ENTOMOLOGY

Chrysis fuscipennis or *Chrysis angolensis*? An answer with new synonymies, a new combination and species resurrected (Hymenoptera, Chrysididae)

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Abstract

All species of the *Chrysis angolensis* group were synonymised with *C. angolensis* Radoszkovsky, 1881, excluding *Chrysis diademata* Mocsáry, 1889, endemic of the Philippines. However, after the study of type materials, four species are herein resurrected: *Chrysis callaina* Gribodo, 1884 stat. reviv., *C. erratica* Abeille de Perrin and du Buysson in du Buysson, 1887 stat. reviv., *C. mossulensis* Abeille de Perrin and du Buysson in du Buysson, 1887 stat. reviv., *C. sulcifera* Bischoff, 1910 stat. reviv. New synonymies are proposed for the following taxa: *C. szalayana* Mocsáry, 1912 n. syn. and *C. ukerewensis* Mocsáry, 1914, n. syn. of *C. callaina* Gribodo, 1884; *Chrysis janthina* Smith, 1874 n. syn. of *C. brachyceras* Bischoff, 1910. The new combination *Praestochrysis brachyceras* (Bischoff, 1910) n. comb. is proposed. *Chrysis fuscipennis* Brullé, 1846, the name in use for the oldest taxon described in the *angolensis* group, was replaced with *Chrysis angolensis* Radoszkovsky, 1881 because primary junior homonym of *C. fuscipennis* Dahlbom, 1829. However, *Chrysis angolensis* is here regarded as nomen dubium, *C. fuscipennis* Dahlbom, 1829 as nomen oblitum, because no longer in use as a valid name after 1899, and *C. fuscipennis* Brullé as nomen protectum, thus making the name *C. fuscipennis* Brullé, 1846 stat. reviv. available and restored.

Introduction

One of the most widespread species of Chrysididae was universally known with the name of *Chrysis fuscipennis* Brullé, 1846 until the publication of Kimsey and Bohart (1991). This species was described from the Philippines and varieties were described from India (*C. fuscipennis* var. *dorsata* du Buysson, 1896), Japan and Korea (*C. fuscipennis* var. *murasaki* Uchida, 1927) and Taiwan (*C. fuscipennis* f. *takanoi* Tsuneki, 1950). Kimsey and Bohart (1991) discovered that the name *C. fuscipennis* Brullé was preoccupied by *C. fuscipennis* Dahlbom, 1829 [currently *Pseudomalus violaceus* (Scopoli, 1763)] and therefore replaced Brullé's name with the first available name: *C. angolensis* Radoszkovsky, 1881, without type examination of the latter. They consequently renamed the *fuscipennis* group, established by Linsenmaier (1959), as *angolensis* group including only two species: *C. angolensis* and *C. diademata* Mocsáry, 1889, an endemic species from the Philippines. In their world catalogue, Kimsey and Bohart (1991) synonymised all the other known

species, forms, and varieties described in this species group with *C. angolensis*. However, Linsenmaier (1997, 1999) in his revisions of the European species (part 4) and northern African species did not adopt this change and persisted in using the name *C. fuscipennis*.

The goal of this contribution, following an examination of nearly all available type specimens and a literature review, is to provide clarification on certain intricate taxonomic and nomenclatural cases observed within this species group of cuckoo wasps. A taxonomic revision of this group is needed due to the introduction of its members in the New World (from US to Argentina) and in Europe (Cyprus) facilitated by commerce or movements of troops during WW2 (Bohart and Kimsey, 1982). In this context, the first required action is to establish a stable species name for future research on invasive insects. This article represents the first step towards a complete revision of the group, which requires the examination of additional material from around the word, considering the broad distributional range of the species group and the potential existence of multiple species, including cryptic ones.

Materials and Methods

The definitions of holotype, lectotype, syntype *etc*., are used according to the International Code of Zoological Nomenclature (ICZN, 1999), fourth edition.

Photographs of the types were taken with a Nikon D3400 and D700 connected to the stereomicroscope Togal SCZ and stacked with the software Combine ZP. The white calibration of the photo camera was applied to reduce the blue effect of fluorescent light of the microscope.

In material examined, labels of type material are reported faithfully and labels are separated from each other by a slash. Data listed for other records are standardised. The list of specimens examined, however, is limited in comparison to the material observed in collections in the recent years. This is because, during the initial stages of research, specimens were identified merely as *Chrysis angolensis*, in accordance with the classification by Kimsey and Bohart (1991). Consequently, there is a necessity to double-check all these identifications to ensure accuracy and reliability.

Institutional abbreviations

ELKU = Entomological Laboratory, Faculty of Agriculture, Kyushu University, Fukuoka Japan
HNHM = Magyar Természettudományi Múzeum, Budapest, Hungary
ISEA-PAS = Invertebrate collections of the Institute of Systematics and Evolution of Animals, Polish Academy of Sciences in Kraków, Poland
MfN = Museum für Naturkunde, Berlin, Germany
MHNL = Museu de História Natural, Lisbon, Portugal
MNHN = Muséum National d'Histoire Naturelle, Paris, France
MSNG = Museo Civico di Storia Naturale "G. Doria", Genova, Italy
NHMUK = Natural History Museum, London, UK
SCAU = South China Agricultural University, Guangzhou, China
TUZ = University of Tartu, Estonia
ZFMK = Zoological Research Museum Alexander Koenig, Bonn, Germany
ZIN = Zoological Institute, St. Petersburg, Russia
ZMMU = Zoological Museum of Moscow Lomonosov State University, Russia.

Private collection abbreviations

PRC = Paolo Rosa collection

Results

Taxonomy

Class Insecta Linnaeus, 1758
Order Hymenoptera Linnaeus, 1758
Superfamily Chrysidoidea Latreille, 1802
Family Chrysididae Latreille, 1802
Subfamily Chrysidinae Latreille, 1802
Genus *Chrysis* Linnaeus, 1761

Chrysis fuscipennis species group

Chrysis (*Chrysis*) *fuscipennis* group: Linsenmaier, 1959: 94 (key), 149 (diagnosis), 191 (catalogue), 217 (fig. 698); 1999: 217 (diagnosis).
Chrysis angolensis group: Kimsey and Bohart, 1991: 32 (fig. 7f), 327 (key), 334 (diagnosis), 336 (fig. 110n), 357 (fig. 113c).

Diagnosis

Large species, up to 11 mm; scapal basin fully punctate or finely transversally microridged; strong transverse frontal carina M-like or straight with two branches encircling anterior ocellus; anterior ocellus lidded; mesopleuron ventrally with two teeth or angles along verticaulus; pronotum anteriorly strongly convergent; wings dark brown; second metasomal tergum without median longitudinal carina; pit row of the third tergum deep; apical margin of third tergum with four short triangular teeth, the median ones closer each other; black spots on the second sternum large and longitudinally elongate.

Hosts

Sphecidae: *Sceliphron caementarium* (Drury, 1773) (Stage, 1960), *S. madraspatanum* (Fabricius, 1781) (Terayama *et al*., 2010), *S. deforme* (Smith, 1856) (Teryama *et al*., 2010; Pauli *et al*., 2019), *Chalybium japonicum* (Gribodo, 1882) (Terayama *et al*., 2010); Vespidae (Eumeninae): *Delta conoideum* (Gmelin, 1790) (Bingham, 1903).

Distribution

The species group includes Afrotropical, Oriental, East Palaearctic and Australian species. At least one member of this species group, *Chrysis fuscipennis* Brullé, 1846 (Figure 1), was considered to be largely spread worldwide by accidental introduction, and it was recorded also from North America (Bohart and Kimsey, 1982), South America (Villu Soon, pers. comm.), and Cyprus in Europe (Linsenmaier, 1959).

Differential diagnosis

The *fuscipennis* species group is easily distinguishable from other groups by dark brown wings, strong transverse frontal carina with branches encircling mid ocellar area, short pronotum, and bidentate mesopleuron.

