Dariusz J. Gwiazdowicz

Sejoidea, Antennophoroidea, Celaenopsoidea, Microgynioidea (Acari, Mesostigmata) of Poland

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Bogucki Wydawnictwo Naukowe
ul. Górna Wilda 90, 61-576 Poznań
tel. + 48 61 833 65 80
fax + 48 61 833 14 68
e-mail: bogucki@bogucki.com.pl
www.bogucki.com.pl

Druk
Totem

for Józefina, Maria and Jan

Content

Introduction

The species from the superfamilies considered here occur primarily in the forest environment and inhabit specific microhabitats such as rotting wood or bark beetles galleries. The Convention on Biological Diversity, of which Poland is a signatory nation, imposes the obligation to describe and protect animals such as mites. In practice, the only possible protection method of such small animals is to protect habitats and microhabitats inhabited by them. Regulations effective in Poland have imposed an obligation on forest managers to leave hollow trees and rotting wood in forests for several years. Furthermore, greater extents of forest areas are left until the natural death of trees. Thus the number of potential microhabitats to be inhabited by these species of mite steadily increases. If this is followed by an increased interest in research on these groups then the aim of this study will be achieved.

Along with the development of new research techniques, acarological knowledge continually increases and new species are discovered which results in changes in the systematics of mites. Invertebrate systematics traditionally relies on morphological structure with particular emphasis on sex organs of females and males. Moreover, the fertilization method is also analyzed. Precisely these characteristics were used by Evans (1992) when he distinguished 12 suborders in the order Mesostigmata: the suborders Antennophorina, Microgyniina and Sejina being among them. In recent years the problem of systematic division was also studied by Lekveishvili and Klompen (2004b) and Klompen et al. (2007). They based their investigation not only on the morphological analysis, including 70 features in their studies, but also on a genetic study. Thus, similarities between individual mite groups have been determined which provides the foundation for the debate about systematics of these animals.

Nonetheless, Karg and Schorlemmer (2008) proposed an alternative classification based on six basic morphological features such as:

- two special tactile setae on a small shield at the metatarsal fissure of tarsus IV of nymphs and adults,
- in the larva, position of setae pair J3 on the dorsum marginal shifted; perigenital grooves developed on the ventral of nymphs and adults; dorsum of adults with marginal grooves; inanal setae in the nymphal stage,
- special form of sperm: ribbon sperm,
- chelicerae of males mostly with a spermatodactyl,
- additional lateral and/or mesonotal plates in protonymph stages,
- podonotal shield bearing 8 to 9 pairs of setae in larva stage.

On this basis they divided Parasitiformes into Antennophorina, Margotrichina and Gamasina (Fig. 1).

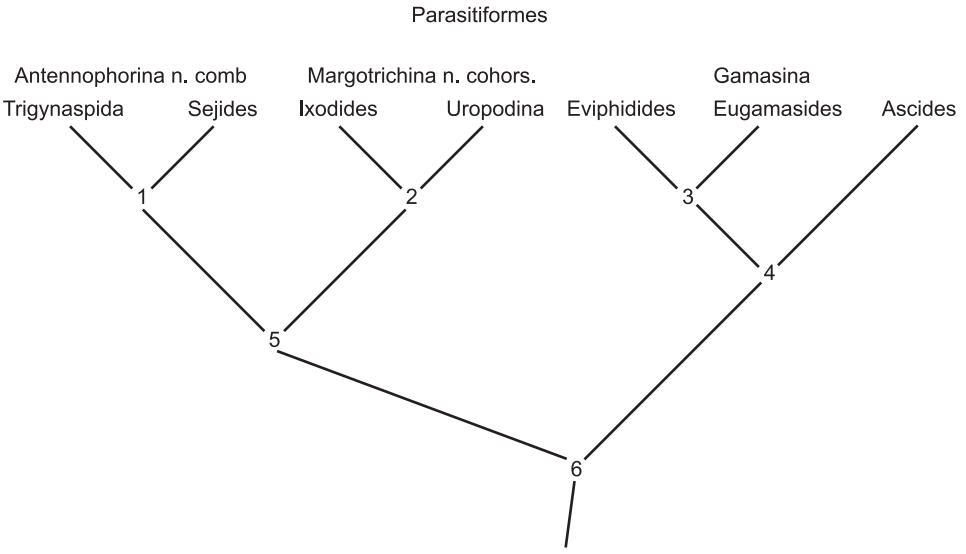

Fig. 1. Cladogram of the group of the Parasitiformes (after Karg and Schorlemmer 2008).

In the latest acarological monograph edited by Krantz and Walter (2009) another division of the order Mesostigmata was proposed. This division is presented below.

Suborder Sejina
Superfamily Sejoidea
Suborder Trigynaspida
Cohort Antennophorina
Superfamily Antennophoroidea
Superfamily Celaenopsoidea
Suborder Monogynaspida
Cohort Microgyniina
Superfamily Microgynioidea

This is the taxonomic approach adopted in this study.

In all life stages except for the larva and protonymph a large number of setae are found both on the dorsal and ventral side. Studies of selected species have shown that the number of these setae vary between individuals to a great extent and that many unpaired setae occur that are especially visible in e.g. *Sejus togatus* (Gwiazdowicz, Gulvik 2009). For this reason a detailed examination of chaetotaxy is rather difficult to make and it has been limited in this study to the larval and protonymph stages. However, for both male and female deutonymphs only peculiar, outstanding setae have been assessed, for instance, j1, setae Z3, J5 or Z5 in *Sejus*. Setae symbols have been adopted following Evans (1993) and Lekveishvili, Klompen (2004a) (Fig. 24).

Sejoidea

Ichthyostomatogasteridae Sellnick, 1953
(=Uropodellidae Camin, 1955)

Idiosoma. Mite of the approximate size of 1.0 mm with an oval body. Body color depends on the degree of chitinization and may be from milky-white to yellow. Female has pronotal and pygidial shields on the dorsal side and the male has one holodorsal shield. Very large number (250–300) of simple setae located on the dorsal side. The shield is covered with delicate, poorly visible reticulate ornamentation.

Tritosternum with large basis, where there are side fruticose branching and two serrate laciniae. The sternal shield markedly reduced, metasternal platelets and setae apparently absent. In female large genital shield covering almost the entire area between coxae II–IV. The shield is covered with numerous simple setae. In the male the sterni-genital shield with the genital orifice is located in the region of coxae III. Both in females and males large ventri-anal shield with large anal orifice nad numerous short simple setae.

Gnathosoma. Corniculi short, wide and bifurcated at ends. Hypostomal groove very narrow. Rows of tiny denticles are located between hypostomal setae h3 and h4 and also below. Epistome is triangular and pointed and its surface is covered by tiny denticles. Chelicerae short, massive, with a small number of teeth.

Legs. Femur and tarsal segments of leg II in the male armed.

Genera such as *Asternolaelaps* and *Japanoasternolaelaps* have been distinguished in this family. Only genus *Asternolaelaps* has been reported in Poland.

***Asternolaelaps* Berlese, 1923**
Synonym: *Ichthyostomatogaster* Sellnick, 1953
Type species: *Asternolaelaps fecundus* Berlese, 1923

Asternolaelaps fecundus Berlese, 1923

Synonyms: *Ichthyostomatogaster nyléni* Sellnick, 1953, *Asternolaelaps querci* Wiśniewski et Hirschmann, 1984 – **new synonym**, *Asternolaelaps putriligneus* Kaczmarek, 1984 – **new synonym**

Holotype: Experimental Institute for Agricultural Zoology in Florence (Istituto Sperimentale per la Zoologia Agraria), Italy, No: 220/7 (1F, 1M)

Paratypes: Experimental Institute for Agricultural Zoology in Florence, (Istituto Sperimentale per la Zoologia Agraria), Italy, No: 220/8 (2F, 1M); 220/9 (1F, 1M); 220/10 (1M, 1?); 220/11 (1F)

Collection in Poland: Poznań University of Life Sciences (Uniwersytet Przyrodniczy w Poznaniu), Department of Forest Protection, Poland

Etymology: (from Latin) *fecundus* – fertile

Locus typicus: Vallombrosa, Italy (43°44'00"N, 11°32'00"E)

Measurements

♀ (F) – 690–820×430–500 μm
♂ (M) – 570–720×360–400 μm
Deutonymph (D) – 590–640×390–490 μm
Protonymph (P) – 460–510×310–390 μm
Larva (L) – 380–400×220–290 μm

Morphology of female

Dorsal. Two shields are located on the dorsal side, one large pronotal shield (560–620×430–500 μm) and below, smaller, bathtub-shaped pygidial shield (120–130×250–270 μm) (Fig. 2). Simple setae (30 μm) are located on both shields. Approximately 250–300 setae are located on the former shield and over 30 on the latter. Reticulate ornamentation very poorly defined. Several rows of tiny denticles are located on the posterior edge of pygidial shield.

Ventral. Base of tritosternum wide, ramose, with numerous tiny denticles (Fig. 4c). Above the genital shield small, thin, curved sternal shield with four setae. Long, thin plates with single setae are located next to this shield[1]. Reduced sternal shield is usually poorly visible as it is covered with an exceptionally large genital shield (175×150 μm) which occupies the entire region between coxae II–IV. This shield is M-shaped in the region of coxae II. Approximately 50 simple setae are located on this shield. Ventri-anal shield very large, bathtub-shaped (375×400 μm), with approximately 220–250 simple setae (40 μm). Very large anal orifice (90×75 μm). Reticulate ornamentation poorly defined. Peritremes on wide peritremal shields. Stigma in the region of coxae IV, while the extremity of peritreme in the region of coxae II (Fig. 3).

1 According to Evans (1954) the sternal shield is split into several parts. Also Sellnick (1953) wrote about the shape of sternal shield.

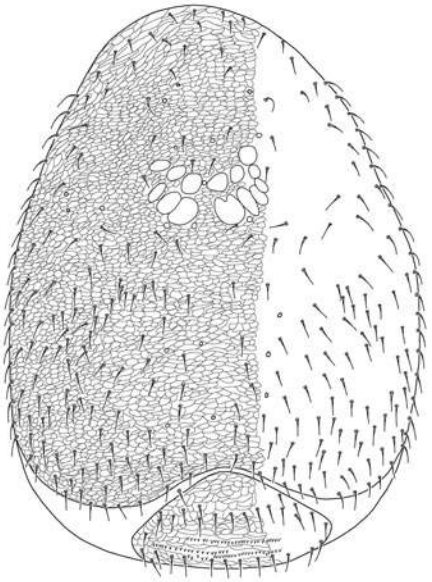

Fig. 2. *Asternolaelaps fecundus* Berlese, 1923: dorsal idiosoma of female.

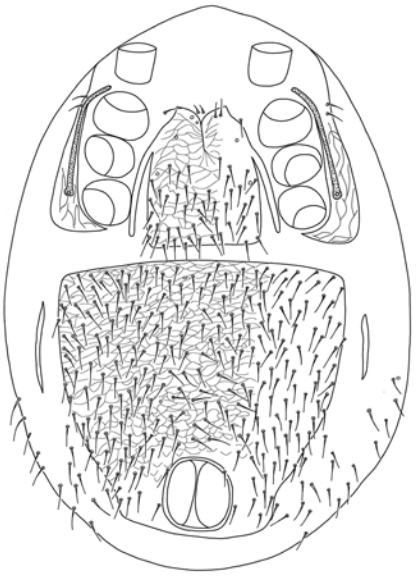

Fig. 3. *Asternolaelaps fecundus* Berlese, 1923: ventral idiosoma of female.

Gnathosoma. Corniculi furcated at extremities. Hypostomal setae, variable in length (h1 – 35 μm, h2 – 40 μm, h3 – 50 μm, h4 – 50 μm) simple or in some cases with tiny barbs (serrate) (Fig. 4a). Hypostomal groove very narrow. Beside the groove seven rows of tiny denticles. Variable number of denticles in these rows from 6+6 in a first row to 16+16 in the fifth row. Triangular epistome with elongated apex. Several rows of tiny denticles are located on its surface. Chelicera with short, rounded (Fig. 4b). Fixed digit with three teeth, a movable digit with one tooth.

Legs variable in length: I – 425 μm, II – 350 μm, III – 325 μm, IV – 400 μm.

Morphology of male

Dorsal. Holodorsal shield on the dorsal side covered with 250 simple setae 30 μm long. Poorly defined reticulate ornamentation. Several rows of tiny denticles on the posterior edge of the shield. In most specimens dorsal shield reaches the ventral side (Fig. 5).

Ventral. Tritosternum similar as in the female. Below, two small presternal plates and one simple seta is located on each of them. Trapezoid sterni-genital shield (110×150 μm), while genital orifice (35×40 μm) in the region of coxae III. 50 setae located on this shield. Below large ventri-anal shield (350×350 μm). 190–210 simple setae, 30–35 μm long, on the shield. Relatively large anal orifice as in the female. Peritremes located on a wide peritremal shield, stigmae in the region of coxae IV (Fig. 6).

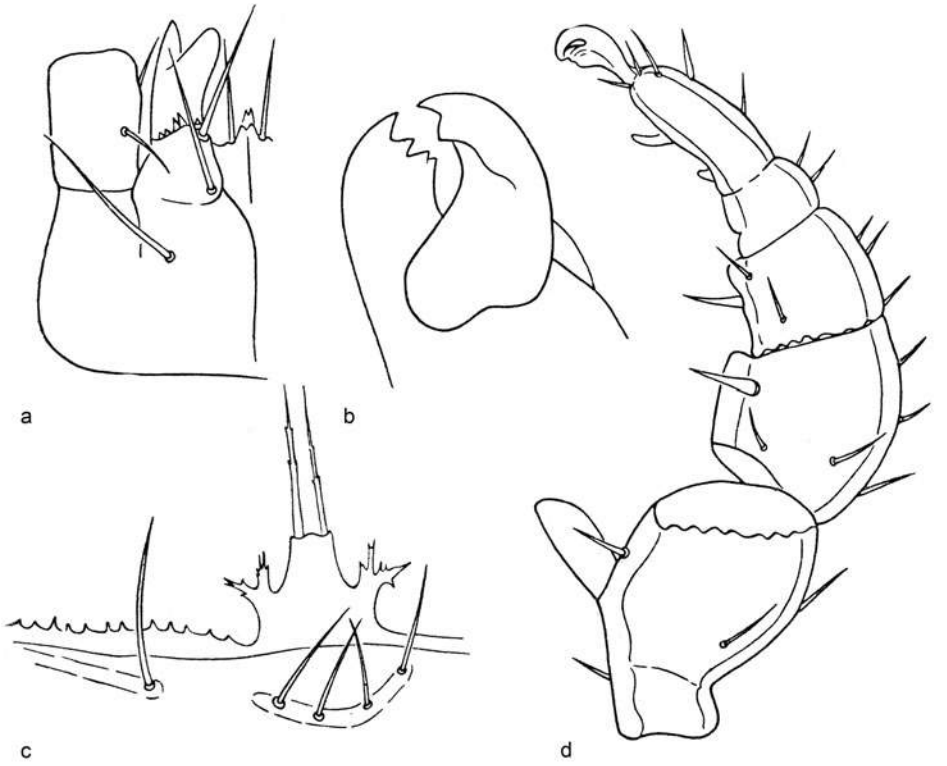

Fig. 4. *Asternolaelaps fecundus* Berlese, 1923, female: hypostome (a), chelicera (b), tritosternum (c); male: leg II (d) (after Evans 1954).

Gnathosoma. Hypostome similar as in the female – corniculi furcated at extremities, and hypostomal setae variable in length, simple or some of with tiny barbs. Most denticles outside hypostomal groove in seven rows. Epistome as in the female triangular, with elongated apex. Several rows of tiny denticles on its surface. Chelicera short, wide and rounded. Fixed digit with three teeth, a movable digit with one tooth. No spermatodactyl.

Legs variable in length: I – 425 μm, II – 325 μm, III – 300 μm, IV – 400 μm. Single digit-shaped apophysis on femur II (Fig. 4d), while two spinate apophyses on tarsus.

Morfology of deutonymph

Dorsal. Two shields are located on the dorsal side: pronotal shield (275×375 μm) with approximately 40–60 setae and opisthonotal shield (240×400 μm) with over 100 setae (Fig. 7). 80 setae, 40 on each side are located outside shields, on membrane. All setae simple with similar length of approximately 20–25 μm. Delicate, poorly visible colliculate ornamentation.

Ventral. Small sternal shield (90×90 μm) with five pairs of simple setae (Fig. 8). Egg-shaped ventri-anal shield (240×200 μm) with approximately 70 setae.

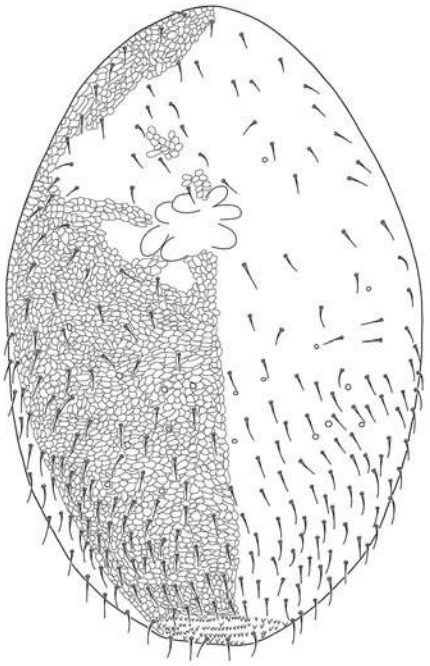

Fig. 5. *Asternolaelaps fecundus* Berlese, 1923: dorsal idiosoma of male.

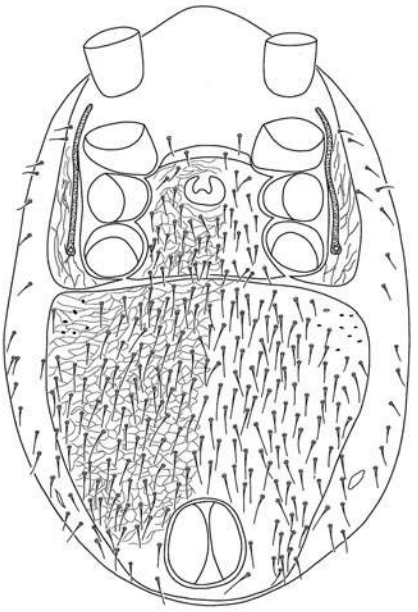

Fig. 6. *Asternolaelaps fecundus* Berlese, 1923: ventral idiosoma of male.

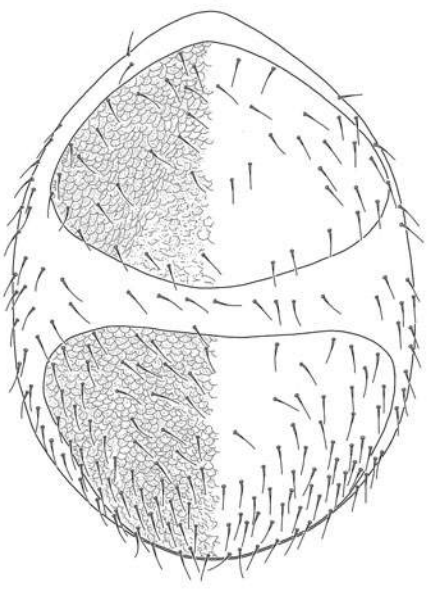

Fig. 7. *Asternolaelaps fecundus* Berlese, 1923: dorsal idiosoma of deutonymph.

Fig. 8. *Asternolaelaps fecundus* Berlese, 1923: ventral idosoma of deutonymph.

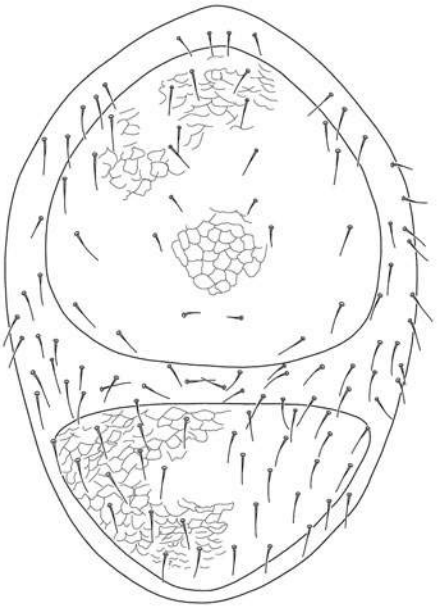

Fig. 9. *Asternolaelaps fecundus* Berlese, 1923: dorsal idiosoma of protonymph.

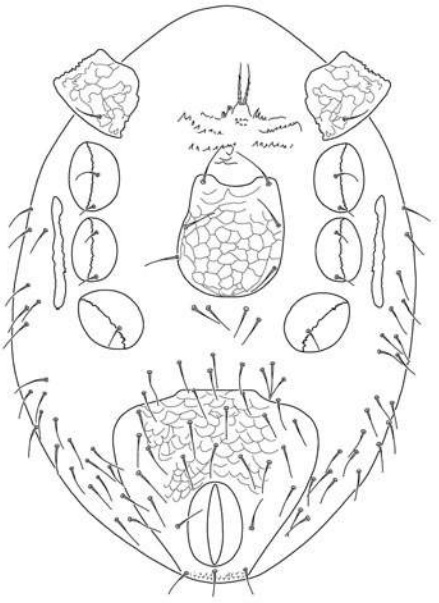

Fig. 10. *Asternolaelaps fecundus* Berlese, 1923: ventral idiosoma of protonymph.

Both shields covered with delicate colliculate ornamentation. 130 setae between the shields and also around ventri-anal shield. All ventral setae of the same length (35–40 μm). Relatively large anal orifice. Alongated metapodal plates on sides. Peritreme very short, located in the region of coxae IV. Single exopodal plates in the region of coxae IV and between coxae II and III.

Gnathosoma. Similar as in adult specimens.

Legs variable in lengths: I – 375 μm, II – 325 μm, III – 280 μm, IV – 350 μm.

Morphology of protonymph

Dorsal. Two shields on dorsal side: pronotal shield (260×280 μm) with 20–30 simple setae and pygidial (130×250 μm) with approximately 20–30 simple setae (Fig. 9). 60 setae, 30 on each side are located outside shields, on membrane. Both shields covered with delicate reticulate ornamentation.

Ventral. Small sternal shield with three pairs of simple setae. Bathtub-shaped ventri-anal shield with approximately 20 setae and anal setae (35–40 μm) (Fig. 10). Both shields covered with delicate reticulate ornamentation. 130 setae between the shields and also around ventri-anal shield. Relatively large anal orifice (60×45 μm). Peritreme short, located in the region of coxae III–IV.

Gnathosoma. Similar as in adult specimens.

Legs variable in lengths: I – 350 μm, II – 250 μm, III – 240 μm, IV – 280 μm.

Morphology of larva

Dorsal. Two shields on dorsal side: pronotal shield with eight pairs of setae and pygidial shield with three pairs of setae (Fig. 11). Setae J2 and J3 located outside the shields. All setae are simple and variable in length. Setae Z4 and J5 are the longest, while the shortest ones are j4 and j5. Both shields covered with delicate reticulate ornamentation. Pygidial shield reach the ventral side.

Ventral. Small sternal shield with simple setae (st1–st3) (Fig. 12). Trapezoid anal shield with three circum-anal setae among which the post-anal one is the longest. Three pairs of setae are located between sternal and anal shields. Relatively large anal orifice. Peritreme invisible.

Gnathosoma. Similar as in adult specimens.

Legs variable in length: I – 240 μm, II – 180 μm, III – 215 μm.

Biology and ecology. Females lay from 3 to 6 eggs. A species found in humus, litter beneath oak-trees, moss, bird nests and also in the nests of *Meriones* sp. i *Rhombomys* sp. (Bregetova 1977c). Studies conducted in Poland demonstrate that this species is most frequently found in rotting wood. The rotting wood was very dry, dusty, brown and of both pine and oak trees. Thus is not the species of tree, rather the type of rotting wood which determines the occurrence of this species.

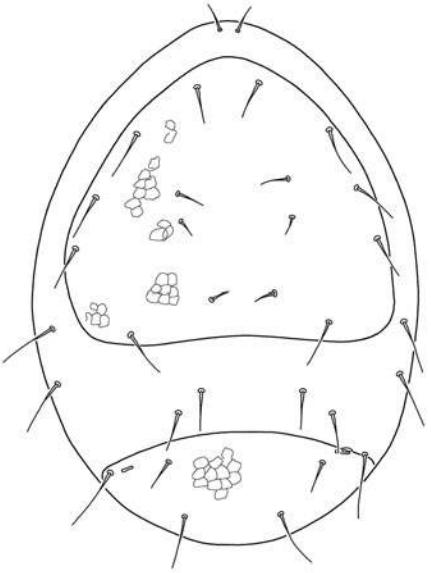

Fig. 11. *Asternolaelaps fecundus* Berlese, 1923: dorsal idiosoma of larva.

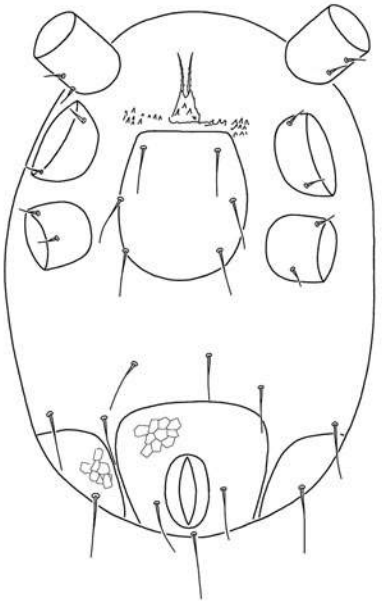

Fig. 12. *Asternolaelaps fecundus* Berlese, 1923: ventral idiosoma of larva.

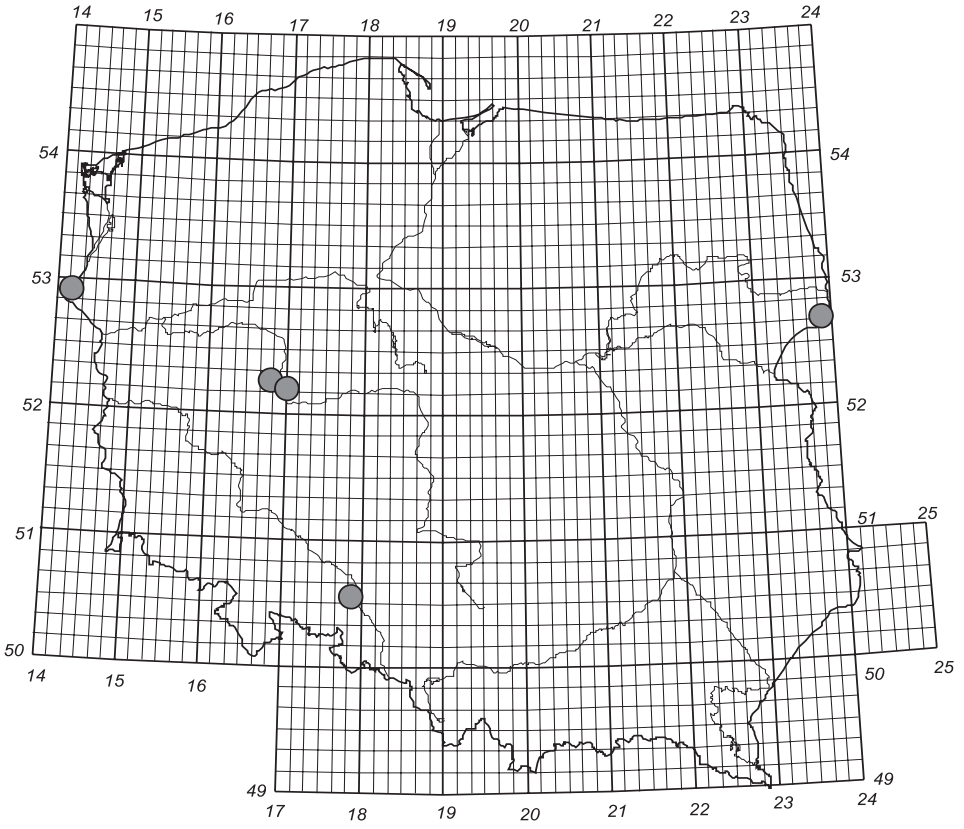

Fig. 13. *Asternolaelaps fecundus* Berlese, 1923: geographic distribution in Poland.

Occurrence in the World: Spain, Sweden, Italy, Russia, Kazakhstan, Central Asia (Bregetova 1977c).

Occurrence in Poland: rotting wood of oak, Krajkowo Reserve, Konstantynowo Forest District (Kaczmarek 1984); rotting wood of oak, Przysiecz, Prószków Forest District (Wiśniewski, Hirschmann 1984); rotting wood of oak, Białowieża NP (Gwiazdowicz 1998); rotting wood of oak, pine and spruce, Białowieża NP (Gwiazdowicz 1999a); under bark, Białowieża NP (Gwiazdowicz 1999b); litter, Białowieża NP (Gwiazdowicz et al. 1999); rotting wood, Białowieża NP (Gwiazdowicz 2000a); rotting wood, Wielkopolska NP (Skorupski 2000, 2001); rotting wood, Bielinek Reserve (Skorupski, Łabędzki 2004) (Fig. 13).

Notes about *Asternolaelaps*

The type material of *A. fecundus* deposited in the Experimental Institute for Agricultural Zoology in Florence (Istituto Sperimentale per la Zoologia Agraria) and the material deposited in Polish acarological collections have been examined. Descriptions and figures of both *A. querci* and *A. putriligneus* (Kaczmarek 1984;

Wiśniewski and Hirschmann 1984) have been studied. It was concluded that *A. querci* and *A. putriligneus* are synonyms of *A. fecundus*.

Sejidae Berlese, 1895
(=Liroaspidae Trägårdh, 1946)

Idiosoma. In many species oval, elongated body with characteristic bottle-shaped processes at the extremity of the idiosoma. These processes occur only in such species as *Sejus congoensis* Wiśniewski et Hirschmann, 1991 and *Sejus sejiformis* (Balogh, 1938). These mites have idiosomas of diverse sizes from 445 μm in *Sejus cubanus* Wiśniewski et Hirschmann 1991 and 500 μm in *Sejus rafalskii* to 1100 μm in *Sejus togatus* C.L. Koch, 1836. Body color usually from light yellow to brown. In some species, for instance, *Sejus sejiformis* the body is milky-white, but dorsal and ventral shields are light brown. The color of shields is in sharp contrast with light color of membrane. The number and shape of shields on the body depends on the species, sex or the developmental stage. Some deutonymphs, for instance, *Sejus solaris* Wiśniewski et Hirschmann 1991, *Sejus savannakhetianus* Hirschman et Kaczmarek 1991, *Sejus indicus* Hirschmann et Kaczmarek 1991, *Sejus javensis* Hirschmann et Kaczmarek, 1991, *Sejus oblitis* Hirschmann, 1991, *Sejus hinangensis* Hirschmann et Kaczmarek, 1991, *Sejus bugrovskii* Wiśniewski et Hirschmann, 1991 and most of males have two shields (pronotal and opisthonotal) on the dorsal side. However, the majority of females have the pronotal shield, four mesonotal plates and the pygidial shield (Fig. 14).

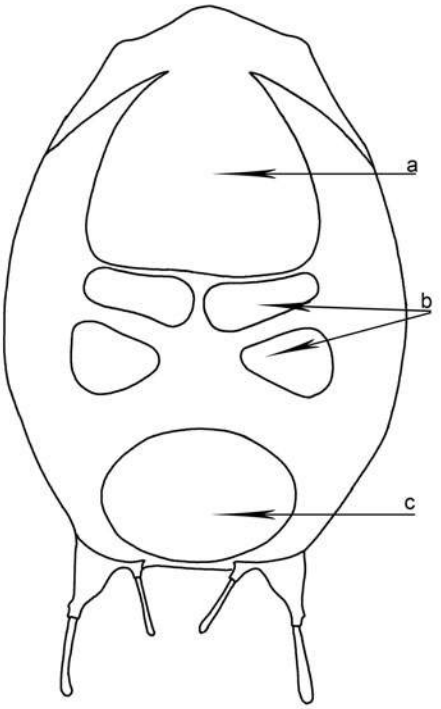

Fig. 14. Dorsal side of *Sejus*: podonotal shield (a), mesonotal plates (b), pygidial shield (c).

Two pairs of presternal plates, short but wide sternal shield, oval genital shield (epigynial shield) and large, trapezoid ventri-anal shield. Most frequently 3 to 4 pairs of setae on the genital shield. Genital orifice of male is located on the sterni-genital shield between II coxa. In some species the ventri-anal shield developed dorsola-

terally and fused to the pygidial shield. Peritremal shields are wide and reach the dorsal side. They are frequently fused with the pronotal shield.

Sculpture which frequently is punctate, granulate, tuberculate or verrucate is visible on both dorsal and sternal shields. Setae are diverse in shapes and length. These setae are most frequently simple, pilose, bipectinate, spatulate, and serrate; some of them have a hyaline sheath at the extremity. Setae J5 and Z5 are usually the longest.

Gnathosoma. Corniculate corniculi. h1 seatae are large, different from other hypostomal setae. Some of them are balloon- or waddy-shaped. Epistome often triangular with serrate edges. At external edge of fixed digit tiny sculpture consisting of small denticles is visible; well-defined pilus dentilis. No spermatodactyl in the males.

Legs of the male without apophyses. Tarsus I often with an acrotarsus, with or without claws. Tarsus IV with 20 or more setae, including setae av4 and pv4 on a well-defined intercalary sclerite (Fig. 29). Palp apotele 2-tined, palpgenu with maximum 6 setae.

It is worth noticing that in some species two types of deutonymphs were found and one of them is a phoretic form. Phoretic deutonymphs are distinct in having two shields on dorsal, relatively large metapodal plates and a small ventrianal shield.

According to Bregetova (1977a) two suborders *Sejus* s.str. (*S. togatus* C.L. Koch, 1836) and *Willmannia* (*S. sejiformis* Balogh, 1938) belong to this family. Hirschmann (1991) and Hirschmann et al. (1991a, b) in their revision based on selected morphological features such as chelicerae, gnathotectum, tritosternum and deutosternum synonymized *Epicroseius* and *Willmannia* with *Sejus*. However, Lekveishvili and Krantz (2004) polemize with Hirschmann's theses (1991) and distinguish the new genus *Adenosejus*. Currently, such genera as *Sejus*, *Epicroseius*, *Adenosejus*, *Africasejus* and *Zuluacaru* are distinguished in the family Sejidae. Only genus *Sejus* has been reported in Poland.

***Sejus* C.L. Koch, 1836**
Synonyms: *Liroaspis* Banks, 1902; *Dwigubskyia* Oudemans, 1936; *Willmannia* Balogh, 1938
Type species: *Sejus togatus* C.L. Koch, 1836

Sejus hinangensis Hirschmann et Kaczmarek, 1991

Holotype: Zoological Collection in Munich (Zoologische Staatssammlung München), Germany, No: 3043 (1F)

Paratypes: Zoological Collection in Munich (Zoologische Staatssammlung München), Germany, No: 3033 (1D), 3034 (2D), 3035 (1P), 3036 (1P), 3037

(1D), 3038 (1D), 3039 (1D), 3040 (1 Dph[2]), 3041 (1 Dph), 3042 (1 Dph), 3044 (only chelicerae of female), 3045 (1M), 3046 (1M)

Etymology: species name derives from Hinang – *locus tipicus*

Locus tipicus: Hinang, Germany (47°28'00"N, 10°17'00"E)

Measurements

♀ – 950–970 × 580–600 μm
♂ – 800–880 × 490–510 μm
D – 750–800 × 500–525 μm
D(ph) – 700–710 × 420–430 μm
P – 640–650 × 430–450 μm
L – unknown

Morphology of female

Dorsal. Six shields on dorsal side: one pronotal shield (450×400 μm), four mesonotal plates (75×200 and 110×125 μm) and one pygidial shield (275×425 μm) (Fig. 15). Dorsal setae are serrate and are located on small tubercles. Setae j1 (55 μm), Z3 (95–100 μm), J5 (95 μm) and Z5 (140 μm) are visibly longer than other dorsal setae (25 μm). The number of setae on individual shields is variable: approximately 60 setae on pronotal shield, from 2 to 5 setae on mesonotal plates and over 20 setae on pygidial shield. Approximately 130 to 140 setae are located on membrane around shields. The shields have characteristic granulate ornamentation.

Ventral. Tritosternum with wide base which has denticles at an extremity (Fig. 27e). Two pairs of denticles on each side of tritosternum. Laciniae fruticose at an extremity. Setae st1 (60 μm) and st2 (55 μm) are located on separate presternal plates. First pair of presternal plates has the dimensions of: 30×90 μm, while the second one 15×40 μm (Fig. 16). Setae st3 (60 μm) and st4 (25 μm) are located on sternal shield (55×135 μm), and st5 (35 μm) and st6 (35 μm) on epigynial shield (190×150 μm). Large ventri-anal (150×225 μm) with approximately 20 setae is located below. Most setae on this shield are serrate and only few of them are simple. They are located on small tubercles. Large anal orifice with three circum-anal setae. The shield is covered with granulate ornamentation, which forms lineate ornamentation (Fig. 17a). Relatively large metapodal plates are located on body sides (100×100 μm). The plates are covered with granulate sculpture, which forms lineate ornamentation. Peritremes are located on wide peritremal shields. Stigma in the region of coxae IV, while the second extremity of peritreme reaches coxae I. Peritremal shield reaches the dorsal side and is fused with the pronotal shield.

Gnathosoma. Narrow corniculate corniculi which narrows at the extremity. Hypostomal setae are variable in shapes and length. Setae h1 club-shaped, balloon-shaped, rounded at the extremity. Setae h2 are simple, while setae h3 and h4 are serrate (Fig. 26d). Rows of denticles are located in the hypostomal groove

2 Phoretic deutonymph.

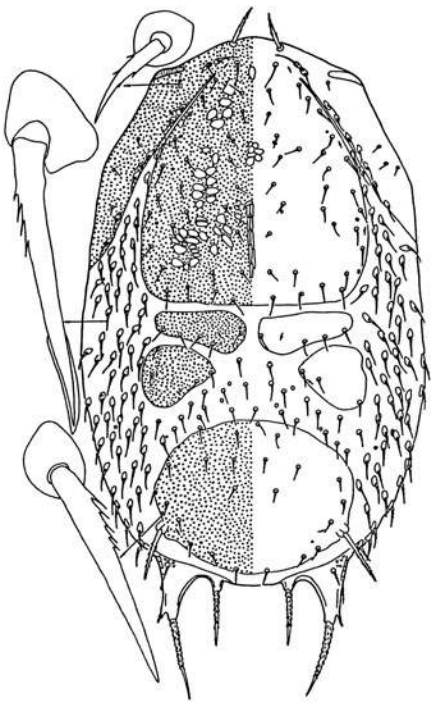

Fig. 15. *Sejus hinangensis* Hirschmann et Kaczmarek, 1991: dorsal idiosoma of female (after Hirschmann et al. 1991b).

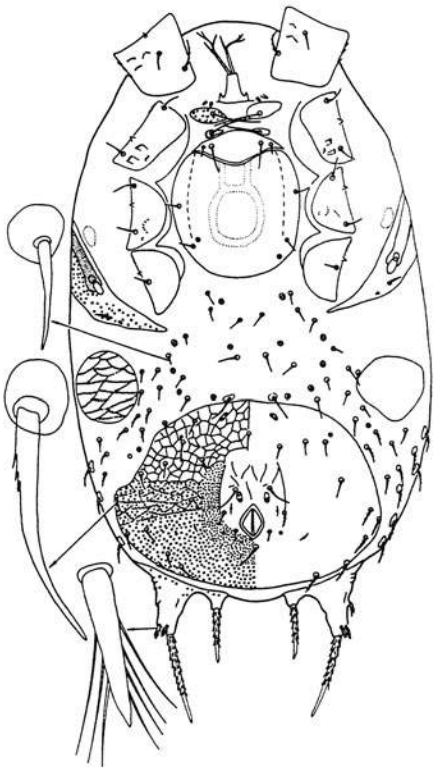

Fig. 16. *Sejus hinangensis* Hirschmann et Kaczmarek, 1991: ventral idiosoma of female (after Hirschmann et al. 1991b).

(from 1 to 7 denticles). Epistome consists of three ragged apices; the central one is the highest (Fig. 27b). A surface covered with tiny, irregular, sharp denticles is located below. Fixed digit usually with 10 teeth, while movable digit with a row of very tiny denticles (Fig. 28d).

Legs variable in length: I – 800 μm, II – 650 μm, III – 650 μm, IV – 870 μm (Fig. 29c, f, h, l).

Morphology of male

Dorsal. Two shields are located on the dorsal side: pronotal shield (400×350 μm) with approximately 60 setae and opisthonotal shield (375×325 μm) with approximately 50 setae (Fig. 18). All setae are serrate and located on small tubercles. Setae j1 (60 μm) Z3 (80 μm), J5 (90 μm) and Z5 (130 μm) are the longest ones. Other dorsal setae are 30–35 μm long. 120 setae, 60 on each side are located on a lateral membrane. The shields are covered with granulate sculpture.

Ventral. Tritosternum as in the female. Two small presternal plates with setae st1 are located above the sternal shield. Sterni-getinal shield (250×140 μm) with

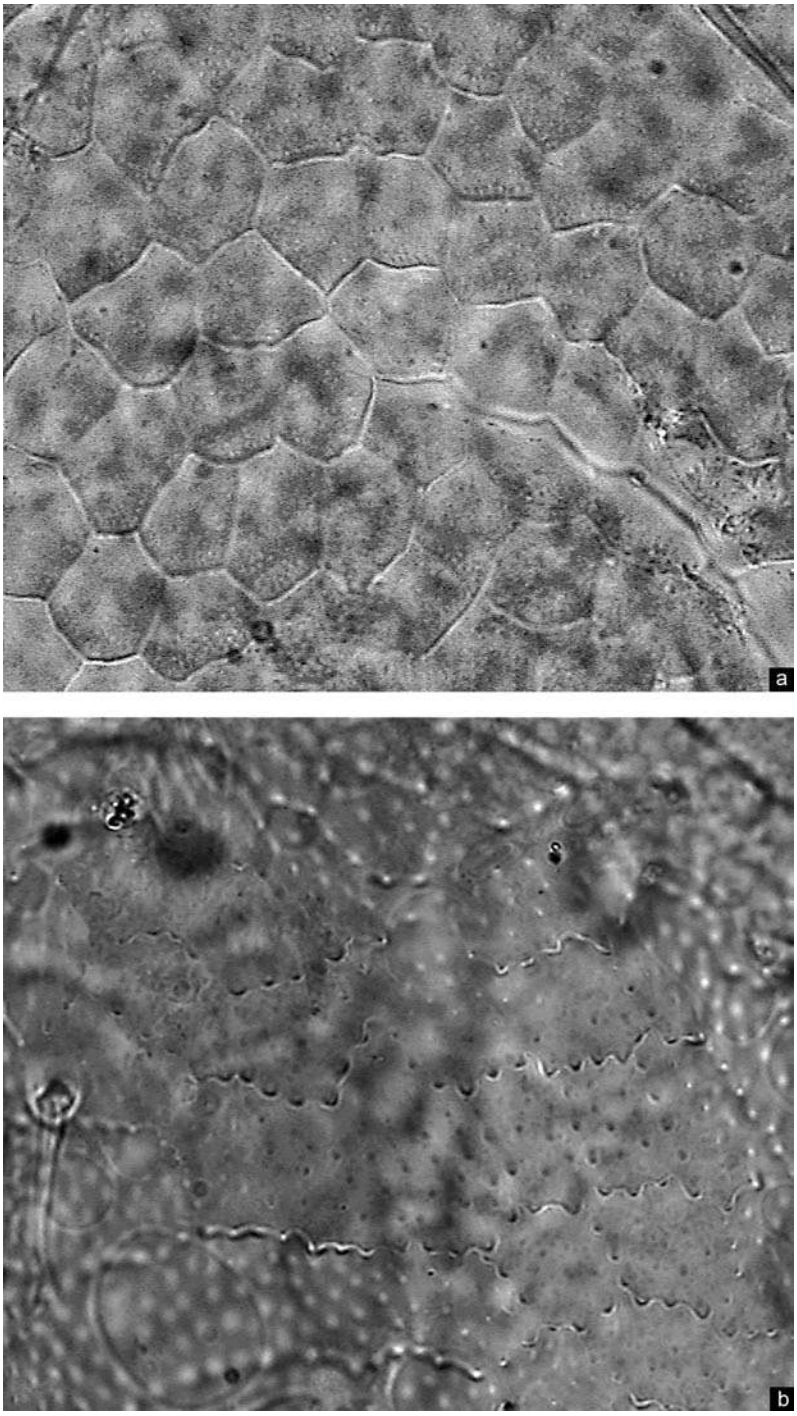

Fig. 17. Ornamentation on ventri-anal shield: *Sejus hinangensis* (a), *Sejus polonicus* (b).

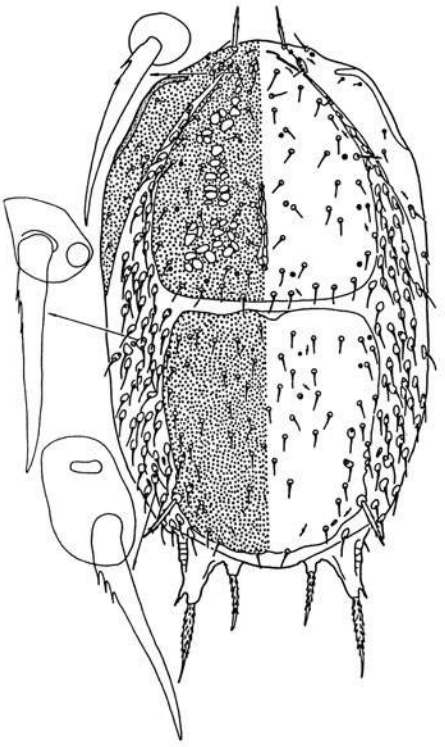

Fig. 18. *Sejus hinangensis* Hirschmann et Kaczmarek, 1991: dorsal idiosoma of male (after Hirschmann et al. 1991b).

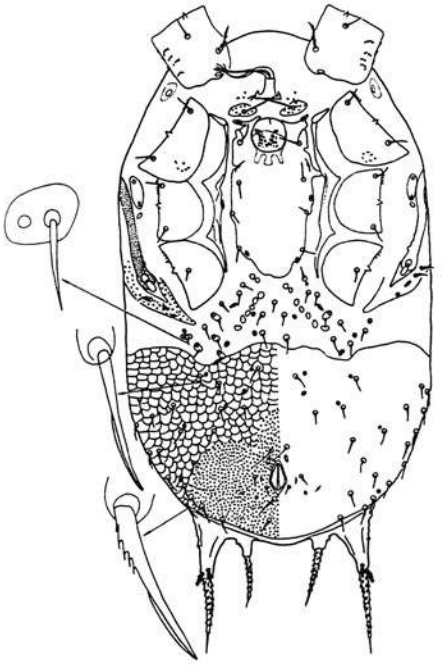

Fig. 19. *Sejus hinangensis* Hirschmann et Kaczmarek, 1991: ventral idiosoma of male (after Hirschmann et al. 1991b).

four pairs of simple setae 35 μm long. Genital orifice of male between setae st2 (Fig. 19). Relatively large ventri-anal shield (310×475 μm) with approximately 40 setae is located below sternigenital shield. Most setae on the shield are serrate, however, there are also several pairs of simple setae. The shield is covered with reticulate ornamentation which in the lower part of the shield turns into granulate sculpture. Approximately 20 simple setae are located between sternigenital and ventri-anal shields. Wide peritremal shields with granulate sculpture are located on sides. Stigma in the region of coxae IV, while the second extremity of peritreme in the region of coxae I.

Gnathosoma. Hypostome similar as in the female. Setae h1 balloon-shaped, h2 simple, while h3 and h4 serrate. Rows of tiny denticles in hypostomal groove (Fig. 26e). Epistome similar as in the female with three ragged apices; the central one is the highest. A surface covered with tiny, irregular, sharp denticles is located below (Fig. 27c). Fixed digit usually with 10 teeth, while movable digit with a row of very tiny denticles. No spermatodactyl (Fig. 28a).

Legs variable in length: I – 800 μm, II – 650 μm, III – 650 μm, IV – 850 μm (Fig. 29d, e, g).

Morfology of deutonymph

Dorsal. Six shields on dorsal side: one pronotal shield (360×325 μm), four mesonotal plates (60×110–125 and 90×100–110 μm) and one pygidial shield (175×300 μm). Pronotal shield is egg-shaped with 50–60 setae (Fig. 20). Mesonotal plates usually with four setae. 20 setae are located on pygidial shield. All dorsal setae (20 μm) are serrate and are located on small tubercles. Setae j1 (50 μm), z3 (40 μm), Z3 and J5 (105 μm) and Z5 (140 μm) are the longest ones. Approximately 90 setae are located on the membrane, 45 on both sides. The shields have characteristic granulate sculpture.

Ventral. Tritosternum similar to the one in adult specimens and tiny denticles are also at the base. Three pairs of setae st1 (50 μm) and st2–st3 (30 μm) are located on the sternal shield (220×110 μm). Setae st4 and st5 shorter (20 μm) and outside the shield (Fig. 21). Oval ventri-anal shield (170×180 μm), with seven simple setae (Fig. 28f). Granulate sculpture on the shield. Setae around the ventri-anal shield are placed on tubercles. Below coxae IV oval metapodal plates (80×100 μm) with granulate ornamentation forming lineate patterns. Stigma in the region of coxae IV, while second extremity of peritreme in the region of coxae I. Two elongated peritremal plates with granulate sculpture are located along the peritreme.

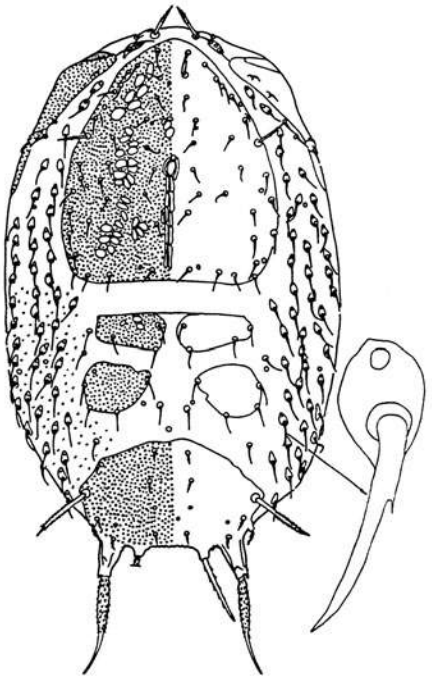

Fig. 20. *Sejus hinangensis* Hirschmann et Kaczmarek, 1991: dorsal idiosoma of deutonymph (after Hirschmann et al. 1991b).

