

Onychiurinae of Poland (*Collembola*: *Onychiuridae*)

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ABSTRACT. A review of all hitherto recorded Polish species of *Onychiurinae* BÖRNER, 1901, and a key to their determination are given. Generic and tribal-level classifications of *Onychiurinae* are critically reviewed. Two new genera: *Detriturus* gen. n., *Agraphorura* gen. n. and one tribus - *Thalassaphorurini* tribus. n. are proposed. Based on the type material the following species are redescribed: *Kalaphorura carpenteri* (STACH, 1919); *Heteraphorura variotuberculata*, (STACH, 1934); *Archaphorura serratotuberculata* (STACH, 1933); *Protaphorura pannonica* (HAYBACH, 1960); *Onychiurus ambulans* (LINNAEUS, 1758) sensu STACH, 1934; *Deuteraphorura variabilis* STACH, 1954; *Orthonychiurus rectopapillatus* (STACH, 1933); *Deharvengiurus denisi* (STACH, 1934); *Onychiuroides granulosus* (STACH, 1930).

Key words: entomology, taxonomy, monograph, *Collembola*, *Onychiuridae*, Poland.

INTRODUCTION

Studies on the *Onychiuridae* of Poland, dating back to 19c. were summarized in a monograph by STACH (1954) which, besides the descriptions of all the then known species of the country, contained also a presentation of the state of systematic knowledge. Since then much has changed in the colembollan taxonomy. Other criteria of taxonomic description have been introduced, many new species described, and the views on the systematic of the *Onychiuridae* as a whole have changed. Besides, many species previously unknown have been recorded from Poland.

Within the last years two papers appeared (POMORSKI 1996, WEINER 1996) discussing the opinions on the systematics of the *Onychiuridae*. It follows from them that there are two general concepts of taxonomic division. One of them postulates the presence of only one genus: *Onychiurus* GERVAIS, 1841, with a few subgenera (STACH 1954, GISIN 1960, PALISSA 1964, CHRISTIANSEN and BELLINGER 1980), the other advocates many genera grouped (or not) in several subfamilies or tribes (BAGNALL 1949, 1949, SALMON 1964, BABENKO et al. 1988). Both POMORSKI (1996) and WEINER (1996) share the latter opinion. Systematic divisions of the *Onychiuridae* proposed by the quoted authors are presented below.

BAGNALL (1949)

Family: *Onychiuridae*

Subfamilia: *Onychiurinae* Subfamilia: *Oligaphorurinae* Subfamilia: *Protaphorurinae*

Genus: *Micronychiurus*

Genus: *Onychiurus*

Genus: *Onychiuroides*

Genus: *Absolonia*

Genus: *Pseudonychiurus*

Genus: *Argonychiurus*

Genus: *Neonychiurus*

Genus: *Paronychiurus*

Subfamilia: *Psyllaphorurinae*

Genus: *Psyllaphorura*

Genus: *Archaphorura*

Genus: *Oligaphorura*

Genus: *Micraphorura*

Genus: *Dimorphaphorura*

Genus: *Protaphorura*

Genus: *Kalaphorura*

Genus: *Thalassaphorura*

Genus: *Allaphorura*

Genus: *Handschiniella*

Genus: *Stenonychiurus*

Genus: *Heteronychiurus*

Genus: *Spelaphorura*

Genus: *Hymenaphorura*

Genus: *Hymenaphorurodes*

Genus: *Heteraphorura*

STACH (1954)

Subfamily: *Onychiurinae*

Genus: *Oligaphorura*

Genus: *Hymenaphorura*

GISIN (1960)

Family: *Onychiuridae*

Genus: *Onychiurus*

Subgenus: *Oligaphorura*

PALISSA (1964)

Family: *Onychiuridae*

Genus: *Onychiurus*

Subgenus: *Cribrochiurus*

Genus: <i>Spelaphorura</i>	Subgenus: <i>Protaphorura</i>	Subgenus: <i>Oligaphorura</i>
Genus: <i>Kalaphorura</i>	Subgenus: <i>Onychiurus</i>	Subgenus: <i>Hymenaphorura</i>
Genus: <i>Supraphorura</i>		Subgenus: <i>Kalaphorura</i>
Genus: <i>Protaphorura</i>		Subgenus: <i>Protaphorura</i>
Genus: <i>Paronychiurus</i>		Subgenus: <i>Onychiurus</i>
Genus: <i>Psyllaphorura</i>		Subgenus: <i>Paronychiurus</i>
Genus: <i>Orthonychiurus</i>		
Genus: <i>Deuteraphorura</i> = <i>Onychiurus</i>		

SALMON (1964)

Subfamily: *Onychiurinae*

Genus: *Archaphorura*
 Genus: *Spelaphorura*
 Genus: *Psyllaphorura*
 Genus: *Kalaphorura*
 Genus: *Handschiniella*
 Genus: *Protaphorura*
 Genus: *Hymenaphorura*
 Genus: *Absolonia*
 Genus: *Onychiurus*
 Genus: *Paronychiurus*
 Genus: *Pseudonychiurus*
 Genus: *Metonychiurus*

BABENKO at all. (1994)

Subfamily: *Onychiurinae*

Genus: *Oligaphorura*
 Genus: *Probolaphorura*
 Genus: *Psyllaphorura*
 Genus: *Kalaphorura*
 Genus: *Uralaphorura*
 Genus: *Protaphorura*
 Genus: *Hymenaphorura*
 Genus: *Ongulonychiurus*
 Genus: *Onychiurus*
 Genus: *Paronychiurus*

CHRISTIANSEN & BELLINGER (1980)

Family: *Onychiuridae*

Genus: *Onychiurus*
 Subgenus: *Archaphorura*
 Subgenus: *Protaphorura*
 Subgenus: *Onychiurus*

POMORSKI (1996)

Subfamily: *Onychiurinae*Tribus: *Onychiurini*

Genus: *Bionychiurus*
 Genus: *Onychiurus*
 Genus: *Deuteraphorura*
 Genus: *Allaphorura*
 Genus: *Tantulonychiurus*
 Genus: *Argonychiurus*
 Genus: *Onychiuroides*
 Genus: *Orthonychiurus*

Tribus: *Oligaphorurini*

Genus: *Archaphorura*
 Genus: *Oligaphorura*
 Genus: *Micraphorura*

Tribus: *Protaphorurini*

Genus: *Protaphorura*
 Genus: *Supraphorura*

Tribus: *Hymenaphorurini*

Genus: *Hymenaphorura*

WEINER (1996)

Subfamily: *Onychiurinae*Tribus: *Onychiurini*

Genus: *Bagnallophorus*
 Genus: *Onychiurus*
 Genus: *Deuteraphorura*

Tribus: *Oligaphorurini*

Genus: *Archaphorura*
 Genus: *Oligaphorura*
 Genus: *Micraphorura*

Tribus: *Protaphorurini*

Genus: *Protaphorura*
 Genus: *Supraphorura*
 Genus: *Allaphorura*

Genus: <i>Paronychiurus</i>	Genus: <i>Dimorphaphorura</i>	Genus: <i>Probolaphorura</i>
Genus: <i>Pseudonychiurus</i>	Genus: <i>Chribellaphorura</i>	Genus: <i>Kalaphorura</i>
Genus: <i>Argonychiurus</i>		Genus: <i>Heteronychiurus</i>
Genus: <i>Onychiuroides</i>		Genus: <i>Hymenaphorura</i>
Genus: <i>Orthonychiurus</i>		Genus: <i>Protaphorurodes</i>
Genus: <i>Deharvengiurus</i>		Genus: <i>Heteraphorura</i>
Genus: <i>Spinonychiurus</i>		Genus: <i>Uralaphorura</i>
Genus: <i>Thibaudichiurus</i>		Genus: <i>Jailolaphorura</i>
Genus: <i>Micronychiurus</i>		
Genus: <i>Formosanonychiurus</i>		
Genus: <i>Onychiurus</i>		Tribus: <i>Cribrochiurini</i>
Genus: <i>Allonychiurus</i>		Genus: <i>Cribrochiurus</i>
Genus: <i>Deuteraphorura</i>		
Genus: <i>Ongulonychiurus</i>		
Genus: <i>Absolonia</i>		

Among the presented concepts only WEINER's (1996) paper is complete. The paper contains a critical review and redescription of all the genera known from literature. This is no doubt a very important achievement, constituting the first step towards a full and modern systematization of this colembollan group. Some doubts, however, are raised by the author's views on the systematic of the taxa above generic rank. She tried to justify the presented division with cladistic analysis, based only on 26 characters, arbitrarily regarded as generic. With 32 taxa the number is insufficient, and the obtained cladograms are at least doubtful. Besides, the author gives no arguments in favor of character polarization, especially that some of her proposals are controversial. The orthodoxically assumed crucial role of the postantennal organ PAO in the division of the *Onychiurinae* into tribes is also doubtful. A consequence of this line of reasoning is assignment of very closely related genera to different tribes (e.g. *Heteraphorura* and *Paronychiurus* differ essentially only in the degree of secondary granulation of PAO and in the cladogram they are next to each other, in the same phylogenetic lineage), or connecting other genera with remote phylogenetic lineages (e.g. assigning the genus *Allaphorura* to the *Protaphorurini* because of simple tubercles in PAO).

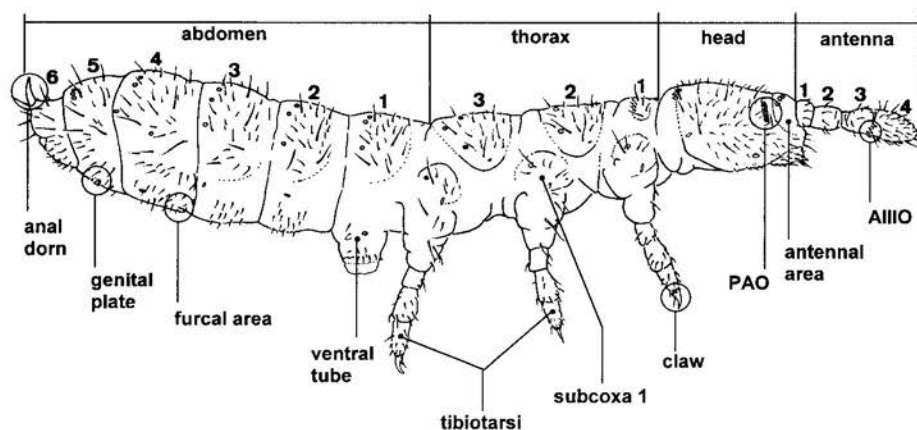
In the light of the above discussion, WEINER's (1996) proposal of taxonomic division at the tribal level is not fully justified, and because of this I divided the *Onychiurinae* according to my own, partly modified criteria, adopted in my studies on juvenile stages (POMORSKI 1996).

The aim of this paper is a redescription of our native species which had been imprecisely described without type designation, and updating descriptions of other species, known from Poland, according to the requirements of modern taxonomy.

MORPHOLOGY OF THE *ONYCHIURINI* WITH SPECIAL REFERENCE TO DIAGNOSTIC CHARACTERS

GENERAL BODY STRUCTURE

The body of any member of the *Onychiurinae* is built according to the pattern typical of *Collembola* of the order *Poduromorpha*. It is usually elongated, from 0.5 to 5 mm long, cylindrical and consisting of three tagmae: head, three-segmented thorax and six-segmented abdomen (fig. 1). The phenomenon of fusing of whole segments does not occur in the *Onychiurinae*, but in some species devoid of abdominal spines there is a partial or complete accretion of terga of last (IV, V, VI) abdominal segments.



1. General morphology of *Onychiurinae*

On the head there are four-segmented antennae, segments III and IV being most often thickened and forming a club (sometimes these segments are partly fused). At the base of antennae there is the postantennal organ (PAO) which only in the genus *Cribrochiurus* WEINER, 1996 has been completely reduced. The mouth parts are of biting type and have a structure typical of *Collembola*. All the *Onychiurinae* are completely devoid of eyes.

Each of the three thoracic segments bears a pair of legs of a typical springtail structure.

On the first abdominal segment, on the ventral body side, there is tubus ventralis. The onychiurine furcula are always reduced to a varied extent and never functional. The retinaculum in a great majority of species is also completely reduced, but there exist whole genera in which it is well visible. On the fifth abdominal segment gonopores are located. The anus, surrounded by three anal lobes, is located on the sixth abdominal segment. Besides, most onychiurines may have setae transformed into more or less pronounced abdominal spines on the sixth abdominal segment.

COLOURATION

Most onychiurines inhabit deeper layers of soil and they are completely unpigmented; their colour can be termed milky white. There are, however, some species, whose cuticle contains a yellow or orange pigment. In the Polish fauna only four species show a slightly yellowish colouration: *Oligaphorura groenlandica* (TULLBERG, 1876), *Protaphorura lata* (GISIN, 1956), *Kalaphorura paradoxa* (SCHÄFFER, 1900) and *Kalaphorura carpenteri* (STACH, 1920). Sometimes in preserved material through the body covers the gut may shine through, brown-, greenish- or reddish-coloured. The colour depends on the last meal of the specimen, which sometimes is of diagnostic value.

BODY COVERS

The outermost body cover of the onychiurines is a chitinous cuticle of granular surface, whose basic structure is well visible only in SEM. The pattern of the granulation - hexagonal arrangement of joined triangular granules - is the same in all *Collembola*. More information on the subject can be found in the monographs of BABENKO et al. (1988) and HOPKIN (1997). In the onychiurines the body granulation is as a rule uniform and consists of secondary granules which in small species (up to 1 mm) may be coarser and more distinct around the submedian pseudocelli. Species or whole genera of a larger size may have the body covered with a very coarse granulation of densely packed secondary granules, sometimes completely hiding the pseudocelli. Sometimes on the terga fields of distinctly coarser granulation occur. Among the members of the Polish fauna such a situation is observed only in the tribe *Hymenaporurini*, and especially in the genera *Hymenaphorura* and *Kalaphorura*.

In the taxonomy of the *Onychiurinae* the granulation is of moderate diagnostic value.

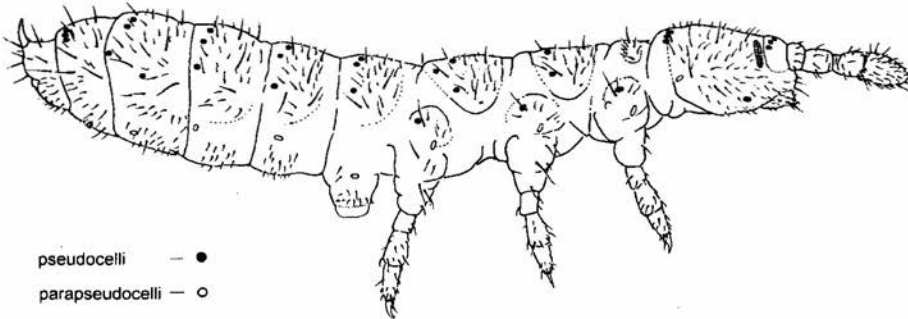
PSEUDOCELLI

A characteristic feature of the entire family *Onychiuridae* is the presence of pseudocelli - epicuticular structures located practically on all the body parts. Their role has not been elucidated in detail but most probably they are defensive structures. Irritated animals eject an opaque, whitish, sticky liquid through their pseudocelli; in alcohol the secretion assumes a pudding-like consistency. The secretion is produced by glandular cells which are embedded in the body cavity and contact with the haemolymph (RUSEK & WEYDA 1981). Two types of pseudocelli are known.

The **pseudocelli** (pso) are circular or, less often, widely oval, with a characteristic ribbing, surrounded by a stronger chitinized border. The ribs are arranged like a zipper, along the long axis of the organ, in two interlocking rows. The number and arrangement of the pseudocelli play an important role in the onychiurine taxonomy (GISIN 1952, 1960, POMORSKI 1990, SKARZYŃSKI 1991).

The number of pseudocelli is presented as a pseudocellar formula which is a formalized number of pso on one body side. Using the pso formula as a diagnos-

tic character is sometimes very problematic. Besides species of a constant number of pso, there are species or even genera in which the character varies widely. Symmetrical reductions or appearance of additional pso are the reason for many erroneous identifications and descriptions. The variation may have a genetic or teratological background. An example of pseudocellar formula is shown in fig 2.



2. Arrangement of pseudocelli and parapseudocelli in *Protaphorura armata*. Pseudocellar formula dorsally: 33/023/33343, ventrally: 1/000/000000. Parapseudocellar formula ventrally: 1/000/111101^m (parapseudocellus on anal lobe is invisible). All subcoxa1 with 1 pseudocellus and 1 parapseudocellus. Parapseudocelli on subcoxa2 and femora not marked

Parapseudocelli (psx) are as a rule elongated or widely oval, with a ribbing like that of pso, but never with a chitinized border (RUSEK 1984). The number of psx can be also presented as a formula identical with that of pso. The number of psx was first used as a diagnostic character in the papers of WEINER (1989) and POMORSKI (1990, 1993)). Psx are usually located on the ventral body side, on legs and anal lobes. Less often they are observed on the dorsal side. Their location is strictly determined. Very often they occur in the same places as pso. The only onychiurine body parts on which only psx were found are inner surfaces of femora and anal lobes. The diagnostic value of psx is comparable to that of pso. Psx, like typical pso, undergo a relatively wide variation, but this is manifest only as reduction. I have never observed a duplication of psx, whereas I have seen additional psx on antennal segments. An example of parapseudocellar formula is shown in fig. 2.

PSEUDOPORES

They are circular structures of a delicate granulation (figs. 31, 73, 74, 446), unknown function and located on almost all the body parts. They are located on: ventral surface of area antennalis, symmetrically submedially on the anterior part of thoracic (II and III) and abdominal (I-IV) terga. On the ventral side of body they may be located symmetrically between the first and second, or second and

third pairs of legs, and medially or symmetrically (only in the genus *Kalaphorura*) on abdominal sterna (I-IV). Besides, pseudopores are located on the outer surfaces of all coxae.

Till now the pseudopores have not been used as diagnostic characters.

CHAETOTAXY

Like in the remaining *Collembola*, onychiurine chaetotaxy provides a considerable number of diagnostic characters. A part of them are associated with definite morphological structures, e.g. sense organs, tibiotarsi, furcal field, and these will be discussed separately. Here only characters of general body chaetotaxy are discussed.

Taxonomic value of chaetotaxy characters is clearly associated with the body size. In relatively small species the number of setae, their proportions and arrangement are easy to determine. Likewise, setae sensuales are distinct and it is easy to determine their location. Relatively large body size is usually associated with an increased number of setae whose presence, absence, location and proportions undergo a wider variation which decidedly decreases their value as diagnostic characters. The problem involves also sensory chaetotaxy which in large species is as a rule completely invisible.

Below I list and characterize in detail the most important characters based on chaetotaxy, used in taxonomy of the *Onychiurinae*.

SENSORY CHAETOTAXY

Setae sensuales (sensilla) differ from the remaining setae, besides the different angle of light refraction visible in microscope, most of all in proportions - as a rule they are bluntly terminated, shorter, thicker and even lanceolate (fig. 3). Their chaetoporus, compared with the neighbouring typical setae, is usually somewhat larger. Sensilla are located on nearly all the onychiurine body regions.

On antennal segment IV there is always a certain number of sensilla, but usually they are morphologically indistinct and till now have not been more widely used as diagnostic characters. They are best visible in some members of the genus *Allaphorura* [= *Thalassaphorura* (WEINER 1996)].

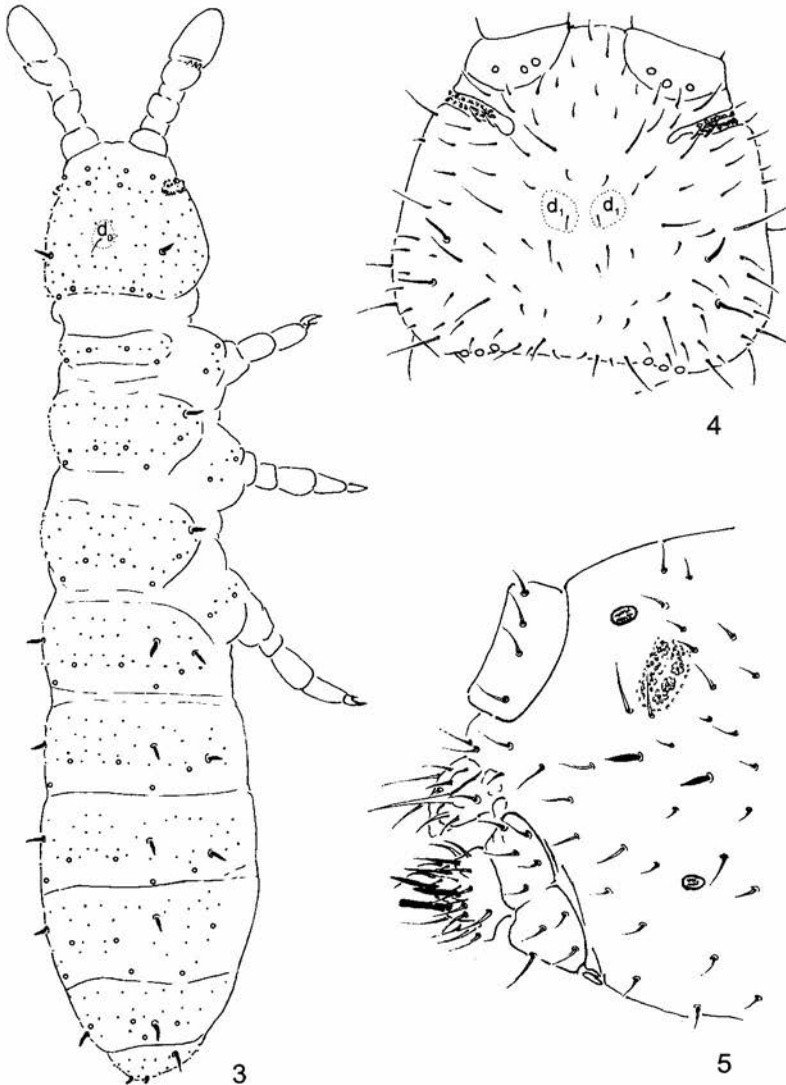
On the head sensilla are present in two positions: from 1+1 to 4+4 sensilla dorsally in the posterior part of head capsule, slightly below the group of pseudocelli and from 0+0 to 2+2 sensilla ventro-laterally, below PAO (figs. 4, 5).

The first thoracic segment is devoid of sensilla, while the terga of segments II and III are provided with 1+1 sensilla, dorso-laterally just above the microsensillum.

Abdominal segments I-III have on their terga 2+2 sensilla, segment IV - 1+1 sensilla on the tergum and 1+1 sensilla ventrally on the laterotergum, segment V - 2+2 (1+1) sensilla on the tergum, and segment VI - 1+1 sensilla on the tergum.

The sensilla are also located on subcoxa 2 and femur, but only in few cases they are possible to observe.

On the dorsal body side the number of sensilla is most often presented as sensillar formula (fig. 3) which is used as a diagnostic character in the onychiurine taxonomy.



3-5. Localization of setae sensuales (sensilla): 3 - dorsal side of body of *Tantulonychiurus volinensis*, sensillar formula 1/011/222111, 4 - dorsal side of head of *Protaphorura* sp. with 2+2 sesillae, 5 - sensilla on ventral side of head of *Tantulonychiurus volinensis*

MICROSENSILLA

In the *Onychiurinae* microsensilla (ms) are present on antennal segments III and IV, and on thoracic terga II and III. On antennae they are usually located just next to AIIIO, and they can even form a part of it (fig. 6). On antennal segment IV ms is located latero-externally, slightly above AIIIO. On antennal segment III ms is also situated latero-externally, but below AIIIO. There are species, however, in which ms are distinctly remote from AIIIO. The location of ms in relation to other antennal structures is a good diagnostic character.

On thoracic terga ms are located laterally, on their outer margins. Sometimes, however, they may be quite reduced. The absence of ms is of a high diagnostic value.

GENERAL BODY CHAETOTAXY

Among the numerous setae that cover the onychiurine body only some are of a high diagnostic value. In this respect unpaired setae are especially important. On the head such a character is the presence vs. absence of seta d_0 (figs. 3, 4). Unpaired setae on abdominal terga IV, V and especially VI are of similar importance (figs. 12-17).

Not only the arrangement of setae, but also their shape plays an important role. In some species the tip of seta may be blunt, rounded, ampulla-like or even bifid (figs. 423, 433). In the native onychiurine fauna such a situation occurs in the genera *Onychiurus*, *Deuteraphorura* and *Kalaphorura*.

In some cases the relative length of setae as compared to the length of abdominal spines or claws is given as a diagnostic character. Regretfully, the character may result in many mistakes and should be applied with great caution, since the length of setae changes with the animal's age. Young individuals (e.g. subadults) have relatively longer setae than fully mature and grown individuals. Besides, in some species with distinct dimorphism, the length of setae is sex-associated - smaller males have relatively longer setae.

ABDOMINAL SPINES

Like in many other taxa within the *Poduromorpha*, most onychiurines have on their abdominal segment VI two setae transformed into stronger or weaker abdominal spines. As a rule, strong abdominal spines are curved and set on cuticular tubercles, traditionally called papillae (figs. 15-17). Weak spines look like thickened setae and are nearly always inserted with no papilla (fig. 13). In the onychiurine taxonomy the abdominal spines provide several rather important diagnostic characters. The most important is the mere presence vs. absence of the spines. The character is generally stable within the genus. Till now only members of the genus *Thalassaphorura* have been observed to vary in the degree of spine development: from strong spines to complete absence of spines. Fairly good diagnostic characters, often used in detailed diagnoses, are the size, insertion and shape of abdominal spines. The size of spines is most often given in relation to the claw length or to the length of some setae.

ANTENNAL III SENSE ORGAN (AIIIIO)

The outer side of the third antennal segment is provided with a sensory complex of chemoreceptor sensilla, called antennal III sense organ (ALTNER & THIES 1972). Compared with other collembolans, its structure in the *Onychiurinae* is comparatively complicated. This results from the edaphic mode of life of most species. AIIIIO is built of two sensory rods and two sensory clubs protected by cuticular papillae and typical setae (figs. 6, 9-11).

Almost every morphological component of AIIIIO provides a considerable number of diagnostic characters. The number and shape of papillae are important characters. Most often they are five in number and finger-like. Some species, however, have fewer papillae of different shape. The number of guard setae is also a good diagnostic character, since it is constant within species. AIIIIO of a great majority of onychiurines has 4-5 guard setae. The structure and surface details of the sensory clubs are other diagnostic characters; there are a dozen or so morphological variants (WEINER 1996). Unfortunately, subtle differences in the morphology of these structures are only partly visible in light microscope which in practice gives a limited possibility of their wider use.

The diagnostic value of AIIIIO structure is high, but its use meets with some difficulties. They result most often from individual or teratological variation of species, populations or specimens. In the fauna of Poland genetically variable number of papillae (from 4 to 6) is found in some populations of *Hymenaphorura polonica*. The reasons for considerable differences in chaetotaxy and structure of other antennal structures are changes associated with regeneration of lost antennae. Usually they result in an increased number of papillae and changed location of chaetotactic elements.

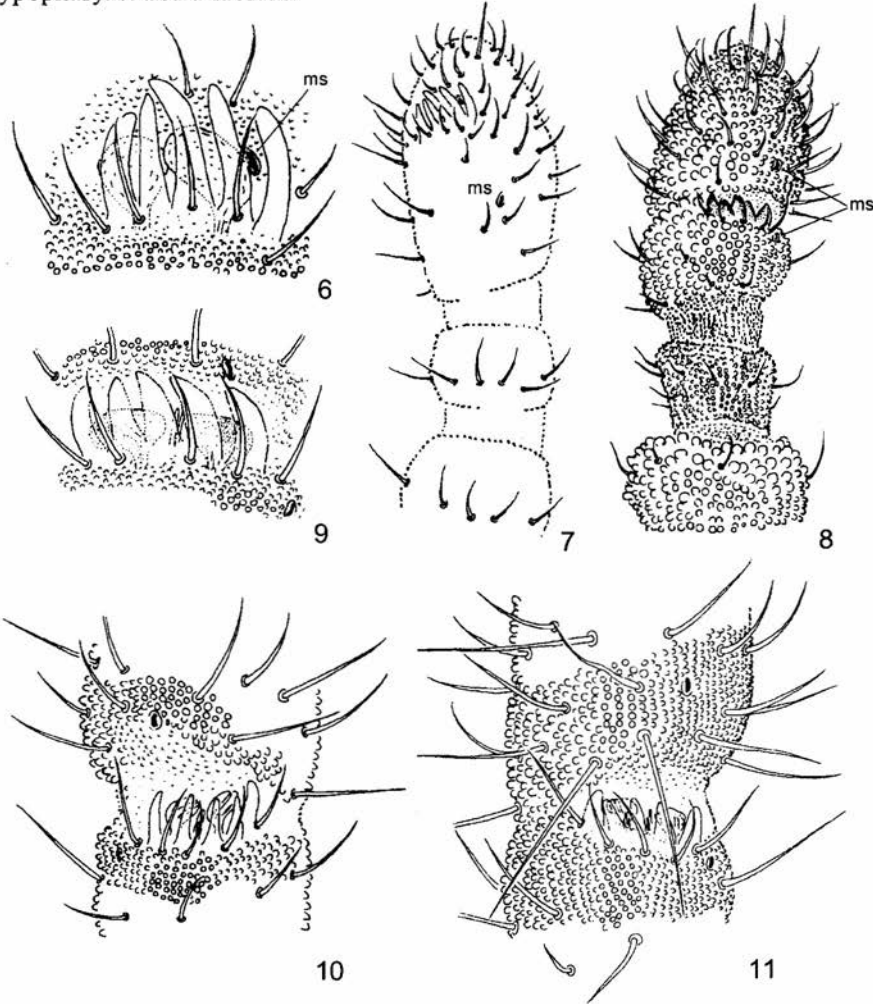
POSTANTENNAL ORGAN (PAO)

Compared with other collembolans, the PAO structure in the onychiurines is relatively complicated. This sensory structure, of incompletely known function, is located just beyond the antennal field (ALTNER et al. 1971, ALTNER & THIES 1976). In its simplest form PAO is a single vesicle divided into several lobes (figs. 18, 19.), located in a cuticular groove or concavity. Most often, however, its structure is more complex - the number of vesicles is higher and additionally they may be secondarily granulated (figs. 20-25).

In the onychiurine taxonomy the morphology of PAO provides many characters, e.g. general shape of PAO, number of vesicles, their arrangement in relation to the long axis, secondary granulation. Their diagnostic value is very high and for this reason they served as a basis to distinguish many subgenera (PALISSA 1964, WEINER 1996, ZIMDARS 1997). Some data indicate, however, that the structure of PAO may vary within a single phylogenetic lineage, or different phylogenetic lineages may have a deceptively similar PAO structure (POMORSKI 1996). Caution should be observed when using these characters in differential diagnoses of supraspecific taxa.

MOUTH PARTS

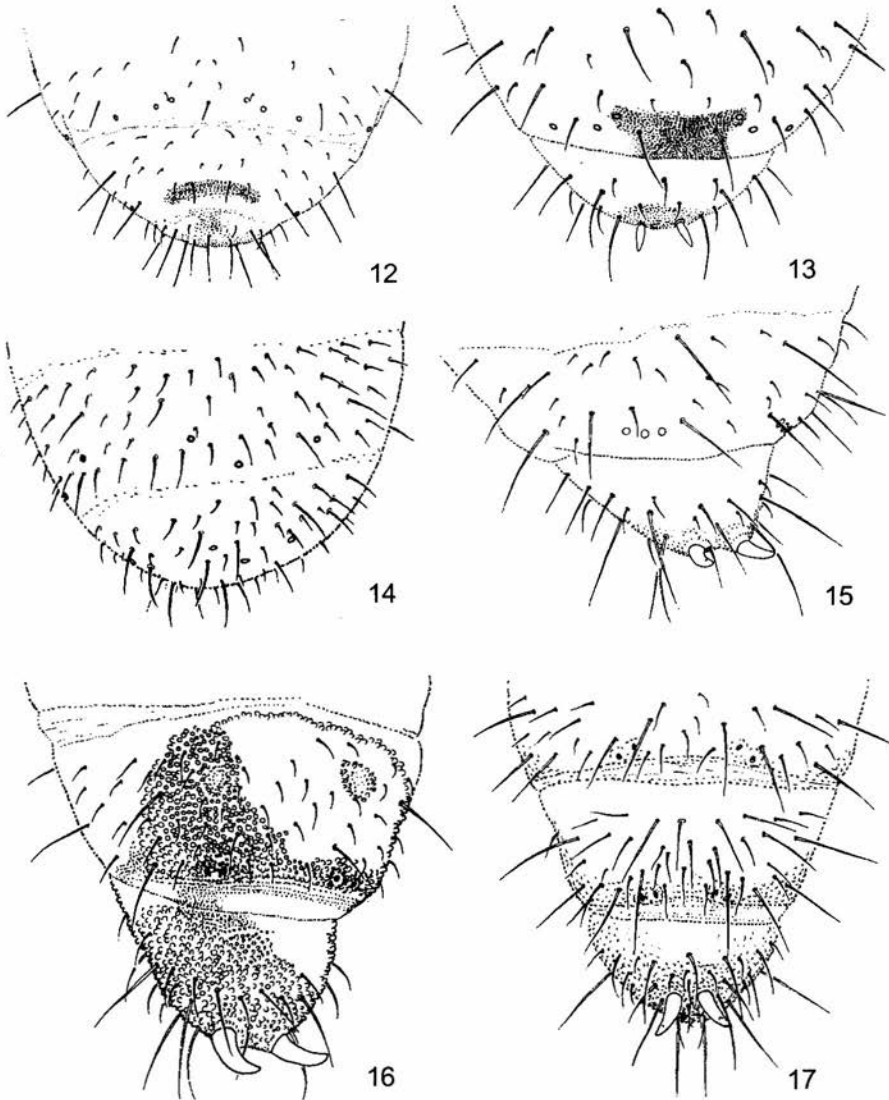
The onychiurine mouth apparatus has a structure typical of most collembola. It is built of a labrum, a pair of mandibles, a pair of maxillae with maxillary palps, hypopharynx and a labium.



6, 10-11. Antennal III sense organ: 6 - *Archaphorura serratotuberculata*, 9 - *Micraphorura pieninensis*, 10 - *Deuteraphorura cebennaria*, 11 - *Protaphorura subarmata*; 7-8. Antennae: 7 - *Archaphorura serratotuberculata*, 8 - *Kalaphorura carpenteri*

Mandibles in all known species are fully developed, provided with a strong molar plate. The capitulum maxillare is strongly toothed and bears six lamellae of different structure (figs. 29, 30.). The externally located maxillary palps bear terminal sensory hairs on coniform papilla with basal seta and one or two sublobal sensory hairs. Within the labium, the mentum is accreted to submentum.

Both these structures have a characteristic chaetotaxy. The most complicated is the structure of the labial palp (palpus labialis) (figs. 26-28). It is characterized by the presence of six thickened setae embedded in conical papillae. Some of these setae may have a different structure - be gently curved, stronger thickened,



12-17. Abdominal terga IV-VI: 12 - *Deuteraphorura silesiaca*, 13 - *Thalassaphorura zchokkei*, 14 - *Onychiuiroides granulatus*, 15 - *Protaphorura fimata*, 16 - *Hymenaphorura nova*, 17 - *Heteraphorura variotuberculata*

and additionally bluntly terminated. Most probably the tips of all the setae just after moulting are sharp, but some definite setae break with the onset of active feeding and only then they become blunt. Furthermore, the papilla of each seta may have additional sensory hairs at its base, the number and shape of the hairs varying between species .

The components of mouth apparatus play an important role in the taxonomy of many collembolan taxa. In the onychiurines they were treated rather marginally, because of their apparently uniform structure within the whole taxon. Only YOSSI (1976) used the labrum chaetotaxy as a character of a high diagnostic value. Besides, FJELLBERG (1987) noted some differences in the number of sublobal sensory hairs on the maxillary palps of some species. Morphological structures of the labium of I instar larvae in the *Onychiurinae* were described by POMORSKI (1996) but not used in the taxonomy of the group. Preliminary observations on the structure of mouth apparatus reveal that some components, and especially maxillae and maxillary palps, are morphologically diverse and may serve as diagnostic characters of species and supraspecific taxa. These characters were used as diagnostic by FJELLBERG (1998) in his monograph of Fennoscandian *Poduromorpha*.

LEGS

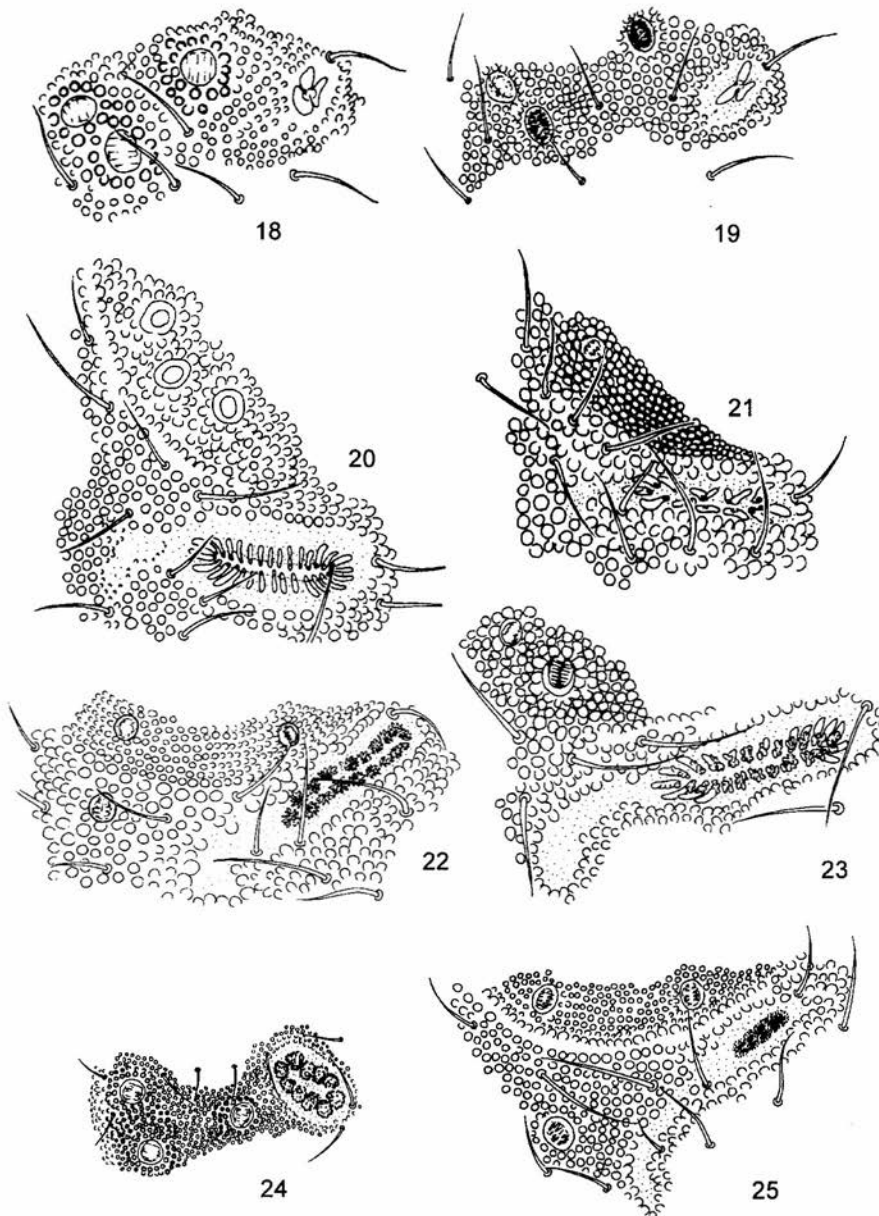
Onychiurine legs are built like those of other *Collembola*. Each leg has the following components: subcoxa (sometimes called subcoxa 1), coxa (sometimes called subcoxa 2), trochanter, femur, tibiotarsus and praetarsus with a claw and empodial appendage (figs. 31, 32.). Only some of these components are taxonomically useful.

The number of setae, pseudocelli and parapseudocelli on subcoxa are of importance.

Likewise, the structure of tibiotarsi, and especially the number of setae in the distal verticil (POMORSKI 1996) are of significance. There may be 11, 9 or 7 such setae (fig. 33-35) and this is a good unvariable diagnostic character. In some genera (*Chribellaphorura*, *Uralaphorura*) dorso-distal setae in this verticil may have ampulla-like terminations.

In the structure of claw an important role is played by the presence/absence of teeth on its inner margin, and lateral teeth. The teeth on the inner margin are found in many species and were often used as a diagnostic character. My observations indicate that their value is high, but they should be used cautiously, since beside species in which the character is constant, there are species in which it may vary individually and probably also seasonally and between populations. In the genus *Orthonychiurus* the teeth on the claw are most often present only in females and often only on one pair of legs. Lateral teeth (figs. 36, 37) till now are known only in members of the genus *Deuteraphorura*.

The length of empodial appendage is a long-used and rather stable diagnostic character. It is usually presented as a fraction of hind leg claw length (e.g.



18-25. Postantennal organ and pseudocelli: 18 - *Micraphorura absoloni*, 19 - *Oligaphorura schoetti*, 20 - *Protaphorura subarmata*, 21 - *Hymenaphorura nova*, 22 - *Onychiurus ambulans*, 23 - *Deuteraphorura silvaria*, 24 - *Tantulonychiurus volinensis*, 25 - *Onychiuroides granulosis*

empodial appendage $3/4$ claw length). Another often used key character is the presence and sometimes width or complete lack of basal lamella on the empodial appendage (GISIN 1960, PALISSA 1964). The character is difficult to define verbally and thus its diagnostic value is high only when the description is accompanied by an illustration.

THORACIC STERNA

They are small, symmetrical surfaces located on both sides of the ventral line, anterior to fore legs, between mid and hind legs. On their surface pso, psx, setae and pseudopores may be located (fig. 38). Both the number of pso and psx are taken into account in ventral formulas. The number of sternal setae undergoes a slight variation and is a fairly good diagnostic character, commonly used in species diagnoses. As has been already mentioned, pseudopores have never been used as a diagnostic character, but I suppose that in some older descriptions they could be treated as pseudocelli.

TUBUS VENTRALIS

The structure is located on the ventral side of the first abdominal segment and plays an important role in electrolyte and fluid balance (Hopkin 1997). It has a shape of two short tubes connected at the base and terminated with a vesicle of delicate cuticle (fig. 39, 40).

Tubus ventralis is most often provided with 1-3 setae at the base and several or a dozen or so subapical setae, and these characters are regarded as taxonomically important. My observations indicate that the number of subapical setae and basal setae is constant in relatively small-sized species (up to 1 mm) and here the value of both characters is really high, whereas in larger species the characters are widely variable and thus of small use.

In adult males of some species some setae on tubus ventralis are thickened, have a shape of an arrowhead or are bifid and form the male ventral organ - a secondary sexual character in the onychiurines. The number, shape and position of these setae are excellent diagnostic characters.

Besides, at the base of tubus ventralis there may be either pso or psx which are always considered in the ventral pseudocellar and parapseudocellar formulas.

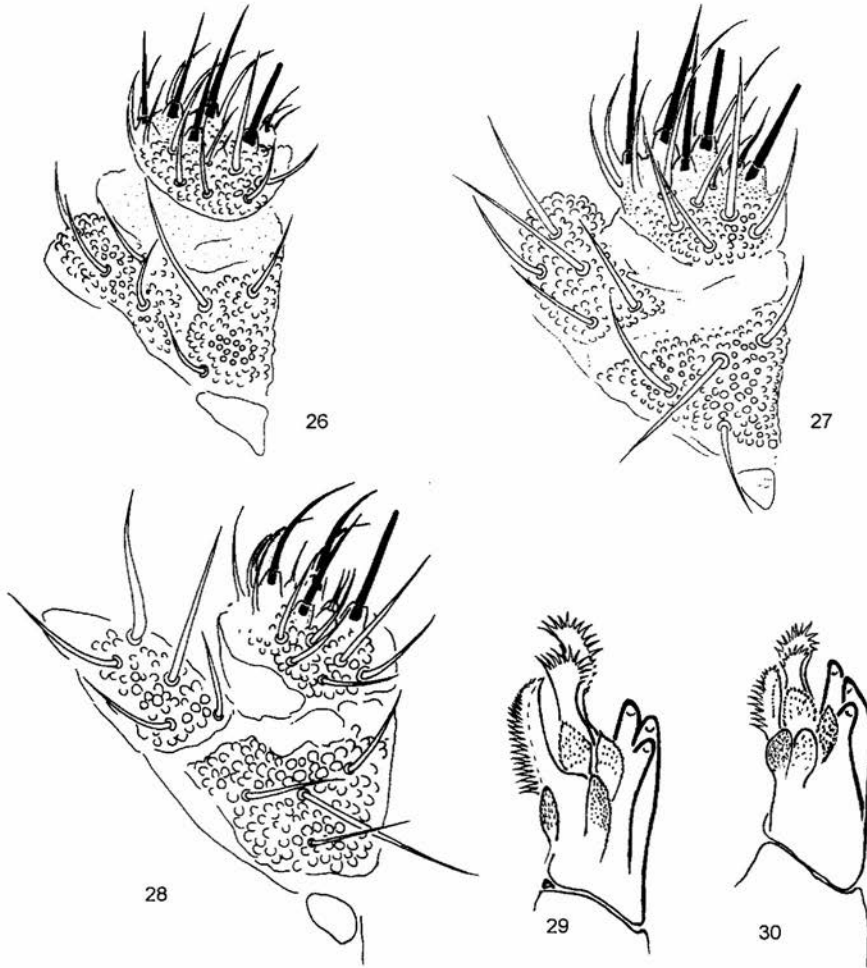
FURCA AND TENACULUM

The onychiurines never spring and their springing apparatus is always reduced, the degree of reduction being varied.

In its most complicated form the apparatus is built of two very short, papilla-like dentes with 3-4 setae and a tiny, vestigial mucro. The manubrium is accreted to the sternite of abdominal segment IV and has a form of a plate provided with several symmetrically arranged setae. Besides, on abdominal sternite III, there is a small, bidentate tenaculum (fig. 41).

The next stage of reduction is the loss of mucro and tenaculum, the dens retaining the form of paired, pailate appendices (fig. 42). A frequent form of

reduction of springing apparatus is the presence of an unpaired cuticular fold, usually bearing 4 (2+2) setae and several setae at base (figs. 43, 44). In the extremely simplified form the only trace of the presence of furca is an area of finer granulation (figs. 45-48). Around this structure there are also characteristic setae whose arrangement is of a high diagnostic value.



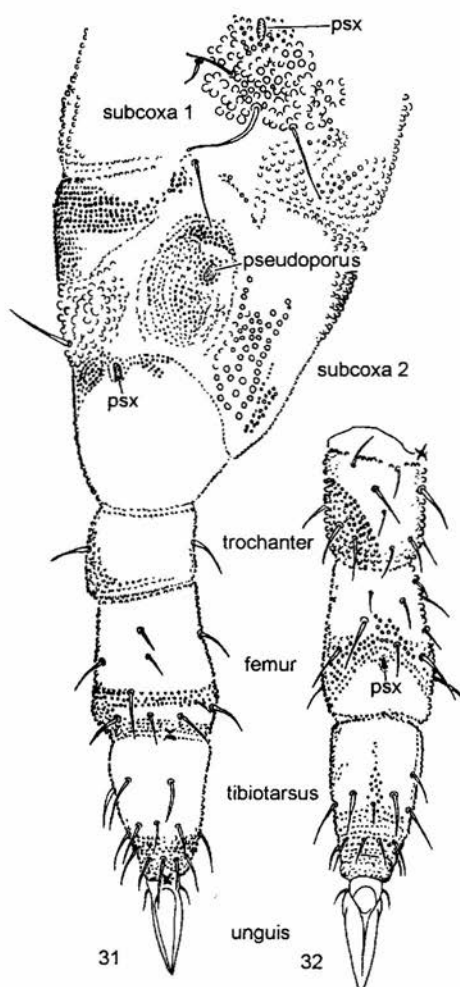
26-30. Labium: 26 - *Protaphorura* sp., 27 - *Deuteraphorura* sp., 28 - *Hymenaphorura* sp.; Head of maxilla: 29 - *Deuteraphorura* sp., 30 - *Protaphorura* sp.

The morphology of the reduced springing apparatus in the *Onychiurinae* provides a great many excellent diagnostic characters at supraspecific level. This was evidenced in studies on adults (WEINER 1996) and I instar larvae (POMORSKI 1996) where these characters were used to distinguish genera.

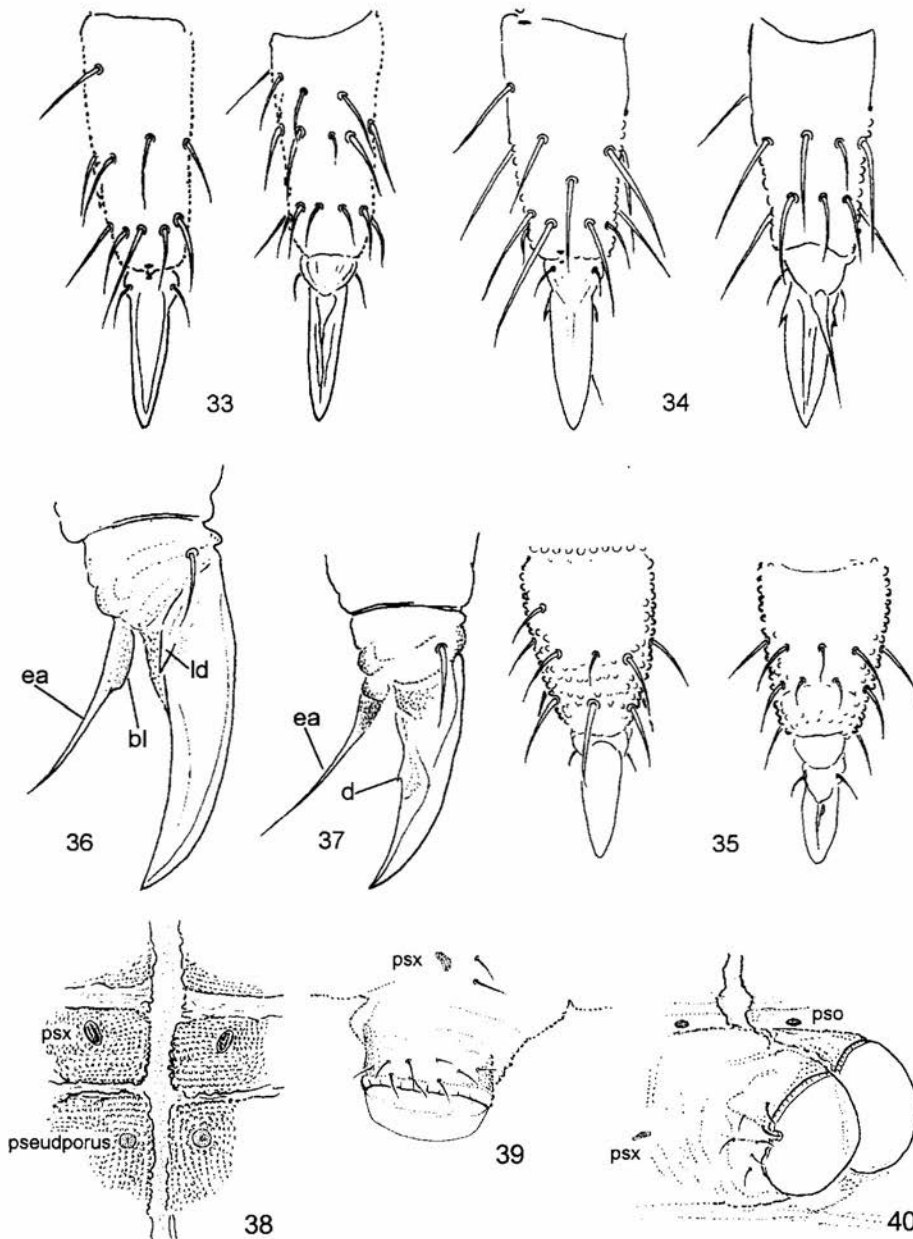
In some cases using these characters may cause problems. In adults the remnants of furca and especially the chaetotaxy are not always possible to describe precisely because of disturbances resulting from numerous additional setae and rather frequent aberrations. In juveniles the chaetotaxy is fully legible, but it is difficult to collect or raise I instar larvae.

SEXUAL DIMORPHISM AND MALE VENTRAL ORGAN

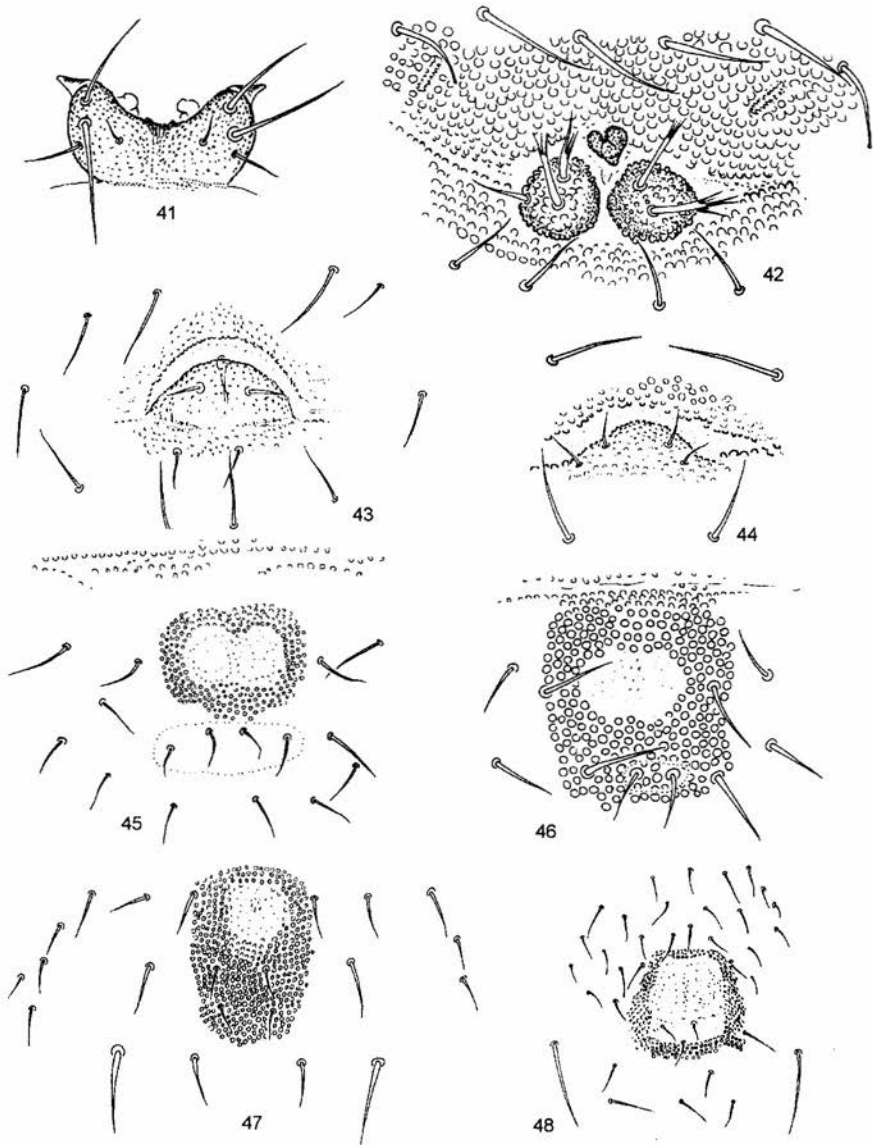
The primary sexual characters in the onychiurines are the same as in other collembola. The female genital plate, located on abdominal sternite V, has a form of a flat protuberance covered with short setae, with a transverse groove - gonopore. Besides, fully mature females after oviposition have below their



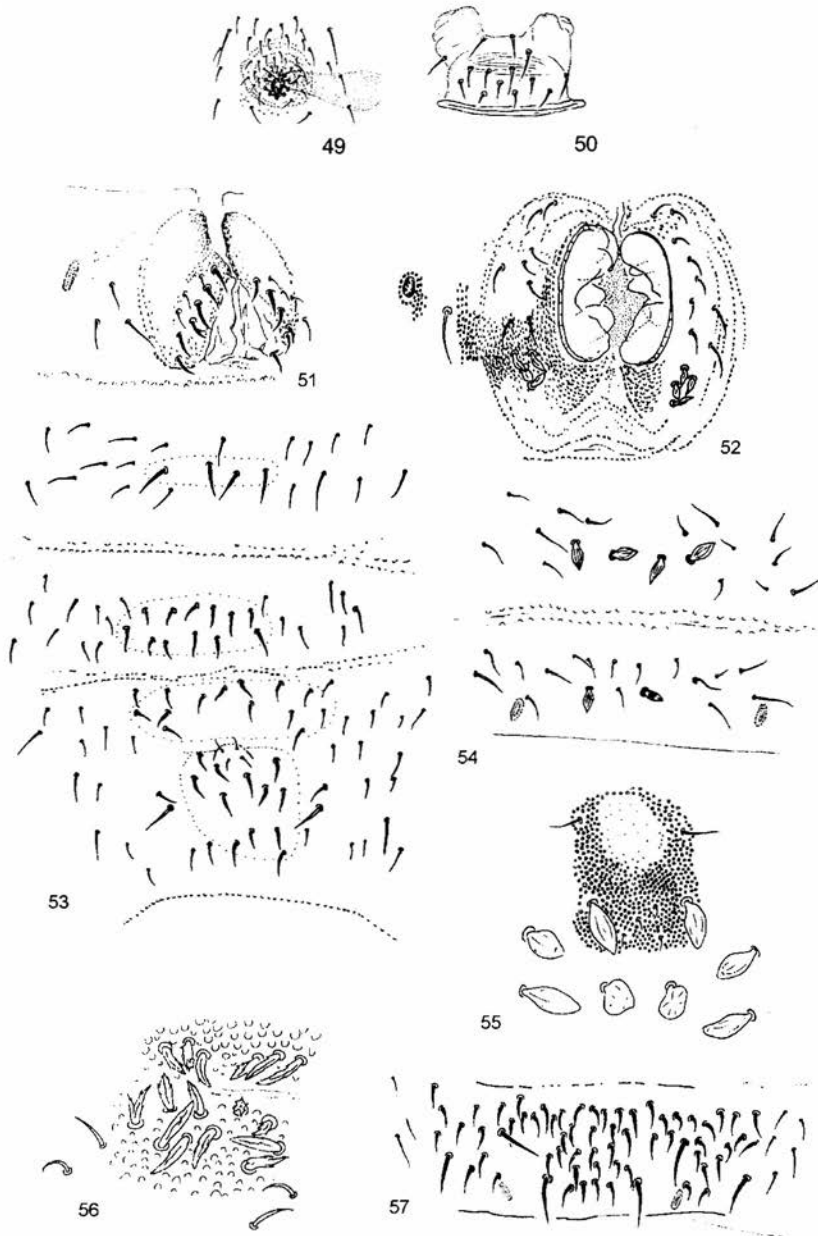
31-32: General morphology of legs of *Onychiurinae* (*Kalaphorura carpenteri*)



33-37: Chaetotaxy of tibiotarsi: 33 - *Protaphorura* sp. (11 setae in distal verticil), 34 - *Deuteraphorura* sp. (9 setae in distal verticil), 35 - *Tantulonychiurus* sp. (7 setae in distal verticil); 36-37. Morphological details of claws: ea - empodial appendage, bl - basal lamella, d - teeth, dl - lateral teeth; 38-40. Morphology: 38 - parapseudocelli and pseudopori on thoracic sternum (*Deuteraphorura silesiaca*), 39 - tubus ventralis (*Protaphorura gisini*), lateral view, 40 - tubus ventralis (*Deuteraphorura silvaria*), ventro-lateral view



41-48. Remnants of furca: 41 - *Supraphorura furcifera*, 42 - *Kalaphorura carpenteri*, 43 - *Protaphorura campata*, 44 - *Bionychiurus normalis*, 45 - *Onychiurus ambulans*, 46 - *Orthonychiurus stachianus*, 47 - *Detriturus jubilarius*, 48 - *Hymenaphorura polonica*



49-50. Genital plates: 49 – male genital plate with ductus ejaculatorius, 50 – female genital plate with chitinezed internal structure; 51-57. Male ventral organ: 51- *Protaphorura campata*, 52 – *Onychiuroides granulosus*, 53 – *Heteronychiurus januarii*, 54 – *Orthonychiurus rectopapillatus*, 55- *Tantulonychiurus volinensis*, 56 – *Deuteraphorura variabilis*, 57 – *Deuteraphorura silesiaca*

genital plate a chitinous three-dimensional structure of an unknown function and origin (fig. 50). The male genital plate is also situated on abdominal sternite V, as a circular protuberance with a transverse groove - gonopore. It is covered with short setae of which 4+4 setae surrounding the gonopore are slightly thickened. In mature males the gonopore is connected with a thickened, chitinized duct - ductus ejaculatorius - clearly shining through the cuticle (fig. 49).

Till now only one morphological character of genital plates (number of setae) in the *Onychiurinae* was used, among others to distinguish between the British species of the genus *Protaphorura* (PITKIN 1980). The method, however, has never been in wider use.

Some onychiurine species are characterized by a distinct sexual dimorphism. This is usually manifest as different size - females are as a rule larger and relatively stouter, especially before oviposition. Another expression of sexual dimorphism is the presence in males of the male ventral organ, always located on abdominal sternites. Its structure is usually different in different phylogenetic lineages. Most often there are strongly thickened, bifid or even multiply branched single setae or groups of setae, located in various combinations on tubus ventralis on abdominal sterna II, III and IV (figs. 51-57). In my opinion the structure of the male ventral organ, e.g. the number and shape of setae, provides good diagnostic characters at specific level, and its mere position may be one of generic diagnostic features. Unfortunately the shape of setae changes with age (SNIDER 1977), and in species diagnoses most of all adult specimens should be described, with fully developed ductus ejaculatorius.

ANAL PLATES

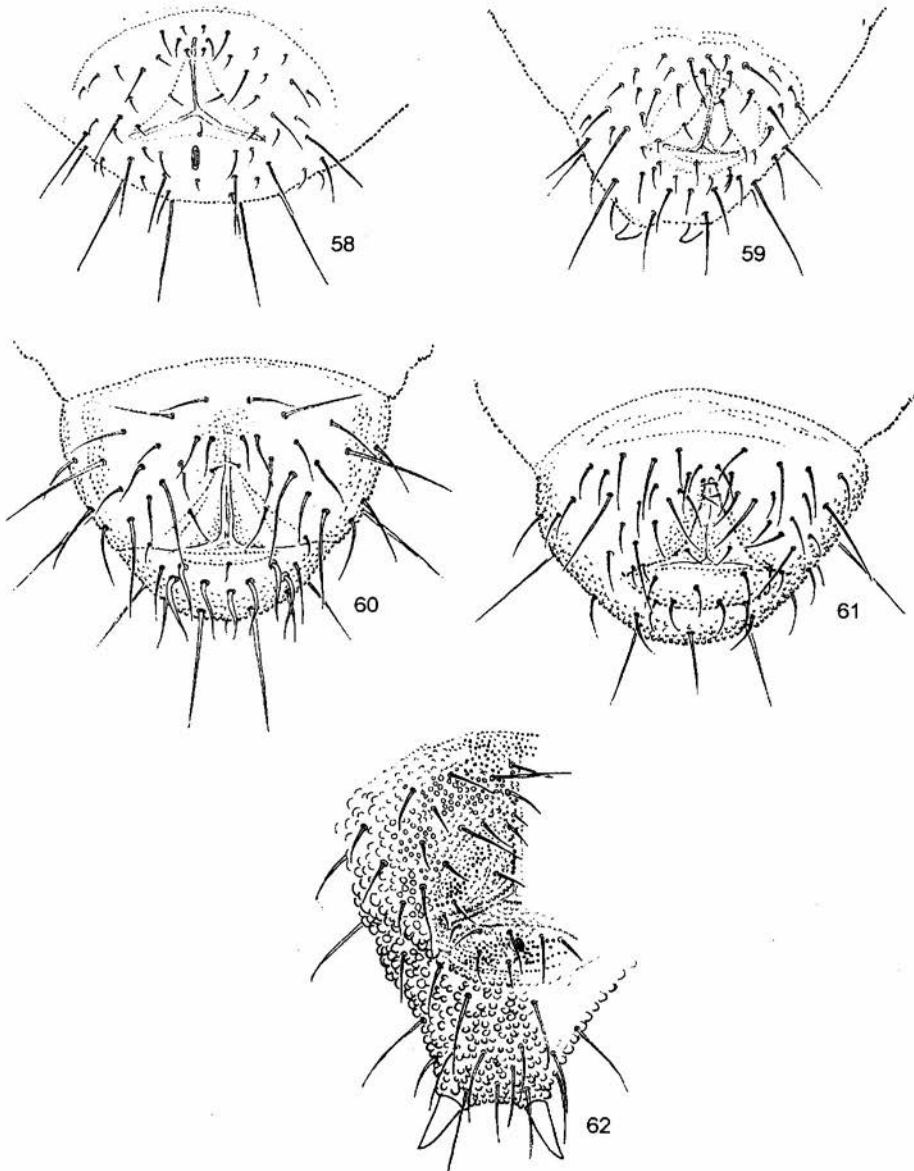
The onychiurine anus is located on the ventral side of abdominal segment VI and surrounded by three anal lobes: unpaired dorsal and two lateral (figs. 58-62). The lobes are provided with a characteristic chaetotaxy and sometimes may bear parapseudocelli. Chaetotaxy of anal lobes has never been used in onychiurine taxonomy. My observations indicate, however, that it may provide a considerable number of diagnostic characters. Parapseudocelli are always included in the ventral parapseudocellar formula.

DEVELOPMENT BIOLOGY

Most onychiurines are bisexual. Only few are certain to reproduce parthenogenically, the type of parthenogenesis being unknown. In the Polish fauna only three such species are known: *Micraphorura absoloni*, *Thalassaphorura encarpata*, *Hymenaphorura polonica*.

FERTILIZATION

Its detailed course is not completely clear. HALE'S (1965a) observations on *Protaphorura procampata* and *Supraphorura furcifera* suggest that males of the *Onychiurinae* contrary to most collembolans do not produce spermatophores.



58-62. Anal lobes. 58 – *Deuteraphorura silvaria*, 59 – *Protaphorura gisini*, 60 – *Heteraphorura variotuberculata*, 61 – *Hymenaphorura polonica*, 62 – *Kalaphorura carpenteri*

Drops of sperm are transferred directly to female gonopores or deposited on the substratum where females search for them actively. My observations in laboratory culture of many species have not contributed to solving this problem. I have repeatedly observed a close, direct contact between individuals of opposite sexes, kept in pairs. Most often it consisted in staying in the same shelter during many hours. I have also observed drops of sticky white substance, deposited on the substratum. Unfortunately, I have not managed to observe sperm transfer or taking it up from the substratum.

EGGS

All the species whose biology was examined in the laboratory and described, lay eggs in batches, most often of 4 to 20 eggs (HALE 1965b, SKARZYŃSKI 1991, POMORSKI 1989, 1990). Singly laid eggs were observed only in laboratory cultures of *Protaphorura aurantiaca* and parthenogenic *Thalassaphorura encarpata*, but most of them were not viable.

During their lifetime females of five species of *Protaphorura* laid from 14 eggs in 3 batches (*P. aurantiaca*), to 62 eggs in 5 batches (*P. fimata*), the total number of eggs and batches depending on the condition of the individual rather than on the species (POMORSKI, 1990). Each batch is placed in a crevice or hole in the soil to ensure shelter and proper humidity.

Collembolan egg shell, structure and origin of egg envelopes and the embryonic development were described in detail for the *Tomoceridae* and *Tetrodontophoridae* (MATSUZAKI 1973, UEMIYA & ANDO, 1987a, b, JURA & KRZYSZTOFOWICZ, 1982, 1986, JURA et al., 1987, KRZYSZTOFOWICZ & KISIEL 1987, BILIŃSKI 1993). The onychiurines have never been subject to separate studies, it seems however that in this respect they do not depart from the remaining *Collembola*, especially the related *Tetrodontophoridae*.

The external structure of the eggs during the embryogenesis undergoes some changes. These changes were described in members of the genera *Protaphorura* and *Deuteraphorura* by HALE (1965b) and SKARZYŃSKI (1991). My observations of over 30 species representing 9 genera confirm both these descriptions. Onychiurine eggs are laid in dehydrated state which makes it possible for them to be "packed" in a relatively high number in the female reproductive tracts. Once in contact with the external environment, they immediately absorb water, assuming their ultimate size, shape and colour. They are spherical, pearl-white and their diameter, depending on species, ranges from 0.11 (*Micraphorura absoloni*) to 0.28 (*Onychiurus ambulans*).

When the egg is fertilized and the embryogenesis starts, in about a week the egg shape changes from spherical to oval, the pearly-white colour disappears and the egg envelopes become amber-transparent, break and fuse with serosal cuticle which is covered with wavy grooves. Under laboratory conditions, at a temperature of 15-18°C, the embryonic development lasts for ca. 19-21 days. This was observed in *Deuteraphorura cebennaria* (SKARZYŃSKI 1991) and in my cultures of several members of *Protaphorura*, *Supraphorura furcifera*, *Micraphorura absoloni*,

Onychiuroides granulosis, *Deuteraphorura silesiaca*, *Thalassaphorura encarpata*, *Onychiurus ambulans*, *Orthonychiurus rectopapillatus*. A decrease in temperature results in a proportional slowing down of development, the lower threshold below which the development is completely inhibited ranging from 3 to 0 °C (HALE 1965b).

In natural conditions in Great Britain HALE (1965b) observed that *Protaphorura tricampata* and *Protaphorura procampata* laid eggs throughout the vegetation season (April till November), whereas *Protaphorura lata* only in May and June. In conditions of constantly high (above zero) temperature e.g. in laboratory, flower pots or in caves, 1 instar larvae are present in samples taken in all the phenological seasons. This means that a great majority of onychiurine species are potentially able to reproduce throughout the year, but in the winter the reproduction is inhibited by low temperatures. Only members of *Hymenaphorura* most probably reproduce once a year. In Poland the youngest juvenile stages of *Hymenaphorura creatricis*, *Heteraphorura carpatica* or *Kalaphorura carpenteri* are caught only in the spring, usually a month after the snow thaws, which in the Sudetes and Carpathians falls in May or June.

POSTEMBRYONIC DEVELOPMENT

Hatching of juveniles in the laboratory takes place most often 3 weeks from oviposition. Juvenile individuals from the same batch hatch more or less synchronously, most often in the night. Hatching of 20 individuals of *Protaphorura fimata*, observed by me, took place within 5 hours. Upon leaving the egg envelopes, the juveniles of most species after a short rest became very active, searching for food and feeding. Only in *Hymenaphorura polonica* and *Hymenaphorura creatricis* the first instar, like in *Protura*, is the resting stage. 1 instar larvae till their first moult do not move or feed, showing some morphological characters most probably associated with resting (absence of pseudocelli, soft undeveloped mouth parts, non-functional legs) (POMORSKI 1995).

Consecutive moults take place after a few and even several dozen days (6 to 22). The duration of particular instars varies and depends on many factors. It was found to increase with decreasing temperature and with the individual age (HALE 1965c).

The moult is preceded by a rest of a dozen or so hours during which time the insect does not move or feed. Microscopic slides of such specimens are difficult to interpret, since they contain setae of two instars at the same time, but they make it possible to ascertain homology of setae between particular instars or even to trace cyclomorphosis (FJELLBERG 1976). The moulting itself lasts most often from 10 to 15 minutes. When the culture conditions allow it, it always takes place in a shelter. Often several individuals moult synchronously in the same shelter. Synchronous moulting is a rule among siblings from the same batch. The exuvia may be consumed, but it is not always so. Besides, I have observed that after oviposition females of most species moult and this takes place most often next to their own batch.

My laboratory observations on species of the genera *Protaphorura*, *Onychiurus*, *Deuteraphorura*, *Onychiuroides*, *Micraphorura*, *Thalassaphorura* indicate that the onychiurines attain sexual maturity after the 7th moult. This confirms HALE's (1965c) data; in his biometrical studies in the laboratory and in the wild that author found that MILNE's (1960) earlier data were erroneous and that the maximum size in case of three species of *Protaphorura* was reached after the 6th or 7th moult.

A variety of studies by HALE (1965c), LOBBES (1977), POMORSKI (1986, 1990) and SKARZYŃSKI (1991) have made it possible to ascertain that I instar larvae differ clearly from subsequent development stages, the greatest differences being those in chaetotaxy which is characterized by a constant number of setae of definite morphology and arrangement. In subsequent stages there is a general re-organization of chaetotaxy, and in some species new pseudocelli appear. The changes in chaetotaxy consist most of all in appearance of new setae and changes in the appearance of those already existing, e.g. transformation of macrochaetae in I instar larvae into microchaetae in II instar larvae. The ultimate number of pseudocelli in the genus *Protaphorura* becomes established usually in instar III, and in the genus *Deuteraphorura* in instar IV. Likewise, separating the sexes becomes possible in instar IV, and then most species-specific characters appear. Lastly, i.e. in instar VI, setae forming the ventral organ develop, but they assume their final form after the 6th moult in species with ejaculatory duct.

FOOD AND FEEDING

The onychiurines feed on any, living and dead, organic matter that is available in the soil. During intense feeding their alimentary tracts are filled with various debris: fungal hyphae, spores, pollen grains, living and dead fragments of higher plants, fragments of other arthropods (including other collembolans or exuvia) and an amorphous material.

In laboratory cultures I repeatedly observed feeding of various onychiurine species. They eat mostly amorphous humus covering plant remnants, sand grains and other structural components of the soil. Hyphae of soil fungi are often consumed, but not all their species are eaten. *Hymenaphorura polonica* feeds only on one kind of food, consuming only damp, rotting wood at a certain stage of decomposition and making characteristic corridors (POMORSKI & WEICHSEL 1993). Whether the wood itself is the source of food, or microorganisms that decompose it, is unknown. A similar mode of life was observed in *Hymenaphorura creatricis*, *Heteraphorura variotuberculata* and *Heteaphorura carpatica*, but their corridors were made in a humus soil, under tufts of moss and stones. In the laboratory they never left these shelters. My field observations suggest, however, that single adult individuals of these species can be caught far from the places of their collective occurrence, and this is possible only in the spring, after thaw.

Besides, I have observed consuming, other dead collembolans and dead mites. Only once I have observed a female *Protaphorura campata* consuming a male of unidentified species of the genus *Protaphorura* when the male was in his

resting stage prior to moulting. In the Sudete caves I have observed abundant occurrence of *Hymenaphorura creatricis* on dead moths, and *Deuteraphorura cebennaria* on dead dipterans, bat carcasses and pellets of birds of prey. It could not be established if they were feeding on the dead organisms or on fungi that were decomposing them.

It is at present unknown how the onychiurines digest their varied food, but the co-operation of some symbionts is likely.

KEY TO THE TRIBES

***Onychiurinae* BÖRNER, 1901**

1. Posterior pseudocelli on the head absent *Hymenaphorurini*
- . Posterior pseudocelli on the head present 2.
2. Postantennal organ with 3-5 lobes of one vesicle *Oligaphorurini*
- . Postantennal organ with numerous vesicles 3.
3. Seta d_0 on the head absent (fig. 253), vesicles in postantennal organ simple, distal verticil on tibiotarsi with 11 setae, thoracic tergum I usually without pseudocelli *Protaphorurini*
- . Combination of characters other than above 4.
4. Furca reduced to finely granulated area with 2+2 setulae in two rows posteriorly (fig. 47). Sensilla on antennomere IV usually well marked, vesicles in postantennal organ usually simple *Thalassaphorurini* **tribus n.**
- . Furca reduced to finely granulated area with 2+2 setulae in one row (fig. 45) or 1+1 setulae posteriorly (fig. 46), or to cuticular pocket with 2+2 setulae (fig. 44). Sensilla on antennomere IV indistinct, vesicles in postantennal organ usually compound *Onychiurini*

***Hymenaphorurini* POMORSKI, 1996**

Hymenaphorurini POMORSKI, 1996, *Genus*, 7 (1): 99.

Hind margin of head capsule and I thoracic tergum without pseudocelli, thoracic II-III and abdominal I-V with only dorsomedial pseudocelli (if present). PAO with simple, multilobed or granulated vesicles located perpendicularly, parallelly or oblique to the long axis of the organ. Granulation coarse or very coarse usually with two kinds of granules. Anal spines strong on distinct papillae. Distal verticil of setae on tibiotarsi symmetrical, with 11 setae. Setae sensuales on head and body poorly marked. Seta d_0 on head usually absent.

KEY TO GENERA OF *HYMENAPHORURINI*

1. Furca reduced to two knobs with 3+3 (4+4) setulae, tenaculum present (fig. 42) *Kalaphorura*
- . Furca reduced to finely granulated area with setulae posteriorly, tenaculum absent (fig. 48, 146) 2.
2. Abdominal tergum VI with 2 medial setae (fig. 16), unpaired anal lobe without thickened setae, area antennalis usually with 1 pseudocellus *Hymenaphorura*
- . Abdominal tergum VI with 3 medial setae (fig. 17), unpaired anal lobe with 7 thickened setae, curved upward (figs. 144, 145), area antennalis with 2 or 3 pseudocelli *Heteraphorura*

***Kalaphorura* ABSOLON, 1901**

Kalaphorura ABSOLON, 1901, Zool. Anz., 24 (647): 388.

