Zootaxa 3615 (1): 001–060
www.mapress.com/zootaxa/

Monograph

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

http://dx.doi.org/10.11646/zootaxa.3615.1.1
http://zoobank.org/urn:lsid:zoobank.org:pub:D53E1122-AA33-4152-90BE-3D717979C648

ZOOTAXA

3615

Revision of the genus *Coletinia* (Zygentoma: Nicoletiidae) in the Iberian Peninsula, with descriptions of nine new species

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Magnolia Press
Auckland, New Zealand

Accepted by E. Bernard: 6 Dec 2012; published: 15 Feb. 2013

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(*Zootaxa* 3615)

60 pp.; 30 cm.

15 Feb. 2013

ISBN 978-1-77557-106-3 (paperback)

ISBN 978-1-77557-107-0 (Online edition)

FIRST PUBLISHED IN 2013 BY

Magnolia Press

P.O. Box 41-383

Auckland 1346

New Zealand

e-mail: zootaxa@mapress.com

http://www.mapress.com/zootaxa/

ISSN 1175-5326 (Print edition)

ISSN 1175-5334 (Online edition)

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Abstract

The discovery of several members of the genus *Coletinia* Wygodzinsky, 1980, from subterranean habitats (endogean and troglobiont), prompted the review of this genus in the Iberian Peninsula. Most of the samples came from caves of the Mediterranean basin of Spain, from Cádiz to the Tarragona province. As a result of this revision, nine new species have been established: *C. herculea* n. sp., an endogean from Cádiz; *C. vergitana* n. sp. from the Gádor calcareous mountains in Almería; *C. calaforrai* n. sp. from the gypsum karst in Almería; *C. intermedia* n. sp. from caves in Murcia and Alicante; *C. diania* n. sp., found in the north of the province of Alicante; *C. longitibia* n. sp. and *C. tessella* n. sp., both troglobites from Valencia; *C. redetecta* n. sp. from Castellón caves and finally *C. hernandoi* n. sp., an endogean from Tarragona. Moreover, *Coletinia maggii* (Grassi, 1887) is reported for the first time in the Iberian Peninsula, and new data are presented regarding *C. mendesi*, *C. tinauti* and *C. capolongoi* that widen their geographic distribution and enhance the information about their anatomic characteristics and biology. These results increase the number of known species of this genus to 14 in the region and to 21 in the world. The new species are described and compared with the most closely related previously known species of the genus. Characters with the most taxonomic relevance are discussed using optical and scanning microscope studies. A key for the identification of the Iberian *Coletinia* species and a distribution map including all of them are also provided.

Key words: Coletiniinae, Thysanura, Spain, taxonomy, identification key, endogean fauna, troglobitic fauna

Resumen

El hallazgo de numerosas muestras del género *Coletinia* Wygodzinsky, 1980, integrado por especies subterráneas (endogeas y troglobias), permite la revisión de dicho género en la Península Ibérica. La mayoría de estas muestras proceden de cuevas situadas en provincias mediterráneas, desde Cádiz a Tarragona. Como resultado de esta revisión, se describen nueve nuevas especies: *C. herculea* n. sp., endogea de Cádiz; *C. vergitana* n. sp. procedente de la sierra de Gádor en Almería; *C. calaforrai* n. sp. del karst en yesos de Almería; *C. intermedia* n. sp., de cuevas de Murcia y Alicante; *C. diania* n. sp., encontrada en el norte de la provincia de Alicante; *C. longitibia* n. sp. y *C. tessella* n. sp., ambas troglobias de Valencia; *C. redetecta* n. sp., de cuevas de Castellón, y finalmente *C. hernandoi* n. sp., endogea de Tarragona. Además, *C. maggii* (Grassi, 1887) se cita por primera vez en la Península Ibérica, y también se aportan nuevos datos sobre *C. mendesi*, *C. tinauti* y *C. capolongoi* que amplían su distribución geográfica y la información disponible sobre sus caracteres anatómicos y biología. Estos resultados incrementan el número de especies conocidas de este género hasta 14 en el área ibérica y hasta 21 a nivel mundial. Las nuevas especies se describen y comparan con las previamente conocidas y más estrechamente relacionadas del género. Se discuten los caracteres con mayor interés taxonómico, utilizando estudios tanto de microscopía óptica como de microscopio electrónico de barrido. Se proporciona también una clave para la identificación de las *Coletinia* ibéricas y un mapa de distribución de las mismas.

Introduction

The genus *Coletinia* Wygodzinsky, 1980 belongs to the family Nicoletiidae (order Zygentoma = Thysanura s. str.) and includes species from subterranean environments collected in the Southwest Palaearctic region; one species has also been described from Brazil (Mendes & Ferreira, 2002). Prior to this study, 12 species belonging to this genus were known, 4 of which were endemic to the Iberian Peninsula (continental Portugal and Spain): *C. mendesi* Wygodzinsky, 1980, *C. capolongoi* Wygodzinsky, 1980, *C. asymetrica* Mendes *et al.* 1985 and *C. tinauti* Molero *et al.*, 1997. Additional data about the previous knowledge of these 12 species are presented in Table 1.

Difficulties in canvassing the habitats (endogean medium and caves) where these insects occur have resulted in a scarcity of knowledge about this genus. Fortunately, samples recently provided by Spanish biospeleologic teams have increased the number of specimens of Nicoletiidae available for taxonomic and biologic research on these poorly known thysanurans. As a result of the study of these specimens, nine new species and new faunistic data are presented in this work.

tessella **n. sp.** a truncated posterior border of the eighth urosternite in males, and also a truncated straight posterior border of the subgenital plate in females. Nevertheless, the eighth urosternites of both species are not as straight posteriorly as in *C. tessella* **n. sp**. These three species are related, but *C. tessella* **n. sp.** is longer, has a higher number of sensory pegs on urotergite X and a higher tibial L/W ratio than the other two species.

Compared with *C. calaforrai* **n. sp**., *C. tessella* **n. sp**. shows a more irregular covering of setae on the tenth urotergite and a higher ratio L/W of the distal article of the maxillary palp.

Compared with *C. intermedia* **n. sp**., *C. tessella* **n. sp.** shows also a more concave posterior margin of the Xth urotergite in males and more straight in females, a slightly shorter subgenital plate and shorter ovipositor.

Coletinia redetecta Molero, Bach & Gaju new species

Figs. 2A, 7, 102–116

= *Coletinia* sp. II in Wygodzinsky (1980).

Studied material. Castellón, Sant Mateu, Cova dels Encenalls, 21 March 2003, male holotype and 1 female paratype, S. Montagud *et al.* coll., captured directly, deposited in MVHN, Cod.: 231108BM32; Castellón, Cabanes, Avenc d'En Serenge, 2 February 2003, 1 male paratype, S. Montagud *et al.* coll., deposited in MVHN, Cod.: 231108BM33; Castellón, Coves de Vinromá, Cova del Mas d'Abat, 17 June 2005, 1 female paratype, F. Fadrique leg., deposited in UCO, Ref. Z2171.

Description. Body length 11–11.5 mm in males, up to 15.5 mm in females. Body uniformly pale yellowish to pale brown, or yellowish with a brownish abdomen.