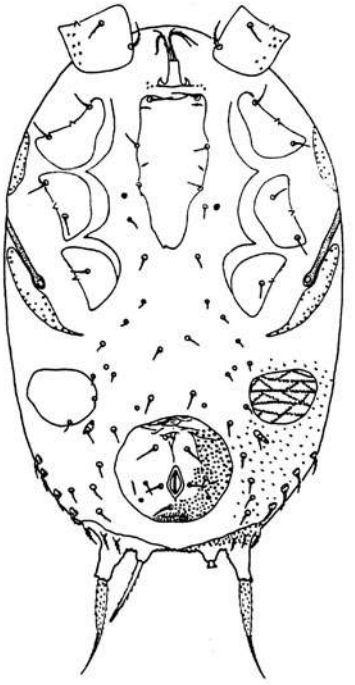

Fig. 21. *Sejus hinangensis* Hirschmann et Kaczmarek, 1991: ventral idosoma of deutonymph (after Hirschmann et al. 1991b).

Gnathosoma. Hypostome similar as in the female. Setae h1 balloon-shaped, h2 and h3 simple, while h4 serrate. Setae h3 are the longest hypostomal setae. Rows of tiny denticles are located in hypostomal groove (Fig. 26a). Epistome similar as in the female. Fixed digit usually with 8 to 10 teeth (Fig. 26g). Long, thin pilus dentilis which is dinstinguishable from teeth. Movable digit with a row of very tiny denticles (Fig. 27g).

Legs variable in length: I – 700 μm, II – 550 μm, III – 550 μm, IV – 750 μm (Fig. 29b, k).

Morphology of phoretic deutonymph

Dorsal. Two shields on dorsal side: pronotal shield (350×310 μm) with approximately 60 setae and opisthonotal one (325×275 μm) with approximately 30 setae (Fig. 22). Setae j1 (55 μm), z3 (40 μm), Z3 (90 μm), J5 (100 μm) ane Z5 (125 μm) are the longest ones. Other dorsal setae are aproximately 30 μm long. 90 setae, 45 on each side are located on the membrane. The shields have characteristic granulate sculpture.

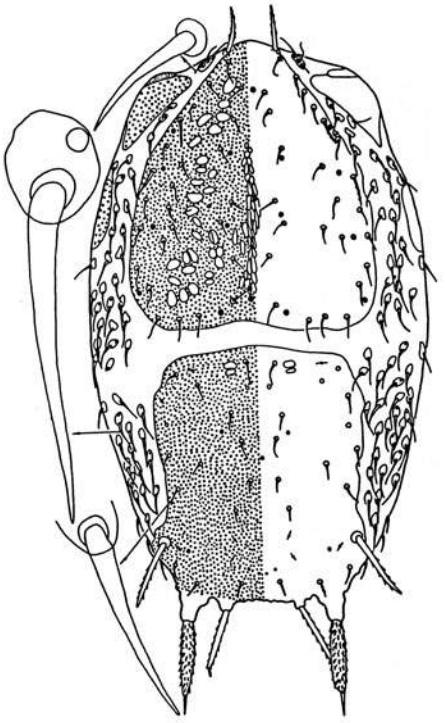

Fig. 22. *Sejus hinangensis* Hirschmann et Kaczmarek, 1991: dorsal idiosoma of phoretic deutonymph (after Hirschmann et al. 1991b).

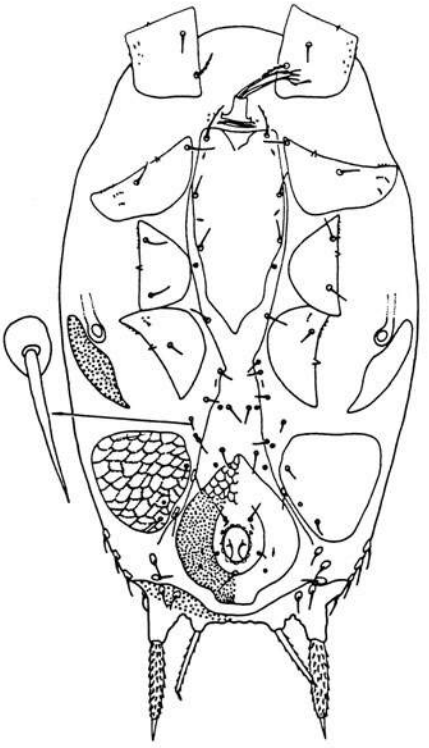

Fig. 23. *Sejus hinangensis* Hirschmann et Kaczmarek, 1991: ventral idosoma of phoretic deutonymph (after Hirschmann et al. 1991b).

Ventral. Tritosternum as in the deutonymph described above (Fig. 27d). On sternal shield (170×90 μm) three pairs of setae st1 (50 μm) and st2–st3 (30 μm). Leaf-shaped ventri-anal shield (170×150 μm), pointed at the upper extremity, with five setae (Fig. 23). Two large metapodal shields (130–150×130–150 μm), with granulate sculpture forming lineate ornamentation are located between coxae IV and ventri-anal shield. Most ventral setae are simple and only few ones, located in the region of the ventri-anal shield are larger and serrate. Stigma in the region of coxae IV, while second extremity of peritreme in the region of coxae I. Similarly as in the deutonymph also in phoretic deutonymph, two peritremal plates covered with granulate sculpture are located along peritremes.

Gnathosoma. Hypostome, epistome and chelicerae similar as in the deutonymph described above (Fig. 26c, f, 27f, 28c, e).

Legs variable in length: I – 650 μm, II – 580 μm, III – 580 μm, IV – 775 μm (Fig. 29i).

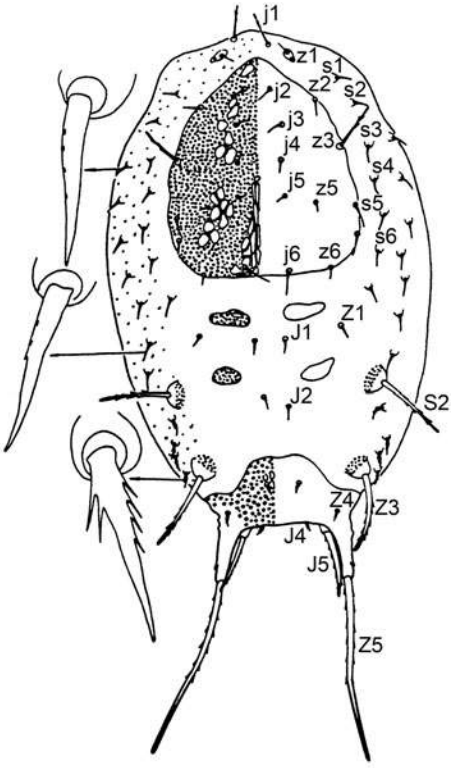

Fig. 24. *Sejus hinangensis* Hirschmann et Kaczmarek, 1991: dorsal idiosoma of protonymph (after Hirschmann et al. 1991b).

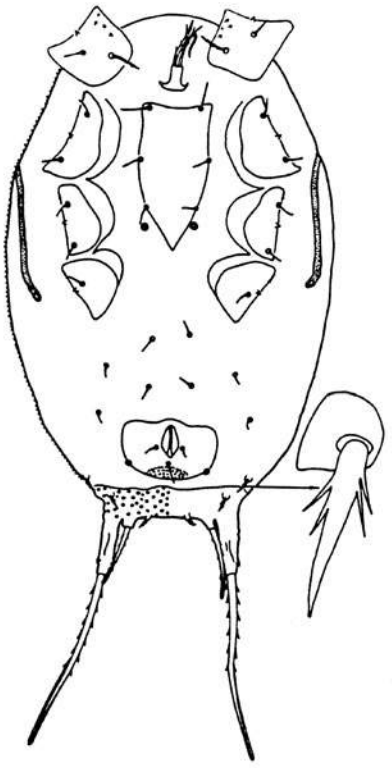

Fig. 25. *Sejus hinangensis* Hirschmann et Kaczmarek, 1991: ventral idiosoma of protonymph (after Hirschmann et al. 1991b).

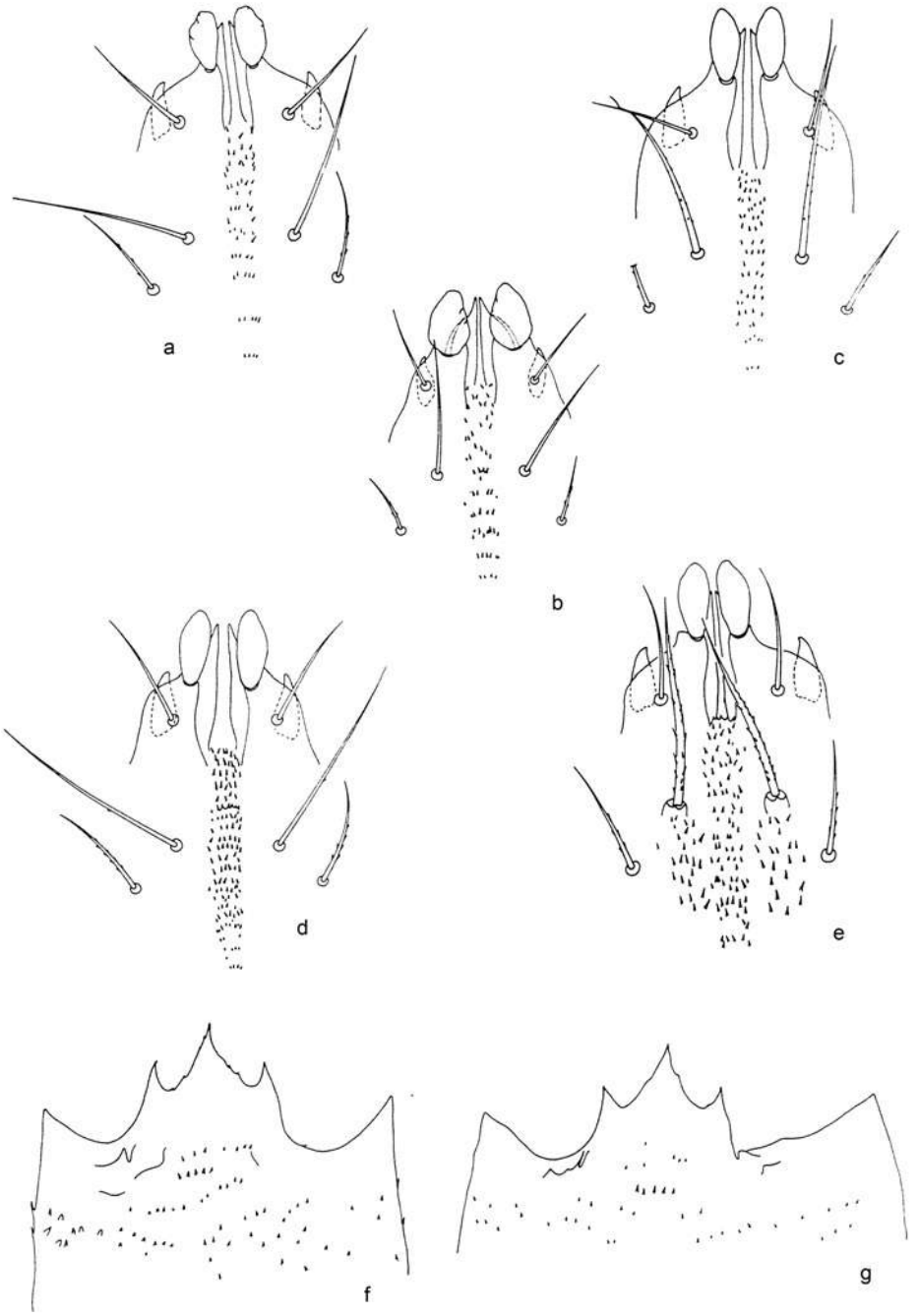

Fig. 26. *Sejus hinangensis* Hirschmann et Kaczmarek, 1991, hypostomes: deutonymph (a), protonymph (b), phoretic deutonymph (c), female (d), male (e); epistomes: phoretic deutonymph (f), deutonymph (g) (after Hirschmann et al. 1991b).

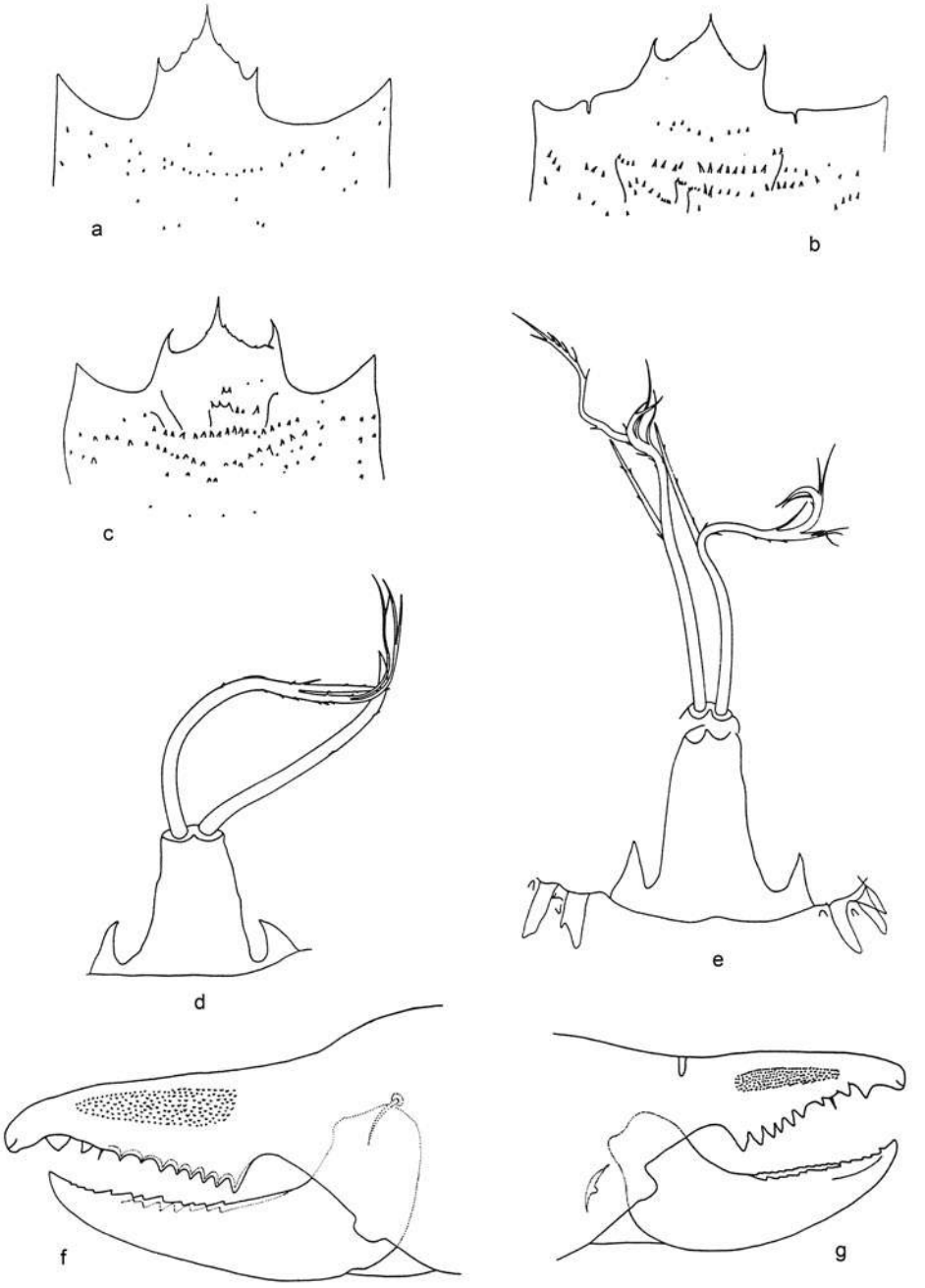

Fig. 27. *Sejus hinangensis* Hirschmann et Kaczmarek, 1991, epistomes: protonymph (a), female (b), male (c); tritosternums: phoretic deutonymph (d), female (e); chelicerae: phoretic deutonymph (f), deutonymph (g) (after Hirschmann et al. 1991b).

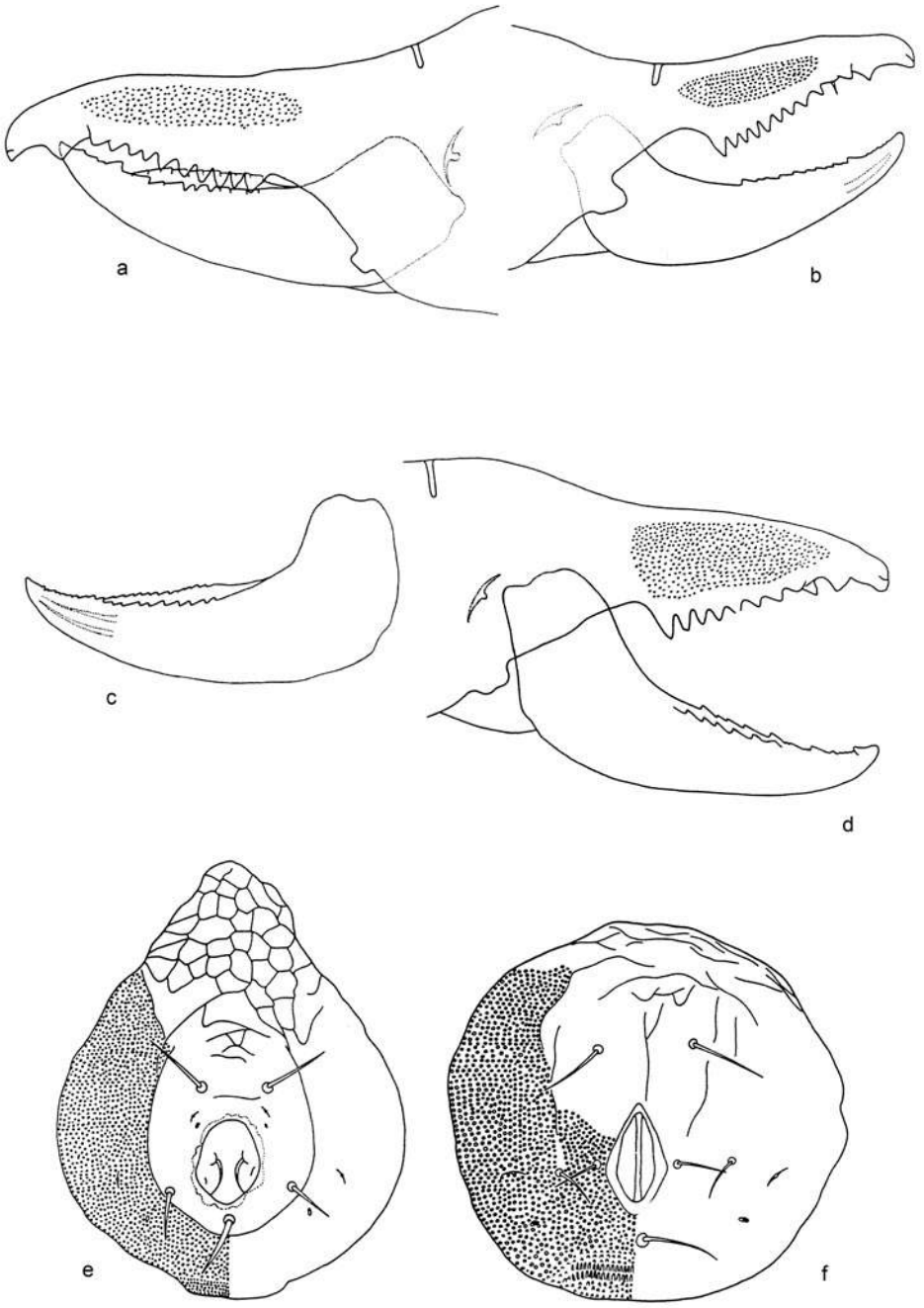

Fig. 28. *Sejus hinangensis* Hirschmann et Kaczmarek, 1991, chelicerae: male (a), protonymph (b), phoretic deutonymph (c), female (d); ventri-anal shields: phoretic deutonymph (e), deutonymph (f) (after Hirschmann et al. 1991b).

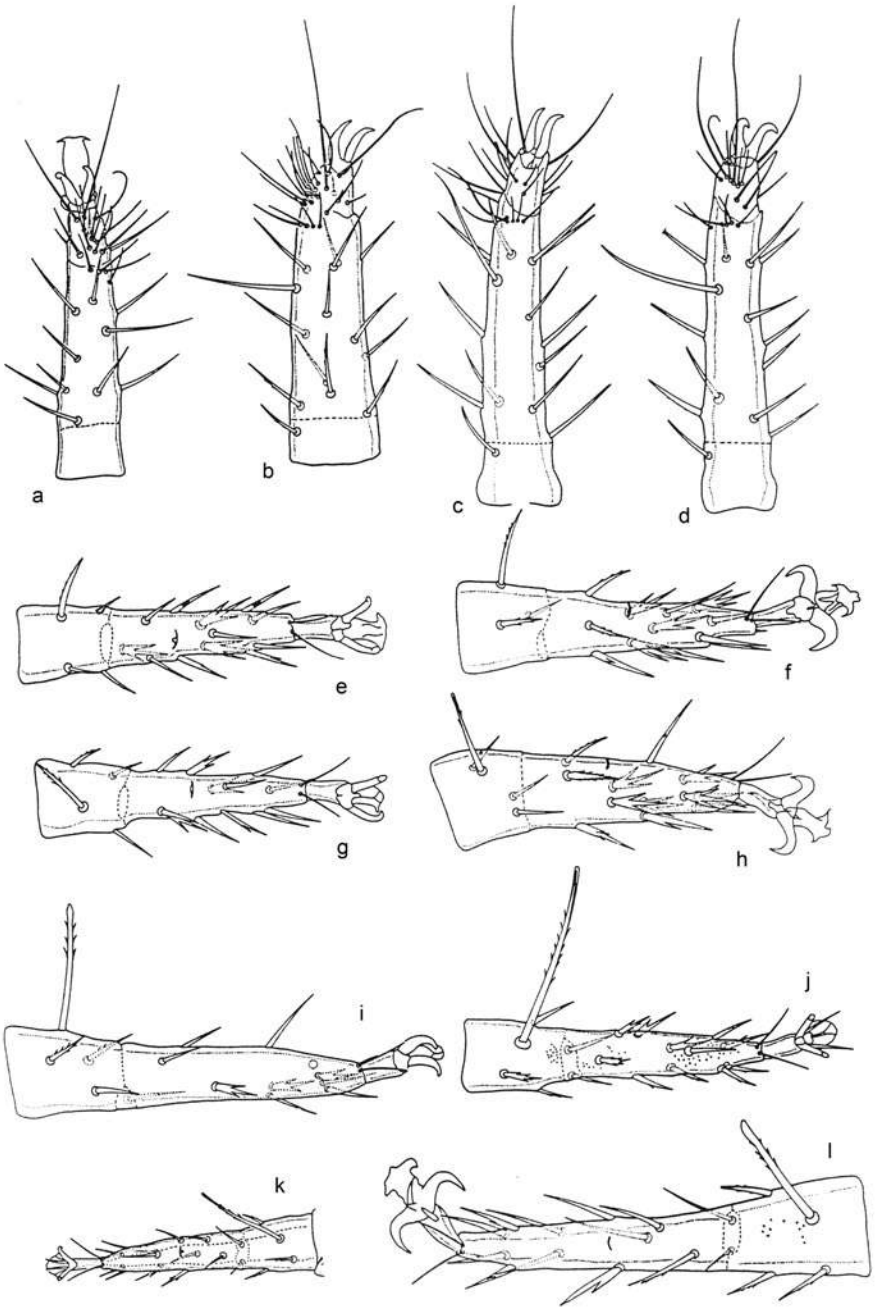

Fig. 29. *Sejus hinangensis* Hirschmann et Kaczmarek, 1991, tarsus: I of protonymph (a), I of deutonymph (b), I of female (c), I of male (d), II of male (e), II of female (f), III of male (g), III of female (h), IV of phoretic deutonymph (i), IV of protonymph (j), IV of deutonymph (k), IV of female (l) (after Hirschmann et al. 1991a).

Morphology of protonymph

Dorsal. Six shields on dorsal side: one pronotal shield (300×325 μm), four mesonotal plates (25×50 μm) and one pygidial shield (100×220 μm) (Fig. 24). Pronotal shield is egg-shaped with 11 pairs of setae (pair z4 absent) and pygidial shield with 5 pairs of setae. All shields have characteristic granulate sculpture. Dorsal setae have small barbs and are located on small tubercles. Setae j1 (30 μm), j6 (35 μm), z3 (50 μm), J5 (90 μm), S2 (100 μm), Z3 (110 μm) and Z5 (250 μm) are the longest ones. Other setae are approximately 20 μm long. Approximately 40 to 50 setae are located on the membrane, 20 on both sides of shields.

Ventral. Three pairs of setae are located on the sternal shield (150×80 μm). Setae st1 (35 μm) serrate, while st2–st3 simple (25 μm) (Fig. 25). Anal shield (100×125 μm) with three circum-anal setae. Cribrum located below post-anal seta. Four pairs of simple setae between sternal and ventri-anal shields. Stigma in the region of coxae IV, while second extremity of peritreme in the region of coxae II.

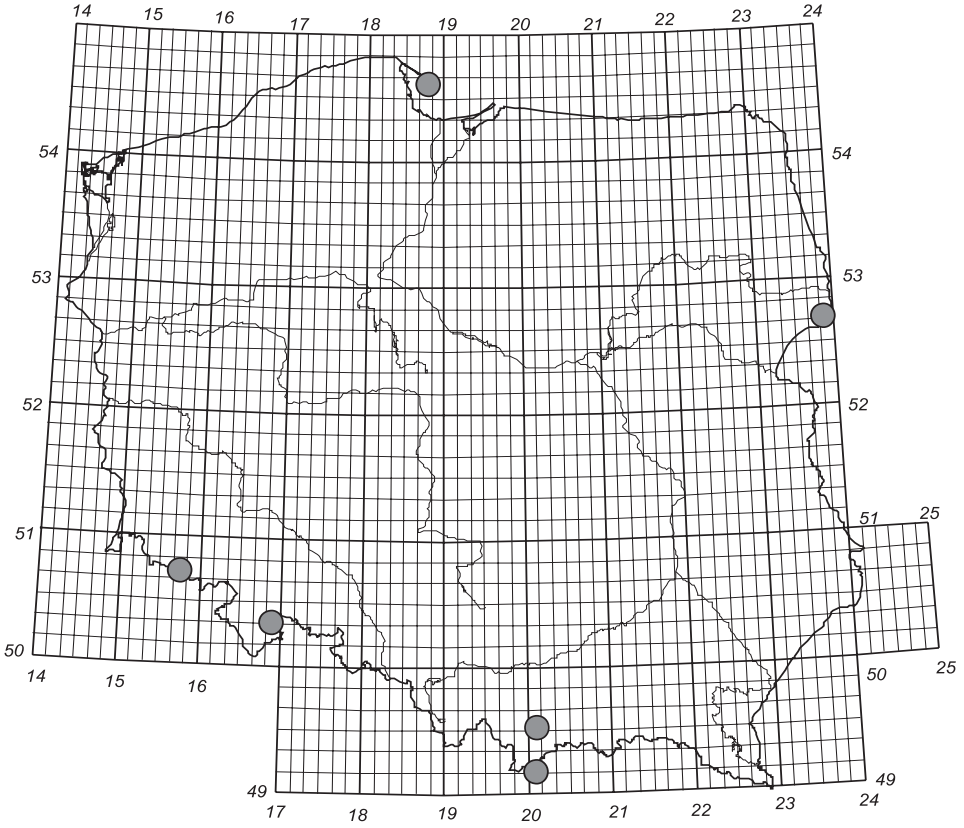

Fig. 30. *Sejus hinangensis* Hirschmann et Kaczmarek, 1991: geographic distribution in Poland.

Gnathosoma. Hypostome and epistome similar to those in dentonymphs describe above (Fig. 26b, 27a, 28b).

Legs variable in length: I – 560 μm, II – 475 μm, III – 475 μm, IV – 600 μm (Fig. 29a, j).

Biology and ecology. The species prefers bark beetle galleries mostly of Scolytinae and rotting wood of various species of trees (Hirschmann et al. 1991b).

Occurrence in the World: Germany, Poland, Russia (Tuva, Uvs-Nuur Ta, Karachol) (Hirschmann et al. 1991b).

Occurrence in Poland: rotting wood of oak, Krajkowo Reserve, Konstantynowo Forest District (Kaczmarek 1994); rotting wood of oak, Przysiecz, Prószków Forest District (Wiśniewski, Hirschmann 1984); rotting wood of oak, Białowieża NP (Gwiazdowicz 1998); rotting wood of oak, pine and spruce, Białowieża NP (Gwiazdowicz 1999a); under bark, Białowieża NP (Gwiazdowicz 1999b); litter, Białowieża NP (Gwiazdowicz et al. 1999); rotting wood, Białowieża NP (Gwiazdowicz 2000a); rotting wood, Wielkopolska NP (Skorupski 2000, 2001); rotting wood, Bielinek Reserve (Skorupski, Łabędzki 2004) (Fig. 30).

Sejus polonicus Hirschmann et Kaczmarek, 1991

Holotype: Zoological Collection in Munich (Zoologische Staatssammlung München), Germany, No 3061 (1F)

Paratypes: Zoological Collection in Munich (Zoologische Staatssammlung München), Germany, No 3059 (1M, 1D), 3060 (2M, 3D, 2P), 3062 (1F), 3063 (1D), 3064 (1F), 3065 (1M)

Etymology: (from Latin) *polonicus* – originating from Poland

Locus tipicus: Międzyrzecz, Poland (52°26'54"N, 15°35'18"E)

Measurements

♀ – 1010–1080 × 650–700 μm
♂ – 910–980 × 600–620 μm
D – 670–680 × 430–440 μm
P – 580–600×420–430 μm
L – unknown

Morphology of female

Dorsal. Light brown body color. Six shields on dorsal side: one pronotal shield (450×400 μm), four mesonotal plates (90×175 and 100×125 μm) and one pygidial shield (275×340 μm) (Fig. 31). Dorsal setae have barbs and are located on small tubercles. On individual shields variable number of setae approximately 30 μm long. Setae Z3 (55–60 μm), J5 (85 μm) and Z5 (120 μm) are slightly longer.

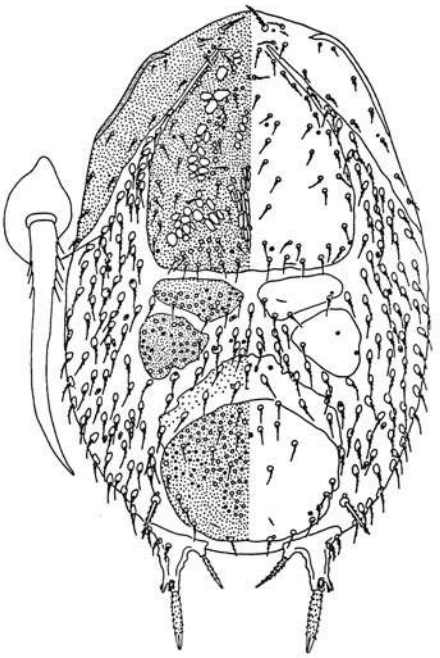

Fig. 31. *Sejus polonicus* Hirschmann et Kaczmarek, 1991: dorsal idiosoma of female (after Hirschmann et al. 1991b).

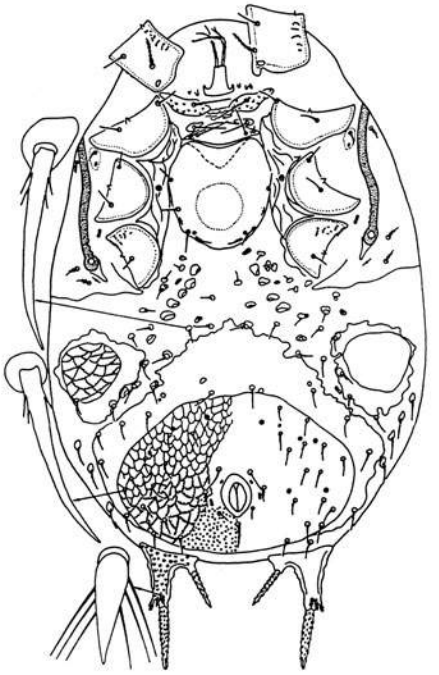

Fig. 32. *Sejus polonicus* Hirschmann et Kaczmarek, 1991: ventral idiosoma of female (after Hirschmann et al. 1991b).

Over 60 setae on the pronotal shield, approximately 20–30 setae on the pygidial shield, while from one to four setae on mesonotal plates. 150 to 170 setae on the membrane located on the dorsal side. All shields feature characteristic granulate ornamentation with small tubercles in some places which are significantly smaller than in *S. togatus*. Characteristic bottle-shaped bases of setae Z5 and fused with them bases of setae J5 are located at the extremity of idiosoma. In some cases single serrate setae are located on bases of setae Z5.

Ventral. Tritosternum with wide base which has denticles at an extremity. Usually two pairs of denticles on each side of tritosternum. Setae st1 (70–75 μm) and st2 (60 μm) are located on separate presternal plates (Fig. 32). First pair of these plates features dimensions: 25–30×100 μm, while the second one: 15×20–25 μm. Setae st3 (60 μm) and st4 (25 μm) are located on a small, short sternal shield (55×120 μm). Epigynial shield (180×190 μm) usually with four pairs of setae with length from 25 to 40 μm is located below. Ventri-anal shield is trapezoid (120×180 μm) with three circum-anal setae and over 30 serrate ventral setae approximately 30 μm long. The shield is covered with reticulate ornamentation which below anus is granulate (Fig. 17b). Relatively large metapodal plates (85×95 μm) also covered with reticulate ornamentation are located on body sides. Exopodal plate is located between coxae II and IV. Peritremes are located

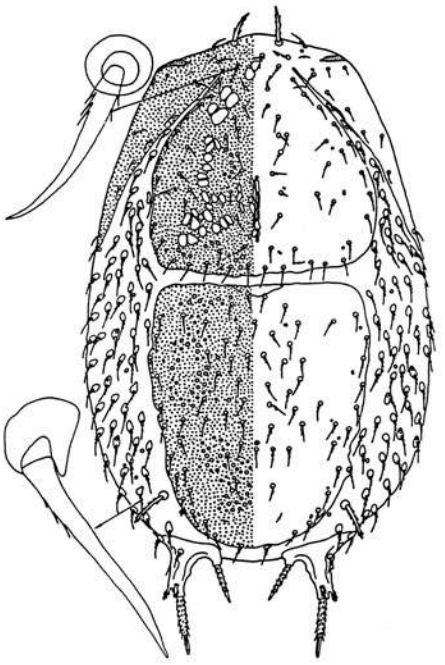

Fig. 33. *Sejus polonicus* Hirschmann et Kaczmarek, 1991: dorsal idiosoma of male (after Hirschmann et al. 1991b).

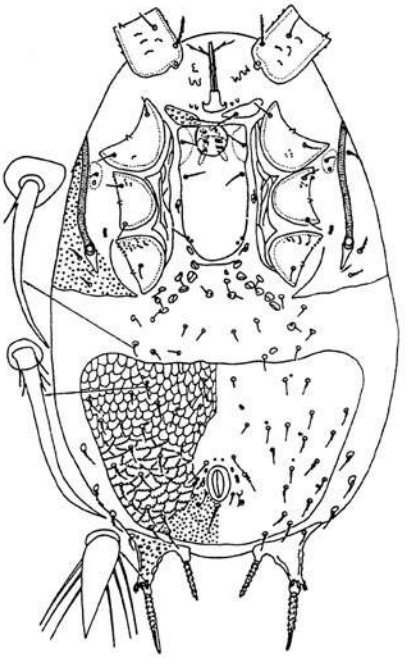

Fig. 34. *Sejus polonicus* Hirschmann et Kaczmarek, 1991: ventral idiosoma of male (after Hirschmann et al. 1991b).

on wide on peritremal shields. Stigma in the region of coxae IV, while second extremity of peritreme reaches coxae I. Peritremal shield reaches the dorsal side and is fused with pronotal shield.

Gnathosoma. Corniculi are corniculate. Setae h1 are balloon-shaped, h2 and h3 simple, while h3 and h4 serrate. A few dozen of sharply-ended denticles are visible in the hypostomal groove, from the region of setae h2 to the base of gnathosoma (Fig. 39b). Epistome consists of three ragged apices; the central one is the highest. A surface covered with tiny, irregular, sharp denticles is located below (Fig. 39f). Fixed digit usually with 9 to 11 teeth, while movable digit with tiny denticles at two edges (Fig. 40b).

Legs variable in length: I – 850 μm, II – 700 μm, III – 700 μm, IV – 870 μm.

Morphology of male

Dorsal. Two shields are located on the dorsal side: pronotal shield (400×400 μm) with approximately 60 to 70 setae and opisthonotal shield (450×400 μm) with approximately 70 to 80 setae (Fig. 33). All serrate setae are located on small tubercles. Setae Z3 (65–70 μm), J5 (85–90 μm) and Z5 (120 μm) are the longest ones. Approximately 110 to 130 setae are located on side membrane. The shields are covered with granulate sculpture, although in some places small tubercles occur, in particular on the opisthonotal shield.

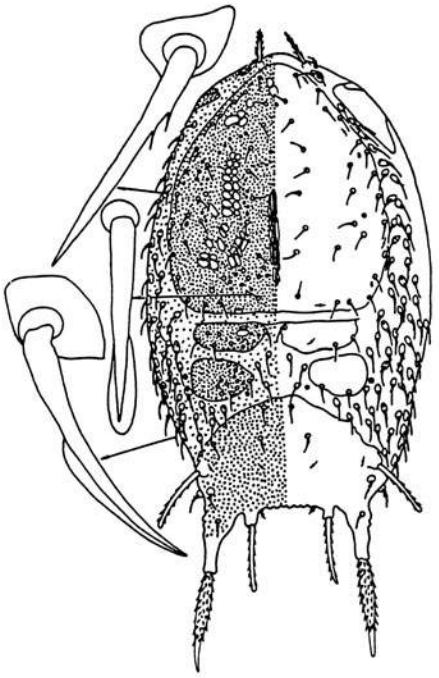

Fig. 35. *Sejus polonicus* Hirschmann et Kaczmarek, 1991: dorsal idiosoma of deutonymph (after Hirschmann et al. 1991b).

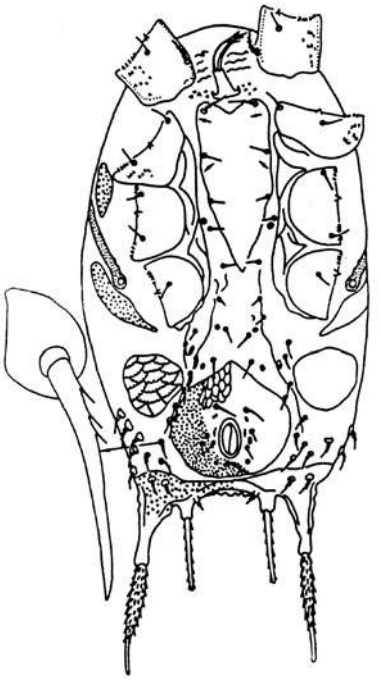

Fig. 36. *Sejus polonicus* Hirschmann et Kaczmarek, 1991: ventral idosoma of deutonymph (after Hirschmann et al. 1991b).

Ventral. Tritosternum as in the female (Fig. 40a). Two small presternal plates with setae st1 are located above the sternal shield. Sterni-genital shield (250×120 μm) usually with four pairs of serrate setae. In some specimens setae st4 are located outside the shield (Fig. 34). Genital orifice of male in the region of coxae II. Relatively large ventri-anal shield with approximately 40 to 50 setae, pilose at their bases, is located below sternigenital shield. Large anal orifice with three circum-anal setae. The shield is covered with reticulate ornamentation which, below anus, is granulate. Exopodal plate is located between coxae II and IV. Wide peritremal shields on sides. Stigma in the region of coxae IV, while the second extremity of peritreme in the region of coxae I.

Gnathosoma. Both hypostome and epistome similar as in the female (Fig. 39c, h). No spermatodactyl on chelicerae (Fig. 40c).

Legs variable in length: I – 800 μm, II – 650 μm, III – 650 μm, IV – 850 μm.

Morfology of deutonymph

Dorsal. Six shields on dorsal side: one pronotal shield (350×300 μm), four mesonotal plates (45×100 μm and 60×90 μm) and one pygidial shield (150×260 μm) (Fig. 35). Pronotal shield is egg-shaped with 27 pairs of setae, mesonotal

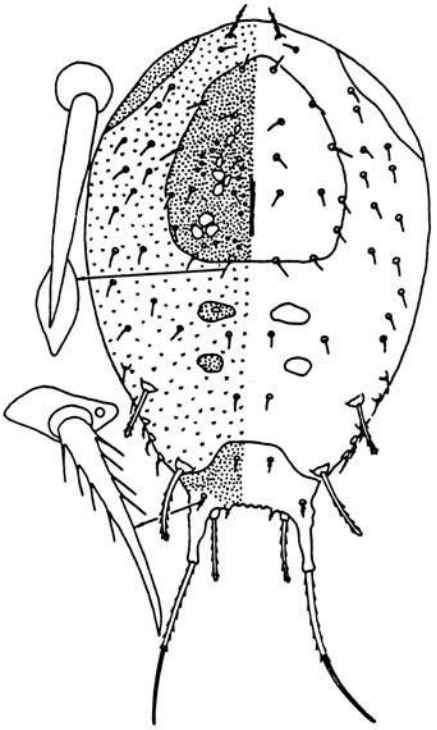

Fig. 37. *Sejus polonicus* Hirschmann et Kaczmarek, 1991: dorsal idiosoma of protonymph (after Hirschmann et al. 1991b).

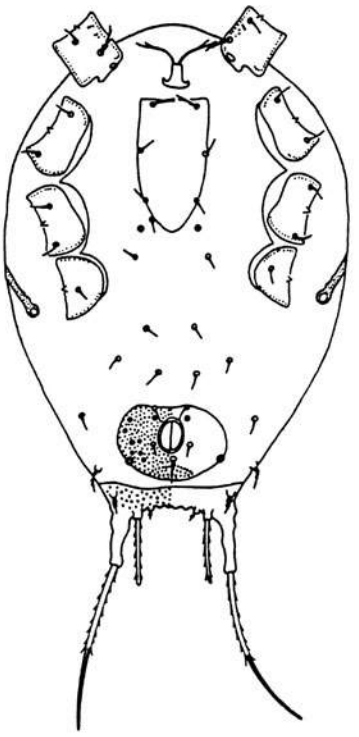

Fig. 38. *Sejus polonicus* Hirschmann et Kaczmarek, 1991: ventral idiosoma of protonymph (after Hirschmann et al. 1991b).

shields with 2 to 3 seate, pygidial shield with 16 to 20 setae. Elongated marginal plates are located on sides of the upper part of the pronotal shield. All shields have characteristic granulate sculpture. Dorsal setae located on small tubercles are curved and have small barbs. Setae j1 (55 μm), Z3 (100 μm), J5 (95 μm) and Z5 (150 μm) are the longest one. Other dorsal setae are approximately 30 μm long. Approximately 110 to 120 setae are located on the membrane, approximately 60 on both sides of shields.

Ventral. Tritosternum similar to the one in adult specimens, however, more denticles, usually five, are present at the base. Three pairs of setae st1–st3 (30 μm long) on sternal shield (210×95 μm), while setae st4 and st5 outside the shield (Fig. 36). Setae st1 are serrate and other setae are simple. Ventri-anal shield (140×160 μm) with 7 simple setae. In the most part the shield is covered with reticulate sculpture and in the lower part the sculpture is granulate. Setae, approximately 30 μm long, around the ventri-anal shield, are placed on tubercles and have barbs. Metapodal plates (80×85 μm) are located below coxae IV and are covered with granulate sculpture forming reticulate ornamentation. Stigma

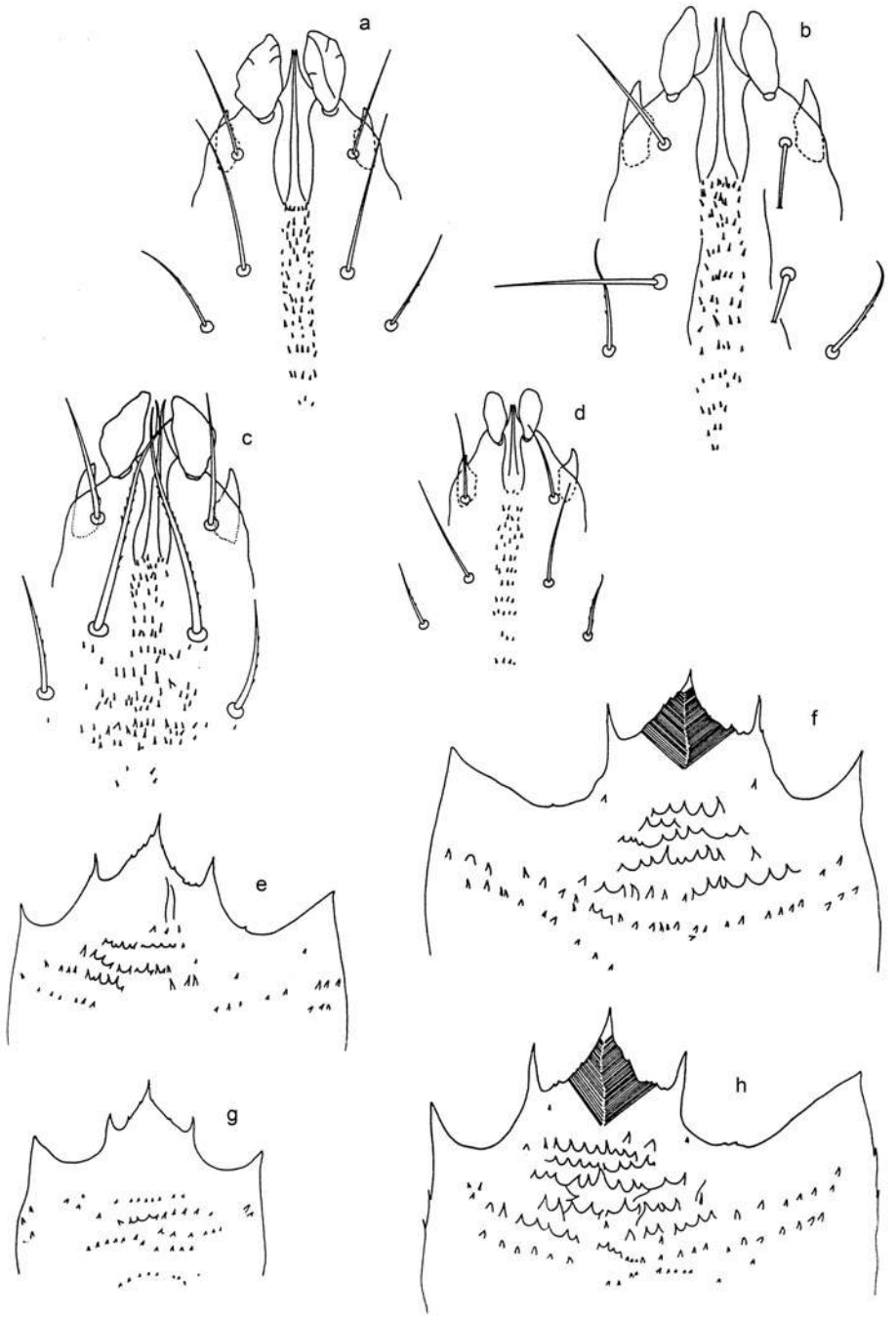

Fig. 39. *Sejus polonicus* Hirschmann et Kaczmarek, 1991, hypostomes: deutonymph (a), female (b), male (c), protonymph (d); epistomes: deutonymph (e), female (f), protonymph (g), male (h) (after Hirschmann et al. 1991b).

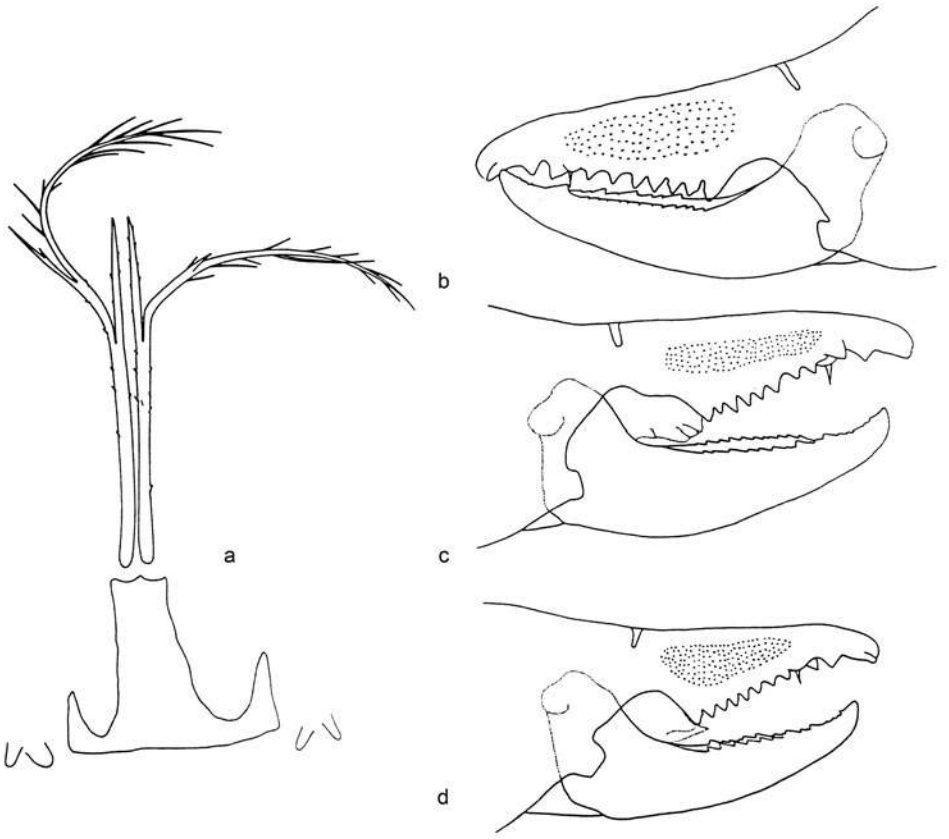

Fig. 40. *Sejus polonicus* Hirschmann et Kaczmarek, 1991: tritosternum of male (a); chelicerae: female (b), male (c), deutonymph (d) (after Hirschmann et al. 1991b).

in the region of coxae IV, while the second extremity of peritreme in the region of coxae I. Two peritremal plates with granulate and punctate sculpture are located along the peritreme.

