

Distribution. China (Fujian).

Etymology. The specific name derives from Latin adjective *coerulea* (=blue) and Latin past participle *maculata* (=spotted) and refers to blue spots on T3 before pit row.

Trichrysis cyanea (Linnaeus, 1758)

Figs 7–18, 97

Sphex cyanea Linnaeus, 1758: 572. Lectotype, ♂, designated by Morgan 1984: 10; Europe (LS) (examined).

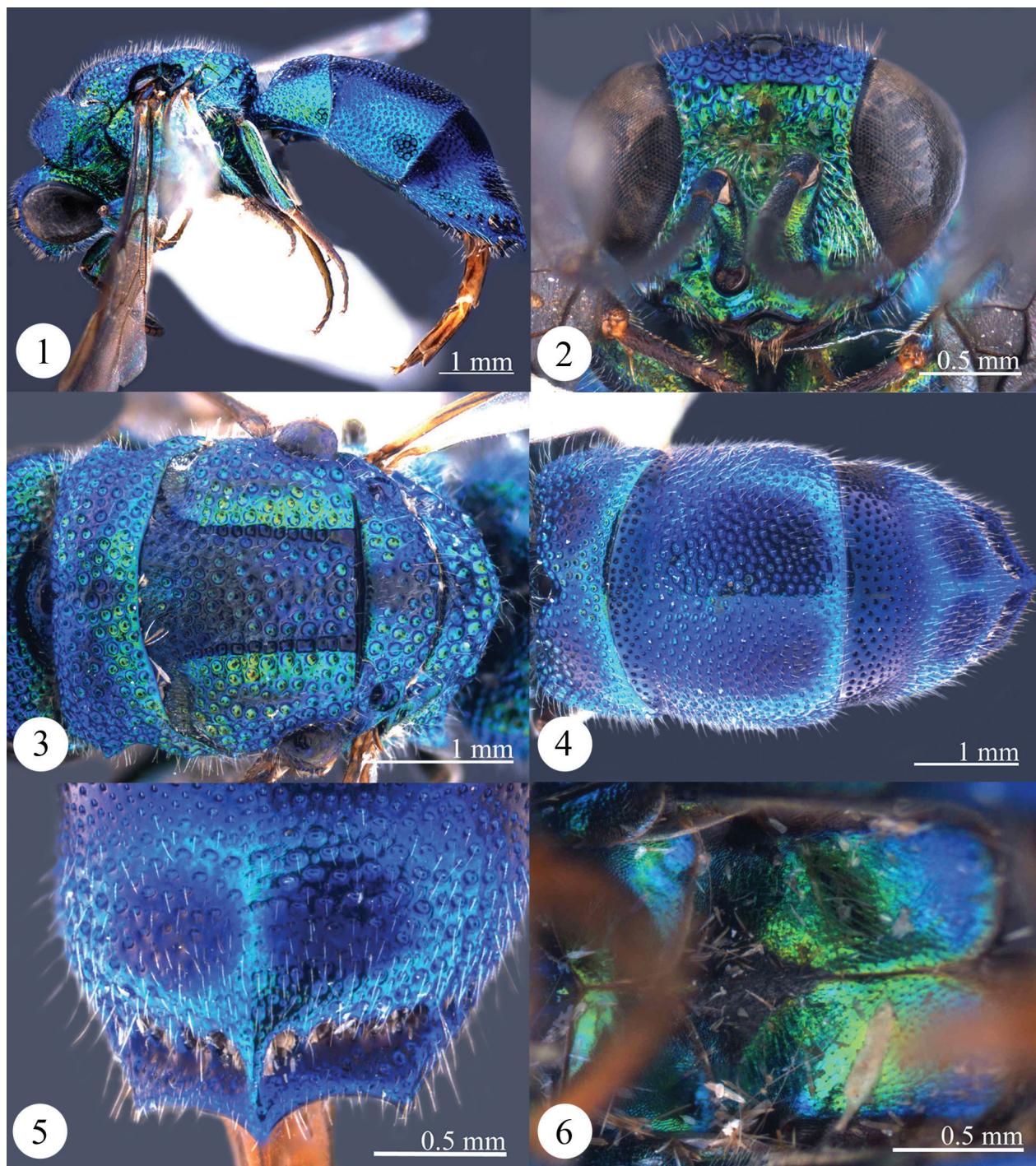
Chrysis (*Trichrysis*) *cyanea* (Linnaeus): Lichtenstein 1876: 27; Tsuneki 1947: 55; 1950: 70; 1953a: 25; 1953b: 58; Linsenmaier 1959: 169.

Trichrysis (*Trichrysis*) *cyanea* (Linnaeus): Kimsey and Bohart 1980: 77.

Trichrysis cyanea (Linnaeus): Kimsey and Bohart 1991: 571; Rosa 2006: 323; Ha et al. 2008: 73; Rosa et al. 2014: 75.

Material examined. “EUROPE”: Lectotype / Lectotype ♂ *Sphex cyanea* L., det. D. Morgan 1983 / ♂ *Trichrysis cyanea* (L.) det. D. Morgan 1983. CHINA: 1♀, Ningxia, Liupanshan Forest Park ($34^{\circ}22'N$ $106^{\circ}18'E$), 21.VI–14.VII.2008, leg. J.-m. Yao (SCAU); 1♀, Ningxia, Liupanshan Forest Park, 3–4.VII.2009, leg. H.-y. Chen (SCAU); 1♂, Liaoning, Laotuzidong Nature Reserve ($41^{\circ}19'7''N$ $124^{\circ}52'27''E$), 18.VII.2011, leg. K.-x. Zhao (SCAU); 1♀, Gansu, Xiahe, Labrang, 1–15.VI.1998, leg. V. Major (PRC); 1♀, Hebei, Mt. Xiaowutai, Yangjiapin, 20.VIII.2005, leg. M. Shi (SCAU); 1♀, Hunan, Mt. Huping, Nianzigu (29°55'38"N 110°48'48"E), 9.VII.2009, leg. Y.-l. Tang et al. (SCAU); 2♀♀, Yunnan, Dali, Shimen ($25^{\circ}41'26''N$ $100^{\circ}10'13''E$), 3.V.2006, leg. H.-s. Wang (SCAU); 3♀♀, Yunnan, Lincang, Fengxiang ($23^{\circ}52'37''N$ $100^{\circ}5'15''E$), 5.X.2004, leg. J.-x. Liu (SCAU); 1♀, Yunnan, Jingdong, Jinping ($24^{\circ}27'14''N$ $100^{\circ}50'4''E$), 28.IV.2005, leg. H.-s. Wang (SCAU); 1♀, Yunnan, Lincang ($23^{\circ}52'37''N$ $100^{\circ}4'46''E$), 5.X.2005, leg. K. Wu (SCAU).

Diagnosis. *Trichrysis cyanea* (Linnaeus, 1758) is similar to *T. secernenda* (Mocsáry, 1912) and *T. triacantha*. However it can be separated from *T. secernenda* by small and fused black spots on S2 (Fig. 97) (large and separated in *T. secernenda*); it can be separated from *T. triacantha* by angle-shaped lateral teeth on T3 (sharp in *T. triacantha*).



Figures 1–6. *Trichrysis coeruleamaculata* sp. n., holotype (female). **1.** Habitus, lateral view; **2.** Head, frontal view; **3.** Mesosoma, dorsal view; **4.** Metasoma, dorsal view; **5.** Apex of T3, dorsal view; **6.** S2, ventral view.

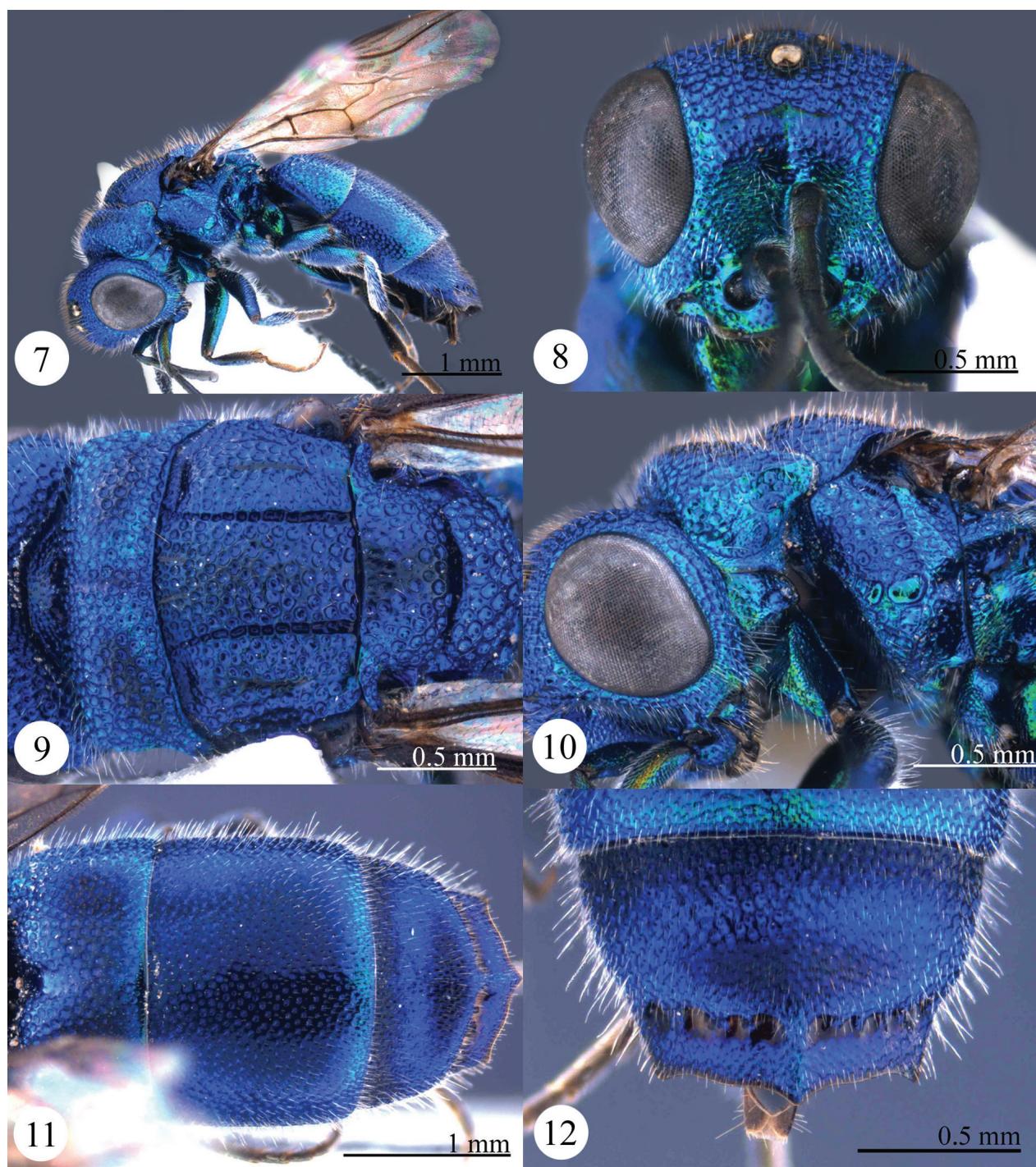
tha) and single TFC, without branches (raised with or without distinct branches in *T. triacantha*).

Description. Female. Body length 4.2–7.0 mm.

Head. Scapal basin deep, densely punctate (Fig. 8). TFC single, straight or slightly inverted V-shape. Frons between TFC and scapal basin not raised. Relative length of P:F1:F2:F3=1.0:1.5–1.8:0.8–1.0:0.6–0.8; F1 l/w=3.3; OOL=1.8–2.4 MOD; BOL=1.5 MOD; POL=2.0–2.4 MOD; MS=1.0 MOD; clypeus slightly concave medially.

Mesosoma. Pronotal groove deep, almost extending to posterior margin (Fig. 9); sublateral carina distinct and usually complete. Punctuation on pronotum, mesoscutum and mesoscutellum with uniform punctures subequally interspaced; interspaces usually punctate. Metanotum with large foveate punctures, contiguous without interspaces. Episternal sulcus and scrobal sulcus with large transversal foveae.

Metasoma. Punctures on T1 and T2 distinctly geminate, micropunctate on interspaces (Fig. 11). T2 and T3



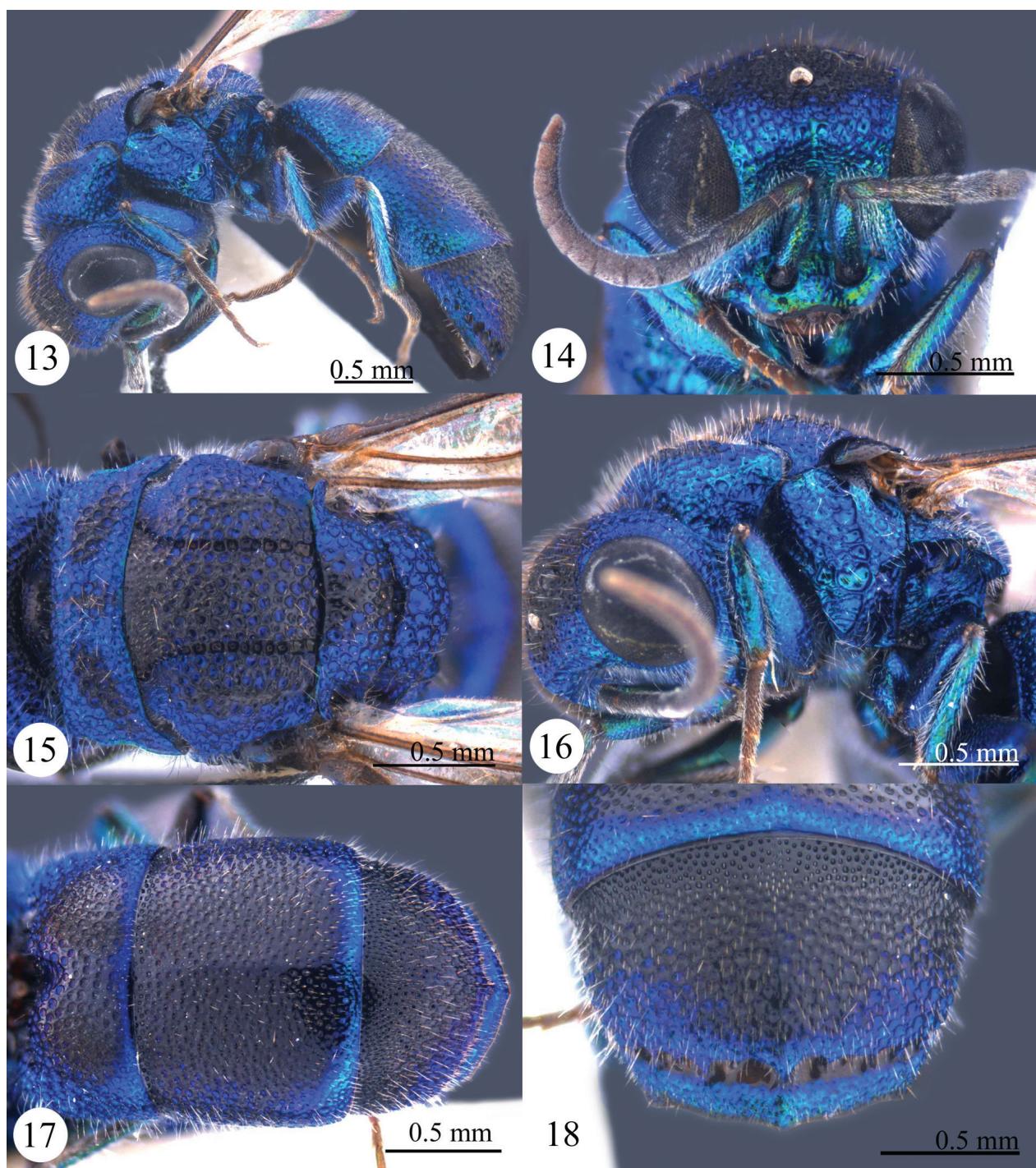
Figures 7–12. *Trichrysis cyanea* (Linnaeus), China: Ningxia (female). **7.** Habitus, lateral view; **8.** Head, frontal view; **9.** Mesosoma, dorsal view; **10.** Head, pronotum, mesopleuron, lateral view; **11.** Metasoma, dorsal view; **12.** T3, dorsal view.

usually without median carina. T3 prepit bulge slightly convex, especially medially; pit row distinct, with large, round and close pits, not fused. Apex of T3 with three distinct teeth similar in size, in dorsal view (Fig. 12); lateral teeth angle-shaped, in lateral view; interval between median tooth and lateral tooth variable, from straight to slightly convex. S2 black spots diamond shaped, medially fused.

Colouration. Body colouration variable, usually light blue to dark blue, or green to dark green with darker areas

dorsally. Scape and pedicel metallic blue, flagellum black. Tegula usually brown, without metallic reflection. Legs metallic blue, with tarsi black.

