SOIL ORGANISMS Volume 83 (2) 2011 pp. 287–306
ISSN: 1864-6417

Oribatid mites (Acari: Oribatida) from the coastal region of Portugal. V. *Xenillus*, *Oribatella, Galumna, Eupelops* and *Lucoppia*.

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Abstract

Two new species of Oribatida were found in coastal habitats in South-West Portugal and three remarkable species are redescribed. *Xenillus halophilus* sp. n. (Liacaridae) was found in three different regions of the Algarve inhabiting salt marsh zones with regular salt water inundation; this ecological preference is unique within this genus. All following described and redescribed species inhabit a rocky area with coastal bushland in the estuary region of Ribeira de Aljezur at the Atlantic west coast of the Algarve: *Galumna paragibbula* sp. n. (Galumnidae), *Oribatella tridactyla* Ruiz, Subías & Khawash, 1991 (Oribatellidae), *Eupelops somalicus* (Berlese, 1916) (Phenopelopidae) and *Lucoppia burrowsi* (Michael, 1990) (Oribatulidae). Taxonomical and systematical remarks are presented on all species, partly with morphological details on related species.

Key words: Taxonomy, systematics, new species.

1. Introduction

This contribution continues a series of papers dealing with the taxonomy of new and remarkable species of Oribatida in salt marshes and adjacent coastal habitats in South Portugal (Weigman 2008b, 2009a,b, 2010). The material originates mainly from the estuary region of Ribeira de Aljezur at the Atlantic west coast of the Algarve. The descriptions are partly complemented by comparative discussion on specimens from other origins and related species. The systematic conception of oribatid families follows Norton & Behan-Pelletier (2009).

2. Materials and Methods

The samples from coastal areas of Portugal were collected by the author in 1971 and 2004 to 2010.

Po 58–83: Samples from a scrubby salt marsh in the Faro lagoon ('Ria Formosa'), April and May 1971.

Po 104–109: Samples from Ribeira de Aljezur, West-Algarve (37°20.3'N, 8°50.02'W); 9 September 2004; about 2 km from the Atlantic shore, an area with brackish water influence, formerly used as salines, under *Sarcocornia* and *Atriplex* scrubs.

Po 117–118: Samples from the river shore of Ribeira da Boina near Portimão about 3 km from the Atlantic shore (37°10'N, 8°31.6'W); 20 September 2004; muddy soil under *Sarcocornia* with brackish and salt water influence.

Po 120–126: Samples from Ribeira de Aljezur, West-Algarve (37°20.1'N, 8°59.50'W); 21 September 2004; about 3 km from the Atlantic shore, an area with brackish water influence, muddy soil under *Sarcocornia* and *Atriplex* scrubs.

Po 127: A sample adjacent Po 126; sandy shore area with dry debris, with *Juncus* and *Carpobrotus* vegetation.

Po 143–146: Samples from estuary region of Ribeiro de Aljezur, West-Algarve (37°20.38'N, 8°50.17'W); 2 November 2008. A bushy area on a large rock, about 5 m higher than the surrounding area.

Po 148: Sample from sandy soil of a meadow near a dune area, about 100 m east of samples Po 143 ff. 2 November 2008.

Po 170–181: Samples from Ribeira de Aljezur, West-Algarve (37°20.27'N, 8°50.28'W); 22 March 2010; about 1.2 km from the Atlantic shore, an area with salt water influence, muddy soil under *Sarcocornia* and *Atriplex* scrubs.

Po 194–205: Samples from Ribeira de Aljezur, West-Algarve (37°20.30'N, 8°50.28'W); 20 October 2010; about 1.2 km from the Atlantic shore, a salt marsh island in the river, with salt water influence, muddy soil under *Sarcocornia* and *Atriplex* scrubs.

The samples Po 58–83 were taken semi-quantitatively with a special shovel, about 250 cm², 1–2 cm depth. The samples Po 104–205 covered about 50 cm² each. The mites were extracted using a modified Tullgren apparatus. The specimens were preserved in ethanol and after clearing they were studied microscopically in lactic acid in cavity slides.

3. Results

3.1. *Xenillus halophilus* sp. n.

In salt marshes of the estuary region of Ribeira de Aljezur several specimens of a *Xenillus* species were found which is similar to *X. tegeocranus* at first sight (cf. Grobler et al. 2003; Mahunka 1996), but differing in characteristic details. Whereas *X. tegeocranus* lives in dry to moist forest soils, the new species inhabits the salty tidal zone with halophilous scrub vegetation (dominated by *Sarcocornia* and *Atriplex*). This ecological preference is unique among European *Xenillus* fauna. The new species will be described below, based on the adult.

Material examined

Holotype: Adult female, sample Po 179; salt marsh in the estuary region of Ribeira de Aljezur; preserved in ethanol, deposited in the collections of the Senckenberg Museum für Naturkunde Görlitz (SMNG). 26 Paratypes from samples Po 171–181; five adult females and one adult male, deposited in SMNG; 21 specimens in the collection of the author. Several specimens in the collection of the author from the sample series Po 104–109, 120–126; nine specimens from the estuary region of Ribeira da Boina near Portimão, samples Po 117–118; Three specimens from a salt marsh in the Faro lagoon ('Ria Formosa'), samples Po 62, 74, 75 (cf. Weigmann 2008a: as '*X. tegeocranus*').

Diagnosis

Body length of females 815–1000 µm, males significantly smaller (610–770 µm). Lamellar cusp with sharp median tooth, with mostly indistinct lateral angle; very small mucro in

translamellar position, absent from some specimens. Anterior edge of rostrum (border of camerostome) protruded, with irregular teeth. Interlamellar seta long; claviform sensillus with short stalk. Cuticular structure of notogaster and ventral plate foveolate; interlamellar area granulated, mentum and genital plates smooth. Eleven pairs of notogastral setae bacilliform, coarsely barbed, distally more or less broadened, length up to 70 µm, humeral setae *c* the shortest.

Description

General characters: Body length range 610–1000 µm; females 815–1000 µm (mean 883 µm, n = 14), males 610–770 µm (mean 698 µm, n = 7). Body colour pale to medium brown.

