

A new species of *Scatoglyphus* Berlese (Acariformes: Astigmata: Scatoglyphidae) associated with nests of the fungus growing ants *Acromyrmex lundii* (Guérin-Méneville) (Formicidae: Myrmicinae: Attini)

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Original research

ABSTRACT

Scatoglyphus myrmecophilus **sp. nov.** (Astigmata: Scatoglyphidae), is described based on material collected in ant nests in Buenos Aires city, Argentina, the second species of the genus and family. Juvenile instars are described for the first time in this family. The new species presents some unexpected traits, representing putatively ancestral states of some characters.

Keywords Astigmata; ant nests; Argentina

Zoobank <http://zoobank.org/5583326C-D069-40EC-AFEB-A131BB92CCEA>

Introduction

The mite genus *Scatoglyphus* was established by Berlese in 1913, with *S. polytrematus* as a type species, based on specimens collected in Florence, Italy, in chicken manure. Berlese (1913) included the genus in Astigmata, without referring to any family. Zachvatkin and Volgin (1956 cited in Schatz *et al.* 2011) erected the family Scatoglyphidae to accommodate this genus. Since the mention of this mite by Berlese, the genus was recorded in many habitats and localities from Asia, Europe, North America and north of Africa: chicken manure in USSR (Zachvatkin 1941, cited in OConnor 2009), Egypt (El-Bishlawy 1989; Nasr Eldin 2017), Brazil (Barbosa *et al.* 2013), but also in an owl nest in USA (OConnor 2009); other findings extend their range to firewood, in China (Fang *et al.* 2021), pig (*Sus scrofa domestica*) carcasses in a decomposition study in England (Rai *et al.* 2021), and ant nests in Argentina (Porta and Martínez 2010).

El-Bishlawy (1989) described *Aegyptoglyphus arabicus*, a species very close to *S. polytrematus*. Although, a comparative study of the types of both species is needed in order to establish the relationship between these taxa. As mentioned, there are two records of mites of the family Scatoglyphidae in South America, one in Argentina and one in Brazil. The

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Figure 1 Collecting locality of *Scatoglyphus myrmecophilus* sp. nov., A – general view of the Avellaneda Park with one of the trees, *Ulmus minor*, where the exemplars were collected; B – exterior of the hole where a nest of the ant *Acromyrmex lundii* were located; C – interior of one of the holes containing wood residuals of an ant nest where the new mite species was collected.

finding in Argentina (Porta and Martínez 2010) was made during a sampling in nests of the ant *Acromyrmex lundii* (Guérin) (Hymenoptera: Formicidae) in Buenos Aires city. These ants make their nests in live trees, excavating the trunk and leaving a visible opening in it. In some nests, a rich mite community was found, including many specimens of a new species of the genus *Scatoglyphus*. In this paper we describe *Scatoglyphus myrmecophilus* sp. nov., the second species known for the genus and family, including the first description of immatures instars of these mites.

Methods and Material

Study site

Parque Avellaneda, an urban park in Buenos Aires city, Argentina, 34.64408°S, 58.47963°W (Fig. 1A). Habitat: Nests of fungus growing ant *Acromyrmex lundii* (Guérin-Ménéville, 1838) (Formicidae: Myrmicinae: Attini) located in the base of trunks of *Ulmus minor* Mill. (Ulmaceae) and *Eucalyptus* spp. L'Hér (Myrtaceae). The nests were exposed through wide, natural holes in the trunks (Figs. 1B-C). These holes were up to one meter high and 20 to 30

cm wide. The extraction of material was carried out from two trees. Sampling: Debris material of the external layer was extracted using a garden shovel. Samples, with a volume of around 500 cm³, were carried to the laboratory and specimens were extracted using Berlese funnels, without any source of light or heat, during five days. Collected specimens were preserved in alcohol 70% until their observation.

Observation

Collected specimens were preserved in alcohol 70% until their observation. *Scatoglyphus* specimens were sorted under a stereomicroscope; some specimens were cleared in lactic acid, heated to the flame of a burner, and mounted in excavated slides in the same medium to be observed in light microscopy; others were cleared in the same way, washed in water and mounted in permanent preparations with Heinze PVA as mounting medium. Drawings were made using a drawing tube attached to an Olympus CX31 microscope. For scanning electron microscopy (SEM), specimens were dehydrated using critical point, mounted on individual stubs using adhesive copper tape, sputter-coated with gold–palladium and examined with a FEI XL 30 TMP scanning electron microscope varying at convenience the working distance and the voltage (15–22 kV).

All measurements are in micrometers, in brackets. Setal nomenclature of the body follows OConnor (2009), whereas for leg setation we follow Grandjean (1939).

Systematics

Family Scatoglyphidae Zachvatkin & Volgin, 1956

Genus *Scatoglyphus* Berlese, 1913

Type-species: *Scatoglyphus polytrematus* Berlese, 1913

Scatoglyphus myrmecophilus sp. nov.

Zoobank: 8B9BC06D-8F54-4571-B5C4-A0B979341CE8

Adult female

(N = 6, Figs. 2-4, 6A, 7-15B)

Size, color — Length = 360 (344-373), width = 201 (192-221); whitish in color.

Cuticle soft, with wrinkles, covered with granular cerotegument.

Body setae — Prodorsal setae *in* (mean = 20.5) claviform with coarse and digitiform barbs covering their surface; setae *ex* and *ro* (Figs. 3B-D) cylindrical and elongated (mean = 113.5 and 33, respectively) both barbulated. Prodorsal setae *ex* 6-8 times longer than *in*. Notogastral setae of the same type as setae *in*; setae of epimera III and IV and genital setae short and barbulated with setules only on the antiaxial side; setae on epimeral and anal setae are setiform, without barbs.

Prodorsum — *in* and *ex* setal insertion on cuticular elevations. Prodorsal ridges delimiting a round area anterior of *in*. From this area to the rostrum, there are four symmetric depressions (Fig. 3A, C, D). Seta *ro* inserted in the external margin of the rostrum and directed forward (Fig. 3B). Outline of the prodorsum abruptly narrowed at its middle, delimiting a narrow rostrum (Fig. 3D).

Notogaster — Subrectangular in shape, lateral sides slightly convex and a truncated distal end (Fig. 2), separated from the prodorsum by deep sejugal furrow. Coarse furrows evident, delimiting a central area and an anterior trapezoidal area (Figs. 2, 3A). Ten pairs of notogastral clavate setae present: *c1* (34), *c2* (30.8), *cp* (33.3), *c3* (35), *d1* (45.6), *d2* (42.1), *e1* (45.6), *e2* (41.6), *h1* (55.3) and *h2* (39.8). A pair of colorless, fusiform opisthonotal glands (*gla*) present (Fig. 6A).

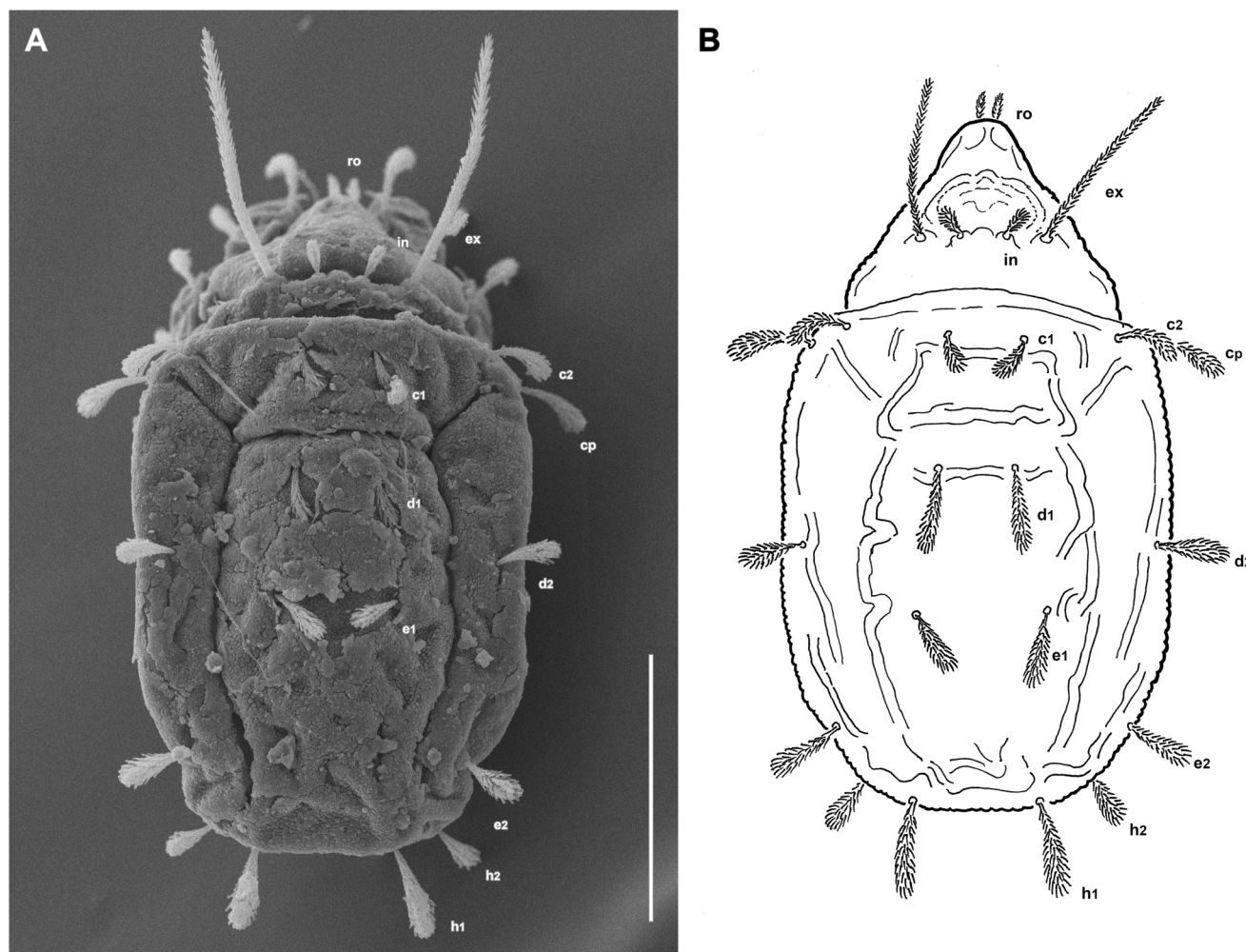


Figure 2 *Scatoglyphus myrmecophilus* sp. nov., female, A – habitus dorsal of paratype (MACN-Ar 42861); B – idiosoma dorsal holotype (MACN-Ar 42858). Scale bars A-B, 100 μ m.

