Zootaxa 3538: 1–53 (2012)
www.mapress.com/zootaxa/

Article

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

urn:lsid:zoobank.org:pub:59F6B2D8-D444-468B-943E-DB4C8DE09259

Review of the genus *Ommatoiulus* in Andalusia, Spain (Diplopoda: Julida) with description of ten new species and notes on a remarkable gonopod structure, the fovea

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Abstract

A comprehensive revision of the species of the genus *Ommatoiulus* in Andalusia, southern Spain, is carried out for the first time, revealing the presence of a total of 19 species, among which are one new record for the country, one for continental Spain, two new records for Andalusia and 10 species new to science: *Ommatoiulus baenai, O. baileyi, O. hoffmani, O. jaenensis, O. kimei, O. pseudoflagellatus, O. recueroi, O. reipi, O. sabinarensis, O. schubarti* **n.spp**. The following taxa are synonymised: *Schizophyllum hoplites* Verhoeff, 1910, *S. diplurum appendiculatum* Brolemann, 1925, and *Ommatoiulus diplurus mauriesi* Hoffman, 1975, are regarded as junior synonyms of *Ommatoiulus diplurus* (Attems, 1903), **n.syn.** *Schizophyllum dorsovittatum estrellanum* Verhoeff, 1910, and *S. calatravanum* Brolemann, 1920, are junior synonyms of *Ommatoiulus dorsovittatus* (Verhoeff, 1893), **n.syn.** *Schizophyllum nivale* Schubart, 1959, is a junior synonym of *Omnmatoiulus ilicis* (Brölemann, 1896), **n.syn.** Full descriptions and diagnostic notes are provided for all the species with accounts on their distributions, habitats, and notes discussing their taxonomy. A dichotomous identification key, based on gonopod structures, is presented to facilitate species identification. In the discussion section, the general patterns of species distribution are underlined, showing a clear tendency to 'endemism' for the majority of species and to polymorphism for species with broader distribution ranges, especially *O. diplurus*. A disjunct distribution Andalusia/Pyrenees is registered for *O. ilicis*. A comprehensive comparison of gonopods is attempted, and three main types of gonopod configuration are delimited, denoting a wide range of structural complexity. The fovea, a cavity in the posterior gonopods, is explored for the first time with scanning electron microscopy, revealing an agglutination of spermatozoa and confirming Verhoeff's original observation dating back nearly 120 years. The constancy of the fovea in all Schizophyllini, combined with its absence in the rest of the julids, provides an additional apomorphy for the tribe.

Key words: Taxonomy, Spain, identification key, species variation, new synonymies, distribution, SEM, gonopods, fovea

Introduction

Schizophyllini is a tribe of julid millipedes comprising ca. 60 described species with the vast majority occurring in the Iberian Peninsula and North Africa. A few species are widely distributed, such as *Ommatoiulus sabulosus* (Linnaeus, 1758), which reaches 64°N in Fennoscandia and *O. moreleti* (Lucas, 1860) which has acquired a near-cosmopolitan, synanthropic distribution. Most species of Schizophyllini are currently classified in the genus *Ommatoiulus* Latzel, 1884, the rest in a few 'satellite' (sub)genera *viz.*, *Rossiulus* Attems, 1926 (E Europe to Iran) and *Tachypodoiulus* Verhoeff, 1893 (W Europe). The monophyly of the Schizophyllini has long been established on the basis of a synapomorphic character consisting in the presence of a leaf-like accessory claw in juvenile stadia (Verhoeff 1926-32, Read 1990) and recently based on molecular data (Enghoff et al. 2011). Only the genus *Tachypodoiulus* was a subject of hesitation due to its very simple gonopods compared to *Ommatoiulus*: it was considered close to the latter by Verhoeff (1910), then placed in Cylindroiulini by Hoffman (1980) before being restored to Schizophyllini by Read (1990), based on the cited synapomorphy plus some other characters, such as

Accepted by W. Shear: 19 Sept. 2012; published: 5 Nov. 2012

ozopores posterior to the suture, observed in all Schizophyllini. Despite their relatively large size and less cryptic habits than most other millipedes, schizophyllines are poorly known taxonomically, and the considerable intraspecific geographical variation has been analyzed for only a few species (Baker 1984, Blower 1985, Hoffman 1975, Prisnyi 1991, Vicente 1985).

Several attempts have hitherto been made to understand the taxonomy of this tribe but the complexity and sometimes variation in gonopod structures have led to a general cumbersome situation. Latzel (1884) created the subgenus *Ommatoiulus* to accommodate species of the genus *Julus* Linnaeus, 1758, characterized by 'clearly distinguishable eyes, convex, arranged in 5–9 transverse rows on each side'. Verhoeff (1894) criticized Latzel's (1884) classification, based on number and shape of ocelli, which he qualified as 'unnatural', giving examples of species with intermediate characters between subgenera *Ommatoiulus* and *Allaiulus sensu* Latzel (1884). Alternatively, Verhoeff (1894) erected the genus *Palaioiulus* with 3 subgenera: *Bothroiulus*, *Eleutheroiulus* and *Mesoiulus*. In the latter genus, Verhoeff (1894) accommodated all the julid species having 'fovea with cavity deeply nesting in the solenomerite, seminal groove or semiflagellum usually present, intercalary stadia in which the first pair of legs is longer; preanal ring with pointed dorsal appendage, frontal pits missing; conspicuous ocelli.' Subsequently, the same author (Verhoeff 1910) synonymised *Palaioiulus* under *Schizophyllum* Verhoeff, 1895 (now a synonym of *Ommatoiulus*) which he placed in the new tribe Schizophyllini, together with the genera *Leptophyllum* Verhoeff, 1895 (now a synonym of *Enantiulus* Attems, 1894, placed in Cylindroiulini) and *Tachypodoiulus*. In the same work, Verhoeff (1910) gave a key for the five *Schizophyllum* subgenera hitherto described, including 3 new ones, *viz. Hemipodoiulus*, *Megaschizophyllum*, and *Solaenophyllum*. Moreover, he provided a detailed study and terminology of the different structures of the schizophylline gonopods. Nearly a decade later, Verhoeff (1921) focused his interest on the genus *Schizophyllum*, describing the subgenus *Elaphophyllum* as well as several species and subspecies, discussing some species variation, intercalary stadia and providing identification keys to the different taxa. Subsequently, the same author (Verhoeff 1926-32) provided a new key to *Schizophyllum* subgenera, including the six he previously described and the subgenera *Schizophyllum* (*Archiulus* Berlese, 1896) and *Schistocoxitus* Attems, 1927. Jawlowski (1925) and Lohmander (1927), respectively, described from Eastern Europe two schizophyllines characterized by a reduced mesomerite: *vilnensis* and *kessleri*, which were placed by Lohmander (1927) in a new subgenus *Sarmatiulus* which was later synonymised with the Russian genus *Rossiulus* Attems, 1926 (see Attems 1952, Hoffman 1980). More recently (e.g., Striganova and Golovatch 1982, Enghoff and Kime 2009) *Rossiulus* has again been treated as a full genus, although a formal resurrection seems not to have been done.

Brolemann (1926) was obviously not very convinced by the expanding classification system provided by Verhoeff (1910) and the multiplicity of the subgenera, so he controversily presented a contracted classification system in which he placed all the described Schizophyllini under 3 subgenera: *Schizophyllum*, *Bothroiulus* and *Hemipodoiulus*, for which he designated different type species than those proposed by Verhoeff. To add to the confusion, Attems (1927, 1952) attempted in his turn to give a classification of the genus while studying Spanish millipedes, giving a key (Attems 1952) to 13 *Schizophyllum* subgenera which count in addition to the already described ones the subgenera *Apareiulus* Attems, 1952, *Thrinaciulus* Attems, 1952, *Thylephorus* Attems, 1952 and *Kabylinum* Attems, 1952.

Studying and describing an extensive number of *Ommatoiulus* species from Algeria and Morocco, Schubart (1963) attempted in his turn to rearrange the taxonomy of the genus, so he described five additional new subgenera in replacement for *Bothroiulus* which he considered as a heterogeneous grouping of species. These are: *Cherifiulus*, *Maghrebiulus*, *Harpagophyllum*, *Ischnophyllum* and *Velophyllum*; the name *Ischnophyllum* was already established but not defined by Brolemann (1924) while the rest Schubart newly diagnosed and assigned new type species. No further attempts have been made to understand the taxonomy of the genus; however, Jeekel (1968) provided a historical account clarifying the nomenclature of the varied Schizophyllini generic and subgeneric names proposed by Verhoeff and Attems and listed 13 'genus-group' names taxonomically associated with '*Schizophyllum*'. Two additionnal subgenera were added later by Ceuca (1974), *viz.*, *Phyllommatoiulus* and *Osellommatoiulus* but the former was later synonymised under *Tachypodoiulus* (see Hoffman 1980).

Whether these subgeneric classifications established over more than a century reflect relationships is seriously questionable, noting the enormous controversy in defining the subgenera, choice of type species and gonopod

structures to define them which seems to be stongly subjective and constantly changing according to authors (i.e., Schubart (1963) based his key solely on the structure of the gonopod solenomerite).

Hoffman (1975) expressed his doubts about *Ommatoiulus* subgenera, giving an example of two subspecies of *Ommatoiulus diplurus* Attems, 1903, used in Attems (1952) key to define two different subgenera. The same author (Hoffman 1980) clearly expressed his opinion about the same issue stating that 'I think that all of the subgeneric names are superfluous and that myriapodologists could do worse than ignore them entirely' and listed 17 subgenera/synonyms of *Ommatoiulus*. Akkari and Voigtländer (2007) commented on the limits of the subgenus *Harpagophyllum*, which they found to be as poorly defined as those of most of the hitherto described subgenera, and tried instead to accommodate the species they described from Tunisia in a species group, the *Ommatoiulus punicus*- group which they established and defined. More recently, Akkari and Enghoff (2011) again discussed the subgeneric subdivision of genus *Ommatoiulus* and preferred at that point not to assign the new species they described to neither of the subgenera nor to the *punicus*-group, despite a number of affinities, which they underlined, waiting for the revision of the genus.

Given the confusion summarised above, the genus is obviously in need of revision with stringent morphological and molecular methods, standard terminology and modern imagery. Since there is no unequivocal way to subdivide the genus according to morphological characters (molecular data are almost non-existent), and since revising the entire genus in one go is practically unfeasible, we have chosen a geographical approach, and as a first part of this ambitious project, we present in this work a detailed review of the *Ommatoiulus* species of Andalusia.

As mentioned earlier, a great number of *Ommatoiulus* species is known to occur in the Iberian Peninsula, with a vast majority known from Spain. In fact, a total of 24 species (out of ca. 60) are known from the Spanish mainland and the Balearic Islands, among which 16 species are probably Spanish endemics. Most of these were described by Attems (1903, 1927, 1952), Brölemann (1897, 1918, 1920) and Verhoeff (1910, 1921), several were additionally described by Ceuca (1974) and Mauriès (1969a), while the latest contribution was added by Vicente and Rodriguez (1992). The most recent review of Spanish Julida was presented by Vicente (1985) who studied epigean millipedes from Cataluña and provided, besides species records, a detailed account of the variation of *Ommatoiulus rutilans* (C. L. Koch, 1847). Mauriès (1978) gave a check-list of southern Spanish diplopods, counting 11 *Ommatoiulus* species among which two are from Murcia and Ciuadad Real, respectively, while the rest occur in Andalusia.

Andalusia constitutes the second largest area of the Spanish communities, covering ca. 17.3 % of the Spanish territory and counting eight provinces, *viz*. Almería, Cádiz, Córdoba, Granada, Huelva, Jaén, Málaga and Sevilla. Andalusia is bordered to the north by the Sierra Morena mountain range, to the west by Portugal, facing the Atlantic Ocean to the southwest and the Mediterranean to the southeast and east, and only separated from North Africa by the Gibraltar strait. Owing to this geographical location, Andalusia definitely holds great potential for species diversity and endemism (i.e. Rivaz-Martínez et al. 1997, Puente et al. 1998, Lorite et al. 2007).

In their work on the distribution of *Ommatoiulus moreleti*, Bailey and De Mendonça (1990) recognized ca. 7 new species from the southwestern Iberian Peninsula, which were quoted as SP1–SP7. Several additional undescribed species from the region exist from previous collections, and more continue to accumulate with every expedition. On the other hand, many of the hitherto described species are just known from their original descriptions while the taxonomy and nomenclature of several others still represent an immense problem. Inadequacy of illustrations was for a number of species a major problem leading to misidentification and problems of synonymy (see also Hoffman 1975).

We here put on record all the *Ommatoiulus* species hitherto recorded from Andalusia, describe 10 species new to science, and, based on the study of the type material, propose several new synonymies. In some cases, intraspecific geographical variation is detailed, and morphotypes are compared. All species are described using a standard terminology detailed in the following (Table 1), illustrated with scanning electron microscopy, and when possible, notes on species distribution and habitat preferences are presented. Comments on taxonomical affinities are provided as well as an identification key to all Andalusian *Ommatoiulus* species, based on the structures of the gonopods. Moreover, the fovea, a structure observed and described by Verhoeff (1894) is for the first time explored by scanning electron microscopy, and the spermatozoa are illustrated.

Material and Methods

All specimens are preserved in 70% alcohol. Measurements were made using a Leica Wild M10 microscope equipped with an ocular micrometer. Parts of the specimens were mounted in glycerin on temporary microscope preparations. Microphotographs were taken using a Leica digital camera M205A mounted on a stereomicroscope Leica DFC 420. Images were processed with a Leica Application Suite program and final stacking made with Helicon Focus 4.60.2 Pro software. For scanning electron microscopy, parts of the specimens were transferred to 96% ethanol then to acetone, air-dried, mounted on aluminium stubs, coated with platinum/palladium and studied in a JEOL JSM-6335F scanning electron microscope. All images were processed with Adobe Lightroom Lr. 3.6 and Adobe Photoshop CS.5.

Repository acronyms are as follow: MCSNV—Museo Civico di Storia Naturale di Verona, Italy; MNCN—Museo Nacional de Ciencias Naturales, Madrid, Spain; MNHN—Muséum National d'Histoire Naturelle, Paris, France; NHMW—Naturhistorisches Museum Wien, Austria; ZMUC—Natural History Museum of Denmark, Zoological Museum, University of Copenhagen.

List of main abbreviations used in the descriptions: AR. Apodous rings, H. Vertical diameter measured at midbody, L. Body length measured along the line of ozopores, PR. Podous rings, T. Telson.

For species descriptions, we follow Verhoeff's (1910) terminology for *Ommatoiulus* which was adopted by most subsequent authors (Attems 1952, Schubart 1963, Hoffman 1975, Mauriès 1969a, Akkari and Enghoff 2011, etc.), summarized in Table 1.

TABLE 1. Terminology used in the text

Structure	Term
Anterior gonopod	Promerite
Posterior gonopod	
1. Anterior process	Mesomerite
2. Posterior processes	
a. Postero-mesal process	Solenomerite
• Cavity containing sperm mass located at base	Fovea
• Groove running from sperm mass to apex of process	Seminal groove
• Accessory main branch	Parasolenomerite
b. Postero-lateral process	
• Base of the process	Coxite
• Distal part of the process	Paracoxite

Results

Taxonomy

Order Julida Brandt, 1833

Family Julidae Leach, 1814

Tribe Schizophyllini Verhoeff, 1909

Ommatoiulini Hoffman, 1980: 113

Genus *Ommatoiulus* Latzel, 1884

Archiulus Berlese, 1886: 84, preoccupied

Mesoiulus Verhoeff 1893b: 480, preoccupied
Palaioiulus Verhoeff 1894: 150
Schizophyllum Verhoeff, 1895: 361
See Hoffman (1980): 113 for a full list of subgenera/synonyms

Main characteristics of the genus

The genus *Ommatoiulus* is morphologically characterized by:
- A distinct suture between prozonites and metazonites with ozopores posterior to it.
- Ocelli present, arranged in triangular ocellar fields.
- Small juveniles with leaf-shaped accessory claws on walking legs.
- Anterior gonopods consisting only of the promerite and bearing no flagellum.
- A mesomerite fully independent from the opisthomerite (solenomerite+paracoxite) but closely connected at base.
- A large fovea for storage of spermatozoa at the base of the solenomerite.

Andalusian species of *Ommatoiulus*

In all species treated in the following, males share these sexual characters:
- Mandibular stipes vertically expanded into rounded lobe.
- Hook-shaped first pair of legs.
- Postfemoral and tibial pads on subsequent legs.

Ommatoiulus andalusius (Attems, 1927)

Archiulus andalusius Attems, 1927: 282–284, figs 66–69
Ommatoiulus andalusius: Mauriès 1978: 585

Material. *Archiulus andalusius* Attems, 1927, holotype ♂, slide preparation of the gonopods (NHMW/3164 [Acquisition number 1919]).

Diagnosis. Similar to *O. ilicis* (Brölemann, 1897), *O. imminutus* (Brolemann, 1926) and *O. terulensis* Ceuca, 1974 in the shape of the promerite (narrow, tapering distally and bearing an apical tooth). Sharing with *O. imminutus* and *O. terulensis* the presence of a small subapical lateral process on the solenomerite but differing in the absence of distal projection of the mesal ridge in the promerite, in the shape of the solenomerite apex and the shape of the mesomerite.

Descriptive notes. Male with 44 podous rings, 1.5 mm broad, general colour reddish-brown with a narrow black mid-dorsal line; sides with series of blackish spots; antenna smoky-brown, legs reddish-brown (Attems 1927).

Gonopods: Promerite (Fig. 1) relatively slender, about 1/3 wide as long, gradually narrowing distally, tip slightly bent laterad and showing an apical tooth (**A**) pointing posteriorly. Mesal ridge (**Mr**) gradually disappearing at about mid-length of the promerite, with no spike apically; lateral margin slightly folded at the base (**Lm**); posterior surface with a triangular rudimentary telopodite (**T**) located sub-basally and pointing mesad. Posterior gonopods (Fig. 2) with slender processes; mesomerite (**Ms**) extending beyond the rest of the gonopod, long, curved, apically hook-shaped with a pointed process pointing posterolaterad; paracoxite (**Px**) and solenomerite (**S**) of the same length, paracoxite uniformly broad and curved anteromesad. Solenomerite simple, distally with an acuminate upturned process on the lateral margin (**sp**); apically with a thickening projecting into a subapical triangular process (**ap**) pointing mesad, connected to two apical asymmetrical processes (**p1**, **p2**) linked by a thin lamella harbouring the opening of the seminal groove (**g**).

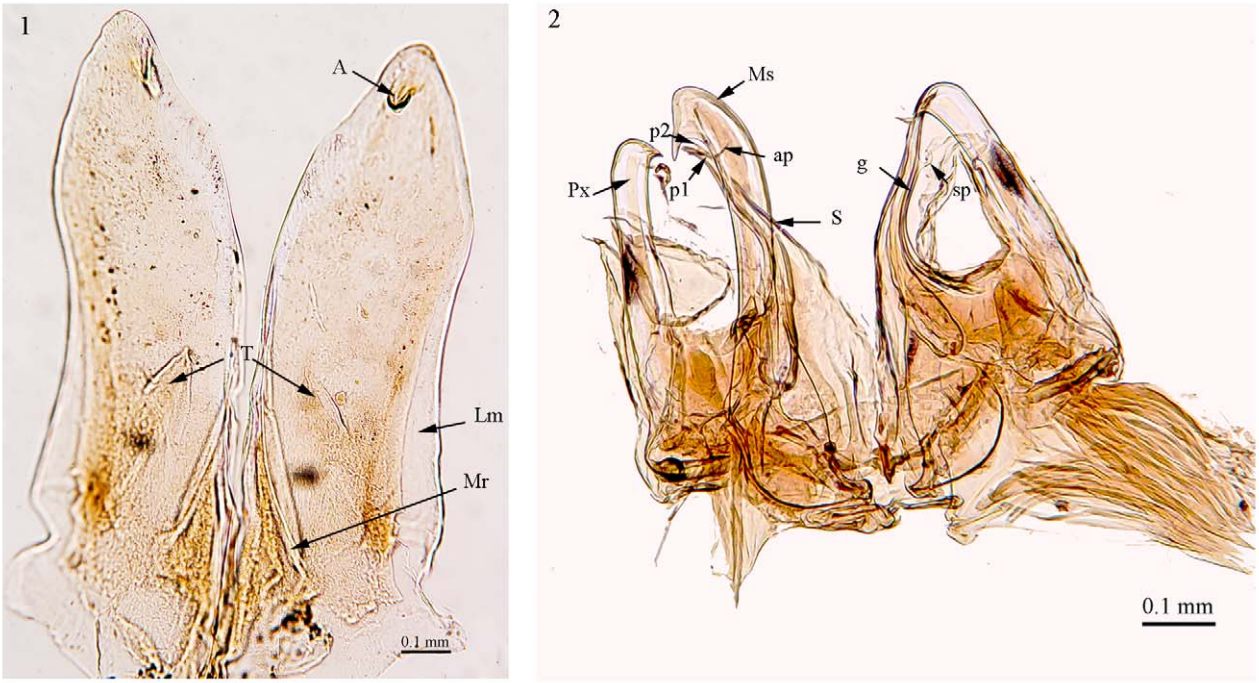
Distribution. Described from Andalusia without exact locality.

Comments. The study of *O. andalusius* was based on Attems' (1927) slide preparation of the type material known from an unspecified locality in Andalusia. No further material of the species is known.

Among the species most similar to *O. andalusius* is *Ommatoiulus imminutus* (Brolemann, 1926) described from the Oriental Pyrenees [Material: *Ommatoiulus imminutus* (Brolemann, 1926), 1 ♂, 1 ♀, Spain, Gerona (NE Spain) Del Pasos di Tosas, Verso Molina, Gerona, 13.viii.1975, Valle Moretti leg. (ZMUC)]. Both species show

similar brownish colour patterns with a black mid-dorsal line, have 40–44 PR and agree in some of the gonopod structures, especially the shape of the solenomerite and paracoxite (see Brolemann 1926, figs 10–12). However, the two species differ in 1) the shape of the promerite: mesal ridge blunt and totally fusing with the edge of the promerite in *O. andalusius* while protruding in a spike in *O. imminutus* and 2) the tip of the mesomerite which is bipartite in *O. imminutus* while simple and hook-shaped in *O. andalusius.*

While *O. andalusius* was described from Andalusia, *O. imminutus* is only known from the region of the Pyrenees in Gerona Province. The observed similarities might, however, reflect a close relationship between the two species.



FIGURES 1–2. *Ommatoiulus andalusius*, holotype (NHMW), slide preparation: Fig. 1: Left and right promerites, posterior view, Fig 2: posterior gonopods, posterior view. Abbreviations: **A**: Apical tooth of promerite, **ap**: Subapical process of solenomerite, **g**: Seminal groove, **Lm**: Lateral margin, **Mr**: Mesal ridge, **Ms**: Mesomerite, **p1**, **p2**: Apical processes of solenomerite **Px**: Paracoxite, **S**: Solenomerite, **sp**: Curved process of solenomerite, **T**: Rudimentary telopodite.

Ommatoiulus baenai Akkari & Enghoff n. sp.

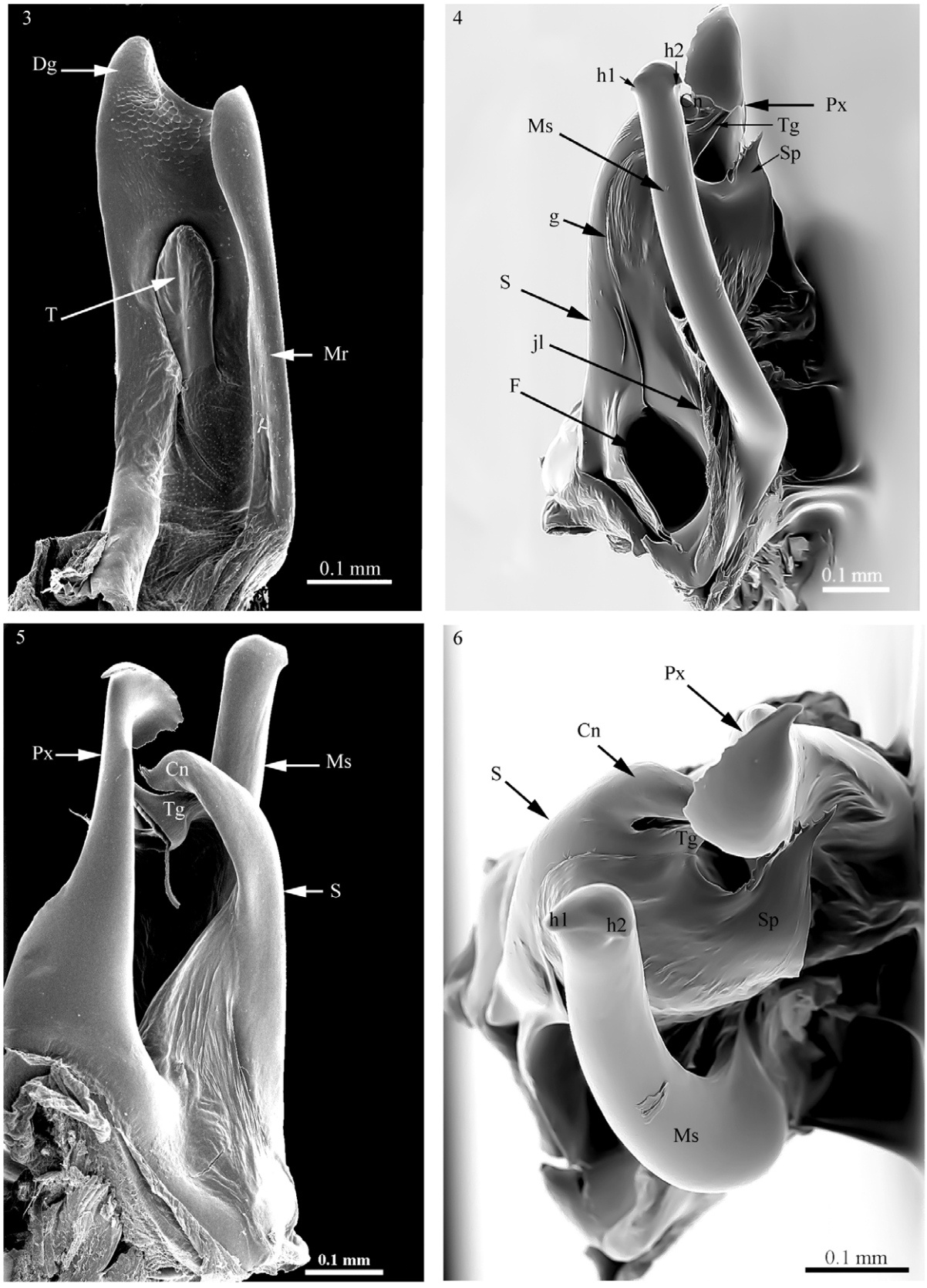
Figs 3–6

Material. **Holotype**: 1 ♂, Andalusia, Casas de Carrasco, Jaén, 38º07'43"N, 2º41'19"W, alt. 1420 m, 2.iv.2012, M. Baena leg. (ZMUC). **Paratype**: 1 ♀, same data as holotype (ZMUC).

Diagnosis. Similar to *O. albolineatus parvus* (Brolemann, 1920), *O. bavayi* (Brölemann, 1897), *O. ibericus* Ceuca, 1974, and *O. niger* (Attems, 1952) in the shape of the promerite and mesomerite, differing however from the first two taxa in the shape of the paracoxite and from the rest in the shape of the distal part of the solenomerite with a strongly bent mesal process lodging the opening of the seminal groove and a jagged and acuminate anterior process.

Etymology. Species named in honour of Manuel Baena, collector of the species.

Description. Male: L: 27 mm, H: 2.0 mm, 49 PR+2 AR+T. Female: 50 PR+3 AR+T. Colour dark grey-blackish. Prozonites uniformly sputtered with gray, metazonites golden brown, darker posteriorly, dorsum with a thin black mid-dorsal line, legs brownish, head dark brown, lighter on the frontal part, mouthparts yellowish, telson dark brown. Prozonites with scattered oblique striae; metazonites with regular striation and short setae on the posterior margin, suture complete, rectilinear and sometimes curving at ozopore level. Telson: anal valves with 1 marginal row of short setae, a submarginal row of longer ones and ca. 6 setae on the disc; subanal scale triangular, pointed and setose; preanal ring with a protruding caudal projection, setose and bearing a small hyaline process and 2–2 setae on the lateral sides.



FIGURES 3–6. *Ommatoiulus baenai* n. sp., holotype: Fig. 3: Right promerite, posterior view, Fig. 4: Right posterior gonopod, mesal view, Fig. 5: Right posterior gonpod, lateral view, Fig. 6: Right posterior gonpod, apical view. Abbreviations: **Cn**: Conical process of solenomerite, **Dg**: Digit-shaped process of promerite, **g**: Seminal groove, **F**: Fovea, **h1**, **h2**: Apical projections of mesomerite, **jl**: Jagged lamella of solenomerite, **Mr**: Mesal ridge, **Ms**: Mesomerite, **Px**: Paracoxite, **S**: Solenomerite, **Sp**: Serrated process of solenomerite, **T**: Rudimentary telopodite, **Tg**: Triangular folded process of solenomerite.

Gonopods. Promerite (Fig. 3) subrectangular, apically protruding in a lateral slender digit-shaped process (**Dg**); mesal ridge (**Mr**) broad, protruding apically, separated from lateral process by an apical notch. Rudimentary telopodite (**T**) broad, rounded and located distally. Posterior gonopod (Figs 4–6): Mesomerite (**Ms**) uniformly broad and slightly longer than the promerite, bearing two apical projections (**h1**, **h2**) (Figs 4, 6); solenomerite (**S**) broad at the base, narrowing at midlength and strongly expanding distally in broad lamella bent basolaterad; basal surface of solenomerite also thickened and serrated anteriorly, bearing several spines protruding up to midlength of the process in an anteromesal jagged lamella (**jl**); distal lamella ramified into: 1) a posterior conical process (**Cn**), apically acuminate and serrated, 2) a mesal folded strongly invaginated process (**Tg**), containing the opening of the seminal groove (**g**), curved in the middle and bearing two extremities pointing laterally, 3) a posterior process with a jagged margin ending in acuminate tip pointing distolaterad (**Sp**). Seminal groove (**g**) running posteriorly from the fovea (**F**) (Fig. 4) located at the base up to the apical folded process (**Tg**). Paracoxite (**Px**) stout, broadest at the base, slightly narrowed distally, apically expanding in a rounded apex with irregular margin bent basomesad.

Distribution. Known only from the type locality in Jaén Province, Andalusia.

Ommatoiulus baileyi Akkari & Enghoff n. sp.