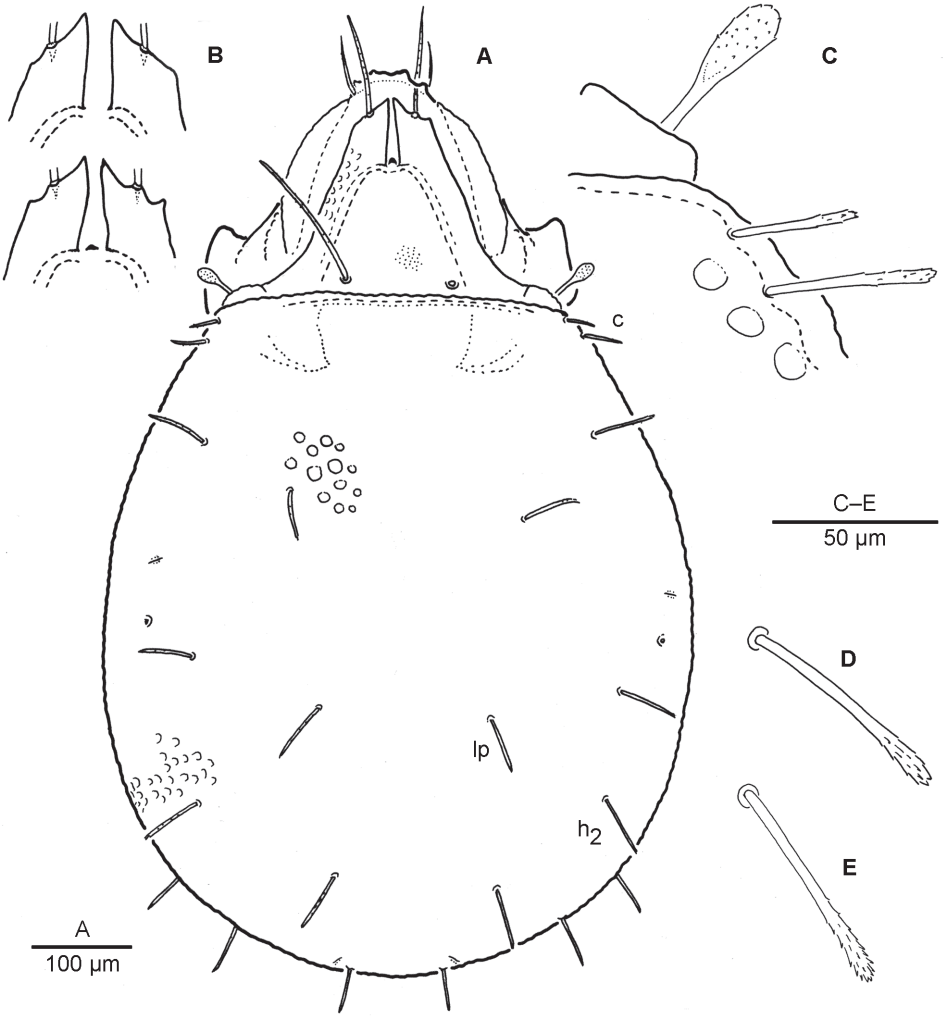

Fig. 1 *Xenillus halophilus* sp. n. **A**: dorsal aspect, legs omitted; **B**: variations of lamellar complex; **C**: sensillus and humeral region; **D**: notogastral seta *lp*; **E**: notogastral seta h_2.

Prodorsum: Surface of interlamellar area granulate; lamella, tutorium and pedotectum I alveolate, lateral surface of prodorsum with few alveoles. Rostrum border with teeth, of variable size and numbers: mostly two pairs of larger protruding teeth, one pair near rostral setae, the other frontal with considerable mutual distance; interspace of the larger teeth irregular (Figs 1A; 2A, B). Lamellar cusp longer than wide, with sharp median tooth, lateral angle variable, but usually indistinct; considerable interspace of cusps, no translamella, small intercuspidal mucro, reduced or absent in some specimens (Figs 1A, B). Rostral seta setiform, barbed, with moderate length; long lamellar and interlamellar setae spiniform, strongly barbed, interlamellar seta longest (about 150 µm and more) positioned on interlamellar area. Sensillus with longish claviform head and short stalk, barbed, about 50 µm in length (Fig. 1C). Tutorium narrow, long, ending near rostral seta (Fig. 2A).

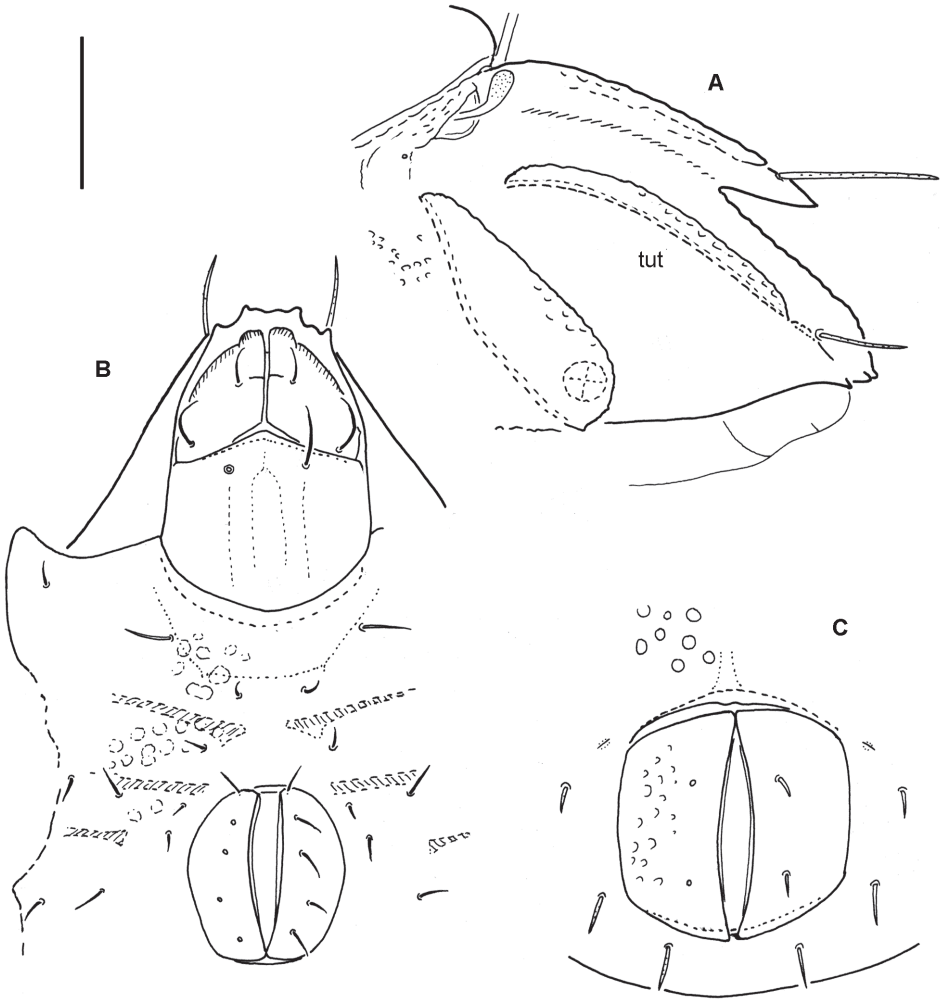

Fig. 2 *Xenillus halophilus* sp. n. **A**: lateral aspect; **B**: ventral aspect, anterior part; **C**: anal region. Abbreviation: *tut* – tutorium. Scale bar 100 µm.

Notogaster: Ovoid in shape, with nearly straight dorsosejugal suture, surface with distinct irregular alveoles (Fig. 1A). Eleven pairs of notogastral setae, about 50–70 µm in length, humeral setae *c* (c_2 and c_3 ?) short, about 35–45 µm length, bacilliform, distally slightly broadened and barbed (Figs 1C–E).

Ventral region: Cuticle of ventral plate alveolate, mentum and genital plates smooth. Epimeral setation formula 3-1-3-3, setae setiform, small, *1b* and *3b* largest; ano-genital setation 5-1-2-3, setae normal, smooth or partly barbed. Inner border of rostrum edge not distinctly demarcated to camerostome cavity (Figs 2B, C).

Legs: Tarsi with three claws each. Setation not studied in detail.

Distribution and ecology: Found in several samples from scrubby salt marsh areas with regular brackish or salty water inundation in the Algarve, Portugal: estuary region of Ribeira de Aljezur (western coast), Ribeira da Boina near Portimão, Faro Lagoon (both southern coast); partly the dominant species besides other halophilous species, as *Hermannia pulchella* and *Scheloribates* (*Euscheloribates) algarvensis*.

Remarks

Xenillus halophilus sp. n. differs from the similar *X. tegeocranus* (Hermann, 1804) mainly in the shorter sensillus, the broader interspace between the lamellar cusps, the smaller (or absent) intercuspidal mucro and explicitly in the form of the frontal rostrum edge with some protruding teeth, and lack of inner demarcation to camerostome cavity. In contrast to *X. halophilus* sp. n., the rostrum edge in *X. tegeocranus*, as observed from ventral, has an inner and outer demarcation, looking like a semicircular bulge with a tooth-like extension near each rostral seta (Fig. 3A; cf. Grobler et al. 2003); a similar rostrum edge with a pair of teeth has been reported for *Xenillus salamoni* Mahunka, 1996 from Hungary. The study of specimens of *X. clypeator* from the sandy area near a salt marsh (sample Po 127) demonstrates a similar semicircular bulge, but there is no tooth-like extension (Fig. 3B).

