Genus	Vol. 21(4): 637-658	Wrocław, 27 XII 2010

Cocceupodidae, a new family of eupodoid mites, with description of a new genus and two new species from Poland. Part I. (Acari: Prostigmata: Eupodoidea)

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Abstract. In this paper, a new family Cocceupodidae, and three genera, *Cocceupodes*, *Filieupodes* gen. n. and *Linopodes*, are diagnosed. An identification key separating the genera and sixteen species is presented. Two new species, *Filieupodes filiformis* and *F. filistellatus*, collected in Poland, are described and illustrated.

Key words: acarology, taxonomy, new family, new taxa, morphology, Poland.

INTRODUCTION

Mites regarded as belonging to the genus *Cocceupodes* Thor, 1934 are most frequently observed in different soil habitats, just after representatives from genus *Eupodes* Koch, 1835. Together they are classified within the family Eupodidae Koch, 1842 which has been poorly studied and includes species of a very diversified features. So far eight families have been distinguished in a common superfamily Eupodoidea Banks, 1894 (Koch 1842, according to Qin 1996). The following families have been listed, viz., Eupodidae Koch, Penthaleidae Oudemans, 1931, Penthalodidae Thor, 1933, Rhagidiidae Oudemans, 1922, Strandtmannidae Zacharda, 1979, Eriorhynchidae Qin et Halliday, 1997, Pentapalpidae Olivier et Theron, 2000 and Dendrochaetidae Olivier, 2008. The diversity of the Eupodidae, Penthaleidae and Penthalodidae is extraordinary, while the Rhagidiidae, Strandtmaniidae and Pentapalpidae are homogeneous as well as the Eriorhynchidae with one genus and five species. Strandtmaniidae, Pentapalpidae and Dendrochaetidae have been distinguished based on one species. The key to the families of the superfamily Eupodoidea can be found in the works of Zacharda (1979),

Qin & Halliday (1997) and Olivier (2008). Cladistic analysis of the superfamily Eupodoidea was suggested by Qin in 1996 and together with Halliday - for Australian and New Zealand species in 1997. Brief characteristics of the families and genera found in Poland have been presented by the author in more detailed studies (Jesionowska 1992, 2008). The number of species that have been hitherto described in sufficient detail to allow placement in *Cocceupodes* amounts fourteen (Shiba 1969, 1978, Strandtmann 1971, Strandtmann & Tilbrook 1968, Strandtmann & Prasse 1977, Abou-Awad et al 1984, 2006, Olivier & Theron 2003, Jesionowska 2005, 2006, 2007a, b). Unfortunately, species described by Thor and Willmann (1941; three species) and Weiss-Fogh (1948; one species) cannot be classified also because the type specimens are lost. Representatives that were included to date within the genus *Cocceupodes* show substantial homogeneous structure, distinctly different from species of typical genus *Eupodes*, and other ones recently regarded as belonging to the family Eupodidae (e.g. *Benoinyssus* or even *Protereunetes*). That is why, in my opinion, they should be classified as a separate family Cocceupodidae, including three genera: *Cocceupodes*, *Filieupodes* gen. n. and *Linopodes*. Main features pointing the distinction it are rostral setae, *ro*, located in bothridia just behind a naso and not on it (differently from those in other eupodoids), and just two pairs of circumanal setae, with total number of ten pairs of setae present on opisthosoma (excluding genital region setae). The latter is considered to be an apomorphy. This paper aims, apart from key morphological features of the group, also at diagnosis facilitation, e.g. in ecological work and studies. This is the first part of work on morphology of the species that have been described up to date and two new ones. The second part will include analysis of leg chaetotaxy and discussion.

MATERIAL AND METHODS

Description of new species are based on specimens collected in Poland. Specimens were extracted in Tullgren apparatus, and then mounted in permanent slide preparation in Faure' medium. All illustration are original made using microscope equipped with phase-contrast optical system and immersion objective when necessary. All measurements are given in micrometers (μm). Key, data contained in tables and diagnoses of family and genera are created on the basis of original descriptions of 16 species gathered in genus *Cocceupodes*: (1) *C. australis* Strandtmann & Tilbrook, 1968; (2) *C. communis* Shiba, 1969; (3) *C. breweri* Strandtmann, 1971; (4) *C. shepardi* Strandtmann, 1971; (5) *C. stellatus* Strandtmann & Prasse, 1977; (6) *C. trisetatus* Strandtmann & Prasse, 1977; (7) *C. planiticus* Shiba, 1978; (8) *C. aegyptiacus* Abou-Awad & El-Bagoury, 1984; (9) *C. strandtmanni* Abou-Awad & El-Bagoury, 1984; (10) *C. fusiformis* Olivier & Theron, 2003; (11) *C. gracilongus* Olivier & Theron, 2003; (12) *C. mollicellus* (Koch, 1838) sensu Jesionowska, 2005; (13) *C. sharkiensis* Abou-Awad, El-Sawaf & Abdel-Khalek, 2006; (14) *C. longisolenidiatus* Jesionowska, 2007; (15) *Filieupodes filiformis* sp. n.; (16). *Filieupodes filistellatus* sp.n. Material is deposited in author's collection and will be transferred to Acarological Collection, Faculty of Biology, Adam Mickiewicz University, Poznań.

PRELIMINARY REMARKS

Cocceupodes australis recognized by STRANDTMANN & PRASSE (1977) as the synonym of *C. mollicellus*, I treat as a valid, separate species. Terms used in the key: "long setae" or "short setae" concern mainly setae *c*, *d* and *e*. If setae are long, this means that they reach to the next row of setae, or beyond, and that the distances between setae are not longer than length of seta. If setae are short, this means that they do not reach the next row of setae and that the distances between setae are longer than the length of seta.

Informations about genus *Linopodes* (KOCH, 1835) are based on author own observations of specimens collected in Poland and six species described by other authors: (1) *L. motatorius africanus* MEYER & RYKE, 1960; (2) *L. pubescens* MORIKAWA, 1963; (3) *L. pubescens iwatensis* MORIKAWA, 1963; (4) *L. iwatensis* MORIKAWA, n. comb. SHIBA, 1969; (5) *L. cameronensis* SHIBA, 1976; (6) *L. barnufi* ABOU-AWAD et al, 2006.

Mite body is divided into three tagmata and gnathosoma. Tagmata are aspidosoma, podosoma and opisthosoma. Together they build idiosoma. Notations for prodorsal setae, pedipalpal tarsus and opisthosoma are the same as in earlier papers (JESIONOWSKA 1991, 2000, 2005, 2007b). General description of gnathosoma was presented by JESIONOWSKA (2003, 2007b). Furrow "das" is an abbreviation of first letters of furrow names, disjugal, abjugal and sejugal. These furrows meet dorsally in one furrow which separates prodorsum from opisthosoma. Solenidia and famuli are indicated by arrows. New genus and species, *Filieupodes filiformis* and *F. filistelatus* were presented partially as "*Cocceupodes* L" and "*Cocceupodes* P", respectively, in earlier study (JESIONOWSKA 1991).

TAXONOMY

Cocceupodidae new family

Type genus: *Cocceupodes* THOR, 1934.

Type species: *Cocceupodes mollicellus* (KOCH, 1838), redescription: STRANDTMANN & PRASSE 1977; JESIONOWSKA 2005.

Synonymies according to STRANDTMANN & PRASSE 1977: *Eupodes clavifrons* CANESTRINI, 1886 (=*Cocceupodes clavifrons* in THOR 1934); *Cocceupodes curviclava* THOR, 1934; *Cocceupodes australis* STRANDTMANN & TILLBROOK, 1968.

ETYMOLOGY

Name of the family refers to the shape of rostral setae, *ro*, expanded distally, similar to the first time described species in the genus *Cocceupodes*.