Macrosetae with a high degree of spiralization; on the head, pedicellus and coxae the number of turns reaching 8–10, these highly twisted macrosetae also inserted on the maxillae and femora (Fig. 2A).

Head with scattered, thin and short setae and a few bifid macrosetae (Fig. 102).

Antennae of the male symmetrical; pedicellar apophysis with its structure resembling *C. capolongoi*, bearing an apical glandular cone (in males, internal glands behind the setae clearly visible by O.M.) and a subapical platelike process with rounded upper margin connecting to the base of the glandular cone through a region of smooth and more sclerotized tegument with an indentation in the upper margin and defining a subapical cavity (Fig. 103). In both observed males, one bifid macroseta inserted near this cavity and an insertion of another macroseta; pedicellus also bearing three long, highly spiralized macrosetae. Tegument of the scapus, pedicellus and basal trunk of the apophysis squamose; basal trunk bearing few thin and relatively long setae. The apical part of the apophysis reaching its limit between the fourth and fifth joints of the flagellum.

Distal article of maxillary palp 5.7 times longer than wide and approximately 1.2 longer than the penultimate article (Fig. 104).

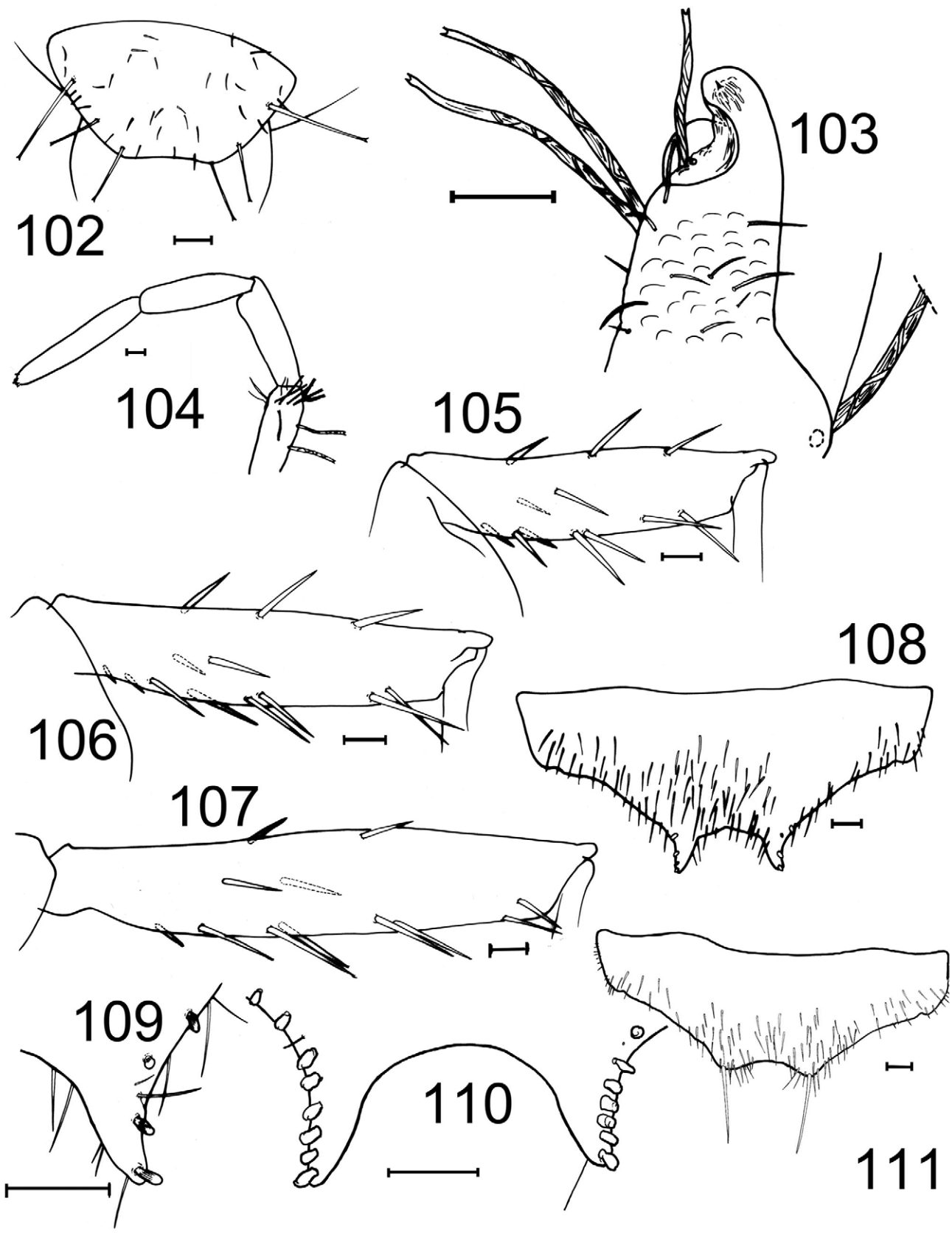
Nota as is usual in the genus. Tibiae relatively long; their L/W ratios given in Table 2. Most tibial spines equal to or shorter than diameter of the tibiae, subdistal ventral spines slightly longer than width of the tibiae. All tibiae with 2 or 3 dorsal, 1 or 2 lateral and usually more than 6 ventral spines; metatibia sometimes with only one dorsal spine. Ventral spines of 2 subdistal, 2 mediobasal and 2 or more basal spimes; additional thin and short spines present mediobasally or basally on the ventral side of tibiae (Figs. 105–107).

Urotergites I-IX typical. Tenth urotergite of male with a concave rear edge between the posterolateral lobes (Fig. 108); margin with obtuse angle in the holotype, more rounded in the other male observed (Fig. 110). Urotergite of holotype appearing somewhat folded in its midline. Posterolateral lobes with 4–8 sensory pegs each; in holotype only 4+4 pegs visible (Fig. 109), but number possibly as posterior segments not well preserved; the other male bearing 7+8 pegs (Fig. 110). In the female, tenth urotergite has with concave posterior border, and its disc extensively covered with thin setae (Fig. 111).