Venter — Apodemes I fused in a Y with distinct sternum; apodemes II not touching medially (Fig. 4B). Other apodemes inconspicuous. Setae *1a* (20-25) thin, setiform; setae *3a*, *4a* and *4b*, small (19), petiolated and barbed. Egg-laying opening in inverted U, covered by a single flap that has a medial keel in basal two thirds (Figs. 4A, 7A). This flap is joined to the ventral wall by its inferior border, opening out and down. Pseudovipositor (terminal portion of reproductive tract) plicated and attached to the internal border of the genital flap. Genital papillae long and narrow, subdivided in a long shaft and a small, spherical head. Egg-laying opening flanked by one pair of adgenital setae (*g*), barbed (15) (Fig. 7). Anal aperture close to the egg-laying opening, covered by paired flaps and surrounded by six pairs of thin, setiform setae (19-28), as long as the distance between its posterior margin and the opening of spermathecal pore. Copulatory opening in a strongly sclerotized tube, directed backwards (Figs. 4-6), with a pair of barbed setae (*p*) flanking it. Copulatory opening and setae *p* located in a quadrangular area outlined by wrinkles. Setae *h3* observable in posterior portion of the ventral surface.

Gnathosoma — ventral surface smooth, with mentum, genae, pseudorutella and lips indistinctly fused (Fig. 8C). Setae *m* 24 long. Pseudorutellae narrow; between them, fused lips appear as a small bell-shaped protrusion (Fig. 8C). Palps simple, their articulation with infracapitulum flexible; with a keel emerging ventrally at the level of this joint (Figs. 8A-B).

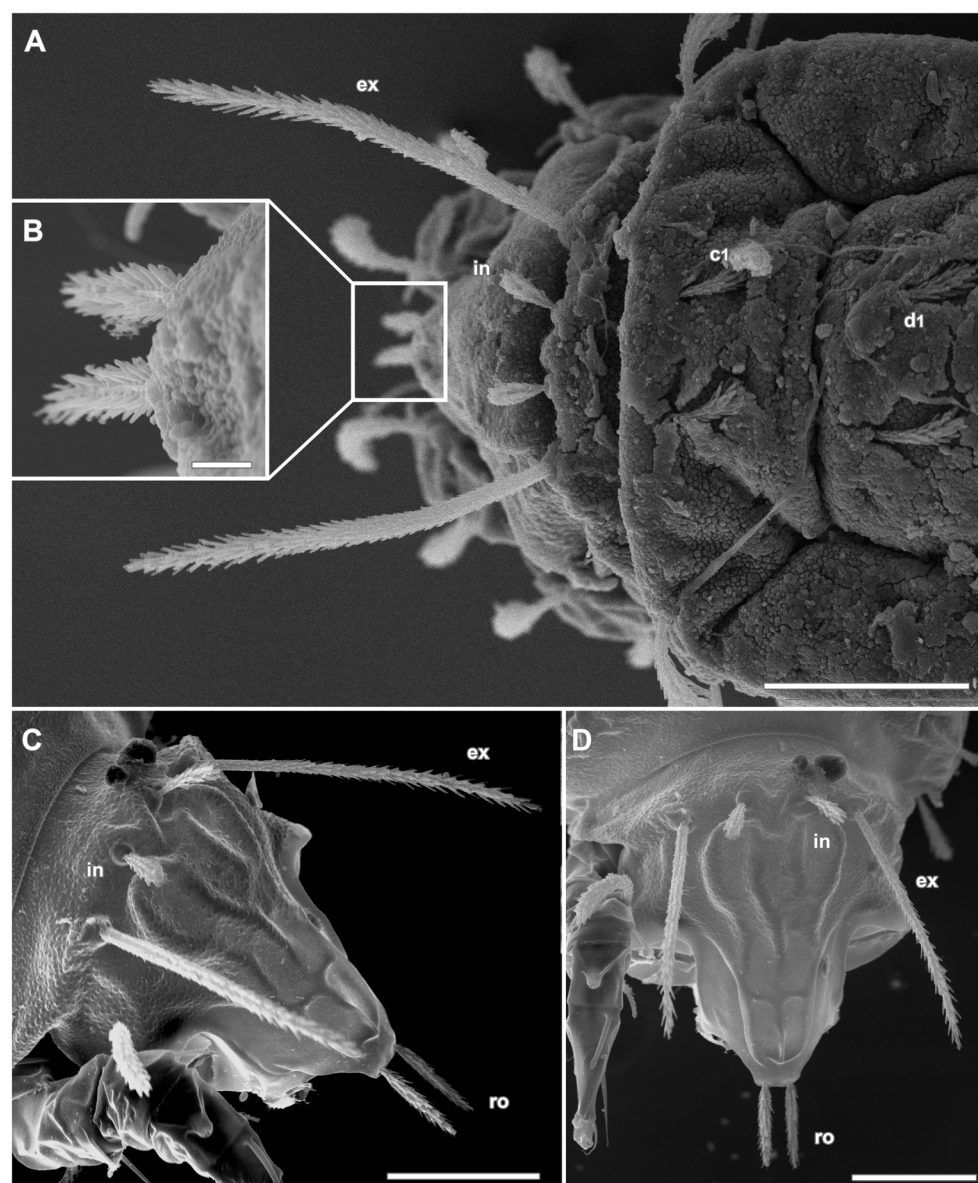


Figure 3 *Scatoglyphus myrmecophilus* sp. nov. Prodorsum, A – dorsal view of paratype (MACN-Ar 42861); B – same, detail of the setae *ro*; C – lateral view of paratype (MACN-Ar 42862); D – frontal view, same exemplar as B. Scale bars A, 50 μ m; B, 5 μ m; C-D 50 μ m.

Basal segment of palp with two setae, distal with one dorsal seta, solenidion ω and two eupathidia are observable, as tiny papillae, in its distal end (Figs. 8A-B). Supracoxal spine (*e*) 8 long (Fig. 8A). Grandjean's organ branched, 50 long (Figs. 8A, C). Chelicerae chelate dentate.

Legs — (Figs. 9-15B) – Strongly sclerotized. Thick cuticle with two kinds of cuticular extrusions: slim keels and heavy folds. Keels are located in the dorsal side of tarsi I, III and IV, folds are restricted to lateral sides of tibiae and tarsi. Solenidion σ of genu I (100-111) inserted at the distal end of a fold (Fig. 10B). Solenidia of the other genera shorter than I (GeII = 83-92, GeIII = 30, GeIV = 15).

Legs setae – Setae *p*, *q*, *u* and *v* leaf-shaped, striated and parallel to the surface of the segment. Setae *s* and spiniform, striated and projected. Remaining setae setiform and either smooth or more or less barbed; setae *w* and *r* of tarsus IV (Figs. 13B, 15) setiform and smooth.

Legs chaetotaxy – (from trochanters to tarsi, from leg I to IV): (1-1-2-2-14) (0-1-2-2-11)

