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Resolution of some taxonomic and nomenclatural issues in a recent revision of *Ceraeochrysa* (Neuroptera: Chrysopidae)

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Abstract

With the purpose of promoting nomenclatural stability, this paper addresses a number of errors, omissions, and controversial conclusions in a recent revision of the green lacewing genus *Ceraeochrysa* by Freitas *et al*. (2009).

1. *Valid species, new combinations and synonymies*: (a) We identified *Ceraeochrysa chiricahuae* Freitas and Penny (in Freitas *et al*. 2009), *Chrysopa forreri* Navás, and *Chrysopa intacta* Navás as subjective synonyms. Thus, *Ceraeochrysa intacta,* a species that was previously synonymized under *Ceraeochrysa placita* (Banks), becomes the valid name of the species [**New status, new combination**]. *Chrysopa forreri* is now synonymized under *Cer. intacta*, not *Cer. placita* [**New synonymy**]. And, *Cer. chiricahuae* becomes a junior synonym of *Cer. intacta,* not a valid species of *Ceraeochrysa* [**New synonymy**]. (b) We enumerate specific internal and external features of the *Chrysopa cornuta* Navás type that identify it as conspecific with *Ceraeochrysa caligata* (Banks), not *Ceraeochrysa cincta* (Schneider) as proposed by Freitas *et al*. (2009). Thus, *Ceraeochrysa cornuta* (Navás), which has priority, is reinstated as the valid name [R**einstated status, reinstated combination**], and *Ceraeochrysa caligata* (Banks) is reinstated as a junior subjective synonym of *Cer. cornuta,* not a valid species [**Reinstated synonymy**]. (c) We provide documented evidence for reinstating three synonymies that Freitas *et al*. had reversed [**Reinstated synonymies**]: (i) *Allochrysa parvula* Banks is a junior subjective synonym of *Ceraeochrysa lineaticornis* (Fitch); (ii) *Chrysopa columbiana* Banks is a junior subjective synonym of *Ceraeochrysa lineaticornis* (Fitch); (iii) *Chrysopa rochina* (Navás) is a junior subjective synonym of *Ceraeochrysa cincta* (Schneider).

2. *Generic assignments:* (a) Visual evidence is provided for the placement of *Ceraeochrysa laufferi* (Navás) in *Ungla*. Therefore, *Ungla laufferi* (Navás) is reinstated as the valid name [**Reinstated combination**]. (b) We question Freitas *et al*.'s rationale for including *Cer. placita* (Banks) and *Cer. intacta* (Navás) (as *Cer. chiricahuae* Freitas and Penny) in the genus *Ceraeochrysa*; female and larval features of the two species differ markedly from those used to characterize *Ceraeochrysa* species. As an alternative that recognizes the uncertainty surrounding the generic placement of these species and that avoids additional, unnecessary name changes, we propose including the caveat "genus *incertae sedis*" with the names, as follows: *Ceraeochrysa placita* (Banks), genus *incertae sedis*, and *Ceraeochrysa intacta* (Navás), genus *incertae sedis.*

3. *Type designations*: (a) Errors concerning the *Chrysopa furculata* Navás type in the Muséum national d'Histoire naturelle, Paris (MNHN), are corrected, and doubts raised by Freitas *et al*. (2009) concerning the identification of this specimen as the holotype are removed. (b) The earlier designation of the *Chrysopa rochina* (Navás) type in the MNHN as the lectotype (not holotype) is verified.

Key words: *Ceraeochrysa*, *Chrysopodes*, *Ungla*, synonymy, generic assignment

Introduction

With a few notable, relatively well-studied exceptions, the world's green lacewing taxa require species-level systematic treatment. The requirements include descriptive and alpha-level taxonomic work, as well as revisionary and phylogenetic studies. One effort to help fulfill the needs, a revision of the largely neotropical genus *Ceraeochrysa* (abbreviation: *Cer.*), was published recently (Freitas *et al*. 2009). This study makes a

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substantive contribution to chrysopid taxonomy and is a welcome addition to the literature. Nevertheless, we believe it contains some errors, omissions, and controversial conclusions. To help preclude taxonomic confusion or unnecessary name changes in the future, herein we identify some of these issues and provide correcting and documented alternative conclusions.

Ceraeochrysa cornuta (Navás, 1925)

Chrysopa cornuta Navás, 1925: 65, fig. 1 (not *Chrysopa cornuta* Navás, 1926) [MNHN, Lectotype]. Junior subjective synonym of *Ceraeochrysa cincta* (Schneider, 1851: 86) by Adams (1982: 72). Synonymy with *Cer. cincta* (Schneider) reversed by Legrand *et al*. (2008: 126), reinstated by Freitas *et al.* (2009: 530).

Ceraeochrysa cornuta (Navás). First designation as a valid species in *Ceraeochrysa* by Legrand *et al.* (2008: 126). Designation reversed by Freitas *et al.* (2009: 530). Here: **Status reinstated, combination reinstated.**

Ceraeochrysa (= Chrysopa) caligata [Banks, 1945: 154; Museum of Comparative Zoology, Harvard University (MCZ), Holotype]. First identification as a junior synonym of *Cer. cornuta* by Legrand *et al.* (2008: 528). Reinstated as a valid species (Freitas *et al.* 2009: 526). Here: **Synonymy reinstated.**

Background: Adams (1982: 72) identified both *Chrysopa caligata* (Banks) and *Chrysopa cornuta* (Navás) as junior synonyms of *Ceraeochrysa cincta* (Schneider). He stated that he considered the *C. cornuta* synonymy as provisional because at that time he had not seen the type. Subsequently, (i) the *C. cornuta* type (a female) was found in the MNHN and Adams & Penny (1985: 440–441) restated Adams' conclusion that *C. cornuta* was synonymous with *Cer. cincta*. (ii) Adams & Penny (1985: 442) also reinstated *Cer. caligata* as a valid species.

FIGURE 1. *Chrysopa cornuta*, lectotype female (MNHN). 1, Head and thorax, dorsolateral. Photo by J. Legrand (MNHN). Note: The distinguishing mesonotal spots are circled in black.

Over the years since 1985, *Ceraeochrysa caligata* (Banks) [here, = *Cer. cornuta*) has been recognized as a valid species separate from *Cer. cincta* [see references in Legrand *et al.* (2008; 126)]. Males of the two species

are easily distinguished on the basis of genitalic characters (Adams & Penny 1985; Freitas *et al.* 2009); the larvae are also distinct (Tauber & de León 2001). Although Freitas *et al.* (2009) claim that *Cer. caligata* and *Cer. cincta* females cannot be differentiated, we have found that species-specific genital characteristics [described and illustrated by Adams and Penny (1985)] consistently separate females of the two species. Moreover, an additional, external character [presence or absence of red spots on the mesonotum) recently was shown to distinguish adults (males and females) of the two species (Viana & Albuquerque 2009, as *Cer. caligata*). These marks occur on a large proportion of *Cer. caligata* adults, but they are absent in *Cer. cincta*.