Male. Body length 4.6–5.5 mm. Male differs from female as follows: apex of T3 with teeth shorter (Fig. 18), sometimes only median tooth is distinctly visible; pre pit row area not bulged (Fig. 18); interval between median tooth and lateral tooth straight; body usually more greenish than that of female, and with blackish area dorsally (Figs 13, 18).



Figures 13–18. *Trichrysis cyanea* (Linnaeus), China: Liaoning (male). **13.** Habitus, lateral view; **14.** Head, frontal view; **15.** Mesosoma, dorsal view; **16.** Mesosoma, lateral view; **17.** Metasoma, dorsal view; **18.** T3, dorsal view.

Biology. Collected from April to October, possibly with more than one generation. In the West Palaearctic it is known as a parasitoid of crabronid wasps (Tormos et al. 1996; Gathmann and Tscharntke 1999; Rosa 2006; Pärn et al. 2014).

Variation. *Trichrysis cyanea* (Linnaeus, 1758) is a variable species due to its wide distribution through Palaearctic and Oriental Regions. Some differences can be observed between the Chinese specimens and western

Palaearctic specimens. For example, western Palaearctic specimens have scapal basin striate medially, sometimes with small aligned punctures within striae (densely punctate in Chinese specimens); pronotum with weak pronotal carina and tegula usually brown, without or with weak metallic reflections (metallic in some Chinese specimens from Yunnan). Nevertheless, in Yunnan more specimens have been collected with and without metallic colouration on tegulae, therefore we consider this character as

variable in this species. For other *Trichrysis* species (as already observed by Bohart (1987)), the colouration of tegulae seems to be a fix and reliable diagnostic character.

Distribution. China (Liaoning, Beijing, Inner Mongolia, Ningxia, Gansu, Hebei, Hunan, Yunnan); widespread in the Holarctic Region (Kimsey and Bohart 1991; Ha et al. 2008: 73; Rosa et al. 2013, 2014).

Trichrysis formosana (Mocsáry, 1912), status revived

Figs 19–30

Chrysis (Trichrysis) formosana Mocsáry, 1912: 380. Lectotype, ♀, Taiwan: Takao [= Kaohsiung], designated by Bohart in Bohart and French 1986: 341; Taiwan: Takao [= Kaohsiung] (HNHM) (examined).

Chrysis (Trichrysis) sauteri Mocsáry, 1912: 381. Holotype, ♂, Taiwan: Takao [= Kaohsiung] (HNHM) (examined). **Syn. n.**

Chrysis (Trichrysis) formosana Mocsáry: Bischoff 1913: 45; Mocsáry 1913b: 614; Uchida 1927: 151; 1933: 3; Tsuneki 1970: 11.

Chrysis (Trichrysis) sauteri Mocsáry: Mocsáry 1913b: 614; 1913c: 289; Uchida 1927: 151; Tsuneki 1970: 13.

Chrysis (Trichrysis) taial Tsuneki, 1970: 11. Holotype, ♀, Taiwan: Nanton: Puli (OMNH, not NIAS). **Syn. n.**

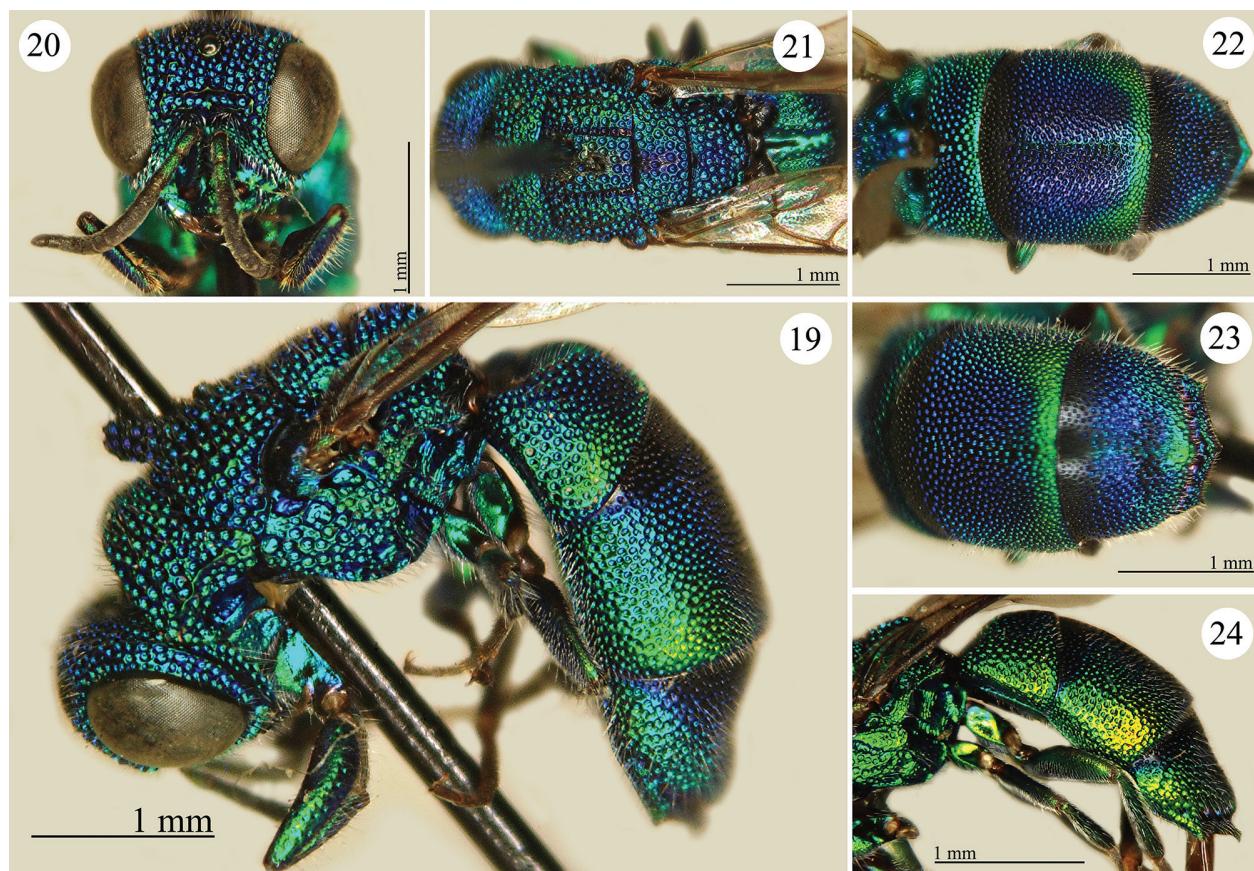
Material examined. CHINA: ♀, Formosa [= Taiwan] Sauter / Takao 1907 / *formosana* Mocs. det. Mocsáry typ. <handwritten in red> / red label / Lectotypus *Chrysis formosana* Mocs., ♀ RM Bohart <red label> / id nr. 135546 HNHM Hym. coll.; ♂, Formosa [= Taiwan] Sauter / Takao 1907 / *Sauteri* Mocs. det. Mocsáry typ. <handwritten in red> / red label / Holotype *Chrysis sauteri* Mocs. ♂ RM Bohart / id nr. 135548 HNHM Hym. coll.; 2♀♀, Kankau (Koshun) Formosa [= Taiwan] H. Sauter / IX.1912 / 12.VII.1907 / *C. formosana* Trautmann det.. PHILIPPINES: 1♀, South Leyte <without further data> (PRC); 1♀, Mt. Makiling Luzon Baker / Ins. Philipp. (HNHM).

Diagnosis. *Trichrysis formosana* (Mocsáry, 1912) is similar to *T. huzonica* (Mocsáry, 1889). It can be easily separated from the latter by median bridge of pit row sharply depressed, leaving median tooth hook-like (Fig. 24), and TFC without branches.

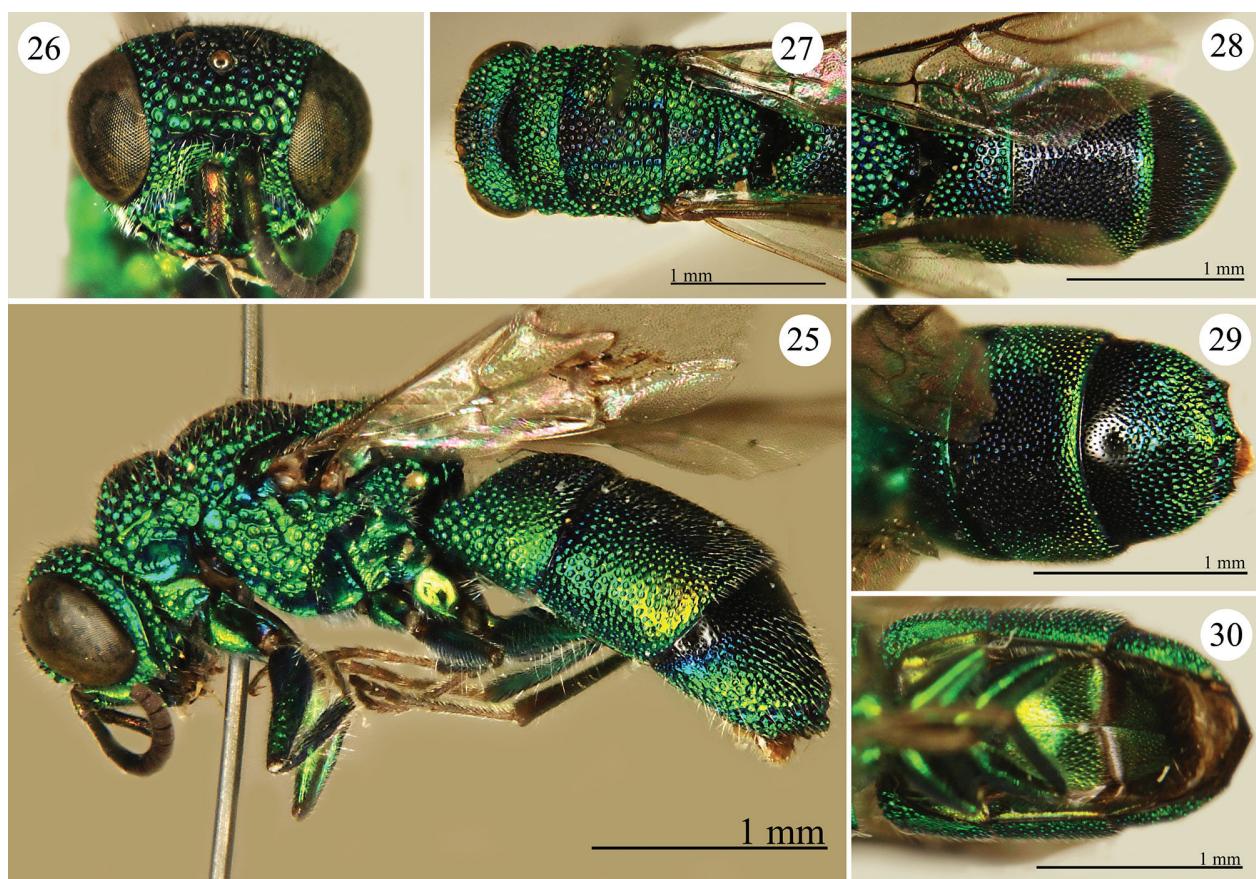
Description. Female. Body length 5.0–6.0 mm.

Head. Scapal basin punctate. TFC double, with lower one weakly developed. Relative length of P:F1:F2:F3=1.0:1.2:0.9:0.6; F1 l/w=2.2; OOL=1.5 MOD; BOL=1.5 MOD; POL=1.7 MOD; MS=0.9 MOD; clypeal apex medially truncated.

Mesosoma. Pronotal groove weak; sublateral carina distinct and complete (Fig. 21). Punctuation on pronotum, mesoscutum and mesoscutellum with consistent



Figures 19–24. *Trichrysis formosana* (Mocsáry), lectotype (female). **19.** Habitus, lateral view; **20.** Head, frontal view; **21.** Mesosoma, dorsal view; **22.** Metasoma, dorsal view **23.** T2 and T3, dorsal view; **24.** Mesosoma, lateral view.



Figures 25–30. *Trichrysis sauteri* (Mocsáry), holotype (male). 25. Habitus, lateral view; 26. Head, frontal view; 27. Head and mesosoma, dorsal view; 28. Metasoma, dorsal view; 29. T2 and T3, dorsal view; 30. Metasoma, ventral view.

punctures subequally interspaced; interspaces punctate. Metanotum with large punctures, without interspaces. Episternal sulcus and scrobal sulcus with large transversal foveae (Fig. 19).

Metasoma. Punctures on T1 and T2 distinctly geminate; interspaces punctate laterally. T2 and T3 with weak median carinae. T3 prepit bulge medially convex; pit row distinct, with large, deep and round pits, close, but not fused (Fig. 23); median bridge of pit row sharply depressed, leaving apical tooth hook-like in lateral view (Fig. 24). Apex of T3 with three teeth similar in size; interval between median tooth and lateral tooth straight. S2 black spots small and round, fused medially.

Colouration. Body blue to bluish-green, with pair of symmetric blue spots on T1, T2 and T3, respectively. Tegula fully metallic blue to bluish-green. Legs metallic blue to bluish-green, with tarsi black or blackish-brown.

Male. Body length 4.5 mm (Fig. 25), more greenish. Different from female as follow: apex of T3 with teeth slightly shorter (Fig. 29); T3 without prepit bulge; pronotum, mesoscutum and mesoscutellum dark metallic blue or black; metasoma dark metallic blue to blackish dorsally (Figs 27, 28).

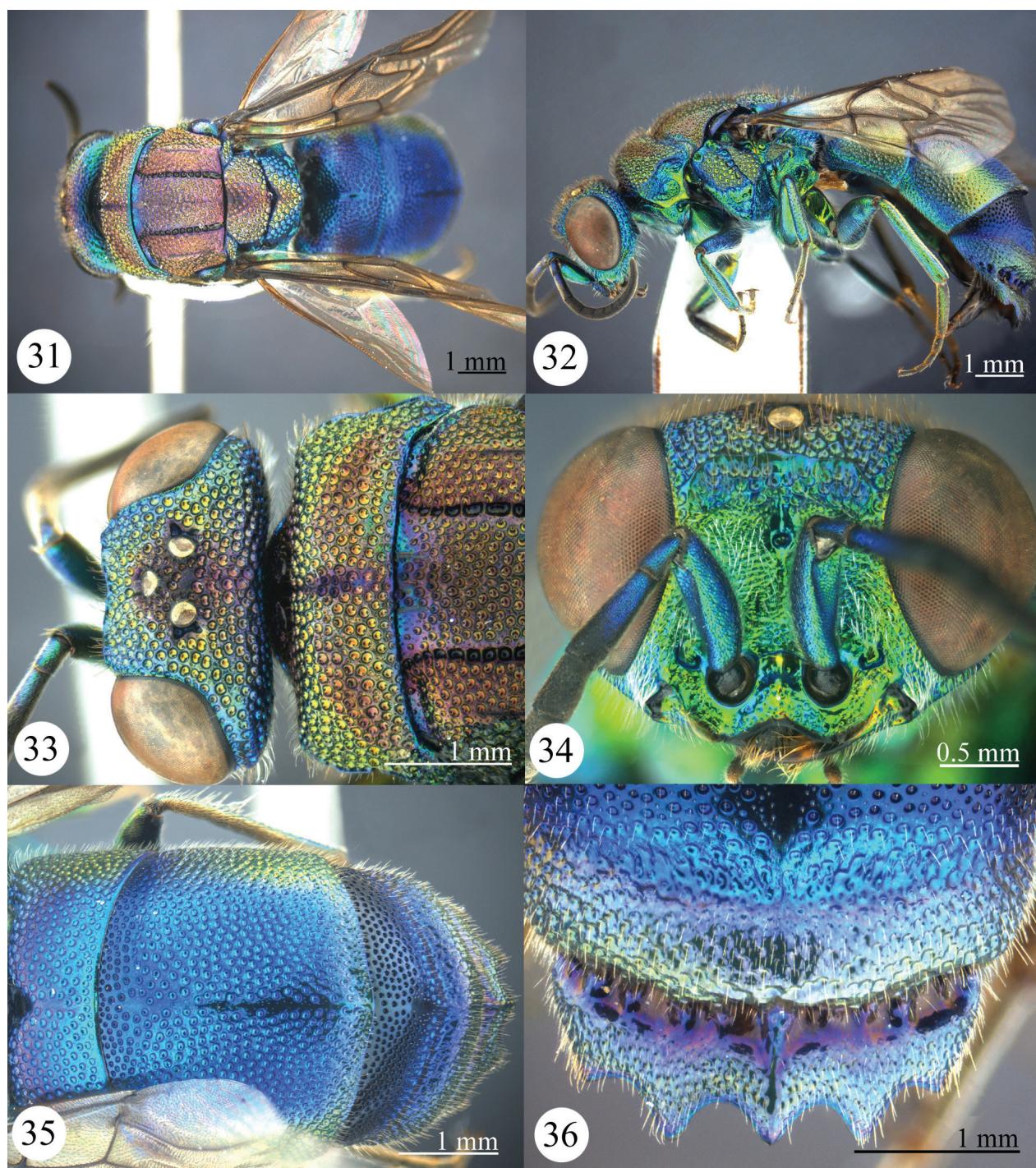
Distribution. China (Taiwan); Philippines (new record).