Figs 7–9

Ommatoiulus SP.1: Bailey and De Mendonça, 1990: 105

Material. **Holotype**: 1 ♂, Andalusia, South of Sevilla, in pine litter on coastal sand dunes, Donaña National Park, 13.x.1986, P. T. Bailey leg. (ZMUC). **Paratypes**: 1 intercalary ♂, 2 preadults, same data as holotype, P. T. Bailey leg. (ZMUC).

Etymology. The species epithet honours P.T. Bailey, collector of the species, in recognition of his work on millipedes and for his several donations which allowed part of this study.

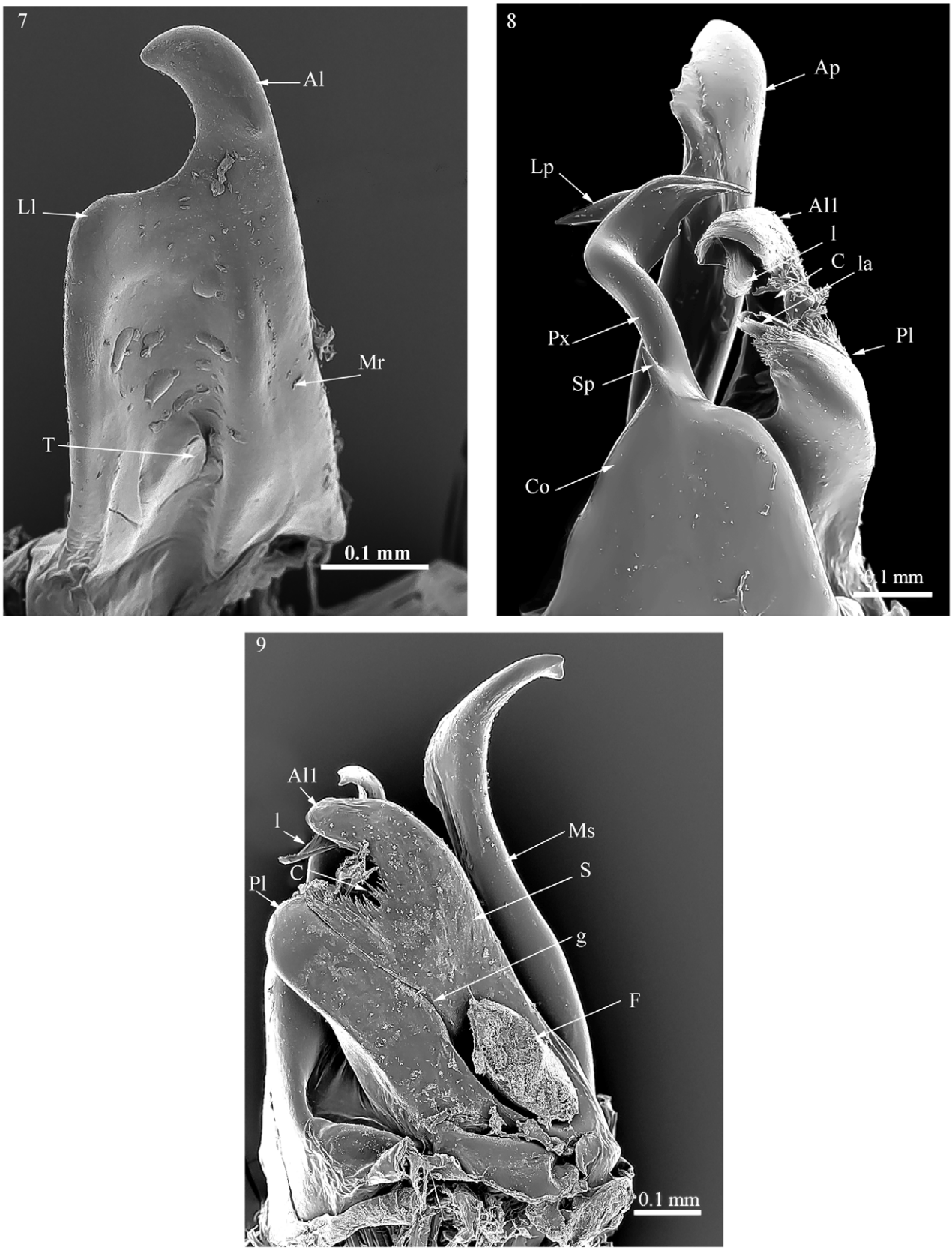
Diagnosis. Similar to *O. armatus* (Verhoeff, 1910) and *O. dorsovittatus* (Verhoeff, 1893) in the presence of a big mesomerite with an expanding apex, a voluminous solenomerite with an anterior lobe projecting over a posterior one, separated by a setose furrow and a reduced paracoxite, but outstanding by more simple lobes of the solenomerite, a much longer paracoxite and broader coxite showing an additional small process.

Description. Male: L: 23 mm; H: 2.2 mm, 46 PR+1 AR+T. General colour fade, after a long stay in alcohol, light brown to yellowish below the line of ozopores, darker brownish above. Prozonites with yellowish background, black, sputtered, fading on the lateral sides below the line of ozopores, metazonites purple grey, also sputterd with black and yellowish on the sides, dorsum with a thin black mid-dorsal line, legs yellowish. Head dominantly light brown on the frontal part and collum, yellowish toward the labral zone. Labral margin and mouthparts bright yellowish. Antennae dark brown.

Prozonites with scattered oblique striae; metazonites with regular striation, suture complete, rectilinear and sometimes curving at ozopore level, ozopores appearing as small rounded spots, opening in metazonites at a distance behind the suture about equal to their diameter.

Telson: Preanal ring dark brown with horizontal caudal projection, bearing 3–3 setae and an upturned hyaline tip; subanal scale with a protruding triangular apex and setose; anal valves with a marginal row of numerous short setae, a submarginal row of longer ones, and ca. 6 setae on disc.

Gonopods. Promerite (Fig. 7) half as broad as long, with parallel margins, strongly narrowed distally into apical and lateral lobes separated by a deep notch. Apical lobe (**Al**), rounded, tapering into a blunt process bent anteriad; lateral lobe (**Ll**) lower and broader; mesal ridge (**Mr**) broad, fusing with the mesal margin; rudimentary telopodite (**T**) located basally. Posterior gonopod (Figs 8–9): Mesomerite (**Ms**) large, extending beyond the rest of the processes, slightly narrowed distally; apically broadened and folded, bearing a broad and marginally serrated apical process (**Ap**), posteriorly protruding into a more slender process which is strongly curved and pointing laterad (**Lp**); solenomerite (**S**) voluminous, showing in mesal and posterior views a big anterior lobe (**Al1**) projecting over a broader posterior one (**Pl**). Both lobes furrowed and separated by a cavity (**C**) bearing on the surface and on the margin several pointed spikes. Anterior lobe apically with a linguiform process (**l**) emerging out of the median furrow. Seminal groove (**g**) running along the solenomerite from the fovea (**F**) to the cavity separating the lobes, opening at the distal margin of the posterior lobe in a folded cylindrical lamella (**la**) facing the linguiform process of the anterior lobe. Paracoxite (**Px**) longer than solenomerite; sinusoid, slightly broadened distally, apically tapering in a tip pointing laterad, emerging from a rounded coxite (**Co**), bearing an additional upturned triangular spike (**Sp**) (Fig. 9).



FIGURES 7–9. *Ommatoiulus baileyi* n. sp., holotype: Fig. 7: Right promerite, posterior view, Fig. 8: Right posterior gonopod, mesal view, Fig. 9: Right posterior gonopod, posterior view. Abbreviations: **Al**: apical lobe of promerite, **Al1**. Anterior lobe of solenomerite, **Ap**: Apical process of mesomerite, **C**: Cavity of solenomerite, **Co**: Coxite, **F**: Fovea, **g**: Seminal groove, **l**: Linguiform process, **la**: Lamella, **Ll**: Lateral process of the mesomerite, **Lp**: Lateral process of mesomerite, **Mr**: Mesal ridge, **Ms**: Mesomerite, **Pl**: Posterior lobe of solenomerite, **Px**: Paracoxite, **S**: Solenomerite, **Sp**: Spike, **T**: Rudimentary telopodite.

Distribution. Known only from the type locality south of Sevilla, Andalusia.

Habitat. Found and locally abundant in leaf litter of the bush *Halimium halimifolium* at the mouth of the Rio Guadalquivir (Bailey and De Mendonça 1990).

Comments. *O. armatus* and *O. dorsovittatus* share similar features with the new species. In fact, the three species show similar promerite structure, a large, distally curved mesomerite, and a voluminous solenomerite with two asymmetrical furrowed lobes separated by a deep cavity. The paracoxite appears as a curved stem emerging from a rounded lobe in all three species, however much more reduced and sinuous in *O. dorsovittatus* and *O. armatus.*

***Ommatoiulus diplurus* (Attems, 1903)**
Figs 10–13, 14–26

Schizophyllum (Bothroiulus) diplurum Attems, 1903: 144–145, Taf. 11, figs 71–72
Schizophyllum hoplites Verhoeff, 1910: 197–198, figs VIII, XVII, XVII **n.syn.**
Schizophyllum diplurus hoplites Hoffman 1975: 460
?*Schizophyllum diplurum appendiculatum* Brolemann, 1925:147 **n.syn.**
Ommatoiulus diplurus mauriesi Hoffman, 1975: 460, fig. 5, **n.syn.**

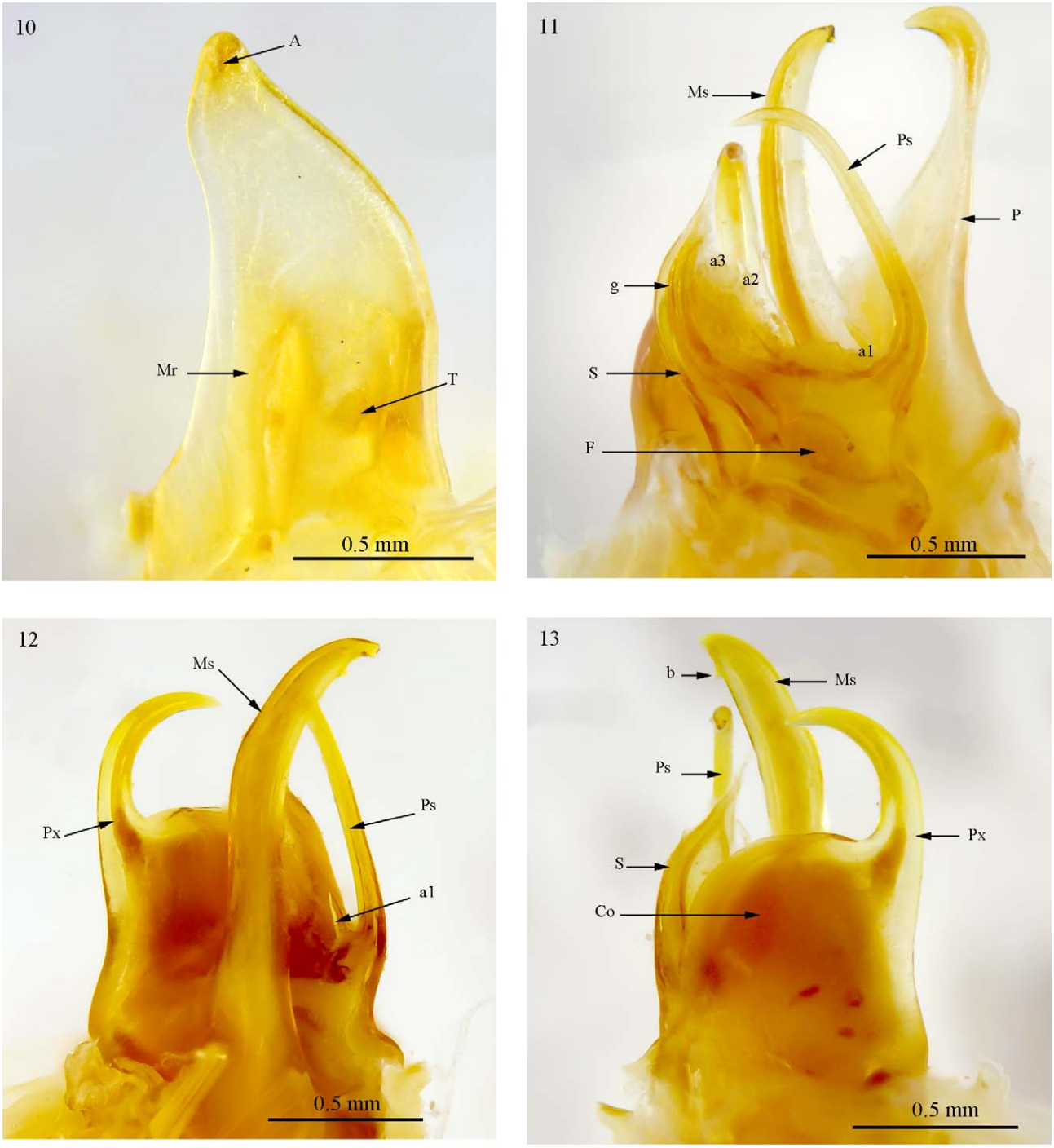
Material. **Type material**: *Schizophyllum (Bothroiulus) diplurum* Attems, 1903, holotype ♂, slide preparation of the gonopods (NMHW/3157). **Non type material**: 1 ♂, Cádiz, Algeciras, 20.ii.1912 (MNCN); 1 ♂, 2 ♀♀, ca. 25 Km North of Ronda, under low bush on rocky grassland, in litter, 17.x.1986, P.T. Bailey leg. (ZMUC); 1 ♂, 2 immatures, 8 Km south Grazalema on Ubrique Road, near Ronda in Serranía de Ronda, alt. 1000 m, in oak litter, beneath tree, 16.x.1986, P.T Bailey. Leg. (ZMUC); 2 ♂♂, 3 immatures, Estepa, East of Sevilla, under small rocks on clay-loan soil, 14.x.1986, P.T. Bailey leg. (ZMUC); 10 ♂♂, 36 ♀♀, 6 immatures, 9 anterior halves ♀♀, 8 anterior halves immatures, several mid-body and posterior body portions, Carratraca, Lund leg. (ZMUC); 6 ♂♂, 10 ♀♀, Granada, xi.1908, F. Aranda leg. (MNCN); 1 ♀, Northern part of Los Alcornocales, south road from Cortes de la Frontera to Alcalá de los Gazules forest road south of Peñon del Berrueco, 36º36'21"N, 5º25'8"W, alt. 780m, Oak forest, 8.ii.2008, H. Reip & K. Voigtländer leg. (ZMUC); 2 ♀♀, Eastern Edge of Grazalema Montejaque between Mures and Cerro de Tavizna, 36º45'14"N, 5º14'16"W, open area, under stones, 7.ii.2008, H. Reip & K. Voigtländer leg. (ZMUC); 1 ♂, 1 ♀, northern part of Los Alcornocales, southern road from Cortes de la Frontera to Alcalá de Los Gazules, Forest road south of Peñón del Berrueco, 36º35'34"N, 5º25'24"W, Oak forest, 8.ii.2008, H. Reip & K. Voigtländer leg. (ZMUC), 1 ♂, Tahivilla, Cádiz, 36º11'N, 5º45'W, 31.iii.2012, Coll. E. Recuero; 1 ♂, Embalse de Almodovar, Facinas, Cádiz, 36º09'N, 5º38'W, 31.iii.2012, Coll. E. Recuero; 1 ♂, Hacia La Fernandina, Jaén, 38º07'25"N, 3º35'52"W, 15.12.2005, Coll. E. Recuero.

Diagnosis. Differing from all the other Andalusian species by a sinuous promerite, narrowing distally and ending in an acuminate tip pointing posteriorly; a long curved mesomerite bearing subapical processes, and a broad distolateral lamella on the solenomerite with 3 processes connected by a thin jagged lamella to a long, slender lateroposteriad curved accessory branch.

Description. Males: L: ca. 45 mm, H: 4.1–4.5 mm, 49–50 PR+1 AR+T. Females: L: ca. 4 mm, H: 5.3 mm, 50 PR+2 AR+T. Large species, with variable, alternating pale yellowish and dark tawny-brownish to blackish colour. Prozonites blackish-tawny, metazonites anteriorly dark brown-black and posteriorly yellow-whitish, dorsum with black midorsal line, legs reddish-brown, head and telson dark brown. Telson: anal valves with 2 parallel rows of dense short setae on the margin and 4–5 on the disc; subanal scale triangular, protruding and setose; preanal ring with a short caudal projection with 2–2 setae and bearing a small hyaline process.

Gonopods. Promerite (**P**) (Figs 10, 11, 14–19) broadest at the basis, bisinuate, distally tapering and apically with an acuminate tip directed posteriorly (**A**), mesal ridge (**Mr**) broad at the base, disappearing at midlenght, rudimentary telopodite (**T**) basal. Posterior gonopod (Figs 11–13, 20–33): Mesomerite (**Ms**) slightly shorter than promerite, elongate, curved anteromesad, uniformly broad, slightly narrowing apically, lateral margin with a lateral process at midlength and sometimes two smaller ones apically on the mesal margin (**b**); solenomerite (**S**) complex with accessory branches; main process broad with a distolateral lamella, basally lodging the fovea (**F**)

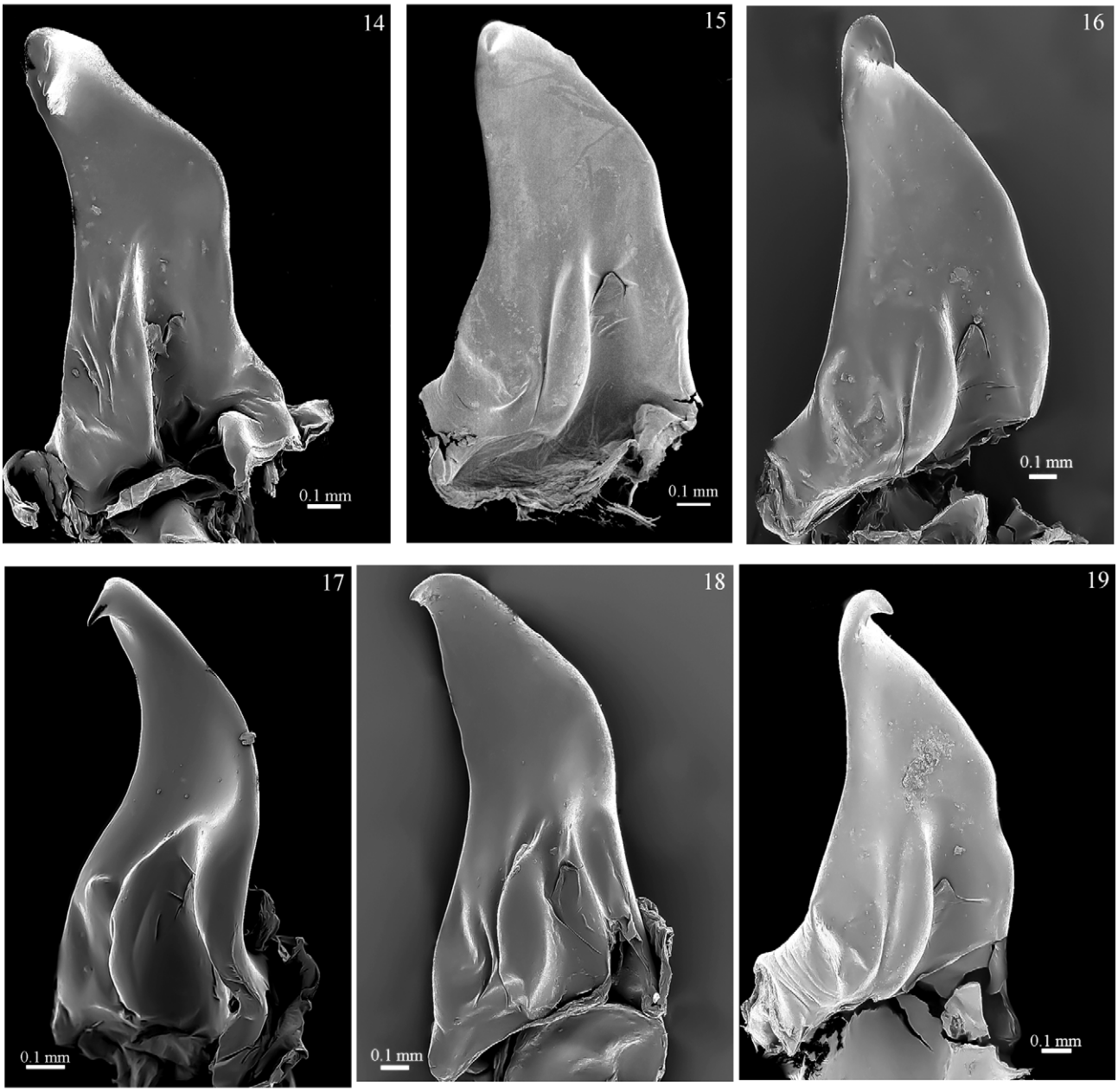
and apically protruding into a main branch lodging the opening of the seminal groove (**g**), and 2 other processes (**a1**, **a2**) of varied shapes and arrangements, parasolenomerite (main accessory branch: **Ps**) of the same length or much longer than the mesomerite (**Ms**), slender, distally curved and connected to the main process by a basal jagged median lamella with a variable degree of serration bearing a third process (**a3**) (Fig. 11) close to the base of the parasolenomerite (**Ps**); paracoxite (**Px**) slender and strongly curved, pointing mesad, emerging from a large, broad coxite (**Co**), abruptly narrowed at midlength (Figs 13, 27–33).



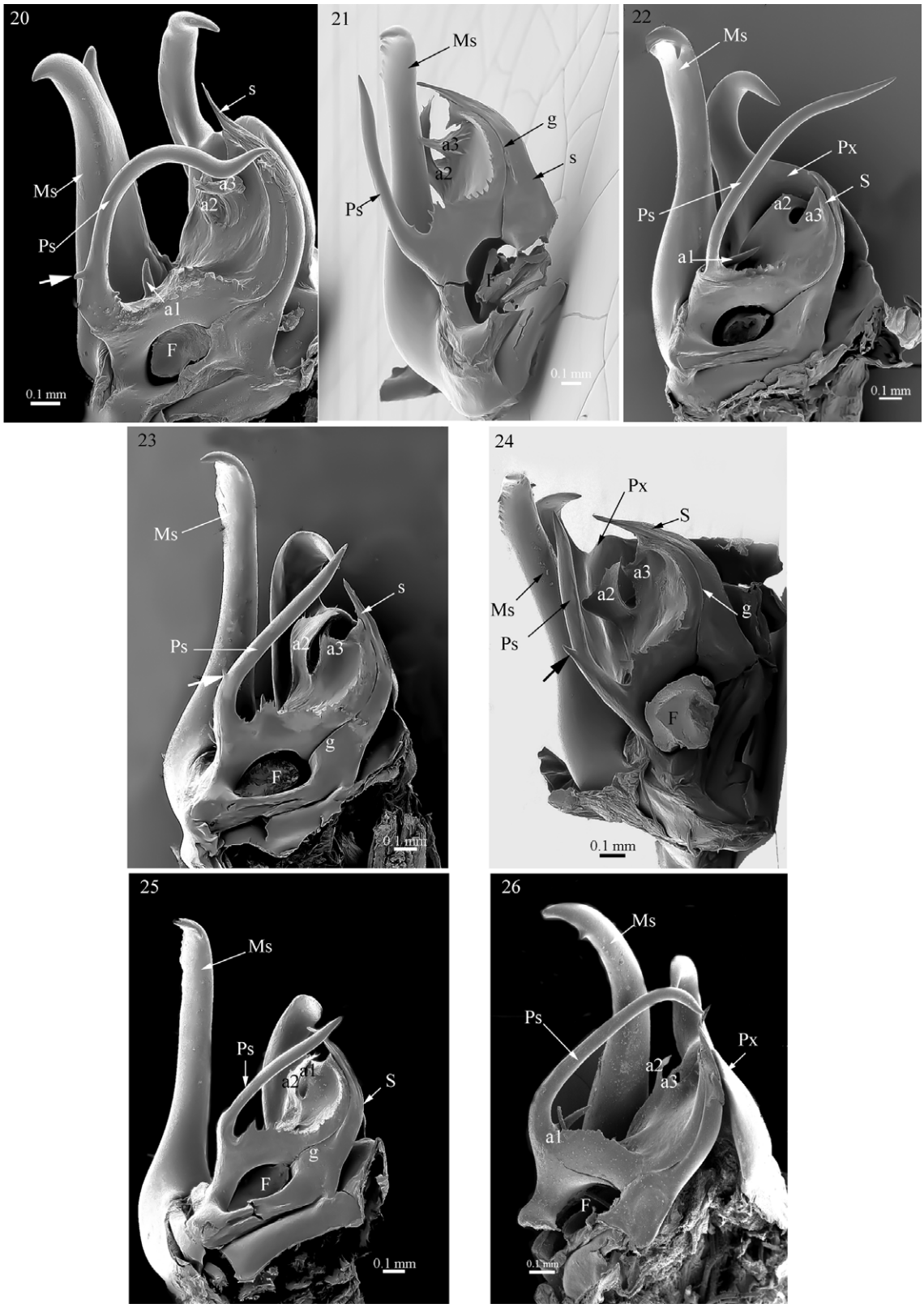
FIGURES 10–13. *Ommatoiulus diplurus*, specimen from Algeciras, Cádiz, (MNCN/20.07/332)*:* Fig. 10: Left promerite, posterior view, Fig. 11: Right gonopod, mesal view, Fig. 12: Right posterior gonopod, anterior view, Fig. 13: Right posterior gonopod, posterior view. Abbreviations: **A**: Apical tooth of promerite, **a1**, **a2**, **a3**: Processes of distolateral lamella of solenomerite, **b**: Mesal subapical process of mesomerite, **Co**: Coxite **F**: Fovea, **g:** Seminal groove, **Mr**: Mesal ridge, **Ms**: Mesomerite, **P**: Promerite, **Ps**: Parasolenomerite, **Px**: Paracoxite, **S**: Solenomerite, **T**: Rudimentary telopodite.

Distribution. Granada, (Attems 1903), Cádiz, Algeciras (Verhoeff 1910 as *Schizophyllum hoplites*); Málaga, Ronda (Attems 1952); Algeciras, Tarifa (Brolemann 1928); Sevilla (Bailey and De Mendonça 1990). Additionally recorded specimens come from Granada and Jaén provinces.

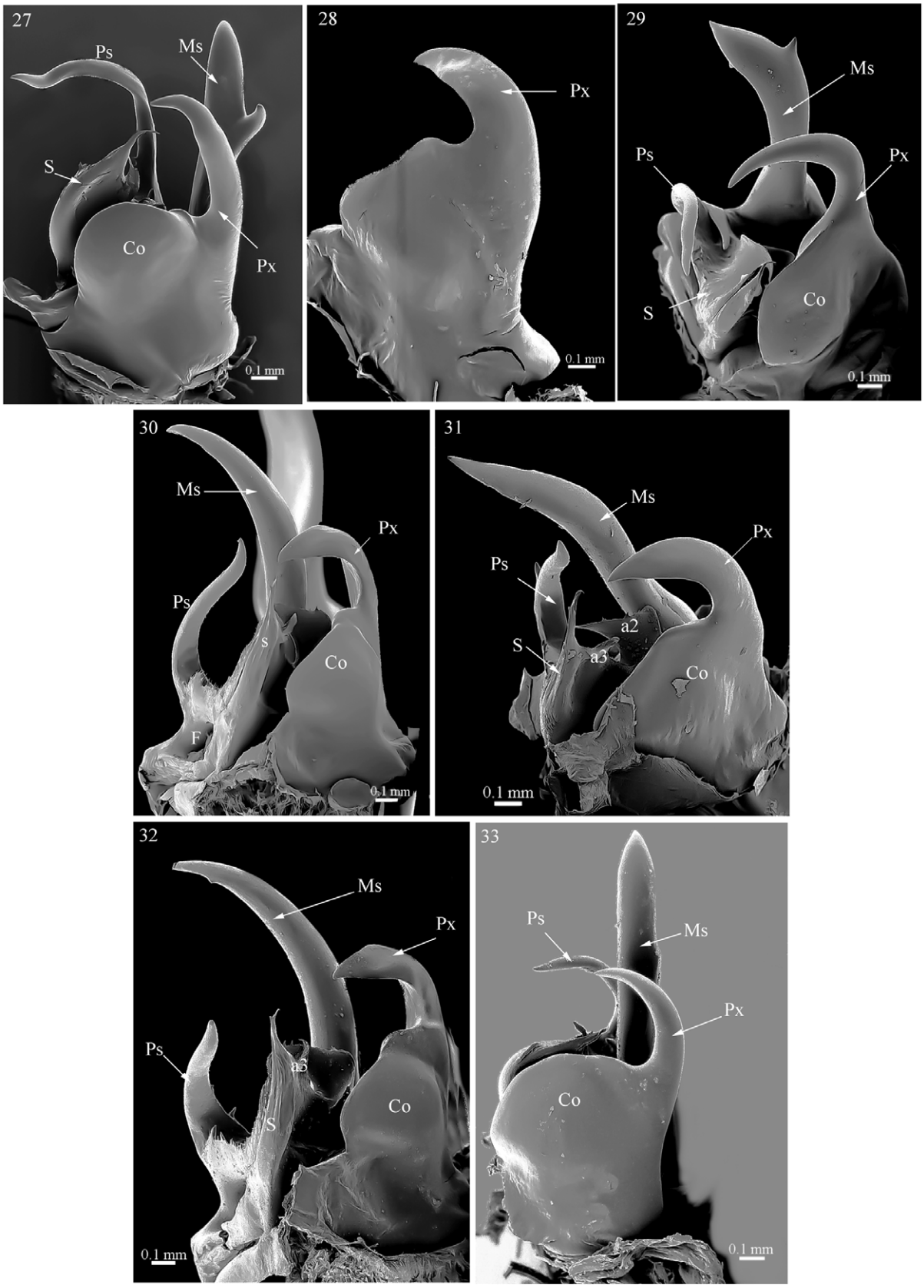
Habitat. Common in grasslands (Bailey and De Mendonça 1990). Also found in oak litter and under small rocks on clay-loam soil.



FIGURES 14–19. *Ommatoiulus diplurus*: Left promerite, posterior view, specimens from: Fig. 14 Tahivilla, Cádiz, Fig. 15: Jaén, Fig. 16: Ronda, Málaga, Fig. 17: Grazalema, Cádiz, Fig. 18: Granada, 19: Carratraca, Málaga.



FIGURES 20–26. *Ommatoiulus diplurus*: Right posterior gonopod, mesal view, specimens from: Fig. 20: Tahivilla, Cádiz, Fig. 21: Jaén, Fig. 22: Ronda, Málaga, Fig. 23: Grazalema, Cádiz, Fig. 24: Granada, Fig. 25: Carratraca, Málaga, Fig. 26: Algeciras, Cádiz. Abbreviations: a1, a2, a3: Processes of distolateral lamella of solenomerite, arrow pointing to mesal process of parasolenomerite, g: Seminal groove, F: Fovea, Ms: Mesomerite, Ps: Parasolenomerite, Px: Paracoxite, S: Solenomerite.