FAMILY DIAGNOSIS

Representatives of the new family Cocceupodidae can be distinguished from all other families of the superfamily Eupodoidea described up to date by a combination of the following characteristics: Idiosoma ovoid to spherical, weakly sclerotized either with ornamentation lines or smooth and finely punctate. Length of idiosoma from 200 to 800 μm, breadth (at the level of setae c_2) 100-310 μm. Ratio of idiosoma length to

length of leg I: 0.19-1.42. Rostral setae, *ro*, in deep bothridia inserted just behind the naso. Therefore, two pairs of well developed trichobothria on prodorsum (rostrals, *ro*, and bothridials, *bo*) are present. Prodorsal plate developed. Naso well formed or reduced. Lack of furrow "das", separated prodorsum from opisthosoma. Instead, transverse ornamentation lines may be visible. Ten pairs of opisthosomal setae, except genital region. Two pairs of circumanal setae only, namely *ad* and *an*. Opisthosomal trichobothria lacking. Setae c_2 may be the longest on opisthosoma. Sometimes setae c_1 very short in relation to other opisthosomal setae. Short anal cleft positioned subterminally on tiny ring-shaped peranal segment, PE. Anal cleft is provided by well developed paraproctal lips. First pair of aggenital setae usually longer than others. Coxal formula: 2-1-2-2, rarely 2-1-3-2, sternal formula: 2-0-2-2. All solenidia T-shaped recumbent in depressions. Rhagidial organ I consists of two solenidia and rhagidial organ II of three, very rarely two solenidia. On tibiae I and II each two solenidia, on tibiae III and IV each one solenidion. Tibia I usually longer than tarsus I. Ambulacrum on legs I may be considerably reduced. Cheliceral seta pilose. On the subcapitulum one pair of setae *n* clavate, inserted somewhat anterior to labium, and one pair of setae *m*, thin, inserted laterobasally. Pedipalpal tarsus with nine to ten setae and with rhagidial solenidion; seta *la*'' (=*sl*) present. Three genera belong to the new family: *Cocceupodes* Thor, 1934, *Filieupodes* genus n. and *Linopodes* Koch, 1835.

KEY TO THE GENERA OF COCCEUPODIDAE

1. All the legs longer than idiosoma. Legs I from three to six times longer than idiosoma ……..... *Linopodes* (Koch, 1835)
–. Legs I slightly longer, equal, or slightly shorter than idiosoma. Remaining legs shorter than idiosoma. Legs IV may be as long as idiosoma …….....… 2
2. Rostral setae, *ro*, clavate, capitate or thickened distally …..….....
..... *Cocceupodes* (Thor, 1934)
–. Rostral setae, *ro*, threadlike ……..…….. *Filieupodes* gen. nov.

DIAGNOSES OF GENERA

Cocceupodes Thor, 1934

Type species: *Cocceupodes mollicellus* (Koch, 1838) sensu Jesionowska 2005.

Etymology

Name of the genus refers to the shape of rostral setae, *ro*, expanded distally, similar to the first time described species in genus *Cocceupodes* (Koch, 1838) sensu Jesionowska 2005.

Diagnosis

Genus *Cocceupodes* is characteristic mainly by rostral setae, *ro*, which are clavate, capitate or only thickened distally. Clavate setae have more or less clearly developed

pedicel which turns gradually into swollen distal part. Capitate setae have thin pedicel which supports spherical distal part; it turns rapidly into spherical distal part. Clavate and capitate setae are hollow (transparent) and covered by tiny thorn-shaped outgrowths. Thickened setae are solid (nontransparent), in proximal part slightly thinner than in distal one which creates a brush-like structure. To the genus *Cocceupodes* the following species with different setae *ro* are included: (1) clavate: *C. australis* Strandtmann & Tilbrook, 1968, *C. communis* Shiba, 1969, *C. breweri* Strandtmann, 1971, *C. planiticus* Shiba, 1978, *C. mollicellus* sensu Jesionowska, 2005; (2) capitate: *C. stellatus* Strandtmann & Prasse, 1977, *C. longisolenidiatus* Jesionowska, 2007; (3) slightly thickened distally: *C. gracilongus* Olivier & Theron, 2003.

***Filieupodes* gen. nov.**

Type species: *Filieupodes filiformis* sp. nov. Gender : masculine.

Etymology

The genus name refers to the thread-like, filiform, rostral setae, *ro*.

Table 1. Some morphological data characteristic for the species of genus *Cocceupodes*.

Species	Length of idiosoma	Length of leg I	Length of leg IV	Ratio of idiosoma length to leg I length	Number of aggenital setae	Number of genital setae	Number of eugenital setae
C. mollicellus Str. et Pr.; sensu Jesionowska	370 (285;120-330)	351 (310;350)	292 (?; ?)	1.05 (0.92)	4+4	4+4	3+3
C. australis Str. et Tilb.	275 [265-290]	slightly longer than body	slightly longer than leg II or III	?	4+4	4+4	3+3
C. communis Shiba.	357	357	?	?	4+4	6+6	?
C. breweri Str.	350 [300-425]	about 1.5 length of body	about body length	?	4+4	4+4	3+3?
C. planiticus Shiba.	450	554	366	0.81	4+4	6+6	?
C. stellatus Str. et Pr.	320 [280-350]	290 female 310 [340] male	about as long as body	1.10 f 1.03 m	4+4	6+6	?
C. gracilongus Ol. and Ther.	231	230	171	1.00	4+4	4+4	4+4
C. longisolenidiatus Jesion.	350	278	251	1.26	3+3	6+6	5+5

Diagnosis

The characteristic feature of representatives of a newly described genus are threadlike setae *ro*. Thin shaft of seta with shorter or longer outgrowths. Proximal part may be covered by tiny pili and distal one by triangle-shaped (thorn-shaped) outgrowths. Then setae *ro* resemble the most setae *bo*. Setae *ro* may be plumose, i.e. with identical outgrowths from base already, or in proximal part outgrowths may be longer than in distal one. Shaft of seta *ro* may be thicker or thinner. In my opinion, to the genus *Filieupodes* should belong the following species with threadlike setae *ro*, formerly described as *Cocceupodes*: *paradoxus* Weis-Fogh, 1948; *shepardi* Strandtmann, 1971; *trisetatus* Strandtmann & Prasse, 1977; *strandtmanni* Abou-Awad & El-Bagoury, 1984; *aegyptiacus* Abou-Awad & El-Bagoury, 1984; *fusiformis* Olivier & Theron, 2003; *sharkiensis* Abou-Awad, El-Sawaf & Abdel-Khalek, 2006. *Filieupodes filiformis* sp. n.; *Filieupodes filistellatus* sp.n. are newly described ones.

Thus, these species are re-named: (1) *Cocceupodes paradoxus* as *Filieupodes paradoxus* (Weis-Fogh, 1948), **new combination**; (2) *C. shepardi* as *Filieupodes shepardi* (Strandtmann, 1971), **new combination**; (3) *C. trisetatus* as *Filieupodes trisetatus* (Strandtmann & Prasse, 1977), **new combination**; (4) *C. strandtmanni* as *Filieupodes strandtmanni* (Abou-Awad & El-Bagoury, 1984), **new combination**; (5) *C. aegyptiacus* as *Filieupodes aegyptiacus* (Abou-Awad & El-Bagoury, 1984), **new combination**; (6), *C. fusiformis* as *Filieupodes fusiformis* (Olivier & Theron, 2003), **new combination**; and (7) *C. sharkiensis* as *Filieupodes sharkiensis* (Abou-Awad, El-Sawaf & Abdel-Khalek, 2006), **new combination**.

Genus *Linopodes* Koch, 1835

Type species: *Linopodes ravus* Koch, 1835. Gender: masculine.

Etymology

The name refers to especially long legs, first of all the first pair which is like lines and may be six times longer than idiosoma length.

