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Parasironidae fam. nov., a Cimmerian lineage of Mediterranean Cyphophthalmi (Opiliones), with the description of three new genera and four new species

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Abstract. A new family of Cyphophthalmi with disjunct Mediterranean distribution, Parasironidae fam. nov., is proposed. The new family comprises four genera and seven species. *Cimmerosiro* gen. nov., *Tirrenosiro* gen. nov. and *Ebrosiro* gen. nov. are described as new genera, and *Tirrenosiro axeli* gen. et sp. nov., *Cimmerosiro krivolutskyi* gen. et sp. nov., *C. juberthiei* gen. et sp. nov. and *C. rhodiensis* gen. et sp. nov. as new species. Parasironidae stands out by a set of characteristics that we recognize as predominantly plesiomorphic. These characteristics and the present distribution indicate the great age of the family, probably early Mesosoic. We attribute its origin to the western part of the Cimmerian terrane, and its current distribution and diversification of the major clades to geotectonic events during the Mesozoic. Additionally, a new sensory organ (sensilla) has been discovered in Cyphophthalmi. This organ is located on the pedipalp coxae and is believed to have a potential hygroreceptive function.

Keywords. Biogeography, geotectonic, Mesozoic, Neotethys, sensilla.

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Introduction

The first species of the genus *Parasiro* Hansen & Sørensen, 1904 was described in the 19th century from Corsica, originally as *Cyphophthalmus corsicus* Simon, 1872. The same author (Simon 1879) transferred it to the genus *Siro* Latreille, 1796, with which he had synonymized the genus *Cyphophthalmus* Joseph, 1868 a few years earlier (Simon 1875). In their revision of the previously known Cyphophthalmi, Hansen & Sørensen (1904) set this species apart in a separate genus, *Parasiro*. In the same genus, Juberthie (1956) described the species *Parasiro coiffaiti* Juberthie, 1956 from the slopes of the eastern part of the Pyrenees in Spain and France. In a wider area of that region, the presence of this species was noted on several occasions (Juberthie 1957; Rambla 1974; Rambla & Fontarnau 1984). In the type series of *Parasiro corsicus*, Juberthie (1958) discovered several specimens of an undescribed species within this genus. With the inclusion of additional material from several specimens found in different parts of Corsica, Juberthie described it as *Parasiro minor* Juberthie, 1958. Brignoli (1968) recorded this species from several localities in two distant areas of the central part of Sardinia. Giribet *et al.* (2012) reported findings of this species at another locality (Monte Rasu) on this island. De Bivort & Giribet (2004) mentioned findings of the same species from the northwestern part of the Apennine Peninsula (Mt Pisano).

Consequently, based on published data, this group of Cyphophthalmi was treated as endemic to the Western Mediterranean (Giribet *et al.* 2017). However, published findings of species clearly closely related to *Parasiro* from remote areas of the Caucasus were overlooked, possibly due to their being published in popular science publications in the Russian language by colleagues who were not experts in Opiliones. In 1969, in the 3rd volume of an excellent multi-volume edition *Жизнь животных* (*Animal Life*), the Russian acarologist Aleksandr Borisovich Lange gave an illustration of a male of an unknown species of Cyphophthalmi which he designated as a juvenile *Siro*. He overlooked that it was an adult male probably because of its small body size and light color. Based on the body profile presented in the figure it is very likely that it is close to the genus *Parasiro* (Lange 1969: pl. 4). The specimen was collected from the slopes of the Caucassus Black Sea coast. Unfortunately, the detailed whereabouts of the specimen are unknown. In the popular Russian science journal *Природа* (*Nature*) acarologist Dmitry Aleksandrovich Krivolutsky (1990) noted findings of Cyphophthalmi in Georgia (Sataplia and Borjomi nature reserves). He mentioned 30 specimens that were extracted from soil samples during 1963–1971. In his article, Krivolutsky (1990) offered material for those interested to process it. Despite all the efforts and helpfulness of colleagues from the Severtsov Institute of Ecology and Evolution of the Russian Academy of Sciences in Moscow, where Krivolutsky worked, these specimens were not found. Along with the text, Krivolutsky (1990) presented two SEM photographs that clearly indicated the closeness of these samples to the genus *Parasiro*.

While examining museum collections, one of the authors of this study (PM) found specimens of unknown Cyphophthalmi from Rhodes (Greece) and northeast Turkey that belong to this group. One of the authors (NS) came into possession of specimens from Georgia which were collected by entomologists from the Czech Republic. Our colleague, Axel Schönhoffer, loaned a specimen he had collected from the west coast of the central part of the Apennine Peninsula to the first author (IK). We had at our disposal a specimen of *P. minor* from Sardinia, from the Senckenberg Museum collection. The first author, together with colleague G. Raspotnig, collected a number of specimens of *P. coifaitti* from France a dozen years ago. For the purposes of this work, the first author also collected an additional series of specimens of the new species from Rhodes. This study was made on the basis of the samples mentioned and literature data (Juberthie 1956, 1958, 1970; de Bivort & Giribet 2004).

In his papers on *Parasiro*, Juberthie (1956, 1957, 1958) provided detailed descriptions of the three known species with high-quality illustrations that indicate an ancient diversification of this genus. The degree of differences among the described species corresponds to the generic level in some other Cyphophthalmi, such as Sironidae (Karaman 2022). However, based on the knowledge of Cyphophthalmi at that time, it was not meaningful to establish three related monotypic genera occurring in a relatively small area. This is the probable reason for the current status of this heterogeneous group of Cyphophthalmi, classified as one genus. By analyzing the available specimens and literature data, we recognized the existence of four new species of this group and a much wider range of distribution. Within the group, we distinguish four phyletic lineages, i.e., four genera. Based on a series of characteristics, we distinguish it from the family Sironidae and describe it at the rank of a family, Paraironidae fam. nov.

The discovery of a new sensory structure, as well as some other details presented in this paper, indicate the probable existence of other still undiscovered important details in this morpho-anatomically conservative group, with an apparently simple structure.

This paper is dedicated to Dr Christian Juberthie (1931–2023) a great expert on Cyphophthalmi, whose contribution to our knowledge of this group is enormous, and his work on parasironids is of key importance for this study. He was also the first author to point out the extraordinary biogeographical importance of Cyphophthalmi (Juberthie & Massoud 1976; Juberthie 1988).

Material and methods

Dissection of the specimens and slide mounting were done as described in Karaman (2009). The separated body parts were prepared by dehydration through a graded alcohol series before being cleaned in a sonicator. Dried samples mounted on stubs were prepared in a Baltec SCD005 sputter coater. Scanning electron microscopy (SEM) photographs were recorded with a JEOL-JSM-64601vSEM microscope under high vacuum. Microscopic photographs were taken on a Zeiss Axio Imager A1. Drawings based on phoptographs were made in Adobe Illustrator CS2 on a Genius graphics tablet.

The acronyms used in the text are as follows:

CIK = Ivo Karaman collection at the Department of Biology and Ecology, University of Novi Sad, Serbia
CJM = Personal collection of Jochen Martens, Mainz, Germany (currently deposited at SMF)
CNS = Nataly Snegovaya personal collection at the Zoological Institute NAS of Azerbaijan, Baku, Azerbaijan
CPM = Personal collection of Plamen Mitov, Sofia, Bulgaria
MHNG = Muséum d'Histoire naturelle de Genève, Switzerland
SMF = Senckenberg Forschungsinstitut und Naturmuseum, Frankfurt am Main, Germany

Results

Taxonomy

Class Arachnida Lamarck, 1801
Order Opiliones Sundevall, 1833
Suborder Cyphophthalmi Simon, 1879

Family **Parasironidae** fam. nov.
urn:lsid:zoobank.org:act:16C321F5-58A2-4E36-AEA3-FEB4A8B02583

Type genus

Parasiro Hansen & Sørensen, 1904.

Included genera

Parasiro Hansen & Sørensen, 1904, *Cimmerosiro* gen. nov., *Tirrenosiro* gen. nov. and *Ebrosiro* gen. nov.

Diagnosis

Most of the diagnostic characters here presented were given by Juberthie (1958) as diagnostic characters for the genus *Parasiro*. Small to medium-sized species. Ozophores located on lateral edges of dorsum (type 1 after Juberthie 1970). Narrow frontal edge of dorsum closely covers basal article of chelicerae on its terminal half, after which basal article of chelicerae rises sharply on its dorsal side, forming a prominent transverse ridge. At height of transverse ridge of chelicerae, a medially oriented ventral process present. Distal cheliceral article wide and stout (its basal part twice as long as wide). Pedipalp tibia as long as or longer than tarsus. Coxal lobes I wide, in basal part as long as wide; basal part longer than distal part; coxal endites I continuous along its entire length. Coxal lobes II cup-shaped; about 2.5 times (2.3–2.7) as wide as long, with almost straight frontal margins. Metatarsi of legs elongated (longer than half of tarsal length), first two pairs subdivided in ornamented astragalus and smooth calcaneus (Fig. 1A).

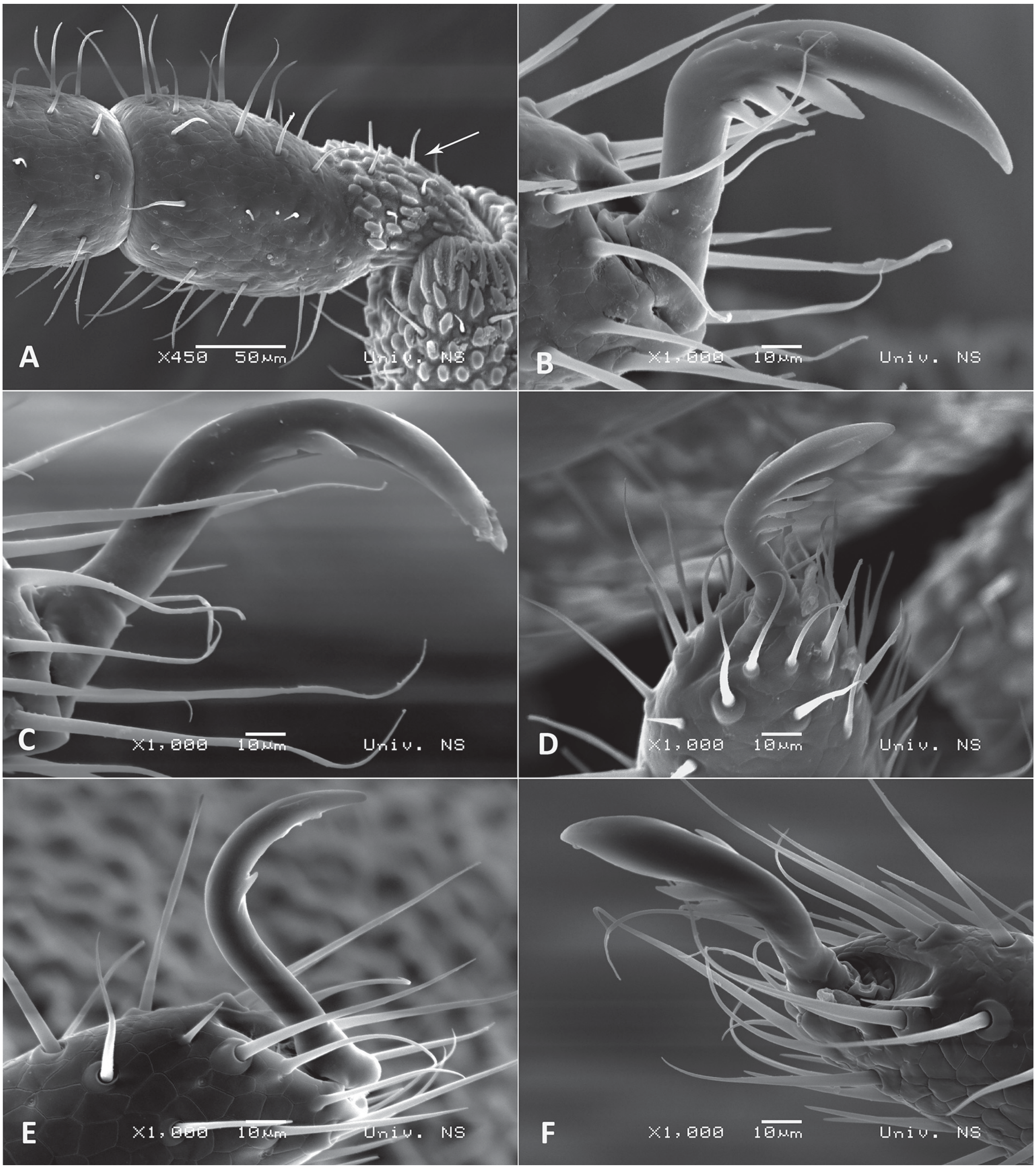

Fig. 1. A–C. *Cimmerosiro krivolutsky* gen. et sp. nov. (CIK). **A**. Male leg I, astragalus (arrow). **B**. Female leg III, claw. **C**. Female leg IV, claw. — **D–E**. *C. rhodiensis* gen. et sp. nov. (CIK). **D**. Male leg III, claw. **E**. Female leg IV, claw. — **F**. *Ebrosiro coiffaiti* (Juberthie, 1956) gen. et comb. nov. (CIK), male III leg, claw.

Claws of legs III–IV with teeth (Fig. 1B–F) (also II in all except Cimmerosiro rhodiensis gen et sp. nov.). Corona analis: sternites 8 and 9 medially fused, tergite IX free. Sensitive structures named "subapical process" or "processus sensitif" (Juberthie 2000) (Fig. 2A–E) located dorsally on tarsi of legs I–II conspicuous and not tapering toward distal portion at all (Willemart & Giribet 2010) or only shortly near tip. Female genital orifice posterior margin thick, wide and smooth (Fig. 2F). Ovipositor short, with small number of articles (8–10). Ovipositor lobi without terminal plumose setae; setation concentrated on their dorsal side (Fig. 3), in Sironidae evenly distributed. Males without anal glands.

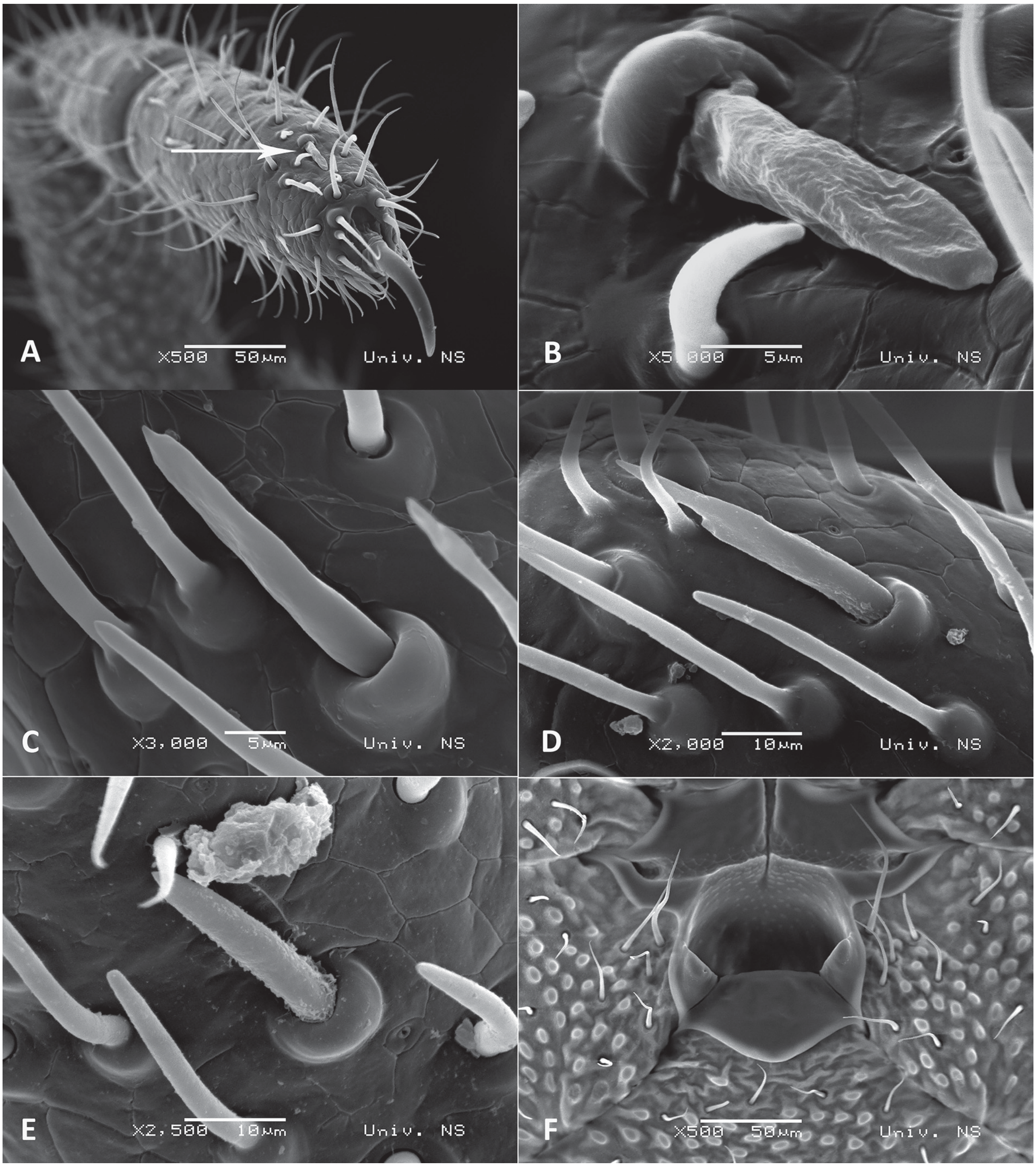

Fig. 2. A–E. Prosessus sensitif on telotarsus of leg I. **A–B**. *Ebrosiro coiffaiti* (Juberthie, 1956) gen. et comb. nov., male (CIK). **C**. *E. coifaitii*, female (CIK). **D**. *Cimmerosiro krivolutskyi* gen. et sp. nov., female (CIK). **E**. *C. krivolutskyi* gen. et sp. nov., male (CIK). **F**. *C. rhodiensis* gen. et sp. nov., female, genital orifice (CIK).