Remarks. The interpretation of *T. formosana* by different authors was sometimes erroneous (Tsuneki 1970;

Hanada 1989), and referable to other species. Kimsey and Bohart (1991) placed *T. formosana* in synonymy with *T. triacantha*. These two species are clearly distinguishable by: body colouration, blue to bluish-green, with contrasting blue area dorsally and greenish to golden-green strips laterally and posteriorly on T1, T2 and T3 (uniform blue in *T. triacantha*); apex of T3 with straight interval between median tooth and lateral tooth (convex in *T. triacantha*); and median bridge of pit row sharply depressed, leaving apical tooth hook-like (median bridge of pit row straight or slightly depressed in *T. triacantha*). We here revalidate *T. formosana* (Mocsáry, 1912) from the previous synonymy.

T. sauteri (Mocsáry, 1912) was described on a male collected by Sauter in July 1907, together with the female type specimens of *T. formosana* at Taiwan (Formosa, Takao [currently Kaohsiung]); the two species share the same main diagnostic characteristic of median bridge of pit row depressed. Therefore, we here consider *T. sauteri* (Mocsáry, 1912) as synonym of *T. formosana* (Mocsáry, 1912).

T. taial Tsuneki, 1970 was synonymised by Kimsey and Bohart (1991) with *T. luzonica* based on median bridge of pit row sharply depressed, leaving apical tooth hook-like. However, this characteristic is valid for *T. formosana* and not for *T. luzonica*, therefore we consider *Chrysis (Trichrysis) taial* Tsuneki, 1970 as a synonym of *T. formosana* (Mocsáry, 1912).



Figures 31–36. *Trichrysis imperiosa* (Smith), China: Guangdong (female). **31.** Habitus, dorsal view; **32.** Habitus, lateral view; **33.** Head, pronotum, dorsal view; **34.** Head, frontal view; **35.** Metasoma, dorsal view; **36.** Apex of T3, dorsal view.

Trichrysis imperiosa (Smith, 1874)

Figs 31–36, 98

Chrysis imperiosus Smith, 1874: 460. Lectotype, ♀, designated by Bohart in Kimsey and Bohart 1991: 533. Australia: Queensland, Moreton Bay (BMNH) (examined). *Chrysis imperiosa* Smith: du Buysson 1898a: 536; du Buysson 1899: 168; Bingham 1903: 479.

Chrysis (Pentachrysis) imperiosa Smith: Mocsáry 1913b:

619; Uchida 1927: 152; Tsuneki 1970: 18.

Chrysis (Trichrysis) imperiosa Smith: Linsenmaier 1959: 170; Linsenmaier 1994: 193.

Praestochrysis imperiosa (Smith): Kimsey and Bohart 1991: 533; Strumia 1996: 62.

Trichrysis imperiosa (Smith): Rosa et al. 2014: 76.

Material examined. AUSTRALIA: Lectotype / ♀ / Australia / *Chrysis imperiosus* type Smith <handwritten>

ten by Smith> / B.M. Type Hym. 13.146 / Lectotype *Chrysis imperiosus* F. Smith R.M. Bohart / BMNH(E) ♀ 970896. CHINA: 1♀, Hunan, Mt. Huping, Nianziguou (29°55'38"N 110°48'48"E), 9.VII.2009, leg. Y-l. Tang (SCAU); 12♀♀, Guangdong, Chebaling National Nature Reserve (24°42'N 114°11'E), 22–28. VII.2008, leg. Z-f. Xu (SCAU); 1♀, idem, 27.VII.2002 (SCAU); 1♀, Guangdong, Guangzhou, Liuxihe Forest Park (23°44'31"N 113°47'0"E), 20.VI.2004, leg. Z-f. Xu (SCAU); 1♀, idem, 29.VIII.2004 (SCAU); 1♀, Guangdong, Shaoguan, Yunjishan Provincial Natural Reserve (24°4'37"N 114°10'14"E), 19.VII.2003, leg. Z-f. Xu (SCAU); 1♀, Guangdong, Meizhou, Fengxi (24°31'43"N 116°16'45"E), 30.VII.2003, leg. J-x. Liu & P-c. Li (SCAU); 1♀, Guangdong, Meizhou, Meixian (24°16'2"N 116°4'58"E), 14–29.VII.2006, leg. C-h. Xie & W-x. Xie (SCAU); 1♀, Guangdong, Heishiding Provincial Nature Reserve (23°27'42"N 111°54'33"E), 1–2.X.2003, leg. W-q. Fan (SCAU); 1♀, 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); 1♀, Hainan, Bawangling National Nature Reserve, 21–21. VI.2007, leg. J-m. Yao (SCAU); 5♀♀, Hainan, Yinggeling National Nature Reserve (19°0'52"N 109°32'47"E), 17–20.VII.2010, leg. H-y. Chen (SCAU). INDONESIA: 1♀, Dutch New Guinea Cyclops Mts. Sabron. 930 ft IV.1936 L.E. Cheesman / B.M. 1936-271 (NMLS). NEPAL: 1♀, West Nepal 13.VI. Myagdi District, Shikha Tatopani (28°28'N 83°40'E) C. Holzschuh (NMLS). PAPUA NEW GUINEA: 1♀, UPNG Waigani Nat. Cap. District 18.III.1916 T. Mala (NMLS); 1♀, Neth. Ind. American-New Guinea Expedition, Mountain slope above Bernhard Camp 100 m, 9.IV.1939 L. J. Toxopeus (NMLS); 1♀, 6 mile Pt. Moresby 9.VII.1967 S. Swanson (NMLS); 1♀, Kokoda 1200 ft IV.1933 L.E. Cheesman / B.M. 1933-42 (NMLS). THAILAND: 1♀, Chiang Dao Hill Reserve 100 km N Chiang Mai, 650 m, 28.V–8. VI.2009 leg. S. Murzin (PRC); 2♀♀, 100 km N Chiang Mai 600 m, 20–31.VII.2008 leg. S. Murzin (PRC).

Diagnosis. *Trichrysis imperiosa* (Smith, 1874) is similar to *T. lusca* (Fabricius, 1804) and it was synonymised with the latter by Kimsey and Bohart (1991). However, it can be easily separated from the latter by: body metallic coppery dorsally on mesosoma; TFC simple, without branches upwards to ocellar area; T2 ending in a raised carina; T3 pre pit row area strongly overhanging over pit row; pit row broad and distinct, with large pits partly fused; S2 black spots small and fused (Fig. 98).

Description. Female. Body length 8.4–10.6 mm.

Head. Scapal basin deep and punctate (Fig. 34). TFC distinct, single and mostly straight, with two ends bending downwards. Relative length of P:F1:F2:F3=1.0:2.0:1.0:0.8; F1 l/w=3; OOL=2.0 MOD; BOL=1.2 MOD; POL=1.6 MOD; MS=1.0 MOD; clypeal apex concave medially.

Mesosoma. Pronotal groove deep, almost extending to posterior margin of pronotum (Fig. 33); sublateral carina distinct and complete. Mesoscutellum and metanotum

with anterior depression polished (Fig. 31). Episternal sulcus with foveae transversally elongated; scrobal sulcus with large and irregular areolae (up to 3 PD) (Fig. 32).

Metasoma. T1 and T2 with uniform punctuation; punctures with same diameter of punctures on mesoscutum, equally interspaced (0.5–1.0 PD). T2 with strong median carina; T2 posterior margin raised (Fig. 35). T3 pit row area beneath strongly overhanging pre pit fold; pit row enlarged sunken and broad, with large pits partly fused (Fig. 36). Apex of T3 with five teeth. S2 black spots small, diamond-shaped, fused medially (Fig. 98).

Colouration. Body metallic greenish-blue to blue. Face with golden reflections. Vertex with metallic coppery reflection; violet in ocellar area. Scape, pedicel and F1 bluish-green to green, rest of flagellum black. Pronotum, mesoscutum, mesoscutellum, metanotum medially, mesopleuron over scrobal sulcus, and metapleuron mostly metallic coppery. Pronotal groove dark blue to violet. Tegula metallic greenish-copper. Legs metallic green, with tarsi blackish-brown. T1 and T2 metallic coppery laterally.

Male. Unknown.

Distribution. China (Taiwan, Hunan, Guangdong, Hainan) (Tsuneki 1970); Australia, Myanmar, India, Sri Lanka (Bingham 1903); Vietnam (Kimsey and Bohart 1991); Indonesia, Nepal, Papua New Guinea, Thailand (new records).

Remarks. Kimsey and Bohart (1991) placed this species in the genus *Praestochrysis* Linsenmaier, 1959, because it bears five teeth on apex of T3. However, as already observed by Linsenmaier (1994) and Madl and Rosa (2012), some important morphological and biological characteristics of the species are indeed typical of the genus *Trichrysis* Lichtenstein, 1876. Apex of T3 with five teeth can be considered as an extreme variation of convex interval between median tooth and lateral tooth, which is variable in the genus *Trichrysis*.

Trichrysis lusca (Fabricius, 1804)

Figs 37–42, 99

Chrysis lusca Fabricius, 1804: 171. Holotype, ♀, Italy (accidentally introduced) (ZMU) (examined).

Chrysis lusca Fabricius: du Buysson 1898a: 536; du Buysson 1899: 168.

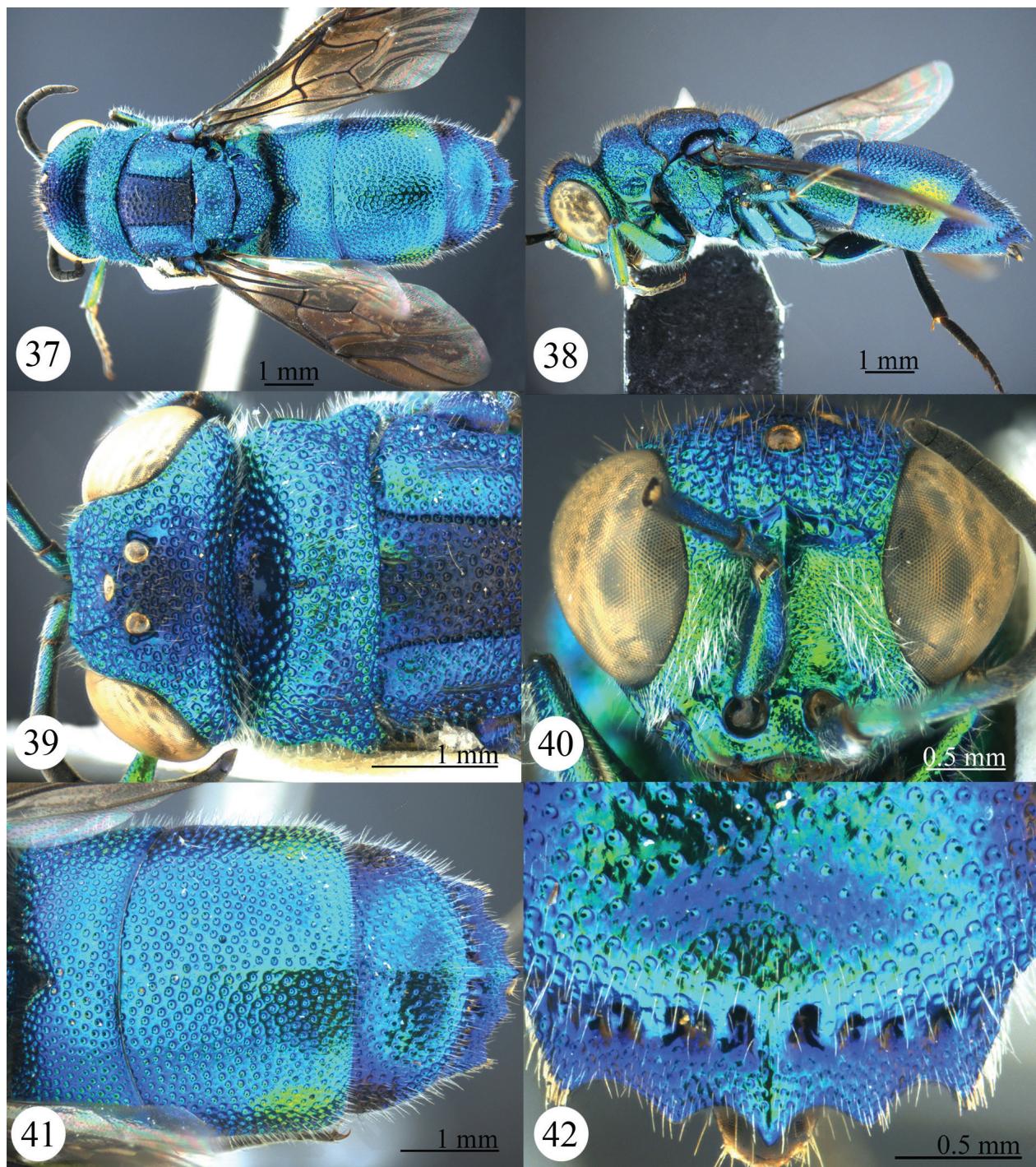
Chrysis (Pentachrysis) dolichoceras Bischoff, 1910: 485. Holotype, ♀, Japan (MNHU) (synonymised by Kimsey and Bohart 1991: 533).

Chrysis (Pentachrysis) lusca Fabricius: Bischoff 1910: 486; Mocsáry 1913a: 11; 1913b: 619; Uchida 1927: 152; Tsuneki 1953b: 28; 1955: 35; 1970: 17.

Chrysis extraniensis Rohwer, 1921: 68. Holotype, ♀, USA: Hawaii (USNM) (synonymised by Kimsey and Bohart 1991: 533).

Chrysis occulta Mader, 1939: 93. Holotype, ♀, Italy (accidentally introduced) (NHMW) (synonymised by Linsenmaier 1959).

Pentachrysis lusca (Fabricius): Hammer 1950: 2.



Figures 37–42. *Trichrysis lusca* (Fabricius), China: Guangdong (female). **37.** Habitus, dorsal view; **38.** Habitus, lateral view; **39.** Head, pronotum, dorsal view; **40.** Head, frontal view; **41.** Metasoma, dorsal view; **42.** Apex of T3, dorsal view.

Praestochrysis lusca (Fabricius): Kimsey and Bohart 1991: 533; Kurzenko and Lelej 2007: 1006; Ha et al. 2008: 73. *Chrysis (Trichrysis) lusca* Fabricius: Linsenmaier 1994: 193. *Trichrysis lusca* (Fabricius): Rosa et al. 2014: 76.