Species included

C. callaina Gribodo, 1884 spec. resurr. (synonyms: *C. szalayana*

Mocsáry 1912 syn. nov., *C. ukerewensis* Mocsáry, 1914 syn. nov.); *Chrysis diademata* Mocsáry, 1889; *Chrysis erratica* Abeille de Perrin and du Buysson in du Buysson, 1887 spec. resurr. (subspecies: *C. erratica murasaki* Uchida, 1927; synonym: *C. pulchella* Cameron, 1887 *nec* Spinola, 1808 syn. nov.); *C. fuscipennis* Brullé, 1846 (synonym: *C. fuscipennis dorsata* du Buysson, 1896 *nec* Brullé, 1833); *C. mossulensis* Abeille de Perrin and du Buysson in du Buysson, 1887 spec. resurr.; *C. sulcifera* Bischoff, 1910 spec. resurr.; *C. angolensis* Radoszkovsky, 1881 nomen dubium.

Remarks

The type of the subspecies *C. fuscipennis takanoi* Tsuneki, 1950 was not examined and its taxonomic position is not discussed in this paper. *Chrysis pulchella* (basionym: *Chrysis pulchellus*) is apparently a valid species related to *C. erratica* for the straight transverse frontal carina, the straight episternal sulcus and the coarse body punctation. However, the name *pulchella* is a primary junior homonym, and therefore invalid; its status must be revised and, if needed, a new name should be proposed by the first revisor. Rosa *et al.* (2015b) synonymised *Chrysis auropunctata* Mocsáry, 1889, described from Vietnam, with *C. angolensis*, following the species concept of Kimsey and Bohart (1991). However, this type must be re-evaluated after the species separation proposed in this article for a correct placement and species attribution (see below).

In comparison to the synonymic list of *Chrysis angolensis* provided in the catalogue by Kimsey and Bohart (1991), examination of the Palaearctic and Oriental regions reveals the presence of at least three distinct morphospecies. These are identified herein as *Chrysis erratica*, *C. fuscipennis*, and *C. mossulensis*. Additionally, in the African region, there are at least three species, two of which are reinstated to species status in this study: *Chrysis callaina* and *C. sulcifera* and likely *C. fuscipennis*. *Chrysis angolensis*, described from Angola, is suggested to be treated as *nomen dubium*, as further discussed below.

The Oriental species *Chrysis janthina* Smith, 1874, *nec* Förster, 1853 is transferred to the *antennata* group and synonymised with *C. brachyceras* Bischoff, 1910. The latter is transferred to the genus *Praestochrysis* Linsenmaier, 1959 (see below). The Australian species *Chrysis bilobipleuris* Linsenmaier, 1982 was already transferred to the *interceptor* group and synonymised with *C. interceptor* Smith, 1874 by Linsenmaier (1997).

List of species

Chrysis angolensis Radoszkovsky, 1881
Chrysis angolensis Radoszkovsky, 1881: 219.

Remarks. The type of *Chrysis angolensis* is considered lost. According to Radoszkovsky (1881) [Radoskovsky is the author name given in the original article] the type specimen was collected by Friderich Welwitsch (1806-1872) along with almost all the other Angolan hymenopterans listed and described in the publication. Welwitsch was the director of the Portuguese botanical gardens and, on behalf of the Portuguese government, conducted research in Angola, at that time a Portuguese colony since 1853. After eight years of research, he returned to Portugal in 1861, and two years later he moved to London, where he worked at the British Museum (NHMUK) and later at the Kew Gardens. Although he left his collections at the British Museum, a dispute arose, as the Portuguese government, which had funded his Angolan research, claimed ownership. The case was settled after three years and one part of his collection was returned to Museum of Natural History in Lisbon.

Despite extensive efforts, I was unable to locate the type of *Chrysis angolensis* at NHMUK and MHNL. Unfortunately, the collections at MNHL were completely destroyed in a fire in 1978. It is reasonable to assume that the type of *C. angolensis*, along with a thousand other specimens, may have been lost in the fire. Over the past few years, I conducted detective researches in various European collections where Radoszkowski's types are known to be deposited, including HMNH, ISEA-PAS, MfN, MSNG, MNHN, and ZMMU, but the type of *angolensis* was not found. Due to these circumstances, I must conclude that the type of *C. angolensis* is lost. Additionally, the description of the species provided by Radoszkovsky (1881) lacks the precision required to distinguish this species from other members of the group (Gribodo, 1884).

Kimsey and Bohart (1991) used the name *Chrysis angolensis* Radoszkovsky to replace the name *C. fuscipennis* Brullé, 1846 *nec* Dahlbom, 1829 because the latter is a junior homonym and therefore considered permanently invalid. *Chrysis angolensis* Radoszkovsky was considered to be the first available name among the synonyms of *C. fuscipennis* Brullé, 1846. However, *fuscipennis* Dahlbom was never treated as a valid species after its description, and Dahlbom himself (1854: p. 34) transferred this species in the genus *Omalus* and synonymised it with *Omalus coerulescens* De Géer [currently

Figure 1. *Chrysis fuscipennis*, syntype, ♀. A) Habitus, dorsal view; B) Habitus, lateral view. Scale bars 1 mm.

Pseudomalus violaceus (Scopoli)] in the family Elampidae [currently tribe Elampini], at that time considered to be a family separated from Chrysididae. All subsequent authors followed Dahlbom (1854) and considered *fuscipennis* Dahlbom to be a synonym of *Pseudomalus violaceus* (Scopoli) (Kimsey and Bohart, 1991).

However, despite the introduction of the name *C. angolensis*, several authors (see the list below) persistently used the name *Chrysis fuscipennis* Brullé, disregarding the interpretation provided by Kimsey and Bohart (1991) and the regulations of the ICZN, for which a primary homonym is permanently invalid (Art. 57.2).

Given that two different names are currently in use for the same species, according to leading authorities in this field (Kimsey and Bohart, 1991; Linsenmaier, 1997; 1999) and by other authors, an official action must be taken. For this reason, I apply the reversal of precedence for the two homonyms: *Chrysis fuscipennis* Dahlbom, 1829 and *Chrysis fuscipennis* Brullé, 1846, according to articles 23.9.1.1 and 23.9.1.2 of the Code. These articles are applicable because both conditions are met: i) the senior homonym, *Chrysis fuscipennis* Dahlbom, 1829, was never used as a valid taxon name after 1899 (actually after its description) and must be considered a nomen oblitum; ii) the junior homonym, *Chrysis fuscipennis* Brullé, 1846, must be considered a nomen protectum because it has been used as its presumed valid name in at least 25 works, published by at least 10 authors in the immediately preceding 50 years and encompassing a span of not less than 10 years: Ikeda (1976); Beardsley (1980); Krombein (1979); Bohart and Kimsey (1982); Tsuneki (1982); Sihag (1983); Bohart (1985); Kadirvelu (1991); Lee *et al*. (1995); Poole and Gentili (1996); Clouse *et al*. (1997); Linsenmaier (1997); Pratt (1998); Linsenmaier (1999); Nakamura and Matsuda (2000); O'Neil (2001); Hisamatsu (2004); González *et al*. (2004); Terayama *et al*. (2005); Kim and Kim (2006); Terayama *et al*. (2010); Strumia and Yıldırım (2012); Abrol (2012); Park *et al*. (2014); Thakkar and Parikh (2018). This action is also made in consideration of the fact that the name *Chrysis fuscipennis* Brullé was used as a valid name in a hundred publications within chrysidid literature before its replacement with the name *Chrysis angolensis*.

Following this reversal of precedence, there is no need to substitute the name *Chrysis fuscipennis* with *C. angolensis* Radoszkovsky. Moreover, I designate *Chrysis angolensis* Radoszkovsky nomen dubium because the type is lost and it is uncertain to which species the name *C. angolensis* refers to.