Types: The *C. cornuta* lectotype (a female, examined, CAT) has very distinct *Cer. caligata*-like markings on the mesonotum (Fig. 1), and its genital characteristics (protruding lip of the subgenitale, the length and tightness of the bend in the U-shaped spermatheca) are those of *Cer. caligata* females as illustrated by Adams & Penny (1985: 469) (notes by CAT and by Gilberto S. Albuquerque, March 2008). Thus, we re-confirm the identification of the *C. cornuta* lectotype as conspecific with *Cer. caligata*.

Conclusion: Given that Navás' description was published before Banks', *Ceraeochrysa cornuta* (Navás) has precedence as the valid name of the species. And, the identification of *Cer. caligata* as a junior subjective synonym of *Cer. cornuta* by Legrand *et al.* (2008) pertains.

Ceraeochrysa everes (Banks, 1920)

Relevant synonymy below (See Freitas *et al.* 2009: 546 for a full list of synonyms).
Chrysopa everes Banks, 1920: 338 [MCZ, Lectotype].
Ceraeochrysa everes (Banks). First combination in *Ceraeochrysa* by Adams & Penny (1985: 452).
Chrysopa furcata Navás, 1922: 53. Preoccupied name.
Chrysopa furculata Navás, 1923: 39. Replacement name for *C. furcata* Navás. [MNHN, Holotype]. Junior subjective synonym of *Ceraeochrysa gundlachi* (Navás, 1924: 329) by Adams (1982: 72); junior subjective synonym of *Ceraeochrysa everes* by Adams & Penny (1985: 452).

Background: Freitas *et al.* (2009: 546) correctly listed *Chrysopa furcata* Navás and *Chrysopa furculata* Navás as synonyms of *Ceraeochrysa everes* (Banks). Also, they correctly mentioned that the original description stated that Navás had held the type in his personal collection and that it was found later in the Muséum national d'Histoire naturelle, Paris (MNHN). However, some of their subsequent comments may cause uncertainty regarding the status of the *Chrysopa furculata* type in the MNHN.

Type: Freitas *et al.* (2009: 548) stated that the type of *C. furculata* "… had a collection label of 1925, three years after the original description of *C. furcata* and one year after the first use of *C. furculata*." This statement could cast doubt on the validity of the *C. furculata* type in the MNHN. However, as Legrand *et al.* (2008: 137) reported: (i) The first label on the Navás type in the MNHN carries a 1910 collection date, which is well before the publication date (1922) of *C. furcata*. (ii) The third and fourth labels on the specimen, a pink "Typus" label and a green printed label, are labels that Navás characteristically applied to the numerous types that he donated to the MNHN from his personal collection (see explanation and illustrations by Legrand *et al.* 2008: 109). Thus, the labels and history of the specimen coincide with published reports for Navás' *C. furculata* type.

Conclusion: Doubts implied by Freitas *et al.* (2009) concerning the validity of the *C. furculata* type in the MNHN are answered, and the identity of the specimen as the holotype is re-confirmed.

Ungla laufferi (Navás, 1922)

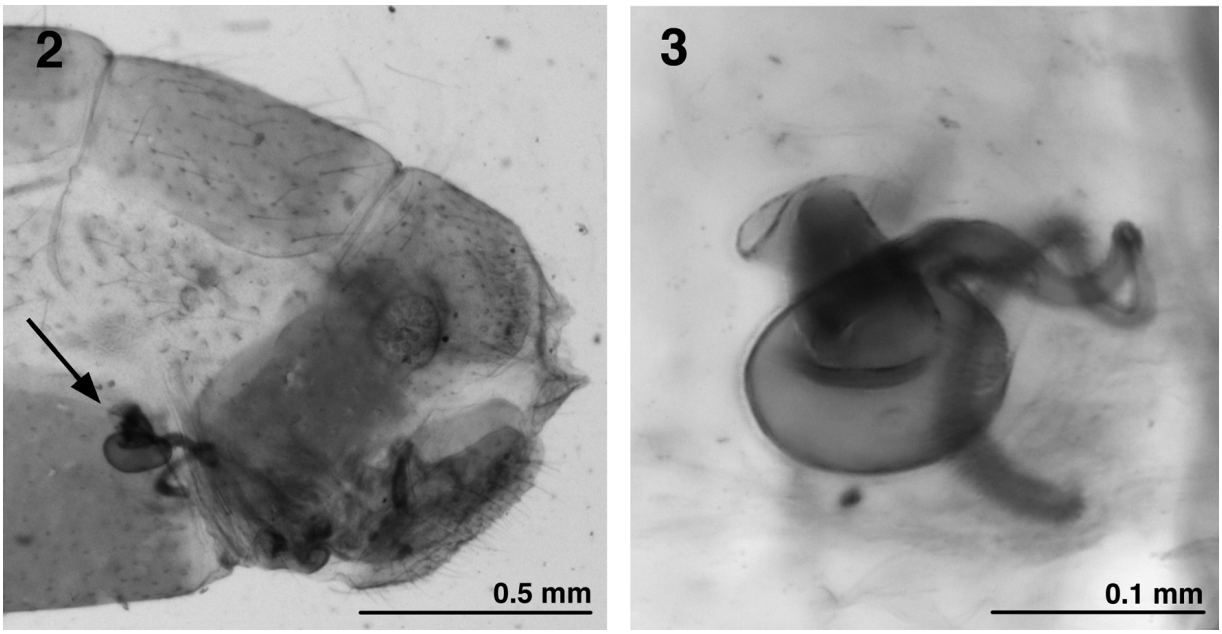
Chrysopa laufferi Navás, 1921 [1922]: 260 [MNHN, Holotype].
Ceraeochrysa laufferi (Navás). First combination in *Ceraeochrysa* by Brooks & Barnard (1990: 269). Removed from *Ceraeochrysa* by Legrand *et al.* (2008: 149); combination reinstated by Freitas *et al.* (2009: 556).
Ungla laufferi (Navás). First combination in *Ungla* by Legrand *et al.* (2008: 149). Combination reversed by Freitas *et al.* (2009: 556). Here: **Combination reinstated.**

Chrysopa aroguesina Navás 1928 [1929]: 32 [MNHN, Lectotype] [= *Ceraeochrysa aroguesina* (Navás 1929) (first combination in *Ceraeochrysa* by Brooks & Barnard 1990: 268]. Junior subjective synonym of *U. laufferi* by Legrand *et al.* (2008: 115) and by Freitas *et al.* (2009: 556, as *Ceraeochrysa laufferi*).