Material examined. ITALY: Schlanbusch (?)/ holotype / ♀/ Mus: T: Lund *Chrysis lusca* Fabr. [label in error after re-writing (Zimsen 1964)] / type <red label> (ZMU). JAPAN: 1♀, Nangasaki / *Pentachrysis dolichoceras*

Bischoff (MNHU). CHINA: 1♀, Kosempo Formosa [= Taiwan] 1911 H. Sauter (MNHU); 2♀♀, Taiwan Chipon VIII.1935 K. Iwata / det. Enslin (NMLS); 1♀, Taiwan Sozan VIII.1935 K. Iwata / det. Linsenmaier (NMLS); 1♂, Formosa Pingtung Hsien, Ssuehungchi, 5.VIII.1968 S. Suzuki (PRC); 1♂, Formosa, Taipei Hsien, Wulai 19.VII.1968 S. Suzuki (PRC); 74♀♀, Guangdong, Guangzhou, Liuxihe Forest Park (23°44'31"N, 113°47'0"E), 13–14.IV.2002, leg. Z-f. Xu (SCAU); 7♀♀, idem,

20.VI.2002 (SCAU); 4♀♀, idem, 29.VIII.2004 (SCAU); 11♀♀, idem, 1–4.VI.2007 (SCAU); 16♀♀, idem, 12.VI.2008 (SCAU); 81♀♀, Guangdong, Guangzhou, Wangzishan Forest Park ($23^{\circ}34'49''N$, $113^{\circ}13'21''E$), 20.V.2006, leg. Z-f. Xu & J-j. Chen (SCAU); 1♀, Guangdong, Guangzhou, campus of SCAU ($23^{\circ}9'31''N$, $113^{\circ}20'41''E$), 5.VII.2007, leg. C-j. Zeng (SCAU); 1♀, idem, 8.IV.2009 (SCAU); 8♀♀, Guangdong, Nanling National Nature Reserve ($24^{\circ}55'43''N$, $113^{\circ}1'1''E$), 16–18.IV.2004, leg. Z-f. Xu (SCAU); 3♀♀, Guangdong, Meizhou, Meixian ($24^{\circ}16'2''N$, $116^{\circ}4'58''E$), 14–29.VII.2006, leg. C-h. Xie & W-y. Xie (SCAU); 1♀, Guangdong, Heishiding Provincial Nature Reserve ($23^{\circ}27'42''N$, $111^{\circ}54'433''E$), 4.VI.2007, leg. Z-f. Xu (SCAU); 1♀, Kouy Tchéou [= Guizhou] 1921 Cavalairre (NMLS); 1♀, Yunnan, Hekou, Nanxi ($22^{\circ}37'31''N$ $103^{\circ}56'53''E$), 16.V. 2006, leg. Z-f. Xu; 1♂, Yunnan, Jingdong, Wenjing ($24^{\circ}18'9''N$ $100^{\circ}55'53''E$), 29.IV.2005, leg. H-s. Wang (SCAU). BANGLADESH: Dacca, Bhawal National Park 27.V.1983 Melon (PRC). CAMBODIA: 1♀, Pailin 200 m, 11–15.V.2009 leg.. S. Murzin (PRC). INDONESIA: 1♀, Borneo, Balikpapan 1947/48 W.A. Mohler (NMLS); 1♀, Java Bandoeng [= Bandung] 760 m XI.1936 E. Jacobson (NMLS); 1♀, Bandoeng [= Bandung] 750 m XI.1937 E. Jacobson / ex clay nest of wasp (!) (NMLS); 1♀, Java Bandoeng [= Bandung] 750 m 12.IX.1937 F.C. Drescher (NMLS); 1♀, Java Buitenzorg [= Bogor] 11.X.1929 van der Vecht (NMLS); 1♀, Java Buitenzorg [= Bogor] 10.X.1932 R.A. Muller (NMLS); 1♀, West Java Djampang Tengak 1934 M.E. Walsh (NMLS); 1♀, Java, Soekaboemi [= Sukabumi] 14.3.1938 M.E. Walsh (NMLS); 1♀, West Java, Soekane-gara 400–1000 m II.1940 (NMLS); 1♀, Sumatra, Siantar XI.1954 Otto-Surbeck (NMLS); 2♀♀, Siantar I–III.1960 Otto-Surbeck (NMLS); 1♀, Siantar Dolok Ulu I.1960 Otto-Surbeck (NMLS); the following specimens were collected at Sumatra, Medan by E. Diehl (NMLS): 3♀♀, 9–20.IV.1967; 2♀♀, 2–12.V.1967; 1♀, 9.X.1967; 3♀♀, 8.VI–15.VII.1969; 6♀♀, 1–20.III.1970; 1♀, 28.I.1971; 1♀, 28.I.1973; 2♀♀, 7–18.V.1973; 1♀, 22.VI.1973; 2♀♀, 3.X.1991; 1♀, 15.III.1992; 1♀, 6.IV.1992; 1♀, 21.VII.1994; the following specimens were collected at Sumatra, Medan, Dolok Merangir by E. Diehl (NMLS): 12♀♀, 4.III–30.V.1967; 1♀, 2.II.1968; 1♀, 20.I.1969; 1♀, 30.VII.1969; 1♀, 5.II.1970; 1♀, IX.1971. MALAYSIA: 1♀, Malacca Selangor (PRC); 1♀, Sarawak Kuching IX.1961 C.R. Wallace (NMLS); 1♀, Kuala Lumpur 8.I.1931 H.M. Pendlebury (NMLS); 1♀, Kuala Lumpur VII.1938 H.M. Pendlebury (NMLS); 1♀, Kuala Lumpur 4.IV.1928 H.T. Pagden (NMLS); 1♀, Kuala Lumpur 4.VIII.1936 H.M. Pagden. SRI LANKA: 1♀, Ceylon, Beuil Oya 20.II.1954 (NMLS); 1♀, Kalutara 1910 E. Comber (NMLS). VIETNAM: 4♀♀, Tonkin, Hoa Binh Province 1926–1928 A. de Cooman (NMLS); 4♀♀, Tonkin Hoa Binh XII.1934 A. de Cooman (NMLS); 1♂, Central Tonkin 1911 A. Krempf (NMLS).

Diagnosis. *Trichrysis lusca* (Fabricius, 1804) resembles *T. imperiosa* (Smith, 1874), but it can be easily sep-

arated from the latter by: body uniformly blue to green, with golden lateral spot on T2; TFC with branches upwards to ocellar area; T2 without apical raised carina; prepit bulge slightly convex, not strongly overhanging over pit row; pit row with single, small and separated pits; S2 with black spots large and partly separated.

Description. Female. Body length 6.4–10.6 mm.

Head. Scapal basin deep, rugose and punctate (Fig. 40). TFC single, forming slightly inverted V-shape, with two branches upwards to ocellar area. Relative length of P:F1:F2:F3=1.0:1.9:0.9:0.6; F1 l/w=3.7; OOL=1.7 MOD; BOL=1.5 MOD; POL=1.7 MOD; MS=1.0 MOD; clypeal apex concave medially.

Mesosoma. Pronotal groove deep, almost extending to posterior margin of pronotum (Fig. 39); sublateral carina distinct and complete. Mesoscutellum and metanotum with anterior depression polished and not distinctly depressed. Metanotum with large contiguous punctures. Episternal sulcus and scrobal sulcus with transversal foveae up to 2 PD (Fig. 38).

Metasoma. T1 and T2 with large punctures equally interspaced (0.5–1.0 PD) (Fig. 41). T2 with median carina. T3 prepit bulge slightly convex; pit row distinct, with small, deep pits clearly separated. Apex of T3 with five teeth (Fig. 42). S2 black spots fused medially or partially to fully separated by narrow metallic line (Fig. 99).

Colouration. Head metallic bluish-green, with green-golden reflection on face and dark blue spot on vertex. Scape, pedicel and F1 metallic bluish-green, rest of flagellum black. Mesosoma metallic bluish-green to green, with mesoscutum medially dark blue to purple, distinctly darker than lateral lobes. Metasoma bluish-green to blue, with golden spots on T2 postero-laterally. Tegula metallic blue. Legs metallic bluish-green, with tarsi black.

Male. Body length 8.3–9.8 mm. Male differs from female as follows: body green, with dark blue in ocellar area, on mesoscutum and on T3 antero-laterally and apically; F2 partially metallic; T3 median tooth and lateral tooth short and blunted.

Distribution. China (Hubei, Hunan, Taiwan, Fujian, Guangdong, Macao, Hainan, Guizhou, Yunnan) (Tsuneki 1953a); Australia, India, Japan, Korea, Madagascar, Myanmar, Philippines, Thailand (Kimsey and Bohart 1991); Bangladesh, Cambodia, Indonesia, Malaysia, Sri Lanka, Vietnam (new records). Afrotropical: Mauritius and Réunion (Azevedo et al. 2010).

Remarks. Similarly to *Trichrysis imperiosa*, this species was included in the genus *Praestochrysis* by Kimsey and Bohart (1991). Species in the genus *Praestochrysis* are parasites of moths in the family Limacodidae (de Joannis 1896; du Buysson 1898b, 1901; Piel 1933; Parker 1936; Edney 1954; Iwata 1963; Yamada 1980, 1990; Polazek 1987; Kimsey and Bohart 1991; Strumia 1996; Komeda and Hisamatsu 2005). However *T. lusca* is known to be parasitoid of Sphecidae, as *Sceliphron fabricator* Smith (Mocsáry 1889, 1912; Linsenmaier 1959), *S. inflexus* Sickmann (Tsuneki 1955) and unidentified Eu-

menids (Kimsey and Bohart 1991). We collected *T. lusca* on mud walls of old houses where sphecid and eumenid wasps built nests. For this trophic differentiation and morphological characteristics, such as developed pronotal carina, we agree with the interpretation given by Linsenmaier (1994) and Madl and Rosa (2012) and include *lusca* and related species in the genus *Trichrysis*, as well as the Afrotropical species included in the *inops* group. We consider as *Praestochrysis* only the species parasitoid of Limacodid moths, independently from number of apical teeth on T3.

Trichrysis luzonica (Mocsáry, 1889)

Figs 43–48, 100

Chrysis (Trichrysis) luzonica Mocsáry, 1889: 328. Holotype, ♀, Philippines: Luzon (ISEA-PAN) (examined).

Chrysis (Trichrysis) bakeri Mocsáry, 1913c: 290. Holotype, ♂, Philippines: Luzon (HNHM) (examined) (synonymised by Kimsey and Bohart 1991: 572).

Trichrysis luzonica (Mocsáry): Bohart 1987: 348; Kimsey and Bohart 1991: 572; Rosa et al. 2014: 76.

Material examined. PHILIPPINES: ♀, Lucon / 275 / *luzonica* Moc <handwritten by Radoszkowski> / Holotype *Chrysis luzonica* Mocsáry det. P. Rosa 2012

(ISEA-PAN); ♂, Los Baños Baker / *Trichrysis bakeri* Mocs det. Mocsáry typ. <handwritten in red> / Holotype *Chrysis bakeri* Mocs. ♂ RM. Bohart / id nr. 135553 HNHM Hym. coll. (HNHM); 3♀♀1♂, Ins. Philipp. / Mt. Makiling Luzon Baker (HNHM).

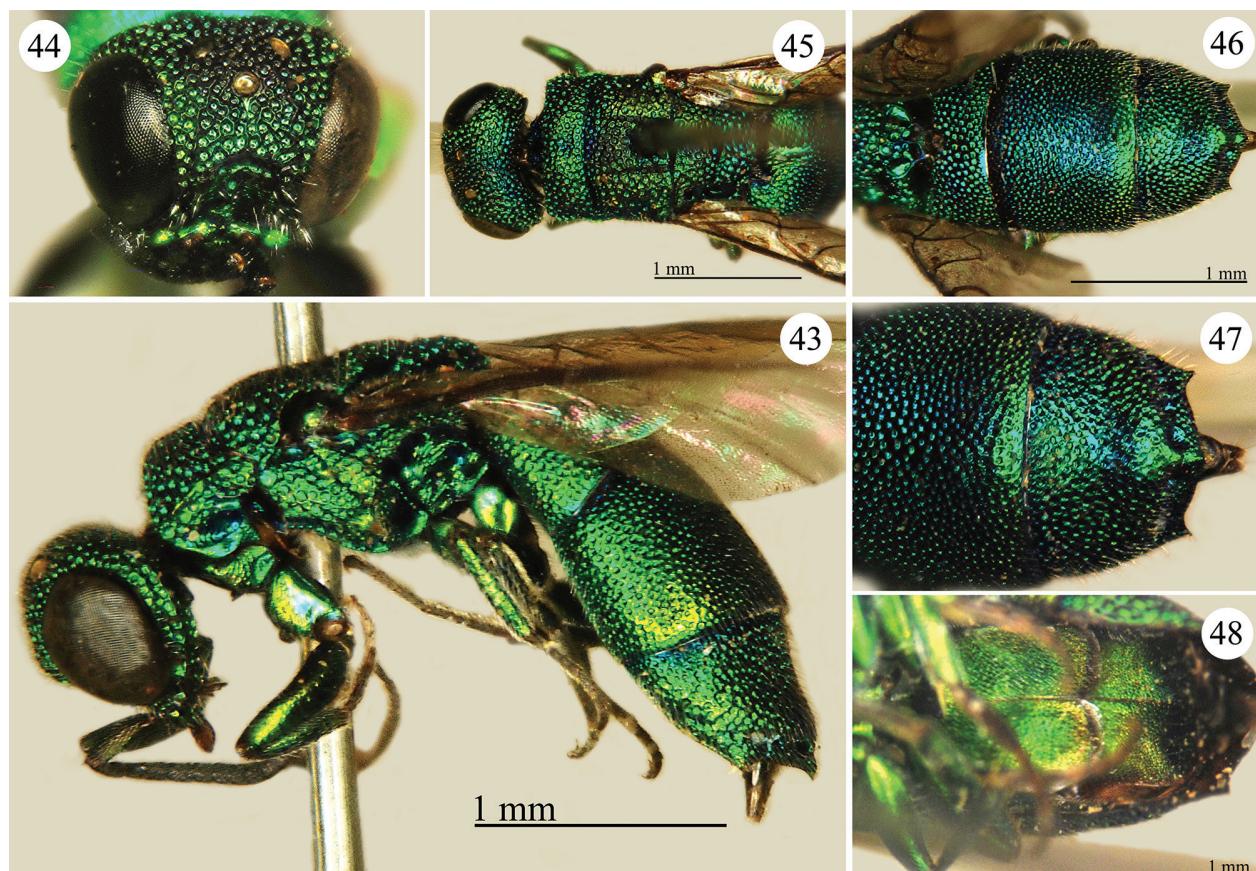
Diagnosis. *Trichrysis luzonica* (Mocsáry, 1889) is similar to *T. formosana* (Mocsáry, 1912), but can be separated from the latter by: median bridge of pit row straight, at most slightly depressed, subdividing pit row; TFC with weak branches.

Description. Female. Body length 4.5–5.0 mm (Fig. 43).

Head. Scapal basin deep, striate medially. TFC single, slightly inverted V-shaped, with two weak dorsal branches upwards to ocellar area (Fig. 44). Relative length of P:F1:F2:F3=1.0:1.4:0.7:0.6; F1 l/w=2.5; OOL=1.5 MOD; BOL=2.0 MOD; POL=2.0 MOD; MS=0.8 MOD; clypeal apex slightly incised.

Mesosoma. Pronotal groove deep, extending to 3/4 length of pronotum; sublateral carina distinct and complete (Fig. 45). Episternal sulcus and scrobal sulcus with large foveae.

Metasoma. Dense punctation on T1 and T2, with large geminate punctures. T2 with weak median carina. T3 prepit bulge slightly convex medially (Fig. 46). Pit row with relatively small pits equally interspaced (Fig. 47); in lateral view, median bridge of pit row straight to slightly depressed, dividing pit row in two parts. Apex



Figures 43–48. *Trichrysis luzonica* (Mocsáry), Philippines: Los Baños (female). **43.** Habitus, lateral view; **44.** Head, frontal view; **45.** Head and mesosoma, dorsal view; **46.** Metasoma, dorsal view; **47.** T2 and T3, dorsal view **48.** Metasoma, ventral view.

of T3 with three teeth, lateral tooth sharper than median tooth (Fig. 47). Interval between median tooth and lateral tooth straight. S2 black spots suboval, fused medially (Fig. 100).

Colouration. Head and mesosoma metallic bluish-green to green, with golden reflections. Scape, pedicel and F1 metallic bluish-green to green, rest of flagellum black. Tegula fully metallic green. Legs metallic bluish-green, with tarsi brown. Metasoma metallic bluish-green to green, with anterior margins of T2 and T3 dark blue and posterior margin of T2 lighter green to golden-green.

Male. Body length 4.5–5.0 mm. Male differs from female as follows: body mostly darker coloured; vertex, pronotum, mesoscutum, T2 and T3 dark metallic bluish to black; teeth on apex of T3 shorter compared to female.

Distribution. China (Taiwan?, Hong Kong?) (Tsuneki 1970; Kimsey and Bohart 1991); Philippines (Mocsáry 1889).

Remarks. This species was reported for China (Hong Kong and Taiwan) by Kimsey and Bohart (1991). Nevertheless, their interpretation was confused with *T. formosana* (Mocsáry), based on shape of T3 (Bohart 1987). Mocsáry's (1889) original description of T3 as follow: “*tertio [segmento] convexo, supra seriem calloso, foveolis paucis, 6 tantum, magnis ac profundis rotundisque per carinulam medianam in spinam brevem acutam triangularem productam interruptis [...]*” (third tergite convex, bulged on pre pit row, with six large, deep and round pits, medially interrupted by median carina extended to short, acute and triangular spine [= median tooth]). Therefore, no available records are currently known from China. However, it is possible that this species could be misidentified in collections and we here list and key it together with other Chinese species.

Trichrysis pellucida (du Buysson, 1887)

Figs 49–54, 101

Chrysis pellucida du Buysson, 1887: 183. Syntypes, ♂♂♀, China, Turkey (MNHN).

Chrysis (Trichrysis) buyssoni Mocsáry, 1889: 323. Replacement name for *Chrysis pellucida* du Buysson 1887 nec *Brugmoia pellucida* Radoszkowski, 1877.

Chrysis pellucida du Buysson: du Buysson 1898a: 525; du Buysson 1899: 164; du Buysson 1900: 144.

Chrysis (Trichrysis) pellucida du Buysson: Bischoff 1913: 46; Tsuneki 1953b: 25; Linsenmaier 1959: 169.

Chrysis (Trichrysis) mongolica Mocsáry, 1914: 24. Lectotype, ♀, designated by Bohart in Kimsey and Bohart 1991: 571; Mongolia (HNHM) (examined) (synonymised by Kimsey and Bohart 1991: 571).

Chrysis (Monochrysis) coreana Uchida, 1927: 153. Syntype, ♀, Korea: Suigen (EIHU) (synonymised by Tsuneki 1947: 47).

Chrysis (Trichrysis) neptunia Semenov, 1967: 162. Holotype, ♀, Korea: Pal'Makh (ZIN) (examined) (synonymised by Kimsey and Bohart 1991: 571).

Trichrysis buyssoni (Mocsáry): Kimsey and Bohart 1991: 571; Ha et al. 2008: 73.