Chrysis callaina Gribodo**,** 1884, stat. rev. (Figures 2A, 2D, 3A, 4A, 4E, 5A)

Chrysis callaina Gribodo, 1884: 319.

Chrysis (*Tetrachrysis*) *Szalayana* Mocsáry, 1912: 397. Syn. nov.

Chrysis (*Tetrachrysis*) *ukerewensis* Mocsáry, 1914: 34. Syn. nov.

MATERIAL EXAMINED. *Holotype*

Ethiopia. ♂; Hadda Galla Dainbi IV-V Antinori 1819; "*Chrysis callaina* ♂ in Grib = *angolensis* Radoz.?"; Typus; "Holotype *Chrysis callaina* ♂ Gribodo" <red label handwritten by Bohart>; MSNG.

Lectotype: Lectotype of ***Chrysis szalayana*** Mocsáry, 1912 (Figures 2B, 3A)

Tanzania. ♂; Africa or[ientalis] Katona, Shirati 1909.III; "*Szalayana* Mocs. typ." Det. Mocsáry; "Lectotypus *Chrysis szalayana* ♂ Mocs. RM Bohart"; id nr. 135271 HNHM Hym. Coll.; HNHM.

Holotype: Holotype of ***Chrysis ukerewensis*** Mocsáry, 1914 (Figure 2C)

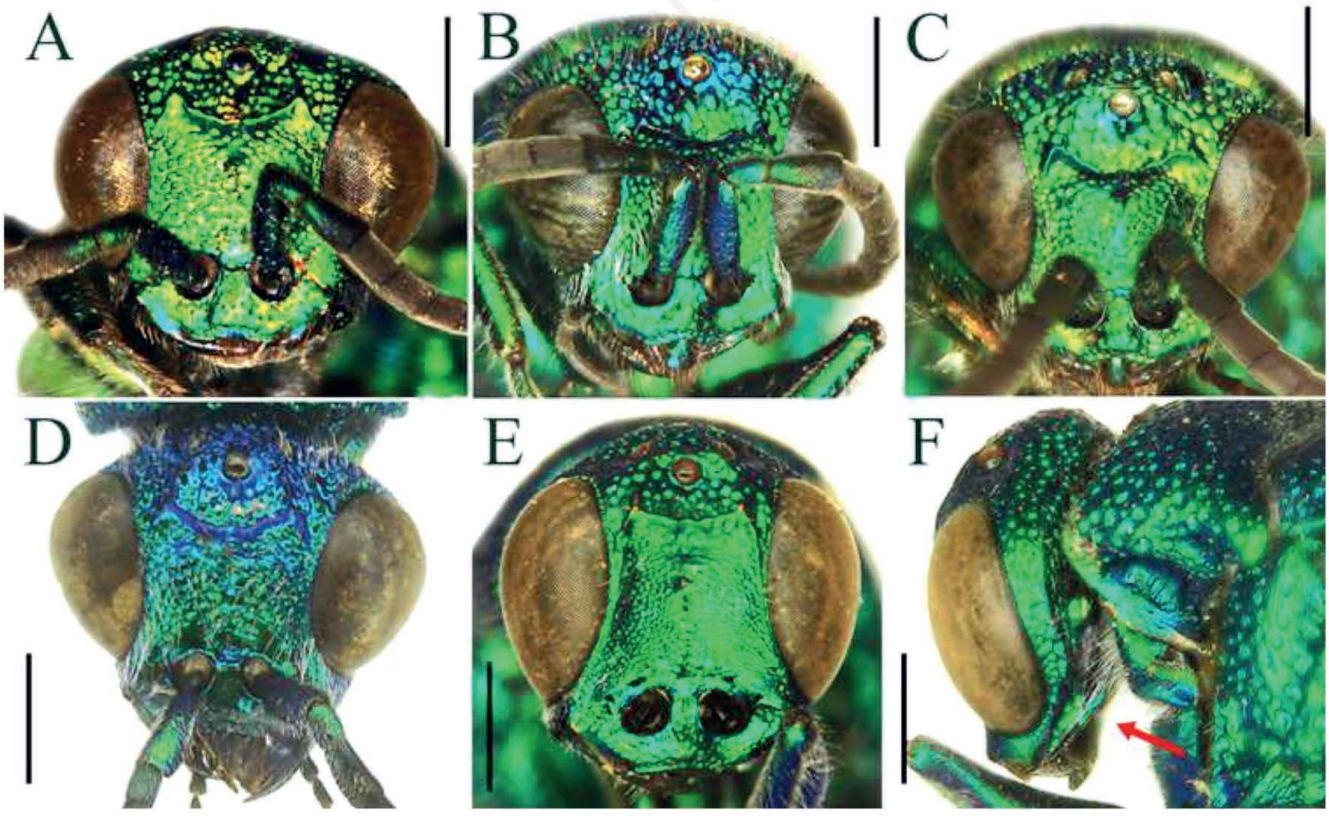

Figure 2. A-E) Face in frontal view; A) *Chrysis callaina*, holotype, ♂; B) *C. szalayana*, holotype, ♂; C) *C. ukerewensis*, holotype, ♂; D) *C. callaina*, ♂, from Zambia; E) *C. sulcifera*, holotype, ♀; F) Face in lateral view, *C. sulcifera,* holotype, ♀. Scale bars 1 mm.

Tanzania. ♂; Afr. Or. Ukerewe Katona 1911.XII; "*ukerewensis* typ. Mocs." Det. Mocsáry; "Holotypus *Chrysis ukerewensis* ♂ Mocsáry Bohart 1982"; id nr. 145270 HNHM Hym. Coll.; HNHM.

Other material. Zambia. 1♂; Mkushi env. 16–18.xii.2004 leg. T. Snižek; PRC.

Remarks. *Chrysis callaina* Gribodo was synonymised with *C. angolensis* by Kimsey and Bohart (1991). However, this taxon can be distinguished from other species, such as the African *C. sulcifera*, by its shape of the head: in frontal view, the head has a triangular profile, with globular eyes protruding from the face profile (Figures 2A-D) (*vs.* round head with eyes that maintain the outer profile of the face, ♀ Figure 2E, ♂ Figure 4D). Additionally, *C. callaina* has dense and coarse punctures on mesosoma (Figure 3A) (*vs.* even punctures, subequally separated by polished interspaces, similarly to *C. fuscipennis* Figure 3B); the apical margin of the third tergum has blunt, well-separated median teeth (*vs.* pointed and narrower median teeth); the black spots on S2 are large and oval (Figure 4E) (*vs.* narrow and elongate similarly to *C. fuscipennis*, Figure 4H); the genital capsule is elongate, with short gonostyle, and elongate inner side of gonocoxa (Figure 5A) (unknown in *C. sulcata*, and with elongate gonostyle in other species, Figure 5B, C).

Two additional African taxa share the same features of *Chrysis callaina*, namely *C. szalayana* Mocsáry, 1912 and *C. ukerewensis* Mocsáry, 1914. I here synonymised these two species with *C. callaina* pending a comprehensive revision of the African species within this group supported by molecular analysis.

Chrysis diademata Mocsáry, 1889

Chrysis diademata Mocsáry, 1889: 414.

Material examined. *Holotype*

Philippines. ♂; golden rounded label; "Mindanao"; Brasilia.; "*diademata* Mocs" <handwritten by Radoszkowski>; 108; ISEA-PAS.

Other material. Philippines. 1♀; Quezon Park Tayabas, P.I. Alt 1000 ft. XI-19-31; NMLU.

Remarks. Species endemic to the Philippines. It easily recognisable by the unique red colouration of the head, contrasting with the blue colour of mesosoma and metasoma. The locality label "Brasilia" is evidently incorrect, as previously observed by Mocsáry himself.