FIGURES 27–33. *Ommatoiulus diplurus*: Right posterior gonopod, specimens from: Fig. 27: Tahivilla Cádiz, posterior view, Fig. 28: Jaén, paracoxite, posterior view, Fig. 29: Ronda, Málaga, posterior-apical view, Fig 30: Grazalema, Sevilla, mesal-posterior view, Fig 31. Granada, posterior-apical view, Fig. 32: Carratraca, Málaga, mesal-posterior view, Fig. 33: Algeciras, Cádiz, posterior view. Abbreviations: **a2**, **a3**: Processes of distolateral lamella of solenomerite, **F**: Fovea **Ms**: Mesomerite, **Ps**: Parasolenomerite, **Px**: Paracoxite, **S**: Solenomerite.

Table 2. Gonopod variation in *O. diplurus*

Locality	Tahivilla (Cádiz)	Jáen	Ronda (Málaga)	Grazalema (south of Sevilla)	Granada	Carratraca (Málaga)	Algeciras (Cádiz)
Promerite **(Figs 10, 14–19)**	Sinuous Lateral margin abruptly bent mesad Apex with a series of processes	Stout Lateral margin gradually narrowed Apex with very small tooth	Broad, slenderer apically Lateral margin gradually narrowed Apex with a big jagged tooth	Sinuous and very slender Lateral margin gradually curved, Apex with an acuminate process	Elongate, less narrowed apically Lateral margin gradually bent mesad	Similar to specimen from Ronda	Broad, slenderer apically Lateral margin gradually narrowed Apex with a big jagged tooth
Mesomerite **(Figs 20–26, 27–33)**	Broad Apically blunt With large lateral process	Less broader Apically blunt With subapical serrations	Broad Apically truncate With small lateral process	Slenderer distad Apically pointed With subapical serrations	Less broader Apically pointed With subapical serrations	Less broader Apically pointed With subapical mesal process	Less broader With small mesal subapical process
Solenomerital complex							
Parasolenomerite **(Figs 20–26)**	Much longer than solenomerite With process on margin	Comparable length with solenomerite No process on margin	Much longer than solenomerite No process on margin	Much longer than solenomerite With process on margin	Comparable length with solenomerite With process on margin	Comparable length with solenomerite No process on margin	Comparable length with solenomerite No process onmargin
Process a1	Present Pointing distad Located in middle of mesal lamella	Absent	Present Pointing laterad Located at base of parasolenomerite	Absent	Absent	Absent	Present Pointing laterad Located at base of parasolenomerite
Process a2	Fairly small	Large	Large	Large	Large	Large	Small
Process a3	Large	Large	Small	Large	Small	Large	Small
Mesal lamella	Scattered serration	Strongly serrated	Strongly serrated	Strongly serrated	Strongly serrated	Strongly serrated	Scattered serration
Paracoxite **(Figs 27–33)**	Coxite rounded Paracoxite slightly broad and long	Coxite with extra bulge and depressed edge Paracoxite short and broad	Coxite rounded Paracoxite slightly broad and long	Coxite with extra bulge and depressed edge Paracoxite short and broad	Coxite with extra bulge and depressed edge Paracoxite short and broad	Coxite with extra bulge and depressed edge Paracoxite short and broad	Coxite rounded Paracoxite slightly broad an long

Comments. Hoffman (1975) recorded four subspecies of *O. diplurus*:

1) *O. diplurus diplurus* (Attems, 1903) recorded from Algeciras, Andalusia, Tarifa,
2) *O. diplurus hoplites* (S*chizophyllum hoplites* Verhoeff, 1910), described from Province of Cádiz, Comarca Campo de Gibraltar, Algeciras,
3) *O. diplurus appendiculatus* (Brolemann, 1925) described from Tipasa, Algeria,
4) *O. diplurus mauriesi* (Hoffman, 1975) corresponding to *Schizophyllum diplurum* sensu Attems (1952) from Cádiz province (localities mentioned in Hoffman 1975).

According to Hoffman (1975) the latter subspecies is characterized by: 1) promerite slender and curved–not short and cuneate as in *hoplites* but less bisinuate than in *diplurus*, 2) subterminal lateral projection of the mesomerite larger than in the two others subspecies, 3) processes 1–3 of the opisthomerite different in size and arrangement from those of *hoplites*, 4) parasolenomerite much longer than the solenomerite, unlike what is observed in the type.

On the other hand, the *hoplites* subspecies (see Verhoeff 1910) is characterized by a 1) promerite of similar shape but more "bumpy" than in *diplurus* with a longer and more prominent tip. 2) mesomerite curved with two teeth on the mesal margin compared to the type; 3) solenomerite very similar to *diplurus* but the processes have different arrangements: the mesal process longer and the lateral-most shorter than in the type, 4) coxa less prominent and paracoxite less curved than in the type.

Having at our disposal an extensive material of *O. diplurus* collected from Andalusia, we examined several specimens collected in different localities. The comparison of the the gonopodal structures of 7 specimens from Tahivilla (Cádiz), Jaén, Ronda (Málaga), Grazalema (Sevilla), Granada and Carrtraca (Málaga) (Table 2) clearly shows that *O. diplurus* is a highly variable species with several morphs. The specimen we examined from Cádiz perfectly corresponds to Hoffman's (1975) description of *mauriesi*, while the sample from Algeciras fits Brolemann's (1928) redescription of *hoplites*. Based on geographical provenance, Hoffman (1975) intuitively referred Attems' record from Ronda to *mauriesi*. The study of fresh material collected in Ronda has proved that Hoffman (1975) was partly right as the sample from Ronda is also characterized by a parasolenomerite much longer than the solenomerite and a lateral process on the mesomerite. However the promerite is different (Fig. 16), the lateral mesomerital process is smaller (Figs 27, 29), the apical part of the mesomerite bears small processes (Fig. 29), and the solenomerite shows different arrangement of the processes **a1**, **a2**, **a3** (Table 2, Fig. 22).

Besides the hitherto described morphotypes of *O. diplurus*, we could cite a number of additional ones: 1) a morph from Jaén characterized by very stout promerite, an extra process on the solenomerite, big processes on the distolateral lamella, strong serrations on the median lamella and a very short and broad paracoxite with a strongly depressed coxal ridge; 2) a morph from Ronda, very similar to *mauriesi* but with a different promerite and arrangement of the teeth on the distolateral lamella; 3) a morph from Carratraca which resembles *hoplites* in the structure of the promerite and paracoxite but differs in the size of the processes of the distolateral edge, absence of process **a1** and of the lateral process of the mesomerite. Moreover, in some of the studied samples, the parasolenomerite bears a small process on the mesal margin which has never been reported in previous descriptions.

In the light of this new evidence we regard the distinction between subspecies of *O. diplurus* a futile exercise.

The Algerian record of *O. diplurus*, based exclusively on females and immatures (Brolemann 1925), is here regarded as uncertain until males are collected from North Africa.

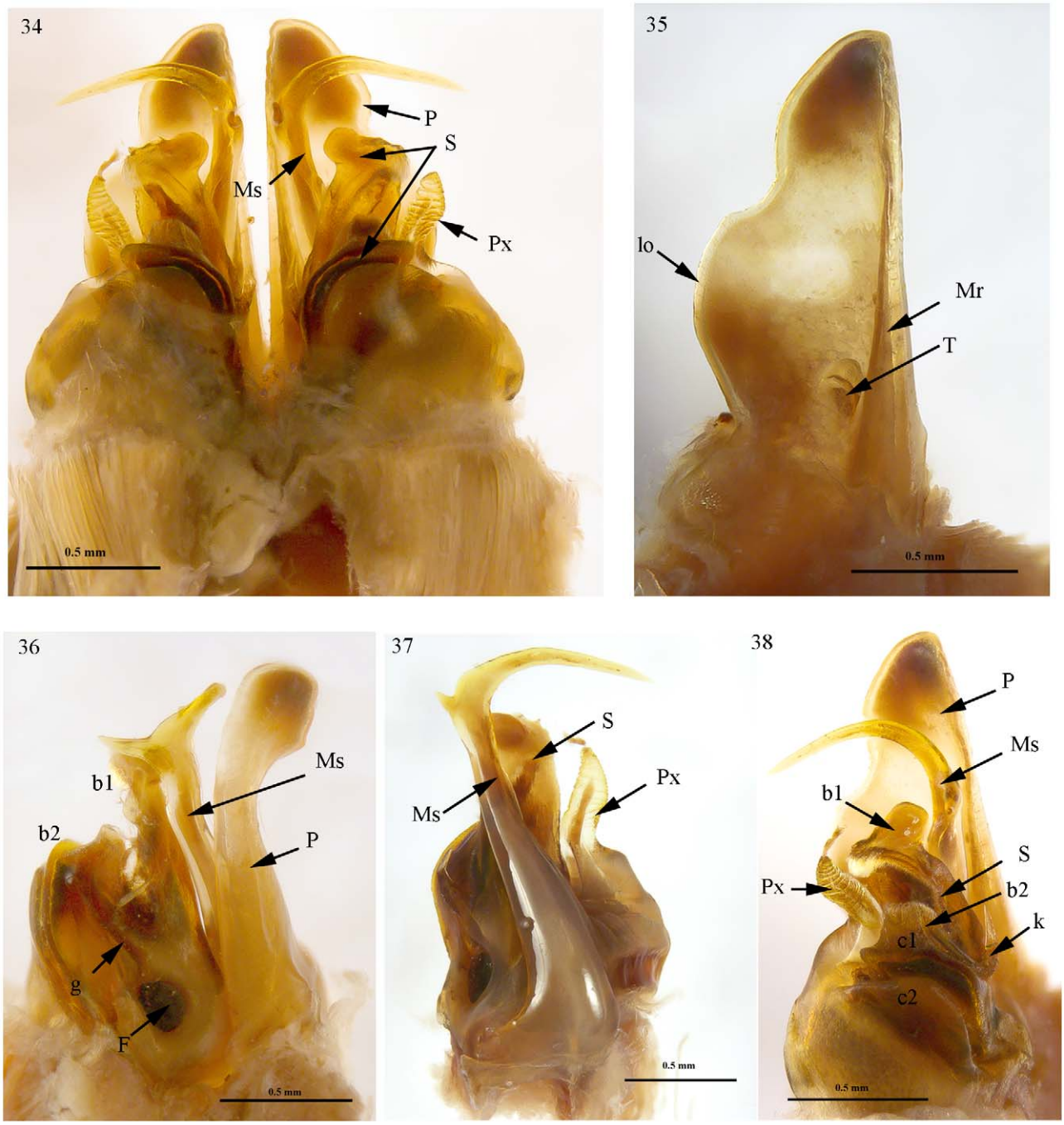
Ommatoiulus dorsovittatus (Verhoeff, 1893)

Figs 34–40

Julus (*Hemipodoiulus*) *dorsovittatus* Verhoeff, 1893: 157–158, figs 24, 27
Palaioiulus dorsovittatus: Verhoeff 1894: 157, Taf. VI, fig. 22
Schizophyllum dorsovittatum estrellanum Verhoeff, 1910: 203–204, figs VII, 22, 22b, XXI, **new syn.**
Schizophyllum calatravanum Brolemann, 1920: 136–138, figs 11–13, **new syn.**
Ommatoiulus calatravanum: Mauriès 1978: 585
Ommatoiulus dorsovittatus: Vicente 1985: 323
Ommatoiulus dorsovittatus estrellanus: Vicente 1985: 323

Material. **Type material**: *Schizophyllum* (*Eleutheroiulus*) *calatravanum* Brolemann, 1920, Espagne, Pozuelo de la Calatrava, holotype ♂ (MNHN/4539). **Non type material**: 2 ♂♂, Andalusia, Jaén, Linares, Ctra. JV-6035 Hacia La Fernandina, 38º07'25"N, 3º35'52"W, Coll. E. Recuero.

Diagnosis. Most similar to *O. armatus*, *O. baileyi* n. sp. and *O. fuentei* (Brolemann, 1920) especially in the shape of the promerite, and the presence of a voluminous solenomerite with an anterior lobe projecting over a posterior one, separated by a setose furrow; like O. *armatus* and *O. baileyi* showing a big, apically expanded mesomerite and a reduced sinuous paracoxite emerging from a reduced coxite (more reduced than in *O. baileyi* n. sp. and *O. armatus*, although striped like the latter). Differing from these species by a bipartite apex of the mesomerite, and a more protruding anterior lobe of the solenomerite (than in *O. baileyi*) bearing an accessory small process.

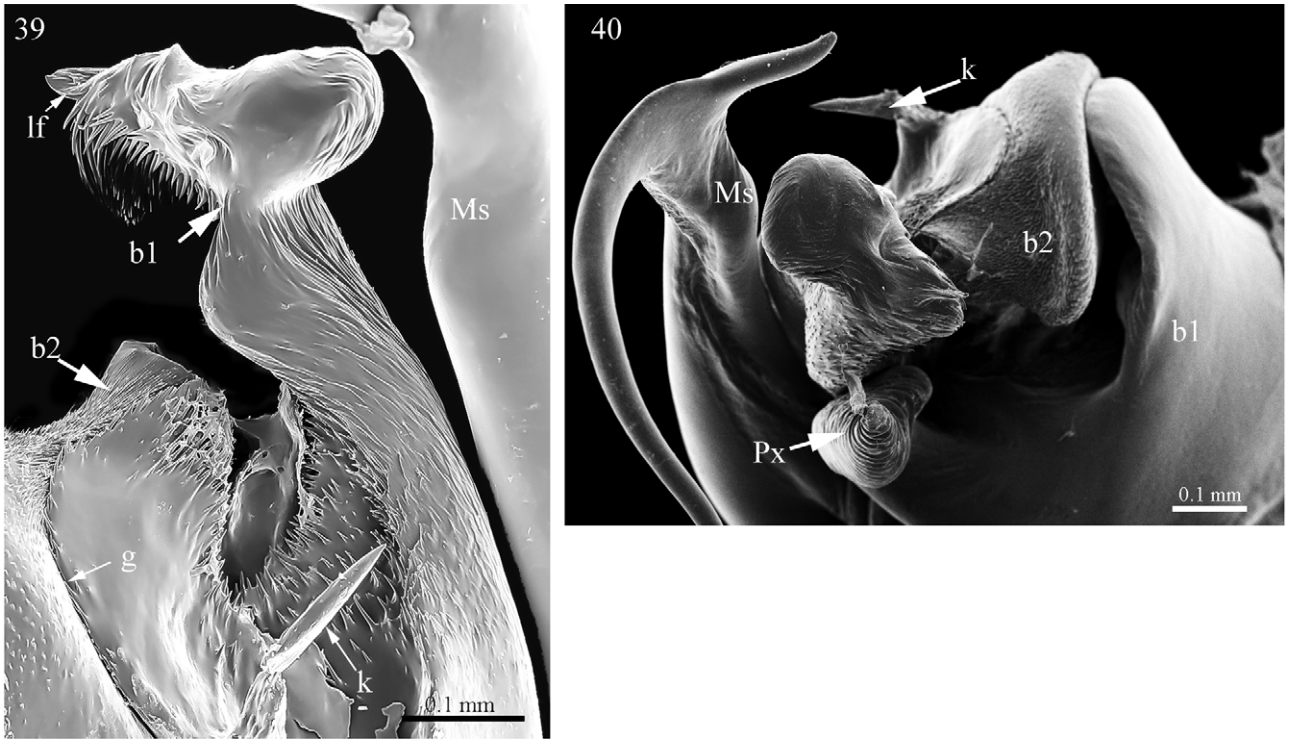


FIGURES 34–38. *Ommatoiulus dorsovittatus*, specimen from Andalusia, Jaén (Coll. E. Recuero): Fig. 34: Full gonopod block, posterior view, Fig. 35: Right promerite, posterior view, Fig. 36: Right gonopod, mesal view, Fig. 37: Left posterior gonopod, anterior view, Fig. 38: right gonopod, posterior view. Abbreviations: **b1**: Anterior process of solenomerite **b2**: Posterior process of solenomerite, **c1**, **c2**: Bulges of posterior process of solenomerite, **F**: Fovea, **g**: Seminal groove, **k**: parasolenomerite, **lo**: Lateral lobe of promerite, **Mr**: Mesal ridge, **Ms**: Mesomerite, **P**: Promerite, **Px**: Paracoxite, **S**: Solenomerite, **T**: Rudimentary telopodite.

Description. Male: L: 32 mm, H: 3.0 mm, 46 PR+1 AR+T. Colour pattern clearly annulated with chestnut-brown and black. Prozonites blackish on the lateral sides, metazonites chestnut brown posteriorly with a golden glow, dorsum with semilunate whitish markings on prozonites, crossed by a series of triangular black spots; metazonites golden brown; legs tawny-brown; head and telson dark. Telson: anal valves with a row of short setae on the margin, a submarginal row of longer ones, and 4–5 setae on the disc; subanal scale triangular, blunt and setose; preanal ring with a protruding caudal projection with 2–2 setae and bearing an upturned hyaline process.

Gonopods: Promerite (**P**) (Figs 34, 35) broad at the base, distally narrowing, lateral margin expanded in a rounded lobe (**lo**) incised in the distal third; mesal ridge (**Mr**) fusing with the mesal margin, the latter making a thin fold; rudimentary telopdite small (**T**), located basally, close to the mesal ridge. Posterior gonopod: mesomerite (**Ms**) broad, hook-shaped (Figs 34, 37, 40), apically bifurcating into a short mesal process pointing posterodistad and a longer curved one pointing laterad; solenomerite (**S**), voluminous, with an anterior process (**b1**) projecting over a posterior process (**b2**) (Figs 36, 38, 39, 40); process **b1** (Fig. 39) large, slightly shorter than mesomerite, with a median groove and covered with spikes all over the surface, apical part expanded anteroposteriorly into hammer-shaped process with the head bearing a small leaf-like horizontal process (Fig. 39: **lf**) and the lower margin fringed with a large number of downturned spikes, opposite side voluminous with uneven surface; process **b2** composed of two bulges (**c1**, **c2**) separated by a shallow incision and a small slender process directed upward, probably the parasolenomerite (**k**) (Figs 38, 39, 40) . Seminal groove (**g**) (Figs 36, 39) running from the fovea (**F**) located in the basal part of the solenomerite (**S**) up to the top of process (**b2**). The two main processes of the solenomerite separated by a deep cavity extensively covered by spikes; paracoxite (**Px**) small, shorter than the solenomerite, emerging from a broad coxa, sinuous, tapering distad and bearing regular transverse striae (Figs 34, 38, 40).

Distribution. Known from Portugal where the species was described twice: from the North (Verhoeff 1893a) and from Sierra de Estrela (Verhoeff 1910). Here, the species is moreover recorded from Spain, Ciudad Real (Brolemann 1920, as *Schizophyllum calavatranum*), Estremadura (Kime, personal communication) and for the first time from Jaén in Andalusia.



FIGURES 39–40. *Ommatoiulus dorsovittatus*, specimen from Andalusia, Jaén (Coll. E. Recuero): details of posterior gonopod: Fig. 39: distal part of solenomerite, Fig. 40: apical view of posterior gonopod. Abbreviations: **c1**, **c2**: Bulges of posterior process of solenomerite, **e1**: Anterior process of solenomerite, **e2**: Posterior process of solenomerite, **g**: Seminal groove, **k**: Parasolenomerite, **lf**: Leaf-shaped process, **Ms**: Mesomerite, **Px**: Paracoxite.

Comments. Verhoeff (1893, 1910) consecutively described *Julus dorsovittatus* and the subspecies *Schizophyllum dorsovittatum estrellanum* from Portugal. Both agree in having a broad promerite becoming slenderer distad with no extension of the mesal ridge; a broad, distally bipartite mesomerite with a short, upturned mesal process and a longer lateral one bent in a hook-manner; a voluminous solenomerite with two bulgy processes marginally bearing spikes and short setae, a distal process protruding over a more basal process, the latter lodging the seminal groove; a sinuous paracoxite with transverse striae, shorter than the solenomerite.The subspecies *estrellanum* differs from *dorsovittatus s.s* in the shape of the distal process of the mesomerite, which is stouter and more bent downward; the distal process of the solenomerite is thicker and strikingly more protruding. Unfortunately Verhoeff gave no complete illustrations for both described taxa but only the posterior view of the promerite and the posterior gonopods for *O. dorsovittatus* which seem a little distorted (Verhoeff 1893a, figs 24, 27) and a different view of an isolated mesomerite, solenomerite and paracoxite for the subspecies *estrellanum* (Verhoeff 1910, figs 28, Abb. VII, Abb. XXI) which doesn't allow one to discern with certainty the cited differences from *dorsovittatus s.s.* The subspecies *estrellanum* is therefore here synonymised under *O. dorsovittatus*.

Schizophyllum calatravanum described by Brolemann (1920) from Ciudad Real, was another species comparable with *O. dorsovittatus* presenting similarly shaped promerite (with less broad lateral margin, Brolemann 1920, fig. 11) and posterior gonopods with a hook-shaped mesomerite apically bifuracte; a voluminous solenomerite showing all the processes described in *O. dorsovittatus* (see Brolemann 1920, figs 12–13). The main difference consisted of the absence of the paracoxite in the interpretation and drawings of Brolemann (see Brolemann 1920, fig. 12). However, the study of the type material revealed the presence a paracoxite, which is, like the rest of the processes, absolutely similar to *O. dorsovittatus*, leaving no doubt that *S. calatravanum* is a junior synonym of *O. dorsovittatus*.

***Ommatoiulus fuentei* (Brolemann, 1920)**
Figs 41–46

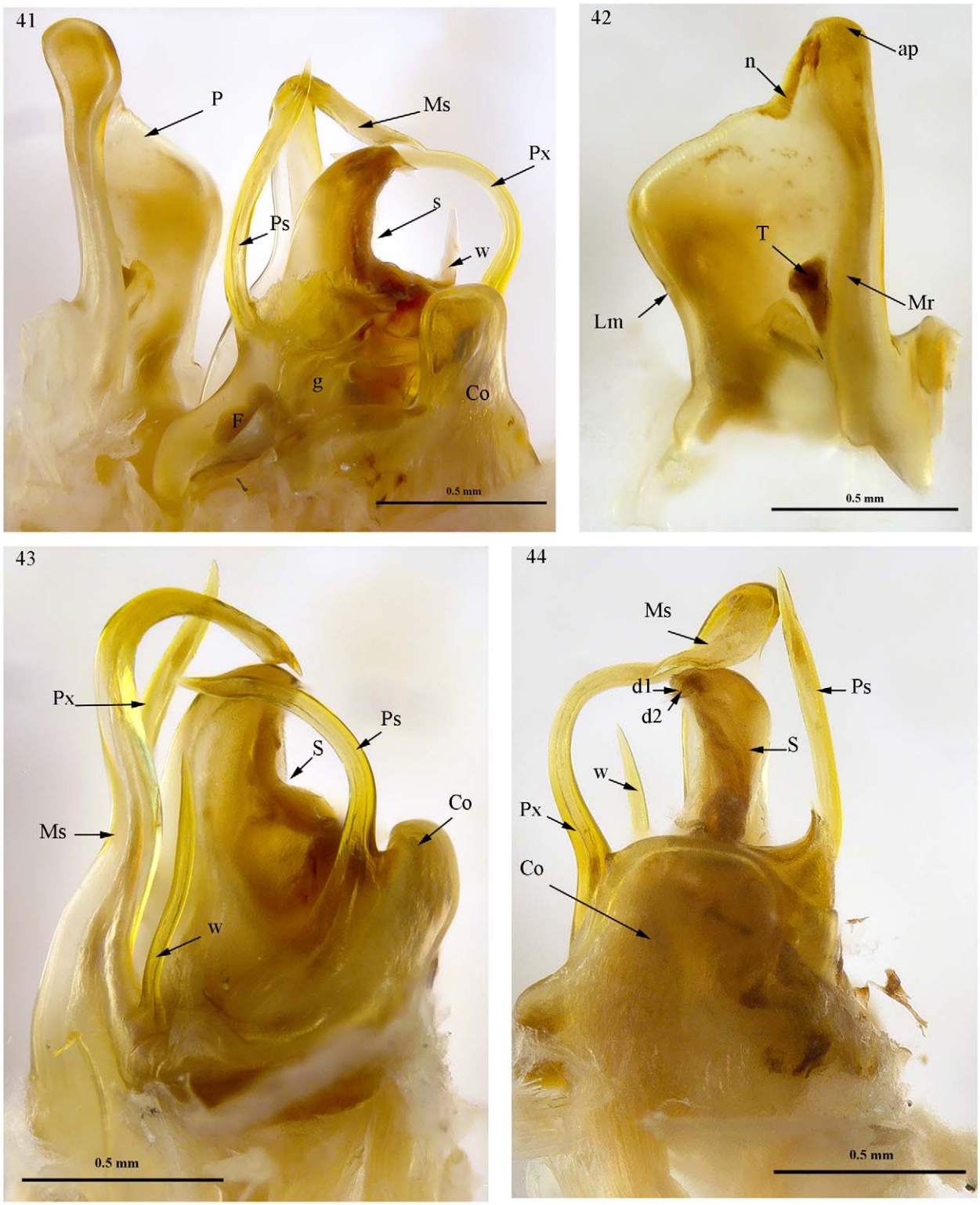
Schizophyllum (*Eleutheroiulus*) *Fuentei* Brolemann, 1920: 132–136, figs 7–10
Ommatoiulus fuentei: Mauriès 1978: 585, Vicente 1985: 323

Material. **Type material**: *Schizophyllum* (*Eleutheroiulus*) *Fuentei* Brolemann, 1920, Espagne, Pozuelo de la Calatrava, holotype ♂ (MNHN/7538). **Non type material**: 2 ♂♂, Córdoba, El Patriarca, 37º54'38"N, 4º48'33"W, alt. 214 m, 7.xi.2011, M. Baena leg. (ZMUC); 1 ♂, 1 ♀, 4 km W La Carolina, Jaén, 38º17'08"N, 3º39'11"W, E. Recuero leg. (ZMUC).

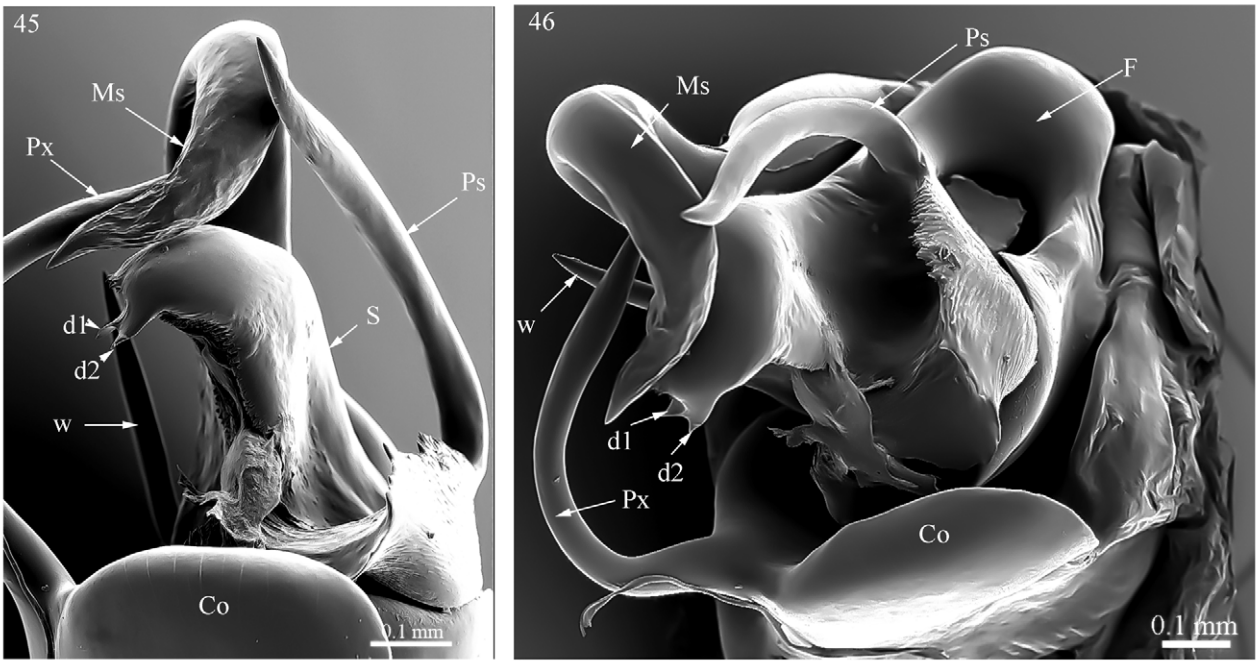
Diagnosis. Most similar to *O. dorsovittatus*, *O. armatus*, and *O. baileyi* n. sp.; differing, however, by a voluminous coxite, a long slender paracoxite and a slender additional process emerging from the mesomerite basis.

Description. Males: L: 36 mm, H: 3.0 mm, 48 PR+1 AR+T. Females: L: 42 mm, H: 4.0 mm, 48 PR+2 AR+T. Colour alternately purple-brown, yellowish, marbled with black and purple brown. Prozonites yellowish marbled with black spots, dorsally paler, metazonites chestnut brown, anteriorly darker, legs purple, head dark brown and telson blackish, dorsum with a thin, dark mid-dorsal line. Telson: anal valves with 1 marginal row of short setae, a submarginal row of longer ones and 4–5 setae on the disc; subanal scale triangular, pointed and setose; preanal ring with a protruding caudal projection bearing a small hyaline process and 2–2 setae on the lateral sides. Gonopods: Promerite (**P**) (Figs 41, 42) broad and short. Mesal ridge (**Mr**) making a fold running along the margin up to the apical part; lateral margin (**Lm**) broader distally, expanding into a lateral lobe; apical margin protruding mesally into a rounded apex **(ap)**; the latter separated from the apical margin by a notch (**n**); rudimentary telopodite (**T**) small, located basally. Posterior gonopod (Figs 42–46): Mesomerite (**Ms**) long, basally broad, gradually narrowing distad into a hook-shaped apex strongly bent posterolaterad, accompanied by a slender and acuminate process emerging from the same basis and pointing apicad (**w**) (Figs 41, 43, 46); solenomerite complex and voluminous, with accessory branches, the main process (**S**) comprising a distal lobe folded mesolaterally and bent apically; tip protruding into two acuminate processes pointing posterolaterad (**d1**, **d2**) (Figs 44, 46), inner margins of the fold bearing several rows of spikes running all along the process (Fig. 45). The latter posteromesally connected to a lower, marginally serrated lamella covered by numerous spikes, connected to a mesal, elongate and slender parasolenomerite (**Ps**). Fovea (**F**) (Figs 41, 46) lodging mesally in the base of the solenomerite giving rise to the

seminal groove (**g**) (Fig. 41). The latter running mesolaterad up to the lamella, before entering the main process (**S**) along the serrated margins and opening between the two apical processes. Coxite (**Co**) (Figs 43–46) broad and rounded, somewhat reminding of *O. diplurus*, paracoxite (**Px**) slenderer and more elongate.



