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A new species of *Eutrachytes* (Acari: Uropodina: Eutrachytidae) associated with the Indian mangrove (*Avicennia officinalis*)

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ABSTRACT — A new species of *Eutrachytes* (*Eutrachytes flagellatus*) is described based on a complete ontogenetic series, starting from larva and including the adult female and male. This Uropodina mite was isolated from the pneumatophore surface of *Avicennia officinalis* having algal (*Bostryschia* sp.) growth in Goa, India. Notable morphological attributes peculiar to immature instars of this species include a flagellate tubular dorsolateral respiratory structure extending from the peritreme, nude pygidial shields in the adult male and female and a deep concave formation at the posterolateral margins of the dorsal shield.
A taxonomic discussion with salient diagnostic features of the genus is given and a key to genera of the family is presented.
We present two nomenclature modifications: Deraiophoridae syn. nov. as the junior synonym of Eutrachytidae and *Dentibaiulus* Hirschmann, 1979 syn. nov. as a junior synonym of *Eutrachytes* Berlese, 1914.
A compiled list of all new species discovered to date from mangrove roots in different parts of the world is given.

KEYWORDS — Uropodina; Eutrachytidae; *Eutrachytes*; *Avicennia officinalis*; Goa; India

INTRODUCTION

Uropodina are one of the characteristic group of the soil dwelling mites, about which very little is known. Currently more than 2000 species are described and named and a recent revision provided details of 300 genus-group names in the suborder (Halliday 2015). Due to the unclear systematic position, the majority of the tropical groups have been very scarcely investigated. One of these groups is the family Eutrachytidae (=Deraiophoridae Trägardh, 1952) which was erected by Trägardh (1944). Hirschmann and Zirngiebl-Nicol (1961) discussed all the eutrachytid mites as members of the genus *Deraiophorus*. Later Hirschmann (1973) subdivided this genus into several groups, and six years later (Hirschmann 1979) includes nine genera in the "Ganggatungn" *Deraiophorus*, including "Stadiengattungen" *Deraiphorous* Canestrini, 1897, *Eutrachytes* Berlese, 1914, *Dentibaiulus* Hirschmann, 1979, *Loksaphorus* Hirschmann, 1979, *Mayaphorus* Hirschmann, 1979, *Dicornutophorus* Hirschmann, 1979, *Neobirophorus* Hirschmann, 1979, *Ceyloniphorus* Hirschmann, 1979

and *Manuleatophorus* Hirschmann, 1979. However, later on neither Hirschmann nor his coworkers (e.g. Hirschmann, 1993; Wiśniewski, 1993; Wiśniewski and Hirschmann, 1993) used these names and this system again. Parallel with this study, Krantz (1969) presented a separation between the Eutrachydae and the Deraiophoridae on the basis of the presence or absence of claws on leg I. However, neither morphological nor molecular evidence for this separation has ever been presented. The Eutrachytidae appears to be monophyletic and the Deraiophoridae is the junior synonymous name of it (as in Hirschmann 1979).

Indian mangroves occupy around 6749 km^2 area, being fourth largest mangrove cover in the world (Naskar and Mandal, 1999). Among the true species of mangroves, *Avicennia officinalis* (L.) is dominant in most of the regions of Indian coast. This is a tall (25 m) and thick (1 m in diameter) evergreen tree with abundant pneumatophores rising above soil from the underground cable root. These pneumatophores are very unique structures because they bear lenticels for gaseous exchange enabling the mangroves to survive in the hypoxic waterlogged environment. Pneumatophores are ideal substratum for the epibiosis and are believed to bear many more cryptic species which are unknown to science (Proches *et al.*, 2010; Sahoo *et al.*, 2013; Larsen *et al.*, 2013).

Most of the uropodina mites are strictly terrestrial in nature. However, some uropodina species, e.g. *Phaulodinychus*, have been found in beach intertidal wrack and algae (Hirschmann 1972), and some others such as *P. mitis* (Leonard) are irregularly submerged by tidal action and are believed to be able to breathe through the plastron during these periods (Krantz 1974). But unfortunately there are no reports on mangrove dwelling uropodina mites till date. It is the first time that an Uropodina mite is found inhabiting the *Avicennia officinalis* L. environment, and in this study, we report the complete ontogeny of a new species starting from larvae to adult.

MATERIALS AND METHODS

Pneumatophores of *Avicennia officinalis* having algal (*Bostryschia* sp.) growth were collected from Divar Island, Mandovi estuary, Goa, India. The specimens of uropodina mites were isolated from the pneumatophore surface after scraping by a nylon brush under a stereo microscope and preserved in 90% ethanol. Then all the developmental stages were segregated and sent to University of Navarra, Spain for identification purpose. The sketches of all developmental stages were drawn under microscope fitted with a camera lucida.

The holotype female and some of the paratypes of the new species are deposited in the Museum of Zoology, University of Navarra (MZUNAV), Pamplona, Spain.

Setal notation for the idiosoma follows Lindquist & Evans (1965) as modified slightly by Lindquist (1994). Measurements of structures are given in micrometers (μm), indicating the ranges among the specimens measured. Idiosoma and shield lengths were taken as midline length from the anterior margin anterior to the bases of vertex setae *j1* to the caudal margin. Distinction of porelike structures, as either poroids (lyrifissures) or glandular openings (solenostomes), on the idiosomal integument is in accordance with morphological and physiological studies by Athias-Henriot (1969) and Krantz & Redmond (1987), respectively, and generally follows the notation of Johnston & Moraza (1991). Epigynal shield and anal opening lengths are midline. Notation for leg follows Evans (1963, 1964, 1972). Leg lengths are from the base of the coxa to apex of the tarsus, excluding the pretarsus.

TAXONOMY

The family Eutrachytidae (Trägardh, 1944) has the following diagnostic attributes: idiosoma oval, pentagonal, or triangular in shape; pygidial shield present, always wider than long (length: width < 1: 5), usually bearing one pair of setae or nude; dorsal and ventral setae pilose, rarely smooth; prestigmatid part of peritreme with some curves and

a sharp bend when it reaches the margin of idiosoma; pedofossae rarely present, genital shield of female scutiform situated between coxae II and III; tritosternum with narrow basis, tritosternal laciniae with three pilose branches; gnathotectum triangular, marginally pilose and sometimes with strong marginal spines; corniculi horn-like, internal malae smooth and short; setae *h1* long and usually wide, *h2* short or longer than *h1*, *h3* and *p4* marginally serrate or pilose; chelicerae with internal sclerotized node, fixed digit longer than movable digit; legs with serrate and simple setae, some fan-like setae situated on basitarsi II-IV; claws on leg I present or absent.

Remarks — This family is missing from the key of the last edition of Manual of Acarology (Lindquist *et al.* 2009), but presented in Beaulieu *et al.* (2011) where they mentioned one genus with 36 species in the family Deraiophoridae and one genus and 36 species again in the family Eutrachytidae. However, they did not get any information about the reason of such a classification but seems obvious that they follow Hirschmann (1979) treating Eutrachytidae and Deraiophoridae as two separate families. After doing a thorough review of the group, our view about the systematics of these mites is close to Hirschmann (1979) system, but he did not get any exact information about his rationale. We agree with Hirschmann (1979) and Beaulieu *et al.* (2011) opinion that the genus *Deraiophorus* needs to have a higher taxonomical unit, a family rank. Contrary we cannot accept concept of Hirschmann (1979) and Beaulieu *et al.* (2011) about the being of the two sister families (Eutrachytidae and Deraiophoridae). Therefore we think that family Eutrachytidae is monophyletic and Deraiophoridae syn. nov. is the junior synonymous name of Eutrachytidae. The Eutrachytidae family includes numerous genera with several easily recognizable characters. Therefore a new key to the genera of family Eutrachytidae is presented here.

Genus *Eutrachytes* Berlese, 1914

Diagnosis: Idiosoma oval in shape, without dorsal anterior prolongation; posterior margin of idiosoma rounded. Other characters same as in family diagnosis. On the basis of existing knowledge on the known species and Hirschmann (1979) system, Krantz's species *Eutrachytes maya* Krantz, 1969 does not belong to the genus *Eutrachytes* based on the shape of idiosoma; its correct position is in the genus *Mayaphorus* Hirschmann, 1979 together with *M. brasiliensis* (Hirschmann and Zirngieble-Nicol, 1969) and *M. sellnicki* (Hirschmann and Zirngiebl-Nicol, 1969) (Hirschmann 1979).

DESCRIPTION

Eutrachytes flagellatus n. sp.

Diagnosis — Adults with idiosoma discoidal in shape, as long as wide, with prominent anterior region and scabellum present; dorsal, marginal and peritrematal shields fused at the anteriormost region; posterior region of dorsal shield with a pair of marginal concave depressions present; submarginal shield with setae to the anterior level of coxa I in adult and nymphal instars; pygidial shield nude in all instars, only bearing one pair of poroids. Nymphal instars with a pairs of lateral flagellate tubular structures emerging from the peritreme. Hypostomal setae *h2* longer than *h1* and *p4* divided in two pilose dissimilar branches. Larval podonotal shield with nine pairs of setae, three pairs of mesonothal scutellae; protonymph with five pairs of setae on podonotal shield, nude mesonotal and nude pygidial; deutonymphs with dorsal and marginal shield fused at anterior region and peritrematal shield free as in the protonymphal instar. Legs I-IV with pretarsus, a pair of well developed claws and three acuminate lobes; femora I-IV with ventral keel; femora II in the male with ventral setae modified as a conspicuous thick spine.