Gnathosoma. Hypostome, epistome and chelicerae similar as in adult specimens (Fig. 39a, e, 40d).

Legs variable in length: I – 650 μm, II – 525 μm, III – 525 μm, IV – 675 μm.

Morphology of protonymph

Dorsal. Six shields on dorsal side: one pronotal shield (250×200 μm), four mesonotal plates (25×45 and 30×30 μm) and one pygidial shield (75×175 μm) (Fig. 37). Pronotal shield is egg-shaped with 11 pairs of setae and pygidial shield with 5 pairs of setae. Elongated marginal plates are located on sides of the upper part of the pronotal shields. All shields have characteristic granulate sculpture. Dorsal setae are located on small tubercles and are pilose at their bases. Setae j1 (30 μm), S2 (70 μm), J5 and Z3 (80 μm), and also Z5 (170 μm) are the longest

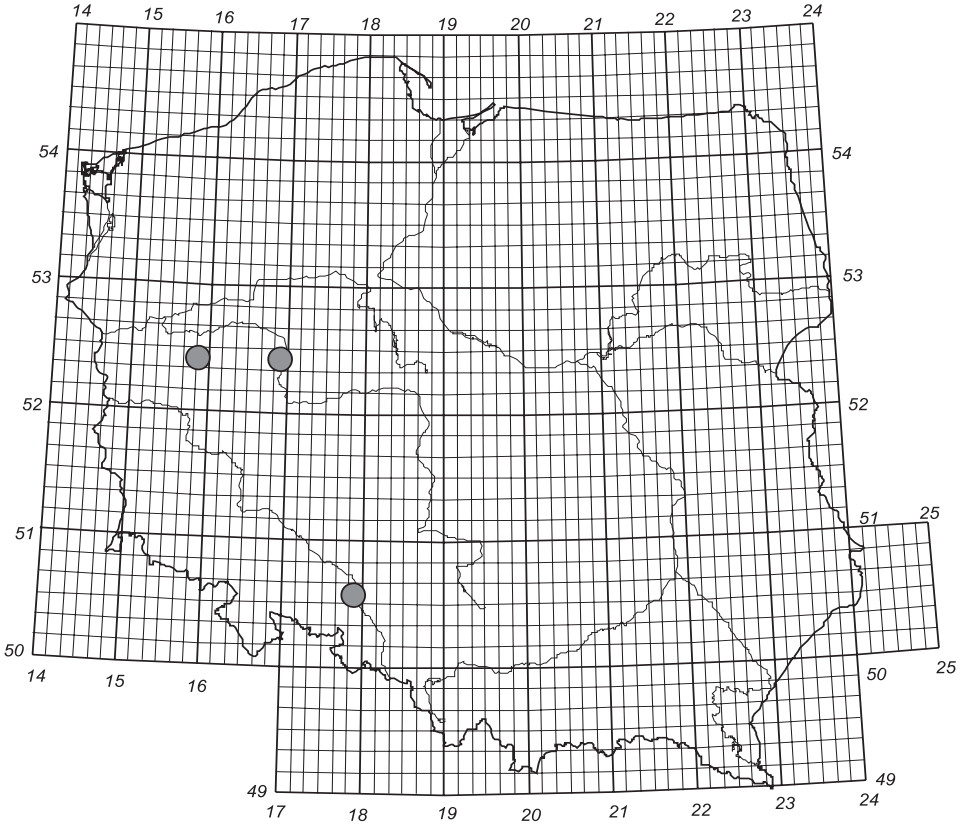

Fig. 41. *Sejus polonicus* Hirschmann et Kaczmarek, 1991: geographic distribution in Poland.

ones. Other dorsal setae are 20–25 μm long. Approximately 40 to 50 setae are located on membrane on sides of shields.

Ventral. Three simple setae (st1–st3) on the sternal shield (Fig. 38). Ventri-anal shield (90×120 μm) with 5 setae. Cribrum located below post-anal seta. Four pairs of simple setae between sternal and ventri-anal shields. Stigma in the region of coxae IV, while the second extremity of peritreme in the region of coxae II.

Gnathosoma. Hypostome, epistome and chelicerae similar as in adult specimens (Fig. 39d, g).

Legs variable in length: I – 500 μm, II – 400 μm, III – 400 μm, IV – 525 μm.

Biology and ecology. The species prefers rotting wood of various species of trees (Hirschmann et al. 1991b).

Occurrence in the World: Poland (Hirschmann et al. 1991b).

Occurrence in Poland: rotting wood of oak, Prószków Protected Landscape; rotting wood, Dendrological Garden, Poznań; rotting wood, Międzyrzecz Protected Landscape (Hirschmann et al. 1991b) (Fig. 41).

Sejus rafalskii Wiśniewski et Hirschmann, 1991

Holotype: Poznań University of Life Sciences (Uniwersytet Przyrodniczy w Poznaniu), Department of Forest Protection, Poland, No JW 1873 (1F)

Paratype: Zoological Collection in Munich (Zoologische Staatssammlung München), Germany, No 3074 (1F);

Collection in Poland: Poznań University of Life Sciences (Uniwersytet Przyrodniczy w Poznaniu), Department of Forest Protection, Poland

Ethymology: the species dedicated to prof. J. Rafalski from the Adam Mickiewicz University, Poland

Locus tipicus: Bielinek nad Odrą, Poland (52°05'50"N, 14°10'00"E)

Measurements

♀ – 515–545 × 375–420 μm
♂ – 450–462 × 316–325 μm
D – 435–472 × 335–342 μm
D(ph) – 497–447 × 285–294 μm
P – unknown
L – unknown

Morphology of female

Dorsal. Six shields on dorsal side: one pronotal shield (275–300×250–275 μm), four mesonotal plates (30×75 and 50×40–50 μm) and one pygidial shield (150×230 μm) (Fig. 42). Dorsal setae are located on small tubercles, curved and with barbs. Setae Z3 (50 μm), J5 (55 μm), Z5 (90 μm) visibly longer than others (25 μm) and with hyaline sheath at the extremity. The number of setae on individual shields are variable: usually 34 to 56 setae on pronotal shield, from 1 to 4 setae on mesonotal plates and from 13 to 26 setae on pygidial shield. 100 setae, 50 on each side are located on the membrane located on sides of shields. The shields are covered with characteristic granulate sculpture, which, in addition, forms lineate ornamentation on the pygidial shield.

Ventral. Tritosternum with wide base which has denticles at an extremity (Fig. 44c). Two pairs of denticles on each side of tritosternum. Laciniae fruticose at the extremity. Setae st1 (30 μm) and st2 (30 μm) are located on separate presternal plates (25×40 oraz 15×40 μm). Setae st1 are serrate, while the other ones are simple (Fig. 43). Setae st3 (30 μm) and st4 (20 μm) are located on sternal shield (25×60 μm) in some cases, although in some specimens they are located on separate plates. Moreover, usually 2–3 pairs of setae (20 μm) are located on

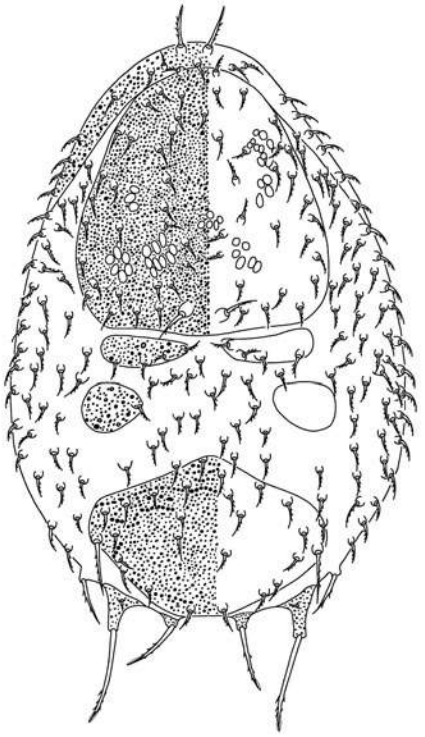

Fig. 42. *Sejus rafalskii* Wiśniewski et Hirschmann, 1991: dorsal idiosoma of female.

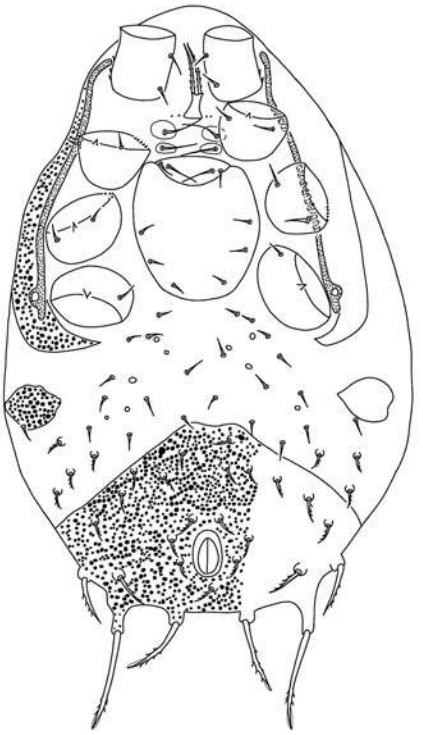

Fig. 43. *Sejus rafalskii* Wiśniewski et Hirschmann, 1991: ventral idiosoma of female.

the epigynial shield (110–120×110–120 μm). Large ventri-anal (175×300 μm) with 13 to 20 pairs of setae is located below. Most setae on this shield are serrate and only few of them are simple. They are located on small tubercles. Large anal orifice and seven setae around it. The shield is covered with granulate sculpture, which forms lineate ornamentation in the upper part of it. Relatively large metapodal plates (50×50–60 μm) are located on body sides. These plates are covered with granulate sculpture and, in some specimens, ventral setae are located on the metapodal plates. Peritremes are located on wide peritremal shields. Stigma in the region of coxae IV, while second extremity of peritreme reaches coxae I. Peritremal shield reaches the dorsal side and is covered with the same sculpture as metapodal plates and ventri-anal shield.

Gnathosoma. Narrow corniculate corniculi which are narrowed at the extremity. Hypostomal setae are variable in shapes and length. Setae h1 club-shaped, balloon-shaped, rounded at the extremity. Setae h2 and h3 are simple, while setae h4 are serrate. Rows of denticles (from 3 to 7 denticles) are located in the hypostomal groove (Fig. 44a). Epistome pointed and elongated with small denticles. Below, on both sides groups of larger denticles, while, at the base,

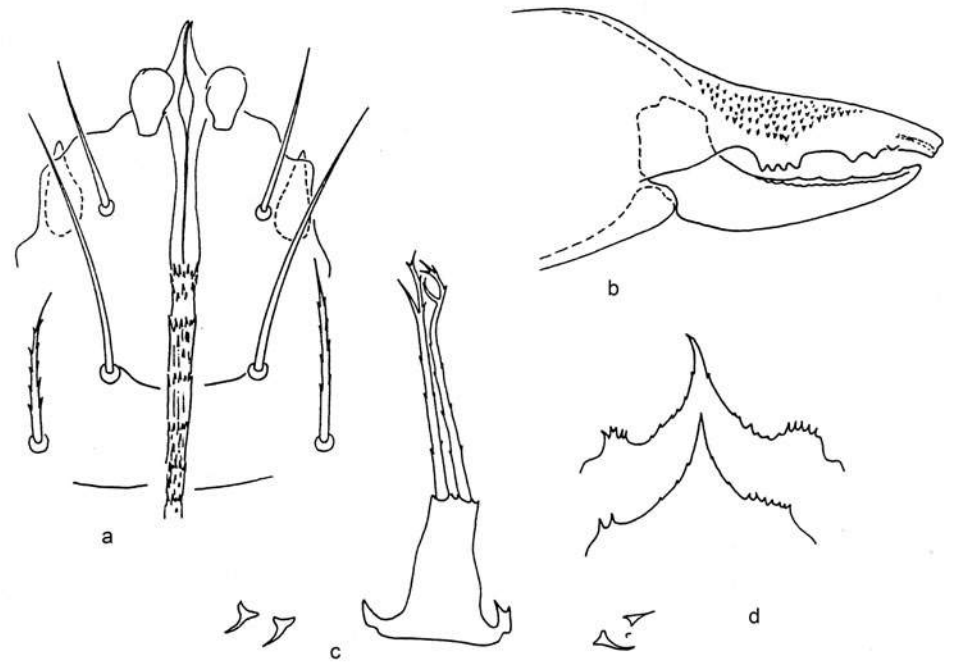

Fig. 44. *Sejus rafalskii* Wiśniewski et Hirschmann, 1991, female: hypostome (a), chelicera (b), tritosternum (c), epistome (d) (after Hirschmann et al. 1991b).

numerous single denticles forming several irregular lines (Fig. 44d). Fixed digit usually with seven teeth. Well-defined diastema between anterior and posterior teeth. Movable digit with a row of very tiny denticles (Fig. 44b).

Legs variable in length: I – 500 μm, II – 400 μm, III – 370 μm, IV – 470 μm.

Morphology of male

Dorsal. Two shields are located on the dorsal side: pronotal shield (250×220 μm) with approximately 60 setae and opisthonotal shield (200×200 μm) with approximately 50 setae (Fig. 45). All setae (25 μm) are located on small tubercles, curved and with barbs. Setae Z3 (50 μm), J5 (45 μm) and Z5 (75–80 μm) are the longest ones. Approximately 50–60 setae, 25–30 on each side are located on the side membrane. The shields are covered with granulate sculpture, which, in addition, forms lineate ornamentation on the opisthonotal shield.

Ventral. Tritosternum as in the female, base 25 μm long, while laciniae 40 μm long. Setae st1 (25 μm) on separate presternal plates (20×30 μm). Sternigetinal shield (150 μm long) with four pairs of simple setae which are variable in length. Genital orifice (30×40 μm) of male between setae st2 (20 μm) (Fig. 46). Relatively large ventri-anal shield (200×340 μm) with approximately 38 setae is located below sternigenital shield. Most setae on the shield are serrate (20 μm), however, there are also several pairs of simple setae (10–15 μm). Seven circumanal setae are located around large anal orifice. The shield is covered with granu-

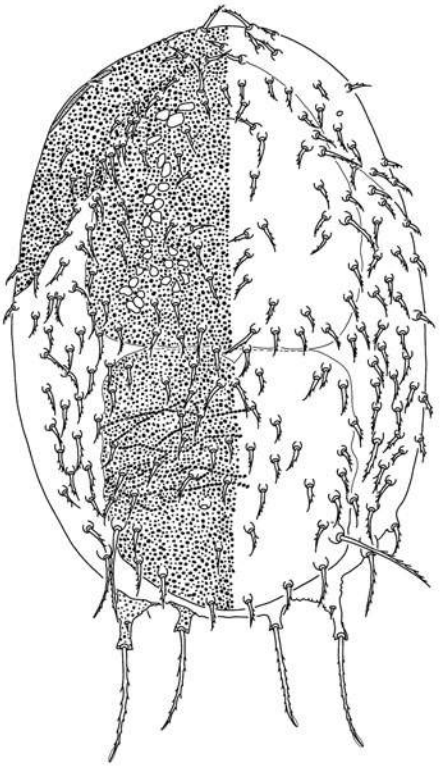

Fig. 45. *Sejus rafalskii* Wiśniewski et Hirschmann, 1991: dorsal idiosoma of male.

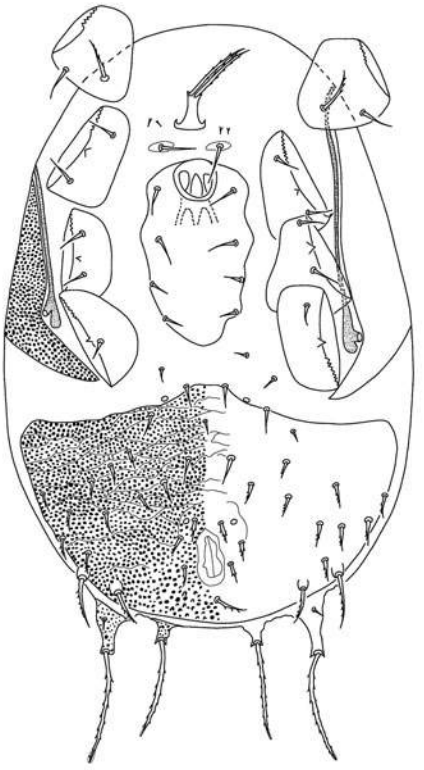

Fig. 46. *Sejus rafalskii* Wiśniewski et Hirschmann, 1991: ventral idiosoma of male.

late sculpture, which forms lineate ornamentation in some places. Single simple setae are located between sternigenital and ventri-anal shields. Wide peritremal shields with the same sculpture as on ventri-anal shield are located on sides. Stigma in the region of coxae IV, while the second extremity of peritreme in the region of coxae I.

Gnathosoma. Hypostome as in the female. Setae h1 balloon-shaped, h2 simple, while h3 and h4 serrate. Setae h3 (40 μm), visibly longer than h2 (30 μm) and h4 (30 μm) are the longest ones. Rows of tiny denticles are located in the hypostomal groove. Epistome as in the female with one elongated apex. Groups of tiny denticles on sides, while below several rows of single, irregular denticles. Fixed digit usually with 7–8 teeth. Well-defined diastema between anterior three teeth and posterior four teeth. Long, thin pilus dentilis which is dinstinguishable from teeth. Movable digit with a row of very tiny denticles (ca. 10).

Legs variable in length: I – 450 μm, II – 350 μm, III – 330 μm, IV – 410 μm.

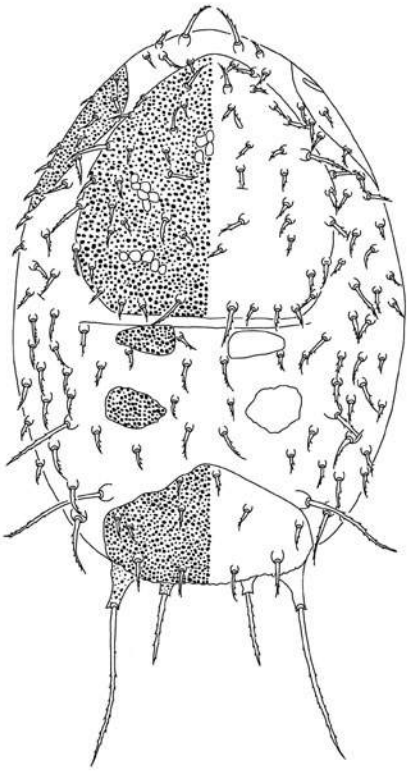

Fig. 47. *Sejus rafalskii* Wiśniewski et Hirschmann, 1991: dorsal idiosoma of deutonymph.

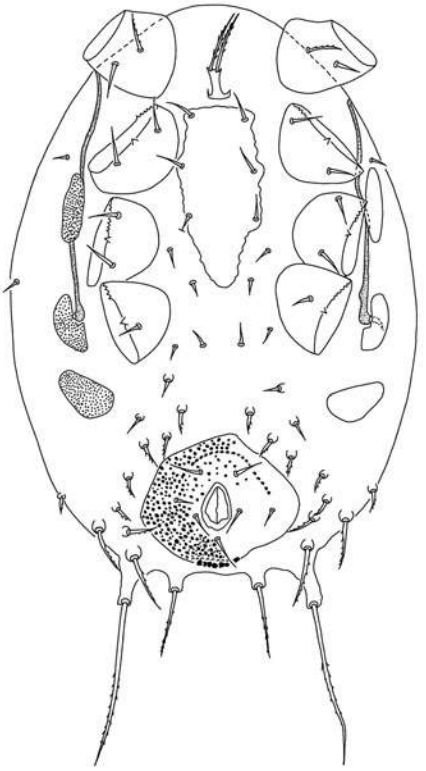

Fig. 48. *Sejus rafalskii* Wiśniewski et Hirschmann, 1991: ventral idosoma of deutonymph.

Morfology of deutonymph

Dorsal. Six shields on dorsal side: one pronotal shield (220–230×200–220 μm), four mesonotal plates (20–25×60 and 30×40–45 μm) and one pygidial shield (80×180 μm). Pronotal shield is egg-shaped with approximately 50 setae (25 μm) (Fig. 47). Mesonotal plates without setae, and pygidial shield with seven pairs of setae. Dorsal setae are located on small tubercles, curved and with barbs. Setae S2 (60 μm) i Z3 (75 μm) located on the membrane and setae J5 (90 μm) and Z5 (110 μm) located on pygidial shield are the longest ones. Moreover, approximately 80 setae, 40 on each side are located on the membrane located on sides of shields. The shields have characteristic granulate sculpture.

Ventral. Tritosternum similar as in adult specimens, however there are no denticles at the base (Fig. 49b). Three pairs of setae st1–st3 (25 μm) are located on the sternal shield (150 μm long). Setae st4 and st5 (10 μm) are shorter and are located outside the shield (Fig. 48). Ventri-anal shield (100×125 μm) with 7 simple setae (20 μm). The shield is covered with granulate sculpture. Setae around the ventri-anal shield are serrate and are placed on tubercles. Metapodal

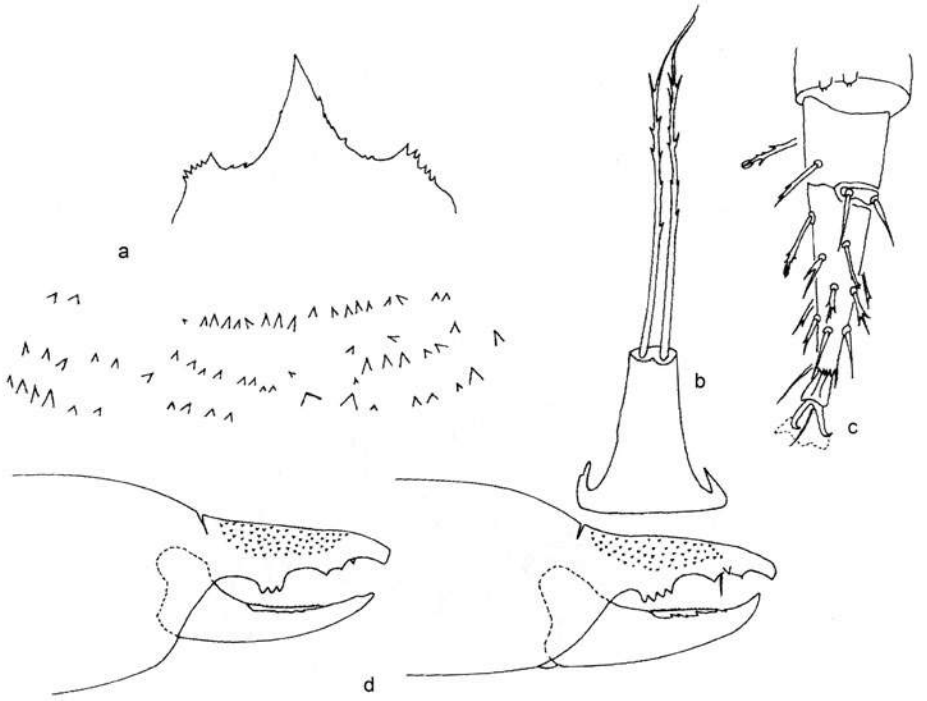

Fig. 49. *Sejus rafalskii* Wiśniewski et Hirschmann, 1991, deutonymph: epistome (a), tritosternum (b), tarsus IV (c), chelicerae (d) (after Gwiazdowicz 1995).

plates (30×50 μm) with punctate sculpture are located below coxae IV. Stigma in the region of coxae IV, while the second extremity of peritreme in the region of coxae I. Two peritremal plates with punctate sculpture are located along the peritreme.

Gnathosoma. Hypostome similar as in the female. Setae h1 balloon-shaped, h2 and h3 simple, while h4 with barbs. Setae h3 (40 μm) are longer than setae h2 (30 μm) and h4 (30 μm). Rows of tiny denticles are located in the hypostomal groove. Epistome as in the female (Fig. 49a). Fixed digit usually with 6–7 teeth. Well-defined diastema between anterior three teeth and posterior four teeth. Long, thin pilus dentilis which is dinstinguishable from teeth. Movable digit with a row of very tiny denticles (Fig. 49d).

Legs variable in length: I – 450 μm, II – 350 μm, III – 330 μm, IV – 410 μm (Fig. 49c).

Morphology of phoretic deutonymph

Dorsal. Two shields on dorsal side: pronotal shield (230×200 μm) with approximately 30 pairs of setae and opisthonotal one (180×200 μm) with approximately 15 pairs of setae (Fig. 50). Setae J5 (70 μm) and Z3 (70 μm) and Z5 (110 μm) are the longest ones on the dorsal side. Other dorsal setae are approximately

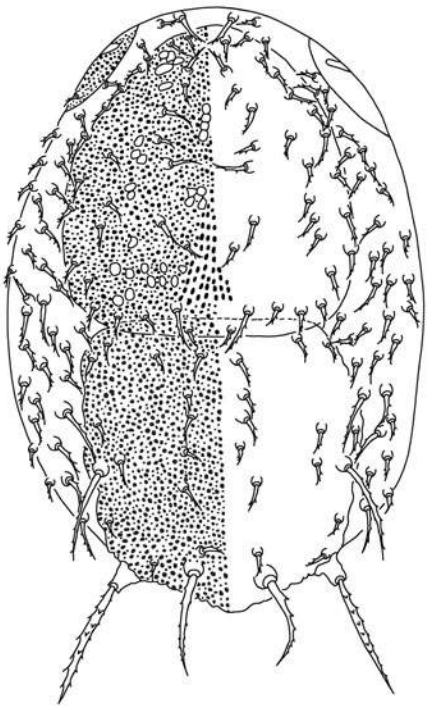

Fig. 50. *Sejus rafalskii* Wiśniewski et Hirschmann, 1991: dorsal idiosoma of phoretic deutonymph.

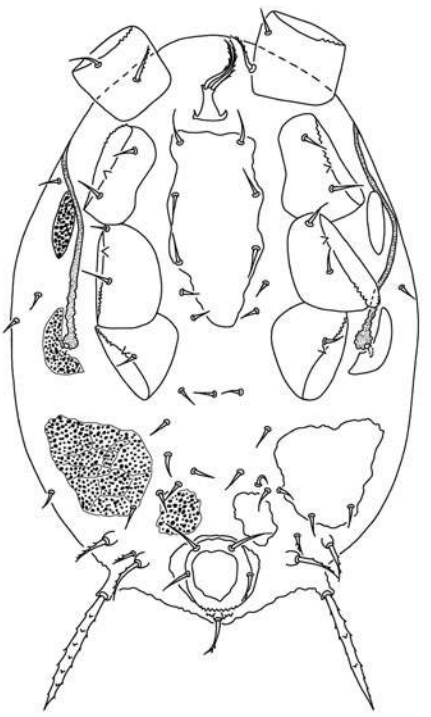

Fig. 51. *Sejus rafalskii* Wiśniewski et Hirschmann, 1991: ventral idosoma of phoretic deutonymph.

10–20 μm long, they are serrate and are located on small tubercles. Both shields are covered with granulate sculpture.

Ventral. Tritosternum as in the deutonymph. Setae st1–st3 (25 μm) on the sternal shield (140 μm long) and setae st4–st5 (15 μm) outside the shield. Very small ventri-anal shield and large anus (50×50 μm) (Fig. 51). Five setae are located around anus, four simple and one post-anal seta serrate. Two pairs of metapodal plates between coxae IV and ventri-anal shield. External metapodal plates (80×100 μm) are larger than the internal ones (30×30 μm) and with single setae in some cases. Metapodal plates are covered with granulate sculpture. Most ventral setae are simple and only few ones, located in the region of the anus are larger and with barbs. Stigma in the region of coxae IV, while the second extremity of peritreme in the region of coxae I. Similarly as in the deutonymph described above, also in phoretic deutonymph, two peritremal plates covered with punctate ornamentation are located along peritreme.

Gnathosoma. Hypostome similar as in the female. Setae h1 balloon-shaped, h2 and h3 simple, while h4 with barbs. Setae h3 (38–39 μm) are longer than setae h2 (27–28 μm) and h4 (27–28 μm). Rows of tiny denticles are located in the hypostomal groove. Epistome similar as in the female. Fixed digit usually with

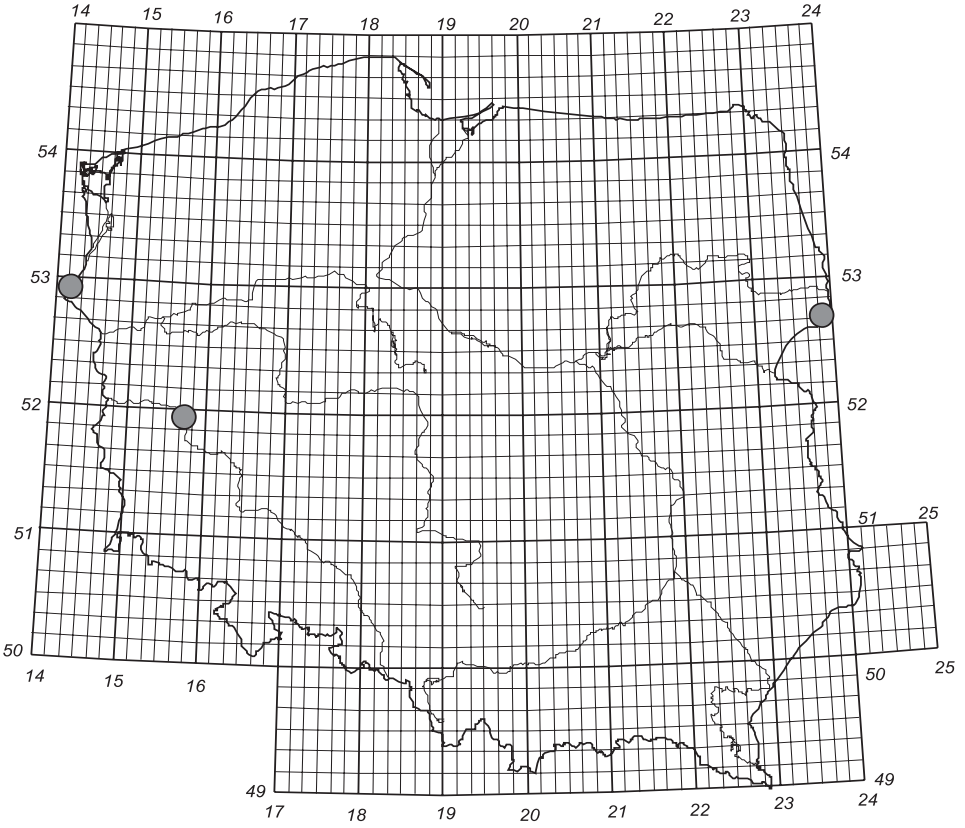

Fig. 52. *Sejus rafalskii* Wiśniewski et Hirschmann, 1991: geographic distribution in Poland.

6–8 teeth. Well-defined diastema between anterior 2–3 teeth and posterior four teeth. Movable digit with a row of very tiny denticles.

Legs variable in length: I – 450 μm, II – 330 μm, III – 320 μm, IV – 400 μm.

Biology and ecology. The species prefers rotting wood. Thus far, it has only been reported in protected areas such as a national park or reserve, where the number of old rotting trees is significant.

Occurrence in the World: Poland (Hirschmann et al. 1991b, Gwiazdowicz 1995).

Occurrence in Poland: rotiing wood of oak, Bielinek Reserve (Hirschmann et al. 1991b); rotting wood, tree hollows, Białowieża NP (Gwiazdowicz 1995, 1998, 1999a, 2000a); rotting wood, Bielinek Reserve (Skorupski, Łabędzki 2004); rotting wood of maple, Zabór (Gwiazdowicz, unpublished) (Fig. 52).

Sejus sejiformis (Balogh, 1938) (=*Willmannia sejiformis* Balogh, 1938)

Synonym: *S. posnaniensis* Hirschmann et Kaczmarek, 1991 – **new synonym**

Holotype: absent[3]

Paratype: absent

Collection in Poland: Poznań University of Life Sciences (Uniwersytet Przyrodniczy w Poznaniu), Department of Forest Protection, Poland

Etymology: (from Greek) *seius* – divine, *sejiformis* – divine-shaped

Locus typicus: Herkulesbad (Baile Herculane), Romania (44°52'14"N, 22°24'43"E)

Measurements

♀ – 870–935 (1050) × 620–720 (825) μm
♂ – 790–820 × 590–620 μm
D – 720–750 × 530–550 μm
P – 450–480×325–370 μm
L – 370×220 μm

Morphology of female

Dorsal. Whitish body color and the color of shields located on the membrane depends on age of specimen (chitinization degree) and may be from light yellow in young specimens to dark brown in older specimens. Six shields on dorsal side: one pronotal shield (430×380 μm), four mesonotal plates (60–80×100×120 μm) and one pygidial shield (240×350 μm) (Fig. 53). Moreover, two posteromarginal shields (250 μm) usually with four longer setae (90 μm) are located on the posterior part of body, below pygidial shields at the between dorsal and ventral sides. The upper part of pronotal shield is fused with the peritremal shield located on the ventral side. Dorsal setae are located on small tubercles, curved and with barbs. Variable number of setae approximately 50 μm long are located on individual shields. Setae j1 are slightly longer (65 μm). 80–90 setae are located on the pronotal shield, 10–20 setae on the pygidial shield, while mesonotal plates have no setae. 240 to 270 setae on the membrane located on the dorsal side. All shields have characteristic tuberculate and punctate ornamentation.

Ventral. Serrate setae st1 (70 μm) and st2 (60 μm) are located on separate presternal plates in the region of coxae II (Fig. 54). Setae st3 (70 μm) are also serrate and are located on sternal shield (40×110 μm). Simple setae st4 (50 μm) are located on separate plates which are located on sides of sternal shield. Epigynial shield (200×150 μm) with three pairs of setae (35 μm) are located below

3 Information obtained from prof. Sandor Mahunka and dr. Jenő Kontschán z Hungarian Natural History Museum in Budapest revealed that prof. Janos Balogh lost his collection in 1945. However all species described by J. Balogh after World War II are deposited at the Eötvös Lorand University.

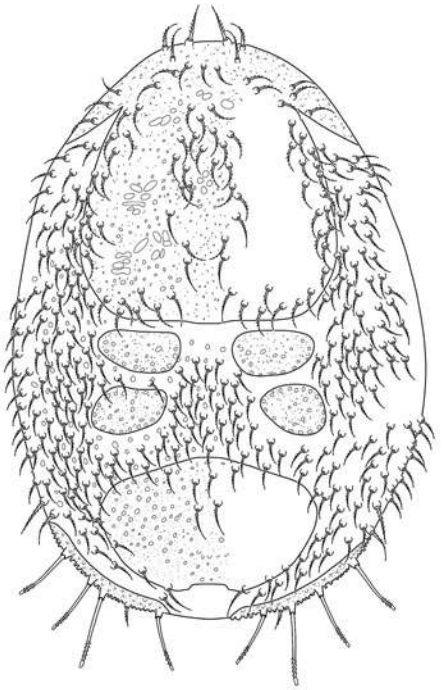

Fig. 53. *Sejus sejiformis* (Balogh, 1938): dorsal idiosoma of female.

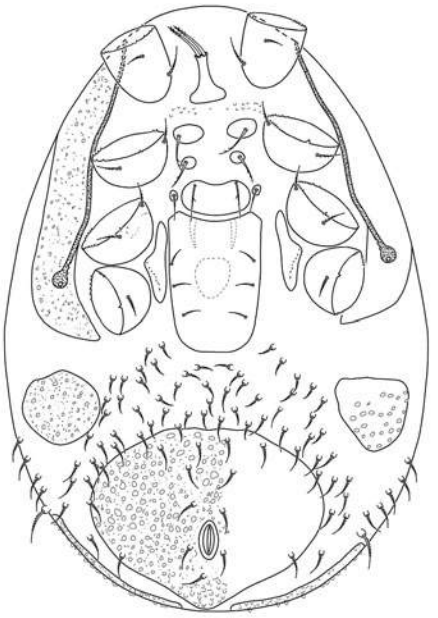

Fig. 54. *Sejus sejiformis* (Balogh, 1938): ventral idiosoma of female.

sternal shield, in the region of coxae III–IV. Exopodal plates (130 μm) with row of tiny tubercles are located on both sides of this shield. The cordiform ventri-anal shield (250×330 μm) is located below epigynial shield. Apart from 5 setae located in the vicinity of anus 10 other setae are located on this shield. All setae are serrate and they are placed on tubercles. The shield is covered with granulate and tuberculate sculpture. Relatively large metapodal plates (110×100 μm) are located on body sides. These plates are covered with tuberculate and punctate sculpture. Peritremes are located on wide peritremal shields. Stigma in the region of coxae IV, while second extremity of peritreme reaches coxae I. Peritremal shield reaches the dorsal side and is covered with the same sculpture as metapodal plates and ventri-anal shield. Approximately 60 serrate setae on tubercles are located between epigynial, ventri-anal shields and metapodal plates.

Gnathosoma. Corniculi are corniculate. Hypostomal setae are variable in shapes and length. Setae h1 club-shaped, balloon-shaped, rounded at the extremity. Setae h2 and h3 are simple, while setae h4 are serrate. 10 rows of denticles (from 3 to 7 denticles) are located in the hypostomal groove (Fig. 64c). Curved epistome curved with 9 to 11 denticles. Its base is covered with numerous tiny denticles (Fig. 65c). Fixed digit usually with several teeth and well-defined pilus dentilis. Movable digit with a row of very tiny denticles (Fig. 63b).

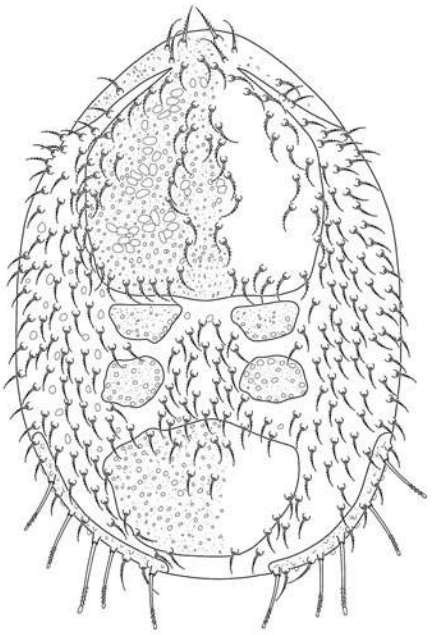

Fig. 55. *Sejus sejiformis* (Balogh, 1938): dorsal idiosoma of male.

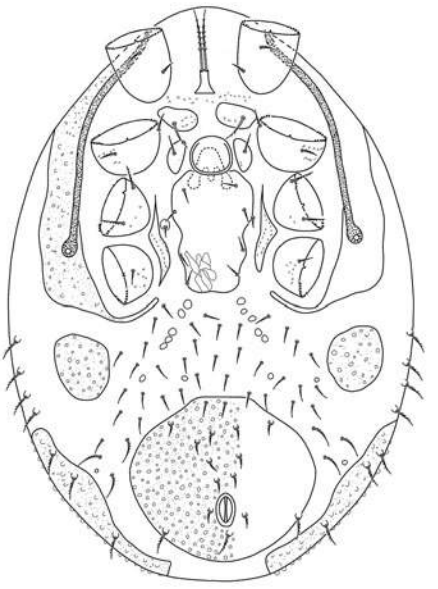

Fig. 56. *Sejus sejiformis* (Balogh, 1938): ventral idiosoma of male.

Legs variable in length: I – 600 μm, II – 525 μm, III – 525 μm, IV – 600 μm (Fig. 63c).

Morphology of male

Dorsal. Similarly as in the females six shields on dorsal side: one pronotal shield (400×350 μm), four mesonotal plates (50–75×100–110 μm) and one pygidial shield (200×310 μm) (Fig. 55). Moreover, two postero-marginal shields (300 μm) usually with 4 to 5 longer setae (75 μm) are located on the posterior part of body, below pygidial shields at the edge between dorsal and ventral sides. All dorsal setae are curved, with barbs and they are located on small tubercles. Dorsal setae of the same length (40–45 μm) and only seta j1 is slightly longer (60 μm). The number of setae is variable depending on the shield: approximately 70 setae on pronotal shield, several setae on the pygidial shield; and on mesonotal plates setae have not been found. Approximately 180 to 200 setae are located on side membrane. The shields are covered with tuberculate and granulate ornamentation.

Ventral. Tritosternum similar as in the female, base 35 μm long, while laciniae several times longer. Several denticles are located in direct vicinity of tritosternum. Serrate seta st1 (50 μm) and simple seta st2 (30 μm) are located on separate presternal plates (30×60 and 60×20 μm). All four plates are located in the region of coxae II. Sterni-getinal shield (225 μm long) with 4 to 5 pairs of simple setae (30 μm). Genital orifice of male (50 μm in diameter) between setae

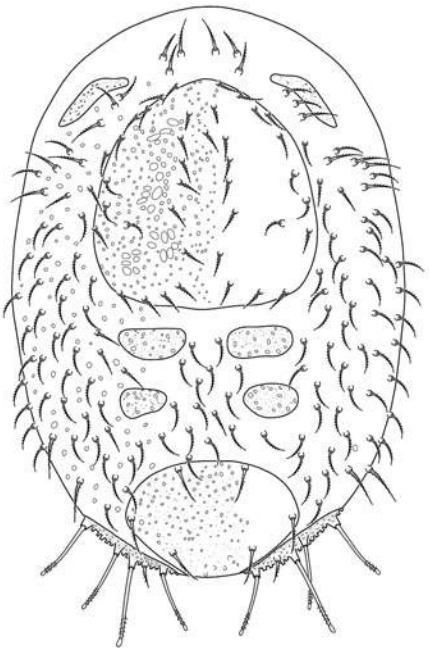

Fig. 57. *Sejus sejiformis* (Balogh, 1938): dorsal idiosoma of deutonymph.

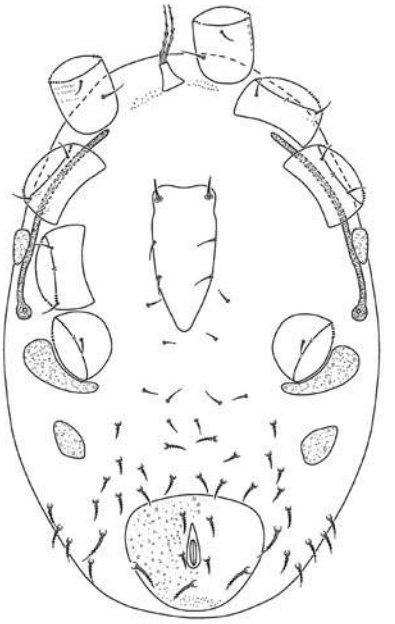

Fig. 58. *Sejus sejiformis* (Balogh, 1938): ventral idosoma of deutonymph.

st2 (Fig. 56). Triangular exopodal plates (110 μm) are located on both sides of the sternigenital shield. Oval ventri-anal shield (230–240×275–300 μm) with several setae (30 μm) among which the post-anal one is the longest (40 μm), it is located below sternigenital shield. This shield is covered with granulate and punctate sculpture. 30 to 40 simple setae (30 μm) are located between sternogenital and ventri-anal shields. Wide peritremal shields with the same sculpture as on ventri-anal shield are located outside limbs (coxae). Stigma in the region of coxae IV, the second extremity of peritreme in the region of coxae I. Oval metapodal plate (80×110 μm) is located between peritremal and posteromarginal shields, while several pairs of sclerites are located between sternigenital and ventri-anal shields.

Gnathosoma. Hypostome, epistome and chelicerae similar as in the female (Fig. 64d, 65d).

Legs variable in length: I – 560 μm, II – 450 μm, III – 450 μm, IV – 560 μm.

Morfology of deutonymph

Dorsal. One pronotal shield, four mesonotal plates and one pygidial shield are located on the dorsal side. Moreover, two shields are located in the upper part of pronotale (anteromarginal shields) and two shields at the edge of the dorsal and ventral side in the vicinity of pygidiale (posteromarginal shields). Egg-

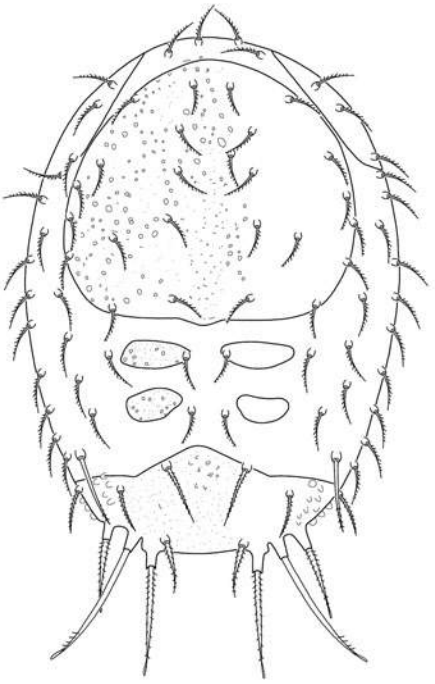

Fig. 59. *Sejus sejiformis* (Balogh, 1938): dorsal idiosoma of protonymph.

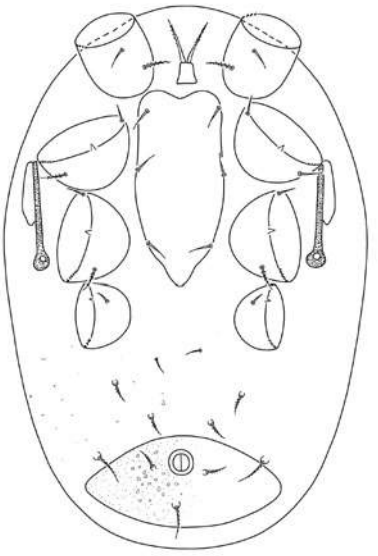

Fig. 60. *Sejus sejiformis* (Balogh, 1938): ventral idiosoma of protonymph.

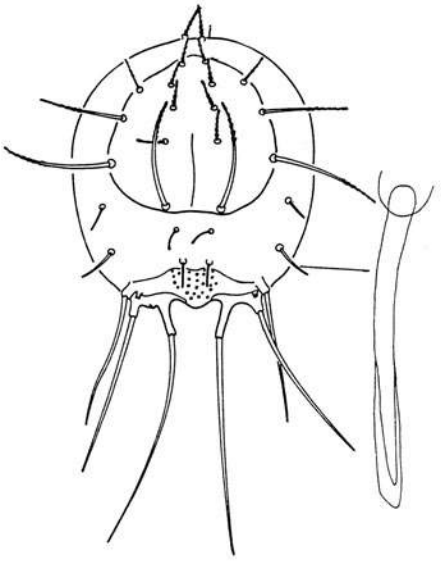

Fig. 61. *Sejus sejiformis* (Balogh, 1938): dorsal idiosoma of larva (after Hirschmann et al. 1991b).

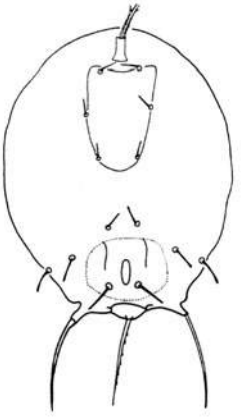

Fig. 62. *Sejus sejiformis* (Balogh, 1938): ventral idiosoma of larva (after Hirschmann et al. 1991b).

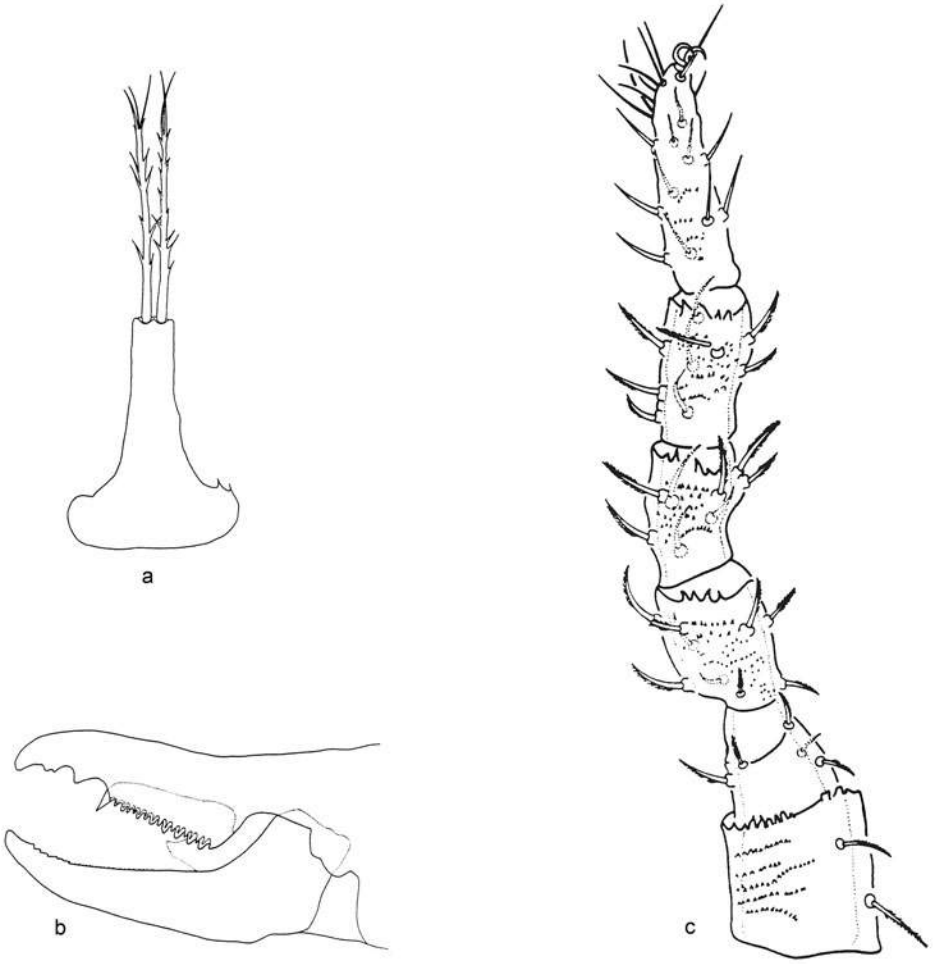

Fig. 63. *Sejus sejiformis* (Balogh, 1938) female: tritosternum (a), chelicera (b), leg I (c) (after Hirschmann et al. 1991b).

shaped pronotal shield (325×300 μm) with 30–40 setae (Fig. 57). Mesonotal plates (50×100 μm) without setae, and pygidial shield (150×250 μm) with 3 pairs of setae. Posteromarginal shields with four long setae (100 μm). Dorsal setae on small tubercles, curved and with barbs (35–40 μm long). Approximately 130 to 140 setae are located on the membrane. The shields have characteristic tuberculate and punctate ornamentation.