Chrysis erratica Abeille de Perrin and du Buysson, 1887 stat. rev. (Figures 4B, 4F, 5B, 6C, 6E, 7B, 7E)

Chrysis erratica Abeille de Perrin and du Buysson in du Buysson, 1887: 189.

Chrysis pulchellus Cameron, 1887: 126, *nom. praeocc.*, *nec* Spinola, 1808.

Chrysis fuscipennis var. *murasaki* Uchida, 1927: 155.

Material examined. *Lectotype (hereby designated)*

China. 1♀; "Coll. Abeille Chine"; Museum Paris Chine Coll. R. du Buysson 1900; "*Chrysis erratica* Ab.-Buyss. type" [handwritten by du Buysson]; Type [handwritten by du Buysson]; MNHN.

Holotype of ***Chrysis pulchellus*** Cameron, 1887

Sri Lanka. ♂; "Ceylon 97.11"; "*Chrysis pulchellus Cam. Type*"; Holotype; B.M. TYPE HYM. 13.76; NHMUK.

Other material. Japan. 1 ♂; Hyogo: Sayo, Harima; *Chrysis fuscipennis murasaki* Uchida, 1927 det. Linsenmaier; NMLU. 1 ♀; Osaka: Ikeda; *Chrysis fuscipennis murasaki* Uchida, 1927 det. Linsenmaier; NMLU.

China. 1 ♂; 24 ♀♀; Jilin, Mao'ershan National Nature Reserve; NMLU.

Korea. 4 ♀♀; Shoyo-zan, Keikido; NMLU. Russia. 1 ♀; Khabarovsk Terr.: Khabarovsk; ZIN. 1 ♀; vill. Kamenets-Podol'sk ZIN. 1 ♀; Primorskii Terr.: Vinogradovka; ZIN. 1 ♀; Yuzhno-Ussurijskij Terr.; ZIN. 1 ♀; Sidemi [= Bezverkhovo]; ZIN . ♀; Kongaus [=Anisimovka] NMLU.

Remarks. *Chrysis erratica* was described based on at least two syntype specimens collected from China and Egypt. The Chinese syntype is presently deposited at MNHN and is hereby designated as the lectotype to establish the species concept and compare it with the type of *C. fuscipennis*. The lectotype is a female and bears the following labels: Coll. Abeille Chine / *Chrysis erratica* Ab.-Buyss, type / type / Museum Paris Chine Coll. R. du Buysson 1900.

Chrysis erratica differs from *C. fuscipennis* by the combination of the following characters: substraight transverse frontal carina

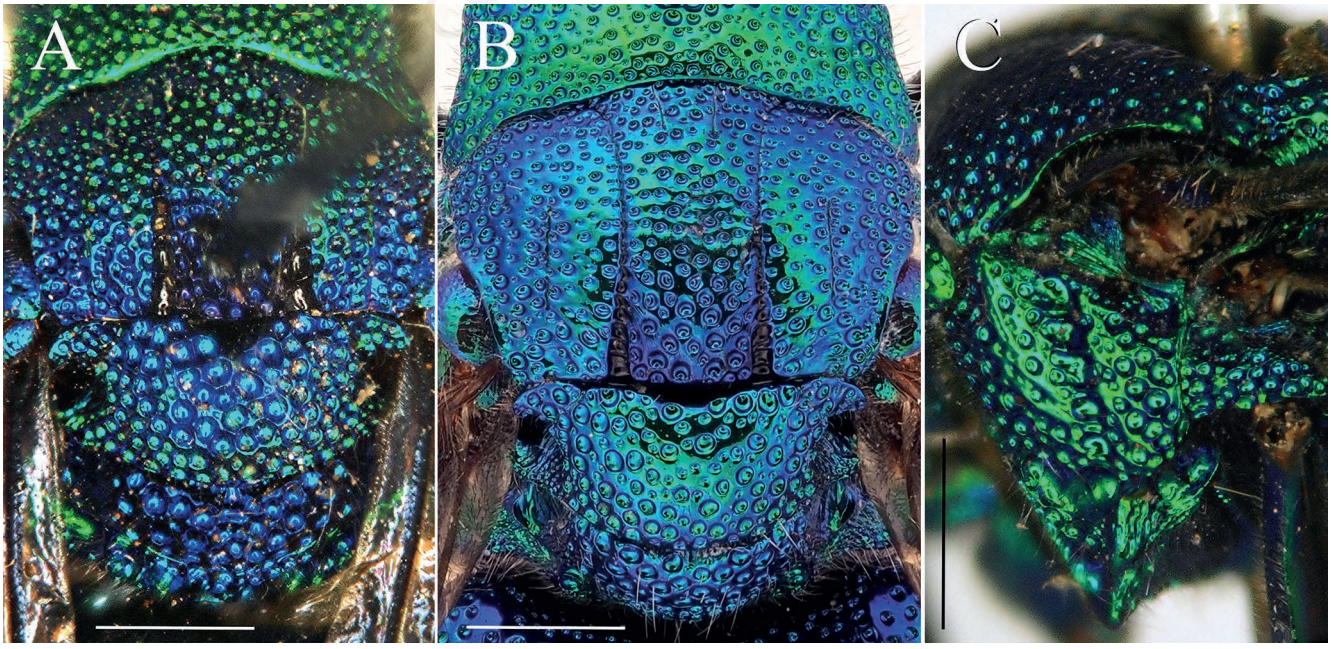

Figure 3. Mesonotum in dorsal view. A) *Chrysis szalayana*, holotype, ♂; B) *C. fuscipennis*, ♂; C) *C. sulcifera*, holotype, ♀. Scale bars 1 mm.

(Figure 6C-E) (*vs.* M-shaped in *C. fuscipennis*, Figure 6A, B), deeper and larger punctures on mesoscutum (Figure 7B) (*vs.* sparser, shallower and smaller, Figure 7A), and on metasoma (*vs.* sparser and smaller); additionally, the lower tooth on the ventral margin of the mesopleuron is closely positioned to the upper one (Figure 7E) (*vs.* more spaced, Figure 7D).