FIGURES 41–44. *Ommatoiulus fuentei*, specimen from Andalusia, Córdoba (ZMUC): Fig. 41: Left gonopod, mesal view, Fig. 42: Right promerite, posterior view, Fig. 43: Right posterior gonopod, antero-lateral view, Fig. 44: Right posterior gonopod, posterior view. Abbreviations: **ap**: Apical lobe of promerite, **Co**: Coxite, **d1**, **d2**: Apical processes of solenomerite, **F**: Fovea, **g**: Seminal groove, **Lm**: Lateral margin, **Mr**: Mesal ridge, **Ms**: Mesomerite, **n**: Notch, **P**: Promerite, **Ps**: Parasolenomerite, **Px**: Parasolenomerite, **S**: Solenomerite, **T**: Rudimentary telopodite, **w**: Process emerging from mesomerite basis.



FIGURES 45–46. *Ommatoiulus fuentei*, specimen from Andalusia, Córdoba, M. Baena leg. (ZMUC), details of the posterior gonopods: Fig. 45: distal part of posterior gonopod, posterior view, Fig. 46: apical view. Abbreviations: **Co**: Coxite, **d1**, **d2**: Apical processes of solenomerite, **F**: Fovea, **Ms**: Mesomerite, **Ps**: Parasolenomerite, **Px**: Paracoxite, **S**: Solenomerite, **w**: Process emerging from mesomerite basis.

Distribution. Hitherto known from Ciudad Real (Type locality, Brolemann 1920), also recorded from Badajoz Province in Estremadura (Kime, Personal communication) and here for the first time recorded in Andalusia in Córdoba and Jaén.

Habitat. Abundant in litter of shrub with *Halimium* spp., also found on roadway (Bailey and De Mendonça 1990).

Comments. *Ommatoiulus fuentei* has a unique feature in the structure of the gonopods which consists in the presence of an accessory process, slender and acuminate, emerging from the same basis as the mesomerite. The latter process was interpreted as a 'possible paracoxite' by Brolemann (1920) in the original description of the species (see fig. 8, **pa**) while what he (Brolemann 1920) described as 'an apical continuation of the coxite' is what we conventionally consider as paracoxite.

Ommatoiulus hoffmani Akkari & Enghoff n.sp.

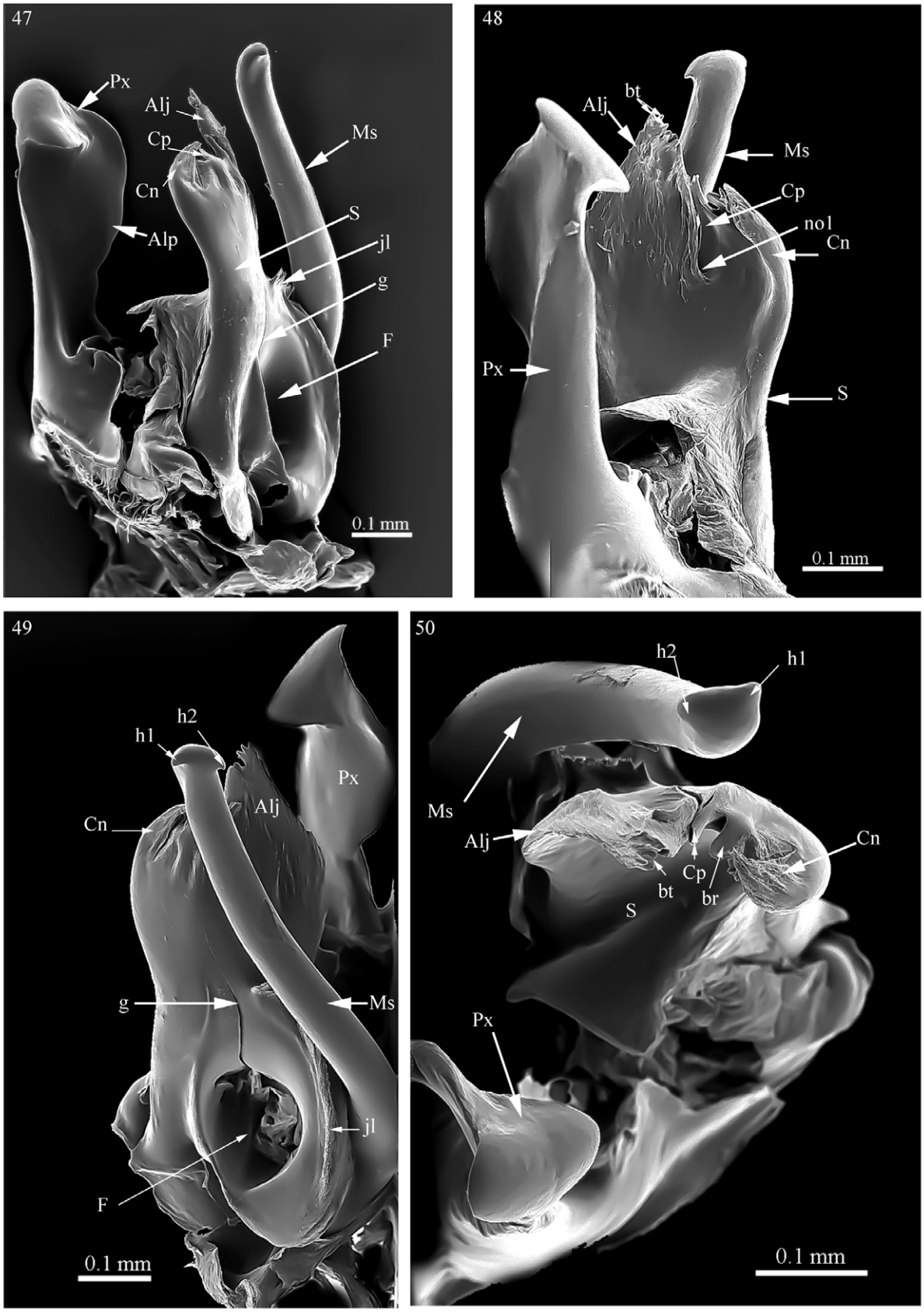
Figs 47–50

Material. **Holotype** : 1 ♂, Andalusia, Almería, Rodalquilar, 36º51'16"N, 2º02'25"W, dry rocky hill, under stones, 22.iv.2008, H. Enghoff, Y. de Jong, K. Mohr leg. (ZMUC). **Paratypes**: 3 ♀♀, 2 immatures, same data as holotype, H. Enghoff, Y. de Jong, K. Mohr leg. (ZMUC).

Diagnosis. Most similar to *O. niger* and *O. ibericus* but differing in the apical part of the solenomerite bearing blunt serrations on the anterior process devoid of a subapical 'claw' (unlike *O. niger*) and a longer mesal process lodging the seminal groove (unlike *O. ibericus*).

Etymology. Species named in honour of the late Richard L. Hoffman (1927–2012), in recognition of his immense contribution to our knowledge of millipede taxonomy.

Description. Male: L: 25 mm, H: 2.5 mm, 50 PR+2 AR+T. Female: L: 32 mm, H: 3.0 mm, 49 PR+2 AR+T. General colour grayish brownish. Prozonites tawny brown sputtered with black on the lateral sides, condensed as black spots at ozopore level, metazonites light brown anteriorly, much darker to black posteriorly. Antennae purple brown; collum and head grayish marbled with yellow in the center, mouthparts yellowish. Dorsum with a thin mid-dorsal line. Legs light brown. Anal valves, subanal scale and preanal ring yellowish, densely sputtered with black. Metazonites with regular striation and short slender setae on the posterior margin, ozopores opening at a distance



FIGURES 47–50. *Ommatoiulus hoffmani* n. sp., holotype: Left posterior gonopod: Fig. 47: Meso-posterior view, Fig. 48: Posterior view, Fig. 49: Mesal view, Fig. 50: Apical view. Abbreviations: **Alj**: Anterior jagged lamella of solenomerite, **Alp**: Anterior lobe of paracoxite, **br**: Blunt round process, **bt**: Blunt teeth, **Cn**: Conical process of solenomerite, **Cp**: Conical process with opening of seminal groove, **F**: Fovea, **g**: Seminal groove, **h1**, **h2**: Apical hooks of mesomerite, **jl**: Jagged lamella of solenomerite, **Ms**: Mesomerite, **no1**: Notch of solenomerite, **Px**: Paracoxite, **S**: Solenomerite.

ca. their diameter behind suture, suture complete, curving at ozopore level. Telson: Preanal ring with a protruding caudal projection bearing several setae and a small hyaline tip; anal valves with a marginal row of short setae, a submarginal row of longer ones and 5–6 setae on the surface, subanal scale triangular with a blunt tip beraing numerous setae. Gonopods: Promerite sub-rectangular, resembling that of *O. baenai* n. sp. (cf. Fig. 3). Posterior gonopod (Figs. 47–50): Mesomerite (**Ms**) simple, longer than promerite, uniformly slender and slightly curved distad, apically bearing 2 small hooks (**h1**, **h2**) (Figs 49, 50); solenomerite (S) broad at the base with a jagged lamella (**jl**) (Fig. 49) at the anterior margin, only slightly narrowed at midlength, distally expanded, asymmetrical and ramified into 1) a posterior lower pointed, strongly serrated, conical process (**Cn**) (Figs 48–50), 2) a blunt rounded process (**br**) (Fig. 50), 3) a small concial process (**Cp**) (Figs 48–50) folded and lodging the opening of the seminal groove (Figs 47, 49), 4) an anterior lamella with jagged surface (**Alj**), separated from the rest by a deep narrow notch (**no1**), apically narrowed, protruding in several small blunt teeth (**bt**) (Fig. 50). Seminal groove (**g**) running posteriorly from the fovea (**F**), located at the base of the solenomerite, up to process **Cp**. Paracoxite (**Px**) stout, of the same length as the solenomerite, broadened distally with a big lobe (**Alp**) on the anterior margin (Fig. 47), subapically strongly narrowed, projecting into a thickened apical triangular process pointing mesad.

Distribution. Known only from the type locality in Almería, Andalusia.

Habitat. Found in dry habitat, under stones.

***Ommatoiulus ilicis* (Brölemann, 1896) n. comb.**

Figs 51–54

Schizophyllum (*Bothroiulus*) *ilicis* Brölemann, 1896: 9–11, figs XXIII, XXV
Schizophyllum (*Bothroiulus*) *nivale* Schubart, 1959: 485–493, figs 7–8, **n.syn.**
Ommatoiulus **(***Bothroiulus***)** *nivalis*: Mauriès 1969b: 133
Ommatoiulus nivalis: Mauriès 1978 : 585
Ommatoiulus nivale: Vicente 1985 : 324

Material. **Type material**: *Schizophyllum* (*Bothroiulus*) *ilicis* Brölemann, 1896, Pyrénées Orientales, holotype ♂ (MNHN/772), *Schizophyllum corsicum* Brölemann, 1902, Ariadne, Ajaccio, Corse, holotype ♂ (MNHN/1132). **Non type material**: 1 ♂, 1 ♀, 3 immatures, 3 juveniles, Sierra de Grazalema, Sierra de Blanquilla (western Sierra del Palo), road from Cortes de la Frontera to Benaoján, southern Barriada de la Estación Valley des Chapí, 36º39'30"N, 5º18'10"W, small valley, moist, dense shrub, in leaf litter, 4.ii.2008, H. Reip & K. Voigtländer leg. (ZMUC); 10 ♂♂, 8 ♀♀, Sierra Nevada, alt. 2500–3000 m, 14.vii.1979, Osella-Bellol leg. (ZMUC); 6 ♂♂, 4 ♀♀, 1 immature, 1983, Sierra Nevada Mte. Veleta, 10.viii.1981, alt. 3300 m, Feraci leg. (ZMUC).

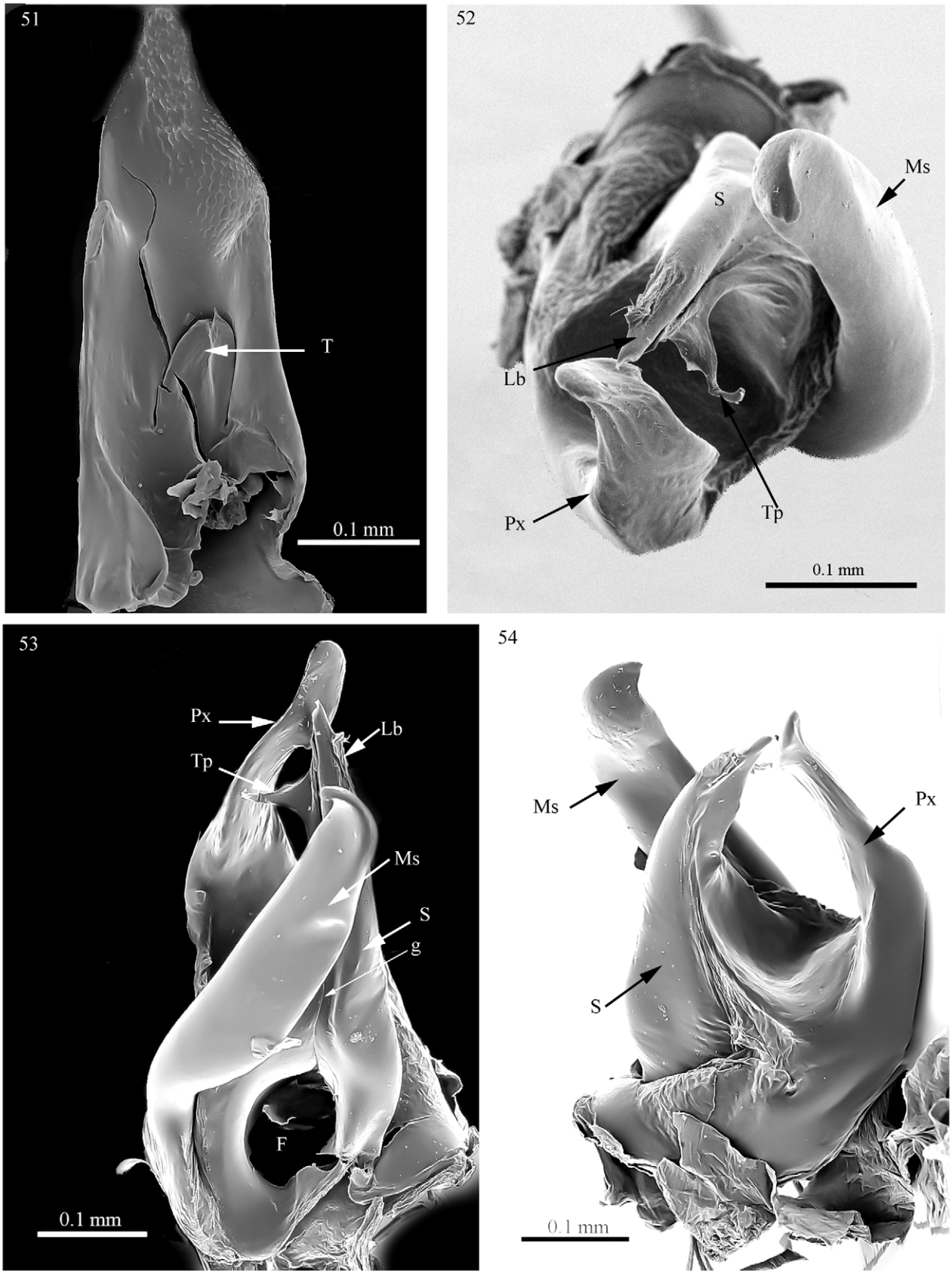
Diagnosis. One of the most slender and elongate species of the genus *Ommatoiulus* with a characteristic colour pattern dark brown contrasted by a pale whitish dorsal longitudinal stripe, pale antennae, mouthparts and legs. Gonopods most resembling *O. corsicus* (Brölemann, 1903) in the general shape of the gonopods but differing in the shape and orientation of the apical process of the solenomerite: strongly serrated and pointing apically in *O. corsicus* while more simple and downturned in *O. ilicis*.

Descriptive notes. Gonopods: Promerite (Fig. 51) uniformly slender, long, tapering distally, ending in a pointed tip bent posteriad; rudimentary telopodite (**T**) conspicuous, rounded and located basally close the the mesal margin. Posterior gonopod: Mesomerite (**Ms**) shorter than promerite, uniformly broad, apically narrowing, ending in a blunt downturned apex; solenomerite (**S**) stout with a broad basal part (Fig. 54), strongly narrowed in the distal third;seminal groove (**g**) running from the fovea (**F**) up to the apical margin of the solenomerite (**S**) (Fig. 53), opening in a folded rounded lobe (**Lb**) (Figs 52, 53) connected to an anterior triangular serrated process (**Tp**); paracoxite (**Px**) almost of the same length as the mesomerite, stout, strongly narrowed and curved distally, apically expanded vertically in an asymmetrical ovoid process (Figs 52–54).

Distribution. Known from France: the Oriental Pyrenees (Brölemann 1896) and Spain: Sierra de Grazalema, several localities in Sierra Nevada (see also Schubart 1959, Mauriès 1969b). *O. nivalis* thus represents a disjunct mountaneous distribution Andalusia/The Pyrenees.

Habitat. Reported from dense shrub, in leaf litter.

Comments. Mauriès (1969b) stated that *O. corsicus* and *O. ilicis* described from Corsica and The Oriental Pyrenees, respectively, are morphologically the closest species to *O. nivalis*. The gonopods of the three species share in fact great similarities i.e. 1) a basally parallel-sided promerite, tapering distlly into a pointed apex and posteriorly bearing an apical tooth, 2) a simple mesomerite, slightly hooked and bent, 3) a basally broad



FIGURES 51–54. *Ommatoiulus ilicis*, specimen from Andalusia, Sierra Nevada, Osella-Bellol leg. (ZMUC): Fig. 51: Promerite, Fig. 52: Right posterior gonopod, apical view, Fig. 53: Right posterior gonopod, mesal view, Fig. 54: Posterior gonopod, posterior view. Abbreviations: **F**: Fovea, **g**: Seminal groove, **Ms**: Mesomerite, **Lb**: Apical lobe of solenomerite, **Px**: Paracoxite, **S**: Solenomerite, **T**: Rudimentary telopodite, **Tp**: Serrated apical process of solenomerite.

solenomerite, narrowing distally, apically with a rounded lobe and a pointed process on either sides of the opening of the seminal groove. Examing the holotype of *O. ilicis* revealed that it strinkingly resembles *O. nivalis* in being unusually elongate and slender with more than 60 podous rings and in showing the same dark colour pattern with a pale longitudinal dorsal stripe. Brölemann (1896) did stress the fact that even if the gonopods of *O. ilicis* are typical for *Ommatoiulus*, the species differs from its congeners in the external morphology, resembling more the genera *Tachypodoiulus* and *Julus*. This applies to *O. nivalis* as well, outstanding in being one of the most slender *Ommatoiulus* species. The study of the holotype of *O. ilicis* left no doubt that Schubart's species is actually a junior synonym of *O. ilicis*, which is the valid name of the species.

Ommatoiulus inconspicuus (L. Koch, 1881)

Figs 55–60

Julus inconspicuus L. Koch, 1881: 673–674
Julus nigritarsis L. Koch, 1881: 674
Schizophyllum (*Bothroiulus*) *ibizianum* Verhoeff, 1924: 107–108, figs 12–14
Ommatoiulus inconspicuus: Enghoff and Vicente 2000: 195–196

Material. 1 ♂, 5 ♀♀, 1 immature, Andalusia, Almería, El Palmer, 28.xii.1969, J. Alvarez leg. (MNCN).

Diagnosis. Most similar to *O. niger*, *O. ibericus* and *O. hoffmani* n. sp., differing from these species by having the paracoxite distally constricted in an much slender apical part with a clavate tip and by the structure of the solenomerite which has a very broad anterior lamella curved laterad and bearing strong apical serrations.

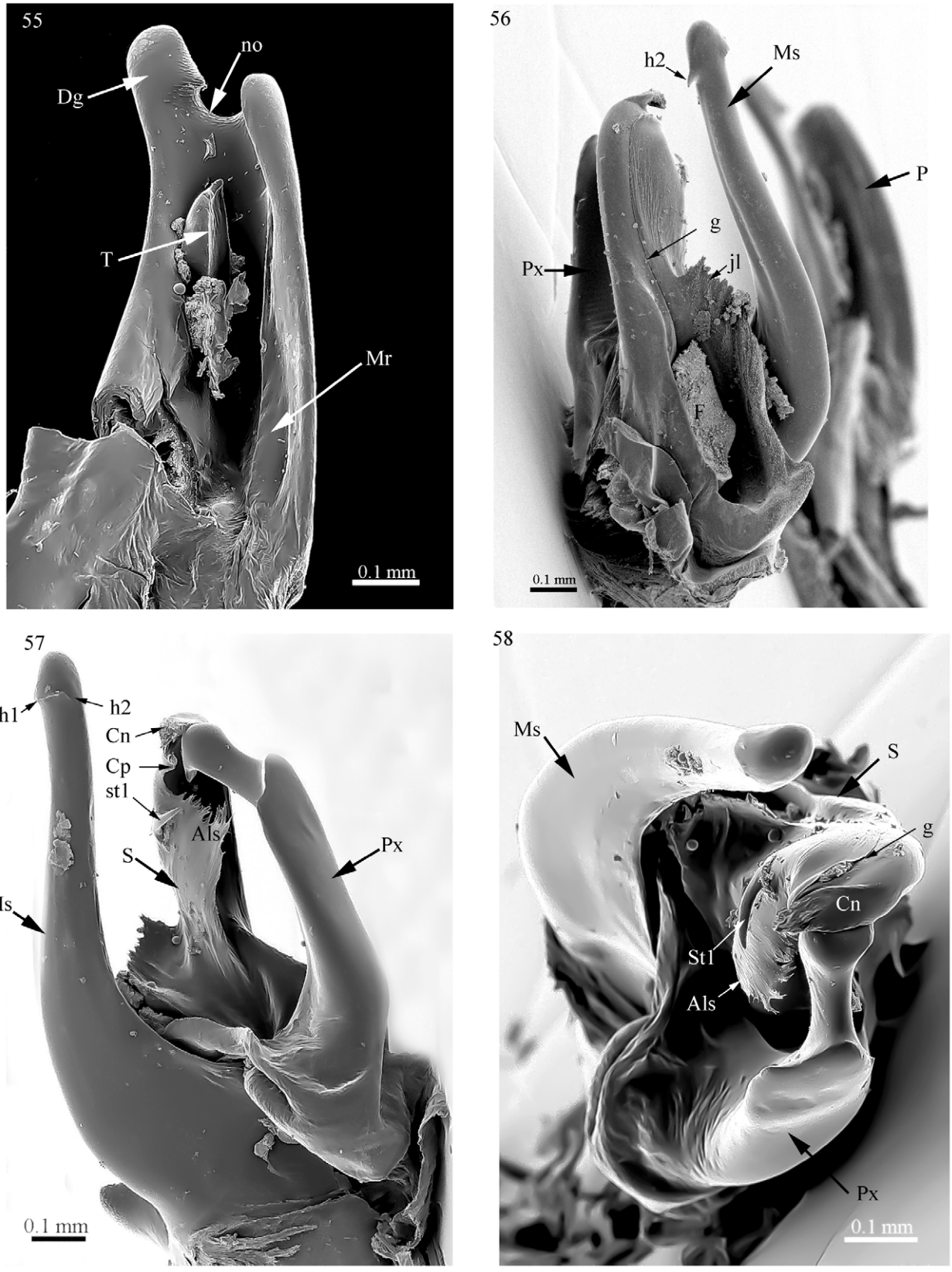
Description. Male: L: 32 mm, H: 2.7 mm, 50 PR+2 AR+T. Females: H: 3.5–4.3 mm, 47 PR+1–2 AR+T. Colour yellowish, faded after a long stay in alcohol. Telson: anal valves with 1 marginal row of short serate, a submarginal row of longer ones and 3–4 setae on the disc; subanal scale triangular and setose; preanal ring with a short caudal projection bearing a small hyaline process and 2–2 setae on the lateral sides and 3–4 on the tip.

Gonopods: Promerite (Fig. 55) sub-rectangular with an apical lateral digit-shaped process (**Dg**) which is rounded, very prominent, and truncate at the level of the apical notch (**no**); mesal ridge (Mr) uniformly broad, distally protruding and folded; rudimentary telopodite (**T**) conspicuous, triangular and located distally. Posterior gonopod: Mesomerite (**Ms**) (Figs 56–58) simple, longer than promerite, uniformly slender, apically bent anteriad and bearing two small apical small hooks (**h1**, **h2**) (Fig. 57); Solenomerite (**S**) broad at base, with a jagged lamella (**jl**) bordering anteriorly the process and rising at midlength as a serrated edge (Fig. 56); solenomerite slightly narrowed at this level, then distally expanded in broad, laterally folded lamella which is ramified into 1) a posterior blunt, strongly crinkly conical process (**Cn**) bearing scattered spikes in the apical part (Figs 59, 60), 2) a small, apically pointed conical process (**Cp**) lodging the opening of the seminal groove (Figs 59, 60) 3) an anterior lamella (**Als**) with jagged surface (Figs 57–59), marginally serrated with strong spines and bearing subapically a big curved spine (**St1**). Seminal groove (**g**) running posteriorly from the fovea (**F**) located at the base up to process **Cp** (Fig. 56). Paracoxite (**Px**) stout, strongly constricted in the apical third, protruding in a hammer-like process with a clavate apex curved mesad (Figs 57, 58).

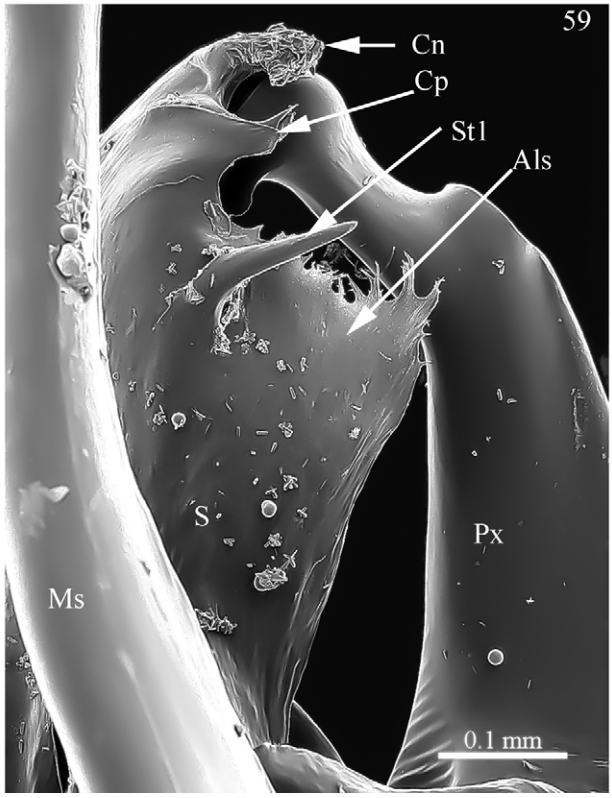
Distribution. *O. inconspicuous* was described from the Balearic Islands: Menorca (L. Koch 1881), Ibiza (Verhoeff 1924), Cabera, Ibiza, Menorca and Menorca (Enghoff and Vicente 2000). It has also been recorded from the Spanish mainland, however, without accurate locality information (Enghoff and Vicente 2000). The present record from Almería, Andalusia, thus constitutes the first precise record of the species from continental Spain.

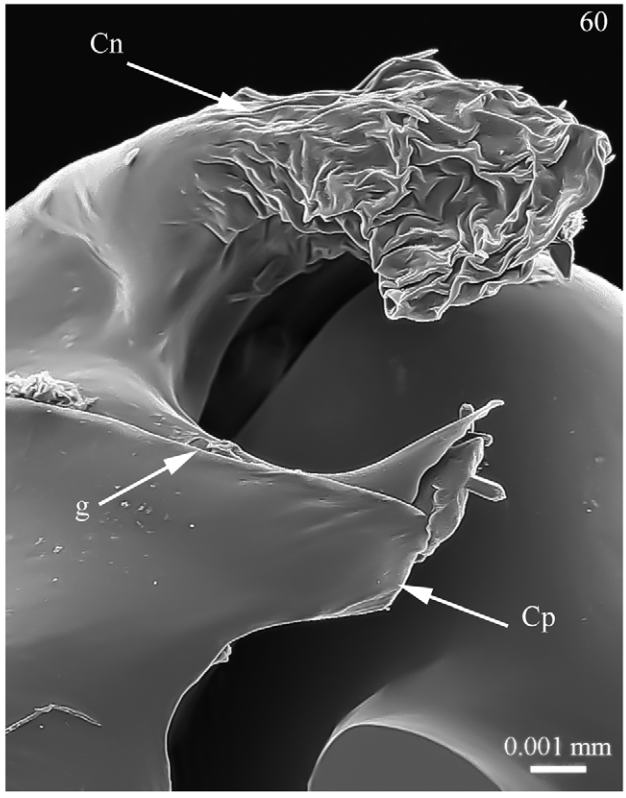
Habitat. Recorded from pine forest on sand dunes and stony-gravelly ground, scattered bushes, garrigue vegetation on limestone (Enghoff and Vicente 2000).

Comments. This species was described twice by Koch (1881) as *Julus inconspicuus* and *Julus nigritarsis*, both from Menorca (Balearic Islands), based on external morphology of female specimens. Enghoff and Vicente (2000) examined type specimens of Koch's two nominal species and synonymized both under *O. inconspicuus*. *Schizophyllum ibizianum* Verhoeff, 1924, described from another Balearic Island, Ibiza, they found to be yet another synonym of the same species.



FIGURES 55–58. *Ommatoiulus inconspicuus*, specimen from Andalusia, Almería (MNCN): Fig. 55: Right promerite, posterior view, Fig. 56: Right posterior gonopod, meso-posterior view, Fig. 57: Right posterior gonopod, lateral view, Fig. 58: Right posterior gonopod, apical view. Abbreviations: **Als**: Anterior jagged lamella of solenomerite, **Cn**: Conical process, **Cp**: Conical process with opening of seminal groove, **Dg**: Digit-shaped apex of promerite, **F**: Fovea, **g**: Seminal groove, **h1, h2**: Apical hooks of mesomerite, **jl**: Jagged lamella, **Ms**: Mesomerite, **no**: Apical notch of promerite, **Px**: Paracoxite, **S**: Solenomerite, **St1**: Big acuminate tooth on solenomerite, **T**: Rudimentary telopodite.