Female

Dorsal idiosoma (Fig. 1A) — Idiosoma discoid in shape, almost as long (570 μm) as wide (522 μm), with smooth margin and humeral peritremal protrusions. Dorsal and marginal shields fused anteriorly at level of humeral protrusions, and fused with peritrematal shield at level of *z2*. Anterior dorsal shield rounded acuminate, slightly bent to ventral region. Pygidial shield ca. 18 times wider than long, with posterior margin slightly lobulated, with

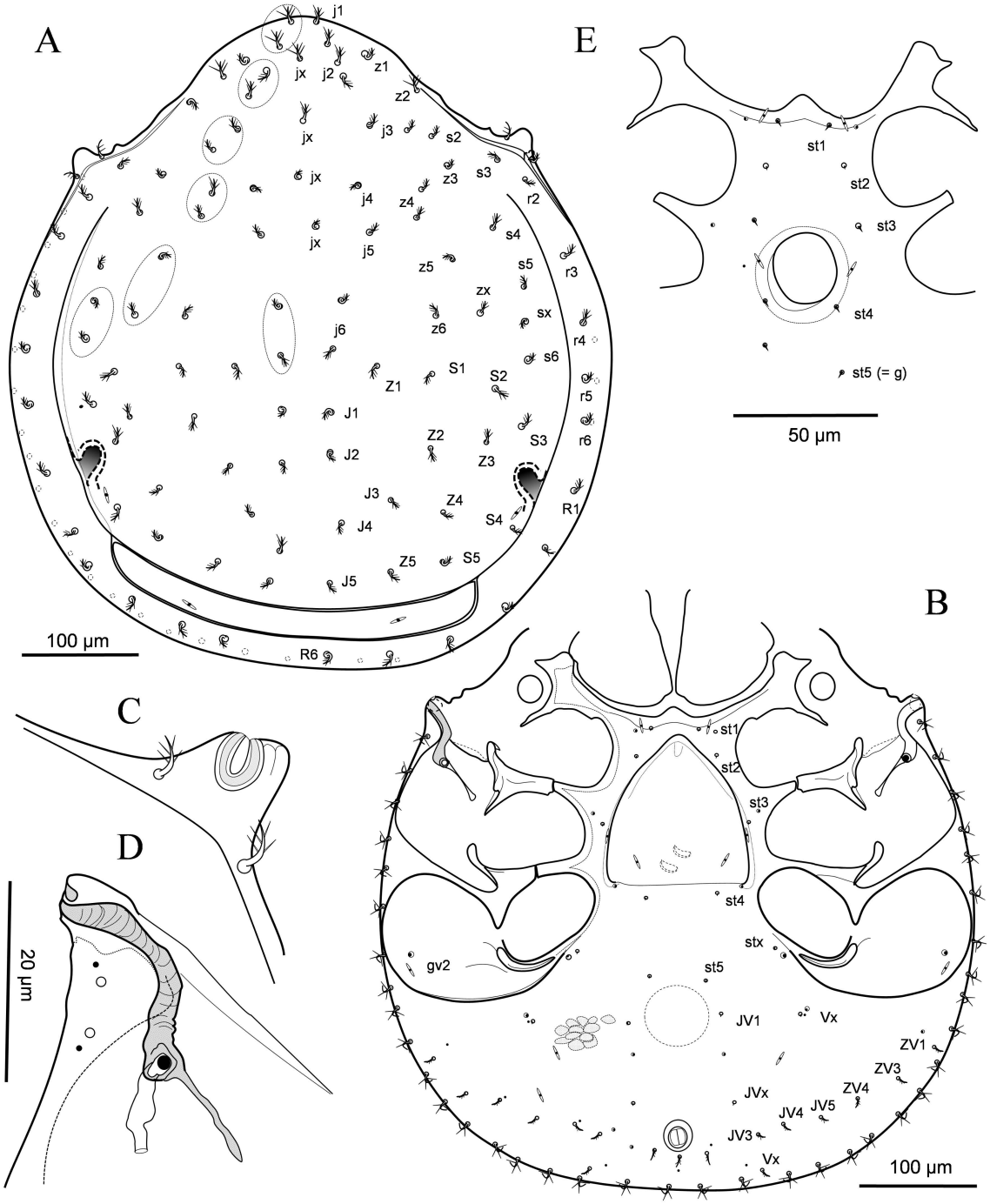

FIGURE 1: *Eutrachytes flagellatus* **n. sp.**, adult female: A – Idiosoma, dorsal view; B – Idiosoma, ventral view; C – Peritrematal shield with detail of distal tip of the peritreme; D – Detail of peritreme; 5. Male, detail of sternitigenital region.

one pair of poroids (lyrifissures) and at least three pairs of punctiform poroids. Submarginal shield rearchs the posterior margin of peritremes where bends ventrally covering part of distal peritremal loop (Figs 1B, 1D).

Dorsal shield with lightly granulate cuticle, c.a 40 pairs of short, homogeneous in length, pilose setae, neotrichy present (podonotal region with several unpaired central setae *jx*, and duplicate setae *j1*, *j2*, *j3*, *j6*, *z4*, *z5*, *s5* ; marginal shield with 11 pairs of setae (*r2-r6*, *R1-R6*) similar in length and shape, and ca. 20 pair of setae with sparse and longer pilosity on the ventral submarginal region (setae *UR*). Most dorsal setae associated to a punctiform pore like structure. Shield with a pair of concave marginal depressions at the posterior region which remain under the shield and open laterally over the marginal shield.

Ventral idiosoma (Fig. 1B) — Tritosternum with a strongly dentate base 34-36 μm long and three pilose laciniae free for most of length; medial lacinia longer (45 μm) than laterals (19 μm), devoid of basal pilosity and with bifid end (Fig. 2D). Sternal shield with anterior margin well delineated and a medial convexity. Sternal setae minute, smooth, poorly discernible; setae *st1* anterior to epigynal shield, accompanied by a pair of elongated lyrifissures *iv1* and a pair of punctiform poroids (*gst1*); *st2* at both sides of epigynal shield, close to *st1*, distance st1-st2 near one third st2-st3; *st3* together with poroids *iv2* at margin of genital opening, and pores *gst2*; *st4* behind the shield and the third pair of pores *gst3* at the posterior corners of the shield; genital setae *st5* behind coxae IV similar to sternal setae. Epigynal shield densely granulated as other idiosomal shields, subtriangular in shape, 125 μm long 118 μm wide, with straight posterior margin and acuminate anterior margin; one pair of liryfissures at the posterior region; shield located between coxae II and anterior margin of coxae IV. Endogynum with a pair or cup-like structures.

Opisthogaster with three pairs of minute ventral setae (*JV1* and two more pairs "*Vx*" associated to glandular pores at the parapodal region of coxae IV), similar to sternal setae, and seven pairs at the posterior region laterals to anal opening which are similar in shape and length to the three circumanal setae such as in figure 1B; at least two pairs of liryfissures *ivo* and eight pairs of pores (at least four are glandular pores). Anal opening framed, small and rounded (diameter 16 μm), with nude anal valves; paranal and postanal setae ciliate, similar to other ventral lateral setae, and posterior to anal opening. Between setae *JV1* and *st5* a circular subcutaneous structure is observed with a pair of sigillar area at both sides of it.

Endopodal elements between legs I-II, II-III and III-IV fused to sternal shield; endopodal I with a strong anterior apophysis with lateral corner acuminate and internal corner rounded; exopodal I-II as a hemispherical apophysis; exopodoal elements between coxae II-III and III-IV free from endopodal; parapodal IV semilunar in shape, well developed, at the botton of pedofosae IV. Pedofosae II, III and IV well delimited, separated by longitudinal bridges.

Peritrematal shield with one pair of dorsal setae at both side of peritreme distal loop (Fig. 1A). Respiratory stigmata situated in pedofosae III; from the stigmata the peritreme ascends to lateral conical protuberance at level of pedofossae II and descends for a shorter and narrow stretch; peritreme curved dorsally at level of the humeral conical protuberance (Figs. 1C, 1D).

Gnathosoma — Gnathotectum (Figs. 2A,B). with a broad dentate base and medial projection with ventral surface provided of minute spines (Fig. 2A), lateral margins with 5-6 strong long spines (Fig. 2B), and a series of marginal strongly ciliate long setae; at the base of the medial projection, bent to ventral side, a strong dorsal bifid tectum (Fig. 2B); dorsally, at the basal region of central projection, three pairs of marginal long barbed straight setae (Figs. 2A,B).