Type species: *Aphorura paradoxa* SCHÄFFER, 1900, by original designation (described from Germany: Wüttenberg, Nebel Cave).

Diagnosis: Hind margin of head capsule and thoracic tergum I without pseudocelli, thoracic terga II-III and abdominal terga I-III usually with 1+1 dorsomedial pseudocelli. Dorsal side of body with parapseudocelli laterally. Body strongly granulated, with two kinds of granules. Bigger and stronger granules cover all terga. Furca reduced to two knobs with 3+3 (4+4) setulae, tenaculum present. Abdominal segment VI elongated with strong anal spines located on distinct papillae. AIIIIO with simple papillae and 5 guard setae. PAO with simple vesicles, located perpendicularly to the long axis of organ. Distal veriticol of setae on tibiotarsi symmetrical, with 11 setae. Most setae on dorsal side of body retused or knobbed. Setae sensuales on head and body poorly marked. Seta d_0 on head absent, abdominal tergum VI dorsally with 2 medial setae.

KEY TO SPECIES

1. Macrochaetae and most other setae apically knobbed, medial seta a_0 on abdominal tergum VI situated distinctly above row of p setae (fig. 81) *K. carpenteri*
- Macrochaetae and most other setae apically retused, medial seta a_0 on abdominal tergum VI situated in one row of p setae (fig. 80) *K. paradoxa*

***Kalaphorura carpenteri* (STACH, 1919) comb. nov.**

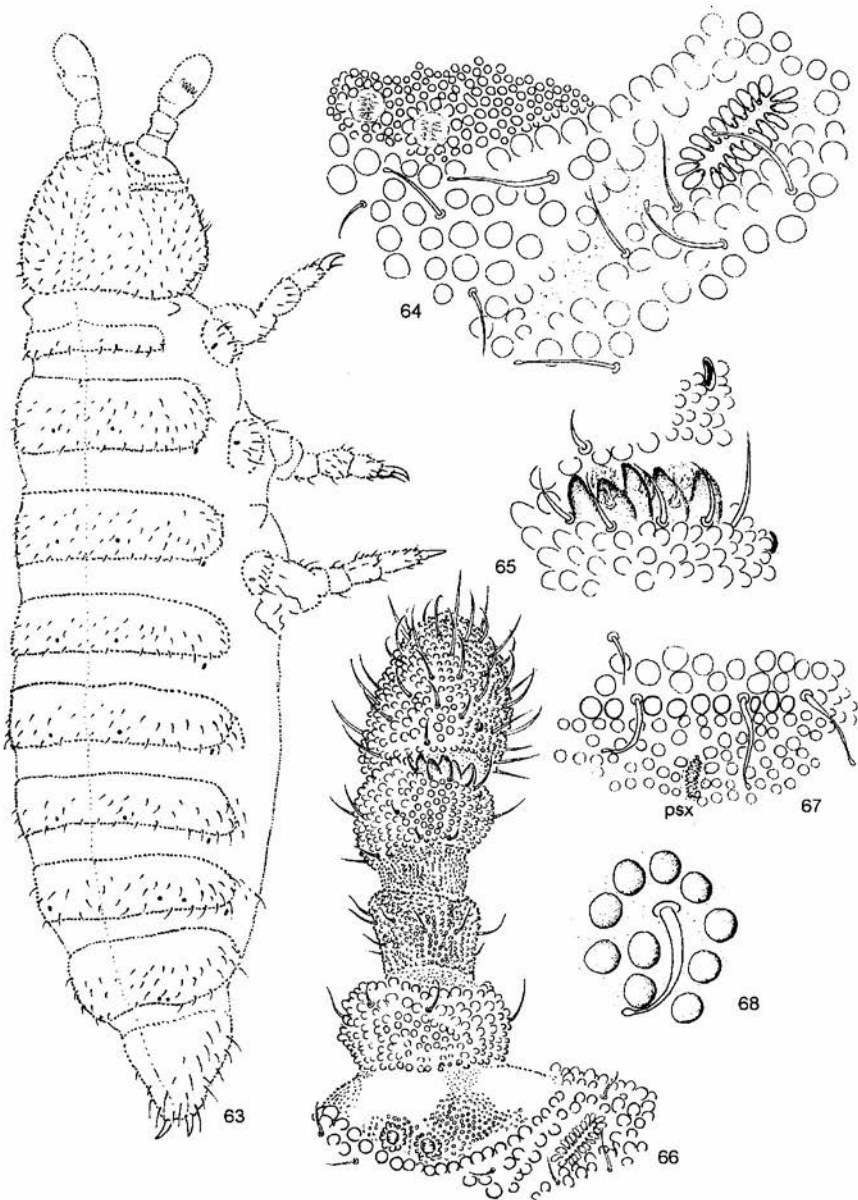
Onychiurus carpenteri STACH, 1919, Bull. de l'Acad. Pol. d. Scienc. B Cracovie: 152.

TYPE MATERIAL

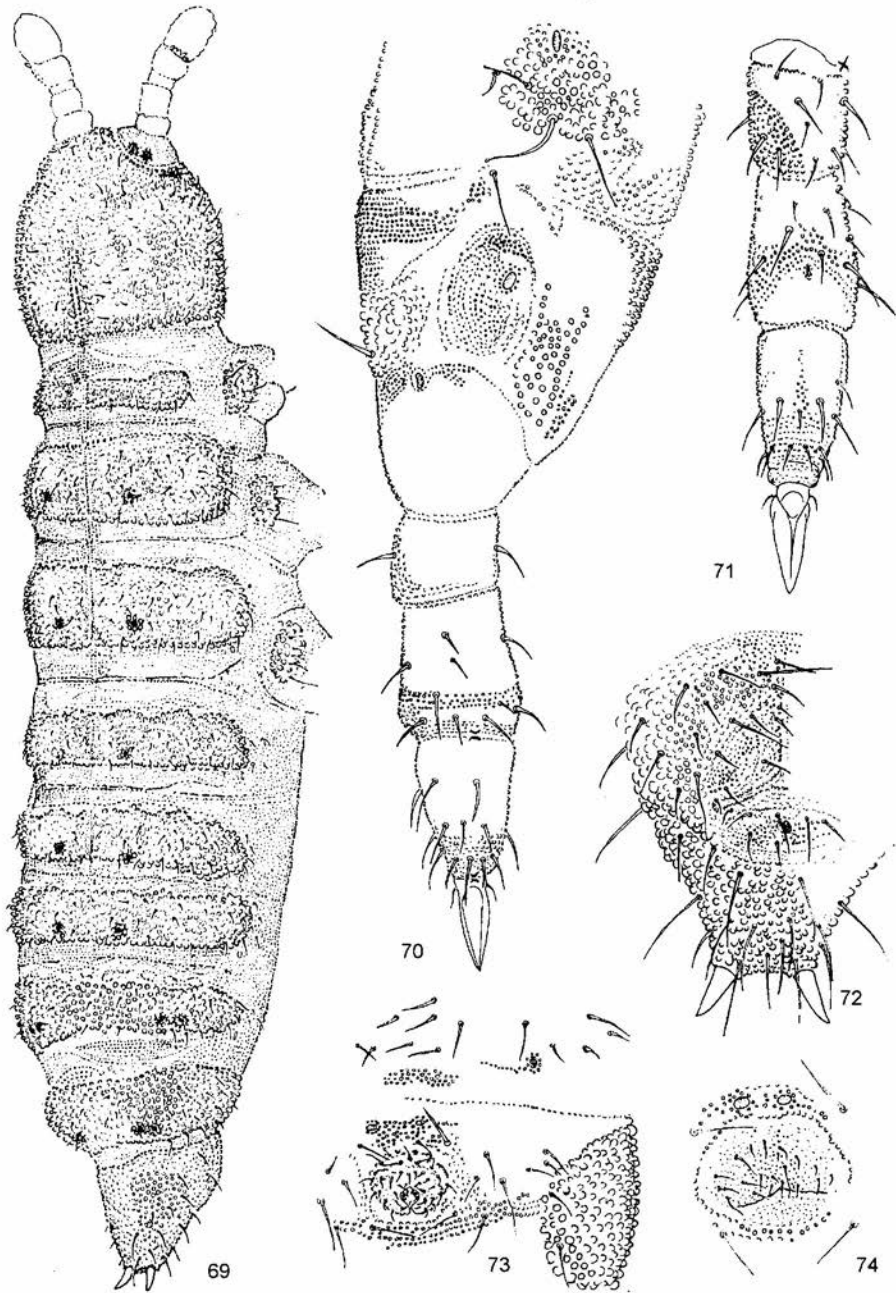
Neotype male (on slide); Carpathians, Pieniny Mts., Pieniny National Park, Dolina Pienińskiego Potoku valley, Poland; under stone in beech forest; 4. 04. 1990; leg. R. J. POMORSKI; paraneotypes - 5 males, 9 females (on slides); Carpathians, Pieniny Mts., Pieniny National Park, Dolina Pienińskiego Potoku valley, Poland; under stones and in litter in beech forest; 4. 04. 1990; leg. R. J. POMORSKI (type material is preserved in collection of Department of Systematic Zoology and Zoogeography, Wrocław University).

REDESCRIPTION

Colour in alcohol yellowish. Size, without antennae 1.7-1.8 mm males, 2.2-2.5 females (neotype - 1.7 mm). Body robust, elongated, somewhat dorso-



63-68. *K. carpenteri*: 63 - chaetotaxy and localization of pseudocelli and parapseudocelli on dorsal side of body, 64 - postantennal organ, 65 - antennal III sense organ, 66 - right antenna, 67 - parapseudocellus on abdominal tergum II, 68 - seta



69-74. *K. carpenteri*: 69 - granulation of dorsal side of body, 70 - II pair of legs, dorsal side, 71 - II pair of legs, ventral side, 72 - anal papillae, 73 - male genital plate, 74 - female genital plate

ventrally flattened, distinctly narrowed in the end of abdomen, as in figs. 63, 69. Antennae shorter than head. Furca reduced to two knobs with 3+3 (4+4) setulae (in adults, especially in males, they can be forked), tenaculum present (fig. 76). Dorsal side of the body covered with very strong granulation, especially coarse on terga. Usually 5-7 grains around each pseudocellus. Pseudocelli without distinct ridges.

AIIIO consists of 5 papillae; 2 sensory rods; 2 finely granulated morel-like sensory clubs; 5 guard setae (fig. 65).

Antennal segment IV with subapical organite and microsensillum located above posterior row of setae (fig. 66). On III antennal segment microsensillum localized laterally, slightly below AIIIO (figs. 65-66).

PAO in a deep, long cuticular groove, with 22-25 simple vesicles perpendicular to the long axis of organ (fig. 64).

Pseudocellar formula (pso) 20/011/11122, ventral pso absent. Parapseudocellar formula (psx) dorsally 0/011/1111, ventrally 1/000/111101^m. Each subcoxal with 1 psx. Each femur with 1 psx ventrally. Localization of pso and psx is presented in fig. 63.

Dorsal chaetotaxy often asymmetrical not differentiated into macrochaetae and microchaetae, most of setae knobbed, as in figs. 67-68. Chaetotaxy of abdominal tergum VI with only S and S' setae, and medial seta a₀ situated distinctly above row of p setae (the nomenclature of setae according to GISIN 1964) (fig. 81). Thorax II-III with lateral microsensilla. Subcoxae usually with 5, 6, 6 setae. Between legs on meso- and metathorax no setae. Tubus ventralis usually with 8(9)+8(9) setae (fig. 77). Male ventral organ absent.

Claw always without denticle. Empodial appendage with narrow basal lamella, appendage length equals 3/4 inner edge of the claw. Distal veriticil of setae on tibiotarsi symmetrical, with 11 setae (fig. 75).

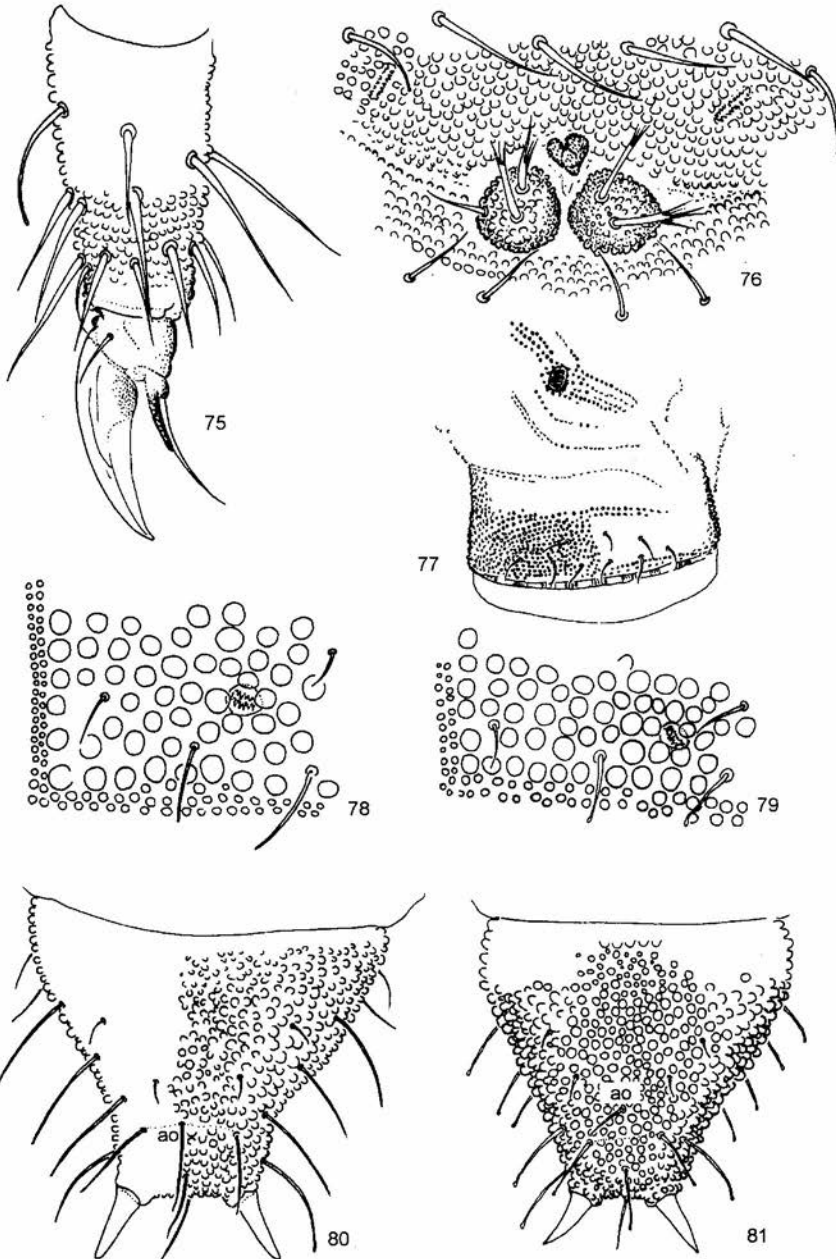
Anal spines strong, weakly curved, pointed, with little basal papillae, as long as the claw.

BIOLOGY

K. carpenteri is a bisexual species, living in mountains in humid litter, under stones and pieces of wood.

TAXONOMIC REMARKS

The specimens of *Kalaphorura*, collected on few localities in the Polish Carpathians (among others in the Pieniny Mts.) were determined by STACH (1954) as *K. burmeisteri* (LUBBOCK, 1873). Based on GISIN's (1964) revision, WEINER (1984) thought that the specimens should be classified as *K. paradoxa* (SCHÄFFER, 1900). Besides, she maintained that *O. carpenteri* was a junior synonym of *K. paradoxa*, because it had been based on a single juvenile specimen, without sex data (the specimen has been lost). In her own materials from Pieniny Mts. WEINER (1984) found a very young specimen, similar to *O. carpenteri*, without



75-81. *K. carpenteri* (75-77, 79, 80): 75 - tibiotarsus and claw of III pair of legs, 76 - remnant of furca with parapsudocelli, 77 - tubus ventralis, 79 - granulation, pseudocellus and setae on abdominal tergum II, 81 - abdominal tergum VI; *K. paradoxa* (78, 80): 78 - granulation, pseudocellus and setae on abdominal tergum II, 80 - abdominal tergum VI

medial seta on VI abdominal tergum. In the revision quoted above, GISIN suggested that Carpathian specimens of *Kalaphorura* might represent a distinct species, because they had knobbed setae. All other species within this genus have only stick-like, retused setae.

Thanks to the kindness of Dr. Erhard CHRISTIAN from Vienna, I had an opportunity to examine of 6 specimens of *K. paradoxa* from the cave "Hohlur" (Austria, Lower Austria, 7. 06. 1993, leg. E. CHRISTIAN). Their comparison with *Kalaphorura* from the Pieniny Mts. convinced me that GISIN was right and re-establishing STACH's specific name *carpenteri* became a necessity.

K. carpenteri is closely related to *K. paradoxa*, from which it differs in distinctly knobbed dorsal setae (*K. paradoxa* has stick-like setae) and in position of a_0 seta on abdominal tergum VI. In *K. paradoxa* the seta is localized in one row with p setae.

DISTRIBUTION IN POLAND

Carpathians – Pieniny Mts.

Kalaphorura paradoxa (SCHÄFFER, 1900)

Aphorura paradoxa SCHÄFFER, 1900, Jahresb. Verr. Vaterl. Naturk. Württemberg: 246.

MATERIAL

2 males (subadulti), 1 female; Carpathians, Bieszczady Mts., Poland; litter in beech forest; 8. 11. 1989; leg. I. KAPRUS'.

DESCRIPTION

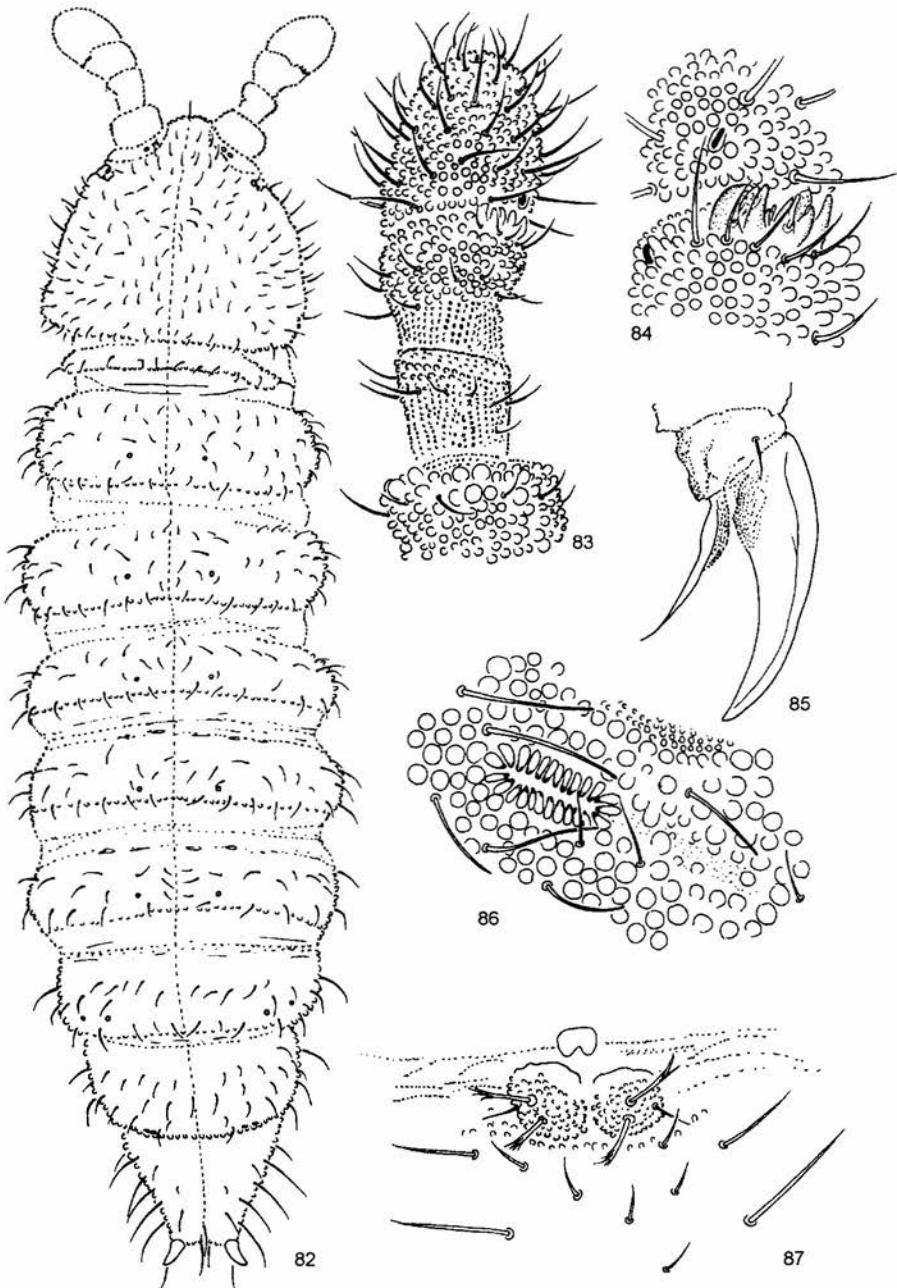
Colour in alcohol yellowish. Size, without antennae 1.7-1.8 mm males, 2.2-2.5 females. Body robust, elongated, somewhat dorso-ventrally flattened, distinctly narrowed in the end of abdomen, as in fig. 82. Antennae shorter than the head. Furca reduced to two knobs with 3+3 (4+4) setulae (in adults, especially in males, they can be forked), tenaculum present (fig. 87). Dorsal side of the body covered with very strong granulation, especially coarse on terga. Usually 5-7 grains around each pseudocellus. Pseudocelli without distinct ridges.

AIIIIO consists of 5 papillae; 2 sensory rods; 2 finely granulated morel-like sensory clubs; 5 guard setae (fig. 84).

Antennal segment IV with subapical organite and microsensillum located above posterior row of setae (figs. 83, 84). On III antennal segment microsensillum localized laterally, slightly below AIIIIO.

PAO in a deep, long cuticular groove, with 24-26 simple vesicles perpendicular to the long axis of organ (fig. 86).

Pseudocellar formula (pso) 20/011/11122, ventral pso absent. Parapseudocellar formula (psx) dorsally 0/011/1111, ventrally 1/000/111101^m. Each subcoxal



82-87. *K. paradoxa*: 82 - chaetotaxy and localization of pseudocelli and parapsudocelli on dorsal side of body, 83 - right antenna, 84 - antennal III sense organ, 85 - claw, 86 - postantennal organ, 87 - remnant of furca

with 1 psx. Each femur with 1 psx ventrally. Localization of dorsal pso is presented in fig. 82.

Dorsal chaetotaxy often asymmetrical, not differentiated into macrochaetae and microchaetae, most setae reduced, as in figs. 78, 86. Chaetotaxy of abdominal tergum VI with only S and S' setae, and medial seta a_0 situated in one row with p setae (fig. 80). Thorax II-III with lateral microsensilla. Subcoxae usually with 5, 6, 6 setae. Between legs on meso- and metathorax no setae. Tubus ventralis usually with 8(9)+8(9) setae. Male ventral organ absent.

Claw always without denticle. Empodial appendage with narrow basal lamella, appendage length equals 3/4 inner edge of the claw. Distal veriticil of setae on tibiotarsi symmetrical, with 11 setae.

Anal spines strong, weakly curved, pointed, with little basal papillae, as long as the claw.

BIOLOGY

K. paradoxa is a bisexual species, living in mountains in humid litter, under stones and pieces of wood.

TAXONOMIC REMARKS

See *K. carpenteri*.

DISTRIBUTION IN POLAND

Carpathians – Bieszczady Mts.

Hymenaphorura BAGNALL, 1949

Hymenaphorura BAGNALL, 1949, Ann. Mag. Nat. Hist., 11 (14): 635.

Hymenaphorurodes BAGNALL, 1949, Ann. Mag. Nat. Hist., 12 (2): 506.

Sibirichiurus STACH, 1954. Państw. Wyd. Nauk., Kraków: 25.

Type species: *Lipura sibirica* TULLBERG, 1876, by original designation. (described from Russia: Siberia, Dudino).

Diagnosis: Hind margin of head capsule and thoracic tergum I without pseudocelli, thoracic II-III and abdominal I-III with 1+1 dorsomedial pseudocelli. Dorsal side of body with parapseudocelli. Granulation strong with granular areas on dorsal side of body. Furca reduced to small area of fine granulation with 2 (3, 4) setulae posteriorly. Anal spines strong on distinct papillae. Distal veriticil of setae on tibiotarsi symmetrical, with 11 setae. AIIIIO with simple or forked papillae and only 4 guard setae. PAO with simple vesicles, located parallelly or oblique to the long axis of the organ. Setae sensuales on head and body poorly marked. Seta d_0 on head absent, abdominal tergum VI dorsally with 2 medial setae.

KEY TO SPECIES

1. On abdominal terga I-II setae p_2 and p_3 located on each side of the pseudocelli of roughly equal length (fig. 100, 115, 122) 2.
- On abdominal terga I-II seta p_3 distinctly longer than p_2 (fig. 92)
..... *H. creatricis*
2. Granular area on abdominal tergum V with 3+3 macrochaetae (fig. 102), on IV antennal segment ms located in one row with posterior setae (fig. 98), claw with denticle *H. nova*
- Granular area on abdominal tergum V with 1+1 posterolaterally poorly distinct macrochaetae (figs. 114, 123), on IV antennal segment ms located distinctly above row of posterior setae (fig. 108, 120), claw without denticle 3.
3. In AIIIO second external papilla forked (fig. 108), adult size 0.8-1.1 mm, granulation of V abdominal tergum regular *H. parva*
- In AIIIO second external papilla simple (fig. 120), adult size 1.6-2.1 mm (only females), granulation of V abdominal tergum very coarse with cauliflower-like areas *H. polonica*

***Hymenaphorura creatricis* POMORSKI, 1990**

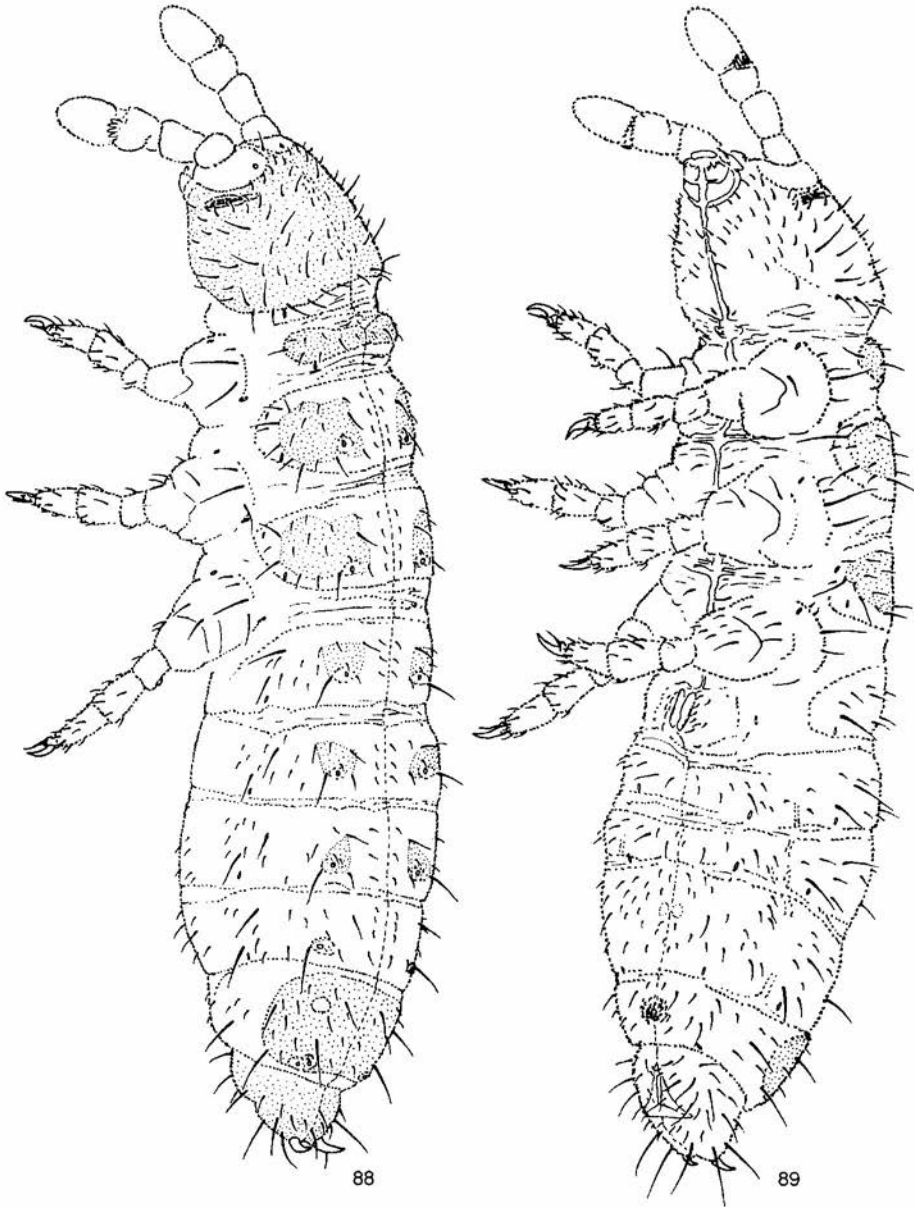
Hymenaphorura creatricis POMORSKI, 1990, Mitt. der. Schwei. Ent. Ges., 63: 216.

TYPE MATERIAL

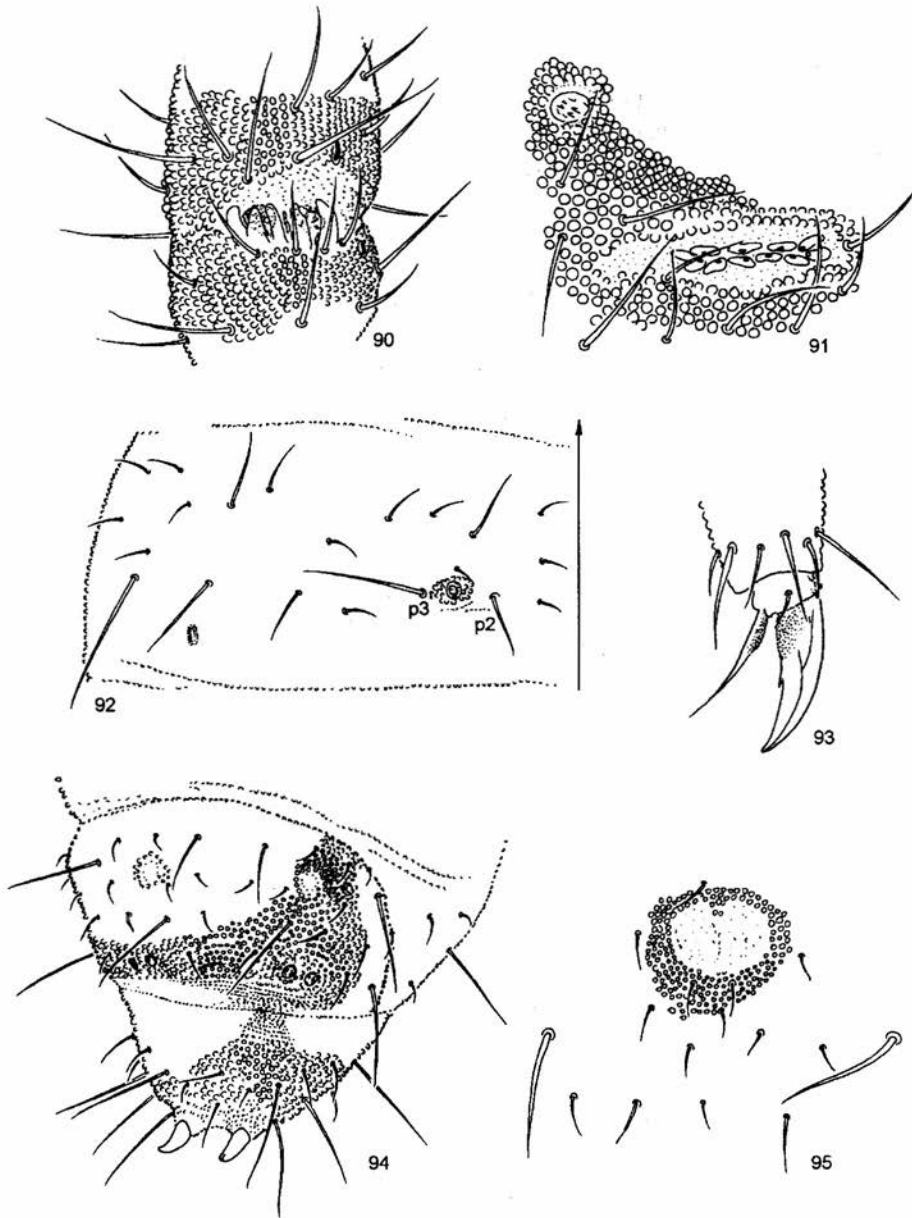
Holotype, female on slide; 20 paratypes on slides (8 females and 12 males); numerous specimens in alcohol; Sudetes, Szczeliniec Wielki, Góry Stołowe National Park, Poland; litter and moss in deep rock crevices, 919 m a.s.l., 14. 01. 1988; leg. M. WEICHSEL & R. J. POMORSKI.

OTHER MATERIAL

5 specimens on slides and numerous specimens in alcohol, Tatra Mts., Carpathians, Poland, 1924-1936; leg. J. STACH, coll. J. STACH. 3 female, Ślęza Massif, Sudetes Highlands, Poland; under moss on rocks, c. 700 m a.s.l., 22. 07. 1988; leg. R. J. POMORSKI. 10 specimens on slides, Sudetes, Śnieżnik Massif, cave "Jaskinia Niedźwiedzia", Poland; on dead insects, c. 900 m a.s.l., 15. 07. 1989; leg. R. J. POMORSKI. 5 specimens on slides, numerous specimens in alcohol, Sudetes, Śnieżnik Massif, cave "Jaskinia Niedźwiedzia", Poland; under moss on rocks in spruce forest, c. 1100 m a.s.l., 22. 08. 1992; leg. R. J. POMORSKI. 4 specimens on slides, Sudetes, Karkonosze, Mały Kocioł Śnieżny, Poland; soil under moss on rocks, c. 1300 m a.s.l., 16. 06. 1990; leg. D. SKARŻYŃSKI. 2 specimens on slide, Sudetes, Karkonosze, old adit in Sowią Dolina, Poland; litter, 19. 02. 1987; leg. T. KOKUREWICZ. 5 specimens in alcohol and numerous specimens, Sudetes, Wałbrzych Highlands, Pełcznica ravine, Poland; under moss on rocks, 25. 05. 1989; leg. D. SKARŻYŃSKI. 1 specimen on slide, Sudetes, Kaczawskie Mts., Różana, Poland; litter, 18. 04. 1990; leg. R. J. POMORSKI.



88-89. *H. creatricis*: 88 - chaetotaxy and localization of pseudocelli and parapseudocelli on dorsal side of body, 89 - chaetotaxy and localization of parapseudocelli on ventral side of body



90-95. *H. creatricis*: 90 - antennal III sense organ, 91 - postantennal organ, 92 - abdominal tergum II, 93 - claw, 94 - granulation, chaetotaxy of abdominal terga V and VI, 95 - remnant of furca

DESCRIPTION

Colour in alcohol white. Size, without antennae, 1.3-1.8 mm (holotype - 1.7 mm). Shape of body cylindrical, robust as in figs. 88-89. Antennae as long as head. Trace of reduced furca in shape of 2 symmetrical small patches of fine granulation with 2-3 small setae posteriorly (fig. 95). Granulation of dorsal side of the body distinct, with well visible granular areas of type C2 - according JORDANA & ARBEA (1994) (fig. 88). Usually 12-13 grains around each pseudocellus.

AIIO consists of 5 papillae; 2 sensory rods; 2 finely granulated, spherical sensory clubs; 4 guard setae (fig. 90).

Antennal segment IV with subapical organite and microsensillum immediately above AIIO. On III antennal segment microsensillum localized laterally, slightly below AIIO (fig. 90).

PAO in a deep, long cuticular groove, with 10 (most often 9-11) simple vesicles (fig. 91).

Pseudocellar formula (pso) 10/011/11112, ventral pso absent. Parapseudocellar formula (psx) dorsally 01/111/1111, ventrally 1/000/11111. Each subcoxal with 2 psx. Each femur with 1 psx ventrally. Localization of pso and psx is presented in figs. 88 and 89.

Dorsal chaetotaxy symmetrical, well differentiated into macrochaetae and microchaetae, as fig. 88. Thorax II-III with lateral microsensilla. On I-IV abdominal terga, setae p_2 shorter than p_3 , (fig. 92). Granular area on abdominal tergum V with 4+4 distinct macrochaetae (fig. 94). Subcoxae with 3, 3 (4), 4 setae. Ventral chaetotaxy as fig. 89, between legs on meso- and metathorax 1+1 setae. Tubus ventralis usually with 8+8 setae. Male ventral organ absent.

Claw always with denticle. Empodial appendage with narrow basal lamella, appendage length as inner edge of claw. Distal verticil of setae on tibiotarsi symmetrical, with 11 setae (fig. 93).

Anal spines strong, weakly curved, pointed, with small basal papillae, as long as the claw.

VARIABILITY

I have observed asymmetrical chaetotaxy and pseudocellar aberrations, manifest as appearance of additional setae and pseudocelli or as their reduction (2 instances of loss of pseudocellus on abdominal terga, 2 instances of appearance of additional pseudocellus at base of antennae).

BIOLOGY

H. creatricis is a bisexual species, living in mountains at higher altitude, in humid litter in rock crevices, under moss in screes. It can be found also in caves and adits. I instar larva - resting stage.

DISTRIBUTION IN POLAND

Sudetes and Carpathians.

Hymenaphorura nova POMORSKI, 1990

Hymenaphorura nova POMORSKI, 1990, Mitt. der. Schwei. Ent. Ges., 63: 210.

TYPE MATERIAL

Holotype, female on slide; 7 paratypes on slides (5 females and 2 males); 10 paratypes in alcohol; E Sudetes, Głuchołazy, Poland; soil from the bottom of an old (19thoracic c.) adits, 29. 10. 1988; leg. R. J. POMORSKI.

OTHER MATERIAL

1 female, Tatra Mts., Carpathians, Poland, 1924-1936; leg. J. STACH. 1 female, Mt. Miłek, Kaczawskie Mts., W Sudetes, Poland; a scree, 18. 10. 1985; leg. R. J. POMORSKI. Many specimens; E Sudetes, Chwalistaw, Poland; bank of Małolnica stream, soil under moss-covered stones, 2. 10. 1991; leg. R. J. POMORSKI. 1 female, Sudetes, Kletno, Śnieżnik Massif, Poland; bank of Kleśnica stream, soil under moss-covered stones, 15. 02. 1992; leg. D. SKARZYŃSKI.

DESCRIPTION

Colour in alcohol white. Size, without antennae, 1.5-2.2 mm (holotype - 1.8 mm). Shape of body cylindrical, elongated as in figs. 96-97. Antennae as long as head or slightly shorter. Trace of reduced furca in shape of 2 symmetrical small patches of fine granulation with 2-3 small setae posteriorly (fig. 101). Granulation of dorsal side of the body distinct, irregular, with good visible granular areas of type C2 - according JORDANA & ARBEA (1994) (fig. 96). Usually 8-9 grains around each pseudocellus.

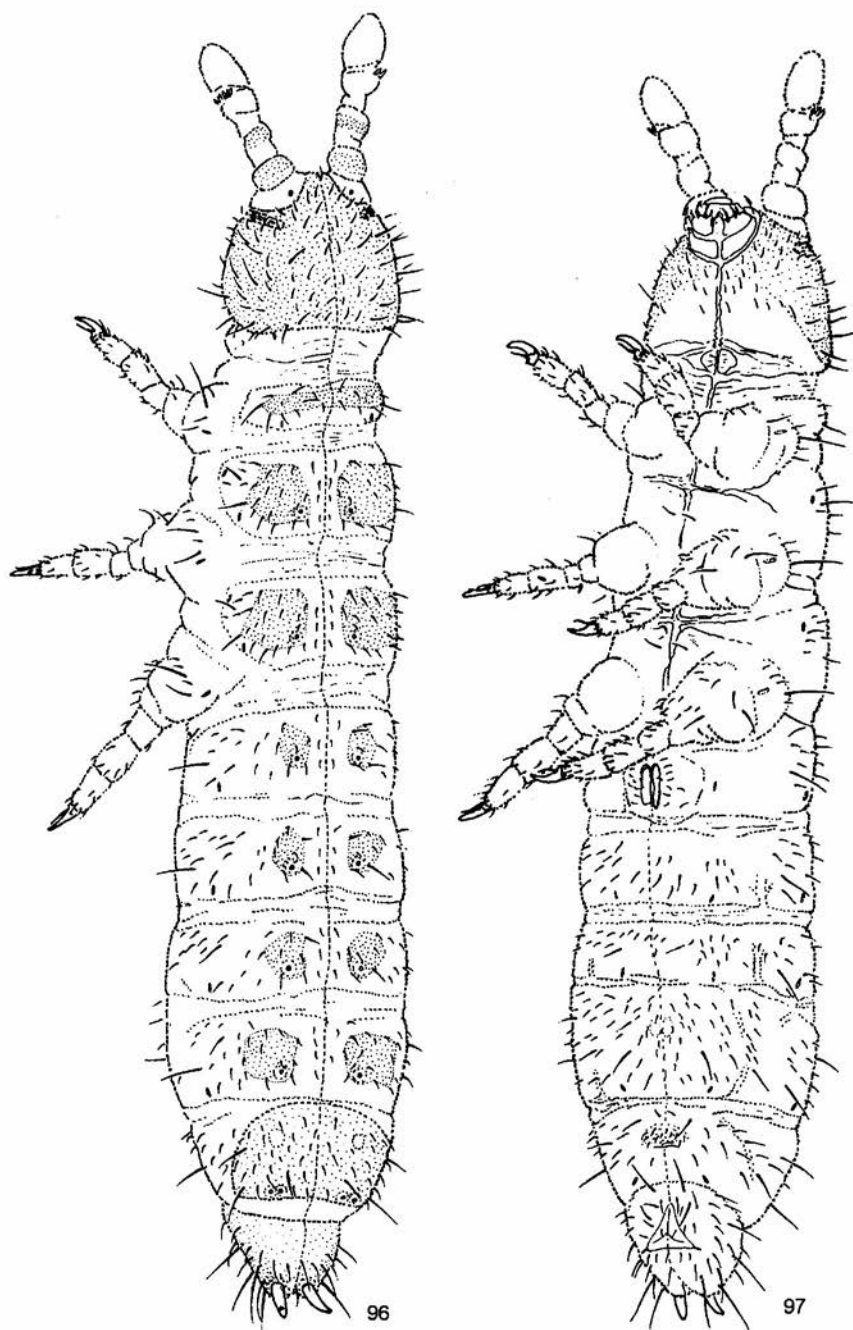
AIII0 consists of 5 papillae of which the second external is usually forked; 2 sensory rods; 2 finely granulated, spherical sensory clubs; 4 guard setae (fig. 98).

Antennal segment IV with subapical organite and microsensillum immediately above AIII0. On III antennal segment microsensillum localized laterally, slightly below AIII0 (fig. 98).

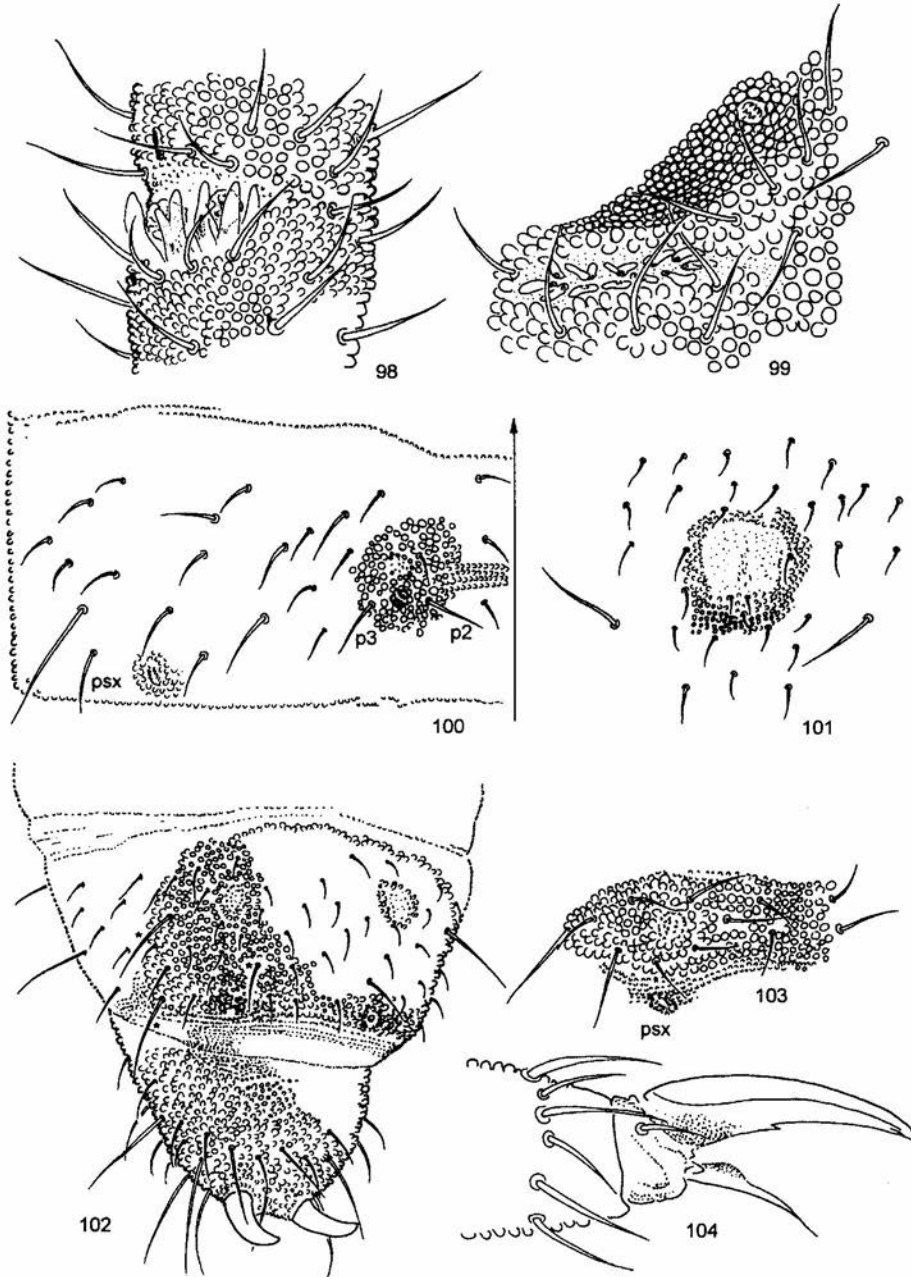
PAO in a deep, narrow and relatively short cuticular groove, with 10 (most often 9-12) simple or bilobed vesicles (fig. 99).

Pseudocellar formula (pso) 10/011/11112, ventral pso absent. Parapseudocellar formula (psx) dorsally 01/111/1111, ventrally 1/000/11111. Each subcoxal with 2 psx. Each femur with 1 psx ventrally. Localization of pso and psx is presented in figs. 96 and 97.

Dorsal chaetotaxy symmetrical, with poorly distinct macrochaetae, as in fig. 96. Thorax II-III with lateral microsensilla. Setae p_2 and p_3 , on abdominal terga I-III, localized on each side of the pseudocelli of roughly equal length (fig. 100); on abdominal tergum IV seta p_3 slightly longer than p_2 . Granular area on abdominal tergum V with 3+3 poorly distinct macrochaetae (fig. 102). Subcoxae with 3, 4, 4 setae. Ventral chaetotaxy as in fig. 97, between legs on meso- and metathorax 1+1 setae. Tubus ventralis usually with 9+9 setae. Male ventral organ absent.



96-97. *H. nova*: 96 - chaetotaxy and localization of pseudocelli and parapseudocelli on dorsal side of body,
97 - chaetotaxy and localization of parapseudocelli on ventral side of body



98-104. *H. nova*: 98 - antennal III sense organ, 99 - postantennal organ, 100 - abdominal tergum II, 101 - remnant of furca, 102 - granulation, chaetotaxy of abdominal terga V and VI, 103 - thoracic tergum I, granulation, chaetotaxy and parapsuedocellus, 104 - claw

Claw usually with denticle. Empodial appendage with narrow basal lamella, appendage length equals 2/3 inner edge of the claw. Distal veritcil of setae on tibiotarsi symmetrical, with 11 setae (fig. 104).

Anal spines strong, curved, pointed, with little basal papillae, distinctly longer than the claw (fig. 102).

VARIABILITY

Chaetotaxy of abdominal terga, especially V, can be asymmetrical. The shape of second external papilla in AIIIO is variable. In 4 paratypes claws on some legs lack the denticle.

BIOLOGY

H. nova is a bisexual species, associated with habitats of banks of a montane and highland rivers. In the light of last records, my suggestion (POMORSKI, 1990) of associations with limestone proves to be incorrect.

DISTRIBUTION IN POLAND

Sudetes and Carpathians.

***Hymenaphorura parva* SKARZYŃSKI et POMORSKI, 1996**

Hymenaphorura parva SKARZYŃSKI et POMORSKI, 1996, Genus, 7, 3: 319.

TYPE MATERIAL

Holotype, male on slide; 12 paratypes on slides; numerous specimens in alcohol; Sudetes, Karkonosze, Szklarska Poręba, Poland; gravel heap of the river Kamienna, 10. 10. 1995; leg. D. SKARZYŃSKI.

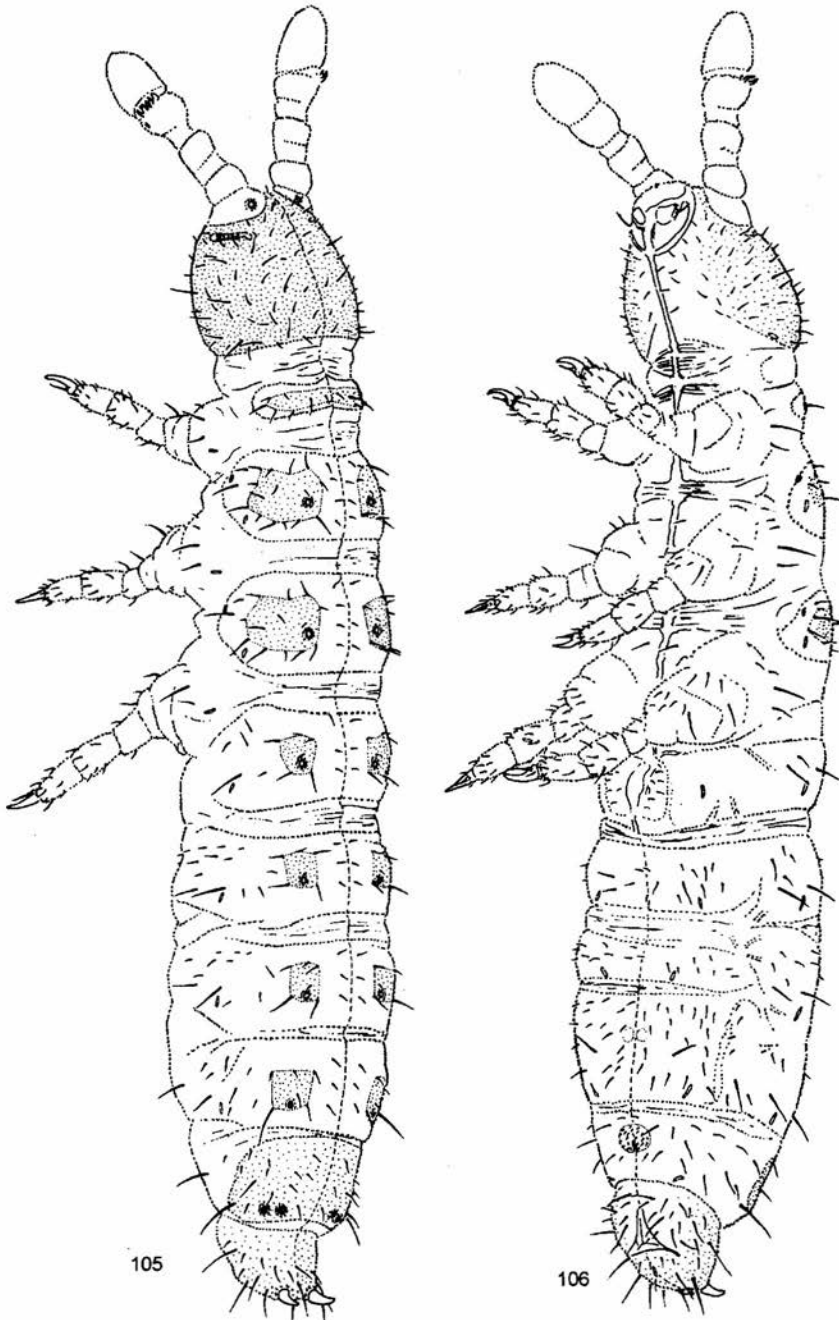
DESCRIPTION

Colour in alcohol white. Size, without antennae, 0.8-1.1 mm (holotype – 0.95 mm). Shape of body rather squat, cylindrical, as in figs. 105-107. Antennae as long as head. Trace of reduced furca in shape of 2 symmetrical small patches of fine granulation with 2 small setae posteriorly. Granulation of dorsal side of the body with poorly visible granular areas of type C2 - according to JORDANA & ARBEA (1994) (fig. 105). Usually 13-15 grains around each pseudocellus (figs. 115-116).

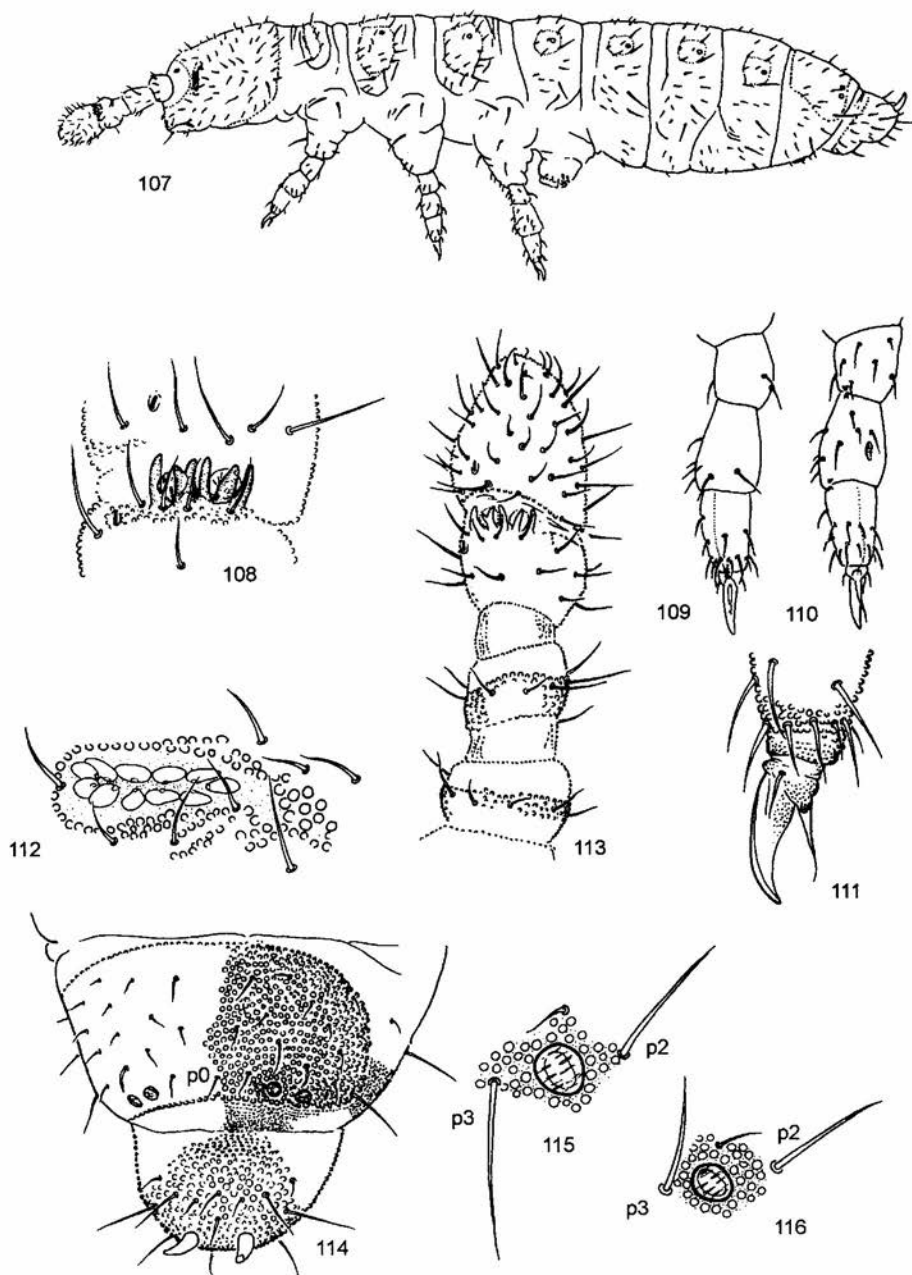
Antennal III sense organ (AIIIO) consists of 5 papillae of which the second external is always forked; 2 sensory rods; 2 smooth, spherical sensory clubs; 4 guard setae (fig. 108)

Antennal segment IV with small subapical organite and microsensillum in basal part of the segment (fig. 113). On III antennal segment microsensillum located laterally, slightly below AIIIO (figs. 108, 113).

Postantennal organ (PAO) in shallow, relatively short cuticular groove, with 8-11 (most often 8-9) simple vesicles (fig. 112).



105-106. *H. parva*: 105 - chaetotaxy and localization of pseudocelli and parapseudocelli on dorsal side of body, 106 - chaetotaxy and localization of parapseudocelli on ventral side of body



107-116. *H. parva*: 107 - shape of body, lateral view, 108 - antennal III sense organ, 109 - legs of II pair dorsal view, 110 - legs of II pair ventral view, 111 - claw, 112 - postantennal organ, 113 - antenna, 114 - granulation, chaetotaxy of abdominal terga V and VI, 115 - granulation, chaetotaxy and pseudocellus, abdominal tergum IV, 116 - granulation, chaetotaxy and pseudocellus, abdominal tergum II

Pseudocellar formula (pso) 10/011/11112, ventral pso absent. Parapseudocellar formula (psx) dorsally 0/011/1111, ventrally 1/000/111111^m. Each subcoxal with 1 psx (higher). Each femur with 1 psx ventrally. Localization of pso and psx is presented in figs. 105, 106, 110.

Dorsal chaetotaxy symmetrical, with distinct macrochaetae, as in fig. 105. Thorax II-III with lateral microsensilla. Setae p_2 and p_3 , on abdominal terga I-III, located on each side of the pseudocelli of roughly equal length (fig. 116); on abdominal tergum IV seta p_3 distinctly longer than p_2 (fig. 115). Granular area on abdominal tergum V with 1 macrochaeta posterolaterally (fig. 114). Subcoxae with 3, 4, 4 setae. Ventral chaetotaxy as in fig. 106, between legs on meso- and metathorax 1+1 setae. Tubus ventralis usually with 8+8 setae. Male ventral organ absent.

Claw always without denticle. Empodial appendage with narrow basal lamella, appendage length equals 3/4 inner edge of the claw. Distal veriticol of setae on tibiotarsi symmetrical, with 11 setae (figs. 109-111).

Anal spines weakly curved, pointed with little basal papillae.

VARIABILITY

The seta p_0 was observed in 6 paratypes on abdominal tergum V (fig. 114). The shape of second internal papilla in AIIIO is variable - in 3 paratypes papillae are forked, like the second external.

BIOLOGY

H. parva n. sp. is a bisexual species, probably associated with interstitial habitats of gravel heaps of rivers.

DISTRIBUTION IN POLAND

Known only from Karkonosze Mts. in the Sudetes.

***Hymenaphorura polonica* POMORSKI, 1990**

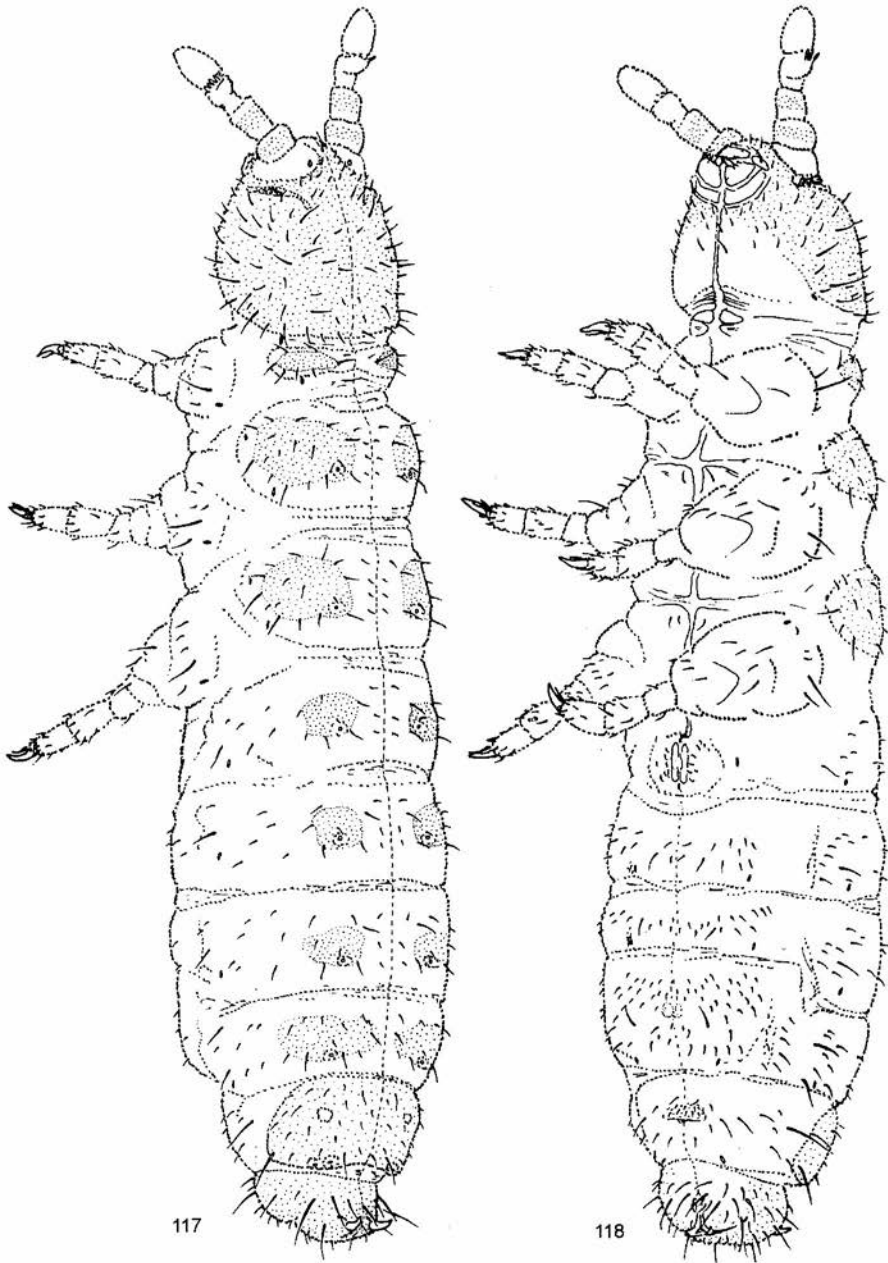
Hymenaphorura polonica POMORSKI, 1990, Mitt. der. Schwei. Ent. Ges., 63: 213.

TYPE MATERIAL

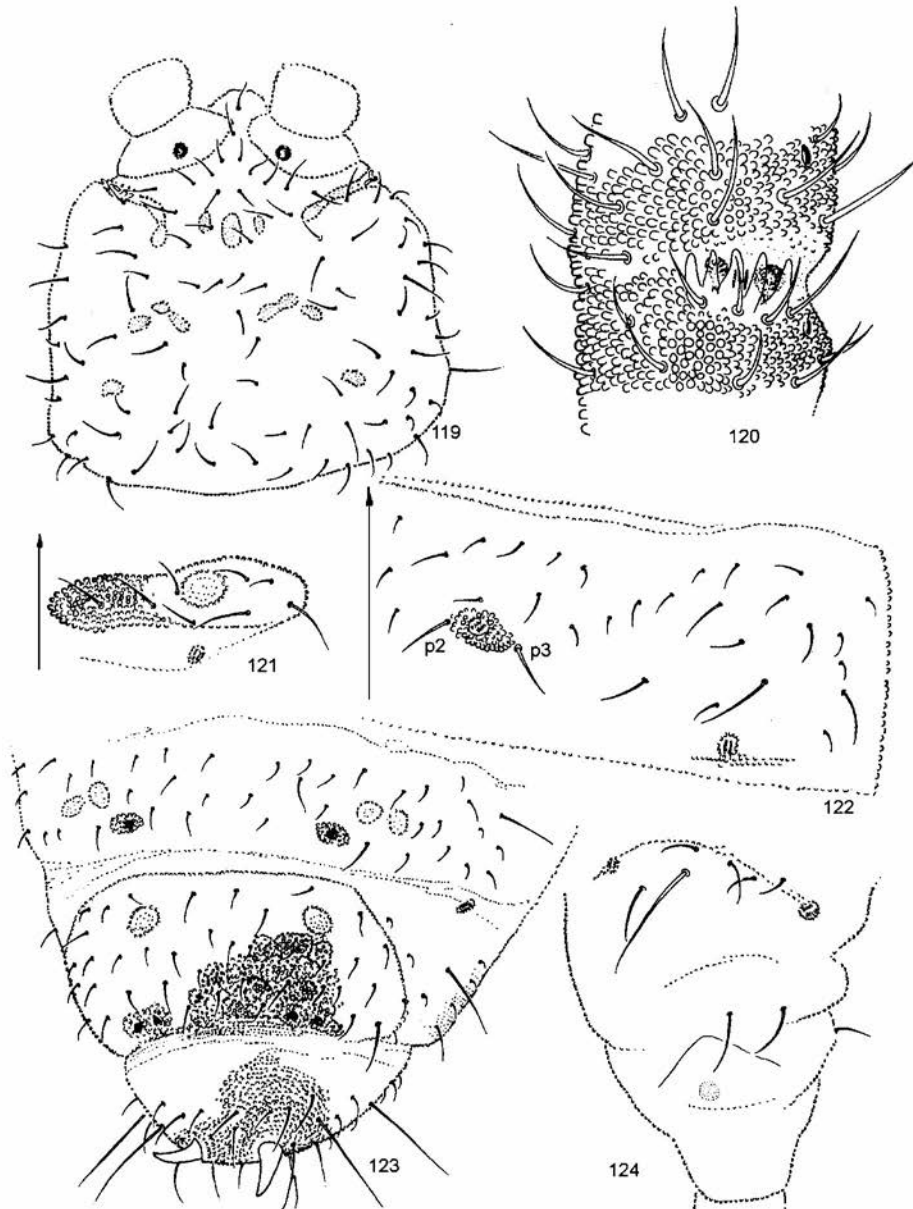
Holotype, female on slide; 14 paratypes on slides; Sudety highlands, Ślęza Massif, Poland; a rotten fallen spruce trunk, c. 700 m a.s.l., 14. 11. 1987; leg. R. J. POMORSKI.

OTHER MATERIAL

35 females; Carpathians, Pieniny Mts., Poland, 1971-1976; leg. M. WEINER. Numerous spp. (females only); E Sudetes, Głuchołazy, Poland; a rotten tree trunk in an old adit, 17. 05. 1979; leg. R. J. POMORSKI. Numerous spp. (females only);



117-118. *H. polonica*: 117 - chaetotaxy and localization of pseudocelli and parapseudocelli on dorsal side of body, 118 - chaetotaxy and localization of parapseudocelli on ventral side of body



119-124. *H. polonica*: 119 - head, dorsal chaetotaxy, 120 - antennal III sense organ, 121 - thoracic tergum I, granulation, chaetotaxy and parapseudocellus, 122 - abdominal tergum II, 123 - granulation, chaetotaxy of abdominal terga V and VI, 124 - subcoxa 1 and subcoxa, chaetotaxy and parapseudocelli

Carpathians, Cave Dziura, Tatra Mts., Poland; 1. 09. 1949; leg. J. MAKÓLSKI, coll. J. STACH. Numerous spp. (females only); Carpathians, Nowy Targ Basin, Czarny Dunajec, Poland; under large stones and pieces of rotting timber, 1919-1922; leg. J. STACH, coll. J. STACH. 2 females; Sudetes, Góry Bystrzyckie, cave Solna Jama, Poland; 20. 04. 1996; leg. R. J. POMORSKI. Numerous spp. (females only); Roztocze, Roztoczański National Park, Zwierzyniec Bukowa Góra, Poland; a rotten fallen trunk, 16. 06. 1996; leg. R. J. POMORSKI. 1 female; Roztocze, Rebizanty, Szumy nad Tanwią reserve, Poland; a rotten fallen trunk, 16. 06. 1996; leg. R. J. POMORSKI.

DESCRIPTION

Colour in alcohol white. Size, without antennae, 1.6-2.1 mm (holotype – 1.9 mm). Shape of body robust, dumpy as in figs. 117, 118. Antennae distinctly shorter than head. Trace of reduced furca in shape of 2 symmetrical small patches of fine granulation with 2-3 small setae posteriorly (fig. 127). Granulation of dorsal side very coarse, on abdominal tergum V with cauliflower-like areas (fig. 123). The body with poorly visible granular areas of type C2 - according JORDANA & ARBEA (1994) (fig. 117). Usually 11-12 grains around each pseudocellus.

Antennal III sense organ (AIII) consists of 5(4, 6) papillae; 2 sensory rods; 2 mulberry-like sensory clubs; 4 guard setae (fig. 120).

Antennal segment IV with small subapical organite and microsensillum in latero-external position, usually at 1/3 height of antennal IV. On III antennal segment microsensillum localized laterally, slightly below AIII (fig. 120).

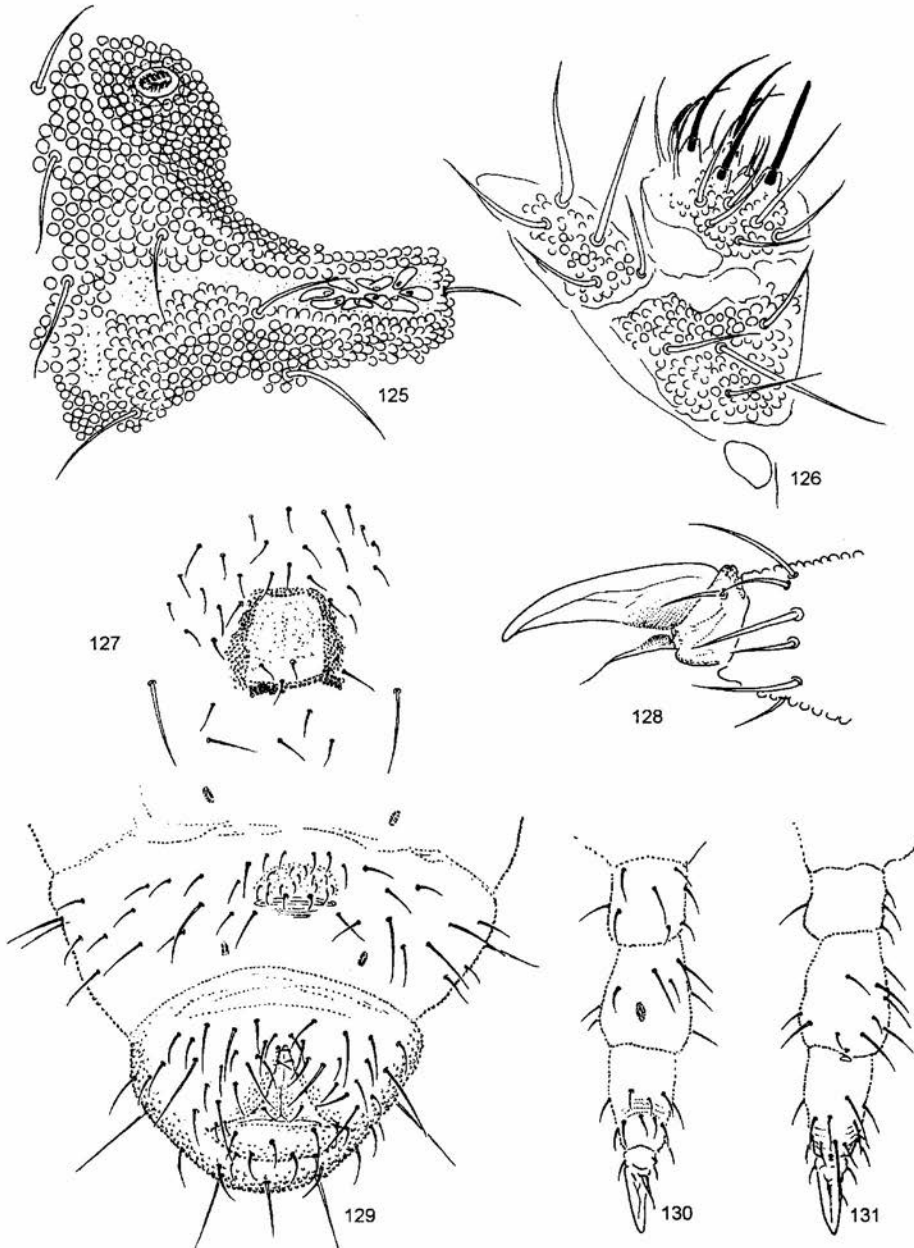
Postantennal organ (PAO) in a deep, narrow and very long cuticular groove, prolonged on the dorsal side of head, with 10 simple or bilobed vesicles (fig. 125).

Pseudocellar formula (pso) 10/011/11112, ventral pso absent. Parapseudocellar formula (psx) dorsally 01/111/1111, ventrally 1/000/11111. Each subcoxal with 2 psx (fig. 124). Each femur with 1 psx ventrally (fig. 130). Localization of pso and psx is presented in figs. 117, 118, 121-123, 129.

Dorsal chaetotaxy often asymmetric, with poorly distinct macrochaetae, as in fig. 117. Thorax II-III with lateral microsensilla. Setae p_2 and p_3 , on abdominal terga I-III, located on each side of the pseudocelli of roughly equal length (fig. 122). Granular area on abdominal tergum V with 1 macrochaeta posterolaterally (fig. 123). Subcoxae with 3, 4, 4 setae. Ventral chaetotaxy as in fig. 118, between legs on meso- and metathorax 1+1 setae. Tubus ventralis usually with 8+8 setae. Male ventral organ absent.

Claw always without denticle. Empodial appendage with distinct basal lamella, appendage length equals 1/2-2/3 inner edge of the claw. Distal veriticil of setae on tibiotarsi symmetrical, with 11 setae (fig. 128).

Anal spines weakly curved, pointed with little basal papillae, shorter than the claw.



125-131. *H. polonica*: 125 - postantennal organ, 126 - labium, 127 - remnant of furca, 128 - claw, 129 - abdominal sterna V and VI, female, 130 - legs of II pair, ventral side, 131 - legs of II pair, dorsal side

VARIABILITY

Chaetotaxy of abdominal tergum V and head in adults are usually asymmetrical. The number of papillae in AIIIIO is also variable: for example - of 37 examined specimens from the same locality, 2 spp. had only 4 papillae, 3 spp. 6 papillae and 26 a typical number of 5 papillae.

BIOLOGY

H. polonica is a parthenogenic species, inhabiting mountains and highlands, living only in humid rotting timber. Specimens of this species bore corridors in rotten wood and build various constructions of their own excrement. I instar larva - resting stage.

DISTRIBUTION IN POLAND

Sudetes, Sudetes highlands, Carpathians, Roztocze upland.

***Heteraphorura* BAGNALL, 1948**

Heteraphorura BAGNALL, 1948, Ann. Mag. Nat. Hist., 11 (14): 640-641.

Type species: *Onychiurus variotuberculatus* STACH, 1934, by original designation (described from Slovenia: San Canziano Cave near Trieste).

Diagnosis: Hind margin of head capsule and thoracic tergum I without pseudocelli, thoracic terga II-III and abdominal terga I-II with 1+1 dorsomedial pseudocelli. Dorsal side of body without parapseudocelli. Granulation strong without granular areas. Furca reduced to small area of fine granulation with 4 setulae in one row posteriorly. Anal spines strong on distinct papillae. Distal veriticial of setae on tibiotarsi symmetrical, with 11 setae. AIIIIO with simple papillae and 5 guard setae. Vesicles in PAO of two kinds, simple or multilobed located perpendicularly or oblique to the long axis of the organ. Setae sensuales on head and body poorly marked. Seta d_0 on head absent, abdominal tergum VI with 3 medial setae. Unpaired anal lobe with 7 thickened setae, curved upward.