Trichrysis coreana (Uchida); Kimsey and Bohart 1991: 571; Ha et al. 2008: 73.

Trichrysis pellucida (du Buysson): Rosa et al. 2014: 77.

Material examined. CHINA: Lectotype ♀ (here designated): Chine <deposited in the Abeille de Perrin collection> / Lectotypus *Chrysis pellucida* Buyss. ♀ P. Rosa vidit 2016 (MNHN); KOREA: [Kor: Pal'Makh 19.VI.900], sp. n. pr. *Pellucidam* Buyss., ♀ *neptunia* A. Semenov-Tian-Shansky det. XI.09 / holotype (ZIN); 12♀, Keikido Shoyozan 2.VII.1943 K. Tsuneki (NMLS). MONGOLIA: Mongolia / *mongolica* Mocs. det. Mocsáry typ. <handwritten in red> / red label / *Chrysis* L. *pellucida* Buyss. Linsenmaier det. 59 / Lectotypus *Chrysis mongolica* Mocs. ♀ RM Bohart / id nr. 135554 HNHM Hym. Coll. (HNHM). CHINA: 1♀, Liaoning, Shenyang Froest Park (42°01'64"N, 123°43'38"E), 15.VII.2011, leg. C-j. Yan et al. (SCAU); 1♀, Liaoning, Laotuziding Nature Reserve (41°19'7"N, 124°52'27"E), 18.VII.2011, leg. K-x. Zhao (SCAU); 1♀, Hunan, Ningxiang, Huangcai woodland, VII.1981 (SCAU).

Diagnosis. *Trichrysis pellucida* (du Buysson, 1887) is similar to *T. yuani* sp. n. for habitus, but it can be easily separated from the latter by: body length 9.0–10.0 mm; body dark blue to violet, or occasionally dark green with bluish areas; apex of T3 with sharp median tooth (Fig. 54); F1 l/w = 3.5.

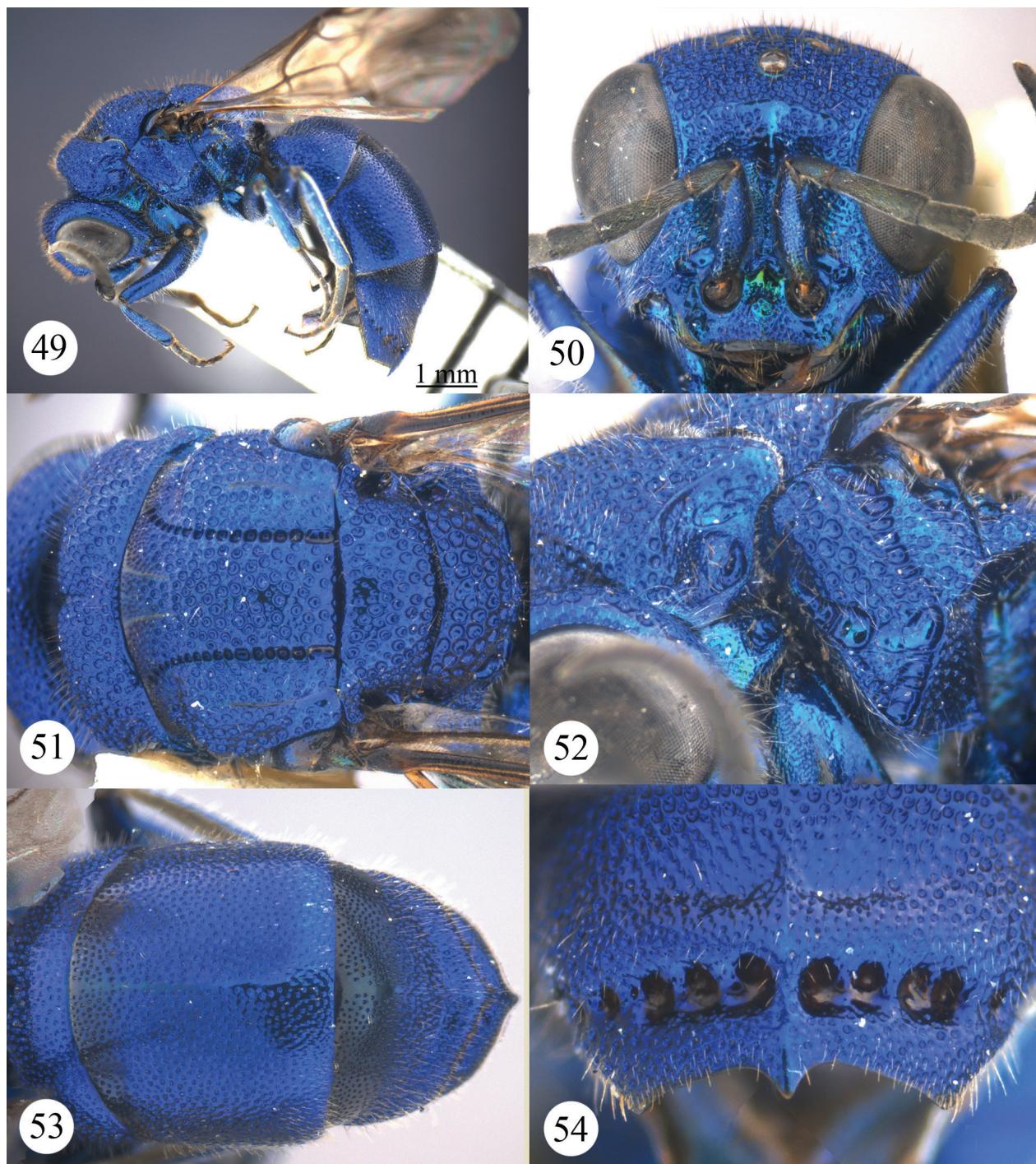
Description. Female. Body length 9.0–10.0 mm.

Head. Scapal basin deep and punctate (Fig. 50). TFC single, slightly inverted V-shaped. Relative length of P:F 1:F2:F3=1.0:1.7–1.8:1.0:0.6–0.7; F1 l/w=3.5; OOL=2.0–2.4 MOD; BOL=1.5 MOD; POL=1.9–2.0 MOD; MS=1.2 MOD; clypeal apex almost truncate.

Mesosoma. Pronotal groove deep, extending to 3/4 length of pronotum; sublateral carina distinct and complete (Fig. 51). Punctuation on mesosoma dense, with consistent punctures relatively deep and small (about 0.5 MOD), subequally interspaced; interspaces punctate. Deep episternal sulcus with large foveate punctures; scrobal sulcus with large transversal areolate punctures (Fig. 52). Hind basitarsus l/w = 5.

Metasoma. Punctures on T1 and T2 geminate, smaller than punctures on mesosoma (Fig. 53); interspaces punctate. T2 and T3 with median carinae. T3 with coarse punctuation and striate sculpture on depression before pre pit row; T3 prepit bulge markedly convex; pit row with round pits, remarkably large and deep, not fused; post pit row area deep and elongated (Fig. 49). Apex of T3 with one sharp median tooth and two blunt lateral teeth; interval between median tooth and lateral tooth usually straight (Fig. 54). S2 black spots medially fused (Fig. 101).

Colouration. Body dark blue to violet; rarely dark green with blackish areas. Scape blue to violet, pedicel and flagellum black. Tegula blackish-brown, with metallic reflections partly. Legs metallic bluish-green, with



Figures 49–54. *Trichrysis pellucida* (du Buysson), China: Liaoning (female). **49.** Habitus, lateral view; **50.** Head, frontal view; **51.** Mesosoma, dorsal view; **52.** Pronotum and mesopleuron, lateral view; **53.** Metasoma, dorsal view; **54.** Apex of T3, dorsal view.

tarsi blackish-brown, without metallic reflections, or with occasionally weak reflections. Sternites greenish-blue.

Male. Not available for this study.

Distribution. China (Liaoning, Inner Mongolia, Hebei, Beijing, Hunan); Middle East to China and Russian Far East (Kimsey and Bohart 1991; Kurzenko and Lelej 2007).

Remarks. The description of *Chrysis pellucida* du Buysson was based on one female collected in China and two males collected in Turkey, all originated from

the Abeille de Perrin collection. At MNHN, one Turkish male is deposited in the general collection (ex du Buysson collection); the other Turkish male and the Chinese female are deposited in the Abeille de Perrin collection. We here select the female specimen labelled as “Chine” as the lectotype. It matches the current interpretation of the species and it is in perfect condition.

Chrysis (Trichrysis) buyssoni Mocsáry, 1889 is a replacement name for *Chrysis pellucida* du Buysson, 1887

nec *Brugmoia pellucida* Radoszkowski, 1877. Mocsáry (1889) included the two species in the genus *Chrysish*: subgenera *Trichrysis* Lichtenstein and *Euchroeus* Latreille (1809). However, *Chrysish pellucida* du Buysson and *Brugmoia pellucida* Radoszkowski are not congeneric, and after Mocsáry (1889) nobody else considered *Euchroeus* (or *Brugmoia*) as a synonym or a subgenus of *Chrysish*. According to the Code (ICZN 1999: Art. 59), we use the original name *T. pellucida* (du Buysson), following the interpretation given by Linsenmaier (1959).

T. coreana Uchida, 1927 was considered as a valid taxon by Kimsey and Bohart (1991). However, we follow Tsuneki's (1953b) interpretation of this taxon. Tsuneki (1947) examined Uchida's collection and placed *T. coreana* in synonymy with *T. pellucida*. This synonym is also confirmed by the original description and drawing given by Uchida (1927).

Trichrysis secernenda (Mocsáry, 1912)

Figs 55–60, 102

Chrysish (Trichrysis) secernenda Mocsáry, 1912: 376. Lectotype, ♂, designated by Bohart in Bohart and French 1986: 342). Uzbekistan: Gouldsha (type series: China: Xinjiang, paralectotypes) (HNHM) (examined).

Trichrysis secernenda (Mocsáry): Kimsey and Bohart 1991: 573; Rosa et al. 2014: 78.

Material examined. UZBEKISTAN: ♀, Gouldscha Ferghana 1905 Korb / *secernenda* Mocs. det. Mocsáry typ. <handwritten in red> / red label / Lectotypus *Chrysish secernenda* ♂ Mocs. RM Bohart / id nr. 135539 HNHM Hym. coll.. CHINA: 1♂, Ningxia, Liupanshan Forest Park (34°22'N 106°18'E), 21.VI–14.VII.2008, leg. J.-m. Yao (SCAU). AFGHANISTAN: 1♀, Kabul 23.VII.1970 Y. Arita (PRC).

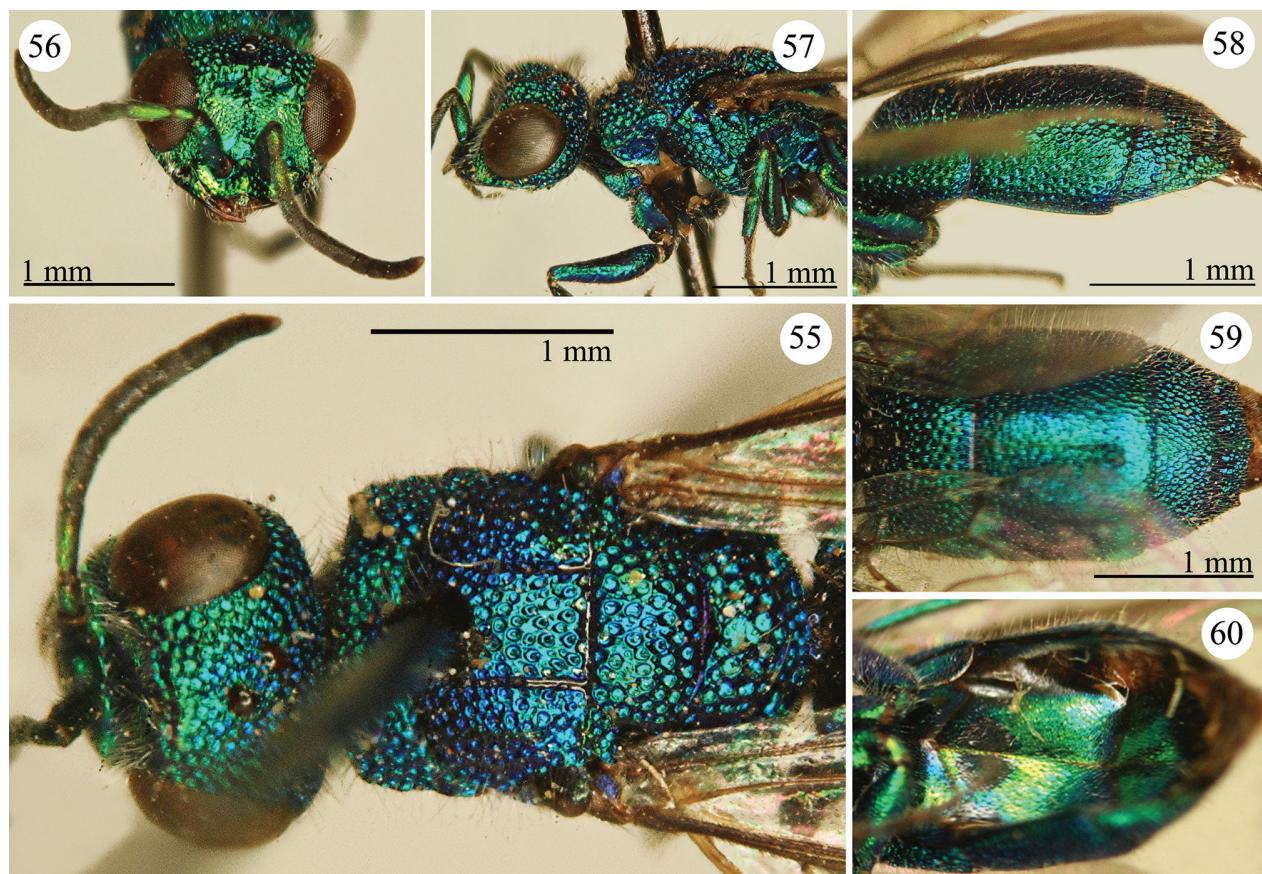
Diagnosis. *Trichrysis secernenda* (Mocsáry, 1912) is similar to *T. cyanea* (Linnaeus, 1758) for habitus, geminate punctures on metasoma and tegula brown; but it can be separated from the latter by: black spots on S2 distinctly large and separated by narrow metallic line (Fig. 102); female F1 fully metallic and F2 partially metallic.

Description. Female. Body length 5.6 mm.

Head. Scapal basin deep, wrinkled and punctate (Fig. 56). TFC single, straight or slightly inverted V-shape. Relative length of P:F1:F2:F3=1.0:2.6:1.4:0.9; F1 l/w=3.5; OOL=1.8 MOD; BOL=1.4 MOD [data taken from pictures]; MS=1.1 MOD; clypeal apex concave.

Mesosoma. Pronotal groove deep; sublateral carina weak and incomplete. Metanotum with large antero-median depression (Fig. 55). Episternal sulcus and scrobal sulcus with irregular large foveate punctures (Fig. 57).

Metasoma. Punctuation geminate, on T1 with large punctures; on T2 with smaller punctures and interspaces large and smooth (about 1 PD). T2 without median cari-



Figures 55–60. *Trichrysis secernenda* (Mocsáry), holotype (female). **55.** Head and mesosoma, dorsal view; **56.** Head, frontal view; **57.** Head and mesosoma, lateral view; **58.** Metasoma, lateral view; **59.** Metasoma, dorsal view; **60.** Metasoma, ventral view.

na. T3 without prepit bulge; pit row with small and isolated pits. Apex of T3 with three short teeth, and straight interval between median tooth and lateral tooth. S2 black spots large and elongated, separated by narrow metallic line medially (Fig. 60).

Colouration. Body green to bluish-green. Scape, pedicel, F1 and F2 basally metallic green, rest of flagellum black. Tegula brown, with few metallic hints. Legs metallic bluish-green, with tarsi brown.

Male. Differs from female as follows: F1 fully metallic, F2 black; antennal segments shorter, P:F1:F2:F3=1.0:1.5:0.7:0.6; F1 l/w=2.3; BOL=1.7 MOD; OOL=2.0 MOD; MS=1.0 MOD.

Distribution. China (Xinjiang, Ningxia), Uzbekistan; Afghanistan (new record).

Trichrysis tonkinensis (Mocsáry, 1914), status revived

Figs 61–66, 103

Chrysis (Trichrysis) tonkinensis Mocsáry, 1914: 25. Holotype, ♀ [not ♂], Vietnam: Tonkin (HNHM) (examined).