Corniculi hornlike, short (32 μm), stout (18 μm), inserted midway between insertions of subcapitular setae *h1* and *h2*, (Fig. 2C); *h1* smooth, shorter (32 μm) than slightly pilose *h2* (40 μm); pilose *h3* the longest setae (64 μm), twice the length of *h1*, capitular setae (*h4*) the shortest (20 μm) with a distal pilosity and a widened pilose process at the medial region (Fig. 2C). Internal malae short with lateral margins pilose, extending to medial length

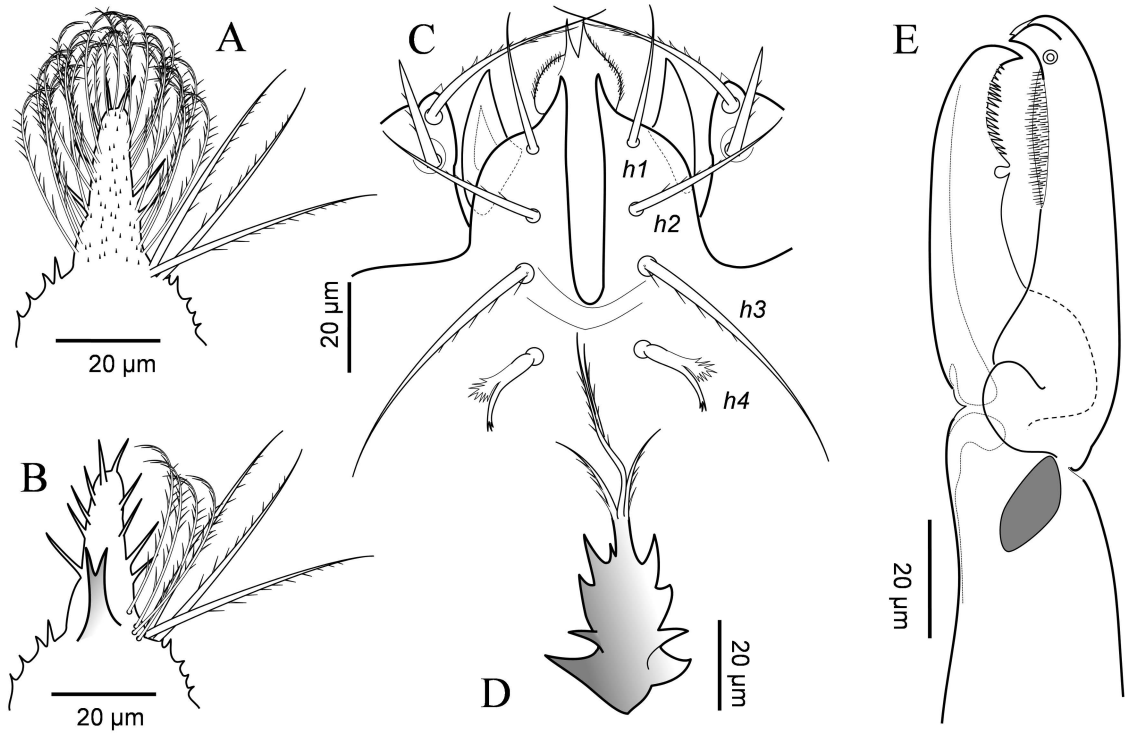

FIGURE 2: *Eutrachytes flagellatus* **n. sp.**, adult female: A – Detail of gnathotectum, ventral view; B – Detail of gnathotectum, dorsal view; C – Detail of subcapitulum; D – Sternapophisis; E – Chelicera, lateral view and detail of tip of fixed digit.

of palpfemora (Fig. 2C). Deutosternum with two smooth and wide groves between *h3* and *h4*. Palpal setation and form of setae as described by Krantz (1969) (2-5-5-14); palp- trochanter with inner setae (47 µm) twice as long as external seta (Fig. 2C), the last spinose; palp-claw two-tined. Chelicerae (Fig. 2E) with fixed digit edentate, (52 µm long) overlapping movable digit and nodulus present; digit with a socket subterminally which receives the hooked tip of the movable digit when the two are appressed (Fig. 2E); a densely pilose surface (brush) at masticatory region; terminally with a spine or lateral mucro. Movable digit of female 61-63 µm long, with a dentate comb at distal region (c.a 17 teeth) followed by a prominent alveolar remnant (or two opposed teeth), and basal region smooth; dorsal cheliceral setae no discernible if present; without conspicuous arthrodial process (Fig. 2E).

Legs — Legs relatively short, clearly shorter than dorsal shield. Coxae I with two groups of coxal glands, dorsal concavity and laterodorsal surface with rounded prominences (Fig. 3E); coxae II-IV with numerous ventro basal glandular openings; except tarsus I-IV, all other segments with a dorso distal striate tectum overlapping the articulation with the following segment; femora I-IV with a conspicuous ventral tectum (Fig. 3A). Tarsus I with a pair of claws and a series of long terminal setae. Pretarsus of legs I to IV with slender claws at the end of a relatively long stalk; legs II-IV with three slender acuminate lobes (Figs. 3D,G). Tarsus II-IV about twice as long as tibia, telotarsus twice longer than basitarsus (2.2 µm); apical ventral process absent; with 17 setae, apical setal processes *ad1*, *pd1* minute ("d1"), spinelike (Fig. 3B), and telotarsal seta *md* twice as long as lateral setae *al1*, *pl1*; basitarsal setae feather-like, dorsal setae short (9 – 10 µm), *al3* reaching *al2* setae (29 – 31 µm) and *pl3* the longest (51 – 53 µm) reaching pair of lateral setae *al1*, *pl1* (Figs. 3B,H). Other leg setae simple or slightly barbed. Full complement of setae: coxae, 2-2-2-1; trochanters, 5-5-5-5; femora, 9 (1 2/1 2/2 1) – 9 (1

2/1 2/2 1) – 7 (1 3/2 1) – 7 (1 3/2 1); genua, 8 (1 2/1 2/1 1) – 8 (1 2/1 2/1 1) – 8 (1 2/1 2/1 1) – 5 (1 2/0 2/0 0); tibiae, 7 (1 1/1 2/1 1) – 7 (1 1/1 2/1 1) – 7 (1 1/1 2/1 1) – 7 (1 1/1 2/1 1). Leg lengths, excluding pretarsi: I 330 – 340 μm, II 320 – 2325 μm, III 300 – 310 μm , IV 300 – 310 μm.

Male

Dorsal idiosoma — Similar to female in shape; dorsal shielding and dorsal setae as for the female.

Ventral idiosoma — Anterior region of sternal region as in the female (Fig. 1E), with four pairs of minute sternal setae, two pairs of poroids (*iv1*, *iv3*), two or three pairs of glandular pores (*gst1*, *gst3*), and one pair of punctiform pores; setae *st5* behind genital opening betwee coxae IV, similar to other sternal setae. Genital opening (23 – 24 μm long) between legs III. Other ventral characteristics as in female.

Gnathosoma — As in female.

Legs — Legs segments not strongly differentiated on either sex, except for a ventral thick claw like setae in femur II (Fig. 3C), spine like setae *pv1* in genua and tibia I-IV, and seta *pv2* with a bulbose base in tasus II-IV (Fig. 3D). Anterior lateral ventral margin of the segments, except tarsi, strongly serrate (Figs. 3C,F). Legs length: I 310 – 315 μm, II 310 – 315 μm, III 290 – 295 μm, IV 300 – 305 μm.

Deutonymph — Idiosoma 497 μm long, 420 μm wide at level of coxae III-IV (n=1).

Dorsal idiosoma — Dorsum (Fig. 4A) discoidal, with acuminate anterior region and humeral angles absent. Marginal shields completely differentiated, separated form dorsal shield by a fine suture which became indistinct anteriorly; pygidial shield undifferentiated except for the presence of a pair of poroids set on conical tubercles.

Dorsal shield fused with marginal shields at level of setae *j3*, with granulate cuticle ornate with rounded shallow pits; shield holotrichous with 23 pairs of similarly short ciliate setae (Fig. 4C) (*j3-j6*, *z3-z6*, *s3-s6*, *J1-J5*, *Z1-Z5*, *S1-S5*), except posteriormost *Z5* elongate and slightly curved (87 μm long); sometimes two setae "x" between *j3* and *j4* present). Marginal shield with setae *j2*, *z1*, *z2* on the anterior acuminate region of shield, similar in shape to *j1* (30 – 34 μm long); other marginal setae (*s2*, *r2-r6*, *R1-R6*) apparently shorter, similar to setae on dorsal shield. Interior region of marginal shield lacks setae, only with three pairs of gland pores (including pygidial pores). Complement of pores as in figure 4A; dorsal shield with four pairs of lyrifissures, six pairs of glandular pores, and five pairs of punctiform poroids (the three pairs of glandular pores at the marginal region of dorsal shield may be related to concave formations in the adult); most setae on marginal shields associate to poroids set on conical tubercles. Submarginal region poorly sclerotized with *j1* and ca. 25 pair of curved and ciliate setae (setae *UR*) similar in length and shape to anteriormost podonotal setae (Fig. 4C); no discernible poroids in this region. All dorsal setae set on conical tubercles.