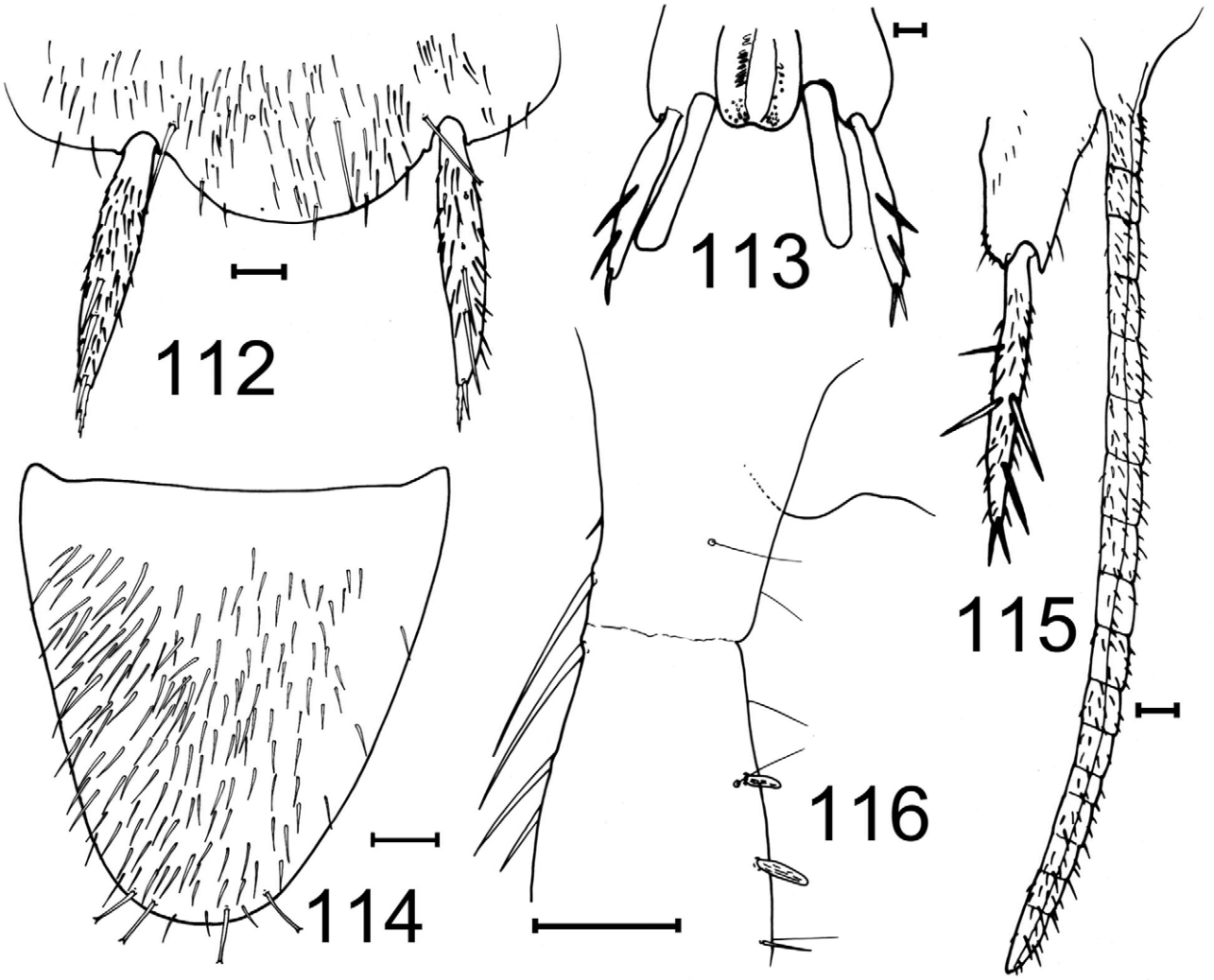
Urosternites I-VII without remarkable characters, with 1+1 discal, 1+1 submedian and 1+1 sublateral bifid macrosetae. Eighth urosternite of the male protruding, convex, nearly flattened and straight near the midline (Fig. 112).

Parameres as long as ninth stylets, somewhat collapsed in the holotype, about 5–6 times longer than wide (Fig. 113).

Subgenital plate of the female with strongly convex hind border and slightly longer than wide at its base (Fig. 114). Ovipositor long with 19–20 divisions, surpassing the level of the ninthth stylets by 1.5–2 times their length (Fig. 115).



FIGURES 102–111. *Coletinia redetecta* **n. sp.** 102. Chaetotaxy of the frons. 103. Pedicellar apophysis of the male. 104. Maxillary palp. 105. Protibia. 106. Mesotibia. 107. Metatibia. 108. Urotergite X of the holotype male. 109. Detail of the sensory pegs of urotergite X of the holotype. 110. Hind border and posterolateral lobes of urotergite X in male from Avenc d'en Serenge. 111. Urotergite X of paratype female. Scales: 0.1 mm.



FIGURES 112–116. *Coletinia redetecta* **n. sp.** 112. Urosternite VIII of the male. 113. Stylets IX and paramera. 114. Subgenital plate of the female. 115. Ovipositor and stylet IX. 116. Basal portion of the cercus of the male. Scales: 0.1 mm.

Male cerci with 0+2 sensory pegs in holotype (Fig. 116) and 2+3 pegs in the specimen from Cabanes; the paracercus apparently lacking sensory pegs.

Etymology. The specific name of this species means "discovered again" and refers to the history of this species commented on in the discussion section.

Remarks. The historic background to the description of *C. redetecta* **n. sp**. is interesting. In the same work in which Wygodzinsky (1980) described the genus *Coletinia*, he also cited *Coletinia* sp. II, a female, from the Cova dels Ensenalls, San Mateu. The species was believed to be new, but was not described as the male was not known. Nevertheless, some taxonomically relevant characteristics of the female, such as the shape and setal pattern of the tenth urotergite, and the ovipositor, were included and drawn.

A sample from the same cave was collected in recent years, with the male and the female collected together to allow their description as a new species. The female characteristics agree with those described by Wygodzinsky (1980), particularly the tenth urotergite; the ovipositor of the specimen studied by him appears to be somewhat shorter than that of the specimens studied here, but it is likely that his female was a subadult insect, and that the gonapophyses were not completely developed. Moreover, two additional samples from other caves in the same geographic region were found to be conspecific and provided details about the variability of this species.

The most important difference between *C. redetecta* n. sp. and the remaining species of the group "*capolongoi"* is the higher number of tibial spines. Moreover, this species shows a high degree of macrosetal spiralization when mounted in Tendeiro medium.

The distal article of the maxillary palp is relatively short, about 5–5.75 times longer than wide and 1.15–1.45 times longer than the penultimate article.

L/W ratios of the tibiae are presented in Table 2; *C. tinauti* has shorter tibiae than related species, in which the metatibiae are approximately 4.5 times longer than wide. All of the tibiae have 1–3 dorsal, 1 lateral and 4–5 ventral spines, and sometimes 1–2 additional short ventrobasal spines (see Fig. 2.3 of the original description).

The tenth urotergite has a concave posterior border (Fig. 158) and 4–6 sensory pegs. These pegs are similar to those of *C. capolongoi*, subcylindrical, with striated tegument and a ventroapical furrow where the striations converge (Fig. 9B). Setae irregularly cover the disc of the urotergite in both sexes. In females, the posterior border is slightly concave (Fig. 159).

The eighth urosternite of the male protrudes, with its posterior border convex and rounded (Fig. 160). Paramera are relatively short, about 4-5,5 times longer than wide (Fig. 161). The subgenital plate of the female is approximately as long as wide at the base or slightly longer than wide, with a truncated and almost straight posterior border (Fig. 162). The long ovipositor long has 18–20 divisions and extends beyond the tip of the ninth stylets by 2.4–2.7 times their length. Cerci of the male have 2–6 acute sensory pegs; the paracercus lacks true pegs but possesses 1 or 2 short spines (Fig. 163).