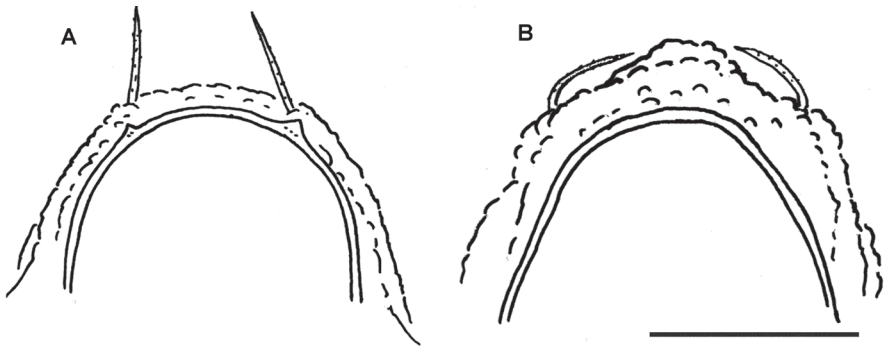

Fig. 3 **A**: *Xenillus tegeocranus,* rostrum, ventral aspect; **B**: *Xenillus clypeator,* rostrum, ventral aspect. – Scale bar 100 µm.

3.2. *Oribatella tridactyla* Ruiz, Subías & Khawash, 1991

This comparably small *Oribatella* species resembles morphologically *O. berlesei* (Michael, 1898) with Ibero-Mediterranean distribution (Subías & Gil-Martin 1997) and Iberian species, *O. berninii* Pérez-Iñigo, 1989, *O. inflexa* Mihelčič, 1957, as well as *O. similesuperbula* Weigmann, 2001, from Germany which will be discussed below. Prof. Luis Subías confirmed in personal communication the high probability of this Portuguese *Oribatella* population belonging to *O. tridactyla*. In the following a short redescription is presented, based on the Portuguese material.

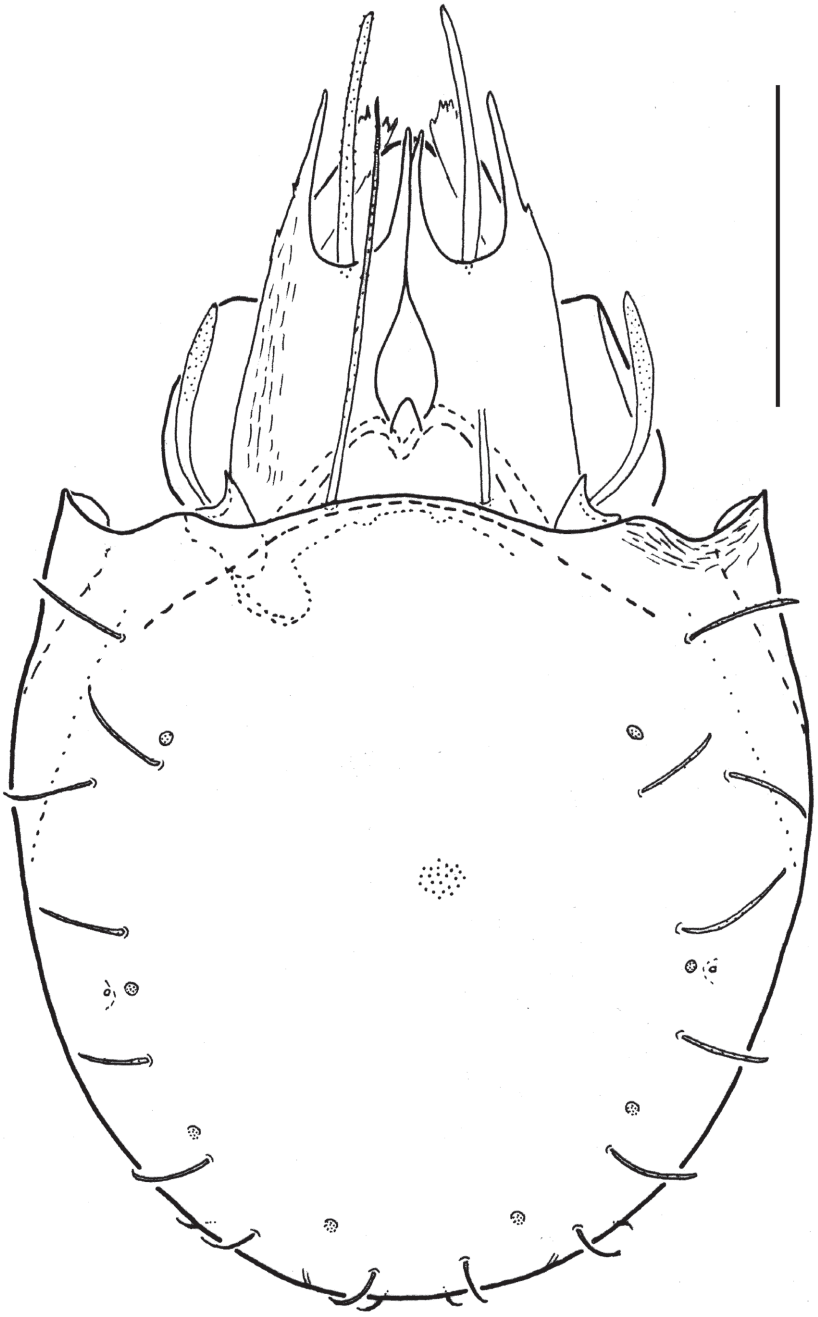

Fig. 4 *Oribatella tridactyla.* Dorsal aspect, legs omitted. Scale bar 100 µm.

Material examined

Five females, sample Po 144; Portugal (Algarve); five specimens deposited in the collection of the author.

Diagnosis

Small species, length 360–375 µm; with mucro (translamellar tubercle) instead of translamella; genal tooth sharply acuminate, with straight ventral and rounded dorsal margin; border of camerostome without further incisions, with two frontal sharp points; notogastral setae less than 40 µm in length; epimeral setae *3c* and *4c* strong and enlarged, *4c* largest. Genital plate granulated.

Redescription

General characters. Body length 360–375 µm (5 females). Cuticle with fine granulation; colour reddish-brown.

Prodorsum. Rostrum with median crest, in dorso-frontal aspect square outline with sharp corners (variable; Fig. 5C). Cuspis of lamella with long median and slightly longer lateral tip, laterally with few small teeth, dorsally striped ornamentation; in translamellar position with distinct mucro (Fig. 4). Large rostral, lamellar and interlamellar setae; sensillus slender fusiform with granulation. Tutorium long, broad, with distal teeth; genal tooth sharply acuminate, with straight ventral and rounded dorsal margin (Fig. 5B).

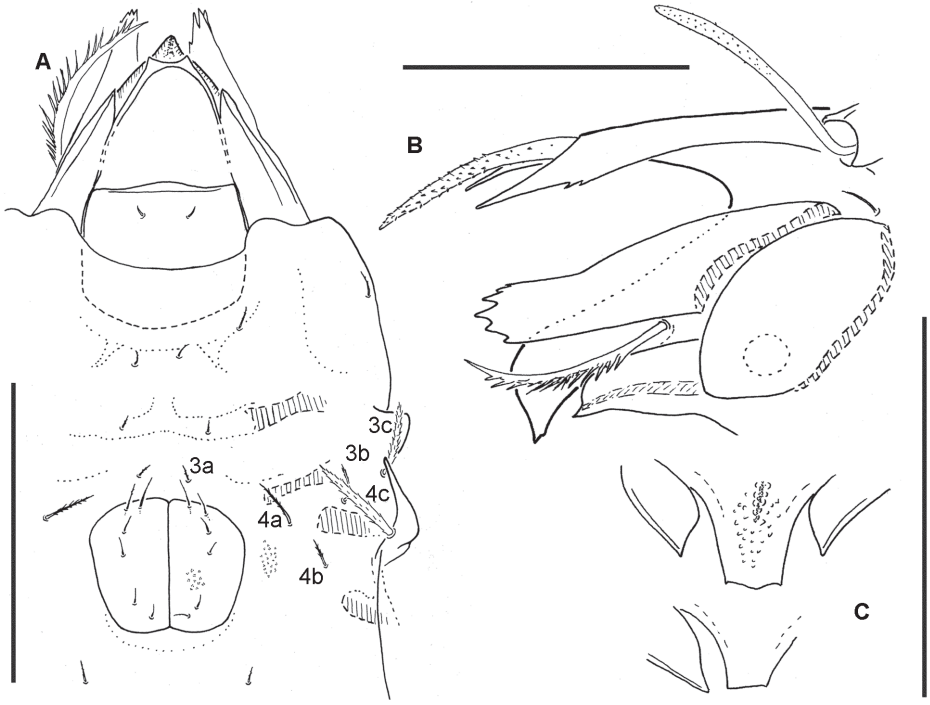

Fig. 5 *Oribatella tridactyla.* **A**: ventral aspect, anterior part; **B**: prodorsum, lateral, legs omitted; **C**: variation of rostrum, dorso-frontal aspect. – Abbreviations: epimeral setae. Scale bars 100 µm.