Background: Navás originally described this species as *Chrysopa laufferi* (Navás 1921: 260); subsequently, it was transferred to *Ceraeochrysa* (Brooks & Barnard 1990: 269), and then to *Ungla* (Legrand *et al.* 2008: 149). Freitas *et al.* (2009: 556) disagreed with the transfer to *Ungla* and stated that their stance was based on the fact that the abdomen is absent from the original type (MNHN) and thus diagnostic genitalic features are unavailable for evaluation. They returned the species to *Ceraeochrysa*.

Types: The types of *Chrysopa laufferi* and *Chrysopa aroguesina* (both examined, CAT) express very similar external characteristics (shape and venation of the wings, facial and head markings, body coloration). Indeed, Legrand *et al.* (2008) and Freitas *et al.* (2009) agree on the identification of *C. aroguesina* as a junior synonym of *C. laufferi*. Thus, the *C. aroguesina* type (a female, MNHN) provides access to genitalic characters that are missing from the *C. laufferi* type.

The *C. aroguesina* type has a small, pillbox-like spermatheca that opens to the bursa copulatrix via the vellum and a short bursal duct and that has a shallow invagination (Figs. 2, 3). These features are typical of *Ungla* females (see Brooks & Barnard 1990). In contrast, the spermathecae of all known *Ceraeochrysa* females are larger, tubular, and U-shaped; they open directly to the bursa via an elongate slit and they have a deep invagination [Adams (1982: 70, 75); also see illustrations in Adams & Penny (1985) and Freitas *et al.* (2009)].



FIGURES 2–3. *Chrysopa aroguesina*, lectotype female (MNHN). 2, Teminalia, lateral. 3, Spermatheca, dorsolateral. Note: The arrow indicates the spermatheca.

In addition, several external features of the *C. aroguesina* and *C. laufferi* types are more like *Ungla* than *Ceraeochrysa*. For example, on the forewings of the *C. laufferi* type the basal inner gradates do not contact the Pseudomedius; this character state is variable, but it is frequently found in *Ungla*, not *Ceraeochrysa* (Brooks & Barnard, 1990). And, the vertex of the head of the *C. aroguesina* and *C. laufferi* types bears a pair of longitudinal, reddish marks that, although short, are more typical of *Ungla* than *Ceraeochrysa*.

Conclusion: We consider *Ungla laufferi* (Navás) to be the valid name for the species.

***Ceraeochrysa lineaticornis* (Fitch, 1855)**

Chrysopa lineaticornis Fitch, 1854 [1855]: 795 [MCZ, Holotype].
Ceraeochrysa lineaticornis (Fitch). First combination in *Ceraeochrysa* by Adams (1982: 73).
Chrysopa columbiana Banks, 1903: 150 [MCZ, Holotype]. Junior subjective synonym of *C. lineaticornis* by Bram & Bickley (1963: 16); later, junior subjective synonym of *Cer. parvula* (Banks) by Freitas *et al.* (2009: 566). Here: **Subjective synonymy with *C. lineaticornis* Fitch reinstated.**
Allochrysa parvula Banks, 1903: 143 [MCZ, Holotype]. Junior subjective synonym of *Cer. lineaticornis* (Banks) by Adams (1982: 73). Synonymy reversed and *Ceraeochrysa* (= *Allochrysa*) *parvula* (Banks) recognized as a valid species by Freitas *et al.* (2009: 566). Here: **Subjective synonymy with *C. lineaticornis* reinstated.**

Background: Freitas *et al.* (2009: 557, 566) recognized *Cer. lineaticornis* and *Cer. parvula* (with junior synonym *C. columbiana*) as two separate species. They claimed that Banks (1903) considered dark genal markings as an important feature that distinguishes the two species; their description and illustration of *Cer. parvula* (Fig. 39C in Freitas *et al.* 2009) include dark genae, whereas pale genae typify *Cer. lineaticornis.* Furthermore, they mentioned that male genital differences distinguish the two species, but they did not specify what the features are.

Types: Banks (1903: 150) described the genae of all three nominal species as pale and without marks. Moreover, the on-line images of the *C. lineaticornis*, *A. parvula* and *C. columbiana* holotypes [MCZ type database; http://insects.oeb.harvard.edu/MCZ/index.htm] and personal examination of the types in the MCZ (CAT), show that the genae of all three nominal species are pale and without marks.

We (CAT) examined the genitalia of the holotypes (all males) of the three nominal species. Those of *C. lineaticornis* and *C. columbiana* are from mature specimens; they are well sclerotized and well preserved. The *A. parvula* holotype is teneral and the genitalia are less well preserved, but they exhibit some of the relevant characters. Below, we assess the three holotypes relative to possible differences and similarities that we could glean from the descriptions by Freitas *et al.* [The terminology for the structures is that used by Freitas *et al.* 2009)

(1) *Dorsal apodeme of ectoproct.* For *Cer. lineaticornis*, Freitas *et al.* (2009) described the dorsal apodeme of the ectoproct as having a "recurved dorsal branch", whereas that of the *Cer. parvula* ectoproct as "bifurcate and ventral branch caudally projected". Freitas *et al.*'s drawings of the male terminalia and our examination of the holotypes show that the dorsal apodemes of both nominal species have a dorsally projecting arm that extends behind the callus cerci, and a caudal arm that projects posteriorly. The lengths and degree of sclerotization of the arms of the two species appear to differ on the drawings for the two species (Figs 33D, 39E in Freitas *et al.* 2009), but the differences shown are well within the continuous range of variation seen amongst *Cer. lineaticornis* specimens, e.g., in a sample of specimens in the USMN.

(2) *Gonarcal arch.* Freitas *et al.* described the "gonarcal arch" of *Cer. lineaticornis* as "short, thick" and the "gonarcal medial arch" of *Cer. parvula* as "stout, anterior margin highly curved"; their drawings are consistent with the descriptions. Our examinations of the holotypes and numerous *Cer. lineaticornis* specimens indicate that there is considerable continuous variation in the curvature and thickness of the gonarcus and that the holotypes of all three nominal species fall well within this range.

(3) *Lateral arms of gonarcus*. For *Cer. lineaticornis,* the gonarcal arms are described as "large, hemispherical, ventrally orientated"; the gonarcal arms of *Cer. parvula* are not mentioned in the description. Our examinations show that they are similar on the holotypes of all three nominal species.