Ventral idiosoma (Fig. 4B) — Anterior acuminate prominence with four dentate marginal lobes. Sternal shield well sclerotized and ornamented with polygonal cells from setae *st2* to posterior margin of the shield; shield free from endopodal extensions between coxae II and III, with five pairs of setae *st1-st5,* three pair of glandular pores (*gst1-3*), and three pairs of no glandular poroids (*iv1*, *iv3*, *iv5*); shield 246 μm long, 76 μm wide at level of *st2*, 27 μm long at level of *st5*; eroded at level of *gv1* and narrowed behind *st4*: *st5* and *iv5* at the posterior margin of the shield at level of coxae IV (Fig. 4B). Setae *st1*, *st3-st5* minute and smooth (2-3 μm), *st2* rod-like, thicker and almost twice longer (5 μm).

Ventrianal shield well sclerotized and ornamented, almost three times wider than long (67 – 69 μm long, 262 μm wide), with pilose circumanal setae similar in length (ca. 27 μm), three pairs of ventral setae at the anterior margin of the shield, *JV3* (16 – 18 μm) poorly ciliate, *JV4* and *JV5* similar to other posterior most opisthogastric setae, two pairs of glandular pores, each associated with ventral setae *JV3* and *JV5* , and *gv3* at the posterior margin at level of postanal setae; one pair of poroids associated to *JV4*; cribrum narrow as in adult. Opisthogaster with five pairs of ventral setae on soft tegument, *JV1* shortest (8 μm) and smooth and four pairs of ciliate setae set on tubercles at the lateral sides (*ZV1, ZV3-ZV5*); two pairs of glandular pores and one pair

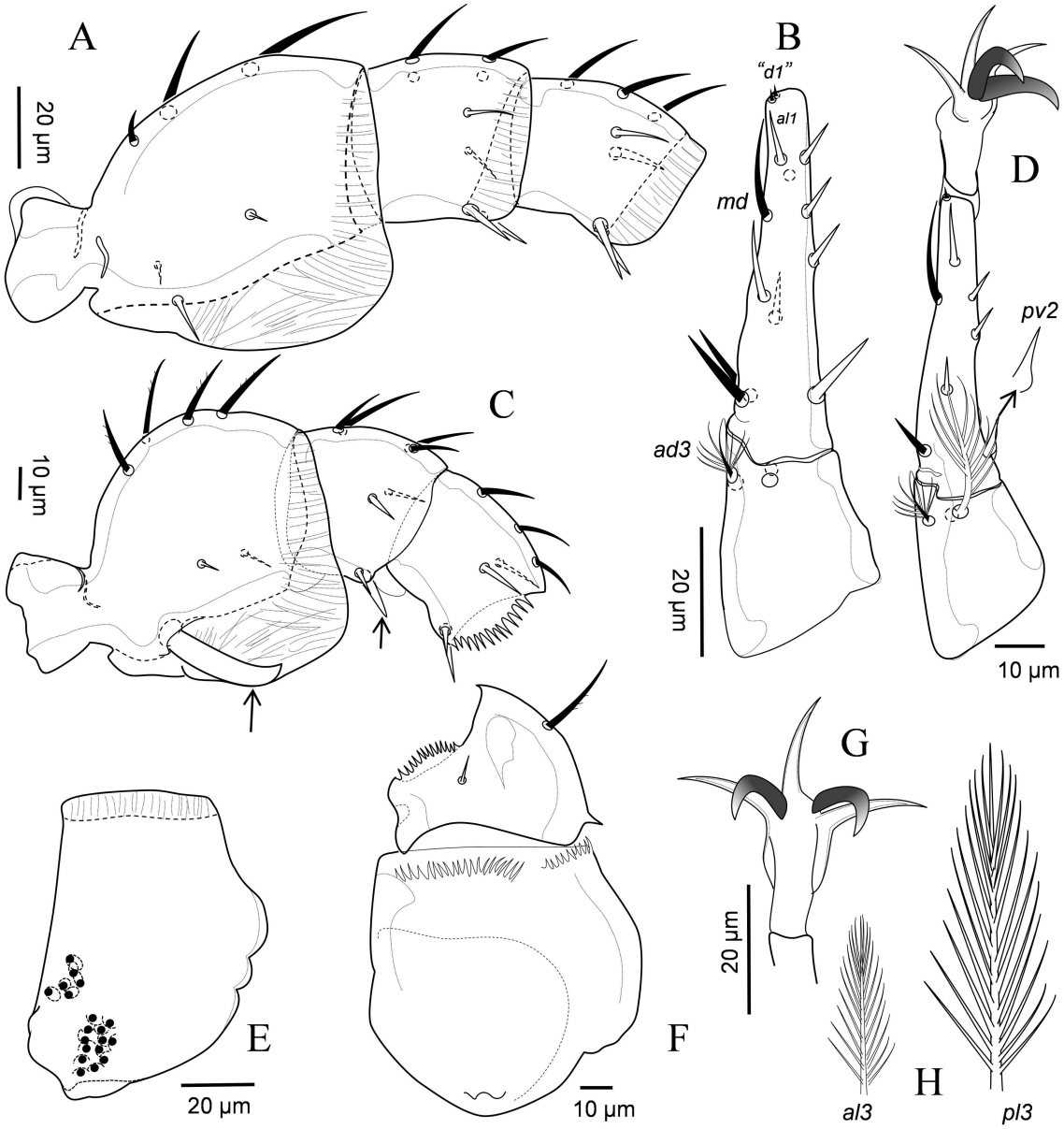

FIGURE 3: *Eutrachytes flagellatus* **n. sp.**: A – Female, leg IV, femur, genu and tibia, lateral view; B – Female, tarsus III, anterolateral view; C – Male, leg II, femur, genu and tibia, lateral view; D – Male, tarsus II, posterolateral view; E – Female, coxae I with glandular fields; F – Male, coxa and trochanter I, detail of serrate distal margins; G – Tarsus II, detail of pretarsus; H – Detail of denoted basitarsal feather-like setae. Dorsal setae in soli black color.

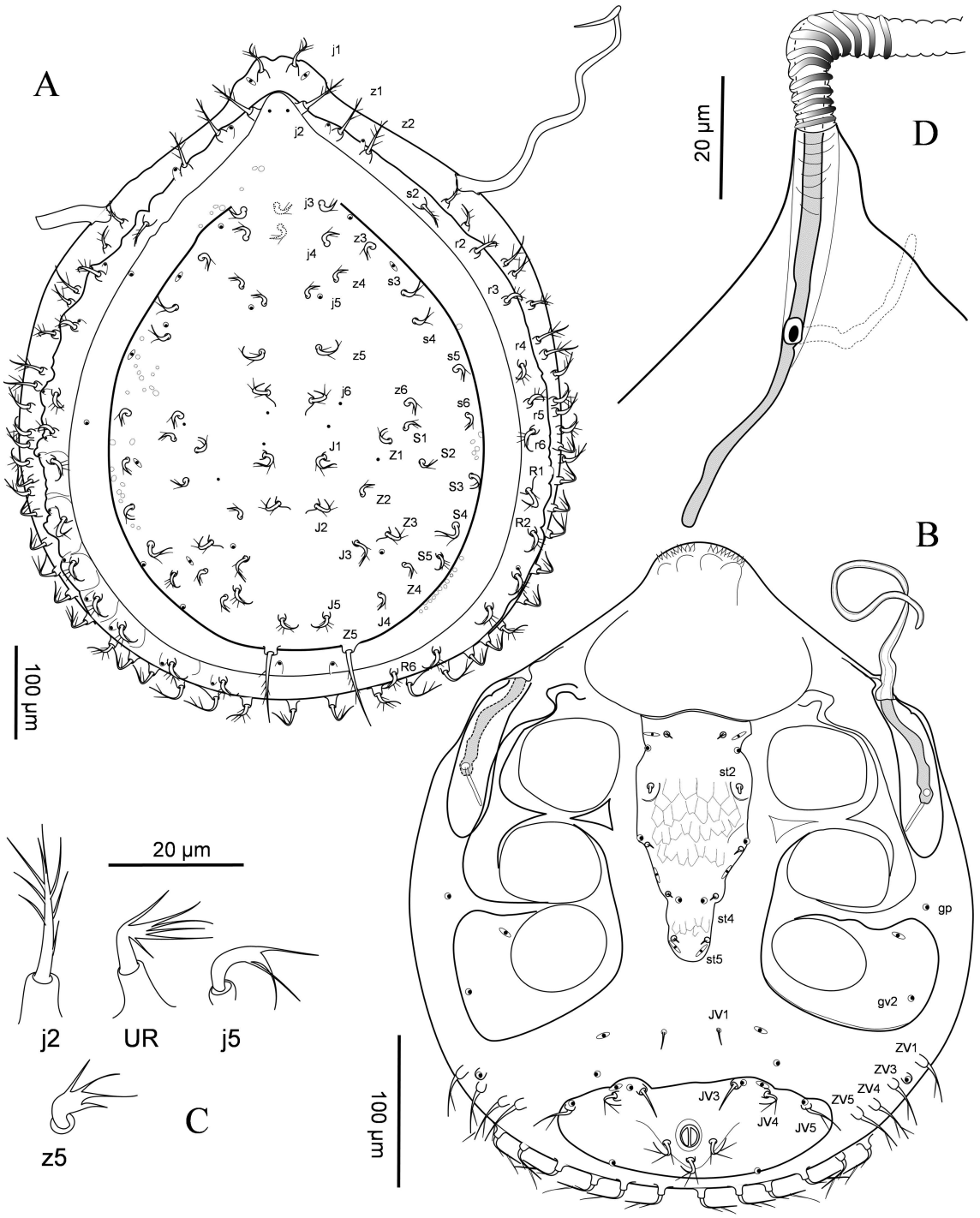

FIGURE 4: *Eutrachytes flagellatus* **n. sp.**, Deutonymph: A – Idiosoma, dorsal view; B – Idiosoma, ventral view; C – Detail of notated dorsal setae; D – Detail of peritreme and flagellate tracheal structure.