Notogaster: With fine striation at anterior region of pteromorph. 10 pairs of bacilliform setae with granulation, the longest about 38 µm long, p_1 and p_2 short. Porose areas small, roundish, about 4–6 µm in diameter (Fig. 4).

Ventral region: Border of camerostome with two sharp points. Epimeral setation formula 3-1-3-3; anterior setae short, setae *4a*, *4b* and *3b* longer (up to about 15 µm), seta *4c* strongly enlarged and thick (about 34 µm long), seta *3c* less enlarged and thick (about 23 µm long). Custodium moderately long. Cuticle of epimeres and genital plates granulated. Ano-genital setation as typical for genus (Fig. 5A).

Legs: Tarsi with three claws each. Setation not studied in detail.

Distribution and ecology: In Spain in different mostly dry soils (Ruiz et al. 1991); records in South-West Portugal near Cabo de São Vicente, in rocky coastal area (Gil & Subías 1990). New records in Portugal in a coastal bush-land in the estuary region of Ribeira de Aljezur, about 40 km northern from Cabo de São Vicente.

Remarks

Morphologically, *Oribatella tridactyla* belongs to a group of species (here named the '*berlesei*-group') with small or medium body size, legs with three claws and some more characters in common: (1) body length below 560 µm; (2) in translamellar position with distinct mucro; (3) border of camerostome anterior genal tooth without further incisions, anterior edge with or without lateral teeth. (Bernini (1975, 1977) demonstrated the variability of the edge for *O. berlesei* and other species); (4) genal tooth acuminate, dorsal margin may be rounded; (5) epimeral seta *4c* thick and elongated; (6) epimeral seta *3c* moderately thick and elongated, smaller than *4c*; (7) other epimeral setae of row 3 or 4 also may be elongated in comparison with seta *3a*. Table 1 presents some comparative data; the measurements are taken from published figures and indicate coarsely estimated values, no variability is proven. The chosen members of this group are: *Oribatella berlesei* – after Bernini (1977) and Pérez-Iñigo (1989); *O. berninii* – after original description; *O. inflexa* – after Pérez-Iñigo (1988); *O. similesuperbula* – after original description, and *O. tridactyla*.

For two further species membership in the *berlesei*-group is debatable. *Oribatella tyrrhenica* Bernini, 1975 differs from all other species included in table 1 by the rounded genal tooth, but other characters indicate some similarity. *Oribatella willmanni* Subías & Gil-Martin, 1995 was described provisionally without figures up to now, based on a single specimen from Spain. Especially two characteristics of *O. willmanni*, an enormous large epimeral seta *4c* and a reduced size of the translamellar mucro (see Subías & Gil-Martin 1995), gives reason that the species is distinct from *O. tridactyla* as well as from *O. similesuperbula* (Subías, pers. comm.; cf. comments in Weigmann 2001).

Oribatella tridactyla and *O. similesuperbula* have in common a small body size (length below 400 µm) and a granulated structure of the ventral cuticle and of the genital plates, but the epimeral setation with regard to setae *3c* and *4b* is sufficiently different.

3.3. Galumna paragibbula sp. n.

In the estuary region of Ribeira de Aljezur, five specimens of a small *Galumna* were found in a rocky area, resembling morphologically *G. gibbula* Grandjean, 1956 and *G. tarsipennata* Oudemans, 1914, yet being distinctly smaller in body size. A large population of the latter species was found nearby in a meadow. The new species is discribed below.

Material examined

Holotype: Adult female, sample Po 146; preserved in ethanol, deposited in the collections of the Senckenberg Museum für Naturkunde Görlitz (SMNG). Paratypes: From sample Po 146; one adult male, deposited in SMNG; 3 specimens in the collection of the author. Compared population of *Galumna tarsipennata* from sample Po 148.

Tab. 1 Diagnostic characters of selected *Oribatella* species.

	tridactyla	***similesuperbula***	***berninii***	***berlesei***	***inflexa***	***tyrrhenica***
Body length	360–375 µm	320–380 µm	**408–444 µm**	**475–520 µm**	**480–560 µm**	**470–505 µm**
notogastral setae length	up to 38 µm	up to 35 µm	up to 77 µm	up to 55 µm	up to 72 µm	up to 45 µm
genal dens	antiax. acuminate, axially rounded	antiax. acuminate, axially rounded	antiax. acuminate, axially rounded	antiax. acuminate, axially strait	antiax. acuminate, axially rounded	**rounded**
genital plate G	44 µm long, granulated	39 µm long, granulated ?	55 µm long, striated	40 ? µm long, **striated**	52 µm long, **striated**	? not indicated
epimeral seta 3a	5 µm	6 µm	6 µm	5 µm	8 µm	10 µm
epimeral seta 3b	elongated 13 µm (30% of G)	elongated 20 µm (51% of G)	**thick**, elongated 28 µm (50% of G)	elongated 21 µm (52% of G?)	elongated 30 µm (57% of G)	**elongated 27 µm**
epimeral seta 3c	thick, elongated 23 µm (52% of G)	**less thick**, elongated 20 µm (51% of G)	thick, elongated 30 µm (58% of G)	thick, elongated 31 µm (78% of G?)	thick, elongated 31 µm (61% of G)	thick, elongated 27 µm
epimeral seta 4a	elongated 17 µm (39% of G)	elongated 20 µm (51% of G)	**elongated 32 µm (61% of G)**	**7 µm (18% of G?)**	15 µm (28% of G)	elongated 27 µm
epimeral seta 4b	10 µm (39% of G)	**elongated 20 µm (51% of G)**	**elongated 27 µm (52% of G)**	10 µm (26% of G?)	11 µm (21% of G)	**elongated 19 µm**
epimeral seta 4c	thick, elongated 34 µm (77% of G)	thick, elongated 43 µm (110% of G)	thick, elongated 52 µm (125% of G)	thick, elongated 44 µm (109% of G?)	**thick, elongated 70 µm (135% of G)**	**thick, elongated 72 µm**
distribution	Iberian	Germany	Iberian	Mediterranean	Iberian	Italy

Remarks: bold indication refers to significant difference of characters in comparison with *O. tridactyla* sp. n. – The lengths values of epimeral setae are given in µm (single measures for compared species taken from descriptions cited in the text), additionally the values are standardized in %-values to genital plate lengths. The length values of epimeral setae for *O. berlesei* are questionable, because the genital length as given by Pérez-Iñigo (1989) may be too small.

Diagnosis

Body length about 420 µm, width without pteromorphs about 270 µm. Dorsosejugal suture indistinct in middle; interlamellar seta small, barbed; lamellar seta very small and fine, inserted near lamellar line; sensillus long with slender fusiform head, ciliated. Notogaster with 10 pairs of vestigial setae, four pairs of small roundish porose areas; in both sexes with centro-dorsal pore.