FIGURES 59–60. *Ommatoiulus inconspicuus*, specimen from Andalusia, Almería (MNCN)*:* Fig. 59: apical part of solenomerite and paracoxite, Fig. 60: Close up of apical part of solenomerite. Abbreviations: **Als**: Anterior jagged lamella of solenomerite, **Cn**: Conical process, **Cp**: Conical process with opening of seminal groove, **g**: Seminal groove, **Ms**: Mesomerite, **Px**: Paracoxite, **S**: Solenomerite, **St1**: Big acuminate tooth on solenomerite.

***Ommatoiulus jaenensis* Akkari & Enghoff n.sp.**
Figs 61–64

Materiel. **Holotype**: 1 ♂, Andalusia, Jaén, Sierra Cazorla, Cabañas, alt. 1900 m, 26.iv.1986, Meregalli leg. (MCSNV). **Paratypes**: 3 ♀♀, same data as the holotype, Meregalli leg. (MCSNV).

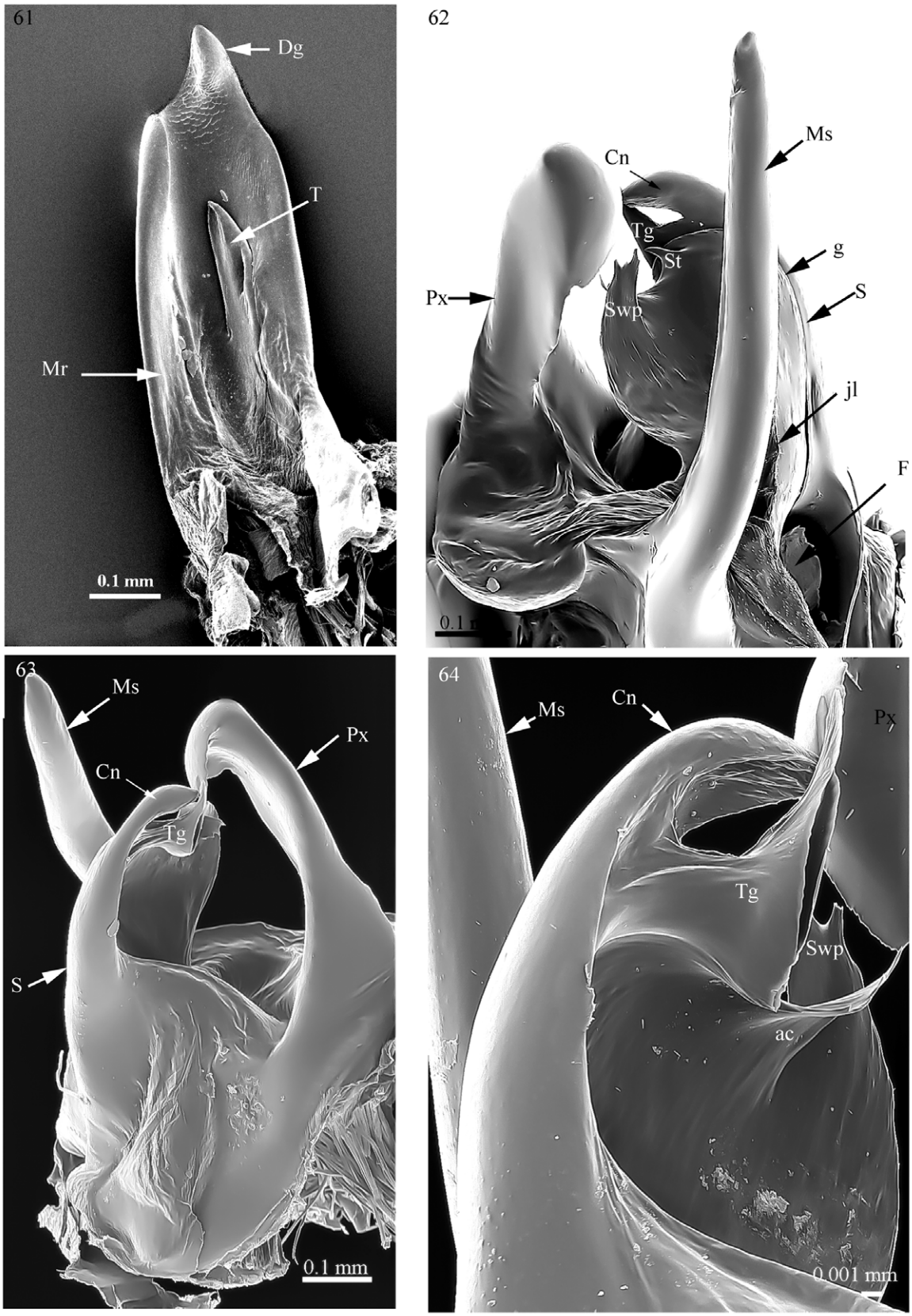
Diagnosis. Similar to *O. baenai* n. sp. in the general shape of the gonopods but characterized by a slenderer promerite with a more protruding lateral apical process, a slenderer mesomerite devoid of subapical processes, and details in the distal part of the solenomerite showing additionally a subapical tooth (**St**), an acuminate curved process (**ac**) and an anterior saw-like process (not with a pointed tip as in *O. baenai* n. sp.).

Etymology. The species epithet refers to the type locality of the species, the province of Jaén.

Description. L: 25 mm, H: 2.1 mm, 53 PR+1 AR+T. Females: L 28.5–37.5 mm, H: 2.7–4.1 mm, 50–53 PR+2 AR+T. General colour yellowish, perhaps faded after a long stay in alcohol, dorsum greyish with a thin black longitudinal line, lateral sides below the line of the ozopores yellowish. Head: dark brown on the occipital part, yellowish toward the labral zone. Labral margin and mouthparts bright yellow. Eyes composed of ca. 34 black ocelli in 9 vertical rows. Prozonites pallid greyish; metazonites yellow showing a regular striation; ozopores rounded, opening behind the suture; the latter rectilinear, sometime curving at ozopore level.

Telson: Preanal ring yellowish with a caudal projection bearing 2+2 setae and a hyaline tip; subanal scale setose; anal valves yellowish with 5–6 setae on the surface, a marginal row of several short setae and a submarginal row of longer ones.

Gonopods: Promerite (Fig. 61) subrectangular (comparable to *O. baenai*) but narrower and more elongate, apically protruding in a lateral slender digit-shaped process (**Dg**); mesal ridge (**Mr**) broad, apically folded and protruding but not extending beyond the apical margin. Rudimentary telopodite (**T**) conspicuous, triangular, located distally. Posterior gonopod (Figs 62–64): Mesomerite (**Ms**) a simple rod, uniformly broad and slightly longer than promerite (Figs 62, 63), straight, bearing no apical projections; solenomerite (**S**) broad at base,



FIGURES 61–64. *Ommatoiulus jaenensis* n. sp., holotype: Fig. 61: Left promerite, posterior view, Fig. 62: Left posterior gonopod, antero-mesal view, Fig. 63: Left posterior gonopod, posterior view, Fig. 64: Left solenomerite, details of distal lamella, posterior view. Abbreviations: **ac**: Acuminate process of solenomerite, **Cn**: Conical process of solenomerite, **Dg**: Digit-shaped process of promerite, **F**: Fovea, **g**: Seminal groove, **jl**: Jagged lamella of solenomerite, **Mr**: Mesal ridge, **Ms**: Mesomerite, **Px**: Paracoxite, **S**: Solenomerite, **St**: Submarginal tooth of solenomerite, **Swp**: Saw-like posterior process of solenomerite, **T**: Rudimentary telopodite, **Tg**: Triangular folded process of solenomerite.

constricted at midlength and strongly expanded distally as broad lamella bent laterad (Fig. 62); basal surface of solenomerite thickened and serrated anteriorly, bearing several spines protruding in an anteromesal jagged lamella (**jl**) to midlength of the process (Fig. 62); distal part complex, ramified into: 1) a conical process (**Cn**) bearing several striae on the surface, 2) a mesal folded process (**Tg**) lodging the opening of the seminal groove and with two pointed tips pointing apicad, 3) a strong submarginal tooth (**St**), 4) an acuminate curved, serrated process (**ac**) pointing laterad, and 5) a posterior, saw-like process (**Swp**) bearing asymmetrical strong teeth. Seminal groove (**g**) running posteriorly from the fovea (**F**) located at the base up to process **Tg** (Figs 62, 64). Paracoxite (**Px**) stout, of the same length as the solenomerite, with irregular anterior margin, uniformly broad and apically strongly bent (Figs 62, 63).

Distribution. Known only from the type locality in Jaén, Andalusia.

Ommatoiulus kimei Akkari & Enghoff n.sp

Figs 65–68

Ommatoiulus SP.3: Bailey and De Mendonça 1990

Material. **Holotype :** 1 ♂, El Salado, Sierra de la Córdoba, Santa María de Tassieria, 37º56'04"N, 4º55'54"W, 511 m, 4.xii.2011, M. Baena leg. (ZMUC). **Paratypes:** 1 ♀, El Salado, Sierra de la Córdoba, Santa María de Tassieria, 37º56'04"N, 4º55'54"W, alt. 511 m, 4.xii.2011, M. Baena leg ; 1 ♂, Andalusia, Sevilla, ca. 20 Km South Guadalcanal, in cork-oak litter, 11. xi. 1986, P.T. Bailey leg. (ZMUC), 1 ♂, 2 ♀♀, 1 subadult, Andalusia, Córdoba, near gardens of Alcázer do Reis, 31.x.1987, P.T. Bailey leg. (ZMUC). 1 ♂, 3 ♀♀, 34 Km N. of Córdoba, in litter of Cistus, 31. xi. 1987, P.T. Bailey leg. (ZMUC).

Diagnosis. Most similar to *O. niger*, *O. ibericus* and *O. hoffmani* n. sp. but differing from these species by a slender protruding apical mesal process on the promerite, a long subapical process on the mesomerite, and similarly long acuminate posterior and mesal processes on the mesomerite.

Etymology. Species named in honour of Desmond Kime in recognition of his multi-decade devotion to the study, especially mapping, of the European millipede fauna.

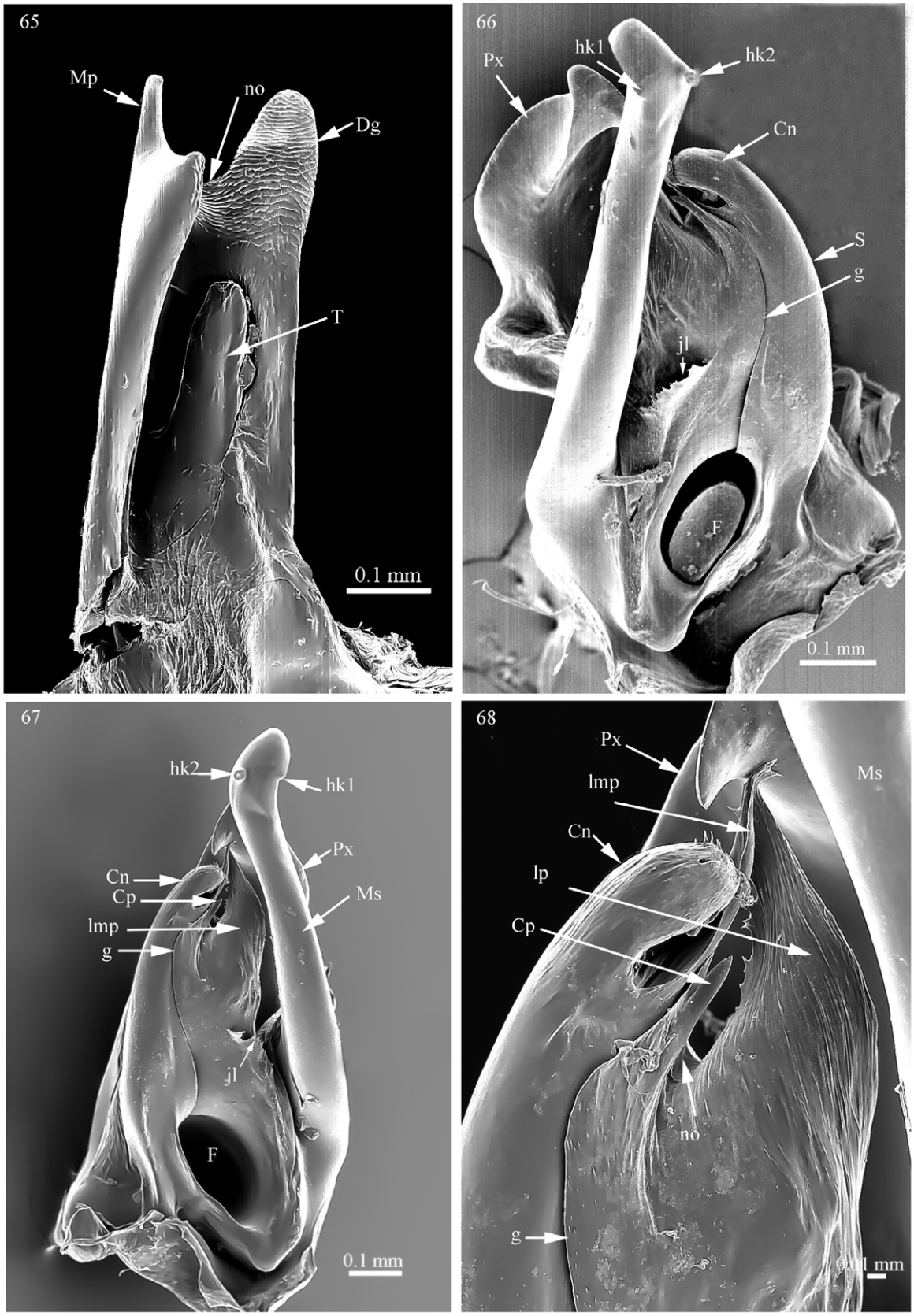
Description. Male: L: 25 mm, H: 2.3 mm, 50 PR+2 AR+T. Female: H: 3.4 mm, 54 PR+1 AR+T. General dark brown-blackish. Head and collum light purple-brown, mouthparts yellowish. Prozonites brownish, moderately sputtered with black below the line of ozopores, dorsally dominantly black with yellowish marbling on the lateral sides, metazonites chocolate brown, slightly lighter posteriorly, dorsum with a thin black mid-dorsal line. Metazonites with regular striation and scattered setae on the posterior margin, ozopores opening at a distance ca. their diameter behind suture; latter complete, curving at ozopore level.

Telson: Preanal ring with a protruding caudal projection and upturned hyaline process; anal valves with a row of short setae on the margin, a submarginal row of longer ones and ca. 5 setae on the surface; subanal scale triangular, pointed and setose, preanal ring with 3–4 setae laterally and several on the tip.

Gonopods: Promerite (Fig. 65) sub-rectangular with two apical projections: a lateral digit-shaped (**Dg**) process which is rounded, very prominent and with a coarsely scaly surface, and a mesal slender process (**Mp**) tapering apically, both separated by a deep notch (**no**); mesal ridge uniformly broad, distally protruding in a small lobe; rudimentary telopodite (**T**) conspicuous, cylindrical, located distally. Posterior gonopod (Figs 66–68): Mesomerite (**Ms**) simple, longer than the promerite, uniformly slender, apically bent anteriad and bearing a small hook (**hk1**) pointing anterobasad and a much longer acuminate hook (broken in the figure) (**hk2**) directed mesoapically (Figs 66, 67); Solenomerite (**S**) broad at the base with anteriorly a jagged lamella (**jl**) (Fig. 66), only slightly narrowed at midlength, distally expanding in broad lamella ramified into 1) a posterior conical, blunt and strongly serrated process (**Cn**), 2) a longer lamellar process (**lmp**) (Figs 66, 67) lodging the opening of the seminal groove (**g**), folded and apically tapering, and anteriorly connected to a small concial process (**Cp**), 3) an anterior lamella (**lp**) with jagged surface, separated from the rest by a deep notch, marginally serrated and apically acuminate with the tip of the same length as (**lmp)** (Fig. 68) . Seminal groove (**g**) running posteriorly from the fovea (**F**) located at the base up to process **Cp** (Fig. 67). Paracoxite (**Px**), stout, slightly longer than solenomerite, gradually narrowed distally and apically bent and projecting into a triangular process pointing mesad (Fig. 67).

Distribution. Known from Córdoba and south of Sevilla, Andalusia.

Habitat. Litter of *Quercus suber* forest and shrub with *Cistus* spp. (Bailey and De Mendonça 1990).



FIGURES 65–68. *Ommatoiulus kimei* n. sp., holotype: Fig. 65: Left anterior gonopod, posterior view, Fig. 66: Right posterior gonopod, antero-mesal view, Fig. 67: Right posterior gonopod, mesal view; Fig. 68: details of apical part of solenomerite, mesal view. Abbreviations: **Cn**: Conical process, **Cp**: Conical process with opening of seminal groove, **Dg**: Digit-shaped process of promerite, **F**: Fovea, **g**: Seminal groove, **hk1**, **hk2**: Apical asymmetrical hooks of mesomerite (**hk2** broken), **jl**: Jagged lamella, **lmp**: Lamellar process, **lp**: Anterior lamella of solemomerite, **Mp**: Mesal apical process of promerite, **Ms**: Mesomerite, **no**: Apical notch of promerite, **Px**: Paracoxite, **S**: Solenomerite, **T**: Rudimentary telopodite.

Ommatoiulus moreleti (Lucas, 1860)

Julus moreleti Lucas, 1860: 96–97
Julus moreleti: Porat 1870: 820–822, pl. 2 figs 9–10 and 1894: 56, pl. 5 figs 9–10
Julus lusitanicus Karsch, 1881: 19–20
Julus karschi Verhoeff, 1892: 380
Hemipodoiulus Karschi: Verhoeff 1892: 380
Palaioiulus (*Mesoiulus*) *Karschi*: Verhoeff 1894: 157–158, figs 16–21
Archiulus (Hemipodoiulus) *moreleti*: Attems 1928: 291–293, plate XVIII, figs 427–432
Schizophyllum moreleti: Brolemann 1921: 182
Schizophyllum (*Eleutheroiulus*) *karschi*: Machado 1946: 19–20
Schizophyllum moreleti: Lohmander 1955: 51–53, Mauriès 1964: 441, Schubart 1966: 23–32, figs 12–20, map 1
Ommatoiulus (*Hemipodoiulus*) *Karschi*: Ceuca 1974: 520
Ommatoiulus moreleti: Mauriès 1975: 128
Ommatoiulus moreletii: Vicente 1985: 324

Diagnosis. Most similar to *O. lienharti* (Brolemann, 1921) and *O. bipartitus* (Verhoeff, 1910) differing in the shape of the promerite and distal part of paracoxite. The taxonomic status and relationship of these three species will be clarified in a subsequent work on the genus.

Distribution. *O. moreleti* is indigenous to continental Portugal and Spain and has been introduced to several Atlantic Islands, South Africa and Australia.

Habitat. In Portugal, recorded in the litter of *Pinus* and *Quercus* forests (Bailey and De Mendonça 1990), collected in the litter of varied forests respectively dominated by *Pinus* spp., *Quercus suber*, *Ulex densus* and *Q. coccifera*, and *Q. coccifera* (Baker 1984). In South Africa, Cape Town, recorded from varied types of natural habitats (see Schubart 1966) and mentioned as very common in gardens (Attems 1928), regarded as a pest of severe nuisance infesting several vegetables and fruits in southeastern Australia (Baker 1984).

Comments. The first record of *O. moreleti* from continental Spain was made by Ceuca (1974) who recorded the species from Zaragoza and Teruel. The same record was subsequently repeated by Mauriès (1975) and Vicente (1985). More recently, Bailey and De Mendonça (1990) who studied the distribution of this species in relation to other *Ommatoiulus* species in the southwestern Iberian Peninsula gave further records of *O. moreleti* from the southwestern coastal plain up to Doñana National Park at the mouth of the Rio Guadalquivir, south of Sevilla.

Intraspecific variation of *O. moreleti* was studied in Portugal (Baker 1984) and South Africa (Attems 1928, Schubart 1966).

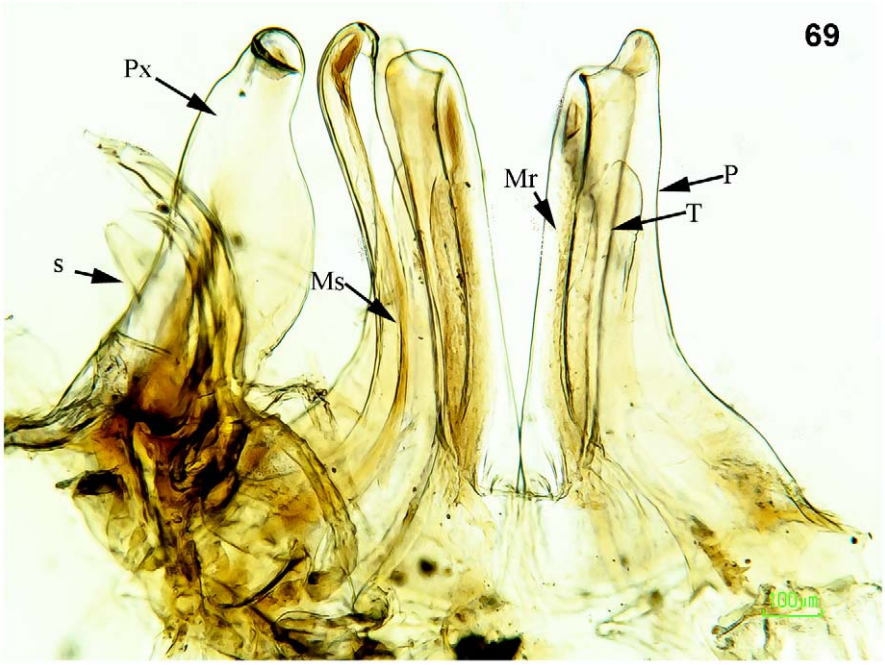
Ommatoiulus niger (Attems, 1952)

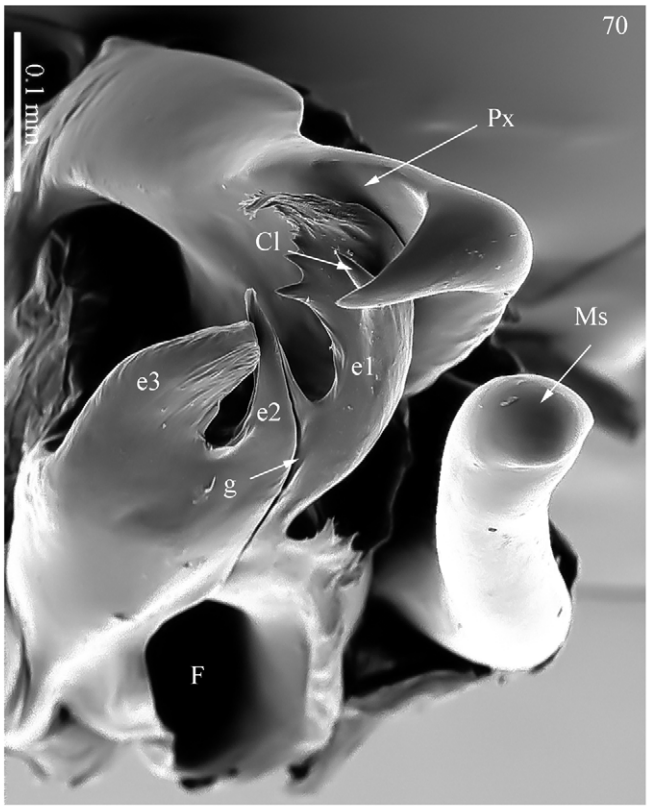
Figs 69–71

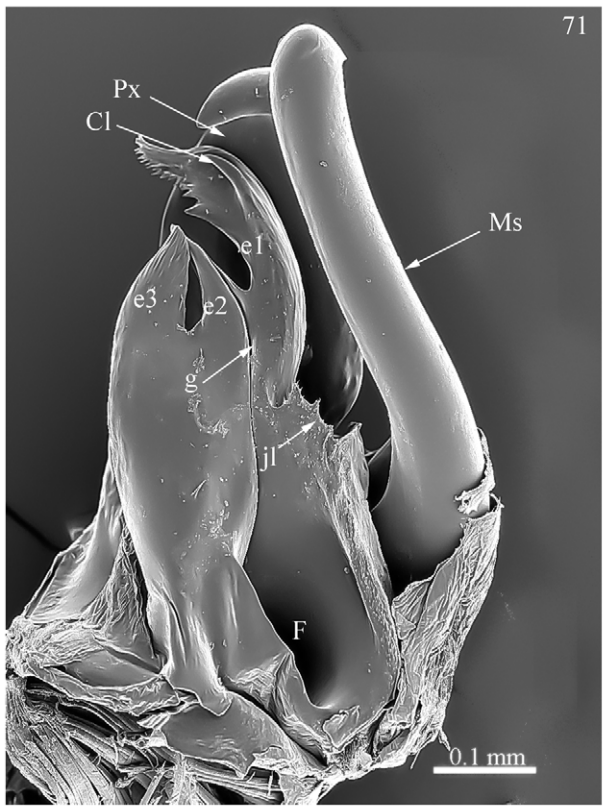
Schizophyllum nigrum Attems, 1952: 359–361, figs 41–44
Ommatoiulus niger: Mauriès 1978: 585
Ommatoiulus nigrus: Vicente 1985: 324

Material. **Type material**: *Schizophyllum nigrum* Attems, 1952, holotype, slide preparation of the gonopods (NHMW/3138). **Non type material**: 1 ♂, Andalusia, Cadíz, North side of Grazalema between Zahara de la Sierra and Grazalema in the mountain area of Los Cambroneros above Garganta Verde, 36º48'N, 5º23'W, alt. 680 m, under stones, 6.ii.2008, H. Reip & K. Voigtländer leg. (ZMUC); 7 ♂♂, 2 ♀♀, Andalusia, S. Sevilla, Estepa, in litter of low bush on rocky hillside, 3.vi.1987, P.T. Bailey leg. (ZMUC). 4 ♂♂, 19 ♀♀, Andalusia, Almería, Calar Alto, Sierra de los Filabres, alt. 2100 m, 16.iv.1969, E. Ortiz leg. (MNCN); 1 ♂, ca. 20 km south of Granada, near Suspero del Moro, in litter under a bush on rocky scrubland, alt. 500–1000 m, 14.x.1986, P.T. Bailey leg. (ZMUC); 1 ♂, 1 ♀, Serranía de Ronda, 2 Km north Ubrique on Grazalema road, in soil, under grass between limestone stones and pebbles, alt. 1000–1500 m, 16.x.1986, P.T. Bailey leg. (ZMUC); 1 ♂, Estepa, in olive litter on rocky hills, 2.xi.1987, P.T. Bailey leg. (ZMUC). 2 ♂♂, 2 ♀♀, Sierra de la Pandera, alt. 1873 m, Valdepeñas, Jaén, 37º37'51"N, 3º46'21"W, alt. 1790 m, 11.iii.2012, L. Vergara leg. (ZMUC); 1♂, Sierra de Baza, Prados del Rey, Granada, 37º22'25"N, 2º51'01"W, alt. 2020 m, 2.iv.2012, M. Baena leg. (ZMUC); 1 ♂, 3 ♀♀, 1 immature, Cima de Parapanda, Illora, Granada, 37º18'15"N, 3º55'41"W, alt. 1576 m, 20.ix.2011, A. Castro Tovar leg. (ZMUC); 2 ♂♂, 17 ♀♀, Sierra del Ahillo, Alcaudete Jaén, 37º36'02"N, 4º01'28"W, alt. 1252 m, 10.iii.2012, M. Baena leg. (ZMUC).

Diagnosis. Most similar to *O. albolineatus parvus*, *O. ibericus* and *O. hoffmani* n. sp. in the general shape of the gonopods, different from *O. a. parvus* by the shape of the paracoxite and from *O. ibericus* and *O. hoffmani* by the distal part of the solenomerite.







FIGURES 69–71. *Ommatoiulus niger*, specimen from Andalusia, Estepa (ZMUC) (except 69): Fig. 69: Slide preparation of the holotype (NHMW), Fig. 70: Right posterior gonopod, apiScal view, Fig. 71: Right posterior gonopod, apical view. Abbreviations: **Cl**: Claw of anterior process of solenomerite **e1**: Anterior process of solenomerite, **e2**: Mesal process of solenomerite, **e3**: Posterior process of solenomerite, **F**: Fovea, **g**: Seminal groove, **jl**: Jagged lamella, **Mr**: Mesal ridge, **Ms**: Mesomerite, **P**: Promerite, **Px**: Paracoxite, **S**: Solenomerite, **T**: Rudimentary telopodite.

Description. Males: L: 22 mm, H: 1.9 mm, 49 PR+1 AR+T. Females: L: 32 mm, H: 3.1 mm, 54 PR+ 2 AR+T. Colour brownish, dorsally with alternation of pale to light brown and blackish with white marbling. Prozonites black with lateral areas of light yellowish marbling, metazonites whitish anteriorly, light brown medially and darker to black with yellow marbling posteriorly, dorsum with big triangular spots at mid-dorsal line, legs purple, head dark brown and telson blackish. Telson: anal valves with 1 marginal row of short setae, a submarginal row of longer ones and 5–7 setae on the disc; subanal scale triangular, pointed and setose; preanal ring with a protruding, setose caudal projection bearing a small hyaline process and 1–2 setae on the lateral sides.

Gonopods: Promerite (**P**) sub-rectangular (Fig. 69), uniformly narrow, mesal ridge (**Mr**) broad, running up to the distal part and folded up, laterally with an apical digit-shaped apex, rudimentary telopodite (**T**) conspicuous and loated distally close to the mesal margin (Fig. 69).

Posterior gonopod (Figs 69–71): Mesomerite (**Ms**) simple, longer than promerite, slender and apically slightly curved laterad (Figs 70–71). Solenomerite (**S**) broadest at the base, distally with an anteromesal, marginally serrated lamella (**jl**) bearing several small spikes, apically divided into 1) a anteriormost, long process (**e1**), subapically with a claw (**Cl**) and apically bent posteriad and bearing on the internal margin several spikes (Figs 70, 71); 2) a shorter process (**e2**) bent posteriad, with acuminate tip lodging the opening of the seminal groove; 3) a process (**e3**), slightly longer than **e2**, triangular with a blunt tip and several striae. Seminal groove (**g**) running from the fovea (**F**) and opening in the tip of process **e2** (Fig. 70). Paracoxite (**Px**) basally broadest, longer than solenomerite (Fig. 70), lateral margin truncate at mid-length, distally narrowed and apically bent into a triangular process with an acuminate tip (Fig. 71).

Distribution. Málaga, Sierra de Ronda, Monte Arastepa; Sierra Guadarrama, Monte Cañal near Villalba (Attems 1952). *O. niger* is recorded here additionally from the provinces Almería, Cadíz, Granada, Jaén and Sevilla.

Habitat. Litter of *Olea europaea* plantations (Bailey and De Mendonça 1990). Here, reported from litter of low bush; in soil, under grass between limestone stones and pebbles.

Ommatoiulus pseudoflagellatus Akkari & Enghoff n. sp.