KEY TO SPECIES

1. Empodial appendage length equals 2/3 inner edge of the claw (fig. 141), basis of antenna usually with 3 pso *H. variotuberculata*
- . Empodial appendage very short, rudimental, do not extend to the denticle on claw (fig. 156), basis of antenna usually with 2 pso *H. carpatica*

Heteraphorura variotuberculata (STACH, 1934)

Heteraphorura variotuberculata STACH, 1934, Ann. Mus. Zoolg. Polonici, 10: 161.

TYPE MATERIAL

Lectotype (present designation), female on slide; 1 paralectotype in alcohol. Cave St. Canzian, Yugoslavia (at present Slovenia), among plant detritus; 14. 05. 1929; leg. H. J. Stammer.

OTHER MATERIAL

2 males, 7 females; Carpathians, Pieniny Mts, Pieniny National Park, Ociemny valley, Poland; under stones in beech forest; 26. 05. 1994; leg. R. J. POMORSKI.

REDESCRIPTION

Colour in alcohol white. Size, without antennae, 1.6-2 mm (lectotype – 1.7 mm). Shape of body cylindrical, robust as in figs. 132-133. Antennae distinctly shorter than head. Trace of reduced furca in shape of 2 symmetrical small patches of fine granulation with 4 small setae in one row posteriorly (fig. 146). Granulation of dorsal side of the body distinct, regular. Usually 9-12 grains around each pseudocellus.

AIIIO consists of 5 conical papillae; 2 sensory rods; 2 finely granulated, spherical sensory clubs; 5 guard setae (fig. 136).

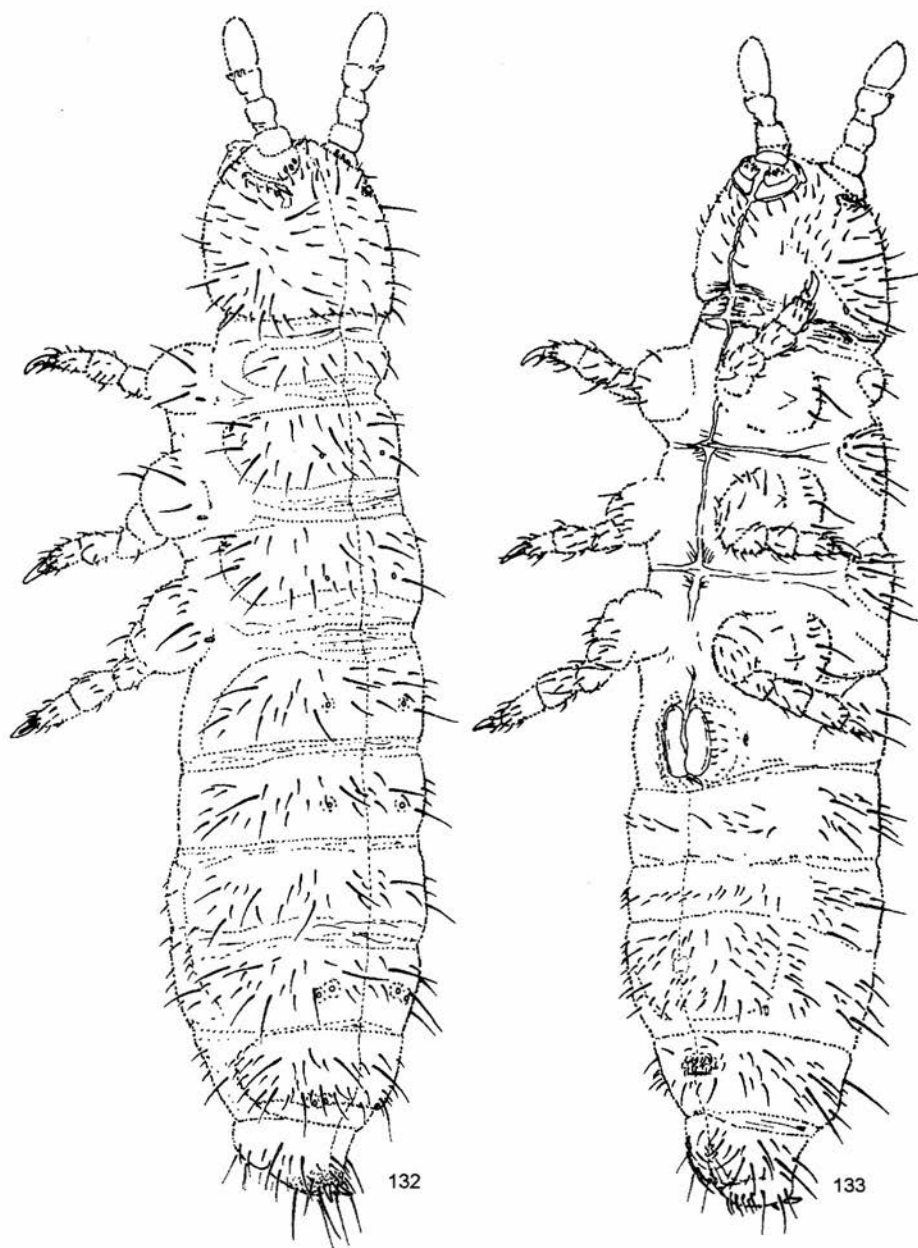
Antennal segment IV with subapical organite and ms located distinctly above row of posterior setae. On III antennal segment microsensillum localized laterally, slightly below AIIIO (figs. 134, 136).

PAO in a deep, long cuticular groove, with 17-25 simple and multilobed vesicles located perpendicularly or oblique to the long axis of organ (fig. 135).

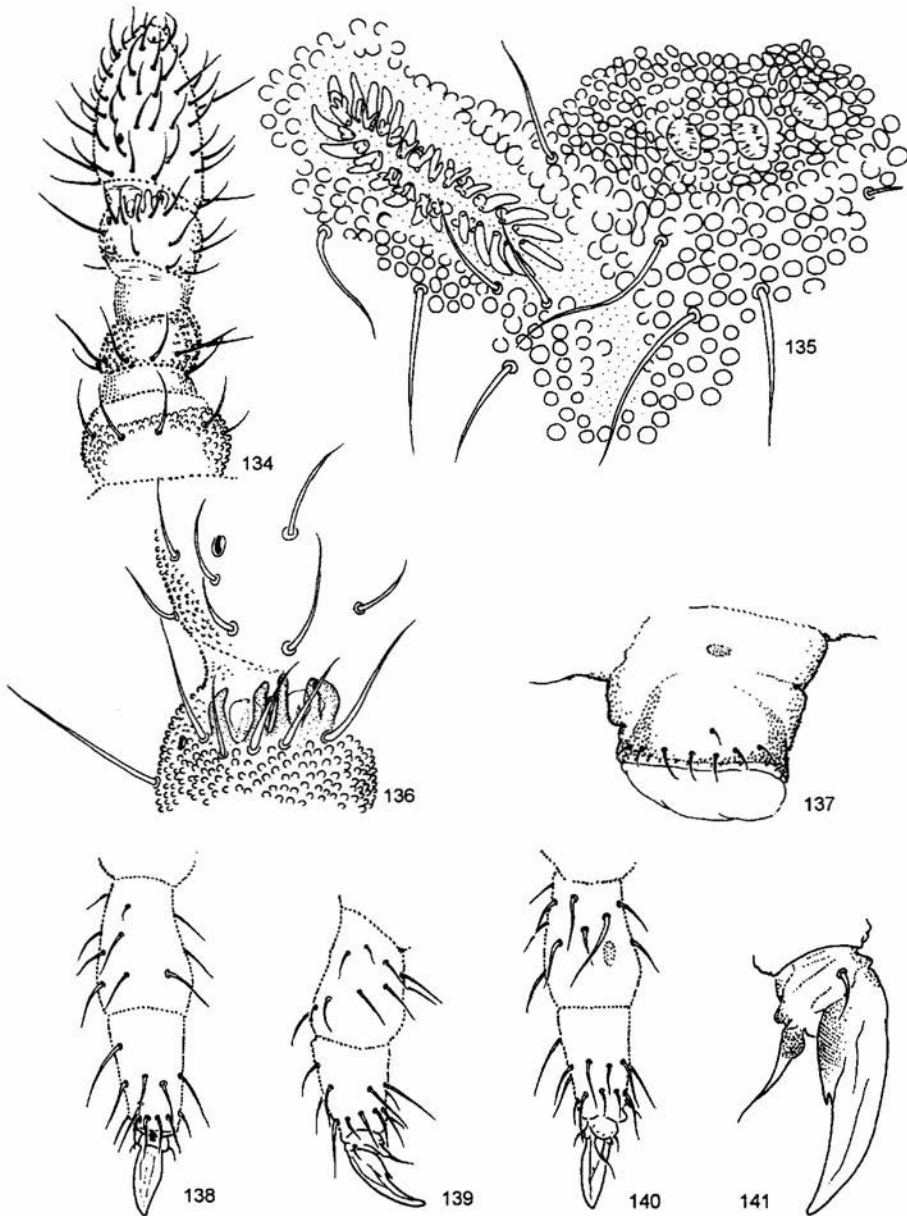
Pseudocellar formula (pso) 3(2)0/011/11022(3), ventral pso absent. Parapseudocellar formula (psx) only ventrally 1/000/1001. Each subcoxa1 with 1 psx posteriorly. Each femur with 1 psx ventrally. Localization of pso and psx is presented in figs. 132, 133.

Dorsal chaetotaxy often asymmetrical, setae relatively long, poorly differentiated into macrochaetae and microchaetae, as in fig. 132. Abdominal tergum VI with 3 medial setae. Thorax II-III with lateral microsensilla. Subcoxae with 4, 6, 6 setae. Ventral chaetotaxy as in fig. 133, between legs on pro-, meso- and metathorax no setae. Tubus ventralis usually with 8+8 setae (fig. 137). Unpaired anal lobe with 7 thickened setae, curved upward (figs. 144, 145). Male ventral organ situated on abdominal sternum III, above trace of reduced furca, consists of 20-40 thick, weakly curved setae, located closely together in elliptical integumentary pocket (fig. 146).

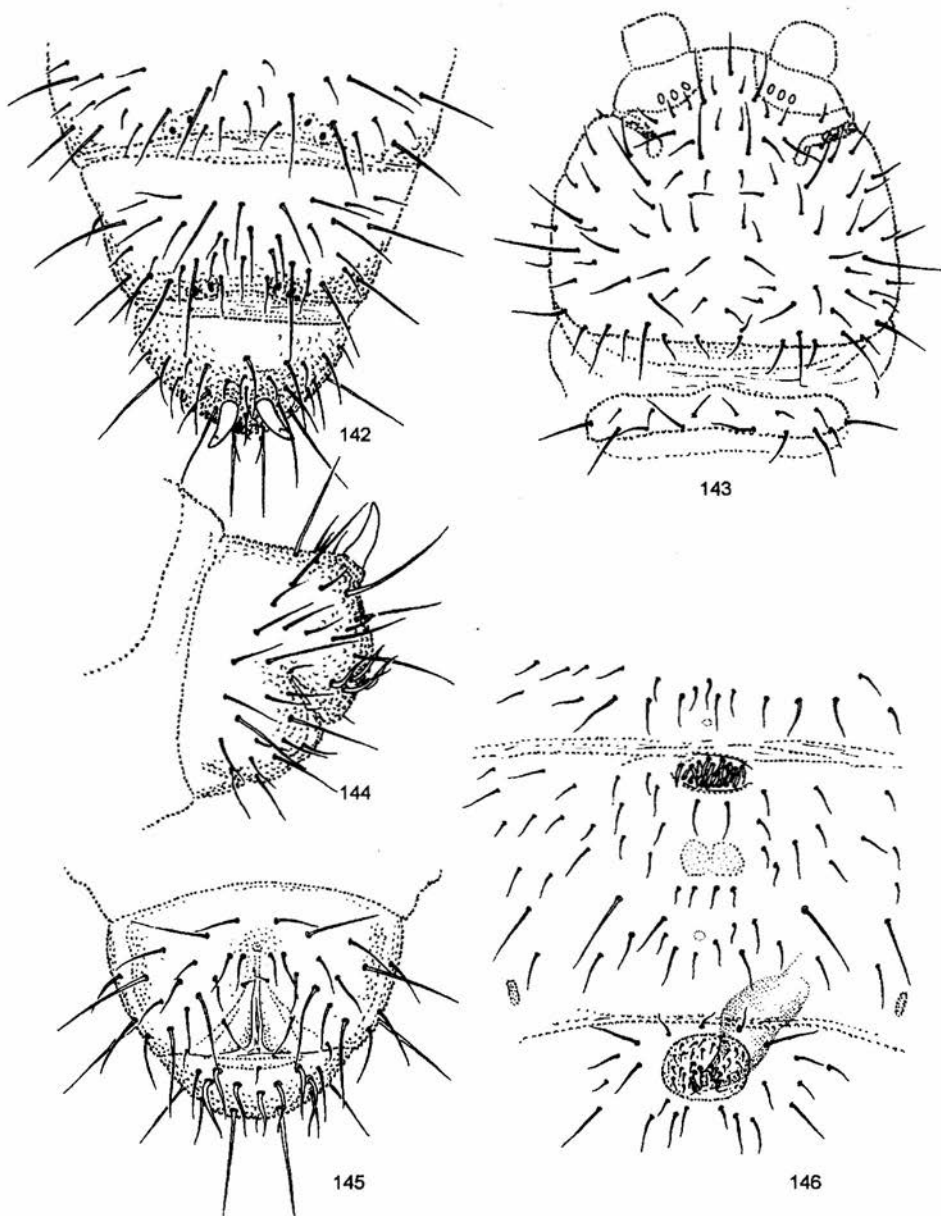
Claw always with strong denticle. Empodial appendage with basal lamella, appendage length equals 2/3 inner edge of the claw (fig. 141). Distal veriticil of setae on tibiotarsi symmetrical, with 11 setae (figs. 138-140).



132-133. *H. variotuberculata*: 132 - chaetotaxy and localization of pseudocelli on dorsal side of body, 133 - chaetotaxy and localization of parapsudocelli on ventral side of body



134-141. *H. variotuberculata*: 134 - antenna, 135 - postantennal organ, 136 - antennal III sense organ, 137 - tubus ventralis, 138 - legs of II pair, dorsal side, 139 - legs of II pair, lateral view, 140 - legs of II pair, dorsal side, 141 - claw



142-146. *H. variotuberculata*: 142 - abdominal terga IV, V, VI, chaetotaxy and granulation, 143 - head, dorsal chaetotaxy, 144 - abdominal segment VI, lateral view, 145 - abdominal sternum VI, anal lobes, chaetotaxy, 146 - abdominal sterna III, IV, V, male ventral organ, remnant of furca, male genital plate

Anal spines located closely together, strong, weakly curved, pointed, with basal papillae, as long as the claw (fig. 142).

VARIABILITY

I observed asymmetrical chaetotaxy and pseudocellar aberrations, manifest as reduction of pseudocelli at the base of antenna and appearance of additional pseudocellus on abdominal tergum V.

BIOLOGY

H. variotuberculata is a bisexual species, living in limestone mountains, in humid soil under stones. It can be found also in caves.

DISTRIBUTION IN POLAND

Carpathians.

Heteraphorura carpatica (STACH, 1954)

Onychiurus carpaticus STACH, 1954, Pol. Akad. Nauk. Inst. Zool.: 106.

MATERIAL

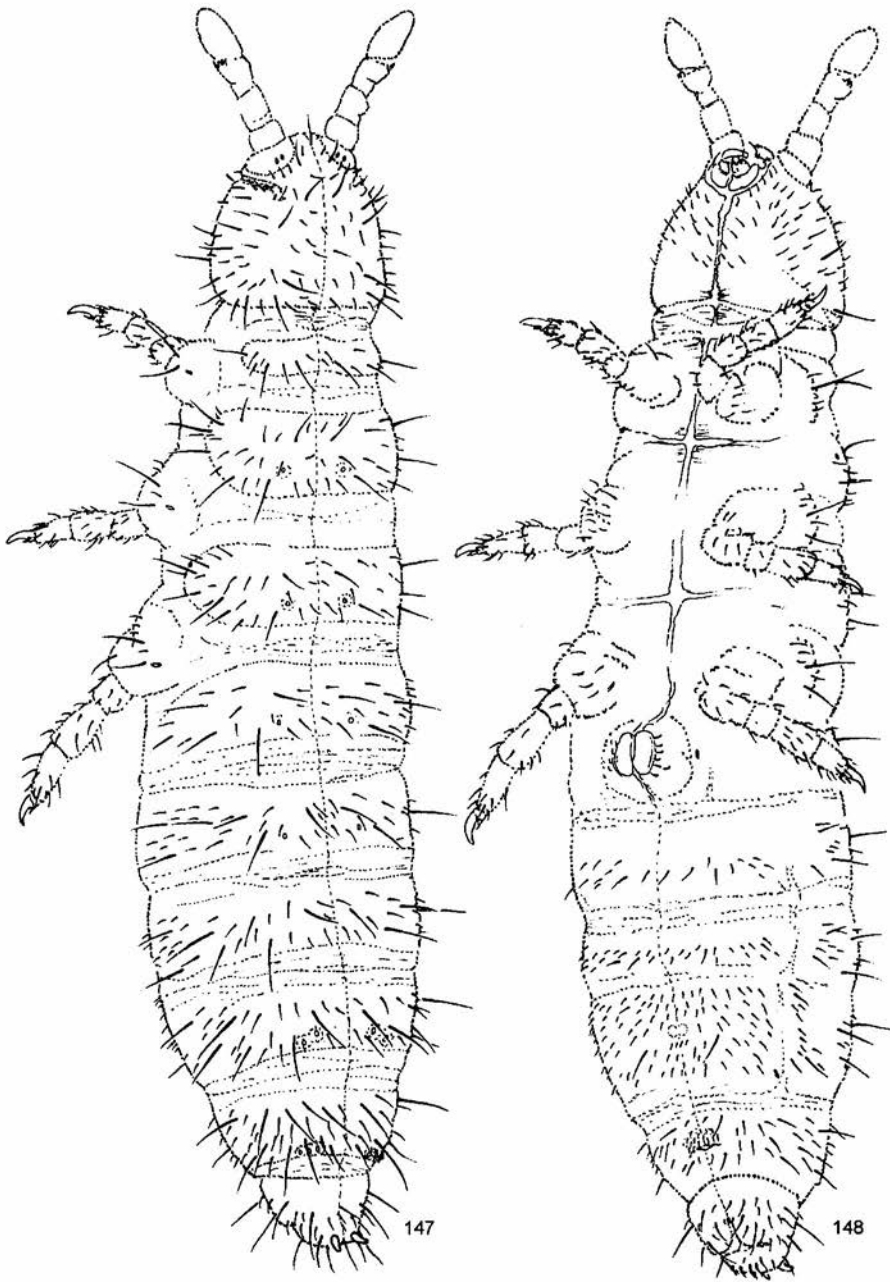
2 males, 5 females; Carpathians, Beskid Wschodni Mts., Niebieszczyńska Góra near Sanok, Poland; forest litter; 10. 08. 1991; leg. B. NAJBAR. 2 females; Carpathians, Pieniny Mts, Pieniny National Park, Dolina Pienińskiego Potoku valley, Poland; beech forest litter; 03. 04. 1990; leg. R. J. POMORSKI. 1 male; Carpathians, Bieszczady Mts, Polańczyk, Poland; litter in beech forest; 01. 08. 1991; leg. D. SKARŻYŃSKI. 2 females; Carpathians, Bieszczady Mts, nature reserve "Hulskie", Poland; under stones near river San; 10. 08. 1991; leg. B. NAJBAR. 3 females; Carpathians, Pieniny Mts, Pieniny National Park, Chwała Bogu, Poland; under pieces of wood on the border of beech forest; 09. 03. 1994; leg. R. J. POMORSKI.

DESCRIPTION

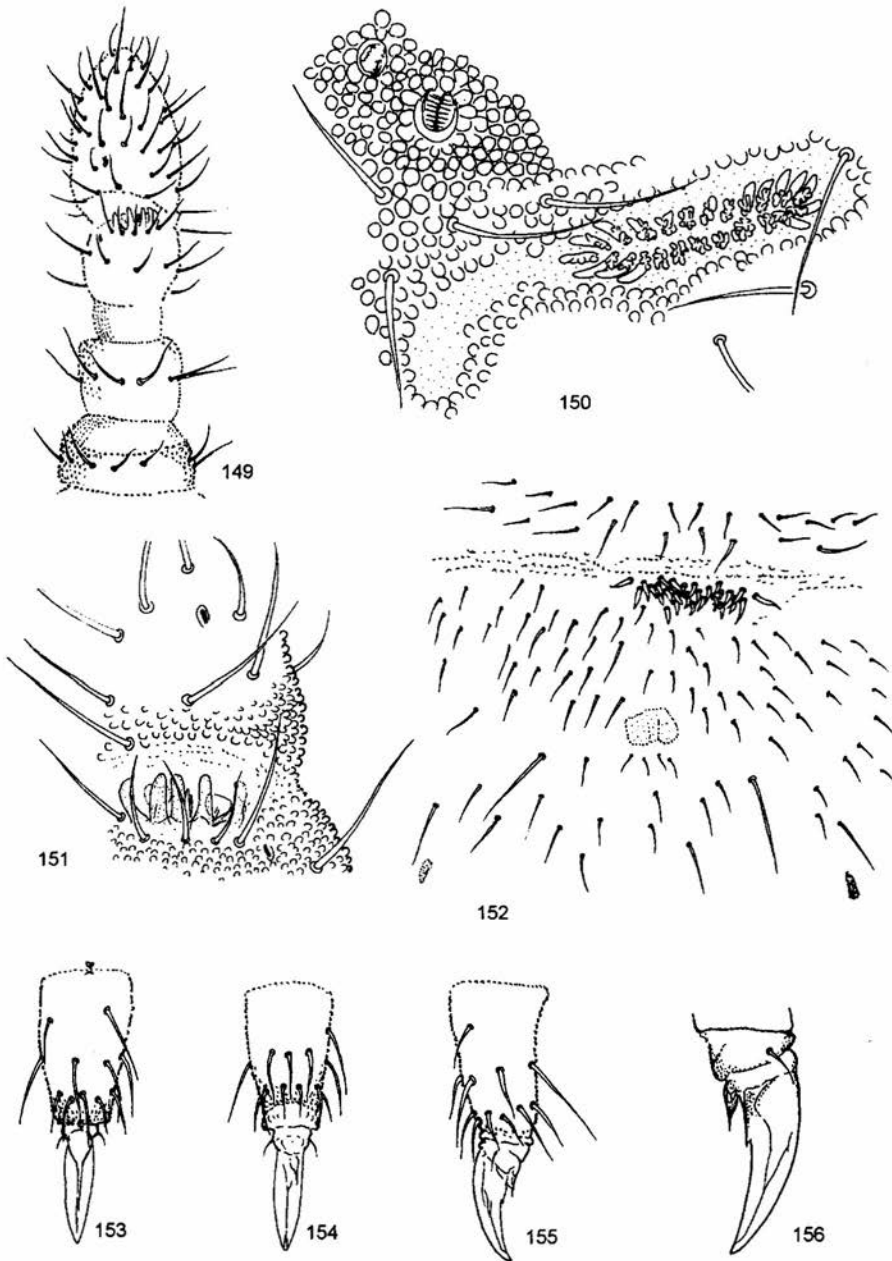
Colour in alcohol white. Size, without antennae, 1.7-1.9 mm (males) 1.9-2.4 mm (females). Shape of body cylindrical, robust, as in figs. 147, 148. Antennae shorter than head. Trace of reduced furca in shape of 2 symmetrical small patches of fine granulation with 4 small setae in one row posteriorly (fig. 152). Granulation of dorsal side of the body distinct, regular. Usually 9-10 grains around each pseudocellus.

AIIIIO consists of 5 conical papillae; 2 sensory rods; 2 finely granulated, spherical sensory clubs; 5 guard setae (fig. 151).

Antennal segment IV with subapical organite and ms located distinctly above row of posterior setae. On III antennal segment microsensillum localized laterally, slightly below AIIIIO (fig. 149, 151).



147-148. *H. carpatica*: 147 - chaetotaxy and localization of pseudocelli on dorsal side of body, 148 - chaetotaxy and localization of parapseudocelli on ventral side of body



149-156. *H. carpatica*: 149 - antenna, 150 - postantennal organ, 151 - antennal III sense organ, 152 - abdominal sterna III, IV, male ventral organ, remnant of furca, 153 - legs of II pair, dorsal side, 154 - legs of II pair, ventral side, 155 - legs of II pair, lateral view, 156 - claw

PAO in a deep, long cuticular groove, with 17-22 simple and multilobed vesicles located perpendicularly or oblique to the long axis of the organ (fig. 150).

Pseudocellar formula (pso) 20/011/11023(2,4), ventral pso absent. Parapseudocellar formula (psx) only ventrally 1/000/1001. Each subcoxa I with 1 psx posteriorly. Each femur with 1 psx ventrally. Localization of pso and psx is presented in figs. 147 and 148.

Dorsal chaetotaxy usually symmetrical, setae relatively long, well differentiated into macrochaetae and microchaetae, as in fig. 147. Thorax II-III with lateral microsensilla. Subcoxae with 4, 6, 6 setae. Ventral chaetotaxy as in fig. 148, between legs on pro-, meso- and metathorax no setae. Tubus ventralis usually with 8+8 setae. Unpaired anal lobe with 7 thickened setae, curved upward. Male ventral organ situated on abdominal sternum III, above trace of reduced furca, consist 20-35 thick, weakly curved setae, located closely together (fig. 152).

Claw always with strong denticle. Empodial appendage very short, rudimental, with small broadening at base, appendage length equals 1/4 or less, inner edge of the claw (fig. 156). Distal veriticol of setae on tibiotarsi symmetrical, with 11 setae (figs. 153-155).

Anal spines located closely together, strong, weakly curved, pointed, with basal papillae, as long as the claw.

VARIABILITY

I observed pseudocellar aberrations, manifest as appearance of 1 or 2 additional pseudocelli on abdominal tergum V.

BIOLOGY

H. carpatica is a bisexual species, living in mountains, in corridors bored in humid soil under pieces of wood.

DISTRIBUTION IN POLAND

Carpathians.

Oligaphorurini BAGNALL, 1949

Oligaphorurinae BAGNALL, 1949, Ann. Mag. Nat. Hist., 12 (2): 500.

Oligaphorurini BAGNALL, 1949, status. n. POMORSKI, 1996, Genus, 7 (1): 99.

Hind margin of head capsule with pseudocelli. Lateral pseudocelli on thoracic and abdominal terga present. PAO with 1 three- or four-lobed vesicle. Granulation fine, sometimes a little coarser around pseudocelli at bases of antenna and abdominal terga IV-V. Anal spines present or absent, if present usually without papilla. Furca reduced to finely granulated area or small cuticular furrow. Distal veriticol of setae on tibiotarsi symmetrical, usually with 11 setae. Setae sensuales on head and body well marked. Seta d_0 on head absent.

KEY TO GENERA OF *OLIGAPHORURINI*

1. Anal spines absent *Archaphorura*
 - Anal spies present 2.
 2. Furca reduced to cuticular furrow with 2+2 setulae posteriorly (fig. 171)
 *Oligaphorura*
 - Furca reduced to cuticular furrow with 1+1 setulae posteriorly (fig. 189)
 *Micraphorura*

***Archaphorura* BAGNALL, 1949**

Archaphorura BAGNALL, 1949, Ann. Mag. Nat. Hist., 12 (2): 509.

Type species: *Onychiurus serratotuberculatus* STACH, 1933, by original designation (described from Poland: Czarny Dunajec).

Diagnosis. Body shape cylindrical, without anal spines. Abdominal segments V and VI accreted dorsally. Antennal segments III and IV accreted, forming a club. Hind margin of head capsule with pseudocelli. Dorsomedial pseudocelli on abdominal terga IV and V displaced anterad. Body finely granulated, with coarser granulation around pseudocelli located on head. Furca reduced to cuticular furrow with 2+2 setulae posteriorly. Papilla of AIIIO long, cover microsensillum of antennal segment IV. On antennal segment III microsensillum displaced downwards. PAO with 1 three- or four-lobed vesicle. Distal veriticil of setae on tibiotarsi symmetrical, with 11 setae. Setae sensuales on head and body well marked. Seta d_0 on head absent, abdominal tergum VI with 1 medial seta.

***Archaphorura serratotuberculata* (STACH, 1933)**

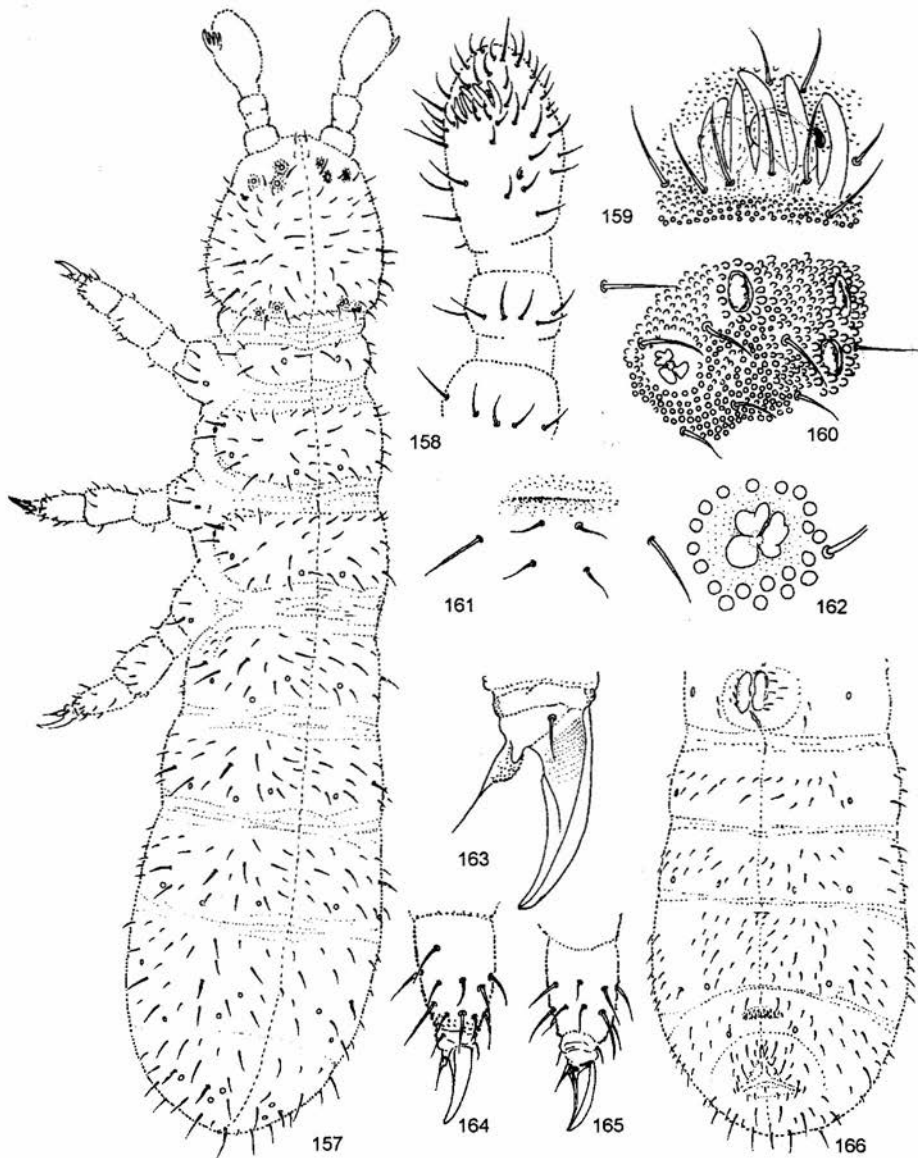
Onychiurus serratotuberculatus STACH, 1933, Bull. Acad. pol. Sci. Lett. Cl. Sci. mathoracic-nat. Sér. B Sci. nat. (II): 238.

MATERIAL

Female; Sudety Highlands, Ślęza Massif, Sulistrowiczki, Poland; under big stone in mixed forest. 20. 04. 1987; leg. R. J. POMORSKI. female; Sudetes, Śnieżnik Massif, Kletno, Poland; litter of beech forest; 17. 04. 1991. leg. M. PAKIET. female; Carpathians, Pieniny Mts, Pieniny National Park, "Chwała Bogu", Poland; tussock of grass on meadow; 09. 03. 1994; leg. R. J. POMORSKI.

DESCRIPTION

Colour in alcohol white. Size, without antennae, 0.6-0.8 mm. Shape of body cylindrical, with abdominal segments V and VI fused dorsally, without anal



157-166. *A. serratotuberculata*: 157 - chaetotaxy and localization of pseudocelli on dorsal side of body, 158 - antenna, 159 - antennal III sense organ, 160 - postantennal organ, 161 - remnant of furca, 162 - postantennal organ, 163 - claw, 164 - tibiotarsus of II pair of legs, dorsal side, 165 - tibiotarsus of II pair of legs, ventral side, 166 - chaetotaxy and localization of pseudocelli and parapseudocelli on abdominal sterna I-VI

spines as in fig. 157. Antennae as long as head, III and IV antennomeres accreted, forming a club. Furca reduced to cuticular furrow with 2+2 setulae posteriorly (fig. 161). Body finally granulated, with coarser granulation on head around pseudocelli. Usually 12-15 grains around each pseudocellus.

Antennal segment IV with subapical organite and microsensillum covered by long papillae of AIIIIO. On III antennal segment microsensillum displaced downwards (figs. 158, 159).

AIIIIO consists of 5 papillae (two medial are longer); 2 sensory rods; 2 smooth, spherical sensory clubs (internal straight, external bent); 5-6 guard setae (fig. 159).

PAO small, as long as pseudocellus, built with 1 three- four-lobed vesicle (figs. 160, 162).

Pseudocellar formula (pso) dorsally 32/122/33343, ventrally 2/000/11111. Parapseudocellar formula (psx) only ventrally 0/000/001. Each subcoxal with 1 pso posteriorly. Localization of pso and psx is presented in figs. 157 and 166.

Dorsal chaetotaxy symmetrical, setae relatively short, poorly differentiated into macrochaetae and microchaetae, as in fig. 157. In adults sensilla distinct distributed according formula 3/011/22212. Abdominal tergum IV with medial seta m_0 . Thorax II-III with lateral microsensilla. Subcoxae with 3, 3, 3 setae. Ventral chaetotaxy as in fig. 166, between legs on pro-, meso- and metathorax with 0, 1, 1 setae. Tubus ventralis usually with 6+6 setae.

Claw without denticle. Empodial appendage, with broad basal lamella, appendage length equals 2/3-3/4, inner edge of the claw (fig. 163). Distal veriticol of setae on tibiotarsi symmetrical, with 11 setae (figs. 164, 165).

BIOLOGY

A. serratotuberculata is a rarely collected species, probably parthenogenic (I have seen only females), living in mountains and highlands in deeper layers of humid soil and under big stones.

DISTRIBUTION IN POLAND

Sudetes, Sudetes highland and Carpathians.

Oligaphorura BAGNALL, 1949

Oligaphorura BAGNALL, 1949, Ann. Mag. Nat. Hist., 12 (2): 510.

Type species: *Lipura groenlandica* TULLBERG, 1876, by original designation (described from Greenland and Spitsbergen).

Diagnosis. Body shape cylindrical, with anal spines. Antennal segments III and IV forming a club. Hind margin of head capsule with pseudocelli. Body with more or less homogeneous granulation. Furca reduced to cuticular furrow with

2+2 setulae posteriorly in 2 rows. Sensory clubs in AIIIO smooth or finely granulated, external one is bigger and bent. PAO with 1 three- or four-lobed vesicle. The lobes are elongated. Distal veriticil of setae on tibiotarsi symmetrical, with 11 setae. Setae sensuales on head and body well marked. Seta d_0 on head absent, abdominal tergum VI with 1 medial seta.

KEY TO SPECIES

1. PAO in long, cuticular furrow, prolonged on dorsal side of the head (fig. 169). Papilla in AIIIO relatively short, sensory clubs smooth (fig. 170) *O. groenlandica*
- PAO in small depression (fig. 180). Papilla in AIIIO relatively long, sensory clubs distinctly granulated (figs. 178, 179) *O. schoetti*

Oligaphorura groenlandica (TULLBERG, 1876)

Lipura groenlandica TULLBERG, 1876, Öfv. K. Vet.-Akad. Förhandl. 23: 41.

MATERIAL

1 male, 4 females, 4 juv.; Wolin Island, Poland; under stone on the shore of Kamieński Gulf; 10. 04. 1991. leg. D. SKARŻYŃSKI, R. J. POMORSKI. 1 male, 3 females; Sudetes, Karkonosze, Szklarska Poręba, Poland; gravel bed of river Kamienna; 10. 10. 1995. leg. D. SKARŻYŃSKI. female; Sudetes, Góry Bardzkie Mts., Morzyszów, flood debris of river Nysa Kłodzka; 25. 10. 1995. leg. D. SKARŻYŃSKI, R. J. POMORSKI.

DESCRIPTION

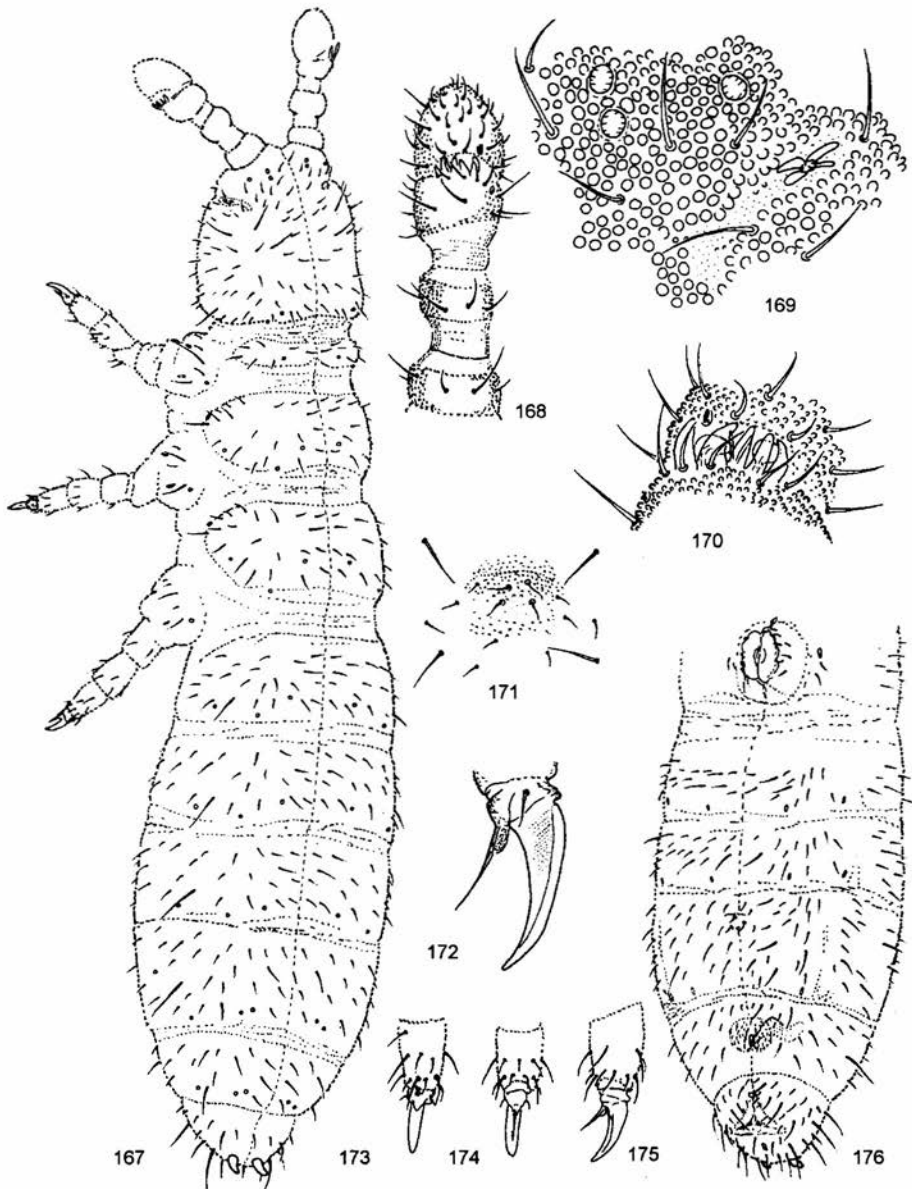
Colour in alcohol yellowish. Size, without antennae, 1.2-1.5 mm males, 1.6-1.8 mm females. Shape of body cylindrical, with anal spines set without papillae, as in fig. 167. Antennae as long as head, forming a club. Furca reduced to cuticular furrow with 2+2 setulae posteriorly in 2 rows (fig. 171). Granulation homogenous, usually 10-12 grains around each pseudocellus.

Antennal segment IV with subapical organite and microsensillum located in one row with posterior setae. On III antennal segment microsensillum localized laterally, slightly below AIIIO (figs. 168, 170).

AIIIO consist of: 5 papillae; 2 sensory rods; 2 smooth, spherical sensory clubs (internal straight, external bigger and bent); 5 guard setae (fig. 170).

PAO located in cuticular furrow, prolonged on dorsal side of head, two times long as pseudocellus, built with 1 three- four-lobed vesicle. The lobes are elongated (fig. 169).

Pseudocellar formula (pso) dorsally 32/133/33343, ventrally 2/000/00000. Parapseudocellar formula (psx) only ventrally 0/000/122101^m (unpaired anal lobe with 1 psx). Each subcoxal with 1 pseudocellus and 2 psx. Localization of pso and psx is presented in figs. 167 and 176.



167-176. *O. groenlandica*: 167 - chaetotaxy and localization of pseudocelli on dorsal side of body, 168 - antenna, 169 - postantennal organ, 170 - antennal III sense organ, 171 - remnant of furca, 172 - claw, 173 - tibia-tarsus of II pair of legs, dorsal side, 174 - tibia-tarsus of II pair of legs, ventral side, 175 - tibia-tarsus of II pair of legs, lateral view, 176 - chaetotaxy and localization of parapseudocelli on abdominal sterna I-VI

Dorsal chaetotaxy symmetrical, setae relatively short, poorly differentiated into macrochaetae and microchaetae, as in fig. 167. In adults sensilla indistinct. Abdominal tergum IV with medial seta m_0 . Thorax II-III with lateral microsensilla. Subcoxae with 4(5), 5(4, 6), 5(4, 6) setae. Ventral chaetotaxy as fig. 176, between legs on pro-, meso- and metathorax with 0, 1, 1 setae. Tubus ventralis usually with 6+6 setae and 2+2 (1+1) setae at base.

Claw without denticle. Empodial appendage, with broad basal lamella, appendage length equals $3/4$, inner edge of the claw (fig. 172). Distal veriticol of setae on tibiotarsi symmetrical, with 11 setae (figs. 173-175).

BIOLOGY

In Poland *O. groenlandica* is a bisexual species, living in gravel and flood debris of mountain rivers. It also occurs under stones, planks and in gravel and flood debris among reeds on the shore of Baltic's brackish gulfs.

DISTRIBUTION IN POLAND

Baltic coast, Sudetes.

Oligaphorura schoetti (LIE PETERSEN, 1896) sensu STACH, 1947

Lipura schötti LIE PETERSEN, 1896, Bergens Mus. Aarb. 8: 21

MATERIAL

2 females, 2 juv.; Sudetes, Śnieżnik Massif, Rogóżka, cave "Na Ścianie", Poland; on surface of water puddles, ca. 30 m deep in the cave; 10. 07. 1985; leg. A. ILSKI, P. PŁOTECKI. 1 female; Sudetes, Kaczawskie Mts. Wojcieszów, cave Jaskinia Nowa, Poland; on surface of water puddles; 21. 07. 1986. leg. R. J. POMORSKI.

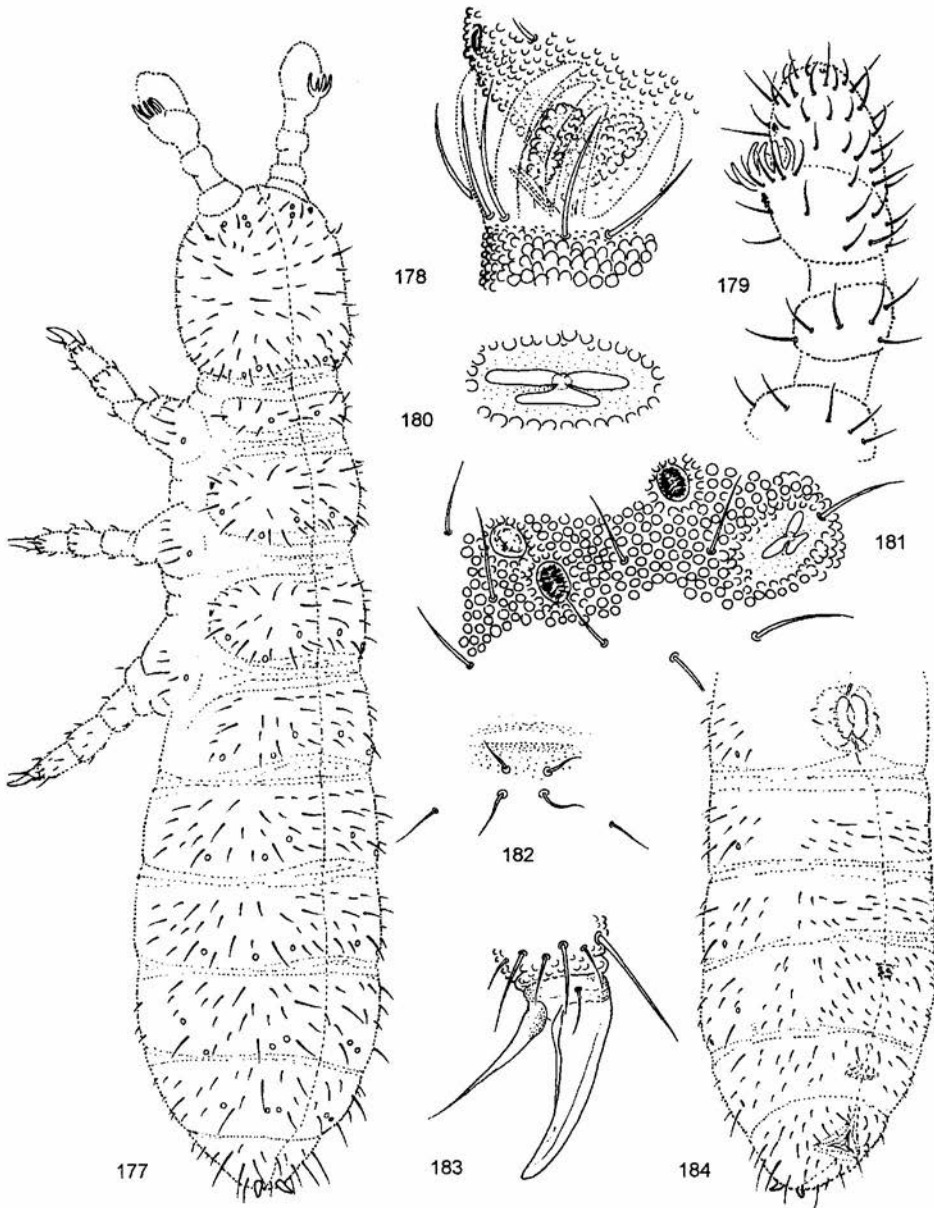
DESCRIPTION

Colour in alcohol white. Size, without antennae, 1.7 mm females, 0.8 mm juv. Shape of body cylindrical, with anal spines set without papillae as in fig. 177. Antennae as long as head, forming a club. Furca reduced to cuticular furrow with 2+2 setulae posteriorly in 2 rows (fig. 182). Granulation homogenic, usually 14-16 grains around each pseudocellus.

Antennal segment IV with subapical organite and microsensillum located in one row with posterior setae. On III antennal segment microsensillum localized laterally, slightly below AIIIO (figs. 178, 179).

AIIIO consists of relatively long 5 papillae; 2 sensory rods; 2 granulated sensory clubs (internal straight, external bigger and bent); 5 guard setae (fig. 178).

PAO located in small cuticular depression, as long as pseudocellus, built of 1 three-lobed vesicle. The lobes are elongated (figs. 180, 181).



177-184. *O. schoetti*: 177 - chaetotaxy and localization of pseudocelli on dorsal side of body, 178 - antennal III sense organ, 179 - antenna, 180 - postantennal organ, 181 - postantennal organ with pseudocelli, 182 - remnant of furca, 183 - claw, 184 - chaetotaxy of abdominal sterna I-VI

Pseudocellar formula (pso) dorsally 32/133/33343, ventrally 2/000/00000. Parapseudocelli (psx) invisible. Each subcoxal with 1 pseudocellus. Localization of pso is presented in figs. 177 and 184.

Dorsal chaetotaxy symmetrical, setae relatively short, poorly differentiated into macrochaetae and microchaetae, as in fig. 177. In adults sensilla indistinct. Abdominal tergum IV with medial seta m_0 . Thorax II-III with lateral microsensilla. Subcoxae with 4, 5, 5 setae. Ventral chaetotaxy as in fig. 184, between legs on pro-, meso- and metathorax with 0, 1, 1 setae. Tubus ventralis usually with 6+6 setae and 2+2 setae at base.

Claw without denticle. Empodial appendage, with broad basal lamella, as long as inner edge of the claw (fig. 183). Distal veriticil of setae on tibiotarsi symmetrical, with 11 setae.

BIOLOGY

In Poland *O. schoetti* occurs only in wet and deep parts of Sudetic caves, as troglobiont.

DISTRIBUTION IN POLAND

Sudetes.

Micraptorura BAGNALL, 1949

Micraptorura BAGNALL, 1949, Ann. Mag. Nat. Hist., 12 (2): 509.

Affinichirus STACH, 1954, Państw. Wyd. Nauk., Kraków: 25

Type species: *Aphorura absoloni* BÖRNER, 1901, by original designation (described from Germany).

Diagnosis. Body shape cylindrical, with anal spines. Antennal segments III and IV forming a club. Hind margin of head capsule with pseudocelli. Body with more or less homogeneous granulation usually with coarse granules around pseudocelli. Furca reduced to cuticular furrow with 1+1 setulae posteriorly. Sensory clubs in AIIIO smooth, external one is bigger and bent. PAO with 1 three-lobed vesicle. Only thoracic tergum I with microsensillum. Setae sensuales on head and body well marked. Distal veriticil of setae on tibiotarsi symmetrical, with 11 setae. Seta d_0 on head absent, abdominal tergum VI with 1 or 2 medial setae.

KEY TO SPECIES

1. Abdominal sternum III without pso, only with 1+1 psx. AIIIO with 4 papilla.
..... *M. absoloni*
- . Abdominal sternum III with 1+1 pso. AIIIO with 5 papilla. *M. pieninensis*

Micraphorura absoloni (BÖRNER, 1901)

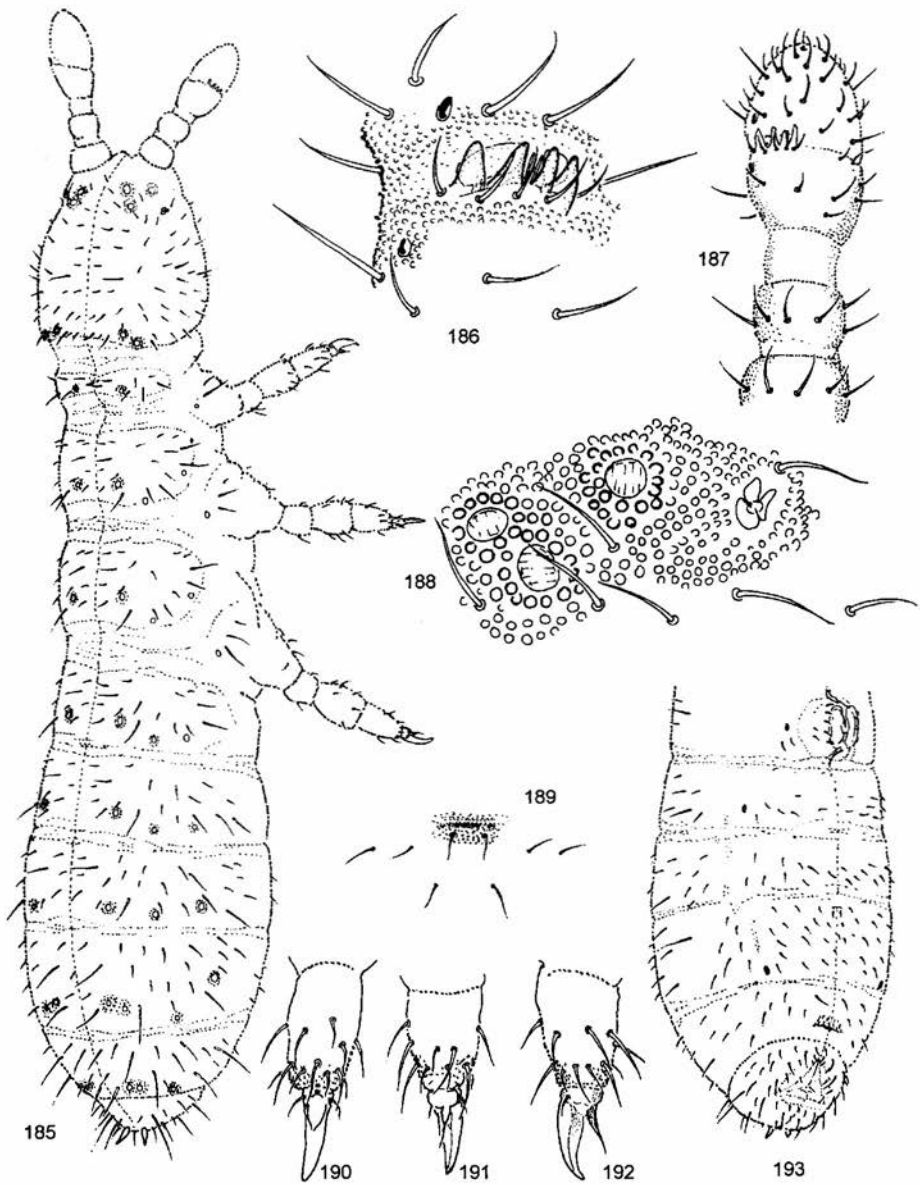
Aphorura absoloni BÖRNER, 1901, Zool. Anz., 24: 422.

MATERIAL

Numerous spp. (only females); Sudety Highland, Śleża Massif, Poland; forest litter; 22. 05. 1985; leg. R. J. POMORSKI. 17. 02. 1990. leg. R. J. POMORSKI. 3 females; Polesie Lubelskie, Cegielnia near Lubartów, Poland; soil in pine forest; 14. 05. 1991; leg. D. SKARŻYŃSKI. 1 female; Nizina Śląska lowland, Kałno near Wrocław, Poland; soil with litter in oak forest; 22.09.1991; leg. D. SKARŻYŃSKI. 1 female; Sudetes, Śnieżnik Massif, Kletno, Poland; litter of beech forest; 17. 04. 1991; leg. M. PAKIET. 1 male, 4 females, 4 juv.; Wolin Island, Dziwnów, Poland; under tree bark on dune; 12. 04. 1991. leg. D. SKARŻYŃSKI, R. J. POMORSKI. Numerous spp. (only females); Sudetes, Śnieżnik Massif, Kletno, Poland; litter of beech forest; 17. 04. 1991; leg. R. J. POMORSKI. 3 females; Carpathians, Beskid Wschodni Mts., Niebieszczańska Góra near Sanok, Poland; forest litter; 10. 08. 1991; leg. B. NAJBAR. Numerous spp. (only females); Wzgórza Trzebnickie Hills, Gruszcza, Poland; forest litter, under heather; 1. 05. 1992; leg. R. J. POMORSKI. 2 female; Wzgórza Trzebnickie, Ruda Milicka, Poland; rotting timber; 25. 10. 1992; leg. R. J. POMORSKI. female; Nizina Podolska lowland, Stare Jezewo near Białystok, Poland; soil with moss in pine forest; 6 females; Carpathians, Pieniny Mts, Pieniny National Park, Chwała Bogu, Poland; tussock of grass on meadow; 09. 03. 1994; leg. R. J. POMORSKI. 2 females; Podlasie, Białowieża National Park, Białowieża, Poland; soil with rotting timber near dead oak "Jagiełło"; 04. 09. 1994; leg. R. J. POMORSKI. 1 female; Tatra Mts., Czarny Staw Gąsienicowy, Poland; 15. 10. 1994; leg. D. SKARŻYŃSKI. 5 females; Bory Dolnośląskie, Lower Silesia, Węglińiec, nature reserve "Torfowisko pod Węglińcem", Poland; soil with moss; 5. 05. 1996; leg. R. J. POMORSKI. 1 female; Pojezierze Suwalskie lakeland, "Głazowisko nad Czarną Hańczą" nature reserve, Poland; tussock of grass on meadow; 09. 06. 1995; leg. R. J. POMORSKI, M. PAKIET. Numerous spp.; Góry Świętokrzyskie Mts., Święty Krzyż, Poland; soil with litter on stones; 28. 07. 1995. Numerous spp.; Polesie, Urszulin, Poleski National Park, Poland; litter and soil near oak "Dąb Dominika"; 12. 06. 1996; leg. R. J. POMORSKI, W. NOWAK. Numerous spp; Roztocze upland, Rebizanty, nature reserve "Szumy nad Tanwią"; litter; 16. 06. 1996; leg. R. J. POMORSKI.

DESCRIPTION

Colour in alcohol white. Size adult females without antennae 0.8 mm. Shape of body cylindrical, with seta-like anal spines set without papillae as in fig. 185. Antennae as long as head, III and IV antennomeres partly accreted, forming a club. Furca reduced to cuticular furrow with 1+1 setulae posteriorly (fig. 189). Granulation homogenous, with coarse granules around pseudocelli especially on head and abdominal terga IV-V. Usually 12-14 grains around each pseudocellus.



185-193. *M. absoloni*: 185 - chaetotaxy and localization of pseudocelli on dorsal side of body, 186 - antennal III sense organ, 187 - antenna, 188 - postantennal organ with pseudocelli, 189 - remnant of furca, 190 - tibiotarsus of II pair of legs, dorsal side, 191 - tibiotarsus of II pair of legs, ventral side, 192 - tibiotarsus of II pair of legs, lateral view, 193 - chaetotaxy and localization of parapseudocelli on abdominal sterna I-VI

Antennal segment IV with subapical organite and microsensillum located in one row with posterior setae. On antennal III segment microsensillum localized laterally, slightly below AIII0 (figs. 186, 187).

AIII0 consists of 4 papillae; 2 sensory rods; 2 smooth, spherical sensory clubs (internal straight, external bigger and bent); 5 guard setae (fig. 186).

PAO located in cuticular depression, as long as pseudocellus, built with 1 three- four-lobed vesicle. The lobes are ovoid, not elongated (fig. 188).

Pseudocellar formula (pso) dorsally 32/133/33343, ventrally 2/000/00000. Parapseudocellar formula (psx) ventrally 0/000/1101. Each subcoxal with 1 pseudocellus. Localization of pso and psx is presented in figs. 185 and 193.

Dorsal chaetotaxy symmetrical, setae relatively short, well differentiated into macrochaetae and microchaetae, as in fig. 185. In adults sensilla distinct - 2/011/22212. Abdominal tergum IV with medial seta m_0 , abdominal tergum VI usually without medial seta. Only thoracic tergum II with lateral microsensillum. Subcoxae with 2, 3, 3 setae. Ventral abdominal chaetotaxy as fig. 193, between legs on pro-, meso- and metathorax with 0, 1, 1 setae. Tubus ventralis usually with 6+6 (7+7) setae and 2+2 (1+1) setae at base.

Claw without denticle. Empodial appendage, with small basal lamella, appendage length equals 3/4, inner edge of the claw (figs. 190-192). Distal veriticial of setae on tibiotarsi symmetrical, with 11 setae.

BIOLOGY

M. absoloni is a parthenogenic species, commonly living in soil, litter, under moss in all types of forests.

DISTRIBUTION IN POLAND

Probably lives in entire Poland.

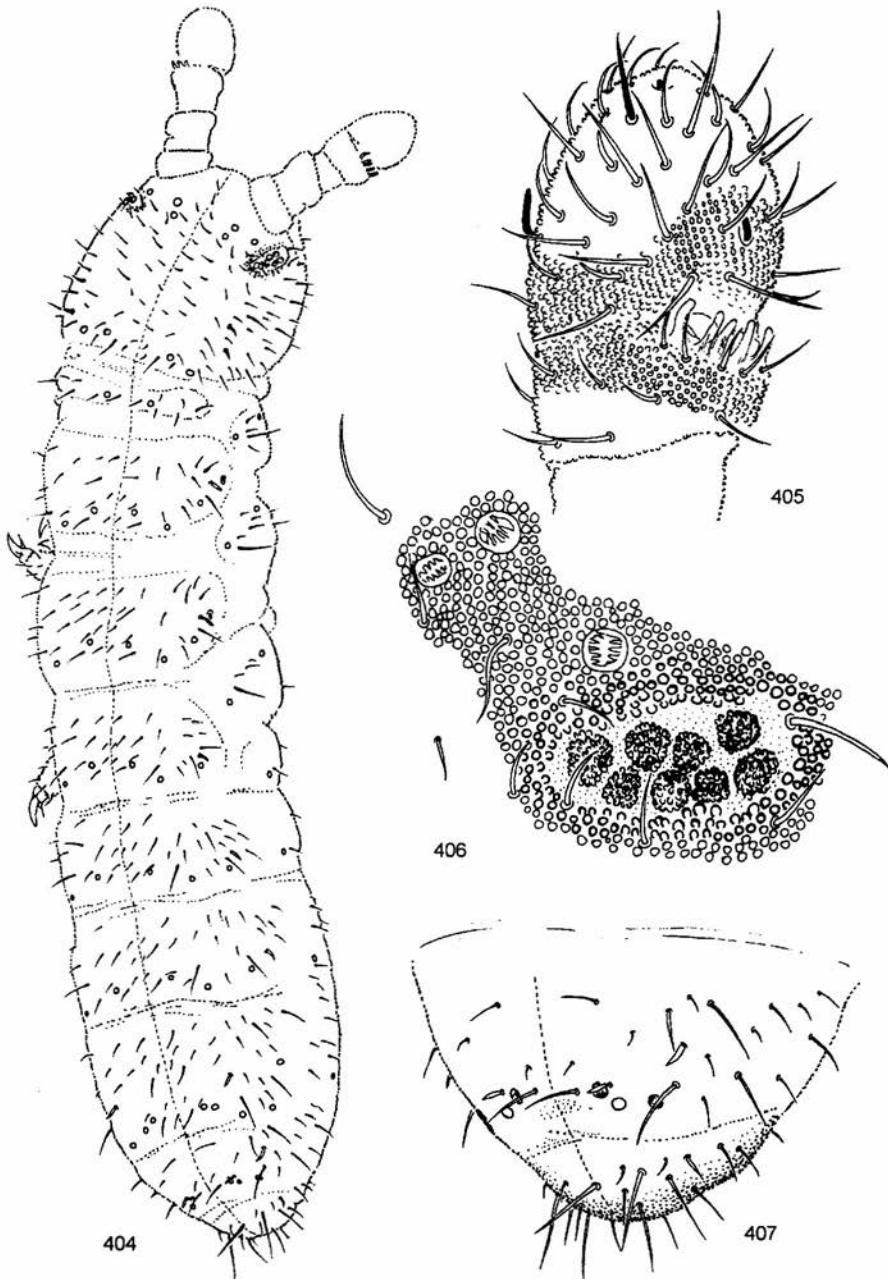
Micraphorura pieninensis WEINER, 1988

Micraphorura pieninensis WEINER 1988, Acta Zool. Cracov., 31, 9: 383.

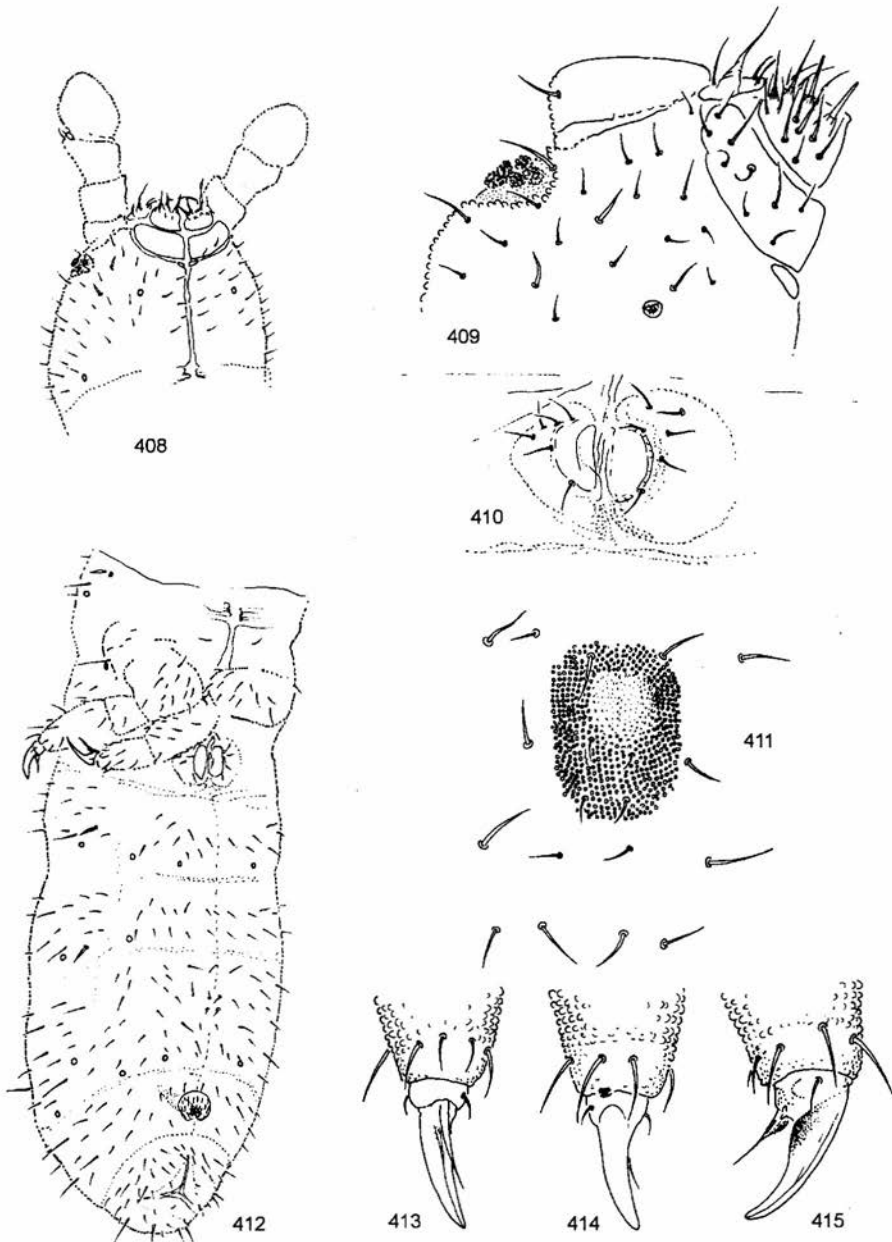
MATERIAL

Numerous spp.; Sudetes, Góry Wałbrzyskie Mts., Książ, Poland, gravel and flood debris of river Pełcznica; 16. 10. 1990. leg. D. SKARŻYŃSKI. 4 females; Carpathian, Beskid Śląski, Wisła, Poland; gravel and flood debris of river Wisła; 13. 11. 1993; leg. R. J. POMORSKI, D. SKARŻYŃSKI. 3 females, 1 male; Nizina Śląska lowland, Wrocław, Niskie Łąki, Poland; flood debris of river Odra; 24. 10. 1994. leg. D. SKARŻYŃSKI. 1 male; Nizina Śląska lowland, Skorogoszcz, Poland; flood debris of river Odra; 4. 11. 1994. leg. D. SKARŻYŃSKI. 3 females, 2 males; Sudetes, Góry Bardzkie Mts., Morzyszów, Poland; flood debris of river Nysa Kłodzka; 25. 10. 1995. leg. D. SKARŻYŃSKI, R. J. POMORSKI. 1 male, 2 females, 3 juv.; Nizina

łazy, Poland; old adit; 6. 10. 1987; leg. R. J. POMORSKI. Female; Sudetes, Pogórze Wałbrzyskie highland, Książ, Poland; under moss on the stones, mixed forest; 15. 01. 1989; leg. D. SKARŻYŃSKI. Female; Nizina Śląska lowland, Czernica Wrocławska near Wrocław, Poland; soil under stones near Odra river; 17. 02. 1990; leg. POMORSKI. 2 females; Sudetes, Góry Bardzkie, Bardo Śląskie, Poland; old adit; 28. 04. 1990; leg. R. J. POMORSKI. Male, 3 female.; Małopolska upland, Góry Świętokrzyskie mountains, Łagów “Jaskinia Zbójecka” cave, Poland; soil under stones on the bottom; 12. 07. 1990; leg. R. J. POMORSKI. Female; Nizina Śląska lowland, Bory Dolnośląskie, Zagajnik; litter in alder forest; 16. 05. 1991; leg. R. J. POMORSKI. 2 female; Carpathians, Tatra Mts., “Dziura” cave, Poland; soil on the bottom; 24. 08. 1991; leg. D. SKARŻYŃSKI. 2 female; Carpathians, Tatra Mts., Dolina Olczyska valley, Poland; spruce forest, litter; 27. 08. 1991; leg. D. SKARŻYŃSKI. 2 males, female; Sudetes, Śnieżnik Massif, Poland; meadow on the top of the mountain, tussock of grass; 1. 10. 1991; leg. R. J. POMORSKI, D. SKARŻYŃSKI. 2 females; Sudetes, Góry Złote, Chwalisław, Poland; under moss on the big stones near Mąkolnica stream; 2. 10. 1991; leg. R. J. POMORSKI. 4 female; Nizina Śląska lowland, Strzelce Opolskie, Poland; soil in the flower pot; 12. 02. 1992; leg. J. KRAWERENDA. 4 females; Sudetes, Śnieżnik Massif, Kletno, Poland; under stones on the bank of Kleśnica stream; 15. 02. 1992; leg. D. SKARŻYŃSKI. Male, 2 females; Sudetes, Śnieżnik Massif, Kletno, Poland; litter in beech forest; 16. 02. 1992; leg. D. SKARŻYŃSKI, R. J. POMORSKI. 2 males, 6 females; Nizina Śląska lowland, Wołów, Poland; soil in the flower pot; 17. 03. 1992; leg. H. PIETRUSZKA. Numerous spp.; Małopolska upland, Wyżyna Krakowsko-Wieluńska, Olsztyn “Jaskinia Pod Sokolą Górą” cave, Poland; soil under stones on the bottom; 16. 09. 1992; leg. R. J. POMORSKI. Numerous spp.; Carpathians, Beskid Śląski Mts., “Jaskinia Malinowa” cave, Poland; soil under stone on the bottom; 13. 01. 1993; leg. R. J. POMORSKI, D. SKARŻYŃSKI. 5 females; Carpathians, Nowy Targ basin, “Przełom Białki” nature reserve, Poland; gravel bed of the river Białka Tatrzańska; 11. 11. 1993, leg. D. SKARŻYŃSKI, R. J. POMORSKI. Male, 5 females; Carpathians, Pieniny Mts., Pieniński National Park, Dolina Pienińskiego Potoku valley, Poland; litter; 12. 11. 1993; leg. R. J. POMORSKI, D. SKARŻYŃSKI. Male, female; Małopolska upland, Wyżyna Krakowsko-Wieluńska, Złoty Potok, Dolina Wiercicy, Poland; dry meadow, under stones; 24. 05. 1994; leg. R. J. POMORSKI. Female; Baltic coast, Wolin island. Dziwnów, Poland; under stones near Dziwna river; 22. 07. 1994; leg. R. J. POMORSKI. Male; Sudetes, nature reserve “Las Muszkowicki”, Muszkowice, Poland; gravel near stream; 16. 10. 1994; leg. D. SKARŻYŃSKI, R. J. POMORSKI. Male, female; Sudetes, Ślęza Massif, Sulistrowiczki, Poland; meadow; 23. 01. 1995; leg. R. J. POMORSKI. 3 males, 3 females; Nizina Śląska, Bory Dolnośląskie, Zagajnik; rotting grass on wet meadow; 4. 04. 1995; leg. R. J. POMORSKI. Numerous spp.; Pojezierze Pomorskie lakeland, Bory Tucholskie, Osie, nature reserve “Jezioro Miedzno”, Poland; alder forest near overgrowing lake; 25. 04. 1995; leg. R. POMORSKI, M. PAKIET. Numerous spp.; Baltic coast, Rowy, Słowiński National Park, Poland; flooded meadow near



404-407. *A. naglitshi*: 404 - chaetotaxy and localization of pseudocelli on dorsal side of body, 405 - antennal III sense organ, 406 - postantennal organ and pseudocelli, 407 - abdominal terga V and VI, chaetotaxy, localization of pseudocelli and granulation



408-415. *A. naglitshi*: 408 - head, chaetotaxy and localization of pseudocelli on ventral side, 409 - labium and setae sensuales on ventral side of head, 410 - tubus ventralis, 411 - remnant of furca, 412 - abdominal sternite I-VI, chaetotaxy and localization of pseudocelli antennal III sense organ, 413-415 - claw and distal verticil of tibiotarsal setae

III segment with microsensillum slightly below antennal III sense organ. Thoracic terga II and III with relatively big microsensilla laterally.

Antennal III sense organ built of 5 papillae, 2 sensory rods, 2 smooth sensory clubs, and 5 guard setae (fig. 405).

Postantennal sense organ (PAO) consisting of 8-10 vesicles, covered with secondary vesicles (fig. 406)

Pseudocellar (pso) formula dorsally: 32/133/33353; ventrally: 11/000/1212; on subcoxa 1 2 pseudocelli. Parapseudocelli (psx) invisible. Position of pso is presented in figs. 404, 408 and 412.

Dorsal chaetotaxy as in fig. 404, usually symmetrical, poorly differentiated into macrochaetae and microchaetae. Sensilla distinct distributed according formula 2/011/111121. Head with seta d_0 , abdominal tergum IV with seta p_0 , abdominal tergum V without medial setae. Abdominal tergum VI with one medial seta (fig. 407). Between legs on meso- and metathorax 1+1 setae. Tubus ventralis subapically with 6+6 setae and no setae at base. Ventral chaetotaxy as in fig. 412.

Claws without teeth (figs. 415). Empodial appendage with small lamella, broadened basally, appendage length equals 2/3 inner edge of the claw. Tibiotarsi with distal verticil, composed of 7 setae (figs. 413-415).

No male ventral organ.

BIOLOGY

According to STERZYŃSKA (1990) *A. naglitschi* in Poland lives singly in anthropogenic, very fine-grained sandy soil. Bisexual.

DISTRIBUTION IN POLAND

Nizina Mazowiecka lowland.

***Onychiurini* BÖRNER, 1906 sensu POMORSKI, 1996**

Onychiurinae BÖRNER, 1906: 159.

Onychiurinae BAGNALL, 1949: 499.

Onychiurini BÖRNER, status n., POMORSKI, 1996: 92.

Onychiurini BÖRNER, status n., WEINER, 1996: 182.

Hind margin of head capsule with pseudocelli, thoracic terga II-III and abdominal terga I-V with dorsomedial and lateral pseudocelli. PAO with granulated, multilobed or simple vesicles. Granulation fine, homogenous, sometimes slightly coarser around pseudocelli located at bases of antennae and abdominal terga IV-V. Anal spines absent or present. Furca reduced to finely granulated area with 1+1 or 2+2 setulae posteriorly arranged in one row, rarely reduced to cuticular pocket. Distal verticil of setae on tibiotarsi with 7, 9 or 11 setae. Setae sensuales on head and body usually indistinct. Seta d_0 on head present.

KEY TO GENERA OF *ONYCHIURINI*

1. Distal veriticol of setae on tibiotarsi, with 9 or 7 setae (figs. 34, 35) 2.
 -. Distal veriticol of setae on tibiotarsi, with 11 setae (fig. 33) 4.
 2. Anal spines present *Onychiurus*
 -. Anal spines absent 3.
 3. Furca reduced to finely granulated area with 2+2 setulae posteriorly arranged in one row (fig. 45), male ventral organ consists of numerous modified setae, localized on abdominal terga II and III or male organ absent, AIIIO with 5 papilla and bent sensory clubs (fig. 451) *Deuteraphorura*
 -. Furca reduced to finely granulated area with 1+1 setulae posteriorly (fig. 46), male ventral organ consists 2+2 modified setae on abdominal sternum II and 2+2 or 1+1 similar setae on abdominal sternum III (figs. 493, 501), AIIIO with straight sensory clubs and usually with 4 papilla (fig. 490) *Orthonychiurus*
 4. Furca reduced to cuticular pocket with 2+2 setulae (fig. 510) *Bionychiurus*
 -. Furca reduced to finely granulated area with 1+1 setulae posteriorly (fig. 522) 5.
 5. Dorsally body with multiplied pseudocelli. Anal spines present
 *Deharvengiurus*
 -. On each tergum, typical number of pseudocelli (3-4). Anal spines absent
 *Onychiuroides*

***Onychiurus* GERVAIS, 1841**

Onychiurus GERVAIS 1841, Echo Monde Savant, 8: 372.