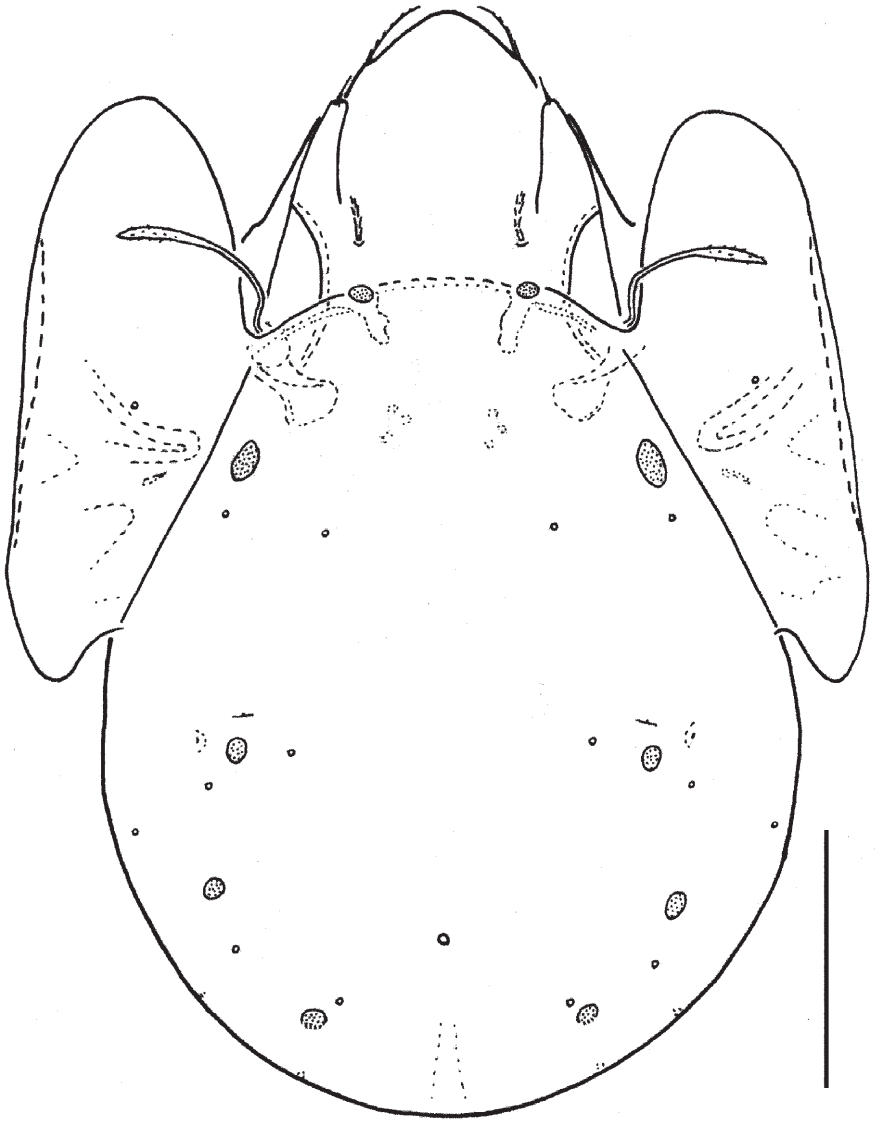

Fig. 6 *Galumna paragibbula* sp. n. Dorsal aspect, legs omitted. Scale bar 100 µm.

Description

General characters: Body length range 395–442 µm; females 428–442 µm (n = 2), males 395–425 µm (n = 3). Body colour reddish brown, cuticle smooth, cerotegument not obviously developed.

Prodorsum: Rostrum rounded, lamellar and sublamellar lines well developed; rostral seta ciliated, short (about 25 µm long), interlamellar seta short (about 35 µm long), lamellar seta near lamellar line, smooth, very short (about 14 µm long), exobothridial seta minute. Sensillus moderately long, with slender fusiform head, ciliated. Genal tooth distinctly developed (Figs 6, 7).

Notogaster: Dorsosejugal suture indistinct in middle between round porose areas *Ad*. With ten pairs of notogaster setae in typical positions, reduced to alveoles; four pairs of porose areas, *Aa* largest (20 µm), A_1 to A_3 roundish and small (diameter about 10 µm); pteromorphs as typical for genus; between porose areas A_2 with centro-dorsal pore in both sexes (Fig. 6).

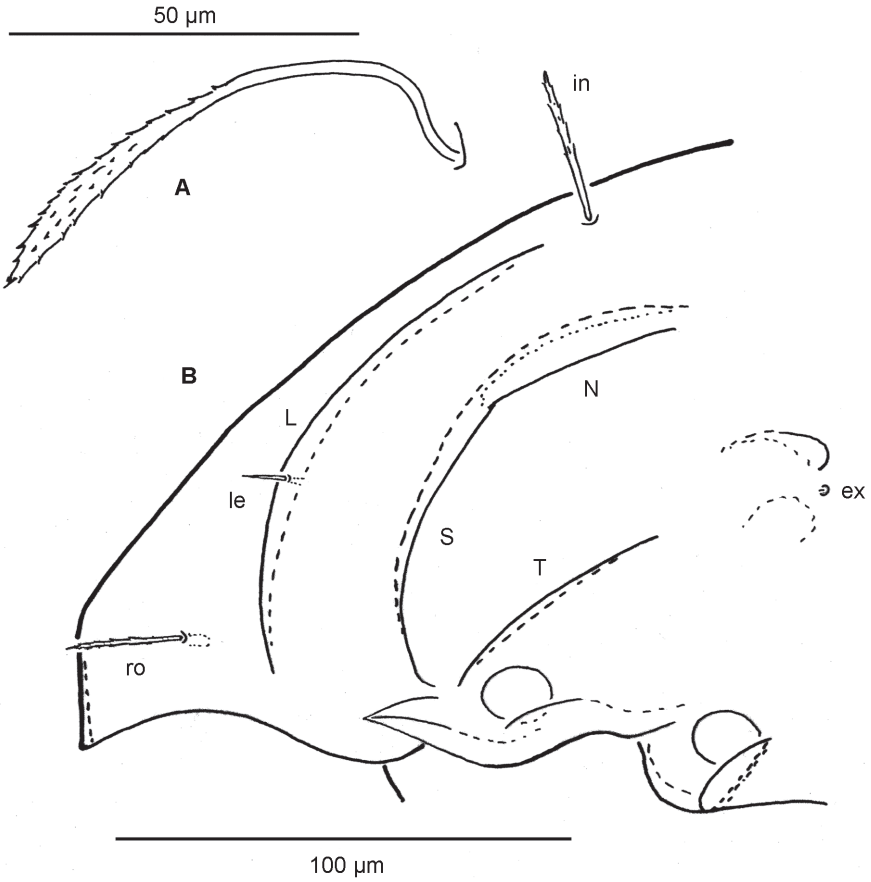

Fig. 7 *Galumna paragibbula* sp. n. **A**: sensillus; **B**: lateral aspect, legs omitted. – Abbreviations: *ro*, *le*, *in*, *ex* – rostral, lamellar, interlamellar, exobothridial seta. *L*, *S*, *N*, *T* – different prodorsal carinas.

Ventral region: Structure and setation as typical for the genus; setae small and smooth, mostly shorter than 10 µm; epimeral setal formula 1-0-2-1 (*4b* and *4c* not observed); slit organ *iad* at the anterior half of the lateral edge of anal plate.

Legs: With tridactylous tarsi; setation not studied in detail.

Distribution and ecology: Found in one sample from a bushy area on a rock near a dune area, South-West Algarve, Portugal.

Remarks

Galumna paragibbula sp. n. is smaller than the related species *G. gibbula* (490–540 µm long: Grandjean 1956; Pérez-Iñigo 1993), occurring in France and Spain, and smaller than *G. tarsipennata*, a wide-spread palearctic species. The length indications for *G. tarsipennata* of authors differ: after Pérez-Iñigo (1993: 78) 530–620 µm; the specimens studied by Pérez-Iñigo (1972: 317) 430–500 µm; calculated from the figure of Travé (1970: 211) about 590 µm. The Portuguese population of *G. tarsipennata* from the neighboring sandy meadow (about 100 m distance from the area with *G. paragibbula* sp. n.) shows the size range 460–500 µm (n = 10).