Diagnosis

Length of idiosoma range from 400 to 800 μm. All legs longer than idiosoma. Legs of first pair extremly long, from three to six times longer than idiosoma. Ratio of idiosoma length to length of leg I 0.19 to 0.27. Legs I very thin, claws and empodium on tarsus I reduced, strikingly smaller than those on other legs. The fourth pair of legs slightly thicker than the others, especially femora. Setae of legs IV longer than those on rest of the legs. Solenidia of rhagidial organs strikingly (extraordinary!) small in comparison with article length on which they are present. Number of genital setae observed ranges from three to six pairs, and usually seven pairs of aggenital setae are present. Setae *ro* filiform. Actually, the genus *Linopodes* classification includes the following six species which are relatively sufficiently described: (1) *L. motatorius africanus* Meyer & Ryke, 1960; (2) *L. pubescens* Morikawa, 1963; (3) *L. pubescens iwatensis* Morikawa, 1963; (4) *L. iwatensis* Morikawa, n. comb. Shiba, 1969; (5) *L. barnufi* Abou-Awad et al, 2006; (6) *L. cameronensis* Shiba, 1976. Nevertheless,

unfortunately, none of the descriptions does lists features allowing direct species classification. Similar inconvenience is observed in the case of Thor & Willmann paper (1941) where they classified 18 species, distinguished only by body colour and length of legs, especially of the first pair of legs. These "ancient" species are listed below: (1) *Linopodes agitatorius* Berlese; (2) *L. ambustus* Koch; (3) *L. antennaepes* Banks; (4) *L. descolorus* Koch; (5) *L. eupodoides* Canestrini; (6) *L. flavipes* Koch; (7) *L. flexuosus* Koch; (8) *L. kochi* Thor; (9) *L. lutescens* Koch; (10) *L. maculates* Koch; (11) *L. mammouthia* Banks; (12) *L. melaleucus* Koch; (13) *L. motatorius* (Linné?) Koch; (14) *L. obsoletus* Koch; (15) *L. ravus* Koch; (16) *L. riparius* Koch; (17) *L. rubiginosus* Koch; (18) *L. subterraneus* Wankel.

KEY TO SPECIES OF THE GENERA *COCCEUPODES* AND *FILIEUPODES*

1. Setae *ro* clavate or capitate (*Cocceupodes*) ……..... 2
–. Setae *ro* threadlike (*Filieupodes*) ……. 9
2. Setae *ro* clavate or thickened in terminal two-thirds ……..…….….. 3
–. Setae *ro* capitate with well developed pedicel ……. 8
3. Setae *ro* hollow, clavate with well developed pedicel …….....…… 4
–. Setae *ro* slightly thickened distally, solid in proximal part …..... ..... *C. gracilongus* Olivier & Theron, 2003
4. Rhagidial organ on tarsus II consists of two solenidia ……..... ..... ……. *C. communis* Shiba, 1969
–. Rhagidial organ on tarsus II consists of three solenidia ……. 5
5. Dorsal opisthosomal setae long, longer than interspaces between them …… 6
–. Dorsal opisthosomal setae short ……..…….. 7
6. Solenidia of rhagidial organ I and II each create tandem in common depression, but on tarsus II depression is arched antiaxially. Stellate famulus on tarsus I inserted laterally, well distant from proximal solenidion. Six pairs of genital setae, four pairs of aggenital setae …….…….....….. *C. planiticus* Shiba, 1978
–. Solenidia of rhagidial organ I and rhagidial organ II each create tandem, both in direct common depression. Stellate famulus on tarsus I inserted laterally near base of proximal solenidion. Four pairs of genital and aggenital setae each …..... .....… *C. breweri* Strandtmann, 1971
7. Solenidia of rhagidial organ I create tandem in confluent depressions. Solenidia of rhagidial organ II lie one behind another in common, arched anti-axial depression. Four pairs of genital and aggenital setae each …..... .....….. *C. mollicellus* (Koch, 1838) Jesionowska, 2005
–. Solenidia of rhagidial organ I and II in separate depressions. Two distal solenidia of rhagidial organ II positioned as slightly at an oblique angle. Four pairs of genital and aggenital setae each …..…… *C. australis* Strandtmann & Tilbrook, 1968
8. Solenidia of rhagidial organ I create tandem in confluent depressions. Solenidia of rhagidial organ II in separate, parallel depressions inserted slantwise in relation to leg axis …….. *C. stellatus* Strandtmann & Prasse, 1977

–. Solenidia of rhagidial organ I parallel in separate depressions. Solenidia of rhagidial organ II arranged in separate parallel depressions, in relation to leg axis; two proximal solenidia laterally and distal one between them dorsally …..... ..... …. *C. longisolenidiatus* Jesionowska, 2007

9. Rhagidial organ on tarsus II with two solenidia ……. 10

–. Rhagidial organ on tarsus II with three solenidia ……. 12

10. Solenidia of rhagidial organ II in separate depressions …….. 11

-. Solenidia of rhagidial organ II create tandem in common depression. Solenidia of rhagidial organ I arranged in separate parallel depressions; tip of proximal solenidion extends to base of distal solenidion. Four pairs of genital and aggenital setae each ……..... *F. sharkiensis* (Abou-Awad et al., 2006)

11. Solenidia of rhagidial organ I and II each in separate, parallel depressions. Proximal solenidion slightly posteriorly. Six and four pairs of genital and aggenital setae, respectively ……..... ….. *F. strandtmanni* (Abou-Awad & El-Bagoury, 1984)

–. Solenidia of rhagidial organ I and II each in separate depressions arranged in line, one behind the other. Six and four pairs of genital and aggenital setae, respectively …… *F. aegyptiacus* (Abou-Awad & El-Bagoury, 1984)

12. Dorsal opisthosomal setae long, longer than interspaces between them. Solenidia of rhagidial organ I and II each create tandem in separate depressions. Setae *ro* slightly thickened proximally. Six and four pairs of genital and aggenital setae, respectively ……..... …… *F. shepardi* (Strandtmann, 1971)

– Dorsal opisthosomal setae short ……...……. 13

13. Solenidia of rhagidial organ on tarsus I create tandem dorsally ….…...…… 14

–. Solenidia of rhagidial organ on tarsus I parallel, proximal solenidion inserted laterally and distal one dorsally ……..... …….. 15

14. Solenidia of rhagidial organ II inserted one behind another in such a way that base of solenidion is situated slightly laterally to previous solenidion (staggered parallel). Only distal solenidion lies in separate depression. Six and four pairs of genital and aggenital setae, respectively …….. *F. fusiformis* (Olivier & Theron, 2003)

–. Solenidia of rhagidial organ II inserted in separate depressions; proximal and distal one lie in line dorsally, removed from each other about the length of medial solenidion. Medial solenidion positioned laterally. Three pairs of genital and aggenital setae each ……... *F. trisetatus* (Strandtmann & Prasse, 1977)

15. Stellate famulus on tarsus I subtending proximal solenidion. Naso weakly developed (reduced). Ambulacrum on tarsus I reduced, claws tiny. Solenidia on tarsus II in separate depressions, proximal and distal ones in one line laterally and medial one parallelly and dorsally. Three pairs of genital and aggenital setae each ……..... …… *F. filiformis* sp. n.

–. Stellate famulus on tarsus I in separate pit laterally and well distant from proximal solenidion. Naso well developed. Ambulacrum on tarsus I well developed (not reduced). Solenidia on tarsus II in separate parallel depressions; medial solenidion inserted between and slightly anteriorly to lateral solenidia. Six and four pairs of genital and aggenital setae, respectively …….. *F. filistellatus* sp. n.

DESCRIPTION OF TWO NEW SPECIES

Filieupodes filiformis sp. nov.

(Figs 1-9)

Etymology

The species name of this new taxon refers to shape of rostral setae, *ro*, which resemble the filiform bothridial setae, *bo*.

Type material

Holotype and one paratype, The Białowieża Forest. Hajnówka (Podlaskie District). Spruce forest. Soil sample with moss. Leg. A. Ferber.