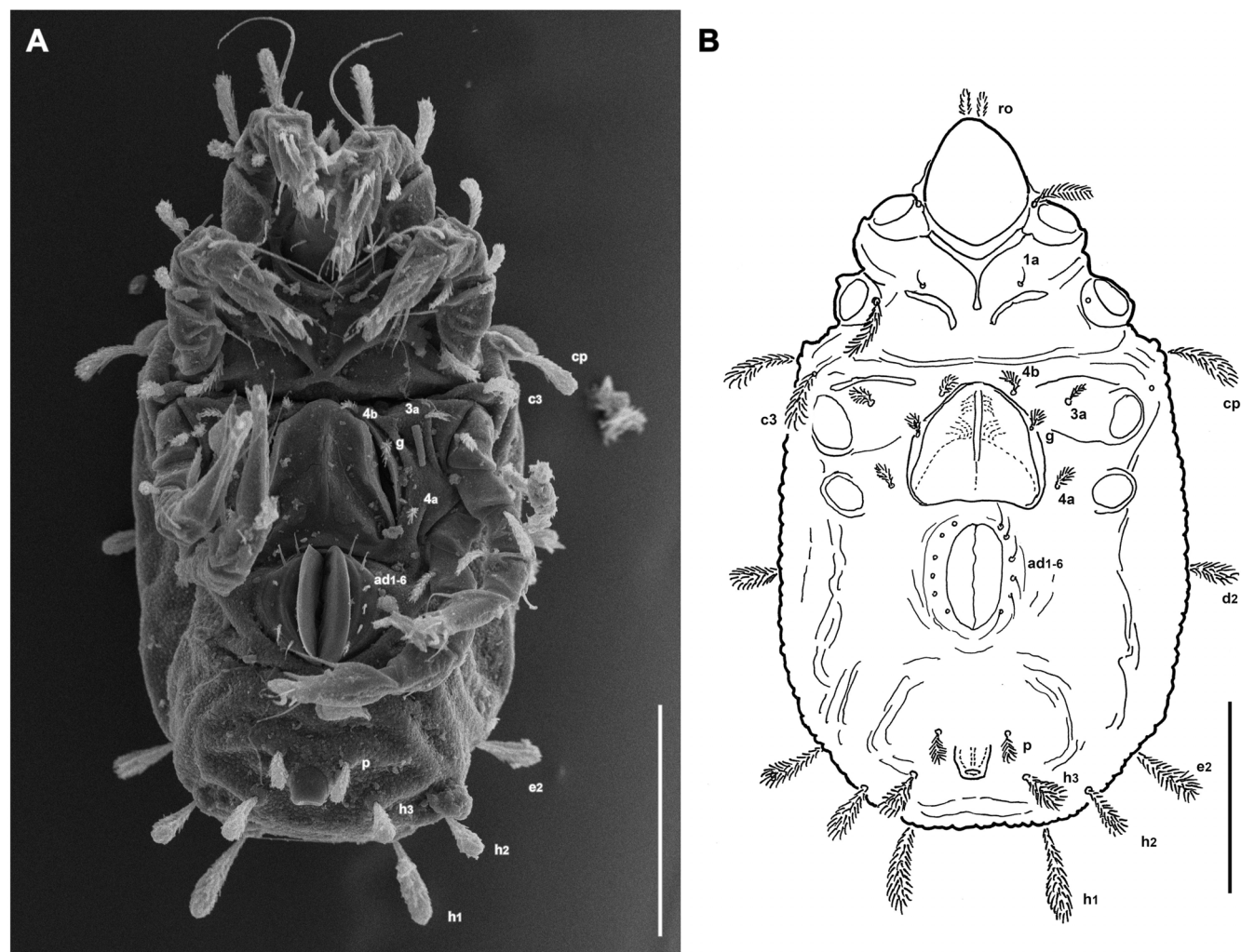


Figure 4 *Scatoglyphus myrmecophilus* sp. nov., female, A – habitus ventral of paratype (MACN-Ar 42861); B – idiosoma ventral holotype (MACN-Ar 42858). Scale bars A-B, 100 μm.

(1-0-1-1-10) (0-1-0-1-10).

Legs solenidiotaxy – (from genua to tarsi, from leg I to IV): (1-1-3) (1-1-1) (0-1-0) (0-1-0).

Adult male

(N = 2, Figs. 5, 6B, 15)

Size, color — Length = 333 (319-346), width = 183 (162-204); whitish in color.

Prodorsum and notogaster: as in the female.

Venter — (Fig. 5) – Epimeral region as in female. Genital aperture in an inverted V, covered with a single, triangular valve; genital apparatus extrusible, with a complicated frame, including sclerites and thin, curved, aedeagus (Figs. 5, 6B; arrow). One pair of barbed genital setae *g* present. Anal opening surrounded by four pairs of setiform setae (19) and close to genital one. Setae *p* and *h3* short and barbed, inserted in roughly rectangular area posterior to anal aperture.

Legs — Similar to female, except tarsus IV (Fig. 15C-E) with setae *e* and *d* modified as suckers.

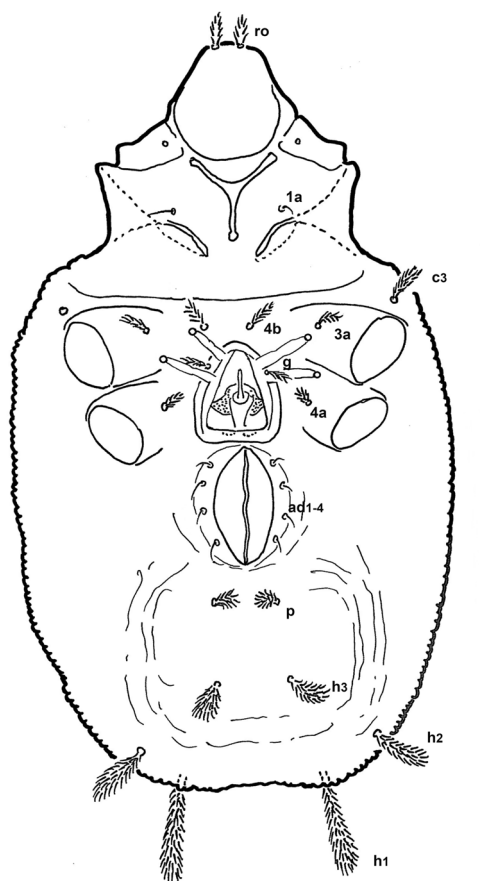


Figure 5 *Scatoglyphus myrmecophilus* sp. nov., idiosoma ventral, male paratype (MACN-Ar 42859). Scale bar 100 μ m.

Larva

(N = 3, Figs. 16A-B, D)

Length = 151 (131-173), width = 91 (88.5-102). Setae *ex* (30.6), *in* (9.7) and *ro* (17.7) barbed. Body segments C-F could be inferred from transversal humps and dorsal setal pairs (*c1*, *c2*, *cp*, *c3*, *d1*, *d2* and *e1*). Setae *e2* and *h1* inserted on two pairs of tubercles directed backwards.

The Claparède organ shaped as a long (15 long) and narrow tube, ending in a small ball. One pair of setiform setae on paraproctal segment (pseudanal).

Leg chaetotaxy: as in adults, except for the lack of setae *pR* in trochanters I and II, and setae *sR* in trochanters III.

Dehiscence line transdehiscent observable in one specimen.

Protonymph

(N = 2, Fig. 16C)

Length = 230 (219-240), width = 124 (115-133).

General aspect as adults. Setae *ex*, *in* and *ro* barbed, their lengths 72.6, 12.1 and 20.2, respectively. Notogaster with nine pairs of setae. One pair of short, setiform adgenital setae. Four pairs of setiform adanal setae. Legs, although not so sclerotized as in adults, show dorsal keels in tarsi III and IV. Leg chaetotaxy as in adults, except for the lack of setae in trochanters and for reduced setation of leg IV (0-0-0-0-7); setae *s*, *e* and *f* lacking.

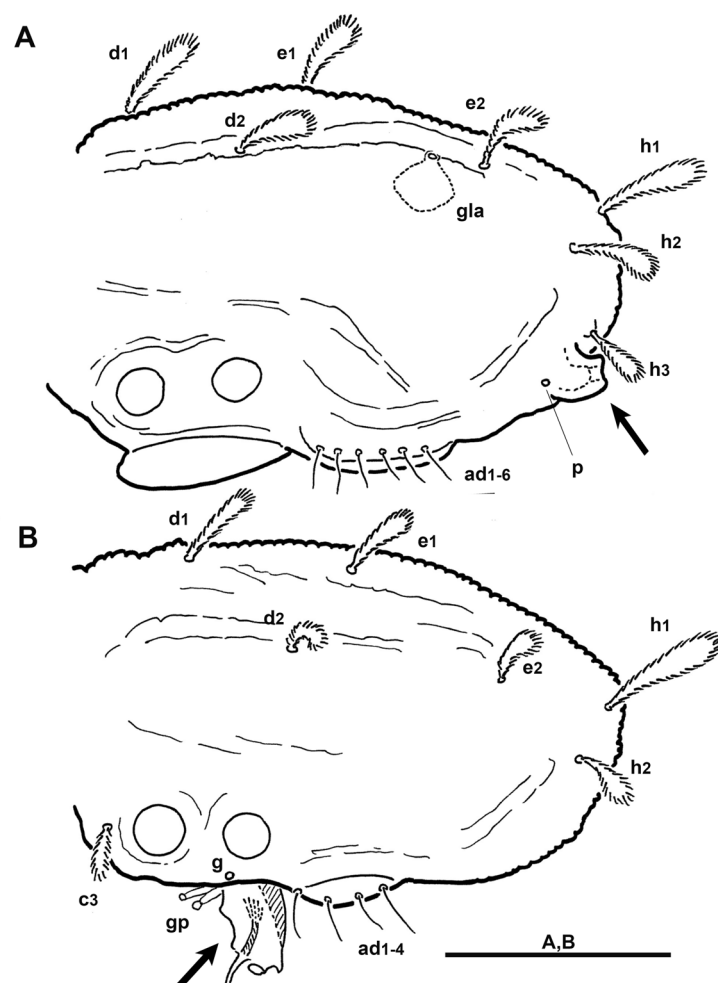


Figure 6 *Scatoglyphus myrmecophilus* sp. nov., lateral view of the posterior portion of the idiosoma, A – female holotype (MACN-Ar 42858), B – male paratype (MACN-Ar 42859), *h3* and *p* omitted. Abbreviations: *gla*, latero-abdominal gland; *gp*, genital papillae. Scale bar A-B 100 μ m.

Deutonymph

Unknown

Tritonymph

(N = 3, Fig. 16E)

Length = 278 (269-283), width = 147 (140-150).

General aspect as adults. Notogaster with nine pairs of setae. One pair of short, setiform adgenital setae. Adanal setation is open to two interpretations. Hypothesis 1 considers four pairs of adanal setae surrounding anal opening, as in the protonymph, but the pair *ad1* change from setiform in N1 to barbed in N3 (Fig. 16E, abbreviations in brackets). Hypothesis 2 considers a reduction of adanal setae from 4 in N1 to 3 in N3. So, barbed setae distal to *ad1* are *p*; besides that, pair *h3* is added ventrally. Leg chaetotaxy as in adults.