Figs 72–77

Material. **Holotype**: 1 ♂, Andalusia, Cádiz Province, west side of Grazalema Benamahoma, Riverbank Rio del Bosque, 36º45'N, 5º28'W, under bark of *Eucalyptus*, 5.ii.2008, H. Reip & K. Voigtländer leg. (ZMUC). **Paratypes**: 2 ♀♀, same data as the holotype (ZMUC).

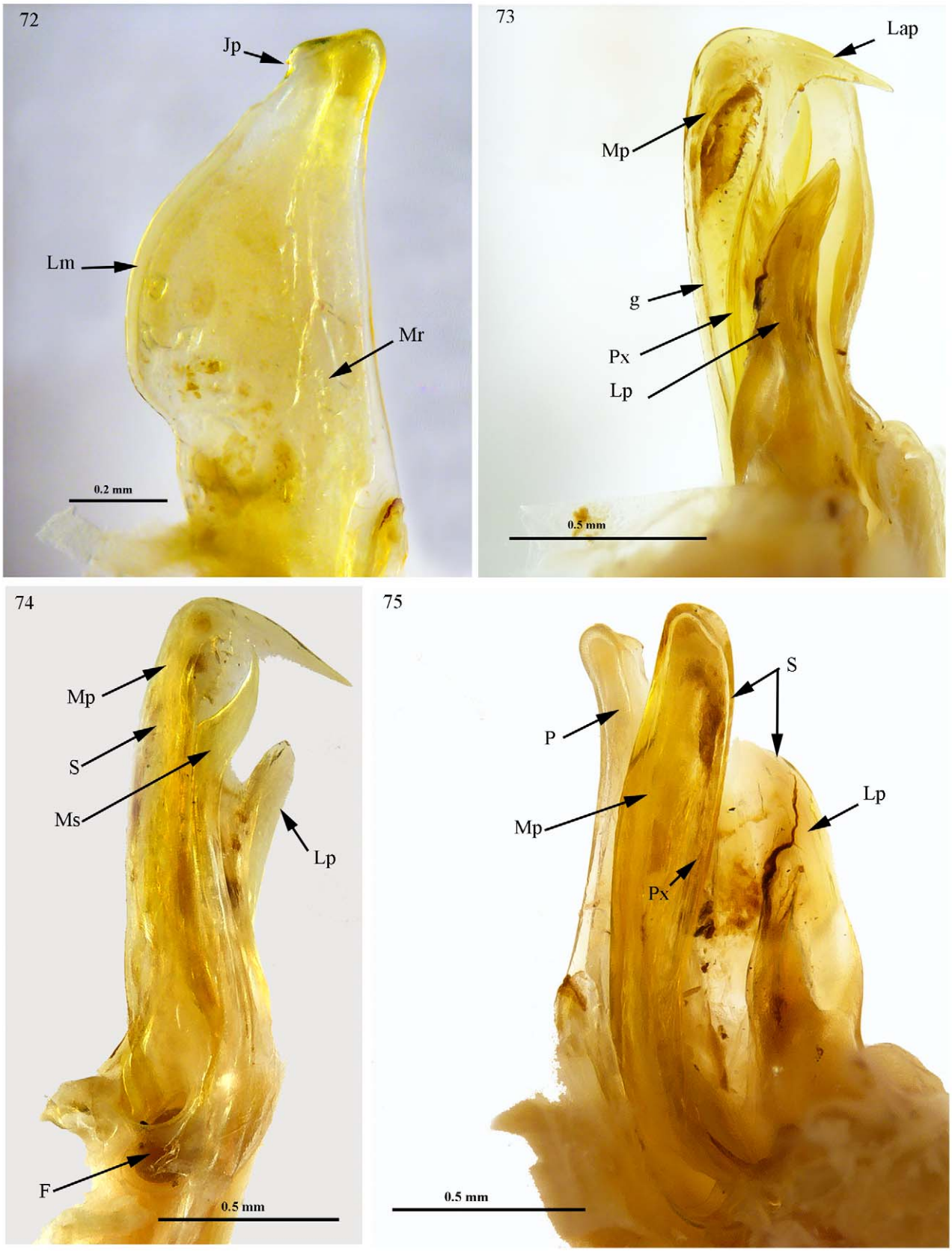
Diagnosis. A most peculiar species, somehow comparable with *O. armatus*, *O. baileyi*, *O. dorsovittatus* and *O. fuentei* in the presence of a voluminous solenomerite with two main lobes separated by a serrated furrow; however, differing from all other *Ommatoiulus* species by the combination of a mesal solenomertial process strongly bent distally and protruding into a pointed process, a reduced mesomerite and a flagelloid paracoxite.

Etymology. The species epithet refers to the particular configuration of the paracoxite, resembling a 'flagellum'.

Description. Male: L: 26.4 mm, H: 2.5 mm, 46 PR+2 AR+T. Females: L: 21.–22.5 mm, H: 2.5–2.9 mm, 42–45 PR+ 1 AR+ T. Eyes composed of 35 black ocelli arranged in 8 vertical rows. General colour with greyish to light purple prozonites and light yellowish metazonites, becoming brownish dorsally. Frontal part of the head and collum dark tawny-brown, labral zone yellowish, mouthparts bright yellow. Antennae dark brown, legs tawny-brown; preanal ring dark brown, anal valves blackish. Ozopores small, circular, openings at ca. their diameter behind suture, suture complete, curving at ozopore level; prozonites with irregular oblique striation; metazonites with regular striation.

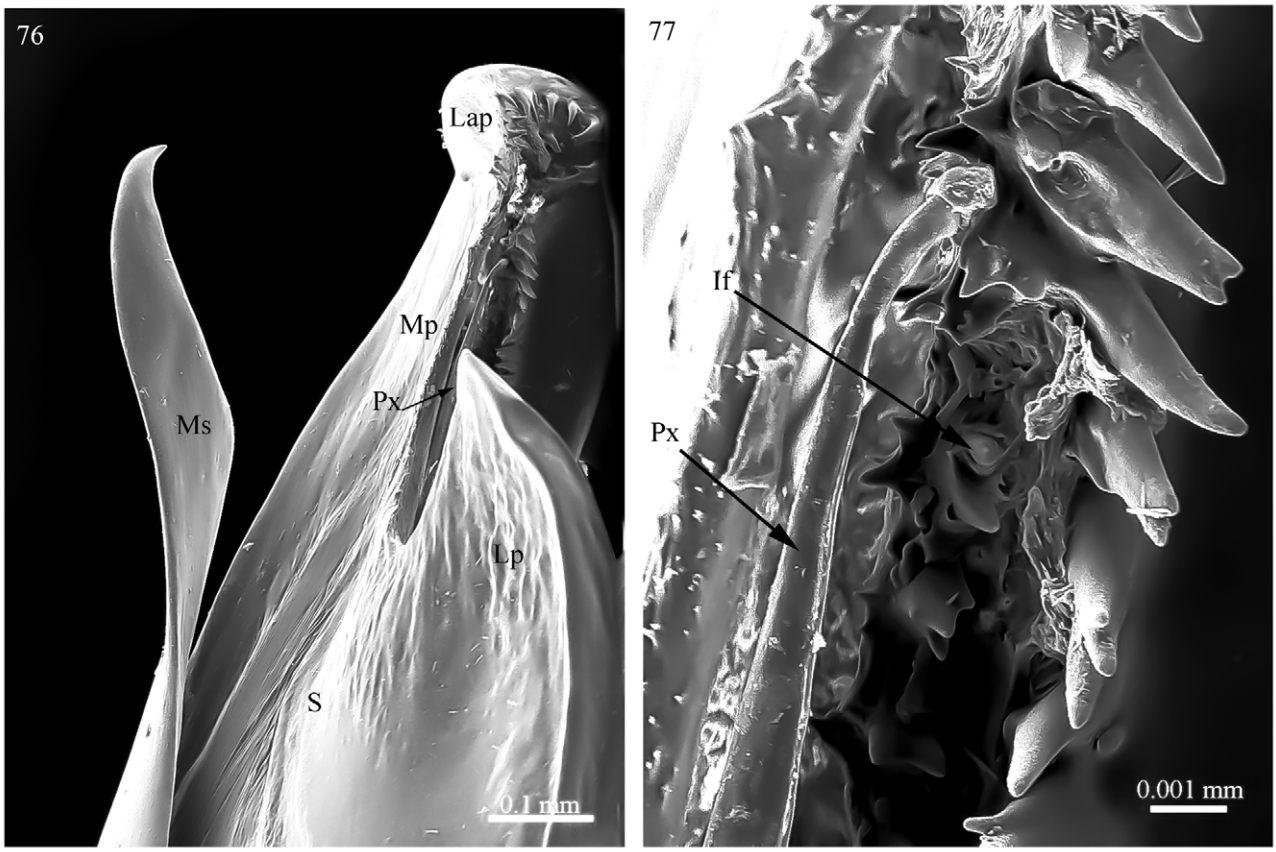
Telson: Preanal ring with a hyaline upturned process and a horizontal caudal projection bearing 5+5 setae on the tip and 2+2 on the sides; subanal scale with a triangular apex and 5+5 setae; anal valves with 4+4 long setae on the surface, a marginal row of several short setae and a submarginal row of ca.10+10 longer ones.

Gonopods. Promerite (**P**) narrow basally, broadest at midlength, lateral margin (**Lm**) expanded in a big rounded lobe (Fig. 72), gradually narrowing distad, apically with a small lateral jagged process (**Jp**); mesal ridge (**Mr**) broad and protruding distally in a rounded lobe, rudimentary telopodite absent or indistinct. Posterior gonopod: Mesomerite (**Ms**) broadest at the basis, gradually narrowing distad, mesal margin bent at blunt angles at about 2/3 length (Figs 74, 76), distal third curved, tapering apically and pointing anteromesad. Solenomerite (**S**) large,



FIGURES 72–75. *Ommatoiulus pseudoflagellatus* n. sp., holotype: Fig. 72: Right promerite, posterior view, Fig. 73: Left gonopod, posterior view, Fig. 74: Right posterior gonopod, anterior view, Fig. 75: Left gonopod, mesal view.: Abbreviations: **F**: Fovea, **g**: Seminal groove, **Jp**: Jagged process **Lap**: Lateral apical process of solenomerite, **Lm**: Lateral margin, **Lp**: Lateral process of solenomerite, **Mp**: Mesal process of solenomerite, **Mr**: Mesal ridge, **Ms**: Mesomerite, **P**: Promerite, **Px**: Paracoxite, **S**: Solenomerite.

extending beyond the other branches, composed of a uniformly broad, folded lateral process (**Lp**), apically with a rounded lobe bearing scattered serrations, and a long mesal process (**Mp**) with a folded, lateral margin showing numerous rows of spikes on the internal fringe (**If**) (Fig. 77), apically bent 90° in a rounded angle, protruding into a transparent process (**Lap**) covered with numerous spikes on the surface and the margin, pointing laterad (Figs 73, 76). Both lateral and mesal processes furrowed and connected distally by a serrated membrane covered by several spikes; fovea (**F**) located at the basis of the mesal process (Fig. 74), seminal groove (**g**) running from the fovea posterodistad up to the extremity of the mesal process of the solenomerite. From the lateral basis of the mesal process emerges a flagelloid process which we interpret as the paracoxite (**Px**), running along the fold, between the jagged internal fringes of the mesal process, ending subapically at the level of the apical flexion (Figs 73, 77).



FIGURES 76–77. *Ommatoiulus pseudoflagellatus* n. sp., holotype: Fig. 76: detail of the distal part of the right posterior gonopod, Fig. 77: Close-up of furrow of mesal process of solenomerite and apical part of paracoxite. Abbreviations: **If**: Internal fringe of solenomerite, **Lap**: Lateral apical process of solenomrite, **Lp**: Lateral process of solenomerite, **Mp**: Mesal process of solenomerite, **Ms**: Mesomerite, **Px**: Paracoxite, **S**: Solenomerite.

Distribution. Known only from type locality in Cádiz Province in Andalusia.

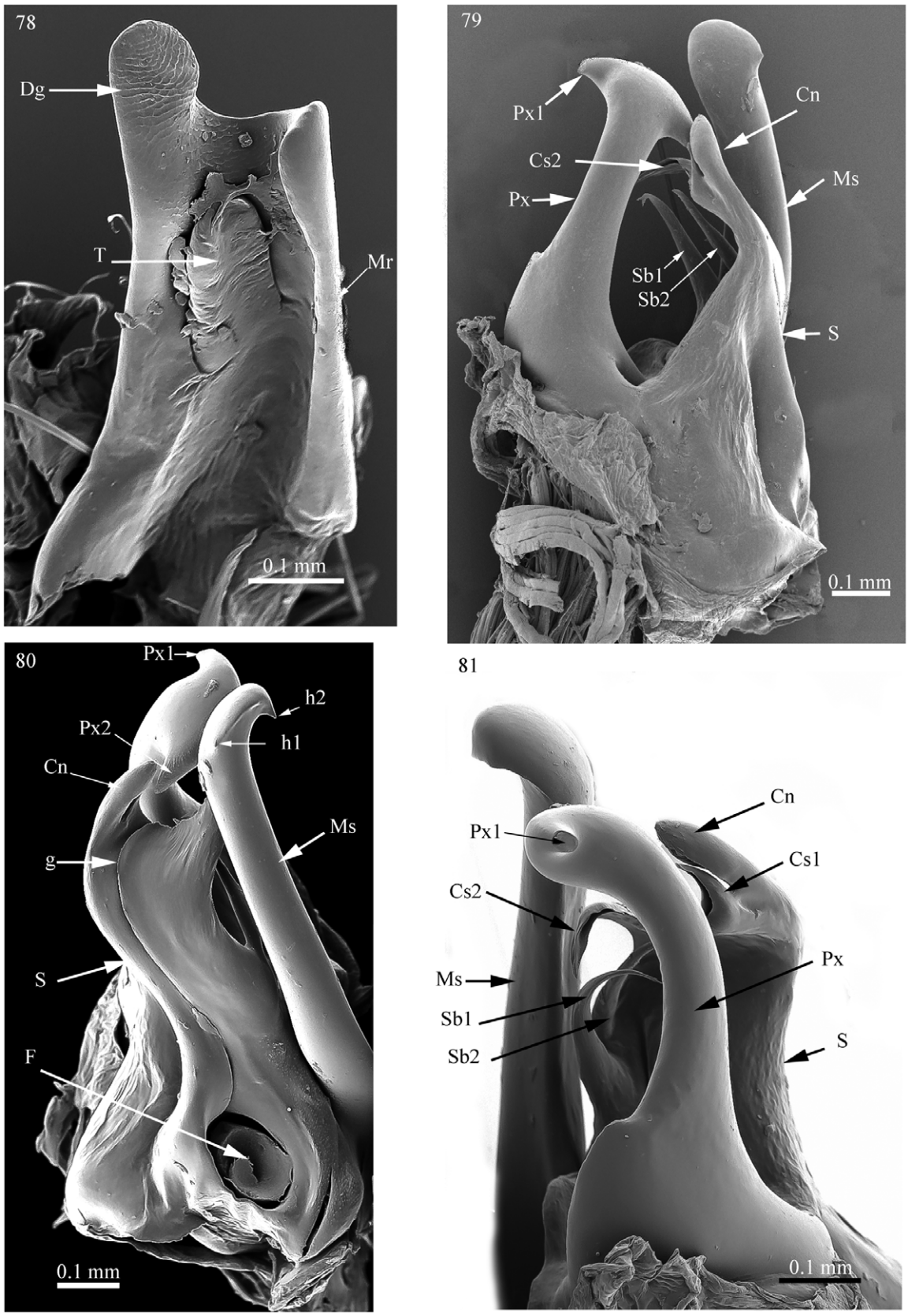
Habitat. Found under bark of *Eucalyptus.*

Comments. The gonopods of *O. pseudoflagellatus* are quite different from those of all other *Ommatoiulus* species, and we had great difficulties homologising the various processes of the posterior gonopod with the normal components of an *Ommatoiulus* gonopod. One might argue that the species is so deviating that it should be placed in is own new genus. However, awaiting further ongoing revisionary work on *Ommatoiulus* and, hopefully, additional material of *O. pesudoflagellatus*, we classify it, for the time being, in the same genus as the other Andalusian schizophyllines.

Ommatoiulus recueroi Akkari & Enghoff n.sp.

Figs 78–81

Material. **Holotype**: 1 ♂, Andalusia, ca. 3 Km SW Aldeaquemada, Jaén, 38º23'53"N, 3º24'W, 7.iii.2012, E. Recuero leg. (ZMUC).



FIGURES 78–81. *Ommatoiulus recueroi* n. sp, holotype: Fig. 78: Right promerite, posterior view, Fig. 79: Right posterior gonopod, posterior view, Fig. 80: Right posterior gonopod, mesal view, Fig. 81. Right posterior gonopod, lateral view. Abbreviations: **Cn**: Conical lobe, **Dg**: Digit-shaped apical process, **F**: Fovea, **g**: Seminal groove, **h1**, **h2**: Apical hooks of mesomerite, **Mr**: Mesal ridge, **Ms**: Mesomerite, **Px**: Paracoxite, **Px1**, **Px2**: Opposite directed tips of apex of paracoxite, **Sb1**, **Sb2**: Accessory branches of solenomerite, **S**: Solenomerite, **Sc1**: triangular mesal curved process, **Sc2**: Triangular posterior curved process, **T**: Rudimentary telopodite.

Diagnosis. Species similar to *O. baenai* n. sp., *O. inconspicuus* and *O. niger* in the shape of the promerite, mesomerite and voluminous solenomerite, but differing from these species by the shape of the mesal apical process of the promerite and the presence of two accessory branches on the solenomerite as well as by the shape of the paracoxite.

Etymology. Species named in honour of Ernesto Recuero, collector of the species.

Description. Male: L: 40 mm, H: 2.7 mm, 53 PR+2 AR+T. General dark brown. Below the line of ozopores, metazonites with a narrow light band anteriorly and dark brown posteriorly, dorsally dominantly light brown; prozonites dark brown to black. Head: dark brown on the occipital and labral zone, much darker to blackish around the ocellar fields and between the antennae. Antennae and mandibular stipes tawny brown; collum blackish. Legs and mouthparts light tawny brown. Anal valves, subanal scale and preanal ring blackish. Metazonites with regular striation and scattered slender setae at posterior margin, ozopores opening at a distance ca. ½ their diameter behind suture, suture complete, curving at ozopore level, especially on the anterior rings; prozonites with conspicuus oblique striae.

Telson: Preanal ring with a protruding horizontal setose projection with a hyaline tip; subanal scale triangular, protruding, with numerous setae; anal valves with a marginal row of short setate, a submarginal row of longer ones and 5–6 setae on the surface.

Gonopods. Promerite (Fig. 78) subrectangular, elongate, twice as broad as long, apically protruding in a lateral globulous digit-shaped process (**Dg**) with scaly surface; mesal ridge (**Mr**) uniformly broad, folded up and apically protruding, rudimentary telopodite (**T**), triangular, located distally. Posterior gonopod (Figs 79–81): Mesomerite (**Ms**) slender, elongate, slightly curved mesad and apically bent, bearing two small spikes (**h1**, **h2**) pointing posteriad (Fig. 80); Solenomerite (**S**) complex, broad and bearing anteriorly two accessory branches (**Sb1**, **Sb2**) both apically tapering and strongly curved (Fig. 81); **Sb1** very strongly curved, with bifurcate tip (Fig. 79). The main process (**S**) broad, slightly narrowed at mid-length (Fig. 80), apically expanding in a broad lamella with a posterior conical blunt lobe (**Cn**) bearing a few serrations on the apex and a anterior folded lamella composed of a triangular mesal, apically acuminate, curved process (**Sc1**) connected to a posterior acuminate, jagged process (**Sc2**) which is strongly bent downwards and lodges the opening of the seminal groove (Figs 80, 81). The latter (**g**) running from the fovea (**F**) mesoposteriorly up to the apical posterior downturned process of the solenomerite (Fig. 78). Paracoxite (**Px**) broadest at the basis, distally uniformly broad, apically expanding in a crescent-shaped process with two oppositely directed tips (**Px1**, **Px2**) (Figs 79, 81).

Distribution. Known only from the type locality in Jaén, Andalusia.

Ommatoiulus reipi Akkari & Enghoff n.sp.

Figs 82–85

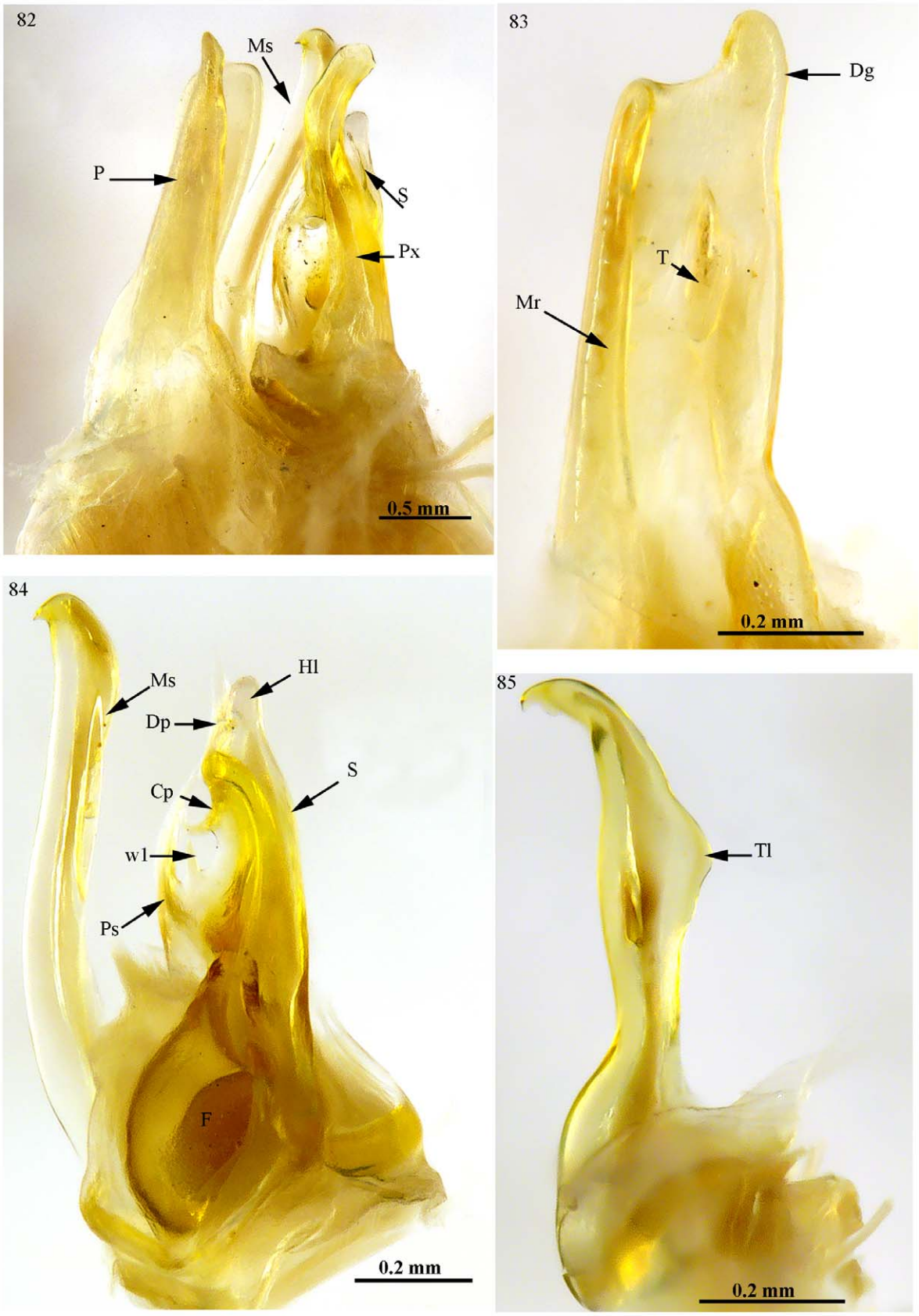
Ommatoiulus SP.5: Bailey and De Mendonça 1990

Material. **Holotype** : 1 ♂, Andalusia, Córdoba, Cerro de la Mazura, Luque, 37º35'09"N, 4º10'01"W, alt. 385m, 10.03.2012, M. Baena leg. (ZMUC); **Paratypes**: 1 ♂, Andalusia, North side of Grazalema between Zahara de la Sierra and Grazalema in the mountain area of Los Cambroneros above Garganta Verde, 36º48'38"N, 5º23'42"W, alt. 680 m, under stones, 6.ii. 2008, H. Reip & K. Voigtländer leg. (ZMUC); 1 ♂, in litter, beneath bush on limestone-rocky hillside, near El Pedroso, ca. 170 Km East of Sevilla, 11.x.1986, P.T Bailey leg. (ZMUC).

Diagnosis. Similar to *O. bavayi* in the general shape of the promerite, mesomerite and paracoxite; characterized, however, by a less sinuous paracoxite and a broader and more complex solenomerite bearing several distal processes (only 3 processes in *O. bavayi*) and displaying a complete different configuration.

Etymology. Species named in honour of one of the collectors, Hans Reip, for his active contribution to the revision of genus *Ommatoiulus* and the present project with samples, literature and illustrations.

Description. Male: L: 25 mm, H: 2.0 mm, 45 PR+1 AR+T. General colour dark brown, dorsally alternated with light brown to yellowish. Head on the frontal part and collum dominantly dark brown, light brown toward the labral zone. Prozonites blackish with scattered rounded-oval pale spots on either sides of a thick, black mid-dorsal line; dorsum overlaid by series of big black spots. Preanal ring and anal valves black, subanal scale brownish. Metazonites with scattered slender setae at posterior margin, showing narrow striation, becoming scarser on the



FIGURES 82–85. *Ommatoiulus reipi* n. sp., paratype: Fig. 82: Right gonopod, lateral view, Fig. 83: Left promerite, posterior view, Fig. 84: Left posterior gonopod, mesal view, Fig. 85: Left paracoxite, anterior view Abbreviations: **Cp**: Curved process, **Dg**: Digit-shaped process of promerite, **Dp**: Distal process, **F**: Fovea, **g**: Seminal groove, **Hl**: Distolateral hyaline lamella, **P**: Promerite, **Mr**: Mesal ridge, **Ms**: Mesomerite, **Ps**: Parasolenomerite, **Px**: Paracoxite, **S**: Solenomerite, **T**: Rudimentary telopodite, **Tl**: Triangular lobe of the paracoxite, **w1**: Pointed process of solenomerite.

sides, ozopores small, rounded, opening at a distance ca. their diameter behind suture, latter complete, rectilinear; prozonites with scarse oblique striae.

Telson: Preanal ring with a protruding horizontal caudal projection bearing 5+5 setae and a hyaline tip, 4+4 on the sides; subanal scale with a pointed triangular apex and several setae; anal valves with (5–7)+(5–7) long setae on the surface, a marginal row of several short setae and a submarginal row of ca. 20+20 longer ones.

Gonopods. Promerite (**P**) subrectangular (Figs 82, 83), elongate, twice as broad as long, apically protruding in a lateral digit-shaped process (**Dg**) with scaly surface; mesal ridge (**Mr**) uniformly broad, folded up, and protruding distally, rudimentary telopodite (**T**) conspicuous, triangular and located distally. Posterior gonopod (Figs 82, 84, 85): Mesomerite (**Ms**) simple, uniformly slender, slightly longer than the promerite (Figs 83, 84), apically domed with a folded apex bearing two small subapical hooks pointing anteriad and mesad, respectively; solenomerite (**S**) broadest at the basis, apically with a hyaline rounded lobe (**Hl**) and a bipartite (bullhorn-shaped) process lodging the opening of the seminal groove (Fig. 84), with a small process tapering distad (**Dp**) and a curved one pointing anteriad (**Cp**); seminal groove (**g**) running from the fovea (**F**), up to the bipartite process; parasolenomerite (**Ps**) short, apically acuminate, pointing distad and separated from the solenomerite by a distolateral hyaline lamella bearing a small pointed process (**w1**) on the margin. Paracoxite (**Px**) large, with a broad base, narrowed sub-basally, narrowing towards tip, apically with a curved margin, tapering and bearing several serrations; posterior margin folded, anterior margin at midlength expanded in a triangular lobe (**Tl**) (Fig. 85).

Distribution. Known from Córdoba and Sevilla in Andalusia.

Habitat. Leaf litter of oak forests with *Quercus suber* and *Quelcus ilex* (Bailey and De Mendonça 1990), also found under stones in oak forests with undergrowth of *Sorbus*, *Juniperus* and *Salix.*

Comments. The similarities in the general shape of *O. reipi* and *O. bavayi* described by Brölemann (1897) from Murcia (southern Spain) were striking, however, the study of the holotype (MNHN) of *O. bavayi* has revealed a number of differences, especially in the shape of the solenomerite which is much broader and bearing more processes in *O. reipi* while in *O. bavayi*, the solenomerite distally bears 3 processes: the anteriormost is long and acuminate, extending beyond the rest of processes, the mesal process (lodging the seminal groove) is simple (not bipartite) and the posteriormost conical process is low and separated from the rest by a deep notch (see also Brölemann 1897: figs I–IV).

Ommatoiulus sabinarensis Akkari, Mauriès & Enghoff n.sp.