In contrast to other Cyphophthalmi, this family is characterized by a rather uniform structure of the ventral prosomal complex. The differences between the species of this family are more pronounced in the genital structures of both sexes.

Remarks

Working on this study, the first author discovered a hitherto unknown sensory organ (sensilla) of Cyphophthalmi, situated medially on the dorsal side of the pedipalp coxae (Fig. 4). It was overlooked in previous studies. In Sironidae (which were in focus), it is represented by a bristle-like structure and looks more like a mechanoreceptor. That structure is a differentiating character between members of the new family and Sironidae, from which it is here separated. In parasironids, the organ forms sensilla that are voluminous, with more or less expressed lobes (Figs 4A-D), while in sironids they are more bristle-like (Fig. 5). A brief overview of a small sample of available material shows that this organ is present in most of Cyphophthalmi in various forms. It is not recognized in *Tucanogovea shusteri* Karaman, 2013 or a specimen of *Metagovea* sp. (Neogoveidae). In parasironids, it is membranous, more or less voluminous (they shrink when drying), suggesting a possible hygroreceptive role. It is similar in structure in Pettalidae and *Suzukiellus sauteri* (Roewer, 1916). In *Ankaratra franzi* Shear & Gruber, 1996 it seems more complex, as well as in *Meghalaya* sp. (Stylocellidae) (Fig. 4E–F). Perhaps this character may have some importance in phyletic analyses of Cyphophthalmi, and it is worth being investigated in more detail.

The structure of the pedipalp coxae shows a strong phylogenetic signal in Cyphophthalmi. They are remarkably different among representatives of two families. In Sironidae it is wider along the sagittal axis than long (Fig. 6A–C) and the articulation with the trochanter is eccentrically placed towards the ventral side. In Parasironidae (Fig. 6D) it is as wide as long, and the articulation is centered in the middle of its width. In addition, the pedipalp coxal lobi in Parasironidae are positioned more ventrally to the coxae compared to in Sironidae.

The setation of the ovipositor terminal lobi in Parasironidae is specific and remarkably different from the situation in Sironidae. Beside the absence of plumose setae, almost all setae are located on the dorsal side, while in Sironidae they are evenly distributed (Karaman 2009: figs 4–5). On the ventral side, there is only a pair of setae on the basal third of the lobi and a subterminal pair. This, together with the fact

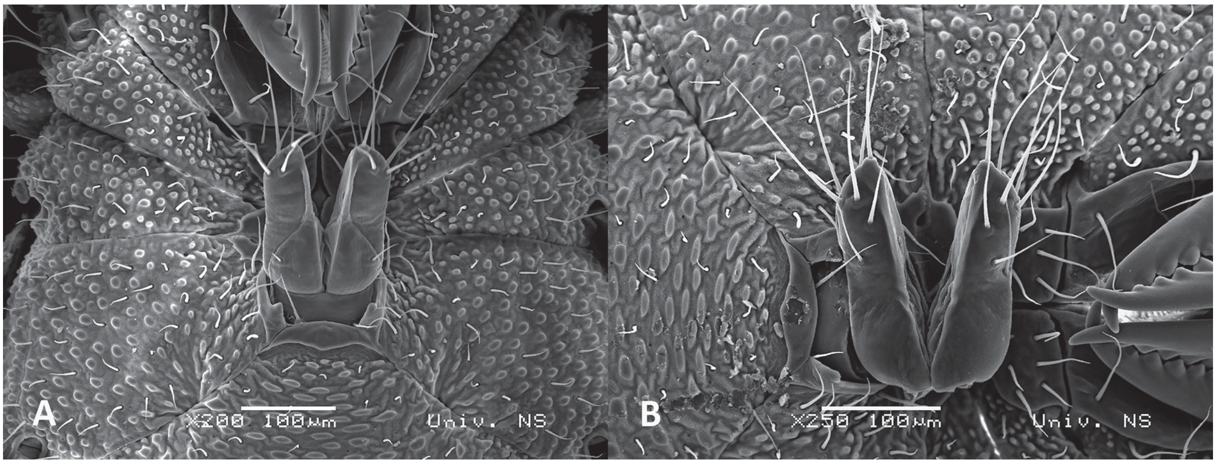

Fig. 3. *Ebrosiro coifaitii* (Juberthie, 1956) gen. et comb. nov., female (CIK), ovipositor apical lobes. **A**. Ventral view. **B**. Dorsal view.

that the ventral prosomal complex is quite conservative in this group and that an anal gland is absent, suggests a possibly different way of spermatophore transfer than the one presented in Karaman (2005a). In *Odontosiro lusitanicus* Juberthie, 1962 the ovipositor setation is similar to that in parasironids, with the difference that one laterodistal seta is plumose (Juberthie 1962: fig. 9). This character mode may be a reflection of the phyletic closeness of this species to the family Parasironidae, despite numerous and significant differences, or a symplesiomorphic feature of phyletically distant taxa.

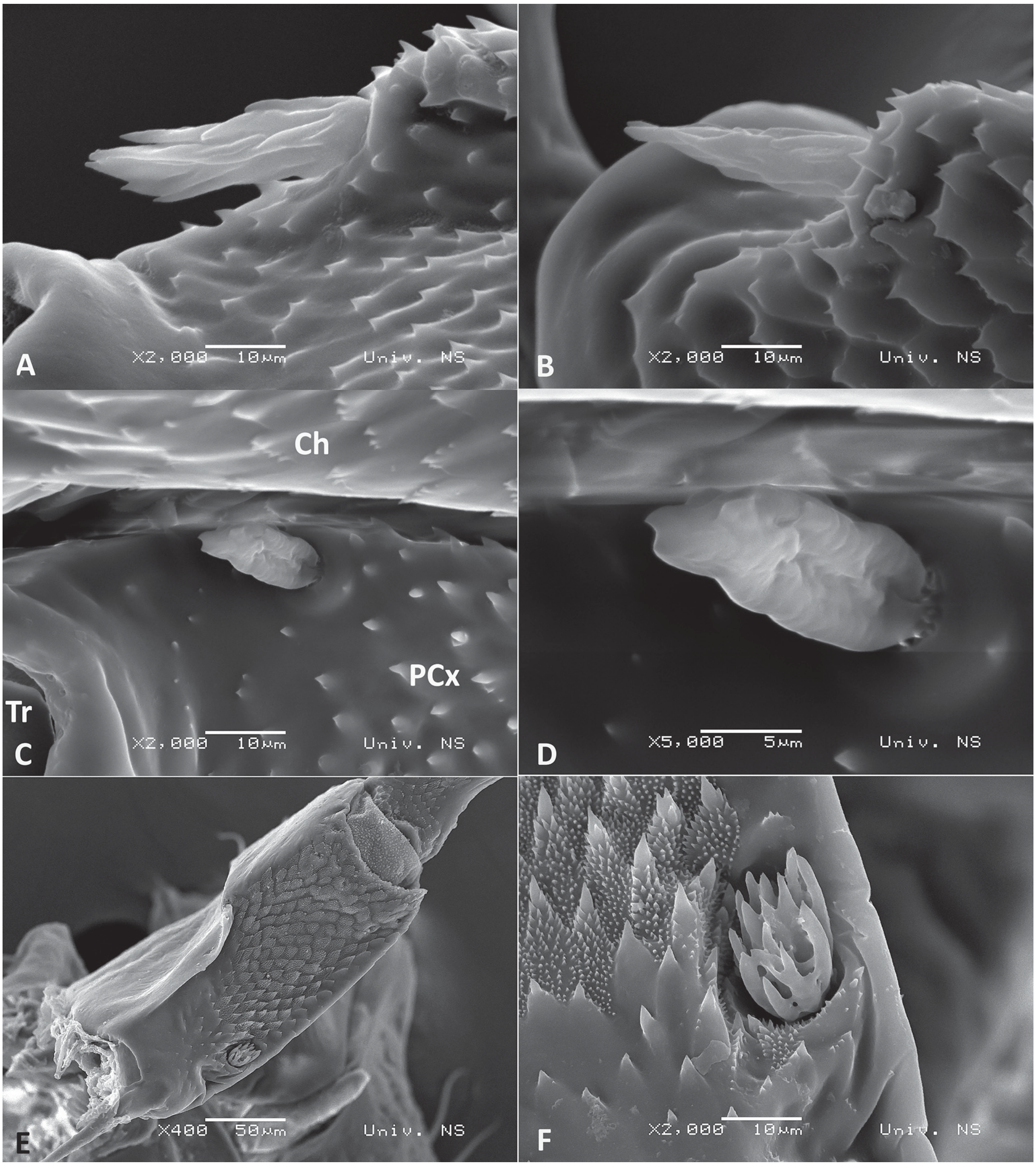

Fig. 4. Sensilla on pedipalp coxae. **A–B**. *Cimmerosiro krivolutskyi* gen. et sp. nov. (CIK) (A, lateral view; B, dorsal view). **C–D**. *Ebrosiro coiffaiti* (Juberthie, 1956) gen. et comb. nov. (CIK). **E–F**. *Meghalaya* sp. (Stylocellidae) (CIK). Ch = chelicerae; PCx = pedipalp coxae; Tr = pedipalp trochanter.

Characters such as the setation and number of claw teeth show a certain degree of variability among specimens and even aberrations, but do not affect their importance as differential characteristics between genera and species.

Distribution

Disjunct distribution in the Mediterranean from the eastern slopes of the Pyrenees in the west to the Transcaucasus in the east.

Genus ***Parasiro*** Hansen & Sørensen, 1904

Parasiro Hansen & Sørensen, 1904: 110.

Parasiro – Roewer 1923: 54; 1927: 266. — Hinton 1938: 332. — Juberthie 1958: 165; 1970: 1382. — Giribet 2000: 57; 2020: 68. — Karaman 2022: 56.

Type species

Cyphophthalmus corsicus Simon, 1872.

Included species

Only the type species, *Parasiro corsicus* (Simon, 1872).

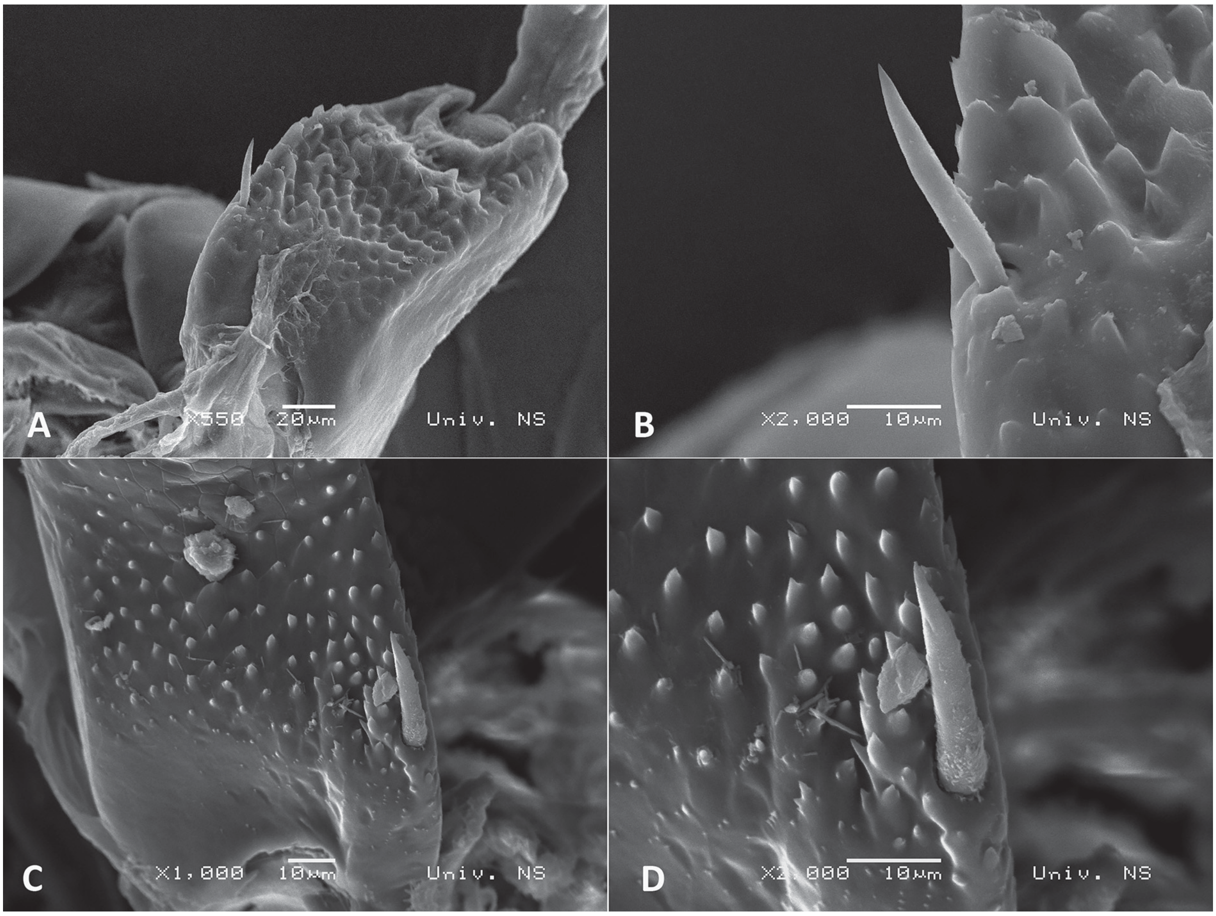

Fig. 5. Pedipalp coxae with bristle-like “sensilla” in Sironidae. **A–B**. *Siro rubens* Latreille, 1804 (CIK). **C–D**. *Cyphophthalmus serbicus* (Hadži, 1973) (CIK).

Diagnosis

Within the family it is clearly distinguished by the spermatopositor structure. Digiti mobiles mediales elongated, as well as terminal lobe; digiti mobiles laterales absent (Juberthie 1958: fig. 16). Ovipositor apical lobi elongated, twice as long as wide, terminal, subterminal and all three laterodistal setae elongated, of the same length (based on Juberthie 1958: fig. 15). Astragalus of legs I–II longer than calcaneus (de Bivort & Giribet 2004: figs 18k, 34k). Coxal lobi II (females?) with central tubercles (de Bivort & Giribet 2004: fig. 24k). Claws of legs I with teeth.

Genus ***Tirrenosiro*** gen. nov.

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Type species

Parasiro minor Juberthie, 1958.

Included species

Tirrenosiro minor (Juberthie, 1958) gen. et comb. nov. and *T. axeli* gen. et sp. nov.

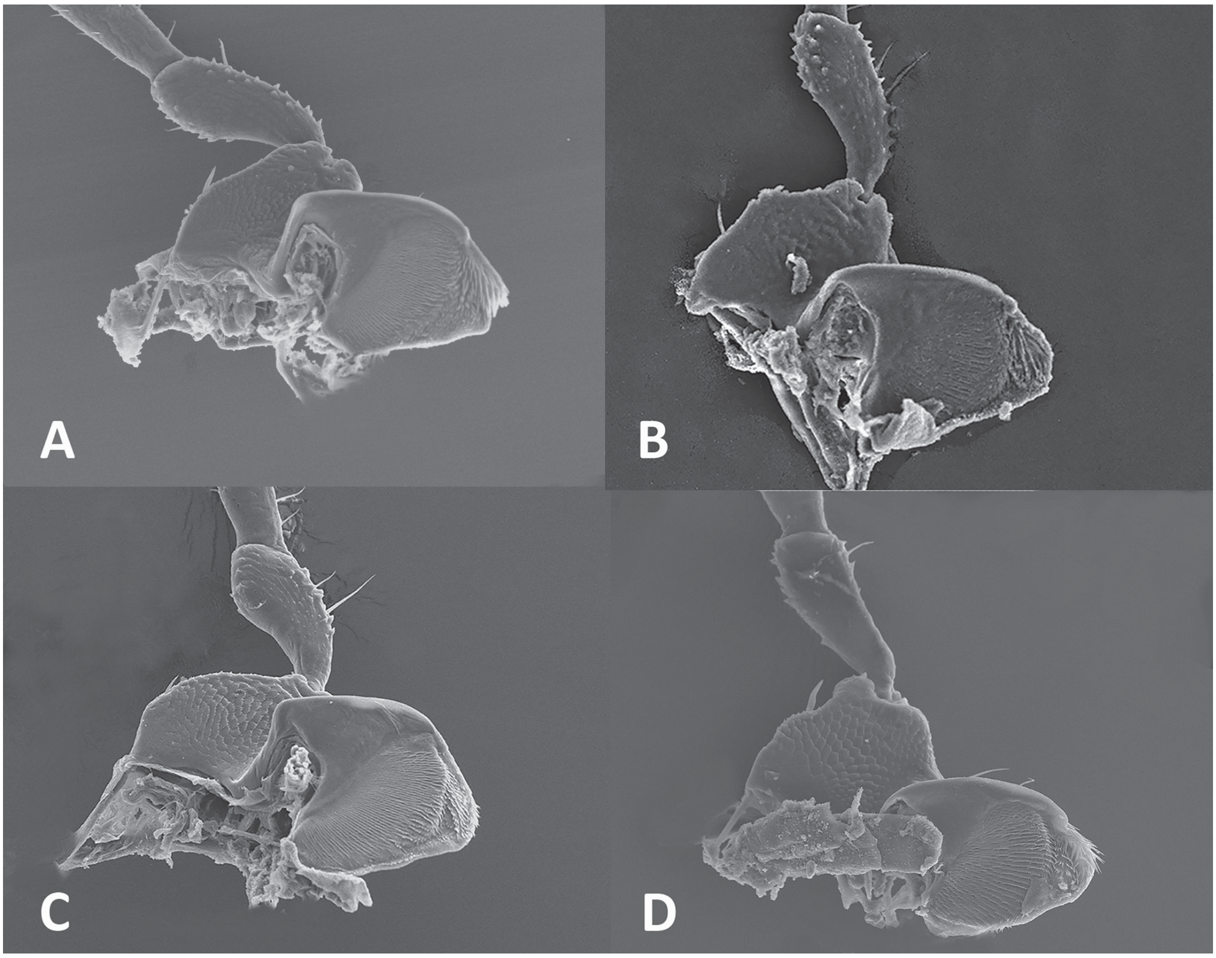

Fig. 6. Pedipalp coxae. **A–C**. Sironidae. **D**. Parasironidae fam. nov. **A**. *Cyphophthalmus duricorius* Joseph, 1868 (CIK). **B**. *Siro rubens* Latreille, 1804 (CIK). **C**. *Neosiro exilis* (Hoffman, 1963) (CIK). **D**. *Ebrosiro coiffaiti* (Juberthie, 1956) gen. et comb. nov. (CIK).