Diagnosis

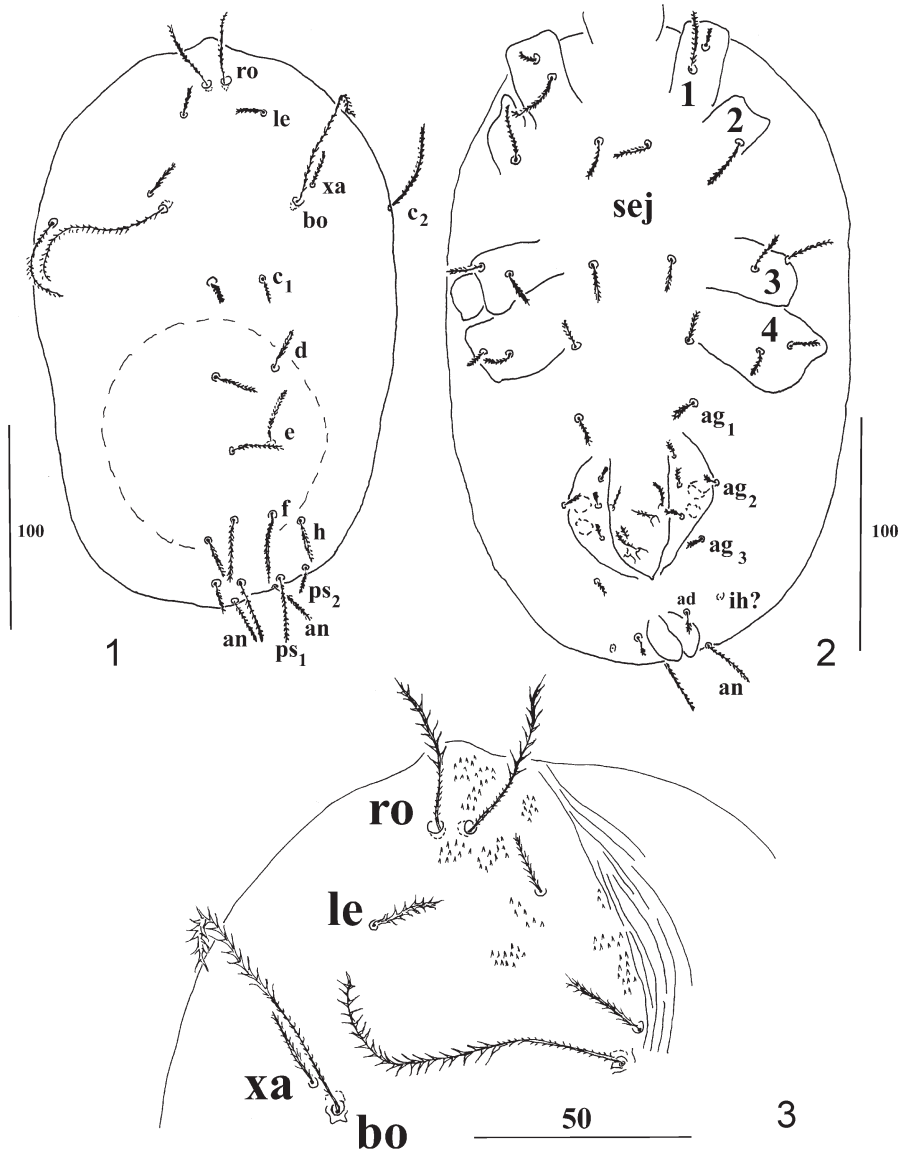
Adults can be distinguished from all other species of the Cocceupodidae by a combination of the following unique characters. Setae *ro* thread-like in bothridia positioned behind naso which is weakly developed. Leg solenidia T-shaped in depressions arranged in the following way: Rhagidial organ on tarsus I consists of two subequal solenidia lying in parallel separate depressions, one behind the other. Proximal solenidion located laterally and distal one dorsally. Rhagidial organ on tarsus II consists of three solenidia positioned in separate depressions. Two dorsal antiaxial solenidia arranged linearly (create tandem) and third paraxial solenidion laterally to them. On tibia I, two solenidia situated close to each other, in separate almost parallel depressions, near to distal margin of article. On tibia II, two solenidia in separate depressions dorsally; proximal solenidion longer than distal one and situated near to proximal margin of article, while distal solenidion near to distal one.

Description

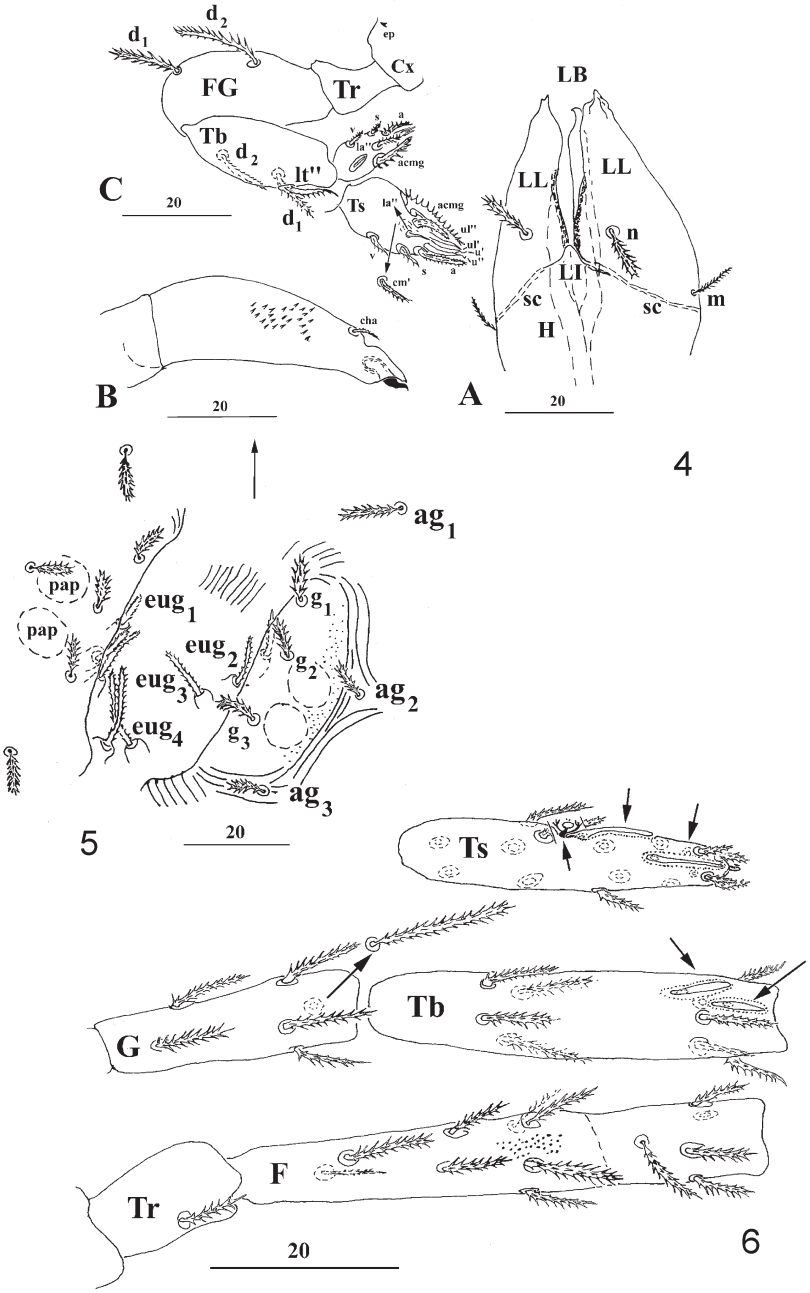
Idiosoma weakly sclerotized, oval (Figs 1, 2). Length of idiosoma 275 and width (at the level of setae c_2) 175 (holotype). Ratio of idiosoma length to leg I length 0.98.

Aspidosoma (Figs 1, 3). Deep furrow "das" not visible. Naso not clearly discernible, seen as a weakly developed protuberance; furrow separating it from the rest of prodorsum lacking. A pair of setae *ro* (35 long) in clearly developed bothridia. Setae *ro* thread-like with small spiculate outgrowths distally and delicate pili proximally. Form of setae *ro* similar to that of setae *bo*. Pair of setae *bo* (80 long) filiform in deep bothridia, in one third of their length shortly pilose. Setae *bo* extends the naso. Pairs of setae *le* (16 long) and *xa* (21 long) plumose. Prodorsal plate presents and contains the nasal protuberance as well. Its ornament consists of tiny spines. Laterally to plate edges parallel ornament lines are visible. All prodorsal setae inserted on prodorsal plate. Setae *xa* lie close to plate edges.