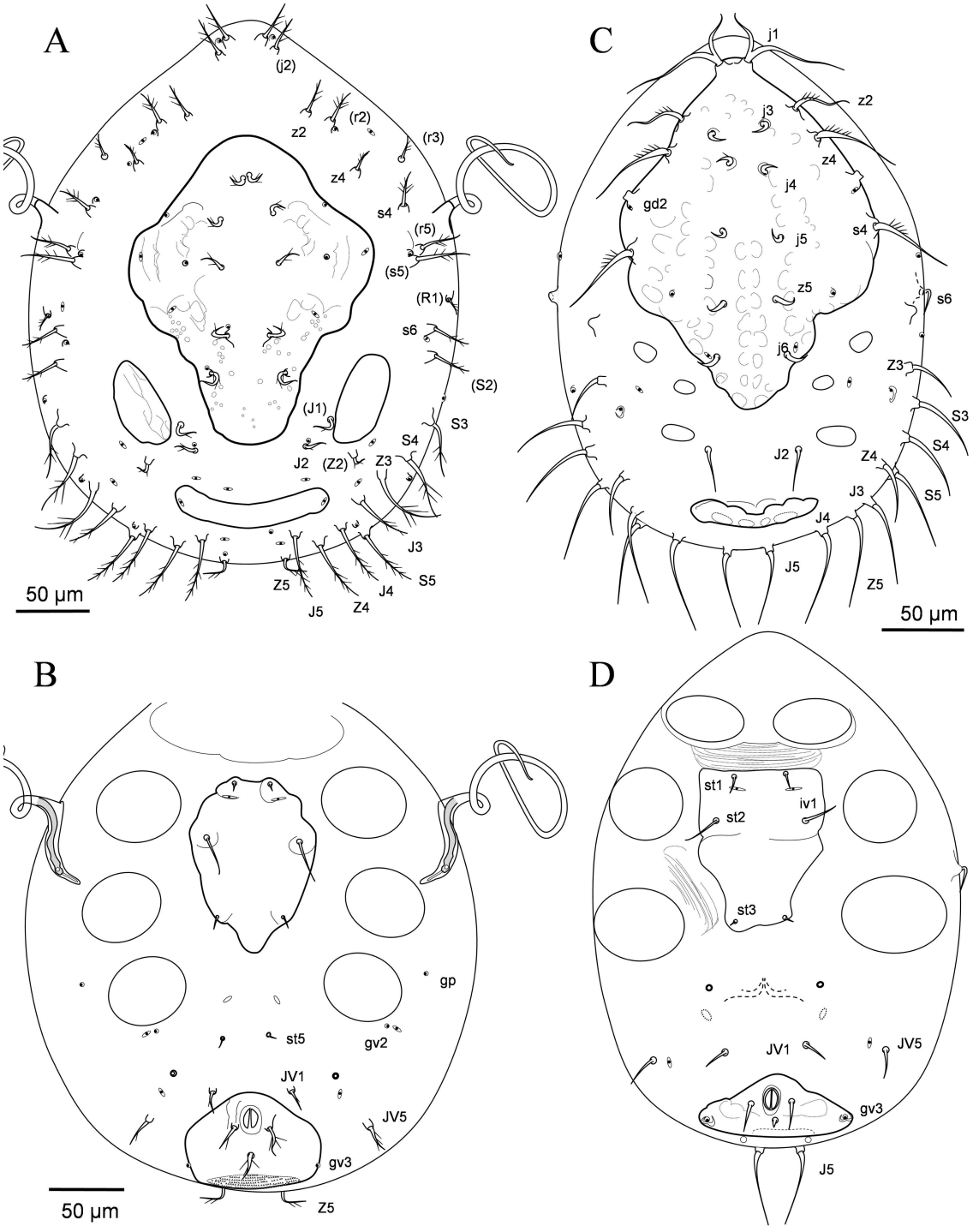

FIGURE 5: *Eutrachytes flagellatus* **n. sp.**: A – Protonymph, idiosoma, dorsal view; B – Protonymph, idiosoma, ventral view; C – Larva, idiosoma, dorsal view; D – Larva, idiosoma, ventral view.

of discernible poroids on soft opisthogastric cuticle (Fig. 4B). Endopodal strips between legs II and III present and free; endopodal between coxae III and IV fused with parapodal elements, and pedofossae IV well developed bearing one anterior liryfissure and one posterior glandular poroid: exopodal elements II and III fused and contiguous with exopodal I-II. One pair of poroids distinct on soft cuticle between legs III and IV. Rim of exopodal plate behind coxa IV inconspicuous.

Peritrematal shield from coxae I to anterior margin of coxae III ornate as exopodal elements; respiratory stigmata at level of coxae II, peritremes extending to a point between coxae I and II and continues outside the body given way to a long, flagellate and tubular structure (Fig. 4B). This hollow cuticular structure has heavily ringed surface and its diameter decreases progressively at the distal end (Fig. 5A).

Gnathosoma — Gnathotectum, chelicerae and other mouthpart structures, corniculi and adjacent structures as in adult female; palpi similar to those in adult female, including similar form of setae on palptrochanter.

Legs — Pretarsal structures, chaetotaxy and form and shape of leg setae similar to those on adult female, except that femora I-IV lack ventral tectum. Legs length: I 330 – 340 μm, II 290 – 300 μm, III 300 – 305 μm, IV 325 – 330 μm. Chaetotaxy of legs I-IV as in adult, including fanlike setae on basitarsi II-IV.

Protonymph — Idiosoma 302 μm long, 242 μm wide at level of coxae III (n=1).

Dorsal idiosoma — Dorsum (Fig. 5A) with well sclerotized rhomboidal podonotal shield with rounded corners and eroded lateral margins; shield ca.171 μm long, 138 μm wide, with central region punctate and lateral regions ornate with round shallow pits; one pair of nude, slightly ornate mesonotal shield at both sides of posterior region of podonotal shield, 49 – 53 μm long, 25 – 26 μm wide, and nude pygidial shield narrow (13 – 14 μm long, 84 μm wide), as a concave strip, and with one pair of poroids at the lateral corners.

Dorsal setation holotrichous, with addition of setae *j2*, *J1*, *Z1*, *Z2*, *s5*, *S2*, *r2*, *r3*, *r5*, *R1*; paravertical poroids associate to *j1* distinct and tuberculate (Fig. 5A). Podonotal shield with five pair of ciliate setae (*j3-j6*, *z5*), similar in length and shape to larval setae and four pairs of poroids (three pairs appear to be glandular pores). Other podonotal and opisthonotal setae on soft cuticle, including setae *J1*, *J2*, *Z1* similar to setae on podonotal shield (short and curved), with sparse and long ciliae and set in conical tubercles; other dorsal setae longer, slightly curved with few ciliae; setae *z4*, *r3*, *R1* (9 – 11 μm); other podonotal setae, *Z5* and *S2* (ca. 22 μm long), *s5* and other opisthonotal setae longer (29 – 40 μm). Soft tegument with 18 pairs of poroids as in figure 23 (eight pododontal and 10 opisthonotal); pores associate at the base of dorsal setae *j1*, *r2*, *z4*, *s4*, *s5*, *s6*, *J2*, *J5*, *S4*, *S5*. Peritremal shields narrow, laterally with a conical peritremal extension at level of setae *s4* and *r5*, of which emerges a tubular flagellate tubular structure similar to the subsequent deutonymphal instar (Fig. 5B).

Ventral idiosoma (Fig. 5B) — Sternal shield as in deutonymph, well sclerotized, pear like in shape, 115 μm long, 82 μm wide and level of setae *st2*; shield entire, without endopodal extensions between coxae II-III and III-IV, and with sternal setae *st1-st3* on rounded rounded tubercles, and poroids *iv1*; setae *st1* (4 – 5 μm long) and *st3* (6 – 7 μm) shorter than *st2* (28 – 29 μm); thin and smooth *st5* behind coxae IV (4 – 5 μm long). Intercoxal soft cuticle with a subcutaneous clear spot between coxae IV. Opisthogaster with well sclerotized subpentagonal anal shield of moderate size (65 μm long, 89 μm wide), relatively longer than in subsequent deutonymphal instar, and with three circumanal pilose setae similar in shape and length to *JV5* (15 – 16 μm), glands *gv3* on the margin posterior to postanal setae, and cribum. Opistogaster with one pair of porelike structures and two pairs of pilose setae (*JV1*, *JV5*) on tubercles. Rim of exopodal plate not discernible behind coxae IV, but inguinal gland pores *gv2* and poroids present there. A pair of poroids lateral to coxae III-IV. Reduce peritrematal shields with short and narrow peritremes between coxae II and III.