Diagnosis

Distinguished by ovipositor setation and spermatopositor structure. Ovipositor terminal lobi short, as wide as two-thirds of their length; terminally with a long terminal and a short subterminal (dorsal) medio-distal setae, two long and two short laterodistal setae. Spermatopositor with wide conical digiti mobiles laterales and short simple digiti mobiles mediales. Integument wrinkled, with three-edged and four-edged protrusions bearing small oval first rank granules.

Etymology

The genus prefix is derived from the Italian name of the Tyrrhenian Sea, as almost all known species of this genus live on the lands surrounding it. The suffix is the name of the first described genus of Cypophthalmi, *Siro*. Gender masculine.

Tirrenosiro axeli gen. et sp. nov.

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Figs 7A–C, 8A–D, 9, 11A

Diagnosis

Small species (1.36 mm) with narrow elongated ozophores; laterodistal setae (t1) of ovipositor apical lobe half length of terminal setae; posterior margin of coxal lobes II half width of anterior margin; rough integument with small, oval, first rank granules.

Etymology

This species is dedicated to our colleague, Dr Axel Schönhofer, who collected the type specimen.

Material examined

Holotype

ITALY • ♀; Lazio, Prov. Latina, Monte Circeo; 41°13′44.1″ N, 13°51′17.5″ E; 77 m a.s.l.; 9 Apr. 2006; A. Schönhofer leg.; CJM 5040 (SMF).

Description

Female (holotype)

Body. Length 1.35 mm, uniformly brown in color. Dorsum oval, rugose (Fig. 7A); anterior margin of prosoma short and protruded, concave; anterolateral margins short, sinuate. Ozophores narrow, longer than wide at their bases, laterally orientated (type 1).

Chelicerae. Stocky (Fig. 9E), basal article 0.58 mm long; second article 0.57 mm long. Basal article smooth, dorsal transverse ridge rises sharply, ventral bulge emphasized. Second article smooth, 3 times as long as wide. Teeth on fixed finger (7) and movable finger (7) tightly spaced.

Pedipalps. Of normal proportions (Fig. 9D), 1.05 mm long without coxa and apotele. Trochanter slightly shorter than patella, more than half of femur length. Tarsus as long as patella, shorter than tibia. Sensilla closer to basal part of coxae.

Legs. Basitarsi I–II elongated (I L/W ratio >3, II L/W ratio >2.5), ornamentation covers more than one-third of their length (Fig. 9A–B); basitarsi III–IV fully ornamented; telotarsus I elongated (L/W ratio >3); telotarsus II L/W ratio >2.5; basitarsi III and IV longer than telotarsi (Fig. 9C). Claws of legs II–IV with two teeth. Measurements of legs (without coxae and claws, in mm): I 1.59; II 1.31; III 1.17; IV 1.37.

Ventral prosomal complex (Fig. 7C). Posterior margin of coxal lobes II half width of anterior margin; coxal lobes III three times as wide as long; posterior margin of gonostome distinctly thickened.

Ovipositor. Apical lobes (Fig. 11A) 2.5 times as long as terminal article. Openings of receptacles situated in terminal quarter of length of apical lobes. Receptacles of saccate form. Each apical lobe bearing one exceptionally long terminal, two short medio-distal, two long and two very short laterodistal setae; laterodistal setae (t_1) half length of terminal setae.

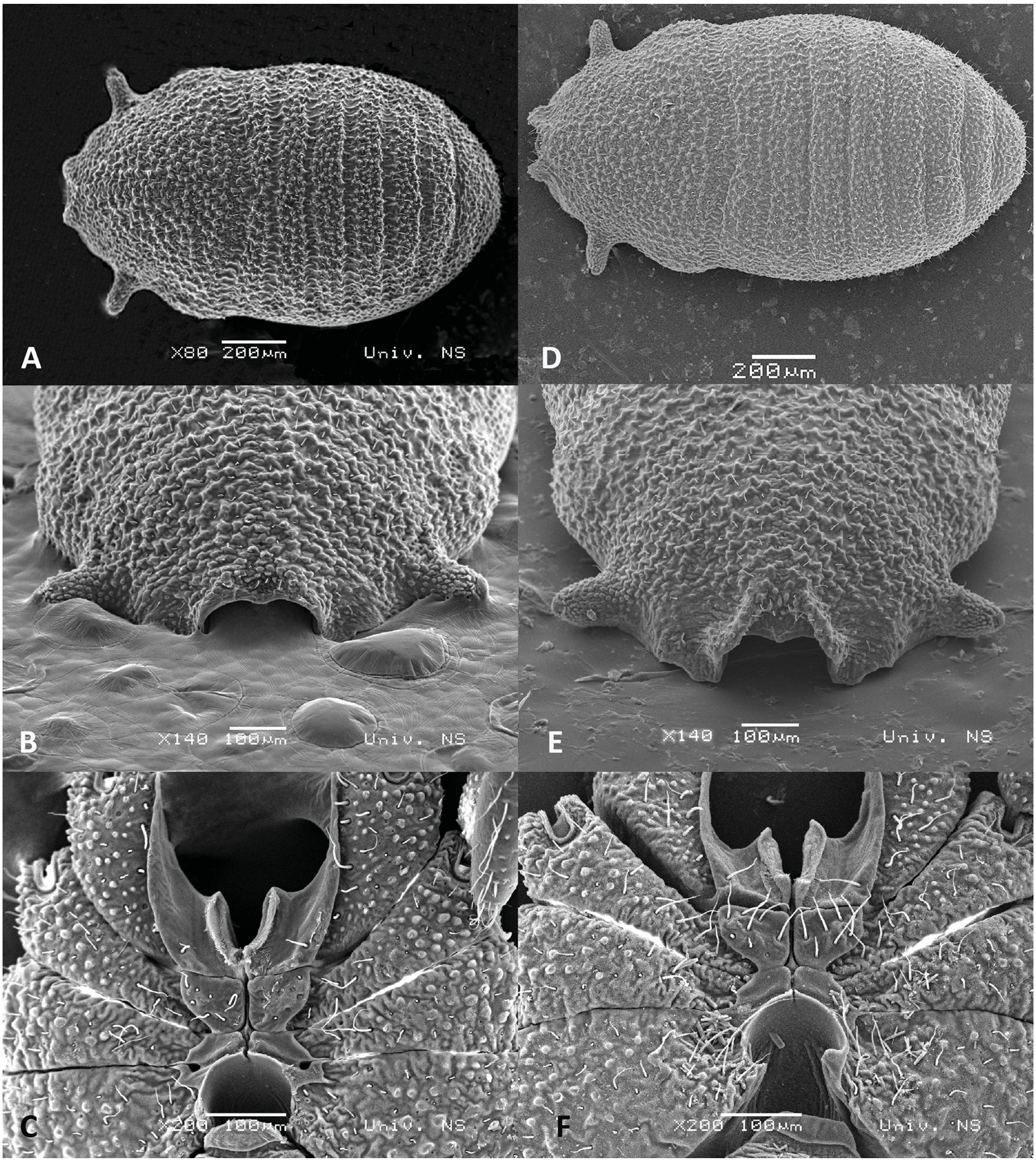

Fig. 7. A–C. *Tirrenosiro axeli* gen. et sp. nov., holotype, female (CJM 5040). **A**. Dorsum. **B**. Dorsum, frontal view. **C**. Ventral prosomal complex. **D–F**. *Tirrenosiro* cf. *minor* (Juberthie, 1958) gen. et comb. nov. (SMF) (Sardinia, Nuoro), female. **D**. Dorsum. **E**. Dorsum, frontal view. **F**. Ventral prosomal complex.

Male

Unknown.

Remarks

Based on the ovipositor setation, *Tirrenosiro* cf. *minor* (Juberthie, 1958) (Figs 7D–F, 8E–F, 10, 11B) from Sardinia (Nuoro, Macomer, M. Borora, 700 m a.s.l., A. Vigna leg., 30 Apr. 1967, SMF 22559/1) is much closer to the new species than to *T. minor* (Juberthie, 1958) from Corsica. It is clearly distinguished

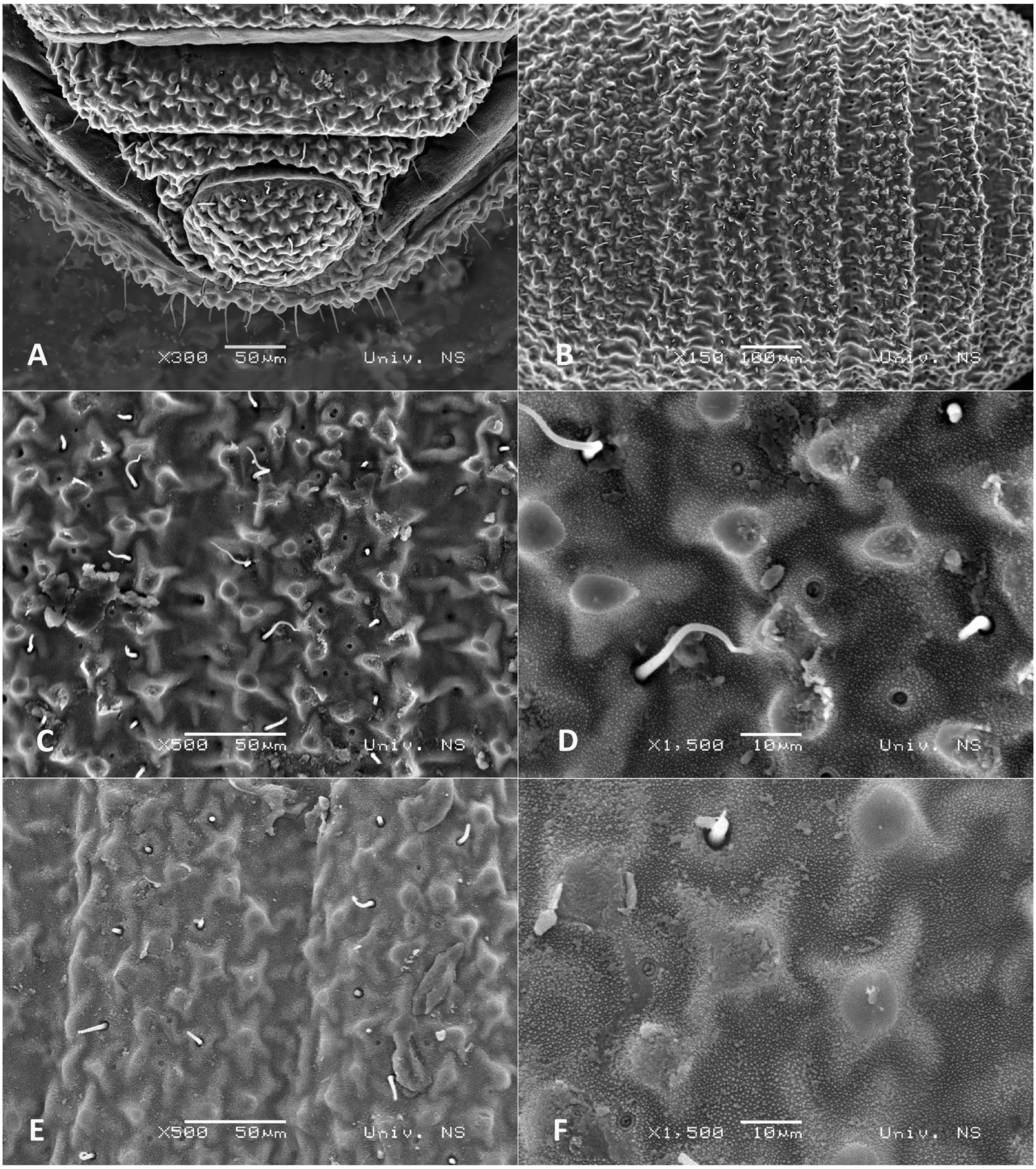

Fig. 8. A–D. *Tirrenosiro axeli* gen. et sp. nov., holotype, female (CJM 5040). **A**. Anal region, ventral view. **B**. Dorsum granulation (sixth to twelfth tergite). **C–D**. Detail of granulation of the ninth tergite. **E–F**. *Tirrenosiro* cf. *minor* (Juberthie, 1958) gen. et comb. nov. (SMF) (Sardinia, Nuoro), detail of granulation of the eighth tergite.

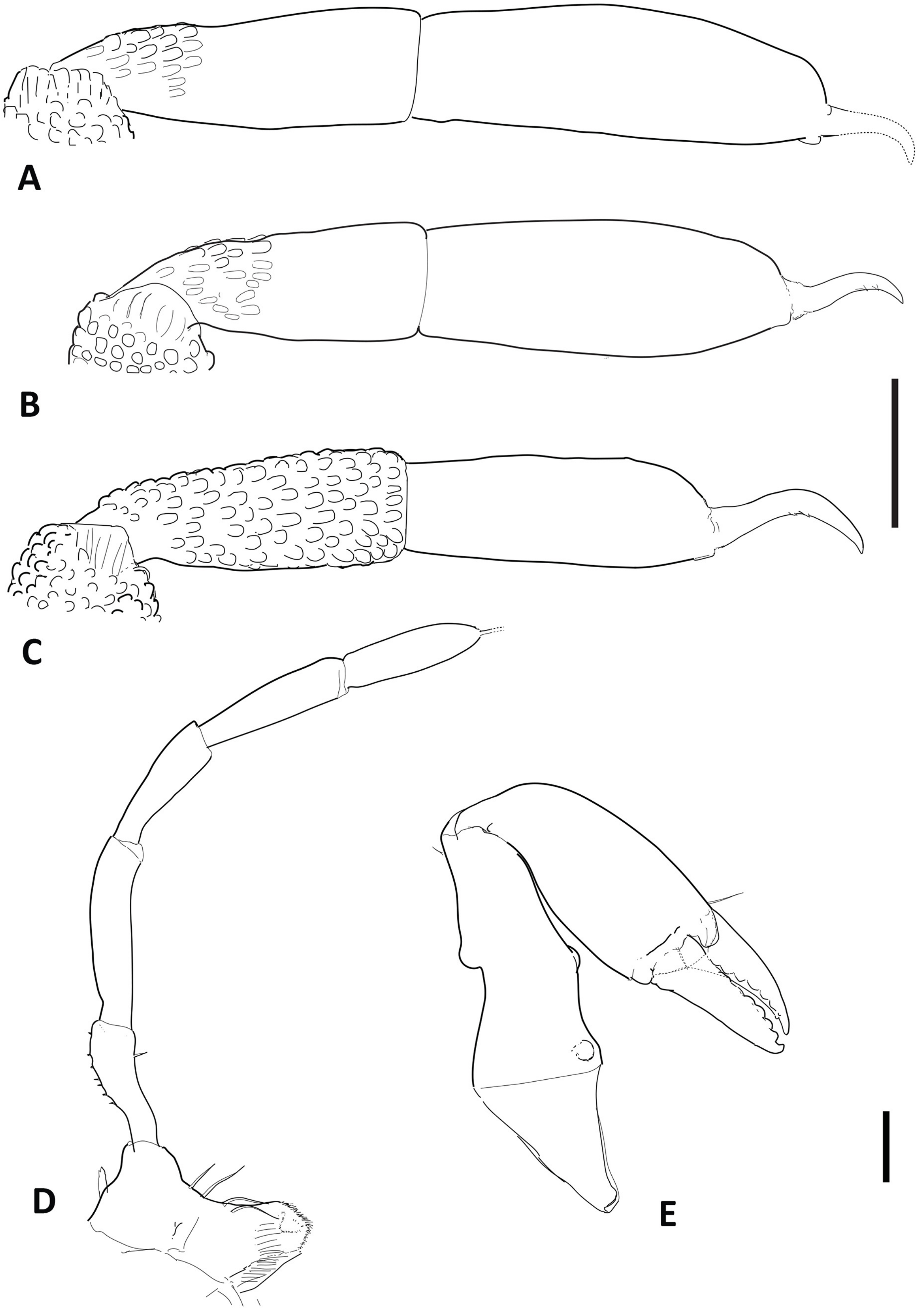

Fig. 9. *Tirrenosiro axeli* gen. et sp. nov., holotype, female (CJM). **A**. Basitarsus and telotarsus of leg I. **B**. Basitarsus and telotarsus of leg II. **C**. Basitarsus and telotarsus of leg IV. **D**. Pedipalp, lateral view. **E**. Chelicerae, lateral view. Scale bars = 100 µm.