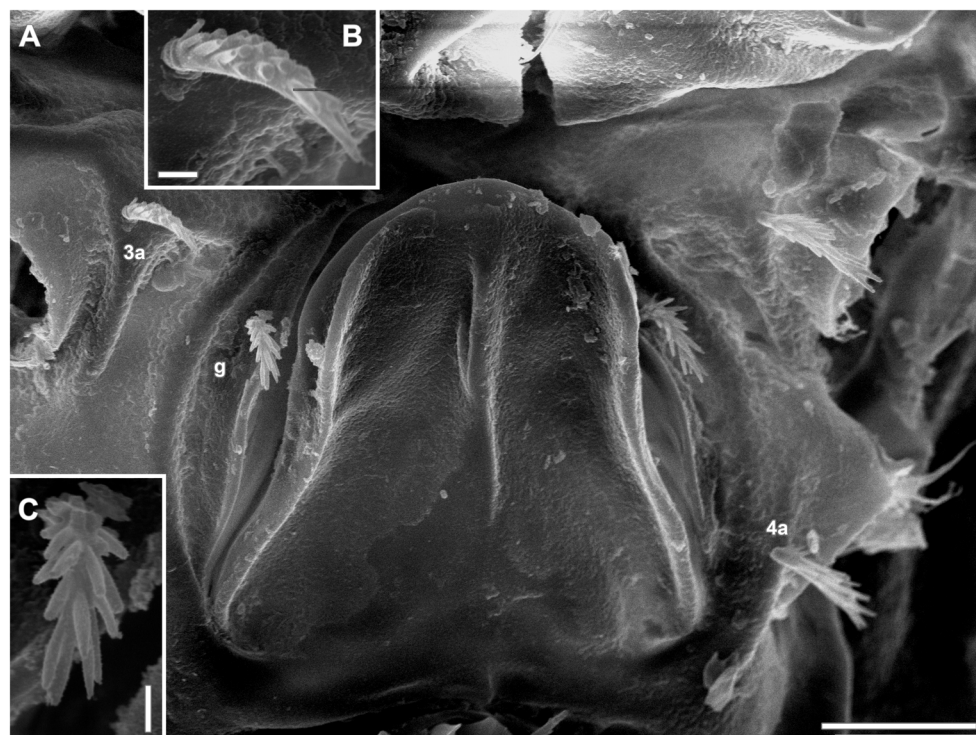


Figure 7 *Scatoglyphus myrmecophilus* sp. nov., A – female genital region, paratype (MACN-Ar 42862), 3b setae missing; B – same, detail of the 3a seta; C – same, detail of the g seta. Scale bars A, 20 µm; B–C, 2 µm.

Variations

Common setal pattern in the prodorsum includes pairs *ex*, *in* and *le*, since the larvae. However, in some cases, vestiges of pair *le* (*ve*) could be observed in front of *in* setae, as a tiny pore and a vestigial seta; even, in a male, a complete seta with alveolus was observed in one side of the prodorsum.

Material examined

Holotype (MACN-Ar 42858), female; Argentina: Buenos Aires city: Parque Avellaneda, 34.64408°S, 58.47963°W; 15.Mar.2022; A.O. Porta leg.; collected using Berlese funnels in nets of *Acromyrmex lundii* in trunks of *Ulmus minor*, preserved in alcohol; paratype (MACN-Ar 42859), male, same data as holotype, preserved in alcohol; 1 tube with 10 paratypes (MACN-Ar 42860), 6 females and 4 males, same data as holotype, preserved in alcohol; 15 paratypes (MACN-Ar 42861), adults, in stubs for SEM, same as holotype, 30.Nov.2021; 10 paratypes (MACN-Ar 42862), adults, in stubs for SEM, same as holotype, May.2009, in nest of *Acromyrmex lundii* in trunks of *Eucalyptus* sp.; four paratypes female, two larvae, one larval skin, one protonymph, three tritonymphs, same data as holotype, in definitive preparations in Heinze PVA medium, in the main author collection.

Etymology

The specific name comes from Greek “myrmeco-” (ant) and “-philus” (beloved), refers to this species living in ant nests

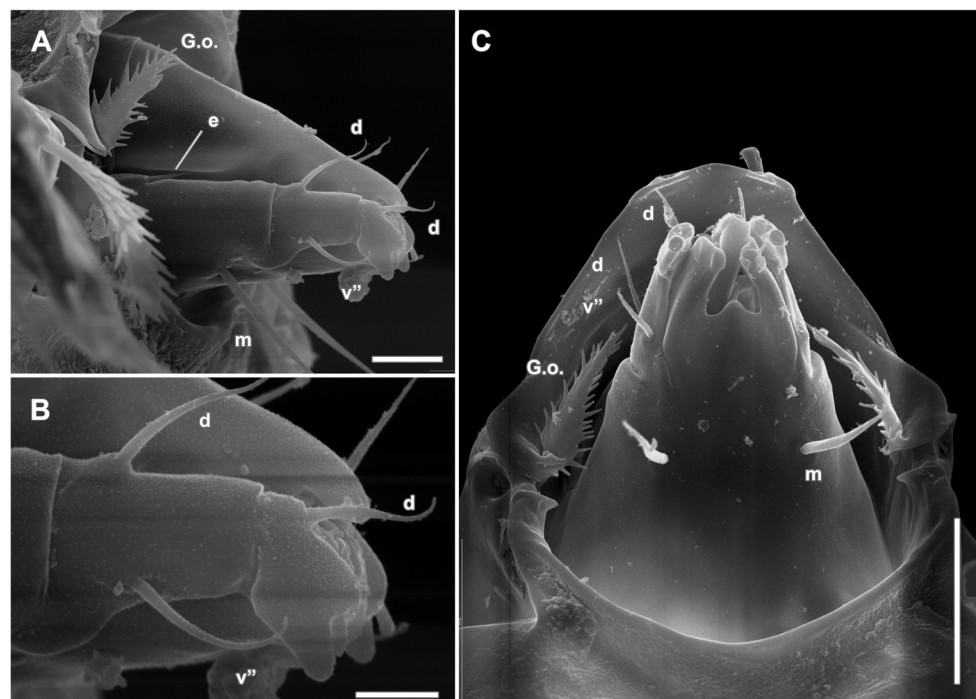


Figure 8 *Scatoglyphus myrmecophilus* sp. nov., A – antiaxial view of the gnathosoma, female paratype (MACN-Ar 42862); B – antiaxial view of the right palp; C – gnathosoma ventral view, female paratype (MACN-Ar 42862). Abbreviations: G.o., Grandjean's organ; e, supracoxal seta, Scale bars A, 10 μ m; B, 5 μ m; C, 20 μ m.

Remarks

Adults of *Scatoglyphus myrmecophilus* sp. nov. are distinguishable from those of *S. polytrematus* Berlese in the following characters: ratio between the lengths of setae *ex* and *in* 6-8, versus less than 4 in *S. polytrematus* (see OConnor 2009, Fig. 16.27C); hysterosomal dorsal ridges evident (Fig. 2), versus not evident in *S. polytrematus*; setae *3a* petiolated and barbed (Figs. 3B-5), versus setiform and smooth in *S. polytrematus* (see OConnor 2009, Figs. 16.27C-D); female genital flap in inverted U (Figs. 4, 7) versus in inverted V in *S. polytrematus*; female with pore directed backwards (Figs. 4A, 6A); setae *w* and *r* of tarsus IV (Figs. 13B, 15A-B) setiform and smooth versus petiolate and barbed in *S. polytrematus* (see OConnor 2009, Fig. 16.27C-D).

Discussion

Morphology

Prodorsal setation

Variations of prodorsal setation mentioned above are indicative of a process of setal instability in the phylogenetic time. This kind of variation was called *vertition* by Grandjean (1952) who considered it a manifestation in the ontogeny of an orthogenetic process of fixation or disappearance of a character state. The position of the vestigial pair *le* is also remarkable. This pair, named *ve* in classical astigmatan nomenclature, is usually placed lateral and posteriorly to *vi* (*ro*). In *S. myrmecophilus* sp. nov. vestigial setae have a typical "oribatid" position, i.e. in the central area of the prodorsum. Considering the accepted hypothesis of the origin of Astigmata from Oribatida (Zachvatkin 1953, cited by Norton 1998; OConnor 1984), more