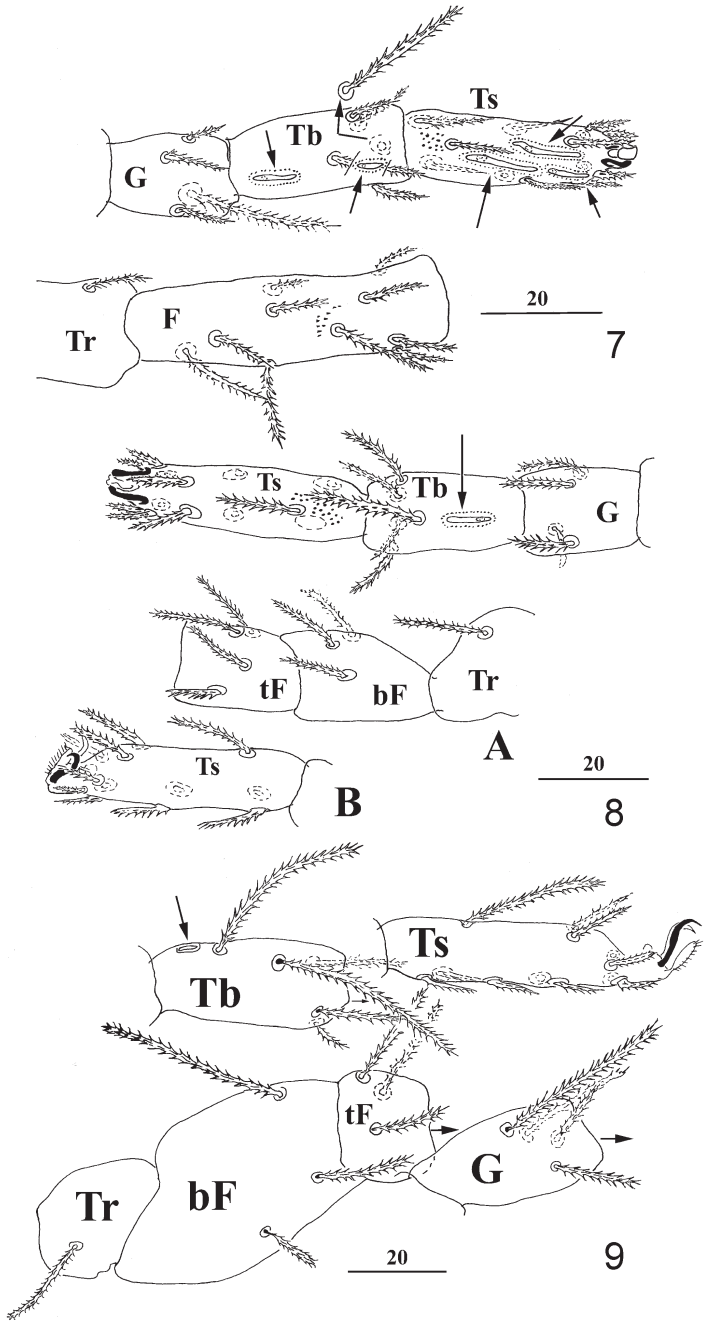
Gnathosoma (Fig. 4). Subcapitulum conical (60 long). Setae *n* (10 long) clavate, shortly plumose. Setae *m* (9 long) thin and delicately pilose. Chelicera about 63 long, fixed digit with convex base which turns into rounded narrow distal part; movable digit strongly sclerotized, tapering into hooked upward tooth; cheliceral seta pilose (7 long);



1-3. *Filieupodes filiformis* sp. nov. 1 – Dorsum : prodorsal setae: *ro*, *le*, *bo*, *xa*, opisthosomal setae: c_1, c_2, *d*, *e*, *f*, *h*, ps_1, ps_2, *an* ; 2 – Venter : coxal regions: cx 1-4; *sej*-sejugal furrow, aggenital setae: *ag* 1-3, opisthosomal setae: *an*, *ad*; 3 – Prodorsum: *ro*- rostral setae, *bo*-bothridial setae, *le*-lamellar setae, *xa*-anterior exobothridial setae



4-6. *Filieupodes filiformis* sp. nov. 4 – Gnathosoma: A. Subcapitulum, ventral view, LB -labrum, LL - lateral lips, LI - labium, H - hypostome, sc - internal sclerites, *n*, *m* - subcapitular setae, cx - coxal region of pedipalp. B. Chelicera, lateral view. C. Pedipalp, lateral view; 5 – Genital region, *ag* - aggenital setae, *g* - genital setae, *eug* - eugenital setae; 6 – Leg I, dorsal view, solenidia and famuli arrowed



7-9. *Filieupodes filiformis* sp. nov. 7 – Leg II, dorsal view. Solenidia and famuli arrowed; 8 – Leg III, dorsal view. Tarsus in lateral aspect as well. Solenidion arrowed; 9 – Leg IV, lateral view, solenidion arrowed

between cheliceral seta and base of fixed digit well visible concavity present. Pedipalps four-segmented, about 88 long. The length of segments from trochanter to tarsus as follows: 13-30-30-15; chaetotaxy 0-2-3-10(1). Setae on femorogenu plumose (d_1-14, d_2-18 long), whereas on tibia pilose (d_1- 11, d_2- 10, lt''- 9 long). Tarsal profile ovoid; ten setae and one solenidion (3-4 long) in depression. Setae with broad bases, except seta *cm*'. Setae *la*'' and *v* present. Seta *acmg* (=*d*) the largest (8 long), angled basally with outgrowths on dorsal side. Setae *ul*', *u*' and *u*'' (5 long each) hollow with short and rare pili. These setae terminating with short filament. Setae *ul*'' (6 long) and *a* (6 long) cylindrical, pilose. Setae *s* and *v* short (3-4 long each), angled basally. Seta *cm*' (4-5 long) solid, pilose. On dorsal part of coxal region one thorn-shaped supracoxal seta (*ep*; 2 long).

Opisthosoma (Figs 1, 2, 5). Ten pairs of opisthosomal setae, except those in genital region. Two pairs of setae associated with anus, namely *ad* in front of paraproctal lips and *an* behind them. Length of anal cleft slightly shorter than seta *an*. Pilose setae c_2 the longest and setae *ad* the shortest. Setae c_1 (11 long) slightly longer than *ad* (9 long). Setae c_2 (50 long) longer than prodorsal setae *ro* (35 long). The rest of setae pilose, slightly thickened distally. Setae *f*, ps_1, *d* and *an* long, *f* similar in length to ps_1, and *d* to *an*. Lengths of setae as follows: c_2-50, c_1-11, *d*-21, *e*-26, *f*-36, *h*-20, ps_1-32, ps_2-15, *ad*-9, *an*-25. Ratio of seta length to idiosoma length: c_1-0.4, c_2-0.18, *d*-0.08, *e*-0.09, *f*-0.13, *h*-0.07, ps_1-0.12, ps_2-0.05, *ad*-0.03, *an*-0.09. Distances between rows of setae c_1 and *d*, *d* and *e*, *e* and *f* longer than length of particular seta. Distances between setae c_1 and *d* longer than length of particular seta. Distances between setae *e*, *f* and ps_1 shorter than length of particular seta. Distances between setae *h* and between setae ps_2 especially large, much more than between setae *f* or ps_1. Distance between row of setae *f* and ps_1 approximately as long as seta *f*. Setae *f* and ps_1 long and similar in length, while setae *h* and ps_2 distinctly shorter. Setae *h* inserted posterolaterally to row of setae *f*. Setae *ad* slightly clavate, similar in shape to genital setae. *Genital region* (Fig. 5). Genital lips semiround, separated from opisthosomal integument. Aggenital (*ag*) and genital (*g*) setae short, except of pair of ag_1 which is visibly longer. Setae *ag* and *g* are somewhat clavate and shortly plumose, aggenital 3+3, genital 3+3. Eugenital stae (*eug*), 4+4, cylindrical, most probably eupathidial in form; first pair is the shortest, remaining pairs successively longer, so the last pair is the longest. These setae arisen from arranged symmetrically protuberances in progenital chamber. Two pairs of genital papillae.