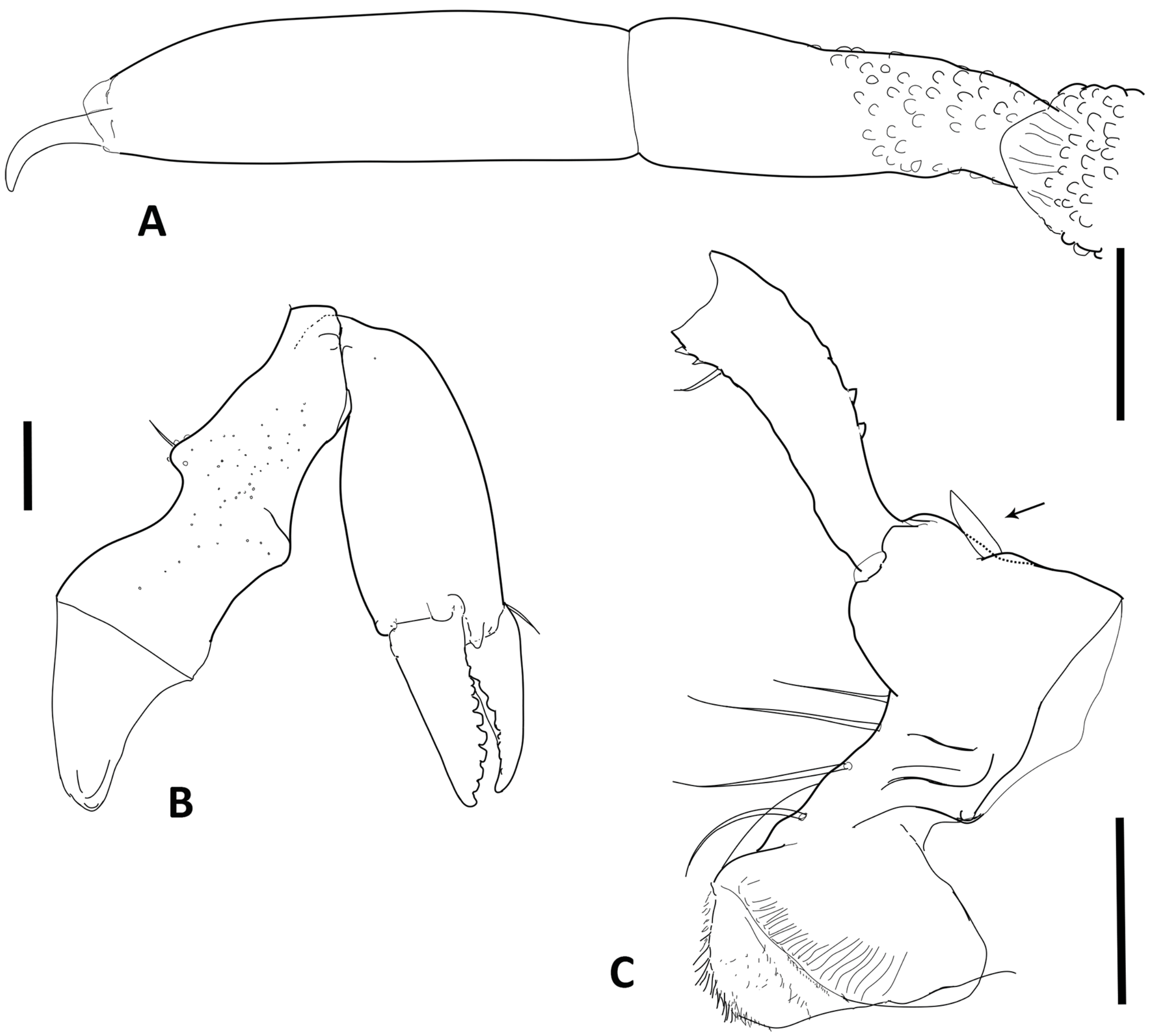

Fig. 10. *Tirrenosiro* cf. *minor* (Juberthie, 1958) gen. et comb. nov. (SMF) (Sardinia, Nuoro). **A**. Basitarsus and telotarsus of leg I. **B**. Chelicerae, lateral view. **C**. Pedipalp coxae and trochanter with sensilla (arrow), medial view. Scale bars = 100 µm.

from the new species by the profile of the coxal lobes II and III, the anterior margin of the prosoma and the position of the sensilla on the pedipalp coxae. It clearly differs from *T. minor* from Corsica by the setation of the ovipositor. Considering the diversity of the ancient fauna in Sardinia (Taiti *et al.* 2018) and the disjunct distribution of the populations of these cyphophthalmids, it is justified to assume that more than one species of the genus *Tirrenosiro* is present in Sardinia itself.

One of the characteristics of the species of the new family is the fragility of the pedipalp apotele, leg claws and setae, which we have not noticed so far in other groups of Cyphophthalmi.

Genus ***Ebrosiro*** gen. nov.

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Figs 1F, 2A–C, 3, 4C–D, 6D, 11C

Type species

Parasiro coiffaiti Juberthie, 1956.

Included species

Only the type species, *Ebrosiro coiffaiti* (Juberthie, 1956) gen. et comb. nov.

Diagnosis

Ovipositor apical lobi short, with terminal setae slightly longer than subterminal (mediodistal) and 4 laterodistal setae. Receptaculum seminis with lateral ampulla which gives it a forked appearance (Fig. 11C). Bottom of ampulla connected with ovipositor lobi wall with tiny tendinous structures. Receptacle orifices located at base of apical half of length of apical lobes. Spermatopositor wide, digiti mobiles mediales with elongated tips, curved outward, exceeds margin of median lobe. Digiti mobiles laterales of irregular rod-shaped form.

Etymology

The genus prefix is derived from the name of the Ebro continental Block to which we attribute the origin of this genus. The suffix is the name of the first described Cypophthalmi genus, *Siro*, a common suffix applied to many cyphophthalmid genera. Gender masculine.

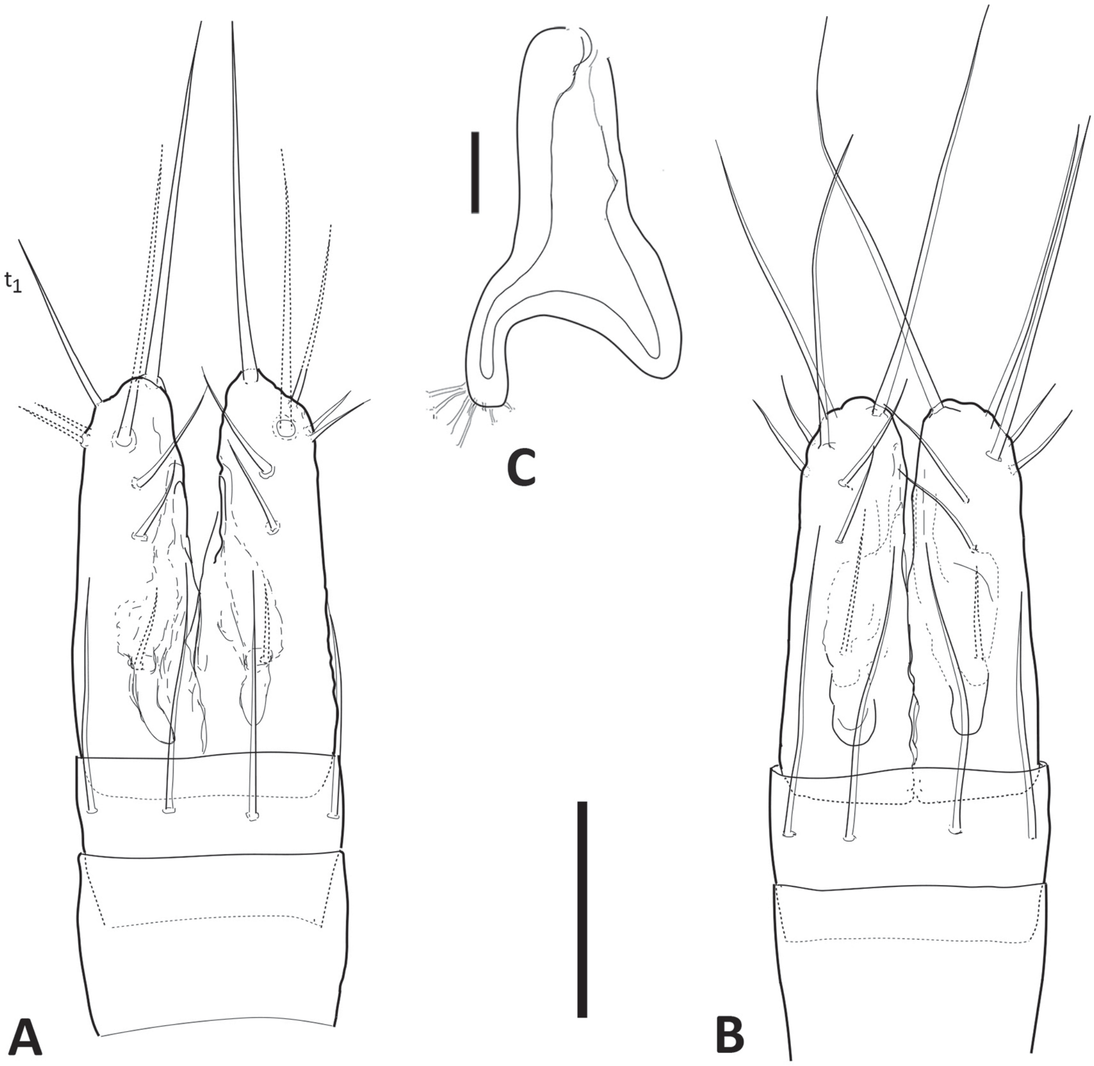

Fig. 11. A–B. Distal portion of ovipositor, dorsal view. **A**. *Tirrenosiro axeli* gen. et sp. nov. (CJM). **B**. *T.* cf. *minor* (Juberthie, 1958) gen. et comb. nov. (SMF) (Sardinia, Nuoro). **C**. Receptacle seminis of *Ebrosiro coiffaiti* (Juberthie, 1956) gen. et comb. nov. (CIK). Scale bars: A–B = 100 µm; C = 20 µm.

Genus ***Cimmerosiro*** gen. nov.

urn:lsid:zoobank.org:act:CBC26AEB-1289-4A97-92E0-4A396F05D0D4

Type species

Cimmerosiro krivolutskyi gen. et sp. nov.

Included species

Cimmerosiro krivolutskyi gen. et sp. nov., *C. juberthiei* gen. et sp. nov. and *C. rhodiensis* gen. et sp. nov.

Diagnosis

Ovipositor apical lobi with a long terminal, 3 equal, slightly shorter laterodistal and a shorter mediodistal setae (Fig. 12). Posterior margin of female genital orifice very thick and strongly convex, lip-like (Fig. 2F). Digiti mobiles mediales of spermatopositor terminally fimbriate. Digiti mobiles laterales of irregular rod-shaped form. Claws III prolaterally with a comb-like row of spines.

Etymology

The genus prefix is derived from the name Cimmeria, the ancient continent to whose western part we associate the origin and distribution of the family Parasironidae. The suffix is the name of the genus *Siro*, a common suffix applied to cyphophthalmid genera. Gender masculine.

Cimmerosiro krivolutskyi gen. et sp. nov.

urn:lsid:zoobank.org:act:A1C347DD-AD99-4041-B6C2-9906C4EECF71
Figs 1A–C, 2D–E, 12A, 13–17

Diagnosis

Medium-sized species. Male tarsus IV short, swollen, adenostyle tubulose with dorsal crest. Digiti mobiles mediales of spermatopositor sharply tapering toward fimbriate tip. Apical lobes of ovipositor elongated, 2.5 times as long as terminal article. Terminal setae long, as long as apical lobes. Claws III prolaterally with a comb-like row of spines.

Etymology

This species is dedicated to the acarologist Dmitry A. Krivolutsky, who previously indicated the existence of this fauna in the Satapalia and Borjomi Nature Reserves in western Georgia.

Material examined

Holotype

GEORGIA • ♂; Satapalia Nature Reserve near Kutaisi, Kutaisi; 42°18′41.2″ N, 42°40′32.2″ E; 411 m a.s.l.; 27 Aug. 2019; P. Hlaváč and P. Baňař leg.; CIK 1541/1.

Paratypes

GEORGIA • 2 ♀♀; same collection data as for holotype; CIK 1541/2 • 1 ♀; Satapalia Nature Reserve near Kutaisi, Kutaisi; 42°18′43.9″ N, 42°40′23.1″ E; 453 m a.s.l.; 27 Aug. 2019; P. Hlaváč and P. Baňař leg.; CIK 1542 • 1 ♂, 1 ♀; same collection data as for preceding; CNS.

Description

Male

Body. If not otherwise stated, measurements for the male holotype. Body length 1.55 mm (males: 1.55–1.60 mm). Body uniformly brown in color, widely oval; anterolateral margins long, sinuate, twice as long as ozophores; posterior margin of opisthosoma broadly conical (Fig. 13A). Ozophores narrow, longer than wide at their bases, laterally orientated (type 1). Integument densely granulated with predominantly oval first rank granules (Figs 14A-C).

CHELICERAE. Slightly elongated (Fig. 16B), basal article 0.69 mm long; second article 0.64 mm long. Basal article on lateral side sparsely granulated with fine granules; dorsal transverse ridge rises sharply,

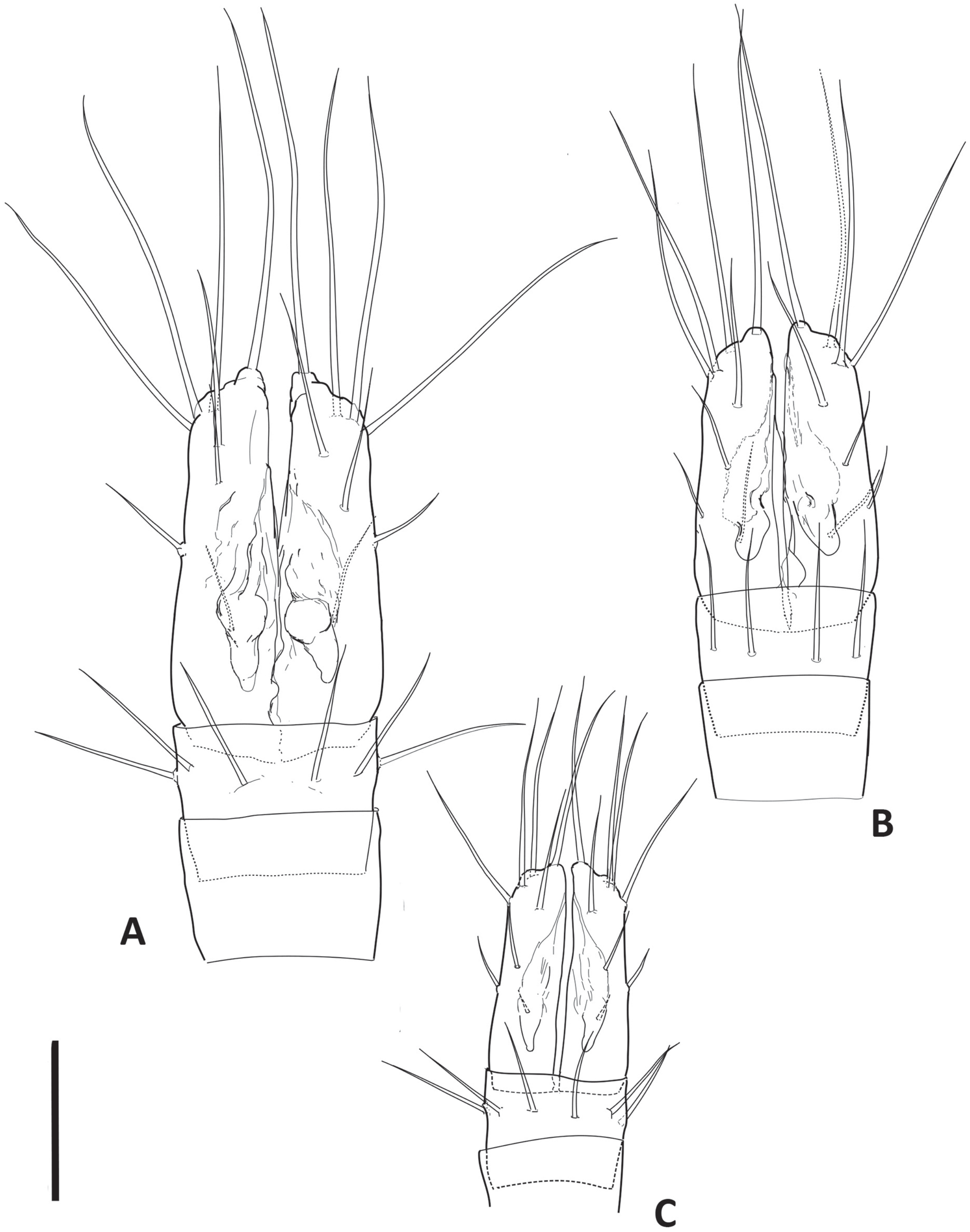

Fig. 12. Distal portion of ovipositor, dorsal view. **A**. *Cimmerosiro krivolutskyi* gen. et sp. nov. (CIK). **B**. *C. juberthiei* gen. et sp. nov. (MHNG). **C**. *C. rhodiensis* gen. et sp. nov. (CIK). Scale bar = 100 µm.

ventral bulge laterally oriented. Second article smooth, 3.5 times as long as wide. Teeth on fixed finger (8) and movable finger (7) tightly spaced.

PEDIPALPS. With chunky articles of normal proportions (Fig. 16A), 1.08 mm long without coxa and apotele; trochanter as long as patella; tarsus as long as tibia. Sensilla closer to terminal part of coxae.