Lipura BURMEISTER, 1838, Handbuch der Entomologie, 2, 2 (1): 447 [nec Illiger, 1811, Prodrromus systematis mammalium et avium: 95 (*Mammalia*)].

Adicranus BOURLET, 1842, Rev. Zool. Soc. Curvierrienne, 5: 20.

Augenius GISTEL, 1848, Naturgeschichte des Tierreich für höhere Schule, Stuttgart: IX.

Aphorura MACGILLIVRAY, 1893, Can. Ent., 25: 313.

Euaphorura BÖRNER, 1901, Zool. Anz., 24 (645): 337.

Type species: *Podura ambulans* LINNAEUS, 1758, by original designation (described from Sweden).

Diagnosis. Body shape cylindrical, slightly broadened in the region of abdominal IV-V segments, with relatively small abdominal segment VI, with anal spines. Hind margin of head capsule with pseudocelli. Body with homogenous granulation, with coarser granules on head and terga. Furca reduced to finely granulated area with 2+2 setulae posteriorly, arranged in one row. Antennal segment IV with a subapical organite, composed of two pits of which one is deep and usually ampullaceous, the other is shallow, with small sensilla. AIIIO usually with 5 papillae, and smooth, bent sensory clubs. PAO with numerous (10-15),

granulated vesicles. Distal veriticil of setae on tibiotarsi symmetrical, with 9 (7) setae. Setae sensuales on head and body indistinct. Seta d_0 on head present, abdominal tergum IV with seta p_0 , abdominal tergum VI with 1 medial seta.

KEY TO SPECIES

1. Ventral pseudocellar formula: 12/011/3212. Macrochaetae on dorsal side of body retused (fig. 423) *O. ambulans*
- Ventral pseudocellar formula: 11/000/1112. Macrochaetae on dorsal side of body apically rounded or forked (fig. 433) *O. rectospinatus*

Onychiurus ambulans (LINNAEUS, 1758) sensu STACH, 1934

Podura ambulans LINNAEUS, 1758: 609.

Onychiurus ambulans GERVAIS, 1841: 372.

Onychiurus ambulans STACH, 1934: 174.

Onychiurus circulans GISIN, 1952: 14, **syn. n.**

TYPE MATERIAL

Neotype male (by present designation), 3 other specimens in alcohol; (originally labelled) Westfalia, cave "Bismarck", about 450 m long, 1930/31; leg. dr W. GRIEPENBURG, coll. J. STACH.

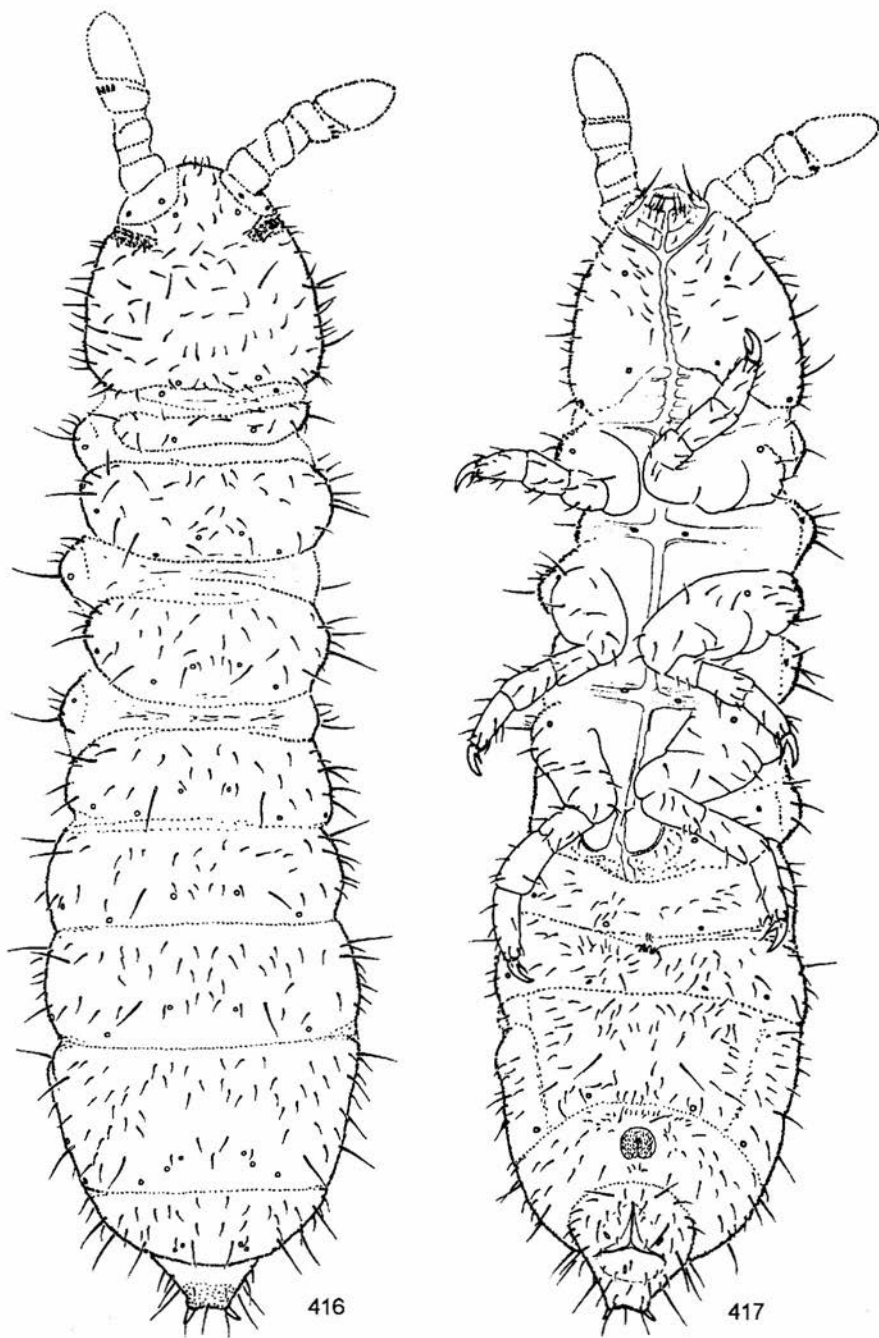
OTHER MATERIAL

Female; Wyżyna Krakowsko-Wieluńska upland, Mników, near Kraków, Poland; in cave under stone, 15. 05. 1921; leg. dr M. KUSIAK. Numerous spp.; Wyżyna Krakowsko-Wieluńska upland, Ojców National Park, Poland; under stone near spring in front of "Brama Krakowska"; 15. 10. 1992, leg. R. J. POMORSKI. Numerous spp.; Wyżyna Lubelska upland, Dobra near Kazimierz, nature reserve "Skarpa Dobrska", Poland; under stone near a house; 9. 07. 1995, leg. R. J. POMORSKI. 2 females; Wyżyna Lubelska upland, Roztocze, nature reserve "Czartowe Pole", Poland; under stones near stream; 16. 06. 1996; leg. R. J. POMORSKI, W. NOWAK.

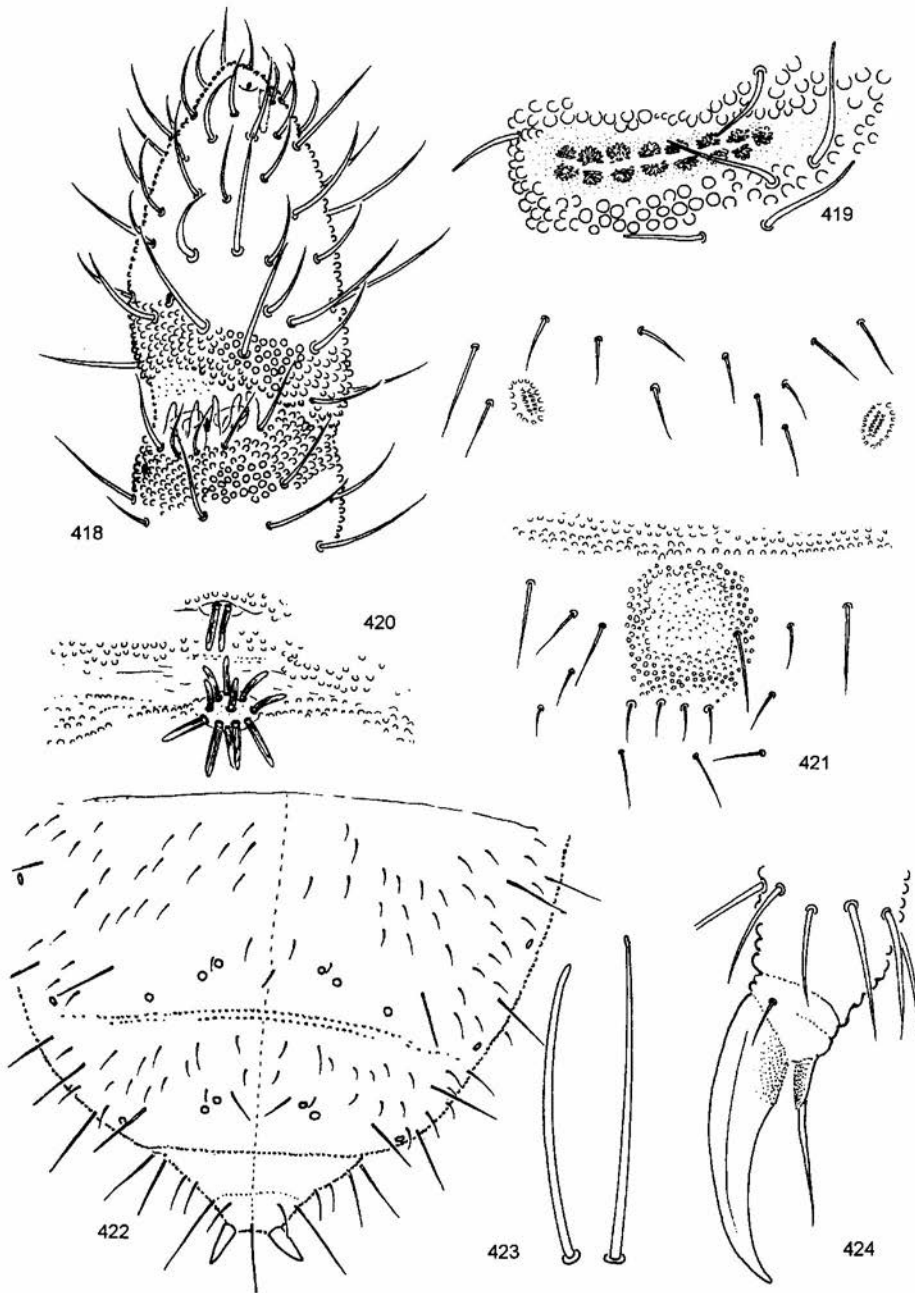
REDESCRIPTION

Colour in alcohol white. Length without antennae 1.9-2.3 mm. Body shape typical of *Onychiurus* s. str. (fig. 416), with relatively small VI abdominal segment, with anal spines. Antennae approximately as long as head. Furca reduced to small area of fine granulation with 2+2 setulae posteriorly, arranged in one row (fig. 421). Granulation more or less uniform, distinct, sometimes somewhat coarser on terga, head capsule and around anal spines. Area antennalis distinct.

Antennal segment IV with a subapical organite, composed of two pits of which one is deep and usually ampullaceous, the other is shallow, with small



416-417. *O. ambulans*: 416 - chaetotaxy and localization of pseudocelli on dorsal side of body, 417 - chaetotaxy and localization of pseudocelli on ventral side of body



418-424. *O. ambulans*: 418 - apical part of antennomere IV and antennal III sense organ, 419 - postantennal organ, 420 - male ventral organ, 421 - remnant of furca and parapseudocelli on abdominal sternum III, 422 - abdominal terga IV-VI, chaetotaxy and localization of pseudocelli, 423 - macrochaetae, 424 - claw

sensilla (fig. 418). Microsensillum on antennal segment IV in latero-external position, c.1/2 length from the base. Antennal segment III with microsensillum slightly below antennal III sense organ. Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ built of 5 guard setae, 2 sensory rods, 2 bent and smooth sensory clubs and 5 papillae (fig. 418).

Postantennal sense organ (PAO) consisting of 13-17 vesicles, covered with secondary vesicles (fig. 419).

Pseudocellar (pso) formula dorsally: 3(4)2/133/3335(4, 6)3; ventrally: 12/011/3(2)212; on subcoxa 2 pseudocelli. Formula parapseudocelli (psx) ventrally: 0/000/001002+1^m (each of anal lobe with 1 psx), all femora ventrally with 1 parapseudocellus. Position of pso and psx is presented in figs. 416, 417.

Dorsal chaetotaxy as in fig. 416, usually symmetrical, well differentiated into macrochaetae and microchaetae. Macrochaetae and most of another setae on dorsal side retused or apically rounded. Abdominal tergum IV with seta p₀, usually without m₀. Setae localized in front of anal spines relatively long, usually reaching anal spines (fig. 422). Between legs on pro-, meso- and metathorax no setae. Tubus ventralis without setae at base. Ventral abdominal chaetotaxy as in fig. 417.

Claws always without teeth. Empodial appendage without basal lamella, appendage length equals 3/4 inner edge of the claw. Tibiotarsi with distal verticil, composed of 9 setae (fig. 424).

Male ventral organ situated on abdominal sterna II and III, fully developed only in mature specimens, with ductus ejaculatorius. It consists of a pair of thickened, sharply pointed setae located on posterior margin of II abdominal sternum and a group of 10-12 similar setae on anterior margin of abdominal sternum III (fig. 420).

VARIABILITY

In all investigated material I found 2 specimens with additional pseudocelli (double pseudocellus on abdominal tergum V, double pseudocellus on area antennalis), and 3 specimens with lack of pseudocellus at base of ventral tube.

BIOLOGY

O. ambulans in Poland lives on warm and wet places in low mountains and uplands. It was collected in humus soil, under stones, usually near human settlements and in caves. Bisexual.

DISTRIBUTION IN POLAND

Sudetes? Wyżyna Krakowsko-Wieluńska upland, Wyżyna Lubelska upland.

TAXONOMIC REMARKS

O. ambulans was described by LINNAEUS in 1758 and until STACH's (1934) redescription, based on material from German caves, was differently identified.

The examination of specimens from caves "Bismarck" and "Hülloch" (Westfalia, Germany, coll. STACH) has shown that the redescription were inaccurate. A very important morphological character - dorsal and ventral pseudocellar formulae was described incorrectly (dorsal: 32/133/33343, ventral: 2/—/1212). Pseudocellar formula of *O. ambulans* should be as follows: dorsal 32/133/33353, ventral 12/011/3212. This inaccuracy was repeated in keys to species (GISIN 1960; PALISSA 1964), and possibly earlier was the reason for description of *Onychiurus circulans* GISIN, 1952 (pso formula: dorsal 32/133/33353, ventral 12/011/3212), which is here synonymized with *O. ambulans*.

Onychiurus rectospinatus STACH, 1922

Onychiurus rectospinatus STACH, 1922, 19: 8.
Syn. *Onychiurus arvensis* RUSEK, 1979: 143.

TYPE MATERIAL

Lectotype (male) on slide, labelled: Berekalia, near Léva (Kom. Bars), Slovakia (Hungaria) under stones near a house, VII-IX. 1915, leg. J. STACH; 10 paralectotypes (3 males, 4 females, 3 juv) on slides and 8 paralectotypes in alcohol, same data, coll. of Institute of Animal Systematics and Evolution, PAS, Kraków, Poland.

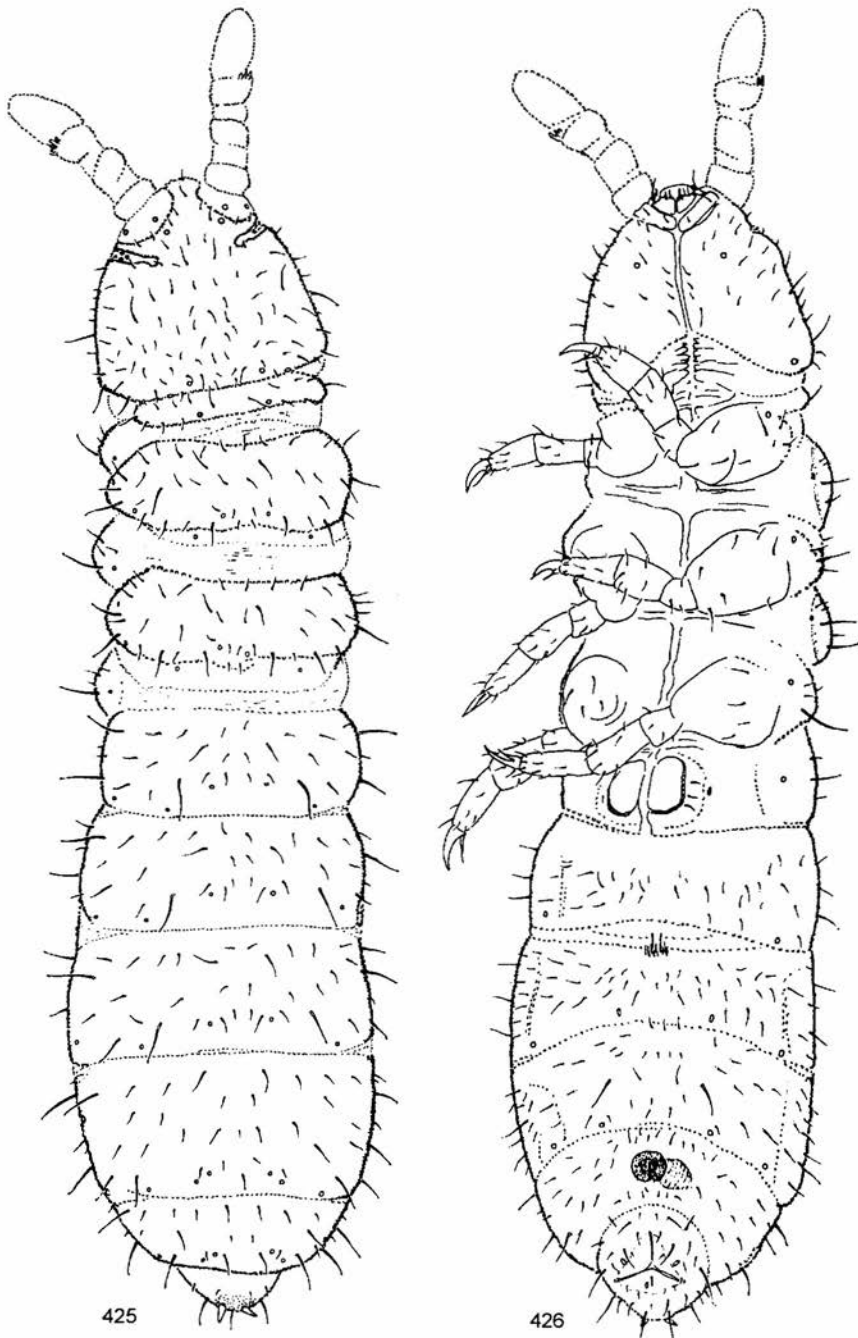
OTHER MATERIAL

7 spp., on slides and 13 spp. in alcohol; labelled as follows: Nagy-Salló (Kom. Bars), Slovakia (Hungaria) 7 VI 1924, leg. E. Dudich, at present Tekovské Luzany, Pohronská pahorkatina, Slovakia, coll. of Institute of Animal Systematic and Evolution, PAS, Kraków, Poland; 1 sp. on slide, 6 sp. in alcohol, labelled as follows: Berek, Slovakia, 1915, leg. J. STACH, at present ?, coll. of Institute of Animal Systematic and Evolution, PAS, Kraków, Poland. 1 sp. (male) on slide, Wyżyna Małopolska upland, Skowronno near Pinczów, Poland, steppe nature reserve "Skowronno", under stone, 10 VII 1995, leg. R. J. POMORSKI.

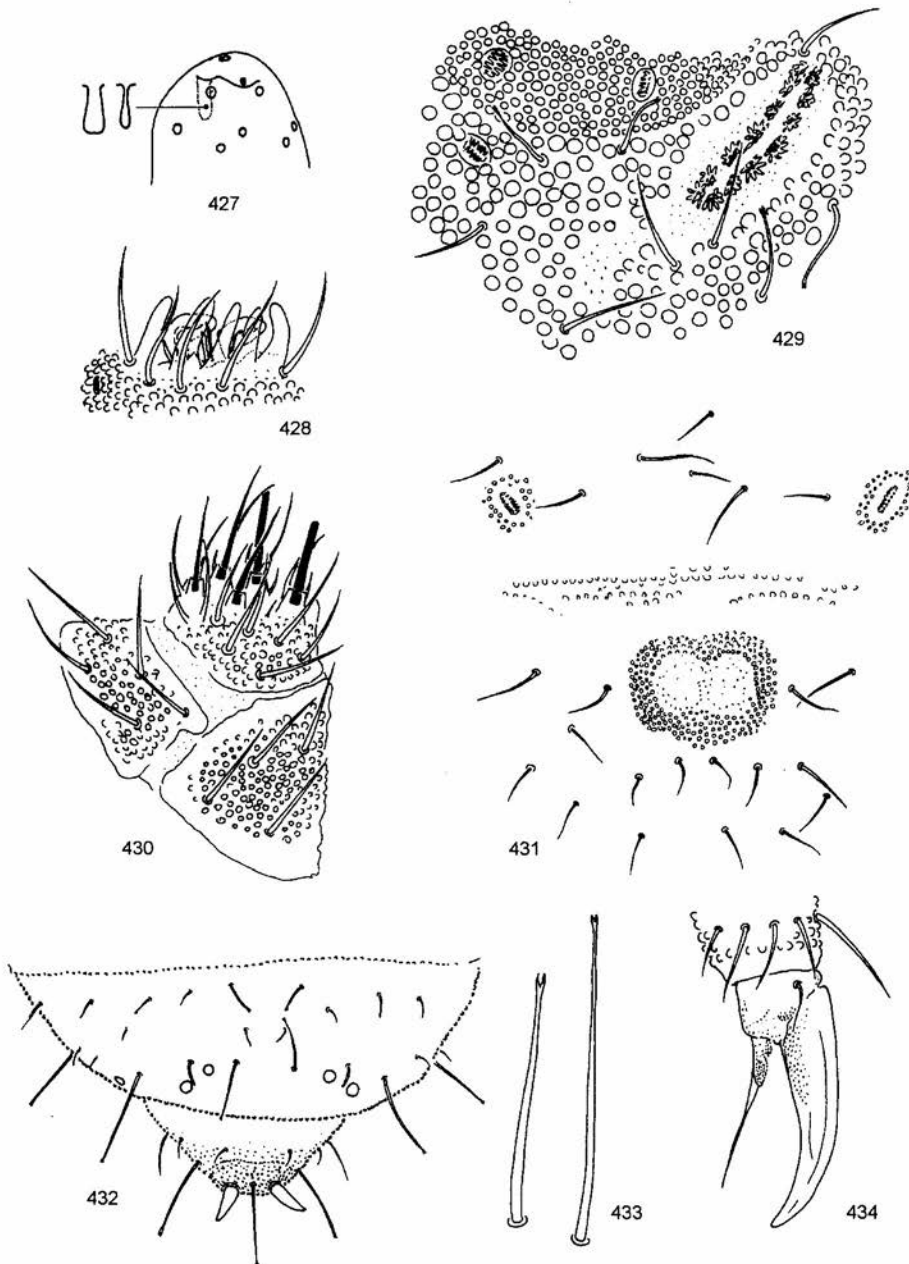
DESCRIPTION

Colour in alcohol white. Length without antennae 1.8-2.3 mm, lectotype 1.85 mm. Body shape typical of *Onychiurus* s. str., with relatively small abdominal segment VI, with anal spines (fig. 425). Antennae approximately as long as head. Furca reduced to small area of fine granulation with 2+2 setulae posteriorly, arranged in one row (fig. 431). Granulation more or less uniform, distinct, somewhat coarser on terga, head capsule and around anal spines (fig. 432). Area antennalis distinct.

Antennal segment IV with a subapical organite, composed of two pits of which one is deep and usually ampullaceous, the other is shallow, with small



425-426. *O. rectospinatus*: 425 - chaetotaxy and localization of pseudocelli on dorsal side of body, 426 - chaetotaxy and localization of pseudocelli on ventral side of body



427-434 - *O. rectospinatus*: 427 - apical part of antennomere IV, 428 - antennal III sense organ, 429 - postantennal organ and pseudocelli, 430 - labium, 431 - remnant of furca and parapseudocelli on abdominal sternum III, 432 - chactotaxy and localization of pseudocelli on dorsal side of abdominal terga V-VI, 433 - macrochaetae, 434 - claw

sensilla (fig. 427). Microsensillum on antennal segment IV in latero-external position, c.1/2 length from the base. Antennal segment III with microsensillum slightly below antennal III sense organ. Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ built of 5 guard setae, 2 sensory rods, 2 bent and smooth sensory clubs and 5 papillae (fig. 429).

Postantennal sense organ (PAO), consisting of 12-17 vesicles, covered with secondary vesicles (fig. 429).

Pseudocellar (pso) formula dorsally: 32/133/33353; ventrally: 11/000/1112; on subcoxal 2 pseudocelli. Formula of parapseudocelli (psx) ventrally: 0/000/101002+1^m (each anal lobe with 1 psx), all femora ventrally with 1 psx. Position of pso and psx as in figs. 425, 426.

Dorsal chaetotaxy as in fig. 425, usually symmetrical, well differentiated into macrochaetae and microchaetae. Macrochaetae and most other setae on dorsal side apically rounded or forked (fig. 433). Abdominal tergum IV always with seta p₀ and sometimes with m₀. Setae located in front of anal spines relatively short, usually not reaching anal spines (figs. 432). Between legs on pro-, meso- and metathorax no setae. Tubus ventralis without setae at base. Ventral abdominal chaetotaxy as in fig. 426.

Claws always without teeth. Empodial appendage without basal lamella, appendage length equals to 3/4 inner edge of the claw. Tibiotarsi with distal vertical, composed of 9 setae (fig. 434).

Male ventral organ situated on abdominal sterna II and III, fully developed only in mature specimens with ductus ejaculatorius. It consists of a pair thickened, sharply pointed setae on posterior margin of abdominal sternum II and a group of 10-12 similar setae on anterior margin of abdominal sternum III (fig. 354).

VARIABILITY

Fully forked setae are present only in adults, and additionally this character is particularly strongly expressed in males. At first, the setae of juvenile specimens are acuminate, after the following moult they become apically rounded.

BIOLOGY

O. rectospinatus in Poland has been collected only once under stone on xerothermic meadow. Bisexual.

DISTRIBUTION IN POLAND

Wyżyna Małopolska upland.

Deuteraphorura ABSOLON, 1901

Deuteraphorura ABSOLON, 1901, Zool. Anz., 24 (647): 387.

Type species: *Onychiurus fimetarius* LINNAEUS, 1933, (auct.) by STACH's designation (= *Podura fimetaria* LINNAEUS, 1767, nec Linnaeus 1758 (= *Lipura inermis* TULLBERG, 1869, nec NICOLET, 1842). Redescribed from Sweden and Poland: Mników (*nomen dubium*).

Diagnosis. Body shape cylindrical, slightly broadened in the region of abdominal IV-V segments, without anal spines. Hind margin of head capsule with pseudocelli. Granulation of body homogenous, with coarser granules on head and terga. Furca reduced to finely granulated area with 2+2 setulae posteriorly arranged in one row. AIIIIO with 5 papilla, smooth and bent sensory clubs with ribs. PAO with numerous (13-20), granulated vesicles. Distal veriticil of setae on tibiotarsi symmetrical, with 9 setae. Setae sensuales on head and body indistinct. Usually macrochaetae and most setae retused, rarely apically rounded. Seta d_0 on head present, abdominal tergum IV with seta p_0 , abdominal tergum VI with 1 medial seta. Male ventral organ usually present, localized on abdominal sternum II or abdominal sterna II and III.

KEY TO SPECIES

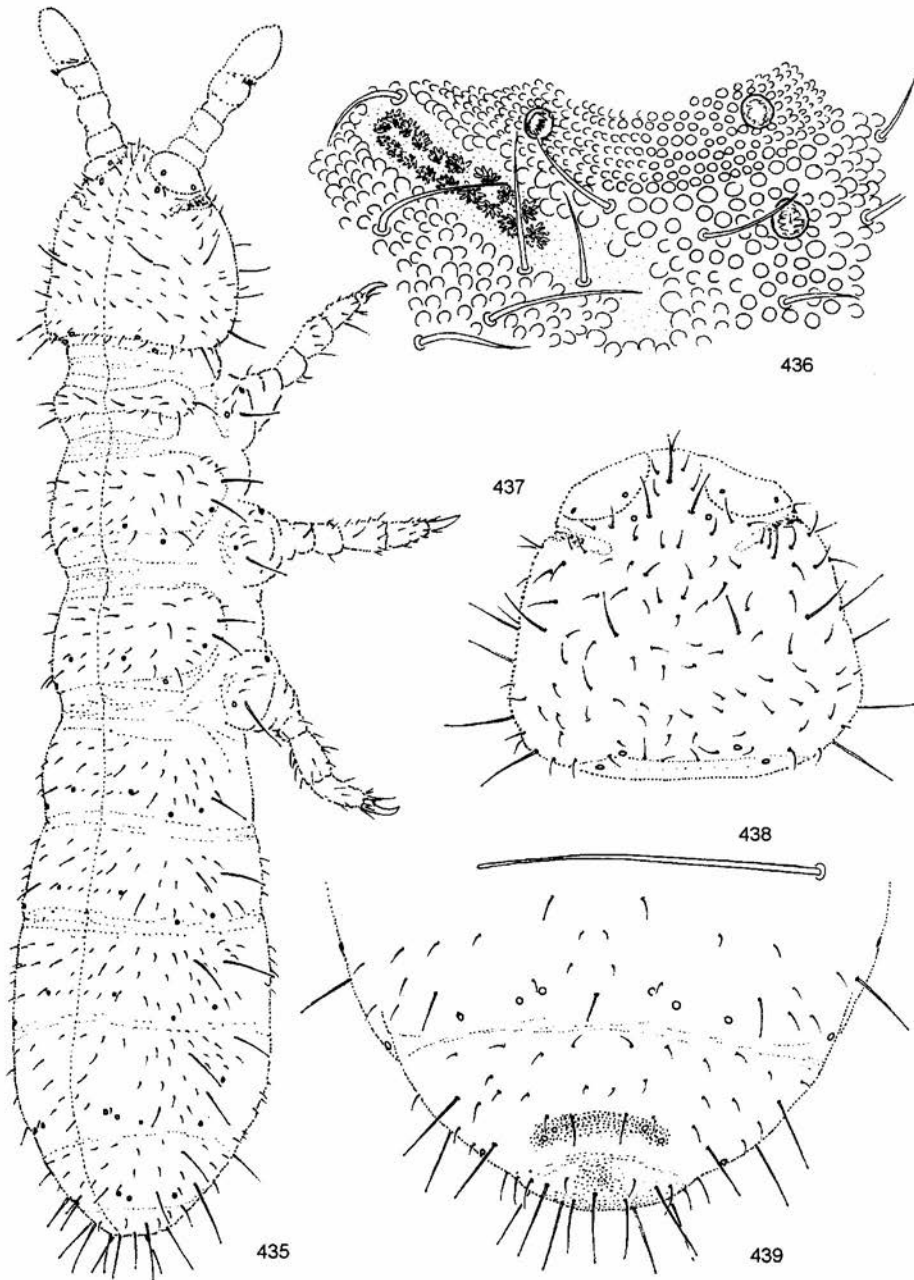
1. Thoracic tergum I without pseudocelli, macrochaetae distinctly apically rounded *D. silesiaca*
- Thoracic tergum I with 1+1 pseudocellus, macrochaetae retused or pointed 2.
2. Abdominal tergum V with 4+4 pseudocelli, claw with distinct teeth laterally (figs. 453, 454) *D. cebennaria*
- Abdominal tergum V with 3+3 pseudocelli, teeth on claw indistinct or absent 3.
3. Pseudocellar formula dorsally 32/133/33353, ventrally 12/011/3212. Male ventral organ absent *D. silvaria*
- Pseudocellar formula dorsally 32/133/33343, ventrally 12/011/2112. Male ventral organ localized on II and III abdominal sterna (figs. 478, 479) *D. variabilis*

Deuteraphorura silesiaca (DUNGER, 1977) comb. nov.

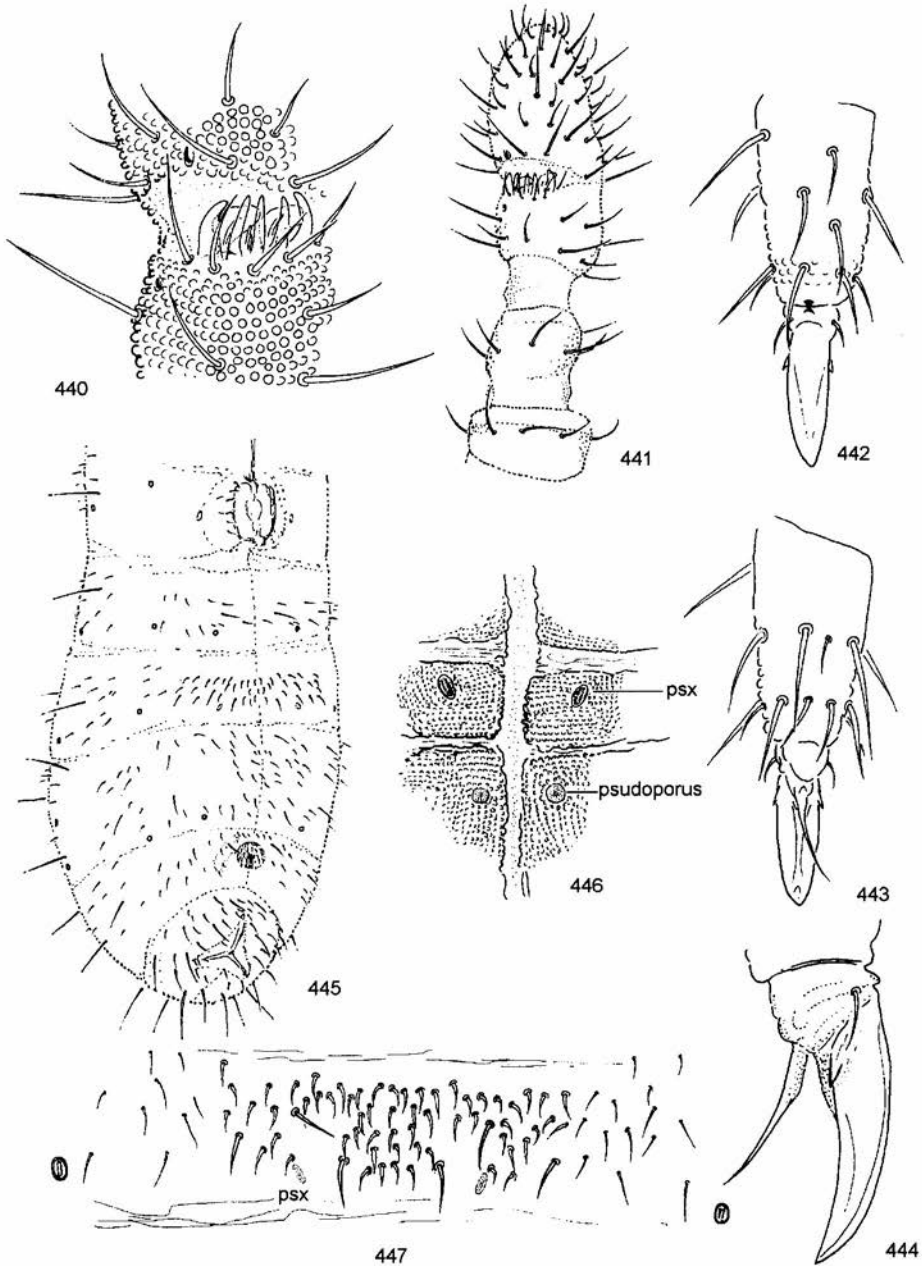
Onychiurus silesiacus DUNGER, 1977:10

MATERIAL

Female; Sudetes, Kaczawskie Mts., Złotoryja, "Wilkołak", Poland; under wet moss on the rocks; 14. 05. 1985, leg. R. J. POMORSKI. Female; Sudetes, Kaczawskie Mts., Wojcieszów, "Miłek", Poland; under wet moss on the rocks; 26. 10. 1985, leg. R. J. POMORSKI. 2 females; Sudetes, Opawskie Mts., Głuchołazy, Poland; soil of the bottom of adit; 6. 10. 1987, leg. D. SKARŻYŃSKI, R. J. POMORSKI.



435-439. *D. silesiaca*: 435 - chaetotaxy and localization of pseudocelli on dorsal side of body, 436 - postantennal organ and pseudocelli, 437 - head, chaetotaxy of dorsal side, 438 - macrochaeta, 439 - abdominal terga V and VI, chaetotaxy, localization of pseudocelli and granulation



440-447. *D. silesiaca*: 440 - antennal III sense organ, 441 - antenna, 442-443 - tibiotarsus of II pair of legs, 444 - claw, 445 - abdominal sterna I and VI, chaetotaxy and localization of pseudocells and parapseudocells, 446 - parapseudocells and pseudopores between II and III pairs of legs, 447 - male ventral organ

2 females; Sudetes, Kaczawskie Mts., Wojcieszów, cave "Nowa", Poland; on the surface of water reservoir; 26. 06. 1988, leg. R. J. POMORSKI; numerous spp.; Sudetes, Wałbrzych Highlands, Pełcznica ravine, Poland; under moss on rocks, 25. 05. 1989; leg. D. SKARŻYŃSKI. Numerous spp.; Sudetes, Góry Żłote, Chwalisław, Poland; under moss on big stones near stream Mąkolnica; 2. 10. 1991, leg. D. SKARŻYŃSKI, R. J. POMORSKI. 1 female, 1 juv.; Wyżyna Krakowsko-Wieluńska upland, Ojców National Park, Poland; under stone near spring in front of "Brama Krakowska"; 15-17. 10. 1992, leg. R. J. POMORSKI. 3 females, 1 male; Carpathians, Nowy Targ Basin, nature reserve "Przełom Białki", Poland; under stones, soil and litter; 11. 11. 1993; R. J. POMORSKI. 4 females, 2 males; Carpathians, Pieniny Mts., Pieniny National Park, Dolina Ociemnego valley, Poland; soil and litter; 26. 05. 1994; R. J. POMORSKI.

DESCRIPTION

Colour in alcohol white. Length without antennae: males – 1.3-1.6 mm, females – 2.1-2.6 mm. Body shape cylindrical, without anal spines, as in fig. 435. Antennae approximately as long as head. Furca reduced to small area of fine granulation with 2+2 setulae posteriorly, arranged in one row. Granulation more or less uniform, distinct, a little coarse on terga, head capsule and on subcoxae 1. Area antennalis distinct.

Antennal IV segment with subapical organite. Microsensillum on antennal IV segment in latero-external position, in one row with posterior setae (fig. 441). Antennal III segment with microsensillum slightly below antennal III sense organ. Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ built of 5 papillae, 2 sensory rods, 2 sensory clubs smooth, bent, with ribs and 5 guard setae (fig. 440).

Postantennal sense organ (PAO) consisting of 16-20 vesicles, covered with secondary vesicles (fig. 436)

Pseudocellar (pso) formula dorsally: 32/033/33353; ventrally: 11/000/1212; on subcoxa 1 2 pseudocelli. Formula of parapseudocelli (psx) ventrally: 0/011/101. Additionally between legs on meso- and metathorax 1+1 pseudoporus (fig. 446). All femora ventrally with 1 parapseudocellus. Position of pso and psx is presented in figs. 435, 445 and 446.

Dorsal chaetotaxy as in fig. 435, usually symmetrical, well differentiated into apically rounded macrochaetae and microchaetae. Abdominal tergum IV with seta p_0 . Abdominal tergum VI with one medial seta (fig. 439). Between legs on pro-, meso- and metathorax no setae. Tubus ventralis subapically with ca. 8+8 setae and without setae at base. Ventral chaetotaxy as in fig. 445.

Claws with distinct teeth laterally, inner edge without teeth (fig. 444). Empodial appendage without basal lamella, appendage length equals 4/5 inner edge of the claw. Tibiotarsi with symmetrical distal verticil, composed of 9 setae (figs. 442-444).

Male ventral organ situated on abdominal sternum II, fully developed only in mature specimens with ductus ejaculatorius. It consists of a group (30) thickened, short, pointed setae localized on medial part of abdominal sternum II (fig. 447).

BIOLOGY

D. silesiaca in Poland lives on warm and wet places in low mountains and uplands. Usually it was collected in litter, under wet moss on rocks and stones and in caves. Bisexual.

DISTRIBUTION IN POLAND

Sudetes, Carpathians, Wyżyna Krakowsko-Wieluńska upland.

TAXONOMIC REMARKS

According to DUNGER (1977), ventral pseudocellar formula of *D. silesiaca* is following: 11/022/2222, but he pays attention on a pair of parapseudocelli - "weakly sclerotized medial pseudocelli on abdominal sternum III". Besides, *D. silesiaca* has parapseudocelli at base of ventral tube and between legs on joint area of meso- and metathorax (together with pseudopores) (fig. 446). Probably it was a reason of inaccurate original description.

Onychiurus scotarius GISIN 1954, *Onychiurus bosnarius* GISIN 1964, *Onychiurus ossarius* GISIN, 1964 have very similar dorsal and ventral pseudocellar formulae as originally described in *D. silesiaca*. Probably GISIN's descriptions, like DUNGER's, are inaccurate, and all these species should be redescribed.

In Poland only *O. scotarius* was found (POMORSKI 1992; SKARŻYŃSKI 1992), but a re-examination of the material, made it possible to ascertain that the first determinations were incorrect and the material represents *D. silesiaca*.

***Deuteraphorura cebennaria* (GISIN, 1956)**

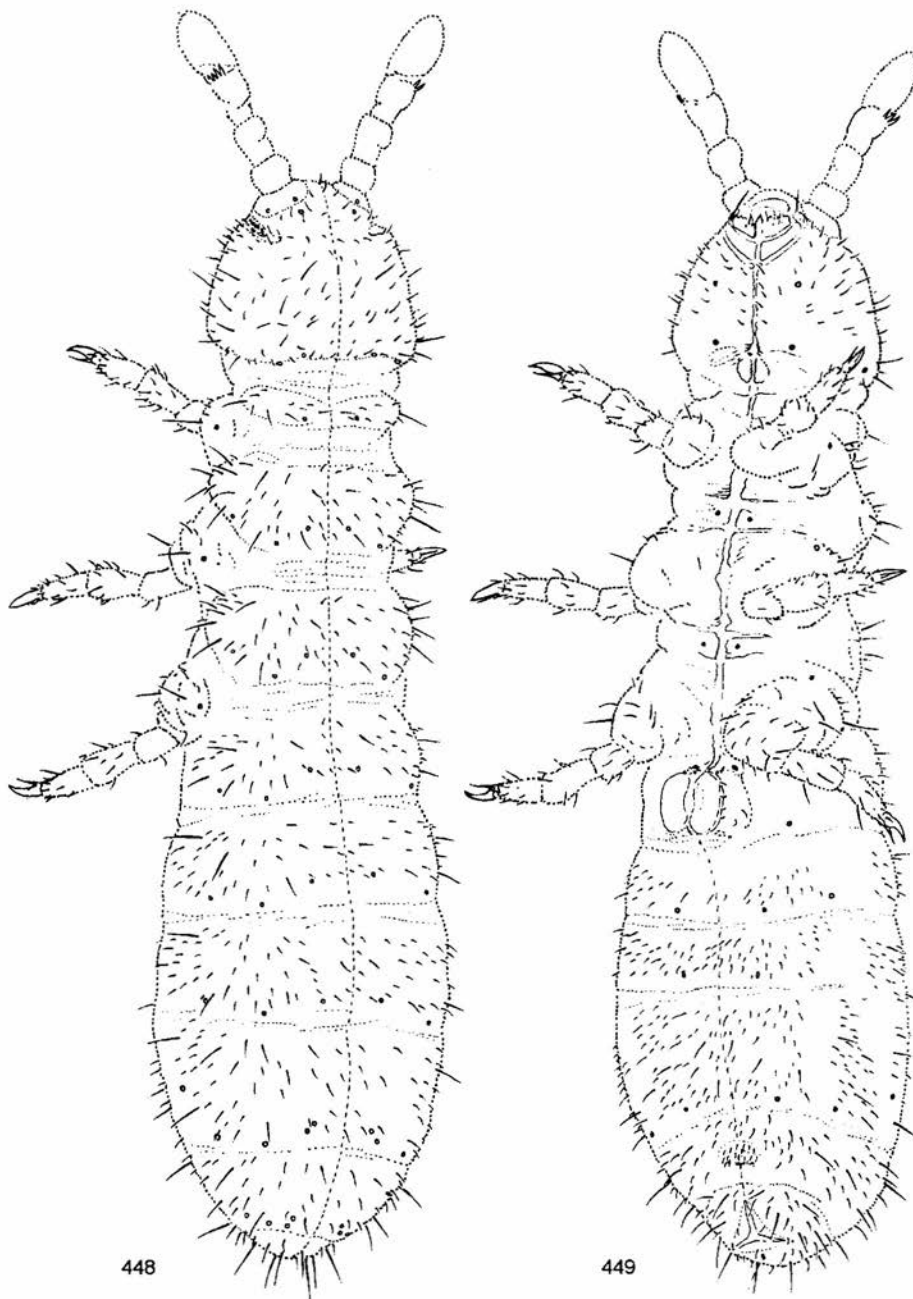
Onychiurus cebennarius GISIN, 1956: 384.

MATERIAL

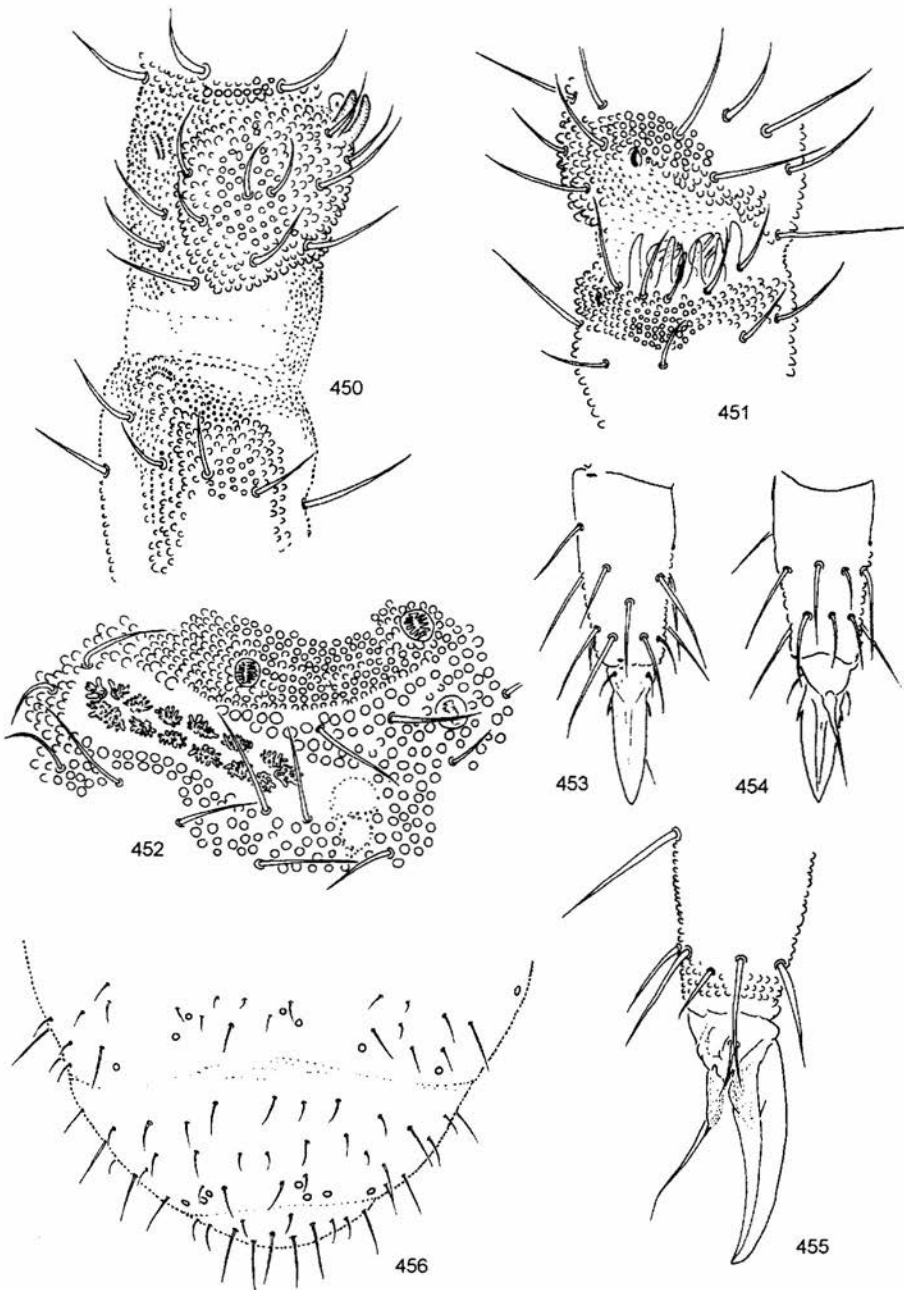
Numerous spp.; Sudetes, Góry Złote, Radochów, "Jaskinia Radochowska" cave, Poland; soil sample taken from the bottom of cave; 24. 10. 1986, leg. D. SKARŻYŃSKI, R. J. POMORSKI. Numerous spp.; Sudetes, Pogórze Kaczawskie highlands, Lwówek Śl., "Lisia" and "Czerwona" caves, Poland; 17. 06. 1988; on a dead bat, in a soil sample from the bottom of cave, on a pellet of a bird of prey; leg. R. J. POMORSKI, D. SKARŻYŃSKI. Numerous spp.; Sudetes, Wałbrzych Highlands, Pełcznica ravine, Poland; gravel, under stones near river, 25. 05. 1989; leg. D. SKARŻYŃSKI. Numerous spp.; Sudetes, Wzgórza Strzelińskie hills, Stolec, nature reserve "Skałki Stoleckie", Poland; soil sample from the bottom of old adit, 15. 05. 1996; leg. R. J. POMORSKI.

DESCRIPTION

Colour in alcohol white. Length without antennae: males - 1.6 mm, females - 1.8-2.0 mm. Body shape cylindrical, without anal spines, as in fig. 448. Antennae approximately as long as head. Furca reduced to small area of fine



448-449. *D. cebennaria*: 448 - chaetotaxy and localization of pseudocelli on dorsal side of body, 449 - chaetotaxy and localization of pseudocelli on ventral side of body



450-455. *D. cebennaria*: 450 - parapseudocelli on antennomeres II and III, 451 - antennal III sense organ, 452 - postantennal organ and pseudocelli, 453-454 - tibiotarsus of II pair of legs, 455 - claw, 456 - abdominal terga IV-VI, chaetotaxy, granulation, localization of pseudocelli

granulation with 2+2 setulae posteriorly, arranged in one row. Granulation more or less uniform, distinct, slightly coarser on terga, head capsule and on subcoxae I. Area antennalis distinct.

Antennal IV segment with subapical organite. Microsensillum on antennal IV segment in latero-external position, in one row with posterior setae (fig. 451). Antennal III segment with microsensillum slightly below antennal III sense organ. Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ built of 5 papillae, 2 sensory rods, 2 sensory clubs smooth, bent, with ribs and 5 guard setae (fig. 451).

Postantennal sense organ (PAO) consisting of 15-18 vesicles, covered with secondary vesicles (fig. 452)

Pseudocellar (pso) formula dorsally: 32/133/33354; ventrally: 12/011/3212; on subcoxal 2 pseudocelli. Formula of parapseudocelli (psx) ventrally: 0/000/00101^m (unpaired anal lobe with psx). All femora ventrally with 1 parapseudocellus. Position of pso and psx is presented in figs. 448, 449.

Dorsal chaetotaxy as in fig. 448, usually symmetrical, well differentiated into apically retused macrochaetae and microchaetae. Abdominal tergum IV with seta p₀. Abdominal tergum VI with one medial seta (fig. 456). Between legs on pro-, meso- and metathorax no setae. Tubus ventralis subapically with ca. 6+6 setae and without setae at base. Ventral chaetotaxy as in fig. 449.

Claw with teeth laterally and without teeth on inner edge (fig. 455). Empodial appendage as long as inner edge of the claw, without basal lamella. Tibiotarsi with symmetrical distal verticil, composed of 9 setae (figs. 453, 454).

Male ventral organ situated on abdominal sternum II, fully developed only in mature specimens with ductus ejaculatorius. It consists of a group (ca. 15) of thickened, short, slightly curved and pointed setae, localized on medial part of abdominal sternum II.

VARIABILITY

Among studied material of *D. cebennaria*, 3 spp. collected in old adit (nature reserve "Skałki Stoleckie"), has additional parapseudocelli on antennomeres II and III (fig. 450).

BIOLOGY

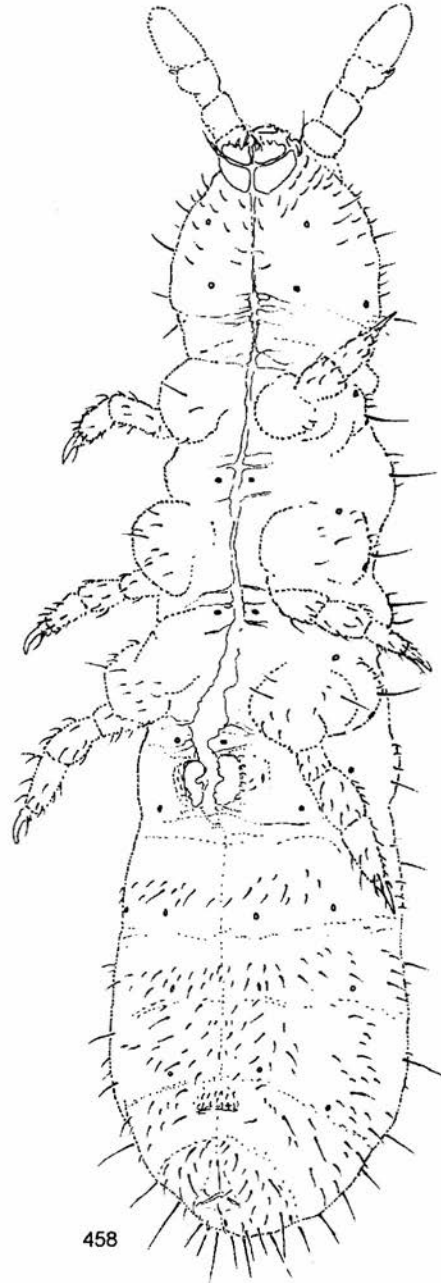
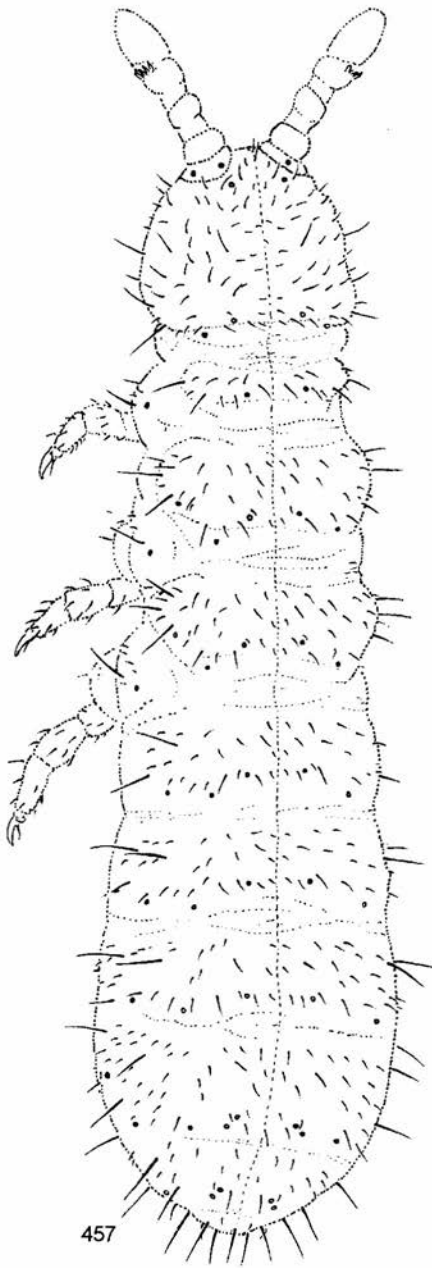
In Poland *D. cebennaria*, lives chiefly in caves of low parts of Sudetes. Besides, it has been collected in gravel in a deep, river gorge. Bisexual.

DISTRIBUTION IN POLAND

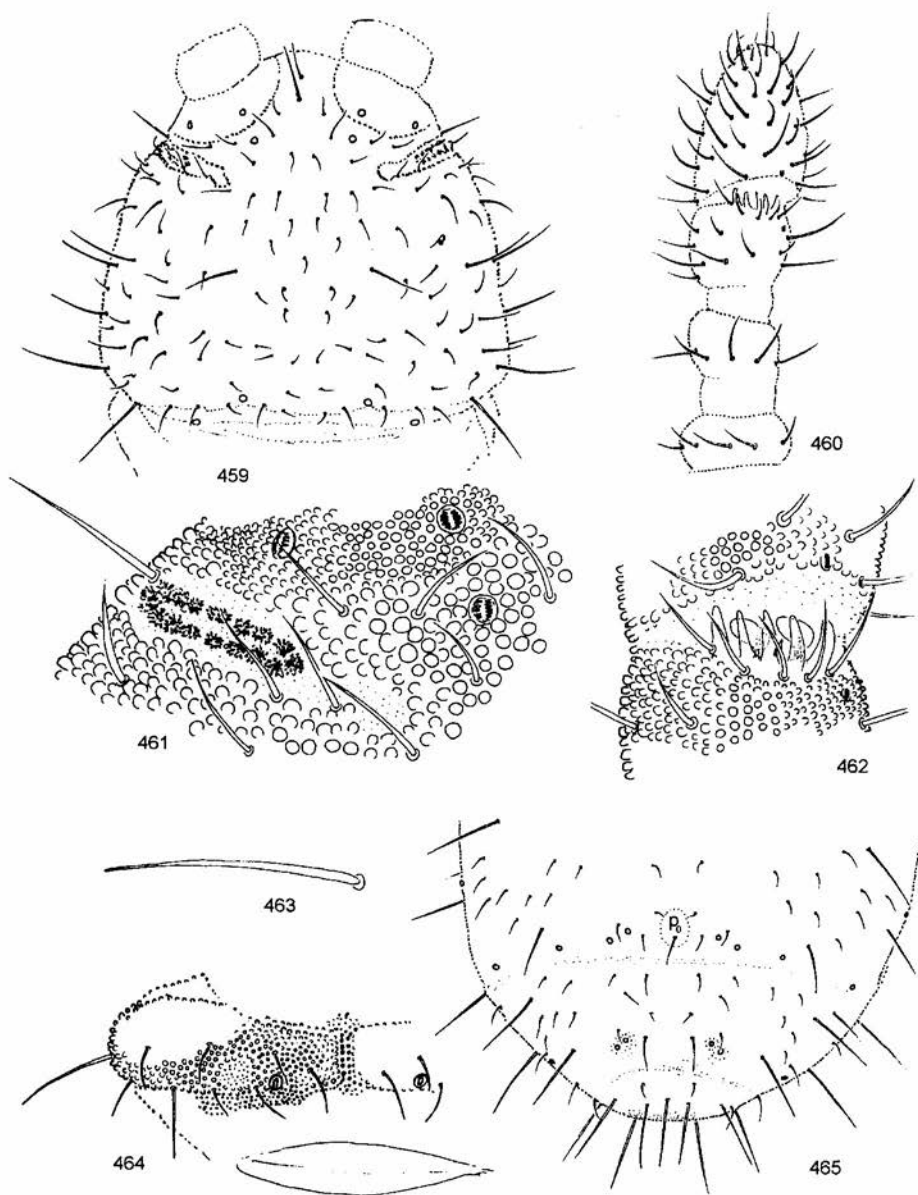
Sudetes.

Deuteraphorura silvaria (GISIN, 1952) comb. n.

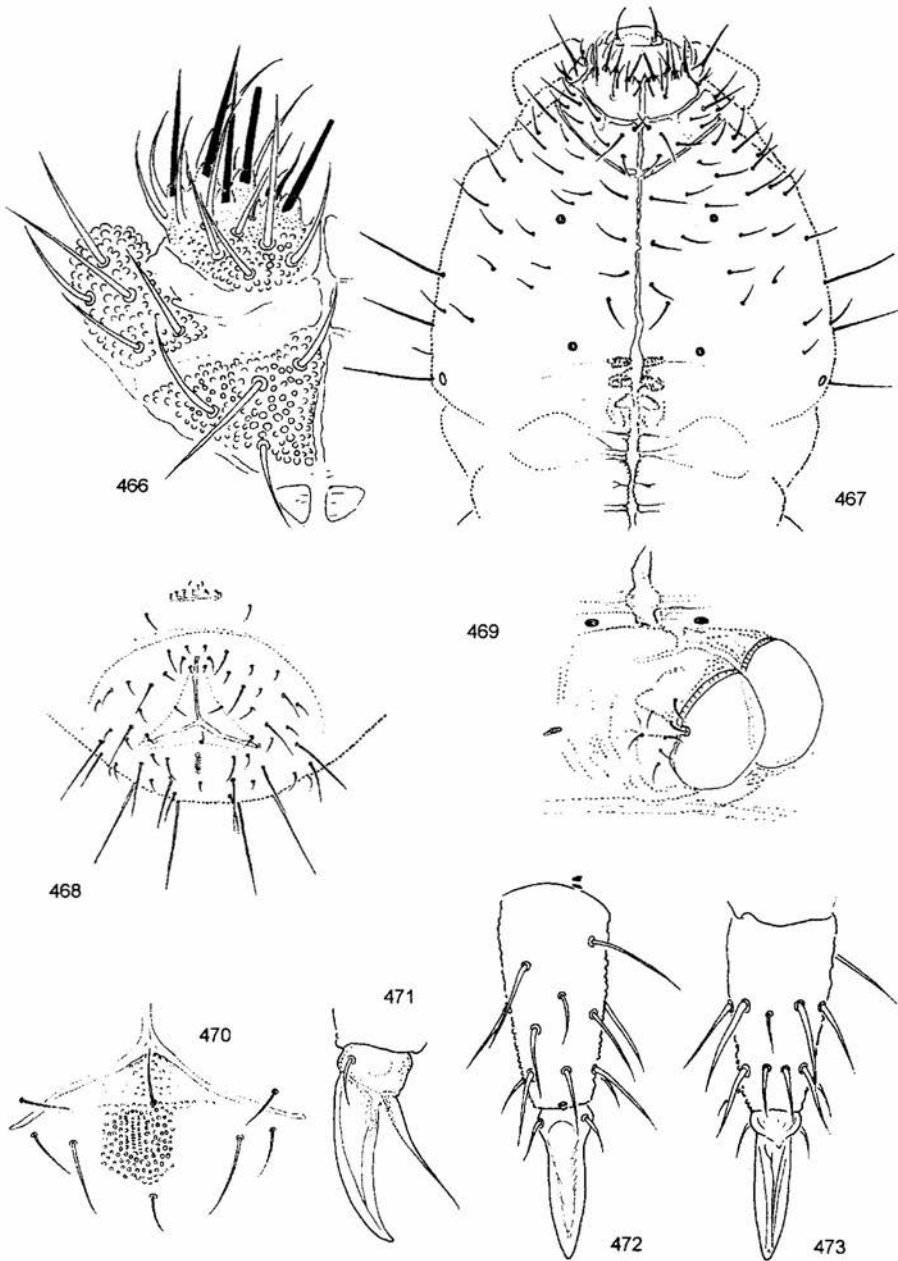
Onychiurus silvarius GISIN, 1952: 19.



457-458. *D. silvaria*: 457 - chaetotaxy and localization of pseudocelli on dorsal side of body, 458 - chaetotaxy and localization of pseudocelli on ventral side of body



459-465. *D. silvaria*: 459 - head, chaetotaxy, 460 - antenna, 461 - postantennal organ and pseudocelli, 462 - antennal III sense organ, 463 - macrochaeta, 464 - thoracic tergum I, 465 - abdominal terga IV-VI, chaetotaxy and localization of pseudocelli



466-473. *D. silvaria*: 466 - labium, 467 - ventral side of head, chaetotaxy and localization of pseudocelli, 468 - anal lobes, 469 - tubus ventralis, 470 - parapsudocellus on anal lobe, 471 - claw, 472-473 - tibiae of II pair of legs

MATERIAL

Female; Kraków-Wieluń upland, Ojców National Park, "Wąwóz Korytnica", Poland; under stone in spruce forest; 28. 04. 1964, leg. A. Szeptycki. 1 female, female, male subadult, 3 juv.; Kraków-Wieluń upland, Ojców National Park, Poland; under stone near spring in front of "Brama Krakowska"; 15-17. 10. 1992, leg. R. J. POMORSKI. 7 females, male subadult.; Carpathians, Pieniny Mts., Pieniny National Park, "Chwała Bogu", Poland; under haystack, 8-9. 03. 1994; R. J. POMORSKI. Male.; Małopolska Upland, Skowronno near Pinczów, Poland, steppe nature reserve "Skowronno", under stone, 10 VII 1995, leg. R. J. POMORSKI.

DESCRIPTION

Colour in alcohol white. Length without antennae: males – 1.3 mm, females – 1.9-2.1 mm. Body shape cylindrical, without anal spines, as in fig. 457. Antennae approximately as long as head. Furca reduced to small area of fine granulation with 2+2 setulae posteriorly, arranged in one row. Granulation more or less uniform, distinct, somewhat coarser on terga, head capsule and on subcoxae I. Area antennalis distinct.

Antennal segment IV with subapical organite. Microsensillum on antennal segment IV in latero-external position, in one row with posterior setae. Antennal segment III with microsensillum slightly below antennal III sense organ (fig. 460). Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ built of 5 papillae, 2 sensory rods, 2 sensory clubs smooth, bent, with ribs and 5 guard setae (fig. 462).

Postantennal sense organ (PAO) consisting of 16-20 vesicles, covered with secondary vesicles (fig. 461).

Pseudocellar (pso) formula dorsally: 32/133/33353; ventrally: 12/011/3212; on subcoxal 2 pseudocelli. Formula of parapseudocelli (psx) ventrally: 0/000/10101^m (unpaired anal lobe with psx). All femora ventrally with 1 parapseudocellus. Position of pso and psx is presented in figs. 457, 458.

Dorsal chaetotaxy as in fig. 457, usually symmetrical, well differentiated into apically retused macrochaetae and microchaetae. Abdominal tergum IV with seta p₀. Abdominal tergum VI with one medial seta (fig. 465). Between legs on pro-, meso- and metathorax no setae. Tubus ventralis subapically with ca. 7+7 setae and without setae at base (fig. 469). Ventral chaetotaxy as in fig. 458.

Claws without lateral teeth and no teeth on inner edge (figs. 471-473). Empodial appendage as long as inner edge of the claw, without basal lamella. Tibiotarsi with symmetrical distal verticil, composed of 9 setae.

Male ventral organ situated on abdominal sternum II, fully developed only in mature specimens with ductus ejaculatorius. It consist a group (30) of thickened, short, curved and pointed setae, localized on medial part of abdominal sternum II.

TAXONOMIC REMARKS

According GISIN (1952), ventral pseudocellar formula of *D. silvaria* is following: 12/011/3222. Is very probably, that parapseudocellus on abdominal sternum III was identified as pseudocellus.

BIOLOGY

In Poland *D. silvaria* is a rare species, living in warm places in low mountains and uplands. Usually it has been collected in humus soil under stones. Bisexual.

DISTRIBUTION IN POLAND

Carpathians – Pieniny Mts., Wyżyna Krakowsko-Wieluńska upland, Wyżyna Małopolska upland.

Deuteraphorura variabilis (STACH, 1954)

Onychiurus variabilis STACH, 1954: 384.

TYPE MATERIAL

Lectotype male (by present designation), 3 paralectotypes in alcohol; (originally labelled) “Polesie, Antonówka (pow. Sarny), wazon, 20. 09. 1929; leg. K. TRACZEWSKI.” at present: Ukraina; coll. J. STACH.

OTHER MATERIAL

Numerous spp.; Lower Silesia, Wołów, Poland; flowerpot in jail; 17. 02. 1992; leg. H. PIETRUSZKA.

DESCRIPTION

Colour in alcohol white. Length without antennae: males – 1.2 mm, females – 1.4-1.6 mm. Body shape cylindrical, without anal spines, as in fig. 474. Antennae approximately as long as head. Furca reduced to small area of fine granulation with 2+2 setulae posteriorly, arranged in one row. Granulation more or less uniform, distinct, slightly coarser on terga, head capsule and on subcoxae I. Area antennalis indistinct.

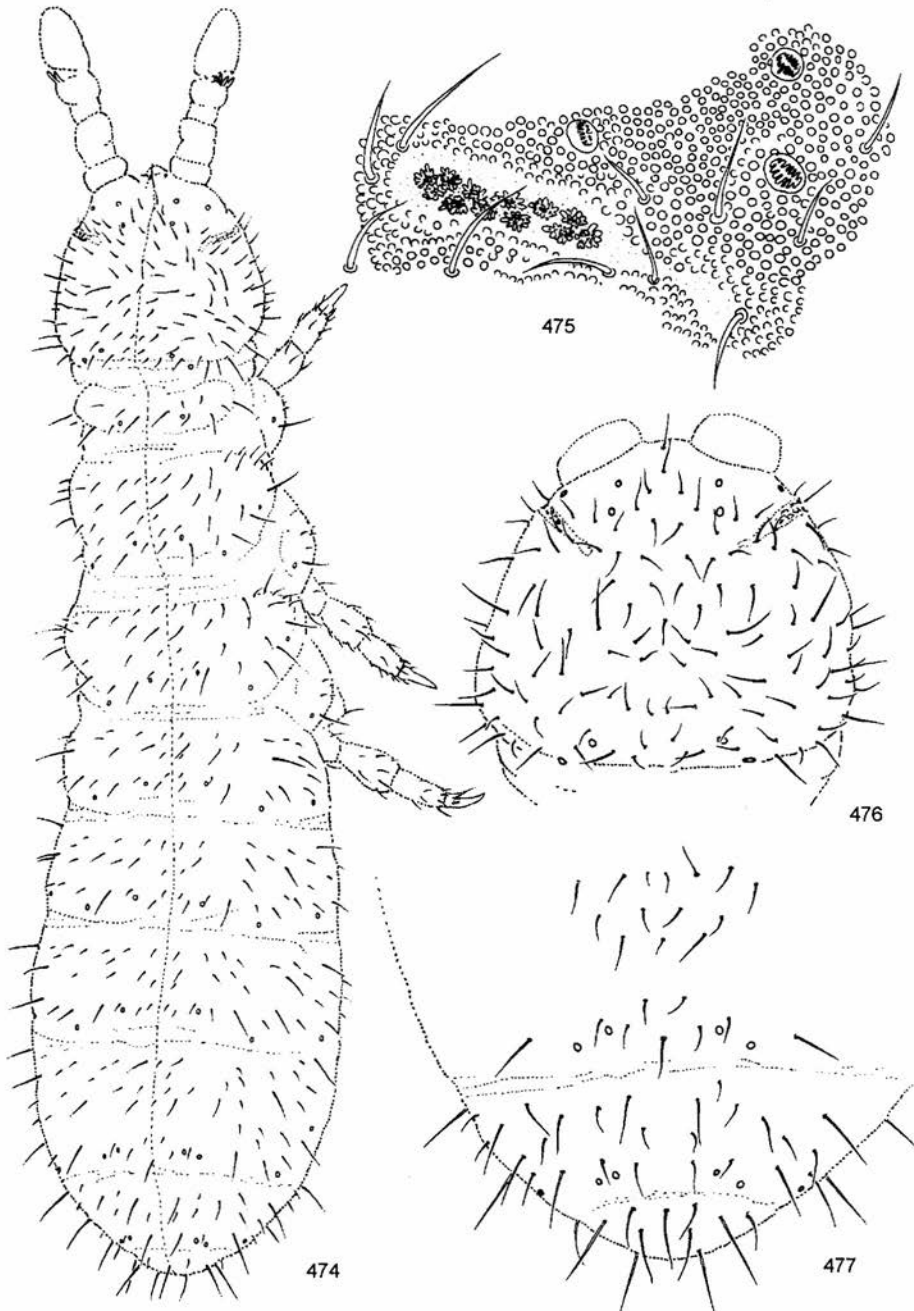
Antennal segment IV with subapical organite. Microsensillum on antennal segment IV in latero-external position, in one row with posterior setae. Antennal III segment with microsensillum slightly below antennal III sense organ (fig. 481). Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ built of 5 papillae, 2 sensory rods, 2 sensory clubs smooth, bent, with ribs and 5 guard setae (fig. 481).

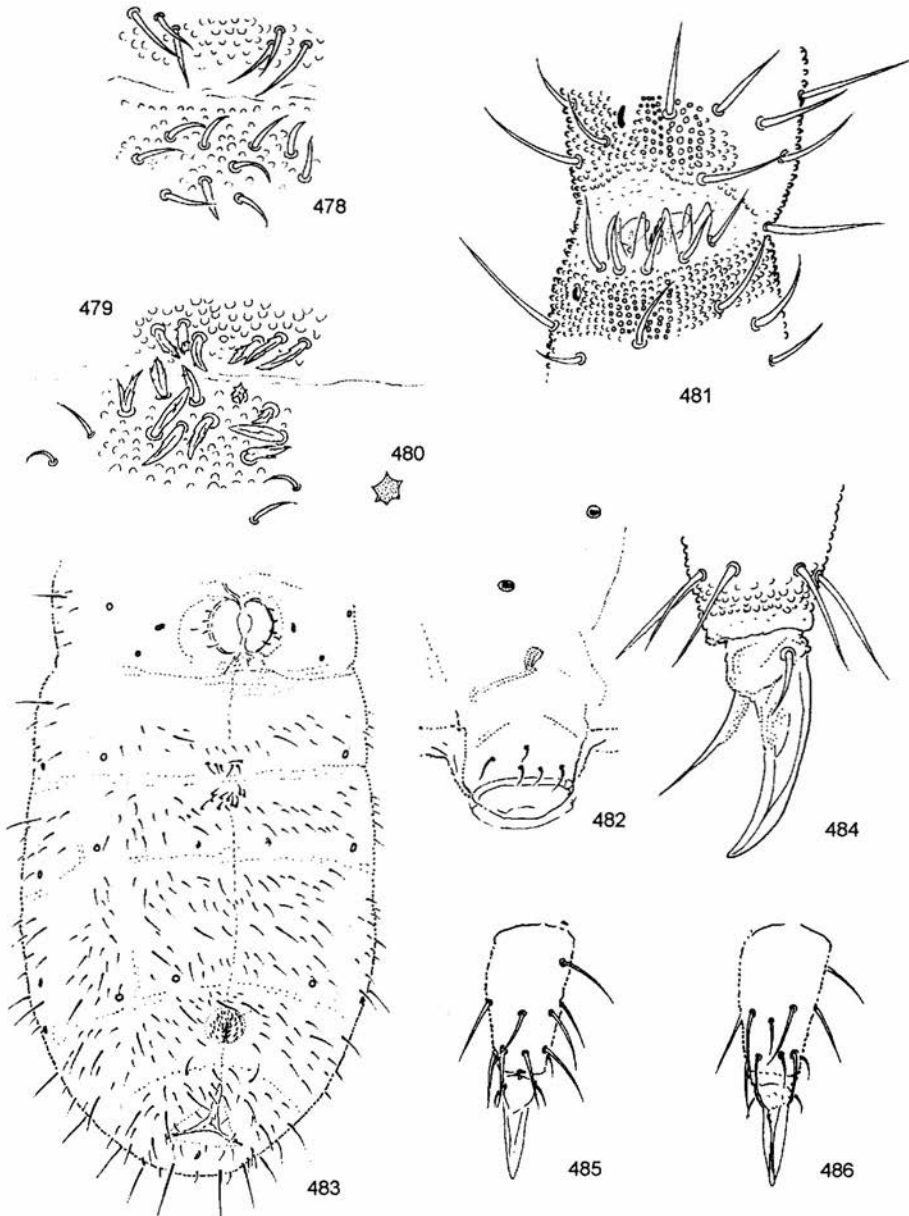
Postantennal sense organ (PAO) consisting of 10-12 vesicles, covered with secondary bladders (fig. 475)

Pseudocellar (pso) formula dorsally: 32/133/33343; ventrally: 12/011/2112; on subcoxa 1 2 pseudocelli. Formula of parapseudocelli (psx) ventrally: 0/000/10101^m (unpaired anal lobe with psx). All femora ventrally with 1 parapseudocellus. Position of pso and psx is presented in figs. 474, 483.