Gnathosoma — Gnathotectum and tritosternal base as in subsequent instars. Form of corniculus and internal malae much as in subsequent instars;

deutosternum similar to those in deutonymphs. Palps with normal complement of setae (1-2-5-12); chelicera not clearly discernible in a single available specimen; palp-trochanter nude.

Legs — Legs I to IV with pretarsi, well-developed claws and pulvillus. Legs complement of setae as follows: coxae, 2-2-2-1; trochanters 5-5-5-5; femora 9 – 9 – 6 – 6 ; genua 6 (1 2/0 2/0 1) – 6 (1 2/0 2/0 1) – 6 (1 2/0 2/0 1) – 5 (0 2/0 2/0 1); tibiae 7 (1 1/1 2/1 1) – 7 (1 1/1 2/1 1) – 7 (1 1/1 2/1 1) – 7 (1 1/1 2/1 1). Basitarsus II-IV as long as telotarsus excluding the pretarsus. Coxa, trochanter, femora, genua and tibia I-IV with ventrolateral distal margins strongly serrate. Leg setae generally simple or pilose, not markedly differentiated.

Larva — Idiosoma 310 μm long, 226 μm wide (n=1).

Dorsal idiosoma — Dorsal shielding clearly delimited and surface discernibly ornamented as on nymphal instars (Fig. 5C). Body dorsum with 20 pairs of setae set on cylindrical tubercles; nine pairs of setae (*j1*, *j3-j6*, *z2*, *z4*, *z5*, *s4*) on rhomboid podonotal shield (212 μm long, 157 μm wide at level of seta *s4*); setae *z5* on the parallel lines connecting *j1* and *j6*; 11 pairs of setae on soft unsclerotized cuticle, podonotal pair *s6* and opisthonotal *J2-J5*, *Z3-Z5*, *S3-S5*; at least eighth pairs of poroids (four podonotal and three opisthonotal) of which one pair of no glandular pores is associated with a conspicuous protuberance on lateral margin of podonotal shield between setae *z4* and *s4*; other conspicuous glandular poroid on soft opisthonotal cuticle behind *Z3*, and three pairs of poroids on soft cuticle at level of coxae II and III. Setae *j1* smooth divided into two dissimilar branches, short branch (24 μm long) half the length of the longest (59 μm); setae *j3-j6*, *z5* shortened (10 – 12 μm), with long ciliate and curved; marginal setae on the shield (*z2*, *z4*, *s4*) elongated and ciliate, *z2* (35 – 37 μm) shorter than *z4*, *s4* (49 – 51 μm); 11 pairs on soft tegument smooth or with few long cilia, *J2* the shortest (25 – 27 μm), *s6*, *Z3*, *Z4* (33 – 35 μm), other setae similar in length (45 – 51 μm). Three pairs of mesonotal ovoid scutellae discernible, posteriomost the largest (12 μm long, 24 μm wide). A second pair of tubercular structures are present at level of setae *s6* which resemble setal bases. Pygidial shield small (10 – 14 μm long by 78-79 μm wide) and nude, with two pairs of anal sigillae. Soft cuticle with granulate striation.

Ventral idiosoma (Fig. 5D) — Tritosternum normally developed, with wide triangular base with slightly serrate margin and three long pilose laciniae. Presternal region with striate soft cuticle. Sternal shield distinguishable, trapezoidal in shape, ca. 94 μm long, 75 μm wide at level of *st1*, and 41 at level of setae *st3*; anterior margin truncate, straight; setae *st1* (9 – 10 μm long), *st2* (21 – 22 μm long), *st3* (3 – 4 μm long), and poroids *iv1*. Anal shield well sclerotized, slightly ornate, widened, subtriangular in shape, wider (92 μm at level of glands *gv3*) than long (39 – 40 μm); adanal setae (17 μm long) inserted at level to anal opening, and longer than postanal spine-like seta (4 μm); adanal gland pores (*gv3)* at level of postanal seta with well sclerotized cuticular ring. Opisthogaster with a pair of discernible subcutaneous horn-like structures behind posterior margins of coxae III; a pair of discernible pore-like structures, a pair of subcutaneous clear areas, two pairs of well developed opisthogastric setae anterolateral to shield, *JV1* (14 μm long) and *JV5* (19 – 20 μm long), and one pair of poroids *ivo*; one pair of poroid posterior to anal shield (*ivp*).

Gnathosoma — Gnathotectum as in subsequent instars. Form of corniculus, internal malae as in subsequent instars. Deutosternum similar to those in nymphs. Palpus with normal larval complement of setae; palp-trochanter nude, plap-genua with five setae.

Legs — Legs I to III with pretarsi, well-developed claws and pulvillus. Legs length: I 119-120 μm, II 116 μm, III 118 μm. Larval complement of setae as follows: coxae, 2-2-2; trochanters 3-3-3; femora 8 (1 2/1 2/1 1) – 7 (1 2/1 2/0 1) – 6 (1 2/0 2/0 1); genua 6 (1 2/0 2/0 1) – 6 (1 2/0 2/0 1) – 6 (1 2/0 2/0 1); tibiae 7 (1 1/1 2/1 1) – 7 (1 1/1 2/1 1) – 7 (1 1/1 2/1 1). Coxa I-III with ventral rim serrate; coxae I with glandular field conspicuous; genua and tibia I, II, III with distal rim serrated lateroventrally. Leg setae generally simple, not markedly differentiated except for fan-like setae on basitarsus II-III. Other legs characteristics as in protonymphal instar.

Etymology — The specific name "flagellatus"

is adjectival and refers to the conspicuous flagellate tubular structure associate to the peritreme in nymphal instars.

Studied material — Holotype: adult female, Goa (India), Divar Island, Mandovi estuary, Lat/Long: 15°30′18.6"N 73°52′43.5"E, collected on 25 January 2014, leg. Gobardhan Sahoo; water temperature, pH, and salinity of the site was 29 °C, 7.81, 17 PSU respectively. Paratypes: three females, four males, three dutonymphs, two protonymphs and one larva, with same data as holotype.

Remarks — Currently 13 species belong to genus *Eutrachytes*. The new species found in Goa, India, has a pair of concave depressions at the posterior dorsal region, which was not observed earlier within the family Eutracyhtidae.

The presence of the complete ontogenetic instars of this species allows us to track back to the larval instar the structural development of idiosomal chaetotaxy and shielding and to speculate on other elements such as the *flagellate structure*.

In the larva and nymphal instars the complement of dorsal and ventral setae is readily recognized and denotable. However, rather than irregularly or asymmetrically multiple, adults display a dorsal and ventral hypertrichy which appears to be a duplicative neotrichy derived secondarily. This hypertrichy of paired setae seems to be in the form of setal duplications, such that symmetrically duplicated pairs can be recognized (in figure 1, outlined duplication fields are speculative). Similar dorsal neotrichy occurs in other Gamasina mites (Moraza and Lindquist, 2015). Other unpaired, asymmetrical setae (some of them present in the deutonymphal instar) complete the hypertrichy in this species.

Opisthogastric setae *JV2* and *ZV2* are absent in the larval and subsequent instars of this and other species of the family (see Krantz, 1969). The pair of larval opisthogastric pore-like structures (Fig. 5D) remains in the protonymph lateral to *JV1*, and a pair of clear areas is distinguishable between coxae IV (Fig. 5B).

In the larva, at the lateral margin of podonotal shield between setae *z4* and *s4*, a pair of conical tubercles with a pore-like structure at the base are present; a second pair of tubercular structures are present on soft tegument at level of setae *s6* (Fig. 5C). In the protonymph, dorsal shield is reduced leaving dorsal setae *j1*, *z2*, *z4* and *s4* on the soft tegument and a humeral dorsolateral protuberance between setae *s4* and *r5* related to the peritreme; the flagellate structure is well developed. In the deutonymph, the dorsolateral protuberances have been reduced to small nodes in the soft unsclerotized submarginal region of idiosoma, nodes that remain related to the peritreme tips in the adult. Out of the two pairs of protuberances described, whether either pair of protuberances could be the possible origin of the peritremal flagellum is uncertain.

Dorsal shield marginal concavities are surrounded by opisthonotal setae *S3*, *Z3, S4* and a conspicuous non glandular poroid at their bases (Fig. 1A). In the deutonymphal instar, three pairs of glandular pores and a pair of poroids are located at the same level than such concavities in the adult (Fig. 4A). The transition of these glandular poroids associated with the concavities may be complete in the adult instar, and if this is the case, the function of such structures would be clarified.

Regarding the flagellated structure being present only in nymphal instars, its structural relationship with the peritreme suggests its possible role in the breathing process, such as providing an air duct to the stigmata when the mite is immersed. However, if that were true, its absence in adults would be difficult to explain as they share the habitat. It is possible that immature instars need this "snorkel" because they live immersed in water while adults do not immerse. Other Gamasina mites which live immersed in fluid have similar structures: *Varroa* (immersed inside a cell in a beehive) has an emergent peritreme (Bruce *et al.*, 1997), and the semi-aquatic *Platyseius italicus* has an expanded peritreme with a plastron (Hilton, 1971). In future, more exhaustive anatomical and physiological study is required to gain some deep insights into the nature and function of this structure.