VENTRAL PROSOMAL COMPLEX (Fig. 13B). Coxal lobes II more than twice as wide anteriorly as at poisterior end. Coxal lobes III more than twice as wide as long; slightly protruded medially at an obtuse

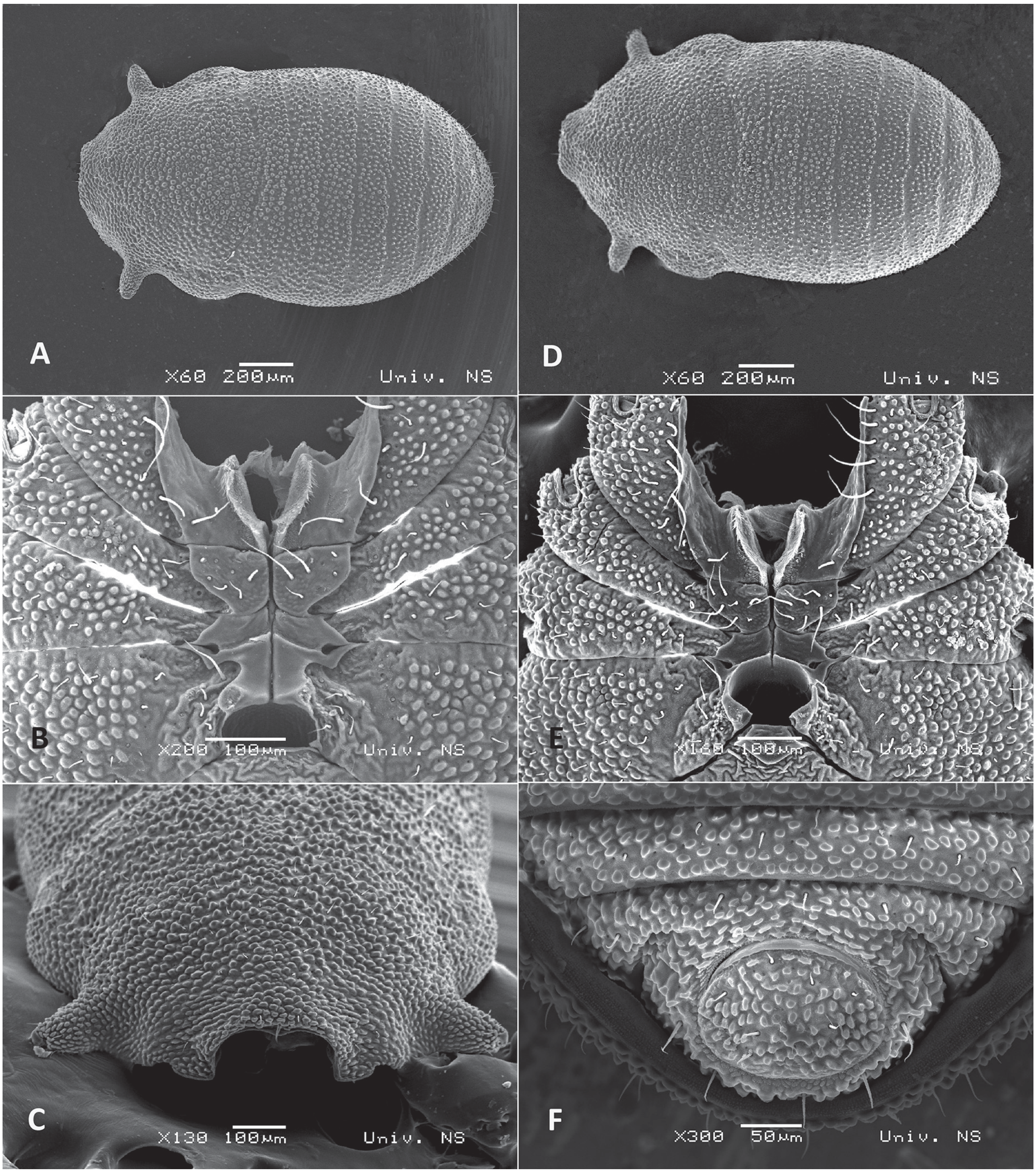

Fig. 13. *Cimmerosiro krivolutskyi* gen. et sp. nov. **A–C**. Male (CIK). **D–F**. Paratype, female (CIK). **A**, **D**. Dorsum. **B**, **E**. Ventral prosomal complex. **C**. Dorsum, frontal view. **F**. Anal region, ventral view.

angle. Coxal lobes IV slightly protruded medially at an obtuse angle, as long as wide at their narrowest part; posteriorly widened with conical processes situated laterally on frontal margin of gonostome.

Legs. Basitarsi I–II chunky (I L/W ratio > 2, II L/W ratio = 2.5); ornamentation covers one-half of length of basitarsus I (Fig. 15A–B); basitarsi III–IV fully ornamented; telotarsus I elongated (L/W ratio > 3); telotarsus II L/W ratio > 2.5; telotarsus IV short, swollen (Fig. 15C); adenostyle elongated tubulose with dorsal crest (Fig. 16C). Claws II with a very small denticle; claws III with prolateral comb-like row of 3 elongated denticles and 2 small retrolateral denticles; claws IV with a small denticle on each side. Measurements of legs (without coxae and claws, in mm): I 1.75; II 1.46; III 1.23; IV 1.52.

Spermatopositor (Fig. 17). Wide (less than two times as long as wide) with short terminal lobe. Setae terminales (4) short, lateral pair slightly shorter than medial pair; setae dorsales (4), lateral pair almost as long as medial pair. Three setae laterales on each side. Setae ventrales (3) located proximal to terminal lobe, medial one located lower. Digiti mobiles mediales wide, with fimbriate tip. Digiti mobiles laterales of irregular rod-shaped form, tapering toward tip. Median lobe slightly granulated.

Female

Body length 1.59–1.65 mm. Dorsum widely oval (Fig. 13D); anterior margin protruded; anterolateral margins long, sinuate. Coxal lobes II of ventral prosomal complex (Fig. 13E) as in male; coxal lobes III twice as wide as long. Ovipositor terminal setae elongate, as long as apical lobes (Fig. 12A); terminal

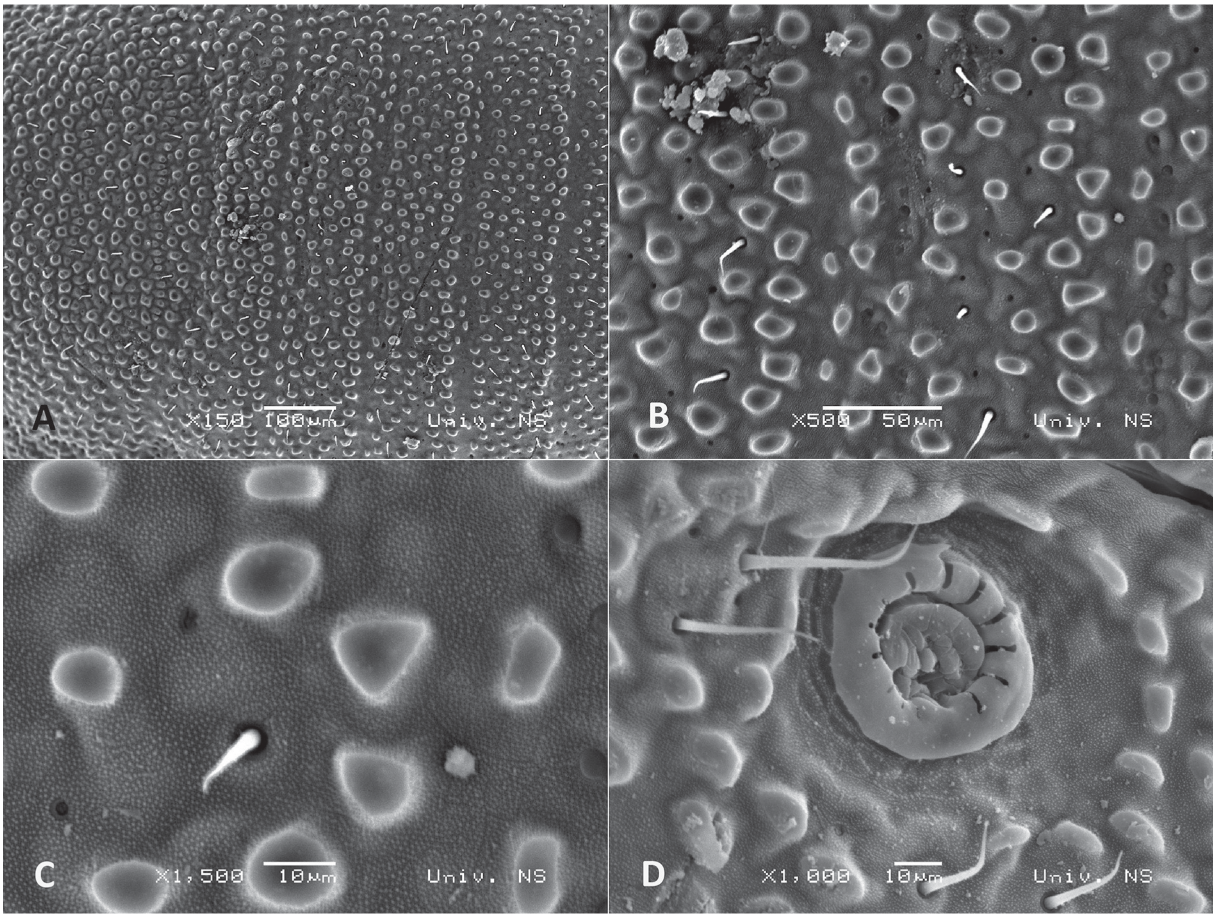

Fig. 14. *Cimmerosiro krivolutsky* gen. et sp. nov., paratype, female (CIK). **A**. Dorsum granulation (sixth to tenth tergite). **B–C**. Details of granulation of the eigth tergite. **D**. Spiracle.

article wider than long. Receptacle orifices situated on terminal third of apical lobes; receptacles of saccate form, tapering towards bottom. Measurements of legs, without coxae and claws (in mm) (female of 1.60 mm body length): I 1.72; II 1.41; III 1.17; IV 1.47.

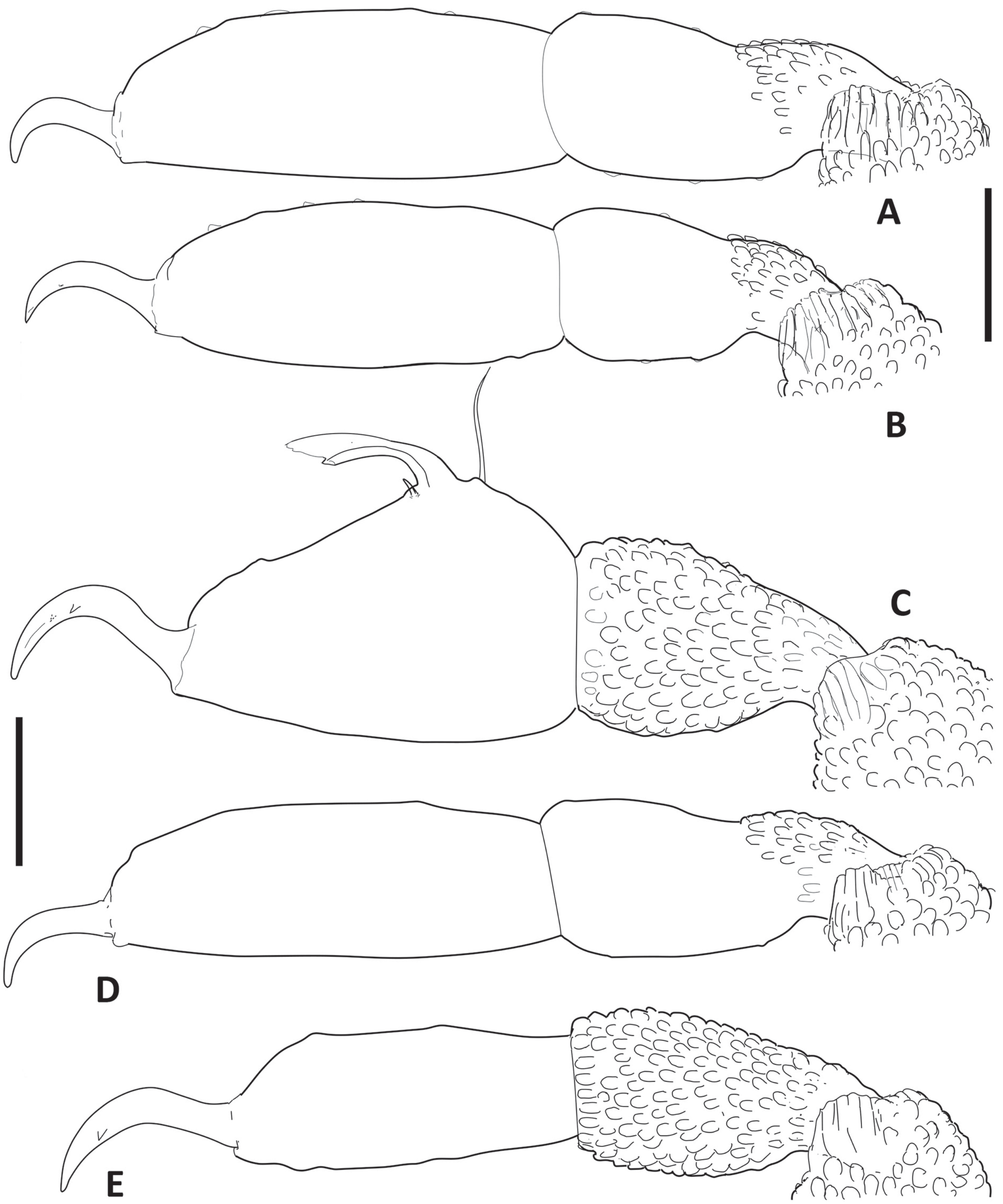

Fig. 15. *Cimmerosiro krivolutsky* gen. et sp. nov. **A–B**. Holotype, male (CIK). **C**. Paratype, male (CIK). **D–E**. Paratype, female (CIK). **A**. Basitarsus and telotarsus of leg I. **B**. Basitarsus and telotarsus of leg II. **C**. Basitarsus and telotarsus of leg IV. **D**. Basitarsus and telotarsus of leg I. **E**. Basitarsus and telotarsus of leg IV. Scale bars = 100 µm.

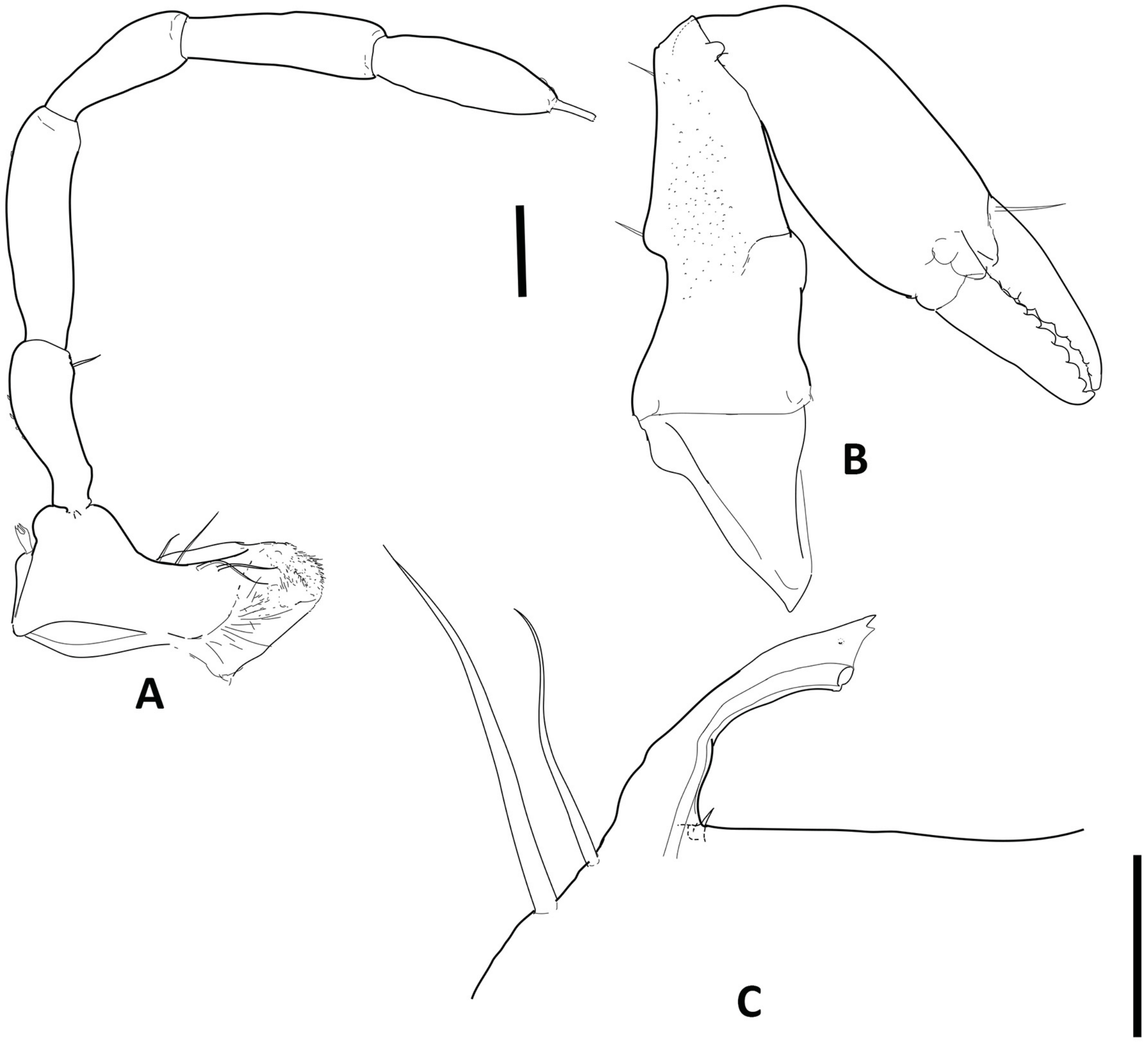

Fig. 16. *Cimmerosiro krivolutsky* gen. et sp. nov., holotype, male (CIK). **A**. Pedipalp, lateral view. **B**. Chelicerae, lateral view. **C**. Adenostyle. Scale bars: A–B = 100 µm; C = 50 µm.