Galumna paragibbula sp. n. shares with *gibbula* the very short lamellar seta. In *G. tarsipennata* the lamellar seta *le* is not very short with about 27–50 µm length (*le* mostly more than ½ the length of *in*); the interlamellar seta *in* is longer (about 60–70 µm in the compared Portuguese population). The ventral setae in *paragibbula* sp. n. are mostly less than 10 µm, in *G. tarsipennata* up to 15 µm. Contrary to *paragibbula* sp. n., the slit pore *iad* in *tarsipennata* is situated in the posterior half of the lateral edge of the anal plate next to the seta ad_3.

A large posterio-dorsal bulge between the porose areas A_3 in the males is unique in *G. gibbula*; the other two species show no obvious sexual-dimorphism. In dorso-frontal aspect, the rostrum edge is rounded in *G. paragibbula* sp. n. and *G. tarsipennata*, but angled in *G. gibbula*.

3.4. *Eupelops somalicus* (Berlese, 1916)

Pelops curtipilus Berlese var. *somalicus* Berlese, 1916: 55.

Eupelops somalicus: Mahunka 1992: 231; Mahunka & Mahunka-Papp 1995.

Some specimens of *Eupelops* were found in a rocky area of the estuary region of the Ribeira de Aljezur, which could not be identified as one of the species known from the Iberian Peninsula or Central Europe. Looking through further literature, the high similarity with *Eupelops somalicus* (Berlese, 1916) as briefly redescribed by Mahunka (1992) was detected. All specific characters of the Portuguese specimens as described below show no remarkable difference from the Somalian species; therefore the newly found population is proposed to be conspecific.

Material examined

Twenty three adult specimens from samples Po 143 and 144 in the estuary region of Ribeira de Aljezur; preserved in ethanol. Three specimens deposited in the collection of the Senckenberg Museum für Naturkunde Görlitz (SMNG); 20 specimens in the collection of the author.

Diagnosis

Morphological characters as genus-typical (Norton & Behan-Pelletier 1986). Body length about 550 µm, width behind pteromorphs about 430 µm. Interlamellar setae extremely broad, leaf-shaped; interspace between lamellar cusps broad, proximally rounded; sensillus slender claviform. Anterior tectum of notogaster with two lobes; notogastral setae mostly smooth, about 30 µm long, h_1 longer (about 45 µm) and barbed, p_1 and p_2 minute, *lp* and h_3 associated, *lp* distinctly shorter than h_3; four pairs of porose areas of notogaster very small.

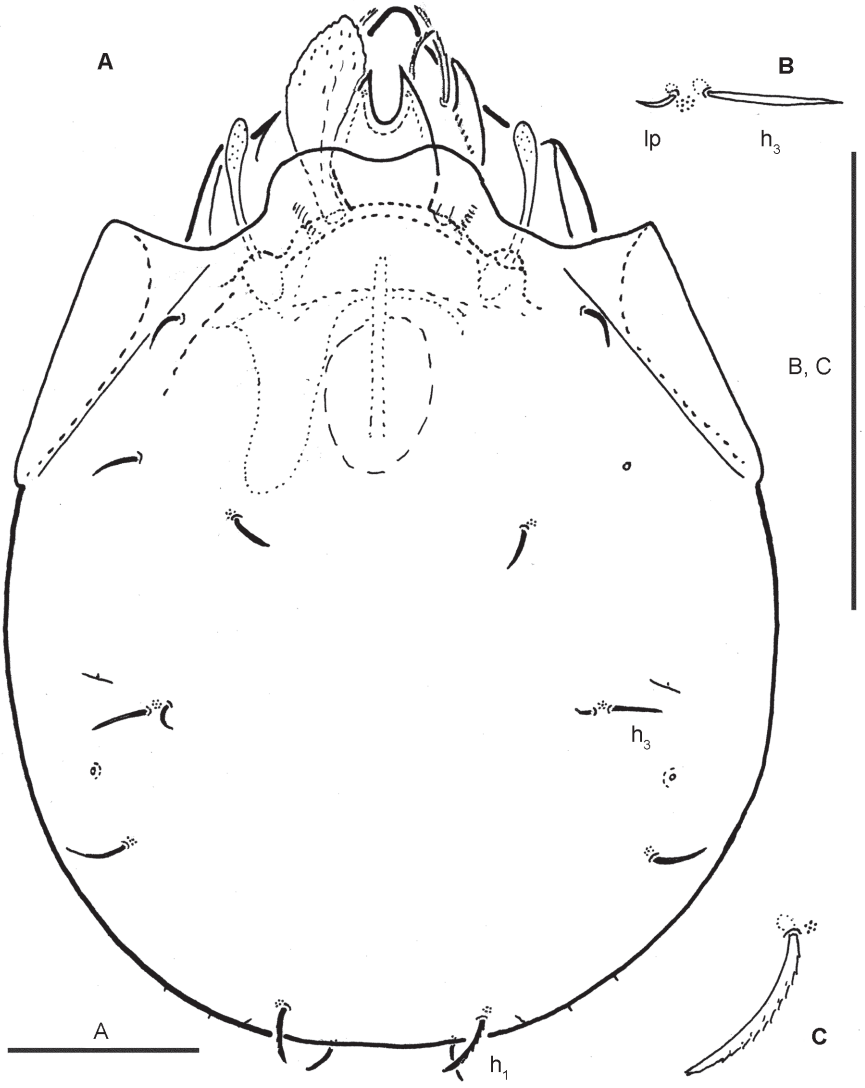

Fig. 8 *Eupelops somalicus*. **A**: dorsal aspect, legs omitted; **B**: associated notogastral setae *lp* and h_3 with porose area A_1; **C**: notogastral seta h_1. Scale bars 100 µm.

Description

General characters: Body length 515–590 µm; females 545–590 µm (mean 569 µm, n = 5), males 515–540 µm (mean 526 µm, n = 5); relation length:width as 1:0.8. Body colour reddish brown, cuticle smooth, cerotegument coarsely granulated in freshly moulted yellow-brown specimens, in older specimens with thin and net-like cerotegument (cf. Fig. 9B) up to thick and blocky cerotegument.