Dorsal chaetotaxy as in fig. 474, usually symmetrical, well differentiated into apically retused macrochaetae and microchaetae. Abdominal tergum IV with seta



474-477. *D. variabilis*: 474 - chaetotaxy and localization of pseudocelli on dorsal side of body, 475 - postantennal organ and pseudocelli, 476 - head, chaetotaxy of dorsal side, 477 - abdominal terga IV-VI, chaetotaxy and localization of pseudocelli



478-486. *D. variabilis*: 478 - male ventral organ (juv.), 479 - male ventral organ (adult), 480 - seta in male ventral organ (cross section), 481 - antennal III sense organ, 482 - tubus ventralis, 483 - abdominal sterna I-VI, chaetotaxy, granulation, localization of pseudocelli and parapseudocelli, 484 - claw, 485-486 - tibiotarsus of II pair of legs

p_0 . Abdominal tergum VI with one medial seta (fig. 477). Between legs on pro-, meso- and metathorax no setae. Tubus ventralis subapically with ca. 5+5 setae and without setae at base (fig. 482). Ventral chaetotaxy as in fig. 483.

Claws without lateral teeth and no teeth on inner edge (figs. 484-486). Empodial appendage ca. as long as inner edge of the claw, without basal lamella. Tibiotarsi with symmetrical distal verticil, composed of 9 setae.

Male ventral organ situated on abdominal sterna II and III, fully developed only in mature specimens with ductus ejaculatorius. It consists of 3+3 short, thickened, longitudinally ribbed, sharply pointed, sometimes slightly serrated or forked setae on posterior margin of abdominal sternum II and a group of 5+5 similar setae on anterior margin of abdominal sternum III (fig. 401-403)

BIOLOGY

In Poland *D. variabilis*, lives only in antropogenic habitats. It has been collected in flower pots. Bisexual.

DISTRIBUTION IN POLAND

Lower Silesia.

Orthonychiurus STACH, 1954

Orthonychiurus STACH, 1954, Państw. Wyd. Nauk., Kraków: 26.

Type species: *Onychiurus rectopapillatus* STACH, 1933, by original designation (Described from Poland: Orłowiny near Łagów).

Diagnosis. Body shape cylindrical, more or less broadened in the region of abdominal segments IV-V, without anal spines. Abdominal V and VI segments accreted dorsally. Hind margin of head capsule with pseudocelli. Body with homogenous granulation, with coarser granules on head and terga. Furca reduced to finely granulated area with 1+1 setulae posteriorly. AIIIO usually with 4 short papillae, and smooth straight sensory clubs with ribs. PAO with numerous (10-15), granulated vesicles. Distal verticil of setae on tibiotarsi symmetrical, with 9 setae. Setae sensuales on head and body indistinct. Seta d_0 on head present, abdominal tergum IV with seta p_0 , abdominal tergum VI with 1 medial seta.

KEY TO SPECIES

1. Male ventral organ consists of a 2+2 thickened, short, serrated setae on abdominal II sternum and 2+2 similar setae on abdominal III sternum (fig. 493) *O. stachianus*
- Male ventral organ consists of a 2+2 thickened, short, fluke-like setae on abdominal II sternum and 1+1 similar setae on abdominal III sternum (fig. 501) *O. rectopapillatus*

Orthonychiurus stachianus (BAGNALL, 1939) comb. nov.

Onychiurus stachianus BAGNALL, 1939, Ent. monthly Mag., 75: 101 (pro *O. stachi* DENIS, 1938: 106).

Syn.: *Onychiurus stachi* DENIS, 1938, nec BAGNALL, 1935.

MATERIAL

3 female, 7 juv.; Carpathians, Beskid Średni Mts., Bednarzówka near Maków Podhalański, Poland; gravel bed of the river Skawica; 11. 11. 1993, leg. D. SKARŻYŃSKI, R. J. POMORSKI. 1 female, 3 juv.; Sudetes, Bardzkie Mts., Opolnica, Poland; roots of grass with sand on the bank of river Nysa Kłodzka; 24. 11. 1994, leg. R. J. POMORSKI; 1 male, 12 female, 5 juv.; Sudetes, Bardzkie Mts., Opolnica, Poland; roots of grasses and herbs with sand, under tree bark, on the bank of the river Nysa Kłodzka; 25. 10. 1995, leg. D. SKARŻYŃSKI, R. J. POMORSKI. 1 male; Sudetes, Karkonosze, Podgórzyn, Poland; flood debris of the river Kamienna; 10. 10. 1995, leg. D. SKARŻYŃSKI,

DESCRIPTION

Colour in alcohol white. Length without antennae: males – 1.2-1.3 mm, females – 1.5-1.8 mm. Body shape as in fig. 487, with relatively small VI abdominal segment, dorsally accreted with abdominal tergum V, without anal spines. Antennae approximately as long as head. Furca reduced to small area of fine granulation with 1+1 setulae posteriorly (fig. 492). Granulation more or less uniform, distinct, slightly coarser on terga, head capsule and on subcoxae I. Area antennalis distinct.

Antennal IV segment with subapical organite. Microsensillum on antennal IV segment in latero-external position, distinctly above posterior setae (fig. 489). Antennal III segment with microsensillum slightly below antennal III sense organ. Thoracic terga II and III with microsensilla laterally.

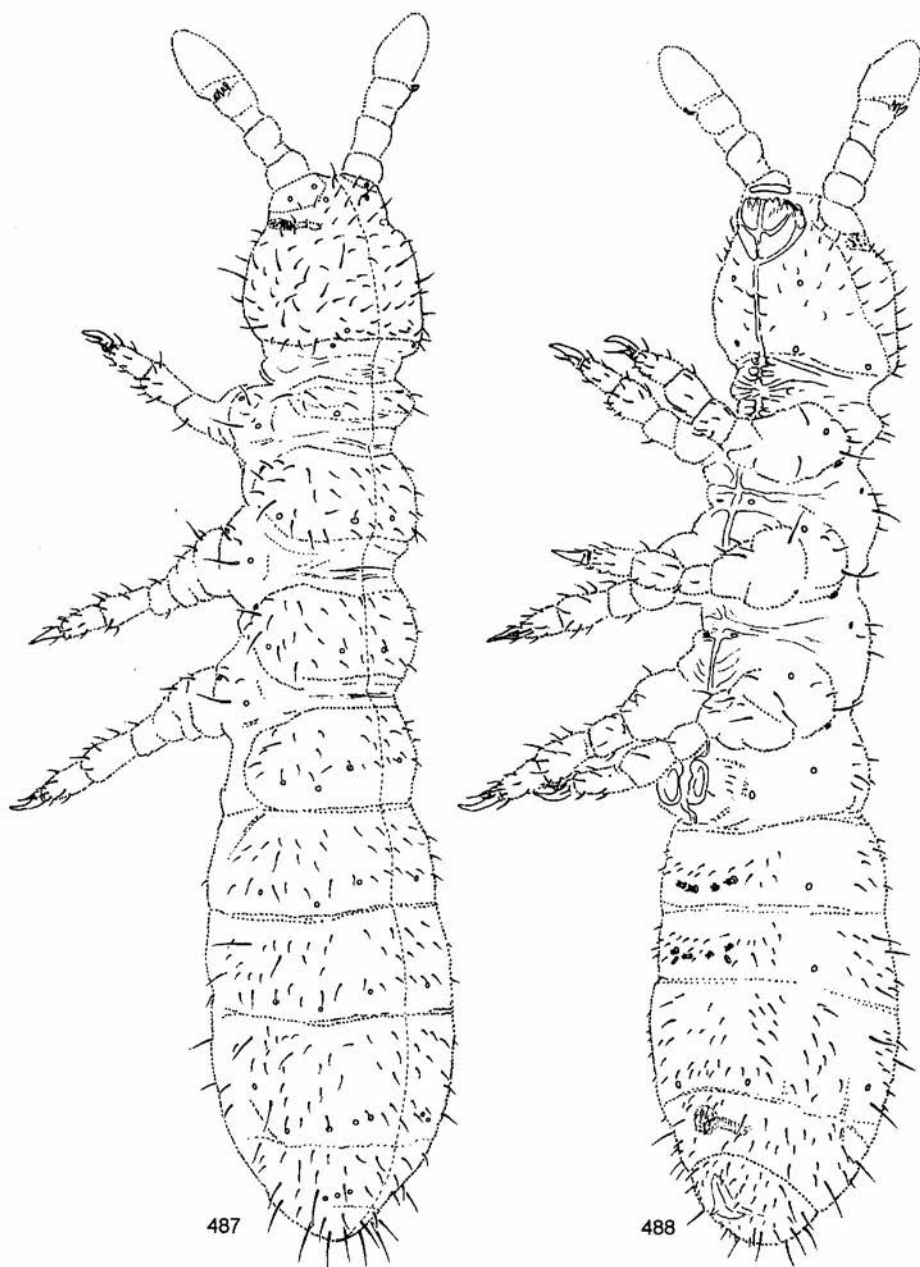
Antennal III sense organ built of 4 papillae, 2 sensory rods, 2 smooth sensory clubs with rib and 5 guard setae (fig. 490).

Postantennal sense organ (PAO) consisting of 11 (10-12) vesicles, covered with secondary bladders (fig. 491)

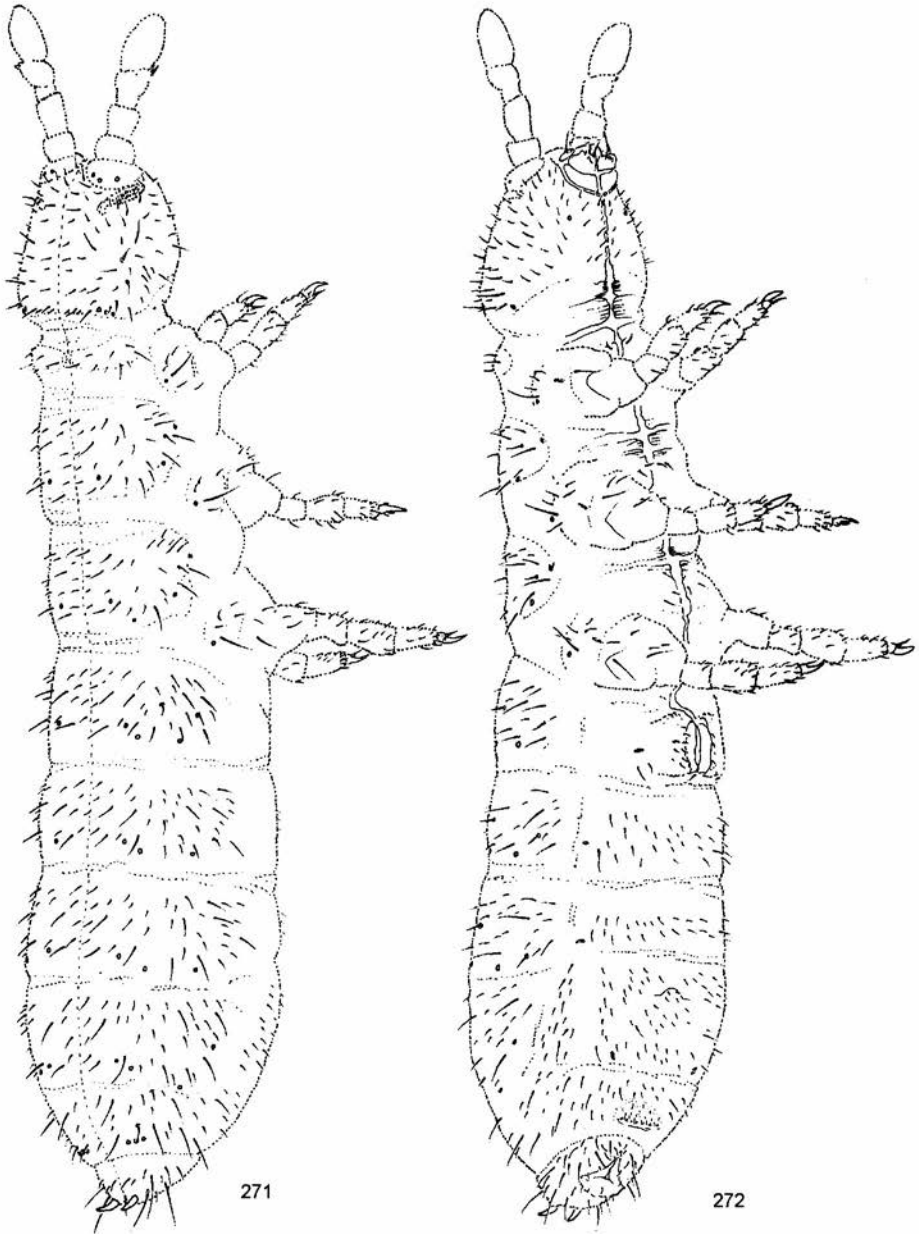
Pseudocellar (pso) formula dorsally: 32/0(1)22/3334(5)2(3); ventrally: 2/011/2111; on subcoxal 2 pseudocelli. Formula of parapseudocelli (psx) ventrally: 0/000/001, all femora ventrally with 1 parapseudocellus. Position of pso and psx is presented in figs. 487, 488.

Dorsal chaetotaxy as in fig. 487, usually symmetrical, well differentiated into macrochaetae and microchaetae only on abdominal terga V and VI. Abdominal tergum IV with seta p_0 . Abdominal tergum VI with one medial seta (fig. 496). Between legs on pro-, meso- and metathorax no setae. Tubus ventralis subapically with ca. 6+6 setae and without setae at base. Ventral chaetotaxy as in fig. 488.

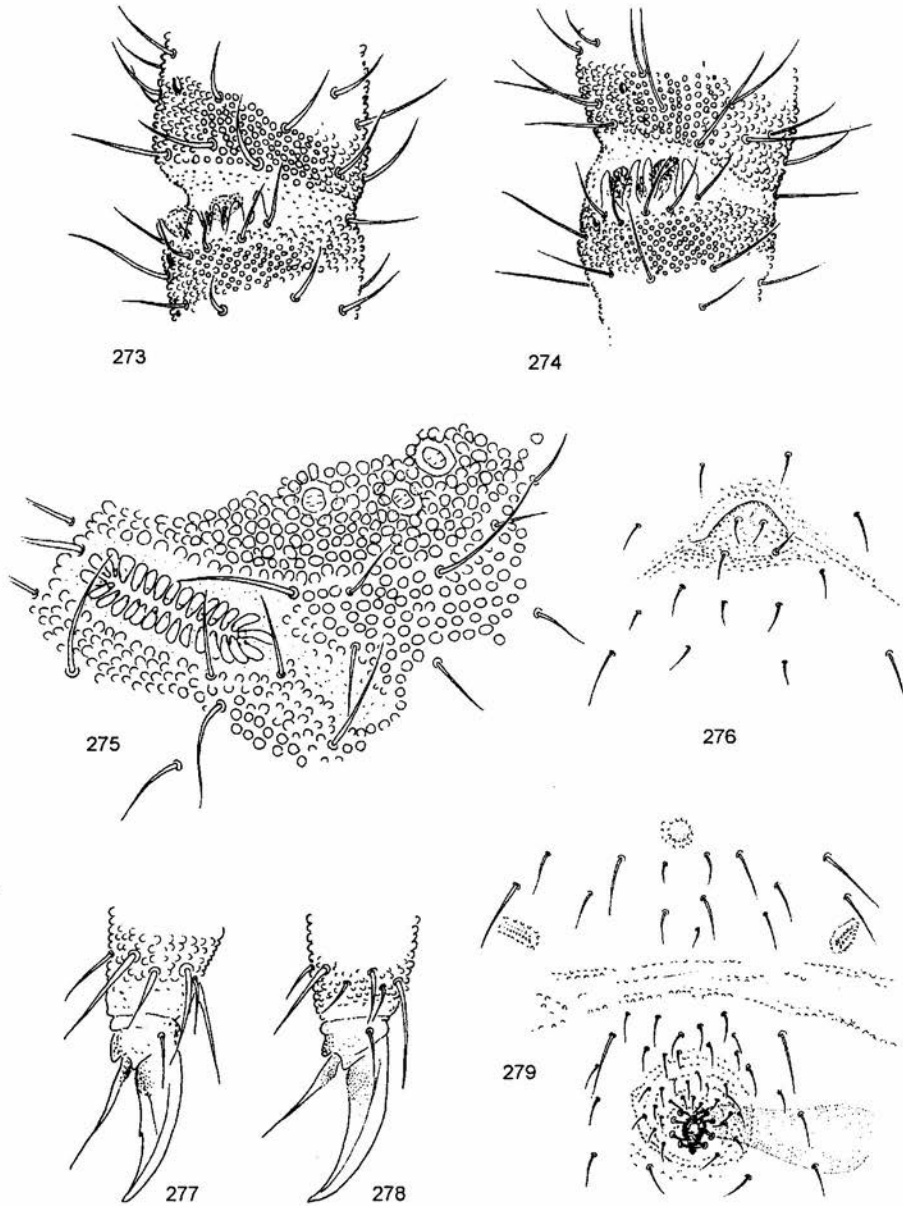
Claws usually without teeth (fig. 420) (in few females on legs a small denticle). Empodial appendage without basal lamella, appendage length equals



487-488. *O. stachianus*: 487 - chaetotaxy and localization of pseudocelli on dorsal side of body, 488 - chaetotaxy and localization of pseudocelli and parapseudocelli on ventral side of body



271-272. *P. armata*: 271 - chaetotaxy and localization of pseudocelli on dorsal side of body, 272 - chaetotaxy and localization of parapseudocelli on ventral side of body



273-279. *P. armata*: 273 - antennal III sense organ (specimen from Sudetes), 274 - antennal III sense organ (specimen from Baltic coast), 275 - postantennal organ and pseudocelli, 276 - remnant of furca, 277 - claw (specimen from Sudetes), 278 - claw (specimen from Baltic coast), 279 - abdominal sterna IV and V, male genital plate, parapseudocelli and pseudoporus

Łupawa river; 27. 04. 1995; leg. R. J. POMORSKI, M. PAKIET. Male, 8 females; Pojezierze Suwalskie lakeland, Puszcza Romnicka, Poland; bank of river Błędzianka, near bridge; 10. 06. 1995; leg. R. J. POMORSKI, M. PAKIET. Female; Wyżyna Lubelska upland, Parchatka near Puławy, Poland; soil with roots of grasses in loess gorge; 8. 07. 1995; leg. R. J. POMORSKI. 2 males, 3 females; Wyżyna Lubelska upland, Dobra near Kazimierz nad Wisłą, nature reserve "Skarpa Dobrska", Poland; soil with roots of grasses in orchard; 9. 07. 1995; leg. R. J. POMORSKI. Numerous spp.; Sudetes, Ślęza Massif, Sulistrowiczki, Poland; oak-pine forest, soil with litter; 23-25. 04. 1996; leg. R. J. POMORSKI. Male, female; Polesie, Poleski National Park, "Durne Bagno", Poland; pine forest near peat bog, soil with roots of grasses and mosses; 12. 06. 1996; leg. R. J. POMORSKI, W. NOWAK. Male, 2 females; Polesie, Wola Wereszczańska, Poleski National Park, Poland; dry meadow, soil with roots of grasses; 12. 06. 1996; leg. R. J. POMORSKI, W. NOWAK. Numerous spp.; Wyżyna Lubelska upland, Roztocze, Roztoczański National Park, Zwierzyniec, "Bukowa Góra", Poland; litter in beech forest; 14. 06. 1996; leg. R. J. POMORSKI, W. NOWAK. 2 females, 1 male; Wyżyna Lubelska upland, Roztocze, Rebizanty, nature reserve "Szumy nad Tanwią", Poland; moss on stones near river Tanew; 17. 06. 1996; leg. R. J. POMORSKI, W. NOWAK.

DESCRIPTION

Colour in alcohol white. Length without antennae:

males 1.2-1.6 mm, females 1.35-1.8 mm (Baltic coast, Słowiński National Park); males 1.5-1.65 mm, females 1.8-2.0 (Sudetes, Ślęza Massif); males 1.9 mm, females 2.1-2.4 mm (Wyżyna Małopolska upland, Wyżyna Krakowsko-Wieluńska, "Jaskinia Pod Skołą Górą" cave); males 2.35 mm, females 2.35-2.7 mm (Carpathians, Beskid Śląski Mts., "Jaskinia Malinowa" cave).

Body shape cylindrical, with strong anal spines set on distinct papillae (fig. 271). Antennae approximately as long as head. Furca reduced to cuticular pocket with 2+2 setulae (fig. 276). Granulation more or less uniform, distinct. Area antennalis well marked.

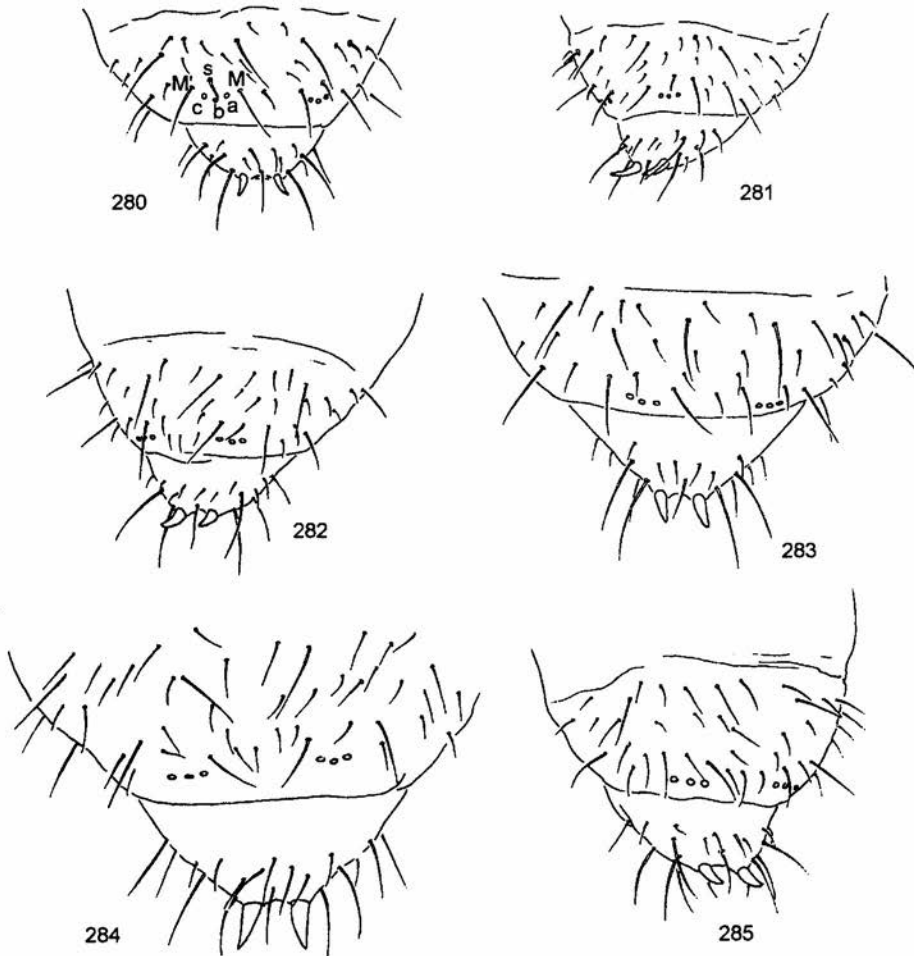
Antennal segment IV with a subapical organite. Microsensillum on antennal segment IV in latero-external position, c.1/3 length from the base. Antennal segment III with microsensillum slightly below antennal III sense organ. Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ built of 5 guard setae, 2 sensory rods, 2 straight and granulated sensory clubs and 5 papillae (figs. 273, 274).

Postantennal sense organ (PAO) consisting of 28-35 simple vesicles (fig. 275).

Pseudocellar (pso) formula dorsally: 33(4)/023/3334(5)3; ventrally: 1/000/00000; subcoxa1 with 1 pseudocellus. Formula of parapseudocelli (psx) ventrally: 1/000/1111(0)01^m. All subcoxa1 with 1 parapseudocellus. Position of pso and psx is presented in figs. 271, 272.

Dorsal chaetotaxy, usually symmetrical, well differentiated into macrochaetae and microchaetae as in fig. 271. Head without seta d_0 . Abdominal tergum V with seta p_0 only, with p_0 and both p_1 setae or with sometimes both p_1 setae only. Abdominal tergum VI usually with 1, or rarely with 2 medial setae. Straight lines, passing through bases of short setae situated above anal spines convergent or subparallel (figs. 280-285). Between legs on pro-, meso- and metathorax 1+1, 2+2 and 2+2(3+3) setae respectively. Tubus ventralis with ca. 8+8 setae and 2+2 setae at base. Ventral abdominal chaetotaxy as in fig. 272.



280-285. *P. armata*, abdominal terga V and VI: 280 - specimen from Bory Tucholskie, 281 - specimen from Słowiński National Park, 282 - specimen from Sudetes, 283 - specimen from Jaskinia Malinowa cave, 284 - specimen from Nowa cave, 285 - specimen from Jaskinia pod Sokolą Górą cave

On claws teeth present or not. Empodial appendage without basal lamella, appendage length equals 3/4 inner edge of the claw. Tibiotarsi with distal verticil, composed of 11 setae (figs. 277, 278).

Male ventral organ absent.

BIOLOGY

P. armata lives in different habitats of all Poland: flowerpots, compost, anthropogenic soil, dry and wet meadow, in litter of different forests. Bisexual.

DISTRIBUTION IN POLAND

Probably all country.

TAXONOMIC REMARKS

From taxonomic point of view *P. armata* is very problematic, because many morphologically different, populations fit GISIN's (1952) diagnosis of this species. As an attempt at solving of this problem I reviewed the following characters in all the investigated material:

- body length of adults,
- differences between adult males and females in body size and proportions,
- presence or absence of p_0 and p_1 setae on abdominal tergum V,
- presence or absence of teeth on claws.

The results are ambiguous, but can be summarized as follows:

- every population is characterized by a constant set of characters,
- the characters in particular population can occur in every combination,
- like in *P. subarmata*, the specimens living in lowlands are usually smaller and differences between males and females in body size are distinct; the specimens living in highlands and mountains, especially in caves, are bigger and differences between males and females in body size are smaller or invisible.

Morphological differences between some Polish populations (for example, from the Baltic coast - S³owiński National Park and Ma³opolska upland - "Jaskinia Pod Sokol¹ Gór¹" cave) can be regarded as specific, however in others region of the country populations are found with intermediate sets of characters. Besides, some specimens, especially from north-eastern Poland, are very similar to *P. subarmata* f. *silesiaca*, because they have prespinal setae arranged subparallelly.

In my opinion, a complete solution of the taxonomic problem of *P. armata*, will be possible only after interpopulation, phenological, and ecological variability is examined. It is possible, that *P. armata*, like Karelian *Protaphorura stogovi* POMORSKI, 1990, undergoes cyclomorphosis (POMORSKI, 1990).

Protaphorura bicampata (GISIN, 1956)

Onychiurus bicampatus GISIN, 1956: 344.

MATERIAL

Numerous spp.; Baltic coast, Słowiński National Park, Rowy, Poland; wet meadow, soil with grass under plank near mouth of Łupawa river to Gardno lake; 25. 04. 1995; leg. R. J. POMORSKI, M. PAKIET. Numerous spp.; Baltic coast, Słowiński National Park, Rowy, Poland; wet meadow near reed zone; 27. 04. 1995; leg. R. J. POMORSKI, M. PAKIET.

DESCRIPTION

Colour in alcohol white. Length without antennae: males 1.75 mm, females 1.8-2.0 mm. Body shape cylindrical, with strong anal spines set on distinct papillae (fig. 286). Antennae approximately as long as head. Furca reduced to cuticular pocket with 2+2 setulae. Granulation more or less uniform, distinct. Area antennalis well marked.

Antennal segment IV with a subapical organite. Microsensillum on antennal segment IV in latero-external position, c.1/3 length from the base. Antennal segment III with microsensillum slightly below antennal III sense organ. Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ built of 5 guard setae, 2 sensory rods, 2 straight and granulated sensory clubs and 5 papillae (fig. 290).

Postantennal sense organ (PAO) consisting of 28-35 simple vesicles (fig. 288).

Pseudocellar (pso) formula dorsally: 33/022/33333; ventrally: 1/000/00000; on subcoxa no pseudocelli. Formula of parapseudocelli (psx) ventrally: 0/000/1100, all subcoxal with 1 parapseudocellus. Position of pso and psx is presented in figs. 286, 287, 289.

Dorsal chaetotaxy, usually symmetrical, well differentiated into macrochaetae and microchaetae as in fig. 289. Head without seta d_0 , abdominal terga I, II, III and V with s' seta (fig. 286), abdominal tergum V with seta p_0 , without p_1 setae, abdominal tergum VI with 1(2) medial seta. Straight lines, passing through bases of short setae situated above anal spines, convergent or subparallel (fig. 292). Between legs on pro-, meso- and metathorax 1+1, 2+2 and 3+3 setae respectively. Tubus ventralis with ca. 8+8 setae and 3+3(2+2) setae at base. Ventral abdominal chaetotaxy as in fig. 287.

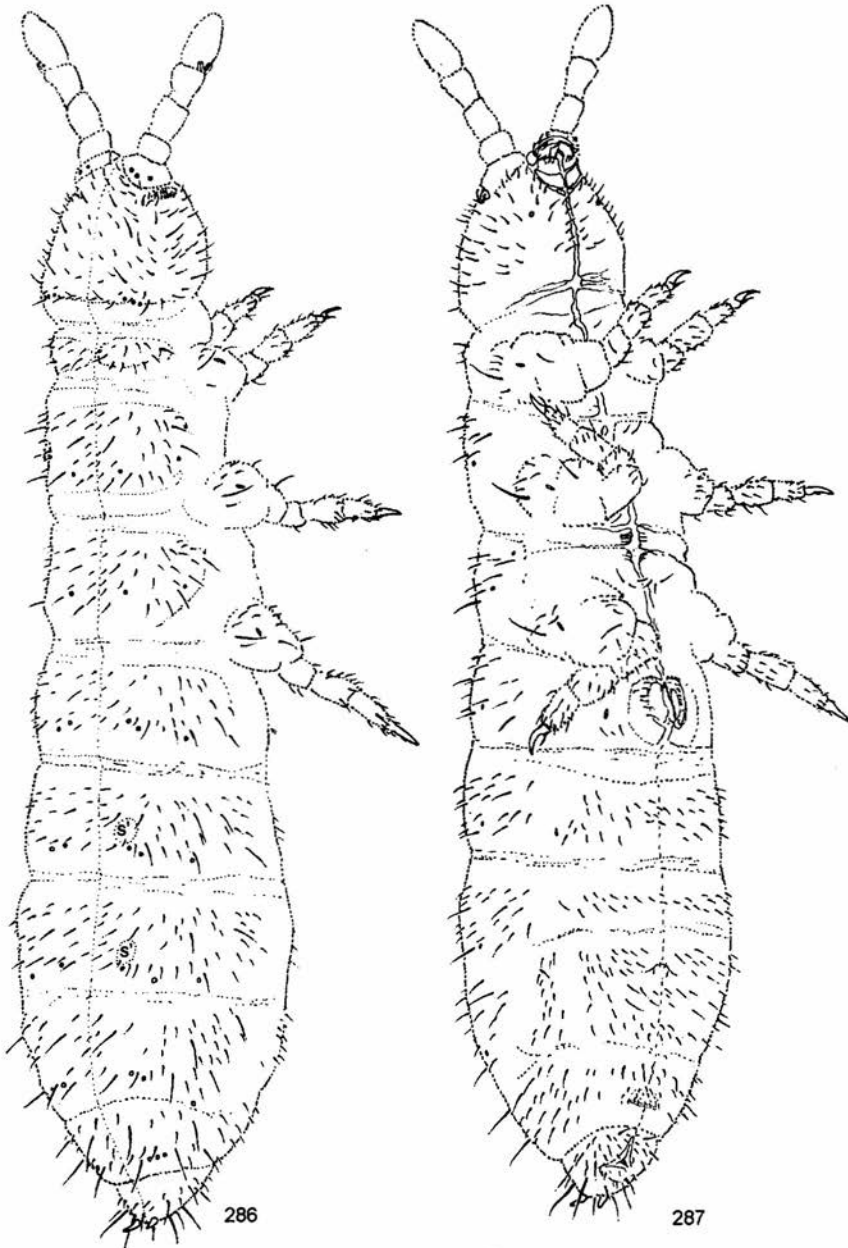
Claws always without teeth. Empodial appendage without basal lamella, appendage length equals 3/4 inner edge of the claw. Tibiotarsi with distal verticil, composed of 11 setae (fig. 293).

Male ventral organ absent.

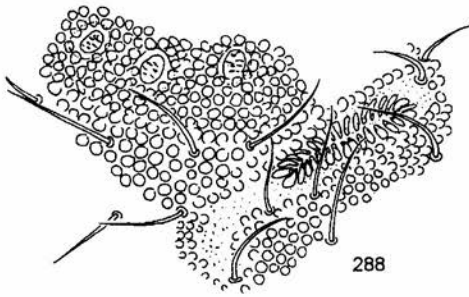
BIOLOGY

P. bicampata is connected with wet meadows and reed beds in brackish zone of Baltic coast. Bisexual.

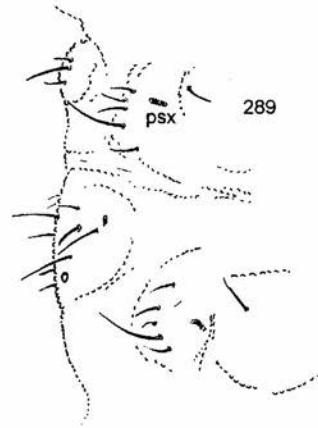
DISTRIBUTION IN POLAND
Baltic coast (species new for Polish fauna).



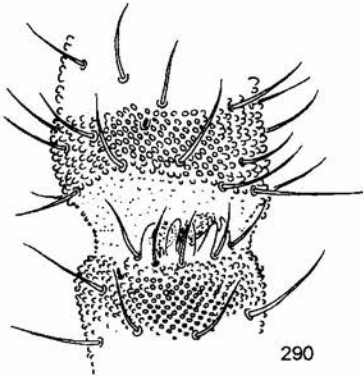
286-287. *P. bicampata*: 286 - chaetotaxy and localization of pseudocelli on dorsal side of body, 287 - chaetotaxy and localization of parapseudocelli on ventral side of body



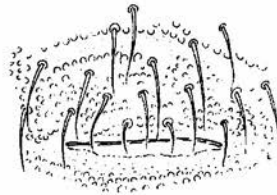
288



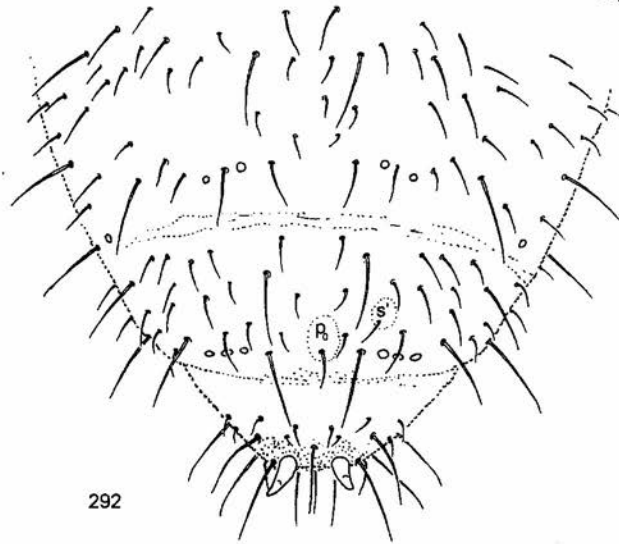
289



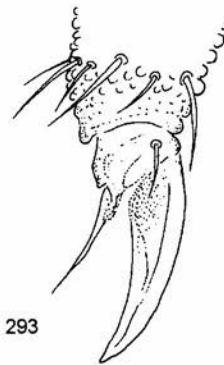
290



291



292



293

288-293. *P. bicampata*: 288 - postantennal organ and pseudocelli, 289 - subcoxal of I and II pair of legs, chetotaxy and localization of parapsudocelli, 290 - antennal III sense organ, 291 - female genital plate, 292 - abdominal terga IV-VI, chetotaxy and localization pseudocelli, 293 - claw

***Protaphorura serbica* (LOKSA et BAGOJEVIC, 1967) status. n., comb. n.**

Onychiurus (Protaphorura) tetragramatus serbicus LOKSA et BAGOJEVIC, 1967: 147.

MATERIAL

6 females, 1 male; Wyżyna Małopolska upland, Młodzawy/Pińczów, Poland; loess scarp, grasses, 121/91; 4. 10. 1991; leg. A. SZEPTYCKI. Numerous spp.; Wyżyna Lubelska upland, Dobra near Kazimierz nad Wisłą, nature reserve "Skarpa Dobrska", Poland; loess gorge, soil with roots of grasses between stones; 9. 07. 1995; leg. R. J. POMORSKI. 2 females; Polesie, Wola Wereszczańska, Poleski National Park, Poland; dry meadow, soil with roots of grasses; 12. 06. 1996; leg. R. J. POMORSKI, W. NOWAK. Numerous spp.; Wyżyna Lubelska upland, Staw, nature reserve "Stawska Góra", Poland; soil with roots of grasses, litter and mosses between stones; 12. 07. 1995; leg. R. J. POMORSKI, W. NOWAK.

DESCRIPTION

Colour in alcohol white. Length without antennae: males 1.2 mm, females 1.4-1.6 mm. Body shape cylindrical, with strong anal spines set on distinct papillae (fig. 294). Antennae approximately as long as head. Furca reduced to cuticular pocket with 2+2 setulae (fig. 298). Granulation more or less uniform, distinct. Area antennalis well marked.

Antennal segment IV with a subapical organite. Microsensillum on antennal segment IV in latero-external position, c.1/3 length from the base. Antennal segment III with microsensillum slightly below antennal III sense organ. Thoracic terga II and III with microsensilla laterally.

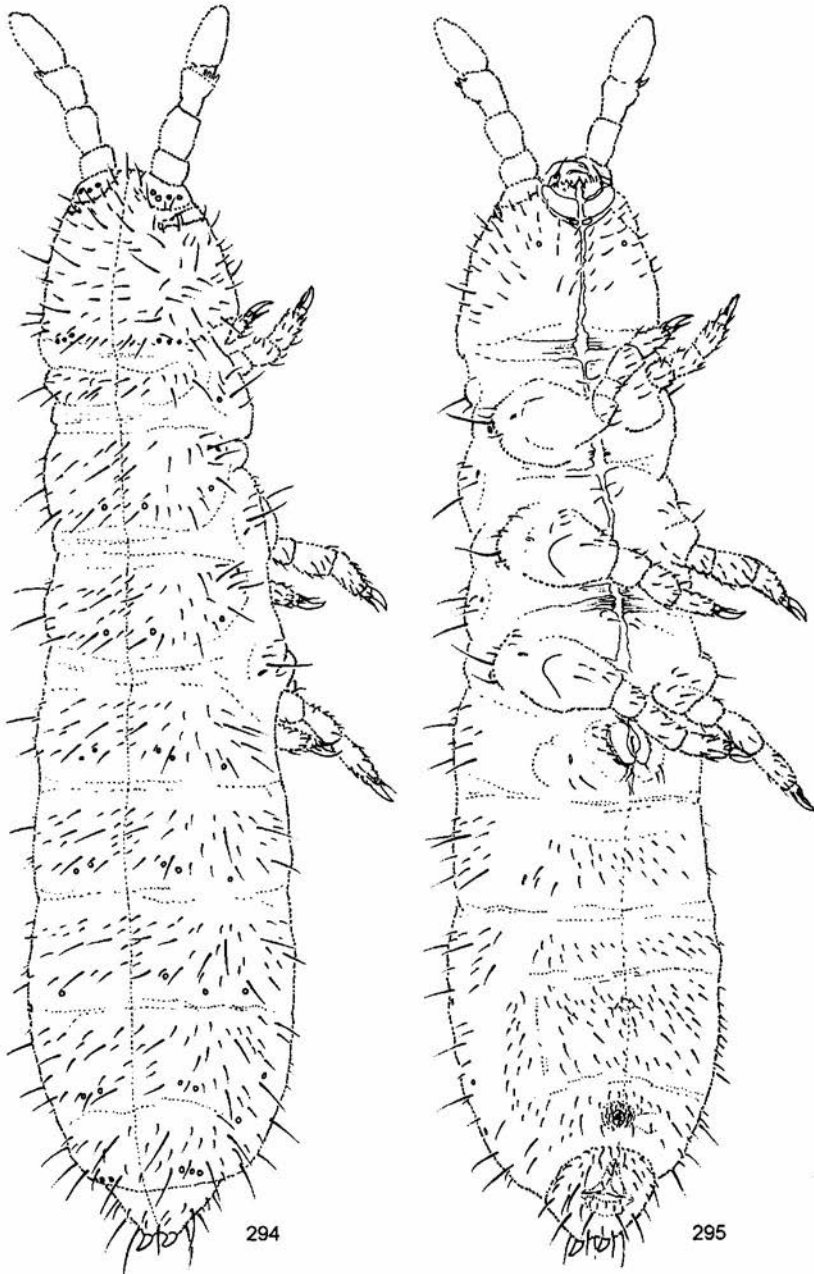
Antennal III sense organ built of 5 guard setae, 2 sensory rods, 2 straight and granulated sensory clubs and 5 papillae (fig. 296).

Postantennal sense organ (PAO) consisting of 30-35 simple vesicles (fig. 297).

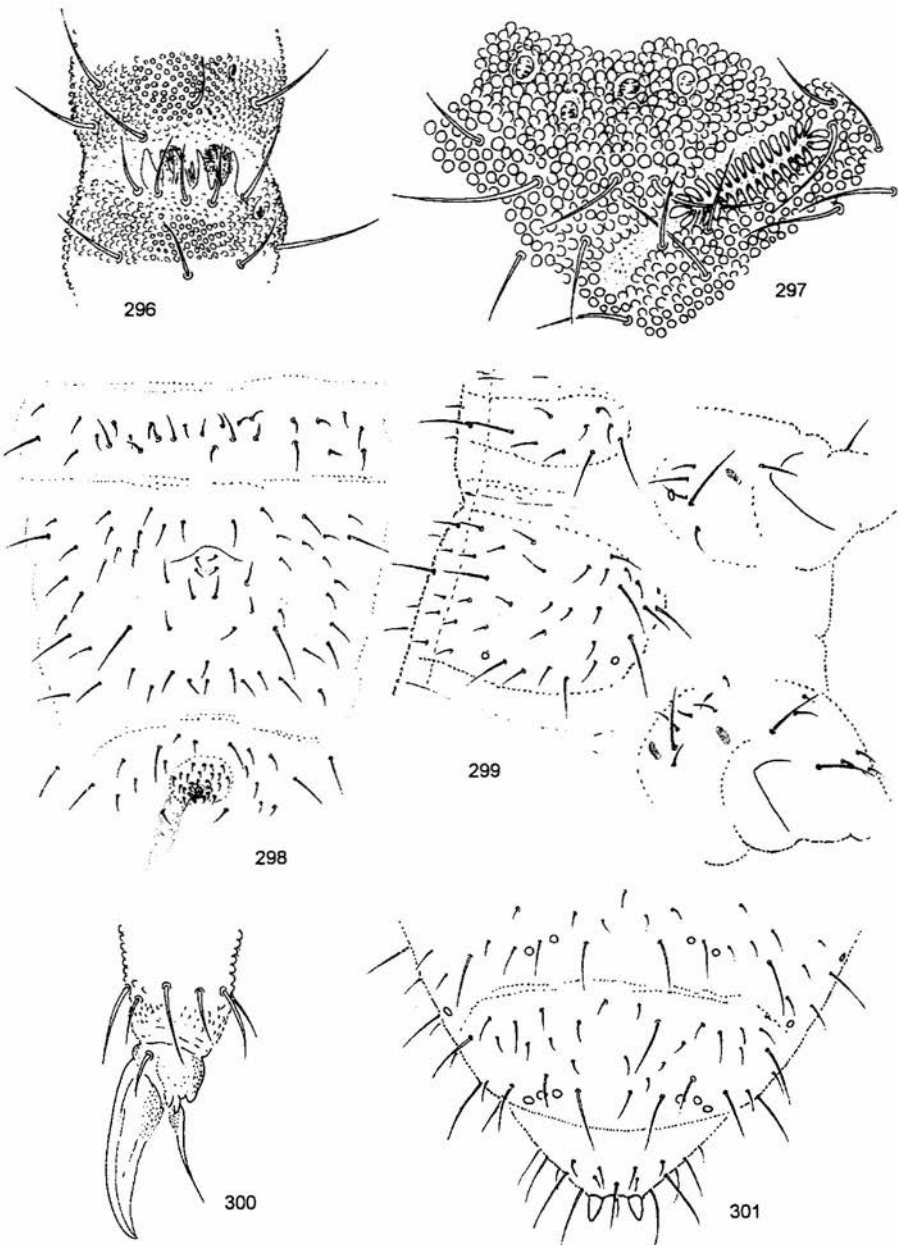
Pseudocellar (pso) formula dorsally: 43/022/33343; ventrally: 1/000/00000; subcoxal 1 of I, II, III pairs of legs with 1, 0, 0 pseudocelli respectively. Formula of parapseudocelli (psx) ventrally: 0/000/1100, subcoxal I, II, III pairs of legs with 1, 2, 2 parapseudocelli respectively. Position of pso and psx is presented in figs. 294, 295, 299.

Dorsal chaetotaxy, usually symmetrical, well differentiated into macrochaetae and microchaetae as in fig. 294. Head without seta d_0 , abdominal tergum V with seta p_0 , without p_1 setae, abdominal tergum VI with 1 medial seta. Straight lines, passing through bases of short setae, situated above anal spines, parallel or subparallel (fig. 301). Between legs on pro-, meso- and metathorax 1+1, 2+2 and 2+2 setae respectively. Tubus ventralis with ca. 8+8 setae and 2+2 setae at base. Ventral abdominal chaetotaxy as in fig. 295.

Claws always without teeth. Empodial appendage without basal lamella, appendage length equals 3/4 inner edge of the claw. Tibiotarsi with distal verticil, composed of 11 setae (fig. 300).



294-295. *P. serbica*: 294 - chaetotaxy and localization of pseudocelli on dorsal side of body, 295 - chaetotaxy and localization of pseudocelli and parapsudocelli on ventral side of body



296-301. *P. serbica*: 296 - antennal III sense organ, 297 - postantennal organ and pseudocelli, 298 - abdominal sterna III-V, remnant of furca, male genital plate, 299 - subcoxa I of I and II pair of legs, chaetotaxy and localization of pseudocelli and parapseudocelli, 300 - claw, 301 - abdominal terga IV-VI, chaetotaxy and localization pseudocelli

The setae located in medial part of abdominal sternum III of adult males are slightly thickened (fig. 298).

BIOLOGY

In Poland *P. serbica* lives only in xerothermic habitats, especially on dry meadows. Bisexual.

DISTRIBUTION IN POLAND

Wyżyna Małopolska upland, Wyżyna Lubelska upland, Polesie.

TAXONOMIC REMARKS

P. serbica together with *P. octopunctata* (TULLBERG 1876), *P. quadriocellata* (GISIN, 1947) and *P. tetragramata* (GISIN, 1961), *P. rectopunctata* BUMACHIU, 1996 belong to the group of *Protaphorura* species with four pseudocelli on area antennalis and 2+2 pseudocelli on thoracic terga II and III. *P. octopunctata* is described on the basis of one specimen from Siberia and still is differently identified. STACH (1934) attempted to solve of this problem, based on material from the Caucasus, but his redescription pertains probably to a different, undescribed species. The taxonomic problem of this species group is still difficult. The Polish material of *Protaphorura* with 4+4 pseudocelli on area antennalis and 2+2 pseudocelli on II and III thoracic terga collected by me, fits the description of *P. serbica*, especially in the absence of pseudocelli on subcoxal II and III pairs of legs. Besides, STACH'S (1964) records of *P. octopunctata* in Poland pertain to probably *P. serbica*.

Protaphorura aurantiaca (RIDLEY, 1880)

Lipura aurantica RIDLEY, 1880: 1.

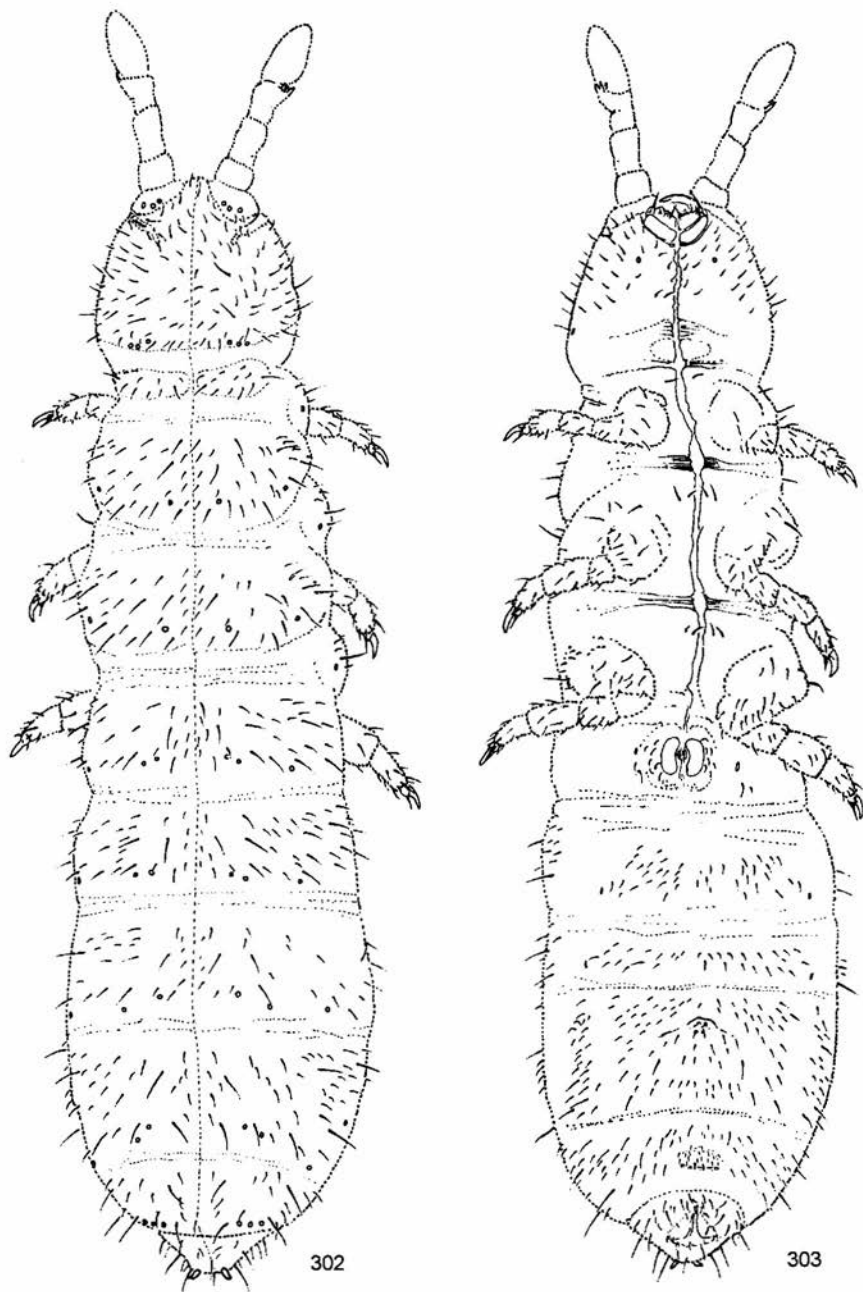
Syn. *Onychiurus flavescens* BAGNALL, 1935: 101 = *Onychiurus flavidulus* BAGNALL, 1937: 94 (PITKIN 1980: 422).

Syn. *Onychiurus magnicornis* BAGNALL, 1937: 88 (PITKIN 1980: 422).

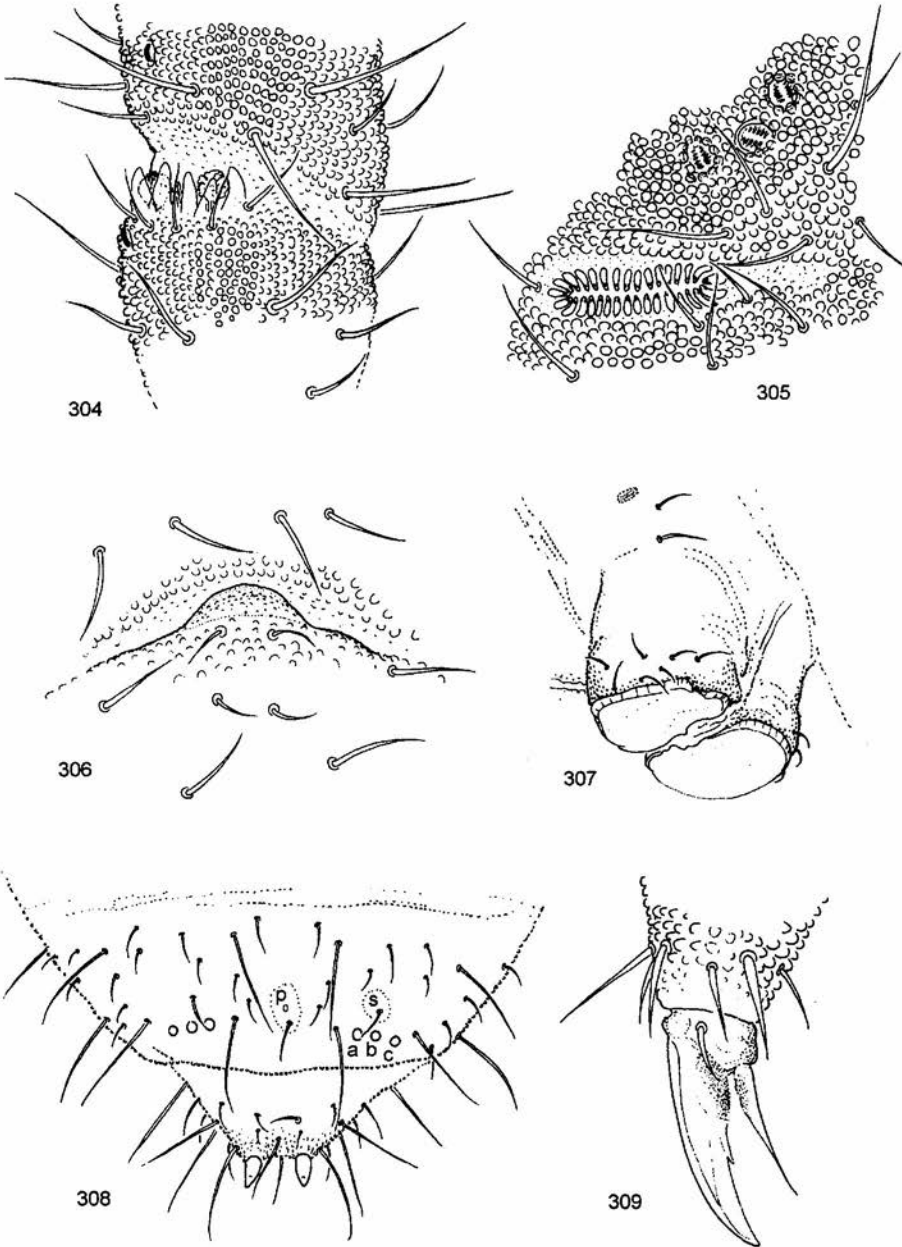
Syn. *Onychiurus latus* GISIN, 1956: 341 (PITKIN 1980: 422)

MATERIAL

Numerous spp.; Sudetes, Góry Bystrzyckie, cave Solna Jama, Domaszków, Poland; soil with litter from bottom of cave; 17. 09. 1984; leg. R. J. POMORSKI. 3 females; Carpathians, Pieniny Mts., Pieniński National Park, Trzy Korony, Poland; litter; 20-21. 09. 1989; leg. R. J. POMORSKI. 1 juv.; Carpathians, Bieszczady, Polańczyk, Poland; litter, beech forest; 1. 08. 1991; leg. D. SKARŻYŃSKI. Female; Sudetes, Śnieżnik Massif, Kletno, nature reserve "Jaskinia Niedźwiedzia", Poland; litter in spruce forest under snow; 16. 03. 1992; leg. R. J. POMORSKI, D. SKARŻYŃSKI. Female; Sudetes, Śnieżnik Massif, Kletno, nature reserve "Torfowisko pod Śnieżnikiem", Poland; rotting spruce trunk; 22. 08. 1992; leg. R. J. POMORSKI.



302-303. *P. aurantiaca*: 302 - chactotaxy and localization of pseudocelli on dorsal side of body, 303 - chactotaxy and localization of parapseudocelli on ventral side of body



304-309. *P. aurantiaca*: 304 - antennal III sense organ, 305 - postantennal organ and pseudocelli, 306 - remnant of furca, 307 - tubus ventralis, 308 - abdominal terga V-VI, chaetotaxy and localization of pseudocelli, 309 - claw

2 subadult males; Kraków-Wieluń upland, Ojców National Park, Poland; under stone near spring in front of "Brama Krakowska"; 15. 10. 1992, leg. R. J. POMORSKI. 2 female; Carpathians, Beskid Średni Mts., Bednarzówka near Maków Podhalański, Poland; gravel bed of the river Skawica; 11. 11. 1993, leg. D. SKARZYŃSKI, R. J. POMORSKI. Numerous spp.; Sudetes, Góry Bystrzyckie, cave Solna Jama, Domaszków, Poland; soil with litter from bottom of cave; 20. 04. 1995; leg. R. J. POMORSKI.

DESCRIPTION

Colour in alcohol yellowish white. Length without antennae: males 1.75-1.9 mm, females 2.2-2.5 mm. Body shape cylindrical, with strong anal spines set on distinct papillae (fig. 302). Antennae approximately as long as head. Furca reduced to cuticular pocket with 2+2 setulae (fig. 306). Granulation more or less uniform, distinct. Area antennalis well marked.

Antennal segment IV with a subapical organite. Microsensillum on antennal segment IV in latero-external position, c.1/3 length from the base. Antennal segment III with microsensillum slightly below antennal III sense organ. Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ built of 5 guard setae, 2 sensory rods, 2 straight and granulated sensory clubs and 5 papillae (fig. 304).

Postantennal sense organ (PAO) consisting of 28-35 simple vesicles (fig. 305).

Pseudocellar (pso) formula dorsally: 33/022/33343; ventrally: 1/000/00000; on subcoxa no pseudocelli. Formula of parapseudocelli (psx) ventrally: 1/000/1110, all subcoxal with 1 pseudocellus and 1 parapseudocellus. Position of pso and psx is presented in figs. 302, 303.

Dorsal chaetotaxy, usually symmetrical, well differentiated into macrochaetae and microchaetae as in fig. 302. Head without seta d_0 , abdominal tergum V with seta p_0 , without p_1 setae, abdominal tergum VI with 1(2) medial seta. Straight lines, passing through bases of short setae situated above anal spines distinctly parallel (fig. 308). Between legs on pro-, meso- and metathorax 1+1, 2+2 and 2+2 setae respectively. Tubus ventralis with ca. 7+7 setae and 2+2 setae at base (fig. 307). Ventral abdominal chaetotaxy as in fig. 303.

Claws always with teeth. Empodial appendage without basal lamella, appendage length equals 3/4 inner edge of the claw. Tibiotarsi with distal verticil, composed of 11 setae (fig. 309).

Male ventral organ absent.

BIOLOGY

Ecological preferences of *P. aurantiaca* are impossible to define precisely. In Poland it lives in mountains and highlands only and probably is connected with rather wet and cool habitats.

DISTRIBUTION IN POLAND

Sudetes, Carpathians, Wyżyna Krakowsko-Wieluńska upland.

Protaphorura fimata (GISIN, 1952)

Onychiurus fimatus GISIN, 1952: 11.

MATERIAL

Numerous spp.; Lower Silesia, Czernica Wrocławska, Poland; compost; 24. 10. 1983; leg. R. J. POMORSKI. Numerous spp.; Lower Silesia, Wrocław, Poland; flower pot; 3. 09. 1992; leg. R. J. POMORSKI. 3 males, 3 females; Sudetes, Wałbrzych Highlands, Pełcznica ravine, Poland; gravel near stream, 5. 10. 1990; leg. D. SKARZYŃSKI. 3 female; Lower Silesia, Wołów, Poland; flower pot; 12. 03. 1991; leg. H. PIETRUSZKA.

DESCRIPTION

Colour in alcohol white. Length without antennae: males 1.8-1.9 mm, females 2.2-2.5 mm. Body shape cylindrical, with strong anal spines set on distinct papillae (fig. 310). Antennae approximately as long as head. Furca reduced to cuticular pocket with 2+2 setulae (figs. 316, 317). Granulation more or less uniform, distinct. Area antennalis well marked.

Antennal segment IV with a subapical organite. Microsensillum on antennal segment IV in latero-external position, c.1/3 length from the base. Antennal segment III with microsensillum slightly below antennal III sense organ. Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ built of 5 guard setae, 2 sensory rods, 2 straight and granulated sensory clubs and 5 papillae (fig. 312).

Postantennal sense organ (PAO) consisting of 25-27 simple vesicles (fig. 313).

Pseudocellar (pso) formula dorsally: 33/022/33333; ventrally: 1/000/00000; all subcoxal with 1 pseudocellus. Formula of parapseudocelli (psx) ventrally: 1/000/110101^m, all subcoxal with 1 parapseudocellus. Position of pso and psx is presented in figs. 310, 311.

Dorsal chaetotaxy, usually symmetrical, well differentiated into macrochaetae and microchaetae as in fig. 310. Head without seta d_0 , abdominal tergum V with seta p_0 , without p_1 setae, abdominal tergum VI with 1(2) medial seta. Straight lines, passing through bases of short setae situated above anal spines, convergent or subparallel (figs. 314, 315). Between legs on pro-, meso- and metathorax 1+1, 2+2 and 2+2 setae respectively. Tubus ventralis with ca. 8+8 setae and 2+2 setae at base. Ventral abdominal chaetotaxy as in fig. 311.

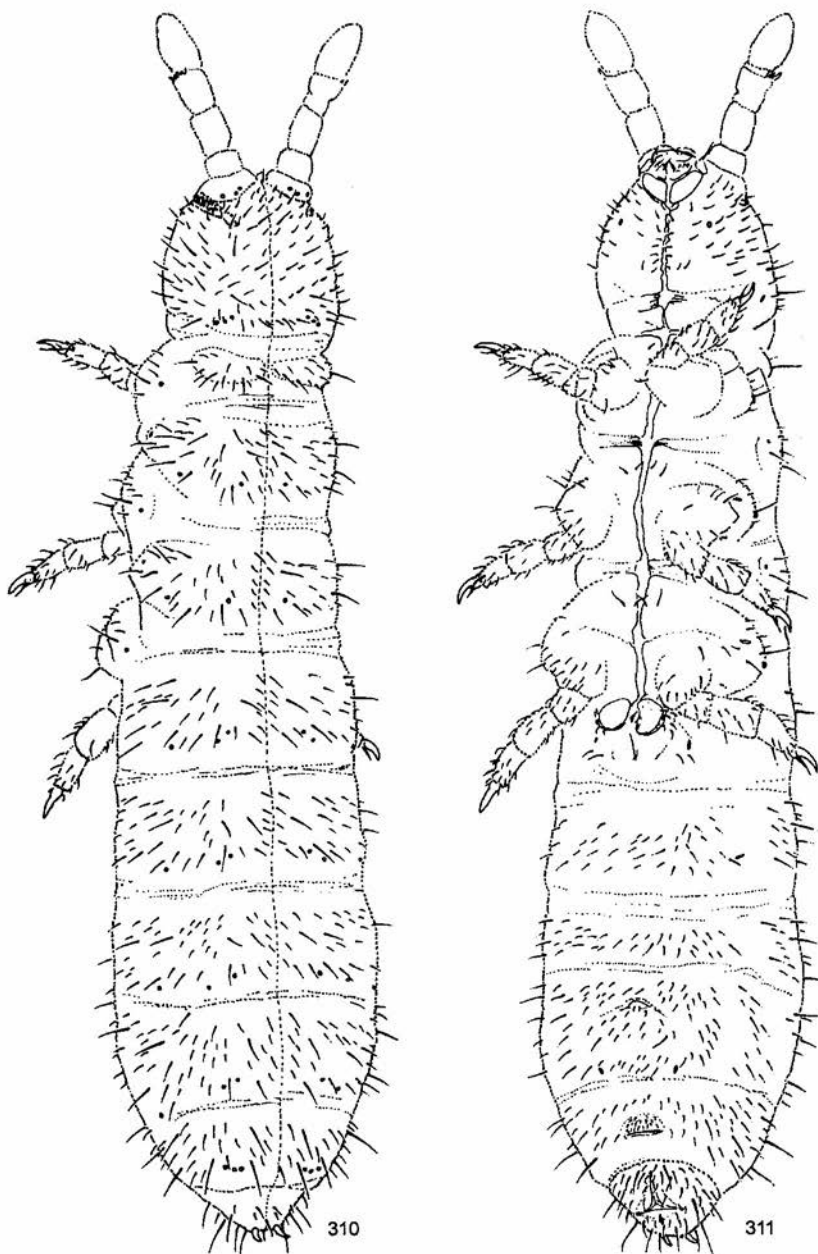
Claws always without teeth. Empodial appendage without basal lamella, appendage length equals 3/4 inner edge of the claw. Tibiotarsi with distal verticil, composed of 11 setae (fig. 318).

Male ventral organ absent.

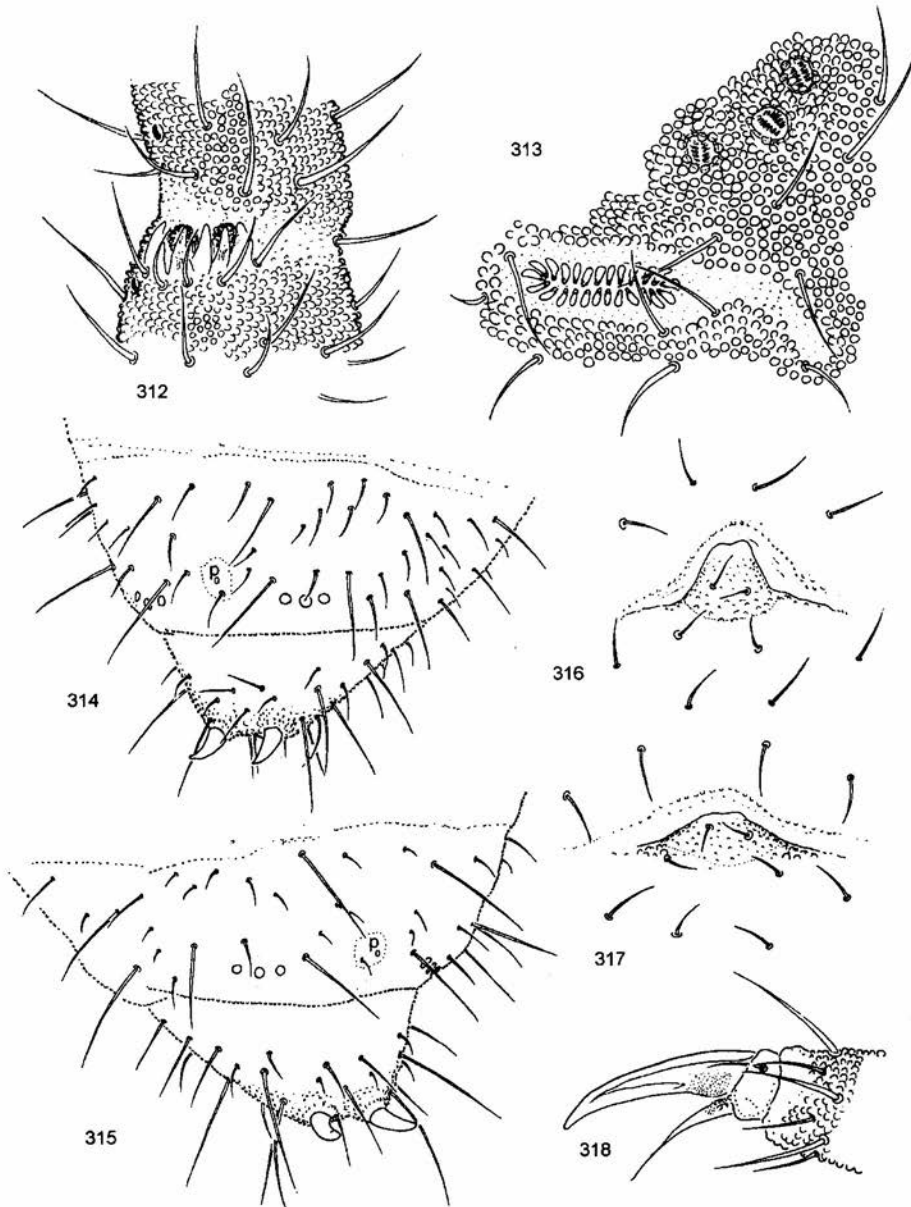
BIOLOGY

In Poland *P. fimata* is connected with antropogenic habitats. Usually it lives in compost and flower pots, rarely it can be found in other conditions. Bisexual.

DISTRIBUTION IN POLAND
Sudetes, Carpathians, Lower Silesia.



310-311. *P. fimata*: 310 - chaetotaxy and localization of pseudocelli on dorsal side of body, 311 - chaetotaxy and localization of parapseudocelli on ventral side of body



312-318. *P. fimata*: 312 - antennal III sense organ, 313 - postantennal organ and pseudocelli, 314 - abdominal terga V-VI, chaetotaxy and localization of pseudocelli (specimen from compost), 315 - abdominal terga V-VI, chaetotaxy and localization of pseudocelli (specimen from flowers pot), 316-317 - different shapes of remnant of furca, 318 - claw

Protaphorura campata (GISIN, 1952)

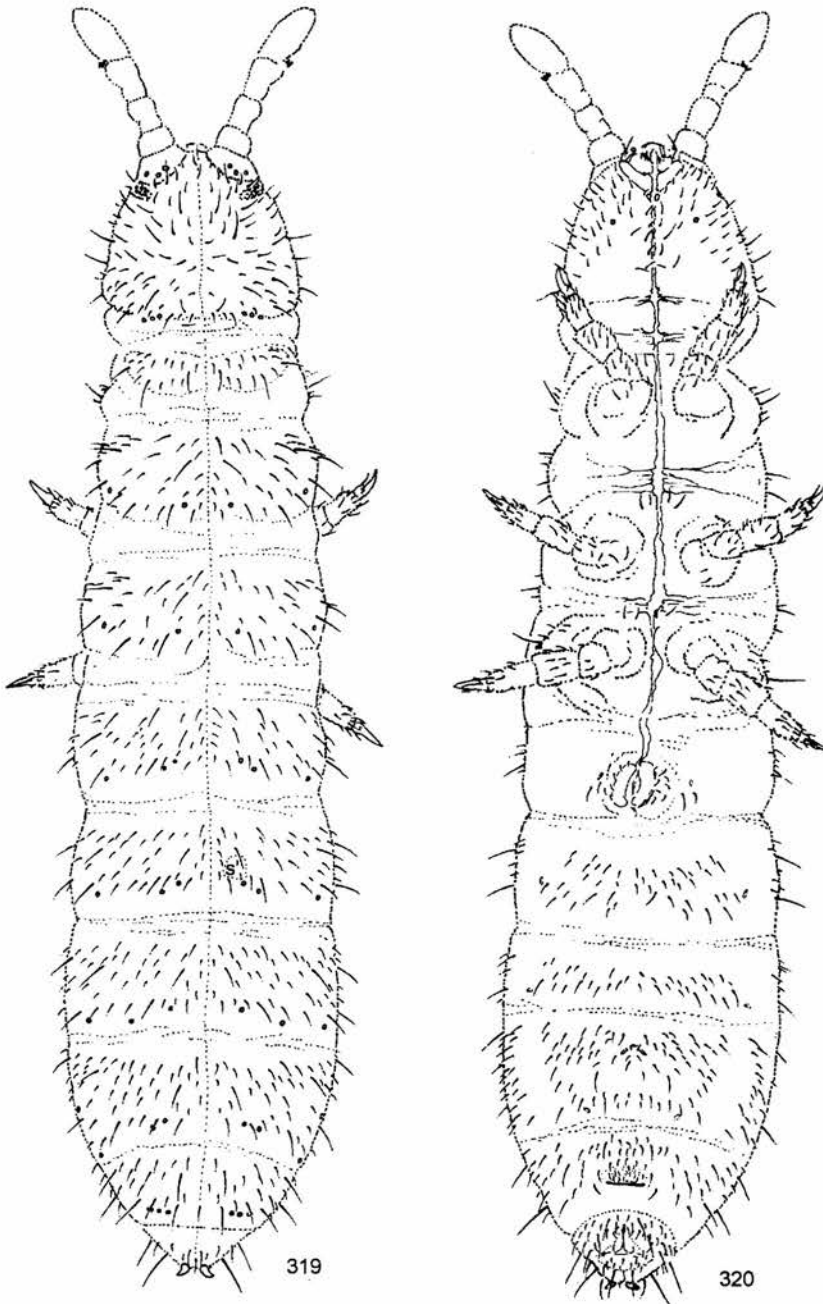
Onychiurus campatus GISIN, 1952: 12.

MATERIAL

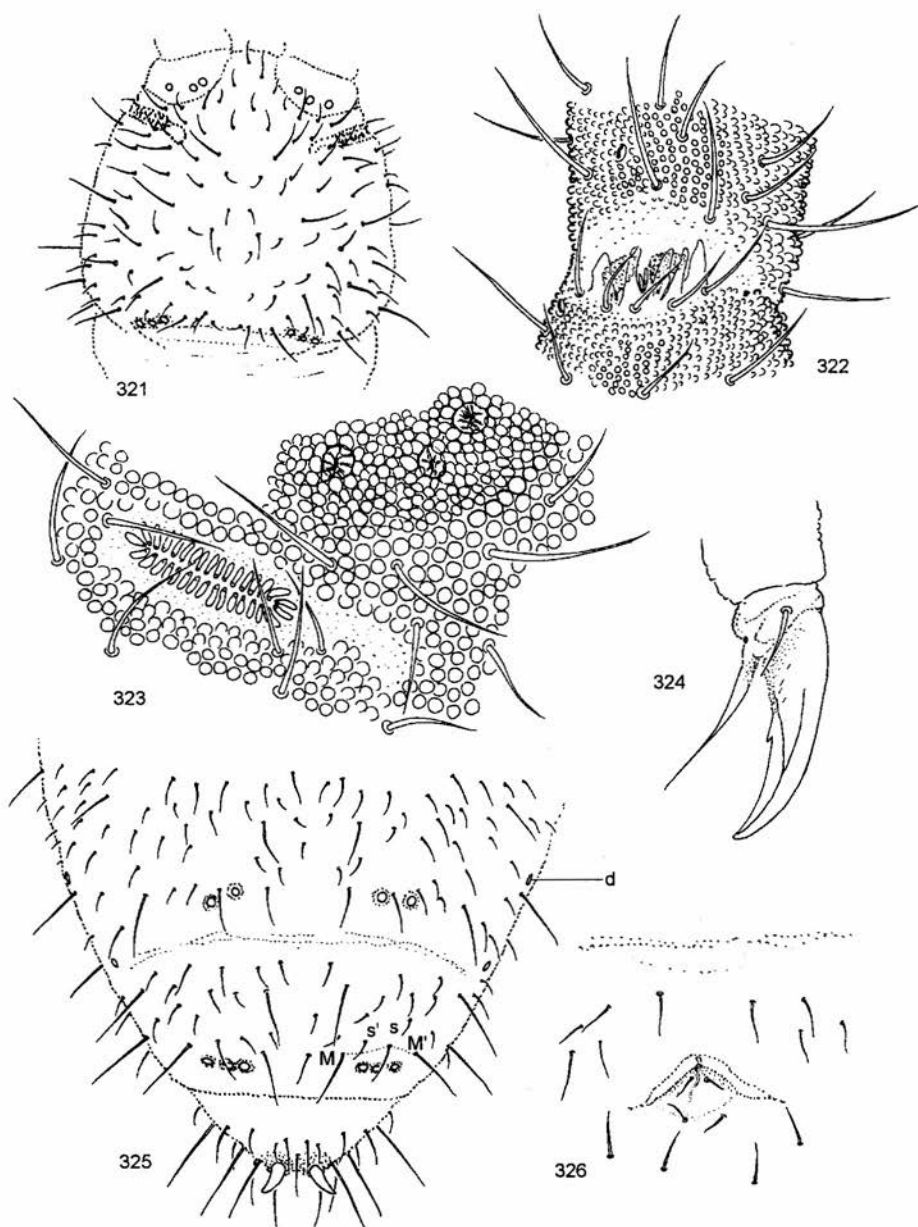
2 males, 4 females, 2 juv.; Sudetes, Karkonosze, Mały Kocioł Śnieżny, Karkonoski National Park, Poland; litter, soil; 16. 06. 1990; leg. D. SKARŻYŃSKI. Female; Sudetes, Śnieżnik Massif, Kletno, Poland; litter and soil in beech forest; 17. 04. 1991; leg. R. J. POMORSKI. Female; Sudetes, Góry Kaczawskie Mts., "Miłek", Poland; moss, litter and soil with roots of grass on limestone rocks in beech forest; 30. 06. 1991; leg. R. J. POMORSKI. Female; Carpathians, Tatra Mts., "Ku Dziurze" valley, Zakopane, Poland; litter with soil; 24. 08. 1991; leg. D. SKARŻYŃSKI. 3 female, 3 males; Carpathians, Tatra Mts., Zakopane - Pod Krokwią, Poland; meadow; 25. 08. 1991; leg. D. SKARŻYŃSKI. Female, 2 males; Carpathians, Tatra Mts., "Ciemniak" valley, Zakopane, Poland; litter in dwarf mountain pine; 27. 08. 1991; leg. D. SKARŻYŃSKI. 3 females, 1 male; Sudetes, Śnieżnik Massif, Stara Morawa, Poland; wet meadow; 17. 06. 1992; leg. R. J. POMORSKI. 2 males subadult.; Kraków-Wieluń upland, Ojców National Park, Ojców, Poland; soil near stream Prądnik; 15. 10. 1992, leg. R. J. POMORSKI. Female, 1 male subadult.; Carpathians, Nowy Targ basin, nature reserve "Przełom Białki", Poland; litter and soil; 11. 11. 1993; leg. D. SKARŻYŃSKI, R. J. POMORSKI. Female, 2 juv.; Kraków-Wieluń upland, Złoty Potok, Poland; soil with humus near stream Wiercica; 24. 05. 1994; leg. R. J. POMORSKI. 3 females; Carpathians, Pieniny Mts., Pieniński National Park, Dolina Ociemnego valley, Poland; litter; 26. 05. 1994; leg. R. J. POMORSKI. 2 juv.; Podlasie, Tonkiele, Poland; soil with roots of grass, near bridge on Bug river; 10. 09. 1994; leg. R. J. POMORSKI. Female; Baltic coast, Słowiński National Park, Rowy, Poland; wet meadow, soil with grass near mouth of Łupawa river to Gardno lake; 27. 04. 1995; leg. R. J. POMORSKI, M. PAKIET. Female; Sudetes, Góry Bystrzyckie, cave Solna Jama, Domaszków, Poland; soil with litter taken from bottom of cave; 20. 04. 1995; leg. R. J. POMORSKI. Numerous spp.; Wyżyna Lubelska upland, Roztocze, Roztoczański National Park, Zwierzyniec, "Bukowa Góra", Poland; litter in beech forest; 14. 06. 1996; leg. R. J. POMORSKI, W. NOWAK. 4 females, 3 males, 1 juv.; Wyżyna Lubelska upland, Roztocze, Rebizanty, nature reserve "Szumy nad Tanwią", Poland; moss on stones near river Tanew; 17. 06. 1996; leg. R. J. POMORSKI, W. NOWAK.