Ventral. Tritosternum similar as in adult specimens. Three pairs of setae st1–st3 on the sternal shield. Serrate setae st1 and longer (50 μm) than setae st2–st3 (30 μm). Setae st4 and st5 (10 μm) shorter and outside the shield (Fig. 58). Ventri-anal shield (160×200 μm) with seven pilose setae. Tuberculate and punctate sculpture on this shield. Setae around the ventri-anal shield on tubercles and

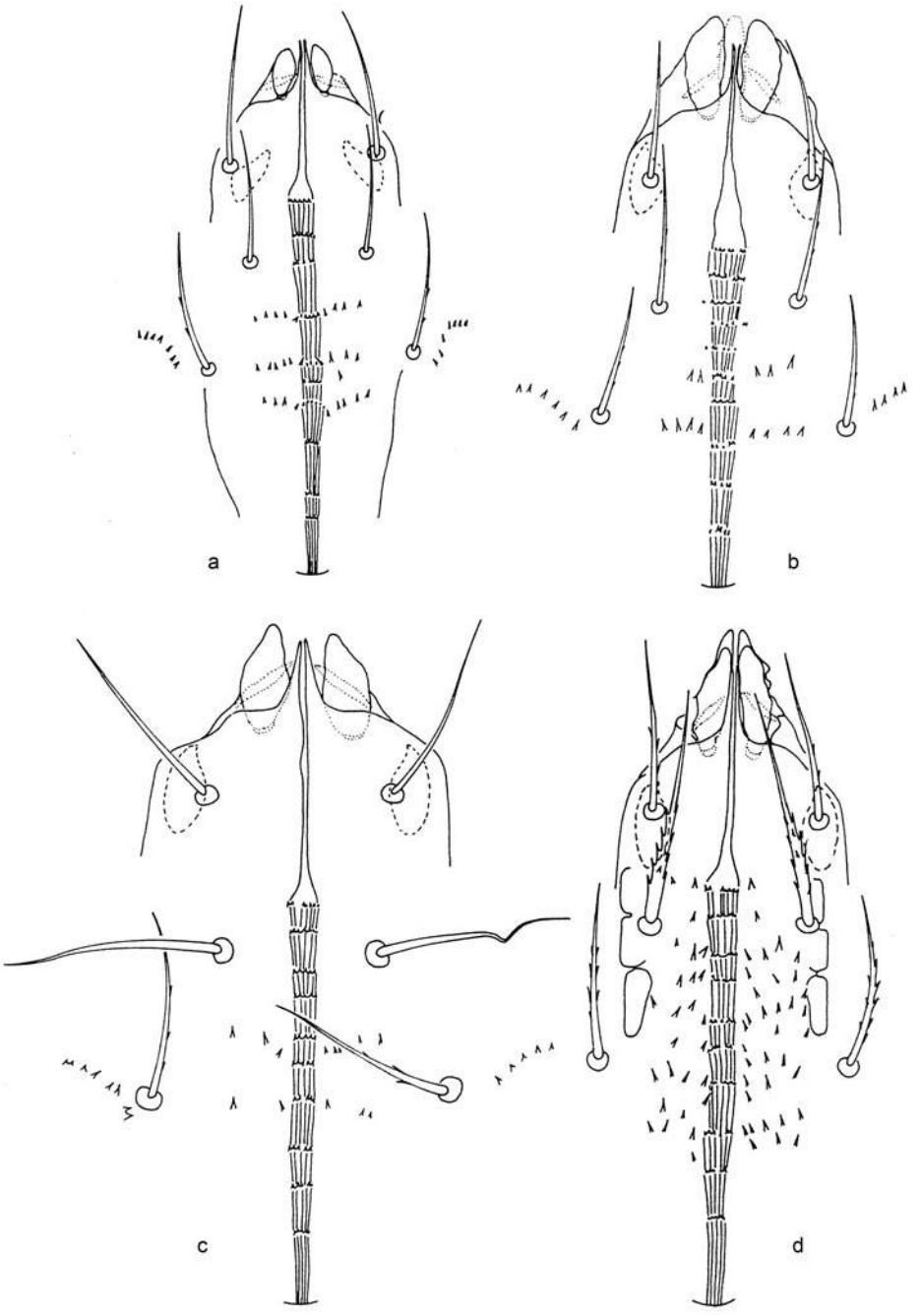

Fig. 64. *Sejus sejiformis* (Balogh, 1938), hypostomes: protonymph (a), deutonymph (b), female (c), male (d) (after Hirschmann et al. 1991b).

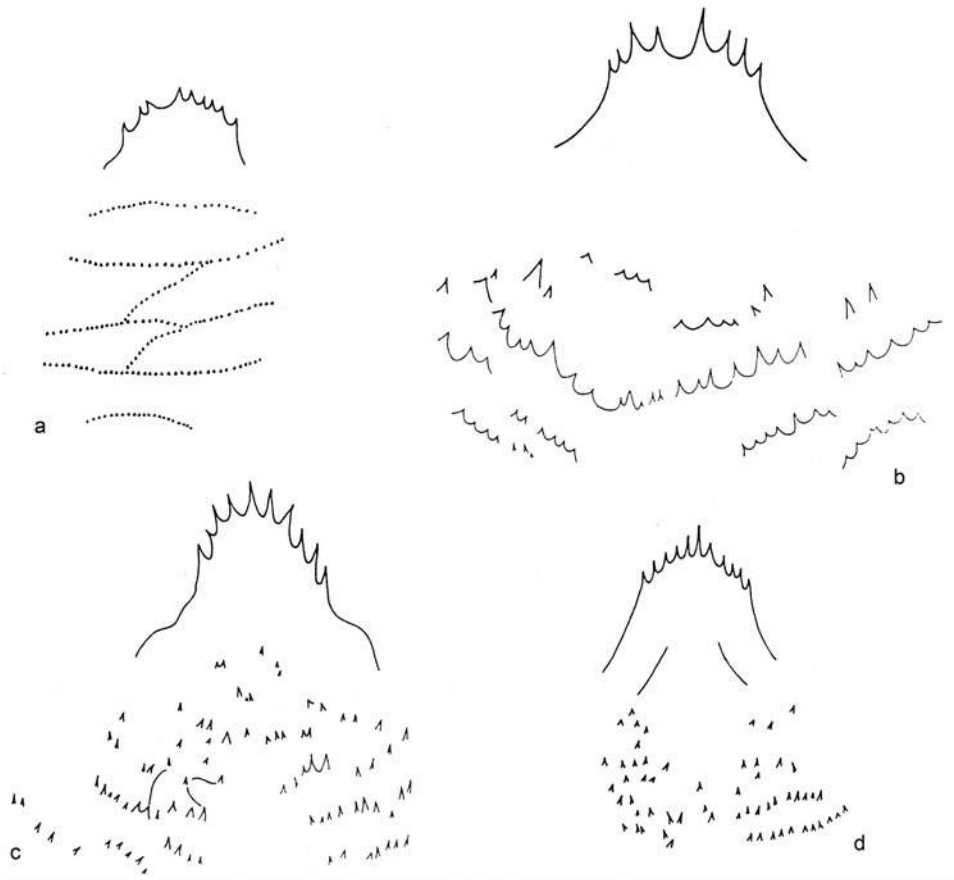

Fig. 65. *Sejus sejiformis* (Balogh, 1938), epistomes: larva (a), deutonymph (b), female (c), male (d) (after Hirschmann et al. 1991b).

with barbs. Two peritremal plates with punctate sculpture along the peritreme. One of them outside peritreme (60 μm long) in the region of coxae III, while the second one below coxae IV. Stigma in the region of coxae IV, while the second extremity of peritreme in the region of coxae II. Metapodal plates (70×45 μm) with punctate sculpture are located below coxae IV.

Gnathosoma. Hypostome, epistome and chelicerae similar as in the female (Fig. 64b, 65b).

Legs variable in length: I – 510 μm, II – 430 μm, III – 430 μm, IV – 510 μm.

Morphology of protonymph

Dorsal. One pronotal shield, four mesonotal plates and one pygidial shield are located on the dorsal side (Fig. 59). Additionally, two shields are on sides of the upper part of pronotale. Oval pronotal shield (260×250 μm) with 12 pairs of setae and several unpaired setae. In some cases mesonotal plates with single

setae and pygidial shield with 7 pairs of setae. Setae Z3 (90 μm), J5 (100 μm) and Z5 (135 μm) which are the longest ones and thus clearly distinguishable. Setae Z3 are located outside the pygidial shield. Other dorsal setae on small tubercles, curved and with barbs, 40–60 μm long. Approximately 30 to 40 setae are located on the membrane. The shields have characteristic tuberculate and punctate sculpture.

Ventral. Three pairs of setae st1–st3 (20 μm) are located on the sternal shield (Fig. 60). Anal shield (80×150 μm) with three setae and tuberculate and punctate sculpture on the shield. Para-anal setae shorter than post-anal seta. Four pairs of ventri-anal setae are located between coxae IV and anal shield. Short peritreme, stigma in the region of coxae IV, while the second extremity of peritreme in the region of coxae II. Small peritral plate on external side of peritreme.

Gnathosoma. Hypostome, epistome and chelicerae similar as in the female (Fig. 64a).

Legs variable in length: I – 380 μm, II – 330 μm, III – 330 μm, IV – 400 μm.

Morphology of larva

Dorsal. Delicate, milk white body. Pronotal shield with 8 pairs of setae and pygidial shield with three setae are located on the dorsal side (Fig. 61). Setae j6, z5 and s4 are the longest on the pronotal shield; seta j1 is located outside the shield. In turn the longest setae J5 and S5 and Z4 are located on the pygidial shield. Setae j1-j5 are serrate and more or less of the same length. Four setae J2, J3 and s6 and Z3 are located between the shields.

Ventral. A poorly visible sternal shield with three pairs of simple setae (st1–st3) are located on the ventral side. Anal shield, wider than longer, with three circum-anal setae. Post-anal seta is serrate, located on the elevation and it is visibly longer than para-anal seta. Moreover, three pairs of shorter and very long seta Z5 are located on the ventral side (Fig. 62).

Gnathosoma. Epistome and chelicerae as in adult specimens, only denticles are significantly smaller (Fig. 65a).

Biology and ecology. The species prefers rotting wood. Thus far, it has only been reported in protected areas such as a national park or reserve, where the number of old rotting trees is great. The species has been additionally reported from bird nests and litter.

Occurrence in the World: Palearctic.

Occurrence in Poland: rotting wood of maple, park, Poznań; rotting wood of maple, Wielkopolska NP; nest of bird, Dzików, close to Opole; Rusałka Lake, Poznań (Hirschmann et al. 1991b); Wolin NP (Gwiazdowicz, Skorupski 1996); rotting wood, tree hollows, soil, Pieniny NP (Skorupski, Gwiazdowicz 1996); rotting wood, tree hollows, Białowieża NP, (Gwiazdowicz 1998, 1999a, 2000a); rotting wood, anthills, Wielkopolska NP (Skorupski 2000, 2001); litter, Bielinek

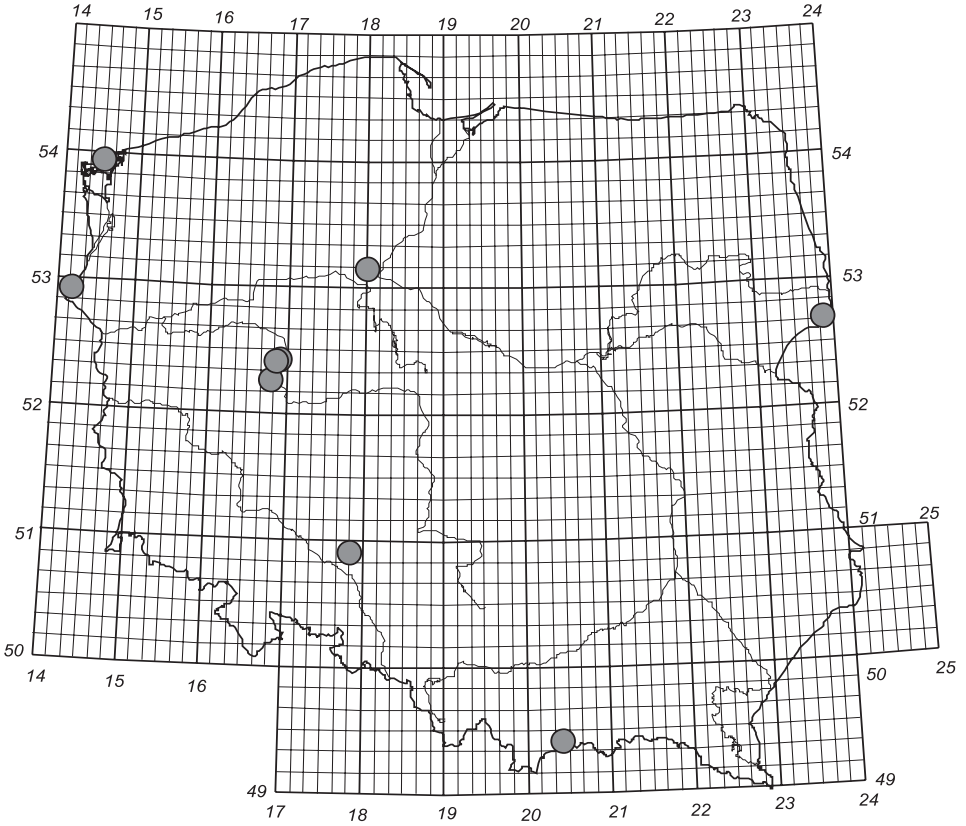

Fig. 66. *Sejus sejiformis* (Balogh, 1938): geographic distribution in Poland.

Reserve (Skorupski, Łabędzki 2004); rotting wood of horse-chestnut, Bydgoszcz (Kaczmarek et al. in press) (Fig. 66).

Sejus togatus C.L. Koch, 1836

Holotype: unknown[4]

Paratype: unknown

Collection in Poland: Poznań University of Life Sciences (Uniwersytet Przyrodniczy w Poznaniu), Department of Forest Protection, Poland

Etymology: (from Latin) *togatus* – dressed in toga

4 The type material of *S. togatus* has not been found. According to Dr. Jason A. Dunlop z Museum für Naturkunde in Berline this material could be demaged as at that time preparation techniques were not perfect ones. Mites have most frequently been sticked to the cardboard sheets and observed this way. The durability of such preparations were limited. This species has not been also found in collections preserved in alcohol.

Locus typicus: Regensburg (49°01'00"N 12°05'00"E)

Measurements

♀ – 890–1100×570–880 μm
♂ – 860×650 μm
D – 720×530 μm
P – 640×460 μm
L – 360×270 μm

Morphology of female

Dorsal. Body color depends on the age of the specimen and is from yellow to dark brown. Six shields on dorsal side: one pronotal shield (450×400 μm), four mesonotal plates (80×170 and 120×150 μm) and one pygidial shield (220–270×310–390 μm) (Fig. 67). Dorsal setae are located on small tubercles, curved and with barbs. Variable number of setae on individual shields, and they are approximately 45–50 μm long. Setae j1 (75 μm) are slightly longer, while visibly longer are setae Z3 (110 μm), J5 (110 μm) and Z5 (140 μm) (Fig. 68, 69). 60–70 setae on the pronotal shield, from 15 to 30 setae on the pygidial shield, while from one to eight setae on mesonotal plates. 150 to 180 setae on the membrane located on the dorsal side. All shields feature characteristic tuberculate sculpture (Fig. 70), which is additionally supplemented with punctate ornamentation. Characteristic bottle-shaped bases of setae Z5 and fused with them bases of setae J5 are located at the extremity of idiosoma. In some cases single serrate setae are located on bases of setae Z5.

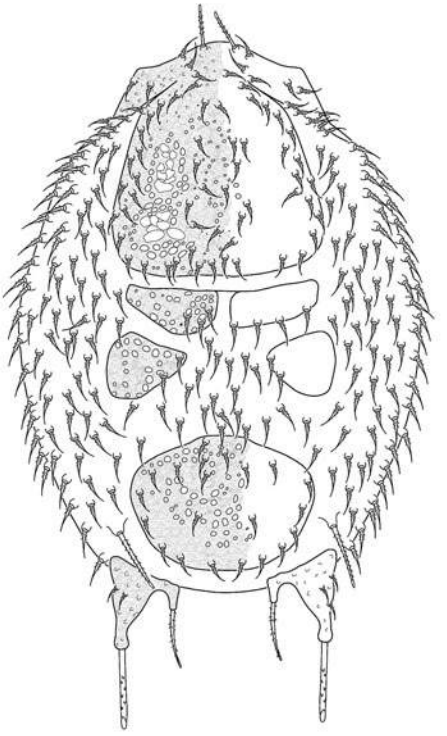

Fig. 67. *Sejus togatus* C.L. Koch, 1836: dorsal idiosoma of female.

Ventral. Tritosternum with wide base which has denticles at an extremity (Fig. 80a). Several tiny denticles on each side of tritosternum. Setae st1 (70 μm) and st2 (70 μm) are located on separate presternal plates (25×50 and 20×30 μm) (Fig. 71). Setae st3 (60 μm) and st4 (30 μm) are located on small, short sternal shield (60×100 μm). The epigynial shield (180×240 μm) usually with 4 to 6 pairs of setae (30 μm) is located below. Ventri-anal shield (300×500–550 μm) is trapezoid with 5 circum-anal setae and approximately 30 pinnate ventral se-

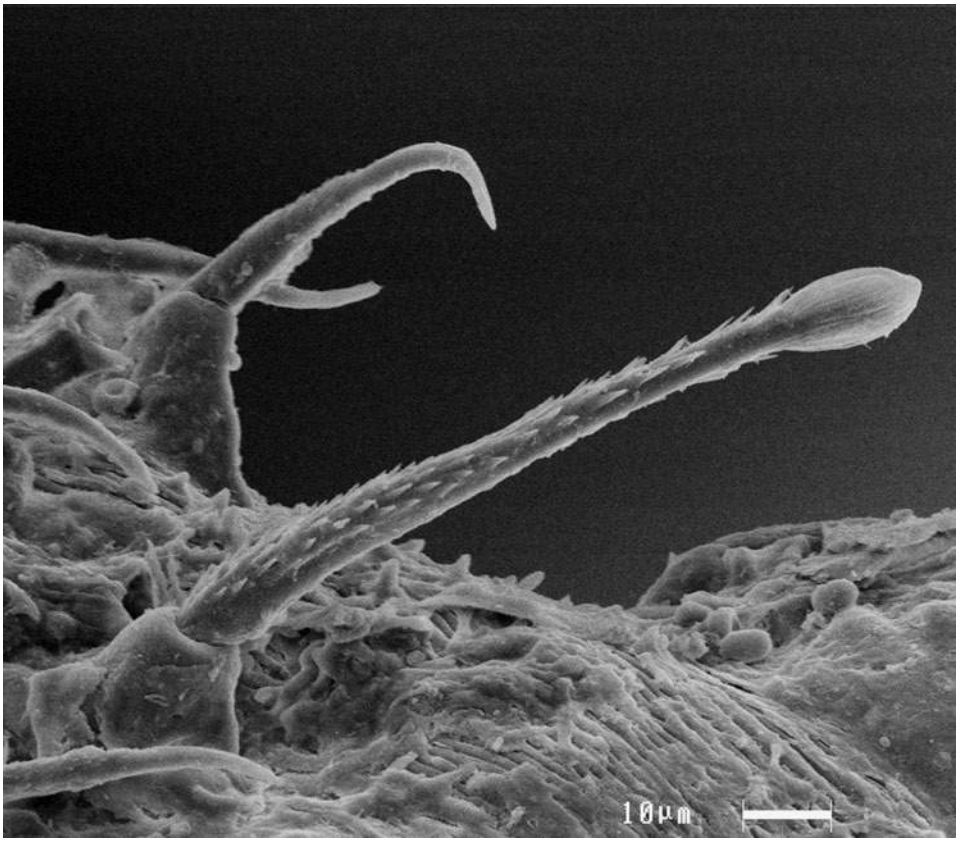

Fig. 68. *Sejus togatus* C.L. Koch, 1836: seta Z3.

tae. They are located on small tubercles. The shield is covered with punctate sculpture which below anus is granulate. Relatively large metapodal plates (110–130×120150 μm) covered with tuberculate sculpture are located on body sides. Exopodal plate (230–250 μm long) is located between coxae II and IV. Peritremes are located on wide peritremal shields. Stigma in the region of coxae IV, while second extremity of peritreme reaches coxae I. Peritremal shield reaches the dorsal side and is fused with pronotal shield. Sculpture on this shield is the same as on the metapodal plates and ventri-anal shield.

Gnathosoma. Corniculi are corniculate. Setae h1 are balloon-shaped, h2 and h3 simple, while h3 and h4 serrate. Hypostomal groove without well-defined boundaries, however from the region of setae h2 to the base of gnathosoma a few dozen sharply ended denticles are visible (Fig. 81c). Epistome consists of three, ragged apices; the central one is the highest. A surface covered with tiny, irregular, sharp denticles is located below (Fig. 81f). Fixed digit with 7 to 10 teeth, while movable digit with two edges with tiny denticles (Fig. 82).

Legs variable in length: I – 830 μm, II – 710 μm, III – 630 μm, IV – 850 μm.

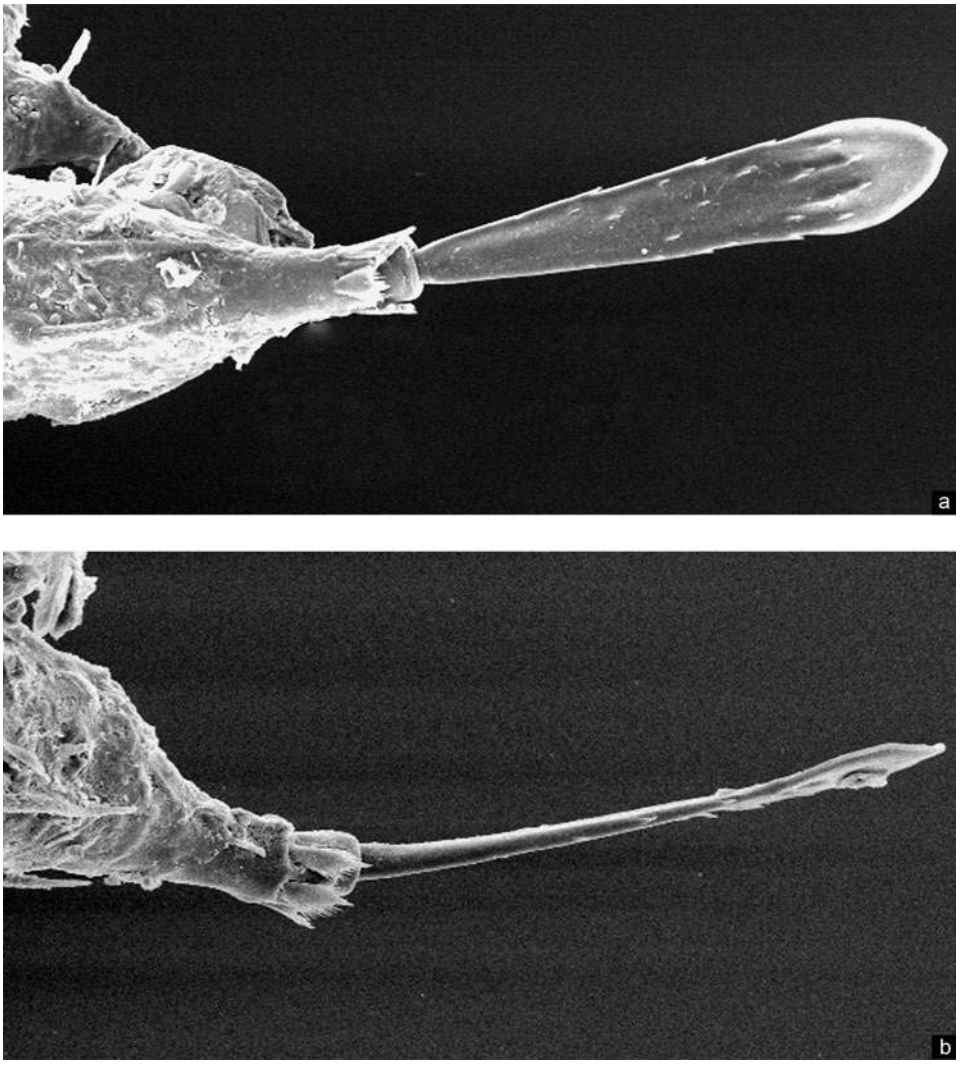

Fig. 69. *Sejus togatus* C.L. Koch, 1836, seta Z5: from side (a), from upside (b).

Morphology of male

Dorsal. Two shields are located on the dorsal side: pronotal shield (400–450×350–375 μm) with approximately 50 to 70 setae and opisthonotal shield (400–450×390–420 μm) with approximately 40–50 setae (Fig. 72). All setae are curved, with barbs and they are located on small tubercles. Setae Z3 (100 μm), J5 (100 μm) and Z5 (150 μm) are the longest ones. Approximately 110 to 130 setae (50 μm) are located on side membrane. The shields are covered with tuberculate and punctate ornamentation.

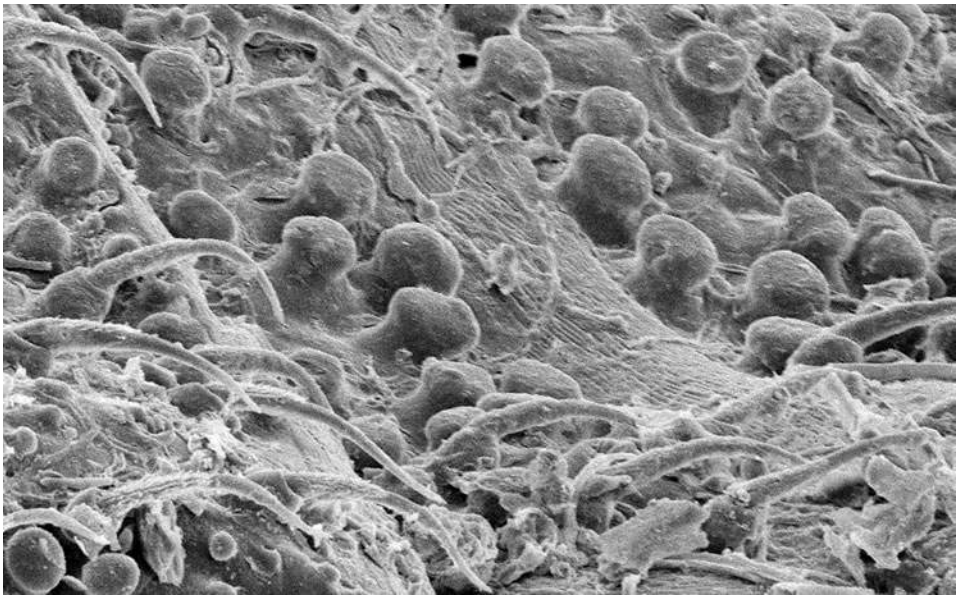

Fig. 70. *Sejus togatus* C.L. Koch, 1836: sculpture on dorsal shields.

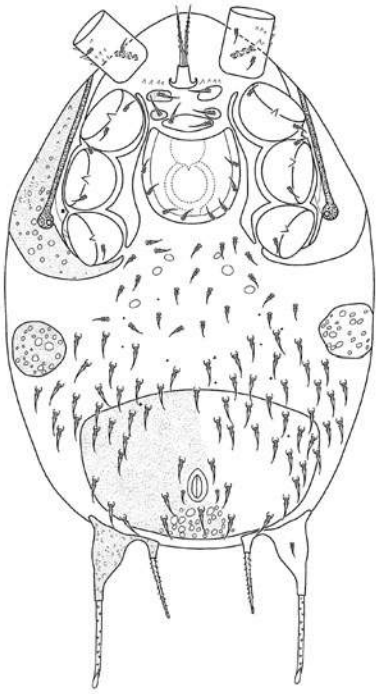

Fig. 71. *Sejus togatus* C.L. Koch, 1836: ventral idiosoma of female.

Ventral. Tritosternum as in the female. Above the sternal shield two small presternal plates (20×40 μm) with setae st1 (50 μm). Sterni-genital shield (230 μm long) usually with four pairs of pilose setae (40 μm). In some specimens selected sternal setae (for instance, st 4) are located outside the shield (Fig. 73). Genital opening in the male (60×50 μm) between setae st2, in the region of coxae II. Below the sterni-genital shield there is a relatively large ventri-anal shield (250–275×500–575 μm) with approximately 50–60 pilose setae. Large anal orifice (50 μm long) with five circum-anal setae around it. The shield is covered with punctate sculpture, but in some places in more chitinized specimens reticulate ornamentation is visible. As in the female the sculpture below the anal orifice is tuberculate. Exopodal plate between coxae II and IV. Wide peritremal shields

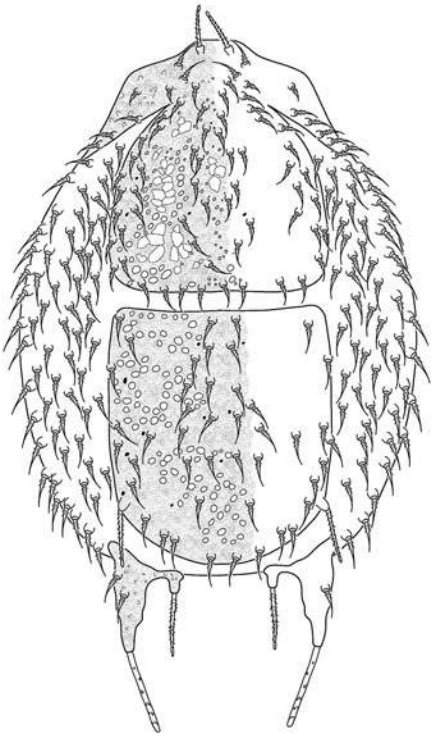

Fig. 72. *Sejus togatus* C.L. Koch, 1836: dorsal idiosoma of male.

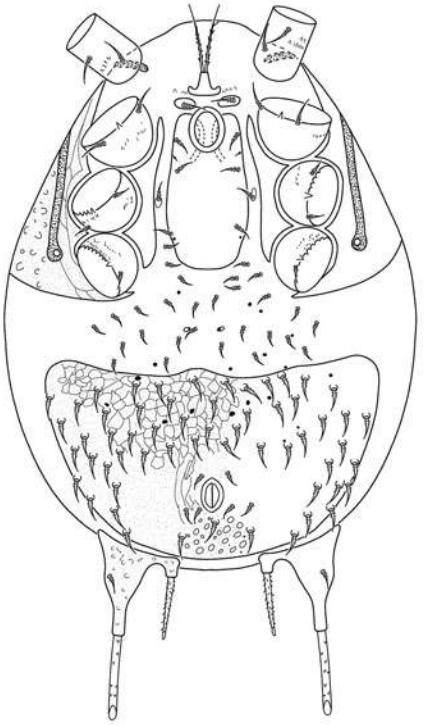

Fig. 73. *Sejus togatus* C.L. Koch, 1836: ventral idiosoma of male.

on the sides. Stigma in the region of coxae IV, the other end of peritreme in the region of coxae I.

Gnathosoma. Both hypostome and epistome similar to those of the female (Fig. 81e, g). No spermatodactyl on chelicerae.

Legs variable in length: I – 810 μm, II – 660 μm, III – 620 μm, IV – 820 μm.

Morphology of deutonymph

Dorsal. There are six shields on the dorsal side: one pronotal shield (320–330×290–300 μm), four mesonotal plates (50×100–110 i 70×90–100 μm) and one pygidial shield (150×320 μm) (Fig. 74). Pronotal shield is egg-shaped with 25 pairs of setae, mesonotal plates with 2–3 setae, the pygidial shield with 9–10 pairs of setae. Elongated marginal plates located on the sides of the upper part of the pronotal shield. All shields with characteristic tuberculate and punctate sculpture. Dorsal setae (30 μm) on small tubercles, curved and with barbs. The longest setae are j1 (70 μm), Z3 (150 μm), J5 (125 μm) and Z5 (150 μm). Approximately 110–120 setae are located on a membrane on the sides of the shields, approximately 50–60 on each side.

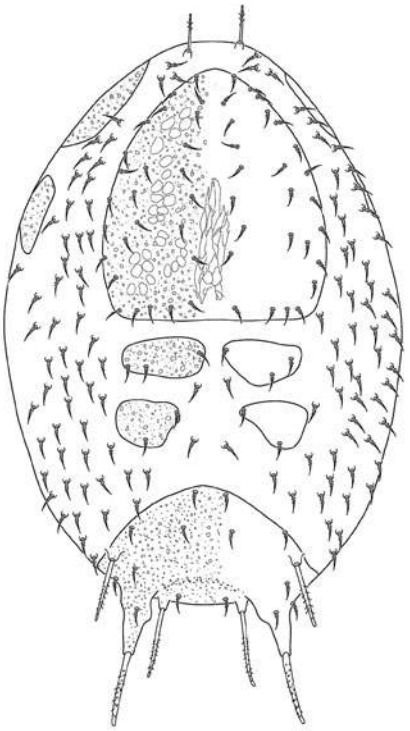

Fig. 74. *Sejus togatus* C.L. Koch, 1836: dorsal idiosoma of deutonymph.

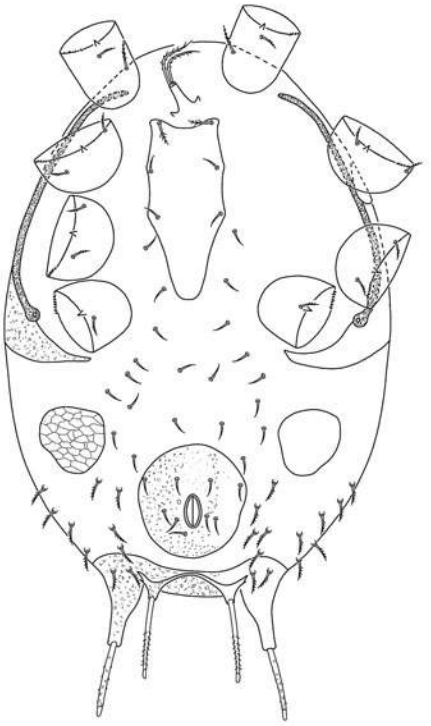

Fig. 75. *Sejus togatus* C.L. Koch, 1836: ventral idosoma of deutonymph.

Ventral. Tritosternum as in adult specimens, however there are no denticles at the base (Fig. 80b). On the sternal shield (225 μm long) there are three pairs of setae st1 (50 μm) st2 (35 μm) and st3 (35 μm), while setae st4 and st5 (25 μm) are located outside the shield (Fig. 75). Setae st1 are serrate, while the other setae are simple. Ventri-anal shield (150×225 μm) with 7–9 setae. The sculpture on the shield is granulate and punctate. Setae around the ventri-anal shield are on tubercles and they have barbs. Below coxae IV there are metapodal plates (40×70 μm) with granulate sculpture forming reticulate ornamentation. Stigma in the region of coxae IV, while the other end of peritreme in the region of coxae I. Two peritremal plates with granulate and punctate sculpture are located along the peritreme on its external side.

Gnathosoma. Hypostome, epistome and chelicerae as in adult specimens (Fig. 81d, i).

Legs variable in length: I – 700 μm, II – 560 μm, III – 550 μm, IV – 700 μm.

Morphology of protonymph

Dorsal. There are six shields on the dorsal side: one pronotal shield (330–340×290 μm), four mesonotal plates (20×30–35 μm i 25×40 μm) and one py-

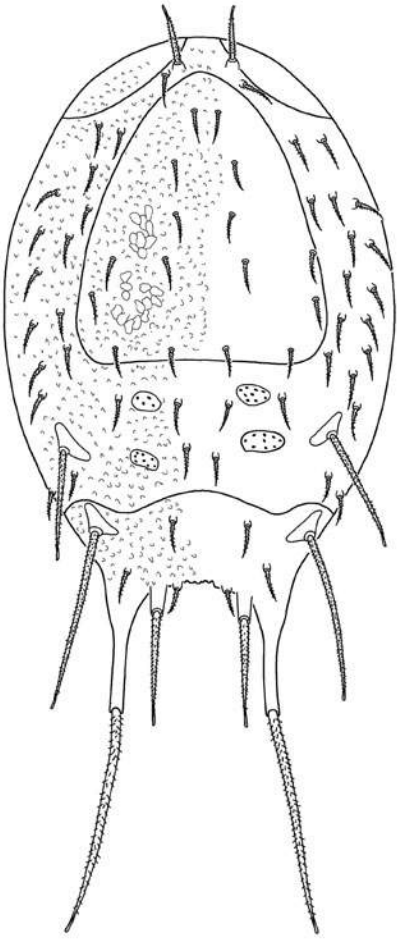

Fig. 76. *Sejus togatus* C.L. Koch, 1836: dorsal idiosoma of protonymph.

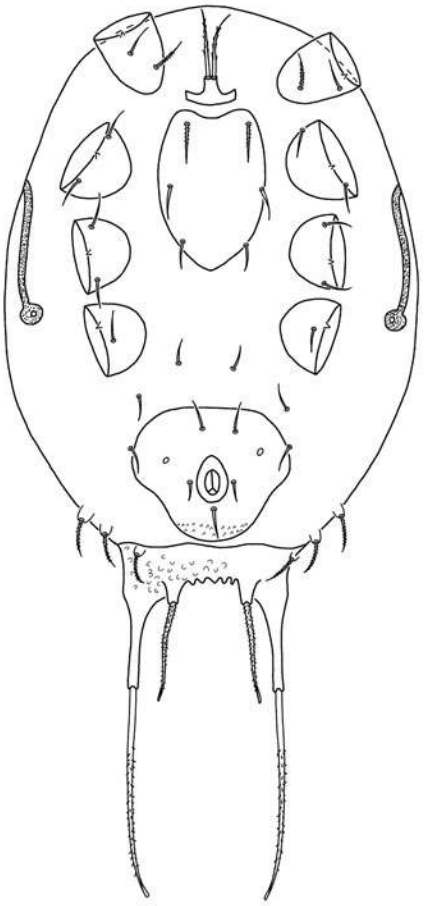

Fig. 77. *Sejus togatus* C.L. Koch, 1836: ventral idiosoma of protonymph.

gidial shield (110×310 μm) (Fig. 76). Pronotal shield is egg-shaped with 11 pairs of setae, and the pygidial shield with 6 pairs of setae. Elongated marginal plates are located on the sides of the upper part of the pronotal shield. All shields with characteristic tuberculate sculpture. Dorsal setae on small tubercles, curved and with barbs. Setae j1 (50 μm), S2 (120 μm), Z3 (150 μm), J5 (100 μm) and Z5 (250 μm) are the longest ones. On the sides of the shields, on a membrane there are approximately 40–50 setae (25–30 μm), 20–25 on each side.

Ventral. Three pairs of setae on the sternal shield. Setae st1 serrate, while st2–st3 simple (Fig. 77). Ventri-anal shield with 7 setae. Cribrum located below the post-anal seta. There are two pairs of simple setae between the sternal shield and the ventri-anal shield. Stigma in the region of coxae III/IV, while the other end of the peritreme in the region of coxae II.

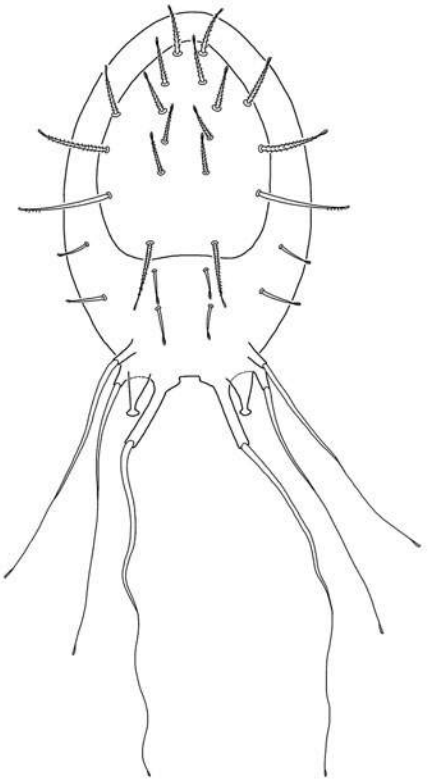

Fig. 78. *Sejus togatus* C.L. Koch, 1836: dorsal idiosoma of larva.

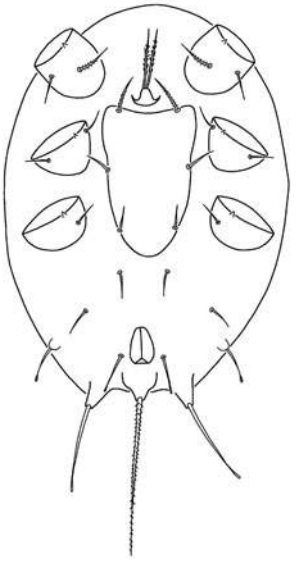

Fig. 79. *Sejus togatus* C.L. Koch, 1836: ventral idiosoma of larva.

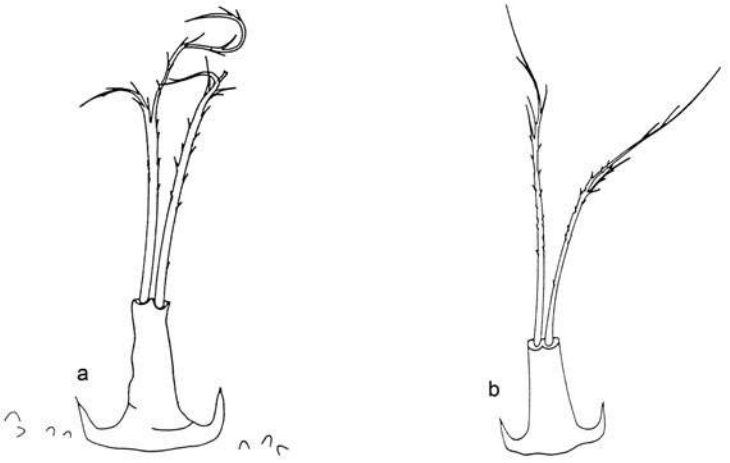

Fig. 80. *Sejus togatus* C.L. Koch, 1836, tritosternums: female (a), deutonymph (b) (after Hirschmann et al. 1991b).

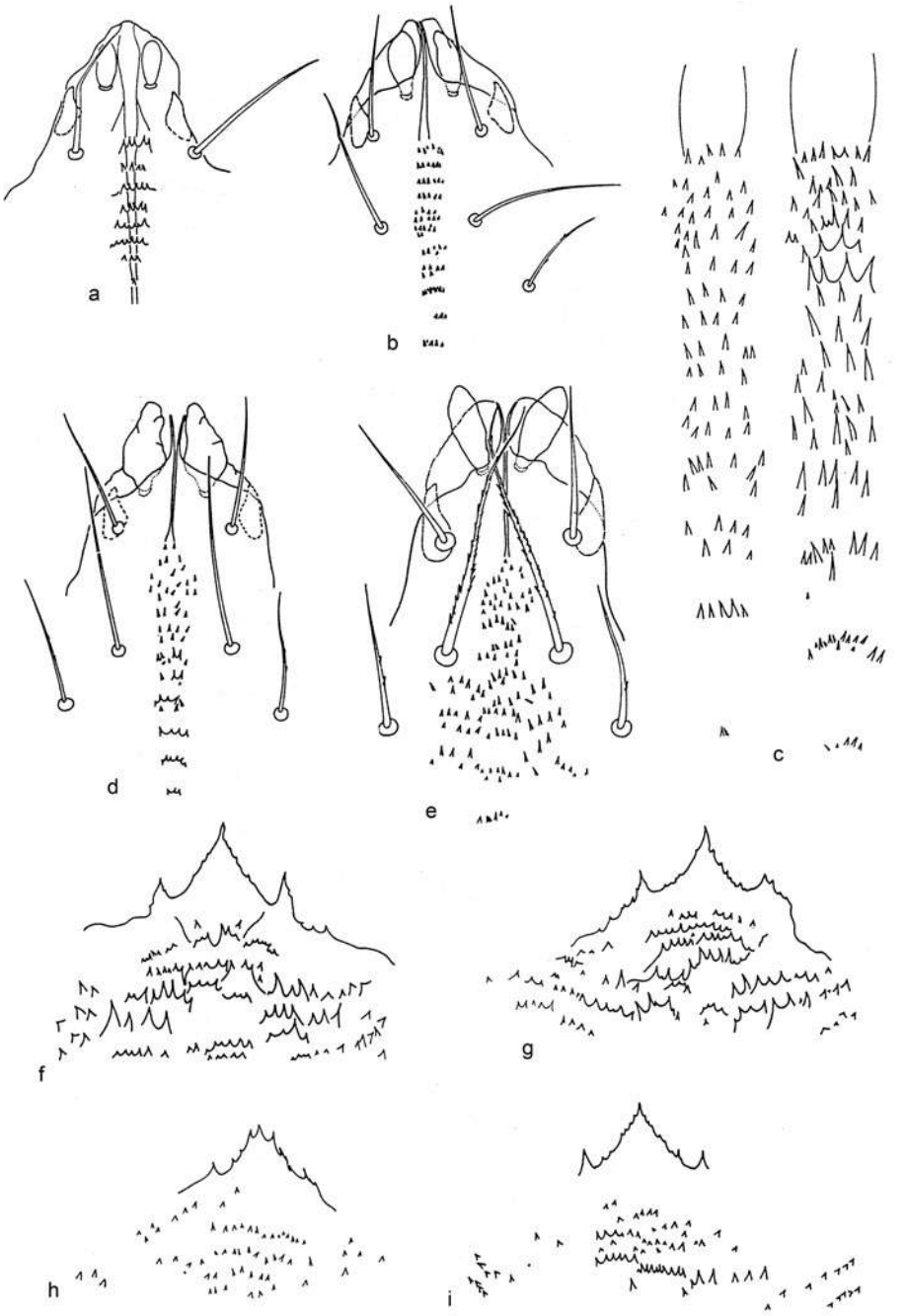

Fig. 81. *Sejus togatus* C.L. Koch, 1836, hypostomes: larva (a), protonymph (b), female (c), deutonymph (d), male (e); epistomes: female (f), male (g), protonymph (h), deutonymph (i) (after Hirschmann et al. 1991b).

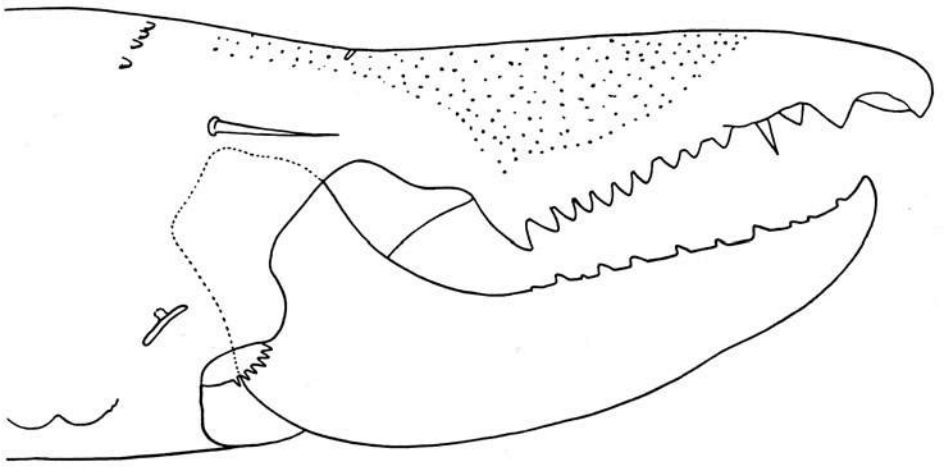

Fig. 82. *Sejus togatus* C.L. Koch, 1836: chelicera of female (after Hirschmann et al. 1991b).

Gnathosoma. Hypostome, epistome and chelicerae as in adult specimens (Fig. 81b, h).

Morphology of larva

Dorsal. Milk white. Pronotal shield with 9 pairs of setae with barbs is located on the dorsal side (Fig. 78). The longest setae are J5, S5, Z4, and on the pronotal shield z5, s4 and j6. Seta j1 is located on the shield, while all setae in row j are serrate. Setae J2, J3, s6 and Z3 are simple with a small boss at the end.

Ventral. Three pairs of setae on the sternal shield. Setae st1 serrate, while st2–st3 simple (Fig. 79). The longest setae are the post-anal seta and setae Z5.

Gnathosoma. Hypostome is presented in Fig. 81a. Epistome is curved and with tiny denticles. Below, the entire surface is covered with rows of sharp denticles.

Biology and ecology. *Sejus togatus* is a species which primarily inhabits forest areas. It can be found especially in rotting wood, bark beetle galleries and anthills, it occurs less frequently in litter.

Occurrence in the World: Palearctic.