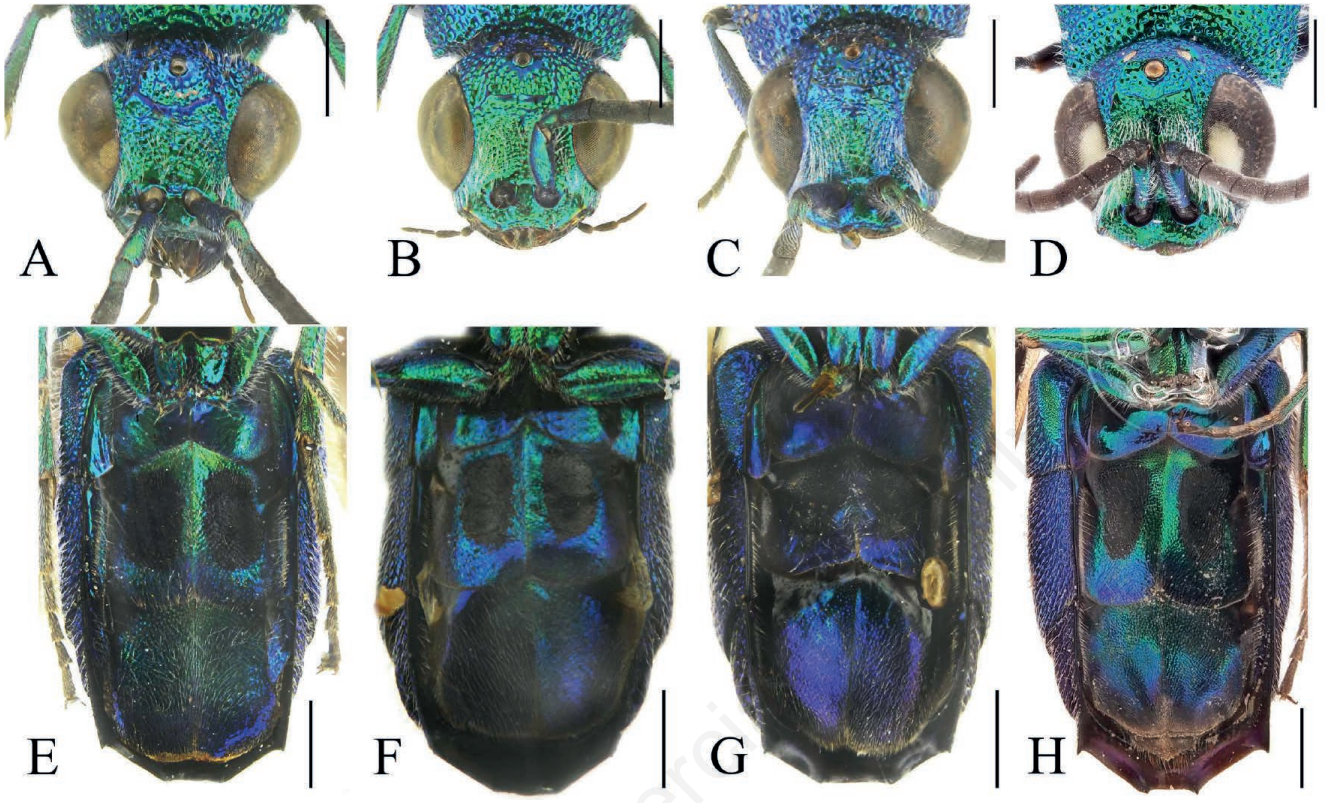

Figure 4. A-D) Face, ♂, frontal view; G-H) Metasoma, ♂, ventral view; A, E). *Chrysis callaina*, Zambia; B, F) *C. erratica*, Cambodia; C, G) *Chrysis* sp., Vietnam; D, H) *C. fuscipennis*, Cyprus. Scale bars 1 mm.

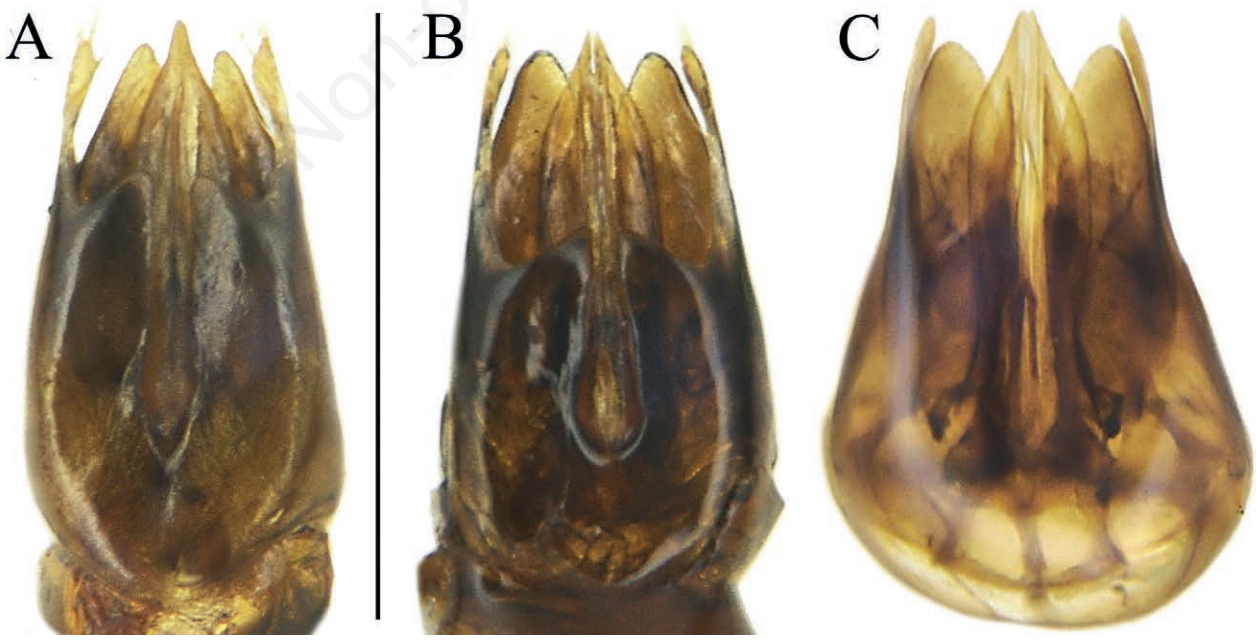

Figure 5. Genital capsule, ♂. A) *Chrysis callaina*, Zambia; B) *C. erratica*, China. C. *Chrysis* sp., Vietnam. Scale bar 1 mm.

Toshiharu Mita (ELKU) reported specimens referrable to *Chrysis erratica* from Japan: Honshu: Yamagata, Tokyo, Fukui, Osaka, Hyogo; Shikoku: Tokushima, Kochi; Kyushu: Fukuoka. Villu Soon (TUZ) reported specimens referrable to *Chrysis erratica* from China, Indonesia, Japan, Korea, USA, and Argentina (new record). Villu Soon (TUZ), has noted that specimens from North and South America align with *Chrysis erratica* rather than *C. fuscipennis* (*C. angolensis* sensu, Kimsey and Bohart, 1991). However, a morphological study of the North American specimens is required, as different species may have been accidentally introduced during or after the World War II from various localities where American troops were operating or through commerce.

Chrysis fuscipennis Brullé, 1846 stat. reviv.
(Figures 1A, 1B, 3B, 4D, 4H, 6A, 7A, 7D)
Chrysis fuscipennis Brullé, 1846: 38, *nom. praeocc., nec* Dahlbom 1829.
Chrysis fuscipennis var. *dorsata* du Buysson in André, 1896: 727, *nom. praeocc*., *nec* Brullé, 1833.
Chrysis (*Tetrachrysis*) *auropunctata* Mocsáry, 1889: 474.
Chrysis angolensis – Kimsey and Bohart 1991: 383.
Chrysis (*Chrysis*) *fuscipennis* – Linsenmaier 1997: 280; 1999: 217.
Material examined. *Syntypes*
Philippines. 1 ♀; "4202 34"; Museum Paris Asie Godefroy 4202-24; TYPE; "*Chrysis fuscipennis* Br."; "*Chrysis fuscipennis* type Brullé" [handwritten by du Buysson]; LECTOTYPE; MNHM. 1 ♀; 418; "4202 34"; Museum Paris Asie Godefroy 4020-34; "*Chrysis fuscipennis Brullé*" R. du Buysson det. 1898; MNHN, Paris EY41532; MNHM
Other material. India. 1 ♀; Tamil Nadu: Coimbatore; NHMW. 1 ♀; Jammu and Kashmir: Srinagar 19.vii.1935 leg. Guannar Jarring; MNLU. 2 ♂♂; Delhi 3.–5.XI.29 Dr. Enslin; MNLU. 4 ♀♀; Tamil Nadu: Omalur Salem iii.1978 leg. W. Perraudin; MNLU. 1 ♀; same locality, 20.xii.1975 MNLU. 1 ♀; same locality, 15.x.1975; MNLU. 1 ♀, same locality, 28.ii.1976; MNLU. 1 ♀; same locality, 13.vii.1976 MNLU. 1 ♀, same locality, 3.iii.1978 MNLU. 6 ♀♀, Tamil Nadu: Settipatti xi.1979 leg. W. Perraudin; MNLU. 1 ♀; same locality, 13.vii.1976; MNLU. Cyprus. 1 ♂; Cherkes 15.IX.1944 leg. G. Mavromoustakis; NMLU. 1 ♂; same locality, 21.X.1944; NMLU. 1 ♀; same locality, 1.IX.1946; NMLU. 1 ♂; same locality, 19.X.1948; NMLU. 1♂; same locality, 11.IX.1949; NMLU;. 1 ♀; same locality, 5.X.1950; NMLU. 1 ♀; Zakaki, 1.VI.1950; NMLU.
Holotype: Holotype of ***Chrysis fuscipennis*** var. *dorsata* du Buysson, 1896 (Figure 6D)
India. 1 ♀; Presid. Bombay Poona R.C. Wroughton; Museum Paris Inde, Poona Coll. R. du Buysson 1900; "*Chrysis fuscipennis* Brullé var. *dorsata* Buyss." R. du Buysson det.; MNHM.
Remarks. The name *Chrysis fuscipennis* Brullé, 1846 is a junior homonym of *Chrysis fuscipennis* Dahlbom, 1829 [currently synonym of *Pseudomalus violaceus* (Scopoli, 1763)] and therefore permanently invalid. Kimsey and Bohart (1991) replaced the name *Chrysis fuscipennis* Brullé, 1846 with *Chrysis angolensis* Radoszkovsky, 1881, the first available name among its synonyms. However, since the senior and the junior homonyms were no longer considered congeneric since 1854, and considering the intricate situation of the name *fuscipennis* Brullé, I apply the reversal of precedence (see the history case above) and continue to use the name *C. fuscipennis*, as Linsenmaier (1997, 1999) and other colleagues did.
Chrysis fuscipennis has a distinct M-shaped transverse frontal carina