DESCRIPTION

Colour in alcohol white. Length without antennae: males 1.9 mm, females 2.0-2.3 mm. Body shape cylindrical, with strong anal spines set on distinct papillae (fig. 319). Antennae approximately as long as head. Furca reduced to cuticular pocket with 2+2 setulae (fig. 326). Granulation more or less uniform, distinct. Area antennalis very well marked.



319-320. *P. campata*: 319 - chaetotaxy and localization of pseudocelli on dorsal side of body, 320 - chaetotaxy and localization of parapseudocelli on ventral side of body



321-326. *P. campata*: 321 - head, chaetotaxy, 322 - antennal III sense organ, 323 - postantennal organ and pseudocelli, 324 - claw, 325 - abdominal terga V-VI, chaetotaxy and localization of pseudocelli, 326 - remnant of furca

Antennal segment IV with a subapical organite. Microsensillum on antennal segment IV in latero-external position, c.1/3 length from the base. Antennal segment III with microsensillum slightly below antennal III sense organ. Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ built of 5 guard setae, 2 sensory rods, 2 straight and granulated sensory clubs and 5 papillae (fig. 322).

Postantennal sense organ (PAO) consisting of 29-34 simple vesicles (fig. 323).

Pseudocellar (pso) formula dorsally: 33/022/33343; ventrally: 1/000/00000; all subcoxa1 with 1 pseudocellus and parapseudocellus. Formula of parapseudocelli (psx) ventrally: 1/000/111101^m. Position of pso and psx is presented in figs. 319, 320.

Dorsal chaetotaxy, usually symmetrical, well differentiated into macrochaetae and microchaetae as in fig. 319. Head without seta d_0 , abdominal terga I, II, III and V with s' seta, abdominal tergum V with seta p_0 , without p_1 setae, abdominal tergum VI with 1(2) medial seta. Straight lines, passing through bases of short setae situated above anal spines convergent (fig. 325). Between legs on pro-, meso- and metathorax 1+1, 2+2 and 2+2 setae respectively. Tubus ventralis with ca. 8+8 setae and 2+2 (3+3) setae at base. Ventral abdominal chaetotaxy as in fig. 320. Claws always with distinct teeth. Empodial appendage without basal lamella, appendage length equals 5/6 inner edge of the claw (fig. 324). Tibiotarsi with distal verticil, composed of 11 setae.

Male ventral organ absent.

BIOLOGY

Ecological preferences of *P. campata* are impossible to define precisely. In Poland it lives in mountains, uplands, and lowlands and probably is connected with habitats of wet forests. Bisexual.

DISTRIBUTION IN POLAND

Sudetes, Carpathians, Wyżyna Krakowsko-Wieluńska upland, Wyżyna Lubelska upland, Baltic coast, Nizina Mazowiecka lowland.

Protaphorura gisini (HAYBACH, 1960) comb. nov.

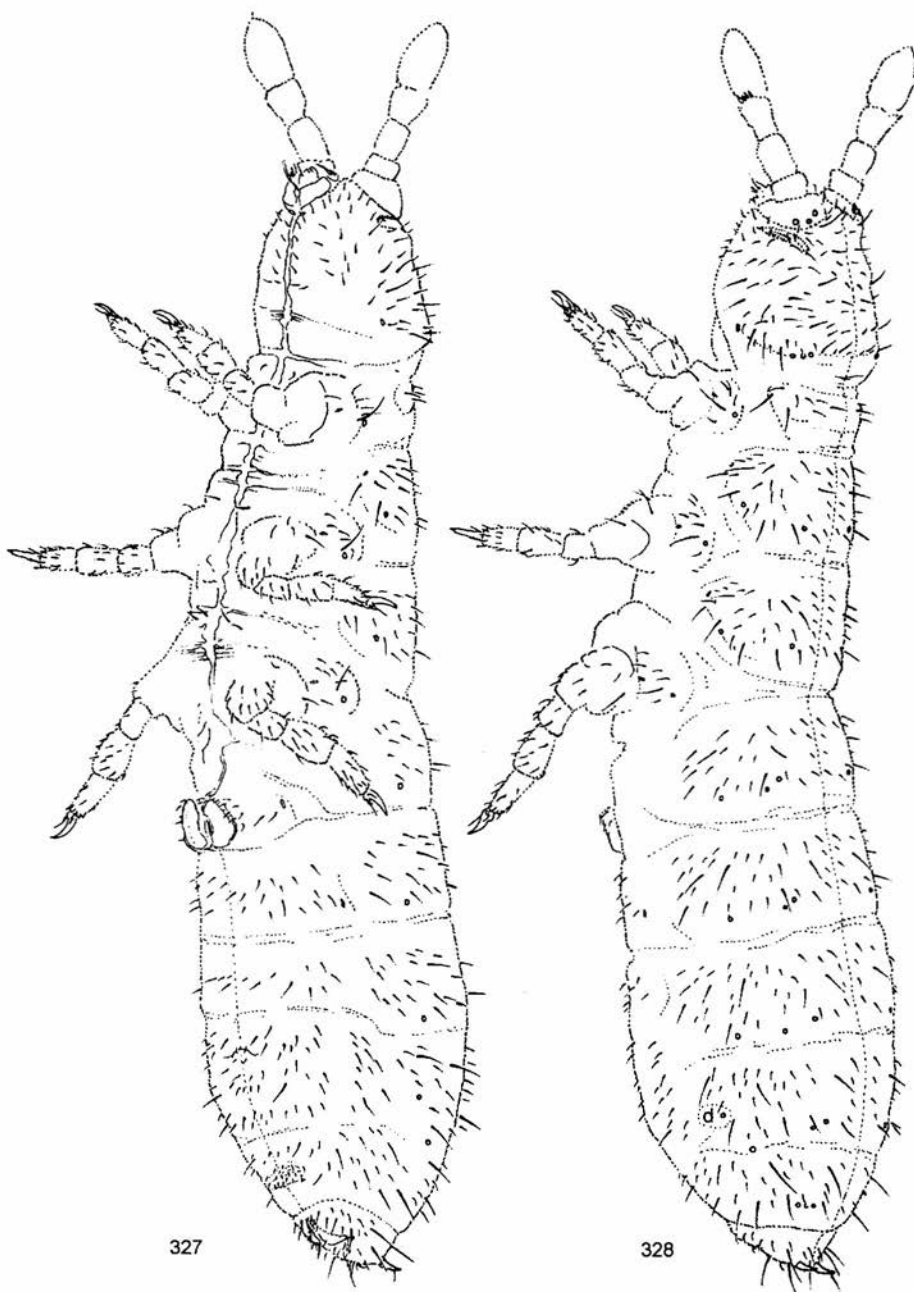
Onychiurus gisini HAYBACH, 1960: 69.

TYPE MATERIAL

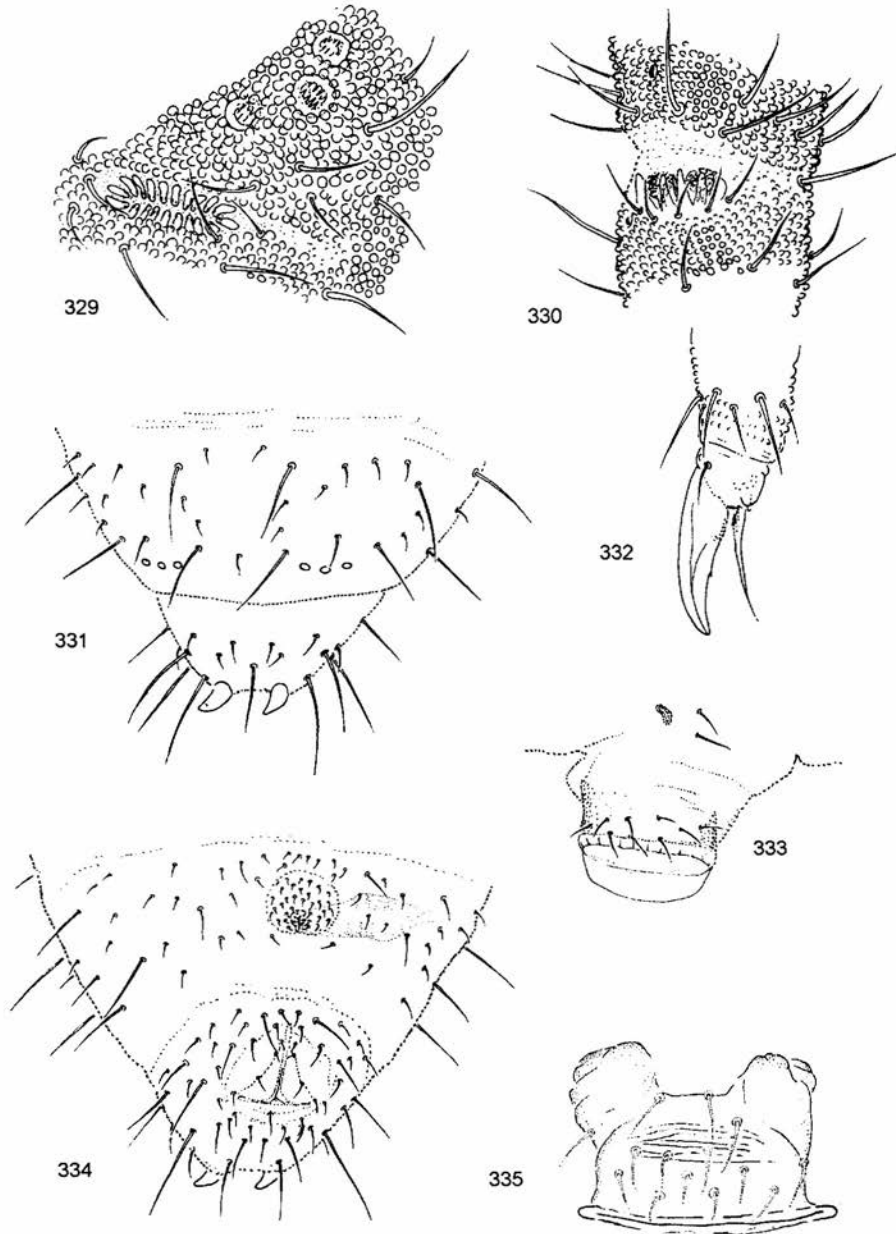
Paratypes: 2 females; Anniger bei Mödling, Austria; terra fusca, beech forest; A I 1959; leg. ?.

OTHER MATERIAL

2 males, 7 females; Polesie, Poleski National Park, kolonia Wola Wereszczańska, Poland; dry meadow; 12. 06. 1996; leg. R. J. POMORSKI, W. NOWAK.



327-328. *P. gisini*: 327 - chaetotaxy and localization of pseudocelli on dorsal side of body, 328 - chaetotaxy and localization of parapseudocelli on ventral side of body



329-336. *P. gisini*: 329 - postantennal organ and pseudocelli, 330 - antennal III sense organ; 331 - abdominal terga V-VI, chaetotaxy and localization of pseudocelli, 332 - claw, 333 - tubus ventralis, 334 - abdominal V-VI sterna, 336 - shape of internal, cuticular structure in adult female

DESCRIPTION

Colour in alcohol white. Length without antennae: males 1.3 mm, females 1.5 mm. Body shape cylindrical, with strong anal spines set on distinct papillae (fig. 327). Antennae approximately as long as head. Furca reduced to cuticular pocket with 2+2 setulae. Granulation more or less uniform, distinct. Area antennalis well marked.

Antennal segment IV with a subapical organite. Microsensillum on antennal segment IV in latero-external position, c.1/3 length from the base. Antennal segment III with microsensillum slightly below antennal III sense organ. Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ built of 5 guard setae, 2 sensory rods, 2 straight and granulated sensory clubs and 5 papillae (fig. 330).

Postantennal sense organ (PAO) consisting of 20-24 simple vesicles (fig. 329).

Pseudocellar (pso) formula dorsally: 33/022/33343; ventrally: 1/000/00000; all subcoxa1 with 1 pseudocellus. Formula of parapseudocelli (psx) ventrally: 1/000/110000 all subcoxa1 with 1 parapseudocellus. Position of pso and psx is presented in figs. 327, 328.

Dorsal chaetotaxy, usually symmetrical, well differentiated into macrochaetae and microchaetae as in fig. 327. Head without seta d_0 , abdominal tergum V with seta p_0 , abdominal tergum VI with 1 medial seta. Straight lines, passing through bases of short setae situated above anal spines, convergent or subparallel (fig. 331). Between legs on pro-, meso- and metathorax 1+1, 1+1 and 2+2 setae respectively. Tubus ventralis with ca. 9+9 setae and 2+2 setae at base (fig. 333). Ventral abdominal chaetotaxy as in fig. 251.

Claws always without teeth. Empodial appendage without basal lamella, appendage as long as claw. Tibiotarsi with distal verticil, composed of 11 setae (fig. 255).

Male ventral organ absent.

BIOLOGY

Ecological preferences of *P. gisini* are impossible to define precisely. Bisexual.

DISTRIBUTION IN POLAND

Polesie (species new for Polish fauna).

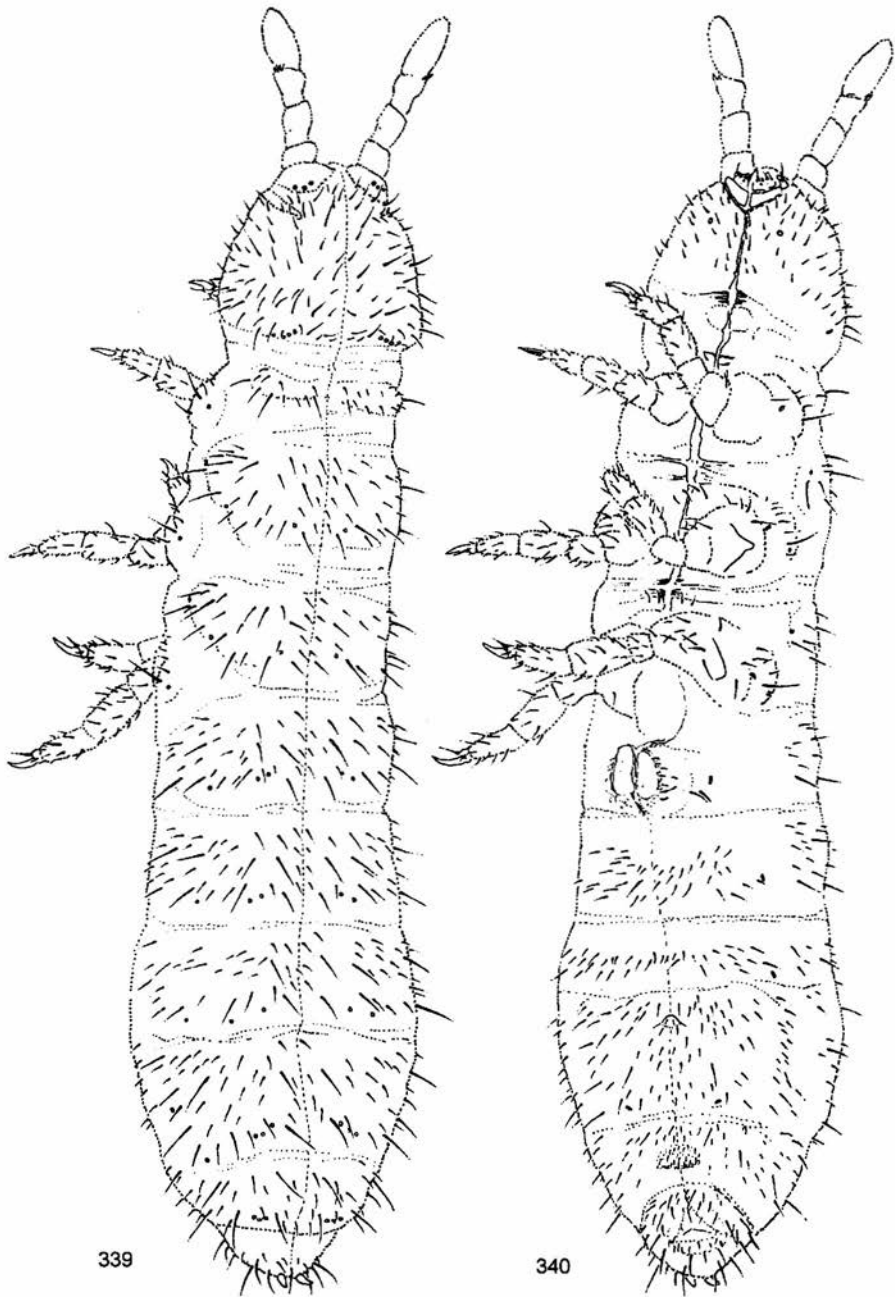
***Protaphorura cancellata* (GISIN, 1956)**

Onychiurus cancellatus GISIN, 1956: 339.

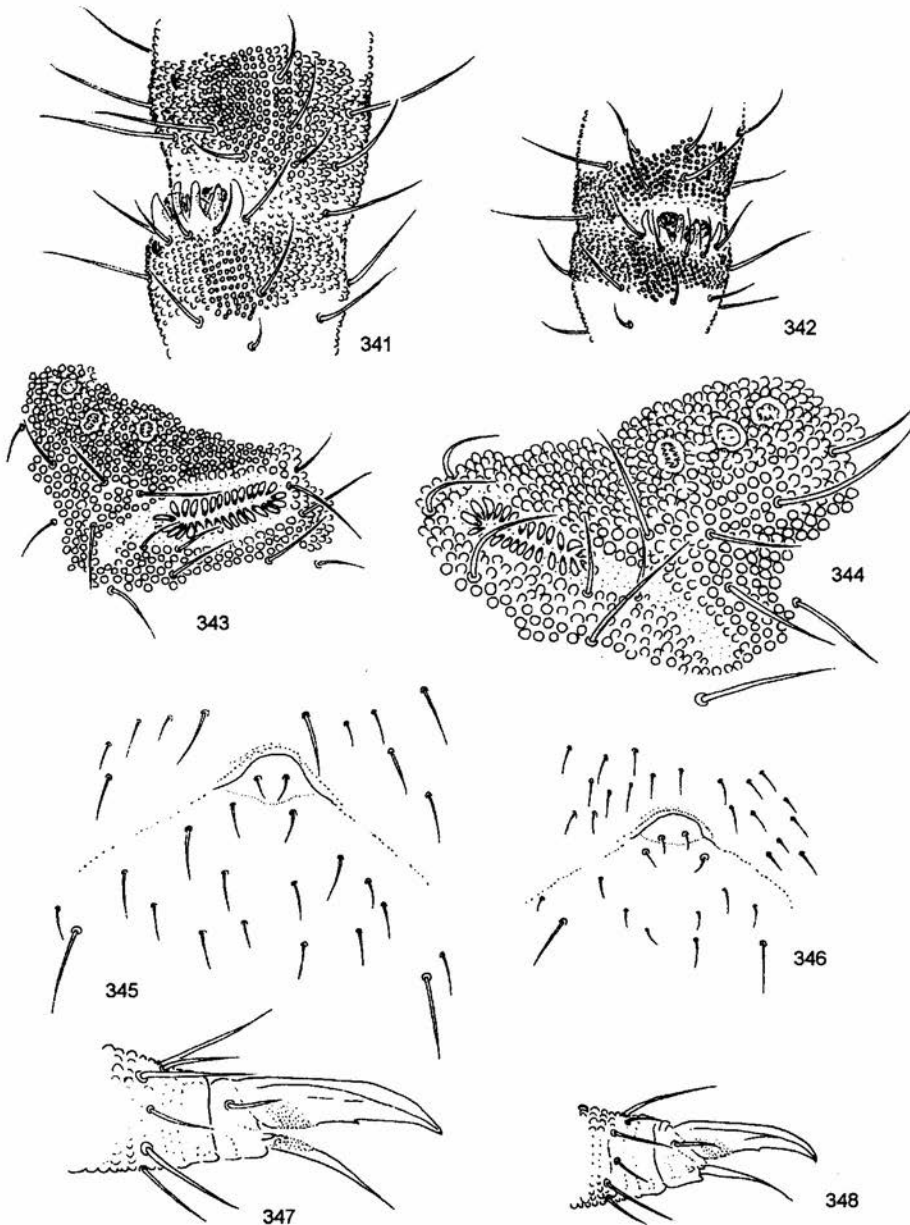
Among the Polish material of *Protaphorura*, I found two populations related to *P. cancellata*. One of them, collected in Pojezierze Pomorskie lakeland, fully fits the description. The other population, from Sudetes, differs in body size and pseudocellar formula.



337-338. *P. cancellata* (specimen from Bory Tucholskie): 337 - chaetotaxy and localization of pseudocelli on dorsal side of body, 338 - chaetotaxy and localization of parapseudocelli on ventral side of body



339-340. *P. cancellata* (specimen from Sudetes): 339 - chaetotaxy and localization of pseudocelli on dorsal side of body, 340 - chaetotaxy and localization of parapseudocelli on ventral side of body



341-348. *P. cancellata*: - 341 - antennal III sense organ (specimen from Sudetes), 342 - antennal III sense organ (specimen from Bory Tucholskie), 343 - postantennal organ and pseudocelli (specimen from Bory Tucholskie), 344 - postantennal organ and pseudocelli (specimen from Sudetes), 345 - remnant of furca (specimen from Sudetes), 346 - remnant of furca (specimen from Bory Tucholskie), 347 - claw (specimen from Sudetes), 348 - claw (specimen from Bory Tucholskie)

MATERIAL

2 males; Pojezierze Pomorskie lakeland, Tleń, nature reserve "Brzęki", Poland; oak-pine forest, soil with litter; 25. 04. 1995; leg. R. J. POMORSKI, M. PAKIET.
3 males, 6 females; Sudetes, Pogórze Izereskie, Złotniki, Poland; moss on rocks; 8. 06. 1994; leg. R. J. POMORSKI.

DESCRIPTION

Colour in alcohol white.

Length without antennae:

Pojezierze Pomorskie - males 1.3 mm, females 1.5 mm (data from literature);

Sudetes - males 1.9 mm, females 2.3-2.4.

Body shape cylindrical, with strong anal spines set on distinct papillae (figs. 337, 339). Antennae approximately as long as head. Furca reduced to cuticular pocket with 2+2 setulae (figs. 345, 346). Granulation more or less uniform, distinct. Area antennalis well marked.

Antennal segment IV with a subapical organite. Microsensillum on antennal segment IV in latero-external position, c.1/3 length from the base. Antennal segment III with microsensillum slightly below antennal III sense organ (figs. 341, 342). Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ built of 5 guard setae, 2 sensory rods, 2 straight and granulated sensory clubs and 5 papillae (figs. 341, 342).

Postantennal sense organ (PAO) consisting of 28-32 simple vesicles (figs. 343, 344).

Pseudocellar (pso) formula dorsally:

Pojezierze Pomorskie - 33/022/33343,

Sudetes - 34(3)/022/3335(4)3,

ventrally: 1/000/00000; all subcoxal with 1 pseudocellus. Formula of parapseudocelli (psx) ventrally: 1/000/111101^m. All subcoxal with 1 pseudocellus and 1 parapseudocellus. Position of pso and psx is presented in figs. 337-340.

Dorsal chaetotaxy, usually symmetrical, well differentiated into macrochaetae and microchaetae. Head without seta d_0 , abdominal tergum V with seta p_0 (specimens from Sudetes with p_1 setae), abdominal tergum VI with 1 medial seta. Straight lines, passing through bases of short setae situated above anal spines, convergent. Between legs on pro-, meso- and metathorax 1+1, 1+1 and 2+2 setae respectively. Tubus ventralis with ca. 8+8 setae and 2+2 setae at base. Ventral abdominal chaetotaxy as in figs. 338, 340.

Claws always with teeth. Empodial appendage without basal lamella, appendage as long as claw. Tibiotarsi with distal verticil, composed of 11 setae (figs. 347, 348).

Male ventral organ absent.

BIOLOGY

Ecological preferences of *P. cancellata* are impossible to define precisely. Bisexual.

DISTRIBUTION IN POLAND

Pojezierze Pomorskie lakeland and Sudetes.

TAXONOMIC REMARKS

Morphological differences between both populations are distinct. Specimens from the Sudetes are bigger and have p_1 setae on abdominal tergum V. Besides, most of them have 4+4 posterior pseudocelli on head and 5+5 pseudocelli on abdominal tergum IV (2 specimens have pseudocellar formula typical for *P. cancellata*). Other important morphological characters are very similar. In the light of taxonomic considerations on *P. armata* and *P. subarmata*, there is no need to distinguish the population from Sudetes as distinct species for the following reasons:

- the material is too poor,
- the knowledge of phenological and ecological variability of this species is insufficient (see Taxonomic remarks on *P. armata*).

***Heteronychiurus* BAGNALL, 1949**

Heteronychiurus BAGNALL, 1949, Ann. Mag. Nat. Hist., 12 (2): 505-506.

Type species: *Onychiurus stiriacus* STACH, 1946, by original designation (described from Austria).

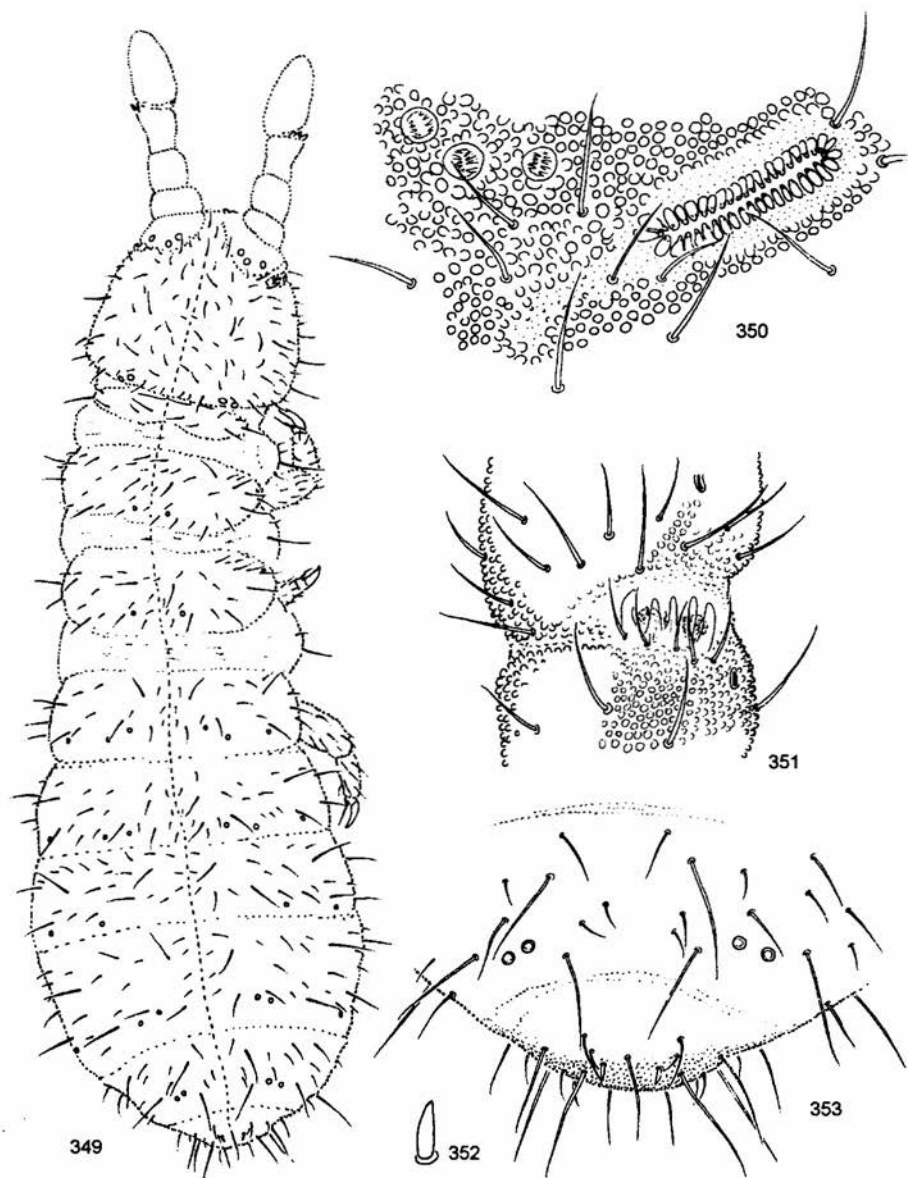
Diagnosis: Hind margin of head capsule with 2 pseudocelli. Body with homogenous granulation. Furca reduced to shallow furrow with 2+2 setulae posteriorly. Abdominal segment VI with small anal spines, located without papillae. AIIIIO with 5 papillae, 5 guard setae and granulated sensory clubs. PAO with numerous simple vesicles, located perpendicularly to the long axis of the organ. Distal veriticol of setae on tibiotarsi symmetrical, with 11 setae. Chaetotaxy of dorsal side well or poorly differentiated into macrochaetae and microchaetae. Setae sensuales on head and body usually invisible. Seta d_0 on head absent, abdominal tergum VI dorsally with 1 medial seta.

***Heteronychiurus januarii* (WEINER, 1977)**

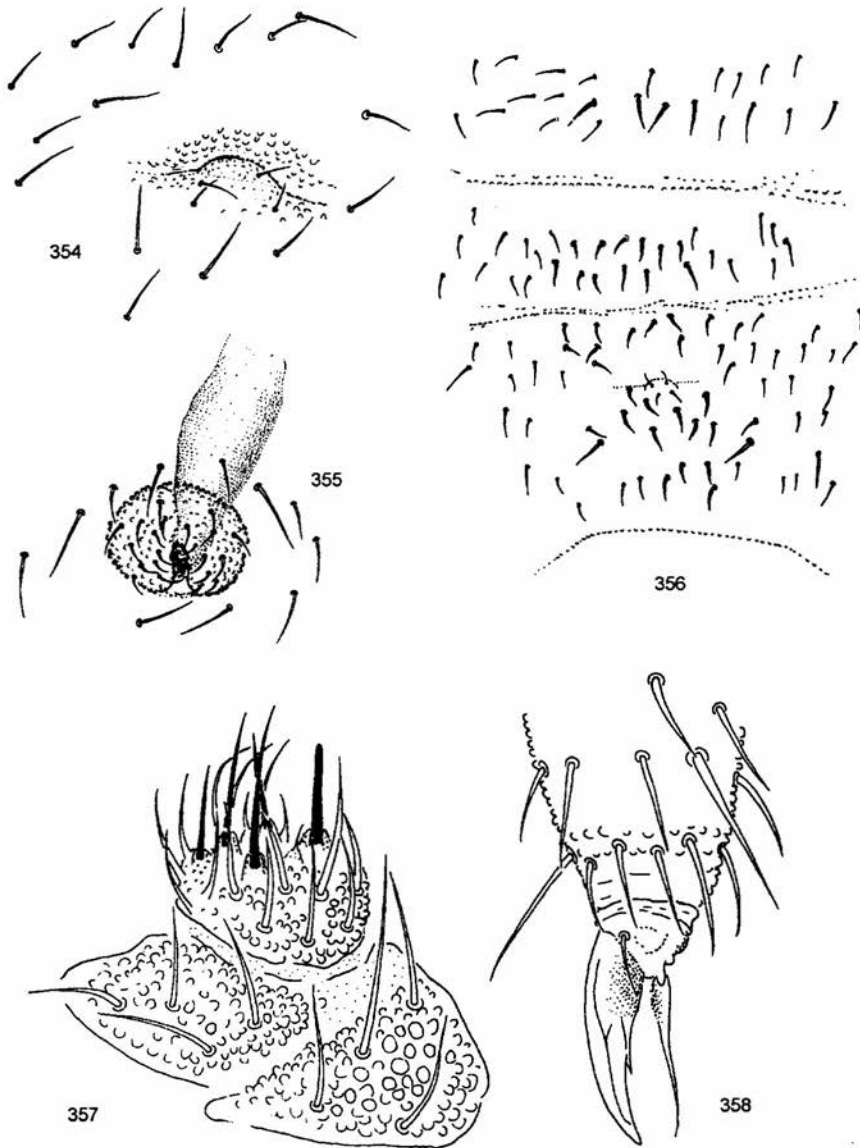
Onychiurus januarii WEINER, 1977: 35.

TYPE MATERIAL

Male paratype; Carpathians, Pieniny Mts., Pieniński National Park, Wielka Dolina, Poland; scrub near meadow; 12. 02. 1972; leg. W. WEINER. Paratypes: 1 females, 1 male subadult., 2 juv.; Carpathians, Pieniny Mts., Pieniński National Park, Polana Wyrobek, Poland; beech forest, litter under snow; 18. 03. 1973; leg. W. WEINER. Paratypes: 3 females; Carpathians, Pieniny Mts., Pieniński National Park, Polana Wyrobek, Poland; beech forest, litter and rotten sticks; 9. 02. 1975; leg. W. WEINER.



349-353. *H. jamaarii*: 349 - chaetotaxy and localization of pseudocelli on dorsal side of body, 350 - postantennal organ and pseudocelli, 351 - antennal III sense organ, 352 - anal spine, 353 - abdominal terga V-VI, chaetotaxy and localization of pseudocelli



354-358. *H. januarii*: 354 - remnant of furca, 355 - male genital plate with ductus ejaculatorius, 356 - abdominal sternae II-IV, male ventral organ, 357 - labium, 358 - claw

DESCRIPTION

Colour in alcohol white. Length without antennae: males 1.4 mm, females 1.7-1.9 mm. Body shape cylindrical, distinctly broadened in region of abdominal segments II-V, with fine, small anal spines set without papillae (fig. 349). Antennae approximately as long as head. Furca reduced to shallow furrow with 2+2 setae below (fig. 354). Granulation more or less uniform, distinct. Area antennalis well marked.

Antennal segment IV with a subapical organite. Microsensillum on antennal segment IV in latero-external position, c.1/3 length from the base. Antennal segment III with microsensillum slightly below antennal III sense organ. Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ built of 5 guard setae, 2 sensory rods, 2 straight and granulated sensory clubs and 5 papillae (fig. 351).

Postantennal sense organ (PAO) consisting of 35-44 simple vesicles (fig. 350).

Pseudocellar (pso) formula dorsally: 32(3)/011/23232; ventrally and on subcoxa no pseudocelli. Parapseudocelli invisible. Position of pso is presented in fig. 349.

Dorsal chaetotaxy, usually asymmetrical, well differentiated into macrochaetae and microchaetae as in fig. 349. The setae relatively long. Head without seta d_0 , abdominal tergum V without medial setae, abdominal tergum VI with one medial seta (fig. 353). Between legs on meso- and metathorax 1+1 setae. Tubus ventralis with ca. 6+6 setae and 1+1 setae at base.

Claws always with teeth. Empodial appendage without basal lamella, as long as claw. Tibiotarsi with distal verticil, composed of 11 setae (fig. 358).

Male ventral organ situated on abdominal sterna II, III, and IV, fully developed only in mature specimens with ductus ejaculatorius. It consists of 2+2 thickened, sharply pointed setae on abdominal sternum III, group of similar setae (ca. 10-12), located in medial part of sternum III and ca. 16 similar setae arranged around remnant of furca on sternum IV (fig. 356).

BIOLOGY

Ecological preferences of *H. januarii* are unknown. It was collected in Poland in early spring in Pieniny Mts. only. Bisexual.

DISTRIBUTION IN POLAND

Carpathians – Pieniny Mts.

***Thalassaphorurini* tribus nov.**

Type genus: *Thalassaphorura* BAGNALL, 1949, Ann. Mag. Nat. Hist., 12 (2): 503.

Hind margin of head capsule with pseudocelli, thoracic II-III and abdominal I-V with dorsomedial and lateral pseudocelli. Antennal IV segment with distinct

2 sensilla, dorsal-subapical and internal-subbasal. PAO with granulated, multilobed or simple vesicles. Granulation fine, homogenous, sometimes slightly coarser around pseudocelli at bases of antennae and IV-V abdominal terga. Anal spines absent or present. Furca reduced to finely granulated area with 2+2 setulae posteriorly arranged in two rows. Distal veriticil of setae on tibiotarsi with 7, 9 or 11 setae. Setae sensuales on head and body usually well marked. Seta d_0 on head usually present.

TAXONOMIC REMARKS

The new tribe comprises taxa belonging to a doubtless phylogenetically distinct lineage, characterized by the structure of remnant of furca and usually well or very well marked setae sensuales on antennae and body.

KEY TO GENERA OF *THALASSAPHORURINI*

1. Distal veriticil of setae on tibiotarsi, with 7 setae (fig. 35), vesicles in postantennal organ compound 2.
- Distal veriticil of setae on tibiotarsi, with 9 setae (fig. 34), vesicles in postantennal organ simple *Thalassaphorura*
- Distal veriticil of setae on tibiotarsi, with 11 setae (fig. 33), vesicles in postantennal organ compound *Detriturus* **gen. n.**
2. Anal spines present *Tantulonychiurus*
- Anal spines absent *Agraphorura* **gen. n.**

Thalassaphorura BAGNALL, 1949

Thalassaphorura BAGNALL, 1949, Ann. Mag. Nat. Hist., 12 (2): 503.

Syn. *Handschiniella* BAGNALL, 1949, Ann. Mag. Nat. Hist., 12 (2): 504-505.

Syn. *Onychiurus* (*Parthenaphorura*) YOSHII & SUHARDJONO 1989, Acta zool., Asia orient., 1: 31

Syn. *Allaphorura* BAGNALL, 1949, Ann. Mag. Nat. Hist., 12 (2): 504.

Type species: *Onychiurus thalassophilus* BAGNALL, 1949, by original designation.

Diagnosis. Body shape cylindrical, with anal spines, spiniform setae or normal setae. Hind margin of head capsule with pseudocelli. Body usually with homogenous granulation, rarely with coarser granules on head and terga. Area antennalis distinct or invisible. Furca reduced to finely granulated area with 2+2 setulae posteriorly arranged in two rows. Antennal IV segment with a subapical organite and 2 sensilla, dorsal-subapical and internal-subbasal. AIIIIO with 5 papilla, 5 guard setae and smooth, straight sensory clubs. PAO with numerous, simple vesicles arranged perpendicularly to the long axis of the organ. Distal

veriticol of setae on tibiotarsi symmetrical, with 9 setae. Small species with very well differentiated setae sensuales on head and body. Setae sensuales of bigger species indistinct or invisible. Seta d_0 on head present, abdominal terga IV and VI usually with setae m_0 . Abdominal tergum VI with 1 or 2 medial setae.

KEY TO SPECIES

1. Thoracic tergum I of adults with 7 setae *T. encarpata*
 -. Thoracic tergum I of adults with 5 setae *T. zschokkei*

***Thalassaphorura encarpata* (DENIS, 1931)**

Onychiurus encarpatus DENIS, 1931: 102.

Syn. *Onychiurus hortensis* GISIN, 1949: 398.

Syn. *Onychiurus parthenogeneticus* CHOUDHURI, 1958: 155.

MATERIAL

Numerous spp.; Nizina Śląska lowland, Wrocław, Zoological Institute, Poland; in flower pot; 20. 09. 1988; leg. R. J. POMORSKI. Numerous spp.; Nizina Śląska lowland, Wrocław, botanical garden, Poland; compost; 20. 09. 1988; leg. R. J. POMORSKI. 3 females; Nizina Śląska lowland, Wołów, Poland; in flower pot; 17. 11. 1991; leg. H. PIETRUSZKA. 6 females; Nizina Śląska lowland, Strzelce Opolskie, Poland; in flower pot; 17. 02. 1992; leg. J. KRAWERENDA. 5 females; Nizina Śląska lowland, Głogów, Poland; plant detritus on bank of Odra river, near garden plots; 15. 10. 1995; leg. B. BALUL.

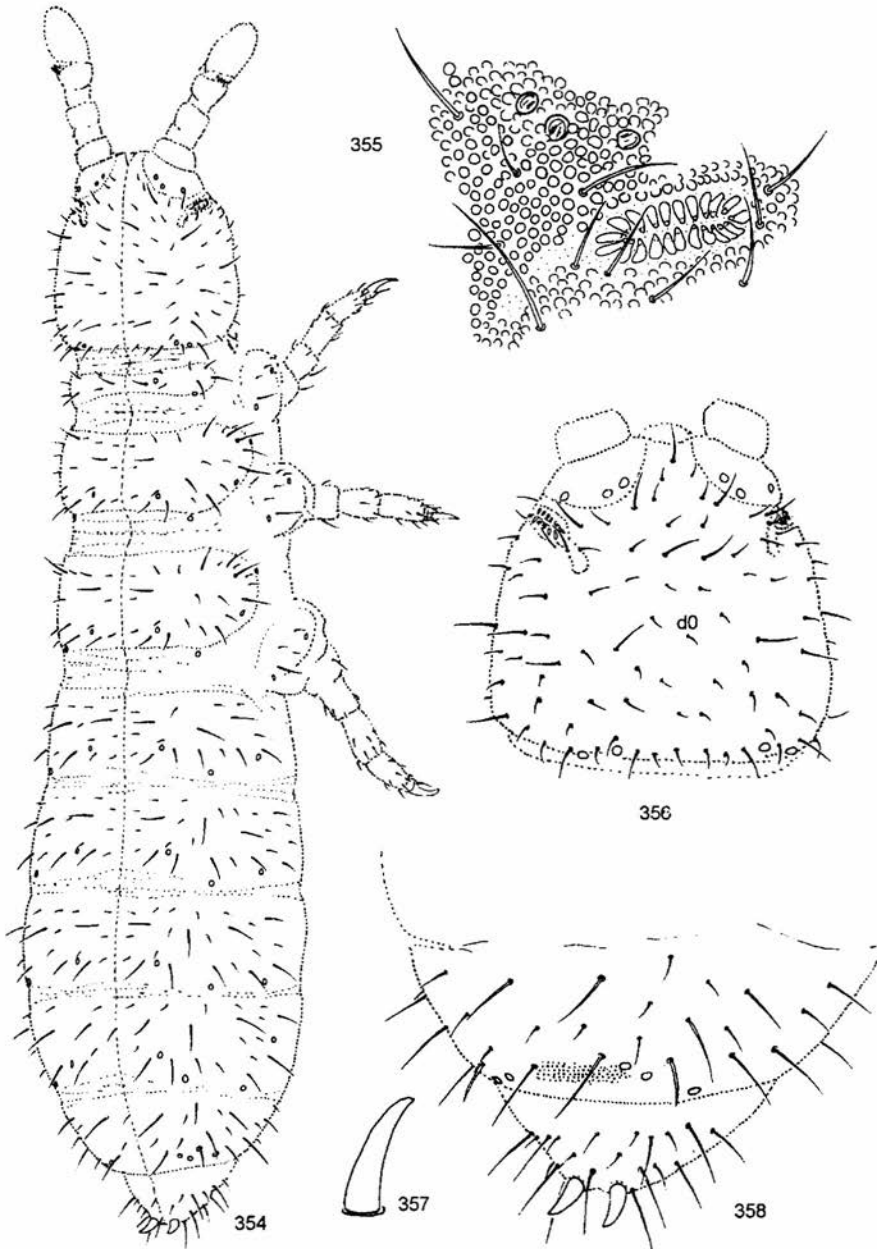
DESCRIPTION

Colour in alcohol white. Length without antennae 1.4-1.6 mm. Body shape cylindrical, with strong anal spines set on distinct papillae (fig. 354). Antennae approximately as long as head. Furca reduced to small area of fine granulation with 2+2 setulae posteriorly arranged in two rows (fig. 367). Granulation more or less uniform, distinct, somewhat coarser on terga, head capsule and around anal spines. Area antennalis distinct.

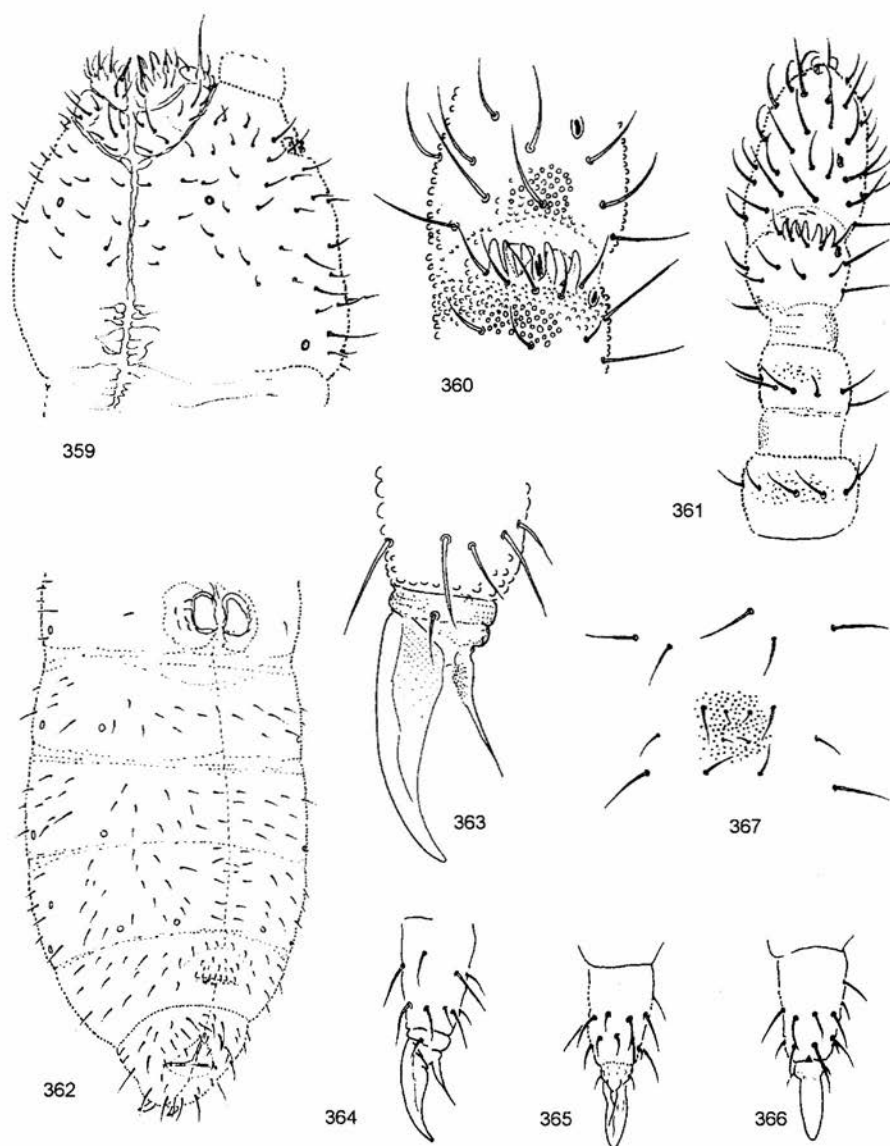
Antennal segment IV with a subapical organite, with and poorly marked sensilla (fig. 361). Microsensillum on antennal segment IV in latero-external position, c.1/2 length from the base. Antennal segment III with microsensillum slightly below antennal III sense organ. Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ built of 5 guard setae, 2 sensory rods, 2 straight and smooth sensory clubs and 5 papillae (fig. 360).

Postantennal sense organ (PAO) consisting of 22-25 simple vesicles, arranged perpendicularly to long axis of the organ (fig. 355).



354-358. *T. encarpata*: 354 - chaetotaxy and localization of pseudocelli on dorsal side of body, 355 - postantennal organ and pseudocelli, 356 - head, chaetotaxy, 357 - anal spine, 358 - abdominal terga V-VI, chaetotaxy and localization of pseudocelli



359-366. *T. encarpata*: 359 - head, chaetotaxy of ventral side, 360 - antennal III sense organ, 361 - antenna, 362 - abdominal sterna I-VI, chaetotaxy and localization of pseudocelli, 363 - claw, 364-366 - tibiotasus of II pair of legs, 367 - remnant of furca

Pseudocellar (pso) formula dorsally: 32/233/33343; ventrally: 11/000/0112; on subcoxa 2 pseudocelli. Parapseudocelli (psx) invisible. Position of pso is presented in figs. 354, 359, 362.

Dorsal chaetotaxy as in fig. 354, usually symmetrical, well differentiated into macrochaetae and microchaetae. Sensilla on body poorly marked. Abdominal tergum IV with setae m_0 , abdominal tergum V sometimes with seta a_0 . Straight lines passing through the bases of setae located in front of anal spines divergent. Abdominal tergum VI with two medial setae (fig. 358). Between legs on pro-, meso- and metathorax 1+1 setae. Tubus ventralis with 2+2 (1+1) setae at base. Ventral abdominal chaetotaxy as in fig. 362.

Claws always without teeth. Empodial appendage with small basal lamella, appendage length equals 3/4 inner edge of the claw. Tibiotarsi with distal verticil, composed of 9 setae (figs. 363-366).

BIOLOGY

In Poland *T. encarpata* is parthenogenic and lives only in antropogenic habitats - in flowerpots and compost.

DISTRIBUTION IN POLAND

Lower Silesia.

Thalassaphorura zschokkei (HANDSCHIN, 1919) comb. nov.

Onychiurus zschokkei HANDSCHIN, 1919: 71.

MATERIAL

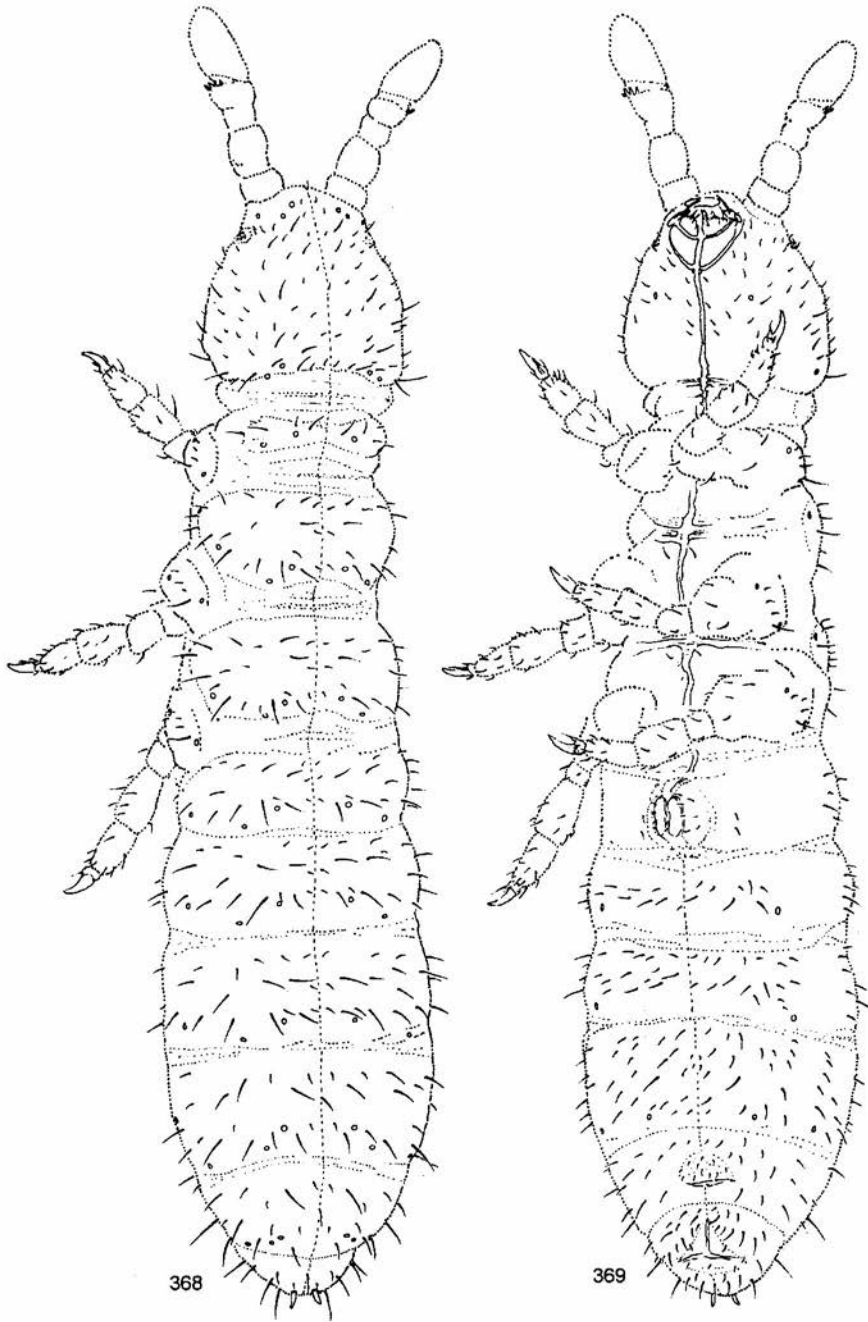
Numerous spp.; Sudetes, Kaczawskie Mts., Wojcieszów, Miłek, Poland; moss and grass on limestone rocks; 30. 06. 1991; leg. R. J. POMORSKI.

DESCRIPTION

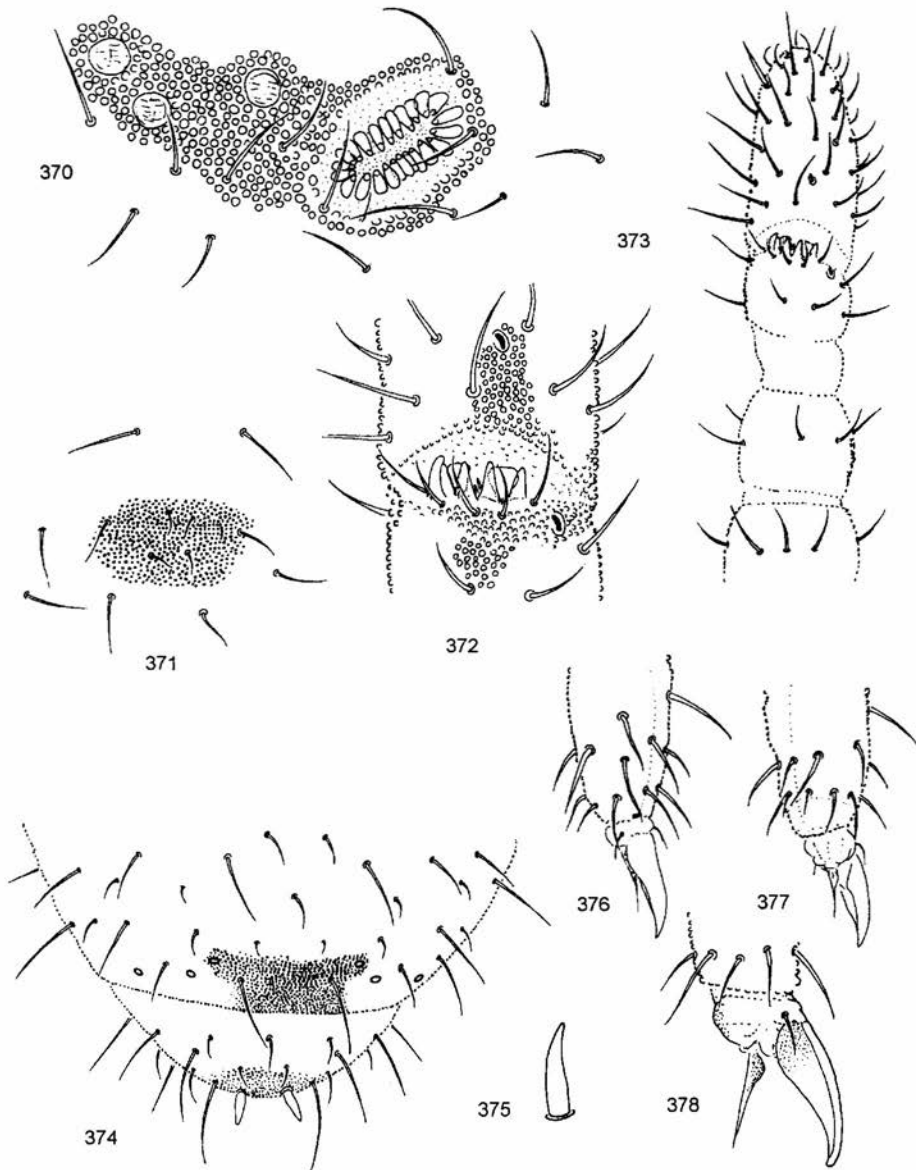
Colour in alcohol white. Length without antennae 0.9-1.1 mm. Body shape cylindrical, anal spines sunken without papillae (fig. 367). Antennae approximately as long as head. Furca reduced to small area of fine granulation with 2+2 setulae posteriorly arranged in two rows (fig. 371). Granulation uniform, area antennalis indistinct.

Antennal segment IV with a subapical organite, with poorly marked sensilla (fig. 373). Microsensillum on antennal segment IV in latero-external position, c.1/2 length from the base. Antennal segment III with microsensillum slightly below antennal III sense organ. Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ built of 5 guard setae, 2 sensory rods, 2 straight and smooth sensory clubs and 5 papillae (fig. 372).



368-369. *T. zchokkei*: 369 - chaetotaxy and localization of pseudocelli on dorsal side of body, 369 - chaetotaxy and localization of pseudocelli on ventral side of body



370-378. *T. zchokkei*: 370 - postantennal organ and pseudocelli, 371 - remnant of furca, 372 - antennal III sense organ, 373 - antenna, 374 - abdominal terga V-VI, chaetotaxy, granulation and localization of pseudocelli, 375 - anal spine, 376-377 - tibiotarsus of II pair of legs, 378 - claw

Postantennal sense organ (PAO) consisting of 24-28 simple vesicles, arranged perpendicularly to long axis of the organ (fig. 370).

Pseudocellar (pso) formula dorsally: 32/233/33343; ventrally: 11/000/0112; on subcoxa 2 pseudocelli. Parapseudocelli (psx) invisible. Position of pso is presented in figs. 367, 368.

Dorsal chaetotaxy as in fig. 367, usually symmetrical, well differentiated into macrochaetae and microchaetae. Sensilla on body poorly marked. Abdominal terga IV and V with setae m_0 . Abdominal tergum VI with one medial setae (fig. 374). Between legs on pro-, meso- and metathorax 1+1 setae. Tubus ventralis with 2+2 setae at base. Ventral abdominal chaetotaxy as in fig. 368.

Claws always without teeth. Empodial appendage with small basal lamella, appendage length equals $3/4$ inner edge of the claw. Tibiotarsi with distal verticil, composed of 9 setae (figs. 376-378).

BIOLOGY

In Poland *T. zschokkei* is a rare, bisexual species. It was collected only in highlands on warm localities, in moss and soil on limestone rocks.

DISTRIBUTION IN POLAND

Sudetes, Wyżyna Krakowsko-Wieluńska upland.

Detriturus gen. nov.

Type species: *Onychiurus jubilarius* GISIN, 1957: 453, by present designation (described from Switzerland) (gender: masculine).

Diagnosis. Body shape cylindrical, without anal spines. Abdominal segments V and VI accreted dorsally. Hind margin of head capsule with pseudocelli. Body finally granulated, with coarser granulation around anterior pseudocelli on head and medial pseudocelli on body. Furca reduced to finely granulated area with 2+2 setulae posteriorly, arranged in two rows. Antennal IV segment with distinct 2 sensilla, dorsal-subapical and internal-subbasal. AIIIO with 5 papilla, 5 guard setae and smooth, bent sensory clubs. PAO with numerous (10-13), granulated vesicles. Distal verticil of setae on tibiotarsi with 11 setae. Setae sensuales on head and body well marked. Seta d_0 on head absent, abdominal tergum VI with 1 medial seta.

TAXONOMIC REMARKS

Among *Thalassaphorurini* the new genus has isolated position, because it differs clearly in the lack of seta d_0 on head and the presence of 11 setae in distal verticil on tibiotarsi.

Detriturus jubilarius (GISIN, 1957) comb. nov.

Onychiurus jubilarius GISIN, 1957: 453.

MATERIAL

3 females; Nizina Śląska lowland, Wrocław, Poland; compost in house garden; 4. 03. 1990; leg J. KUBRAKIEWICZ.

DESCRIPTION

Colour in alcohol white. Length without antennae: females – 0.9-1.1 mm. Body shape cylindrical, without anal spines, as figs. 381, 384. Abdominal segments V and VI accreted dorsally. Antennae approximately as long as head. Furca reduced to small area of fine granulation with 2+2 setulae posteriorly, arranged in two rows (fig. 388). Granulation more or less uniform, slightly coarser around pseudocelli on head capsule and medial pseudocelli on body. Area antennalis absent.

Antennal IV segment with subapical organite. Microsensillum on antennal IV segment in latero-external position, distinctly above posterior setae. Antennal III segment with microsensillum slightly below antennal III sense organ. Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ built of 5 papillae, 2 sensory rods, 2 sensory clubs smooth, bent and 5 guard setae (fig. 381).

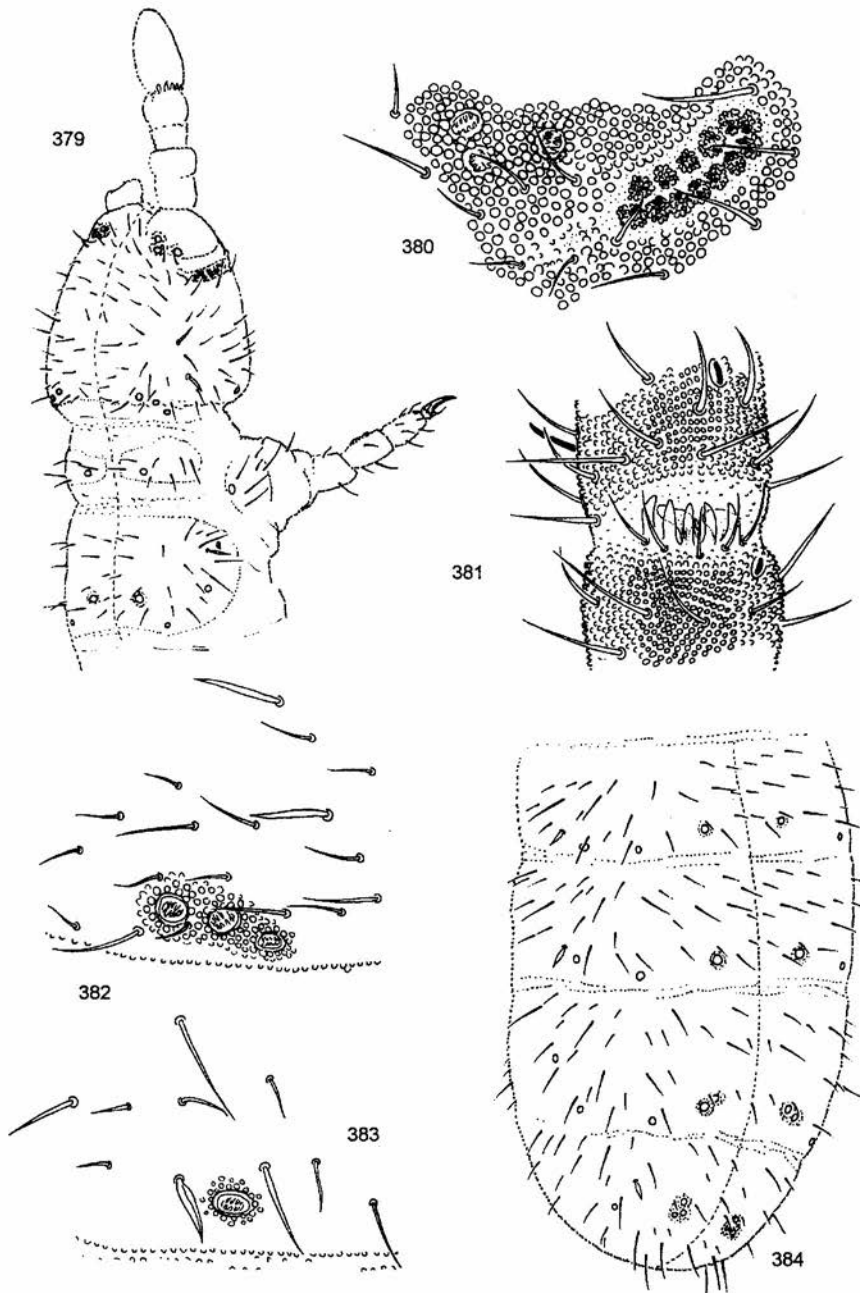
Postantennal sense organ (PAO) consisting of 12-15 vesicles, covered with secondary vesicles (fig. 380)

Pseudocellar (pso) formula dorsally: 33/133/33354; ventrally: 11/000/0000; on subcoxal 1 pseudocellus. Formula of parapseudocelli (psx) ventrally: 0/000/1121. All femora ventrally with 1 parapseudocellus. Position of pso and psx is presented in figs. 381, 384, 385 and 386.

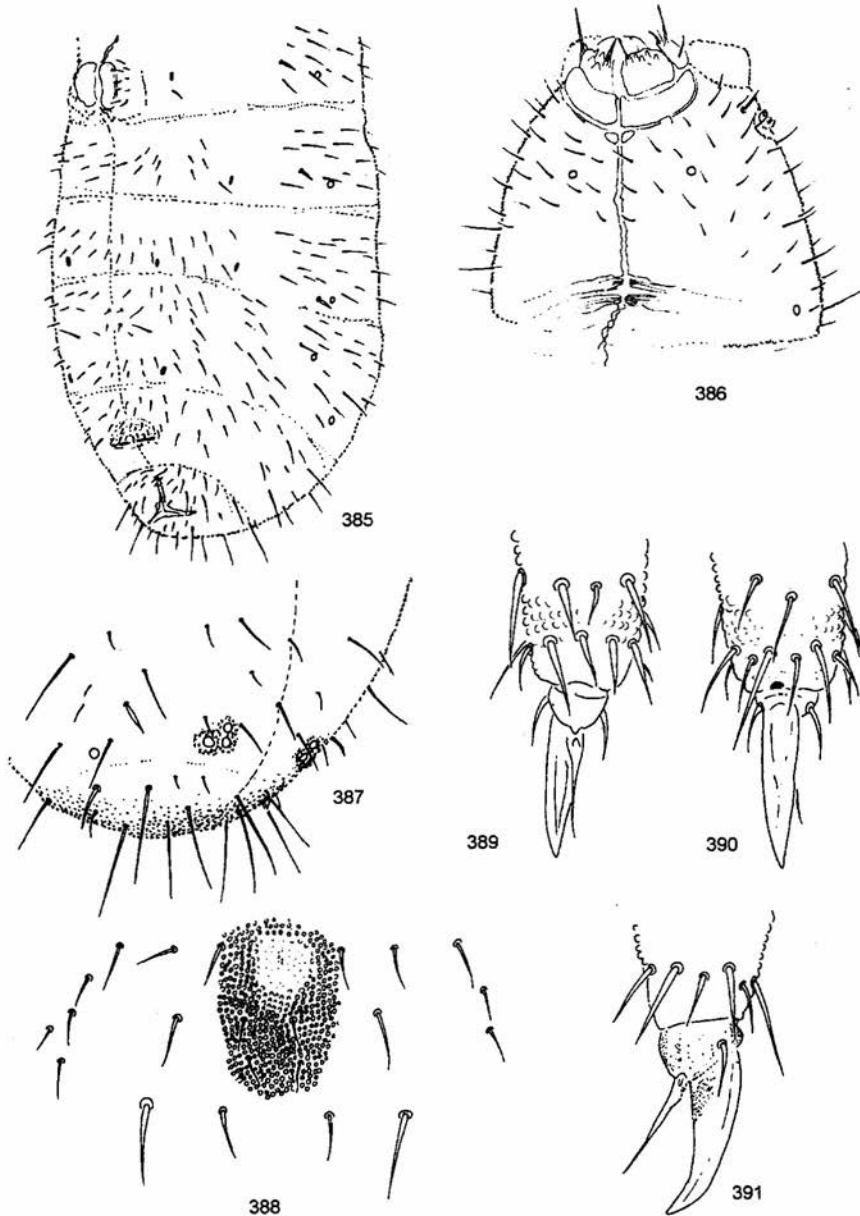
Dorsal chaetotaxy as in figs. 379, 384, usually symmetrical, poorly differentiated into macrochaetae and microchaetae. In adults sensilla distinct, lanceolate (figs. 382, 383) distributed according to formula 2/011/11101. Head without seta d_0 , abdominal tergum IV with seta p_0 , abdominal tergum V with seta m_0 , abdominal tergum VI with one medial seta (fig. 387). Between legs on meso- and metathorax 1+1 setae. Tubus ventralis subapically with 6+6 setae and 1+1 setae at base. Ventral chaetotaxy as in figs. 385, 386.

Male ventral organ situated on abdominal sterna III and IV. It consist of 4+4 thickened setae situated in one row in front of furcal area on abdominal sternum IV and 4+4 similar setae along posterior edge of abdominal sternum III (FJELLBERG, 1998).

Claws without teeth. Empodial appendage without basal lamella, as long as inner edge of the claw. Tibiotarsi with distal verticil, composed of 11 setae (figs. 389-391).



379-384. *D. jubilarius*: 379 - head, thoracic terga I and II, chaetotaxy and localization of pseudocelli, 380 - postantennal organ and pseudocelli, 381 - antennal III sense organ, 382 - hind margin of head, pseudocelli and setae sensuales, 383 - abdominal tergum III, pseudocellus and seta sensuales, 384 - abdominal terga II-VI, chaetotaxy and localization of pseudocelli



385-391. *D. jubilarius*: 385 - abdominal sterna II-VI, chaetotaxy and localization of pseudocelli and parapseudocelli, 386 - head, ventral chaetotaxy, 387 - abdominal terga V-VI, localization pseudocelli, granulation and chaetotaxy, 388 - remnant of furca, 389-390 - tibiotarsus of II pair of legs, 391 - claw

BIOLOGY

In Poland *D. jubilarius* was collected only once (only females) in compost.

DISTRIBUTION IN POLAND

Lower Silesia.

Tantulonychiurus POMORSKI, 1996

Tantulonychiurus POMORSKI, 1996, Genus, 7, 1: 94.

Type species: *Onychiurus volinensis* SZEPTYCKI, 1964, by original designation (described from Poland).

Diagnosis. Body shape cylindrical, with small anal spines set without papillae. Hind margin of head capsule with pseudocelli. Dorsomedial pseudocelli on IV and V abdominal terga displaced anterad. Body finely granulated, with coarser granulation around pseudocelli located on head. Furca reduced to finely granulated area with 2+2 setulae posteriorly, arranged in two rows. Antennal segment IV with distinct 2 sensilla, dorsal-subapical and internal-subbasal. AIIIO with 4 short papilla, 5 guard setae and smooth sensory clubs. PAO with numerous (9-11), granulated vesicles. Distal veriticol of setae on tibiotarsi with 7 setae. Setae sensuales on head and body well marked. Seta d_0 on head present, abdominal tergum VI with 2 medial setae. Male ventral organ present, localized on abdominal sternum IV, below remnant of furca.

TAXONOMIC REMARKS

In the generic revision of *Onychiurinae* WEINER (1996) established the genus *Thibaudichiurus* with type species *Onychiurus mariangeae* THIBAUD & LEE, 1994 and included *Onychiurus foliatus* RUSEK, 1967 and *Onychiurus volinensis* SZEPTYCKI, 1964, as examples. Earlier POMORSKI (1996), based on I instar larvae of *O. volinensis*, established the genus *Tantulonychiurus*.

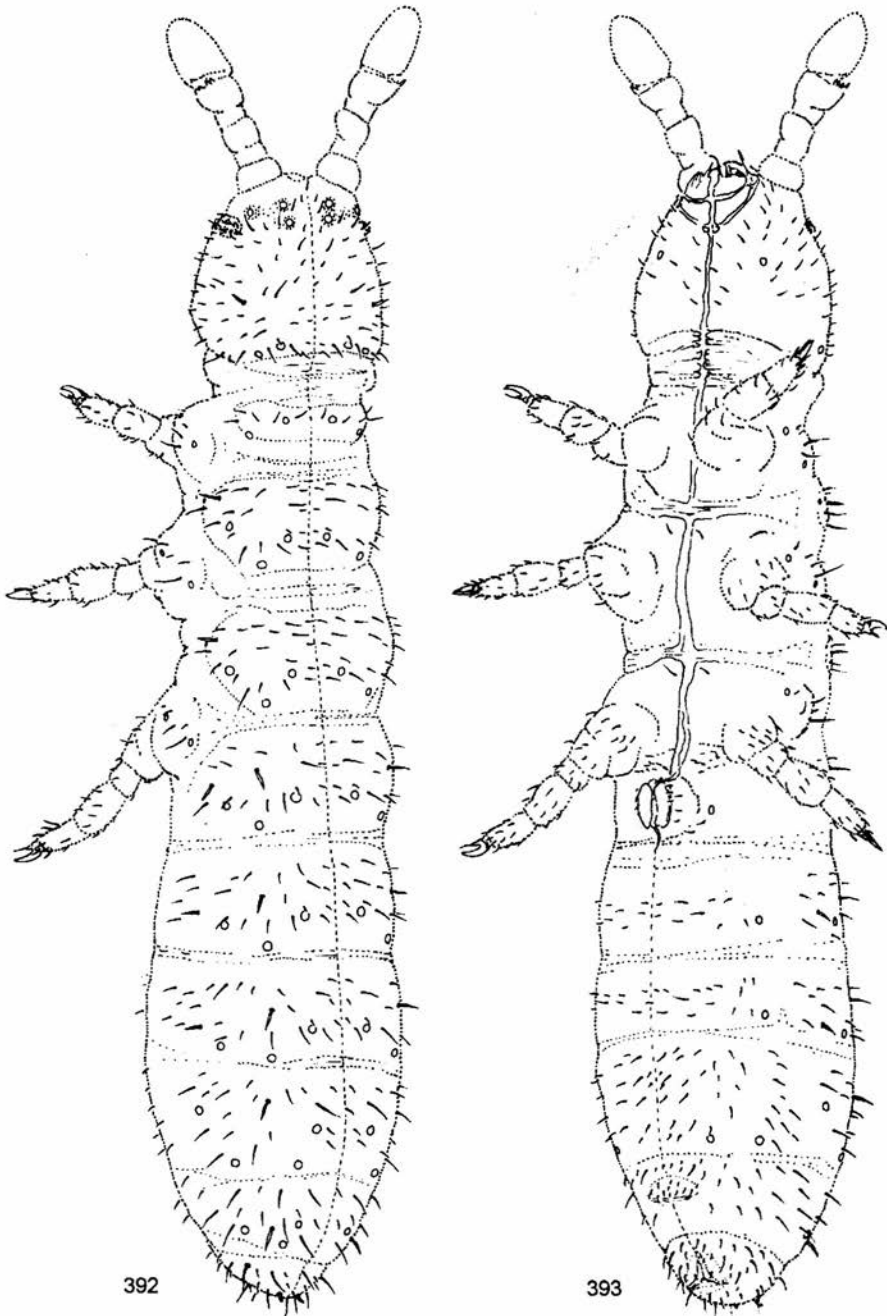
Many characters of both genera are common and they are closely related, but because of important differences (structure of male ventral organ, position of dorsomedial pseudocelli on abdominal terga IV and V, and probably number of setae in distal verticil on tibiotarsi), they represent separate taxa.