Occurrence in Poland: in nests of many species of ants such as *Camponotus herculeanus* (L.) – Śnieżnik, Międzylesie Forest District (Wiśniewski 1983); *Formica polyctena* Foerster – Zielonka Experimental Forest, Monasterzec, Lesko Forest District, Podgórze, Świętokrzyski NP (Wiśniewski 1965, 1983); Białowieża NP (Gwiazdowicz 2000a, 2001); *Formica pratensis* Retzius – Promno, Gniezno Forest District (Wiśniewski 1983); *Formica rufa* L. – Spychowo Forest District (Wiśniewski 1983); *Lasius fuliginosus* (Latreille) – Wielkopolska NP (Skorup-

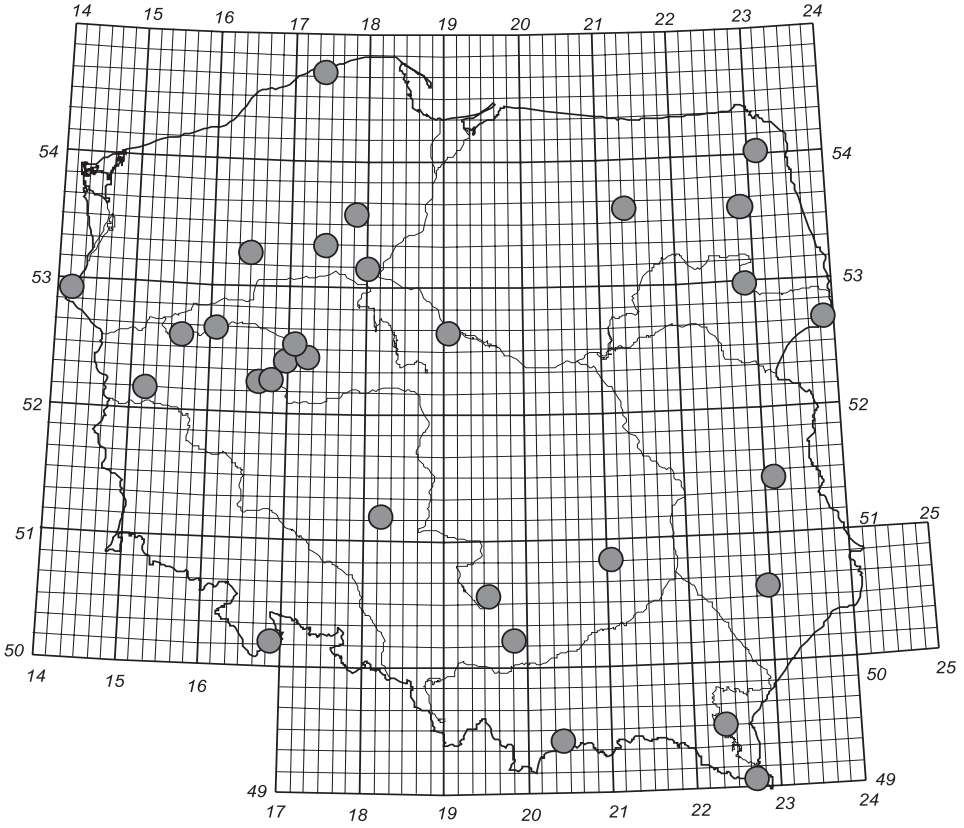

Fig. 83. *Sejus togatus* C.L. Koch, 1836: geographic distribution in Poland.

ski 2001); *Lasius niger* (L.) – Spychowo Forest District (Wiśniewski 1983) and Wielkopolska NP (Skorupski 2001); *Myrmica rubra* L. – Wielkopolska NP (Skorupski 2001); in galleries of *Ips typographus* (L.) – Wigierski NP (Kaczmarek, Michalski 1995c); *Pityokteines vorontzowi* (Jacobson) – Roztocze NP (Michalski et al. 1992b; Michalski, Ratajczak 1994); rotting wood, Dłusko, Międzychód Forest District (Bałazy et al. 1987b); rotting wood of pine, Lichwin, Pniewy Forest District; rotting wood of ash and fir, Nowy Tomyśl; rotting wood of poplar, Poznań; rotting wood, Bolesławiec, Bolewice Forest District; under bark of beech, "Bukowa Góra" Reserve, Roztocze NP; anthills, Strykowo (Hirschmann et al. 1991b); bark beetle galleries in pine and spruce, anthills, Białowieża Forest (Gwiazdowicz 1993); Ojców NP, Roztocze NP, Słowiński NP, Świętokrzyski NP (Gwiazdowicz, Skorupski 1996); under bark, rotting wood, Pieniny NP (Skorupski, Gwiazdowicz 1996); under bark, Runowo Forest District (Skorupski, Krzemiński 1997); rotting wood, "Góra Zborów" Reserve (Skorupski, Dobies 1997); rotting wood, tree hollows, litter, bark beetle galeries, moss, anthills, excrements, Białowieża NP (Gwiazdowicz 1998, 1999a,b, 2000a, 2001); rotting wood, litter, Białowieża NP (Gwiazdowicz et al. 1999); peat bog, Narew NP (Gwiazdowicz, Szadkowski

2000); Bieszczady NP (Gwiazdowicz, Sznajdrowski, 2000); litter, sapling stand, Włocławek (Kaczmarek 2000); rotting wood, anthills, Wielkopolska NP (Skorupski 2000, 2001); Ojców NP (Gwiazdowicz, Fabrowski 2001); fruiting bodies, Wałcz Forest District (Gwiazdowicz, Łakomy 2002); Polesie NP (Gwiazdowicz 2002b); Bory Tucholskie NP (Gwiazdowicz, Matysiak 2004); rotting wood, Biebrza NP (Gwiazdowicz, Klemt 2004); rotting wood of plane-tree, Bydgoszcz (Kaczmarek, Marquardt 2004); rotting wood, Bielinek Reserve (Skorupski, Łabędzki 2004); nest of *Haliaeetus albicilla* (L.), Bytnica Forest District (Gwiazdowicz et al. 2005); Grzędy, Biebrza NP (Skorupski, Falencka-Jabłońska 2006) (Fig. 83).

Notes about *Sejus*

There are approximately 50 known species from the family Sejidae worldwide. Due to their specific morphology they are each quite characteristic. For instance, specimens of *Sejus togatus* are relatively large in comparison to other species of mesostigmatid mites, as the female is 0.9–1.1 mm long. Given the characteristic structure of the idiosoma with bottle-shaped bases of setae Z5 this species may be considered easy to recognize even by a novice acarologist.

However, the problem is more complex. For this species, as in other species of the genus *Sejus*, there is great morphological variability (Gwiazdowicz 1995, 2000b), and morphological changes may often lead to problems with the determination of the species. Several features that can help determine selected species were suggested in the review of the genus *Sejus* (Hirschmann 1991, Hirschmann et al. 1991a, b), and also in subsequent studies (Hirschmann, Wiśniewski 1994). Morphological features which were suggested for six species described in Europe include: the length and the width of the idiosoma and of selected shields (genital, ventri-anal, pygidial), the ratio of the length to the width of these shields and the number of setae on selected shields.

Assuming that morphological features used to determine selected species are constant and not subject to change, Gwiazdowicz and Gulvik (2009) decided to analyze them in females of *Sejus togatus*. The aim of the analysis was to determine the usefulness of some taxonomic features from the perspective of distinguishing species within the genus *Sejus*.

The analysis included 54 females of *Sejus togatus* and it was concluded that the length of the idiosoma of the analyzed females was very variable and it ranged between 890–1100 μm, with the average of 1015 μm. The ratio of the length of the idiosoma to its width ranged between 1.23–1.56 (the average is 1.37). Slightly lesser variability was found in the case of the analyzed shields. The length of the pygidial shield was from 220 to 270 μm (on average 245 μm), and the width was from 310 to 390 μm (on average 356 μm). The ratio of the length of this shield to its width was 0.62–0.81 (on average 0.69). The ventri-anal shield was 240–320 μm long (on average 284 μm) and the width was 450–550 μm (on average 496 μm). The ratio of the length of this shield to its width was 0.49–0.69 (on average 0.57).

There was great variability in the number of setae on the genital shield. Three to five pairs of setae were found in the females studied. Paired setae were found

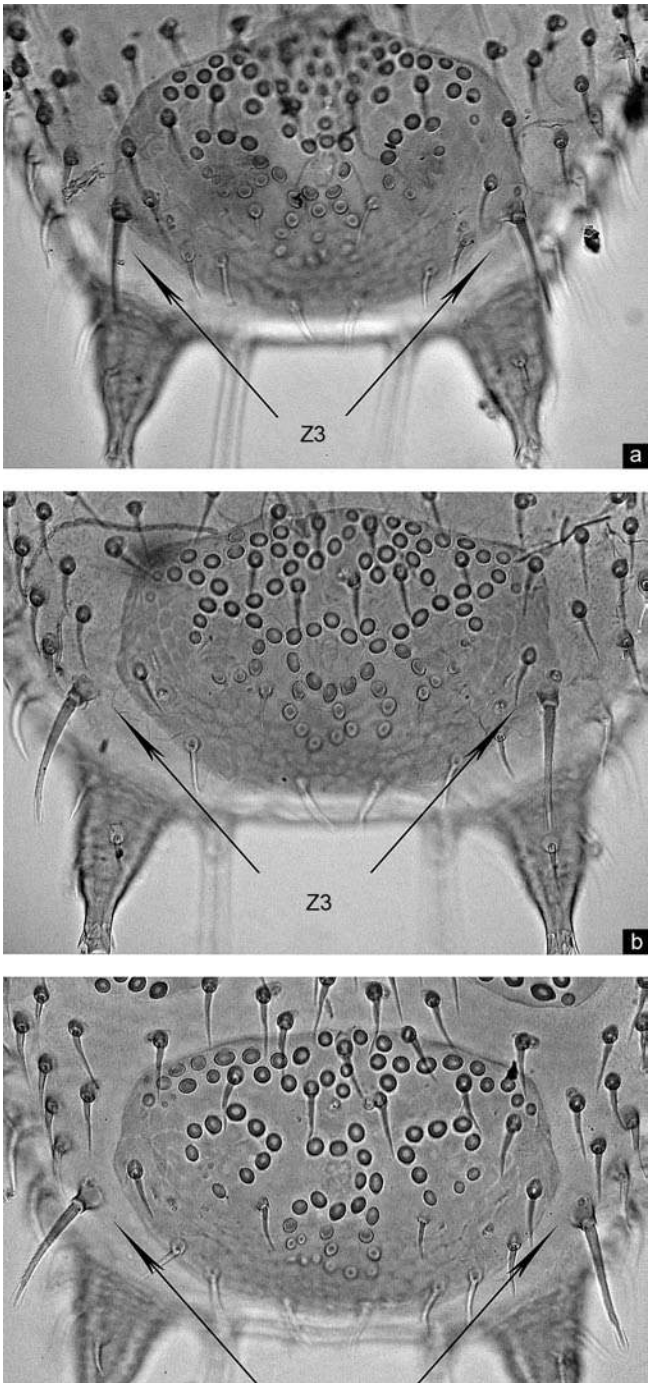

Fig. 84. Positions of setae Z3 of *Sejus togatus* females: two setae on pygidial shield (a), only one seta on pygidial shield (b), both setae outsite of pygidial shield (c).

in 24 females, and unpaired setae were found in 20 females. However, the most frequent arrangement was four pairs of setae.

Setae st1 and st2, which are usually located on separate presternal plates, were not studied as this feature was not treated as taxonomically significant (Hirschmann et al. 1991b). According to Bregetova (1977a) the occurrence of these setae on presternal plates is also variable.

However, the number of setae on the pygidial shield has been studied. It was found that the number of these setae ranges from 16 to 27 (on average 22 setae). It was observed that seta Z3 can be located on this shield and also outside the shield. In 19 females both setae Z3 were located on the pygidial shield, in 18 females one seta Z3 was on the shield, and one outside the shield, while in 17 females both setae Z3 were outside the shield (Fig. 84).

Additionally, setae on mesonotal plates characteristic for this species were analyzed. 3–8 setae (on average 5 setae) were found on the first, upper plates, while 1–5 setae (on average 3 setae) were found on the lower pair of plates.

On the basis of this research Gwiazdowicz and Gulvik (2009) concluded that females of *Sejus togatus* are characterized by great morphological variability and the morphological features used in taxonomic studies, for instance, when describing new species from the genus *Sejus*, have to be verified. The shape of specific shields, the ratio of their length to their width, the number of setae or the location of setae Z3 cannot be the basic taxonomic features used in keys for the determination of *Sejus* species.

Similar observations concerning morphological variability were made in the case of *S. sejiformis*. It was observed in several specimens that the differences (ranges) in the size of the body, for instance of *S. sejiformis* may be connected with several factors such as preparation techniques. Owing to the delicate membrane the body of *S. sejiformis* is very flexible. When applying more or less pressure on a microscopic cover glass the size (length and the width) of the idiosoma may change.

Hirschmann et al. (1991b) presented a description of a new species *Sejus posnaniensis* Hirschmann et Kaczmarek, 1991, which was compared to a similar species of *S. sejiformis*. The distinguishing features presented by the aforementioned authors include:

- the ratio of the length to the width of the female idiosoma (*S. posnaniensis* – 1.35, *S. sejiformis* – 1.27–1.29),
- the ratio of the length to the width of the male idiosoma (*S. posnaniensis* – 1.33, *S. sejiformis* – 1.31),
- the ratio of the length to the width of the opisthonotal shield of the male (*S. posnaniensis* – 0.58, *S. sejiformis* – 0.75),
- the ratio of the length to the width of the ventri-anal shield of the female (*S. posnaniensis* – 0.79, *S. sejiformis* – 0.82),
- the ratio of the length to the width of the female genital shield (*S. posnaniensis* – 1.00, *S. sejiformis* – 1.04),
- the ratio of the length to the width of the male ventri-anal shield (*S. posnaniensis* – 0.92, *S. sejiformis* – 1.05).

Unfortunately, the author could not investigate the type material which Balogh (1938) used to describe *S. sejiformis*, as it was destroyed during World War II. Instead, the type material of *S. posnaniensis* was analyzed. It is deposited in the Zoological Collection in Munich, Germany (No: 3066 (12) – 1L, 3067 (13) – 1P, 3068 (14) – 1D, 3069 (15) – 1D, 3070 (17) – 1F, 3071 (18) – 1M, 3072 (19) – 1M, 3073 (16) – 1F). On the basis of the analysis of descriptions of both species and the analysis of the variability within the species it was concluded that *S. posnaniensis* is a synonym of *S. sejiformis*.

Antennophoroidea

Antennophoridae Berlese, 1888

Idiosoma. Oval body, relatively wide and of the size 0.8–1.2 mm. The holodorsal shield with a very large number (900–1500) of simple setae or setae with barbs is located on the dorsal side. Ornamentation is poorly visible.

The sternal shield is complete or it is split in two parts. Below, in the region of coxae II–III, there is a pair of latigynal shields; the mesogynal shield is reduced. The male has a sternal shield or a sterni-genital shield with a genital orifice between coxae III. The ventri-anal shield is elongated; in the front the shield is narrow and reaches the latigynal plates, while wide and rounded at the base. Wide peritremal shields overlap beyond coxae IV. Peritremes are short and in the region of coxae II–III.

Gnathosoma. Corniculi are wide, with an irregular edge, rounded at the top. Setae h1 clearly larger and wider than the other hypostomal setae, in size similar to corniculi. Epistome is triangular with one pointed apex. On the cheliceral digits of both sexes occurrence a brush-like processes; the absence of a spermatodactyl and spermatotreme in the male and of a sperm access system in the female.

Legs and palps: Legs I clearly longer. Tarsus I lacks an ambulacral apparatus, while tarsi II, III, and IV have pretarsi and caruncles and at times weak claws. Tarsus IV of deutonymph and adult with minimum 20 setae, the presence of setae av4 and pv4. The palpgenu usually bears seven setae; palptibia and tarsus distinct, unfused.

Antennophorus **Haller, 1877**
Type species: *Antennophorus uhlmanni* Haller, 1877

Antennophorus boveni Wiśniewski et Hirschmann, 1992

Holotype: Poznań University of Life Sciences (Uniwersytet Przyrodniczy w Poznaniu), Department of Forest Protection, Poland – No JW1847 (W)

Paratypes: Poznań University of Life Sciences (Uniwersytet Przyrodniczy w Poznaniu), Department of Forest Protection, Poland – No JW 1847 (1P), JW 1848 (2M), JW 1871 (2M, 1L), JW 1990 (1F); Zoological Collection in Munich (Zoologische Staatssammlung München), Germany – No 3128 (1L), 3129 (1F), 3130 (1P), 3131 (1F), 3132 (1F), 3133 (1M), 3134 (1M)

Etymology: species dedicated to a myrmecologist prof. dr. J.K.A von Boven from the Institute of Zoology, University Leuven (Belgium)

Locus tipicus: Puszczykowo, Poland (52°16'54"N, 16°51'15"E)

Measurements

♀ – 850–1010 × 830–1020 μm
♂ – 975–980 × 955–975 μm
D – unknown
P – 515–520 × 450–460 μm
L – 310–335 × 275–315 μm

Morphology of female

Dorsal. The color of the body is from yellow to light brown, depending on the degree of chitinization. Oval idiosoma which has more or less the same length and width, or it is slightly wider. The dorsal side is densely covered with simple setae, which may have tiny barbs at the apices (Fig. 85). Setae on the anterior of the idiosoma are longer (80 μm) than in the posterior (50 μm). Punctate ornamentation.

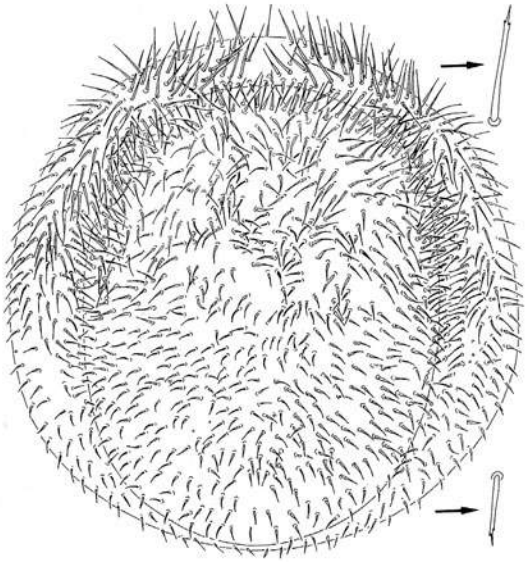

Fig. 85. *Antennophorus boveni* Wiśniewski et Hirschmann, 1992: dorsal idiosoma of female (after Wiśniewski, Hirschmann 1992).

Ventral. Trapezoid base of tritosternum, laciniae with tiny barbs, they are approximately 3 times longer than the base (Fig. 87c). Above the sternal shield there is a jugular shield which is elongated, narrow in the middle and wide at the edges, with setae st1 (50 μm). Setae st2 (40 μm) between jugular and sternal shields. Sternal shield in the region of coxae II; it is wide at the top and narrows in the lower part (Fig. 86). There are setae st3 (35 μm) and st4 (20 μm) on this shield, although in some specimens there are also unpaired setae. In the region of coxae III, there are two latigynal shields, and a spatulate ventri-anal shield is located below (330 μm long). It is narrower in the region of coxae IV and it is wider below peritrematal shields, rounded at the bottom. There are approximately 50–60 simple setae (40 μm) on the ventri-anal shield. The aforementioned shields have punctate ornamentation. Peritremal shields are wide and covered with reticulate ornamentation. Peritremes are relatively short (310 μm), reaching from coxa II to coxa III, while the stigma in the region of coxa III.

Gnathosoma. Corniculi corniculate with irregular edges. Setae h1 (80 μm) club-shaped, with tiny denticles and pointed at the end. The other setae serrate and of variable length: h2 (100 μm), h3 (90 μm), h4 (90 μm) (Fig. 87a). The hypostomal groove is short and reaches only the region (level) of h3. Triangular epistome is pointed at the end, and its surface is covered with delicate reticulate-foveate ornamentation (Fig. 87b). Elongated chelicerae (120 μm), fixed digit with several very small denticles, a few (6–7) denticles in the middle part of the movable digit. Morover, the underneath side of the movable digit is covered with small setae, and the middle part with pulvillumbrush (Fig. 87d, e).

Legs variable in length: I – 1200 μm, II – 800 μm, III – 800 μm, IV – 850 μm.

Fig. 86. *Antennophorus boveni* Wiśniewski et Hirschmann, 1992: ventral idiosoma of female (after Wiśniewski, Hirschmann 1992).

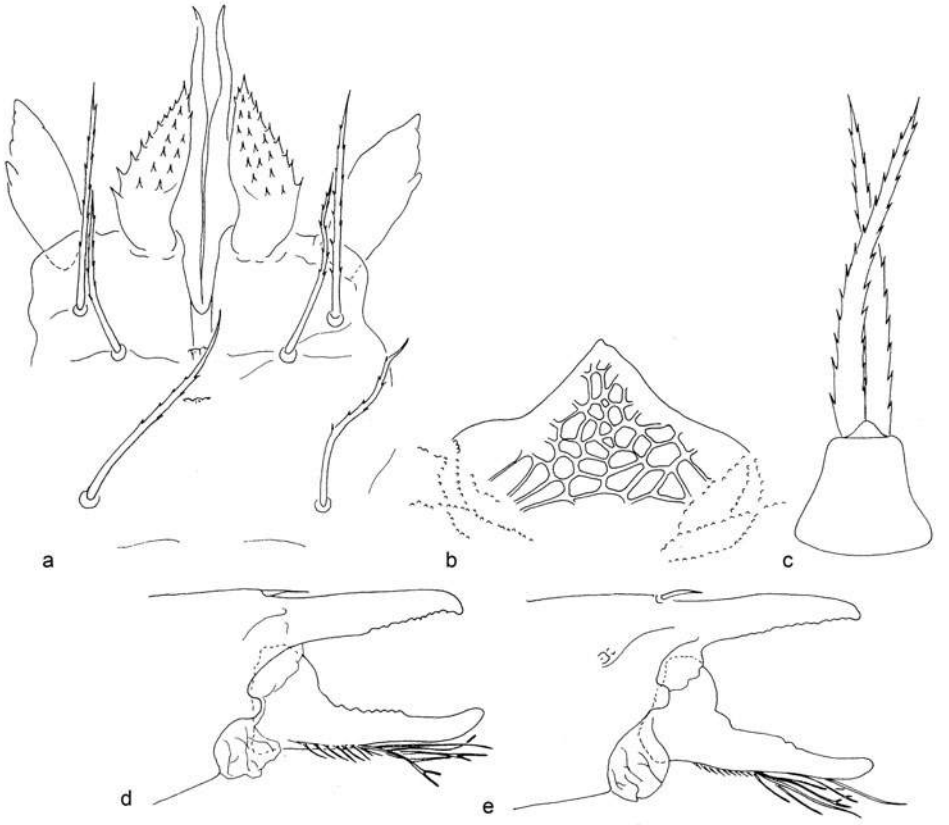

Fig. 87. *Antennophorus boveni*, Wiśniewski et Hirschmann, 1992, female: hypostome (a), epistome (b), tritosternum (c), chelicerae (d, e) (after Wiśniewski, Hirschmann 1992).

Morphology of male

Dorsal. The dorsal side is very similar to that of the female, it is also densely covered with short simple setae (40–70 μm), some of which have barbs (Fig. 88).

Ventral. Tritosternum the same as in the female (Fig. 90b). In the region of coxae II–III there is the sternal shield (200 μm long), there is no jugular shield as in the female. Moreover, in comparison to the female the ornamentation on the sternal shield is different. In the anterior of the shield in the region of st1–st2 there is lineate ornamentation, while below the ornamentation is reticulate-foveate (Fig. 89). There are five pairs of setae (st1–st5) on the sternal shield, although in many specimens there are also unpaired setae. Setae st1 are definitely longer (50 μm) than the other setae, for instance, than st5 (30 μm). In the region of coxae III, there is the genital orifice, while below there is the ventri-anal shield (375 μm long), whose shape resembles that of the female. There are over 100 simple setae (40 μm) on this shield. The ornamentation on the ventri-anal shield

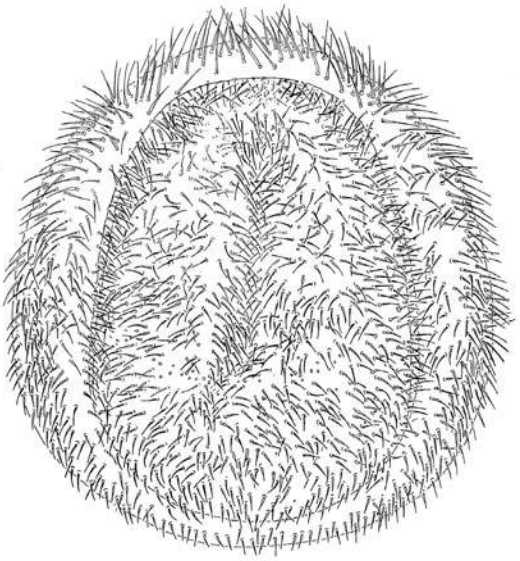

Fig. 88. *Antennophorus boveni* Wiśniewski et Hirschmann, 1992: dorsal idiosoma of male (after Wiśniewski, Hirschmann 1992).

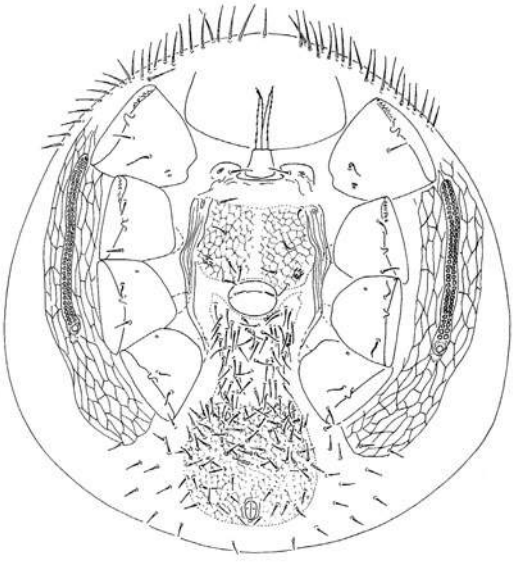

Fig. 89. *Antennophorus boveni* Wiśniewski et Hirschmann, 1992: ventral idiosoma of male (after Wiśniewski, Hirschmann 1992).

is also different than in the female, as it is not punctate but reticulate. Peritremal shields and the peritremes (325 μm) are the same as in the female (Fig. 90c).

Gnathosoma. Hypostome similar to that of the female, however there are small differences in the length of the setae, as h1=1 1/2 × h2, h3 are slightly

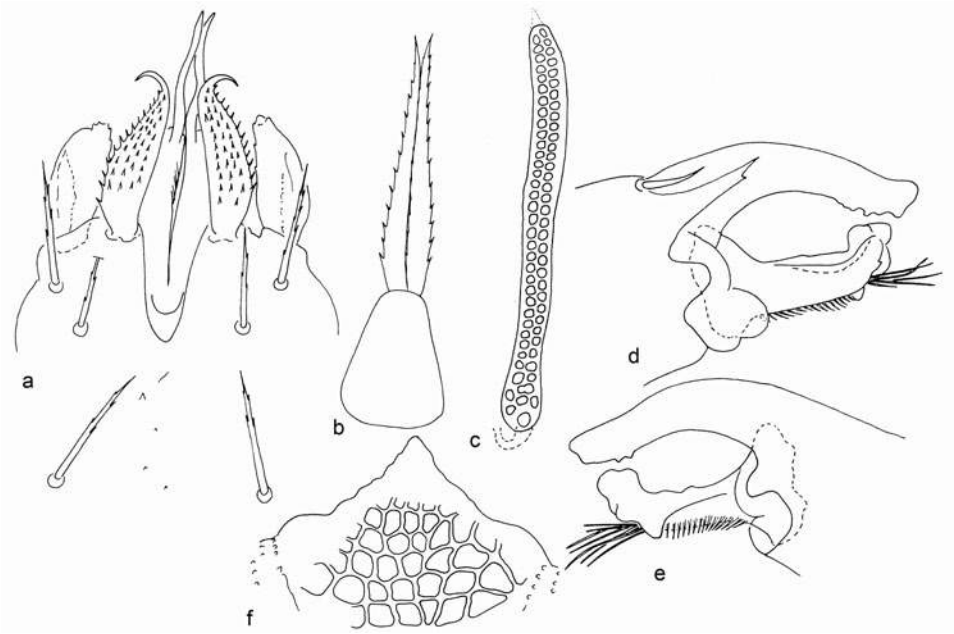

Fig. 90. *Antennophorus boveni* Wiśniewski et Hirschmann, 1992, male: hypostome (a), tritosternum (b), peritrema (c), chelicerae (d, e), epistome (f) (after Wiśniewski, Hirschmann 1992).

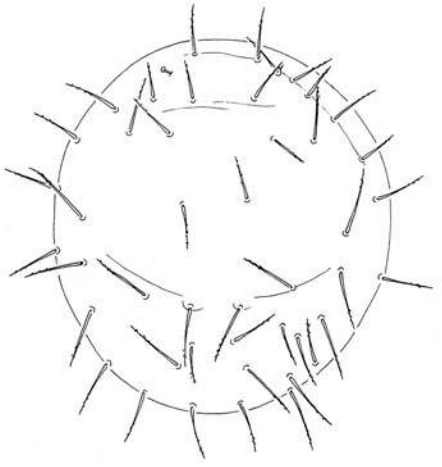

Fig. 91. *Antennophorus boveni* Wiśniewski et Hirschmann, 1992: dorsal idiosoma of protonymph (after Wiśniewski, Hirschmann 1992).

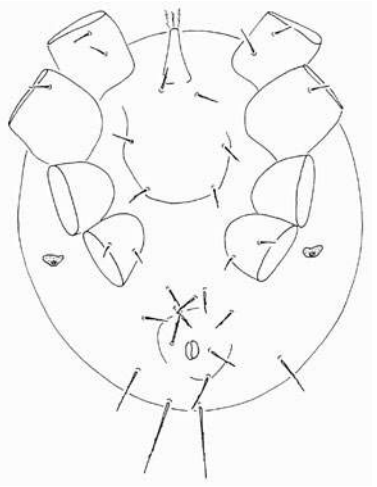

Fig. 92. *Antennophorus boveni* Wiśniewski et Hirschmann, 1992: ventral idiosoma of protonymph (after Wiśniewski, Hirschmann 1992).

shorter than h2, while h4=h2 (Fig. 90a). Epistome as in the female (Fig. 90 f) and there are only differences in the chelicerae, which are clearly shorter. Fixed digit is curved (175 μm), with 2–3 denticles, while the movable digit (125 μm) has irregular edges, no denticles and setae underneath. As in the female, the male also has a pulvillumbrush (Fig. 90d, e).

Legs variable in length: I – 1160 μm, II – 830 μm, III – 830 μm, IV – 900 μm.

Morphology of protonymph

Dorsal. Oval body, milk white; 40–50 serrate setae on the dorsal side, which are more or less the same length (100 μm) (Fig. 91).

Ventral. The base of tritosternum slightly shorter than laciniae (Fig. 93b). The sternal shield poorly visible with three pairs of setae (st1–st3) and the anal shield with three circum-anal setae of the same length (40 μm). Usually three pairs of setae in the vicinity of the anal shield, although single unpaired setae may occur. Peritreme very short, slightly extending beyond stigma. It is located in the region of coxae IV (Fig. 92).

Gnathosoma. Corniculi corniculate. All hypostomal setae with barbs, of variable length: h1 (80 μm), h2 (60 μm), h3 (50 μm), h4 (30 μm). The hypostomal groove is not visible, however there are several (6) rows of hypostomal denticles between the setae, from 2 to 6 denticles in a row (Fig. 93a). Epistome is triangular, with serrate edges (Fig. 93e, f). Chelicerae are elongated (130 μm), both the fixed digit and the movable digit with one large tooth and several smaller ones. Morover, there is a pulvillumbrush visible on the underneath of the movable digit (Fig. 93c, d).

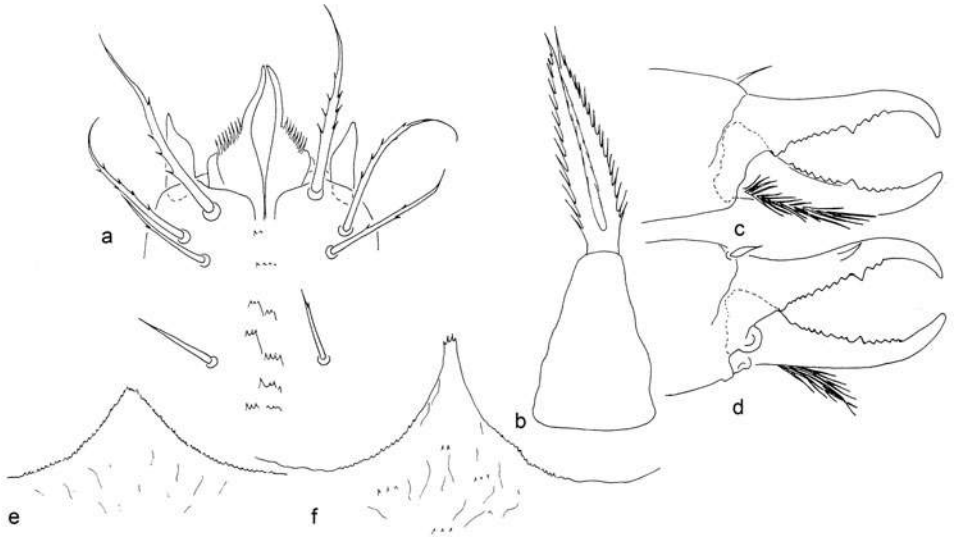

Fig. 93. *Antennophorus boveni* Wiśniewski et Hirschmann, 1992, protonymph: hypostome (a), tritosternum (b), chelicerae (c, d), epistomes (e, f) (after Wiśniewski, Hirschmann 1992).

Fig. 94. *Antennophorus boveni* Wiśniewski et Hirschmann, 1992: dorsal idiosoma of larva (after Wiśniewski, Hirschmann 1992).

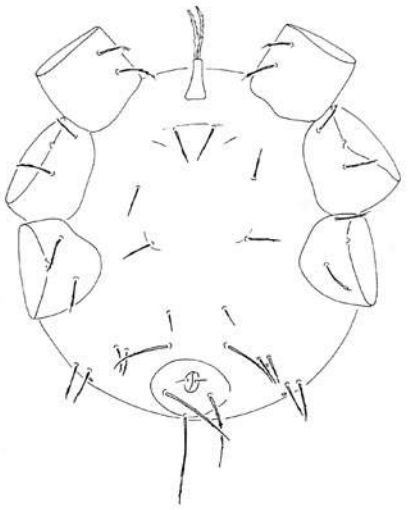

Fig. 95. *Antennophorus boveni* Wiśniewski et Hirschmann, 1992: ventral idiosoma of larva (after Wiśniewski, Hirschmann 1992).

Legs and palps. Limbs variable in length: I – 530 μm, II – 400 μm, III – 400 μm, IV – 450 μm. On the ventral side of palptrochanter there is one, thick, club-shaped seta (Fig. 97a).

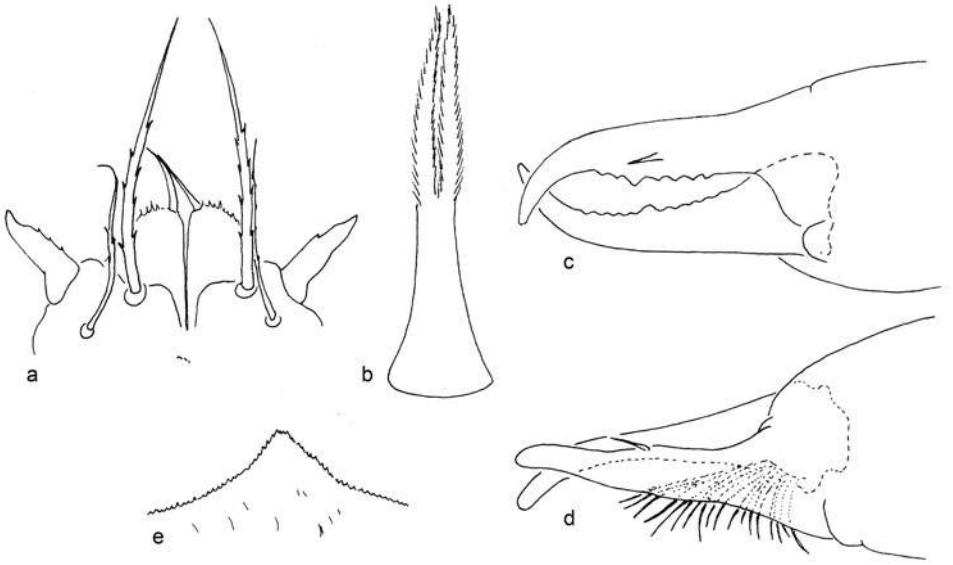

Fig. 96. *Antennophorus boveni* Wiśniewski et Hirschmann, 1992, larva: hypostome (a), tritosternum (b), chelicerae (c, d), epistome (e) (after Wiśniewski, Hirschmann 1992).

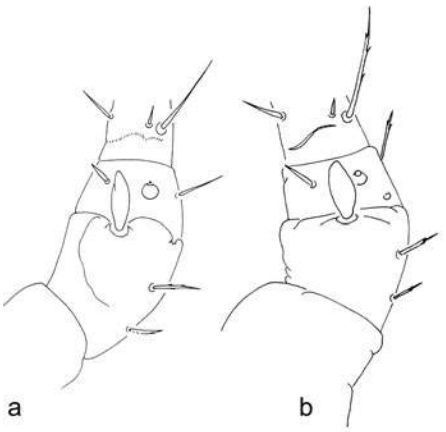

Fig. 97. *Antennophorus boveni* Wiśniewski et Hirschmann, 1992, palpes: protonymph (a), larva (b).

Morphology of larva

Dorsal. Oval body, milk white. There are 14 pairs of setae on the dorsal side of variable length (30–100 μm) (Fig. 94).

Ventral. The base of tritosternum is elongated, it is of the same length as laciniae (Fig. 96b). The poorly visible sternal shield features three pairs of setae (st1–st3), 25 μm long. The anal shield is wider than long, with three circum-anal setae, which are the longest setae (75 μm) on the ventral side (Fig. 95). There are also 6 pairs of ventral setae in the vicinity of the anal

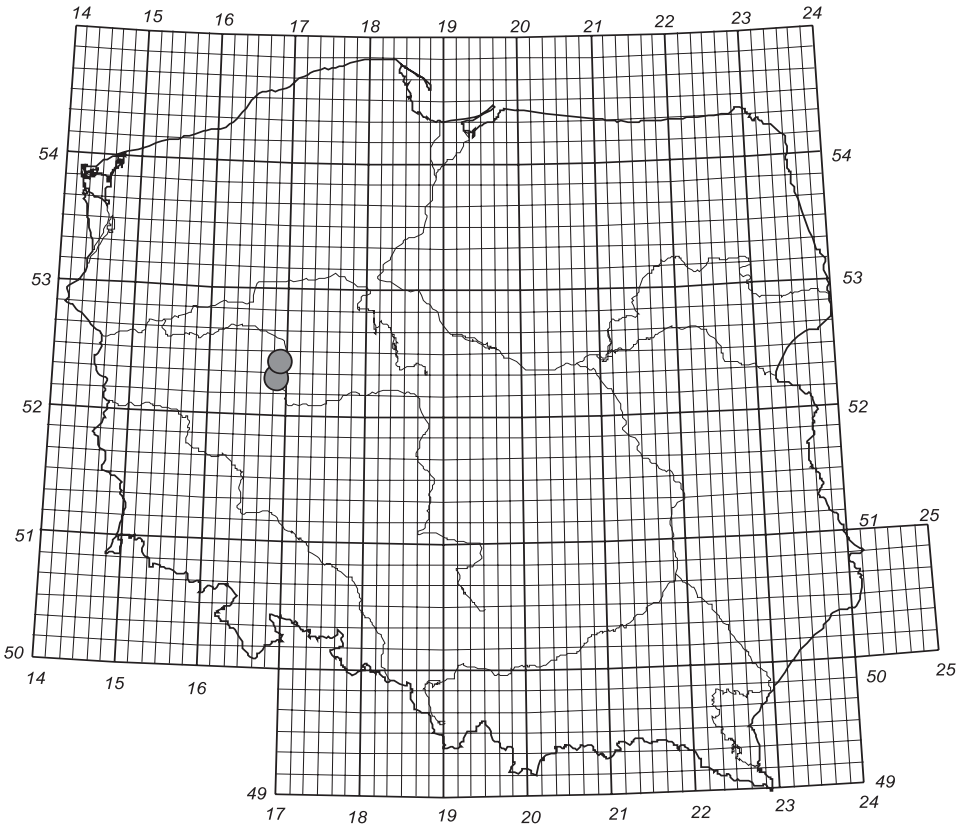

Fig. 98. *Antennophorus boveni* Wiśniewski et Hirschmann, 1992: geographic distribution in Poland.

shield. The peritreme is short as in the protonymph and it is located in the region of coxae IV.

Gnathosoma. Hypostome, epistome (Fig. 96a, e) and chelicerae as in the protonymph (Fig. 96c, d).

Legs and palps. Limbs variable in length: I – 375 μm, II – 375 μm, III – 375 μm. On the ventral side of palptrochanter there is one, thick, club-shaped seta (Fig. 97b).

Biology and ecology. The female lays one egg 350×300 μm in length. It is a myrmecophilous species, reported from workers of *Lasius flavus* (F.), most frequently on the underneath of the head and in the nests, for instance in trunks of plane and birch trees (Wiśniewski, Hirschmann 1992).

Occurrence in the World: Poland (Wiśniewski, Hirschmann 1992).

Occurrence in Poland: on ants *Lasius flavus* (F.) and their nests, Puszczykowo, Dendrological Garden in Poznań (Wiśniewski, Hirschmann 1992) (Fig. 98).

Antennophorus goesswaldi Wiśniewski et Hirschmann, 1992

Holotype: Zoological Collection in Munich (Zoologische Staatssammlung München), Germany – No 3126

Paratype: absent

Etymology: species dedicated to the memory of a German myrmecologist prof. dr. K. Gösswald from Ameisen-Schutzwarte, Würzburg

Locus tipicus: Dendrological Garden, Poznań, Poland (52°42'84"N, 16°89'75"E)

Measurements

♀ – unknown
♂ – 1020 × 905 μm
D – unknown
P – unknown
L – unknown

Morphology of male

Dorsal. The color of the body is from yellow to light brown, depending on the degree of chitinization. Oval idiosoma, widened at the bottom. The dorsal side is densely covered with simple setae, which may have tiny barbs at the apices (Fig. 99). Setae on the anterior idiosoma are longer (80 μm) than on the posterior (50 μm) ones.

Ventral. The base of tritosternum is trapezoid and laciniae with tiny barbs (Fig. 101b). In the region of coxae II–III there is a sternal shield (150 μm long).

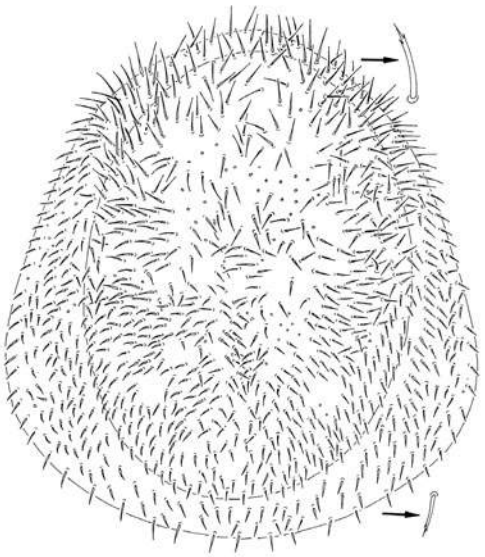

Fig. 99. *Antennophorus goesswaldi* Wiśniewski et Hirschmann, 1992: dorsal idiosoma of male (after Wiśniewski, Hirschmann 1992).

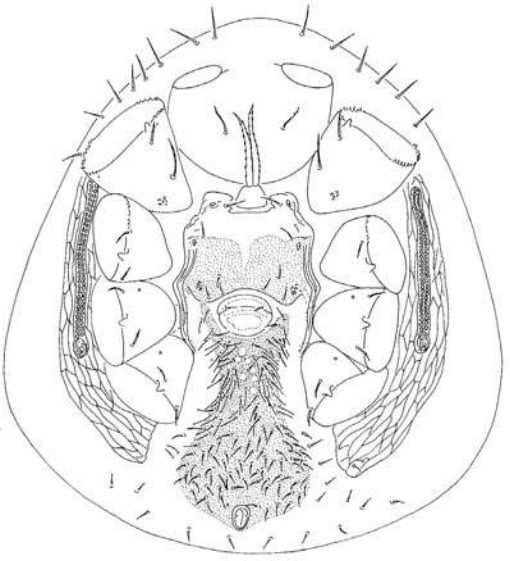

Fig. 100. *Antennophorus goesswaldi* Wiśniewski et Hirschmann, 1992: ventral idiosoma of male (after Wiśniewski, Hirschmann 1992).

In the anterior of the shield in the region of st1–st2 there is no ornamentation, while below the ornamentation is punctate (Fig. 100). There are five pairs of setae (st1–st5) on the sternal shield, although in some cases unpaired setae oc-

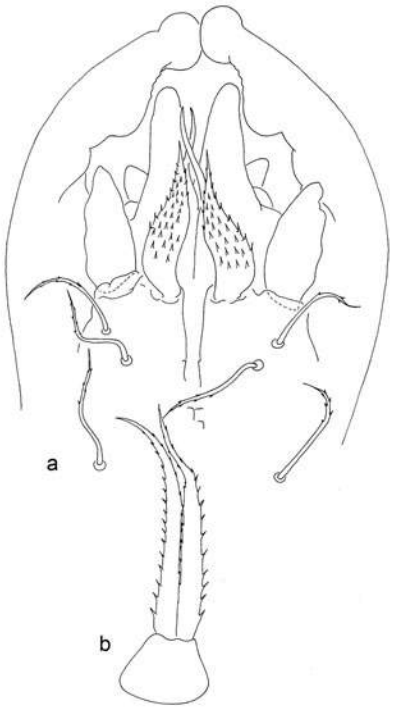

Fig. 101. *Antennophorus goesswaldi* Wiśniewski et Hirschmann, 1992, male: hypostome (a), tritosternum (b) (after Wiśniewski, Hirschmann 1992).

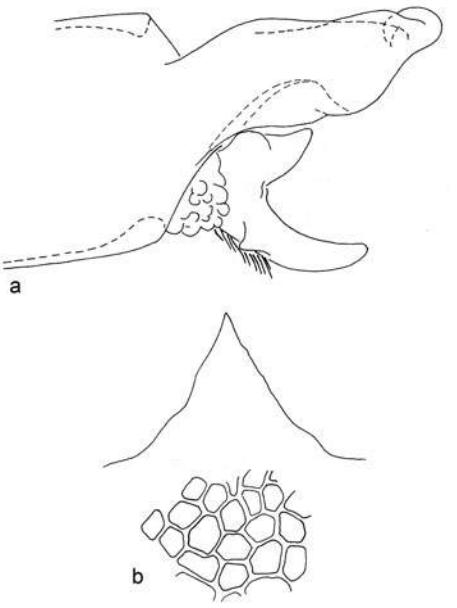

Fig. 102. *Antennophorus goesswaldi* Wiśniewski et Hirschmann, 1992, male: chelicera (a), epistome (b) (after Wiśniewski, Hirschmann 1992).

cur. In the region of coxae III, there is the genital orifice (80×100 μm), while below there is an elongated ventri-anal shield (450 μm long). It is narrower in the region of coxae IV and it is wider below peritrematal shields, rounded at the bottom. There are over 140 simple setae (50 μm) on this shield and punctate ornamentation. Peritremal shields are wide and covered with reticulate ornamentation. Peritremes are relatively short (300–330 μm), reaching from coxa II to coxa III, while the stigma is in the region of coxa III.

Gnathosoma. Corniculi corniculate with irregular edges. Setae h1 are club-shaped, with tiny denticles and pointed at the end. Other setae with barbs. The length of the setae: h1 (75 μm), h2=h3 (50 μm), h4 (60 μm). The hypostomal groove is short and reaches only the region (level) of h3 (Fig. 101a). Triangular epistome, pointed at the end, and its surface is covered with delicate reticulate-foveate ornamentation (Fig. 102b). Fixed digit (175 μm) with irregular edges, no visible denticles, as in the case of the movable digit (125 μm). Morover, there is a pulvillumbrush on the underneath of the movable digit (Fig. 102a).

Legs variable in length: I – 1350 μm, II – 850 μm, III – 850 μm, IV – 950 μm.

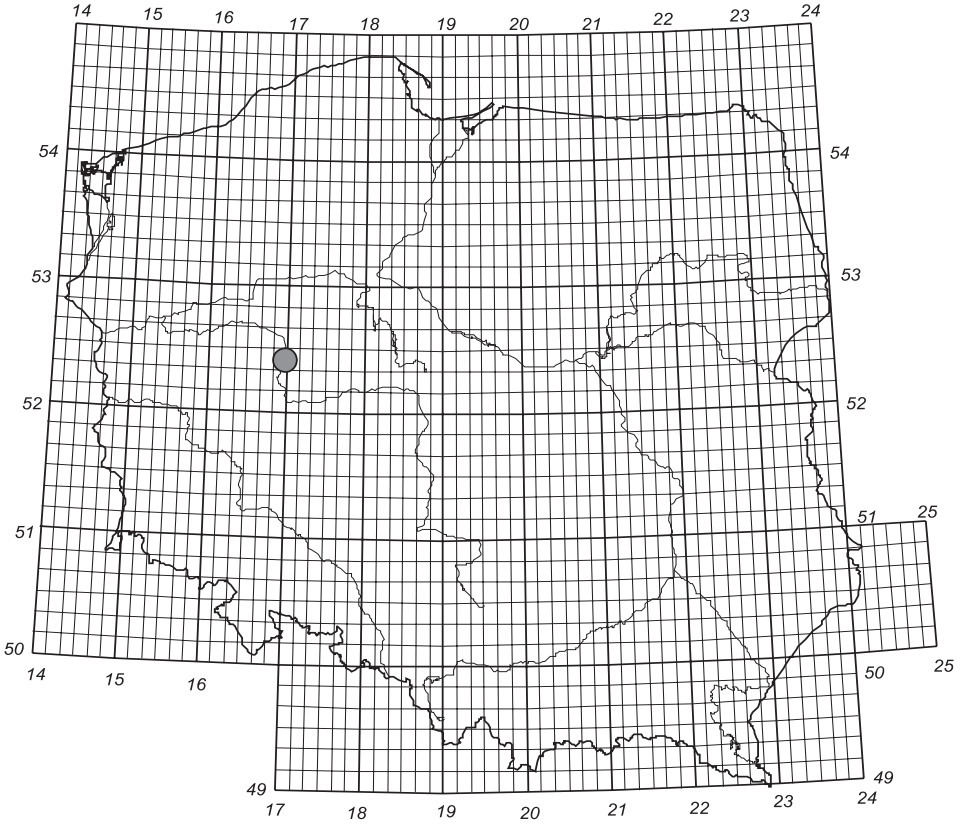

Fig. 103. *Antennophorus goesswaldi* Wiśniewski et Hirschmann, 1992: geographic distribution in Poland.

Biology and ecology. It is a myrmecophilous species, reported from workers of *Lasius flavus* (F.), collected from a nest in the trunk of a plane tree (Wiśniewski, Hirschmann 1992).

Occurrence in the World: Poland (Wiśniewski, Hirschmann 1992).

Occurrence in Poland: on ants *Lasius flavus* (F.), Poznań (Wiśniewski, Hirschmann 1992) (Fig. 103).