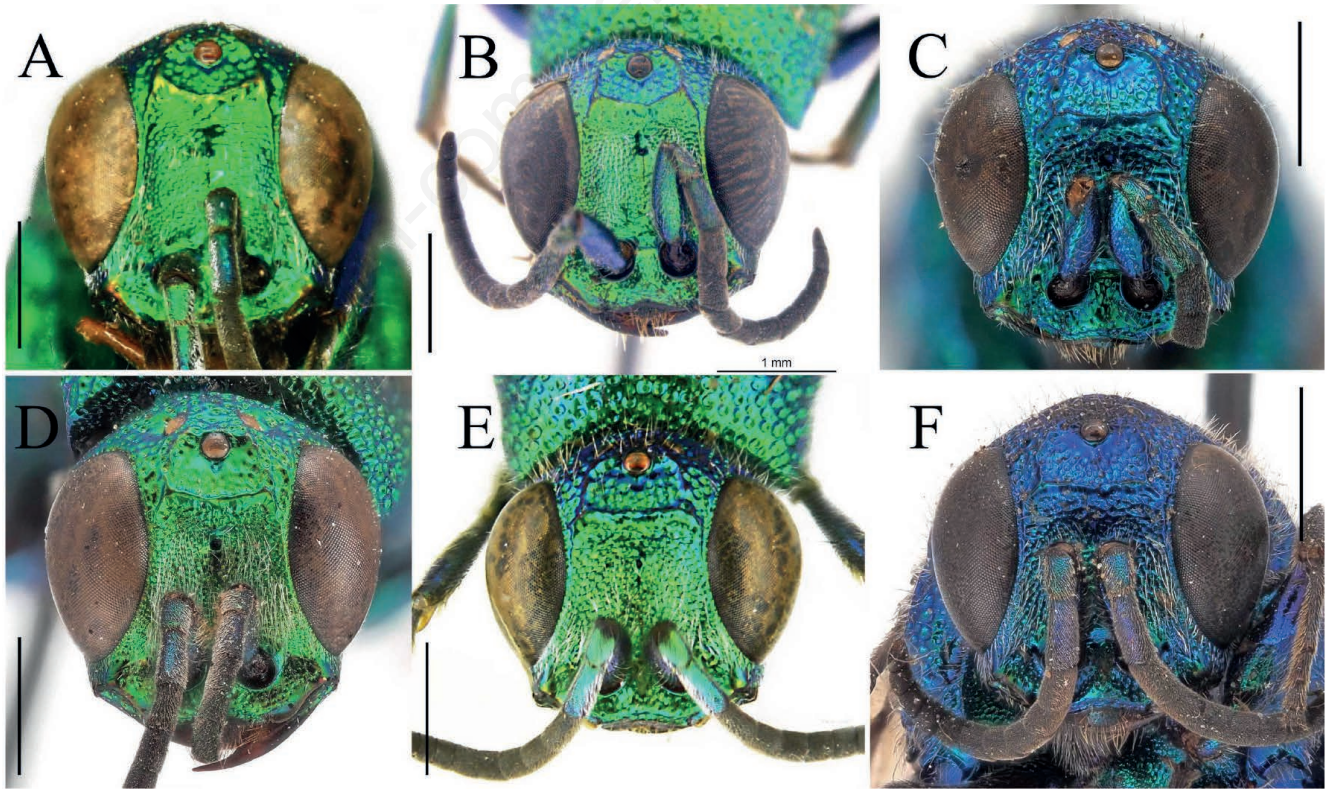

Figure 6. Face in frontal view, ♀. A) *Chrysis fuscipennis*, syntype, Philippines; B) *C. fuscipennis*, India; C) *C. erratica*, lectotype, China; D) *C. fuscipennis dorsata*, syntype, India; E) *C. erratica,* Cambodia; F) *C. mossulensis*, syntype, Iraq.

(Figure 6A, B), while other Asian (*C. erratica*, Figure 6C, E, F) and African species (*C. sulcifera,* Figure 2E) have a substraight frontal carina. It is separated from *Chrysis callaina* by the oval shape of the head in frontal view (*vs.* triangular in *C. callaina*, Figures 2A-D), and narrow and elongate black spots on the second sternum (Figure 4H) compared to other species.

Rosa *et al.* (2015b) synonymised *Chrysis auropunctata* Mocsáry, 1889, described from Vietnam, with *C. angolensis*, following the species concept of Kimsey and Bohart (1991). However, a re-evaluation of the type is necessary in light of the species separation proposed in this article for correct placement and species attribution. The unidentified male from Vietnam (Figures 4C, 4G, 5C, collected at Tam Dao, vii.1990, leg. local collector, PRC) may indeed belong to *Chrysis auropunctata*.

The European population of *Chrysis fuscipennis* is based on specimens collected by A. Mavromoustakis at Cyprus from 1944 to 1950 (Linsenmaier, 1959). Despite efforts by Christodoulos Makris (Limassol, Cyprus) over the past two decades to locate this species in the same collecting localities, no success has been reported. It is presumed that the species was introduced through commerce or during World War II by the British Army and temporarily established on the island. C. Makris and I consider this species extinct in Cyprus, as the last specimen was collected 74 years ago.

Chrysis mossulensis Abeille de Perrin and du Buysson, 1887 stat. reviv.

(Figures 6F, 7C, 7F)

Chrysis erratica mossulensis Abeille de Perrin and du Buysson in du Buysson, 1887: 190.