TABLE 1: Check list of new species discovered from the surface of mangrove roots from different parts of the world.

Species	Group	Substratum	Location	Special remarks	Reference
Schusteria melanomerus	Oribatida	*Avicennia* pneumatophores	Barra reef, Mozambique		Marshall and Pugh, 2000
Selenoribates quasimodo	Oribatida	Roots of *A. germinans*	Bermuda		Pfingstl, 2013
Carinozetes mangrovi	Oribatida	Mangrove roots of *A. germinans* and *R. mangle*	Bermuda	Exclusive to mangrove roots Proved by molecular taxonomy	Pfingstl *et al.*, 2014
Rhombognathus ocularis	Halacarida	Pneumatophores of *Avicennia marina*	Australia		Bartsch, 2003a
Rhombognathus aribus	Halacarida	Roots of *Rhizophora mangle* and *Avicennia schaueriana*	Brazil		Pepato *et al.*, 2015
Rhombognathus picinguabensis	Halacarida	Roots of *Rhizophora mangle* and *Avicennia schaueriana*	Brazil		Pepato *et al.*, 2015
Rhombognathus aspidotus	Halacarida	*Avicennia* pneumatophores	Singapore		Bartsch, 2006a
Rhombognathus bulbosus	Halacarida	*Avicennia* pneumatophores	Singapore		Bartsch, 2005
Copidognathus latusculus	Halacarida	*Sonneratia pneumatophores*	Singapore		Bartsch, 2015
Copidognathus lutarius	Halacarida	*Avicennia* pneumatophores	Australia		Bartsch, 2003a
Copidognathus piger	Halacarida	*Avicennia* pneumatophores	Australia		Bartsch, 2003a
Copidognathus bruneiensis	Halacarida	*Avicennia marina* pneumatophores	Darussalam		Chatterjee *et al.*, 2012a
Copidognathus mangrovorum	Halacarida	*Avicennia marina* pneumatophores	Darussalam		Chatterjee *et al* ., 2012a
Copidognathus caloglossae	Halacarida	*Avicennia marina* pneumatophores	South Africa		Proches, 2002
Agauopsis arborea	Halacarida	*Avicennia* pneumatophores	Australia		Bartsch, 2003b
Acarothrix grandocularis	Halacarida	*Avicennia* pneumatophores	India		Chatterjee *et al.*, 2012b
Acarothrix umgenica	Halacarida	*Avicennia marina* pneumatophores	South Africa		Proches, 2002
Teleotanais indiaensis	Tanaidacea	*Avicennia officinalis* pneumatophores	India	Abundance is more on roots than the sediment suggesting their endemicity to root	Larsen *et al.*, 2013 Sahoo *et al.*, 2013
Eutrachytes flagellatus	Uropodina	*Avicennia officinalis* pneumatophores	India		Present Study
Amhyadesia pacifica	Hyadesiidae	Mangrove roots	Philippines		Fain and Schuster, 1984
Litarachna caribica	Pontarachnidae	*Rhizophora mangle* roots	Neterland Antilles		Pesic *et al.*, 2008
Litarachna indica	Pontarachnidae	*Rhizophora* roots	India		Pesic *et al.*, 2012
Litarachna bruneiensis	Pontarachnidae	*Avicennia marina* pneumatophores	Darussalam		Pesic *et al.*, 2011
Litarachna minuta	Pontarachnidae	*Avicennia* pneumatophores	Darussalam		Pesic *et al.*, 2013
Bolttsia myersi	Amphipoda	Prop roots of *R. stylosa*	Australia		Azman and Lowry, 2009
Criconemella avicenniae	Nematoda	Roots of *A. marina*	Australia		Nicholas and Stewart, 1984
Enchodelus coomansi	Nematoda	Roots of *A. marina*	Australia		Nicholas and Stewart, 1984
Vaucheria karachiensis	Yellow green algae	Pneumatophores of *A marina*	Pakistan		Saifullah *et al.*, 2003
Lithothamnion carpoklonion	Red algae	Roots of *R. mangle*	Puerto Rico		Athanasiadis and Ballantine, 2011

Key to the genera of family Eutrachytidae

1. Anterior prolongation present on dorsal body . . 5
— Anterior prolongation absent on dorsal body . . 2

2. Posterior prolongation well developed. . . . . *Dicornutophorus* Hirschmann, 1979
— Posterior prolongation absent 3

3. Posterior margin of idiosoma rounded. . . . . *Eutrachytes* Berlese, 1914
— Posterior margin of idiosoma angular 4

4. Idiosoma pentagonal in shape. . . . . *Loksaphorus* Hirschmann, 1979
— Idiosoma triangular in shape. . . . . *Mayaphorus* Hirschmann, 1979

5. Anterior prolongation with numerous long setae. 6
— Anterior prolongation with three-four pairs of long setae 7

6. Posterior prolongation extreme long. . . . . *Manuleatophorus* Hirschmann, 1979
— Posterior prolongation short. . . . . *Neobirophorus* Hirschmann, 1979

7. Posterior prolongation absent. . . . . *Ceyloniphorus* Hirschmann, 1979
— Posterior prolongation present. . . . . *Deraiophorus* Canestrini, 1897

Notes to the key: The differences between the Hirschmann's genera *Dentibaiulus* and *Eutrachytes* are very weak and the posterior idiosomal margin is more or less rounded in the both genera, although there are some species (*Eutrachytes*-like) with a more edge-like margin, others (*Dentibaiulus*-like) have it strongly rounded. In our opinion this difference is not enough to separate these two genera, therefore we think that *Dentibaiulus* Hirschmann, 1979 syn. nov. is a junior synonymous name of *Eutrachytes* Berlese, 1914.

After the description of this new species, the number of new species discovered till date from the surface of mangrove roots from different parts of

the world is 29 (Table 1). The data suggests a high biodiversity potential of mangrove roots.

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REFERENCES

Athanasiadis A., Ballantine D.L. 2011 — *Lithothamnion carpoklonion* sp. nov. (Melobesioideae, Corallinales, Rhodophyta) from Puerto Rico, Caribbean Sea: an epiphytic encrusting coralline alga producing conceptacle protuberances — Bot. Mar., 54(4): 403-410. doi:10.1515/bot.2011.047

Athias-Henriot C. 1969 — Les organes cuticulaires sensoriels et glandulaires des Gamasides. Poroïdotaxie et adénotaxie — B. Soc. Zool. Fr., 94: 485-492.

Azman B.A.R., Lowry J.K. 2009 — Bolttsiidae — Zootaxa, 2260: 285-289.

Beaulieu F., Dowling A.P.G., Klompen H., de Moraes G. J., Walter D.E. 2011 — Superorder Parasitiformes Reuter, 1909 — Zootaxa, 3148: 123-128.

Bartsch I. 2003a — Mangrove halacarid fauna (Halacaridae, Acari) of the Dampier region, Western Australia, with description of five new species — J. Nat. Hist., 37(15): 1855-1877. doi:10.1080/00222930110089184

Bartsch I. 2003b — A new species of the *Brevipalpus* group, genus *Agauopsis* (Halacaridae: Acari) from Dampier, Western Australia: description and key to related species — In: Wells F.E., Walker D.I., Jones D.S. (Eds.). The Marine Flora and Fauna of Dampier, Western Australia. Western Australian Museum, Perth. pp. 241-254.

Bartsch I.L.S.E. 2006a — A new species and new record of *Rhombognathus* from Singapore (Acari: Halacaridae) — Zootaxa, 1120: 41-49.

Bartsch I. 2005 — Upper littoral rhombognathines (Acari: Halacaridae) of Singapore: description of three new species — Cah. Biol. Mar., 46: 273-287.

Bartsch I. 2015 — Halacaridae (Acari) amongst the epiflora and fauna on trunks, branches, roots, and pneumatophores on the coast of Singapore: A survey — Raffles B. Zool., Supplement No. 31: 96-138.

Brucea W.A., Delfinado-Bakerb M., Vincenta D.L. 1997 — Comparative morphology of the peritremes of *Varroa* and *Euvarroa* (Varroidae), parasites of honey bees (Apidae) — Int. J. Acarol., 23(1): 13-20. doi:10.1080/01647959708684114

Chatterjee T., Marshall D.J., Pešić V. 2012a — New records of *Copidognathus* mites (Acari: Halacaridae) from mangroves in Brunei Darussalam with descriptions of two new species — Zootaxa, 3269: 18-30.

Chatterjee T., Marshall D.J., Guru B.C., Ingole B.S., Pešić V. 2012b — A new species of the genus *Acarothrix* (Acari: Halacaridae) from Brunei Darussalam and India — Cah. Biol. Mar., 53: 541-546.