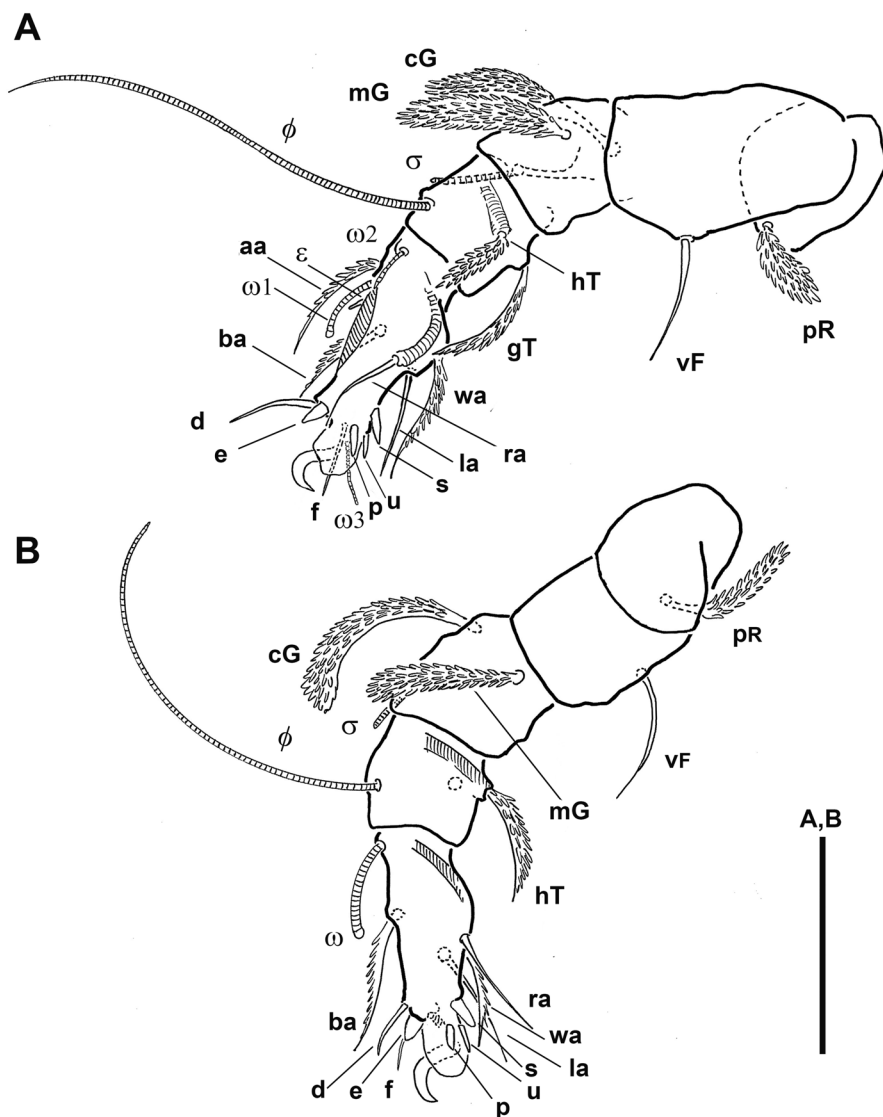


Figure 9 *Scatoglyphus myrmecophilus* sp. nov., female paratype (UNMP-A0012) A – antiaxial of the left leg I; B – antiaxial of the left leg II. Scale bars, A-B, 50 μ m.

specifically from a nothroid group (Griffiths *et al.* 1990; Norton 1994, 1998), these vestigial setae positioned in the middle of prodorsum can be taken as another supporting evidence of that origin. In the actual evolutionary time, these setae are regressive, but we can hypothesize that they were fully developed in that position in the past, as occur in nothroid taxa.

Ventral development

The ontogenetic development of the caudal region of *S. myrmecophilus* could be resumed as follows: the larva (Fig. 16B) presents a pair of pseudanal setae, *p*, in the paraproctal segment (PS); in the protonymph (Fig. 16C), an adanal segment (AD), with four pairs of setae is added; then, no paraproctal segments are added. As discussed above, adanal setation in tritonymphs could be interpreted in two ways: 1) the four pairs surrounding anal opening (three setiform and one barbed) are all adanal, and the barbed pair between them and *h2* are setae *p* or 2) the three setiform pairs around anal opening are adanal (one pair less than in protonymphs), barbed,

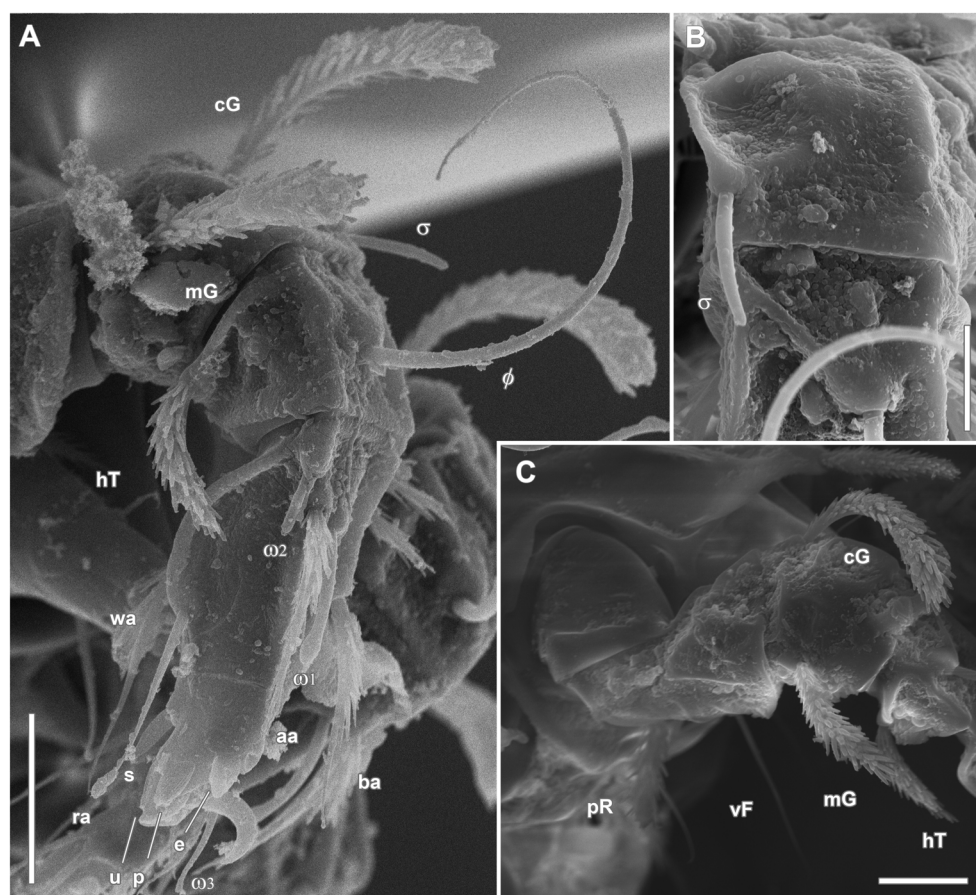


Figure 10 *Scatoglyphus myrmecophilus* sp. nov., Leg I, A – antiaxial of the right leg I, female paratype (MACN-Ar 42861), from genu to tarsus; B – dorsal view of the genu showing the σ solenidium, left leg I of male paratype (MACN-Ar 42861); C – antiaxial of the right leg I, female paratype (MACN-Ar 42861), from trochanter to genu. Scale bars, A, 20 μ m; B, 10 μ m; C, 20 μ m.

distal pair is *p*, and the barbed pair between them and *h2* is *h3*, added in that instar. From a second interpretation, one adanal pair is added in males and three pairs are added in females, in a case of polytrichosis. In light microscope observations, a pair of supposed lips, internal to the adanal segment, can be seen in nymphs and adults. One explanation is that internal lips are actually the last portion of the digestive tract. In other words, the anamorphosis process stops in the adanal segment. According to Griffiths *et al.* (1990) “[in Astigmata] there is no evidence that segment AN ever forms and it is doubtful that it does”. Another possibility, supported by Norton’s (1990) assertions regarding Astigmata, is that such pair of apparent lips, represent a regressive anal segment, that have lost its setae and lyrifissures, as well as any sclerotization.

In the development of anal region, there are also changes in setal morphology. Whereas pseudanal setae *p* in larva are thin and smooth, they are barbed in the subsequent instars. The presence of a pair of setae in paraproctal segment of the larva (PS) is very unusual in Astigmata.

Legs chaetotaxy and solenidiotaxy

Leg setae formulae of *S. myrmecophilus* sp. nov. corresponds to the common condition in Astigmata (Grandjean, 1939). With respect to the solenidiotaxy, *S. myrmecophilus* sp. nov. presents some differences with respect to the normal condition: the new species present only one solenidium in genu I and none in genu III. This condition was also recorded by Grandjean (1939) in other Astigmata (e.g. *Chortoglyphus*), and were considered as a deficiency (*déficience*) by