Tantulonychiurus volinensis (SZEPTYCKI, 1964)

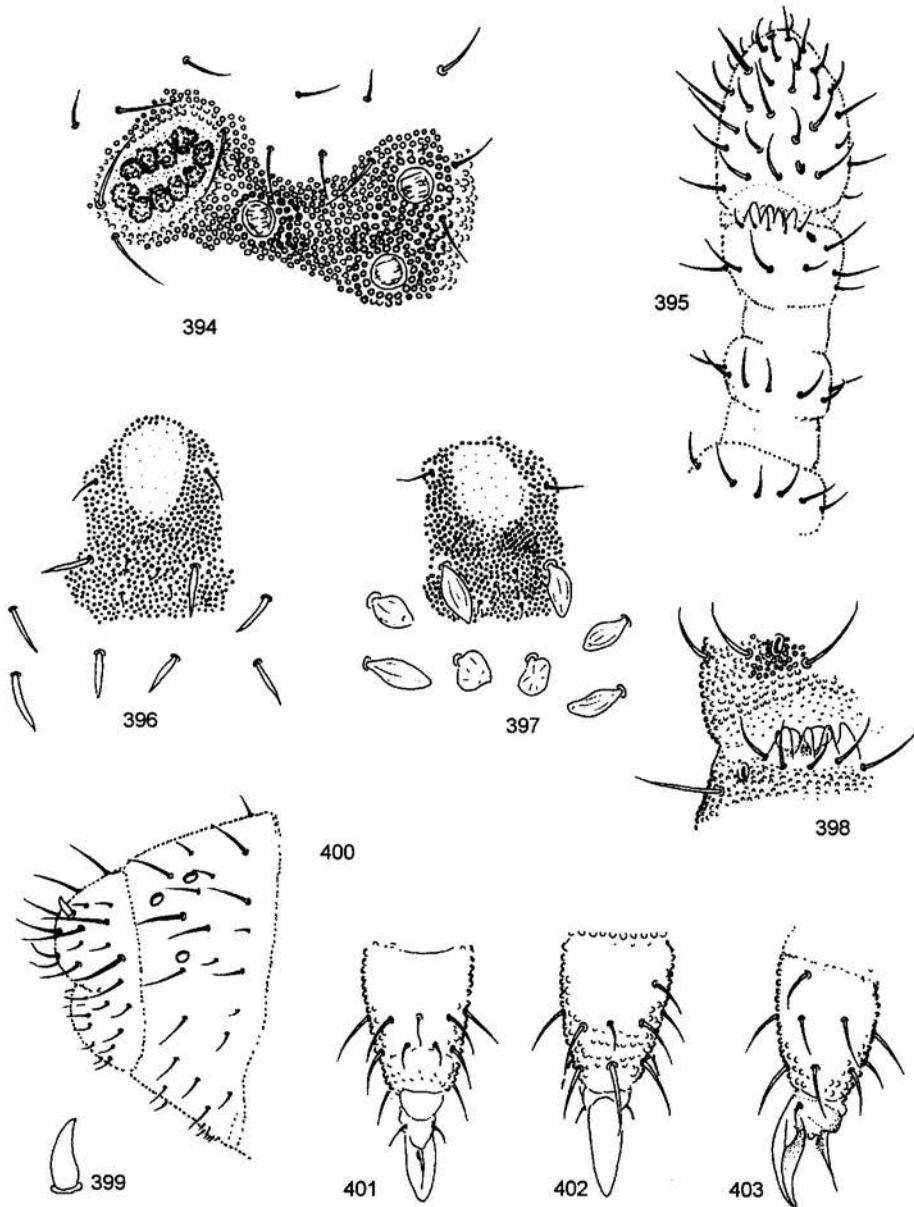
Onychiurus volinensis SZEPTYCKI, 1964: 171.

MATERIAL

Numerous spp.; Baltic Coast, Wolin island, Międzyzdroje, Poland; moss on sand dunes; 12. 04. 1991; leg. R. J. POMORSKI, D. SKARŻYŃSKI. Numerous spp.;



392-393. *T. volinensis*: 392 - chaetotaxy and localization of pseudocelli on dorsal side of body, 393 - chaetotaxy and localization of pseudocelli on ventral side of body



394-403. *T. volinensis*: 394 - postantennal organ and pseudocelli, 395 - antenna, 396 - remnant of furca, and male ventral organ (juv.), 397 - remnant of furca, and male ventral organ (adult.), 398 - antennal III sense organ, 399 - anal spine, 400 - abdominal terga V-VI, chaetotaxy, granulation and localization of pseudocelli, lateral view, 401-403 - tibiotasus of II pair of legs and claw

Baltic Coast, Sopot, Poland; moss on sand; 1. 09. 1991; leg. R. J. POMORSKI. Female; Baltic Coast, Kołobrzeg, Poland; moss on sand dunes; 8. 05. 1993; leg. M. Woźny. Numerous spp.; Baltic Coast, Słowiński National Park, Rowy, Poland; moss on sand dunes; 27. 04. 1995; leg. R. J. POMORSKI, M. PAKIET. 3 females; Baltic Coast, Stegny, Poland; moss on sand dunes; 11. 06. 1995; leg. R. J. POMORSKI, M. PAKIET.

DESCRIPTION

Colour in alcohol white. Length without antennae: males – 0.5 mm, females – 0.6-0.7 mm. Body shape cylindrical, with small anal spines set without papillae, as fig. 392. Antennae approximately as long as head. Furca reduced to small area of fine granulation with 2+2 setulae posteriorly, arranged in two rows. Granulation fine, somewhat coarser around anterior pseudocelli on head. Area antennalis indistinct.

Antennal segment IV with subapical organite and with distinct 2 sensilla, dorsal-subapical and internal-subbasal. Microsensillum on antennal IV segment in latero-external position, in one row with posterior setae (fig. 398). Antennal III segment with microsensillum slightly below antennal III sense organ. Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ built of 4 papillae, 2 sensory rods, 2 smooth sensory clubs, and 5 guard setae (fig. 398).

Postantennal sense organ (PAO) consisting of 9-11 (usually 10) vesicles, covered with secondary vesicles (fig. 394)

Pseudocellar (pso) formula dorsally: 32/233/33343; ventrally: 11/000/1112; on subcoxal 2 pseudocelli. Parapseudocelli (psx) invisible. Position of pso is presented in figs. 392, 393.

Dorsal chaetotaxy as in fig. 392, usually symmetrical, poorly differentiated into macrochaetae and microchaetae. In adults sensilla distinct, distributed according to formula 1/011/222121. Head with seta d_0 . Abdominal tergum IV with seta m_0 , abdominal tergum V with seta a_0 . Abdominal tergum VI with two medial setae. Between legs on meso- and metathorax 1+1 setae. Tubus ventralis subapically with 6+6 setae and 2+2 setae at base. Ventral chaetotaxy as in fig. 393.

Claws without teeth. Empodial appendage without basal lamella, appendage length equals 4/5 inner edge of the claw. Tibiotarsi with distal verticil, composed of 7 setae (figs. 401-403).

Male ventral organ situated on abdominal sternum IV, fully developed only in mature specimens with ductus ejaculatorius. It consists of 4+4 thickened, short, fluke-like setae, localized behind of finely granulated area, around of 2+2 setulae (figs. 396, 397).

BIOLOGY

T. volinensis in Poland lives only in mosses, covering sand dunes near sea shore. Bisexual.

DISTRIBUTION IN POLAND
Baltic coast.

Agraphorura gen. nov.

Type species: *Onychiurus naglitschi* GISIN, 1960: 315, by present designation (described from Germany) (gender: feminine).

Diagnosis. Body shape cylindrical, without anal spines. Hind margin of head capsule with pseudocelli. Body finally granulated, with coarser granulation around postantennal organ. Furca reduced to finely granulated area with 2+2 setulae posteriorly, arranged in two rows. Antennal IV segment with distinct 2 sensilla, dorsal-subapical and internal-subbasal. AIIIIO with 5 papilla, 5 guard setae and smooth sensory clubs. PAO with numerous (8-10), granulated vesicles. Distal verticil of setae on tibiotarsi with 7 setae. Setae sensuales on head and body well marked. Seta d_0 on head present, abdominal tergum VI with 1 medial seta. Male ventral organ absent.

TAXONOMIC REMARKS

The new genus is closely related with *Micronychiurus* BAGNALL, 1949 of which it differs in number of setae in distal tibiotarsal verticil (*Micronychiurus* - 9, *Agraphorura* - 7) and number of pseudocelli on head and abdominal terga. Species belonging to *Micronychiurus* have a tendency to multiplication of dorsomedial pseudocelli, especially on abdominal terga IV and V.

Agraphorura naglitschi (GISIN, 1960) comb. nov.

Onychiurus naglitschi GISIN, 1960: 315.

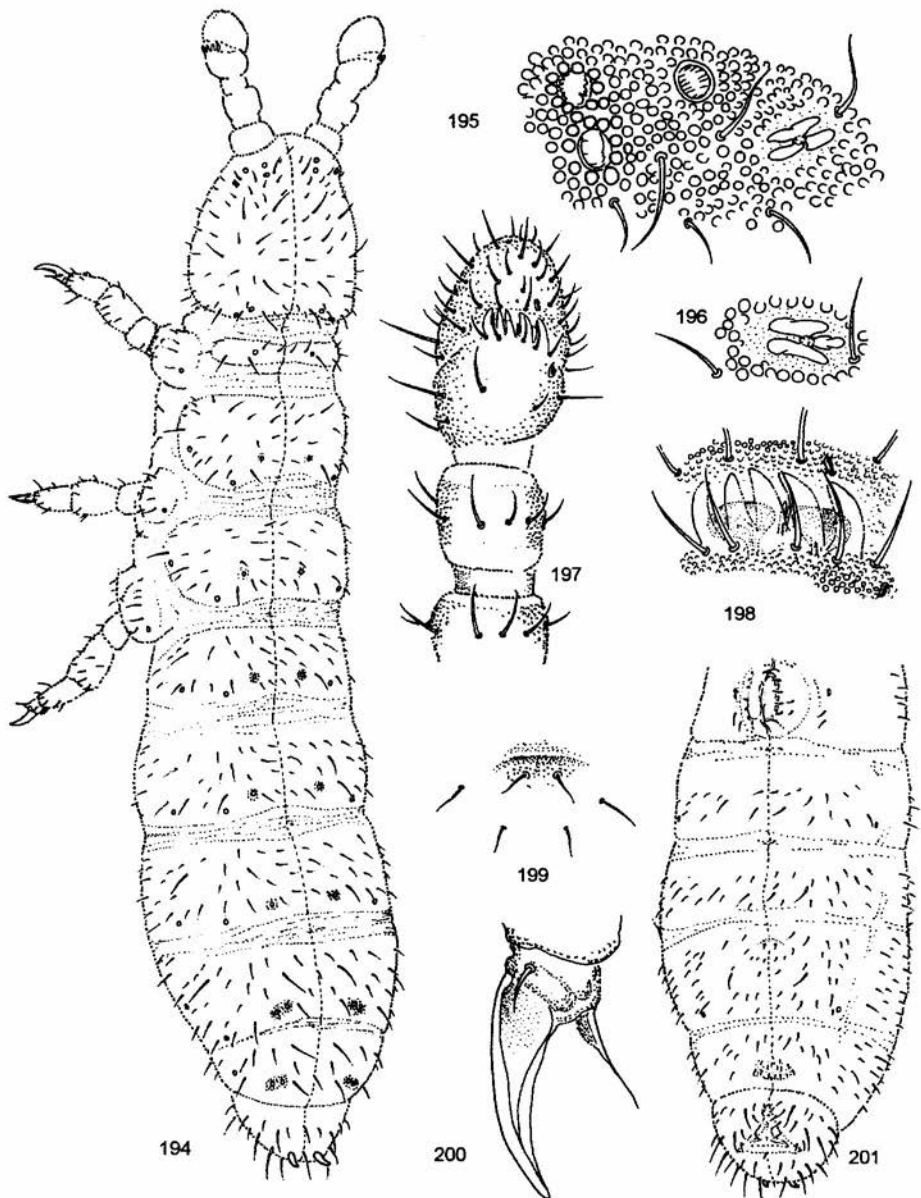
MATERIAL

Male adult; Nizina Mazowiecka lowland, Belsk, Poland; soil with grass in apple-tree orchard; 3. 08. 1982; leg. M. STERZYŃSKA.

DESCRIPTION

Colour in alcohol white. Length without antennae: males - 0.6 mm, females - 0.8-0.9 mm. Body shape cylindrical, without anal spines, as fig. 404. Antennae somewhat shorter than head. Furca reduced to small area of fine granulation with 2+2 setulae posteriorly, arranged in two rows (fig. 411). Granulation fine, distinctly coarser around postantennal organ. Area antennalis indistinct.

Antennal IV segment with subapical organite and with distinct 2 sensilla, dorsal-subapical and internal-subbasal. Microsensillum on antennal IV segment in latero-external position, distinctly above posterior setae (fig. 405). Antennal



194-201. *M. pieninensis*: 194 - chaetotaxy and localization of pseudocelli on dorsal side of body, 195 - postantennal organ with pseudocelli, 196 - postantennal organ, 197 - antenna, 198 - antennal III sense organ, 199 - remnant of furca, 200 - claw, 201 - chaetotaxy and localization of pseudocelli and parapseudocelli on abdominal sterna I-VI

Śląska lowland, Głogów, Poland; flood debris of river Odra in roots zone; 4. 11. 1994. leg. D. SKARZYŃSKI. Numerous spp.; Sudetes, Góry Opawskie Mts., Głuchołazy, Poland, gravel and flood debris of river Biała Głuchołaska; 25. 10. 1995. leg. D. SKARZYŃSKI, R. J. POMORSKI.

DESCRIPTION

Colour in alcohol white. Size without antennae 1.0 mm males, 1.2 mm females. Shape of body cylindrical, with bent anal spines, set without papillae as fig. 194. Antennae as long as head, antennomeres III and IV forming a club. Furca reduced to cuticular furrow with 1+1 setulae posteriorly. Granulation homogenic, with coarse granules around pseudocelli especially on abdominal terga I-V. Usually 11-12 grains around each pseudocellus.

Antennal segment IV with subapical organite and microsensillum located in one row with posterior setae. On III antennal segment microsensillum localized laterally, slightly below AIIIO (fig. 197).

AIIIO consists of 5 papillae; 2 sensory rods; 2 smooth, spherical sensory clubs (internal straight, external bigger and bent); 5 guard setae (fig. 198).

PAO located in small cuticular depression, slightly longer than the pseudocellus, built of 1 three- four- or five-lobed vesicle. The lobes are elongated (figs. 195, 196).

Pseudocellar formula (pso) dorsally 32/133/33343, ventrally 2/000/0001. Parapseudocellar formula (psx) ventrally 0/000/11. Each subcoxal with 1 pseudocellus. Localization of pso and psx is presented in figs. 194 and 201.

Dorsal chaetotaxy symmetrical, setae relatively short, well differentiated into macrochaetae and microchaetae, as fig. 194. In adults sensilla indistinct - 2/011/22211. Abdominal tergum IV with medial seta m_0 , abdominal tergum VI with medial seta. Only thoracic tergum II with lateral microsensillum. Subcoxae with 4, 5, 5 setae. Ventral abdominal chaetotaxy as in fig. 201, between legs on pro-, meso- and metathorax with 0, 1, 1 setae. Tubus ventralis usually with 7+7 (8+8) setae and 2+2 setae at base.

Claw without denticle. Empodial appendage, with distinct basal lamella, appendage length equals 3/4, inner edge of the claw (fig. 200). Distal veriticil of setae on tibiotarsi symmetrical, with 11 setae.

BIOLOGY

M. pieninensis is a bisexual species, living in flood debris and in gravel of submountane parts of rivers.

DISTRIBUTION IN POLAND

Lower Silesia, Sudetes and Carpathians.

***Protaphorurini* BAGNALL, 1949 sensu POMORSKI, 1996**

Protaphorurinae BAGNALL, 1949, Ann. Mag. Nat. Hist., 12 (2): 499.

Protaphorurini BAGNALL, 1949 status n., POMORSKI, 1996, Genus, 7 (1): 97.

Protaphorurini BAGNALL, 1949 status n., WEINER, 1996, Ann. Soc. Entomol. Fr. (N. S.), 32 (2): 176.

Hind margin of head capsule with pseudocelli, thoracic terga II-III, abdominal terga I-V with dorsomedial and lateral pseudocelli. Thoracic tergum I usually without pseudocelli. PAO with numerous simple vesicles, arranged perpendicularly to the long axis of organ. Granulation homogenous, sometimes slightly coarser on head and terga. Anal spines usually strong, set on distinct papillae or anal spine small without papillae. Furca reduced to two knobs, cuticular pocket or furrow. Distal veriticol of setae on tibiotarsi with 11 setae. Setae sensuales on head and body usually invisible. Seta d_0 on head absent.

KEY TO GENERA OF *PROTAPHORURINI*

1. Furca reduced to two knobs with rudiment of mucro (fig. 41) *Supraphorura*
- . Furca reduced to cuticular pocket with 2+2 setulae (figs. 43, 354) 2
2. Anal spines strong with papillae (fig. 15) *Protaphorura*
- . Anal spines very small without papillae (fig. 353) *Heteronychiurus*

***Supraphorura* STACH, 1954**

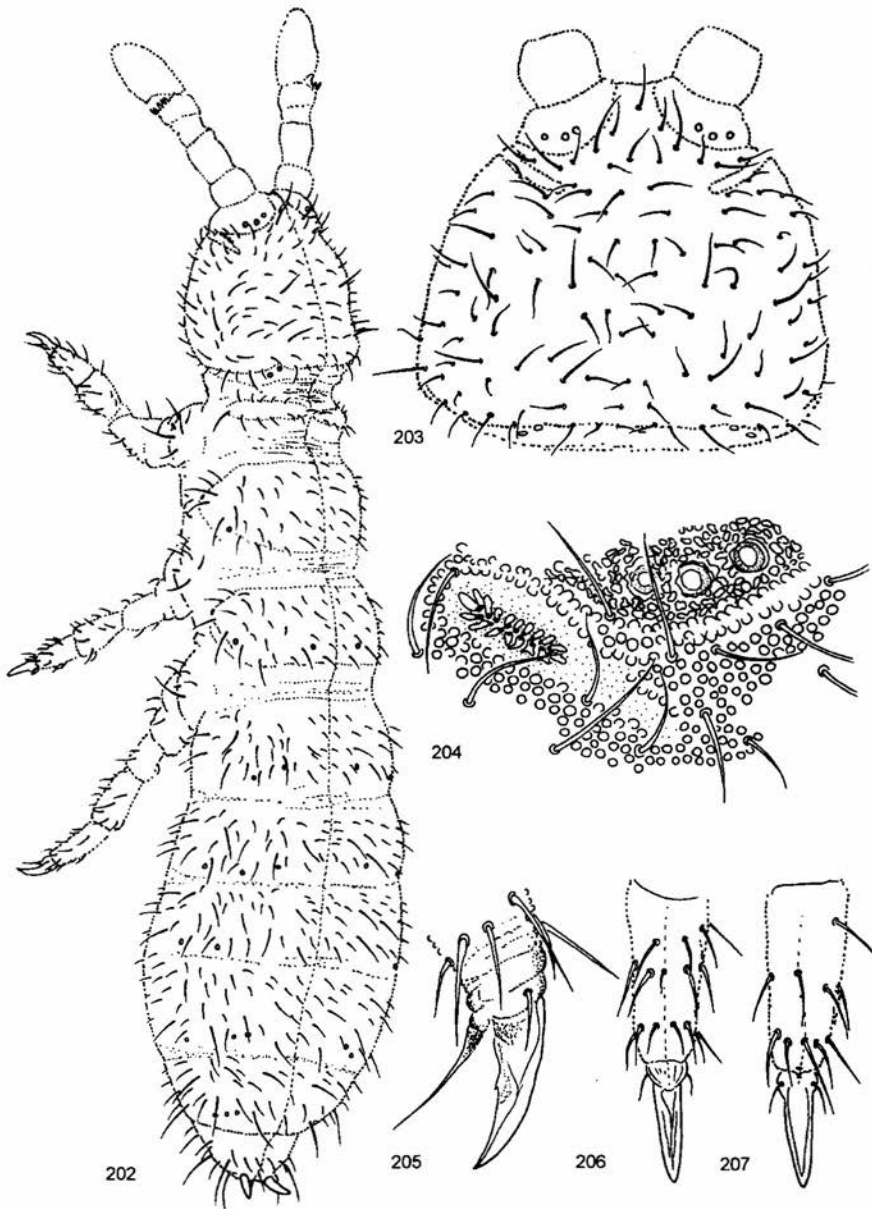
Supraphorura STACH, 1954, Państw. Wyd. Nauk., Kraków: 26.

Type species: *Aphorura furcifera* BÖRNER, 1901, by original designation (described from Germany).

Diagnosis: Hind margin of head capsule with pseudocelli. Body with homogenous granulation. Furca reduced to two knobs with 3+3 (4+4) setulae, tenaculum present. Abdominal segment VI with strong anal spines, located on distinct papillae. AIIIO with 5 papillae, 5 guard setae and granulated sensory clubs. PAO with numerous simple vesicles, located perpendicularly to the long axis of the organ. Distal veriticol of setae on tibiotarsi symmetrical, with 11 setae. Chaetotaxy of dorsal side poorly differentiated into macrochaetae and microchaetae. Setae sensuales on head and body invisible. Seta d_0 on head absent, abdominal tergum VI dorsally with 1 medial seta.

***Supraphorura furcifera* (BÖRNER 1901)**

Aphorura furcifera BÖRNER, 1901: 22.



202-207. *S. furcifera*: 202 - chaetotaxy and localization of pseudocelli on dorsal side of body, 203 - head, chaetotaxy, 204 - postantennal organ with pseudocelli, 205 - calyx, 206 - tibiotarsus of II pair of legs, ventral side, 207 - tibiotarsus of II pair of legs, dorsal side

MATERIAL

2 females; Sudety highlands, Ślęza Massif, Poland; wet meadow, moss; 5. 11. 1985; leg. R. J. POMORSKI. Numerous spp.; Sudetes, Wałbrzych highlands, Pełcznica ravine, Poland; under moss on rocks, 15. 01. 1989; leg. D. SKARŻYŃSKI. Numerous spp.; Sudetes, Góry Złote Mts., Chwalisław, Poland; moss on stones near stream Mąkolnica; 2. 10. 1991; leg. R. J. POMORSKI. 1 juv; Nizina Śląska lowland, Wrocław-Biskupin; compost; 17. 02. 1992; leg. POMORSKI. Numerous spp.; Sudetes, Śnieżnik Massif, Stara Morawa, Poland; wet meadow, moss; 16. 03. 1992; leg. R. J. POMORSKI. 1 male, 3 females, 4 juv.; Sudetes, Góry Bardzkie Mts., Bardo Śl, Poland; under fallen tree trunk near bank of river Nysa Kłodzka; 24. 11. 1994; leg. R. J. POMORSKI. 5 females, 2 male; Carpathians, Beskid Średni Mts., Bednarzówka near Maków Podhalański, Poland; moss in the gravel bed of the river Skawica; 11. 11. 1993, leg. D. SKARŻYŃSKI, R. J. POMORSKI. 2 females, 2 male; Carpathians, Nowy Targ Basin, nature reserve "Przełom Białki", Poland; gravel with roots of grass near river Białka Tarzańska; 11. 11. 1993; leg. R. J. POMORSKI.

DESCRIPTION

Colour in alcohol white. Length without antennae: males 1.5 mm, females 1.7-1.9 mm. Body shape cylindrical, with strong anal spines set on distinct papillae (fig. 202). Antennae approximately as long as head. Furca reduced to two knobs with mucro and 4+4 setae (figs. 211, 213, 214). Tenaculum present, with 2+2 teeth. Granulation more or less uniform, distinct. Area antennalis well marked.

Antennal segment IV with a subapical organite. Microsensillum on antennal segment IV in latero-external position, c. 1/3 length from the base. Antennal segment III with microsensillum slightly below antennal III sense organ (fig. 208). Thoracic terga II and III with microsensilla laterally.

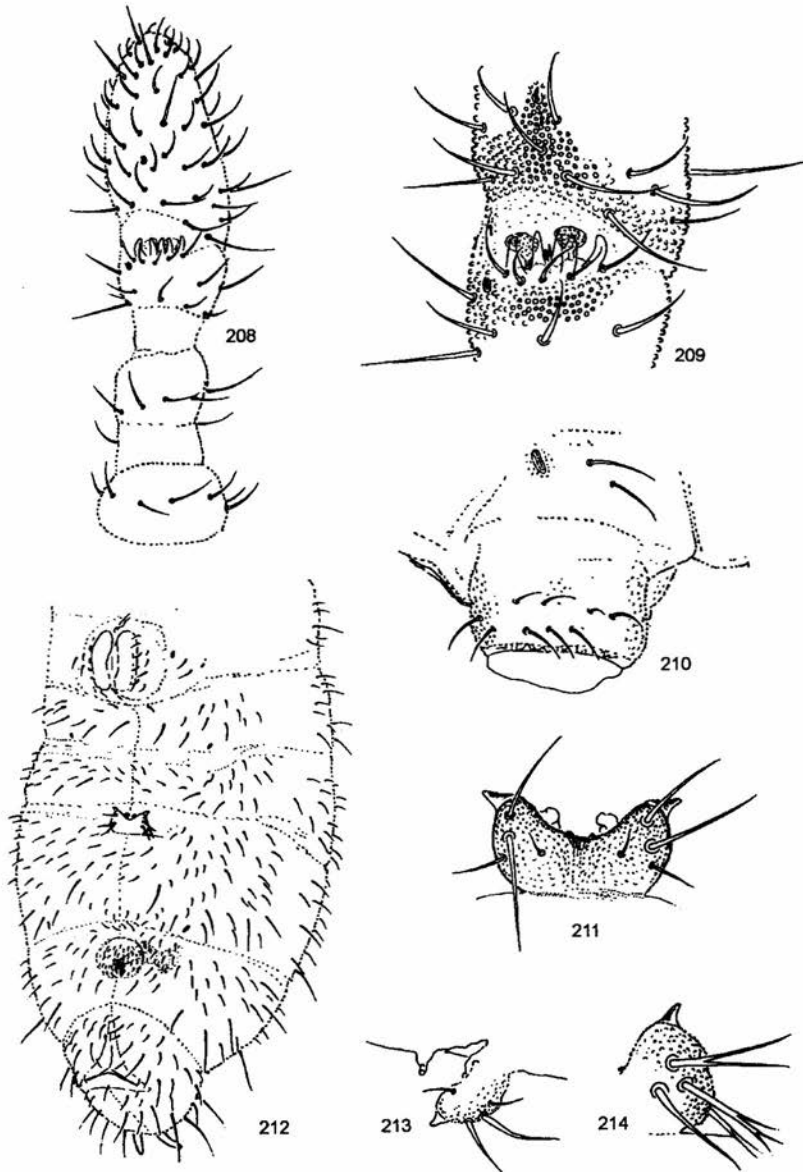
AIIIO built of 5 guard setae, 2 sensory rods, 2 straight and granulated sensory clubs and 5 papillae (fig. 209).

PAO consisting of 19-22 simple or bilobed vesicles (fig. 204).

Pseudocellar (pso) formula dorsally: 32/012/23233(2); ventrally: 1/000/00000; on subcoxa no pseudocelli. Formula parapseudocelli (psx) ventrally: 0/000/1101, all subcoxal and femora ventrally with 1 parapseudocellus. Position of pso and psx is presented in figs. 202, 212.

Dorsal chaetotaxy, usually asymmetrical, poorly differentiated into macrochaetae and microchaetae as in fig. 202. The setae relatively long. Head without seta d_0 , abdominal tergum V with setae m_0 and p_0 , abdominal tergum VI with one medial seta. Between legs on meso- and metathorax 1+1 setae. Tubus ventralis with ca. 9+9 setae and 2+2 setae at base (fig. 210). Ventral abdominal chaetotaxy as in fig. 212.

Claws always with teeth. Empodial appendage without basal lamella, as long as claw. Tibiotarsi with distal verticil, composed of 11 setae (figs. 205-207).



208-214. *S. furcifera*: 208 - antenna, 209 - anteninal III sense organ, 210 - tubus ventralis, 212 - chactotaxy and localization of parapseudocelli on abdominal sterna I-VI, 211, 213, 214 - remnant of furca

The setae localized on remnant of furca in adult males always forked or serrated, (sometimes this character can be expressed in females) (fig. 214).

BIOLOGY

S. furcifera in Poland lives in cold and wet places in mountains, highlands, rarely in lowlands. Usually it was collected in moss on mountain wet meadows and in moss with humus, covering stones and gravel near mountain and highland streams and rivers. Bisexual.

DISTRIBUTION IN POLAND

Sudetes, Carpathians, Sudety highland, Lower Silesia, Nizina Wielkopolsko-Kujawska lowland, Nizina Mazowiecka lowland.

***Protaphorura* ABSOLON, 1901**

Protaphorura ABSOLON, 1901, Zool. Anz., 24 (647): 387.

Type species: *Lipura armata* TULLBERG, 1869, by original designation (described from Sweden).

Diagnosis: Hind margin of head capsule with pseudocelli. Body with homogenous granulation. Furca reduced to cuticular pocked with 2+2 or 1+1 setulae, tenaculum absent. Abdominal segment VI with strong anal spines, located on distinct papillae. AIIIIO with 5 papillae, 5 guard setae and granulated sensory clubs. PAO with numerous simple vesicles, located perpendicularly to the long axis of organ. Chaetotaxy of dorsal side well or poorly differentiated into macrochaetae and microchaetae. Distal veriticol of setae on tibiotarsi symmetrical, with 11 setae. Setae sensuales on head and body usually invisible. Seta d_0 on head absent, abdominal tergum V with seta p_0 , abdominal tergum VI dorsally with 1 or 2 medial setae. Male ventral organ absent or present.

KEY TO SPECIES

1. Thoracic terga II and III with 3+3 and 3+3 pseudocelli respectively 2.
- Thoracic terga II and III with 2 +2 and 3+3 pseudocelli respectively 3.
- Thoracic terga II and III with 2 +2 and 2+2 pseudocelli respectively 7.
2. Basis of antennae and hind margin of head with 3+3 and 3+3 pseudocelli respectively *P. pannonica*
- Basis of antennae and hind margin of head with 4+4 and 4+4 pseudocelli respectively *P. pseudocellata*
3. Abdominal tergum V with seta s' situated in one row with setae M, M', s (fig. 238; males with ventral organ on ventral tube (fig. 242) *P. tricampata*
- Abdominal tergum V without s' seta; no male ventral organ 4.

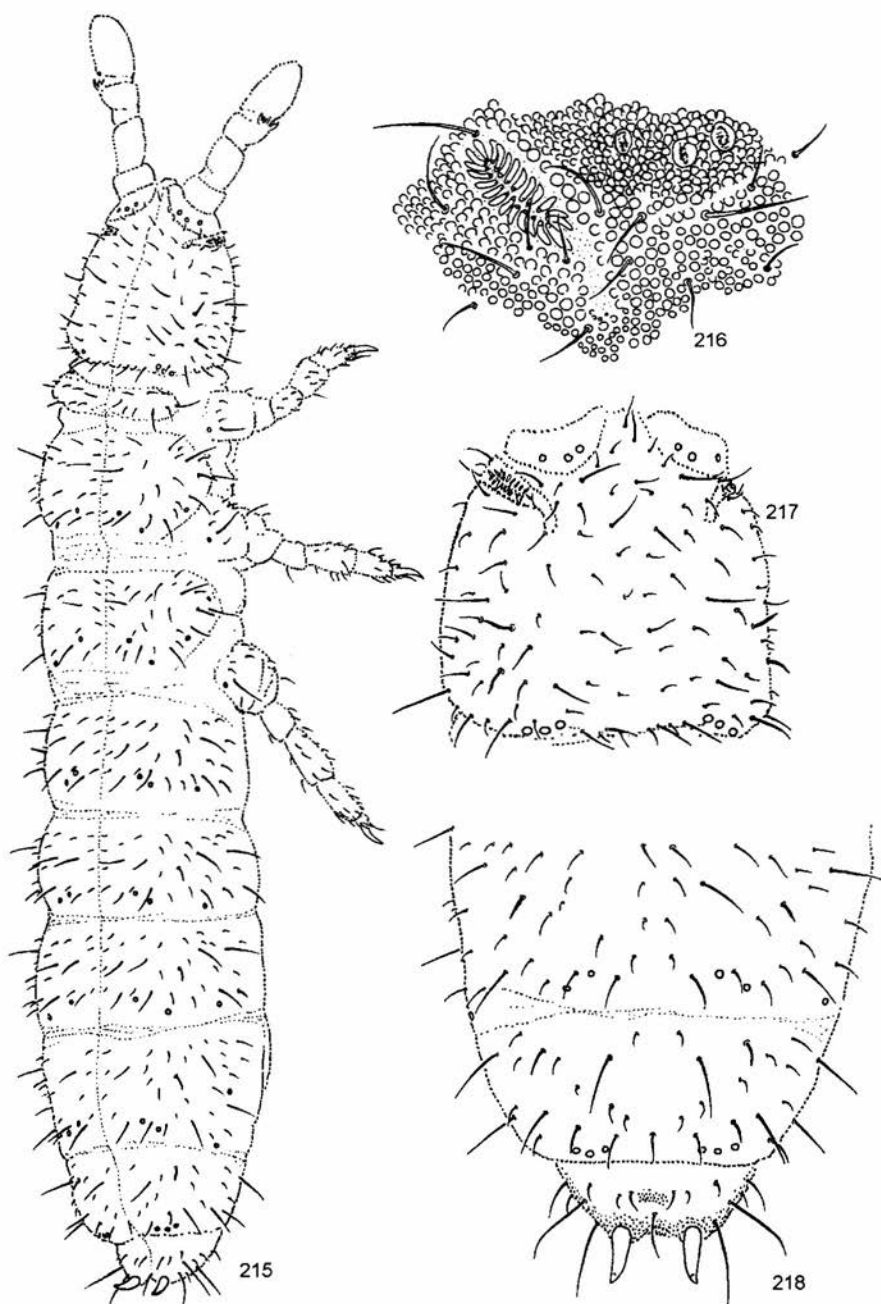
4. Length of adults up of 3 mm, PAO with ca. 40 vesicles *P. janosik*
 -. Length of adults less of 3 mm, PAO with 25-30 vesicles 5.
5. Pseudocellar formula: 34/023/33353; straight lines, passing through bases of short setae situated above anal spines, parallel or nearly so; between M setae medially with 3 setae (fig. 254); *P. pseudovanderdrifti*
 -. Pseudocellar formula: 33/023/33343; straight lines, passing through bases of short setae situated above anal spines, convergent, subparallel or parallel; abdominal tergum V, between M setae medially with 1, 2 or 3 setae 6.
6. Straight lines, passing through bases of short setae situated above anal spines, distinctly parallel; on abdominal tergum V s seta situated between pseudocelli a and b (fig. 270) *P. subarmata*
 -. Straight lines, passing through bases of short setae situated above anal spines, convergent or subparallel, on abdominal tergum V s seta situated above c or between pseudocelli b and c (figs. 280-285) *P. armata*
7. Subcoxa1 all pair of legs without pseudocelli *P. bicampata*
 -. Subcoxa1 of I, II, and III pair of legs with 1, 0, 0 pseudocelli respectively
 *P. serbica*
 -. Subcoxa1 of I, II, and III pair of legs with 1, 1, 1 pseudocelli respectively 8.
8. Straight lines, passing through bases of short setae situated above anal spines, parallel or nearly so (fig. 308) *P. aurantiaca*
 -. Straight lines, passing through bases of short setae situated above anal spines, distinctly convergent 9.
9. Abdominal tergum IV with 3+3 pseudocelli (lack of anterolateral pseudocellus d) (fig. 310) *P. fimata*
 -. Abdominal tergum IV with 4+4 or 5+5 pseudocelli (anterolateral pseudocellus d always present) (figs. 325, 328) 10.
10. Abdominal tergum V with seta s', situated distinctly above row with M, M' and s setae; adults usually with seta s' on I-V abdominal terga (figs. 319, 325)
 *P. campata*
 -. Adults on abdominal terga I-V without s' seta 11.
11. Abdominal sterna III and IV without parapseudocelli (fig. 327) *P. gisini*
 -. Abdominal sterna III and IV with 1+1 parapseudocelli respectively (fig. 338)
 *P. cancellata*

***Protaphorura pannonica* (HAYBACH, 1960)**

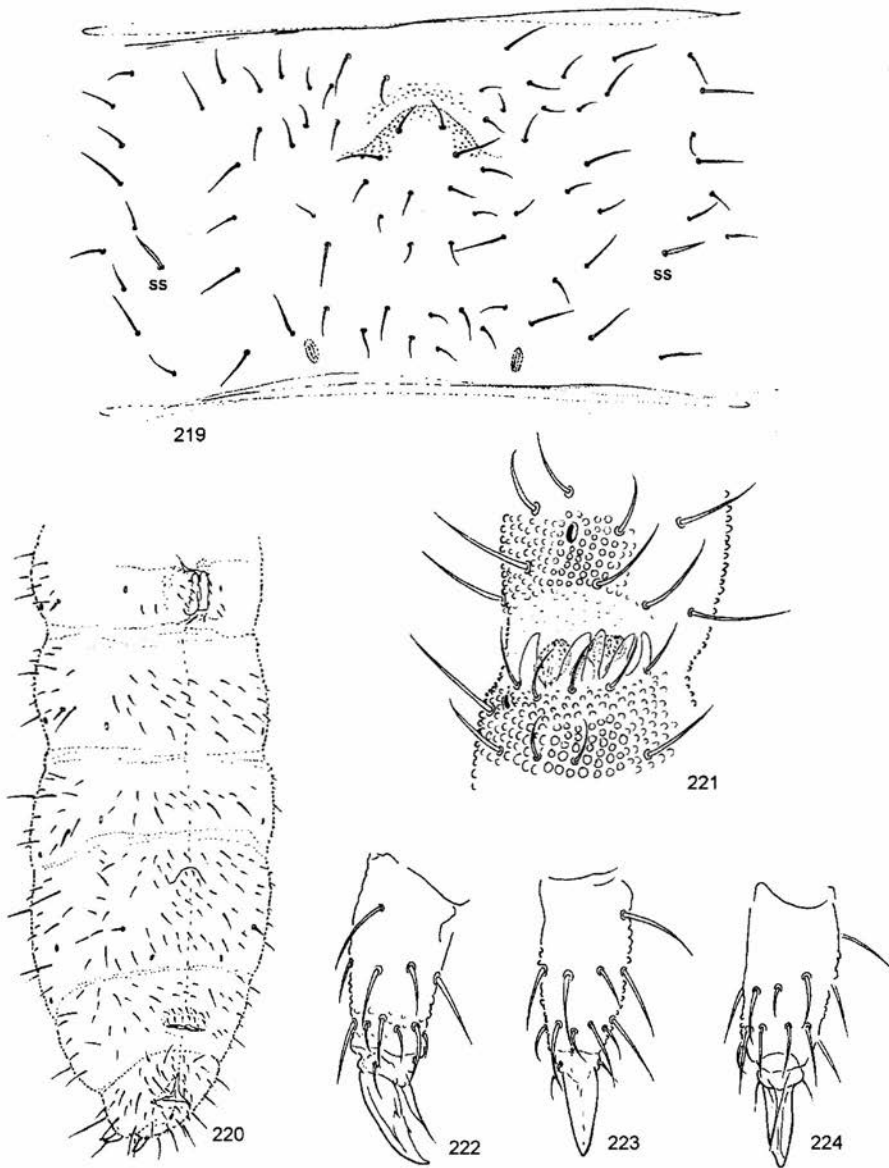
Onychiurus pannonicus HAYBACH, 1960: 70.

TYPE MATERIAL

Paratypes, 2 males on slide, 1 juv.; Frauenstein bei Mödling, Austria; Rendsina - under *Pinus nigra*; Fr II/IV 1959; leg. FRANZ.



215-218. *P. pannonica*: 215 - chaetotaxy and localization of pseudocelli on dorsal side of body, 216 - postantennal organ with pseudocelli, 217 - head, chaetotaxy, 218 - abdominal terga IV-VI, chaetotaxy, localization of pseudocelli



219-224. *P. pannonica*: 219 - abdominal sternum IV, remnant of furca, localization of parapseudocelli, 220 - chaetotaxy and localization of parapseudocelli on abdominal sterna I-VI, 221 - antennal III sense organ, 222 - tibotarsus of II pair of legs, lateral view, 223 - tibotarsus of II pair of legs, dorsal side, 224 - tibotarsus of II pair of legs, ventral side

OTHER MATERIAL

1 male, 2 females; Upper Silesia, Strzelce Opolskie, Poland; soil in flower pot; 14. 04. 1992; leg. J. KRAWERENDA. Numerous spp., Sudetes, "Strzeliniec Wielki", Góry Stołowe National Park, Poland; soil on rocks, 919 m a.s.l., . 01. 1997; leg. A. SMOLIS.

DESCRIPTION

Colour in alcohol white. Length without antennae: males 0.9 mm, females 1.1-1.2 mm. Body shape cylindrical, with very strong anal spines set on distinct papillae (fig. 218). Antennae approximately as long as head. Furca reduced to cuticular pocket with 2+2 setulae (fig. 219). Granulation more or less uniform, distinct. Area antennalis well marked.

Antennal segment IV with a subapical organite. Microsensillum on antennal segment IV in latero-external position, c.1/3 length from the base. Antennal segment III with microsensillum slightly below antennal III sense organ. Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ built of 5 guard setae, 2 sensory rods, 2 straight and granulated sensory clubs and 5 papillae (fig. 221).

Postantennal sense organ (PAO) consisting of 20-26 simple vesicles (fig. 216).

Pseudocellar (pso) formula dorsally: 33/033/33343; ventrally: 1/000/00000; all subcoxa1 with pseudocellus. Formula parapseudocelli (psx) ventrally: 1/000/111101^m, parapseudocelli on subcoxa1 invisible. Position of pso and psx is presented in figs. 215, 220.

Dorsal chaetotaxy, symmetrical, very well differentiated into macrochaetae and microchaetae as in fig. 215. In adults sensilla distinct - 2/011/22212. Head without seta d_0 , abdominal tergum V with seta p_0 , abdominal tergum VI with one medial seta. Straight lines, passing through bases of short setae situated above anal spines, convergent (fig. 218). Between legs on pro-, meso- and metathorax 1+1, 2+2 and 2+2 setae respectively. Tubus ventralis with ca. 7+7 setae and 2+2 setae at base. Ventral abdominal chaetotaxy as in fig. 220.

Claws always with small teeth. Empodial appendage without basal lamella, appendage length equals 4/5 inner edge of the claw. Tibiotarsi with distal verticil, composed of 11 setae (figs. 222-224).

Male ventral organ absent.

BIOLOGY

Ecological preferences of *P. pannonica* are difficult to define precisely. Probably this species is connected with warm and dry sandy places. Bisexual.

TAXONOMIC REMARKS

P. pannonica belongs to the group of *Protaphorura* species with 3+3 pseudocelli on II and III thoracic terga. It is very similar to *P. daviesi* (BAGNALL,

1935) sensu CHOUDHURI, 1963, *P. trinottata* (GISIN, 1961) and *P. pseudocellata* (NAGLITSCH, 1962). The examination of paratypes of *P. pannonica* and Polish material of *P. pseudocellata* has enabled me to ascertain that they represent separate species, distinctly differ in pseudocellar formula and chaetotaxy (*P. pannonica* has very well marked macrochaetae and sensilla). Specific distinctness of *P. pannonica* and *P. pseudocellata* from *P. daviesi* and *P. trinottata* should be confirmed by detailed examination of type materials.

All localities of *P. pannonica* reported in Polish literature (SKARŻYŃSKI 1992, SKARŻYŃSKI & POMORSKI 1996) pertain to *P. pseudocellata*.

DISTRIBUTION IN POLAND
Sudetes, Upper Silesia.

Protaphorura pseudocellata (NAGLITSCH, 1962)

Onychiurus pseudocellatus NAGLITSCH, 1962: 155.

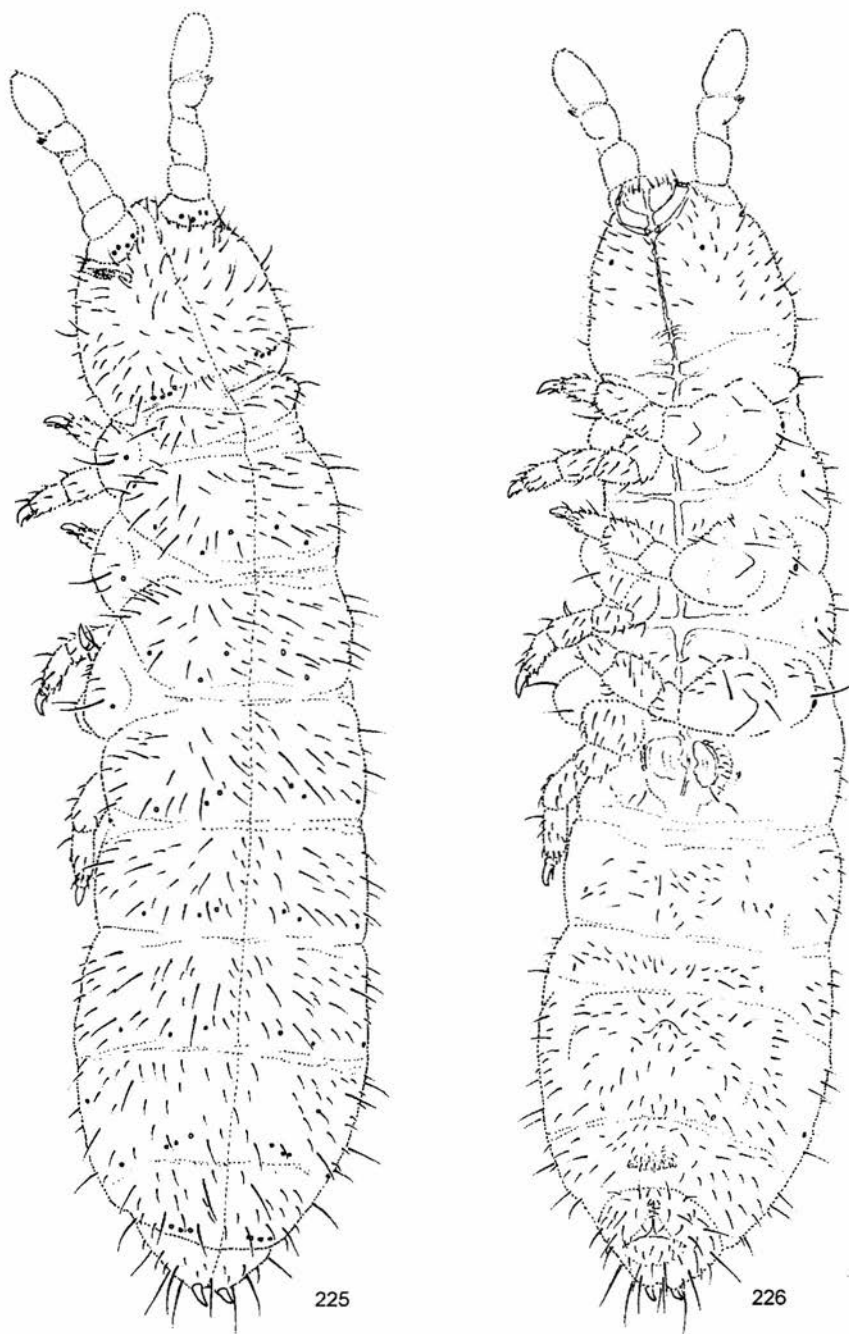
MATERIAL

Numerous spp.; Sudetes, Kaczawskie highland, nature reserve "Ostrzyca Proboszczowicka", Poland; in dry soil with roots of grasses, growing in rocks crevices, 22. 07. 1988; leg. R. J. POMORSKI. Numerous spp.; Sudetes, Wałbrzych highland, Pełcznica ravine, Poland; in dry soil with roots of grasses, growing in rocks, 15. 01. 1989; leg. D. SKARŻYŃSKI. Numerous spp.; Baltic coast, Wolin island, Międzyzdroje, Poland; moss covered sandy dune near sea shore; 10-11. 04. 1991; leg. R. J. POMORSKI. 4 spp.; Upper Silesia, Strzelce Opolskie, Poland; soil in flower pot; 12. 04. 1992; leg. J. KRAWERENDA. 6 spp.; Pojezierze Suwalskie lakeland, nature reserve "Głazowisko nad Czarną Hańczę", Poland; soil with roots of grasses, between big stones lying on dry meadow; 9. 06. 1995; leg. R. J. POMORSKI, M. PAKIET. 3 spp.; Baltic coast, Rowy, Słowiński National Park, Poland; moss covered sandy dune near sea shore; 27. 04. 1995; leg. R. J. POMORSKI.

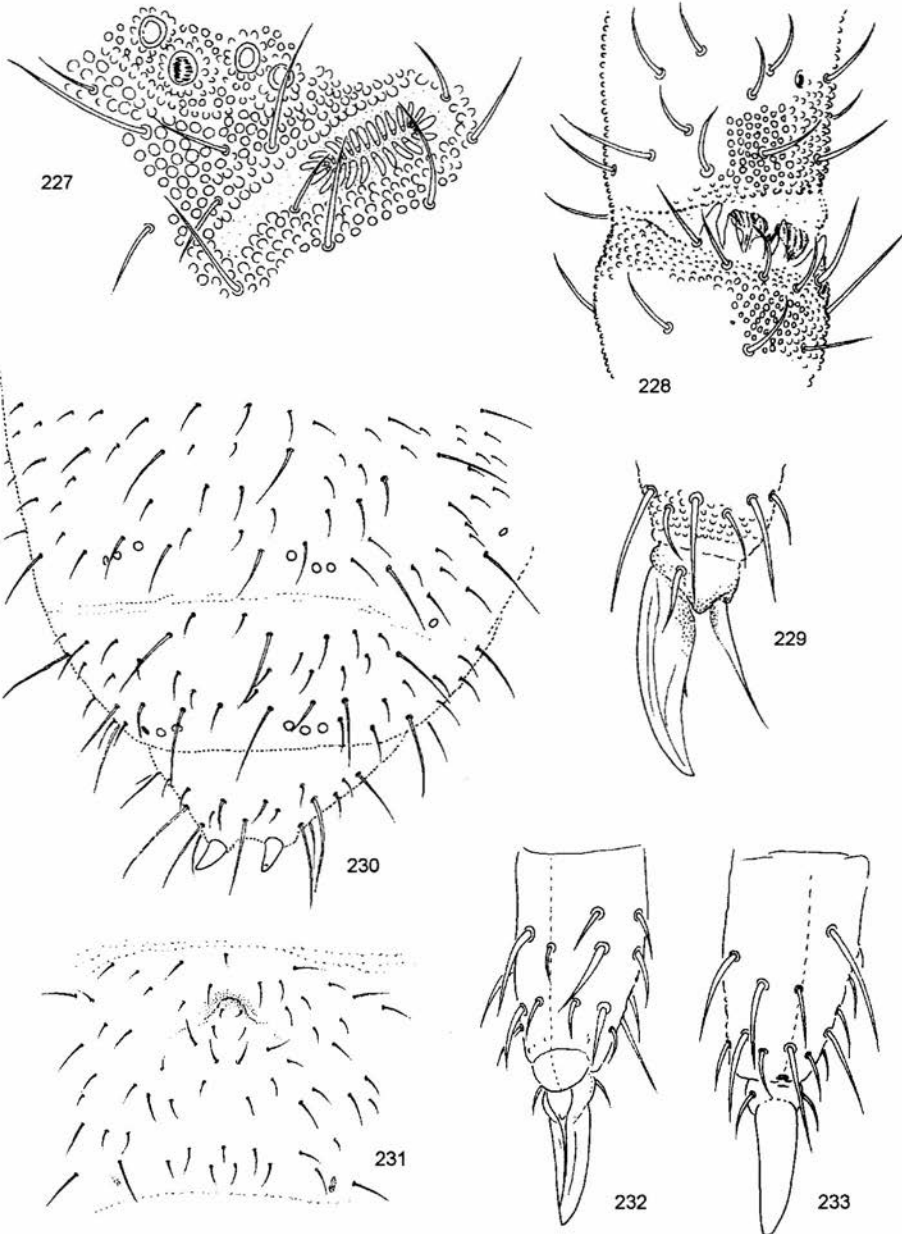
DESCRIPTION

Colour in alcohol white. Length without antennae: males 1.5 mm, females 1.7-1.9 mm. Body shape cylindrical, with strong anal spines set on distinct papillae (figs. 225, 230). Antennae approximately as long as head. Furca reduced to cuticular pocket with 2+2 setulae (fig. 231). Granulation more or less uniform, distinct. Area antennalis well marked.

Antennal segment IV with a subapical organite. Microsensillum on antennal segment IV in latero-external position, c.1/3 length from the base. Antennal segment III with microsensillum slightly below antennal III sense organ. Thoracic terga II and III with microsensilla laterally.



225-226. *P. pseudocellata*: 225 - chaetotaxy and localization of pseudocelli on dorsal side of body, 226 - chaetotaxy and localization of parapseudocelli on ventral side of body



227-233. *P. pseudocellata*: 227 - postantennal organ and pseudocelli, 228 - antennal III sense organ, 229 - claw, 230 - abdominal terga IV-VI, chaetotaxy and localization pseudocelli, 231 - abdominal sternum IV, remnant of furca and parapseudocelli, 232 - tibiotarsus, ventral side, 233 - tibiotarsus, dorsal side

Antennal III sense organ built of 5 guard setae, 2 sensory rods, 2 straight and granulated sensory clubs and 5 papillae (fig. 228).

Postantennal sense organ (PAO) consisting of 20-26 simple vesicles (fig. 227).

Pseudocellar (pso) formula dorsally: 4(3)4/033/3335(4)3; ventrally: 1/000/00000, all subcoxal with pseudocellus. Formula parapseudocelli (psx) ventrally: 0/000/1111, parapseudocelli on subcoxal invisible. Position of pso and psx is presented in figs. 225, 226.

Dorsal chaetotaxy, usually symmetrical, well differentiated into macrochaetae and microchaetae as in fig. 148. Sensilla weakly marked. Head without seta d_0 , abdominal tergum V with seta p_0 , abdominal tergum VI with one medial seta. Straight lines, passing through bases of short setae situated above anal spines, convergent or subparallel (fig. 230). Between legs on pro-, meso- and metathorax 1+1, 2+2 and 2+2 setae respectively. Tubus ventralis with ca. 9+9 setae and 2+2 setae at base. Ventral abdominal chaetotaxy as in fig. 226.

Claws always with small teeth. Empodial appendage without basal lamella, appendage length equals 4/5 inner edge of the claw. Tibiotarsi with distal verticil, composed of 11 setae (figs. 232, 233).

Male ventral organ absents.

BIOLOGY

P. pseudocellata in Poland lives in warm, dry and sandy places in mountains, highlands and lowlands. It has been collected in mosses covered sandy dune near sea shore, in sandy soil-covered limestone rocks and in dry soil with roots of grass and other plants, growing in rock crevices. Bisexual.

DISTRIBUTION IN POLAND

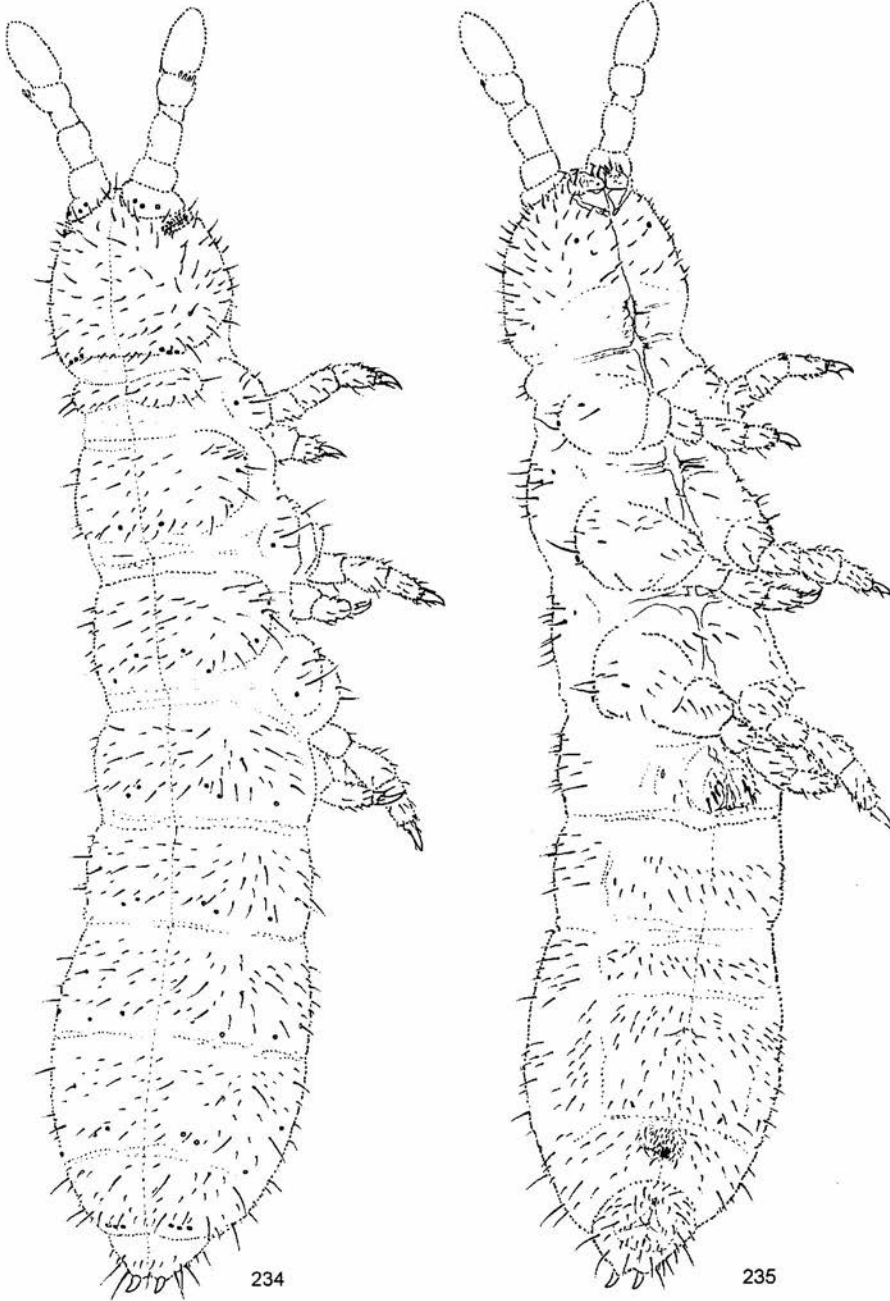
Baltic coast, Sudetes, Sudetes highland, and Carpathians.

Protaphorura tricampata (GISIN, 1956)

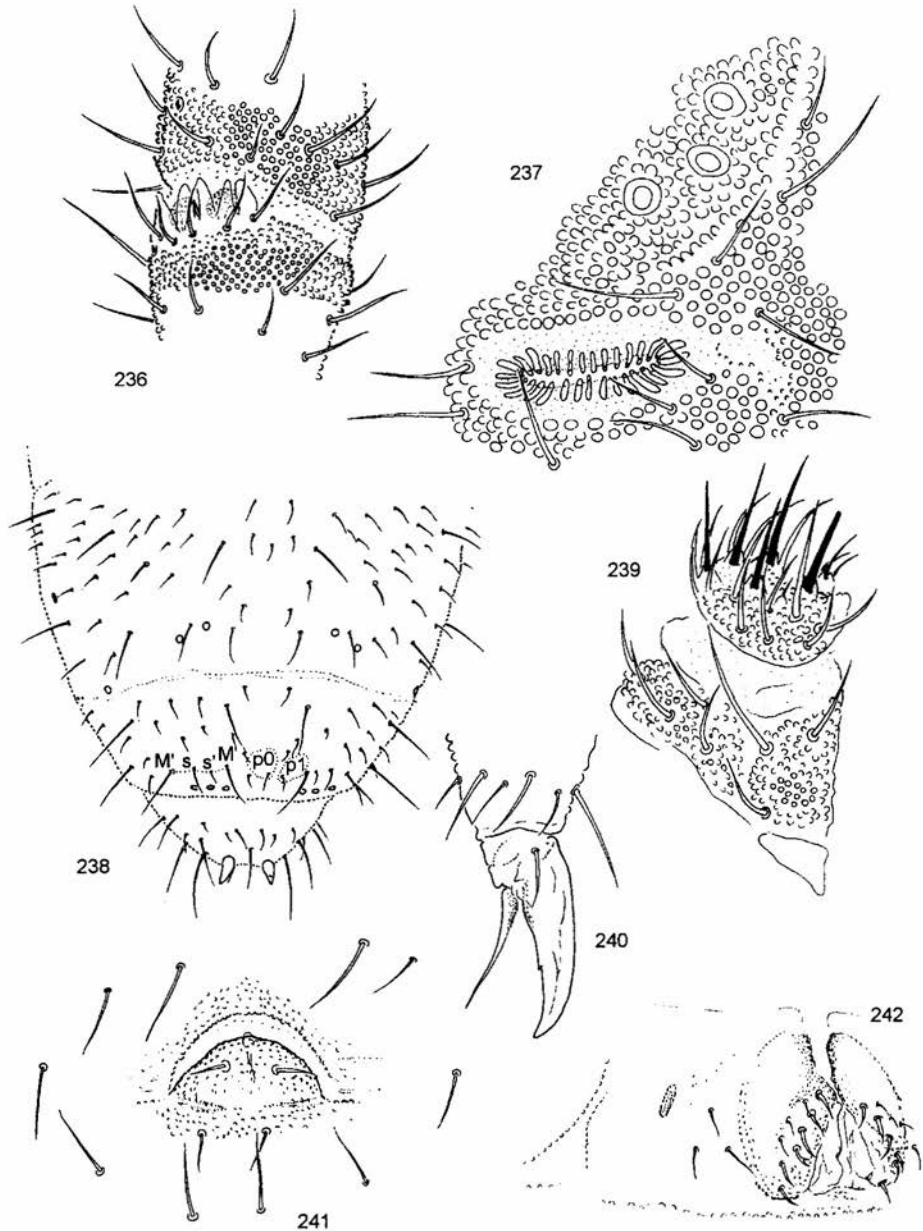
Onychiurus tricampatus GISIN, 1956: 343.

MATERIAL

3 females; Baltic coast, Woliński National Park, Międzyzdroje, Poland; beech forest, near sea shore; 12. 04. 1991; leg. R. J. POMORSKI, D. SKARZYŃSKI. 1 male subadult., 2 females; Nizina Śląska lowland, Kątna near Wrocław, Poland; soil with litter in pine forest; 22. 09. 1991; leg. POMORSKI. 3 females; Nizina Śląska lowland, Bory Dolnośląskie, Osiecznica, Poland; sand with moss near river Kwisa; 22. 06. 1994; leg. POMORSKI. 1 male subadult.; Baltic coast, Zalew Wiślany bay, Suchacz, Poland; soil with grass in canebrake near shore; 11. 06. 1995; leg. R. J. POMORSKI, M. PAKIET. 2 males subadult.; Pojezierze Suwalskie lake land, "Głazowisko nad Hańczą" nature reserve; moss with grass between big stones on dry meadow; 9. 06. 1995; leg. R. J. POMORSKI, M. PAKIET. 3 males, 2 females; Puszcza Romnicka, "Wilczy Kąt" nature reserve; sandy soil with litter under



234-235. *P. tricampata*: 234 - chaetotaxy and localization of pseudocelli on dorsal side of body, 235 - chaetotaxy and localization of parapseudocelli on ventral side of body



236-242. *P. tricampata*: 236 - antennal III sense organ, 237 - postantennal organ and pseudocelli, 238 - abdominal terga IV-VI, chaetotaxy and localization pseudocelli, 239 - labium, 240 - claw, 241 - remnant of furca, 242 - male ventral organ on tubus ventralis

fallen tree trunk, spruce forest; 10. 06. 1995; leg. R. J. POMORSKI, M. PAKIET. 2 males, 1 female; Pojezierze Pomorskie lakeland, Pomorze Środkowe, Stara Brda near Miastko; sandy soil; 3. 06. 1996; leg. M. SŁAWSKA.

DESCRIPTION

Colour in alcohol white. Length without antennae: males 1.75 mm, females 1.8-2.0 mm. Body shape cylindrical, with strong anal spines set on distinct papillae (figs. 234, 238). Antennae approximately as long as head. Furca reduced to cuticular pocket with 2+2 setulae (fig. 241). Granulation more or less uniform, distinct. Area antennalis well marked.

Antennal segment IV with a subapical organite. Microsensillum on antennal segment IV in latero-external position, c.1/3 length from the base. Antennal segment III with microsensillum slightly below antennal III sense organ. Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ built of 5 guard setae, 2 sensory rods, 2 straight and granulated sensory clubs and 5 papillae (fig. 236).

Postantennal sense organ (PAO) consisting of 28-35 simple vesicles (fig. 237).

Pseudocellar (pso) formula dorsally: 33/023/33343; ventrally: 1/000/00000; subcoxal with 1 pseudocellus. Formula parapseudocelli (psx) ventrally: 1/000/111101^m, all subcoxal with 1 parapseudocellus. Position of pso and psx is presented in figs. 234, 235.

Dorsal chaetotaxy, usually symmetrical, well differentiated into macrochaetae and microchaetae as in fig. 234. Head without seta d_0 , abdominal tergum V with s' seta, localized in one row with M, M' and s setae, abdominal tergum V with seta p_0 and p_1 setae, abdominal tergum VI with 1 medial seta. Straight lines, passing through bases of short setae situated above anal spines convergent (fig. 238). Between legs on pro-, meso- and metathorax 1+1, 2+2 and 3+3 setae respectively. Tubus ventralis with ca. 8+8 setae and 3+3(2+2) setae at base. Ventral abdominal chaetotaxy as in fig. 235.

Claws always with teeth. Empodial appendage without basal lamella, appendage length equals 3/4 inner edge of the claw. Tibiotarsi with distal verticil, composed of 11 setae (fig. 240).

Male ventral organ consist 6+6 thickened curved, pointed, rarely forked setae, localized subapically on ventral tube (fig. 242).

BIOLOGY

Ecological preferences of *P. tricampata* are difficult to define precisely. Probably this bisexual species is connected with dry sandy soil.

DISTRIBUTION IN POLAND

Baltic coast, Pomerania lakeland, Suwalskie lakeland, Lower Silesia.

Protaphorura janosik WEINER, 1990

Protaphorura janosik WEINER, 1990: 453.

TYPE MATERIAL

2 females, paratypes; Tatra Mts., Kościeliska Valley, Mylna Cave, Poland; on the surface of water; 9. 07. 1988; leg. A. W. SKALSKI.

DESCRIPTION

Colour in alcohol white. Length without antennae: 3.5-4.2 mm. Body shape cylindrical, with strong anal spines set on distinct papillae (fig. 243). Antennae approximately as long as head. Furca reduced to relatively small and shallow cuticular fold 2+2 setulae (fig. 246). Granulation more or less uniform, distinct. Area antennalis well marked.

Antennal segment IV with small subapical organite. Microsensillum on antennal segment IV in latero-external position, c.1/3 length from the base. Antennal segment III with microsensillum slightly below antennal III sense organ. Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ built of 5 guard setae, 2 sensory rods, 2 straight and granulated sensory clubs and 5 papillae (fig. 244).

Postantennal sense organ (PAO) consisting of 36(32)-46(51) simple vesicles (fig. 245).

Pseudocellar (pso) formula dorsally: 33/023/33343; ventrally: 1/000/00000; each subcoxal with 1 pseudocellus. Parapseudocelli (psx) invisible. Position of pso is presented in fig. 243.

Dorsal chaetotaxy, rather asymmetrical, poorly differentiated into macrochaetae and microchaetae as in fig. 243. Head without seta d_0 , abdominal tergum VI with 2 medial setae (fig. 247). Between legs on pro-, meso- and metathorax 1+1 (1+2), 2+2 (2+3, 3+4) and 3+3 (3+4, 4+4) setae respectively. Tubus ventralis with ca. 18-22+18-22 setae and 3+3(4+4, 2+2) setae at base.

Claws always with teeth. Empodial appendage without basal lamella, appendage length equals 3/4 inner edge of the claw. Tibiotarsi with distal verticil, composed of 11 setae.

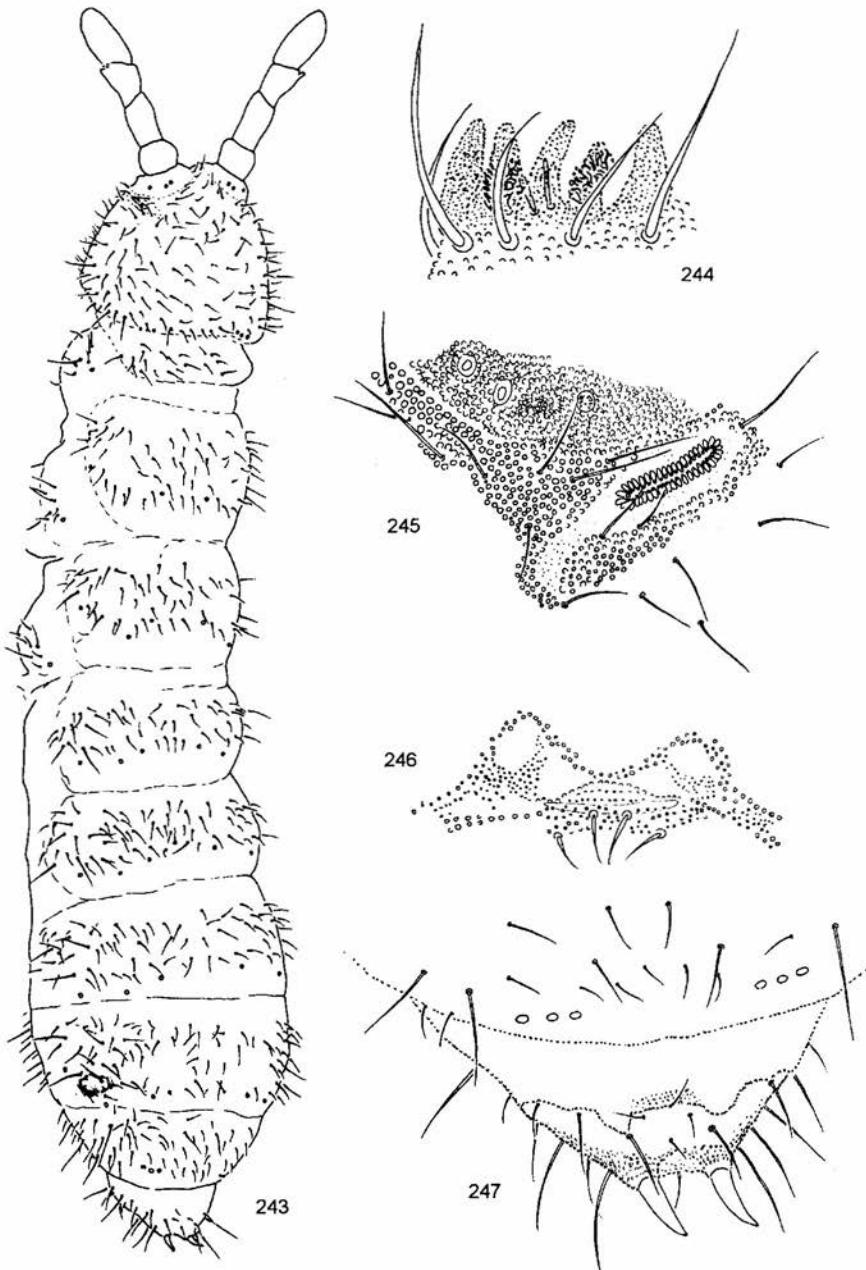
Male ventral organ absent.

BIOLOGY

P. janosik is a bisexual species known only from caves.

DISTRIBUTION IN POLAND

Carpathians – cave in Tatra Mts.



243-247. *P. janosik*: 243 - chaetotaxy and localization of pseudocelli on dorsal side of body, 244 - antennal III sense organ, 245 - postantennal organ and pseudocelli, 246 - remnant of furca, 247 - abdominal terga V and VI chaetotaxy and granulation (figs. 243, 244 and 246 according to WEINER, 1990)

Protaphorura pseudovanderdrifti (GISIN, 1957)

Onychiurus pseudovanderdrifti GISIN, 1957: 482.

MATERIAL

Numerous spp.; Lower Silesia, Bory Dolnośląskie, Węgliniec, Poland; wet moss and humus on bank of stream Mała Czerna in spruce forest; 17. 10. 1994; leg. R. J. POMORSKI.

DESCRIPTION

Colour in alcohol white. Length without antennae: males 1.5 mm, females 1.6-1.8 mm. Body shape cylindrical, with strong anal spines set on distinct papillae (fig. 248). Antennae approximately as long as head. Furca reduced to cuticular pocket with 2+2 setulae (fig. 252). Granulation more or less uniform, distinct. Area antennalis well marked.

Antennal segment IV with a subapical organite. Microsensillum on antennal segment IV in latero-external position, c.1/3 length from the base. Antennal segment III with very small microsensillum slightly below antennal III sense organ (fig. 251). Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ built of 5 guard setae, 2 sensory rods, 2 straight and granulated sensory clubs and 5 papillae (fig. 251).

Postantennal sense organ (PAO) consisting of 28-30 simple vesicles (fig. 250).

Pseudocellar (pso) formula dorsally: 34/023/33353; ventrally: 1/000/00000; on subcoxa no pseudocelli. Formula of parapseudocelli (psx) ventrally: 1/000/1110, all subcoxa1 with pseudocellus and 1 parapseudocellus. Position of pso and psx is presented in figs. 248, 249, 254.

Dorsal chaetotaxy, usually symmetrical, well differentiated into macrochaetae and microchaetae as in fig. 248. Head without seta d_0 , abdominal tergum V with seta p_0 and p_1 setae, abdominal tergum VI with 1(2) medial seta. Straight lines, passing through bases of short setae situated above anal spines, parallel or subparallel (fig. 254). Between legs on pro-, meso- and metathorax 1+1, 2+2 and 2+2 setae respectively. Tubus ventralis with ca. 9+9 setae and 2+2 setae at base. Ventral abdominal chaetotaxy as in fig. 249.

Claws always with distinct teeth. Empodial appendage without basal lamella, appendage length equals 4/5 inner edge of the claw. Tibiotarsi with distal verticil, composed of 11 setae (fig. 255).

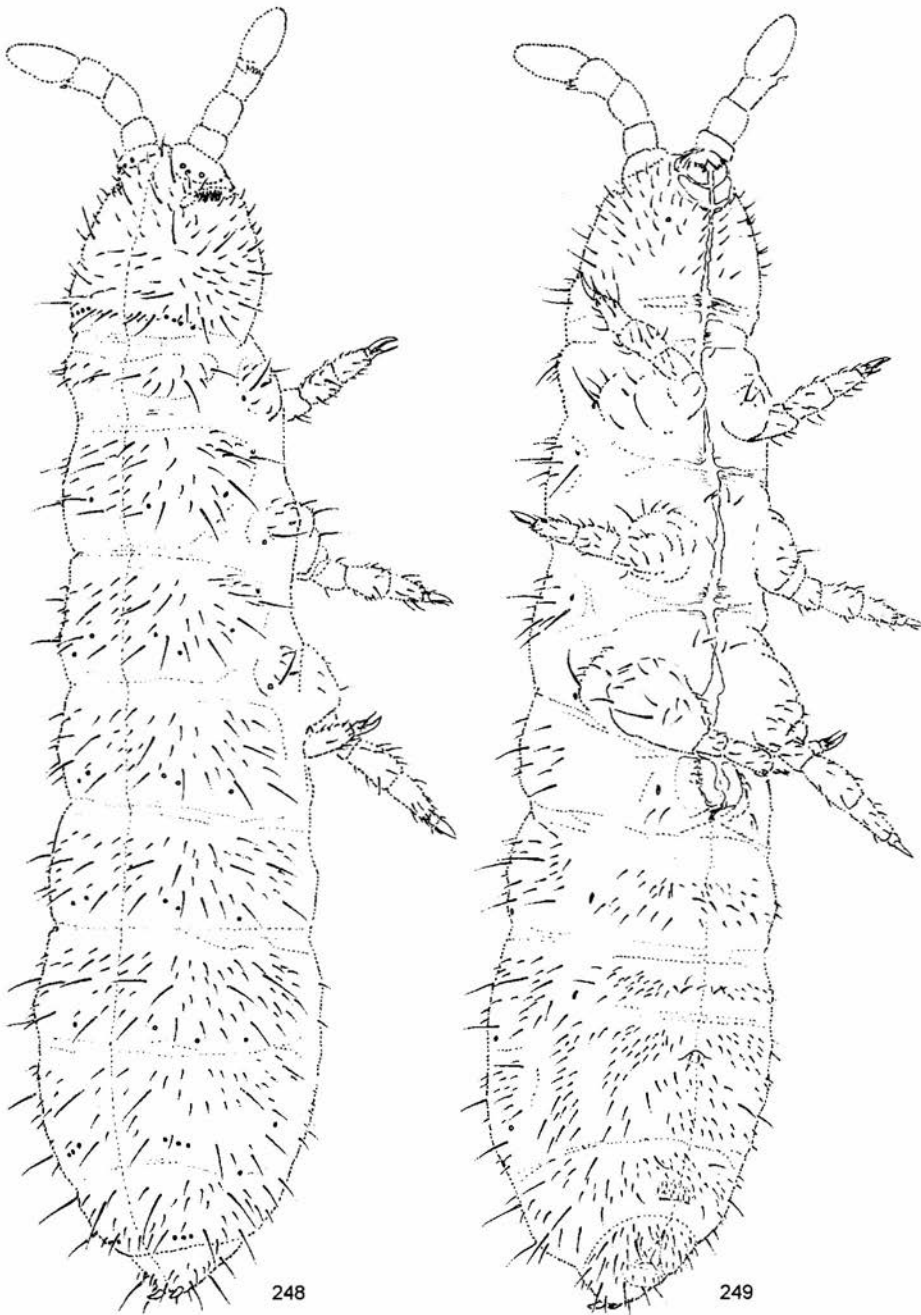
Male ventral organ absent.