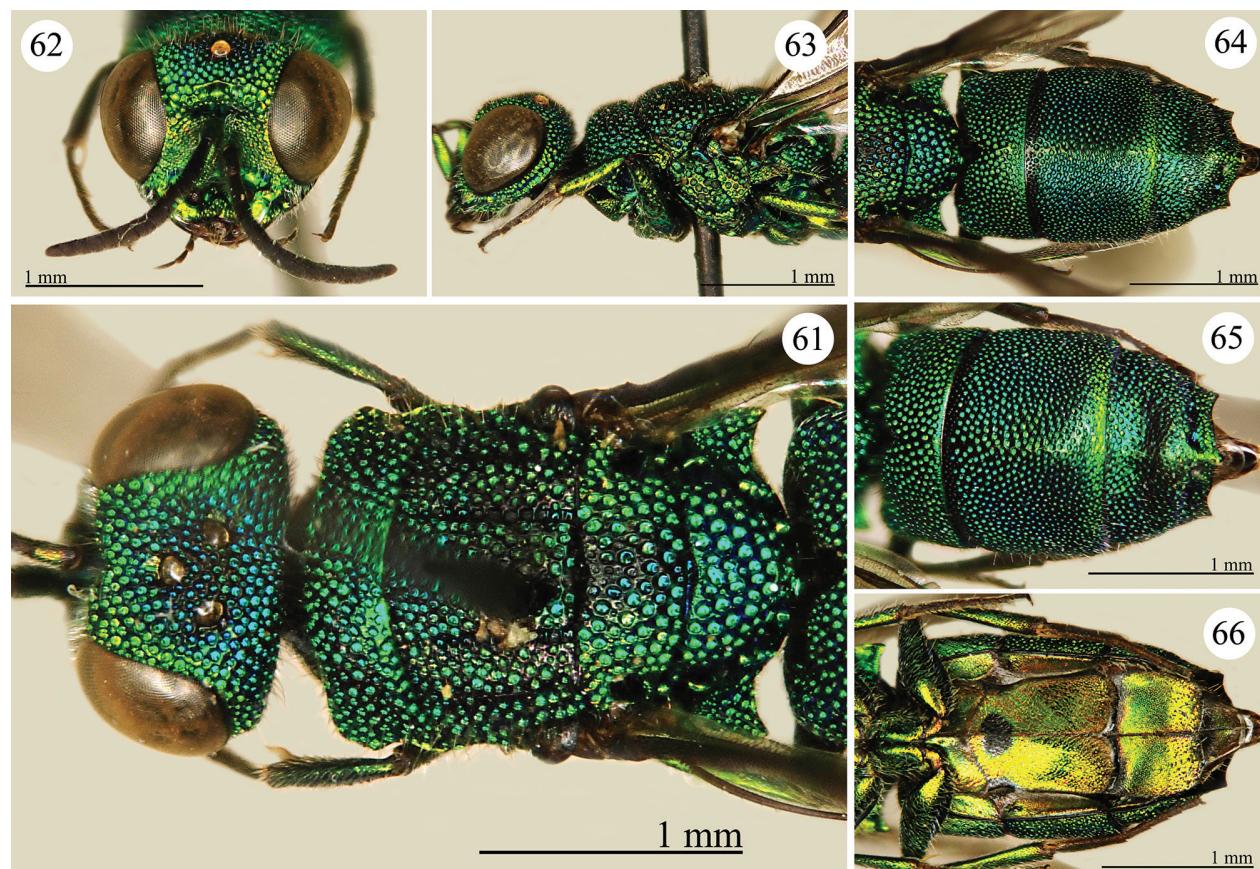
Chrysis (Trichrysis) tonkinensis var. *cyanescens* Mocsáry, 1914: 26. Holotype, ♀, China: Poo Chow [= Fuzhou] (BMNH).

Chrysis (Trichrysis) tonkinensis Mocsáry: Linsenmaier 1959: 169.

Chrysis (Trichrysis) rossi Linsenmaier, 1984: 207. Holotype, ♀, Philippines (not Chile!) (NMLS) (examined).

Material examined. VIETNAM: ♀, Tonkin China / *tonkinensis* Mocs. det. Mocsáry typ. <handwritten in red> / red label / Holotypus *Chrysis tonkinensis* Mocs. ♀ RM Bohart / id. nr. 135549 HNHM Hym. coll. (HNHM). PHILIPPINES: ♀, San José Mindoro P.I. II.45 F.E. Skinner / *Chrysis (Trichrysis) rossi* Lins. det. Linsenmaier 1973 (NMLS). CHINA: 2♀♀, Yunnan, Jingdong, Jinping (24°27'14"N 100°50'4"E), 28.IV.2005, leg. H.-s. Wang (SCAU); 1♀, Yunnan, Jingdong, 10–14.VII.1990, S. Bečvár (PRC). INDIA: 1♀, Nedungadu X.1932 P.S. Nathan (NMLS). INDONESIA: 60♀♀, from various localities and collectors housed in NMLS: Java: Bandung, Blawan, Bogor, Jampang Tengah; Lebak, Medan, Dolok Merangir, Semarang, Sukabumi. MALAYSIA: 2♀♀, Sabah, Tuaran 24–30. III.1973 K.M. Guichard (NMLS); 1♀, Sabah, Poring Springs 1600 ft 10.V.1973 K.M. Guichard (NMLS); 1♀, Kota Kinabalu 20.III.1992 Inderbitzin (NMLS).

Diagnosis. *Trichrysis tonkinensis* (Mocsáry, 1914) is similar to *T. cyanea* (Linnaeus, 1758); however it can be separated from the latter by: sharp lateral tooth of T3; dense punctuation on metasoma; body usually metallic green or light greenish-blue, with some characteristic olive green to blackish mat areas on mesosoma and metasoma; different shape of S2 black spots (Fig. 103).



Figures 61–66. *Trichrysis tonkinensis* (Mocsáry), holotype (female). 61. Head and mesosoma, dorsal view; 62. Head, frontal view; 63. Head and mesosoma, lateral view; 64. Metasoma, dorsal view; 65. T2 and T3, dorsal view; 66. Metasoma, ventral view.

Description. *Female.* Body length 6.0–7.0 mm.

Head. Scapal basin deep, punctate laterally and striate medially (Fig. 62). TFC single, short, slightly inverted V-shape. Area between TFC and scapal basin slightly raised. Relative length of P:F1:F2:F3=1.0:1.6:0.7:0.6; F1 l/w=2.9; OOL=2.0 MOD; BOL=1.7 MOD; POL=1.8 MOD; MS=1.0 MOD; clypeal apex slightly concave.

Mesosoma. Pronotal groove deep, extending to 3/4 length of pronotum; lateral margins of pronotum concave medially; sublateral carina distinct and complete (Fig. 61). Metanotum depressed antero-medially. Punctuation contiguous on metanotum. Episternal sulcus and scrobal sulcus with large areolate punctures (Fig. 63).

Metasoma. Punctures on T1 and T2 geminate, with punctate interspaces (Fig. 64); punctuation decreasing in diameter toward posterior margin on T2. T2 and T3 with weak median carinae. T3 prepit bulge medially convex; pit row with small and round separated pits. Apex of T3 with three teeth similar in size, with interval between median tooth and lateral tooth straight or occasionally slightly convex (Fig. 65). S2 black spots small (Figs 66, 103), medially fused.

Colouration. Body metallic bluish-green to green, with golden reflection on face and sternites. Scape and pedicel metallic green, flagellum black. Tegula brown, with weak metallic reflections. Legs metallic green, with tarsi black.

Male. Unknown.

Biology. One specimen in NMLS labelled as collected from nest of *Pison obliteratum* Smith, 1858 (Crabronidae) by J. van der Vecht.

Distribution. China (Fujian, Yunnan); Vietnam (Mocsáry 1914); Philippines (Linsenmaier 1984); India, Indonesia, Malaysia (new records).

Remarks. Tsuneki (1961: 374) gave the description and line drawings of *C. (Trichrysis) tonkinensis* based on one specimen collected in Thailand (Doi Inthanon), without checking its type. The drawings do not match the type. The characteristics given by Tsuneki (1961) more closely resemble *T. luzonica* (Mocsáry) or *T. triacantha* (Mocsáry). Therefore the synonym proposed by Tsuneki, *T. bicarinata* (Tsuneki)=*T. tonkinensis* is incorrect.

Linsenmaier (1984) described *Chrysis (Trichrysis) rossi* based on a specimen collected at San José, Mindoro P.I. [Philippine Islands]. Linsenmaier (1984) erroneously considered locality San José as a Chilean locality. Later Kimsey and Bohart (1991) recognized right locality, and placed *T. rossi* and *T. tonkinensis* in synonymy with *T. triacantha* (Mocsáry) without type examination of the latter. *T. tonkinensis* and *T. triacantha* are similar, but can be separated by different colouration, with a characteristic olive green or bluish matt colouration dorsally on *T. tonkinensis* and non metallic tegula (fully metallic in *T. triacantha*); TFC simple, without branches (double and usually with branches in *T. triacantha*); and different shape of S2 black spots (Figs 66, 72, 103, 104). We here revalidate *T. tonkinensis* (Mocsáry, 1914).

Trichrysis triacantha (Mocsáry, 1889)

Figs 67–75, 104

Chrysis (Trichrysis) triacantha Mocsáry, 1889: 325. Syntypes, ♀♀, Indonesia: Sumatra (NHMW) (examined).

Chrysis (Trichrysis) sumbawamba Mocsáry, 1912: 378. Holotype, ♀, Indonesia: Sumbawa Isl. (HNHM) (synonymised by Kimsey and Bohart 1991: 573).

Chrysis (Trichrysis) transmutata Mocsáry, 1914: 26. Lectotype, ♀, designated by Bohart in Bohart and French 1986, Myanmar: Tenasserim (HNHM) (examined) (synonymised by Kimsey and Bohart 1991: 574).

Chrysis (Trichrysis) saohime Tsuneki, 1950: 68. Holotype, ♀, Japan: Nagano (HUM, not NIAS) (synonymised by Kimsey and Bohart 1991: 574).

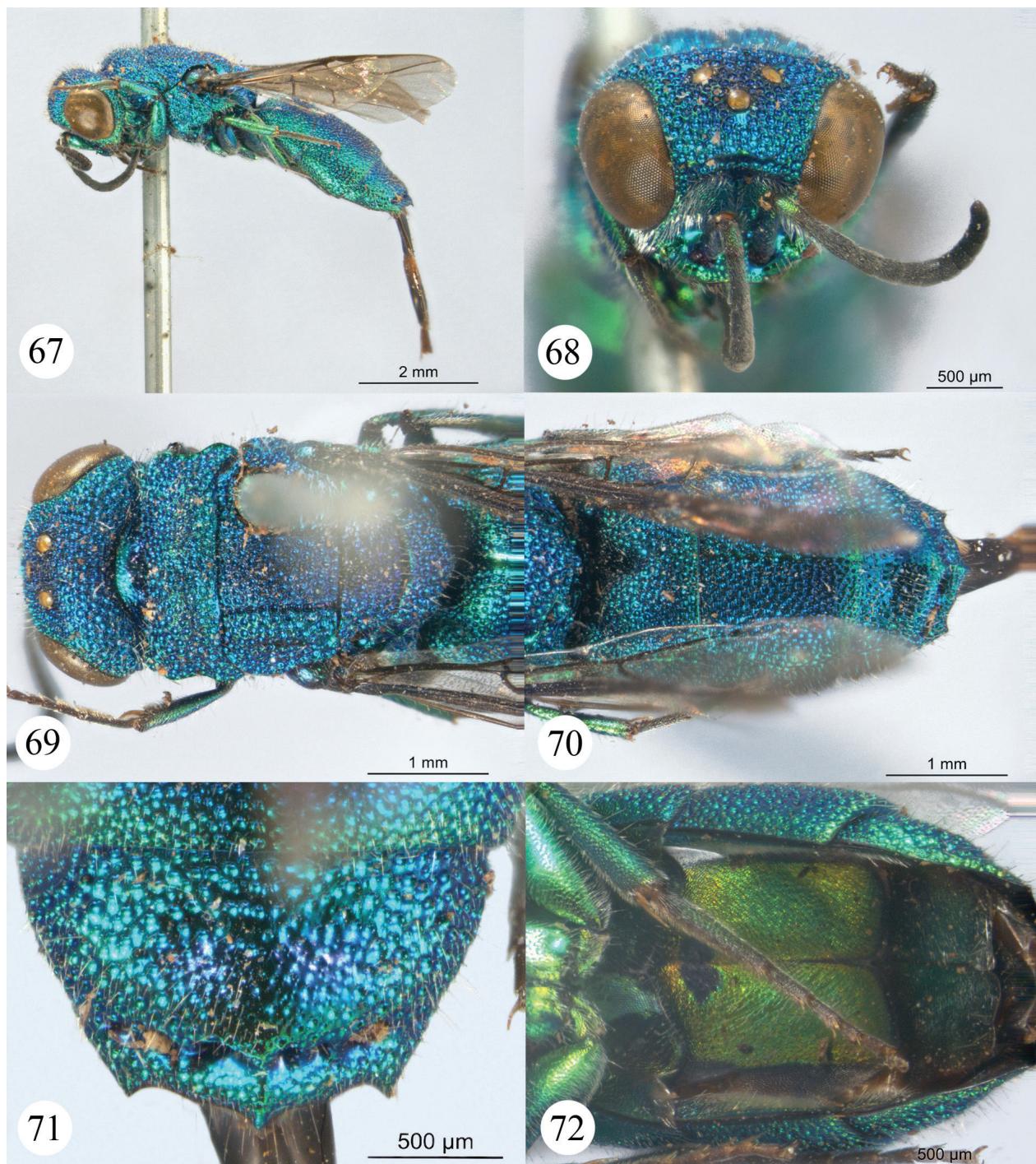
Chrysis (Trichrysis) bicarinata Tsuneki, 1950: 69. Holotype, ♀, China: Hong Kong (EIHU) (synonymised by Kimsey and Bohart 1991: 574).

Chrysis (Trichrysis) transmutata Mocsáry: Tsuneki 1950: 70; 1961: 374.

Trichrysis triacantha (Tsuneki): Kimsey and Bohart 1991: 573; Rosa et al. 2014.

Material examined. INDONESIA: 1♀, *Plason* Sumatra 877-2 / *triacantha* det. Mocsáry Type <handwritten in red>; 1♀, Sumatra, *triacantha* det. Mocsáry <handwritten in red> (NHMW); MYANMAR: 1♀, Lower Burma Tenasserim Haundraw Valley 5.98 Bingham Coll. / *transmutata* Mocs., det. Mocsáry typ <handwritten in red> / Coll. Bingham / red label / Lectotypus *Chrysis transmutata* Mocs. ♀ RM Bohart / id nr. 135542 HNHM Hym. Coll. (HNHM). CHINA: 3♀♀, Guangdong, Qingyu-an (24°8'31"N 112°55'15"E), 9.IX.2014, leg. Z-f. Xu (SCAU); 2♀♀, Guangdong, Nankunshan Provincial Nature Reserve (23°39'28"N 113°55'23"E), 2.VII–3.IX.2005, leg. Z-f. Xu (SCAU); 1♀, Guangdong, Nanling National Nature Reserve (24°55'43"N 113°1'1"E), 16–18.IV.2004, leg. Z-f. Xu (SCAU); 1♀, Guangdong, Foga-gang, Mt. Guanyin (23°57'57"N 113°33'55"E), 15–16.IX.2007, leg. Z-f. Xu (SCAU); 1♀, Guangdong, Zhao-qing, Fenghuang, Tonggu (23°13'26"N 112°31'55"E), 14–15.VII.2007, leg. Z-f. Xu (SCAU); 1♀, Guangdong, Guangzhou, Liuxihe Forest Park (23°44'31"N, 113°47'0"E), 13–14.IV.2002, leg. Z-f. Xu (SCAU); 1♂, Guangdong, Huizhou, Rengtu (23°10'50"N, 114°35'1"E), 27.VIII.2008, leg. H-y. Chen (SCAU); 2♀♀, 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); 1♀, Hainan, Bawangling National Nature Reserve, 1–3.V.2008, leg. C-d. Hong (SCAU); 1♀, Yunnan, Jingdong, Jinping (24°27'14"N 100°50'4"E), 28.IV.2005, leg. H-s. Wang (SCAU); 1♀, Yunnan, Jinggu, Weiyuan (23°29'30"N 100°42'29"E), 4.X.2004, leg. J-x. Liu & W-q. Fan (SCAU); 1♀, Yunnan, Hekou, Nanxi (22°37'31"N 103°56'53"E) 21.VII.2003, leg. T-j. Li (SCAU).