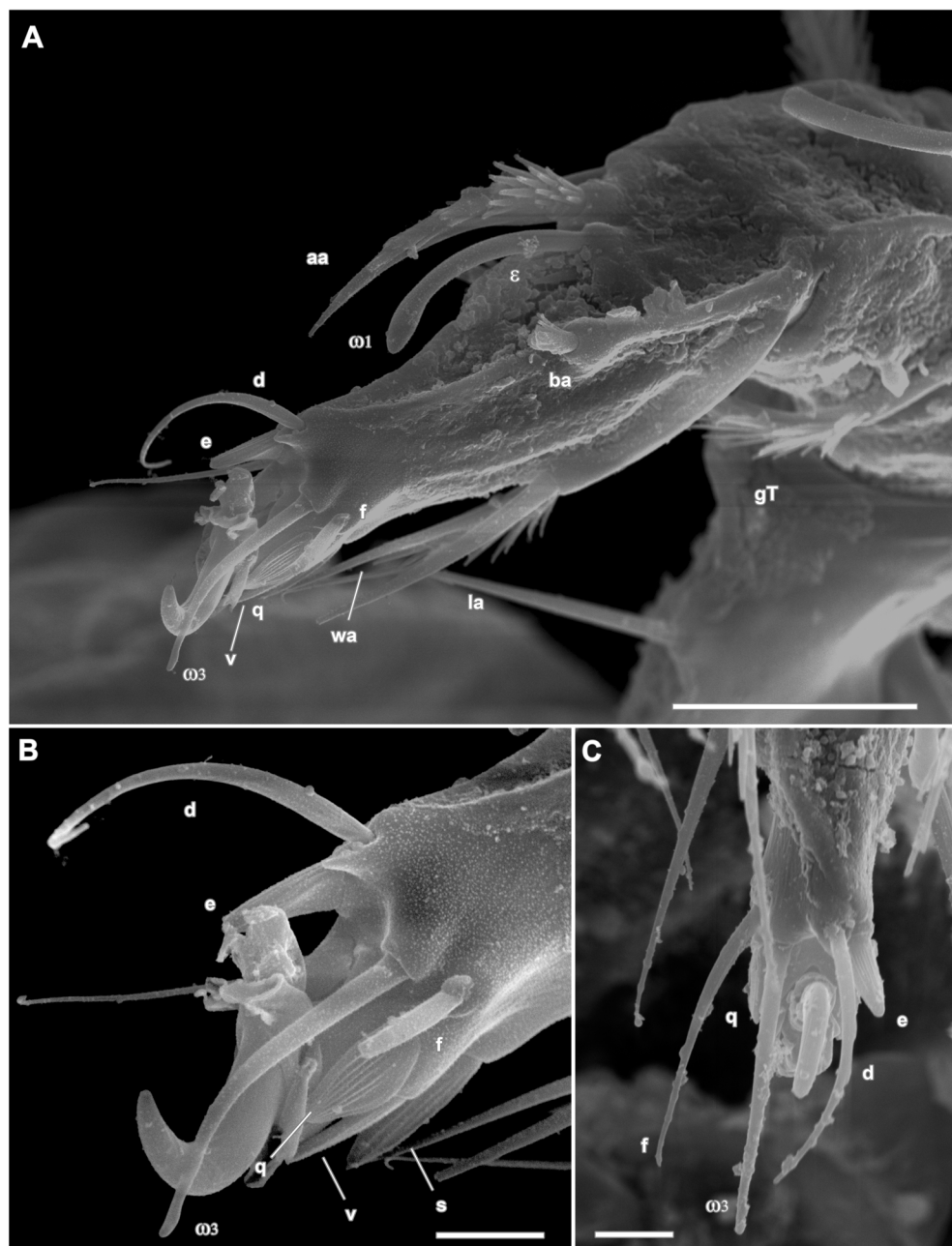


Figure 11 *Scatoglyphus myrmecophilus* sp. nov., A – paraxial view of the tarsus of left leg I, female paratype (MACN-Ar 42862), claw rotated 180°, B – same, detail of the distal portion, seta *f* broken; C – dorsal view of the distal portion of the tarsus of left leg I, male paratype (MACN-Ar 42861) Scale bars A. 20 μ m; B-C 5 μ m.

him.

The presence of a famulus on tarsi II is another astonishing finding (Fig. 12D-E). This condition was only cited from Palaeosomata (Grandjean 1957; Norton 1977), the most basal group of Oribatida (Grandjean 1953). To find it in a highly derivative group as Astigmata is unexplained. Their presence is not constant, as said above. It was observed only in one tarsus of one specimen, observed in scanning electron microscope. Unlike the case of lamellar setae, the occurrence of a vertition, presence of famulus in tarsi II could be interpreted as a mutation (sensu Grandjean 1952). This phenomenon, studied in oribatids by Grandjean, has no pattern,

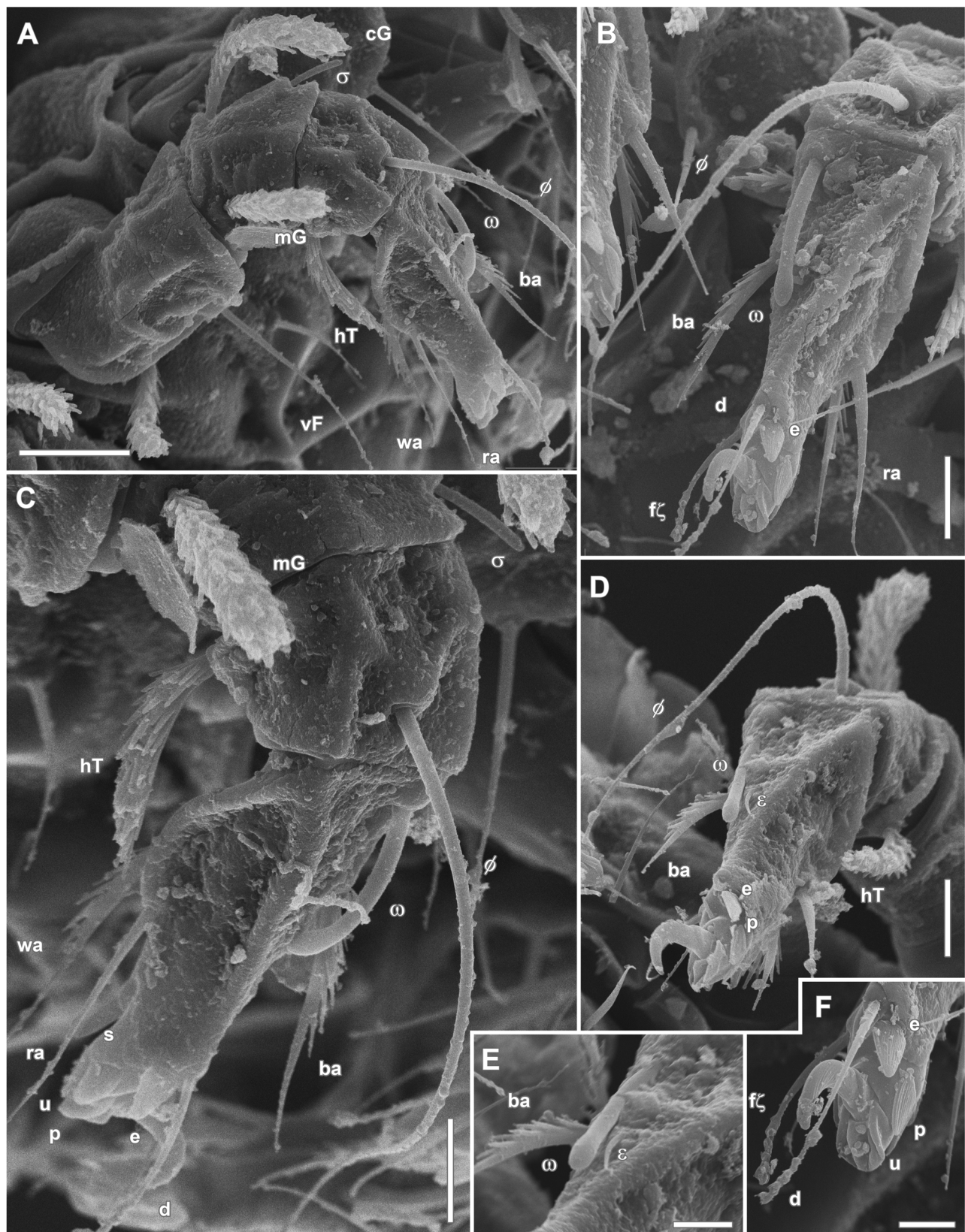


Figure 12 *Scatoglyphus myrmecophilus* sp. nov., Leg II, A – antiaxial of the right leg II, female paratype (MACN-Ar 42861), from genu to tarsus; B – dorsal view of tarsus and tibia of the left leg II of the female paratype (MACN-Ar 42861), from tibia to tarsus; D – dorsal view of tarsus and tibia of the presenting a famulus ϵ paratype female (MACN-Ar 42861); E – same detail of the cluster solenidium-famulus in leg II; F – same as D, detail of the distal portion. Scale bars, A-D, 10 μ m; E-F, 5 μ m.

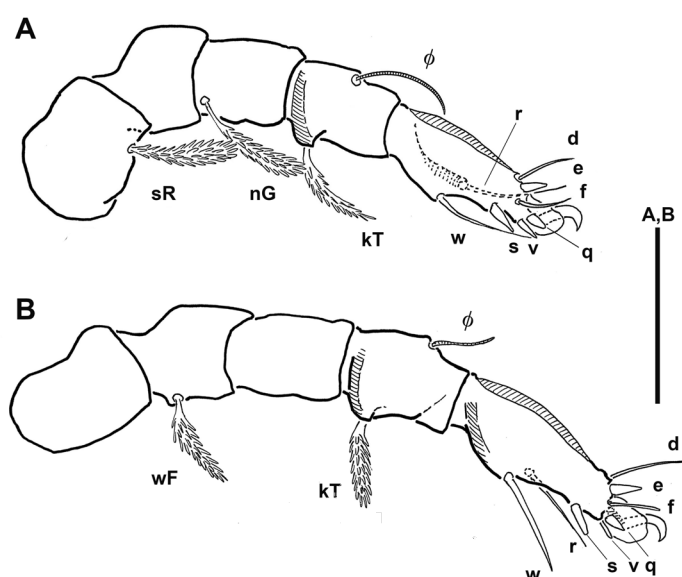


Figure 13 *Scatoglyphus myrmecophilus* sp. nov., female paratype (UNMP-A0012) A – antiaxial of the left leg III; B – antiaxial of the left leg IV. Scale bars, A-B, 50 μ m.

it can simply mean the random reappearance of a long-vanished character. Although we do not have a clear explanation, one thing is evident: *S. myrmecophilus* sp. nov. is a mosaic of modern and ancestral traits. And this ancestry goes back not only to its most recent possible relatives but to the very roots of the Acariformes.

Life cycle

The samples, taken at different times of the year, were always dominated by adults, in a ratio of 4 to 1 with respect to immatures. The sex ratio was nearly 1:1. Deutonymphs were not collected. Is this stage absent in the life cycle? Taking into consideration the stability of the nest, with conditions of humidity and temperature regulated by the ants, one possibility is that a phoretic stage, ready to disperse to new habitats, would not be an evolutive advantage. However, heteromorphic deutonymphs stages are present in some astigmatans associated with hymenopters that presumably have stable levels of humidity and temperature in their nest (e.g., for bees, Okabe and Makino 2002; Klimov *et al.* 2007; for ants, Sokolov *et al.* 2003; Campbell *et al.* 2013). A second possibility is that production of phoretic deutonymphs is restricted to the short period of time when some members of the ant colony migrate to establish new nests.