Figs 86–89

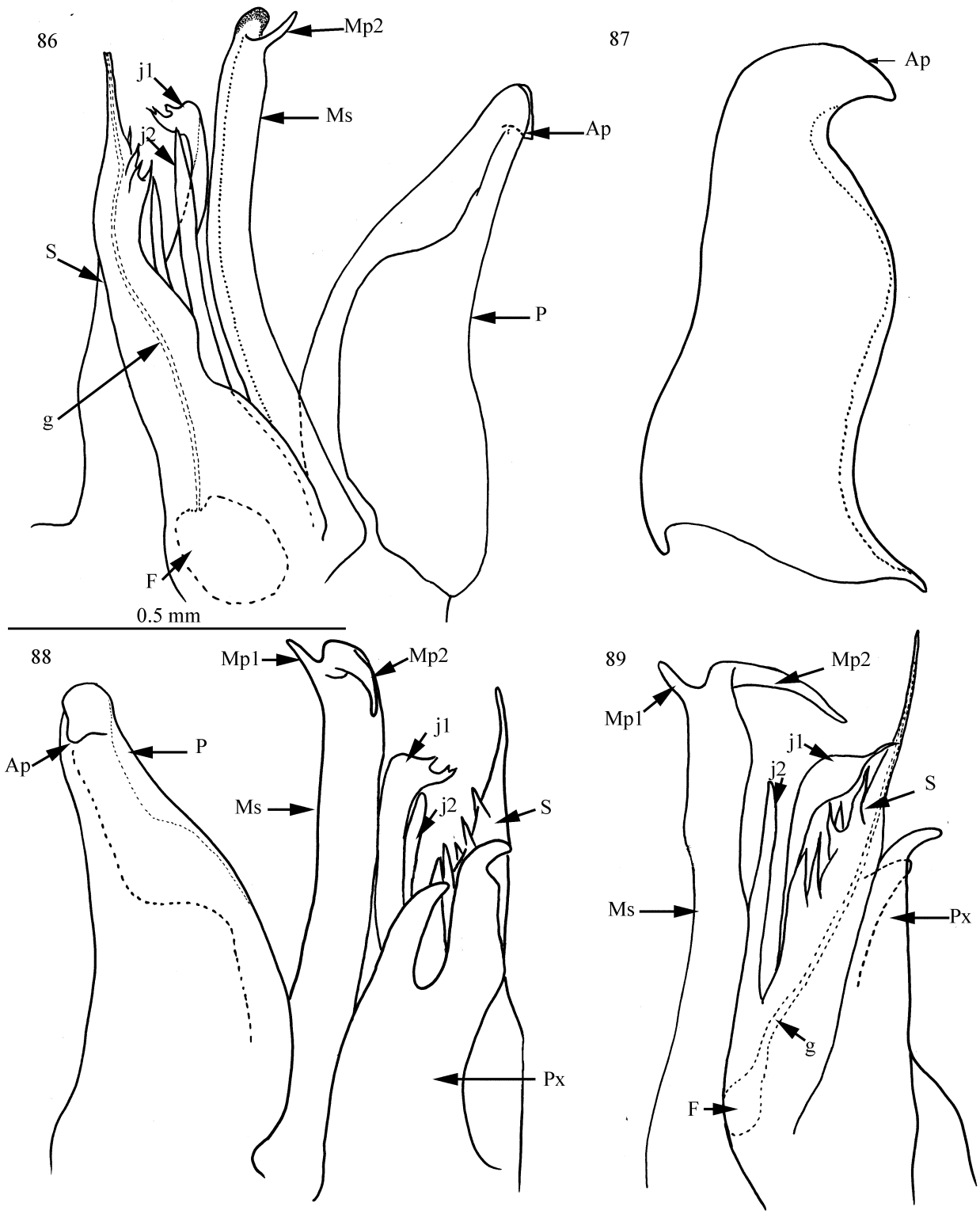
Materiel. **Holotype**: 1 ♂, Andalusia, Almería Province, Dalias, Punta del Sabinar, 29.iii.1992, A. Tinaut leg. (MNHN). **Paratypes**: 1 intercalary ♂, same locality as holotype, 28.v. 1992, A. Tinaut leg. (MNHN), 1 juvenile ♂, same locality as holotype, A. Tinaut leg. (MNHN), 14.iii. 1992, 2 ♀♀, same locality as holotype, 26.i.1992, A. Tinaut leg. (MNHN).

Diagnosis. Resembling *O. gauthieri* (Brolemann, 1931) from Algeria and *O. cingulatus* (Attems, 1927) from Portugal in having a bifurcate paracoxite; differing from these species by the complex structure of the solenomerite: thin, elongate, bearing at midlength several thorn-like processes, accompanied by two differently shaped accessory processes.

Etymology. Species epithet refers to Punta del Sabinar, type locality of the species.

Description. Males: L: 21.5–26 mm, H: 1.8–1.9 mm, 45–46 PR+2–3 AR+T. Females: L: 22–23 mm, H: 2–2.2 mm, 45 PR+3 AR+T. General colour dark brown. Metazonites blackish brown becoming golden brown on the lateral sides below the line of the ozopores; prozonites dominantly dark brown laterally and yellowish dorsally with at the middle a big triangular spot pointing posteriad. Head: brown on the occipital and labral zone, much darker to blackish around the ocellar fields and between the antennae. Antennae and mandibular stipes brownish; collum blackish. Legs and mouthparts yellowish. Anal valves, subanal scale and preanal ring brownish. Metazonites with regular striation, ozopores opening at a distance ca. ½ their diameter behind suture, suture complete, curving at ozopore level, especially on the anterior rings; prozonite with conspicuous oblique striae laterally.

Telson: Preanal ring with a protruding caudal projection bearing numerous setae; subanal scale triangular, pointed and setose; anal valves with a marginal row of short setae, a submarginal row of long ones and 3–4 setae on the surface.



FIGURES 86–89. *Ommatoiulus sabinarensis* n. sp., holotype: Fig. 86: Right gonopod, mesal view, Fig. 87: Right promerite, anterior view Fig. 88: Left posterior gonopod, lateral view, Fig. 89: Right gonopod, anterolateral view. Abbreviations: **Ap**: Apical lobe of promerite, **F**: Fovea, **g**: Seminal groove, **j1**, **j2**: Accessory branches of solenomerite, **Mp1**: Apical posterolateral process of mesomerite, **Mp2**: Apical lateral process of mesomerite, **Ms**: Mesomerite, **P**: Promerite, **Px**: Paracoxite **S**: Solenomerite. Drawings by J.-P. Mauriès.

Gonopods. Promerite (**P**) half as broad as long, gradually narrowed in the distal third (Fig 86, 87, 88), with a broad mesal ridge which fuses with the mesal margin at about midlength. Distal part slightly concave with a lateral subapical notch and an apical process (**Ap**) curved laterad, ending in an acuminate tip pointing anteriorly (Fig. 88).

Posterior gonopod: Mesomerite (**Ms**) long, uniformly broad, apically bifurcating into a small blunt process pointing posterolaterad (**Mp1**) and a longer curved process (**Mp2**) pointing laterally (Figs 86, 88, 89). Solenomerite complex with a main process lodging the seminal groove (**g**) and two lateral additional branches emerging from the same base (**j1**, **j2**) (Figs 86, 88, 89). Main process (**S**) broadest at the base, distally bearing several thorns on the anterior margin (Figs 88, 89), apically protruding into an acuminate process extending beyond the rest of the gonopod and harboring the opening of the seminal groove (Figs 86, 89). The latter running from the fovea (**F**) located at the base, along the posterior margin of the process to the apex of the same (Fig. 86). Branch **j1** anterolateral, shorter than the main process, apically expanded in a leaf-shaped hyaline process pointing posteriad (Figs 86, 88, 89); second accessory branch (**j2**) located anteromesally, also slender but much shorter and pointing apicad. Paracoxite (**Px**) broad, distally bifurcating in two asymmetrical hook-shaped processes, the mesal-most process slightly longer and apically curved (Figs 88, 89).

Distribution. Known only from the type locality in Almería, Andalusia.

Comments. J. -P. Mauriès very kindly transferred his drawings and notes to us in order to have the new species incorporated in the present work.

Ommatoiulus schubarti Akkari & Enghoff n.sp.

Figs 90–93

Material. **Holotype**: 1 ♂ Andalusia, Granada, Collin leg. 1863 (ZMUC). **Paratypes**: 6 ♂♂, 16 ♀♀, 1 preadult ♀, 1 juvenile, same data as holotype (ZMUC).

Diagnosis. Most similar to *Ommatoiulus fuscounilineatus* (Lucas, 1846) from North Africa (Algeria, Tunisia) in the general shape of the gonopods, but differs in the shape of the apical part of the promerite, and the distal processes of the solenomerite.

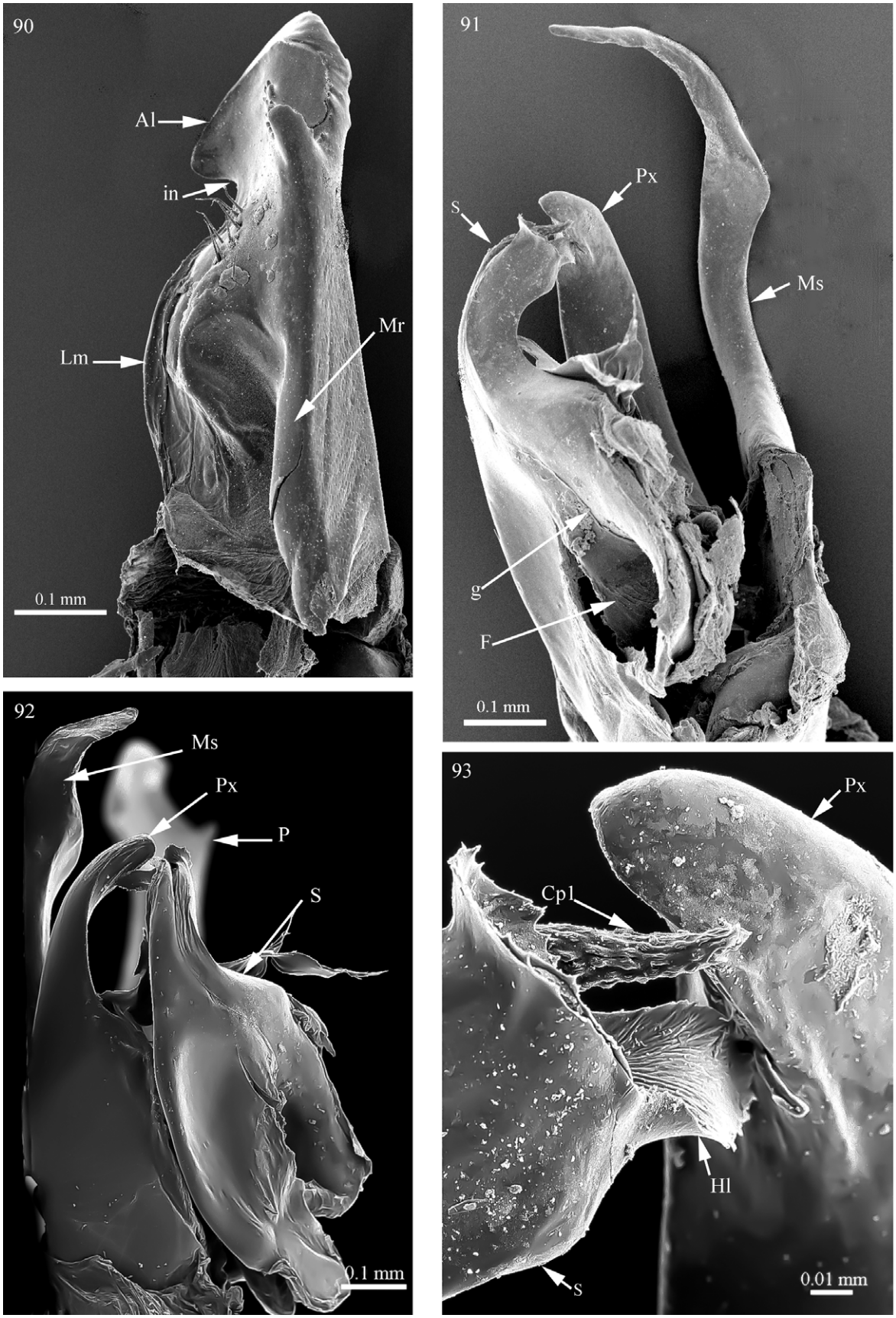
Etymology. Species named in honour of Otto Schubart (1900–1962), an authority in millipede taxonomy who described several *Ommatoiulus* species from North Africa and looked at the type material of this species more than 80 years ago.

Description. Males: L: 26–30 mm, H: 2.0–2.5 mm, 47–51 PR+1–2 AR+T. Females: H: 2.7–3.0 mm, 48–52 PR+ 1–3 AR+T. Generally pallid after one and a half century in alcohol, but prozonites and posterior margin of metazonites obviously darker. Metazonites with regular striation, ozopores opening at a distance ca. their diameter behind suture, the latter complete, slightly curving at ozopore level. Telson: Preanal ring with a protruding caudal projection and a conspicuus upturned hyaline process; anal valves with a row of short setae on the margin, a submarginal row of longer ones and 1–3 setae on the surface; subanal scale setose triangular, pointed but not protruding, preanal ring with 3–4 setae on the tip.

Gonopods: Promerite (**P**) (Figs 90, 92) with a broad mesal ridge (**Mr**) distally protruding into a subapical blunt, marginally serrated process, lateral margin (**Lm**) rounded, broadest at midlength with a deep supapical incision (**in**) separating it from the apical lobe (**Al**), the latter only slightly pointed; posterior surface with subapical rows of scattered setae near the lateral margin, rudimentary telopodite not very conspicuus. Posterior gonopods (Figs 90–93): Mesomerite (**Ms**) broad in the proximal third, gradually narrowing distad, anterior margin angled and strongly curved at 2/3 of the process (Figs 89, 90), distal part tapering and pointing posteriad. Solenomerite (**S**) simple with no accessory branches, broadest at the base, gradually narrowed in the distal third (Figs 91, 92), apically consisting of a conical process (**Cp1**) with a pointed tip and a convoluted surface and a lamella bordered with strong spines, expanded in the lower margin in a rounded serrated hyaline process (**H1**) (Fig. 93). Seminal groove (**g**) running mesoposteriad from the fovea (**F**), located at the base of the solenomerite (Figs 89, 90) and opening at the tip of process **Cp**1; paracoxite (**Px**) simple, of the same length as mesomerite, stout, rising from a broad coxa, curved mesad, apically slightly broadened with jagged surface (Figs 92, 93).

Distribution. Known only from the type locality in Granada, Andalusia.

Comments. In 1931, Schubart looked at the type material, identified and labeled it as '*Archiulus* cf. *fuscounilineatus*' suggesting a great resemblance of the new species with *O. fuscounilineatus* (Lucas, 1846). The latter species, described by Lucas (1846) from Algeria, was known to include several subspecies which were raised later to species level or synonymised with the nominal species (see Akkari et al. 2009), i.e., *O. aumalensis* (Brolemann, 1925) described from Algeria, as well as *O. seurati* (Brolemann, 1925) and *O. fuscounilineatus denticulatus* (Attems, 1927) described from Tunisia. One of the most similar species in terms of gonopod structures is *O. oxypygus* (Brandt, 1841), described from Sicily.



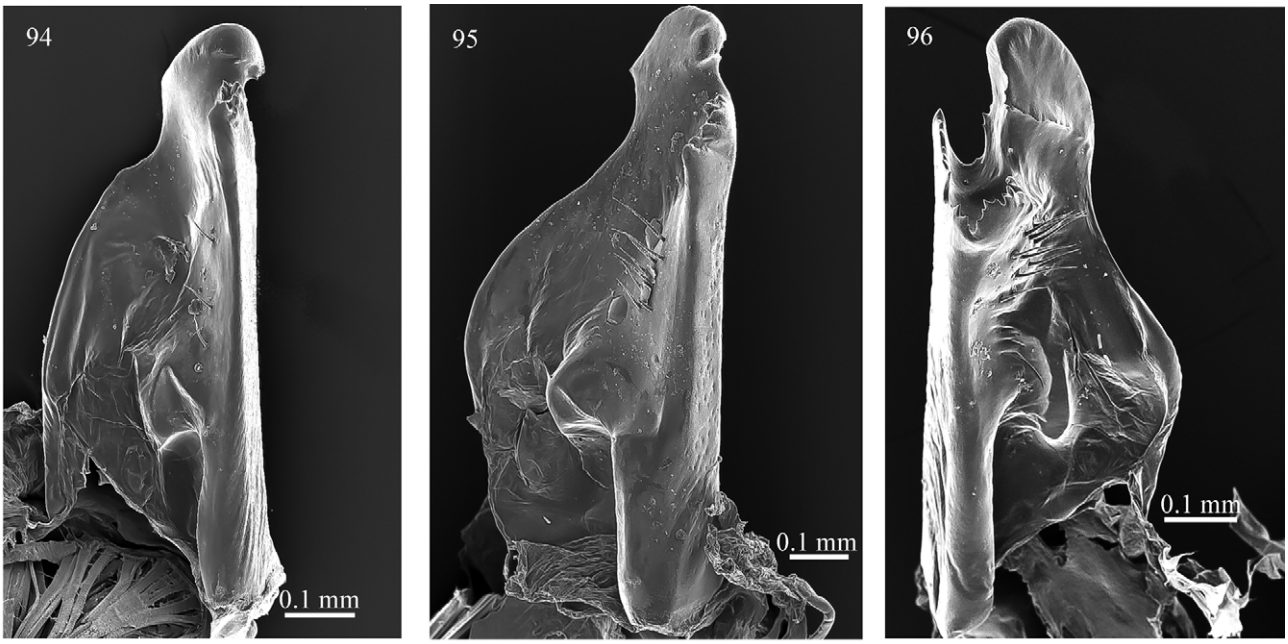
FIGURES 90–93. *Ommatoiulus schubarti* n. sp., paratype: Fig. 90: Left promerite, posterior view, Fig. 91. Left posterior gonopod, mesal view, Fig. 92: Left posterior gonopod, postero-mesal view, Fig. 93: Details of apex of solenomerite, mesal view. Abbreviations: **Al**: Apical lobe of promerite, **CP1**: Conical process, **g**: Seminal groove, **F**: Fovea, **H1**: Hyaline lamella, **in**: Lateral incision, **Lm**: Lateral margin, **Mr**: Mesal ridge, **Ms**: Mesomerite, **P**: Promerite, **Px**: Paracoxite, **S**: Solenomerite.

Having at our disposal samples from Tunisia of *O. fuscounilineatus* and *O. seurati* (from Aïn Draham, NW Tunisia and Ichekeul National Park, N Tunisia, respectively, ZMUC) and *O. oxypygus* (from Sicily, ZMUC) we compared the structures of these three species with those of *O. schubarti* n. sp. using scanning electron microscopy (Figs 94–102).

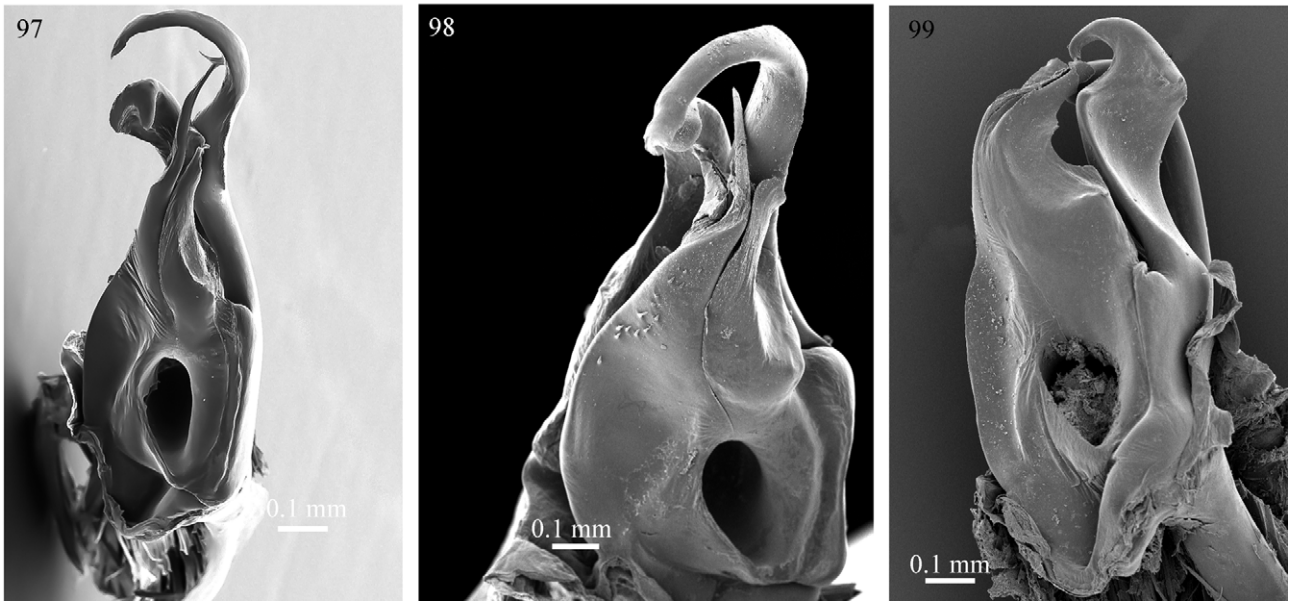
These species share a number of structures:

1) Promerite gradually narrowing distally, apically with a more or less prominent rounded lobe, separated from a broad lateral margin by a subapical incision; a broad mesal ridge, apically protruding in a serrated process, a tuft of strong setae posteriorly near the mesal margin (Figs 90, 94–96).

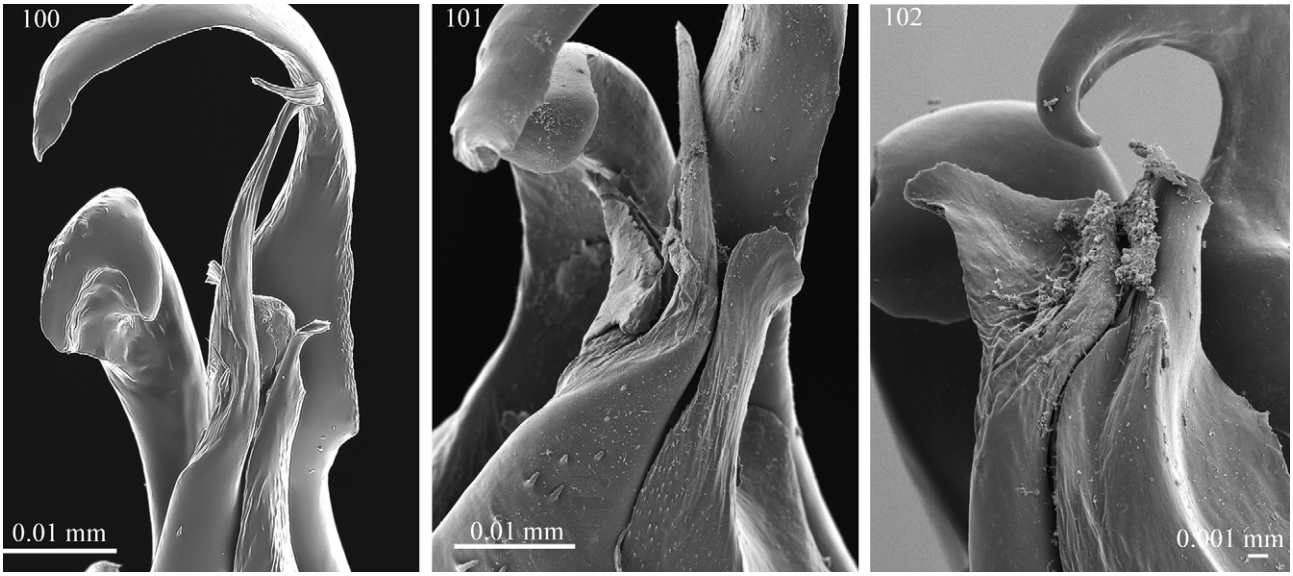
2) Mesomerite elongate, strongly bent at 2/3 length, tapering apically and pointing posteriad (Figs 91, 97–99).



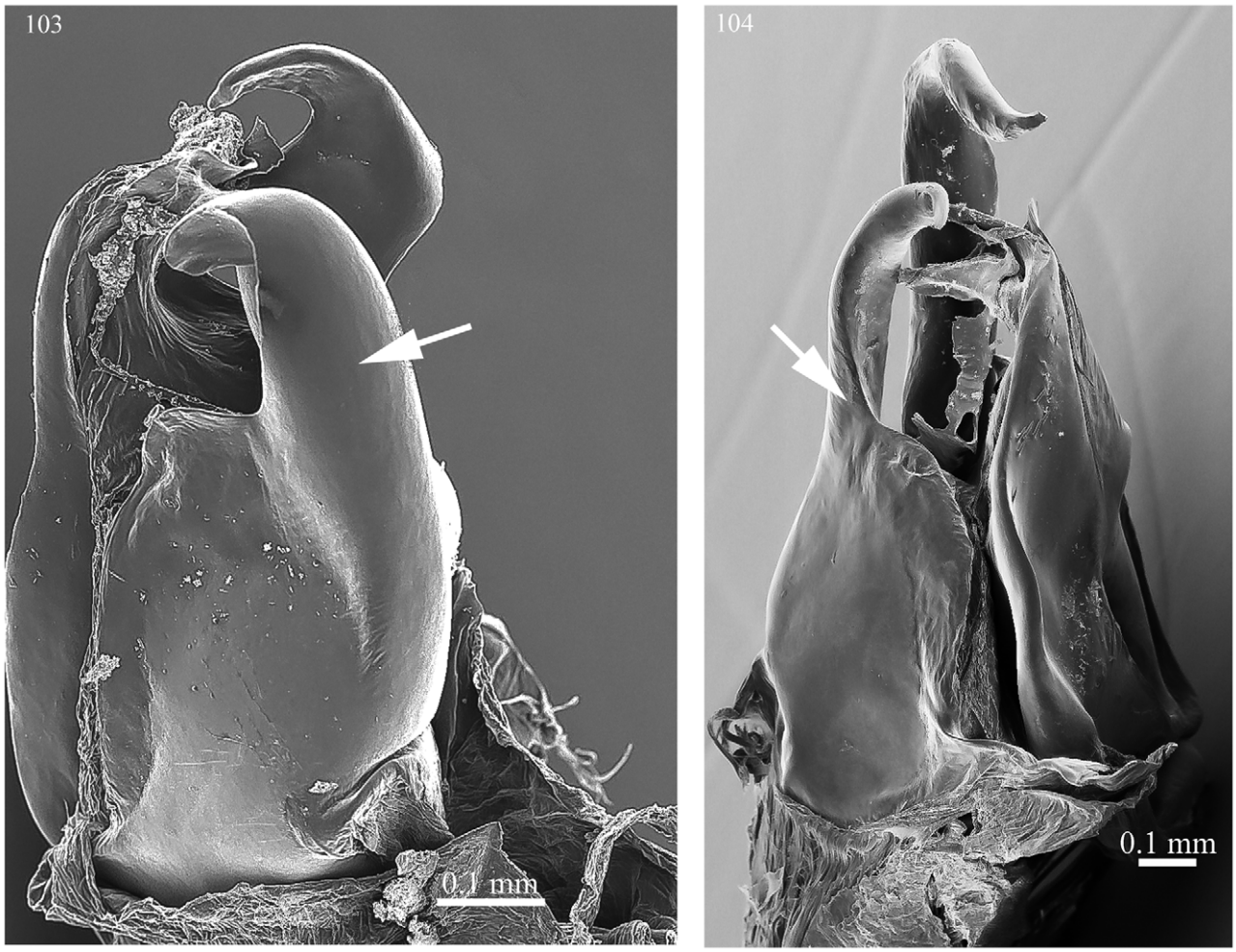
FIGURES 94–96. Promerite, posterior view: Fig. 94: *O. seurati*, specimen from Tunisia, Ichkeul N.P. (ZMUC), right promerite, Fig. 95: *O. oxypugus*, specimen from Sicily (ZMUC), Fig. 96: *O. fuscounilineatus*, specimen from NW Tunisia, Aïn Draham (ZMUC).



FIGURES 97–99. Structure of the posterior gonopod, mesal view (same specimens as in Figs 94–96): Fig. 97: *O. seurati*, Fig. 98: *O. oxypygus*, Fig. 99: *O. fuscounilineatus*.



FIGURES 100–102. Details of apex of solenomerite (same specimens as in Figs 94–96): Fig. 100: *O. seurati*, Fig. 101: *O. oxypygus*, Fig. 102: *O. fuscounilineatus*.



FIGURES 103–104. Paracoxite in *O. fuscounilineatus* and *O. oxypygus* (same specimens as in Figs 94–96): Fig. 103: *O. fuscounilineatus*, Fig. 104: *O. oxypygus*, arrows point to paracoxite.

3) Solenomerite broad, without accessory branches, narrowing distally and apically with a conical process of varied length, containing the opening of the seminal groove, and a more or less simple jagged lamella (Figs 91, 97–102).
4) Paracoxite stout, apically broadened and serrated, bent mesad (Figs 100, 103–104).

As implicated by Schubart, the new species is most comparable with *O. fuscounilinetaus*, especially in the shape of the paracoxite but also in the apical part of the solenomerite consisting of a rounded lobe and a serrated conical process (Figs 93, 102). On the other hand, the mesomerite is much more slender in *O. schubarti*, extending beyond the rest of the processes (like in *O. seurati* and *O. oxypugus*) although not similarly curved. The promerite of *O. schubarti* is also clearly different from the three other species and stands out by the presence of a broader, laterally angular apical process and a deeper notch separting the latter from the mesal margin (Fig. 90, **Al**) while the the apical process is uniformly rounded in *fuscounilineatus*, instead having a deep apical incision mesally (Fig. 96). Moreover, while the mesal margin of the promerite is irregularly toothed apically in *O. seurati* and *O. oxypugus* (Figs 94, 95), it is transformed into a slender apical, strongly jagged mesal process linked to the mesal margin by a serrated oblique lamella in *fuscounilineatus* (Fig. 96) and to a blunt, short, weakly serrated process in *O. schubarti* (Fig. 90, **Bt**).

Discussion

The revision of the genus *Ommatoiulus* in Andalusia has revealed the presence of 19 species, more than half of which, 10 species, are newly described. Among the known species, *O. inconspicuus* is for the first time recorded from a specific locality in continental Spain. Likewise, *O. dorsovittatus* is now established from Spain and together with *O. fuentei* is recorded for the first time from Andalusia. Moreover, five new synonymies are proposed, i.e. the subspecies *O. diplurus mauriesi* and *O. diplurus hoplites* are here synonymised with the nominal species *O. diplurus*, similarly *Schizophyllum dorsovittatum estrellanum* Verhoeff, 1910 and *Schizophyllum calatravanum* Brolemann, 1920 with *O. dorsovittatus.* In addition, *Schizophyllum nivale* Schubart, 1959 is here regarded as a junior synonym of *O. ilicis*.

Most of the described Andalusian species seem to have quite restricted geographical distributions. This is, as far as known, true of *O. andalusius, baenai, baileyi, diplurus, fuentei, hoffmani, jaenensis, kimei, niger, pseudoflagellatus, recueroi, reipi, sabinarensis* and *schubarti* which are confined to southern Spain. Among the more widely distributed species, *O. ilicis* also occurs in the Oriental Pyrenees (Brolemann 1896, 1920) and thus presents a case of a disjunct distribution Pyrenees/Sierra Nevada+Sierra de Grazalema. This distribution pattern is not really surprising knowing that Sierra Nevada, a major mountain range of the Baetic system, might have shared comparable geodynamic events with the Pyrenees during the alpine orogeny. Both constitute Mediterranean basin hotspots of biodiversity and shelter a great number of endemic and relictual organisms (i. e. Blanca et al. 1997, Valdés 2006, Rams et al. 2004). Similar Pyreneo-Andalusian fragmented distributions are also found in other organisms, for example the pill millipede *Glomeridella kervillei* (also further north in France) (Kime and Enghoff 2011) and mosses (Rams et al. 2004).