Coletinia maggii (Grassi, 1887)

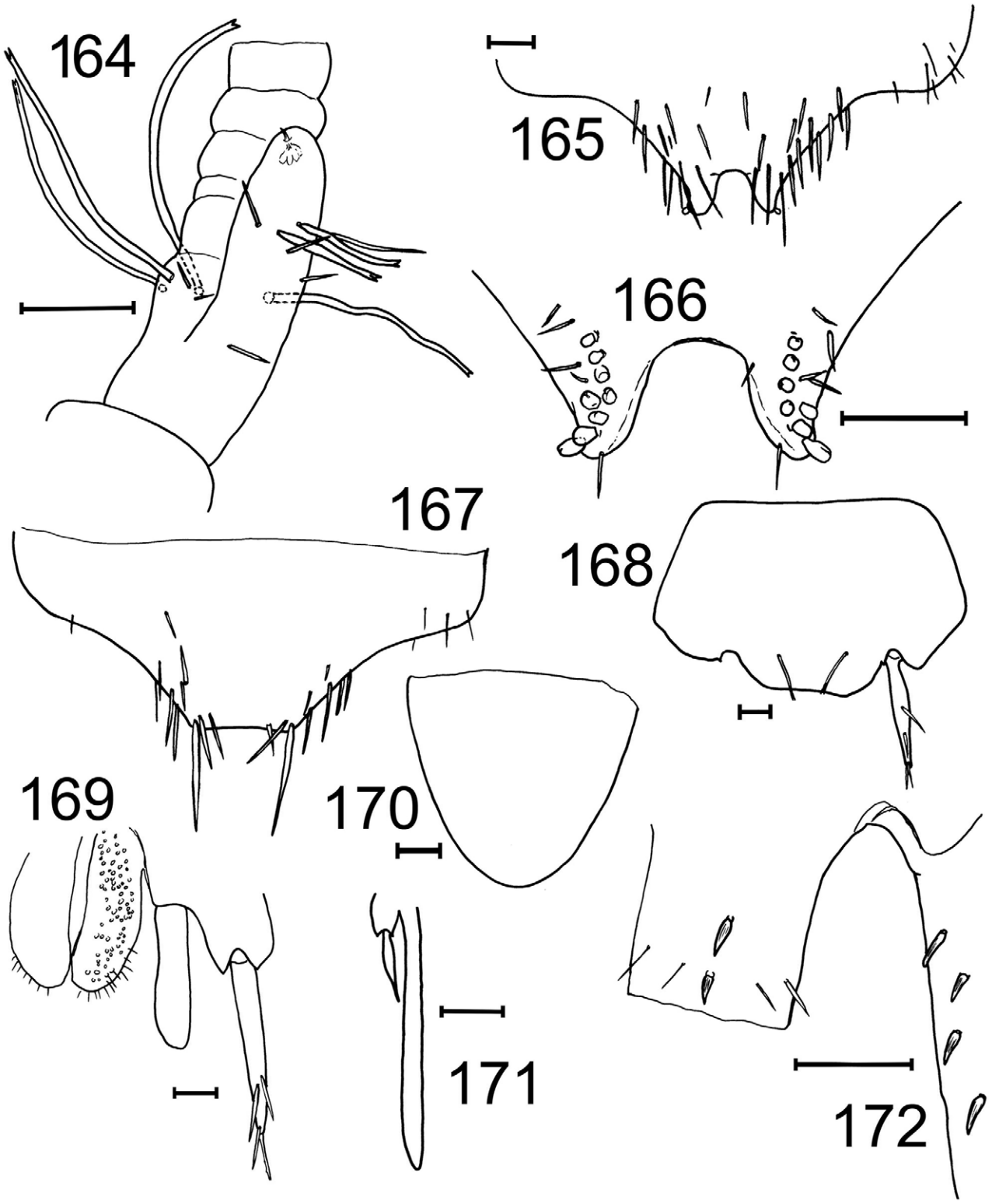
Figs. 164–172

Studied material. Burgos, Cueva Grande, Atapuerca. July 2003. J. Zaragoza, V. Ortuño and A. Sendra leg., 1 male, deposited in MVHN, Cod.: 201206RV53; Burgos, Cueva de Atapuerca, 30 May 1975, A. Serra leg., 1 female, published in Molero-Baltanás *et al.* (1997) as *Coletinia* sp. VI, deposited in UCO, Ref. Z1959; Burgos, Barbadillo de Herreros, road to Monterrubio de la Demanda, 25 August 1992, inside a nest of *Messor capitatus* (Formicidae), 1 female, published in Molero-Baltanás *et al.* (1997) as *Coletinia* sp. VI, deposited in UCO, Ref. Z1870. A male specimen from northern Italy, lent by L. F. Mendes, also was examined.

Descriptive remarks. The specimens from Burgos agree well with the redescription by Wygodzinsky (1980). The body length of the male is 9 mm, and both females are approximately 10 mm long. Macrosetae arew moderately twisted, those of the coxa with 3–5 turns. Apophyses of the antennal pedicellus of the male are simple, subcylindrical and apically rounded (Fig. 164, also see Wygodzinsky 1980, Figs. 4A, 4B). In the male from Burgos, the apical part of the apophysis reaches the fourth joint of the flagellum. L/W ratio of tibiae are as follows: protibiae 3.1–3.8, mesotibiae 3.5–4.1, metatibiae 4–4.5. Each tibia with 1 dorsal spine inserted in the distal half, 1 lateral spine inserted basally, and 4 ventral spines. Lateral spines on the protibiae and mesotibiae are inserted more dorsally than those on the metatibiae. The tenth urotergite of the male has a nearly semicircular emargination in the posterior border between the posterolateral lobes (Fig. 165); the shape in our specimens fall within the range of variability given in Wygodzinsky (1980). The disc of this urotergite is irregularly covered with thin setae (male) and devoid of setae in females, where the hind margin is typically straight across (Fig. 166); posterolateral lobes in the male specimen have 8+8 sensory pegs arranged in two irregular rows (Fig. 167). Urosternite VIII of the male protrudes posteriorly and has a straight hind margin (Fig. 168). Paramera slightly shorter than the ninth stylets and about 4–4.5 times longer than wide (Fig. 169). Subgenital plate semielliptical, wider at the base than long (Fig. 170) and with a rounded posterior border. The ovipositor has 20 and 21 divisions in the two females available, and extends beyond the ninth stylets by 2–3 times their length (Fig. 171). The cerci of the Iberian male bear 3–4 acute sensory pegs and the paracercus has 2 spiniform basal pegs (Fig. 172).

Coletinia sp.

Studied material. Castellón, Eslida, Cova Ferrera, 11 January 2004, 1 male and 1 juvenile (both in poor condition), deposited in UCO, Ref. Z2191; Córdoba. Montoro, 12 September 1991, 1 subadult male in poor condition (UCO Ref. Z2073); Jaén, Villacarrillo, Cueva de la Morciguilla, 24 March 2002, GEV leg., 1 female (UCO Ref. Z2178); Málaga, Antequera, Cueva del Yeso III, 28 September 2008, GEV leg., 1 female (UCO Ref. Z2179); same locality, 4 May 2009, GEV leg., 1 incomplete male (UCO, Ref. Z2180).



FIGURES 164–172. *Coletinia maggii*, specimens collected from Burgos. 164. Pedicellar apophysis of the male. 165. Urotergite X of the male. 166. Sensory pegs of urotergite X of the male. 167. Urotergite X of a female. 168. Urosternite VIII of the male. 169. Stylet IX and paramera. 170. Subgenital plate of the female. 171. Ovipositor. 172. Basal portion of the terminal filaments of the male. Scales: 0.1 mm, except Fig. 171: 0.5 mm.