The phylogenetic relationships of *Scatoglyphus* are also inconclusive to support the absence of deutonymphs. According to Fang *et al.* (2021), who studied the mitochondrial genome of *S. polytrematus*, scatoglyphids are related to species of Acaridae of the genera *Rhizoglyphus*, *Caloglyphus*, *Aleuroglyphus* and *Tyrophagus*. Of these taxa, the first two genera have deutonymphs, while all species of *Aleuroglyphus* and most of *Tyrophagus* do not.

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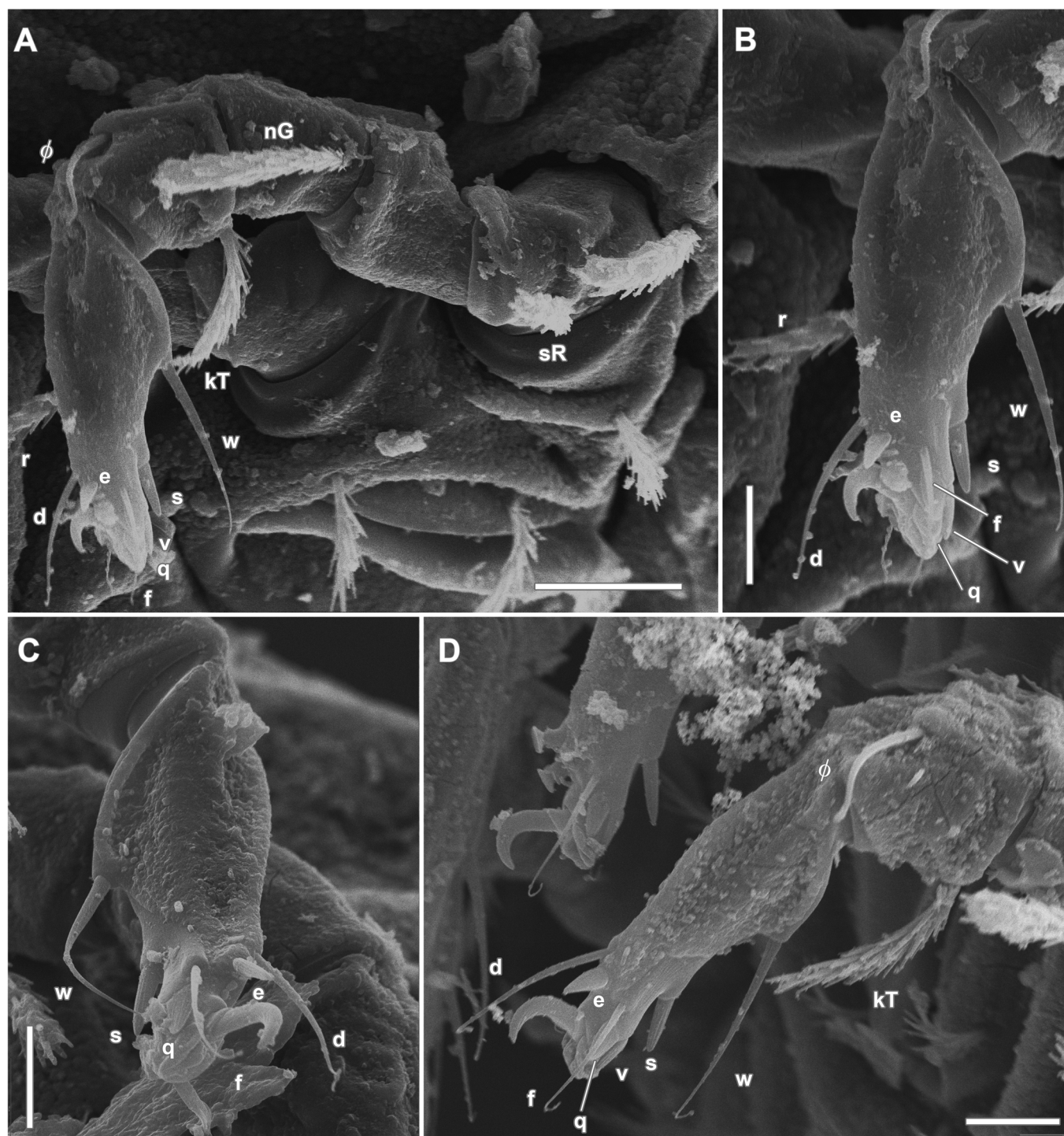


Figure 14 *Scatoglyphus myrmecophilus* sp. nov., Leg III, A – antiaxial of the right leg III, female paratype (MACN-Ar 42861); B – same, dorsal view of tarsus; C – dorsal view of tarsus, male paratype (MACN-Ar 42861); D – antiaxial view of right tarsus, male paratype (MACN-Ar 42861). Scale bar A, 20 µm; B–D, 10 µm.

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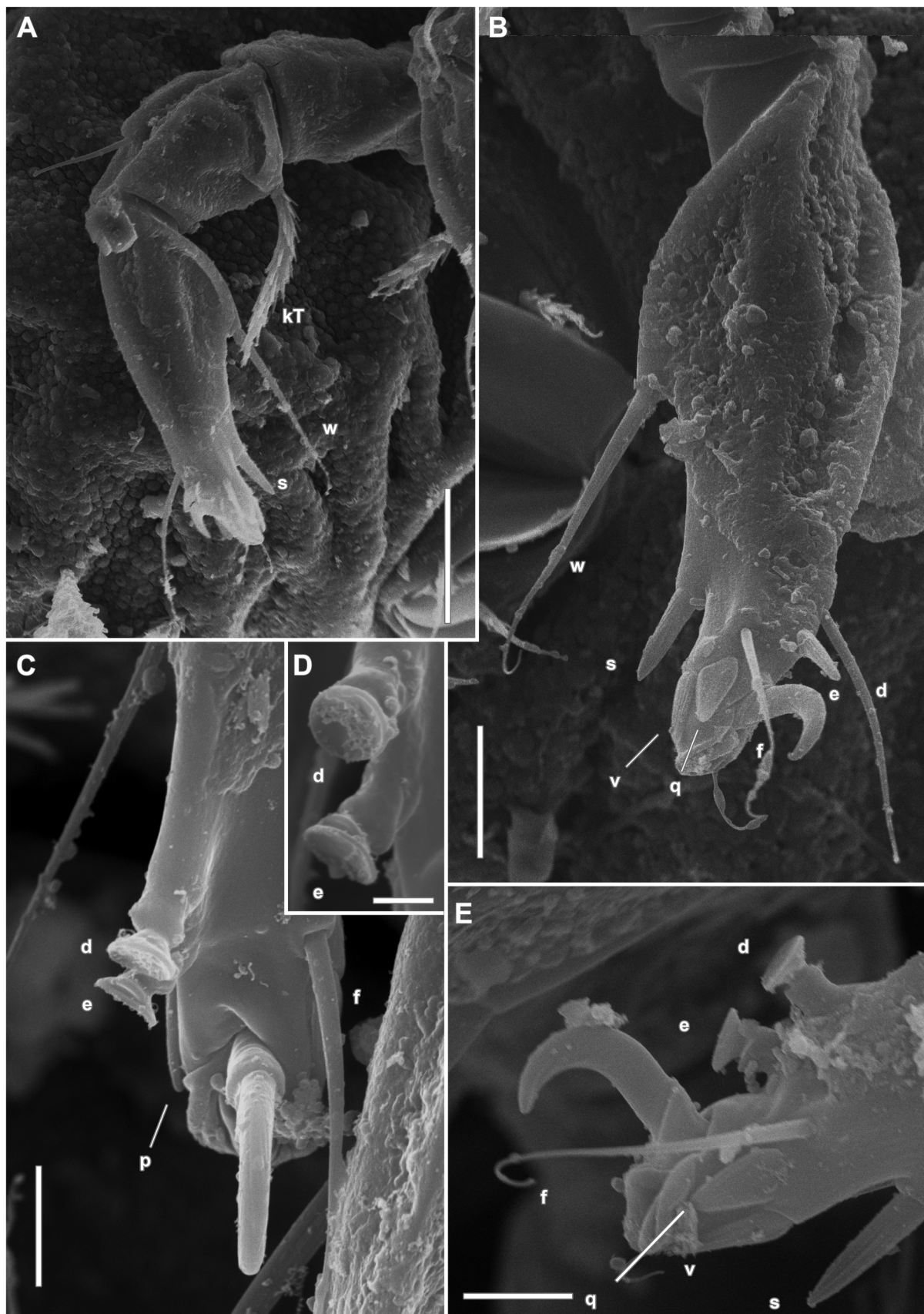


Figure 15 *Scatoglyphus myrmecophilus* sp. nov., Leg IV, A–B, female; C–E male, A – antiaxial of the right leg III, from genus to tarsus, female paratype (MACN-Ar 42861); B – dorsal view of a left tarsus; C, dorsal view of the distal portion of the right tarsus, male paratype (MACN-Ar 42861); D – detail of the setae *e* and *d* of the right tarsus of the male paratype (MACN-Ar 42861); E – antiaxial view of the distal portion of the right tarsus, same exemplar as D. Scale bars A, 20 µm; B, 10 µm; C, 5 µm; D, 2 µm; E, 5 µm.