Evans G.O. 1963 — Observations on the chaetotaxy of the legs in the free-living Gamasina (Acari: Mesostigmata) — Bull. br. Mus. nat. Hist. Zool., 10: 275-303. doi:10.5962/bhl.part.20528

Evans G.O. 1964 — Some observations on the chaetotaxy of the pedipalps in the Mesostigmata (Acari) — Ann. Mag. nat. Hist. Series 13, 6: 513-527.

Evans G.O. 1972 — Leg chaetotaxy and the classification of the Uropodina (Acari: Mesostigmata) — J. Zool., 67(2): 193-206. doi:10.1111/j.1469-7998.1972.tb01729.x

Fain A., Schuster R. 1984 — Four new species of the genus *Amhyadesia* Fain and Ganning, 1979 from the intertidal zone of several indo-pacific islands (Acari: Hyadesidae) — Int. J. Acarol., 10(2):103-111. doi:10.1080/01647958408683359

Halliday R.B. 2015 — Catalogue of genera and their type species in the mite Suborder Uropodina (Acari: Mesostigmata) — Zootaxa, 3972(2): 101-147. doi:10.11646/zootaxa.3972.2.1

Hinton H.E. 1971 — Plastron respiration in the mite, *Platyseius italicus*. —J. Insect. Phisiol., 17(7): 1185-1199. doi:10.1016/0022-1910(71)90184-3

Hirschmann W. 1972a — Gangsystematik der Parasitiformes, Teil 94, Teilgänge, Stadien von 3 neuen Discourella-Arten (Uropodini, Uropodinae) — Acarologie. Schriftenreihe für Vergleichende Milbenkunde, 17: 13-14.

Hirschmann W. 1972b — Gangsystematik der Parasitiformes, Teil 95, Gang von *Urodiaspis castrii* nov. spec. (Dinychini, Uropodinae) — Acarologie. Schriftenreihe für Vergleichende Milbenkunde, 17: 14-15.

Hirschmann W. 1973 — Gangsystematik der Parasitiformes.Teil 183. Stadien von 4 neuen Uroobovella-Arten (Dinychini, Uropodinae) — Acarol. Schriftenreihe Vergleichende Milbenkunde, 19: 166-168.

Hirschmann W. 1979 — Stadiensystematik der Parasitiformes. Teil 1. Stadienfamilien und Stadiengattungen der Atrichopygidiina, erstellt im Vergleich zum Gangsystem — Acarologie. Schriftenreihe Vergleichende Milbenkunde, 26: 57-70.

Hirschmann W. 1993 — Gangsystematik der Parasitiformes, Teil 550. Bestimmungstabellen der Uropodiden der Erde, Atlas der Ganggattungen der Atrichopygidiina — Acarologie, Schriftenreihe für vergleichende Milbenkunde, Folge 40, Hirschmann-Verlag, pp. 292-370.

Hirschmann W., Zirngiebl-Nicol I. 1961 — Gangsystematik der Parasitiformes. Teil 4. Die Gattung *Trichouropoda* Berlese 1916 nov. comb., die Cheliceren und das System der Uropodiden — Acarol. Schriftenreihe vergleichende Milbenkunde, Folge 4, Hirschmann-Verlag, pp. 1-41.

Johnston D.E., Moraza M.L. 1991 — The idiosomal adenotaxy and poroidotaxy of Zerconidae (Mesostigmata: Zerconina) — In: Dusbábek F., Bukva V. (Eds). Modern Acarology. Vol. 2. Prague, Academia and The Hague, SPB Academic Publishing bv. pp. 349-356.

Krantz G.W. 1969 — The Mites of Quintana Roo. I. A new species of *Eutrachytes* from the Yucatan Peninsula, with observations on the classification of the genus — Ann. Entomol. Soc. Am., 62(1): 62-70.

Krantz G.W., Redmond B.L. 1987 — Identification of glandular and poroidal idiosomal systems in *Macrocheles perglaber* F. & P. (Acari: Macrochelidae) — Exp. & Appl. Acarol., 3: 243-253. doi:10.1007/BF01270460

Larsen K., Sahoo G., Ansari Z.A. 2013 — Description of a New Mangrove Root Dwelling Species of *Teleotanais* (Crustacea: Peracarida: Tanaidacea) from India, with a Key to Teleotanaidae — Species Diversity, 18: 237-243.

Lindquist E.E. 1994 — Some observations on the chaetotaxy of the caudal body region of gamasine mites (Acari: Mesostigmata), with a modified notation for some ventrolateral body setae — Acarologia, 35: 323-326.

Lindquist E.E., Evans G.O. 1965 — Taxonomic concepts in the Ascidae, with a modified setal nomenclature for the idiosoma of the Gamasina (Acarina: Mesostigmata) — Mem. Entomol. Soc. Can., 47: 1-64. doi:10.4039/entm9747fv

Lindquist E.E., Krantz G.W., Walter D. E. 2009 — Order Mesostigmata — In: Krantz G.W., Walter D.E. (Eds). A Manual of Acarology. Third edition. Texas University Press, Lubbock, USA. pp. 124-232.

Marshall D.J., Pugh P.J. 2000 — Two new species of *Schusteria* (Acari: Oribatida: Ameronothroidea) from marine shores in southern Africa — Afr. Zool., 35(2): 201-205.

Moraza M.L., Lindquist E.E. 2015 — Systematics and biology of mites associated with neotropical hispine beetles in unfurled leaves of *Heliconia*, with descriptions of two new genera of the family Melicharidae (Acari: Mesostigmata: Gamasina: Ascoidea) — Zootaxa 3931(3): 301-351 doi:10.11646/zootaxa.3931.3.1

Naskar K.R., Mandal R.N. 1999 — Ecology and Biodiversity of Indian Mangroves — New Delhi: Daya Publishing House. pp. 754.

Nicholas W.L., Stewart A. 1984 — *Criconemella* a *Vicenniae* n. np. (Nematoda: Criconematidae) and *Enchodel* Us *Coomansi* n. sp. (Nematoda: Nordiidae) associated with the roots of the mangrove *Avicennia marina* (Forsk.) Vierh — Nematologica, 30(4): 429-436.

Pešić V., Chatterjee T., Schizas N. 2008 — Marine water mites (Acari: Hydrachnidia: Pontarachnidae) from the Caribbean Sea, with description of one new species — Cah. Biol. Mar., 49: 253-259.

Pešić V., Chatterjee T., Ingole B.S., Velip D., Pavicevic A. 2012 — A new species of *Litarachna* Walter, 1925 (Acari: Hydrachnidia) from the West Indian Coast, with a discussion on the diversity of the family Pontarachnidae Koenike, 1910 — Cah. Biol. Mar., 53: 547-553.

Pešić V., Chatterjee T., Marshall D.J. 2013 — Marine water mites (Acari: Hydrachnidia: Pontarachnidae) from the Brunei Bay, with a description of one new species — Cah. Biol. Mar., 54(3): 405-410.

Pešić V., Chatterjee T., Marshall D., Pavićević A. 2011 — New records of water mites (Acari: Hydrachnidia) from Brunei Darussalam, Borneo, with descriptions of two new species — Zootaxa, 3018: 50-58.

Pfingstl T. 2013 — Revealing the diversity of a once small taxon: the genus *Selenoribates* (Acari, Oribatida, Selenoribatidae) — ZooKeys, 312: 39-63. doi:10.3897/zookeys.312.5478

Pfingstl T., Lienhard A., Jagersbacher-Baumann J. (2014). Hidden in the mangrove forest: the cryptic intertidal mite *Carinozetes mangrovi* sp. nov.(Acari, Oribatida, Selenoribatidae) — Exp. Appl. Acarol., 63(4): 481-495. doi:10.1007/s10493-014-9802-2

Procheş Ş. 2002 — New species of Copidognathinae (Acari: Halacaridae) from southern Africa — J. Nat. Hist., 36(8): 999-1007. doi:10.1080/00222930110034571

Procheş Ş., Warren M., McGeoch M.A., Marshall D.J. 2010 — Spatial scaling and transition in pneumatophore arthropod communities — Ecography, 33(1): 128-136.

Pepato A.R., Da Silveira P.S.A. 2015 — Two new species of *Rhombognathus* (Halacaridae, Trombidiformes) from a Mangrove in the northern littoral zone of São Paulo State (Brazil). Zootaxa, 3905(4): 500-510. doi:10.11646/zootaxa.3905.4.4

Saifullah S.M., Nizamuddin M., Gul S. 2003 — A new species of *Vaucheria* epiphytic on mangroves — Bot. Mar., 46(6): 531-533. doi:10.1515/BOT.2003.055

Sahoo G., Suchiang S.R., Ansari Z.A. 2013 — Meiofauna-Mangrove interaction: a pilot study from a tropical mangrove habitat — Cah. Biol. Mar., 54: 349-358.

Trägardh I. 1944 — Systematik der Uropodinen — Entomol. Tidskr. 65: 173-186.

WiŠniewski J. 1993 — Die Uropodiden der Erde nach Zoogeographischen Regionen und Subregionen geordnet (Mit Angabe der Lande) — Acarologie, 40: 221-291.

WiŠniewski J., Hirschmann W. 1993 — Katalog der Ganggattungen, Untergattungen, Gruppen und Arten der Uropodiden der Erde — Acarologie, 40: 1-220.

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