Descriptive remarks. The absence of adult males and the poor condition of the material do not allow the specific identification of these samples. It is likely that in some cases, these insects correspond to new species, but supplementary material must be collected to confirm this and describe them.

Discussion and general conclusions

1. Species of the "*asymetrica* group". Two new species are described belonging to this group: *Coletinia herculea* **n. sp.** and *C. vergitana* **n. sp.** In addition to the presence of asymmetric apophyses in the pedicel of males (the left apophysis is much more developed than the right one), all of the species in this group also share other features, such as the cephalic setation, a long and thin ovipositor with a high number of divisions (20 or more) and, at least in the Iberian species, a convex and more or less protruding posterior border of the VIIIth urosternite in males.

The most surprising feature of both new species is the different condition of the antennae in the adult and subadult specimens. While the juvenile has nearly symmetrical apophyses, adult males have a greatly reduced right apophysis and a strongly developed left one. The following two hypotheses can be proposed:

1) The subadult specimens belong to a different symmetrical species (they are not adults because they show immature characteristics, such as the absence of sensory pegs in the tenth urotergite and terminal filaments);

2) The adult and subadult specimens are conspecific, which implies that the asymmetrical condition is a character that appears very late in the postembryonic development of *C. herculea* and *C. vergitana*. Juveniles first develop symmetrical antennae, and when they reach the sexual maturity, the left pedicellar apophysis grows and differentiates lamellae and other processes or sclerotized projections, and the right atrophies.

In this work the second hypothesis is assumed, which is supported by the following reasons:

a) The adult and subadult specimens were collected together in the same sample (locality and date);

b) The adult and subadult specimens have many similar non-sexual features, such as habitus, pigmentation and cephalic and tibial setation;

c) This postembryonic change from symmetrical to asymmetrical condition of the antennal apophyses likely occurs in other related *Coletinia* species, such as *C. vergitana* **n. sp.** (in this case, three specimens have been collected in the same cave, and the juvenile is symmetrical, while the adult male shows asymmetrical antennae).

However, in another related species, *C. asymetrica*, a subadult male specimen (length 6.2 mm) collected together with the adult holotype (8.4 mm) bears asymmetrical antennae very similar to those of the adult male (Bach *et al.*1985).

The finding of more specimens of these insects will clarify the doubts concerning the identity of the subadult specimen and the postembryonic development of asymmetrical antennae.

The shape of the eighth urosternite in males of *C. vergitana* **n. sp.** differs from previously known species. Another unique characteristic of the male of this species is the presence of 1+1 discal sensory pegs on the tenth urotergite. Moreover, this species from Almería shows a characteristic intense pigmentation of the condylic region of the maxillae and head.

Comparing females, *Coletinia vergitana* **n. sp.** is different from other species because it has a high number of divisions in its long ovipositor (30); only *C. asymetrica* bears 33–35 divisions. Females of both species have similar subgenital plates and tibial setation, but the new species has more robust setation on the tenth urotergite (Figs. 35, 36).

Unfortunately, no females of *C. herculea* **n. sp.** have yet been found, so nothing can be said about the differences between this new species and other related ones in terms of female characters.

2. Species of the "*mendesi* group". Only one species of this group, *Coletinia mendesi*, occurs in Spain. The description of this species is improved and its geographic distribution is extended.

3. Species of the "*capolongoi* group". All of the Iberian species of this group share features such as symmetrical antennae in males, cephalic setation and configuration of the male pedicellar apophysis, with lamellar expansions beside-the glandular cone as photographed in Fig. 8. This type of apophysis appears only in the Iberian species of this group and in the two known species of the group "*mendesi*" (including *C. mendesi* and *C. setosula*). Viewed with OM, the configuration of the pedicellar apophysis in all the species of this group seems to be very similar, and

the apparent differences may be due to different mounting angles. The relevant details can only be discerned with SEM. These observations have been made on four species; three of these seem to be very closely interrelated, in agreement with their more meridional geographic distribution: *C. tinauti*, *C. calaforrai* **n. sp.** and *C. intermedia* **n. sp.** Compared with the remaining species of this group, these three species have a combination of shorter tibiae, smaller sizes and a lower degree of macrosetal spiralization. The fourth species visualized with SEM is *C. capolongoi*. The low number of specimens of the four remaining new species has prevented any SEM studies of these taxa.

Our comparison of apophyses of *C. calaforrai* **n. sp.** (Figs. 41–43), *C. intermedia* **n. sp.** (Figs. 54, 55), *C. capolongoi* (Figs. 141–144) and *C. tinauti* (Figs. 154–157) shows that their structure is very similar in these four species, especially when they are observed from the same point of. Only the apophysis of *C. tinauti* appears to be slightly more distinctive: its basal trunk is more setose, and the lateral lamella is as long as the apical cone and joins with to form a roof (tectum); this plate-like projection is shorter in *C. calaforrai* **n. sp.** and *C. capolongoi*. In *C. intermedia* the roof is not complete.

Although the structure of the pedicellar apophysis in the males does not clarify the differences among the species of this group, other characteristics allow separation of the six new species. These characters (22 in total) are summarized in Table 2 and are explained in the first section of the results of this work. The main features that are useful for each distinction are included in Tables 3 and 4. This is also complemented by the identification key that follows the discussion.

TABLE 4. Cross-wise comparison of species of the *Coletinia* "*capolongoi*" group. The numbers in each box refer to the characteristics detailed in table 2 that are most relevant to distinguish between each pair of species.

	C. tinauti	***C. calaforrai*** **n. sp.**	***C. intermedia*** **n. sp.**	***C. diania*** **n. sp.**	***C. capolongoi***	***C. longitibia*** **n. sp.**	***C. tessella*** **n. sp.**
C. redetecta n. sp.	1, 2, 4, 5, 6, 7, 8, 9, 16, 20	1, 2, 3, 4, 5, 6, 19, 20, 21, 22	1, 2, 3, 4, 5, 6, 19, 20	4, 5, 6, 12, 15, 16, 18	1, 4, 5, 6, 10, 13, 19, 21	1, 2, 4, 5, 6, 7, 8, 9, 12, 15, 19, 22	4, 5, 6, 11, 15, 16, 17, 19, 20, 21, 22
C. tessella n. sp.	1, 2, 7, 8, 9, 17, 19, 21, 22	1, 2, 3, 8, 11, 12, 14, 15, 16, 17, 20, 22	1, 2, 3, 9, 10, 11, 12, 14, 17, 19, 22	7, 8, 9, 10, 15, 16, 17, 18	1, 7-9?, 10, 17, 20	1, 3, 9, 17, 20	
C. longitibia n. sp.	1, 2, 7, 8, 9, 14, 19, 20, 22	1, 2, 7, 8, 9, 14, 15, 20, 21	1, 2, 8, 9, 12, 14, 15, 19, 20	1, 7, 8, 9, 14, 16, 17, 18	7-9?, 17, 18, 21		
C. capolongoi	1, 2, 9, 10, 14, 19, 20, 21	1, 2, 10, 14, 15, 17, 20	1, 2, 14, 17, 19, 20, 21	1, 8, 9, 15, 16, 18			
C. diania n. sp.	1, 2, 7, 8, 9, 10, 16, 18	1, 2, 3, 10, 12, 15, 16, 17, 18	2, 3, 12, 15, 16, 17, 18				
C. intermedia n. sp.	3, 7, 8, 9, 10, 12, 17, 18, 22	10, 13, 19, 21, 22					
C. calaforrai n. sp.	3, 7, 8, 9, 17, 19, 21, 22						