BIOLOGY

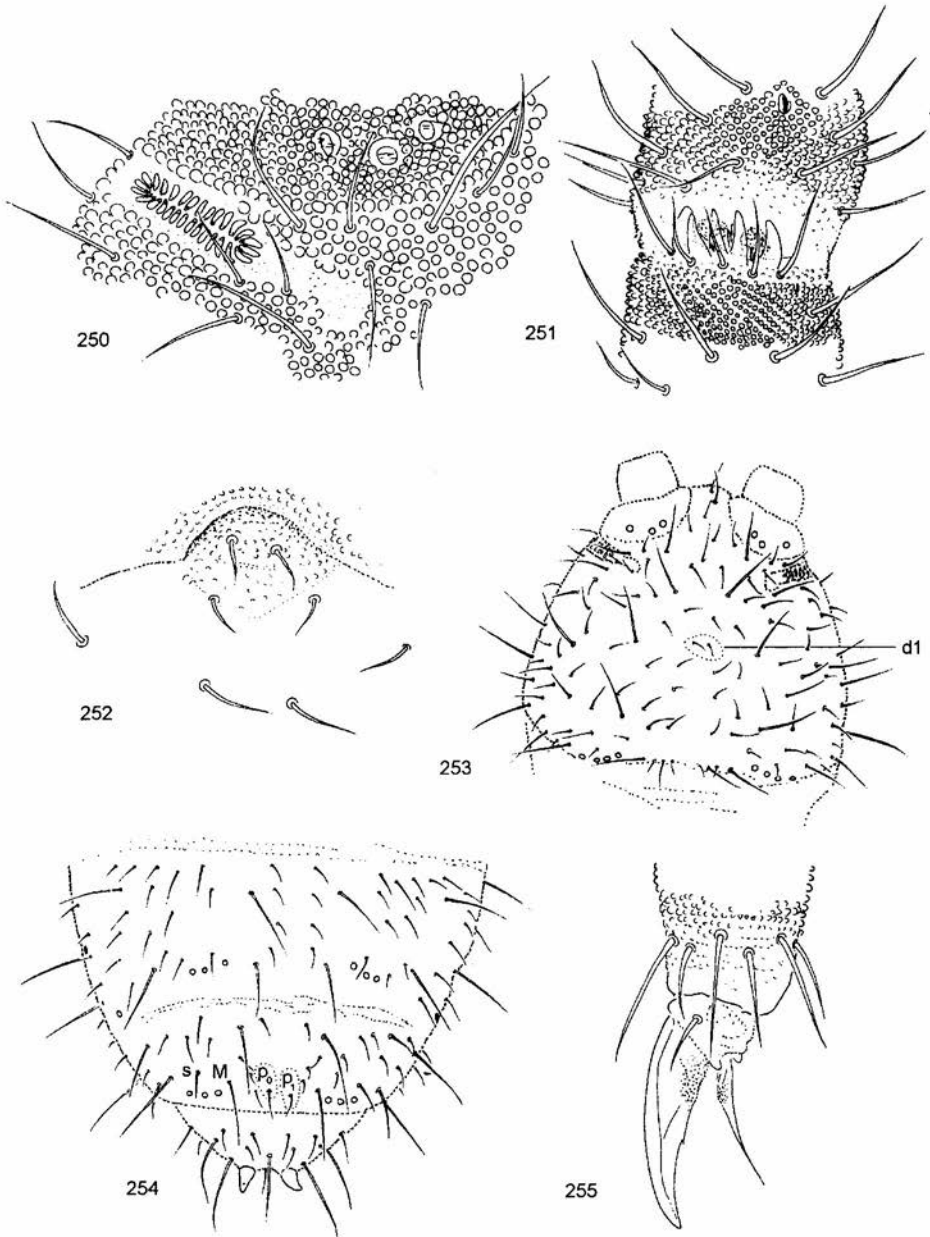
P. pseudovanderdrifti is probably connected with wet spruce forests. Bisexual.

DISTRIBUTION IN POLAND

Nizina Mazowiecka lowland, Lower Silesia.



248-249. *P. pseudovanredifti*: 248 - chaetotaxy and localization of pseudocelli on dorsal side of body, 249 - chaetotaxy and localization of parapseudocelli on ventral side of body



250-255. *P. pseudovanderdrifti*: 250 - postantennal organ and pseudocelli, 251 - antennal III sense organ, 252 - remnant of furca, 253 - head, chaetotaxy, 254 - abdominal terga IV-VI, chaetotaxy and localization of pseudocelli, 255 - claw

Protaphorura subarmata (GISIN, 1957)*Onychiurus subaramatus* GISIN, 1957: 479

Among the Polish specimens of *Protaphorura* that fit the description of *P. subarmata*, I found two forms, which can be distinguished according to the following characters:

1. Abdominal sternum IV with 1+1 parapseudocellus; claws usually with denticle (fig. 269); straight lines, passing through bases of short setae situated above anal spines parallel. *P. subarmata* f. *silesiaca*
- . Abdominal sternum IV without parapseudocelli (fig. 257); claws usually without denticle; straight lines, passing through bases of short setae situated above anal spines parallel or subparallel *P. subarmata* f. *occidentalis*

P. subarmata f. *silesiaca*

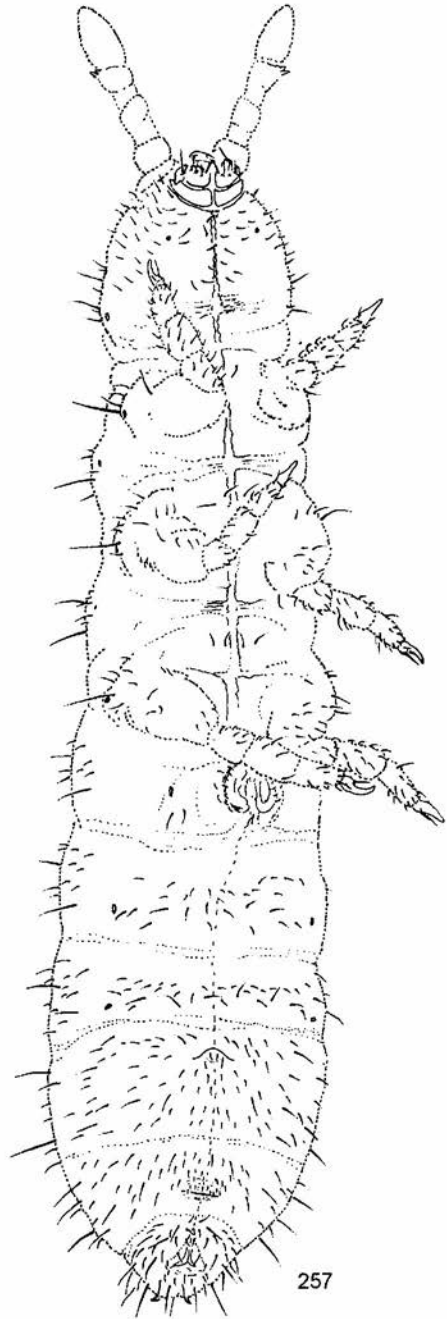
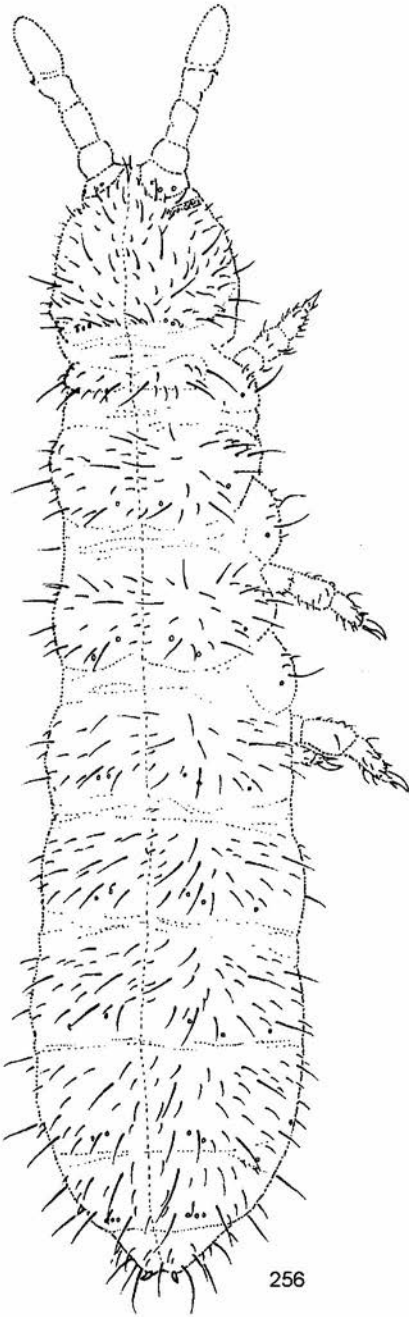
MATERIAL

Numerous spp.; Sudetes, Ślęza Massif, Sulistrowiczki, Poland; meadow, soil sample; 17. 09. 1984; leg. R. J. POMORSKI. Numerous spp.; Nizina Śląska lowland, Głogów, Poland; sand with grasses near bank of river Odra; 31. 10. 1995; leg. B. BALUL.

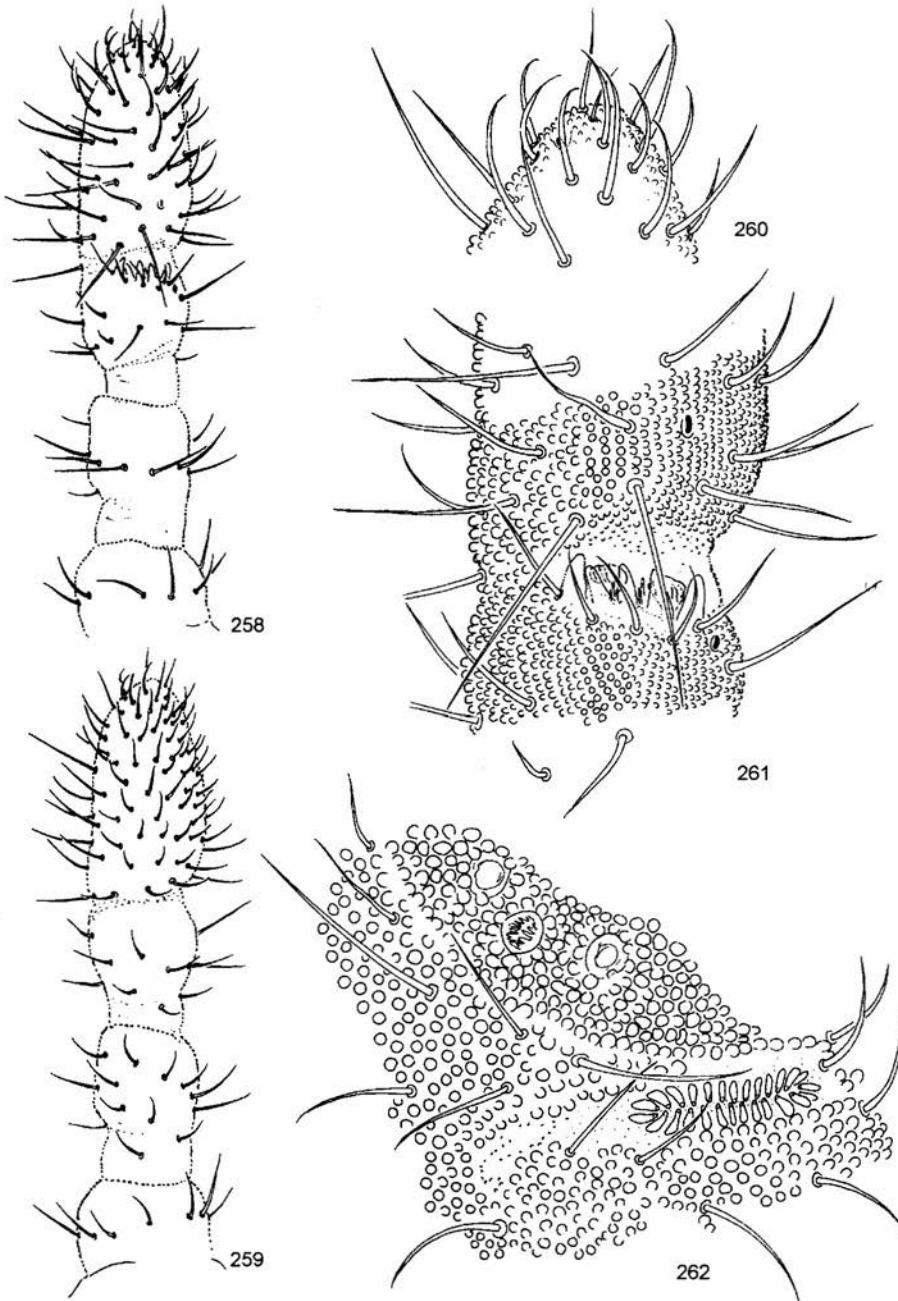
P. subarmata f. *occidentalis*

MATERIAL

Male; Polesie Lubelskie, Cegielnia, Poland; litter in mixed forest; 14. 05. 1991; leg. D. SKARŻYŃSKI. 5 females; Carpathians, Beskid Średni Mts., Bednarzówka near Maków Podhalański, Poland; gravel bed of the river Skawica; 11. 11. 1993, leg. D. SKARŻYŃSKI, R. J. POMORSKI. Male, 3 females; Carpathians, Pieniny Mts., Pieniński National Park, Dolina Ociemnego valley, Poland; litter; 25. 05. 1994; leg. R. J. POMORSKI. Numerous spp.; Nizina Podlaska, Białowiecki National Park, Hajnówka, Poland; soil with litter, oak-pine forest; Numerous spp.; Pojezierze Suwalskie lakeland, "Głazowisko nad Hańczą" nature reserve; under moss on big stones on dry meadow; 8. 06. 1995; leg. R. J. POMORSKI, M. PAKIET. Male, 3 females; Pojezierze Suwalskie lakeland, Puszcza Romnicka, Poland; bank of river Błędzianka, near bridge; 10. 06. 1995; leg. R. J. POMORSKI, M. PAKIET. Numerous spp.; Wyżyna Małopolska upland, Góry Świętokrzyskie mountains, "Święty Krzyż", Poland; litter on rocks in spruce forest; 25. 08. 1995; leg. R. J. POMORSKI. Numerous spp.; Nizina Mazowiecka lowland, Jaktorów, Poland; wet meadow on border with older forest; 14. 11. 1996. leg. R. J. POMORSKI.



256-257. *P. subarmata*: 256 - chaetotaxy and localization of pseudocelli on dorsal side of body, 257 - chaetotaxy and localization of parapseudocelli on ventral side of body



258-262. *P. subarmata*: 258-259 - antenna, 260 - apical part of antennomere IV, 261 - antennal III sense organ, 262 - postantennal organ and pseudocelli

DESCRIPTION

Colour in alcohol white. Length without antennae:

P. subarmata f. *silesiaca* -

males 1.6 mm, females 1.9-1.8 mm.

P. subarmata f. *occidentalis* -

males 1.3 mm, females 1.6-1.7 mm (Polesie - Białowiecki National Park); males 1.5-1.6 mm, females 1.7-1.8 mm (Wyżyna Małopolska upland - Świętokrzyski National Park); males 1.6 mm, females 1.7 mm (Pojezierze Suwalskie lakeland); males 1.6 mm, females 1.8-1.9 mm (Nizina Mazowiecka lowland); males 1.7 mm, females 1.8-2.0 mm (Carphatians - Pieniński National Park, Beskid Makowski).

Body shape cylindrical, with strong anal spines set on distinct papillae (fig. 256). Antennae approximately as long as head. Furca reduced to cuticular pocket with 2+2 setulae. Granulation more or less uniform, distinct. Area antennalis well marked.

Antennal segment IV with a subapical organite (fig. 260). Microsensillum on antennal segment IV in latero-external position, c.1/3 length from the base (figs. 258, 261). Antennal segment III with microsensillum slightly below antennal III sense organ. Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ built of 5 guard setae, 2 sensory rods, 2 straight and granulated sensory clubs and 5 papillae (fig. 261).

Postantennal sense organ (PAO) consisting of 28-35 simple vesicles (fig. 262).

Pseudocellar (pso) formula dorsally: 33/023/33343; ventrally: 1/000/00000; subcoxal with 1 pseudocellus. Formula of parapseudocelli (psx) ventrally:

1/000/111101^m - *P. subarmata* f. *silesiaca*

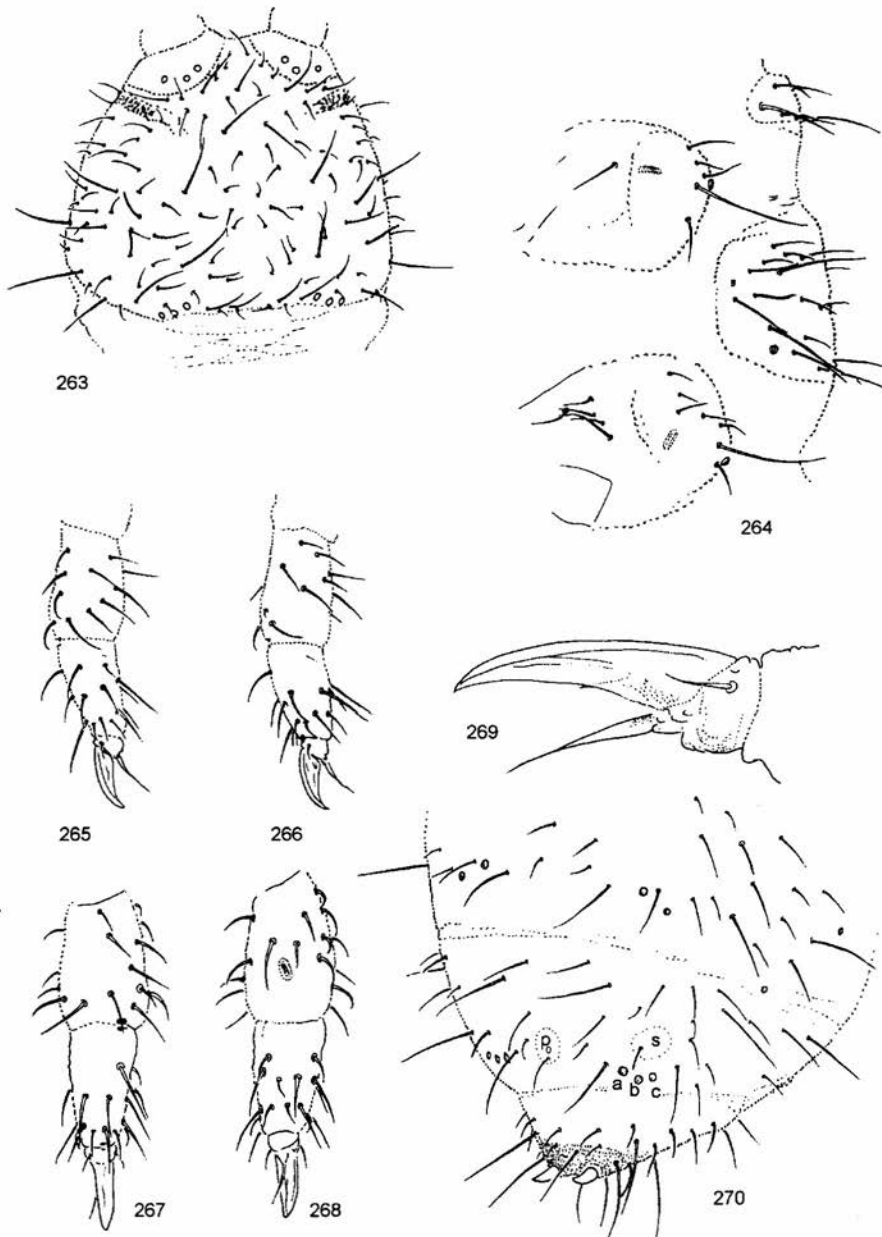
1/000/11100 - *P. subarmata* f. *occidentalis*

All subcoxal with 1 parapseudocellus. Position of pso and psx is presented in figs. 256, 257.

Dorsal chaetotaxy, usually symmetrical, well differentiated into macrochaetae and microchaetae as in fig. 256. Head without seta d_0 , abdominal tergum V with seta p_0 , abdominal tergum VI with 1 medial seta. Straight lines, passing through bases of short setae situated above anal spines parallel or subparallel (fig. 270). Between legs on pro-, meso- and metathorax 1+1, 2+2 and 2+2 setae respectively. Tubus ventralis with ca. 8+8 setae and 2+2 setae at base. Ventral abdominal chaetotaxy as in fig. 257.

Claws usually without teeth (*P. subarmata* f. *occidentalis*) or with small teeth (*P. subarmata* f. *silesiaca*). Empodial appendage without basal lamella, appendage length equals 3/4 inner edge of the claw. Tibiotarsi with distal verticil, composed of 11 setae (figs. 265-268).

Male ventral organ absent.



263-270. *P. subarmata*: 263 - head, chaetotaxy, 264 - subcoxal of I and II pair of legs, fragment of thoracic terga I and II, chaetotaxy, localization of pseudocelli and parapseudocelli, 265-268 - leg of II pairs (*P. subarmata f. occidentalis*), 269 - claw (*P. subarmata f. silesiaca*), 270 - abdominal terga IV-VI, chaetotaxy, granulation and localization of pseudocelli

BIOLOGY

Ecological preference of *P. subarmata* difficult to define. The species is probably connected with wet, woodland habitats.

DISTRIBUTION IN POLAND

P. subarmata f. *silesiaca* – Lower Silesia, Sudetes highland.

P. subarmata f. *occidentalis* – Carpathians, Wyżyna Małopolska upland, Nizina Mazowiecka lowland, Nizina Podlaska lowland, Pojezierze Suwalskie lakeland.

TAXONOMIC REMARKS

In Poland fauna *P. subarmata* includes two, morphologically different groups of populations.

P. subarmata f. *silesiaca* lives in south-west and Poland and is characterized by consequent presence of 1+1 parapseudocelli on abdominal sternum IV and presence of teeth on claws. These characters place *P. subarmata* f. *silesiaca* close to some populations of *P. armata*, especially to specimens with seta p_0 on abdominal tergum V (without p_1 setae), subparallel prespinal setae and with teeth on claws (see Taxonomic remarks on *P. armata*).

P. subarmata f. *occidentalis* lives in different habitats in the middle and east Poland and is characterized by the lack of parapseudocelli on abdominal sternum IV and teeth on claws. The populations of this form are differentiated with respect to the length of body and sex dimorphism. The specimens living in lowlands are usually smaller and differences between males and females in body size are distinct. The specimens living in highlands and mountains are bigger and differences between males and females in body size are smaller

When I distinguished both morphological forms I could not decide whether they should be given specific or subspecific rank for the following reason:

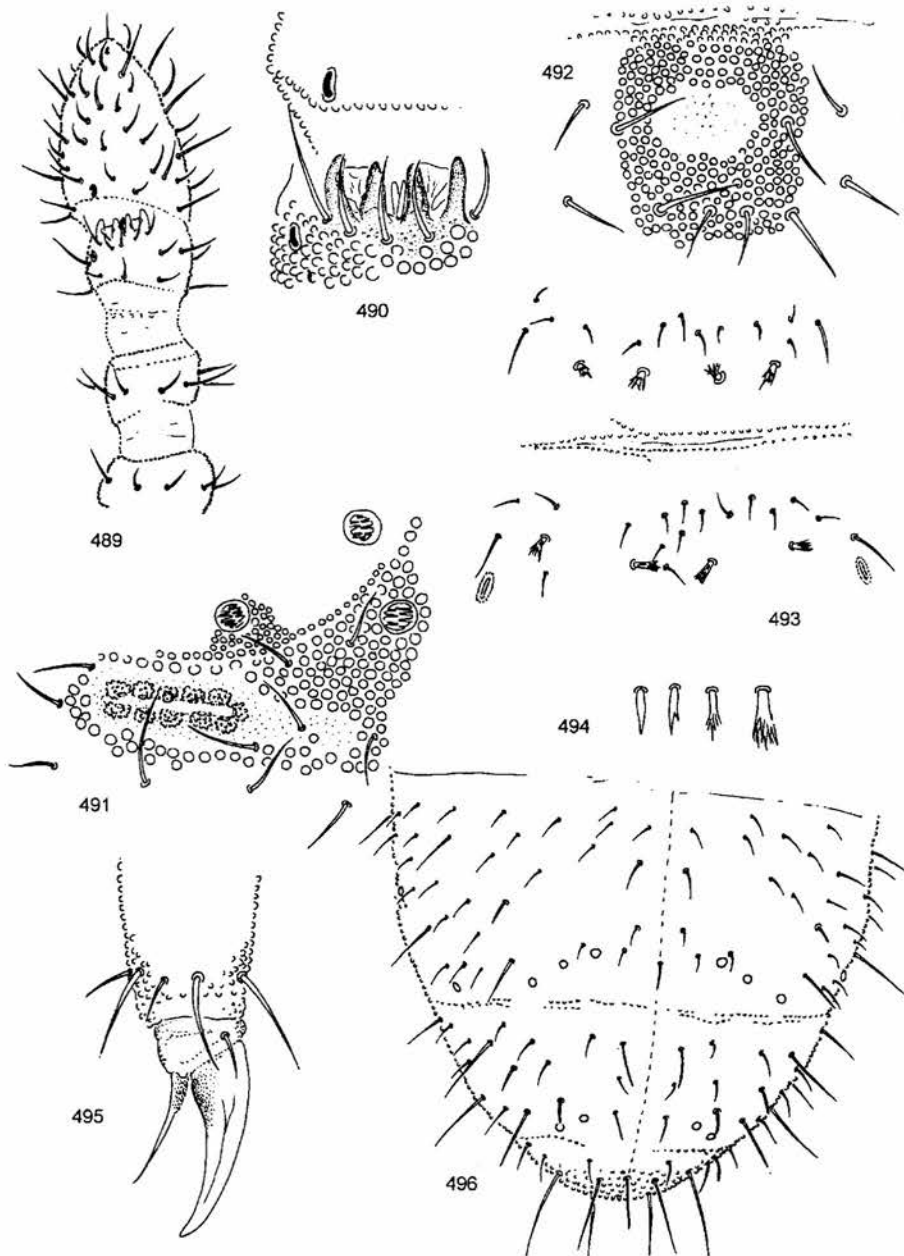
- *P. subarmata* needs a redescription, based on the type material,
- the knowledge of phenological and ecological variability of this species and related species belonging to the genus *Protaphorura* is indispensable (see Taxonomic remarks in *P. armata*).

***Protaphorura armata* (TULLBERG, 1869) sensu GISIN, 1952**

Lipura armata TULLBERG, 1869: 18.

MATERIAL

Numerous spp.; Sudetes, Ślęza Massif, Sulistrowiczki, Poland; oak-pine forest, soil with litter; 17. 09. 1984; leg. R. J. POMORSKI. 5 females; Sudetes, Góry Kaczawskie, Wojcieszów, Poland; "Nowa "and "Północna Wielka" caves; 21. 07. 1986; leg. R. J. POMORSKI. Numerous spp.; Sudetes, Góry Opawskie, Głucho-



489-496. *O. stachianus*: 489 - antenna, 490 - antennal III sense organ, 491 - postantennal organ and pseudocells, 493 - male ventral organ, 494 - changes in shape of setae in male ventral organ in postembryonic development, 495 - claw, 496 - abdominal terga IV-VI, chaetotaxy and localization of pseudocells

3/4 inner edge of the claw. Tibiotarsi with symmetrical distal verticil, composed of 9 setae.

Male ventral organ situated on abdominal sterna II and III, fully developed only in mature specimens with ductus ejaculatorius. It consists 2+2 thickened, short, serrated setae on abdominal II sternum and 2+2 similar setae on abdominal sternum III (fig. 493). The shape of these setae is changed during postembryonic development (fig. 494)

BIOLOGY

O. stachianus is a bisexual species, connected with roots of grass covering sand and gravel in the banks of submountane parts of rivers.

DISTRIBUTION IN POLAND

Sudetes and Carpathians.

REMARKS

The number of pseudocelli in the Polish material of *O. stachianus* is very variable, described it with the following formula: 32/0(1)22/3334(5)2(3). Besides, the additional pseudocelli often occurs symmetrically. RUSEK (1964) described similar variability of the number pseudocelli in population of *Onychiurus pseudostachianus* GISIN, 1956 from Germany. In all Polish localities, between specimens with typical pso formula, I found few specimens with higher number of pseudocelli on abdominal terga V and VI (32/022/33353). This formula is typical for *O. pseudostachianus*. In my opinion, the separateness of this species should be confirmed by a detailed examination.

Orthonychiurus rectopapillatus (STACH, 1933)

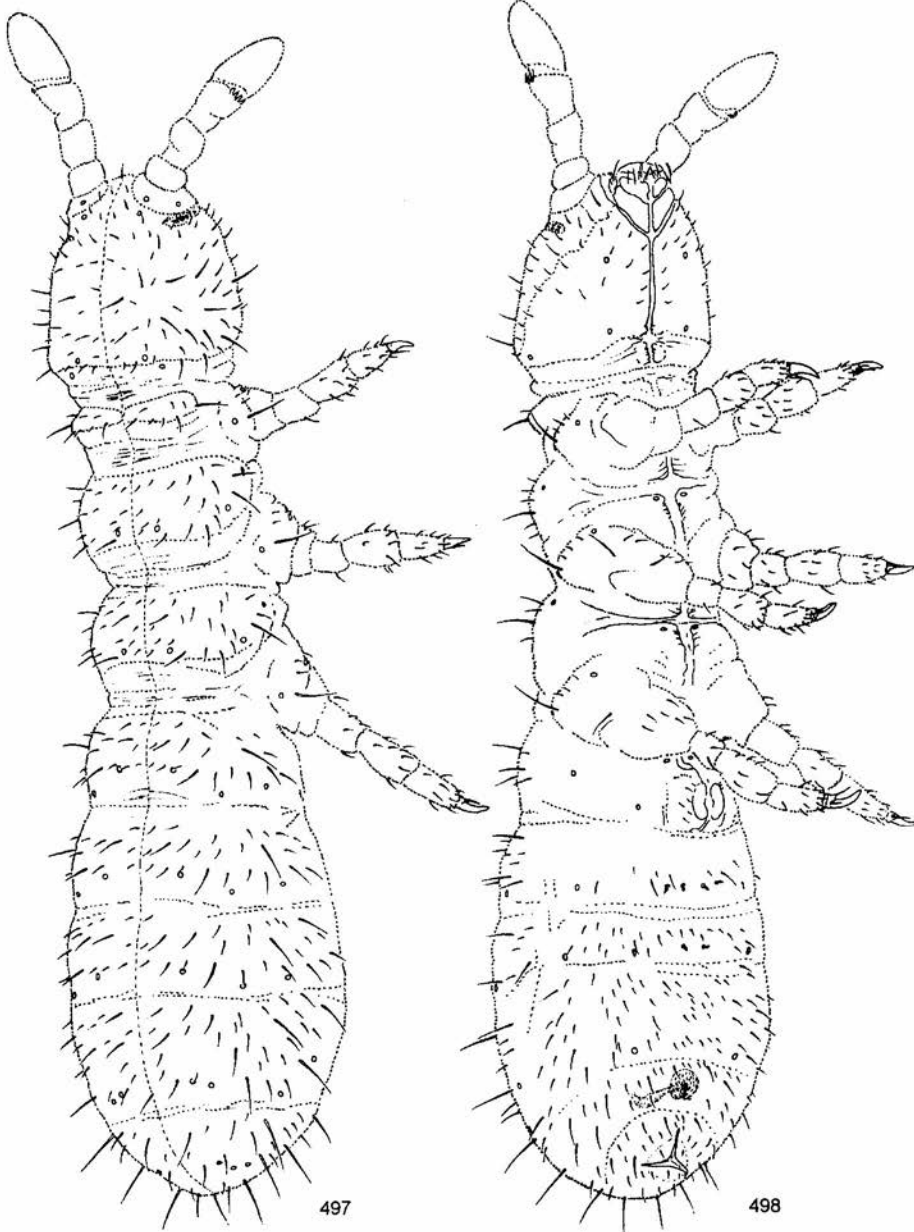
Onychiurus rectopapillatus STACH, 1933, Acad. pol. Sci., (B) Sci. Nat.: 236.

TYPE MATERIAL

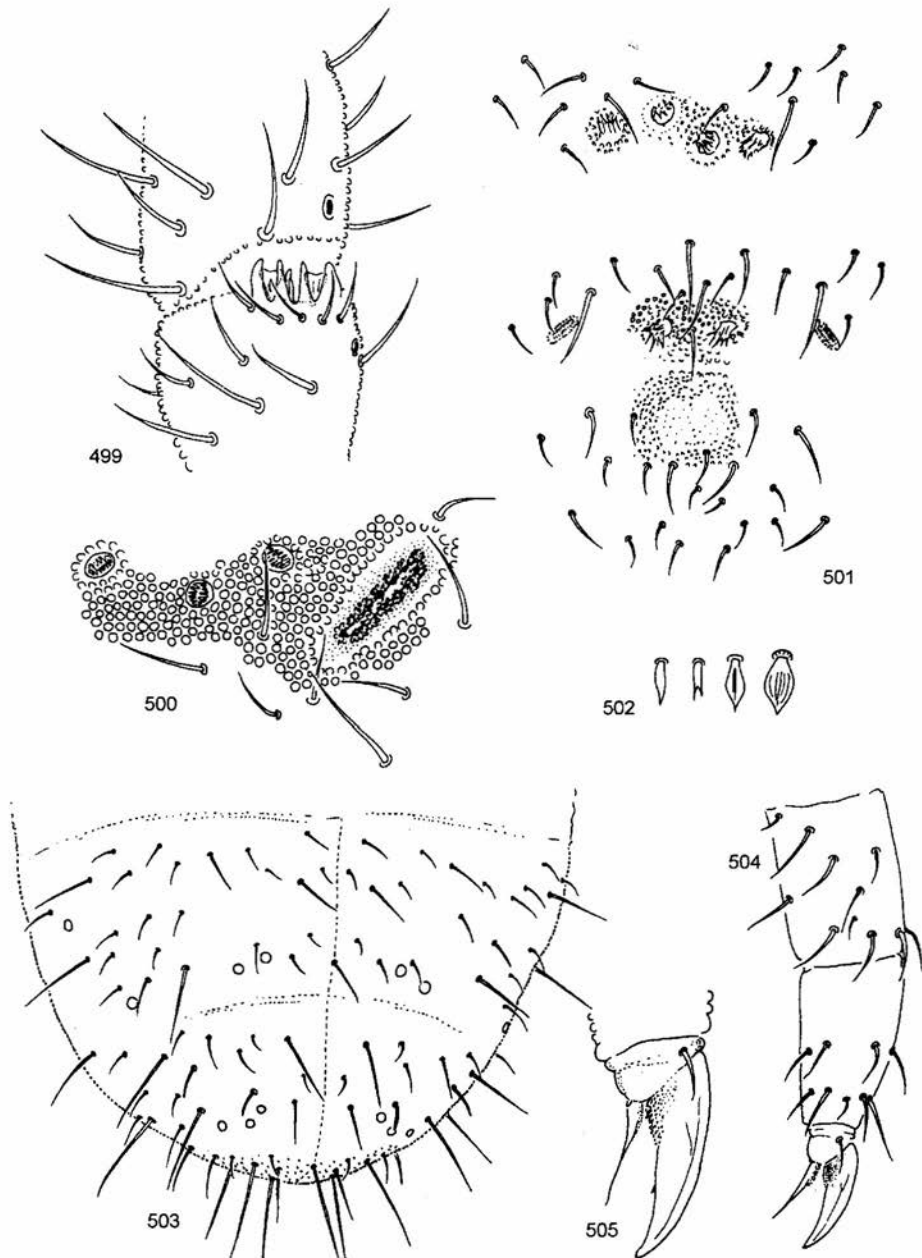
Lectotype male (on slide) (present designation), paralectotypes numerous spp. in alcohol; originally labelled "Orłowiny ad Łągów, 18. VII. 1935 l. PANOW"; Małopolska, Poland.

OTHER MATERIAL

Numerous spp.; Carpathians, Beskid Wschodni Mts., neighbourhood of Sanok, Poland; moss and litter; 12. 07. 1987; leg. D. SKARŻYŃSKI. 7 spp.; Carpathians, Bieszczady Mts., neighbourhood of Polańczyk, Poland; moss and litter; 20. 08. 1991; leg. D. SKARŻYŃSKI. 3 spp.; Carpathians, Bieszczady Mts., Smerek, Poland; wet mountain meadow; 20. 08. 1991; leg. D. SKARŻYŃSKI. Numerous spp., Carpathians, Pieniny Mts., Pieniński National Park, Dolina Pienińskiego Potoku,



497-498. *O. rectopapillatus*: 497 - chaetotaxy and localization of pseudocelli on dorsal side of body, 498 - chaetotaxy and localization of pseudocelli and parapseudocelli on ventral side of body



499-505. *O. rectopapillatus*: 499 - antennal III sense organ, 500 - postantennal organ and pseudocelli, 501 - male ventral organ (very old specimen), 502 - changes in shape of setae in male ventral organ in postembryonic development, 503 - abdominal terga IV-VI, chaetotaxy and localization of pseudocelli, 504 - legs of male, 505 - claw of female

Poland; litter; 12. 11. 1992; leg. R. J. POMORSKI. 3 spp.; Wyżyna Lubelska upland, Parchatka near Puławy, Poland; loess gorge, litter; 8. 07. 1995; leg. R. J. POMORSKI. 4 spp.; Wyżyna Małopolska upland, Puszcza Świętokrzyska, Lasy Siekierzyńskie, Wąchock, nature reserve "Wykus", Poland; litter; 17-18. 07. 1995, leg. R. J. POMORSKI. 6 spp.; Wyżyna Małopolska upland, Świętokrzyskie Mts., Świętorzyski National Park, "Święty Krzyż", Poland; moss and litter; 28. 07. 1995; leg. R. J. POMORSKI. Numerous spp.; Wyżyna Lubelska upland, Roztocze, Roztoczański National Park, Zwierzyniec, "Bukowa Góra", Poland; 14. 06. 1996; leg. R. J. POMORSKI, W. NOWAK.

REDESCRIPTION

Colour in alcohol white. Length without antennae: males – 1.0-1.2 mm, females – 1.3-1.6 mm. Body shape of males as in fig. 497. The abdomen of females is distinctly broadened in the region of abdominal segments IV-V. Abdominal segment VI without anal spines. Antennae approximately as long as head. Furca reduced to small area of fine granulation with 1+1 setulae posteriorly (fig. 501). Granulation more or less uniform, distinct, slightly coarser on terga, head capsule and on subcoxae I.

Antennal segment IV with subapical organite. Microsensillum on antennal segment IV in latero-external position, above the row of posterior setae. Antennal segment III with microsensillum slightly below antennal III sense organ (fig. 499). Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ built of 4 papillae, 2 sensory rods, 2 smooth sensory clubs with rib and 5 guard setae (fig. 499).

Postantennal sense organ (PAO) consisting of 10-15 vesicles, covered with vesicles (fig. 500)

Pseudocellar (pso) formula dorsally: 32/022/33343; ventrally: 12/011/3111; on subcoxa 2 pseudocelli. Formula of parapseudocelli (psx) ventrally: 0/000/001, all femora ventrally with 1 parapseudocellus. Position of pso and psx is presented in figs. 497, 498.

Dorsal chaetotaxy as in fig. 497, usually symmetrical, well differentiated into macrochaetae and microchaetae. Abdominal tergum IV with seta p_0 , abdominal tergum VI with one medial seta (fig. 503). Between legs on pro-, meso- and metathorax no setae. Tubus ventralis subapically with ca. 6+6 setae and without setae at base. Ventral abdominal chaetotaxy as in fig. 498.

Claws of females usually with small teeth (fig. 505), male's claws always without teeth. Empodial appendage without basal lamella, appendage length equals 3/4 inner edge of the claw. Tibiotarsi with symmetrical distal verticil, composed of 9 setae (fig. 504).

Male ventral organ situated on abdominal sterna II and III, fully developed only in mature specimens with ductus ejaculatorius. It consists of 2+2 thickened, short, fluke-like or serrated setae on abdominal sternum II and 1+1 similar setae on abdominal sternum III (fig. 501). The shape of these setae changes during postembryonic development (fig. 502)

BIOLOGY

O. rectopapillatus is a bisexual species, commonly living in various wet places in mountains, uplands and sometimes in lowlands, especially in litter and under moss covering rotting timber.

DISTRIBUTION IN POLAND

Carpathians, Wyżyna Krakowsko-Wieluńska upland, Wyżyna Małopolska upland, Wyżyna Lubelska upland.

***Bionychiurus* POMORSKI, 1996**

Bionychiurus POMORSKI, 1996, Genus, 7, 1: 92.

Bagnallophorus WEINER, 1996, Ann. Soc. Entomol. Fr. (N. S.), 32 (2): 183. syn. n.

Type species: *Onychiurus normalis* GISIN, 1949, by original designation (described from Switzerland).

Diagnosis. Body shape cylindrical with strong anal spines on distinct papillae. Hind margin of head capsule with pseudocelli. Body with homogenous granulation, with coarser granules on head and terga. Furca reduced to cuticular pocket with 2+2 setulae. AIIIO with 5 papillae, granulated sensory clubs. PAO with numerous (18-20), granulated vesicles. Distal veriticol of setae on tibiotarsi with 11 setae. Setae sensuales indistinct. Seta d_0 on head present, abdominal tergum IV with seta p_0 , abdominal tergum VI with 2 medial setae.

TAXONOMIC REMARKS

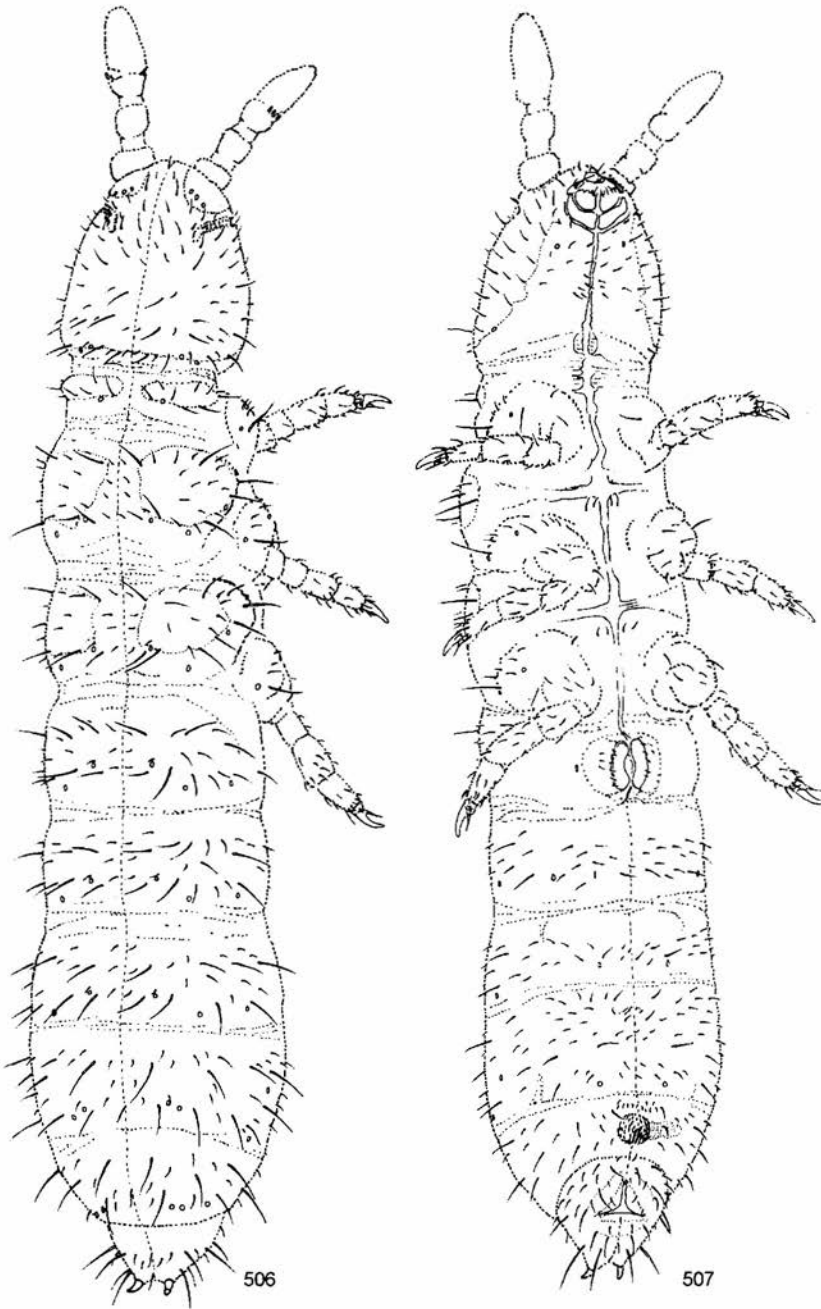
The proposal to establish a of separate genus with type species *O. normalis*, appeared in literature twice; in the generic revision of *Onychiurinae* WEINER (1996) and in a systematic study of I instar larvae of *Onychiurinae* (POMORSKI, 1996). My work was published and distributed two months earlier and this is why the, generic name *Bagnallophorus* is regarded as a junior synonym of *Bionychiurus*.

***Bionychiurus normalis* (GISIN, 1949)**

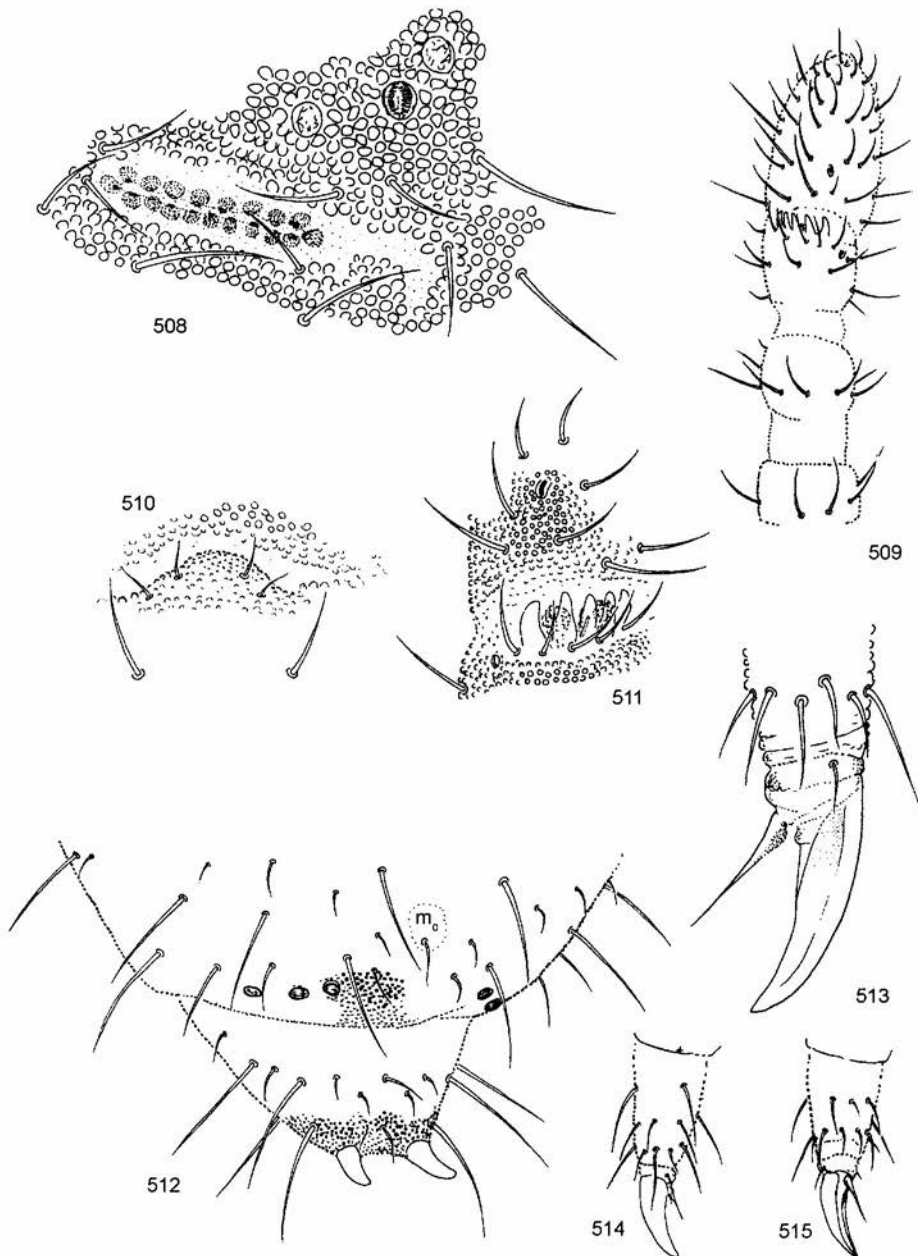
Onychiurus normalis GISIN, 1949: 400.

MATERIAL

Numerous spp.; Nizina Mazowiecka lowland, Skierniewice, Poland; soil in greenhouse; 15. 05. 1991; leg. G. SOJKA.



506-507. *B. normalis*: 506 - chaetotaxy and localization of pseudocelli on dorsal side of body, 507 - chaetotaxy and localization of pseudocelli and parapseudocelli on ventral side of body



508-515. *B. normalis*: 508 - postantennal organ and pseudocelli, 509 - antenna, 510 - remnant of furca, 511 - antennal III sense organ, 512 - abdominal terga V and VI, chaetotaxy and localization of pseudocelli, 513 - claw, 514-515 - tibiotarsus of II pair of legs

DESCRIPTION

Colour in alcohol white. Length without antennae 1.7-2.0 mm. Body cylindrical, elongated, with strong anal spines (fig. 506). Antennae approximately as long as head. Furca reduced to cuticular pocked with 2+2 setulae. Granulation more or less uniform, distinct, somewhat coarser on terga, head capsule and around anal spines (fig. 432). Area antennalis distinct.

Antennal segment IV with a subapical organite and microsensillum located distinctly above posterior setae. Antennal segment III with microsensillum slightly below antennal III sense organ (fig. 509). Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ built of 5 guard setae, 2 sensory rods, 2 bent granulated sensory clubs and 5 papillae (fig. 511).

Postantennal sense organ (PAO), consisting of 18-22 finely granulated vesicles (fig. 508).

Pseudocellar (pso) formula dorsally: 32/133/33343; ventrally: 11/000/0101; on subcoxal 2 pseudocelli. Formula of parapseudocelli (psx) ventrally: 0/000/101, all femora ventrally with 1 psx. Position of pso and psx as in figs. 506, 507.

Dorsal chaetotaxy as in fig. 423, usually symmetrical, well differentiated into macrochaetae and microchaetae. Abdominal tergum IV with seta p_0 , abdominal tergum V with seta m_0 , abdominal tergum VI with 2 medial setae. Straight lines passing through the bases of setae located in front of anal spines divergent (fig. 512). Between legs on meso- and metathorax 2+2 setae. Ventral tube without setae at base and ca. 9+9 apical and subapical setae. Ventral abdominal chaetotaxy as in fig. 507.

Claws always without teeth. Empodial appendage with small basal lamella, appendage length equals 3/4 inner edge of the claw. Tibiotarsi with distal verticil, composed of 11 setae (figs. 513-515).

Male ventral organ absent.

BIOLOGY

In Poland *B. normalis* lives in greenhouses only. Bisexual.

DISTRIBUTION IN POLAND

Nizina Mazowiecka lowland.

***Deharvengiurus* WEINER, 1996**

Deharvengiurus WEINER, 1996, Ann. Soc. Entomol. Fr. (N. S.), 32 (2): 183.

Type species: *Onychiurus argus* DENIS, 1924, by original designation (described from France).

Diagnosis. Body shape thick, bulgy, distinctly broadened in region of abdominal segments II-IV, with anal spines. Dorsal side of body with multiplication of pseudocelli. Granulation homogenous and fine. Furca reduced to fine granulated area with 1+1 setulae posteriorly. AIIIO usually with 5 papillae, granulated, bent sensory clubs. PAO with numerous, granulated vesicles. Distal veriticil of setae on tibiotarsi with 11 setae. Setae sensuales on head and body indistinct. Seta d_0 on head present. Chaetotaxy of abdominal tergum IV and V in adults usually asymmetrical. Abdominal tergum VI with 1 medial seta.

***Deharvengiurus denisi* (STACH, 1934) comb. nov.**

Onychiurus denisi STACH, 1934: 191.

Syn. *Onychiurus paxi* STACH, 1939: 172.

Argonychiurus denisi (STACH, 1934), POMORSKI, 1996: 65, 85 [incorrect interpretation].

MATERIAL

Numerous spp.; Sudetes, Góry Bystrzyckie Mts., cave Solna Jama, Poland; soil and litter on the bottom; 17. 07. 1984. leg. R. J. POMORSKI. 3 spp. juv.; Sudetes, Góry Złote Mts., cave Jaskinia Radochowska; Poland; soil and litter on the bottom; 12. 10. 1985; leg. R. J. POMORSKI. 5 spp. and numerous specimens in alcohol; Sudetes, Wałbrzych Highlands, Pełcznica ravine, Poland; under moss on rocks, 25. 05. 1989; leg. D. SKARZYŃSKI. 2 spp.; Sudetes, Góry Bardzkie Mts., old adit in Bardo Śląskie near river Nysa Kłodzka, Poland; soil and litter on the bottom; 24. 11. 1994; leg. R. J. POMORSKI. male subadult.; Carpathians, Babia Góra Massif, Sokolica, Poland; soil in scrub of dwarf mountain pine 1347 m a.s.l.; leg. D. SKARZYŃSKI, R. J. POMORSKI.

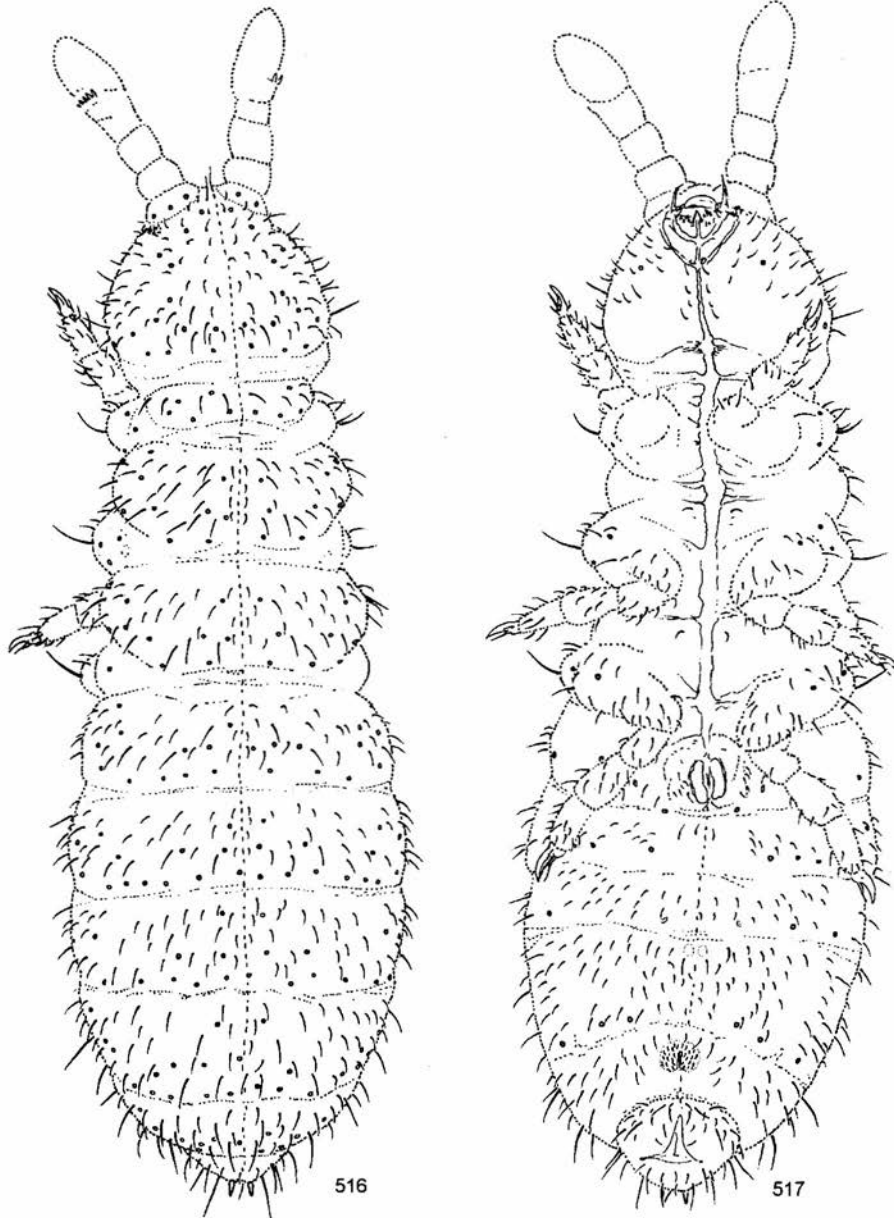
DESCRIPTION

Colour in alcohol white. Length without antennae males – 1.2 mm, females – 1.5-1.6 mm. Body thick, bulgy, particularly in females, a little dorso-ventrally depressed (fig. 516, 517). Antennae approximately as long as head. Furca reduced to finely granulated area with 1+1 setulae posteriorly (fig. 522). Granulation uniform, fine, area antennalis poorly marked.

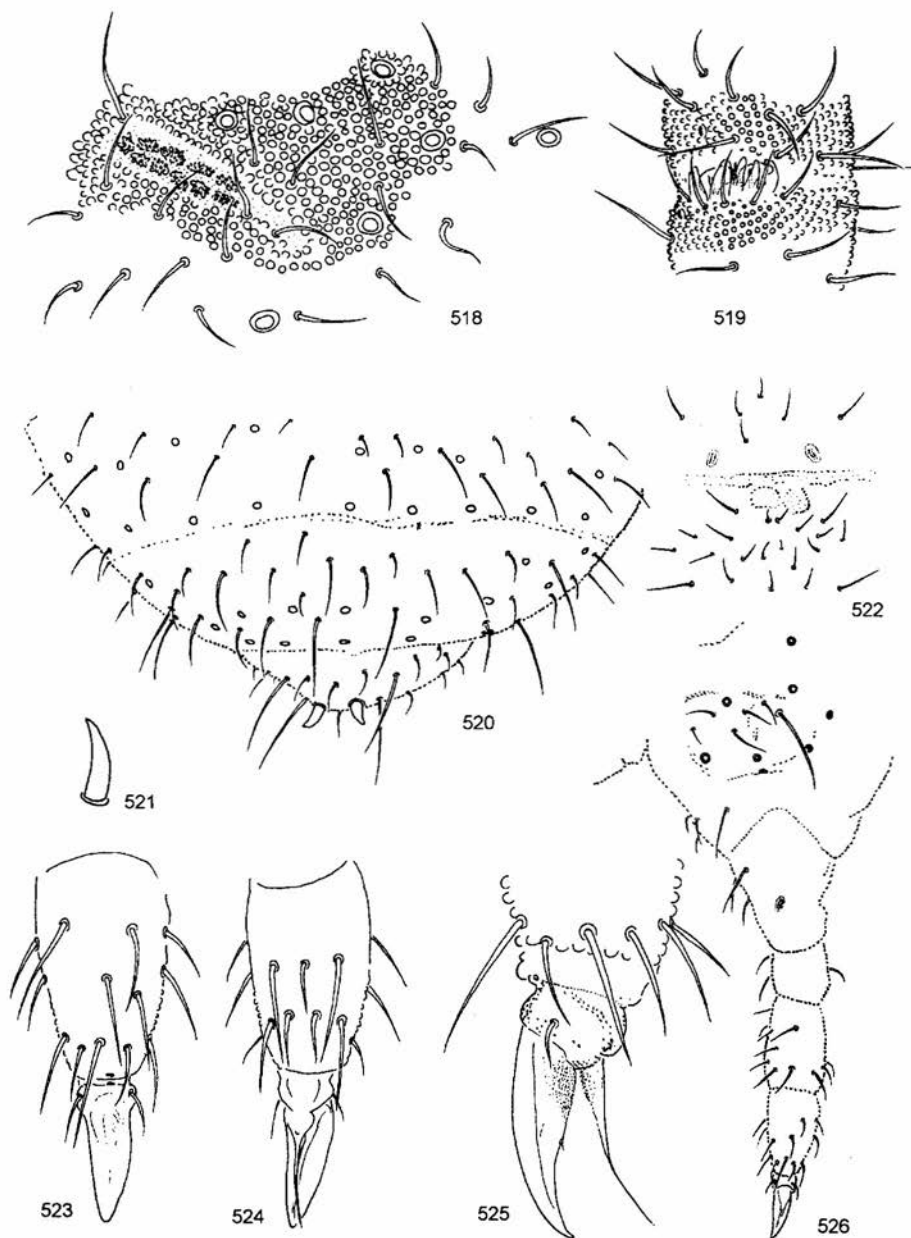
Antennal segment IV with a subapical organite and small microsensillum located in one row with posterior setae. Antennal segment III with microsensillum slightly below antennal III sense organ (fig. 519). Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ built of 5 guard setae, 2 sensory rods, 2 smooth, bent sensory clubs and 5 papillae (fig. 519).

Postantennal sense organ (PAO), consisting of 10-11 finely granulated vesicles (fig. 518).



516-517. *D. denisi*: 516 - chaetotaxy and localization of pseudocelli on dorsal side of body, 517 - chaetotaxy and localization of pseudocelli and parapsudocelli on ventral side of body



518-526. *D. denisi*: 518 - postantennal organ and pseudocelli, 519 - antennal III sense organ, 520 - abdominal terga V and VI, chaetotaxy and localization of pseudocelli, 521 - anal spine, 522 - remnant of furca, 523-524 - tibiotarsus of II pair of legs, 525 - claw, 526 - legs of III pair, chaetotaxy, localization of parapseudocelli and pseudocelli

Pseudocellar (pso) formula dorsally in larger females: 34(5)6(7)/71010/11(12)11(12)11(12)15(16)9(10); ventrally: 1/000/3(4)2(3)12(3); on subcoxal 7(8) pseudocelli. Formula of parapseudocelli (psx) ventrally: 1/000/001, all femora ventrally with 1 psx. Position of pso and psx as in figs 516, 517.

Dorsal chaetotaxy as in fig. 516, usually asymmetrical, not differentiated into macrochaetae and microchaetae. Medial setae on abdominal terga IV-V difficult to distinguish (fig. 516, 520). Between legs on meso- and metathorax 1+1 setae. Ventral tube with 2+2 setae at base and ca. 8+8 setae apically. Ventral abdominal chaetotaxy as in fig. 517.

Claws always with small teeth. Empodial appendage without basal lamella, as long as inner edge of the claw. Tibiotarsi with distal verticil, composed of 11 setae (figs. 523-525)

Male ventral organ absent.

BIOLOGY

D. denisi is a bisexual species, living in cold and wet places in mountains, especially in deep parts of litter, under moss, often in caves and old adits.

DISTRIBUTION IN POLAND

Sudetes, Carpathians.

Onychiuroides BAGNALL, 1948

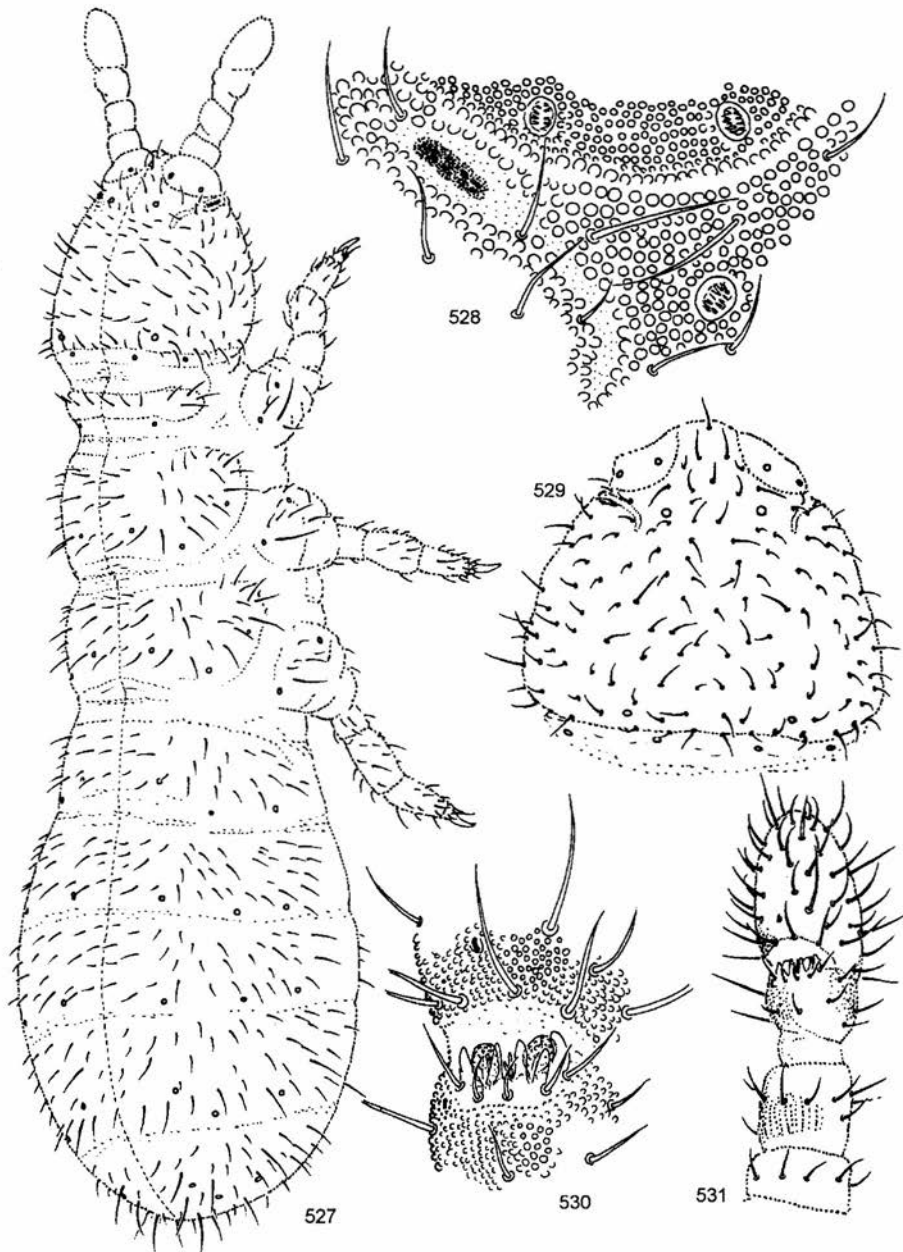
Onychiuroides BAGNALL, 1948, Ann. Mag. Nat. Hist., 11 (14): 633.

Type species: *Onychiurus postumicus* BONET, 1931, by original designation (described from Slovenia).

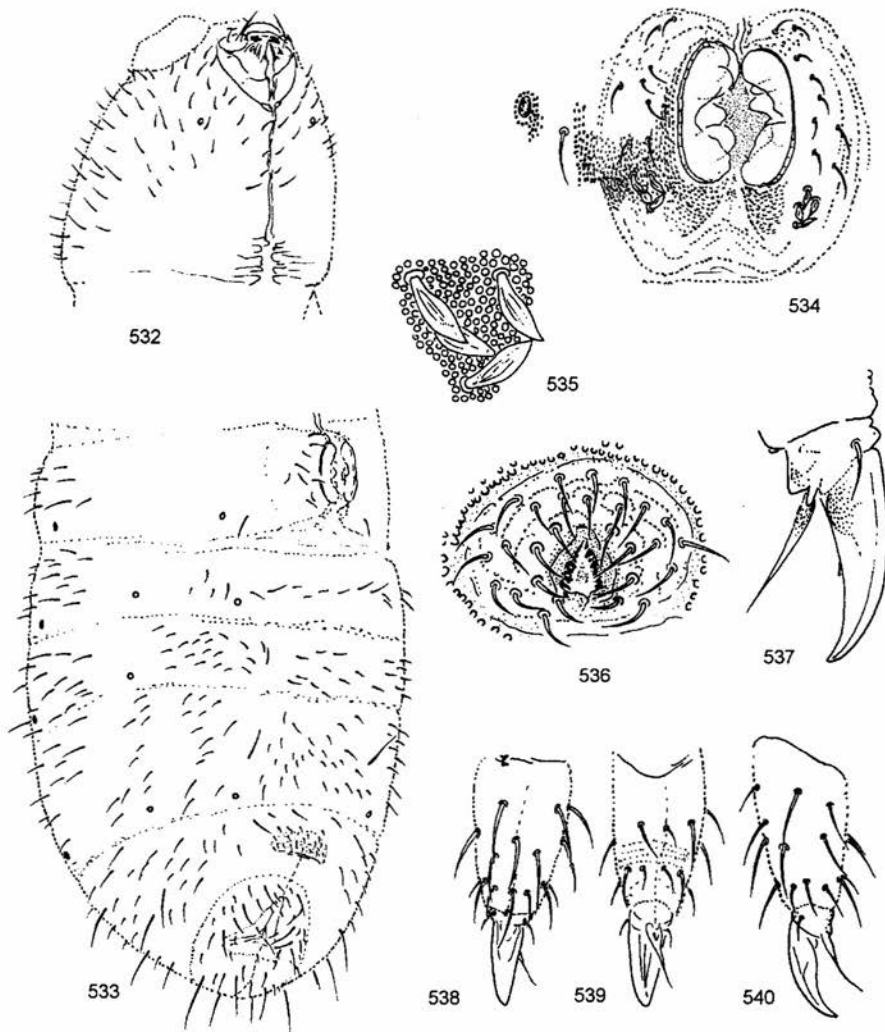
Diagnosis. Body shape thick, bulgy, distinctly broadened in region of abdominal segments II-IV, without anal spines. Abdominal segments V and VI accreted dorsally. Hind margin of head with pseudocelli arranged in a triangle. Granulation homogenous and fine. Furca reduced to finely granulated area with 1+1 setulae posteriorly. AIIIO usually with 5 or 4 papilla and granulated sensory clubs. PAO with 8-9 granulated vesicles. Distal verticil of setae on tibiotarsi with 11 setae. Setae sensuales on body indistinct. Seta d_0 on head present. Abdominal tergum IV with seta p_0 , abdominal tergum VI without medial setae.

Onychiuroides granulosis (STACH, 1930)

Onychiurus granulosis STACH, 1930: 285.



527-531. *O. granulatus*: 527 - chaetotaxy and localization of pseudocelli on dorsal side of body, 528 - postantennal organ and pseudocelli, 529 - head, chaetotaxy of dorsal side, 530 - antennal III sense organ, 531 - antenna



532-540. *O. granulatus*: 532 - head, chaetotaxy and localization of pseudocelli, 533 - abdominal sterna I-VI, chaetotaxy, granulation, localization of pseudocelli and parapseudocelli, 534 - tubus ventralis, male ventral organ, 535 - shape of setae in male ventral organ, 536 - male genital plate, 537 - claw of female from Ćwiętokrzyskie Mts., 538-540 - tibiotarsus of II pair of legs

MATERIAL

3 spp.; Sudetes, Góry Bystrzyckie Mts., cave Solna Jama, Poland; soil and litter on the bottom; 17. 07. 1984. leg. R. J. POMORSKI. Numerous spp.; Sudetes, Góry Żłote Mts., cave Jaskinia Radochowska; Poland; soil and litter on the bottom; 12. 10. 1985; leg. R. J. POMORSKI. 5 spp. and numerous specimens in

alcohol; Sudetes, Wałbrzych Highlands, Pełcznica ravine, Poland; under moss on rocks, 25. 05. 1989; leg. D. SKARŻYŃSKI. 5 spp.; Carpathians, Babia Góra Massif, Sokolica, Poland; litter; leg. D. SKARŻYŃSKI, R. J. POMORSKI. 10 spp.; Carpathians, Bieszczady Mts., neighbourhood of Polańczyk, Poland; moss and litter; 20. 08. 1991; leg. D. SKARŻYŃSKI. 3 spp.; Carpathians, Bieszczady Mts., Smerek, Poland; wet mountain meadow; 20. 08. 1991; leg. D. SKARŻYŃSKI. Numerous spp.; Carpathians, Pieniny Mts., Pieniński National Park, Dolina Pienińskiego Potoku, Poland; litter; 12. 11. 1992; leg. R. J. POMORSKI. 4 spp.; Carpathians, Beskid Średni Mts., Bednarzówka near Maków Podhalański, Poland; gravel bed of the river Skawica; 11. 11. 1993, leg. D. SKARŻYŃSKI, R. J. POMORSKI. Numerous spp.; Sudetes, Góry Bardzkie Mts., old adit in Bardo Śląskie near river Nysa Kłodzka, Poland; soil and litter on the bottom; 24. 11. 1994; leg. R. J. POMORSKI. 4 spp.; Małopolska upland, Puszcza Świętokrzyska, Lasy Siekierzyńskie, Wąchock, nature reserve "Wykus", Poland; litter; 17-18. 07. 1995, leg. R. J. POMORSKI. Numerous spp.; Małopolska upland, Świętokrzyskie Mts., Świętorzyski National Park, "Święty Krzyż", Poland; moss and litter; 28. 07. 1995; leg. R. J. POMORSKI. 1 spp. juv.; Baltic Coast, Wzniesienie Elbląskie, Kadyny, Poland; litter in beech forest; 10. 06. 1995; leg. R. J. POMORSKI, M. PAKIET. Numerous spp.; Wyżyna Lubelska upland, Roztocze, Roztoczański National Park, Zwierzyniec, "Bukowa Góra", Poland; 14. 06. 1996; leg. R. J. POMORSKI, W. NOWAK. Numerous spp.; Wyżyna Lubelska upland, Roztocze, nature reserve "Szumy nad Tanwią", Rebizanty, Poland; 16. 06. 1996; leg. R. J. POMORSKI, W. NOWAK.

DESCRIPTION

Colour in alcohol white. Length without antennae males – 1.0 mm, females – 1.5-1.6 mm. Body thick, bulgy, particularly in females, somewhat dorso-ventrally depressed (fig. 527). Antennae approximately as long as head. Furca reduced to finely granulated area with 1+1 setulae posteriorly. Granulation uniform, fine, area antennalis well marked.

Antennal segment IV with a subapical organite and small microsensillum located distinctly above posterior setae. Antennal segment III with microsensillum slightly below antennal III sense organ (figs. 530, 531). Thoracic terga II and III with small microsensilla laterally.

Antennal III sense organ built of 5 guard setae, 2 sensory rods, 2 smooth, bent sensory clubs and 5(4) papillae (fig. 530).

Postantennal sense organ (PAO), consisting of 10-11 finely granulated vesicles (fig. 528).

Pseudocellar (pso) formula dorsally: 33/133/33333; ventrally: 1/000/1212; on subcoxal 2 pseudocelli. On the body no parapseudocelli (psx), on femora psx invisible. Position of pso as in figs. 527, 532, 533.

Dorsal chaetotaxy as in fig. 527, usually asymmetrical, not differentiated into macrochaetae and microchaetae. Abdominal tergum IV with seta p_0 , abdominal terga V-VI without medial setae. Between legs on pro-, meso- and metathorax no

setae. Ventral tube with 1+1 setae at base and ca. 8+8 setae apically. Ventral abdominal chaetotaxy as in fig. 533.

Claws usually without teeth (fig. 540) (females collected in Góry Świętokrzyskie Mts. always has claws with a small denticle as in fig. 537). Empodial appendage without basal lamella, appendage length equals 3/4 or 4/5 inner edge of the claw. Tibiotarsi with distal verticil, composed of 11 setae (figs. 538-540).

Male ventral organ, well developed only in adults with ductus ejaculatorius, situated on ventral tube, consist 4+4 thick, fluke-like setae (figs. 534, 535).

BIOLOGY

O. granulosis is a bisexual species, commonly living in various wet places in mountains, highlands, uplands and sometimes in lowlands, especially in litter.

DISTRIBUTION IN POLAND

Sudetes, Carpathians, Lower Silesia, Upper Silesia, Wyżyna Krakowsko-Wieluńska upland, Wyżyna Małopolska upland, Wyżyna Lubelska upland, Nizina Mazowiecka lowland, Baltic coast.

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