Remarks

We have analyzed specimens of two populations from relatively close sites which show differences in body dimensions and in the expression of the male adenostyle dorsal crest. These and other possible differences have to be investigated in a larger number of samples.

Cimmerosiro juberthiei gen. et sp. nov.
urn:lsid:zoobank.org:act:6773D047-03E1-42F8-96B4-F4654914A8FA
Figs 12B, 18–20

Diagnosis

Small species (1.38–1.40 mm). Claws III with a comb-like row of short spines. Pedipalp tibia as long as tarsus. Coxal lobi II short, three times as wide as long.

Etymology

This species is named after Dr Christian Juberthie, a renowned expert on Cyphophthalmi.

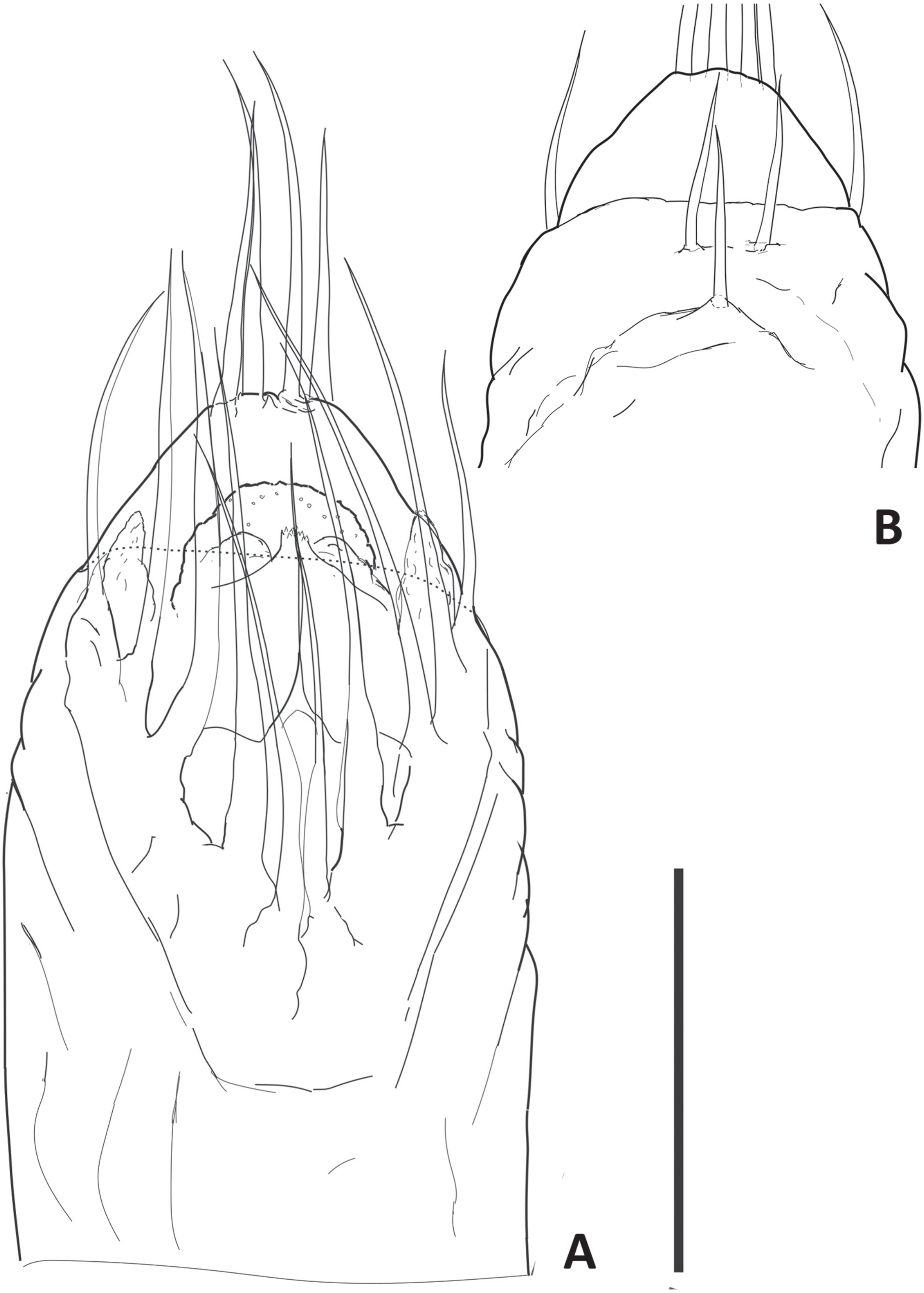

Fig. 17. *Cimmerosiro krivolutsky* gen. et sp. nov., paratype, male (CIK). Spermatopositor (dorsal view). Scale bar = 100 µm.

Material examined

Holotype

TURKEY • ♀; Artvin, above Artvin; 800 m a.s.l.; 7 Jun. 1986; litter sifting in oak forest; C. Besuchet, I. Löbl and D.H. Burckhardt leg.; MHNG-ARTO-0034047.

Paratype

TURKEY • ♀; same collection data as for holotype; MHNG-ARTO-0034048.

Description

Female (holotype)

Body. Length 1.38 mm (paratype 1.40 mm); uniformly amber color (possibly faded). Dorsum narrow, elongated (almost twice as long as wide) (Fig. 18A); anterior margin of prosoma with shallow notch; anterolateral margins short, sinuate; posterior margin of opisthosoma rounded. Ozophores slightly longer than wide at their bases, laterally orientated (type 1). Integument densely granulated with oval to slightly elongated first rank granules (Fig. 19A–C).

Chelicerae (Fig. 20D). Stocky; basal article 0.53 mm long; second article 0.51 mm long; smooth with slightly sparsely granulated ventral process of basal article; on fixed finger 7, on movable finger 6 tightly spaced teeth.

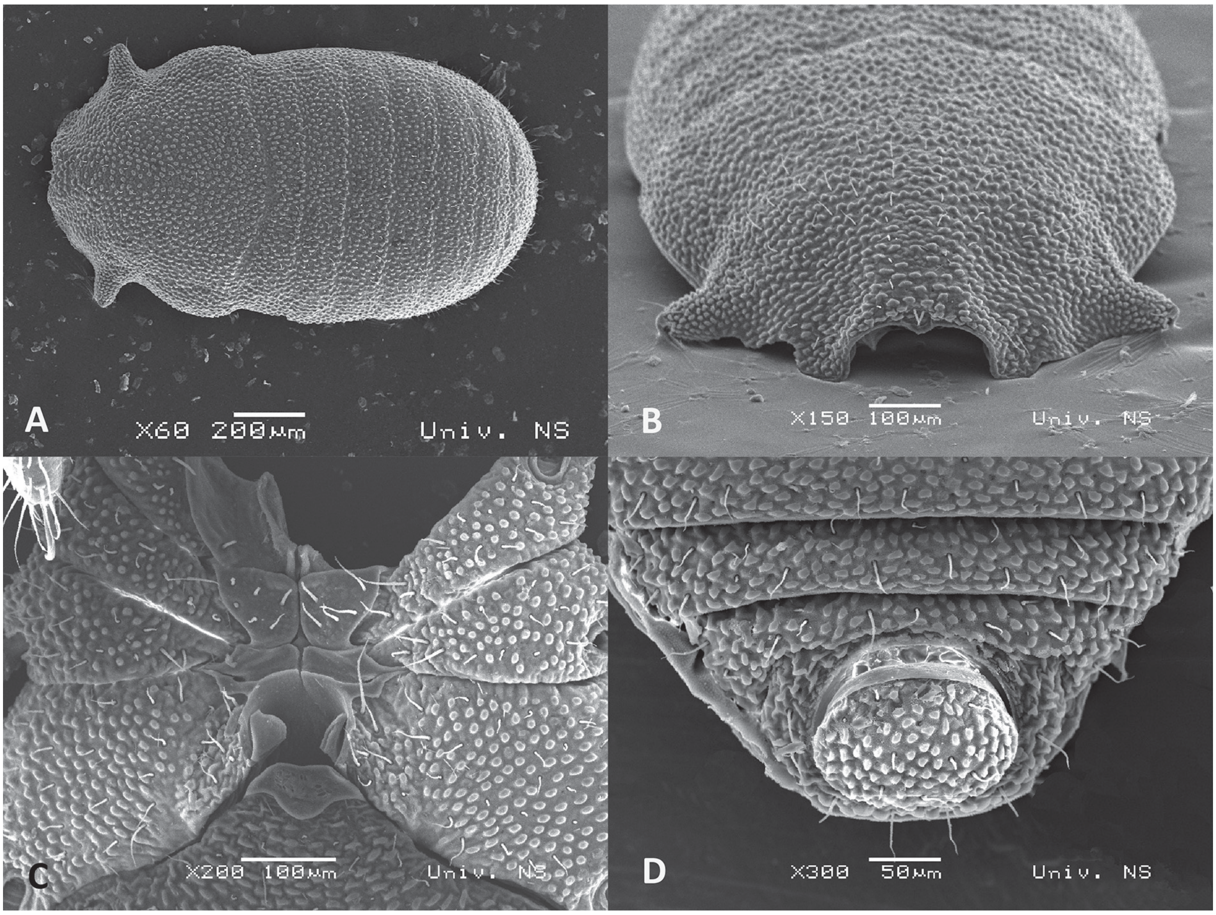

Fig. 18. *Cimmerosiro juberthiei* gen. et sp. nov., holotype, female (MHNG). **A**. Dorsum. **B**. Dorsum, frontal view. **C**. Ventral prosomal complex. **D**. Anal region, ventral view.

Pedipalps (Fig. 20E). Of normal proportions, 0.93 mm long without coxa and apotele; trochanter as long as patella; tarsus as long as tibia; apotele elongated.

Ventral prosomal complex (Fig. 18C). Coxal lobes II are twice as wide anteriorly as at poisterior end. Coxal lobes III short, three times as wide as long.

Legs. Metatarsi elongated. Basitarsi I with ornamented astragalus occupying less than half of their length. Telotarsus I L/W ratio: 3; telotarsus II L/W ratio: 2.5 (Fig. 20A–B). Sensory structure – "subapical process" present on telotarsi I–II, large, thick, not tapering toward distal portion; almost laid flat on surface of telotarsi. Telotarsus IV relatively short, slightly longer than basitarsus (Fig. 20C). Claws II with two short denticles; claws IV with a short denticle; claws III with a row of 4 prolateral and 2 short retrolateral dentlices; two basal retrolateral denticles very short, distal two elongated. Measurements of legs (without coxae and claws, in mm): I 1.47; II 1.17; III 0.98; IV 1.22.

Ovipositor. Apical lobes short (Fig. 12B) two times as long as terminal article. Terminal article as long as wide at its base. Receptacle orifices located subterminally on apical lobes. Receptacles of saccate form. Terminal setae slightly longer than apical lobes. Subterminal mediodistal setae half as long as terminal ones.

Male

Unknown.

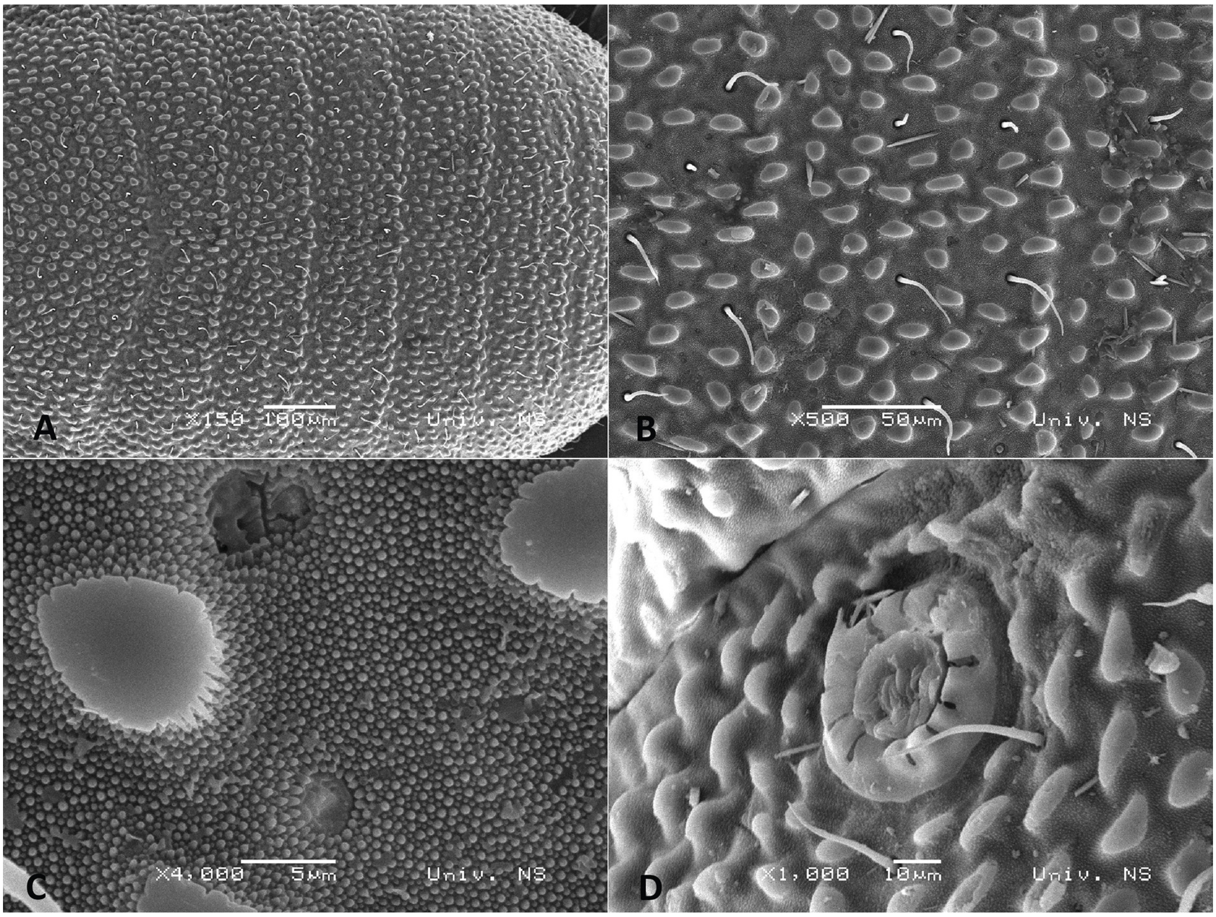

Fig. 19. *Cimmerosiro juberthiei* gen. et sp. nov., holotype, female (MHNG-ARTO-0034047). **A**. Dorsum granulation (sixth to eleventh tergite). **B–C**. Details of granulation of eighth tergite. **D**. Spiracle.

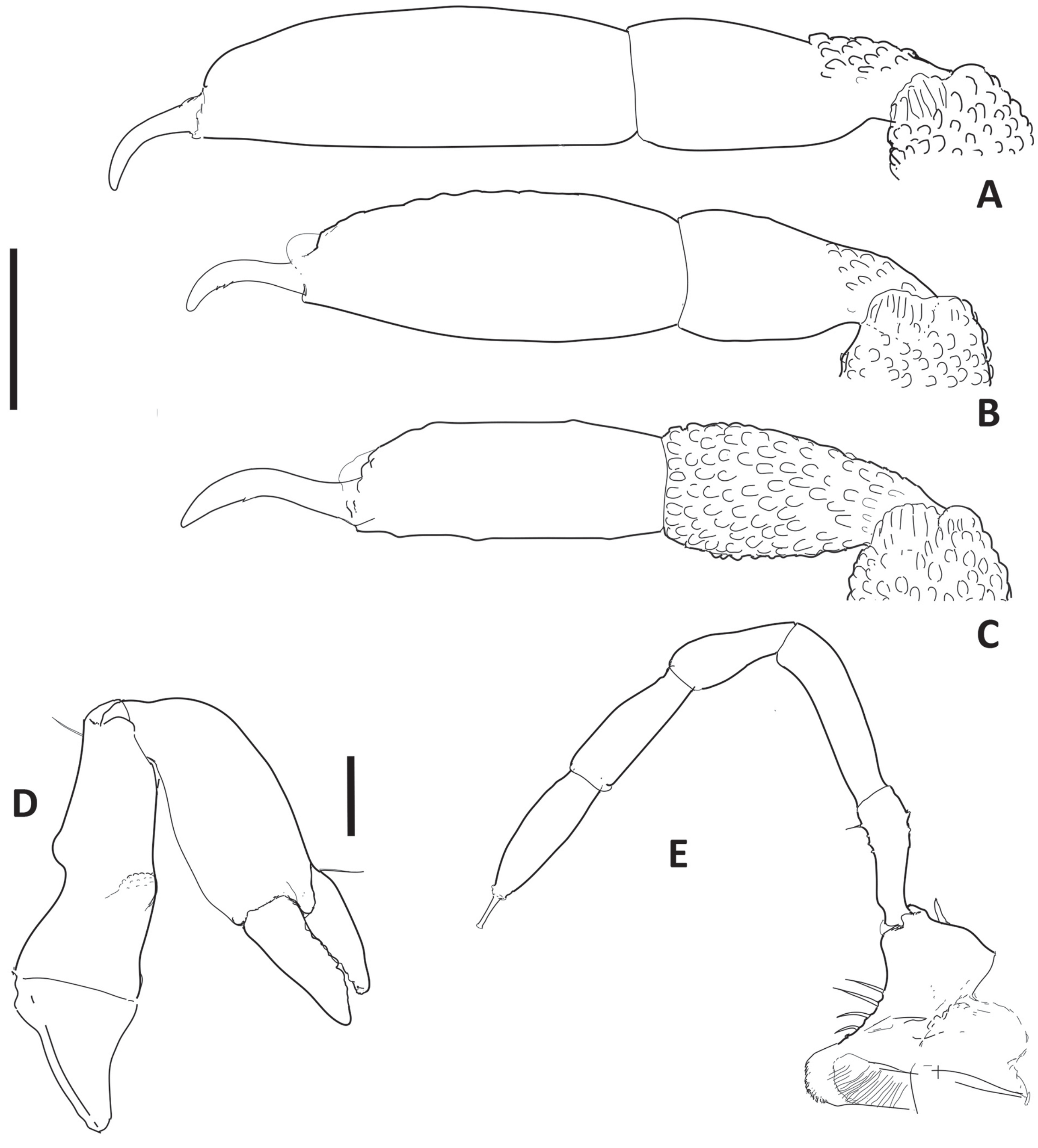

Fig. 20. *Cimmerosiro juberthiei* gen. et sp. nov., holotype, female (MHNG-ARTO-0034047). **A**. Basitarsus and telotarsus of leg I. **B**. Basitarsus and telotarsus of leg II. **C**. Basitarsus and telotarsus of leg IV. **D**. Chelicerae, lateral view. **E**. Pedipalp, medial view. Scale bars = 100 µm.