(4) *Gonocornua.* The *Cer. lineaticornis* gonocornua are described and figured as "long, arched and acutely pointed apically and with small ventral projection which may be the entoprocesses". The *Cer. parvula* gonocornua are described as having an "acute apex and ventral projection"; in Fig. 39G of Freitas *et al.* (2009), the *Cer. parvula* gonocornua are shown to be somewhat shorter than those of *Cer. lineaticornis* (Fig. 33F), and with a slightly larger ventral projection. Here, again, the differences between the types of the nominal species in the lengths of their gonocornua and the associated ventral projections are small and within the range of variation of *Cer. lineaticornis* specimens.

(5) *Arcessus*. The arcessus of *Cer. lineaticornis* is described as having a "long dorsal horn, apical plate trilobed with long acute lobes"; *Cer. parvula* is described as having a "narrow arcessus, apical plate trilobed,

the medial point horn-like, no dorsal processes". Figs. 33G and 39I in Freitas *et al.* (2009) are consistent with the descriptions. Our examination of the *C. lineaticornis* holotype indicates that indeed its arcessus is longer and narrower, the three terminal lobes are more elongate, and the dorsal processes are more prominent than those on the other two holotypes. However, *Cer. lineaticornis* specimens generally are very variable in these characteristics, and the three holotypes fall well within the range of continuous variation exhibited by *Cer. lineaticornis* specimens. It is noteworthy that the dorsal processes on the arcessus are often flat and closely aligned to the surface of the arcessus; they can be difficult to see, especially on teneral specimens like the *A. parvula* holotype.

(6) *Gonosaccus.* Both species are described and figured as having a gonosaccus with long gonosetae. Indeed, this is the case for the holotypes of all three nominal species.

(7) *Gonapsis*. The gonapsis of *Cer. lineaticornis* is not mentioned or figured; that of *Cer. parvula* is described as "apically forked". Indeed, the gonapsides of the *C. lineaticornis* and *C. columbiana* holotypes are forked at their junction with the tip of S8+9; the free end on both specimens is spatulate. The gonapsis of the teneral *A. parvula* holotype is difficult to see.

In summary, we were unable to identify any genitalic features that would distinguish the *A. parvula* or *C. columbiana* holotypes from *Cer. lineaticornis.* Thus, on the basis of external (head markings) and internal (male genitalic) characters, we consider that all three belong in the same species.

As an aside, it is appropriate to mention here an independent, biological, character that supports the synonymy of *A. parvula* with *Cer. lineaticornis*. The "mass of rubbish" (Banks 1903: 144) that encloses the cocoon from which the *A. parvula* type emerged consists largely of spiny trichomes. *Cer. lineaticornis* larvae are the only *Ceraeochrysa* larvae known to carry and incorporate spiny trichomes into their cocoons (Eisner *et al.* 2002).

Conclusion: It appears that the recognition (by Freitas *et al.* 2009) of *Cer. parvula* as a valid species (with *Cer. columbiana* as a junior synonym) was based on an obvious error and conjecture. We consider that the earlier identifications (by Bram & Bickley 1963 and Adams' 1982) of *A. parvula* and *C. columbiana* as junior subjective synonyms of *Cer. (=C.) lineaticornis* are correct and should be maintained.

Moreover, the specimen with dark genae illustrated as *Cer. parvula* in Freitas *et al.* (2009: 567, Figs. 39C and 39D) is clearly not the holotype of either *A. parvula* or *C. columbiana*. Its identity should be re-evaluated. Other than the *A. parvula* and *C. columbiana* type specimens, the only specimen of *Cer. parvula* that Freitas *et al*. (2009) reported to have examined is a male from Honduras [in the California Academy of Sciences (CAS)]. Thus, we conclude that the illustrations mentioned above were derived from this specimen. Given that it was collected far from the previously reported range of *Cer. lineaticornis* (and its two synonyms) and given its dark genae, the identification should be re-evaluated.

Ceraeochrysa placita (Banks, 1908), genus *incertae sedis*

Chrysopa placita Banks, 1908: 259 [MCZ, Lectotype].

Ceraeochrysa placita (Banks). First combination in *Ceraeochrysa* by Adams (1982: 73). Removed from *Ceraeochrysa* by Tauber (2003: 484). Combination reinstated by Freitas *et al.* (2009: 568). We consider the generic placement uncertain and refer to the species as *Ceraeochrysa placita* (Banks), genus *incertae sedis*.

Chrysopa forreri Navás, 1913–14 [1914]: 97 [Syntype, The Natural History Museum, London (BMNH)]. Junior subjective synonym of *Cer. placita* by Adams (1982: 73). Here, recognized as a junior subjective synonym of *Ceraeochrysa intacta* (Navás) (see below).

Chrysopa intacta Navás, 1912: 199 [Neotype, Canadian National Collection, Ottawa, (CNC)]. Junior subjective synonym of *Cer. placita* by Garland (1985a: 137). Here, recognized as a valid species currently included in *Ceraeochrysa* (see below).

Chrysopodes (Neosuarius) placitus (= *placita*) (Banks). First combination in *Chrysopodes (Neosuarius)* by Tauber (2003: 484). Removed from *Chrysopodes* by Freitas *et al.* (2009: 568). Generic and subgeneric association with *Chrysopodes (Neosuarius)* considered uncertain by Tauber (2010: 12).

The species was also referred to as *Oviedus placitus* (Banks) in an unpublished thesis (Garland 1982; see Garland & Kevan 2007: 59).

Background: Freitas *et al.* (2009: 568) recognized that the species name "*placita"* had commonly been used in the literature and on museum specimens to refer to two species. Thus, they redescribed *Ceraeochrysa placita* (Banks) and restricted the usage of the name. Also, they described the new species *Ceraeochrysa chiricahuae* Freitas and Penny to refer to the species that had not previously been differentiated from *Cer. placita* (Freitas *et al.* 2009: 594). There are significant differences between the *Chrysopa placita* Banks syntypes and the majority of specimens that previously had been identified as *C. placita* or *Cer. placita*; thus we concur that the two should be treated as separate species [see *Ceraeochrysa intacta* (Navás), genus *incertae sedis* below]. We also agree with Freitas *et al.* (2009) that the name *Cer. placita* refers to the less common species that currently is known only from western USA. However, several taxonomic problems presently surround the two species. As a first step in stabilizing the situation, it is important to designate a lectotype for *Chrysopa placita*.

Types: In his original description of *C. placita*, Banks (1908: 259) mentioned specimens from two localities (Clear Creek, and Chimney Gulch, Golden, Colorado); he did not designate a holotype or indicate the number of specimens in the type series. Five specimens that appear to be syntypes are in the MCZ (examined, CAT); one of these (a male) has a Banks "type" label, is recognized as the primary type on the MCZ database, and was referred to as the lectotype by Freitas *et al*. (2009: 569). We concur with this lectotype assignment, and we consider it important for stabilization of the nomenclature concerned with *Cer. placita* and the species with which it has been confused.