Diagnosis. *Trichrysis triacantha* (Mocsáry, 1889) can be separated from all other Chinese species by follow-



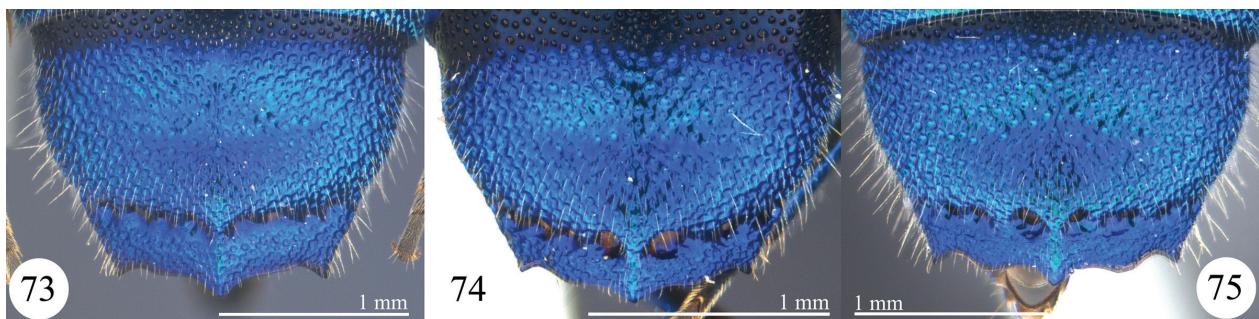
Figures 67–72. *Trichrysis triacantha* (Mocsáry), syntype (female). **67.** Habitus, lateral view; **68.** Head, frontal view; **69.** Head and mesosoma, dorsal view; **70.** Metasoma, dorsal view; **71.** T3, dorsal view; **72.** Metasoma, ventral view. (Photos courtesy of Dr. Dominique Zimmermann).

ing characteristics: tegula fully metallic blue; pronotal sublateral carina complete; TFC well developed, usually appearing double and sometimes with weak branches upward to ocellar area; S2 black spots small (Fig. 104); T3 prepit bulge medially convex; interval between median tooth and lateral tooth slightly convex. It is separated from the common species, *T. cyanea*, by TFC (single, never double or with branches upwards to ocellar area in

T. cyanea) and by S2 black spots (Fig. 104) differently shaped (*T. cyanea*, Fig. 97).

Description. Female. Body length 5.5–8.0 mm.

Head. Scapal basin deep, striate, with aligned small punctures across striae. TFC well developed, usually beneath raised and laterally directed downward, appearing as double TFC, sometimes even with traces of dorsal branches upwards to ocellar area. Relative length of



Figures 73–75. *Trichrysis triacantha* (Mocsáry), variations of apex of T3 in females collected at Qingyuan, Guangdong.

P:F1:F2:F3=1.0:1.5–1.8:0.8–1.0:0.6–0.8; F1 l/w=3.3; OOL=1.6–1.9 MOD; BOL=1.5–1.7 MOD; POL=1.6–1.8 MOD; MS=1.0 MOD; clypeal apexus concave.

Mesosoma. Pronotal groove deep, extending to half length of pronotum; sublateral carina distinct and complete (Fig. 69). Mesoscutellum and metanotum without antero-median depression or pit. Punctuation uneven, with shining and wrinkled or punctate interspaces; mesoscutellum usually impunctate antero-medially. Mesopleuron with large punctures; episternal sulcus not particularly deep or enlarged.

Metasoma. Punctuation uniform on metasoma (Fig. 70); punctures on T1 larger than on T2; T1 and T2 laterally with small punctures on interspaces between large punctures. T2 with median carina. T3 prepit bulge convex; when evidently bulged then pre pit row area with large impunctate and shining area; pit row with large isolate pits. Apex of T3 with three pointed teeth, with convex interval between median tooth and lateral tooth (Fig. 71). S2 black spots small (Fig. 104), fused medially.

Colouration. Body metallic blue to bluish-green. Scape and pedicel metallic bluish-green, F1 from black to partially or fully metallic bluish-green, rest of flagellum black. Tegula metallic blue, or blackish-brown with extensive metallic reflections. Legs metallic bluish-green, with fore tarsi blackish-brown with reflection, mid and hind tarsis fully or partially metallic green.

Male. Similar to female, except for: apex of T3 with smaller teeth and without pre pit area.

Variation. *Trichrysis triacantha* is one of the most variable species. Its TFC varies from straight to down-curved at two ends, usually appearing as double TFC, with or without branches pointing to ocellar area, with some intermediate forms. Tsuneki (1961) synonymised *T. bicarinata* with *C. tonkinensis* without type examining; this identification was incorrect, but the drawings of *T. bicarinata* and *T. tonkinensis* in his publications (Tsuneki 1950, 1961) confirm the synonymy with *T. triacantha*. Other variable characteristics of *T. triacantha* are: metallic colouration of F1 (from fully black to partially or fully metallic green); metallic colouration of basitarsus (partially or fully metallic green); and interval between median tooth and lateral tooth (vary from gently convex

to markedly convex) (Figs 73–75). However, these specimens do not show variation for OOL, BOL, POL and relative length of P:F1:F2:F3.

Distribution. China (Fujian, Taiwan, Guangdong, Hong Kong, Hainan, Yunnan) (Rosa et al. 2014). Widely distributed in the Oriental Region (Kimsey and Bohart 1991).

Remarks. *Trichrysis singalensis* (Mocsáry, 1889) was synonymised with *T. triacantha* by Kimsey and Bohart (1991). *T. singalensis* was described from a single (?) specimen from Sri Lanka, originally housed in MNHU, and not from a syntype series including Myanmar specimens housed in MSNG as stated by Kimsey and Bohart (1991). The holotype was not found during our research (P.R. and N-s.W.) in the institute and not even by Dr. Frank Koch, curator at MNHU, and we could not find it in other museums. The four specimens identified as *C. singalensis* in MSNG do not match the original description. They were collected after the description and belong to different species. In Mocsáry's collection in Budapest there are seven specimens labelled as *C. singalensis*, but they also belong to different species.

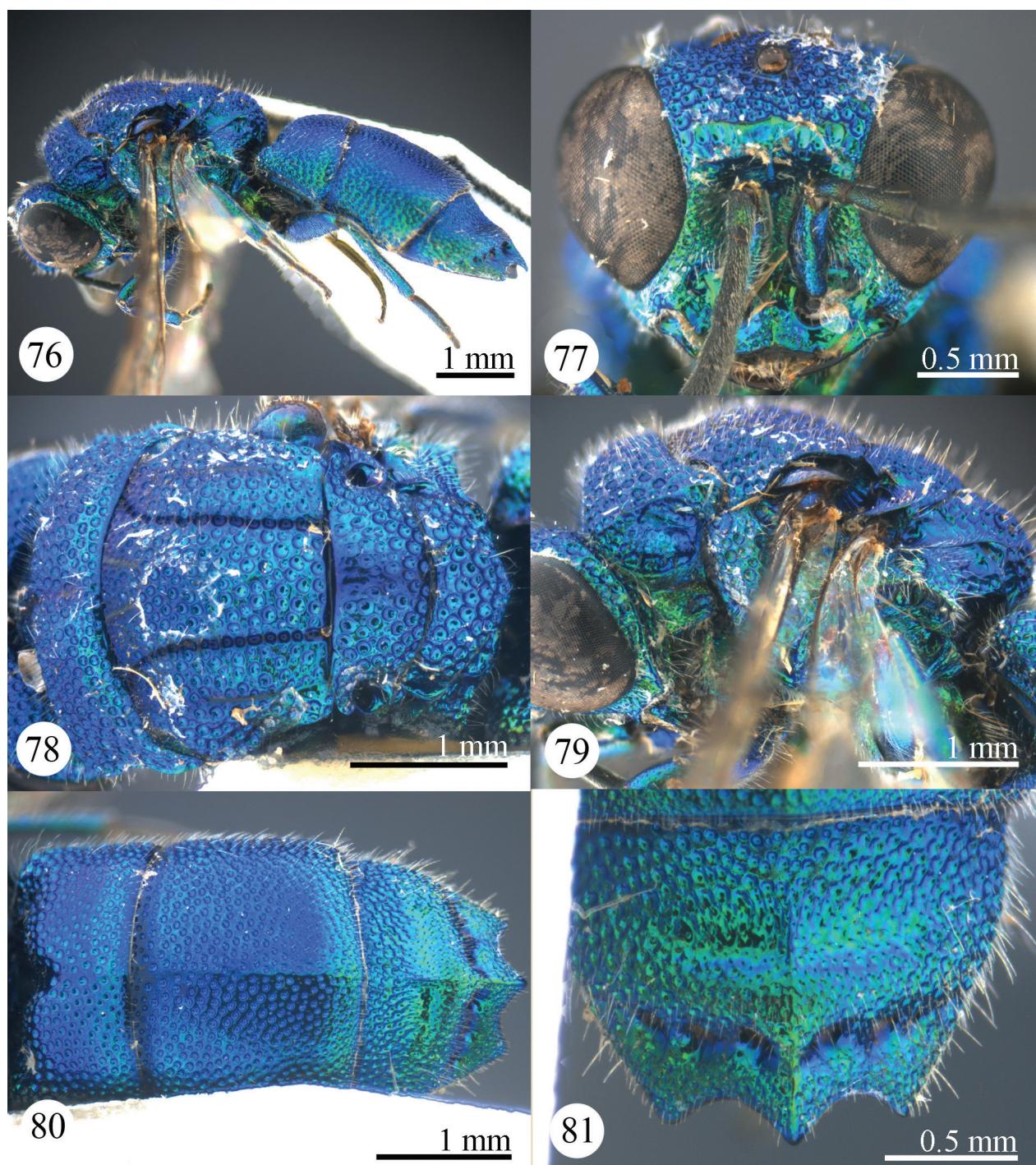
T. vestigator (Smith, 1858) was described from Borneo and could be present in Sumatra, from where *T. triacantha* (Mocsáry, 1889) was described. The two species are very likely synonymy, but the type of *T. vestigator* was not available for this study. Based on short description and key given by Bohart (1987), we could not state that *T. triacantha* is a junior synonym of *T. vestigator* at present.

Trichrysis tridensnotata Rosa, Wei & Xu, sp. n.

<http://zoobank.org/5AC9D089-A5DA-4130-BAF9-84A76B598CAE>
Figs 76–81, 105

Material examined. Holotype, ♀: CHINA, Hainan, Yinggeling National Nature Reserve (19°0'52"N, 109°32'47"E), 11.V.2005, leg. L-s. Chen (SCAU). Paratype: 1♀, same locality as holotype, 26–27.VIII.2005, leg. L-s. Chen (SCAU).

Diagnosis. *Trichrysis tridensnotata* sp. n. is close to *T. triacantha* (Mocsáry, 1889) based on tegula fully metallic blue, pronotal sublateral carina distinct and complete, TFC well developed, appearing double, and T3



Figures 76–81. *Trichrysis tridensnotata* sp. n., holotype (female). **76.** Habitus, lateral view; **77.** Head, frontal view; **78.** Mesosoma, dorsal view; **79.** Mesosoma, lateral view; **80.** Metasoma, dorsal view; **81.** T3, dorsal view.

prepit bulge distinctly convex. However, it can be separated from *T. triacantha* by: deep concave interval between median tooth and lateral tooth and different shape of S2 black spots (Fig. 105).

Description. Female. Holotype. Body length 7.3 mm.

Head. Scapal basin deep, striae medially with aligned small punctures across striae and punctuate laterally. TFC almost straight. Area beneath TFC raised with punctures elongate longitudinally, TFC appearing double (Fig. 77).

Relative length of P:F1:F2:F3 = 1.0:1.6–1.8:0.7–0.8:0.5–0.7; F1 l/w = 3.3; OOL = 1.7–2.2 MOD; BOL = 1.6–2.2 MOD; POL = 2.4 MOD; MS = 0.6–1.0 MOD; clypeal apex slightly concave.

Mesosoma. Pronotal groove deep, almost extending to posterior margin of pronotum (Fig. 78); pronotum concave laterally; sublateral carina distinct and complete. Mesoscutellum impunctate antero-medially. Episternal sulcus and scrobal sulcus with large areolate punctures.

Metasoma. T1 and T2 with punctuation geminate and evenly distributed. T2 and T3 with raised median carinae (Fig. 80). T3 prepit bulge distinctly convex; pit row with deep and isolated pits. Apex of T3 with three long and large teeth; interval between median tooth and lateral tooth markedly concave (Fig. 81). S2 black spots small (Fig. 105), fused medially.

Colouration. Head metallic blue, with greenish reflections on face. Mesosoma metallic blue, with greenish-golden reflections on mesopleuron and metapleuron. T1 and T2 metallic blue, with greenish-golden reflections laterally; T3 metallic blue, with greenish-golden reflections laterally and posteriorly. Scape and pedicel metallic bluish-green, flagellum black. Tegula entirely metallic blue. Legs metallic greenish-blue, with fore tarsi blackish-brown.

Male. Unknown.

Variation. The paratype of *Trichrysis tridensnotata* sp. n. shows some variations in relative length of flagellomeres, OOL, BOL and MS, as given in the description of head.

Distribution. China (Hainan).

Etymology. The specific name *tridensnotata* derives from the Latin adjective *tridens* (= with three teeth) and the Latin adjective *notatus* (= evident) and refers to three large teeth on apex of T3.

Trichrysis trigona (Mocsáry, 1889)

Figs 82–87, 106

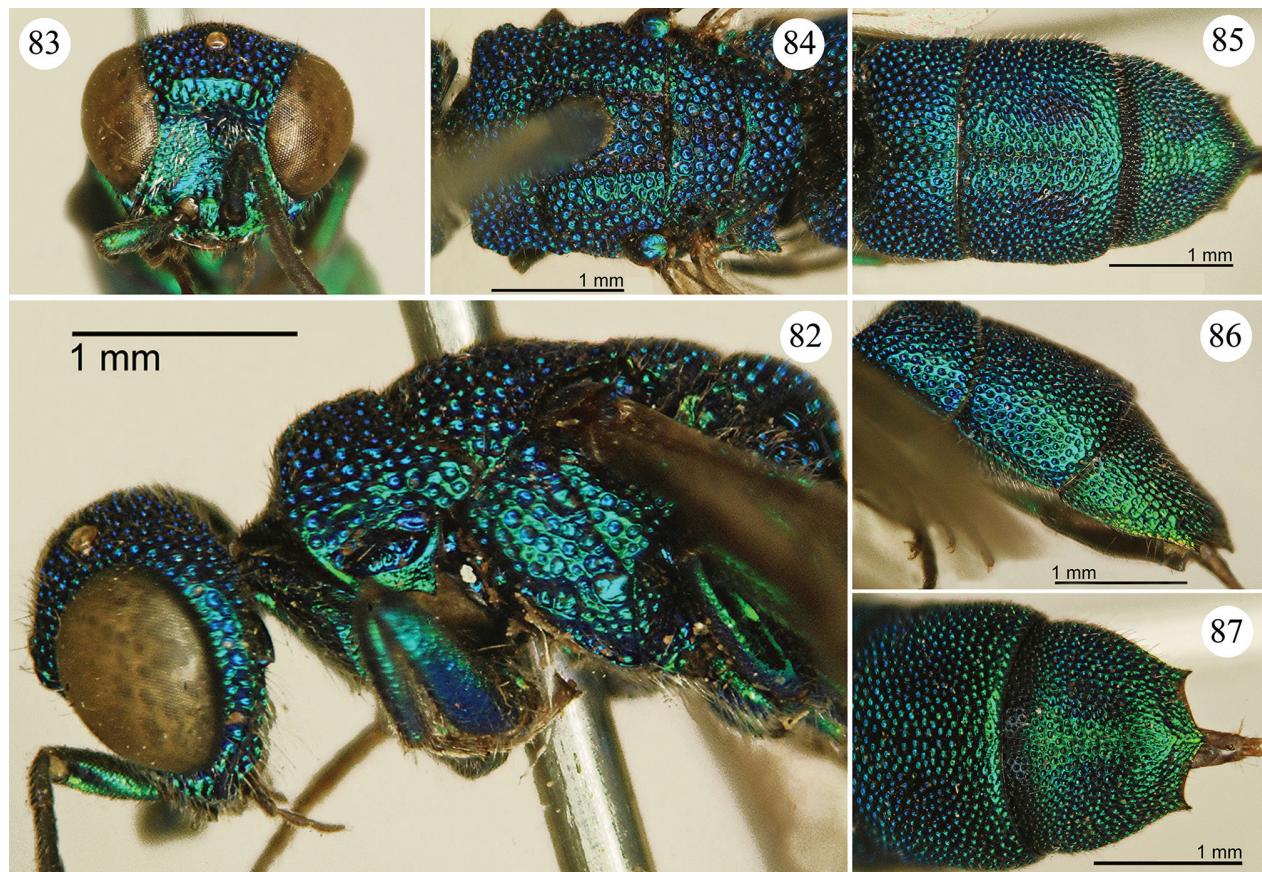
Chrysis (Trichrysis) trigona Mocsáry, 1889: 327. Holotype, ♀, Indonesia: Sulawesi: Bonthain (HNHM) (examined).

Trichrysis trigona (Mocsáry): Kimsey and Bohart 1991: 574; Rosa et al. 2014: 79.