Cimmerosiro rhodiensis gen. et sp. nov.
urn:lsid:zoobank.org:act:5B581EC5-9155-44F1-9A48-1477669D4F04
Figs 1D–E, 2F, 12C, 21–25

Diagnosis

Small species (1.10–1.18 mm) with narrow, elongated body; in females posteriorly with protrusion of duck-bill form. Integument granulation with densely distributed first rank granules of irregular form.

Adenostyle elongated, with long filiform distal processus. Spermatopositor elongated. Claws I without denticles. Claws III with prolateral comb-like row of 4–5 denticles.

Etymology

The name of this species is the adjective 'rhodiensis', based on the island of Rhodes, where this species was found.

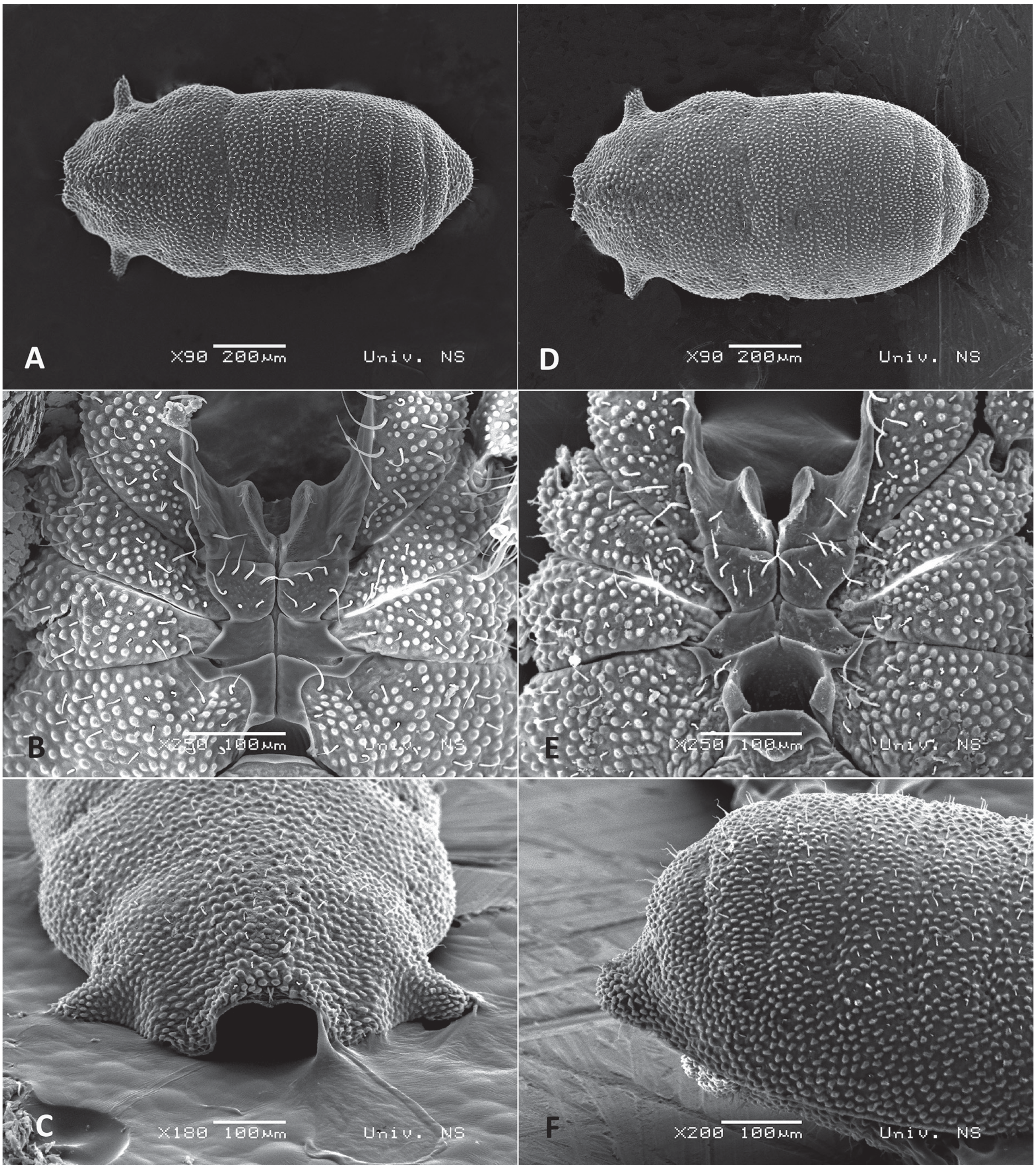

Fig. 21. *Cimmerosiro rhodiensis* gen. et sp. nov. **A–C**. Male (CIK). **D–F**. Paratype, female (CIK). **A, D**. Dorsum. **B, E**. Ventral prosomal complex. **C**. Dorsum, frontal view. **F**. Opisthosoma, posterior part, lateral view.

Material examined

Holotype

GREECE • ♂; Epta Piges, Rhodes; 36°15′7.24″ N, 28°6′42.69″ E; 120 m a.s.l.; 20 Apr. 2022; I. Karaman and M. Horvatović leg.; CIK 1542/1.

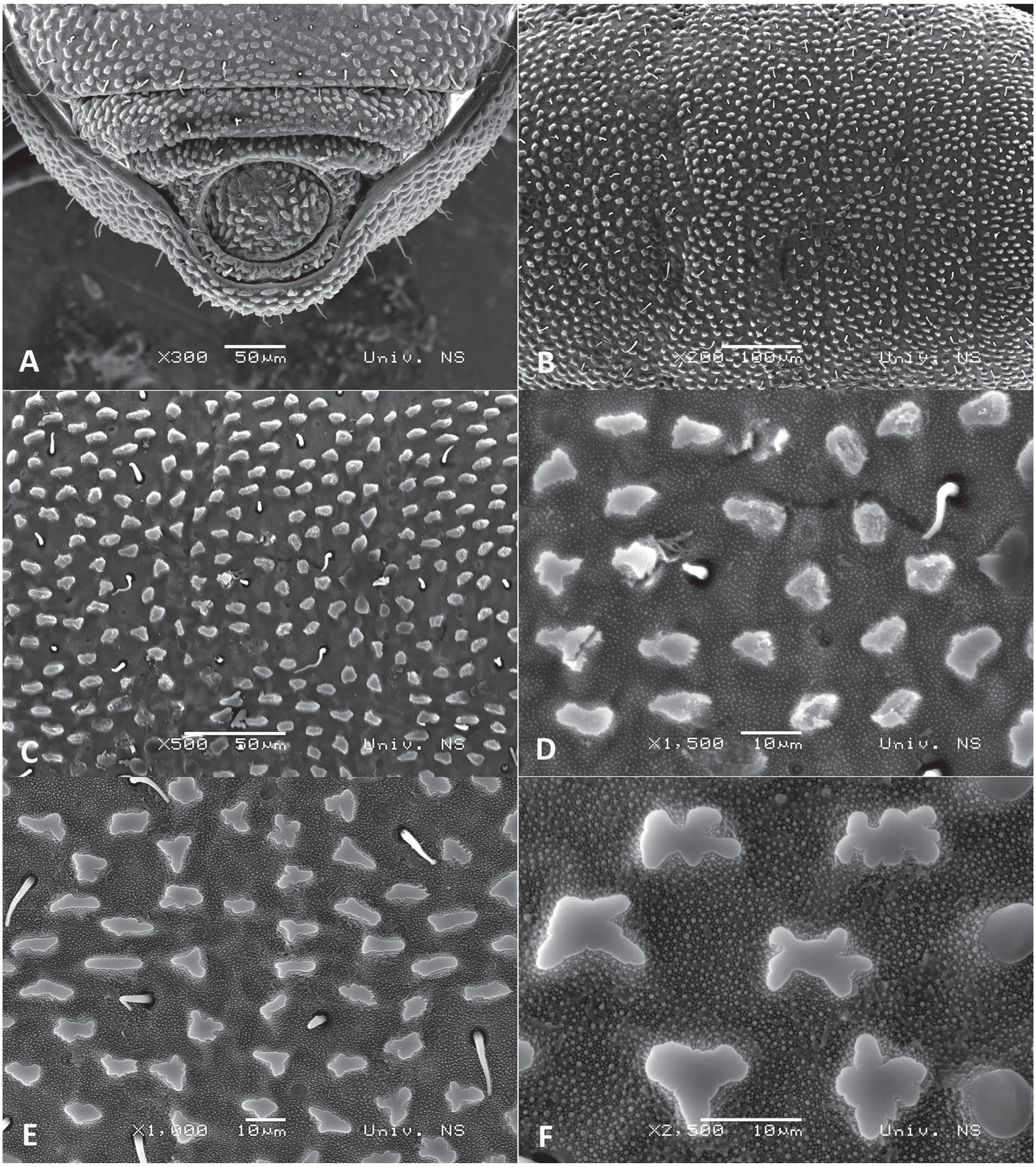

Fig. 22. *Cimmerosiro rhodiensis* gen. et sp. nov., paratype, female (CIK). **A**. Anal region, ventral view. **B**. Dorsum granulation (sixth to eleventh tergite). **C–D**. Details of granulation of ninth tergite. **E–F**. Details of dorsum granulation.

Paratypes

GREECE • 2 ♂♂, 10 ♀♀, 6 juvs; same collection data as for holotype; CIK 1542/2 • 1 ♂, 1 ♀; same collection data as for holotype; CJM 9582 (SMF) • 1 ♂, 1 ♀; same collection data as for holotype; CPM • 3 ♀♀; Epta Piges, Rhodes; 9 Apr. 1977; C. Besuchet leg.; MHNG-ARTO-0034049.

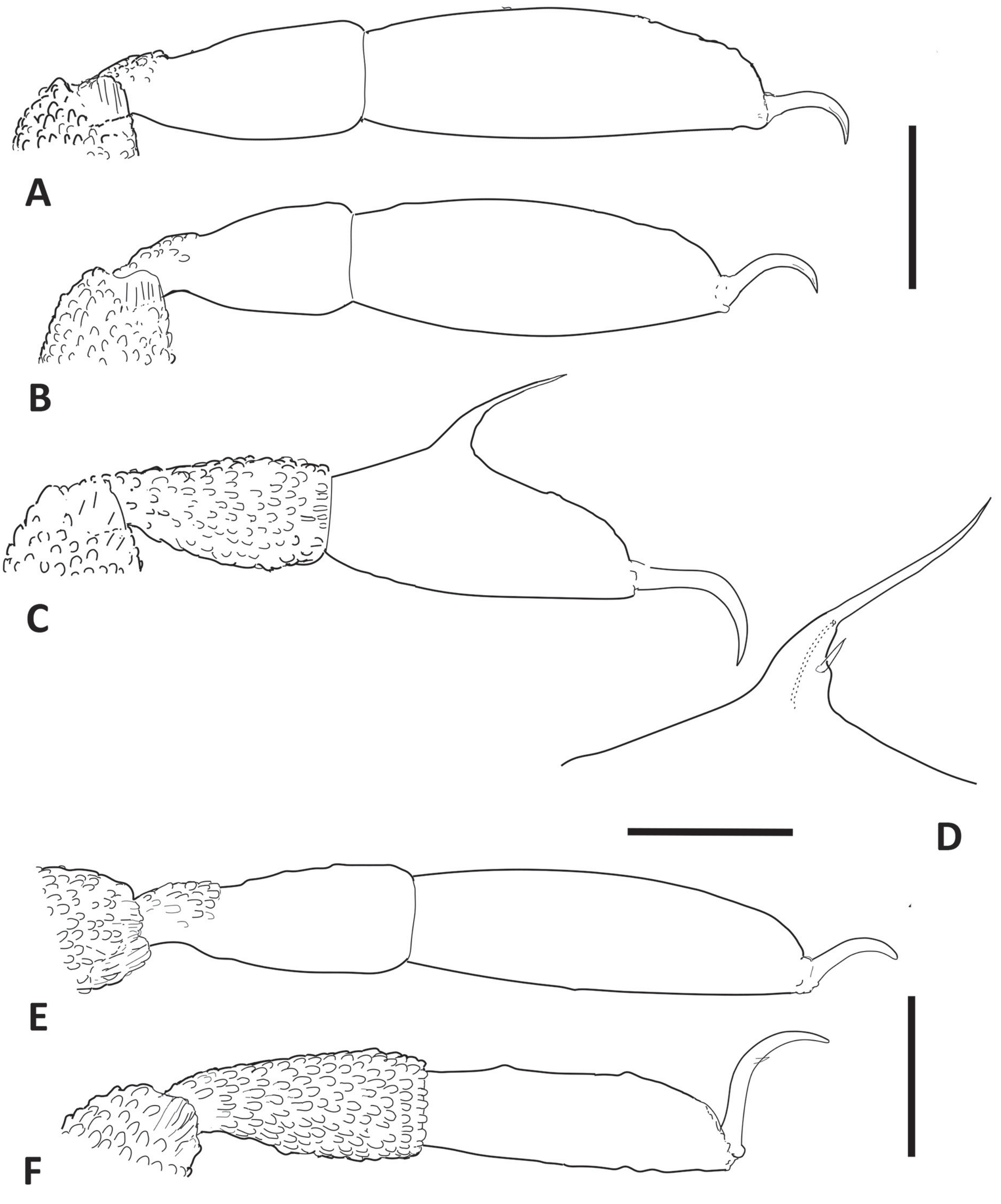

Fig. 23. *Cimmerosiro rhodiensis* gen. et sp. nov. **A–D**. Male (CIK 1542/2). **E–F**. Paratype, female (CIK 1542/2). **A**. Basitarsus and telotarsus of leg I. **B**. Basitarsus and telotarsus of leg II. **C**. Basitarsus and telotarsus of leg IV. **D**. Adenostyle. **E**. Basitarsus and telotarsus of leg I. **F**. Basitarsus and telotarsus of leg IV. Scale bars: A–C, E–F = 100 µm; D = 50 µm.

Description

Male

Body. If not otherwise stated, measurements for the male holotype. Body length 1.15 mm (males: 1.10–1.15 mm). Body uniformly light brown in color. Dorsum narrow (Fig. 21A), elongated (more than twice as long as wide), posteriorly conically pointed; anterior margin of prosoma short and slightly protruded, concave; anterolateral margins long, sinuate. Ozophores narrow, slightly longer than wide at their bases, laterally orientated (type 1). Integument densely granulated with first rank granules of irregular forms (Fig. 22B–F).

Chelicerae (Fig. 24A). Slightly elongated, smooth; basal article 0.49 mm long; second article 0.45 mm long; transverse ridge rises more gradually than sharply from dorsal depression, ventral bulge emphasized. Second article almost 4 times as long as wide. Teeth on fixed finger (6) and movable finger (7) tightly spaced.

Pedipalps (Fig. 24B). Of normal proportions, 0.77 mm long without coxa and apotele; trochanter elongated, longer than patella, as long as tibia; tarsus longer than tibia; apotele elongated. Sensilla closer to basal part of coxae. Ornamented astragalus and smooth calcaneus.