Podosoma and legs (Figs 2, 6-9). Coxal regions more sclerotized than finely linear sternal region. Coxal setal formula: 2-1-2-2. Sternal setal formula: 2-0-2-2. Coxal regions I and II separated from coxal regions III and IV by sejugal furrow (*sej*). Second pair of setae on coxal region I and seta on coxal region II similar in length, longer distinctly than rest of coxal setae. Legs shorter than idiosoma, but first pair subequal with idiosomal length. Lengths of legs and particular leg segments, Tr-Ts: I 280 (25-90-43-68-54), II 165 (18-55-21-31-40), III 176 (22-28+24-22-31-49), IV 235 (27-50+20-38-40-60). Ambulacrum of leg I tiny, without empodium. Femur I divided partially. Femora III and IV fully divided, femur IV into long, swollen basifemur and short telofemur. Chaetotaxy and solenidiotaxy (in parentheses) for legs I-IV: Tr 1-1-1-1, F 13-10-3+4-3+3, G 6-4-4-4, Tb 9(2)-5(2)-5(1)-5(1), Ts 19(2)-13(3)-13-12.

All solenidia smooth, T-shaped in separate rhagidial depressions. Rhagidial organ on tarsus I (Fig. 6) consists of two solenidia arranged parallelly in separate depressions; proximal solenidion inserted behind and laterally in relation to distal one which lies dorsally. Stellate famulus is characteristic; it is big with large hollow spherical distal part surrounded by solid branched outgrowths. Famulus positioned slightly behind proximal solenidion laterally. Rhagidial organ on tarsus II (Fig. 7) consists of three solenidia in separate depressions. Two antiaxial solenidia lie one behind the other in one line, while paraxial solenidion parallely to them. Two solenidia on tibia I arranged close to each other nearby distal margin of article. Proximal solenidion positioned slightly slantwise. On tibia II two solenidia dorsally, proximal solenidion longer than distal one, distance between them about 1.5 times of the proximal solenidion length. On tibia III one solenidion middorsally. On tibia IV one tiny solenidion dorsoproximally. All setae plumose, ventrals on tarsi I-IV angled basally. Setae with broad bases seems to be eupathidial in form. Three pairs of setae nearby tarsal apotel short and slightly expanded distally. Characteristic angled basally setae occur on tarsi (e.g. ventrals) and on other leg articles as well (e.g. dorsals on tibia and genu I). Large club-shaped ventral

Table 2. Some morphological data characteristic for the species of genus *Filieupodes*.

Species	Length of idiosoma	Length of leg I	Length of leg IV	Ratio of idiosoma length to leg I length	Number of aggenital setae	Number of genital setae	Number of eugenital setae
F. pardoxus (Weis-Fogh)	215	230	190	0.93	4+4	6+6	?
F. shepardi (Strandt.)	380 (365-425)	slightly longer than body	slightly shorter than leg I	?	4+4	6+6	?
F. trisetatus (Str. et Prasse)	250 (240-270)	240	shorter than body	1.42	3+3	3+3	?
F. strandtmanni (Ab.-Aw.)	347 (333-371	280	221	1.24	4+4	6+6	?
F. aegyptiacus (Ab.-Aw.)	338 (327-363)	411	262	0.82	4+4	6+6	?
F. fusiformis (Ol. et Ther.)	316	469	283	0.67	4+4	6+6	6+6
F. sharkiensis (Ab.-Aw.)	224	245	177	0.91	4+4	4+4	?
F. filiformis sp. n.	275	280	235	0.98	3+3	3+3	3+3
F. filistellatus sp.n.	330	326	279	1.01	4+4	6+6	5+5 female 13 male

seta is characteristic for tibia II and genua I and II. On basifemur IV short club-shaped ventral seta with especially thin base is characteristic.

Differentiating diagnosis

Filieupodes filiformis sp. n. resembles the most *Filieupodes trisetatus* (Strandtmann & Prasse, 1977) in having three pairs of aggenital and genital setae each and in thread-like rostral setae, *ro*. *Filieupodes filiformis* differs from *F. trisetatus* in arrangement of rhagidial solenidia on tarsi I and II. In *F. filiformis* solenidia on tarsus I are inserted in separate depressions, proximal solenidion with famulus laterally and distal one dorsally; length of both solenidia almost equal. In *F. trisetatus* both solenidia create tandem dorsally, proximal solenidion clearly longer than distal one (about 2 times). In *F. trisetatus* proximal and distal solenidia on tarsus II are well distant (removed) each other about in length of mid solenidion inserted slightly laterally, whereas in *F. filiformis* proximal and distal solenidion lie strictly one behind other, with no gap between them.

***Filieupodes filistellatus* sp. nov.**

(Figs 10-19)

Etymology

The species name of the new taxon refers to filiform setae *ro* and unusual position of stellate famulus, namely laterally and well distant from solenidia of rhagidial organ I.

Type material

One male holotype. One male paratype. Ciechocinek near by to Toruń (Kujawsko-Pomorskie District). Reservation of halophyte. 19.07.1981. Leg. B. Leoniak.

Further material. Four males and three females. Częstochowa vicinity (Śląsk District) „Zielona Góra" reservation. Mosses, detritus, rotten grasses from sunny limestone. Leg. J. Rafalski.

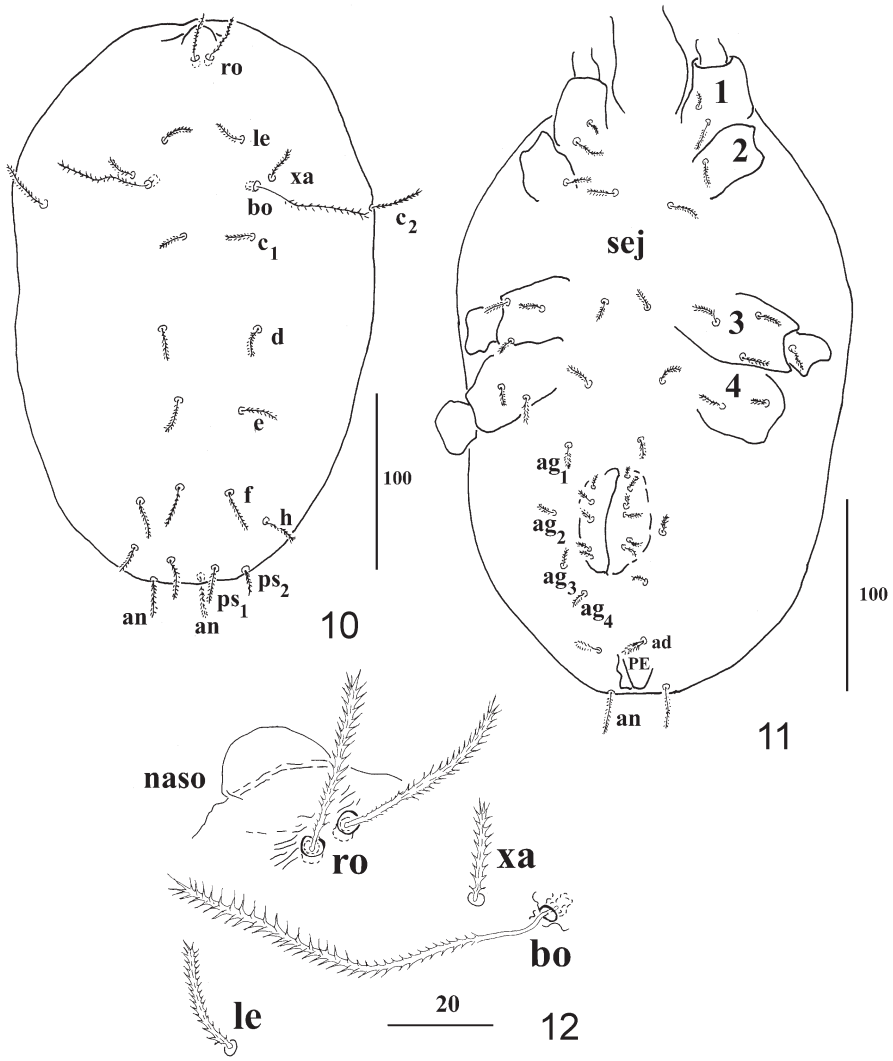
Diagnosis

Adults of this species can be distinguished from all other species of the Cocceupodidae by a combination of the following characteristics. Setae *ro* thread-like positioned in bothridia slightly behind a well developed naso. Setae c_1 similar in length to setae *ad*. All solenidia T-shaped in depressions. Rhagidial organ I consists of two solenidia arranged parallelly in separate depressions. Proximal solenidion situated slightly posterolaterad of distal solenidion. Stellate famulus well removed from proximal solenidion, positioned laterally. Rhagidial organ II consists of three parallel solenidia in separate depressions. Clearly shorter middle solenidion flanked by two parallel solenidia. Middle solenidion positioned dorsally, slantwise antiaxially. Thorn-shaped famulus situated laterally at the level of midlength of antiaxial solenidion.