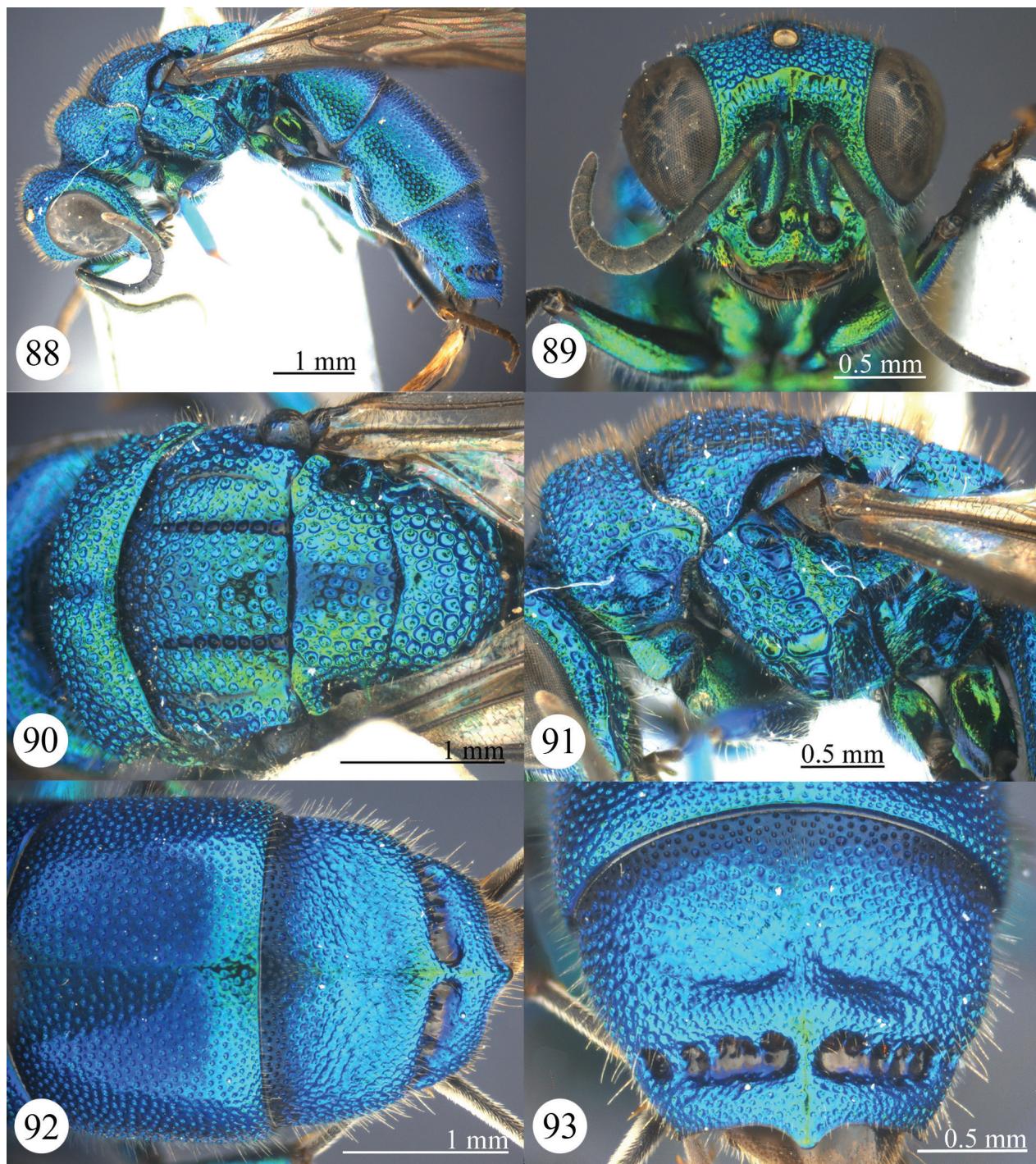
Material examined. INDONESIA: ♀, S Celebes [= Sulawesi] Bonthain C. Ribbe 1882 / 714-11 / , *trigona* Mocs det. Mocsáry typ. <handwritten in red> / Holotypus *Chrysis trigona* Mocs. ♀ RM Bohart / id nr. 135552 HNHM Hym. coll. (HNHM). PAKISTAN: 1♀, Indien Karachi [currently Pakistan] Coll. Linsenmaier / type *Chrysis L. azuripicta* det. Linsenmaier 1991 / no type sp. *in litteris* P. Rosa det. 2010 GBIF-Chrysidae / ex-synoptic collection / NML_ENT GBIF_Chro00041038 (NMLS).

Diagnosis. *Trichrysis trigona* (Mocsáry, 1889) is similar to *T. coeruleamaculata* sp. n., but it can be easily separated from the latter by: body punctuation without inter-spaces between large punctures or with small wrinkled interspaces; OOL=2.0 MOD; scapal basin striate medially; T1, T2 and T3 each with two small blue spots; tegula entirely metallic blue.

Description. *Female.* Body length 7.0 mm.



Figures 82–87. *Trichrysis trigona* (Mocsáry), holotype (female). 82. Head and mesosoma, lateral view; 83. Head, frontal view; 84. Mesosoma, dorsal view; 85. Metasoma, dorsal view; 86. Metasoma, lateral view; 87. T2 and T3, dorsal view.



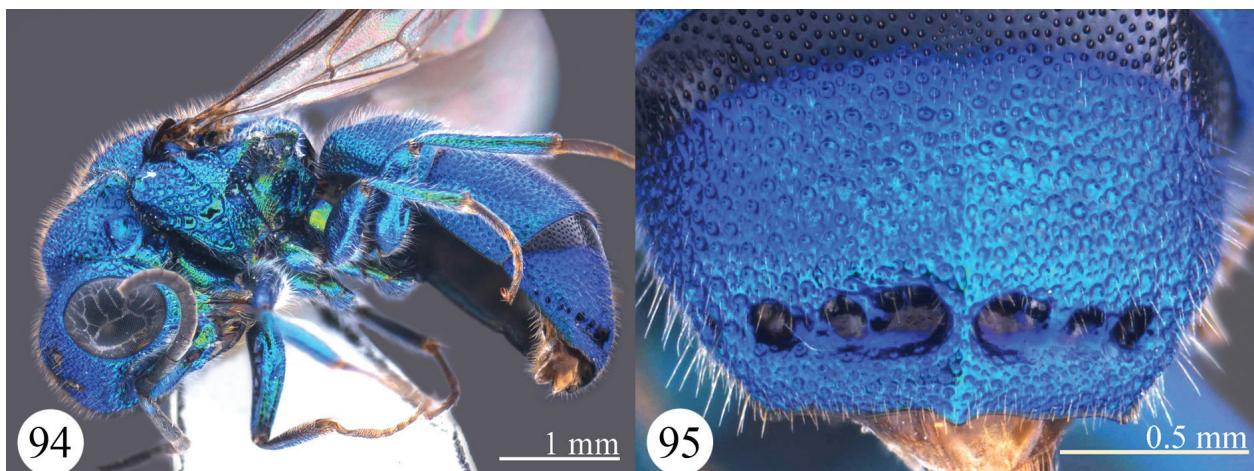
Figures 88–93. *Trichrysis yuani* sp. n., holotype (female). **88.** Habitus, lateral view; **89.** Head, frontal view; **90.** Mesosoma, dorsal view; **91.** Mesosoma, lateral view; **92.** T2 and T3, dorsal view; **93.** T3, dorsal view.

Head. Scapal basin deep, punctate laterally and striate medially (Fig. 83). TFC with endbending downwards. Area beneath TFC raised with punctures elongate longitudinally, TFC appearing double. Clypeus almost truncated. P:F1:F2:F3 = 1.0:1.2:0.8:0.8; F1 l/w = 2.5; OOL = 1.5 MOD; BOL = 1.6 MOD; POL = 2.2 MOD; MS = 1.1 MOD.

Mesosoma. Pronotal groove weak; pronotum deeply concave laterally; sublateral carina incomplete, well de-

veloped only anteriorly. Mesoscutellum and metanotum without antero-median depression or pit. Punctuation on mesosoma continuous without interspaces between large punctures or with small and wrinkled interspaces (Fig. 84). Episternal sulcus and scrobal sulcus with large foveate punctures (Fig. 82).

Metasoma. Metasoma with dense and large punctures (Fig. 85), dorsally on T2 with large punctures geminate



Figures 94–95. *Trichrysis yuani* sp. n., paratype (male). **94.** Habitus, lateral view; **95.** T3, dorsal view.

and with wrinkled interspaces between punctures, with punctures subtransversely aligned; punctures on T3 smaller, wrinkled over pre pit area (Fig. 87). T2 without median carina. T3 prepit bulge medially convex; pit row distinct, with small, almost indistinct and separated pits (Fig. 87). Apex of T3 with three sharp teeth, with interval between median tooth and lateral tooth concave. S2 black spots triangular, elongated longitudinally and partially fused medially (Fig. 106).

Colouration. Body bluish-green, with small blue spots on vertex, mesoscutum, mesoscutellum, metanotum, with two small symmetric blue spots on T1, T2 and T3, respectively. Antenna blackish, with scape, pedicel and F1 metallic bluish-green. Tegula metallic blue. Legs metallic bluish-green, with tarsi blackish-brown without metallic reflections.

Male. Unknown.

Distribution. China (Hong Kong?), Laos (Kimsey and Bohart 1991); Indonesia; Pakistan (new record).

Trichrysis yuani Rosa, Feng & Xu, sp. n.

<http://zoobank.org/4A2A02BA-5EC7-4458-8D73-83AE3FBF42AD>
Figs 88–95, 107

Material examined. Holotype, ♀: CHINA: Hubei, Jingmen, Jingshan ($31^{\circ}1'1.05''N$ $114^{\circ}7'10''E$), 15.VII.2009, leg. Y. Yuan (SCAU). Paratypes: 1♂, same data as holotype (SCAU); 1♀, Hunan, Huaihua ($27^{\circ}33'11''N$, $109^{\circ}59'53''E$), VIII.2004, leg. J.-h. Zhou (SCAU); 1♂, Hunan, Mt. Huping, Nianzigou ($29^{\circ}55'38''N$ $110^{\circ}48'48''E$), 9.VII.2009, leg. S.-h. Wang (SCAU).

Diagnosis. *Trichrysis yuani* sp. n. is similar to *T. pellucida* (du Buysson, 1887); however it can be separated from the latter by: different shape of T3; distance from anterior margin of pit row to posterior margin of median tooth about 2 MOD (Fig. 88); T3 median tooth blunt in dorsal view (Fig. 93); F1 l/w=3.0; body light blue in both sexes; P entirely metallic; body length about 7.0 mm.

Description. Female. Holotype. Body length 7.0 mm.

Head. Scapal basin deep, punctuate laterally, striate and punctate medially. TFC single, slightly inverted V-shape. Area between TFC and scapal basin raised (Fig. 89). Relative length of P:F1:F2:F3=1.0:1.6:0.9:0.7; F1 l/w=3.0; OOL=1.9–2.4 MOD; BOL=1.5 MOD; POL=1.5–2.0 MOD; MS=1.0 MOD; clypeal apex almost truncate.

Mesosoma. Pronotal groove deep, almost extending to posterior margin of pronotum (Fig. 90); sublateral carina distinct and complete. Metanotum with shallow depression antero-medially. Punctuation on mesosoma dense, with consistent punctures relatively small (about 0.5 MOD), subequally interspaced; interspaces punctate (Fig. 90). Episternal sulcus and scrobal sulcus with large areolate punctures. Hind basitarsus l/w = 4.5.

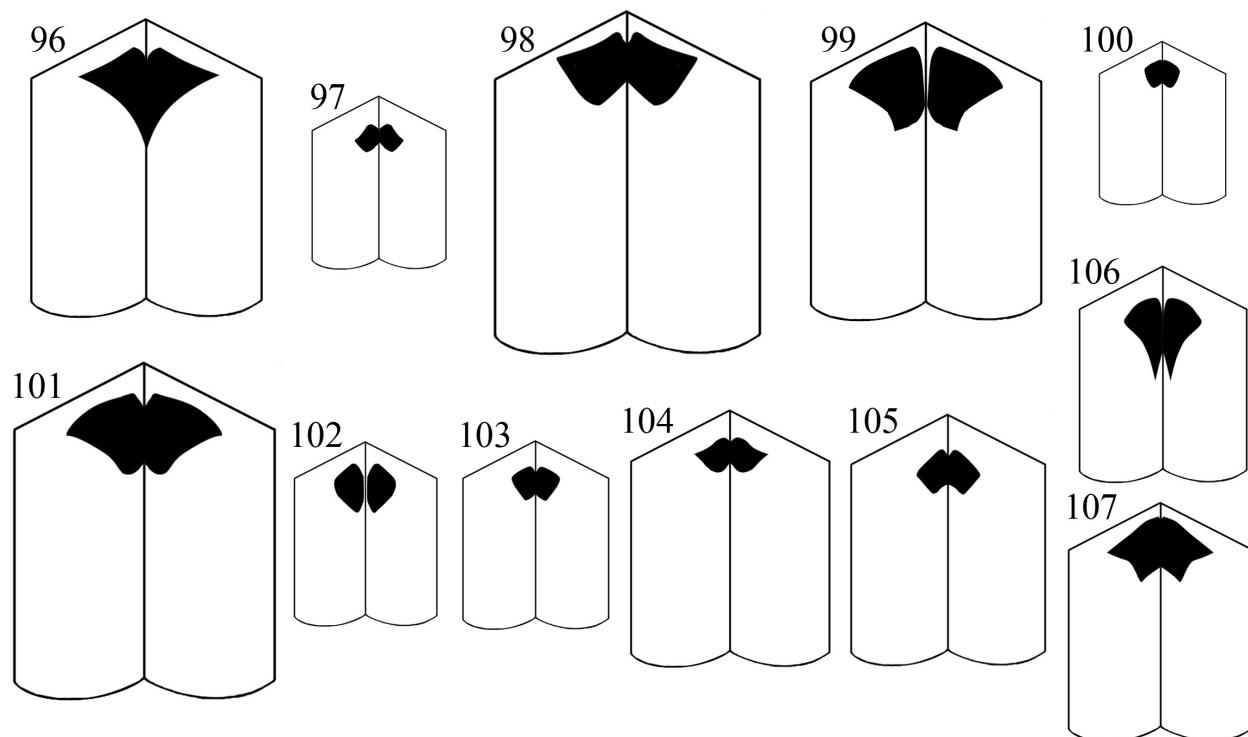
Metasoma. Punctures on T1 and T2 geminate and punctate on interspaces (Fig. 92); on T1 increasing in diameter toward lateral margins. T2 and T3 with median carina. T3 with coarse punctuation; prepit bulge convex; pit row with remarkably large and deep pits partially fused. Apex of T3 with one blunt median tooth and two blunt angulate lateral teeth; interval between median tooth and lateral tooth straight to slightly convex. S2 black spots enlarged and medially fused (Fig. 107).

Colouration. Body metallic greenish-blue, with dark blue spots on vertex, mesoscutellum and T2. Scape and pedicel greenish-blue, flagellum black. Face with greenish-golden reflections. Tegula blackish-brown, with metallic greenish-blue reflections. Legs metallic greenish-blue, with tarsi black without metallic reflections.

Male. Similar to female (Fig. 94), except for: apex of T3 subtruncate; T3 without prepit bulge; median tooth more blunt (Fig. 95).

Distribution. China (Hubei, Hunan).

Etymology. The species is named after the collector of holotype.



Figures 96–107. Black spots on S2. **96.** *Trichrysis coeruleamaculata* sp. n.; **97.** *T. cyanea* (Linnaeus); **98.** *T. imperiosa* (Smith); **99.** *T. lusca* (Fabricius); **100.** *T. luzonica* (Mocsáry); **101.** *T. pellucida* (du Buysson); **102.** *T. secernenda* (Mocsáry); **103.** *T. tonkinensis* (Mocsáry); **104.** *T. triacantha* (Mocsáry); **105.** *T. tridensnotata* sp. n.; **106.** *T. trigona* (Mocsáry); **107.** *T. yuani* sp. n..

Acknowledgements

We are grateful to the following curators for their cooperation and assistance in the study of type material: Dr. Marco Bernasconi (NMLS, Switzerland); Dr. Sergey Belokobylskij (ZIN, Russia); Dr. Frank Koch (MNHU, Germany); Dr. Masahiro Ohada (HUM, Japan); Dr. Roberto Poggi and Dr. Maria Tavano (MSNG, Italy); Dr. Claire Villemant and Dr. Agnièle Touret-Alby (MNHN, France), Dr. Zoltán Vas (HNHM, Hungary); Dr. Bogdan Wiśniowski (ISEA-PAN, Poland); Dr. Dominique Zimmermann (NHMW, Austria). Dr. Dominique Zimmermann (NHMW, Austria) also for taking the pictures of *Chrysis (Trichrysis) triacantha* Mocsáry. A special thank to Dr. Villu Soon (Tartu, Estonia), Dr. Kyu Jeong Kim (Hanseo, Korea), subject editor Dr. Michael Ohl and two anonymous referees for critical review of the manuscript. The study was partially supported by SYNTHESYS Project <http://www.synthesys.info/>, which is financed by European Community Research Infrastructure Action under the FP7 “Capacities” Program” (HU-TAF-4013) (FR-TAF-5995) and by the National Basic Research Program of China (No. 2013 CB127600) and the National Natural Science Foundation of China (30770265).

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