Antennophorus pavani Wiśniewski et Hirschmann, 1992

Holotype: Poznań University of Life Sciences (Uniwersytet Przyrodniczy w Poznaniu), Department of Forest Protection, Poland – No JW 1850d (1M)

Paratypes: Poznań University of Life Sciences (Uniwersytet Przyrodniczy w Poznaniu), Department of Forest Protection, Poland – No JW 1850c (1M),

Zoological Collection in Munich (Zoologische Staatssammlung München), Germany – No 3135 (1M), 3127 (fragment)

Etymology: species dedicated to a myrmecologist prof. dr. M. Pavan from Institute of Entomology (Istituto Entomologia Agraria), University of Pavia (Italy)

Locus tipicus: Dendrological Garden, Poznań, Poland (52°42'84"N, 16°89'75"E)

Measurements

♀ – unknown
♂ – 1030–1050 × 1020–1050 μm
D – unknown
P – unknown
L – unknown

Morphology of male

Dorsal. The color of the body is from yellow to light brown, depending on the degree of chitinization. Oval idiosoma which has more or less the same length and width. The dorsal side is densely covered with simple setae, which may have tiny barbs at the apices (Fig. 104). Setae on the anterior of the idiosoma are longer (70 μm) than in the posterior (40 μm).

Ventral. The base of tritosternum is trapezoid, laciniae with tiny barbs are three times longer than the base (Fig. 106b). In the region of coxae II–III there

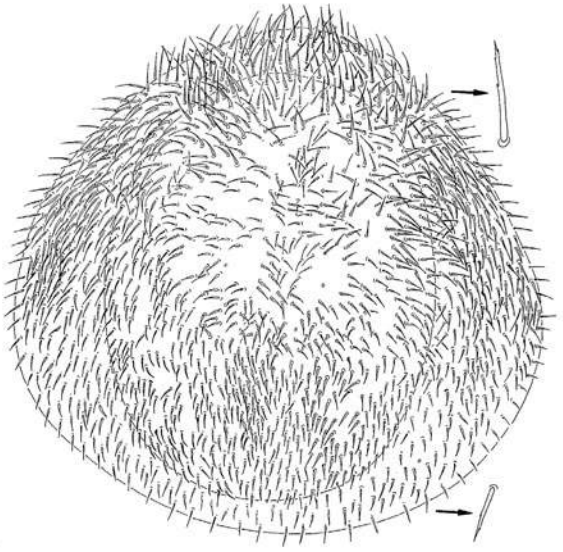

Fig. 104. *Antennophorus pavani* Wiśniewski et Hirschmann, 1992: dorsal idiosoma of male (after Wiśniewski, Hirschmann 1992).

is a sternal shield with approximately 20 simple setae. The shield is covered with punctate ornamentation and only between setae st1–st2 there is a visible strip without ornamentation (Fig. 105). In the region of coxae III, there is the genital orifice (80×100 μm), while below there is an elongated ventri-anal shield (475 μm long). It is narrower in the region of coxae IV and it is wider below peritrematal shields, rounded at the bottom. There are over 140 simple setae (40 μm) on this shield and punctate ornamentation. Peritremal shields are wide and covered with reticulate ornamentation. Peritremes are relatively short, reaching from coxa II to coxa III, while the stigma is in the region of coxa III.

Gnathosoma. Corniculi corniculate with irregular edges. Setae h1 club-shaped, with tiny denticles and pointed at the end. Other setae with barbs. The length of the setae: h1 more than 2 × h2, h3= 1 1/2 × h2, h4=h2. The hypostomal groove is short and reaches only the region (level) of h3 (Fig. 106a). Triangular epistome, pointed at the end, and its surface is covered with delicate reticulate-foveate ornamentation (Fig 106c). Fixed digit with irregular edges, no visible denticles, as in the case of the movable digit. Morover, there is a pulvillumbrush and tiny setae on the underneath of the movable digit (Fig. 107).

Legs variable in length: I – 1420 μm, II – 900 μm, III – 900 μm, IV – 950 μm.

Biology and ecology. It is a myrmecophilous species, reported from the underneath of the heads of workers of *Lasius* sp. inhabiting tree trunks (Wiśniewski, Hirschmann 1992).

Occurrence in the World: Poland.

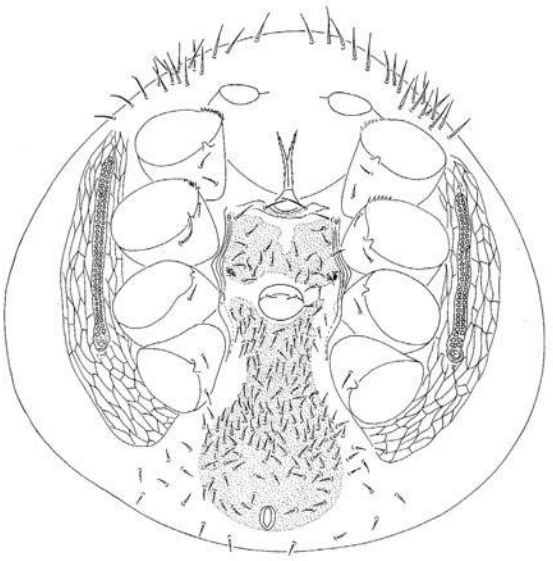

Fig. 105. *Antennophorus pavani* Wiśniewski et Hirschmann, 1992: ventral idiosoma of male (after Wiśniewski, Hirschmann 1992).

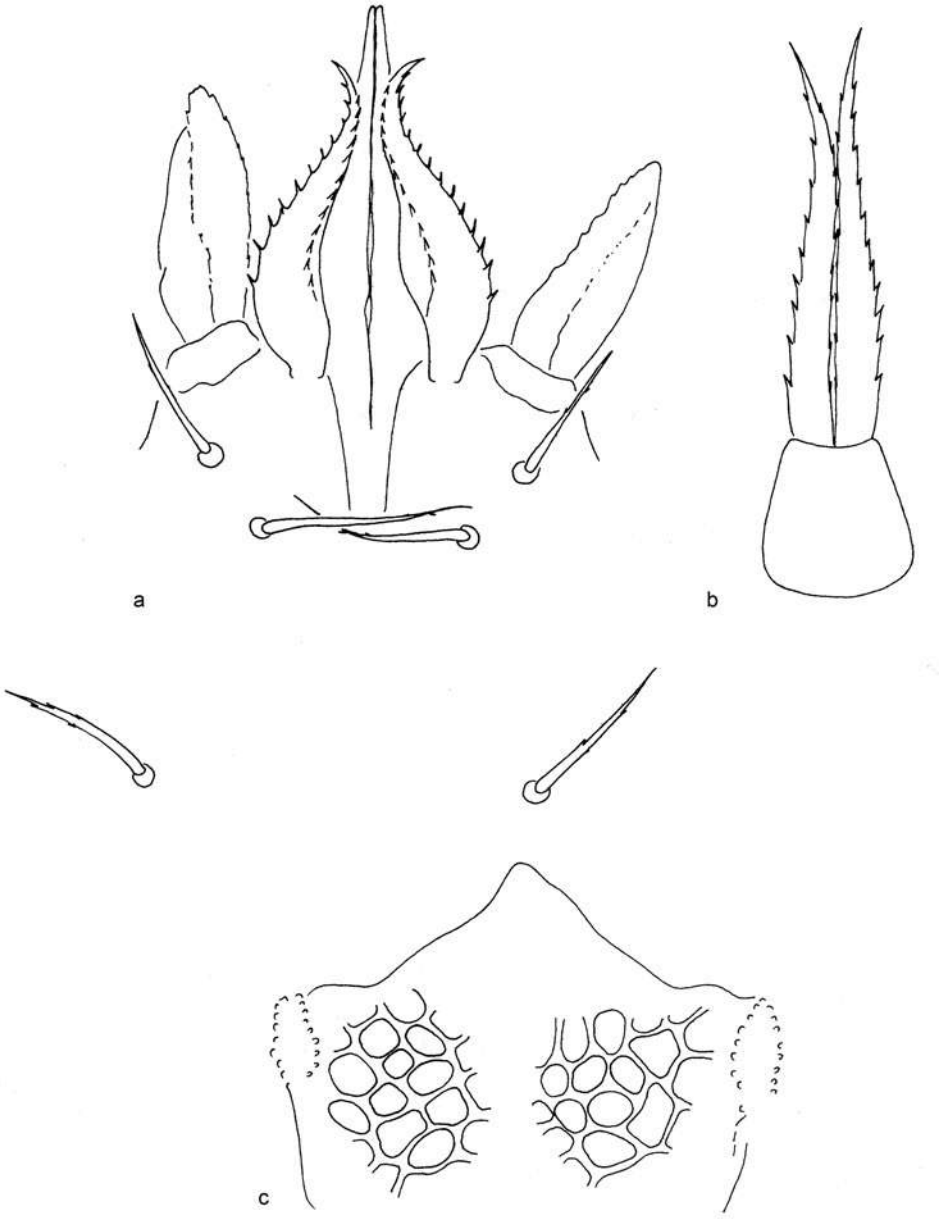

Fig. 106. *Antennophorus pavani* Wiśniewski et Hirschmann, 1992, male: hypostome (a), tritosternum (b), epistome (c) (after Wiśniewski, Hirschmann 1992).

Occurrence in Poland: reported from ants of the genus *Lasius*, Dendrological Garden in Poznań (Wiśniewski, Hirschmann 1992) (Fig. 108).

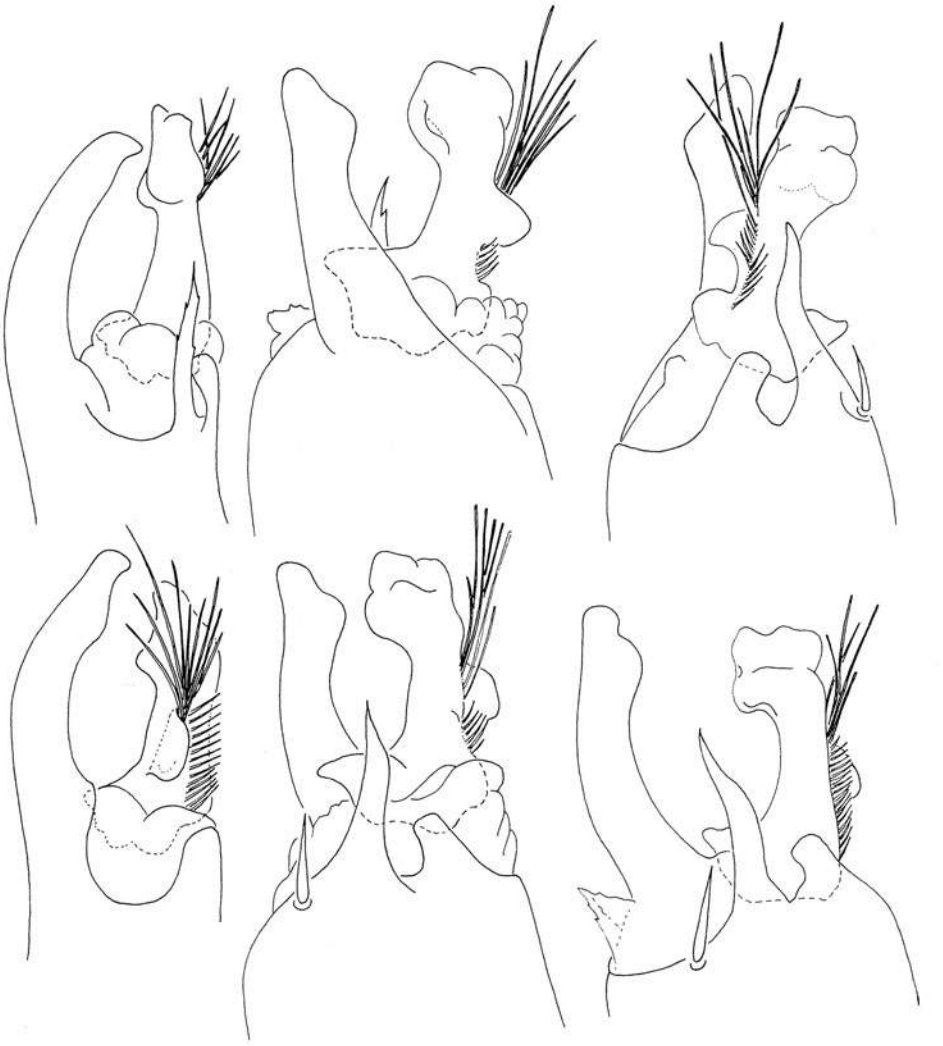

Fig. 107. *Antennophorus pavani* Wiśniewski et Hirschmann, 1992: chelicerae of male (after Wiśniewski, Hirschmann 1992).

Notes about *Antennophorus*

At present there are seven known species worldwide. Apart from the previously mentioned ones these include: *A. foreli* Wasmann, 1902, *A. grandis* Berlese, 1904, *A. pubescens* Wasmann, 1899 and *A. uhlmanni* Haller, 1877. A species which is probably new to science is also *Antennophorus* presented in the studies by Krantz (1970), and also by Lindquist at al. (2009), for which Wiśniewski and Hirschmann (1992) suggested the name of *A. krantzi*. Unfortunately, the species has not been described yet and thus it fails to meet the criteria of the International Code of Zoological Nomenclature.

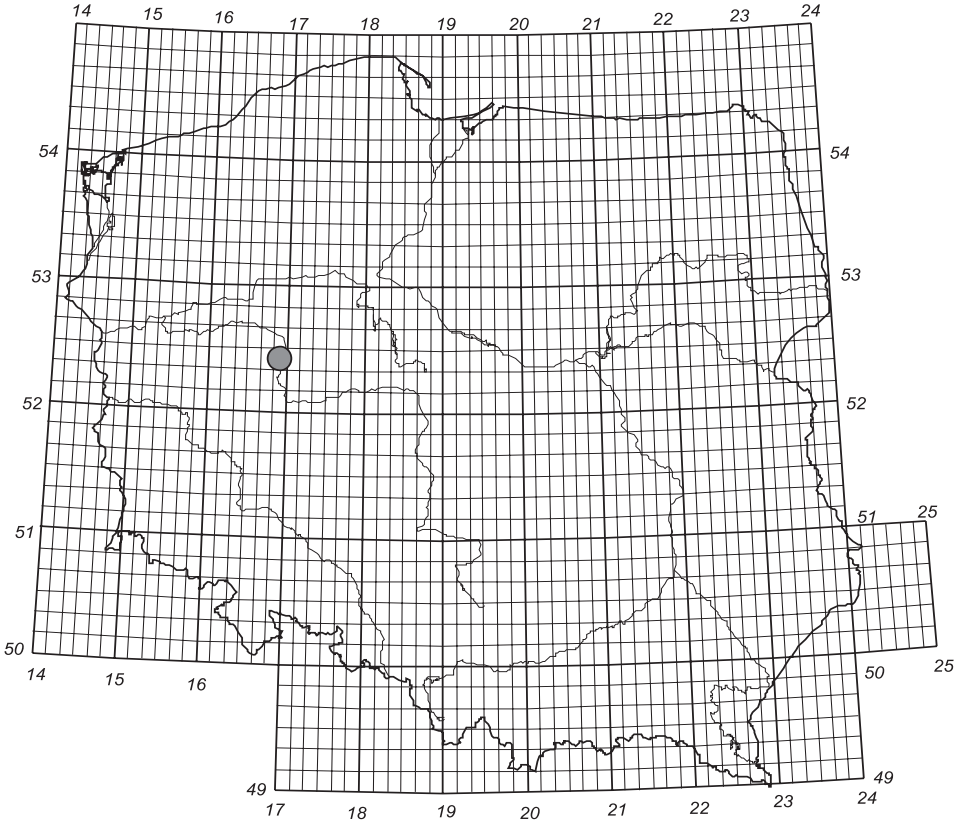

Fig. 108. *Antennophorus pavani* Wiśniewski et Hirschmann, 1992: geographic distribution in Poland.

The species from this genus are myrmecophilous most frequently found on ants or in their nests. For instance, *A. foreli* related to *Lasius alienus* (Foerster) *A. grandis* to *L. fuliginosus* (Latreille) *A. uhlmanni* to *L. niger* (L.) (Wasmann 1902; Berlese 1904), and *A. boveni* to *L. flavus* (F.) (Wiśniewski, Hirschmann 1992).

The rare occurrence of mites from the genus *Antennophorus*, and thus the difficulties in collecting the material, put many limitations on the research into the biology and ecology of these animals. The lack of preserved material also precludes the preparation of reviews since it is difficult to determine the level of morphological variability (morphological changeability) within a species on the basis of single specimens. Moreover, except for the study by Wiśniewski Hirschmann (1992) there are no detailed drawings, which is not surprising as previous studies were undertaken over a hundred years ago. Certainly, in the near future molecular techniques will be helpful, as they will allow one to confirm or reject membership to a given species on the basis of genetic analysis. Unfortunately, the initial results of studies on the acarofauna of *Lasius flavus* (F.) conducted as part of the present project failed to provide the anticipated effects.

Not a single specimen from the genus *Antennophorus* which could be subjected to genetic analysis has been found. Thus, attempts to conduct a morphological analysis and a revision of this genus were abandoned, due to the small number of specimens that are available.

A revision of this interesting group of mites seems to be a necessity, at least to develop clear criteria to distinguish species on the basis of their morphological features. Species from the genus *Antennophorus* are very similar to one another and therefore numerous doubts arise. For instance, is the number of setae on the sternal shield, or the ventri-anal shield, which is a distinguishing criterion at present, a constant or a variable feature? If it is variable then what are the ranges of the variability? Such doubts can only be resolved by moving beyond morphological studies towards genetic analyses, which was not possible in the past.

Due to the rarity of the occurrence and thus the scarcity of the material it is worth mentioning in which acarological collections in Europe species from this genus are deposited. Some of the oldest slides are deposited in the Zoological Collection in Munich. These are the Kneissl Collection, such as:

– *Antennophorus foreli* Wasmann, 1902 – K310 (1F), K311 (1F), K312 (1M), K313 (1F),
– *Antennophorus grandis* Berlese, 1904 – K314 (1F), K315 (1F),
– *Antennophorus pubescens* Wasmann, 1899 – K316 (1M), K317 (1F), K318 (1M), K319 (1M), K320 (1F).

The A. Berlese collection, in the Experimental Institute for Agricultural Zoology in Florence, features:

– *Antennophorus foreli* Wasmann, 1902 – 1/5 (2F), 1/6 (1F), 1/13 (chelicerae of female),
– *Antennophorus grandis* Berlese, 1904 – 1/50 (1F, 2M), 2/1 (1F, 1M), 2/2 (1F, 1M), 2/3 (chelicerae of female), 2/4 (1M), 6/17 (3F), 6/18 (2F), 6/19 (gnathosoma and chelicerae of male), 6/20 (2F, 1M), 6/21 (chelicera and palp of female),
– *Antennophorus pubescens* Wasmann, 1899 – 1/7 (1M), 1/30 (1F).

Celaenopsoidea

Celaenopsidae Berlese, 1892

Idiosoma. Oval body, approximately 0.5–0.8 mm long, from light yellow to dark brown. One holodorsal shield on the dorsal side in both females and males. Deutonymphs with three, parallel dorsal shields (podonotal, mesonotal and pygidial). A large number of unpaired setae on the dorsal shield. Most of them are simple, and some, for instance, marginal ones may be with barbs. Coliculate ornamentation, poorly visible.

Sternal shield with 3 pairs of setae. Two metasternal plates with 1 to 2 pairs of setae at the base of the sternal shield. Genital orifice in the male on the front edge of the sternal shield, frequently poorly visible (Bregetova 1977d). Fused mesogynal-latigynal shield located below. Wide ventri-marginal shields are located along the body.

Gnathosoma. Corniculate corniculi; hypostomal setae, simple, variable in length; hypostomal groove poorly defined. Chelicerae with robust, dentate digits, movable digit with a large proximal tooth and dentritic or brushlike excrescences. No spermatodactyl in the male. Triangular epistome; its surface covered with tiny denticles.

Legs and palps. Legs of the pair I without claws, legs II without apophyses. Palptibia and tarsus distinct, unfused; palpgenu with 5–7 setae.

***Celaenopsis* Berlese, 1886**
Type species: *Celaenopsis badius* (C.L. Koch, 1839)
***Pleuronectocelaeno* Vitzthum, 1926**
(=*Ceratocelaenopsis* Trägårdh, 1950)
Type species: *Pleuronectocelaeno austriaca* Vitzthum, 1926
***Schizocyrtillus* Kinn, 1970**
Type species: *Schizocyrtillus lathrius* Kinn, 1970

Celaenopsis badius (C.L. Koch, 1839) (=*Gamasus badius* C.L. Koch, 1839)

Synonym: *Celaenopsis cuspidata* (Kramer, 1876) (=*Gamasus cuspidatus* Kramer, 1876)

Holotype: unknown[5]

Paratype: unknown

Collection in Poland: Poznań University of Life Sciences (Uniwersytet Przyrodniczy w Poznaniu), Department of Forest Protection, Poland

Etymology: (from Latin) *badius* – brown, maroon

Locus typicus: Regensburg[6]

Measurements

♀ – 650–700×450–500 μm
♂ – 670–680×450–460 μm
D – 550–600×360–400 μm
P – 520–550×340–350 μm
L – unknown

Morphology of female

Dorsal. Oval body, from yellowish to dark brown depending on the degree of chitinization. Approximately 130–150 simple setae on the dorsal side and irregularly arranged (Fig. 109). The length of these setae is comparable and it usually does not exceed 50–60 μm. The body is covered with delicate, reticulate ornamentation, which is visible in specimens with stronger chitinization.

Ventral. Small sternal shield (65 μm) with three pairs of simple setae 50 μm long. It is located between coxae II and covered with lineate ornamentation. Two metasternal plates located below, between coxae II and coxae III (Fig. 110). There is one pair of setae (40–45 μm) on these plates. Mesogynal-latigynal shield located from coxae III to the lower edge of the shield. There are approximately 30–40 acicular setae 45–50 μm long on this shield. The sculpture on the ventri-anal shield is reticulate and poorly visible. A crescent-shaped, narrow post-anal shield 35 μm long and approximately 200 μm wide below this shield, with two pairs of simple setae (20 and 40 μm). A pair of setae on small sclerites in the vicinity of the post-anal shield. Long ventri-marginal shields, along the body and relatively wide. Single, simple setae (usually 1–2 pairs) located on these shields. A line separating two types of ornamentation runs through the center of the shield. Stigma in the upper region of coxae IV, whereas the other end of the peritreme reaches the beginning of coxae II.

Gnathosoma. Hypostomal groove very narrow and hypostomal setae variable in length: h1 – 45 μm, h2 – 35 μm, h3 – 45 μm, h4 – 25 μm. These setae are sim-

5 Similarly as in case of *S. togatus*.

6 In the original C.L. Koch's description the author does not mention a specific place, he mention only 'this surroundings'. The analysis of the study revealed that this was Regensburg (49°01'00"N 12°05'00"E).

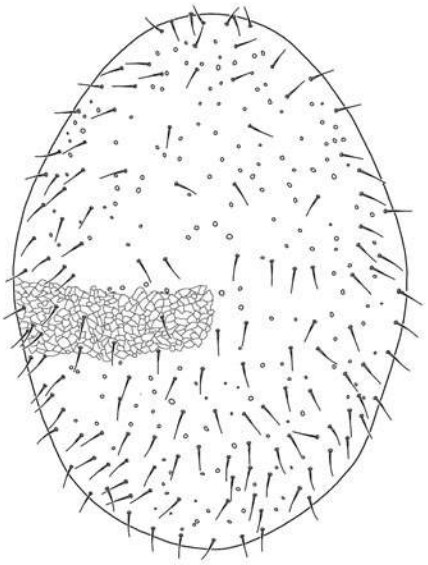

Fig. 109. *Celaenopsis badius* (C.L. Koch, 1839): dorsal idiosoma of female.

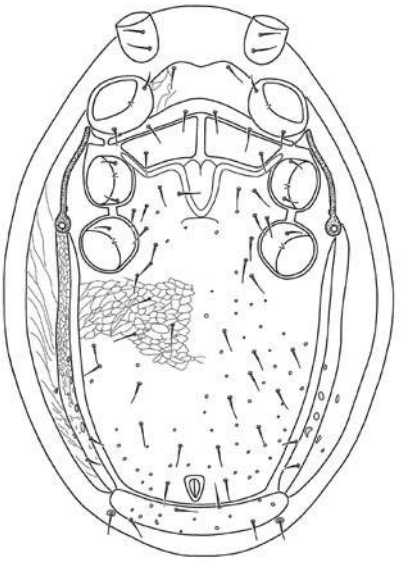

Fig. 110. *Celaenopsis badius* (C.L. Koch, 1839): ventral idiosoma of female.

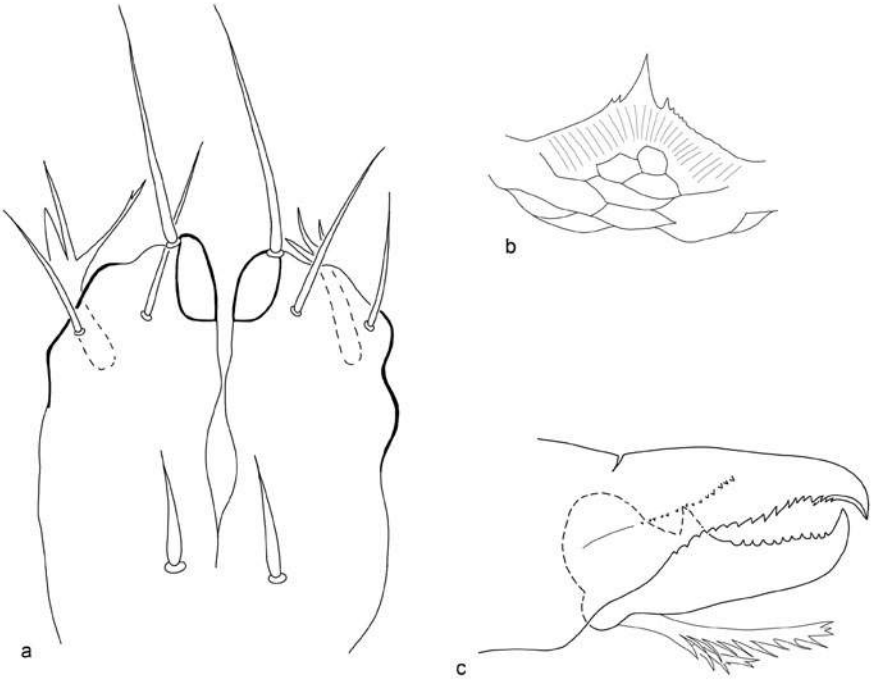

Fig. 111. *Celaenopsis badius* (C.L. Koch, 1839) – female: hypostome (a), epistome (b), chelicera (c).

ple, except for h4 which are spiniform (Fig. 111a). Epistome with a pointed apex and tiny denticles on the sides; delicate reticulate ornamentation at the base (Fig. 111b). Elongated chelicerae, fixed digit with several tiny denticles, and the movable digit with approximately 10 smaller teeth and one large tooth (Fig. 111c).

Legs variable in length: I – 420 μm, II – 400 μm, III – 400 μm, IV – 500 μm, while pair I significantly thinner and more delicate than the others.

Morphology of male

Dorsal. Dorsal side similar to the one found in the female. Oval, with a large number of simple setae. Young specimens which are poorly chitinized are yellow, whereas older ones which are more chitinized are brown.

Ventral. Genital orifice is located on the edge of a very large sterni-ventral shield (500–520 μm long), between coxae I and II (Fig. 112). There are approximately 40 simple setae on this shield and variable ornamentation – it is lineate between coxae II and reticulate below. Ventri-marginal shields similar as in the female, they are relatively wide and run to the lower edge of the idiosoma. Similarly to the female the male has a post-anal shield (30×190 μm) with two pairs of setae. There is a pair of acicular setae located on sclerites between the ventri-marginal and post-anal shields.

Gnathosoma. Hypostome clearly different from the one in the female, with one pair of short setae (20 μm). Similar to the male hypostome of *Pleuronectocelaeno austriaca*. Epistome and chelicerae similar to those of the female.

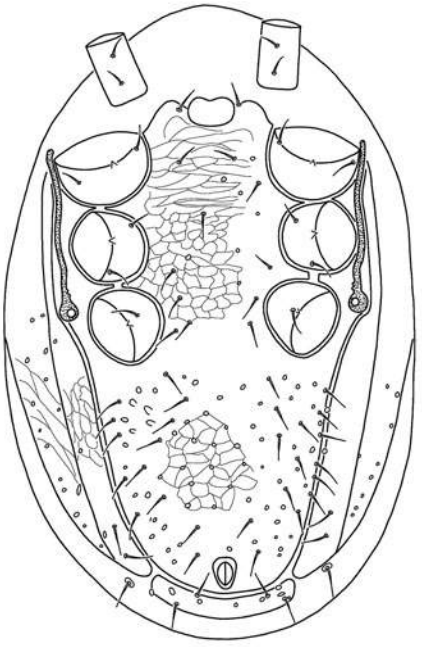

Fig. 112. *Celaenopsis badius* (C.L. Koch, 1839): ventral idiosoma of male.

Legs variable in length: I – 420 μm, II – 400 μm, III – 400 μm, IV – 500 μm.

Morphology of deutonymph

Dorsal. Oval body, white or dirty white. Three shields on the dorsal: pronotal (260×320 μm) with approximately 30–40 setae, mesonotal (170×320 μm) with approximately 30–40 setae and opisthonotal (50×150 μm) with two pairs of setae (Fig. 113). All of these setae are simple and comparable in length which is approximately 25–30 μm. All three shields are covered with a very delicate, reticulate ornamentation. There are approximately 70 simple setae, 25–30 μm long, on small sclerites around the body.

Ventral. Between coxae II and III there is a sternal shield, 150 μm long,

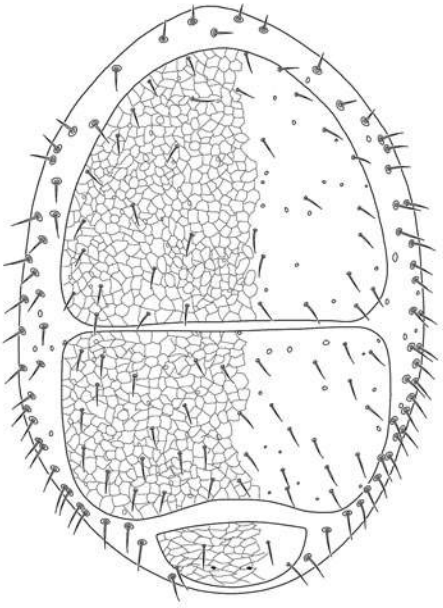

Fig. 113. *Celaenopsis badius* (C.L. Koch, 1839): dorsal idiosoma of deutonymph.

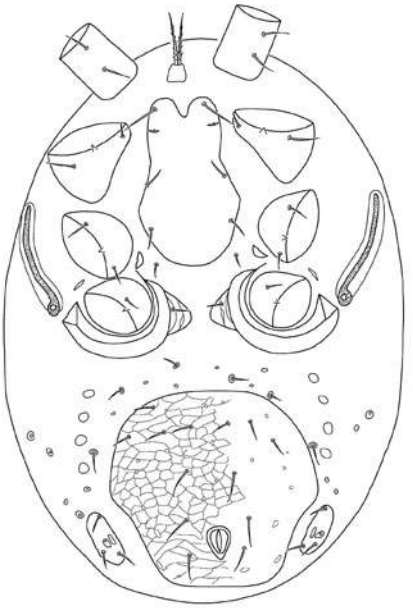

Fig. 114. *Celaenopsis badius* (C.L. Koch, 1839): ventral idosoma of deutonymph.

with three pairs of simple setae. Setae st1 are longer (50 μm) than setae st2–st3 (30 μm) (Fig. 114). Small sclerites are located between coxae III and IV. There is a large, curved coxal shield in the lower region of coxae IV. The ventri-anal shield is relatively large (200×200 μm), usually with 10 ventral setae and four circumanal setae. This shield is covered with reticulate ornamentation. There are plates (50×20 μm) with three setae (25 μm) on both sides of the ventri-anal shield in the region of the anus. There are four circular sclerites (10 μm) located along the ventri-anal shield below coxae IV. Stigma in the region of coxae IV. Peritreme located on a small shield, it is short and reaches coxae III.

Gnathosoma. Hypostomal groove is narrow. Hypostomal setae are simple, variable in length: h1 – 40 μm, h2 – 40 μm, h3 – 25 μm, h4 – 20 μm. Epistome as in adult specimens with one apex and serrate edges, however there is no ornamentation at the base. Chelicerae as in adult specimens.

Legs variable in length: I – 350 μm, II – 330 μm, III – 330 μm, IV – 425 μm.

Morphology of protonymph

Dorsal. Oval body, milk white. The dorsal side with pronotal shield (230×230 μm), two mesonotal shields (25×90 μm) and a pygidial shield (95×200 μm) (Fig. 115). There are 20 simple setae on the pronotal shield, one seta on mesonotal shields and 10 setae on the pygidial shield. Most of them are 30 μm long and only seta Z5 is significantly longer (70 μm). Moreover, there are single sclerites located on a membrane in the vicinity of mesonotal shields and between those

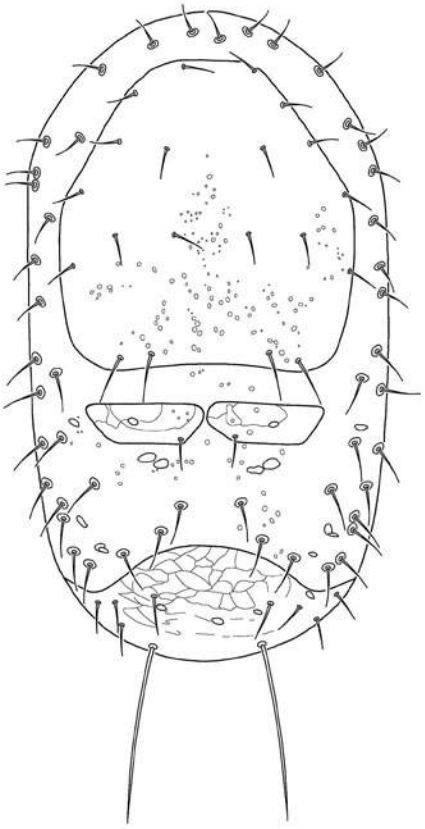

Fig. 115. *Celaenopsis badius* (C.L. Koch, 1839): dorsal idiosoma of protonymph.

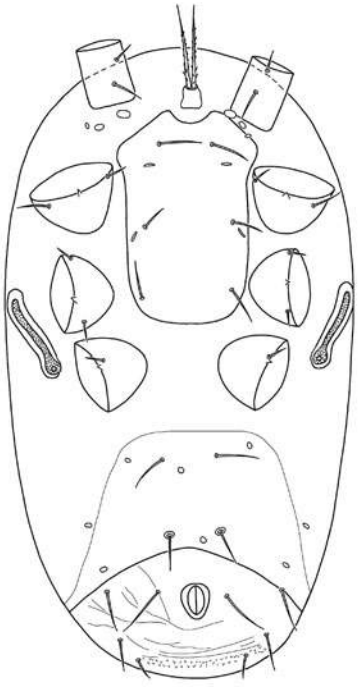

Fig. 116. *Celaenopsis badius* (C.L. Koch, 1839): ventral idiosoma of protonymph.

shields and the pygidial shield. There are 24 pairs of simple setae around the body, located on small plates.

Ventral. There are three simple setae on the sternal shield, of which st1 are the longest (35 μm) (Fig. 116). There are three pairs of presternal shields above this shield. The ventri-anal shield is small (100–200 μm) usually with four pairs of setae variable in length (from 20 to 40 μm). There are two pairs of setae (30 μm) between coxae IV and the ventri-anal shield. Setae located in the vicinity of the ventri-anal shield are located on shields and in some specimens these shields may be fused with the ventri-anal shield. Peritremes are short (65 μm), in the region of coxae III–IV.

Gnathosoma. Hypostome similar to that in the deutonymph. Hypostomal setae are simple, variable in length: h1 – 30 μm, h2 – 45 μm, h3 – 25 μm, h4 – 15 μm. Epistome and chelicerae as in the deutonymph.

Legs variable in length: I – 330 μm, II – 320 μm, III – 320 μm, IV – 370 μm.

Biology and ecology. The female lays one egg of the size 340–370×240–280 μm. The species is found in rotting wood, in tree hollows, bark beetle galleries, litter, rotting bracket fungi, but also sporadically in bird nests and in anthills.

Occurrence in the World: Palearctic.

Occurrence in Poland: in anthills of *Formica polyctena* Foerster – Potasze, Zielonka Experimental Forest (Wiśniewski 1966) and Białowieża NP (Gwiazdowicz 2000a, 2001); *Formica rufa* L. – Borówiec, Babki Forest District, Puszczykowo (Wiśniewski 1983); *Formica* sp. – Wielkopolski NP (Wiśniewski 1983); *Lasius fuliginosus* (Latreille) – Pieniny NP (Skorupski, Gwiazdowicz 1996, 2002) and Wielkopolska NP (Skorupski 2001); *Lasius niger* (L.) – Wielkopolska NP (Skorupski 2001); *Lasius* sp. – Torzym and Niemieczkowo, Oborniki Forest District (Majewski 1984, 1994); in bark beetle galleries of *Cryphalus piceae* (Ratzeburg) – Gorce NP (Kaczmarek et al. 1992; Kaczmarek, Michalski 1995b, c); *Dryocoetes autographus* (Ratzeburg) – Gorce NP (Kaczmarek, Michalski 1995c); *Ips typographus* (L.) – Gorce NP (Michalski et al. 1992a), Białowieża NP, Gorce NP (Kaczmarek, Michalski 1994, 1995b, c); *Pityokteines curvidens* (Germar) – Świętokrzyski NP (Michalski et al. 1985; Michalski, Ratajczak 1989); *Pityokteines spinidens* (Reitter) – Świętokrzyski NP (Michalski et al. 1985); *Scolytus multistriatus*, Wielkopolska NP (Skorupski 2000); *Scolytus* sp. – Turew (Bałazy et al. 1987b); *Tomicus piniperda* (L.) – Roztocze NP (Michalski et al. 1992b; Michalski, Ratajczak 1994); Babki Forest District (Bałazy et al. 1987b); under bark, Białowieża Forest (Gwiazdowicz 1993, 1999b); Gorce NP, Roztocze NP, Słowiński NP, Świętokrzyski NP, Wielkopolska NP (Gwiazdowicz, Skorupski 1996); in soil of forest, Włocławek (Seniczak et al. 1994a, b; Kaczmerek et al. 1996; Kaczmarek, Seniczak 1997; Kaczmarek 2000); bark of fir, rotting wood from tree hollows, fruiting bodies, litter and soil, Pieniny NP (Skorupski, Gwiazdowicz 1996, 1997); rotting wood, litter, tree hollows, moss, fruiting bodies, anthills, Białowieża NP (Gwiazdowicz 1998); tree hollows of hornbeam, spruce, alder, maple, Białowieża NP (Gwiazdowicz 1999a); Białowieża NP (Gwiazdowicz 2000a); under bark, tree hollows, Palace Park, Białowieża (Gwiazdowicz 2000c); under bark, anthills, Bieszczady NP (Gwiazdowicz, Sznajdrowski 2000); in soil, sapling stand, Toruń (Kaczmarek, Seniczak 2000); soil, anthills, Wielkopolska NP (Skorupski 2001); nest of *Lanius collurio* L., close to Leszno (Tryjanowski et al. 2001); fruiting bodies, Wałcz Forest District (Gwiazdowicz, Łakomy 2002); litter, Karkonosze NP (Gwiazdowicz 2003); Bory Tucholskie NP (Gwiazdowicz, Matysiak 2004); Biebrza NP (Gwiazdowicz, Klemt 2004); litter, rotting wood of willow, Ujście Warty NP (Gwiazdowicz, Kmita 2004); rotting wood of horse-chestnut and linden, Bydgoszcz (Kaczmarek, Marquardt 2004; Kaczmarek et al. in press); litter, rotting wood, Bielinek Reserve (Skorupski, Łabędzki 2004); nest of *Haliaeetus albicilla* (L.) (Gwiazdowicz et al. 2006); soil, Karkonosze NP (Gwiazdowicz et al. 2006); Grzędy, Biebrza NP (Skorupski, Falencka-Jabłońska 2006); litter, soil, park-arboretum, Forest Culture Centre, Gołuchów (Gwiazdowicz, Mazurczak 2007) (Fig. 117).

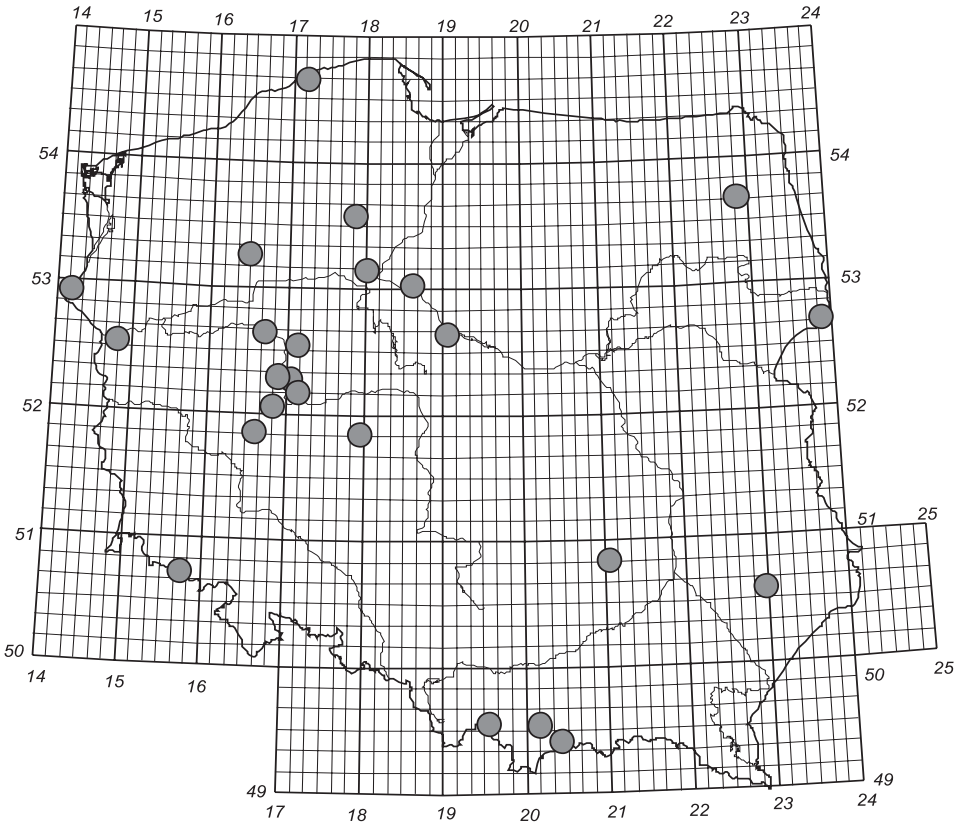

Fig. 117. *Celaenopsis badius* (C.L. Koch, 1839): geographic distribution in Poland.

Notes about *Celaenopsis*

The author has not found the type material. The oldest slides of this species were found in the Zoological Collection in Munich, and they originate from the Kneissl Collection from the years 1909–1910. These are slides K291 (female), K293 (female and male), K294 (male), K296 (male), which are described as *Celaenopsis cuspidata* (Kramer 1876). They were studied with regard to the supplementary description prepared by Kramer (1886).

Pleuronectocelaeno austriaca Vitzthum, 1926

Holotype: Zoological Collection in Munich (Zoologische Staatssammlung München), Germany, No V1222 (A20031171)

Paratype: absent

Collection in Poland: Poznań University of Life Sciences (Uniwersytet Przyrodniczy w Poznaniu), Department of Forest Protection, Poland

Etymology: (from Latin) *austriacus* – originating from Austria

Locus tipicus: Waidhofen, Austria, (48°49'00"N, 15°17'00"E)

Measurements

♀ – 650×480 μm
♂ – 620–630×470–480 μm
D – 550×380 μm
P – 530×340 μm
L – 460×290 μm

Morphology of femal

Dorsal. Oval body, wider in the upper part, from yellowish to dark brown. On the dorsal side setae are arranged irregularly and their number is approximately 140–160 (Fig. 118). Most of the setae are simple, and only individual setae on the edge of the shield may have small barbs. The length of the setae is comparable and it usually does not exceed 35 μm. The body is covered with a very delicate colliculate ornamentation.

Ventral. Small sternal shield, approximately 50 μm long; three pairs of simple setae 25 μm long on the shield. The shield is located between coxae I and II. Two triangular metasternal plates are located below (Fig. 119). There is one seta on these shields. Mesogynal-latigynal shield reaches from coxae III to the lower edge of the shield. There are approximately 40–60 simple setae, 20 μm long, on this

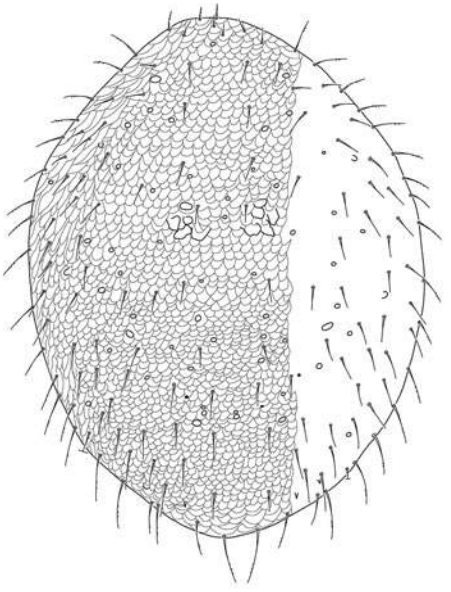

Fig. 118. *Pleuronectocelaeno austriaca* Vitzthum, 1926: dorsal idiosoma of female.

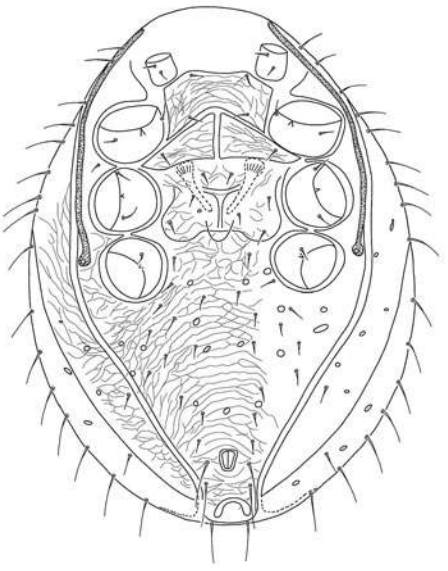

Fig. 119. *Pleuronectocelaeno austriaca* Vitzthum, 1926: ventral idiosoma of female.

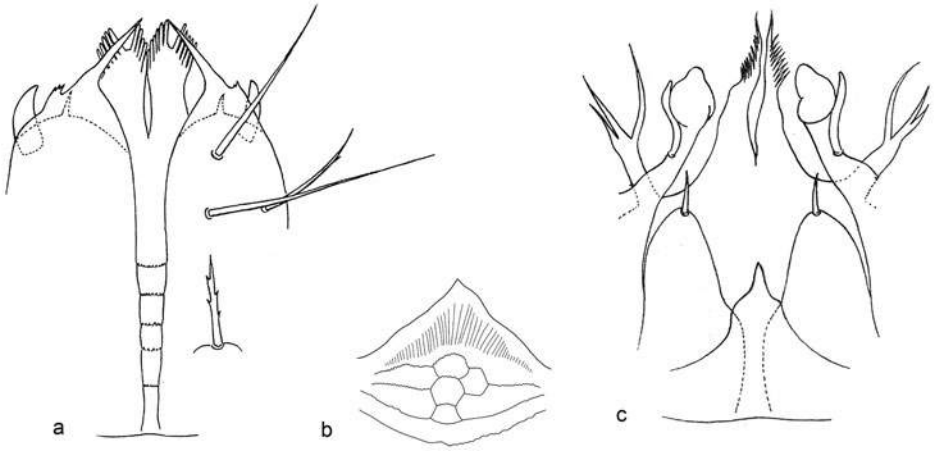

Fig. 120. *Pleuronectocelaeno austriaca* Vitzthum, 1926 – female: hypostome (a), epistome (b); male: hypostome (a, c after Hirschmann 1959).

shield. There is no post-anal shield. Circum-anal setae are longer than the other setae. Long ventri-marginal shields are located along the body and are relatively wide. Single, simple setae (usually one pair) located on these shields. Stigma in the region of coxae IV, whereas the other end of peritreme reaches coxae I. Ventral shields covered with a very delicate, poorly visible, reticulate ornamentation.

Gnathosoma. Small and corniculate corniculi. Hypostomal groove with five rows of tiny denticles. The longest setae are h3 and then h1, h2 and h4, which are pilose (Fig. 120a). Triangular epistome, pointed at the end. Delicate, reticulate ornamentation at the base (Fig. 120b). Fixed digit with over twenty tiny denticles, while the movable digit features one large tooth and approximately eight small ones.

Legs variable in length: I – 350 μm, II – 350 μm, III – 400 μm, IV – 500 μm.

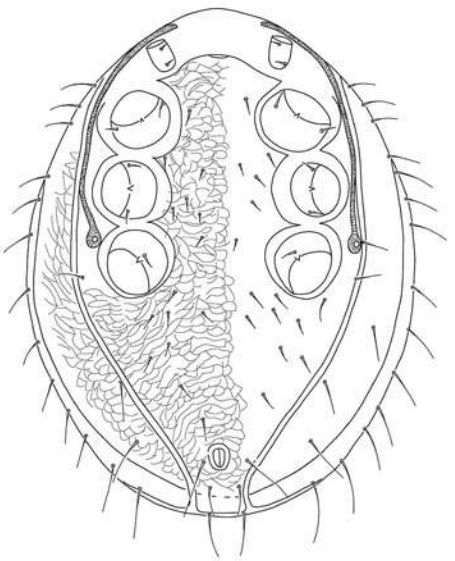

Fig. 121. *Pleuronectocelaeno austriaca* Vitzthum, 1926: ventral idiosoma of male.

Morphology of male

Dorsal. Dorsal side similar to the one found in the female. Oval, with a large number of simple setae. Young specimens which are poorly chitinized are yellow, whereas older ones which are more chitinized are brown.

Ventral. Genital orifice located on the edge of the sterni-ventral shield and it is usually poorly visible. The sterno-ventral shield occupies almost the entire ventral side and it features approximately 40 simple setae (Fig. 121). Ventri-marginal shields similar to those of the female. They are relatively wide and run to the lower edge of the idiosoma. There is no post-anal shield. Circum-anal setae are longer. Shields on the ventral side are covered with a delicate, poorly visible, reticulate ornamentation.