4. Species of the "*maggii* group". *Coletinia hernandoi* **n. sp.** and *C. maggii* are the known members of this group, characterized by the subcylindrical shape of the pedicellar apophyses. Differences between the two species are discussed under the description of *C. hernandoi* **n. sp.**

This is the first report of *C. maggii* in the Iberian Peninsula. Few differences were observed between Iberian specimens and the central European specimens on which Wygodzinsky (1980) based his redescription of the species. Males from central Europe have a slightly different arrangement of the sensory pegs (1 row on

the tenth urotergite, 4 or 5 blunt pegs on the cerci and more than 2 sensory spines in the basal region of the paracercus), and females have a shorter subgenital plate, according to Fig. 5H in Wygodzinsky (1980). In comparison of Fig. 164 with Wygodzinsky's Figs. 4B and 4C, the antennal process of the Spanish male seems to be somewhat wider than those from central Europe. The number of divisions of the ovipositor in Iberian females (20–21) is less than that described by Wygodzinsky (25). Nevertheless, we believe that these differences are not substantial enough to consider the Iberian specimens as a different species, taking into account the intraspecific variability in many of the characteristics reported in Wygodzinsky's description. The availability of additional new specimens from different countries and molecular complementary studies will clarify the specific identity of the Iberian insects. *Coletinia maggii* is widespread in central Europe (Paclt & Christian, 1996; Mendes, 1992) from northwest Italy to Hungary, but there are no reports from southern France, so there is a gap of more than 1000 km between the Iberian localities and the nearest previously known populations. This gap may indicate an important geographic isolation or perhaps only the scarcity of samplings of endogean Nicoletiidae.

The known distributions of Iberian *Coletinia* spp. are given in Fig. 173. This map is certainly provisional, as new prospecting will likely provide specimens to describe additional new taxa and enlarge the geographic distribution of the previously known species. Also, as commented previously, more material is needed to adequately describe the intraspecific variability of these taxa to ensure they can be adequately differentiated from each other, and especially for studies on the phylogeny of these edaphic or cave-living insects.

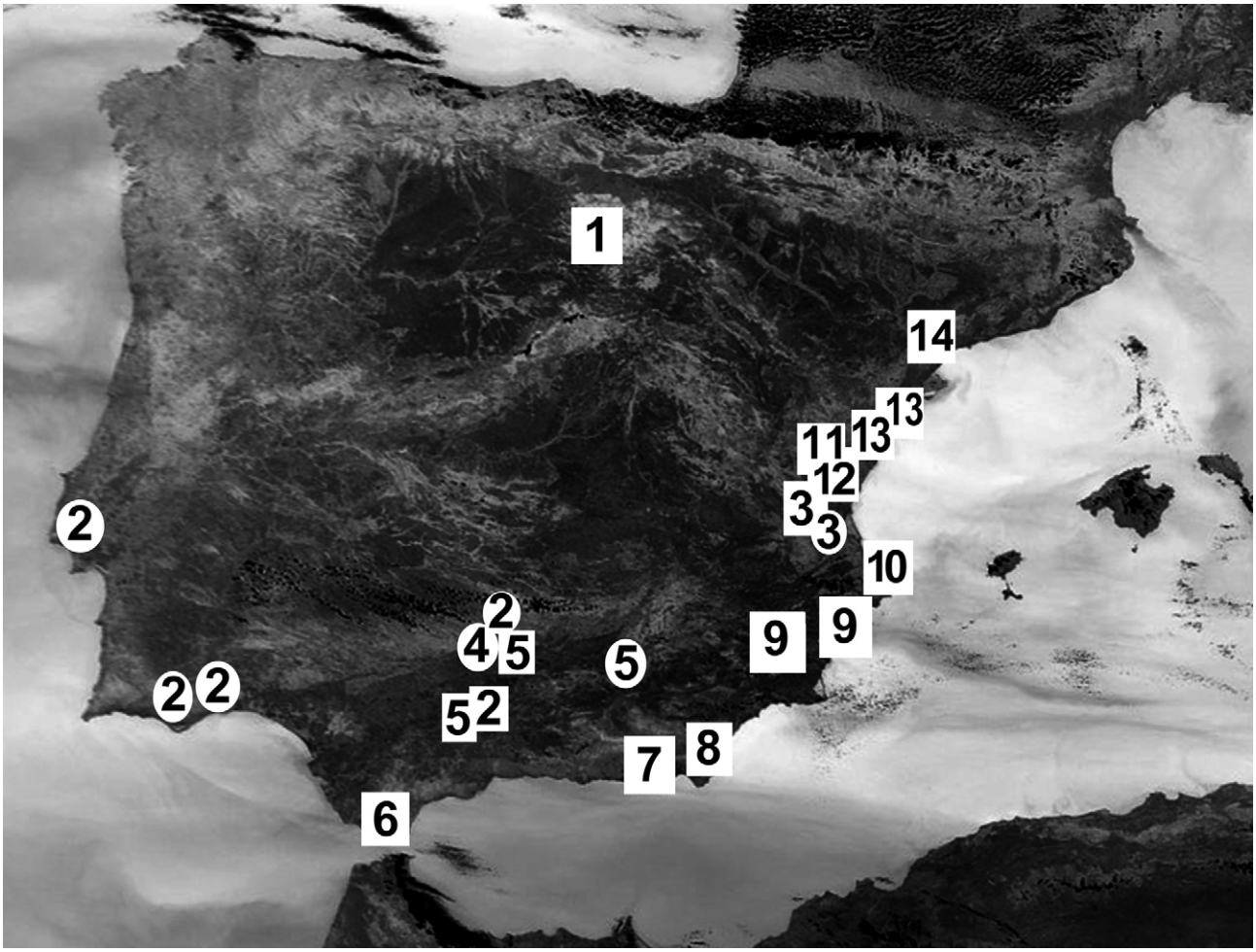


FIGURE 173. Distribution map of the known species of *Coletinia* in the Iberian Peninsula. 1—*Coletinia maggii*. 2—*C. mendesi*. 3—*C. capolongoi*. 4—*C. asymetrica*. 5—*C. tinauti*. 6—*C. herculea* **n. sp.** 7—*C. vergitana* **n. sp.** 8—*C. calaforrai* **n. sp.** 9—*C. intermedia* **n. sp.** 10—*C. diania* **n. sp.** 11—*C. tessella* **n. sp.** 12—*C. longitibia* **n. sp.** 13—*C. redetecta* **n. sp.** 14—*C. hernandoi* **n. sp.** The numbering is consistent with the chronological order of their original description. Squares indicate new reports, circles indicate previous reports. Samples identified as *Coletinia* sp. are not included.