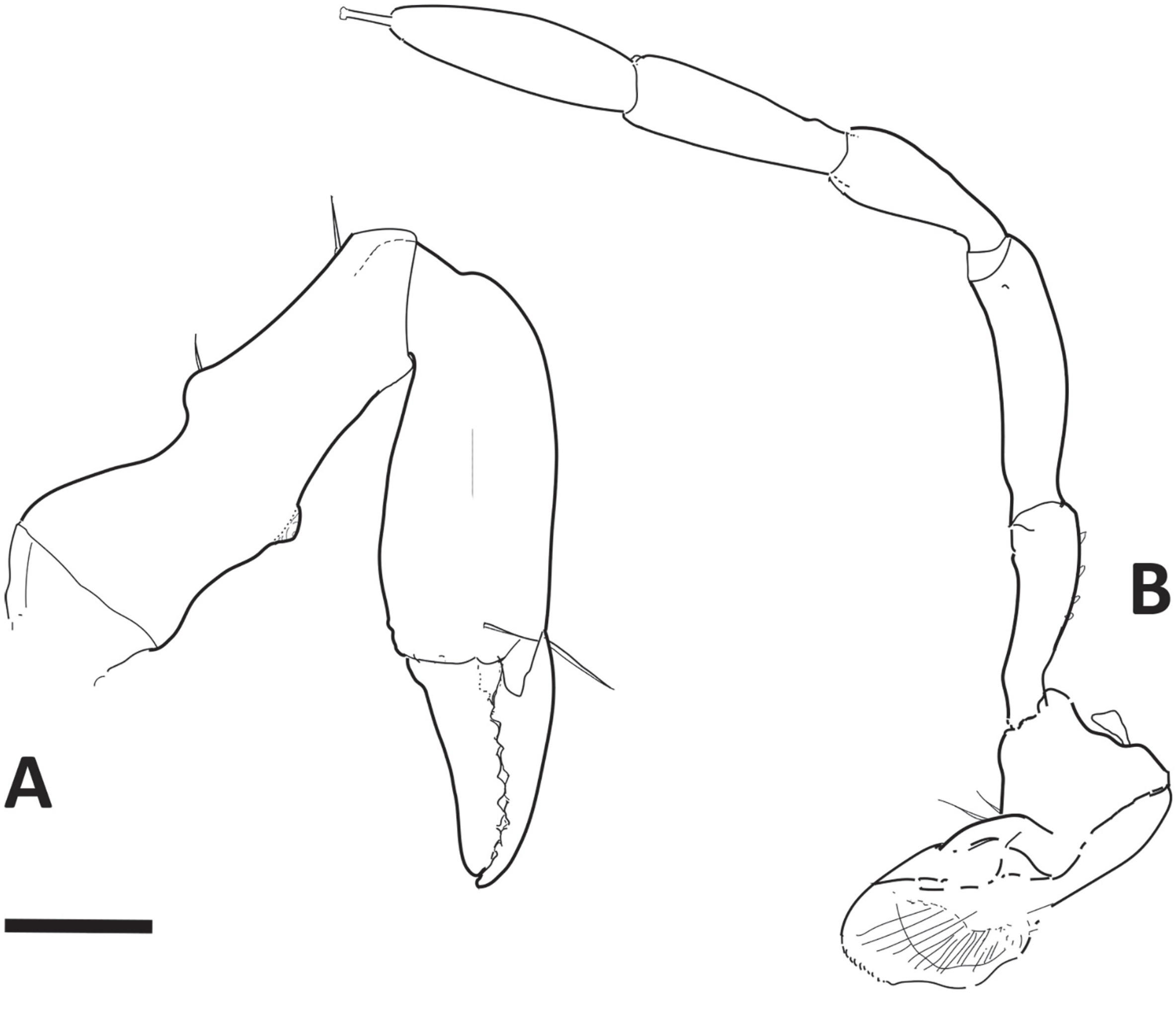

Fig. 24. *Cimmerosiro rhodiensis* gen. et sp. nov., male (CIK). **A**. Chelicerae, lateral view. **B**. Pedipalp, medial view. Scale bar = 100 µm.

Ventral prosomal complex (Fig. 21B). Coxal lobes II as wide anteriorly as at posterior end. Coxal lobes III more than twice as wide as long; slightly protruded medially at an obtuse angle. Coxal lobes IV slightly longer than wide at their narrowest part; posteriorly with almost parallel sides, widened with conical processes situated laterally on frontal margin of gonostome.

Legs. Basitarsi I–II with ornamented astragalus occupying about a third of their length (Fig. 23A–B); basitarsi III–IV fully ornamented. Telotarsus I elongated, L/W ratio: 3; telotarsus II L/W ratio slightly more than 2.5. Telotarsus IV elongated, with adenostyle at end of basal half of its length (Fig. 23C); adenostyle with long filiform distal processus (Fig. 23D). Claws II without denticles; claws III with prolateral comb-like row of 4 elongated denticles and 2 small retrolateral denticles; claws IV with 2 small denticles. Measurements of legs (without coxae and claws, in mm): I 1.24; II 1.02; III 0.88; IV 1.10.

Spermatopositor (Fig. 25). Narrow, elongated (more than 2 times as long as wide) with short and wide terminal lobe. Medial pair of setae terminales (4) much longer than lateral pair; setae dorsales (4) long, length of medial pair exceeding terminal lobe. Three setae laterales on each side. Setae ventrales (3)

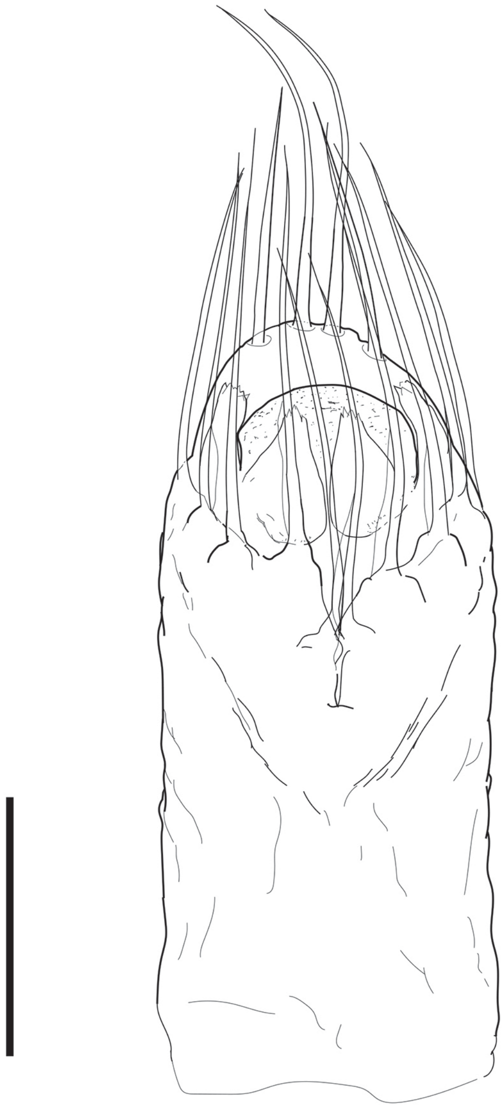

Fig. 25. *Cimmerosiro rhodiensis* gen. et sp. nov. (CIK). Spermatopositor. Scale bar = 50 µm.

short, medial one located lower; digiti mobiles mediales taper conically towards fimbriated tip; digiti mobiles laterales elongated, with wide serrated tip.

Female

Body length 1.10–1.18 mm. Dorsum narrow, elongated (twice as long as wide) (Fig. 21D); posteriorly with protrusion of duck-bill form which frames corona analis on ventral side (Figs 21F, 22A); coxal lobes II–III as in male (Fig. 21E). Ovipositor apical lobes short (Fig. 12C), two times as long as terminal article. Terminal article as long as wide at its base. Receptacles orifices located subterminally on apical lobes. Receptacles of saccate form, tapering towards bottom. Terminal setae shorter than apical lobes. Subterminal mediodistal setae two-thirds the length of terminal setae.

Measurements of legs, without coxae and claws (in mm) (female of 1.18 mm body length): I 1.21; II 1.01; III 0.82; IV 1.07.

Remarks

Cimmerosiro juberthiei gen. et sp. nov. and *C. krivolutskyi* gen. et sp. nov. are closely related and they represent the *Cimmerosiro* fauna of the Menderes Platform (MP) of the Anatolide-Tauride Block (ATB) (Fig. 27C). *Cimmerosiro rhodiensis* gen. et sp. nov. is significantly morphologically different from both these species and is probably phyletically significantly distant from them as well. It could represent the *Cimmerosiro* fauna of the Tauride Platform (TP) of the same Block.

Discussion

Parasironidae is a Mediterranean family (Fig. 26) of Cyphophthalmi whose predominantly plesiomorphic characteristics and distribution suggest an ancient age. The Mediterranean represents a complex geotectonic region on the boundary of two large tectonic plates (African and Eurasian), between the ancient continents of Gondwana and Laurasia. It has a complex paleogeography with ribbon continents and narrow, elongated basin systems (Van Hinsbergen *et al.* 2020). The Mediterranean history began with the opening of the Neotethys Ocean and then its subduction underneath Eurasia, accompanied by dynamic movements of microplates and smaller tectonic units around the perimeter and within it, caused by various driving forces.

Understanding geotectonic dynamics requires a precise description of the succession of tectonic events, achieved through reconstructions (Jolivet 2023). Reconstructions of geotectonic dynamics are

Fig. 26. Distribution map of the genera of Parasironidae fam. nov.

mainly based on the study of magnetic anomalies that record the age, speed and direction of seafloor spreading and the interpretation of the structure of the corresponding rocks and orogens. However, there are considerable difficulties and limitations, which is a source of disagreement among geologists. Fossil traces are certainly important in geotectonics. Tectonic plates can include continental and oceanic crust, and it is often difficult to distinguish the boundaries and reconstruct the precise dynamics of land masses. However, unlike the marine environment, there are old animal groups on land ('living fossils'), which by their distribution, due to their specific requirements and low vagility, can testify to the distant geological past. This applies to Cyphophthalmi, a conservative endogean group of the order Opiliones, harvestmen.

The wider area of the Mediterranean and its diverse living world was defined by complex geotectonic events during the Mesozoic, when the two Tethys oceans, the Paleo-Tethys and the Neo-Tethys, were largely overlapped by double orogenic systems. The two oceans existed during the early and middle Mesozoic, separated by a strip of land masses, the Cimmerian terrane, which had separated from the northeastern rim of Gondwana. In its western part, the Cimmerian terrane contained the fauna of the suborder Cyphophthalmi, which we here recognize as members of the family Parasironidae fam. nov. With the separation of the Adriatic (Apulian) microplate from the northern rim of Gondwana, the dynamic history of the predominantly Balkan genus *Cyphophthalmus* began. The Neotethys Ocean opening was initiated in the early Permian on the northern Gondwana margin by the northward drift of the Cimmerian terrane (Stampfli & Borel 2002) (Fig. 27A). Neotethys rift propagated westwards by diffuse continental rifting to the position of the Paleozoic Variscan and Caledonian orogenic belts in the west (Angrand *et al.* 2020). That western boundary of the Cimmerian terrane could also have included the Corsica-Sardinia-Ebro Block (Fig. 27B), which seems to be indicated by Angrand *et al.* (2020) on maps of large scales. Diffuse continental rifting throughout Western Europe at that time makes the history of the westernmost part of the Cimmerian terrane unclear. During the Late Triassic–Early Jurassic, displacement of the Adria microplate relative to Iberia and Africa occurred and induced trans-tension between Adria and Iberia (Angrand *et al.* 2020). This coincides with the time of separation of the two genera of the family

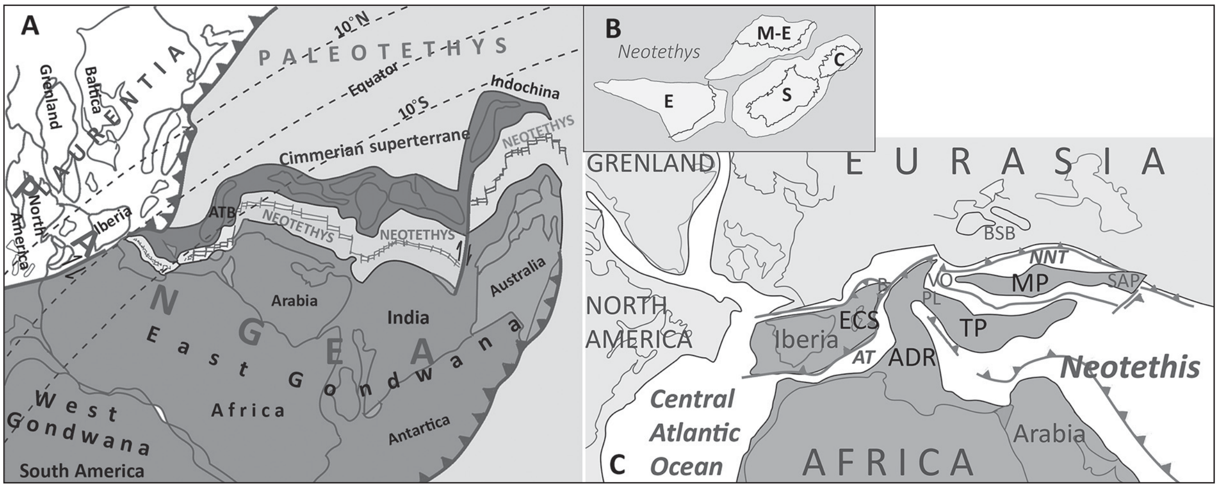

Fig. 27. A. Early Triassic reconstruction of Pangaea showing Cimmerian superterrane and Neotethys opening. **B**. Late Triassic paleogeography of Corsica (C), Sardinia (S), Maures, Estérel (M-E), and the Ebro Block (E) in western Neotethys. **C**. Cretaceous Western Neotethys realm with Adria continental crust stretching from North Gondwana and inserting between westernmost parts of Cimmerian superterrane. (A, C from Dilek & Furnes 2019; B from Edel *et al.* 2015, modified). ADR = Adria; AT = Alpine Tethys; ATB = Anatolide-Tauride Block; B = Briançonnais; BSB = Black Sea Basin; ECS = Ebro–Corso–Sardinian Blocks; MP = Menderes Platform; NNT = Northern Neotethys; PL = Pelagonia; SAP = South Armenian Platform; TP = Tauride Platform; VO = Vardar Ocean.

Sironidae, the Iberian genus *Paramiopsalis* and the Balkan–NW Anatolian genus *Cyphophthalmus* (Murienne *et al.* 2010; a rough distribution of the two genera is shown in Karaman 2022: fig. 20). The Adria microplate, or more accurately a dynamic archipelago of the intraoceanic carbonate platform of Tethys (Karaman 2005b) carried by the Adria microplate, carried the gernus *Cyphophthalmus*. That caused a great diversification of this genus. This diversification already started before the collision with the Eurasian continent, and then it continued with the further dynamics of these areas. The history of the Cimmerian terrane, its western part with representatives of the family Parasironidae, was apparently not influenced by that dynamic, which is manifested by the lower diversity of this family compared to the genus *Cyphophthalmus*, although the diversification of Parasironidae began earlier. On its way to Eurasia and by its collision with it, the Adria microplate was inserted between the westernmost parts of the Cimmerian superterrane, separating the family Parasironidae into two areas, the Anatolide-Tauride Block (Menderes-Tauride Block) and the Corsica-Sardinia-Ebro Block. The collision of the Adria microplate with the Euroasian plate happened before the collision of the Anatolide-Tauride Block with the Euroasian plate, evident by the boundary of two faunas in northwest Asia Minor. The southeastern known distribution of the genus *Cyphophthalmus* is bounded by the Izmir-Ankara suture (Karaman 2022: fig. 20).

We link the Parasironidae to the Cimmerian superterrane because their current distribution suggests this possibility. Also, in the molecular analyses of Giribet *et al.* (2012), parasironids often appear at the base of the family Stylocellidae, which is distributed throughout Southeast Asia. In the same analyses, the Japanese species *Suzukielus sauteri* is grouped with Stylocellidae and with parasironids as well. It should belong to the family Stylocellidae due to its morpho-anatomical characteristics (Karaman 2022). The family Stylocellidae has a Cimmerian origin, as clearly proven and chronologically reconstructed by Clouse & Giribet (2010). Regarding the close relationship between Parasironidae and Stylocellidae, the small sample size (two species of parasironids) and the low posterior probability shown in BEAST in Giribet *et al.* (2012) leave room for doubt. An earlier phylogenetic analysis by Giribet & Boyer (2002), under certain parameter sets, distinguished the genus *Parasiro* from the family Sironidae, but it did not indicate its closeness to the family Stylocellidae.

Based on geological data, Juberthie (1988) linked the time of differentiation of the by then known species of the genus *Parasiro* (now separate genera) to the Miocene period, when the Western Mediterranean opened up. That is, separating *Ebrosiro* gen. nov. from *Parasiro* and *Tirrenosiro* gen. nov. during the period when the Corso-Sardinian Block broke away from the European plate. Considering the pronounced degree of differences (contrary to the claims of Juberthie 1988), the differentiation of these genera probably occurred much earlier. The morphoanatomical and, hence assumed, the phyletic distance between *Parasiro* and the rest of the parasironids, seem to be the larger. Based on morphoanatomy, *Tirrenosiro* could be more closely related to *Ebrosiro* than to *Cimmerosiro* gen. nov., but based on the same criteria the opposite relationship is quite possible ((T+C)+E) as well, although less logical. The separation of the genus *Ebrosiro* from *Tirrenosiro* probably occurred after the separation of the Ebro Block from the Corso-Sardinian Block in the Triassic (Edel *et al.* 2015) (Fig. 27B). Diversification of the genus *Tirrenosiro*, which is much younger, can be used as the basis for calibrating the time of separation of species and genera in the family Parasironidae, and in other Mediterranean Cyphophthalmi as well. In this genus there are two described species, *T. minor* (south Corsica) and *T. axeli* sp. nov. (Mt Circeo), and at least two additional species waiting to be described, *T.* cf. *minor* (Sardinia, Macomer) presented above and *Tirrenosiro* sp. (Mt Pisano, Tuscany), molecularly analyzed in Giribet *et al.* (2012). It is possible that there are more species of this genus in Sardinia, since this island has a very diverse ancient fauna (Taiti *et al.* 2018). The separation of the species *T. axeli* sp. nov. from *T.* cf. *minor* (Sardinia, Macomer) can be related to the period of extension between Sardinia and Calabria (~13–11 Ma) in the South Tyrrhenian Basin (van Hinsbergen *et al.* 2020). The separation of the species *T. minor* (Corsica) from

Tirrenosiro sp. (Mt Pisano, Tuscany) should be related to the extension between Corsica and Tuscany (~20 Ma) (van Hinsbergen *et al.* 2020).

All hypotheses presented here are based on the current knowledge of this ancient group in the Mediterranean. Rare refugial habitats, extremely local occurrences, small body sizes, as well as the cryptic way of life of Cyphophthalmi make it difficult to find them. Data on their findings are very often accidental (exceptions are from the Balkan and Iberian Peninsulas) and not the result of organized research, which this group would certainly deserve.

Further research focus in this group, in order to contribute to the reconstruction of the geotectonic dynamics of the Mediterranean, should be in the appropriate areas of Turkey south and east of the Izmir-Ankara suture, as well as in Cyprus. By analyzing a single juvenile specimen from Cyprus, it is evident that it is not a representative of the family Parasironidae, but possibly a species related to the genus *Cyphophthalmus*. Such an assumption makes sense, considering that Cyprus is the extended continental margin of Africa (McPhee & van Hinsbergen 2019).

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