O. dorsovittatus and *O. inconspicuus* also present a broader distribution range, the former occurring in Portugal, the latter known from the Balearic Islands. Some records from Andalusia of *O. rutilans* (C.L.Koch, 1847), one of the most common *Ommatoiulus* species in Spain, have been cited in the literature. Thus Attems (1952) recorded *Schizophyllum mediterraneum* (Latzel, 1884) [synonym of *O. rutilans*] from Sevilla, Cinca de Pino, Pantano di Alarcón (Andalusia). The same record was subsequently cited in Mauriès (1978) but without any details on the recorded material in both references. Although the occurrence of *O. rutilans* in Andalsusia is not unlikely, it remains undocumented for the time being.

O. moreleti is the most widely distributed among the Andalusian *Ommatoiulus* species, having been introduced from its original Iberian range, to several other parts of the world.

The gonopod structures of *Ommatoiulus* species described here show a great variation ranging from relatively simple, single-branched processes to highly complex processes involving numerous accessory branches and elaborate structures. We distinguish three main groups:

A. Species with more or less simply shaped gonopods characterized by: 1) a slender promerite, narrowing distally, and bearing a pointed tip directed posteriorly, 2) a large mesomerite, apically hook-shaped, 3) a single-branched solenomerite and a simple paracoxite (*O. ilicis* and *O. andalusius*).

B. Species with 1) a subrectangular promerite with an apical rounded lobe and a lateral rounded lobe separated by a notch, 2) a large apically curved and bifurcate mesomerite, 3) a voluminous solenomerite with an anterior process projecting over a posterior one, the two separated by a median strongly serrated furrow 4) a curved and slender paracoxite, sometimes very reduced (*O. baileyi*, *O. dorsovittatus*).

C. Species with 1) a subrectangular promerite with a broad, apically folded mesal ridge, a protruding digit-shaped process with a strongly rugose surface, and a very prominent rudimentary telopodite located distally, 2) a slender mesomerite partly lodging in the promerital mesal fold and bearing two apical small hooks, 3) a broad solenomerite, distally expanded in a broad lamella ramified in several processes, 4) a broad paracoxite, apically narrowing and curved (*O. recueroi*, *O. inconspicuus*, *O. baenai*, *O. kimei*, *O. hoffmani*).

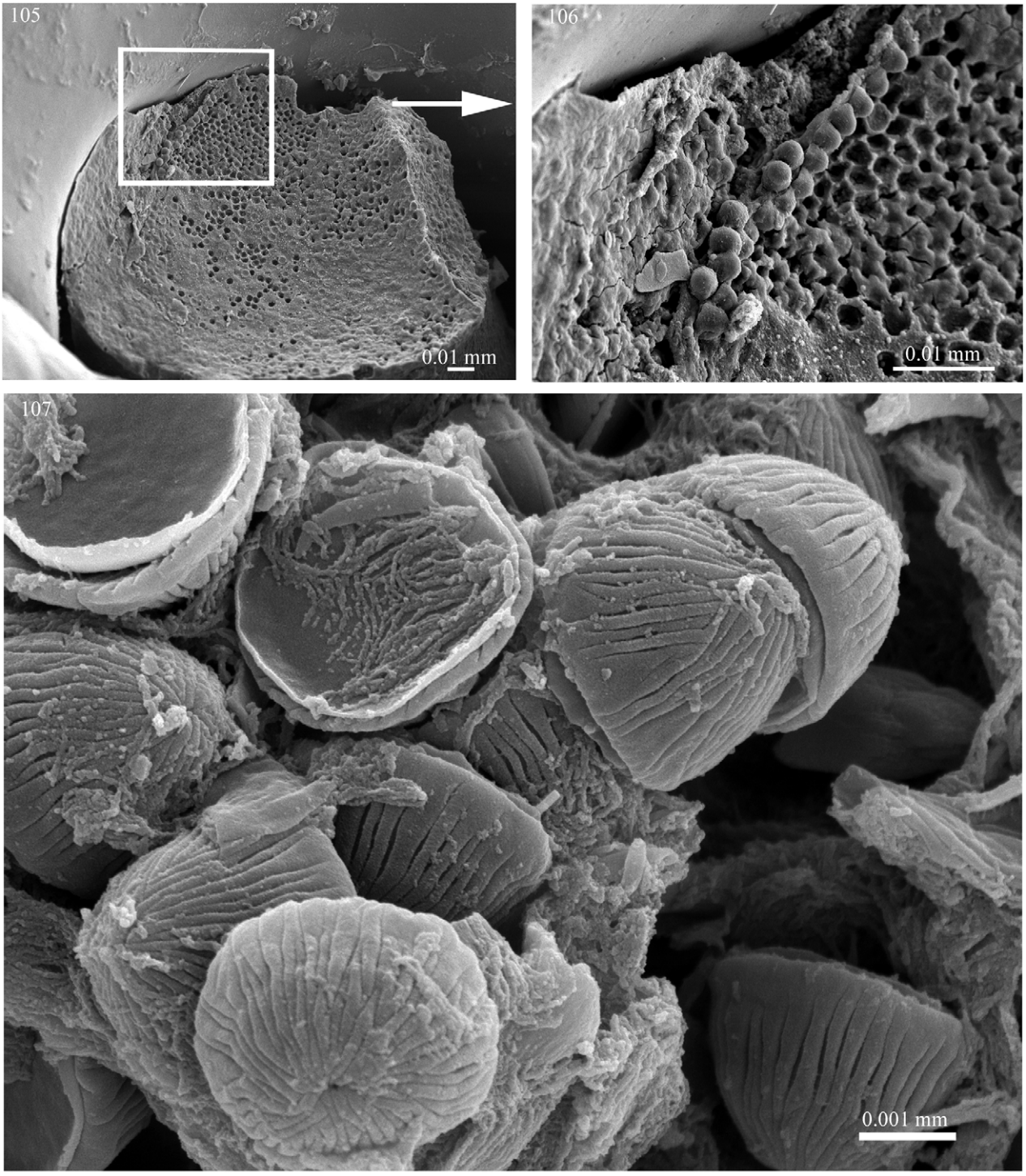
Some of the described species do, however, not fit in any of these groups, i.e., *O. sabinarensis* which is the only species with a bifurcate paracoxite, *O. pseudoflagellatus* which has the unique features of a reduced mesomerite and an extremely slender, flagellum-like paracoxite, *O. fuentei* in which an additional branch was noticed to be bifurcating from the same basis as the mesomerite, and *O. schubarti* which shows an evident affinity with the North African species *O. fuscounilineatus*. *O. diplurus*, one of the most common species in Andalusia, is characterized by quite complex gonopods displaying considerable intraspecific variation; hence a number of morphotypes with localized geographic distribution were distinguished. However, variation in *Ommatoiulus* species is not unusual: *O. rutilans* represents another case of a highly variable species (Vicente, 1985), *O. sabulosus* (Linnæus, 1758) is also a polymorphic species for which several 'varieties' have been described (i. e. Verhoeff 1921, Attems 1927, Attems 1952). Baker (1984) documented the variation of *O. moreleti* in Portugal, Prisnyi (1991) described varieties of *O. (Rossiulus) kessleri* (Lohmander, 1927) in Russia, while Akkari et al. (2009) pointed to the presence of different morphotypes of *O. punicus* (Brolemann, 1894) in Tunisia.

Among the most remarkably complex gonopods of the species treated here are those of *O. dorsovittatus* (Figs 34, 36, 38, 39), *O. fuentei* (Figs 41, 43, 45) and *O. sabinarensis* (Figs 86, 89, 89). Several hypotheses could be made on the biological and evolutionary significance of the broad range of the gonopod complexity and their implication in the reproductive success of the species in general. Shear (2012) pointed to the same fact in polydesmidans, suggesting that the presence of minute details might actually have significance for females and play a key role in the reproductive success. This hypothesis seems to stand and was supported by other studies which aimed to understand the functional morphology of millipede gonopods (Tadler 1996, Wojcieszek et al. 2012).

The mesomerite in the species belonging to group C closely nests in the mesal fold of the promerite, whose distal surface is rugose and where the rudimentary telopodite is located distally. This may suggest that promerite and mesomerite may act as a forceps to pull out the vulva from the vulval sac, as suggested by Haacker & Fuchs (1970) for *Cylindroiulus punctatus* (Leach, 1815) of the tribe Cylindroiulini and Tadler (1996) for *Unciger foetidus* (C. L. Koch, 1838) of the tribe Oncoiulini. This, however, remains purely speculative until a comparative study of vulvae of *Ommatoiulus* females are carried out.

Regardless of the degree of complexity the genitalia of all *Ommatoiulus* species always carry a remarkable structure in the basal part of the posterior gonopods, the fovea. The term "fovea" goes back to Verhoeff (1894: 145) (HE transl.): "The bladder and the dark sperm substance was apparently also seen by Latzel who wrote, l.c., p. 330: 'One notices in the middle of the posterior 'Klammerblatt' a red-brown, almost hemispherical to spherical-tetrahedron like body of unknown significance'. I have now convinced myself that the 'body of unknown significance' in this [*sabulosus*] as well as other species of the by myself separated genus *Palaioiulus* is nothing but the sperm mass contracted by alcohol. In all *Palaioiulus* species this mass is located in a bladderlike cavity and its external surface therefore after the contraction reproduces the shape of the bladder. It must be emphasized as very important that this bladderlike cavity, which I name Fovea, opens anteriorly and mesally through a wide opening …..At the edge of the sperm mass one can usually, at 250–300 times magnification, clearly recognize the roundish spermatozoa, especially where the sperm ball (as in fig. 22) extends into the opening of the fovea. In the illustrations the spermatozoa were only partly indicated as it was moreover sufficient to indicate the contour of the sperm mass."

Since Verhoeff's original observation (1894) no further attempts have been made to document this structure. While examining gonopods of a number of the species with scanning electron microscopy, we paid special attention to the fovea and nearly 120 years after its description were able to recognize the 'sperm mass' as described by Verhoeff (1894). The fovea, investigated here for the first time with SEM, consists of a large ovoid cavity located at the basis of the solenomerite lodging an agglutination of spermatozoa (Figs 105, 106, 107). The spermatozoa of *Ommatoiulus* spp. have the same shape and surface structure as seen in two genera of the tribe Pachyiulini: *Pachyiulus* (Baccetti and Dallai 1978) and *Dolichoiulus* (Enghoff 1992).



FIGURES 105–107. Fovea and spermatozoa: Fig. 105: Fovea in *O. fuentei*, Fig. 106: Close-up of the quadrat, Fig. 107: Spermatozoa in *O. baileyi*.

The fovea is in direct connection with an efferent groove leading to the apex of the solenomerite. The efferent groove is decidedly routing the spermatozoa to the distal part of the solenomerite, where they are evacuated through an apical opening. In *O. dorsovittatus*, the spermatozoa were spotted close to the opening of the seminal groove (Fig. 108) which is also in accordance with Verhoeff's observations. In order to compare with other schizophyllines, we additionally scanned *O.* (*Rossiulus*) *kessleri* and *Tachypodoiulus niger* (Leach, 1814). In both species, the fovea (Figs 109, 110) was clearly noticeable and quite similar in shape and location with what we observed in *Ommatoiulus* species. The fovea may qualify as an apomorphy for the tribe Schizophyllini.

Pouchlike structures in the posterior gonopods for storage of spermatozoa have been reported in other julids than Schizophyllini. For instance, Enghoff (1995: figs 1–16) described for *Paectophyllum* a 'membranous pouch' situated close to the tip of the solenomerite and contains a compact 'sperm mass'. However, the pouch of *Paectophyllum* is probably not homologous with the fovea of *Ommatoiulus*. Several unique morphological characters place *Paectophyllum* in a clade constituted by the two tribes Paectophyllini and Calyptophyllini; this clade is retrieved in molecular analyses of the Julidae (Enghoff et al. 2011) and is far removed from *Ommatoiulus* on the trees. Golovatch (1979) described from middle Asia a millipede *Dangaraiulus valiachmedovi* Golovatch, 1979 outstanding by the presence of a big 'fovea' in the basal part of the posterior gonopods. However, we were not able to recognize homologies with the Schizophyllini fovea when we looked at a paratype (ZMUC).

Concerning the status of *Rossiulus* and *Tachypodoiulus* as full genera separate from *Ommatoiulus* (cf. introduction), our examination of both nominal genera leads us to preliminarily retain *Rossiulus* as a synonym of *Ommatoiulus* while leaving *Tachypodoiulus* valid. We emphasize, however, that until a comprehensive phylogenetic analysis can be carried out for all Schizophyllini, any subdivision will remain more or less arbitrary. For the same reason, we do not suggest a new genus for the highly deviating species *O. pseudoflagellatus*.

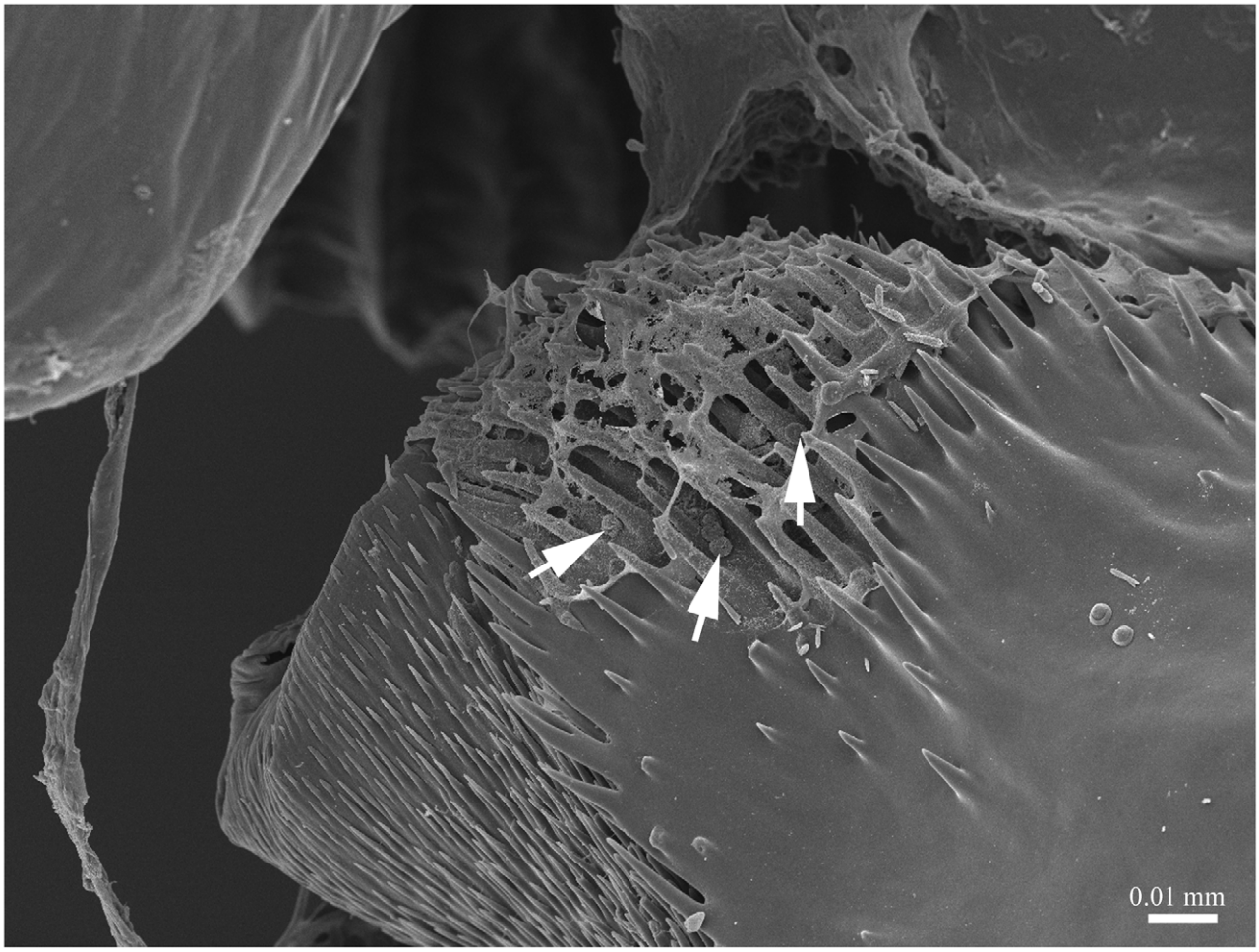
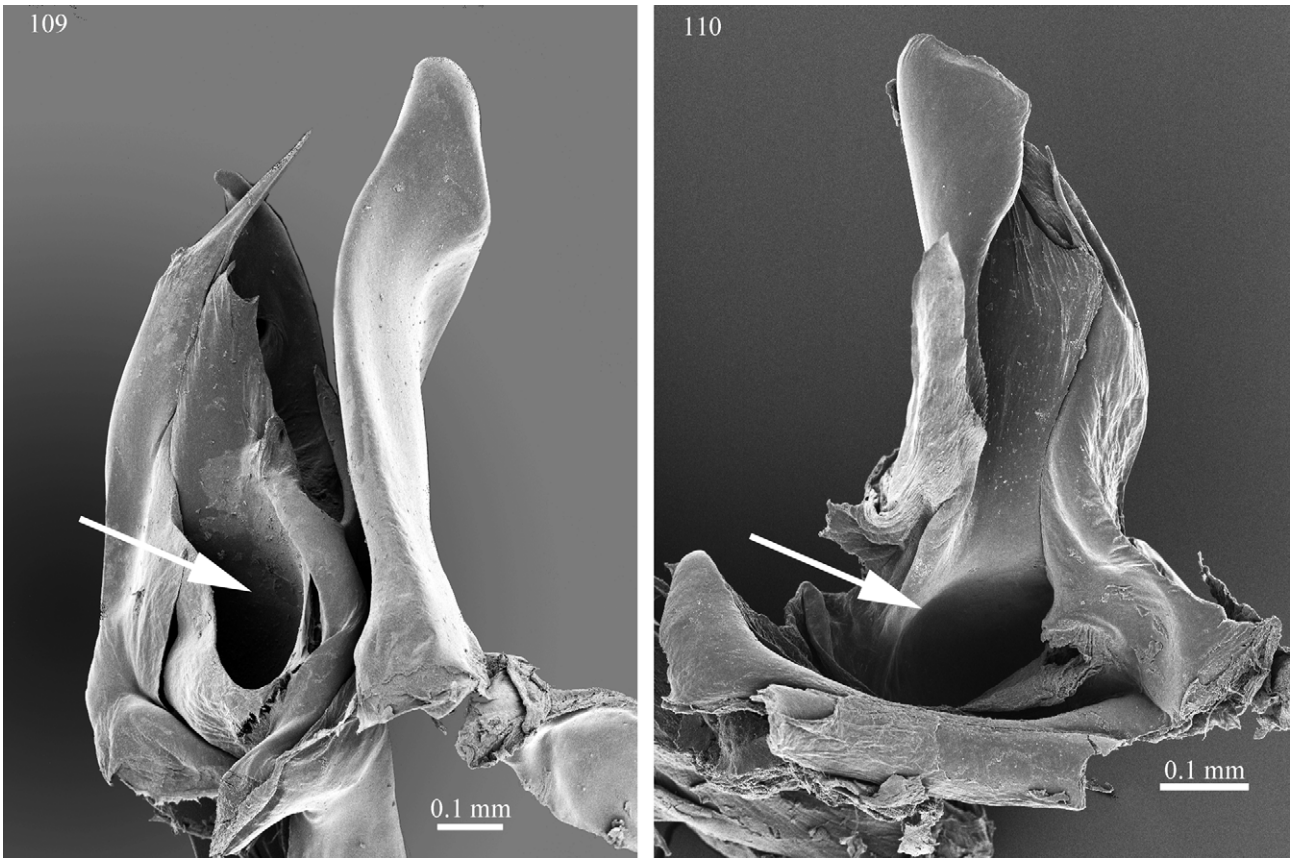
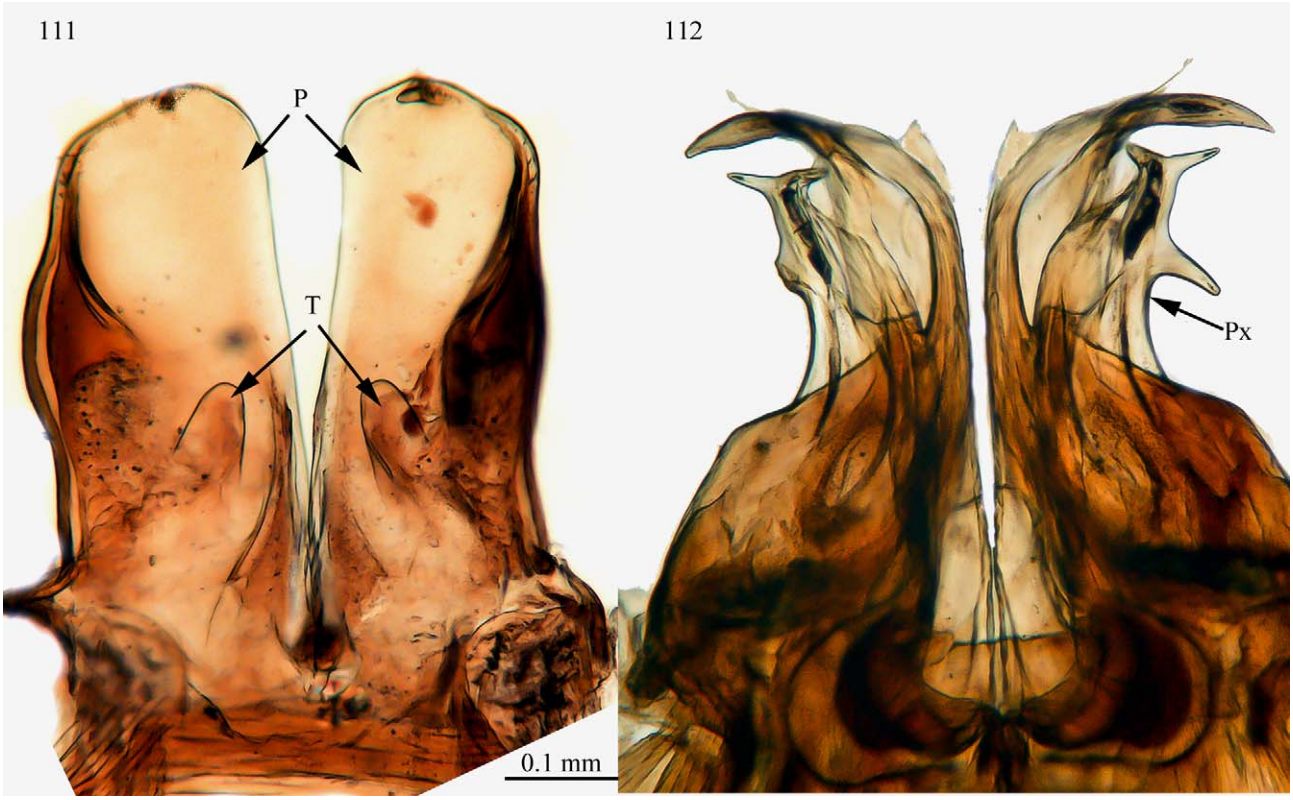


FIGURE 108. Spermatozoa in the distal part of the solenomerite of *O. dorsovittatus*. Arrows point to the spermatozoa.



FIGURES 109–110. Gonopods of *O*. (*Rossiulus kessleri*), specimen from Russia (ZMUC), and *Tachypodoiulus niger*, specimen from France (ZMUC), mesal view. Fig. 109: *R. kessleri*, Fig. 110: *T. niger*. Arrows point to the fovea.



FIGURES 111–112. Gonopods of *O. moreleti*, Slide preparation of a specimen (uncertain type status) from Portugal, Coimbra, 1896, Verhoeff don. (NHMW): Fig. 111: Promerites, posterior view, Fig. 112: Posterior gonopods, posterior view. Abbreviations: **P**: Promerites, **Px**: Paracoxite, **T**: Rudimentary telopodite.

Identification key to Andalusian species of *Ommatoiulus*, based on gonopod structures

1. Promerite subrectangular, with an apical digit-shaped lobe with scaly surface and a folded mesal ridge, rudimentary telopodite located distally (Figs 3, 55, 61, 65, 69, 78, 83) . . . 11
- Promerite differently shaped, rudimentary telopodite located basally (Figs 1, 7, 10, 35, 42, 51, 72, 87, 90) . . . 2
2. Promerite with parallel margins, strongly narrowed distally, ending apically in a pointed tip (Figs 1, 10, 51) . . . 9
- Promerite with lateral lobe, apically rounded (Figs 7, 35, 42, 72, 87, 90) . . . 3
3. Mesomerite long, extending beyond the rest of the processes of the posterior gonopod, distally hook-shaped and curved, paracoxite conspicuous . . . 4
- Mesomerite small, shorter, distally angled (Fig. 74), paracoxite very slender, flagellum-like (Figs 73, 77) . . . *O. pseudoflagellatus* n. sp.
4. Solenomerite complex, with voluminous lobes or accessory processes (Figs 9, 36, 41, 88) . . . 5
- Solenomerite simple, without accessory processes (Fig. 91) . . . *O. schubarti* n. sp.
5. Main process of solenomerite short, voluminous, with an anterior lobe projecting over a posterior lobe, separated by a median strongly serrated furrow, paracoxite simple, diatally narrowing (Figs 9, 36, 41) . . . 7
- Main process of the solenomerite long, without such lobes, paracoxite complex, distally ramified (Fig. 88, 112) . . . 6
6. Promerite subapically incised, with a big lateral lobe, solenomerite with two lateral accessory branches, main process with several thorns on the margin, paracoxite bifurcate . . . *O. sabinarensis* n. sp.
- Promerite with parallel margins and no subapical incision (Fig. 111, **P**), solenomerite without accessory branches, main process without thorns, paracoxite antler-shaped (Fig. 112, **Px**) . . . *O. moreleti*
7. Paracoxite more or less long and bent (Figs 8, 41) . . . 8
- Paracoxite very reduced and sinuous (Fig. 38) . . . *O. dorsovittatus*
8. Coxite voluminous; solenomerite with posterolateral jagged lamella and accessory processes, mesomerite with additional process emerging from the same base (Fig. 43) . . . *O. fuentei*
- Coxite less voluminous (Fig. 8); solenomerite without such a lamella or accessory processes, mesomerite without such additional process (Fig. 8) . . . *O. baileyi* n. sp.
9. Mesomerite with subapical processes, solenomerite with a complex distolateral lamella and long accessory process, paracoxite tapering apically, coxite voluminous and very broad (Fig. 13). . . . *O. diplurus*
- Mesomerite with no subapical processes, solenomerite in one branch, simple, without such lamella and long process, paracoxite broadening apically, coxite not voluminous (Figs 2, 52) . . . 10
10. Solenomerite with a subapcial acuminate curved process on the lateral margin, apically with 3 processes linked by a thin lamella, paracoxite apically bent (Fig. 2) . . . *O. andalusius*
- Solenomerite without subapical processes, apically with a folded lobe and triangular lateral lamella (Fig. 52) . . . *O. ilicis*
11. Solenomerite without accessory branches emerging from the proximal part at about mid-length of the process (Figs 4, 48, 57, 62, 68, 71) . . . 13
- Solenomerite with two curved accessory branches emerging from the proximal part at mid-length of the process (Figs 81, 84) . . . 12
12. Accessory branches of the solenomerite of comparable size; paracoxite uniformly broad, distally expanded in semilunar-shaped apical process with two opposite directed tips (Fig. 81). . . . *O. recueroi* n. sp.
- Accessory branches different, the anteriormost long and curved and the posteriormost spikelike; paracoxite broadened at mid-length, distally tapering in a curved pointed process (Fig. 84) . . . *O. reipi* n. sp.
13. Distal part of the solenomerite anteriorly with a broad lamella which is lower than the rest of the processes, strongly serrated on the margin and bearing several thorns; paracoxite strongly constricted in the distal third, apically with a clavate tip (Fig. 57) . . . *O. inconspicuus*
- Distal part of the solenomerite without such lamella, paracoxite not constricted, apically with a rounded or triangular tip (Figs 4, 48, 62, 68, 71) . . . 14
14. Mesal process of the solenomerite simple, straight, paracoxite apically reduced in a triangular pointed process (Figs 47, 68, 71) . . . 16
- Mesal process of the solenomerite folded, strongly downturned (Figs 5, 61), paracoxite stout, apically expanded in a rounded curved tip (Figs 4, 62) . . . 15
15. Promerite slender (Fig. 61); mesomerite simple without subapical hooks (Figs 62, 63); solenomerite with a strong subapical spine and a saw-like lateral process; paracoxite slightly extending mesoposteriad and bent (Fig. 62) . . . *O. jaenensis* n. sp.
- Promerite broader (Fig. 3), mesomerite with subapical hooks (Fig. 4); solenomerite without strong subapical spine and with an acuminate lateral process (Fig. 6) *O. baenai* n. sp
16. Promerite without a protruding apical mesal lobe (Fig. 69), apical processes of the mesomerite symmetrical (Figs 49, 71), mesal process of the solenomerite short and blunt, not protruding beyond the anterior and posterior processes of the solenomerite, paracoxite with a broad rounded lobe on the anterior margin. . . . 17
- Promerite with a protruding apical mesal lobe (Fig. 65), apical processes of the mesomerite assymetrical, mesal process of the solenomerite long and acuminate, of the same length as the anterior process, paracoxite uniformly broad without big lobe on the anterior margin . . . *O. kimei* n. sp
17. Anterior lamella of the solenomerite subapically with a strong curved claw, apically broadened and curved posteriad, bearing sharp serrations on the margin (Fig. 71) . . . *O. niger*
- Anterior lamella of the somelenomerite subapically without claw, apically narrowing and straight, bearing blunt teeth on the margin (Fig. 48). . . . *O. hoffmani* n. sp.

Acknowledgements

This project is financed by the CARLSBERG foundation and also received support from the SYNTHESYS Project which is financed by European Community Research Infrastructure Action under the FP7 Capacities Program and which allowed N. A. short visits to Natural History Museum Wien (Austria) and Natural History Museum of Madrid (Spain). Fauna Ibérica X (Ref.CGL2010-22267-C07-01) extended N. A.'s stay in Madrid.

We are particularly grateful to the following curators who provided loans under their care: Javier Sánchez Almazan (MNCN), Jean-Jacques Geoffroy (MNHN), Roberta Salmoso and Leonardo Latella (MCSNV). Our gratitude is also due to Jean-Paul Mauriès (MNHN) for kindly donating material, personal notes and drawings of one of the new species and to Desmond Kime for kindly checking the geographical localities and commenting on species distribution. Many thanks are also extended to the colleagues and collectors who actively provided valuable material for study: Ernesto Recuero, Hans Reip, Karin Voigtländer, Manuel Baena, and Mario García París.

Nikolaj Scharff (ZMUC) kindly allowed access to the photography equipment and Dave Cheung-Boung (ZMUC) gave useful hints to improve and process the pictures. N. A. is also most obliged to Verena Stagl (NHMW); Marian Ramos and Josefina Cabarga (MNCN) for their support during the visits to the respective Museums as well as to the colleagues of the entomological department (ZMUC) for their great encouragement.

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