MATERIAL EXAMINED. *Syntypes*

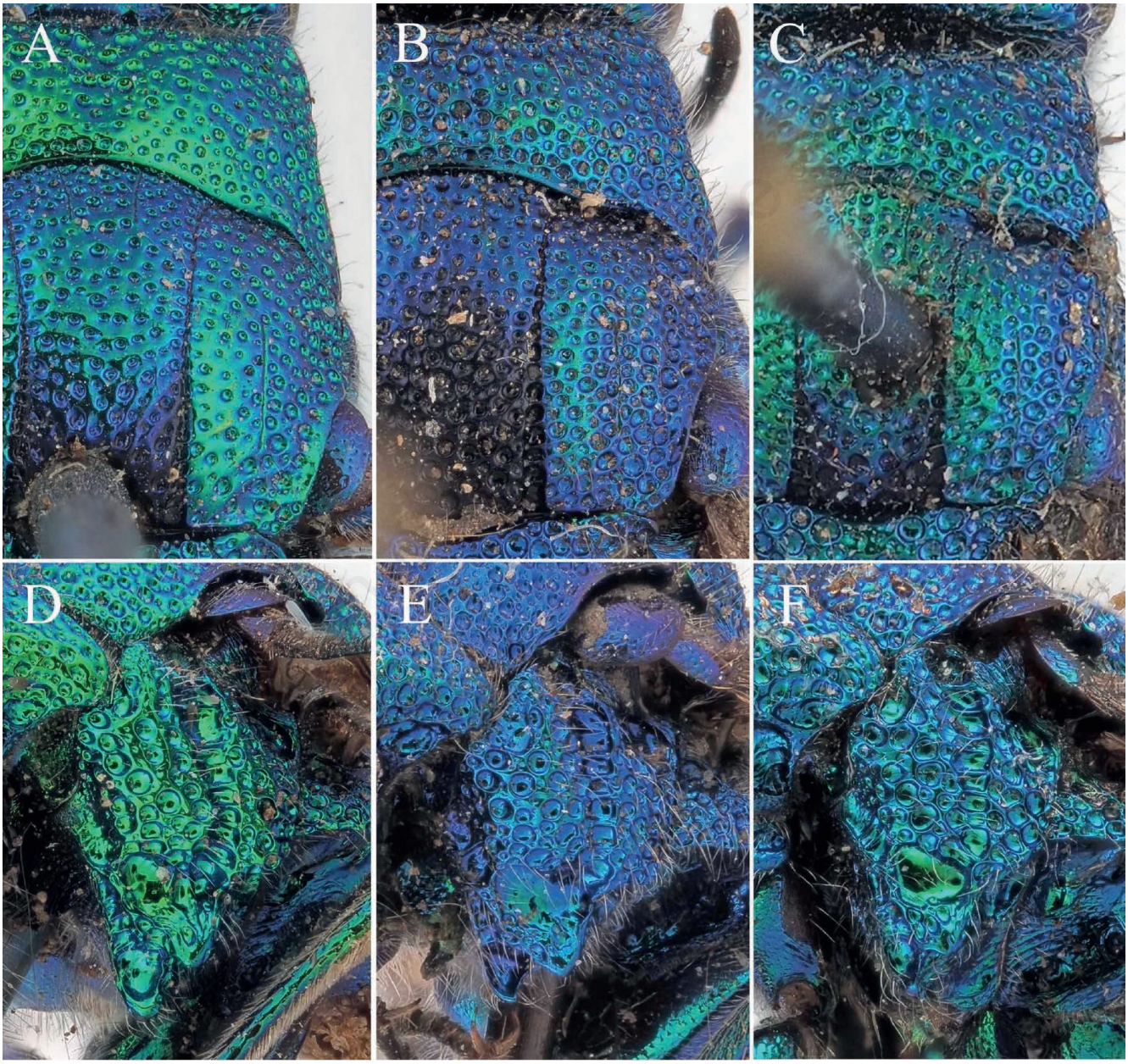

Figure 7. A-C) Mesosoma, ♀, dorsal view; A) *Chrysis fuscipennis*, syntype; B) *C. erratica*, lectotype; C) *C. mossulensis*, syntype; D-F) Mesopleuron, ♀, lateral view; D) *C. fuscipennis*, syntype; E) *C. erratica*, lectotype; F) *C. mossulensis*, syntype.

Iraq. 1 ♀; "Mossul"; "Coll. Abeille Mesopotamie"; "type"; Museum Paris Mossul Coll. R. du Buysson 1900; "*Chrysis fuscipennis* Brullé var. *mossulensis* Ab.-Buyss R." du Buysson det.; MNHM. 1 ♀; "Mossul"; [silver square label]; MHNN.

Remarks. *Chrysis mossulensis* shares affinities with *C. erratica*, characterized by substraight transverse frontal carina and straight episternal sulcus. However, major differences distinguish it from the Chinese *C. erratica*. Specifically, the shape of the mesopleuron is different due to a different position of the lower tooth and to the presence of an extended lobe posterior to the two mesopleural teeth (Figure 7F); the shape of the black spots on the second sternum are smaller and rounded; the body punctation is shallow and more spaced, particularly on metasoma, resulting in a more shining cuticle with a greenish hue. Given these distinctions, I propose to consider *Chrysis mossulensis* separated from *C. erratica* and *C. fuscipennis*, pending examination of more material, which is necessary to evaluate the variability of this taxon and its relationship with *C. erratica*.

Chrysis sulcifera Bischoff, 1910, stat. reviv.
(Figure 2E, 2F)
Chrysis (*Tetrachrysis*) *sulcifera* Bischoff, 1910: 469.
Material examined. *Holotype*
South Africa. ♀; "Capland Krebs S."; "7786"; Type; "*Tetrachrysis sulcifera* Bisch. ♀" [handwritten by Bischoff]; MfN.

Remarks. *Chrysis sulcifera* Bischoff is the African species most similar to *C. fuscipennis* from a morphological point of view, although some differences can be observed in the transverse frontal carina, which is slightly downcurved (Figure 2E), the hypertrophic subgenal carina (Figure 2F) and the mesopleuron, with wide and straight episternal sulcus and small punctures on the mesepisternum. Additional differences, such as body punctation, must be evaluated on a larger scale, and not only on the single type. However, differences in the head structure should be significant enough to consider *Chrysis sulcifera* as distinct from *C. fuscipennis*.

Species not belonging to the *fuscipennis* group

Chrysis janthina Smith, 1874
(Figure 8)
Chrysis (*Tetrachrysis*) *brachyceras* Bischoff, 1910: 474.
Chrysis janthina Smith, 1874: 459, *nom. praeocc.*, *nec* Förster, 1853. Syn. nov.
Praestochrysis brachyceras – Present paper. Comb. nov.
Material examined. Holotype: Holotype of ***Chrysis brachyceras*** Bischoff, 1910
Malaysia. ♀; "Ost Malacca Kelanton Rolle V."; "*Chr. brachyveras* Bisch."; Type; MfN.
Holotype: Holotype of ***Chrysis janthina*** Smith, 1874 (Figure 8A-D)
China. ♀; "N. China 54.8"; "*Chrysis janthinus.* Type. Smith"; Holotype; B.M. TYPE HYM. 13.104; MHNH(E) #970875; NHMUK.
Other material. China. 5 ♀♀; Guangxi, Maoershan National Nature Reserve 3.viii.2005 leg. Liu-sheng Chen; ANT001–