Identification key for Iberian *Coletinia* species

1. Head with numerous subequal strong setae, lacking bifid macrosetae (Fig. 4). Ventral macrosetae of tibiae strong and (at least in mesotibiae) clearly longer than the diameter of the tibia (Fig. 6). Lateral spine of tibiae absent. Discal macrosetae of urosternites absent . . . . . *C. mendesi*
– Head with dispersed small setae and few regularly arranged bifid macrosetae (Fig. 3). Ventral macrosetae of tibiae slender, usually shorter or as long as the diameter of the tibia. Lateral spine of tibiae usually present. Discal macrosetae of urosternites present 2
2. Males 3
– Females 15
3. Antennae asymmetrical, the apophysis of the left pedicellus in adult specimens more developed than the right 4
– Antennae symmetrical, the pedicellus of both antennae with similarly developed apophyses 6
4. Posterior margin of eighth urosternite not very protruding and slightly convex (Fig. 37). Apophysis of the left pedicellus of adults as in Figs. 28–30, with a sclerotized region next to the glandular cone and a subapical lateroexternal process very well-developed, showing no sclerotizations but densely covered with small hairs . . . . . *C. vergitana* **n. sp.**
– Posterior margin of eighth urosternite more protruding and convex (Figs. 25, 160). Apophysis of the left pedicellus of adults different; if bearing a lateral process, it is hook-shaped and not densely pilose 5
5. Apophysis of the left pedicellus of adults with a sclerotized crest in the subapical zone of the basal trunk and two short bifid macrosetae (Fig. 128).. . . . . *C. asymetrica*
– Apophysis of the left pedicellus of adults with two lamellar processes, one apical without sclerotization, and one subapical with hook-shaped sclerotization and with a long and strong macrochaeta plus a few thin setae (Figs. 11, 12) *C. herculea* **n. sp.**
6. Pedicellar apophysis simple, cylindrical, with no plate-like structures (Fig. 119) 7
– Pedicellar apophysis complex, with plate-like (lamellar) subapical expansions and/or sclerotizations next to the glandular cone 8
7. Pedicellar apophyses relatively wide and short (Fig. 164); their L/W ratio less than 2.5; base of the flagellum less than twice the width of the apophysis. . . . . *C. maggii*
– Pedicellar apophyses more narrow and long (Fig. 119) their L/W ratio more than 2.5; base of the flagellum more than 2 times the width of the apophysis. . . . . *C. hernandoi* **n. sp.**
8. Posterior border of urosternite VIII protruding, convex and rounded (Fig. 112); if somewhat straight or truncated in the median region, then fewer than 6+6 sensory pegs on the tenth urotergite 9
– Posterior border of urosternite VIII protruding but straight (rounded truncate) in its median region (Fig. 97). Sensory pegs of the tenth urotergite 6+6 or more (Fig. 95) . . . . . *C. tessella* **n. sp.**
9. Metatibia with at least 6 ventral bifid spines (Fig. 107). No more than 3 sensory pegs on terminal filaments *C. redetecta* **n. sp.**
– Metatibia with 4–5 ventral bifid spines; if 6 or more, sensory pegs of terminal filaments very numerous. Cerci with at least 4–5 pegs each 10
10. Larger species, body length of adults surpassing 13 mm. Metatibiae usually long, L/W ratio greater than 6.5 except in some specimens of *C. capolongoi* 14
– Smaller species. Metatibiae short, L/W ratio clearly less than 6.5. 11
11. Hind border of tenth urotergite straight between the posterolateral lobes or slightly concave (Figs. 70, 147) 12
– Hind border of the tenth urotergite clearly concave and rounded between the posterolateral lobes (Figs. 47, 95, 158) 13
12. At least 5 sensory pegs in the paracercus; cerci with more than 6 pegs. Paramera short, no more than 4.5 times longer than wide . . . . . *C. dianía* **n. sp.**
– Paracercus with few sensory pegs (0–2), cerci with no more than 6 pegs, often fewer. Paramera longer, usually 5 or more times longer than wide . . . . . *C. intermedia* **n. sp.**
13. Tibiae relatively short, L/W ratio of mesotibiae less than 4 of metatibiae less than 4.5. Eighth urosternite with very convex hind margin (Fig. 160) . . . . . *C. tinauti*
– Tibiae relatively long or slender, L/W ratio of mesotibiae 4 or more, of metatibiae 4.5 or more. Eighth urosternite variable, sometimes with rounded hind margin (Fig. 49) but usually less convex, more straight and truncated posteriorly . . . . . *C. calaforrai* **n. sp.**
14. L/W ratio of metatibiae greater than 6. Paramera about 5 times longer than wide. Posterolateral lobes of urotergite X with 8 sensorial pegs each . . . . . *C. longitibia* **n. sp.**
– L/W ratio of metatibiae variable, greater than 6 in larger specimens (18 mm or more). Paramera about 6 times longer than wide. Posterolateral lobes of urotergite X with at most 6 sensorial pegs each. . . . . *C. capolongoi*
15. Ovipositor long, with more than 25 divisions 16
– Ovipositor with fewer than 25 divisions 17
16. Ovipositor with about 30 divisions. Robust and dense setae covering disc of tenth urotergite. Subgenital plate wider at the base than long (Fig. 38) . . . . . *C. vergitana* **n. sp.**
– Ovipositor with 33–35 divisions. Setae of the disc of the tenth urotergite scarce and thin (Fig. 131). Subgenital plate as long as wide at the base . . . . . *C. asymetrica*
17. Posterior border of the tenth urotergite straight, the disc lacking setae (Fig. 167) . . . . . *C. maggii*
– Posterior border of the tenth urotergite slightly concave, the disc with more or less abundant setae 18
18. Posterior border of the subgenital plate rounded-truncate, nearly near the midline (Fig. 162) 19
– Posterior border of the subgenital plate arched, convex, semielliptical (Fig. 87) 22
19. Ovipositor short, surpassing the apex of the ninth stylets by less than their length (Fig. 99). Macrosetae mounted in Tendeiro

medium with a high degree of spiralization ..... *C. tessella* **n. sp.**

– Ovipositor longer, usually surpassing the apex of the ninth stylets by more than their length; some specimens of *C. calaforrai* with shorter ovipositor but macrosetae mounted in Tendeiro medium with a low degree of spiralization 21

20. Ovipositor with a low number of divisions (less than 17). Subgenital plate relatively short, L/W ratio no more than 0.9 ..... *C. calaforrai* **n. sp.**

– Ovipositor with more than 17 divisions and surpassing the apex of the ninth stylets by at least 1.5 times their length. L/W ratio of the subgenital plate 0.9 or more 21

21. Metatibiae not conspicuously long, L/W ratio about 4.5 or lower. Very scarce and dispersed setae covering disc of tenth urotergite (Fig. 159). Ovipositor long, surpassing the apex of the ninth stylets by at 2 or more times their length ... *C. tinauti*

– Metatibiae with L/W ratio clearly more than 4.5. Setae of the tenth urotergite scattered irregularly all over the disc (Fig. 58). Ovipositor shorter, surpassing the apex of the ninth stylets by 1.5–2 times their length ..... *C. intermedia* **n. sp.**

22. Tibiae very long, L/W ratio of the metatibiae greater than 6.5. Ovipositor with about 18 divisions. Body length up to 17 mm ..... *C. longitibia* **n. sp.**

– Tibiae shorter, L/W ratio of the metatibiae clearly less than 6; if longer (only in large specimens more than 18 mm long) bearing ovipositor with 15–16 divisions 23