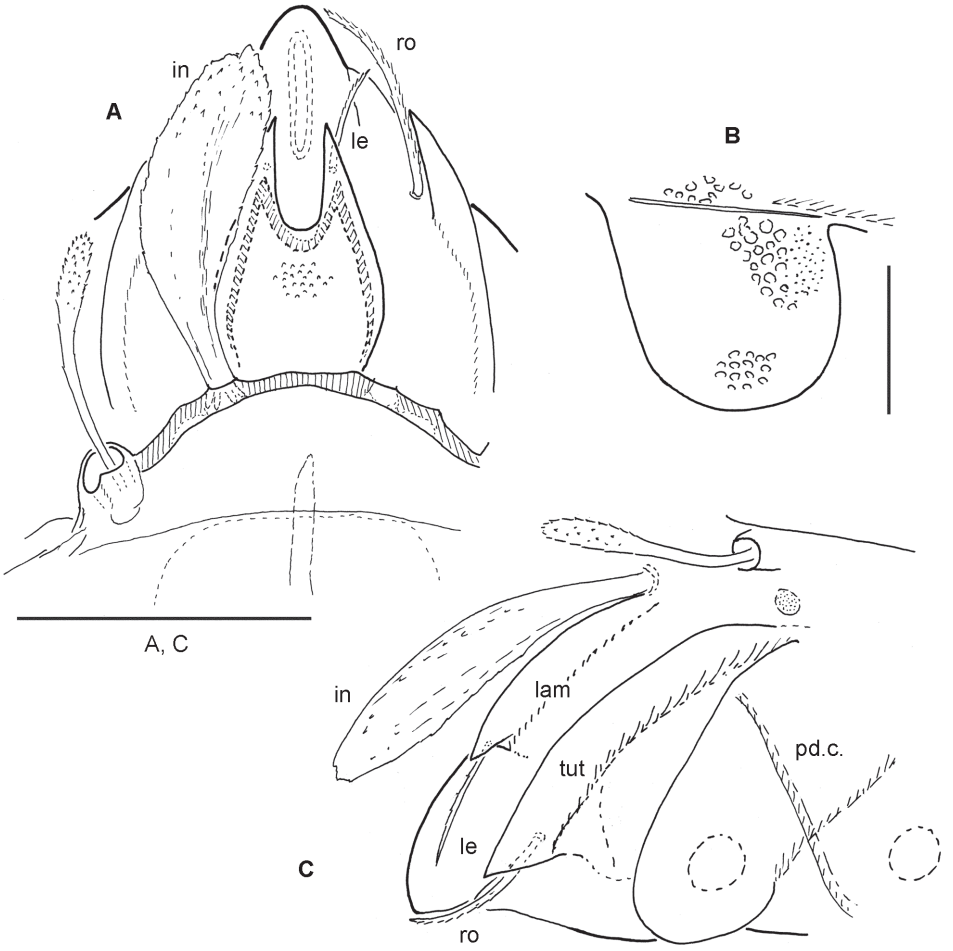

Fig. 9 *Eupelops somalicus*. **A**: prodorsum, notogaster tectum omitted; **B**: left pteromorph with net-like cerotegument; **C**: prodorsum, lateral aspect. – Abbreviations: *ro*, *le*, *in* – rostral, lamellar, interlamellar seta; *lam* – lamella; *tut* – tutorium; *pd.c.* – transversal carina of pedotectum I. Scale bars 100 µm.

Prodorsum: Rostral seta rather long and thick, unilaterally barbed; lamellar seta shorter, sparsely barbed, inserted on the ventral side of lamellar cusp; leaf-shaped interlamellar seta extremely broad (compared with most other species) rostrum protruding in lateral aspect. Lamella with acute cusp of moderate length, with short free part (lateral aspect), interspace between lamellar cusps rounded, proximally broad U-shaped. Sensillus with slender-claviform barbed head. Tutorium moderately broad, with acute cusp (Figs 9A, B).

Notogaster: Anterior tectum of notogaster with two lobes, concave medially, covering posterior part of prodorsum with insertion of interlamellar setae; 10 pairs of notogastral setae strong and setiform, smooth except barbed h_1, mostly about 30 µm long, h_1 longer (about 45 µm), p_1 and p_2 minute; *lp* and h_3 associated, *lp* distinctly shorter than h_3, usually less than the half

length, *lp* about 8–18 µm long, h_3 about 22–30µm. Four pairs of porose areas of notogaster in usual positions, very small, less than 2 µm. Five pairs of lyrifissures as usual (Fig. 8A–C).

Ventral region: Older specimens with coarse cerotegument. Mentum with longitudinal striation. Epimeral formula probably 2-1-3-3, setae very small or vestigial (*1c* not found); ano-genital formula 6-1-2-3, setae very small or vestigial, ad_1 and ad_2 behind level of posterior border of anal plates, ad_3 besides anal plates, well removed from fissure *iad.*

Legs: Tarsi hetero-tridactylous; setation not studied in detail.

Distribution and ecology: This new record in a bushy area on a rock near a dune area in South-West Portugal is the second one besides the original sampling in Somalia (Berlese 1916).

Remarks

The Portuguese population has the same specific characters as described by Mahunka (1992) for the lectotype specimen: U-shaped interspace of lamellar cusps; very large interlamellar setae; anterior tectum of notogaster with two lobes; notogastral seta *lp* distinctly shorter than h_3 (the most specific and diagnostic character); seta h_1 the largest and barbed, other notogastral setae smooth.

The Somalian material may be smaller; Berlese (1916) indicates 480 µm in length, Mahunka (1992) gives no measurements; but this possible size difference is considered insufficient to separate two species. The size-relation of setae *lp* to h_1 seems to be somewhat variable (about 1:2 to 1:3); in the figure 33 (Mahunka 1992) the seta *lp* is straight, in the Portuguese population mostly arcuate (exceptionally straight). Curiously, a different size in *lp* and h_3 can be observed also in *E. variatus* (Mihelčič, 1957) as redescribed by Pérez-Iñigo (1972); but in Spanish species h_3 is remarkably smaller than *lp*, and most notogastral setae are distally broadened; therefore, both species are well differentiated.

3.5. *Lucoppia burrowsi* (Michael, 1990)

During the studies of the oribatid mites in the estuary region of Ribeira de Aljezur, four specimens of *Lucoppia* were found of which the dorsal aspects with very long notogastral setae resemble the figures of *L. burrowsi*, given in the original description (Michael 1890: Algeria). Yet within published redescriptions and figures I found two different 'forms'. The 'first form' shows a broad notogaster with very long setation, e.g. the setae *da*, *dm* and *dp* with about 150 µm lengths are much longer than up to the insertion point and that of the next more posterior respective seta (see Fig. 10A). The second 'form' shows a smaller ovoid notogaster with obviously shorter setae (about 80–100 µm), e.g. the setae *da*, *dm* and *dp* reach at most the insertion point of the next posterior respective seta or are shorter (figured e.g. in Kunst 1971; Pérez-Iñigo 1993; Weigmann 2006).

Further, no helpful description or illustration of the ventral characters is presented in the literature on the species, as far as I know. Hereunder a short redescription is presented, based on the Portuguese specimens and comparative material (origin Hungary) from the collection of Museum für Naturkunde Berlin (MNB). In a discussion on the characters with reference to the literature the taxonomy within the genus is reflected below.

Taxonomical history

Notaspis burrowsii Michael, 1890 (p. 418, plate XXXVII, Figs 1–4).

Oppia lucorum (Koch) sensu Berlese 1892: fasc. 44, 2.

Lucoppia lucorum: Berlese 1908: 8 (type species); Sellnick 1928: 37; Willmann 1931: 135; Balogh 1943: Tab. XI, 1.

Lucoppia burrowsi: Grandjean 1950: 344; Sellnick 1960: 126; Kunst 1971: 573, Fig. 147; Pérez-Iñigo 1987: 218, Fig. 32; Pérez-Iñigo 1993: 220, Fig. 79A; Weigmann 2006: 433, Fig. 232a,b.

Zygoribatula spinosissima Mihelčič, 1956: 158, Fig. 7.

Lucoppia spinosissima: Pérez-Iñigo 1974: 380, Fig. 6. – Junior syn. of *L. burrowsi*: Pérez-Iñigo 1993: 304.

Further synonyms of *L. burrowsi*: in Subías 2004, 2011; Mahunka & Mahunka-Papp 2004.

Material examined

Two females each in samples Po 146 and Po 149 in the estuary region of Ribeira de Aljezur, Portugal; preserved in ethanol, in the collection of the author.

Two adult females and one adult male from Hungary (leg. J. Balogh 1964), deposited in MNB, collection Moritz, vial 270, in ethanol.

Diagnosis

With characters typical for the genus: Lamella and translamella comparatively short and narrow; lamellar seta closer to interlamellar seta than to rostral seta; 14 pairs of notogastral setae; five pairs of genital setae. – Specific characters: Body length 620–780 µm; large to very large notogastral setae (from about 80 to 155 µm); notogastral porose areas oval; notogastral and ventral cuticle smooth, finely shagreened in part.

Redescription

General characters: Body length range after literature 620–780 µm; four females from Portugal 660–780 µm; one male 630 µm; two females 660 µm (studied specimens from Hungary); 660–700 µm after Pérez-Iñigo (1987; from Azores); 620–750 µm after Pérez-Iñigo (1993). Cuticle smooth, colour pale brown.

Prodorsum: Lamella and translamella narrow, without cuspis; all prodorsal setae compact setiform, straight and with granulation; lamellar seta longest, about 175 µm, interlamellar seta about 165 µm, rostral seta about 100 µm, exobothridial seta about 85 µm (Fig. 10A; data from Portuguese specimens). Sensillus with moderately long stalk and fusiform head with some small spines (Fig. 10C).