Gnathosoma. Hypostome differs significantly from the one found in the female (Fig. 120c). Epistome similar to that in the female. No spermatodactyl on chelicerae.

Legs variable in length: I – 350 μm, II – 350 μm, III – 400 μm, IV – 500 μm.

Morphology of deutonymph

Dorsal. Oval body, white with darker, light yellow shields. Three shields located on the dorsal side: pronotal one with 14 pairs of simple setae, mesonotal one with 11 pairs of simple setae and the opisthonotal one with two pairs of setae (Fig. 122). Setae on the dorsal side are variable in length. The shortest setae are

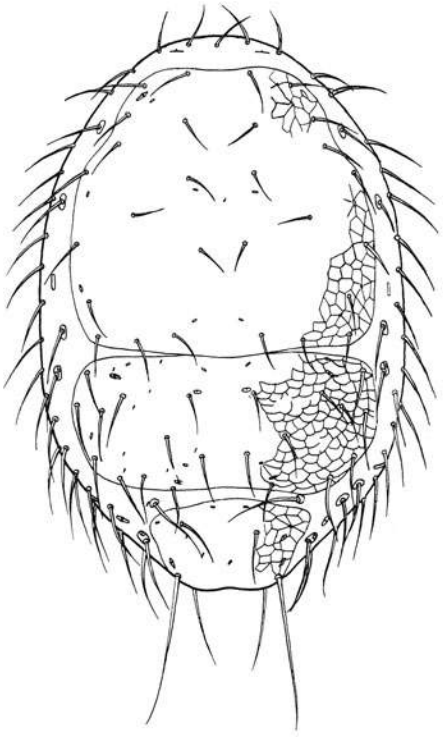

Fig. 122. *Pleuronectocelaeno austriaca* Vitzthum, 1926: dorsal idiosoma of deutonymph (after Hirschmann, Zirngiebl-Nicol 1961).

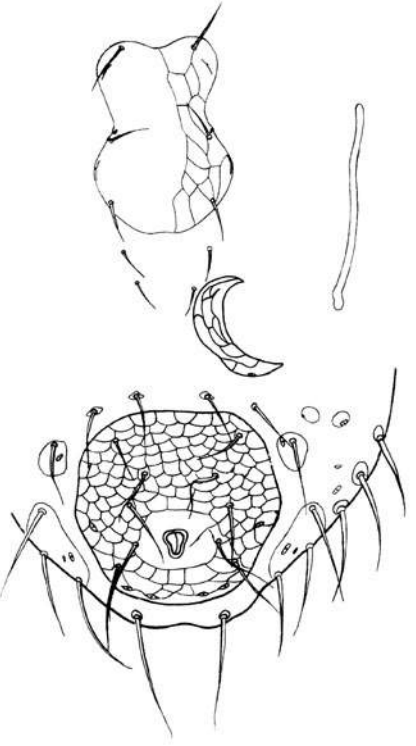

Fig. 123. *Pleuronectocelaeno austriaca* Vitzthum, 1926: ventral idosoma of deutonymph (after Hirschmann, Zirngiebl-Nicol 1961).

those in row 'j', whereas the longest ones are J5 (3×j4) and Z5 (5×j4). All three shields are covered with a very delicate, reticulate ornamentation. There are approximately 60 simple setae in the marginal part of the membrane around the shields.

Ventral. Between coxae II and III there is a sternal shield with three pairs of simple setae (st1–st3). Setae st4–st5 are outside the shield and they are slightly shorter than st1 (Fig. 123). Between setae st1 and st2 there is a narrowing of the sternal shield – the shield is the narrowest in this place. Between setae st2 and st3, on the other hand, the shield widens – the shield is the widest in this place. There is a large, curved coxal shield in the lower region of coxae IV. The ventri-anal shield is relatively large, slightly wider than long, usually with 10 setae. Both the sternal and the ventri-anal shields are covered with reticulate ornamentation. There are plates with three setae on both sides of the ventri-anal shield in the region of the anus. There are several circular sclerites and three pairs of setae located along the ventri-anal shield below coxae IV. Stigma in the region of coxae IV.

Gnathosoma. Hypostome, epistome and chelicerae similar to those of the female.

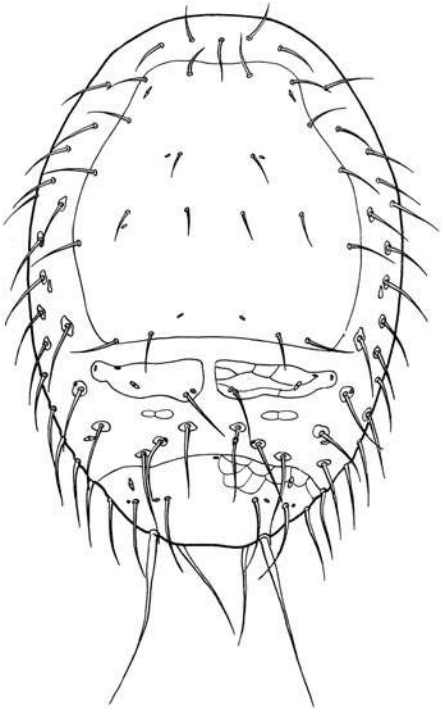

Fig. 124. *Pleuronectocelaeno austriaca* Vitzthum, 1926: dorsal idiosoma of protonymph (after Hirschmann, Zirngiebl-Nicol 1961).

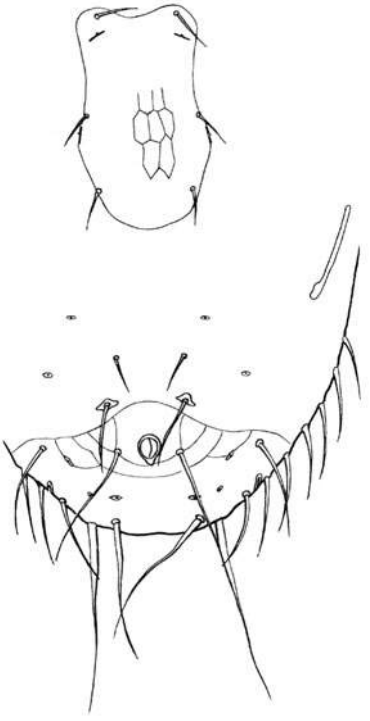

Fig. 125. *Pleuronectocelaeno austriaca* Vitzthum, 1926: ventral idiosoma of protonymph (after Hirschmann, Zirngiebl-Nicol 1961).

Morphology of protonymph

Dorsal. Oval body, milk white. The dorsal side with the pronotal shield, two mesonotal shields and a pygidial shield (Fig. 124). There are 10 simple setae on the pronotal shield, one seta on mesonotal shields and 5 setae on the pygidial shield. The shortest setae are setae j3-j5, whereas the longest ones are J5 (3.5×j4) and Z5 (6×j4). Moreover, there are single sclerites located on a membrane in the vicinity of mesonotal shields and between those shields and the pygidial shield. There are 24 pairs of simple setae around the body, located on small plates.

Ventral. Three pairs of simple setae on the sternal shield, of which st1 are slightly longer (Fig. 125). The shape of the shield similar to that of the deutonymph. The ventri-anal shield relatively small, with long para-anal setae. There are two pairs of setae between the sternal shield and the ventri-anal shield. Setae in the vicinity of the ventri-anal shield are located on plates. Peritremes are short, in the region of coxae III–IV.

Gnathosoma. Hypostome, epistome and chelicerae similar to those of the deutonymph.

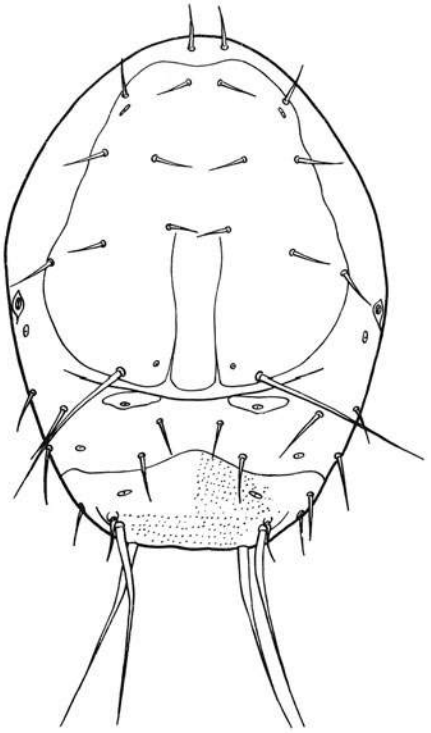

Fig. 126. *Pleuronectocelaeno austriaca* Vitzthum, 1926: dorsal idiosoma of larva (after Hirschmann, Zirngiebl-Nicol 1961).

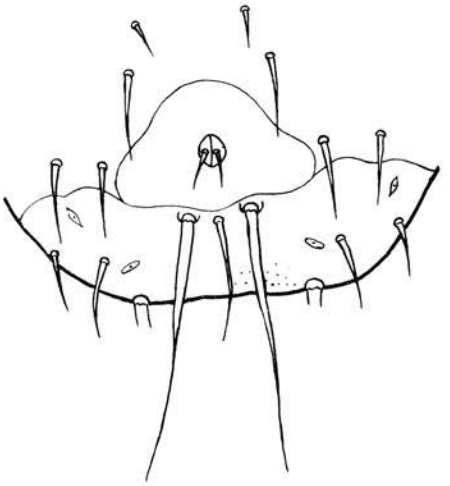

Fig. 127. *Pleuronectocelaeno austriaca* Vitzthum, 1926: ventral idiosoma of larva (after Hirschmann, Zirngiebl-Nicol 1961).

Morphology of larva

Dorsal. Oval body, milk white. The dorsal side with the pronotal shield with 8 pairs of setae, of which j4 are the shortest, and j5 are the longest (6×j4). Setae j1 are located outside the shield. There are two small mesonotal plates without setae under the pronotal shield, and the pygidial shield with five pairs of setae is located on the posterior of the dorsal side (Fig. 126). The longest setae on the pygidial shield are setae J5 and Z5, whose length is comparable to setae j5. There are five pairs of setae on a membrane between the pronotal shield and the pygidial shield. All setae on the dorsal side are simple.

Ventral. The anal shield is very small, triangular with rounded apices. Paraanal setae twice as long as the post-anal setae (Fig. 127).

Gnathosoma. Unlike the previously described developmental stages, the apex of the epistome is rounded and with tiny denticles.

Biology and ecology. Most frequently found under tree bark, in bark beetle galleries of *Ips* and *Scolytus* (Bregetova 1977d). Phoresy on *Scolytus laevis* (Bregetova 1977d) and on wing covers of *P. curvidens* and *I. acuminatus* (Michalski et al. 1985) was reported. Thus it may be concluded that phoresy is the basic method of transport and colonising bark beetle galleries.

Occurrence in the World: Europe, Asia, Africa, North and Central America (Bregetova 1977a), Iran (Gwiazdowicz, unpublished).

Occurrence in Poland: in anthills of *Formica polyctena* Foerster – Zielonka Experimental Forest (Wiśniewski 1980); in bark beetle galleries of *Cryphalus abietis* (Ratzeburg) – Roztocze NP (Michalski et al. 1992b; Michalski, Ratajczak 1994); *Cryphalus piceae* (Ratzeburg) – Świętokrzyski NP (Michalski, Ratajczak 1989); *Crypturgus pusillus* (Gyllenhal) – Piwnice, Olek Forest District (Kiełczewski, Wiśniewski 1983); *Dryocoetes autographus* (Ratzeburg) – Roztocze NP (Michalski et al. 1992b; Michalski, Ratajczak 1994); *Hylurgops palliatus* (Gyllenhal) – Roztocze NP (Michalski et al. 1992b; Michalski, Ratajczak 1994); *Ips acuminatus* (Gyllenhal) – Piwnice, Olek Forest District (Kiełczewski, Wiśniewski 1983); Świętokrzyski NP (Michalski et al. 1985); Łagów Forest District, Wymiarki Forest District, Świętokrzyski NP (Bałazy et al. 1987a); Świętokrzyski NP (Michalski, Ratajczak 1989); Roztocze NP (Michalski et al. 1992b; Michalski, Ratajczak 1994); Świętokrzyski NP (Kaczmarek, Michalski 1995a, c); *Ips amitinus* (Eichhoff) – Karkonosze NP (Kaczmarek, Michalski 1995a, c); *Ips cembrae* (Heer) – Gorce NP (Kaczmarek, Michalski 1995a, b, c); *Ips typographus* (L.) – Siemianice Experimental Forest (Kiełczewski, Wiśniewski 1983); Roztocze NP (Michalski et al. 1992b; Michalski, Ratajczak 1994); Białowieża NP, Gorce NP, Karkonosze NP, Lądek Zdrój Forest District (Kaczmarek, Michalski 1994, 1995a, b, c); *Pityogenes bidentatus* (Herbst) – Piwnice, Olek Forest District, Lubasz, Oborniki Forest District, Potasze, Zielonka Experimental Forest (Kiełczewski, Wiśniewski 1983); Świętokrzyski NP (Michalski et al. 1985; Michalski, Ratajczak 1989); *Pityogenes chalcographus* (L.) – Wolin NP, Puszczykowo, Wielkopolska NP, Potasze, Zielonka

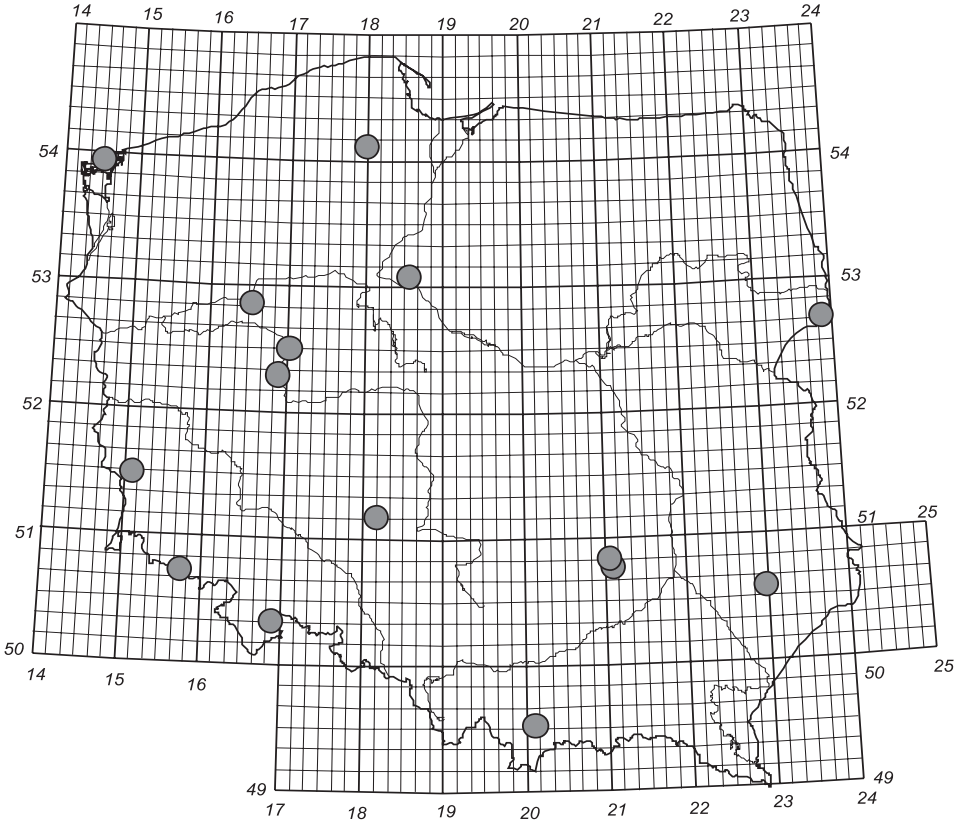

Fig. 128. *Pleuronectocelaeno austriaca* Vitzthum, 1926: geographic distribution in Poland.

Experimental Forest, Siemianice Experimental Forest (Kiełczewski, Wiśniewski 1983); Świętokrzyski NP (Michalski et al. 1985; Michalski, Ratajczak 1989); Strzelnica, Kościeżyna Forest District (Kaczmarek et al. 1992); Roztocze NP (Michalski et al. 1992b; Michalski, Ratajczak 1994; Kaczmarek, Michalski 1995c); *Pityokteines curvidens* (Germar) – Świętokrzyski NP (Michalski et al. 1985; Michalski, Ratajczak 1989; Kaczmarek, Michalski 1995c); *Pityokteines spinidens* (Reitter) – Świętokrzyski NP (Michalski, Ratajczak 1989); Roztocze NP (Michalski et al. 1992b; Michalski, Ratajczak 1994); *Pityophthorus pityographus* (Ratzeburg) – Roztocze NP (Michalski et al. 1992b; Michalski, Ratajczak 1994); *Polygraphus poligraphus* (L.) – Świętokrzyski NP (Michalski et al. 1985; Michalski, Ratajczak 1989); Roztocze NP (Michalski et al. 1992b; Michalski, Ratajczak 1994; Kaczmarek, Michalski 1995c); *Tomicus minor* (Hartig) – Piwnice, Olek Forest District, Potasze, Zielonka Experimental Forest (Kiełczewski, Wiśniewski 1983); Świętokrzyski NP (Michalski et al. 1985; Michalski, Ratajczak 1989); Roztocze NP (Michalski et al. 1992b; Michalski, Ratajczak 1994); Roztocze NP, Świętokrzyski PN, Wielkopolska NP (Gwiazdowicz, Skorupski 1996); rotting wood, under bark,

Białowieża NP (Gwiazdowicz 1998); under bark, Białowieża NP (Gwiazdowicz 1999b); Białowieża NP (Gwiazdowicz 2000a) (Fig. 128).

Notes about *Pleuronectocelaeno*

Athias-Henriot (1959) compared specimens of the genus *Pleuronectocelaeno* on the basis of selected biometric features. She found the specimens collected in Algeria to be morphologically different and therefore she described them as *Pleuronectocelaeno austriaca* var. *barbara*.

While conducting the present study morphological variability was also investigated with regard to this genus. Specimens which were investigated included not only those found in Central Europe but also those, for instance, from Iran. The most frequently observed variation concerned individual serrate setae located on the edge of the holodorsal shield. Their number was variable depending on the specimen. Barbs on the setae were less or more visible. It is difficult to clearly conclude what the cause of this is. An attempt to answer the question whether this type of setae is the result of inheriting certain features or simply a matter of the aging of the setae, which makes them more frayed, was made by Adamski et al. (2008). However, the issue has not been solved yet.

Schizocyrtillus josefinae Gwiazdowicz, 2002

Holotype: Poznań University of Life Sciences (Uniwersytet Przyrodniczy wPoznaniu), Department of Forest Protection – No BPN 284 (1F)

Paratypes: Poznań University of Life Sciences (Uniwersytet Przyrodniczy w Poznaniu), Department of Forest Protection – No BPN 278 (1F, 1M)

Etymology: species dedicated to Józefina Victoria Gwiazdowicz, the daughter of the author of the description.

Locus tipicus: Białowieża National Park, Poland (52°40'00"N, 23°50'00"E)

Measurements

♀ – 610–650×380–420 μm
♂ – 600×350 μm
D – unknown
P – unknown
L – unknown

Morphology of female

Dorsal. Idiosoma strongly chitinized, egg-shaped body, narrower at the top and at the bottom, while the widest in the region of coxae IV (Fig. 129). The dorsal side clearly protruding and covered with the holodorsal shield with approximately 80 simple setae (35–40 μm). Setae located in the posterior edge of the idiosoma are slightly longer (45 μm). The holodorsal shield clearly overlaps

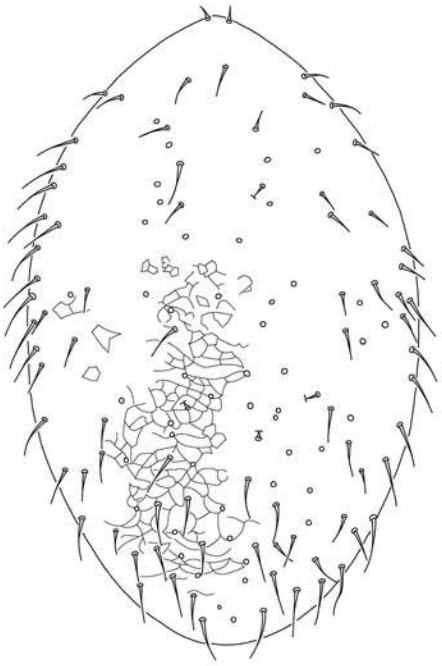

Fig. 129. *Schizocyrtillus josefinae* Gwiazdowicz, 2002: dorsal idiosoma of female.

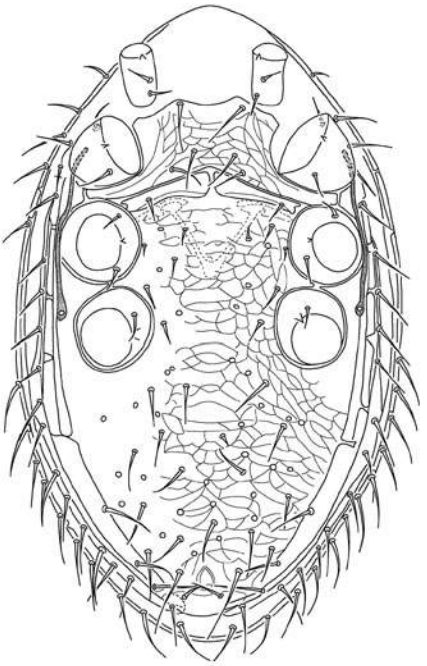

Fig. 130. *Schizocyrtillus josefinae* Gwiazdowicz, 2002: ventral idiosoma of female.

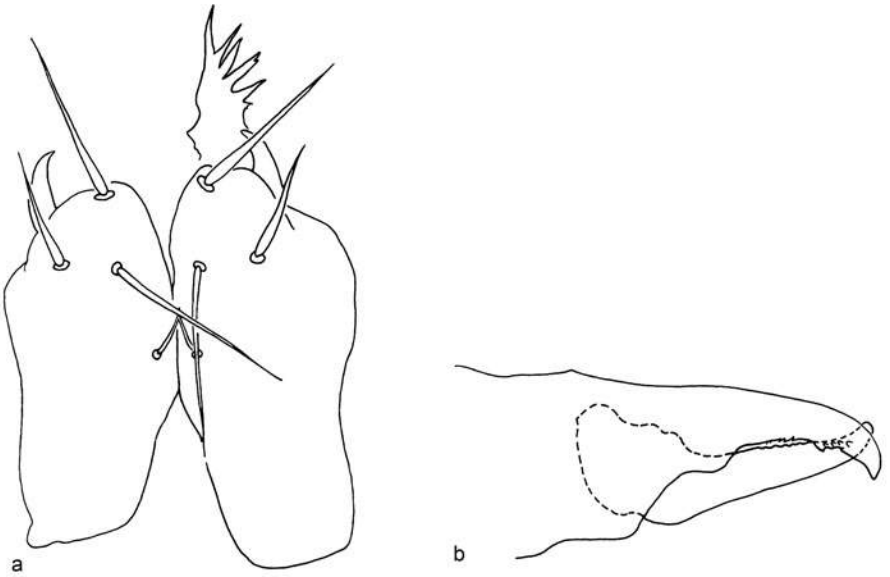

Fig. 131. *Schizocyrtillus josefinae* Gwiazdowicz, 2002, female: hypostome (a), chelicera (b) (after Gwiazdowicz 2002a).

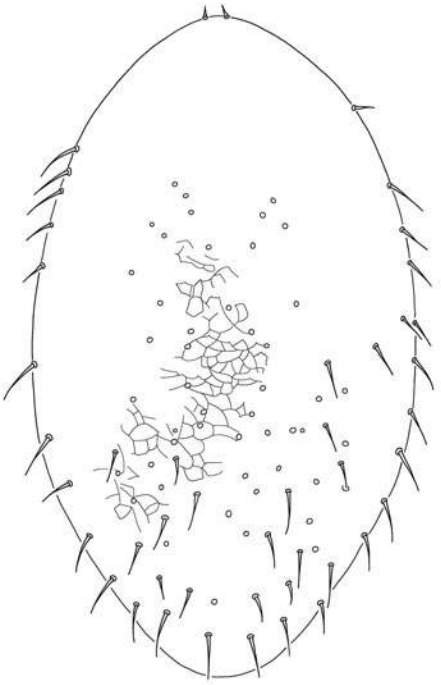

Fig. 132. *Schizocyrtillus josefinae* Gwiazdowicz, 2002: dorsal idiosoma of male.

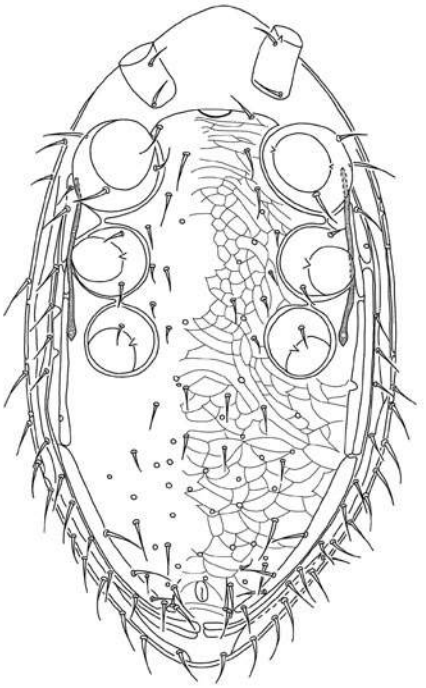

Fig. 133. *Schizocyrtillus josefinae* Gwiazdowicz, 2002: ventral idiosoma of male.

the ventral side. Reticulate ornamentation in the central and the posterior part of the body.

Ventral. The sternal shield is wider (250 μm) than long (60 μm). Its lower part reaches beyond coxa II and borders with two metasternal shields (Fig. 130). There are three pairs of simple sternal setae on the sternal shield, of which the longest ones are st1 (60 μm) and they are located on the edge of the shield. The remaining two pairs st2 and st3 are located between coxae II. The sternal shield is covered with a clearly reticulate ornamentation. Two metasternal shields, narrow and typical of the genus *Schizocyrtillus* (20×80–85 μm), are located between coxae II and coxae III. Their external edges, reaching nearly to coxa II, have a shallow indenture, the posterior part of the marginal shields is curved. There are single setae st4 (25 μm) on both metasternal shields. Mesogynal-latigynal shield located from coxae III to the lower edge of the shield. There are approximately 30 simple setae, 15–40 μm long, on this shield. The ornamentation on the ventri-anal shield is reticulate and poorly visible. A crescent, narrow post-anal shield, 20 μm long and 80 μm wide, is located below this shield, and it has a pair of simple setae. On the sides of the body, from coxa II to the post-anal shield, there are wide, composed of several parts, ventri-marginal shields. Peritremes reach from the middle of coxa II to the middle of coxa IV and they are terminated with a stigma.

Gnathosoma. Corniculate corniculi. All hypostomal setae are long and simple. The hypostomal seta h1 is 35 μm long, setae h2 and h3 are the longest of the setae – 60 μm. Seta h4 is the shortest of the hypostomal setae (Fig. 131a). Epistome is pointed, triangular, with several barbs on the sides (Fig. 134a). Fixed digit with one large tooth in the front and five smaller ones in the back, movable digit with four teeth of equal size in the front and five smaller ones in the back (Fig. 131b).

Legs variable in length: I – 400 μm, II – 375 μm, III – 350 μm, IV – 425 μm (Fig. 134b).

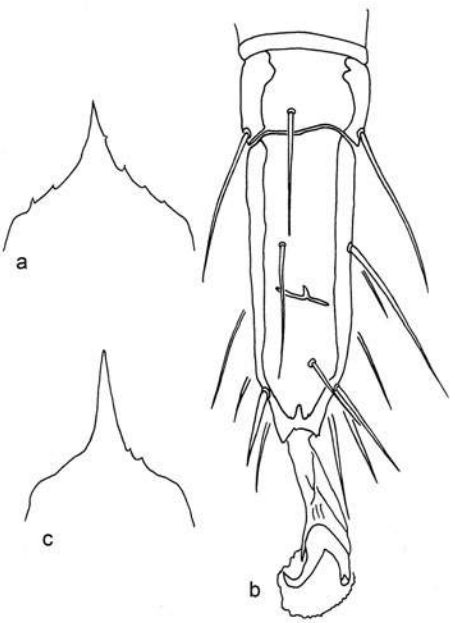

Fig. 134. *Schizocyrtillus josefinae* Gwiazdowicz, 2002, female: epistome (a), tarsus III (b); male: epistome (c) (after Gwiazdowicz 2002a).

Morphology of male

Dorsal. Idiosoma similar as in the female, strongly chitinized, with numerous simple setae (Fig. 132). The body shape, lengths of the setae and the ornamentation similar to those of the female.

Ventral. Genital orifice on the front edge of the sterno-ventral shield and similarly to males of other species from this genus – poorly visible. There are over 30 simple setae (20–40 μm) on the sterni-ventral shield. Setae st1–st3 are clearly longer than the other setae located between coxa II and coxa III (Fig. 133). Circum-anal setae are not as long as in the female. Their length is equal to st1. The sterni-ventral shield with reticulate ornamentation. The post-anal shield and the ventri-marginal shields, and the peritreme, similar to those of the female.

Gnathosoma. Epistome is sharpened and more pointed than in the female and with a smaller number of barbs (Fig. 134c). Chelicerae half the length of the female ones, the fixed digit and the movable digit curved.

Legs variable in length: I – 380 μm, II – 350 μm, III – 325 μm, IV – 400 μm.

Biology and ecology. Probably similar requirements to those of other species from the family Celaenopsidae, i.e. bark beetle galleries and anthills.

Occurrence in the World: Poland (Gwiazdowicz 2002a).

Occurrence in Poland: sawdust under the bark of dry pine, anthill of *Formica polyctena* Foerster, Białowieża NP (Gwiazdowicz 2002a) (Fig. 135).

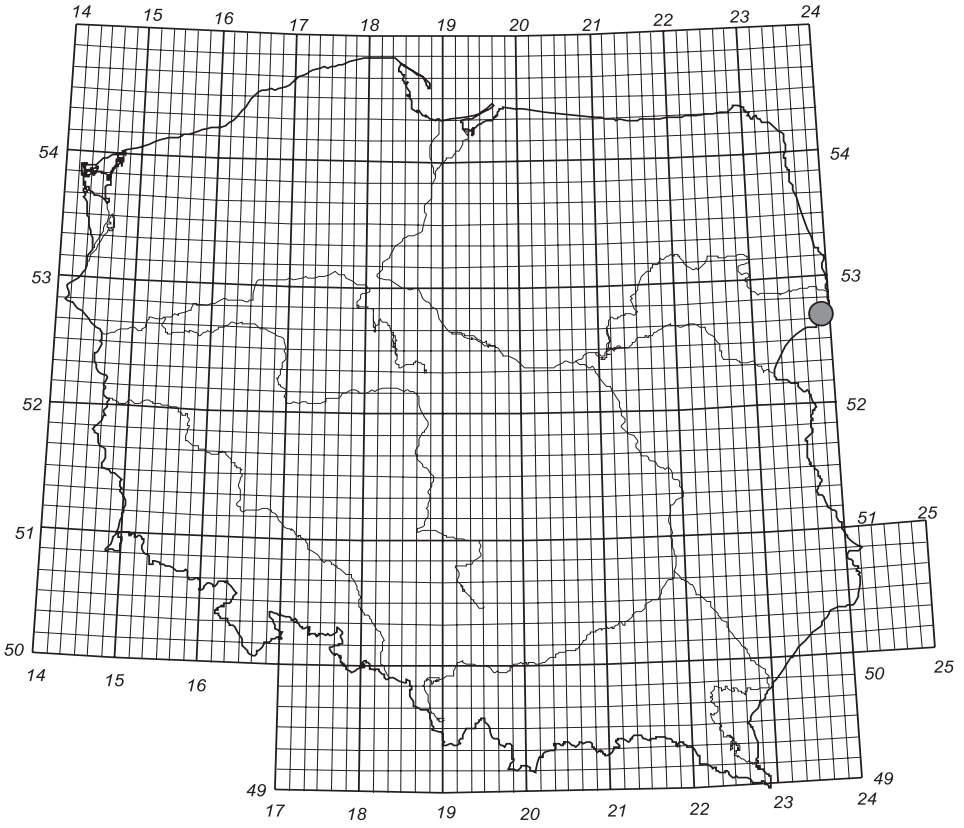

Fig. 135. *Schizocyrtillus josefinae* Gwiazdowicz, 2002: geographic distribution in Poland.

Notes about *Schizocyrtillus*

The genus *Schizocyrtillus* was described by Kinn (1970), on the basis of specimens found in feeding layers of *Scolytinae* under bark of *Pinus monophylla* Torr. et Frém. in California. Only two species of this genus have been described since then and the currently known ones include *Schizocyrtillus lathrius* Kinn, 1970, *S. rarus* Khaustov, 1999 and *S. josefinae* Gwiazdowicz 2002 (Khaustov 1999; Gwiazdowicz 2002a).

It may be concluded that mites of the genus *Schizocyrtillus* are relatively rare, therefore the knowledge about their biology and ecology is poor. Many issues concerning the acarofauna of anthills and bark beetle galleries have been investigated in Poland. As a result of this research over 50 studies have been published, however a species from this genus had not been reported until 2002.

Microgynioidea

Microgyniidae Trägårdh, 1942

Idiosoma. Oval body, 0.3–0.8 mm long, milk white. The dorsal side of adult specimens and of deutonymphs with three or four shields – pronotal, mesonotal (pair or single) and pygidial. Several basic types of setea, such as simple, serrate and pilose, can be distinguished on these shields. The chaetotaxy is hypertrichous.

The sternal shield of the female is split into two parts below setae st2. The genital shield is uniform or in the form of two sclerites. One pair of genital setae. The genitial orifice of the male is located below coxae III–IV. The ventri-anal shield is usually present in both sexes. Short peritremes reach coxae II.

Gnathosoma. The cheliceral digits are weakly dentate and those of the male are not modified for the sperm transfer.

Legs and palps. The claws on legs I are sessile; femur, genu, and tibia I each with 10 setae; tibia II–IV with 9 setae (2 1/1, 2/1 2); tarsus IV has 18 setae at maximum, but without setae av4 and pv4. Pair II of limbs in the female without apophysis. Palp apotele 2-tined.

Microgynium **Trägårdh, 1942**
Type species: *Microgynium rectangulatum* Trägårdh, 1942
Microsejus **Trägårdh, 1942**
Type species: *Microsejus truncicola* Trägårdh, 1942

Microgynium rectangulatum Trägårdh, 1942

Lectotypes: Swedish Museum of Natural History, Stockholm, Sweden, no Mt 341 (1F, 1M)

Paralectotypes: Swedish Museum of Natural History, Stockholm, Sweden, no: Mt 339 (1M), Mt 342 (1D), Mt 393 (1F)

Collection in Poland: Poznań University of Life Sciences (Uniwersytet Przyrodniczy w Poznaniu), Department of Forest Protection, Poland

Etymology: (from Latin) *rectangulatum* – rectangular

Locus typicus: Kulbäcksliden, Sweden (64°12'00"N, 19°33'00"E)

Measurements

♀ – 360–410×180–200 μm
♂ – 320–350×140–190 μm
D – 320–340×160 μm
D(ph) – lack of data
P – 320–330×140–160 μm
L – 180×120 μm

Morphology of female

Dorsal. Three shields located on the dorsal side. The pronotal shield is the largest (200×170–180 μm), the mesonotal shield is located below (90–100×170–

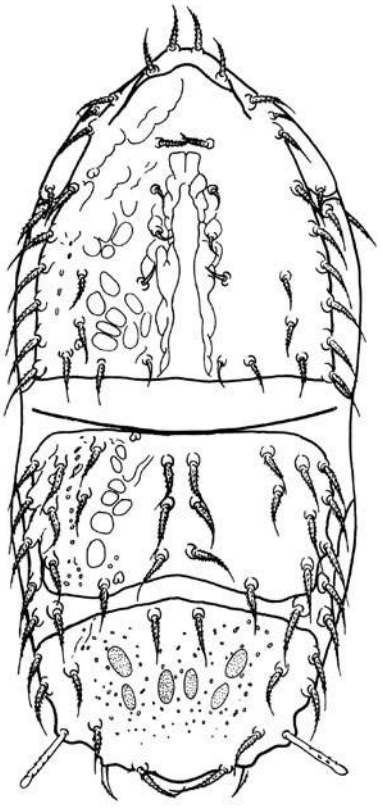

Fig. 136. *Microgynium rectangulatum* Trägårdh, 1942: dorsal idiosoma of female (after Hirschmann, Zirngiebl-Nicol 1961).

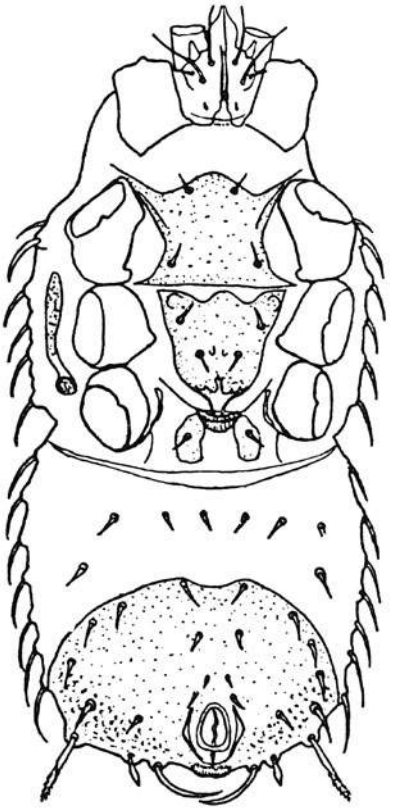

Fig. 137. *Microgynium rectangulatum* Trägårdh, 1942: ventral idiosoma of female (after Trägårdh 1942).

175 μm), and the pygidial shield is at the very bottom (100–120×160–170 μm) (Fig. 136). Pilose setae are located on these shields. 19 pairs on the pronotal shield, 12 pairs on the mesonotal shield and 8 pairs on the pygidial shield. Setae j1 are 30 μm long, the remaining seate in row "j": 20 μm long, while setae on the other shields also 30 μm long. The longest setae are setae S5 (50 μm), which have a hyaline sheath. All shields are covered with granulate ornamentation.

Ventral. The sternal shield is split into two parts, each of them has two pairs of acicular setae. Below, in the region of coxae IV, there is a split, very small epigynial shield with one pair of setae. There is a ventri-anal shield (110×140–150 μm) with 9 pairs of setae at the bottom of the ventral part (Fig. 137).

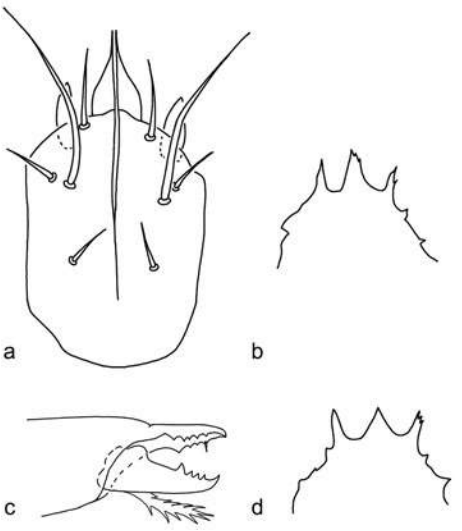

Fig. 138. *Microgynium rectangulatum* Trägårdh, 1942 – female: hypostome (a), epistome (b), chelicera (c); male: epistome (d).

Gnathosoma. Corniculate corniculi. Hypostomal setae variable in length: h1 – 20 μm, h2 – 10 μm, h3 – 40 μm, h4 – 10 (Fig. 138a). These setae are usually simple, although in some specimens there are small barbs on the setae. Hypostomal groove is very narrow. Epistome consists of three apices, which sometime have tiny denticles (Fig. 138b). Fixed digit with 7–9 teeth and pilus dentilis, while the movable digit has three small and one large tooth. Underneath the movable digit there are brush-like processes (Fig. 138c).

Legs variable in length: I – 215 μm, II – 200 μm, III – 175 μm, IV – 225 μm.

Morphology of male

Dorsal. The dorsal side of the male is similar to that of the female and consists of the pronotal shield (190×150 μm), the mesonotal shield (75×140 μm) and the pygidial shield (90×120 μm) (Fig. 139). In many specimens the dorsal setae from row 'R' are located on the mesonotal shield, therefore the number of setae on this shield is 15 pairs in some cases. Setae are pilose, and the sculpture is granulate.

Ventral. The sternal shield of the male, as in the female, consists of two parts. The genital orifice (25×20 μm) is located in the region of coxae III (Fig. 140). Four pairs of simple sternal setae are 10 μm long. There is a ventri-anal shield on the posterior idiosoma. Stigma between coxae III–IV, peritreme shorter reaching the beginning of coxae II.

Gnathosoma similar to that in the female. Epistome is presented in Fig. 138d.

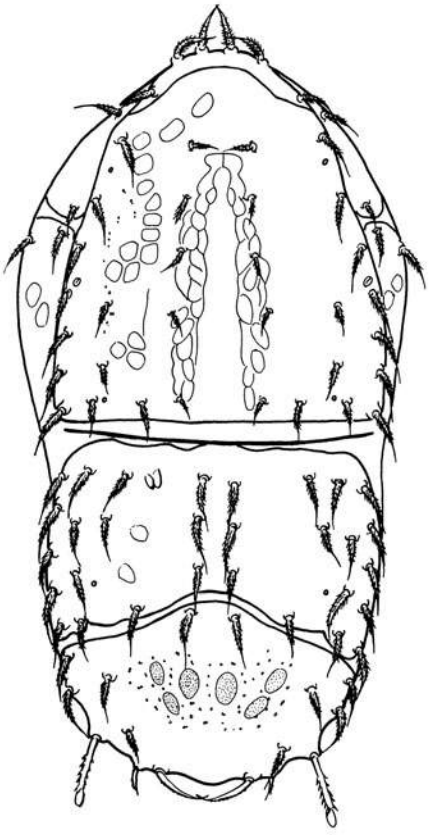

Fig. 139. *Microgynium rectangulatum* Trägårdh, 1942: dorsal idiosoma of male, (after Hirschmann, Zirngiebl-Nicol 1961).

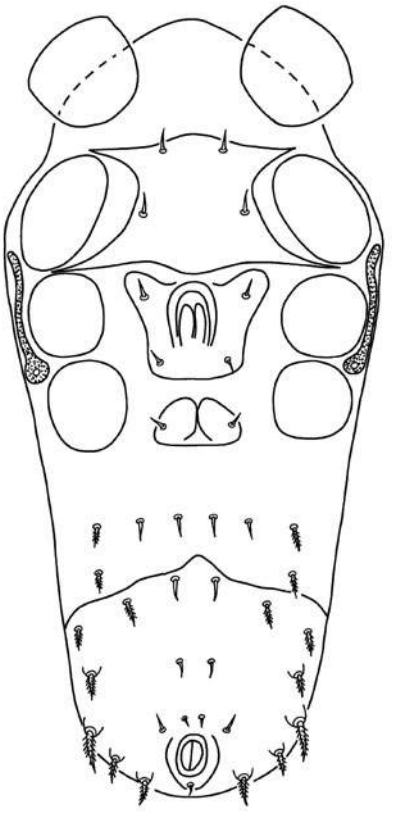

Fig. 140. *Microgynium rectangulatum* Trägårdh, 1942: ventral idiosoma of male.

Legs variable in length: I – 205 μm, II – 190 μm, III – 175 μm, IV – 225 μm.

Morphology of deutonymph

Dorsal. There are four shields on the dorsal side: pronotal (170×140 μm), two mesonotal shields (75×60 μm) and the pygidial shield (80×115 μm) (Fig. 141). There are 15 pairs of setae on the pronotal shield, four pairs on the mesonotal shield and six pairs on the pygidial shield. Setae j1 25 μm long, the remaining ones in the row 'j' – 10 μm long. Other dorsal setae are 20–25 μm long, and only seta S5 is longer – 50 μm.

Ventral. There are four pairs of simple setae (st1–st3) on the sternal shield 10 μm long. The ventri-anal shield of the size 90×115 μm with nine pairs of setae (Fig. 142). There are four pairs of setae between the sternal shield and the ventri-anal shield. Peritremes are short and located in the region of coxae III.

Gnathosoma as in adult specimens.

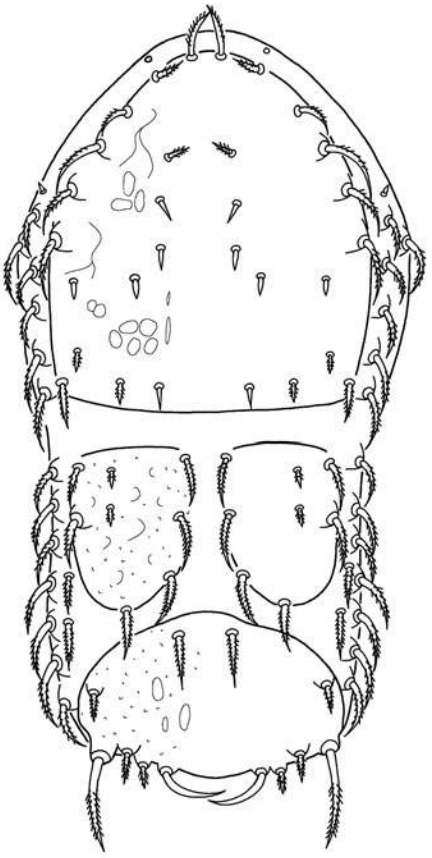

Fig. 141. *Microgynium rectangulatum* Trägårdh, 1942: dorsal idiosoma of deutonymph.

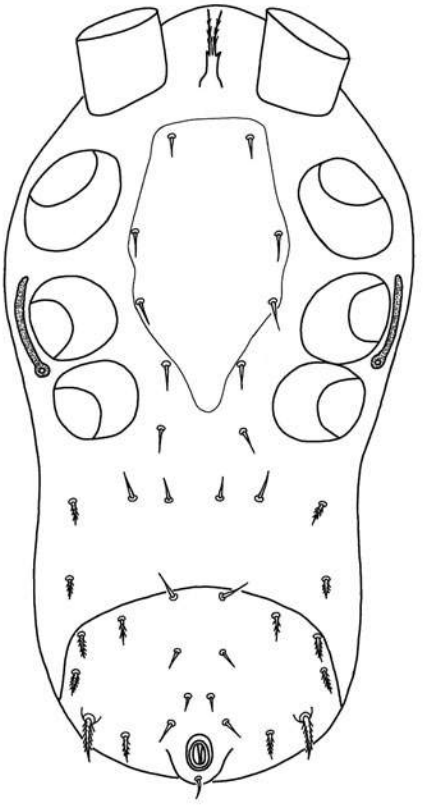

Fig. 142. *Microgynium rectangulatum* Trägårdh, 1942: ventral idosoma of deutonymph.

Legs variable in length: I – 170 μm, II – 150 μm, III – 140 μm, IV – 190 μm.

Morphology of phoretic deutonymph

Dorsal. There are two shields on the dorsal side, pronotal shield with 19 pairs of setae and the opisthonotal shield with 23 pairs of setae (Fig. 143). All dorsal setae are pilose, more or less of the same length and only setae J5 and S5 are several times longer, bluntly ended, smooth or with delicate barbs. Sculpture irregular, reticulate-foveate.

Ventral. Four pairs of simple setae on the sternal shield. Ventri-anal shield is heart-shaped with six pairs of setae. There are three pairs of setae between the sternal shield and the ventri-anal shield, and two pairs of setae in direct contact with the ventri-anal shield (Fig. 144). Peritreme is short, in the region of coxae III.

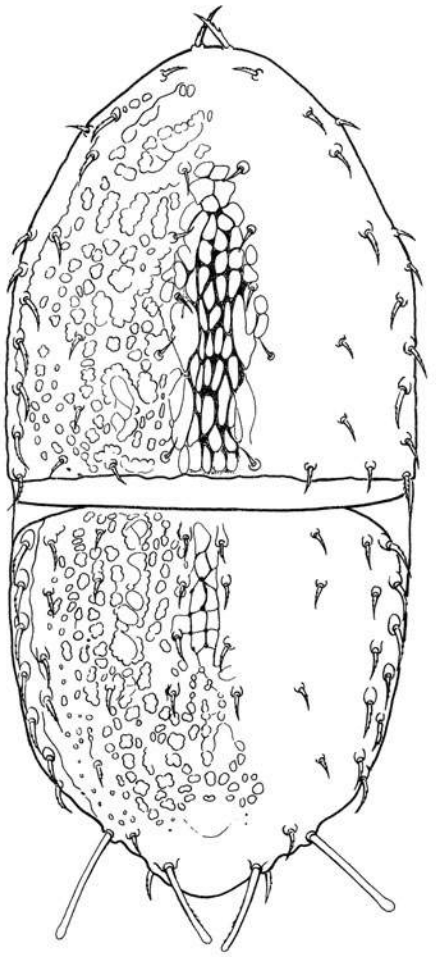

Fig. 143. *Microgynium rectangulatum* Trägårdh, 1942: dorsal idiosoma of phoretic deutonymph (after Hirschmann, Zirngiebl-Nicol 1961).

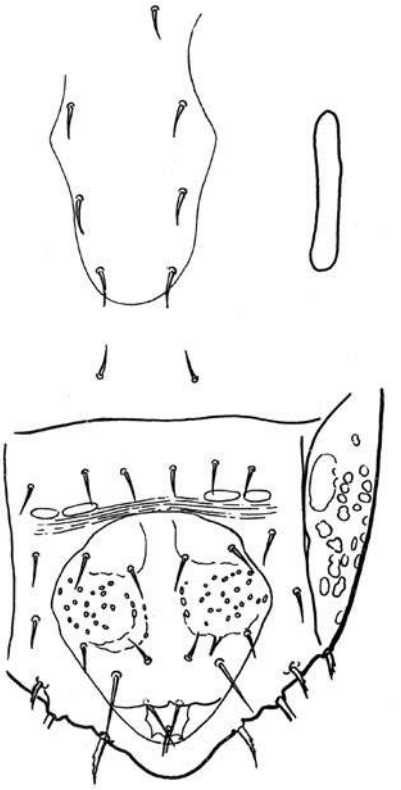

Fig. 144. *Microgynium rectangulatum* Trägårdh, 1942: ventral idiosoma of phoretic deutonymph (after Hirschmann, Zirngiebl-Nicol 1961).