The labels on the lectotype read: (1) "Oslar / Chimney Gulch / Golden, Colo. / 7-20-07"; (2) "Collection / N. Banks"; (3) "type" [red (faded), Banks' hand]; (4) "Type / 11337" [red, printed & Banks' hand]; (4) "Chrysopa / placita/ Bks type [white, red border, Banks' hand]; (6) "Jan-July 2003 / MCZ Image / Database"; (7) LECTOTYPE / *Chrysopa placita* / Banks 1908; det. / C. Tauber & O. Flint '10" [red].

We have labeled the other four specimens (one male, three females) as paralectotypes. The three female specimens bear labels (1) and (2) identical to those above; each also has a third label reading "placita" [Banks' hand]; one has a fourth label with "Chrysopa placita B" [Banks' hand]. The male paralectotype has labels reading: (1) "Oslar / Clear Creek / Colo."; (2) "Collection / N. Banks"; (3) "placita" [probably P. A. Adams' hand]; (4) "MCZ / Museum of / Comparative / Zoology". Each has a label that reads: PARALECTOTYPE / *Chrysopa placita* / Banks 1908; det. / C. Tauber & O. Flint '10" [red]. We confirmed that all of the paralectotypes are conspecific with the lectotype.

Conclusion: The "express statement of the taxonomic purpose" above, now fulfills the requirements for designating the *C. placita* lectotype (Article 74.7 of the International Code of Zoological Nomenclature).

Also, it should be noted for *Cer. placita* that the branches of the Radial sector (especially the basal branches) of both the fore and hind wings are sinuate; in Freitas *et al.* (2009) this condition is described and illustrated only for *Cer. chiricahuae* (= *intacta* here).

Ceraeochrysa intacta (Navás, 1912), genus *incertae sedis*

Chrysopa intacta Navás, 1912: 199 [Original syntype reported to have been retained in Navás collection, probably destroyed; Neotype, CNC; designated by Garland (1985a: 137)]. Junior subjective synonym of *Cer. placita* by Garland (1985a: 137). Here, recognized as a valid species. **New status.**

Ceraeochrysa intacta (Navás). **New combination*.** We consider the genus to be uncertain and we refer to the species as *Ceraeochrysa intacta* (Navás), genus *incertae sedis*.

Chrysopa forreri Navás, 1913–14 [1914]: 97 [Syntype, BMNH]. Junior subjective synonym of *Cer. intacta*. **New synonymy.**

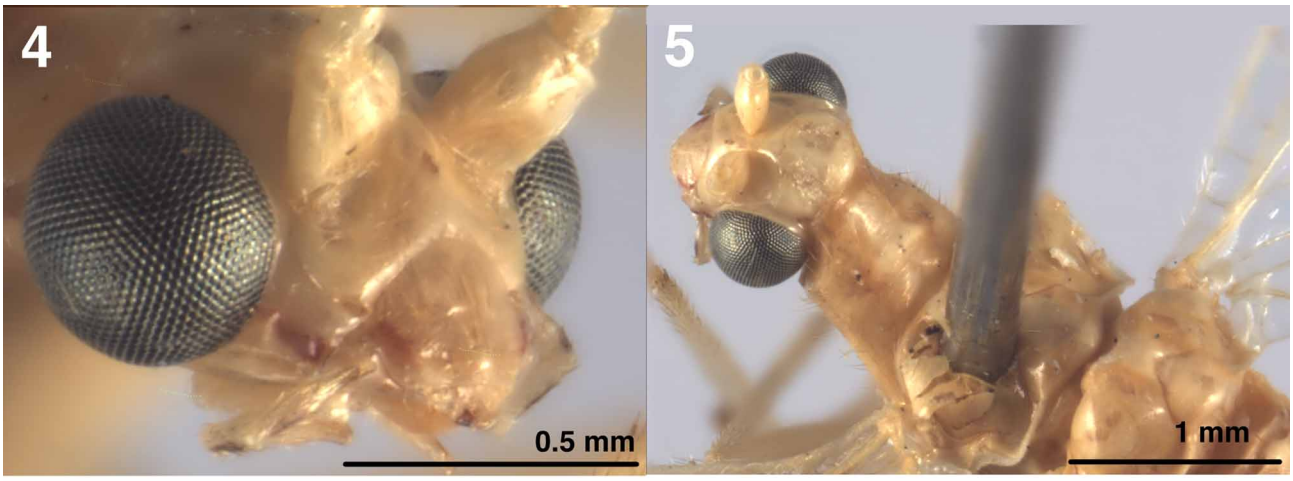
Ceraeochrysa chiricahuae Freitas and Penny, in Freitas *et al.* 2009: 594 [Holotype, CAS]. Junior subjective synonym of *Cer. intacta*. **New synonymy.**

* Published information concerning *Cer. intacta* under the name *placita/placitus* (as *Chrysopa, Ceraeochrysa, Chrysopodes (Neosuarius), Oviedus*) is listed by Garland & Kevan (2007: 59); other references include Tauber & de León (2001, as *Cer. placita*); Tauber (2010: 12, as *Chrysopodes placitus*).

Below we discuss three issues. The first concerns the name of the species that Freitas and Penny (in Freitas *et al.* 2009) recently described as distinct from *Cer. placita* and the identity of its synonyms; the second concerns morphological differences between that species and *Cer. placita*; and the third addresses the generic affiliation of the two species.

Species name and synonyms. *Chrysopa intacta* Navás, *Chrysopa forreri* Navás, and *Ceraeochrysa chiricahuae* Freitas and Penny are here recognized as subjective synonyms. The first two names are former synonyms of *Cer. placita*. The species-name with precedence is *C. intacta* Navás.

Types: Navás stated that he retained the type of *C. intacta* (collected in Toronto, Canada) in his personal collection. However, it has been missing for a long time. It is not in the Natural History Museum of Barcelona (MZB) (Garland 1985a: 137; Monserrat 1985: 237), nor was it found in the MNHN (Legrand *et al.* 2008). Garland (1985a: 137) designated a neotype (male), which resides in the Canadian National Collection (CNC); it was collected from Kazabazua, Québec, Canada (Fig. 6), and he recognized the species as a junior subjective synonym of *Cer. placita*. In their revision, Freitas *et al.* (2009) did not indicate that they had examined the specimen. Our (CAT) examination indicates that Garland's neotype is conspecific with *Cer. chiricahuae* of Freitas and Penny (in Freitas *et al.* 2009). It has red markings on the gena and clypeus, a pale, unmarked vertex, a slight rosy tinge sublaterally on the pronotum, sinuate branches of the radial sector, and slightly enlarged costal cells (Figs. 4, 5, 7 here) – all features that Freitas and Penny used to characterize *Cer. chiricahuae*. In addition, the genitalia closely resemble those illustrated by Freitas and Penny for *Cer. chiricahuae*.