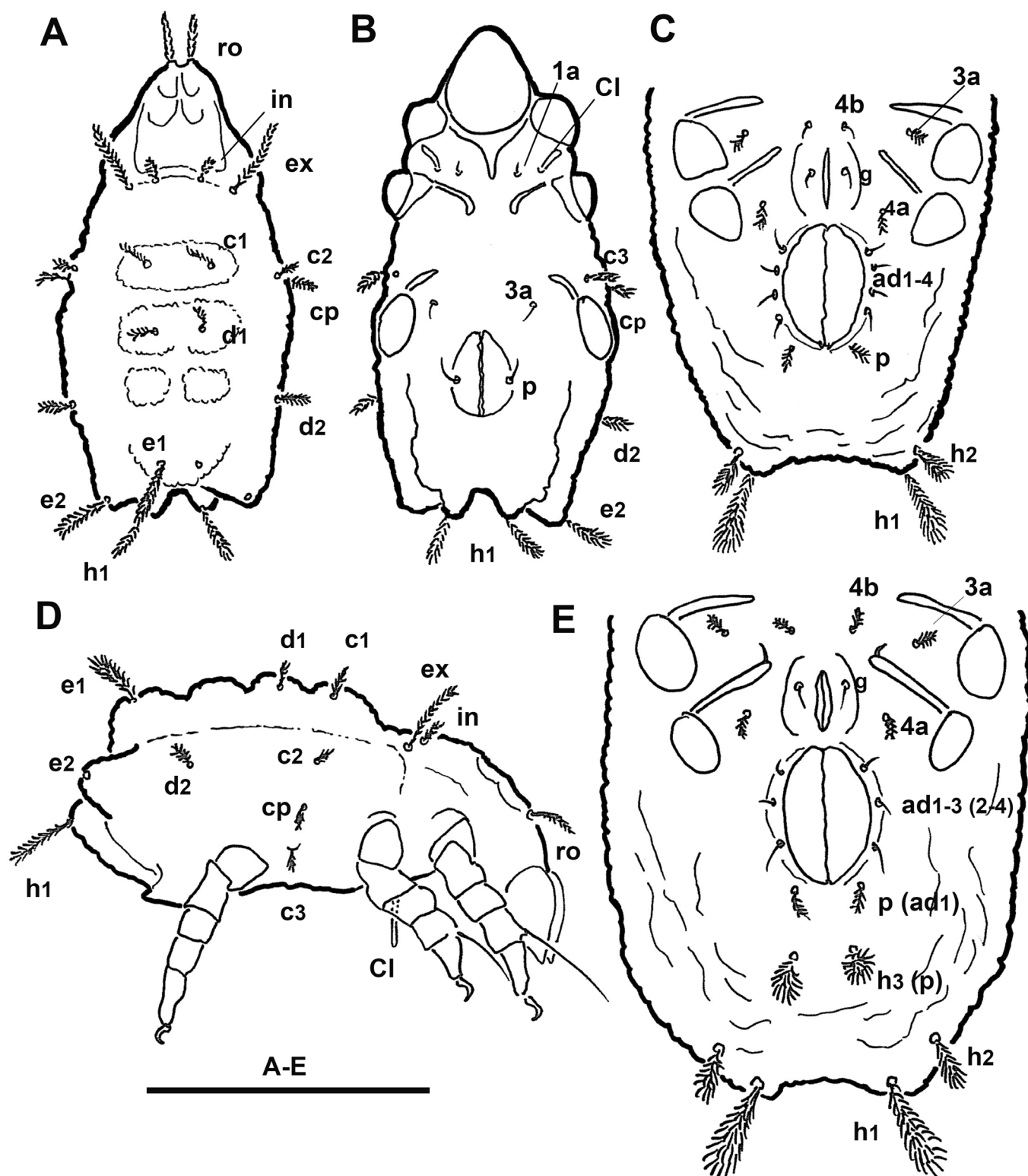


Figure 16 *Scatoglyphus myrmecophilus* sp. nov., A – larva paratype (UNMP-A0017), idiosoma dorsal; B – same, idiosoma ventral; C – protonymph paratype (UNMP-A0020), ventral view of the posterior portion of the idiosoma; D – same as A., habitus lateral; E – tritonymph paratype (UNMP-A0025), ventral view of the posterior portion of the idiosoma. Abbreviation, Cl, Claparède organ. Scale bar, A-E, 100 µm.

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References

- Barbosa M.F.C., Faquini L.L., de Moraes G.J. 2013. Diversidade de ácaros do grupo Astigmatina (Acari: Sarcoptiformes) de vida livre no Brasil. Abstracts IV Simposio Brasileiro de Acarologia: 87.
- Berlese A. 1913. Acarinuovi, Manipoli VII-VIII. Redia, 9: 77-111.
- Campbell K.U., Klompen, H., Crist, T.O. 2013. The diversity and host specificity of mites associated with ants: the roles of ecological and life history traits of ant hosts. Insectes Sociaux, 60, 31-41. <https://doi.org/10.1007/s00040-012-0262-6>
- El-Bishlawy S.M. 1989. A new species and genus of the family Acaridae. Proc. Egypt. Acad. Sci., 39: 63-66.
- Fang Y., Tao L., Zhou X., Liu L., Li F., Yang Q., Xia X., Zhou S., Sun E. 2021. The complete mitochondrial genome of *Scatoglyphus polytrematus*. Mitochondrial DNA Part B, 6 (6): 1680-1681. <https://doi.org/10.1080/23802359.2021.1927874>
- Grandjean F. 1939. La chaetotaxie des pattes chez les Acaridae. Bull. Soc. Zool. France, 64: 50-60.
- Grandjean F. 1952. Sur les variations individuelles. Vertitions (écarts) et anomalies. Comptes rendus des séances de l'Académie des Sciences, 235: 640-643.
- Grandjean F. 1953. Essai de classification des Oribates (Acariens). Bull. Soc. Zool. France, 78: 422-446.
- Grandjean F. 1957 Observations sur les Palaeacaroides (4e série). Bull. Mus. Nat. Hist., 2e série 29: 213-220.
- Griffiths D.A., Atyeo W.T., Norton R.A., Lynch C.A. 1990. The idiosomal chaetotaxy of astigmatid mites. J. Zool., 220(1): 1-32. <https://doi.org/10.1111/j.1469-7998.1990.tb04291.x>
- Klimov P.B., Vinson S.B., OConnor B.M. 2007. Acarinaria in associations of apid bees (Hymenoptera) and chaetodactylid mites (Acari). Invertebrate Systematics, 21, 109-136. <https://doi.org/10.1071/IS06019>
- Nasr Eldin M.A.S.I. 2017. Studies on mite species associated with farm manures at Menoufia province. Ph. D. Thesis, unpublished. Menoufia University, Faculty of Agriculture.
- Norton R.A. 1977. A review of F. Grandjean's system of leg chaetotaxy in the Oribatei and its application to the Damacidae. In: Biology of Oribatid Mites (D.L. Dindal, ed.), pp. 33-63. SUNY College of Environmental Science and Forestry, Syracuse, NY, USA.
- Norton R.A. 1994. Evolutionary Aspects of Oribatid Mite Life Histories and Consequences for the Origin of the Astigmata. In: Mites. Ecological and Evolutionary Analyses of Life-History Patterns (M. Houck, ed.), pp. 99-135. Chapman & Hall, New York. https://doi.org/10.1007/978-1-4615-2389-5_5
- Norton R.A. 1998. Morphological evidence for the evolutionary origin of Astigmata (Acari: Acariformes). Exp. Appl. Acarol., 22: 559-594.
- OConnor B.M. 1984. Phylogenetic relationships among higher taxa in the Acariformes, with particular reference to the Astigmata. In: Acarology VI, Vol. 1 (D.A. Griffiths & C.D. Bowman eds.), pp. 19-27. Ellis Horwood Limited, Chichester, England.
- OConnor B.M. 2009. Cohort Astigmatina. In: A manual of acarology, 3rd edition (G.W. Krantz & D.E. Walter eds.), pp. 565-657. Texas Tech University Press, Lubbock, USA.
- Okabe K, Makino S. 2002. Phoretic mite fauna on the Large Carpenter Bee *Xylocopa appendiculata* *cumvolans* (Hymenoptera: Apidae) with descriptions of its acarinarium on both sexes. J Acarol. Soc. Japan, 11(2), 73-84. <https://doi.org/10.2300/acari.11.73>
- Porta A.O., Martínez P.A. 2010. Mites associated with nests of *Acromyrmex lundii* (Hymenoptera: Formicidae: Attini) in Buenos Aires, Argentina. Abstracts XIII International Congress of Acarology: 212.
- Rai J.K., Pickles B.J., Perotti M.A. 2021. Assemblages of Acari in shallow burials: mites as markers of the burial environment, of the stage of decay and of body-cadaver regions. Exp. Appl. Acarol., 85: 247-276. <https://doi.org/10.1007/s10493-021-00663-x>
- Schatz H., Behan-Pelletier V.M., OConnor B.M., Norton R.A. 2011. Suborder Oribatida van der Hammen, 1968. In: Zhang, Z.-Q. (Ed.) Animal biodiversity: An outline of higher-level classification and survey of taxonomic richness. Zootaxa, 3148: 141-148. <https://doi.org/10.11646/zootaxa.3148.1.26>
- Sokolov I.M., Sokolova Y.Y., Fuxa J.R. 2003. Histiostomatid mites (Histiostomatidae: Astigmata: Acarina) from female reproductives of the red imported fire ant (Hymenoptera: Formicidae). J. Entomol. Sci., 38(4), 699-702. <https://doi.org/10.18474/0749-8004-38.4.699>
- Wang S.-C. 1964. Five new records to Chinese Acaridae. Acta Entomologica Sinica, 13: 900-902.