Notogaster: Long to very long setiform notogastral setae, from about 80 up to 155 µm long, with granulation; seta h_1 shifted from the normal position in Oribatulidae near porose area *A3* to a position medial to h_1. Four pairs of oval porose areas in typical positions, *Aa* the largest (length about 30 µm), *A3* the smallest (about 10 µm) (Fig. 10A).

Ventral region: Epimeral setation formula 3-1-3-3; setae mostly small, *1c*, *3c*, *4c* the largest. Five pairs of small genital setae (exceptionally four pairs); aggenital seta small, anal setae moderately long and fine; adanal seta ad_3 very small, positioned anterior to anal plates, ad_1 and ad_2 enlarged (about 70 µm long) behind anal plates (Fig. 10B).

Legs: Tarsi with three claws each. Setation not studied in detail.

Distribution and ecology: Distributed in the Holarctic and Hawaii, in Europe most common in southern countries. The species is reported from poor and rocky soils in Spain (Subias 1977; Pérez-Iñigo jr. 1990). Now found in a bushy area on a rock and in lichens on dune sand in south-western Portugal.

Remarks

Lucoppia is a species-poor genus (cf. Subías 2011) with three European species up to now: *L. burrowsi* (several synonyms cited in Subías 2004, 2011; Mahunka & Mahunka-Papp 2004) with worldwide distribution. – *L. nicora* Djaparidze & Gomelauri, 1986 from Caucasus is possibly not a *Lucoppia*, the lamellar complex is different and may indicate relation with *Zygoribatula*. – *L. feideri* Subías, 2009 from Romania as nom. nov. for *Romanobates reticulatus* Feider, Vasiliu et Calugar, 1970. *Romanobates*

was considered a junior synonym of *Lucoppia*, as proposed by Subías (2004), which is followed here: lamella and translamella and dorsal setation as in *Lucoppia*; lamellar seta closer to interlamellar seta than to rostral seta; five pairs of genital setae, as mostly also in *L. burrowsi* (rarely 4 pairs: cf. Grandjean 1950). Subías (2009) also proposed the new species name, *L. feideri* Subías, 2009 for *Romanobates reticulatus* (nom. preocc.), because of the junior homonymy with *Lucoppia reticulata* Willmann, 1933 (now regarded as a *Chaunoproctus* species) within the genus *Lucoppia*. *Lucoppia feideri* shares with *L. burrowsi* the general appearance and the anterior position of notogastral seta h_1; the notogastal setae are moderately long (up to 125 µm); diagnostic characters of *L. feideri* are: the distinct cuticular reticulation of the notogaster and obviously longer ventral setae, especially epimeral setae and ad_3.

A further *Lucoppia* species from eastern Africa, *L. ornata* Berlese, 1916, was restudied and figured by Mahunka (1991) who confirmed the genus membership and distinct specific characters (short and globular sensillus, short notogastral setae, posterior position of seta h_1 in contrast to *L. burrowsi*).

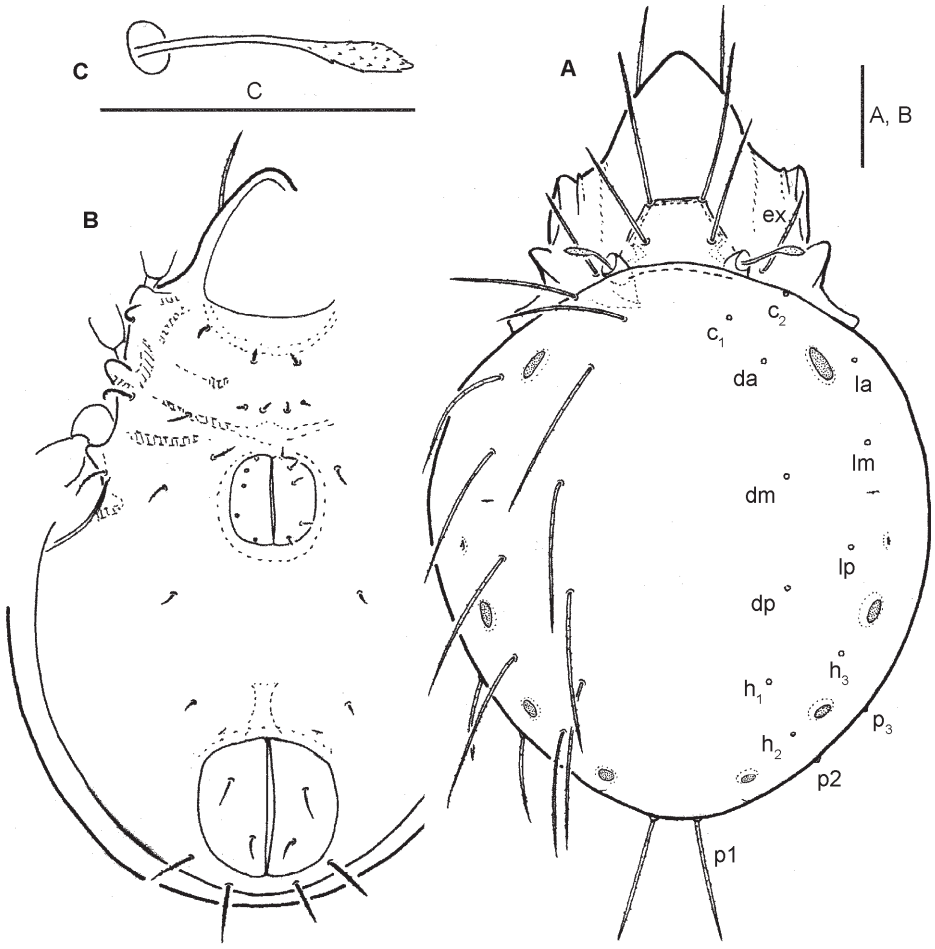

Fig. 10 *Lucoppia burrowsi.* **A**: dorsal aspect, legs omitted; **B**: ventral aspect; **C**: sensillus. – Abbreviations: c_2 - p_1 – notations of notogastral setae; *ex* – exobothridial seta. Scale bars 100 µm.

Descriptions and illustrations of the shape of the notogaster in *L. burrowsi* have been quite variable, from slender to broad ovoid; but similar variation has been noted even within populations of other oribatuid species (e.g. *Phauloppia rauschenensis*, figured in Wunderle et al. 1990). Therefore the shape of the notogaster probably is no useful specific and diagnostic character in Oribatulidae.

Concerning the different length range of notogastral setae in *L. burrowsi*, we have no indication of high variability within single populations which include both of the two 'forms'. Neither there is a biogeographical separation: populations with longer setation are found in Algeria (Michael 1890), Azores Islands (Pérez-Iñigo 1987), Georgia (as synonym *Lucoppia orientalis* Djaparidze, 1985) and in Portugal (this study). Populations with shorter setation are found in Spain (Mihelčič 1956 and Pérez-Iñigo 1974 as *L. spinosissima*; Pérez-Iñigo 1993) and in Hungary (Balogh 1943; this study). Obviously there is no correlation between the notogaster width and the length type of notogastral setae. The comparison of specimens from Portugal with long notogastral setation (about 150 µm length) and specimens from Hungary with short notogastral setation (about 100 µm length) did not reveal further diagnostic characters; the ventral setation is very similar with regard to sizes, lengths and positions, whereas in *L. feideri* the ventral setation differs obviously. There is no convincing reason to declare the two 'forms' of *L. burrowsi* with moderately long versus very long notogastral setation or with slender versus broad ovoid notogaster shapes as different species.

4. Acknowledgements

The author is grateful to his colleagues, Prof. Dr Roy Norton, Syracuse, and Prof. Dr Luis Subías, Madrid, for valuable information and for taxonomical consultations and to the anonymous reviewers for corrections and important comments.

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Accepted 29 June 2011