FIGURES 4–5. *Chrysopa intacta*, neotype (CNC). 4, Head, frontolateral. 5, Head, thorax, dorsolateral.

Chrysopa forreri Navás was described from Mexico City, and the syntype is in the BMNH. Freitas *et al.* (2009) did not list the syntype among the specimens that they had examined; our (CAT) examination of the specimen (abdomen missing, sex unknown) indicates that it is conspecific with the *C. intacta* neotype. It shares all the external features listed above for *Cer. chiricahuae* and the *C. intacta* neotype.

In addition to the *C. forreri* type from Mexico City, we (CAT) have seen a number of *C. intacta* specimens from Mexico. There is a series of thirteen specimens from Durango [in the San Diego County Museum of Natural History (SDMNH)] and one specimen from Chihuahua, Mexico [Royal Ontario Museum, Ottawa (ROM)]. There also is a record from Michoacan, Mexico (Oswald *et al.* 2002: 578). Thus, the *C. forreri* type currently represents the southern-most record for *Cer. intacta.*

Conclusion: We conclude that *Ceraeochrysa intacta* (Navás) is the valid name for the species that Freitas and Penny (in Freitas *et al.* 2009) differentiated from *Cer. placita*. It has two junior subjective synonyms – *C. forreri* and *Cer. chiricahuae*.

Genitalic differences between *Ceraeochrysa placita* and *Cer. intacta* females.

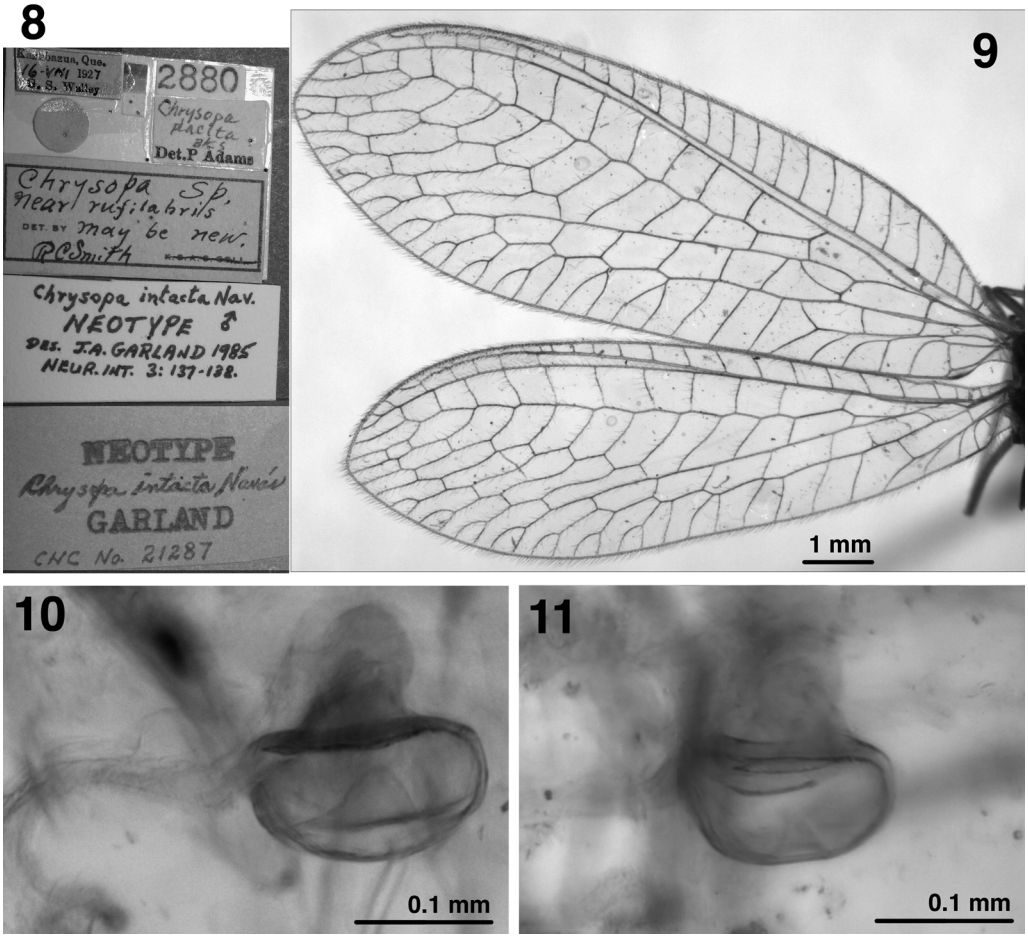
Background & discussion: Freitas and Penny (in Freitas *et al.* 2009) described genital differences between the males of *Cer. placita* and the species they referred to as *Cer. chiricahuae* (= *Cer. intacta* here)—

specifically, they stated that the *Cer. placita* gonocornua are "much longer" than those of *Cer. intacta*. Indeed, the gonocornua of the two known male *Cer. placita* specimens (the MCZ syntypes) appear longer than those of *Cer. intacta* males; they are also more robust basally and more closely aligned mesally than those of *Cer. intacta*.

Freitas *et al.* did not treat the females of the two species in their revision. Our examination of numerous female *Cer. intacta* specimens and four cleared and dissected *Cer. placita* females [two paralectotypes, one of two non-types from New Mexico [National Museum of Natural History, Washington, DC (USNM)], and another non-type from Oregon (MCZ)] showed significant differences between the females of the two species. First, among the female *Cer. placita* specimens that are cleared, all have smaller spermathecal invaginations than do the *Cer. intacta* females that we examined (compare Figs 8 and 9 here). Second, on *Cer. intacta* females, the lobe at the tip of the seventh sternite (first discovered and considered to be the praegenitale by Garland 1982: 254, Fig. 116) is elongate and has well defined sides; it protrudes beyond the tip of sternite VII (Fig. 10b). In contrast, the *Cer. placita* praegenitale is shorter and compressed, with folded sides; it protrudes very little, if at all, from beneath the seventh sternite (Fig. 10a).