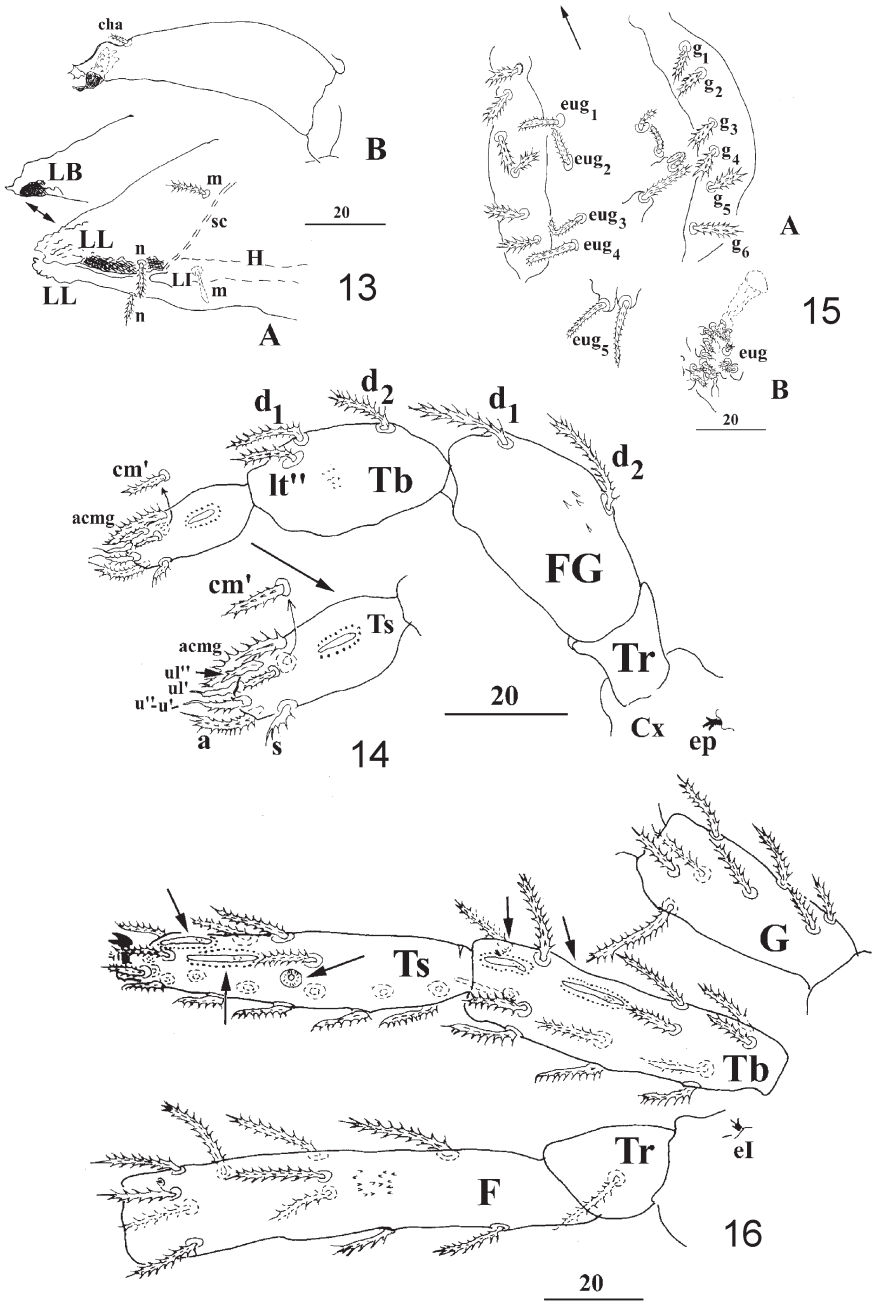
Description

Idiosoma weakly sclerotized, oval (Figs 1, 2). Length of idiosoma 330 μm, width at the level of setae c_2 210 μm (holotype). Ratio of idiosoma length to leg I length is 1.

Aspidosoma (Figs 10, 12). No discernible furrow "das". Instead of it transverse lines of ornamentation positioned behind the prodorsal plate present. Naso distinctly developed, separated from prodorsum by semicircular lines. Prodorsal plate present,



10-12. *Filieupodes filistellatus* sp. nov. 10 – Dorsum. Prodorsal setae: *ro*, *le*, *bo*, *xa*, opisthosomal setae: c_1, c_2, *d*, *e*, *f*, *h*, ps_1, ps_2, *an*; 11 – Venter. Coxal regions: cx 1-4; *sej*-sejugal furrow; aggenital setae: *ag* 1-4. Opisthosomal setae: *an*, *ad*; 12 – Prodorsal details, *ro*- rostral setae; *bo*-bothridial seta; *le*-lamellar seta; *xa*-anterior exobothridial seta



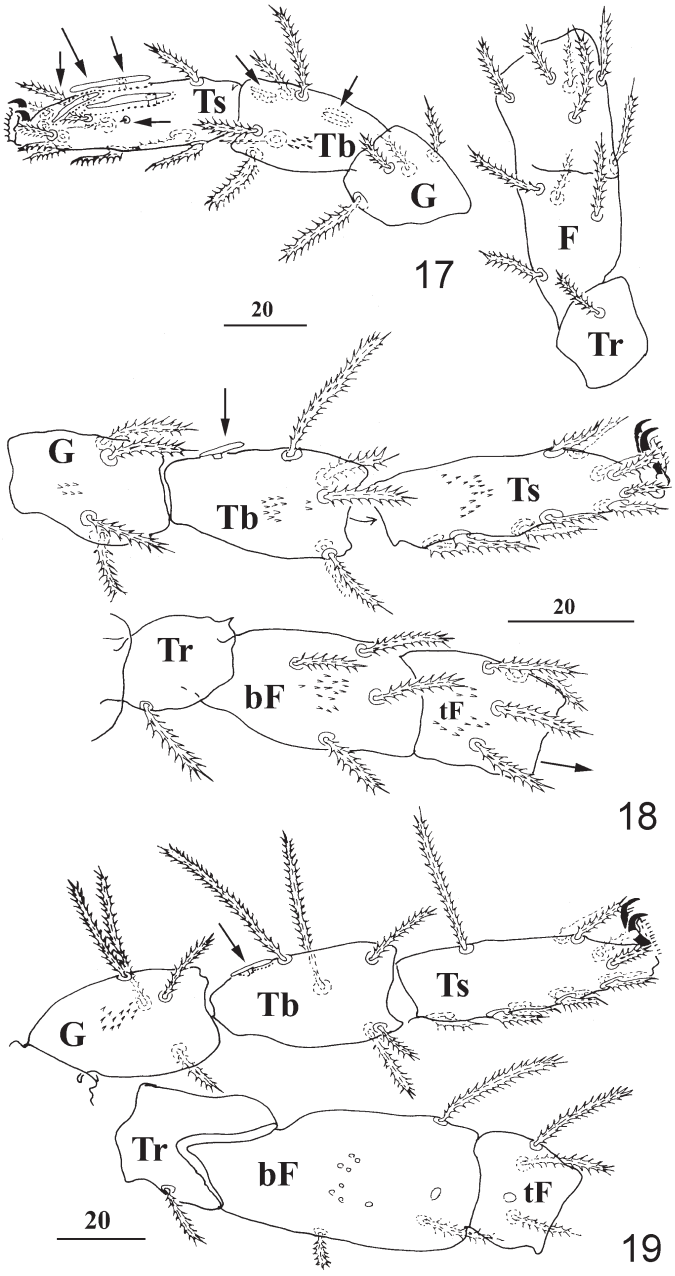
13-16. *Filieupodes filistellatus* sp. nov. 13 – Gnathosoma: A. Subcapitulum, latero-ventral view, B. Chelicera, lateral view, LB - labrum, LL - lateral lips, LI - labium, H - hypostome, sc - internal sclerites, *n*, *m* - subcapitular setae; 14 – Gnathosoma, pedipalp, lateral view ; 15 – Genital region, *g*-genital setae, *eug*- eugenital setae : A. Female. B. Male eugenital setae ; 16 – Leg I, dorso-lateral view, solenidia and famuli arrowed

well sclerotized, covered by tiny spicules. Laterally to prodorsal plate parallel ornamentation lines occur. Four pairs of prodorsal setae, two of which are situated in deep bothridia, namely *ro* and *bo*. Setae *ro* (about 36 long) lying behind the naso; they are thread-like, delicately plumose, in a basal third of its length shortly plumose. Setae *bo* filiform (about 75 long), in about half of its length with short pili. Setae *bo* inserted nearly posterior margin of prodorsal plate. Setae *xa* (about 20 long) and setae *le* (about 19 long) subequal, shortly plumose.