23. Ovipositor with more than 22 divisions. ..... *C. hernandoi* **n. sp.**

– Ovipositor with a low number of divisions (20 or less). 24

24. Body length of adults usually more than 12 mm. Macrosetae mounted in Tendeiro medium with high spiralization, usually with 4–5 or more turns 26

– Body length less than 12 mm. Macrosetae mounted in Tendeiro medium slightly spiralized, no more than 2–3 turns 25

25. Ovipositor with 17 or more divisions. Disc of the tenth urotergite covered rather densely with setae (Fig. 58) ..... *C. intermedia* **n. sp.**

– Ovipositor with 16 or fewer divisions. Disc of the tenth urotergite with very scarce setae (Fig. 48) ..... *C. calaforrai* **n. sp.**

26. Ovipositor with more than 18 divisions. Tibiae usually with 6 macrosetae and additional short spines (Fig. 107). Subgenital plate longer than wide at the base or as long as wide (Fig. 114) ..... *C. redetecta* **n. sp.**

– Ovipositor with fewer than 17 divisions. Tibiae usually with 4 macrosetae, apart from additional short spines (Fig. 145). Subgenital plate wider at the base than long (Fig. 152) ..... *C. capolongoi*

Acknowledgements

We thank Dr. Luis F. Mendes from IICT (Lisbon) for the loan of the material of *C. mendesi* and *C. asymetrica*, and for scientific advice. We are grateful to Dr. Alberto Tinaut for transfer of the type material of *C. herculea* **n. sp.** and to Carlos Hernando for providing the type material of *C. hernandoi* **n. sp.** We also express our gratitude to the biospeleologic group GEV from Villacarrillo (Jaén) that has provided us with some of the material from caves and to Manuel Baena, who provided us with some samples and allowed us to be in contact with GEV and Carlos Hernando. We also thank Manuel Urbano for the design of some of the figures describing *C. tinauti*, *C. redetecta*, *C. capolongoi* and *C. mendesi*.

Samplings of material collected by A. Sendra and S. Montagud were financed by the Consellería de Territori i Habitatge, Servei de Conservació i Gestió de la Biodiversitat, Generalitat Valenciana, within the Project "I+D a la conservación de los Invertebrados cavernícolas de la Comunidad Valenciana". Some samplings and research works were financed with the support of Spanish MCYT "Fauna Ibérica VII Project" (REN2001-1956-C17-05).

Finally, we wish to thank the Spanish Education and Science Ministry for the funding of the project CICYT 1FD97-1577 to sample the caves of the Paraje Natural del Karst en Yeso de Sorbas where *C. calaforrai* n. sp. was found. We also thank Carmen Ruiz Portero and Ángel Fernández Cortés, who took the samples.

References

Bach de Roca, C., Mendes, L.F. & Gaju Ricart, M. (1985) Sur une nouvelle espèce et une nouvelle citation de Nicoletiinae de Sierra Morena (Cordoue, Espagne) (Nicoletiidae Zygentoma). *Bollettino della Società Entomologica Italiana, Genova*, 117 (8–10), 132–140.

Chopard, L. (1924) Description d'un *Nicoletia* de Corse (Thys. Lepismidae). *Bulletin de la Société Entomologique de France*, 16, 174–176.

Escherich, K. (1905) Das System der Lepismatiden. *Zoologica* (Stuttgart) 43, 1–164.

Grassi, B. (1887) I progenitore dei Miriapodi e degli Insetti. Altre recerche sui Tisanuri. Nota preliminare. *Bullettino della Società Entomologica Italiana*, 19, 52–74.

Kozaroff, G. (1939) Eine neue Nicoletiaart in Bulgarien. *Bull. Soc. Ent. Bulgarie, Izvestiia na Bulgarskoto Entomologichno Druzhestvo*, 10, 45–50.

Mendes, L.F. (1981) Nova nota sobre os tisanuros (Apterygota, Microcoryphia e Zygentoma) da Europa e da bacia mediterranica. *Boletim da Sociedade Portuguesa de Entomologia*, 18, 1–9.

Mendes, L.F. (1985) Nota preliminar sobre os tisanuros (Microcoryphia e Zygentoma) do Algarve (Portugal). *Boletim da Sociedade Portuguesa de Entomologia*, 1 (suppl. 1), 239–262.

Mendes, L.F. (1988) Sur deux nouvelles Nicoletiidae (Zygentoma) cavernicoles de Grèce et de Turquie et remarques sur la systématique de la famille. *Revue Suisse de Zoologie*, 95 (3), 751–772.

Mendes, L.F. (1992) Some new data on the Nicoletiidae (Insecta: Zygentoma) from Europe and Asia Minor. *Revue Suisse de Zoologie*, 99 (4), 821–834.

Mendes, L.F. (1996) Further data on the Nicoletiidae (Zygentoma) with description of a new species from Mauritius. *Revue Suisse de Zoologie*, 103 (3), 749–756.

Mendes, L.F. & Ferreira, R.L. (2002) On a new cave-dwelling Nicoletiidae (Zygentoma : Insecta) from Brazil. *Garcia de Orta, Série de Zoologia, Lisboa*, 24, 101–106.

Molero-Baltanás, R., Gaju-Ricart, M. & Bach de Roca, C. (1997) *Coletinia tinauti* n. sp., nueva especie de Nicoletiidae de Andalucía (Insecta, Apterygota, Zygentoma). *Zoologica Baetica*, 8, 95–110.

Molero-Baltanás, R., Gaju-Ricart, M. & Bach de Roca, C. (2000) On the taxonomic use of the distribution pattern of the antennal asteriform sensilla in *Neoasterolepisma* and *Tricholepisma* (Insecta, Zygentoma, Lepismatidae). *Pedobiologia*, 44, 248–256. http://dx.doi.org/10.1078/S0031-4056(04)70045-1

Paclt, J. & Christian, E. (1996) Die Gattung *Coletinia* in Mitteleuropa (Thysanura: Nicoletiidae). *Deutsche Entomologische Zeitschrift*, 43, 275–279. http://dx.doi.org/10.1002/mmnd.19960430211

Parona, C. (1888) Res Ligusticae. VI. Collembole e Tisanuri finora riscontrante in Liguria. *Annali del Museo Civico di Storia Naturale di Genova, Ser. 2a*, 6, 133–154.

Silvestri, F. (1902) Materiali por lo studio dei Tisanuri. III. Nuove specie di *Nicoletia*. *Bollettino della Società Entomologica Italiana*, 33, 223–227.

Silvestri, F. (1908) Materiali per lo studio dei Tisanuri. X. Su alcuni Tisanuri di Corfu. *Bollettino del Laboratorio di Entomologia Agraria, Portici*, 2, 381–393.

Silvestri, F. (1938) Descrizione di una nuova specie di *Nicoletia* vivente in una grotta della Francia (Insecta Thysanura). *Revue Française d'Entomologie*, 5, 188–193.

Ubero-Pascal, N., Fortuño, J.M. & Puig, M.A. (2005) New application for air-drying techniques for studying Ephemeroptera and Plecoptera eggs by Scanning Electron Microcopy. *Microscopy Research and Technique*, 68, 264–271. http://dx.doi.org/10.1002/jemt.20248

Wygodzinsky, P. (1980) A survey of the Nicoletiidae of Europe (Nicoletiidae, Thysanura, Insecta). *American Museum Novitates*, 2695, 1–24.

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