It is noteworthy that the *Cer. intaca* praegenitale can express two types of asymmetry. Garland (1982, 1985b; Garland & Kevan [2007, as *Chrysopodes (Neosuarius) placita*] reported that the *Cer. intacta* praegenitale bears, asymmetrically, a single stiff, robust seta at its tip; indeed, we also found the seta, but only on some, not all specimens. However, we noted that on some specimens the tip of the praegenitale can be asymmetrically expanded on one side and not the other. The significance of the two forms of asymmetry is unknown.

Conclusion: Females of *Cer. placita* and *Cer. intacta* express consistent and taxonomically useful, genitalic differences.



FIGURES 6–9. *Ceraeochrysa intacta* . 6, Labels, neotype (CNC). 7, Left wings, neotype (CNC). 8, Spermatheca, Contra Costa County, California [Essig Museum, University of California, Berkeley (UCB)]. 9, *Ceraeochrysa placita*, Spermatheca, paratype (MCZ).

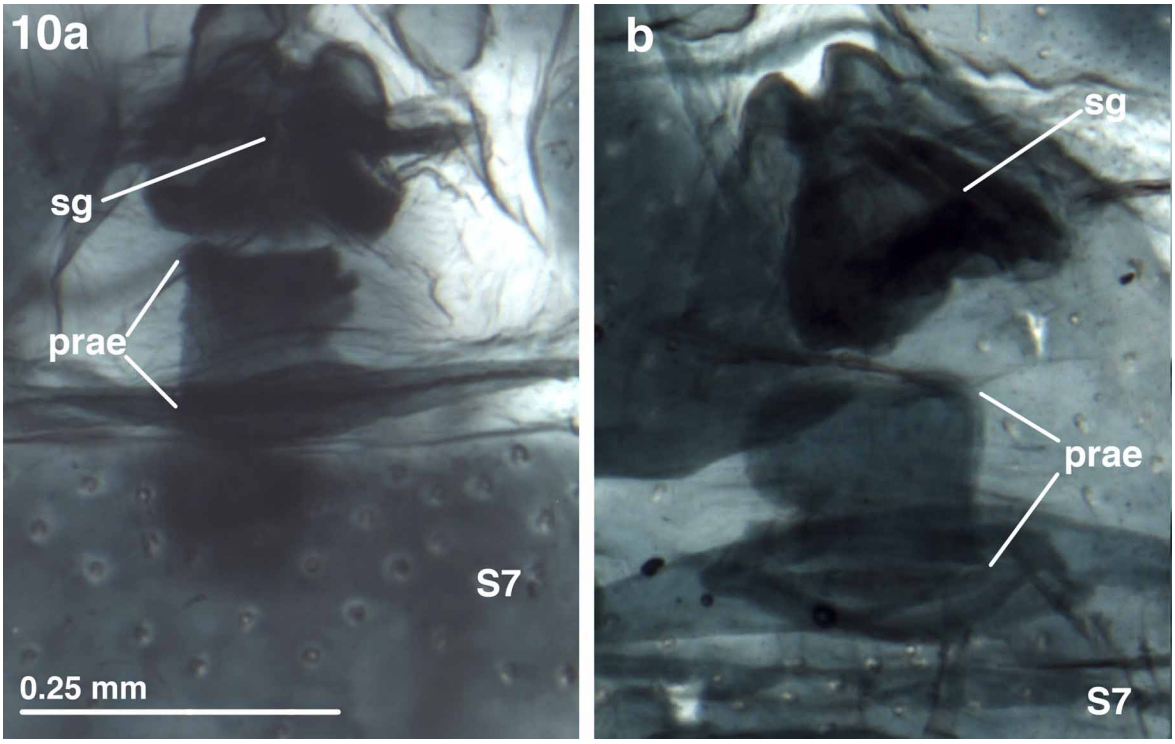


FIGURE 10. Praegenitale of (a) *Ceraeochrysa placita* (Navás), genus *incertae sedis* and (b) *Ceraeochrysa intacta* (Navás), genus *incertae sedis*. The scale applies to both illustrations. Abbreviations: prae, praegenitale; sg, subgenitale; S7, seventh abdominal sternite.

Generic assignments of *Ceraeochrysa placita* and *Cer. intacta.*

Background: Freitas *et al.* 2009: 594 reversed Tauber's (2003) transfer of *Cer.placita* (now = *Cer. intacta*) from *Ceraeochrysa* to *Chrysopodes*. Tauber's transfer of the species to *Chrysopodes* was made largely on the basis of a long series of features on the *intacta* larvae that are more typical of *Chrysopodes* than *Ceraeochrysa*. Freitas *et al.* (2009) made the change in generic assignment because *Cer. intacta* (= *Cer. chiricahuae* of Freitas and Penny) and *Cer. placita* males have two major genitalic features that are typically expressed by *Ceraeochrysa*, and not by *Chrysopodes*: an elongate, tubular gonapsis and elongate gonocornua on the gonarcus.

Discussion: We agree with Freitas *et al.* (2009) that the presence of *Ceraeochrysa*-like gonapsides and gonocornua on *Cer. intacta* and *Cer. placita* are inconsistent with the species' placement in *Chrysopodes*. Nevertheless, we continue to question the assignment of the two species to *Ceraeochrysa* for two reasons:

(i) The female genitalia of both *Cer. intacta* and *Cer. placita* (Figs. 8, 9 here) differ markedly from those of all other known *Ceraeochrysa* females. Specifically, *Ceraeochrysa* females have characteristically elongate, U-shaped spermathecae that open to the bursa copulatrix via an elongate slit; they also have deep invaginations (see illustrations in Adams & Penny 1985; Brooks & Barnard 1990; Freitas & Penny 2001; Freitas et el. 2009; Tauber 2003). In contrast, females of both *Cer. intacta* and *Cer. placita* have pillbox-shaped spermathecae that connect to the bursa via the vellum and a short bursal duct; they also have shallow invaginations [described and figured by Garland (1982, as *Oviedus placitus*, unpublished combination; Tauber 2003, as *Chrysopodes placita*)]. None of these features are typical of either *Ceraeochrysa* or *Chrysopodes*. Moreover, females of both *Cer. intacta* (Garland 1982: 254, Fig. 116; Garland 1985b: 741) and *Cer. placita* (see Fig 10a, b here) have a lobe (praegenitale) at the tip of the seventh sternite that has not been reported for any other *Ceraeochrysa* or *Chrysopodes* species.

(ii) Despite the statement by Freitas *et al.* (2009: 505) to the contrary, an extensive suite of diagnostic larval features has been shown to distinguish *Ceraeochrysa* from other neotropical chrysopid genera (Tauber *et al.* 1998, 2000; Tauber 2003). The characters are from both Semaphoront A (first instar: 12 characters) and Semaphoront B (second and third instars: 18 characters each); they were scored for the larvae of twelve

Ceraeochrysa species, including *Cer. intacta* (as *"placita"*) and seven *Chrysopodes* species (Tauber 2003). The results of Tauber's (2003) study demonstrated numerous, very striking differences between the *Cer. intacta* larvae and those of other *Ceraeochrysa* species. The larvae showed strong [albeit, incomplete] similarity with those of the *Chrysopodes* species.