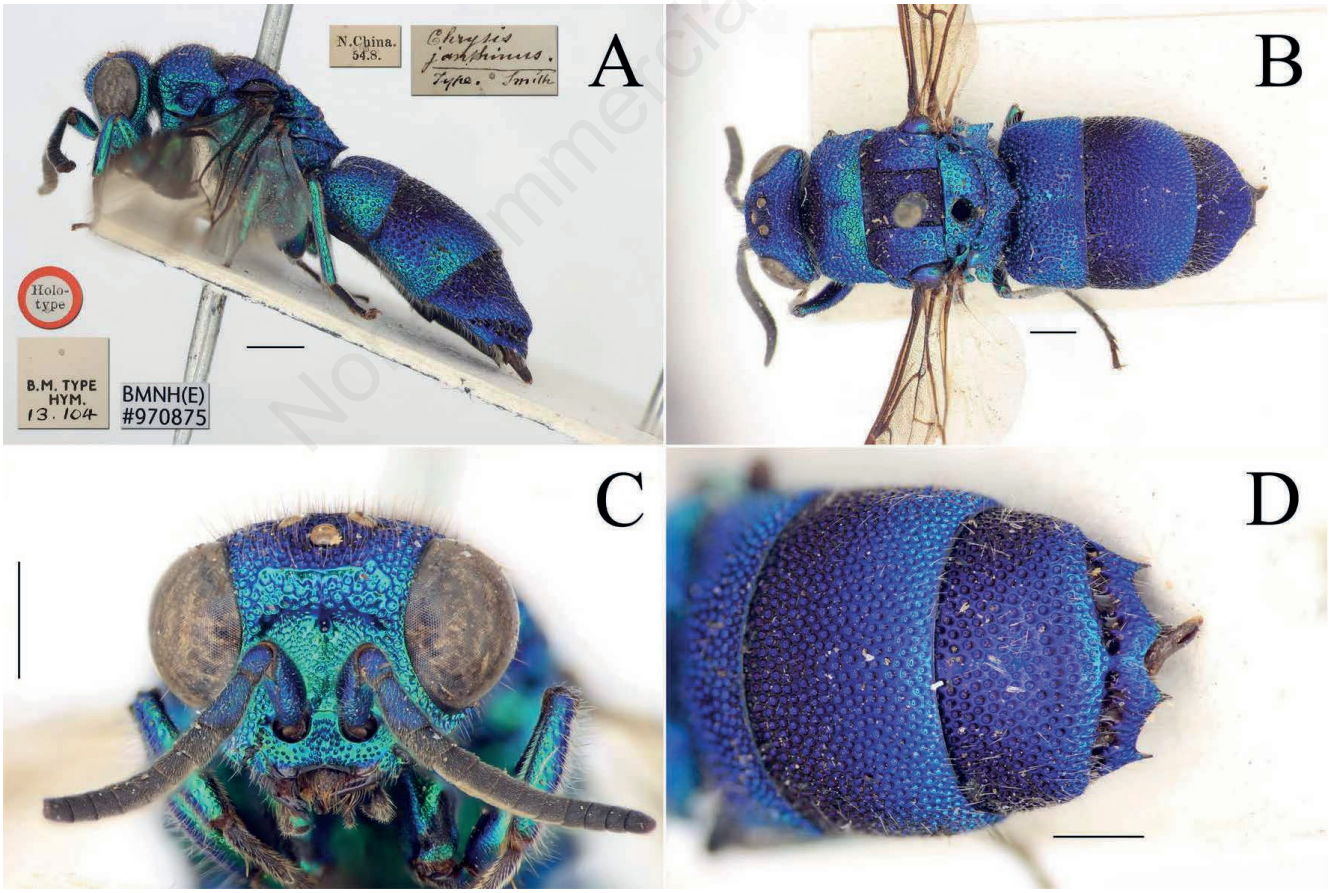

Figure 8. *Chrysis janthina* Smith, holotype, ♀. A) Habitus, lateral view; B) Habitus, dorsal view; C) Head, frontal view; D) Metasoma, dorsal view. Scale bars 1 mm.

ANT005; SCAU. 2 ♀♀; Guizhou, Tianzhu viii.2009 leg. Yang-wen Wang; ANT006, ANT007; SCAU.
Vietnam. 1 ♂; Phu Tho/Thanh Son, Xuan Dai 200m 14.–19.iv.2009 leg. Dang Long Khuat; ZFMK.

Remarks. *Chrysis janthina* Smith, 1874, *nec* Förster 1853 is the senior synonym of *Chrysis brachyceras* Bischoff, 1910. However, the latter is the valid name for this species being *C. janthina* already preoccupied and therefore invalid.

The placement of *brachyceras* in the genus *Chrysis* Linnaeus, 1761 was previously questioned by Rosa *et al*. (2017) due to shared characteristics with members of the genus *Praestochrysis*. These characteristics include general habitus; shape of the head distinctly broader than high (Figure 8C); broadened flagellomeres; subantennal space measuring 1.0 MOD shorter than malar space; transverse frontal carina weakly indicated across a strongly developed brow; non-microridged scapal basin; pronotum with deep lateral depressions; metanotum with a short, stout tooth (Figure 8A); well-developed scrobal and episternal sulci, ventrally expanded; small black spots on second sternum, almost fused along the midline. Kimsey and Bohart (1991) also noted some similarities between species of the *Chrysis antennata* group and *Praestochrysis*, but they included these species in the genus *Chrysis* for the four toothed apical margin of the third tergum (Figure 8D), contrary to the five toothed margin, which is usually observed in members of *Praestochrysis*.

Lastly, Pauli *et al.* (2019) analysed a specimen (named *Praestochrysis* sp. from Vietnam, Phu Tho/Thanh Son) which I later identified as *C. brachyceras*. Barcoding and multigene analyses confirmed that this species belongs to the genus *Praestochrysis*. For these morphological and genetic evidences, I propose transferring *Chrysis brachyceras* Bischoff, 1910 comb. nov. in the genus *Praestochrysis* Linsenmaier, 1959.

Conclusions

This small contribution underscores the complexity in the taxonomy and systematics of Chrysididae, revealing the extent to which it remains unsettled. In recent years, a substantial number of species, previously synonymized in the world catalogue by Kimsey and Bohart (1991), have been reinstated (a total of 122 species). Particularly noteworthy are cases involving taxa initially synonymized with seemingly widespread species, such as *Chrysis ignita* (Linnaeus, 1758) (Soon *et al*., 2014), *Chrysis parallela* Brullé, 1846 (Rosa, 2023), *Stilbum cyanurum* (Forster, 1771) (Rosa *et al.,* 2023), *Cleptes semiauratus* (Linnaeus, 1758) (Móczár 2001, Rosa *et al*. 2015a), only to mention a few, which were proven to be incorrectly synonymised, as suggested by examination of external morphology (Linsenmaier 1997; 1999; Móczár 2001, Niehuis 2000, Rosa *et al*., 2015a) and molecular analyses (Soon *et al*., 2014; Rosa *et al.*, 2023).

Several challenges persist in resolving outstanding issues across all species groups and genera. Many synonymised taxa are still awaiting revision, like those included in the synonymic list of *Chrysis nitidula* Fabricius, 1775, in the Nearctic region, and *C. rastellum* Brullé, 1846, in the Neotropical one. Moreover, the types of numerous Palaearctic species of *Hedychridium* and *Holopyga* do not align with the current interpretation of the species and actions must be taken to stabilise the taxonomy of the family.

The taxonomy of West Palaearctic Chrysididae is particularly complex because it was primarily influenced by the works of a single specialist, Walter Linsenmaier, in the second half of the 20th century. Linsenmaier's classification relied solely on morphology, with geographical variations often represented by an extensive use of subspecies. Kimsey and Bohart (1991) subsequently incorporated many of these subspecies into the synonymic list of nominal taxa, raising questions about whether these subspecies truly represent distinct taxa or simply variations.

Currently, Europe hosts approximately 490 species and 135 subspecies (Mitroiu *et al*., 2015). Comprehensive studies conducted with molecular analyses and morphometry (Soon *et al*., 2014; Orlovskytė *et al*., 2016) have been limited to taxa that Linsenmaier classified as subspecies of *Chrysis ignita* and have revealed that these subspecies are indeed valid species. However, all the other European and Palaearctic subspecies remain unexplored in this regard. Molecular analyses are necessary to ascertain their accurate placement and understand the genetic distances between the taxa involved. An ongoing project at the University of Mons is focused on barcoding the European fauna, aiming to contribute valuable insights into the molecular aspects of these intricate taxonomic relationships.

The challenges faced are therefore manifold. On one hand, the study of type material is crucial to evaluate synonymies based on morphological analysis, as exemplified in the present study. On the other hand, molecular studies are needed to contribute to a more reliable definition of the species concept. Unlike certain Apoidea groups, such as bumble bees (Williams *et al*., 2020; Rasmont *et al*., 2021), there has been limited discussion on species concepts within Chrysididae. Applying a biological species concept is premature given the limited understanding of their mating systems and pre- and post-zygotic reproductive barriers. It is reasonable to assume that an integrative taxonomy approach, incorporating genetic, morphological, and ecological data, can facilitate the establishment of a robust species concept (Schlick-Steiner *et al*., 2010).

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