Gnathosoma (Figs 13, 14). Subcapitulum (Fig. 13A) conical, about 69 µm long. Pair of setae *n* (9 long) and pair of setae *m* (10 long) shortly plumose. Chelicerae (about 74 long; Fig. 13B). Movable digit strongly sclerotized with hooked upwards thorn-like distal part; fixed digit hood-shaped, three-tipped; basal part of fixed digit convex, just posterior to it one cheliceral seta (*cha*) with delicate pili. Pedipalps (Fig. 14) about 116 long, Tr-FG-Tb-Ts: 14-47-33-22; coxal region developed with three-tipped tiny supracoxal seta (*ep*). Setae on femorogenu and tibia shortly plumose. Setae d_1 (18 long) and d_2 (20 long) on femorogenu similar in length. On tibia both setae *d* subequal (d_1-14, d_2-12 long), seta *lt*'' (12 long). Tarsus eliptical in profile with nine setae and one T-shaped small (4-5 long) solenidion in depression. Shortly pilose seta *la*'' (4 long) present. Seta *acmg* (=*d*; 11 long) the biggest, angled basally, similarly seta *s* (5 long). Setae *cm*', *a* and *ul*'' (7, 9, 6 long, respectively) with thick stem, shortly pilose; setae *ul*', *u*'', *u*' (7, 8, 8 long, respectively) cylindrical with very rare long pili, hollow and terminated to a whip.

Opisthosoma (Figs 10, 11, 15). Opisthosoma bears ten pairs of setae, except those of genital region, two of which associated the anal cleft, that is *ad* and *an*; *ad* in front of paraproctal lips and *an* behind them. Distances between rows of setae c_1 and *d*, *d* and *e*, *e* and *f*, *h* and ps_1 exceeding the length of seta. Distance between rows of setae *f* and *h* does not exceed length of seta. Setae c_2 the longest (about 35 long). Setae c_1, ps_2 and *ad* short and similar in length. Setae *d*, *e* and *an* equal, similarly setae *f* and ps_1. Setae *f* a bit longer than *h*, and setae *h* than ps_2. Lengths of setae c_1-18, c_2-35, *d*-22, *e*-22, *f*-27, *h*-23, ps_1-27, ps_2-18, *ad*-15, *an*-23. Ratio of seta length to idiosoma length: c_1-0.05, c_2-0.11, *d*-0.07, *e*-0.07, *f*-0.08, *h*-0.07, ps_1-0.08, ps_2-0.05, *ad*-0.05, *an*-0.07. Length of setae without great differences, however, posterior of those slightly longer (*f*, ps_1). Setae *ad* morphologically resembles those of genital region. *Genital region* (Figs 11, 15). Genital lips weakly developed with six pairs of genital setae (*g*) arranged in one row. Aggenital setae (*ag*) positioned in one longitudinal row laterally to genital lips, 4+4. Eugenital setae (*eug*) in progenital chamber arisen from more sclerotized protuberances; most probably eupathidial in form. There are differences between sexes; male eugenital setae are short and arranged in six pairs, while female ones have five pairs of long setae. In both sexes stem of seta is thick with short outgrowths, in males slightly longer.

Podosoma and legs (Figs 11, 16-19). Coxal regions well visible, strongly sclerotized. Between them clearly distinguished sternal region with finely ornamentation lines arranged paralelly to long axis of the body. Contiguous coxal regions I and II separated from contiguous coxal regions III and IV by sejugal furrow (*sej*). Coxal formula: 2-1-3-2, sternal formula: 0-2-2-2. Supracoxal seta (*e*) the same as that on pedipalpal



17-19. *Filieupodes filistellatus* sp. nov. 17 – Leg II, dorso-lateral view, solenidia and famuli arrowed; 18 – Leg III, lateral view, solenidion arrowed; 19 – Leg IV, lateral view, solenidion arrowed

coxal region. Legs shorter than idiosoma, except the first ones which are as long as the body. Lengths of legs and particular leg segments (approximately), Tr to Ts: I 326 (29-102-48-72-75), II 213 (23-39+34-29-35-53), III 213 (22-40+30-31-37-53), IV 279 (35-70+26-45-44-59). Femora III, IV divided into basi- and telofemur, femur II partly divided. Basifemur of leg IV slightly swollen, longer clearly from short telofemur. Legs II and III subequal, while legs IV shorter than legs I. Apotelae with ambulacra consisting of two claws and pad-like empodium with setules. Claws with rays. Ambulacra clearly larger on tarsi III and IV. Chaetotaxy and solenidiotaxy (in parentheses) for legs I to IV: Tr 1-1-1-1, F 11-4+6-4+4-3+3, G 8-4-4-4, Tb 13(2)-5(2)-5(1)-5(1), Ts 20(2)-12(3)-12-12. Solenidia smooth, without striae, T-shaped in depressions. Rhagidial organ I (Fig. 16) consists of two parallel solenidia in separate depressions, proximal solenidion (14 long) positioned slightly laterally, while distal one (11 long) dorsally; distal part of proximal solenidion apparently at the level of stem of distal solenidion. Stellate famulus situated laterally distant form proximal solenidion, at the level of dorsal seta and nearly lateral seta. Stellate famulus with big hollow head surrounded by lateral solid ("black") outgrowths. Rhagidial organ II (Fig. 17) consists of three parallel solenidia in separate depressions, two of them long (20 long each) flanked medial dorsal one; medial solenidion (15 long) slightly slantwise and more distally than two laterals. Both lateral solenidia inserted at the same level. Tiny thorn-shaped famulus positioned in tiny pit laterally to antiaxial solenidion. On tibia I two solenidia in separate depressions arranged linearly one behind the other; distance between them (about 8 long) similar to length of distal solenidion; distal solenidion (10 long) in broad depression together with tiny three-tipped famulus laterally; proximal solenidion (15 long) about 1.5 times longer than distal one. Both solenidia situated on distal part of leg article. On tibia II two solenidia, distal smaller (5 long) than proximal one (7 long), and situated in very small depression; proximal solenidion inserted in proximal part of article and distal one near to distal margin of leg article. On tibiae III and IV one solenidion each (8 and 10 long, respectively) in proximal part of leg article. All setae plumose, no longer than length of leg article (except those on tibia IV), similar morphologically to those in other species (e.g. *F. filiformis* sp.n.; Jesionowska 2006, 2007a, b).

Differentiating diagnosis

Filieupodes filistellatus resembles the most *Filieupodes stellatus* (Strandtmann & Prasse, 1977). *Filieupodes filistellatus* differs from *F. stellatus*, in having thread-like setae *ro* and in arrangement of solenidia on tarsi I and II. Solenidia in rhagidial organ I in *F. filistellatus* lying in separate parallel depressions, while in *F. stellatus* they are arranged one behind the other in confluent depression. Middle solenidion of rhagidial organ II in *F. filistellatus* is clearly and partially in front of lateral solenidia, while in *F. stellatus* the most removed (distant) is antiaxial solenidion. In *F. filistellatus* lateral solenidia are parallel, while in *F. stellatus* they lie obliquely.

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