Conclusion: The generic assignments of *Cer. intacta* and *Cer. placita* continue to present a problem because their male, female and larval characters appear to provide contradictory information. Specifically, the male genitalia share more features with *Ceraeochrysa* than with *Chrysopodes*; the female genitalia are not consistent with those of either *Ceraeochrysa* or *Chrysopodes*; and, the larval characters (*Cer. intacta*) are much closer to *Chrysopodes* than to *Ceraeochrysa*.

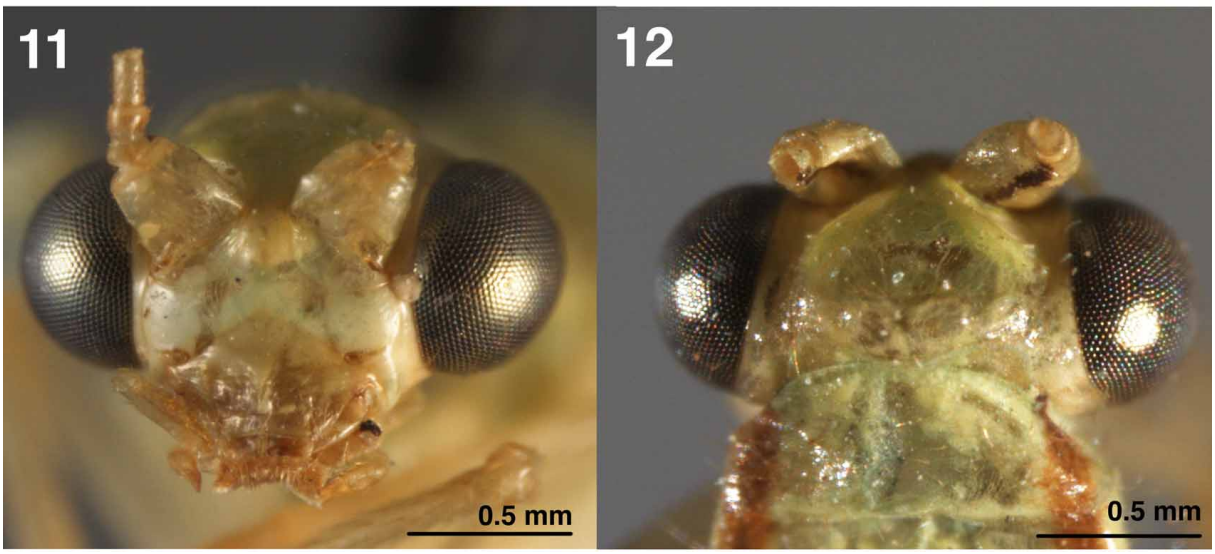
Given the ambiguities, we propose that it is preferable to admit uncertainty concerning the two species' generic assignments than it is to place the species in an inappropriate genus. Thus, we recommend retaining the species in *Ceraeochrysa* temporarily, recognizing that *Ceraeochrysa* is paraphyletic, and referring to the species as *Ceraeochrysa placita* (Banks), genus *incertae sedis* and *Ceraeochrysa intacta* (Navás), genus *incertae sedis* until further studies are conducted. This recommendation highlights the need for broadly based research that ultimately promotes nomenclatural stability.

Freitas *et al.* (2009: 597) claim that larval features should not be used in assigning chrysopid species to genera because the larvae of too many species are unknown; they stated that doing so "… raises doubts about dozens of other species and great nomenclatorial instability." We disagree strongly with this stance, and we refer readers to the following literature that substantiates the taxonomic value of chrysopid larval characters (Principi 1948–49; Díaz-Aranda & Monserrat 1995; Tsukaguchi 1995; Díaz Aranda *et al.* 2001; Tauber 2003; Tauber *et al.* 2006). Rather than ignoring the larval characters, we encourage neuropterists to obtain and characterize the larvae of previously unstudied taxa.

***Ceraeochrysa rochina* (Navás, 1915) = *Ceraeochrysa cincta* (Schnieder, 1851)**

Chrysopa rochina Navás 1915: 195 [Lectotype (not holotype), MNHN].

Ceraeochrysa rochina (Navás). First combination in *Ceraeochrysa* by Adams (1982: 73). Junior subjective synonym of *Cereaochrysa cincta* (Schneider, 1851) by Legrand *et al.* (2008:165). Recognized as a valid species and combination reinstated by Freitas *et al.* (2009: 574). Here: **Synonymy with *Ceraeochrysa cincta* reinstated.**



FIGURES 11–12. *Chrysopa rochina*, lectotype (MNHN). 11, Head, frontal. 12, Head and part of pronotum, dorsal. Note: The dark mark on the left maxillary palp in Fig. 11 is a bit of debris, not intrinsic coloration.

Background: Legrand *et al.* (2008: 165) treated *Chrysopa rochina* (Navás) as a junior subjective synonym of *Ceraeochrysa cincta* (Schneider) with little supporting evidence. Freitas *et al.* (2009: 574) questioned the synonymy and recognized *Ceraeochrysa rochina* as a valid species. However, they appear to have done so based on erroneous information. Here, we provide visual evidence that corrects the errors and supports the synonymy.

Type: (i) Navás (1915: 195), in his original description of *C. rochina*, stated that the antennae are "flavis", not black, as stated by Freitas *et al.* (2009: 574); (ii) the figure that accompanies Navás' original description of *C. rochina* shows pale (not dark) scapes and pedicel, each with a dorsal stripe (Navás 1915: 195, his Fig. 6); and (iii) the basal flagellomeres on the *C. rochina* lectotype (MNHN) and paralectotype (MZB) are pale (not black) (Figs. 11, 12 here, CAT notes). In these features, the *C. rochina* lectotype clearly resembles *Cer. cincta*.

The head, thorax and one forewing remain on the *C. rochina* lectotype, and its genitalia (female) are cleared and contained in an attached vial. The head of the pinned specimen has a brown longitudinal stripe on the dorsum of the scape and pedicel, as in *Cer. cincta*, and the thoracic markings are those of *Cer. cincta* (Figs 11, 12 here). Moreover, the female genitalia are similar to those figured for *Cer. cincta* by Adams & Penny (1985: 440, Figs 110–113) and Freitas *et al.* (2009: Figs 14D, E, G).

Conclusion: We consider the synonymization of *C. rochina* with *Cer. cincta* to be well justified.

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