Gnathosoma. Epistome consists of three apices, of which the middle one is higher than the lateral ones. Unlike adult specimens the edges of the epistome are smooth, without denticles.

Morphology of protonymph

Dorsal. The pronotal shield (150×140 μm) with 12 pairs of setae. Setae j1, 20 μm long, the remaining ones in the row 'j', 10 μm long. Other dorsal setae are approximately 20 μm long (Fig. 145). There are three mesonotal plates located below. The first ones are the largest (15×20 μm), the next ones are slightly smaller (6×15 μm), and the third ones are the smallest (3×5 μm). The pygidial

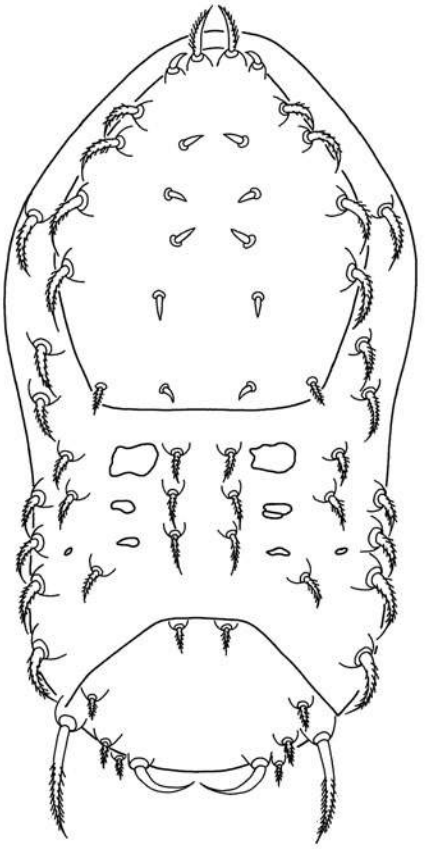

Fig. 145. *Microgynium rectangulatum* Trägårdh, 1942: dorsal idiosoma of protonymph.

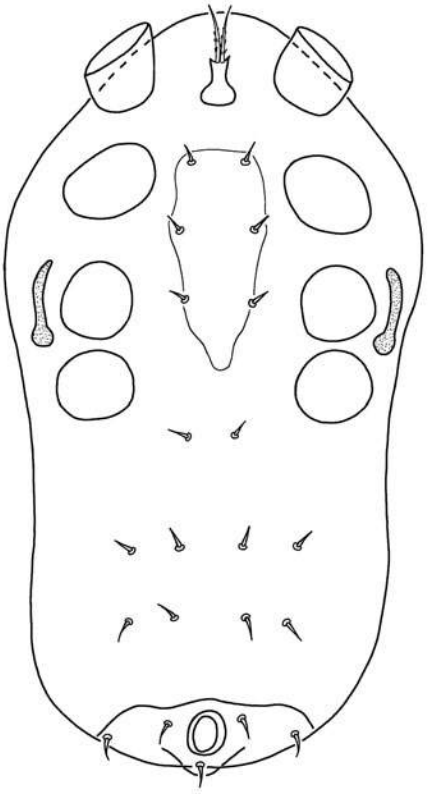

Fig. 146. *Microgynium rectangulatum* Trägårdh, 1942: ventral idiosoma of protonymph.

shield of the size 65×85 μm with six pairs of setae. Setae S5 50 μm long. All setae placed on tubercles.

Ventral. The sternal shield is narrow and long, there are three pairs of simple setae on it, 10 μm long (Fig. 146). The ventri-anal shield is small and wide (45×95 μm) with five setae. There are four pairs of setae between the shields. Peritremes are short and located in the region of coxae III.

Gnathosoma similar to that of the deutonymph.

Legs variable in length: I – 170 μm, II – 160 μm, III – 150 μm, IV – 175 μm.

Morphology of larva

Dorsal. There are 9 pairs of setae on the pronotal shield, of which z5 is the longest (Fig. 147). There are three pairs of setae on the pygidial shield, while there are 7 pairs of setae on a membrane between shields.

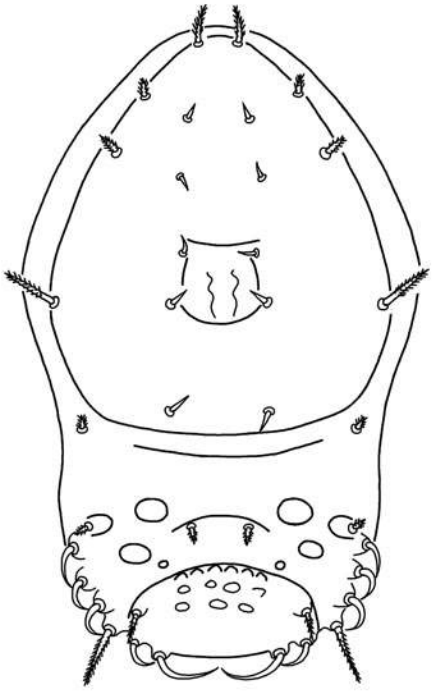

Fig. 147. *Microgynium rectangulatum* Trägårdh, 1942: dorsal idiosoma of larva.

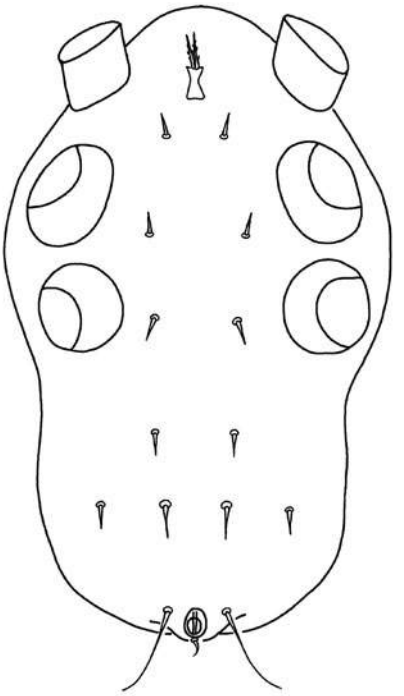

Fig. 148. *Microgynium rectangulatum* Trägårdh, 1942: ventral idiosoma of larva.

Ventral. There are six pairs of setae on the ventral side. Para-anal setae are at least 4 times longer than the post-anal setae. All ventral seate are simple (Fig. 148).

Gnathosoma. Epistome consists of three apices of more or less equal height. The middle one without denticles on the edges, while the lateral ones with denticles.

Biology and ecology. Females usually lay one egg (170–180×140–150 μm). The species is most frequently reported from rotting wood, bark beetle galleries, litter, from among tree roots and from rodent nests.

Occurrence in the World: Palearctic.

Occurrence in Poland: in bark beetle galleries of *Ips typographus* (L.) – Gorce NP, Świętokrzyski NP (Kaczmarek, Michalski 1994, 1995b, c); Gorce NP, Słowiński NP, Świętokrzyski NP (Gwiazdowicz, Skorupski 1996); rotting wood, under bark, litter, Pieniny NP (Skorupski, Gwiazdowicz 1996); litter, Pieniny NP (Skorupski, Gwiazdowicz 1997); rotting wood, Białowieża NP (Gwiazdowicz 1998); under

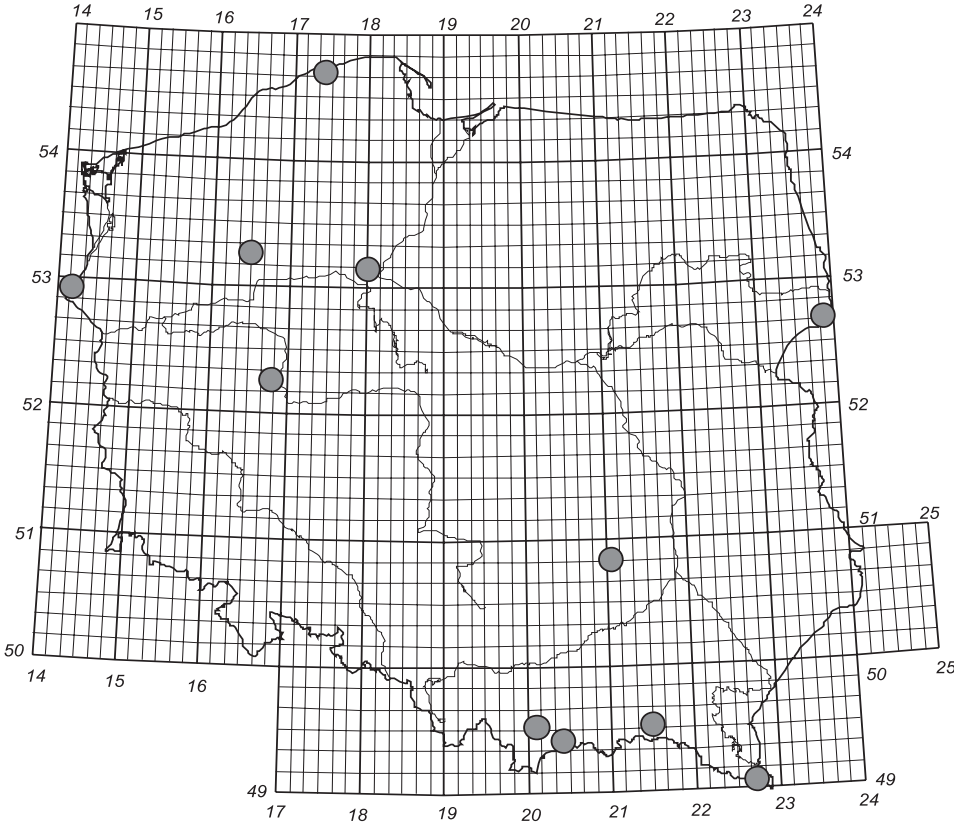

Fig. 149. *Microgynium rectangulatum* Trägårdh, 1942: geographic distribution in Poland.

bark, Białowieża NP (Gwiazdowicz 1999b); Bieszczady NP (Gwiazdowicz, Sznajdrowski 2000); anthills, Wielkopolska NP (Skorupski 2000, 2001); Białowieża NP (Gwiazdowicz 2000a); fruiting bodies, Wałcz Forest District (Gwiazdowicz, Łakomy 2002); rotting wood, Magura NP (Skorupski et al. 2004); rotting wood, Bielinek Reserve (Skorupski, Łabędzki 2004); rotting wood of linden, Bydgoszcz (Kaczmarek et al. in press) (Fig. 149).

Notes about *Microgynium*

When describing the ventral side of the male of this species Trägårdh (1942) neither drew the sternogenital shield nor presented its description. Hirschmann and Zirngiebl-Nicol (1961) presented this shield as uniform. However, it was noticed in the speciemns studied here that the sternal shield is split and, as in the female, consists of two parts.

Differences were also reported when comparing the ventral side of the female drawn by Hirschmann and Zirngiebl-Nicol (1961). According to those authors the sternal shield is uniform, not divided. It is difficult to clearly conclude whether this is due to their mistake or whether it results from the individual variability

of the studied mites. No specimens which were the basis for the drawing were found in the Hirschmann collection located in the Zoologische Staatssammlung München.

Microsejus truncicola Trägårdh, 1942

Lectotype: Swedish Museum of Natural History, Stockholm, Sweden, no Mt. 348 (1F)

Paralectotypes: Swedish Museum of Natural History, Stockholm, Sweden, no Mt 234 (1F), Mt 238 (1F, 1M), Mt. 348 (1F)

Collection in Poland: Poznań University of Life Sciences (Uniwersytet Przyrodniczy w Poznaniu), Department of Forest Protection, Poland

Etymology: (from Latin) *truncus* – trunk, *colo* – inhabits, *truncicola* – inhabiting trunks

Locus typicus: Kulbäcksliden, Sweden (64°12'00"N, 19°33'00"E)

Measurements
♀ – 370–420×180–230 μm
♂ – 320×170 μm
D – 290×160 μm
P – 280–290×155–160 μm
L – 220–260×145–195 μm

Morphology of female

Dorsal. Oval body, white with four shields on the dorsal side (Fig. 150). The pronotal shield is the largest (210–220×200–220 μm), two mesonotal shields are located below (80–90×60–65 μm), and the pygidial shield is at the very bottom (90–95×110–115 μm). Setae with delicate edges are located on these shields. 44 pairs on the pronotal shield, 7 pairs on the mesonotal shield and 4 pairs on the pygidial shield. Most of the dorsal setae are 25 μm long, while setae J5, Z5 and S5 are approximately 50 μm long. All shields are covered with irregular, reticulate-foveate ornamentation.

Ventral. The sternal shield is split into two parts, each of them has two pairs of simple setae (20 μm) (Fig. 151). The first shield is trapezoid (60×60 μm), located between coxae II, while the other one is semi-circular (50×90 μm) and located between coxae III. Below, in the region of coxae IV, there is the epigynial shield (60×100 μm). There is a ventri-anal shield (100–110×170–180 μm) with 11 setae (20 μm) at the bottom of the ventral part. There are seven pairs of setae (20 μm) between the epigynial shield and the ventri-anal shield. Stigma in the region of coxae III/IV, while the other end of the peritreme reaches coxae II. The peritremal shield is small.

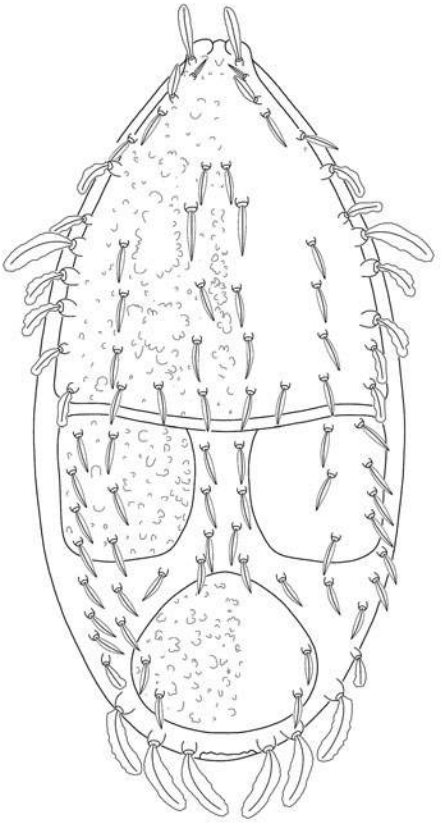

Fig. 150. *Microsejus truncicola* Trägårdh, 1942: dorsal idiosoma of female.

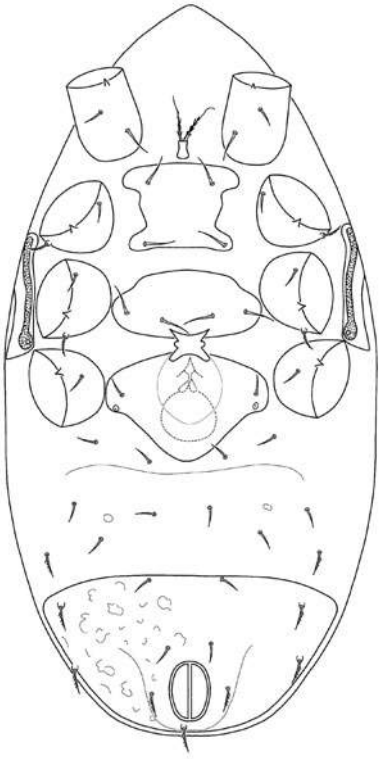

Fig. 151. *Microsejus truncicola* Trägårdh, 1942: ventral idiosoma of female.

Gnathosoma. Corniculate corniculi. Hypostomal setae variable in length: h1 – 35 μm, h2 – 15 μm, h3 – 60 μm, h4 – 15 μm (Fig. 152a). Epistome consists of two apices, whose external edges are dentate (Fig. 152b). Fixed digit is longer (30 μm) and it has four teeth, while the movable digit is shorter (25 μm) and it has two teeth (Fig. 152c).

Legs variable in length: I – 325 μm, II – 300 μm, III – 275 μm, IV – 400 μm.

Morphology of male

Dorsal. Dorsal side similar to the one found in the female.

Ventral. There are four pairs of setae on the sternogenital shield, which is located below coxae I and reaching coxae IV. Genital orifice in the region of coxae III/IV (Fig. 153). The ventri-anal shield is bathtub-shaped with 13 setae, covered with punctate ornamentation. The post-anal seta is longer than para-anal setae. There are six pairs of setae located between the sterni-genital shield and the ventri-anal shield. Stigma in the region of coxae III/IV, while the other end of the peritreme reaches coxae II.

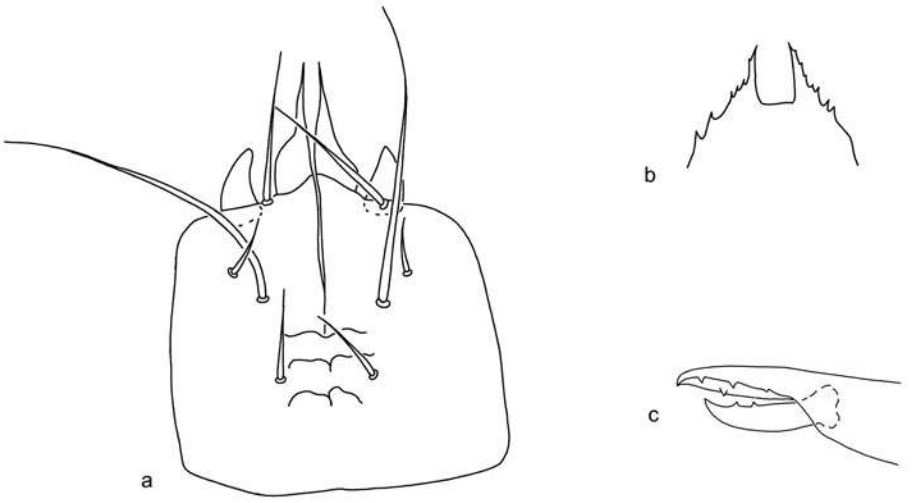

Fig. 152. *Microsejus truncicola* Trägårdh, 1942, female: hypostome (a), epistome (b), chelicera (c).

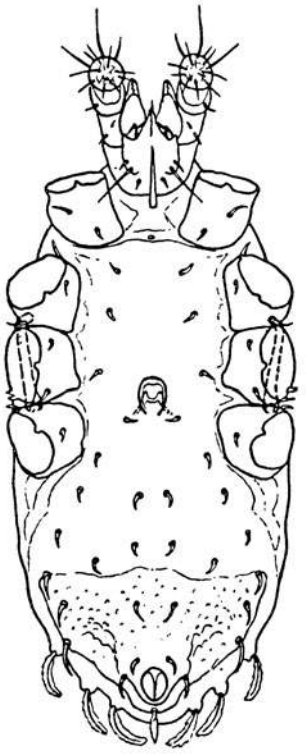

Fig. 153. *Microsejus truncicola* Trägårdh, 1942: ventral idiosoma of male (after Trägårdh, 1942).

Gnathosoma. Hypostome, epistome and chelicerae similar to those of the female.

Legs variable in length: I – 325 μm, II – 285 μm, III – 265 μm, IV – 375 μm.

Morphology of deutonymph

Dorsal. As in adult specimens there are four shields with irregular reticulate-foveate ornamentation on the dorsal side (Fig. 154). There are usually 20 pairs of setae on the pronotal shield. Setae on these shields are slightly shorter than in the female and the male.

Ventral. There are four pairs of simple setae on the sternal shield. A relatively large anal orifice (Fig. 155). Post-anal seta clearly shorter than the other ventral setae. Stigma in the region of coxae III/IV, while the other end of the peritreme reaches coxae II.

Gnathosoma. Hypostome, epistome and chelicerae as in adults.

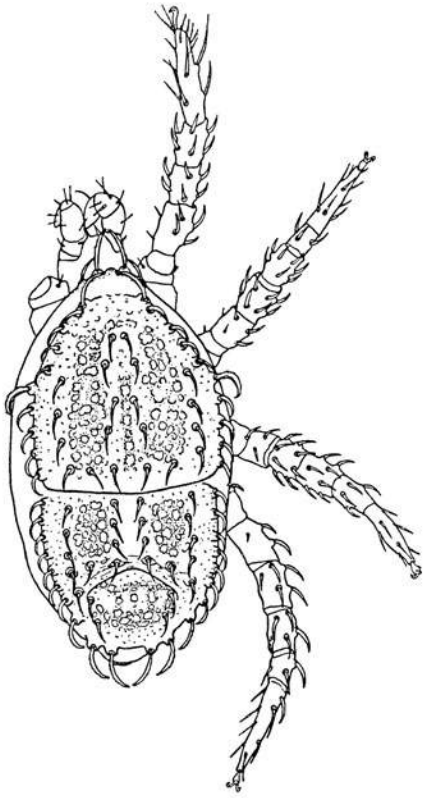

Fig. 154. *Microsejus truncicola* Trägårdh, 1942: dorsal idiosoma of deutonymph (after Trägårdh, 1942).

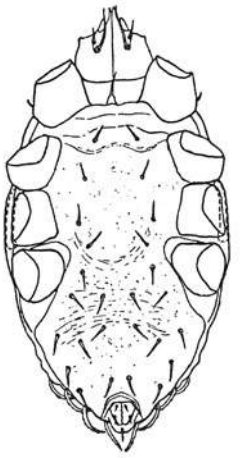

Fig. 155. *Microsejus truncicola* Trägårdh, 1942: ventral idosoma of deutonymph (after Trägårdh, 1942).

Legs variable in length: I – 260 μm, II – 235 μm, III – 225 μm, IV – 310 μm.

Morphology of protonymph

Dorsal. Elongated body, milk white with four shields (Fig. 156). There are 11 pairs of setae on the pronotal shield, while seta j1 is outside the shield. There are two oval mesonotal plates below, without setae. There is also an oval pygidial shield in the posterior part of idiosoma, usually with two pairs of setae. Setae J5 and Z5 are located outside the shield. There are four pairs of setae between the pronotal and the pygidial shields, and there are 12 setae on each side on the edges of the idiosoma. The longest setae are j1 and J5 (3×j4). All setae on tubercles and surrounded by a hyaline sheath. Shields are covered with irregular, scrobiculate ornamentation.

Ventral. Tritosternum with enlarged base and one lacinia (Fig. 158d). There are several tiny denticles in the central part of the tritosternum. Three pairs of simple setae on the sternal shield (st1–st3). The anal shield is slightly wider than long with three circum-anal setae of the same length. There are three pairs

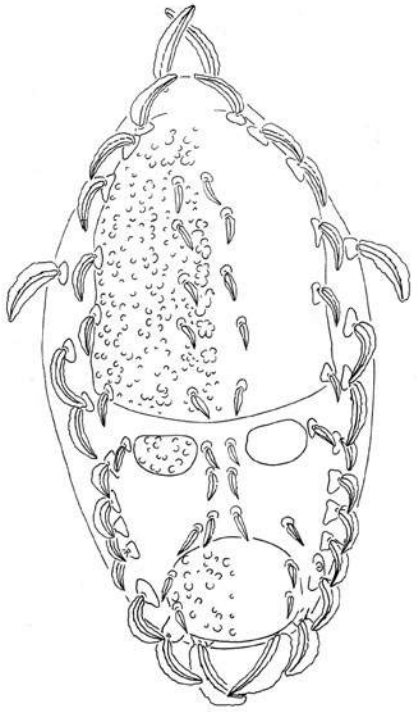

Fig. 156. *Microsejus truncicola* Trägårdh, 1942: dorsal idiosoma of protonymph (after Wiśniewski, Hirschmann 1991).

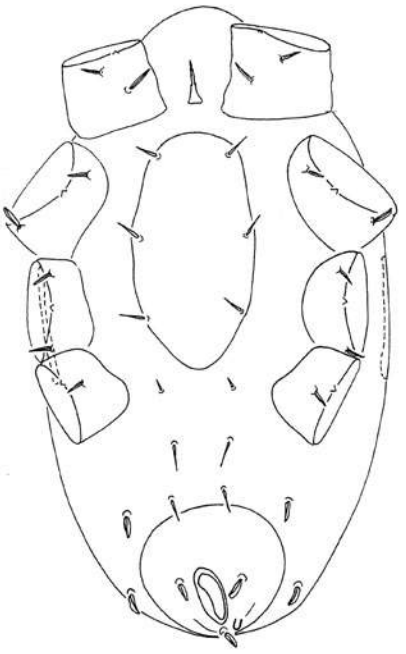

Fig. 157. *Microsejus truncicola* Trägårdh, 1942: ventral idiosoma of protonymph (after Wiśniewski, Hirschmann 1991).

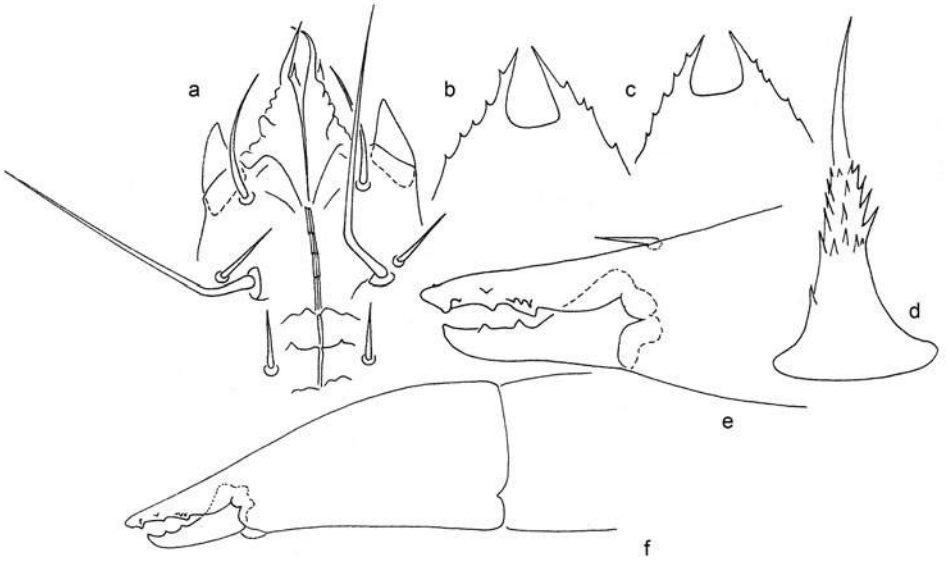

Fig. 158. *Microsejus truncicola* Trägårdh, 1942, protonymph: hypostome (a), epistomes (b, c), tritosternum (d), chelicerae (e, f) (after Wiśniewski, Hirschmann 1991).

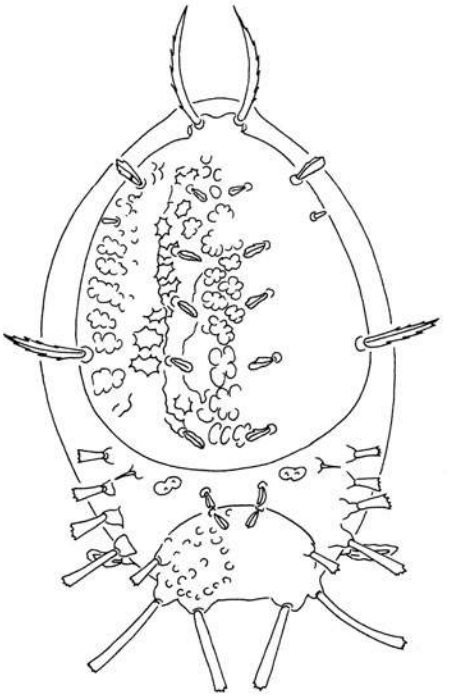

Fig. 159. *Microsejus truncicola* Trägårdh, 1942: dorsal idiosoma of larva (after Wiśniewski, Hirschmann 1991).

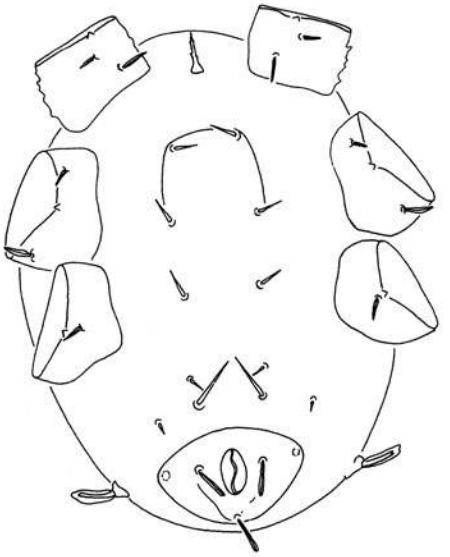

Fig. 160. *Microsejus truncicola* Trägårdh, 1942: ventral idiosoma of larva (after Wiśniewski, Hirschmann 1991).

of setae between the sternal shield and the anal shield, and two pairs of setae in the vicinity of the anal shield. Peritreme is short, in the region of coxae III (Fig. 157).

Gnathosoma. Corniculate corniculi, hypostomal setae simple while the longest one is h3. The length of the other setae is as follows: h1=1.5–2×h2, h3=4×h2, h4 slightly shorter than h2 (Fig. 158a). Epistome consists of two apices, whose edges have tiny denticles (Fig. 158b, c). Fixed digit with several denticles, while the movable digit with two denticles (Fig. 158e, f).

Legs variable in length: I – 225 μm, II – 200 μm, III – 180 μm, IV – 250 μm.

Morphology of larva

Dorsal. Oval body, milk white with four shields (Fig. 159). There are 9 pairs of setae on the large pronotal shield; seta j1 is on the shield. There are two, very small mesonotal plates below, without setae. There is a pygidial shield on the posterior idiosoma with four pairs of seate; setae J5 and Z5 on the shield. There are six pairs of setae between the pronotal shield and the pygidial shield. Dorsal setae vary in terms of the length and shape. The longest setae are j1, z5, J5 and Z5, while the dominant types of setae are serrate and cuneiform. All setae placed

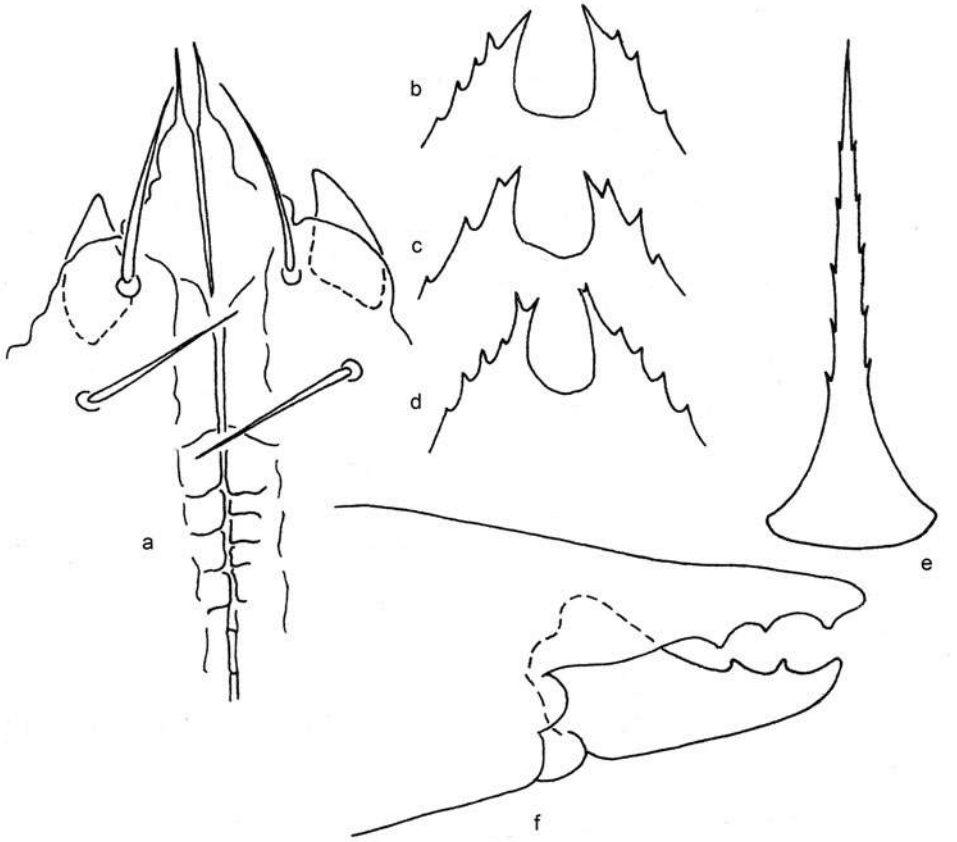

Fig. 161. *Microsejus truncicola* Trägårdh, 1942, larva: hypostome (a), epistomes (b-d), tritosternum (e), chelicera (f) (after Wiśniewski, Hirschmann 1991).

on small tubercles. Shields are covered with irregular, scrobiculate ornamentation.

Ventral. Tritosternum with enlarged base and one lacinia having edges with barbs (Fig. 161e). The sternal shield poorly defined, with three pairs of simple setae (st1–st3). The anal shield is slightly wider than long with three circum-anal setae of the same length. There are three pairs of setae between the sternal shield and the anal shield (Fig. 160).

Gnathosoma. Corniculi corniculate with wide bases. Hypostomal setae simple while the longest one is h3 (Fig. 161a). Epistome consists of two apices, whose edges have tiny denticles (Fig. 161b-d). Fixed digit with three teeth, while the movable digit with two teeth (Fig. 161f).

Legs variable in length: I – 200 μm, II – 175 μm, III – 175 μm.

Biology and ecology. Females lay one egg. The species is most frequently found in rotting wood and litter, but also in bark beetle galleries and anthills.

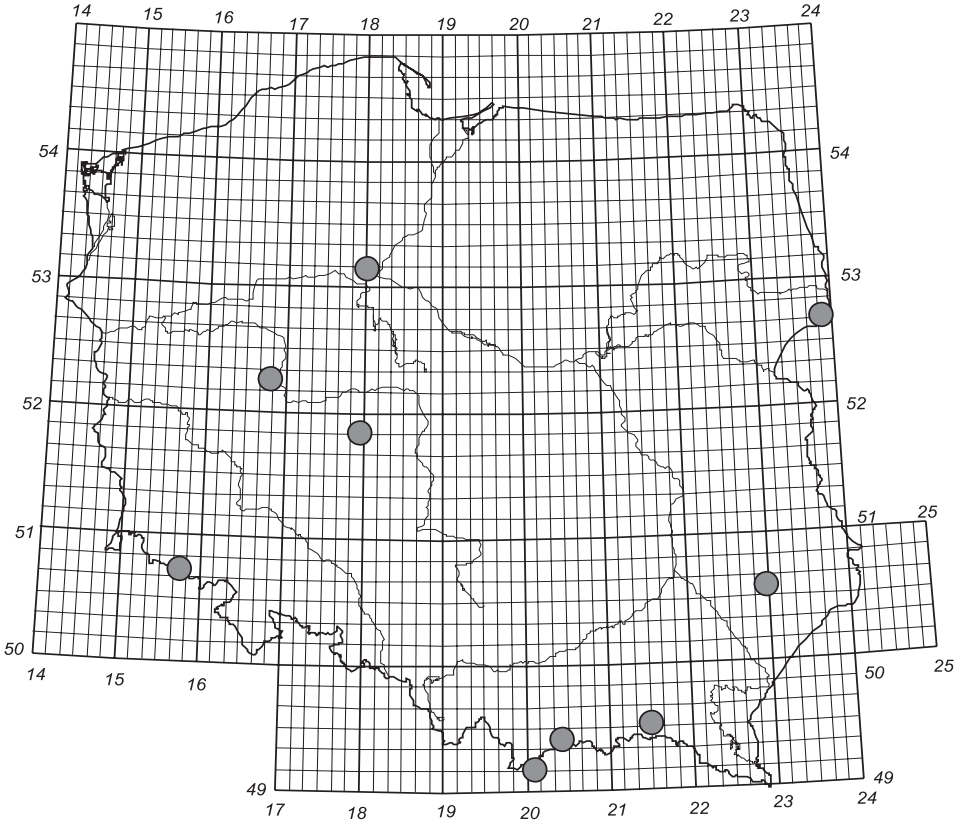

Fig. 162. *Microsejus truncicola* Trägårdh, 1942: geographic distribution in Poland.

Occurrence in the World: Palearctic.

Occurrence in Poland: in bark beetle galleries of *Hylurgops palliatus* (Gyllenhal) – Roztocze NP (Kaczmarek, Michalski 1995c); in anthills of *Lasius fuliginosus* (Latreille) – Wielkopolska NP (Skorupski 2001); rotting wood, Roztocze NP (Wiśniewski, Hirschmann 1991); Roztocze NP (Gwiazdowicz, Skorupski 1996); rotting wood, under bark, soil, Pieniny NP (Skorupski, Gwiazdowicz 1996); litter, Pieniny NP (Skorupski, Gwiazdowicz 1997); rotting wood, Białowieża NP (Gwiazdowicz 1998); under bark, Białowieża NP (Gwiazdowicz 1999b); rotting wood of oak, Podcerkwy, Białowieża Forest (Gwiazdowicz et al. 1999); Białowieża NP (Gwiazdowicz 2000a); anthills, Wielkopolska NP (Skorupski 2000, 2001); run ski, Karkonosze NP (Gwiazdowicz 2002c); rotting wood, Magura NP (Skorupski et al. 2004); litter, park-arboretum, Forest Culture Centre, Gołuchów (Gwiazdowicz, Mazurczak 2007); rotting wood, Tatra NP (Gwiazdowicz 2010); rotting wood of willow, Bydgoszcz (Kaczmarek et al., in press) (Fig. 162).

Notes about *Microsejus*

It is probable that phoretic deutonymphs (Evans 1992) may occur in the developmental cycle, although the authors of the present study have not managed to determine this. When studying drawings of *M. truncicola* (for instance, Trägårdh 1942; Krantz 1961; Evans 1992) and prepared material what draws one's attention is the variability of the shape of the epigynial shield of females.

Conclusions

As has been mentioned on several occasions the biology and ecology of species from families Sejidae, Ichtyostomatogasteridae, Antennophoridae, Celaenopsidae and Microgyniidae is relatively poorly known. This is mainly due to the rare occurrence of the selected species and their habitat, which has not been frequently investigated. Mites from these families are most frequently found in rotting wood, in tree hollows, bark beetle galleries, in anthills and litter, but they also inhabit bat caves and other habitats associated with mammals. Given the preference for such specific microhabitats these mites are mainly found in forests. According to Lindquist et al. (2009) they are more frequently found in the subtropics and tropics than in the Holoarctic region.

Very little can be said about their feeding preferences. Nothing is known about the diet of Microsejidae (Evans 1992). Sometimes conclusions on the food are drawn on the basis of the structure of the chelicerae. For instance, *Asternolaelaps* species have massive chelicerae and bifurcate corniculi that are used to 'grind' food (Athias-Henrior 1972) – that is, to bite off and swallow pieces of fungi and small mites (Walter, Proctor 1998), and enlarged anal openings for eliminating solid waste. On the other hand, Australian *Sejus* are predatory on small arthropods and nematodes (Walter, Proctor 1998). The chelicerae have small, serrate teeth, and the anal opening is small – characteristics that relate to the fact that these mites digest their food externally and ingest only the resultant fluids.

An interesting method of feeding is found in mites from the genus *Antennophorus*, which occur on ant heads. It is connected with the fact that these ants never leave their nests and thus have no means of getting food. They approach other, satiated ants and they irritate their mouthparts with antennae by performing so-called 'beggar movements'. The satiated ant secretes the food which the hungry one feeds on. Sometimes mites from the genus *Antennophorus*, which are found underneath the heads of some ant from the genus *Lasius* (Fig. 163), join in this relationship of food transfer. They hold the head of the host with three pairs (II–IV) of massive, short limbs, while stroking the mouthparts of the ant with front, long limbs. The stimulation is so strong that the ant secretes food which *Antennophorus* eats. Sometimes two specimens of *Antennophorus* have been observed on one ant (Wasmann 1902).

The specific structure and the shape of the body of *Antennophorus*, wider than long and very flat idiosoma have been the subject of analyses and observations. According to Trägårdh (1907) a rounded broad shape very often occurs in ectoparasitic and commensualistic mites. According to this author such a specific shape of the body allows them to move not only ahead and backwards, but also to move in other directions, for instance sideways, without the need to turn.

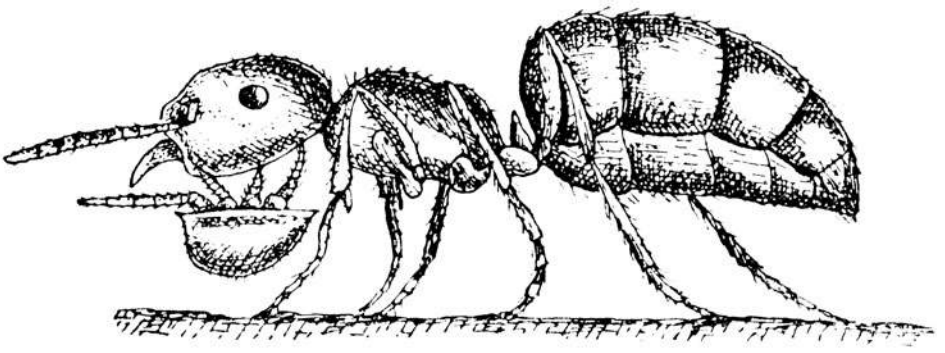

Fig. 163. *Antennophorus* on a head of ant (after Viehmeyer 1908).

The most frequent method of dispersal of the studied mite species is probably phoresy. According to Lekveishvili and Klompen (2004a) the deutonymphs of *Sejus* may be phoretic, usually on beetles (especially Cerambycidae), but the remaining instars appear to be free living predators. Among the genus *Sejus* there are species which have two forms of deutonymphs, which differ significantly. One of them is a migrating, phoretic form and the other is a sedentary form. Examples of such species with two nymph forms are *S. hinangensis* and *S. rafalskii* (Hirschmann et al. 1991; Gwiazdowicz 1995).

According to Trägårdh (1942) the anal aperture is large and surrounded by a small, oval shield raised above the level of the body, with free, projecting posterior edge. This feature is commonly found in forms which are able to attach themselves to other arthropods for the purpose of transport to other localities. For this reason it seems justified to assume that the deutonymph of *Microsejus* may be distributed in the same way.

Sejina and probably also Antennophorina are tocospermic[7] (Evans 1992). Males of *Sejus* use their chelicerae to transfer a flask-shaped spermatophore to the anterior cleft to the female's genital shield (Lindquist et al. 2009). The number of laid eggs depends on the species. For instance, the female of *Asternolaelaps* may lay 3 to 6 eggs (Evans 1954, Bregetova 1977), *Sejus* – one to four eggs are carried by gravid females (Lindquist et al. 2009), while Microgyniina usually lays one egg (Fig. 164).

According to Trägårdh (1942) the type of genital aperture in *Microgynium*, a small, transverse fissure, without any shields or any other structures adapted to the purpose of opening or closing the aperture, is a feature encountered only in the genus *Microsejus*. It seems strange considering the fact that the single egg found in some females is exceptionally large, almost completely filling the posterior half of the body. It seems evident that either the egg must be capable of changing its form to such an extent that it may pass through the small opening,

7 Tocospermy – a sperm transfer system where the spermatophore is deposited directly into the female genital opening.

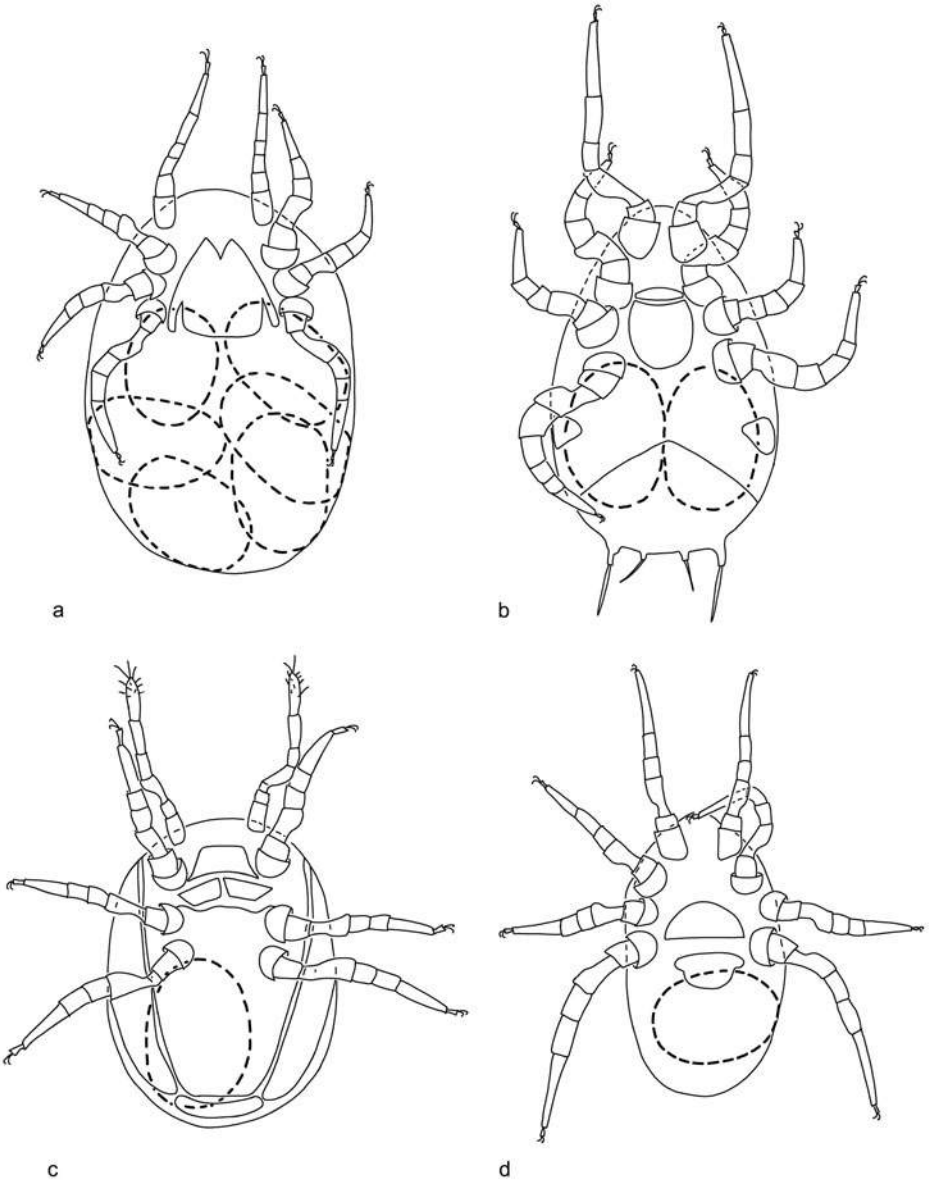

Fig. 164. Eggs in the idiosoma: Ichthyostomatogasteridae (a), Sejidae (b), Celaenopsidae (c), Microgyniidae (d).

or else the larva escapes only after the death of the mother, as is the case in some oribatid mites.

The relationships between the studied mite species and fungi are very interesting. They are of two types, as these are parasitic correlations or zoochoria, i.e.

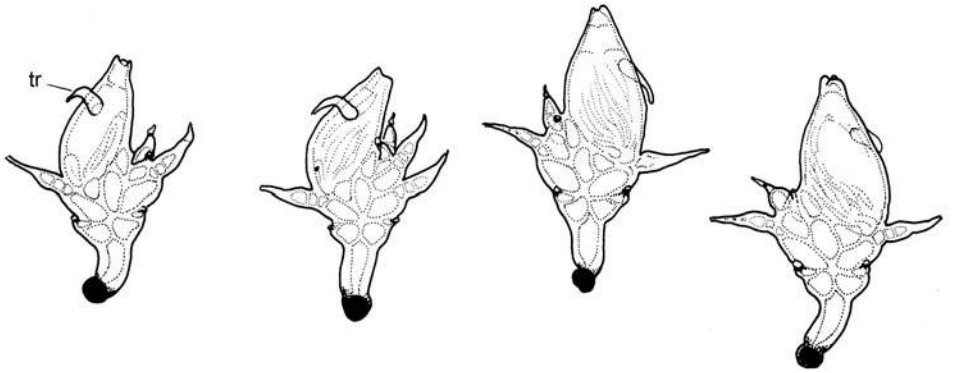

Fig. 165. *Rickia stellata* Majewski, 1984, mature thali, tr – stump of trychogyne (after Majewski 1994).

using arthropods for the purpose of spreading out. An example of parasitic fungi are the representatives of the order Laboulbeniales. These include the obligate insect or mites parasites, with cellular thalli, predisposing this fungi to certain death without a mite host.

Laboulbeniales fungi have been described on merely four species of mesostigmatid mites such as: *Hypoaspis cuneifer* (Michael, 1891), *Macrocheles glaber* (Müller, 1860), *Pachylaelaps holothyroides* (Leonardi, 1896) and *Celaenopsis badius* (C.L. Koch, 1839) (Majewski 1994). And it is on the legs of *Celaenopsis badius* that Majewski (1984) found four specimens of the fungus, which he described as a species new to science with the name *Rickia stellata* (Fig. 165).

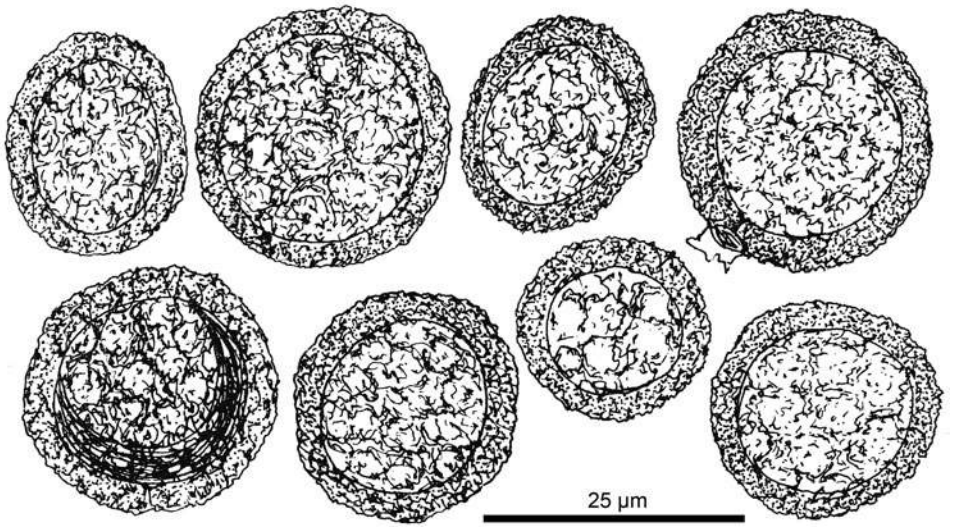

Fig. 166. *Tarichium verruculosum* Bałazy, Wiśniewski et Kaczmarek, 1987, resting spores (after Bałazy et al. 1987).

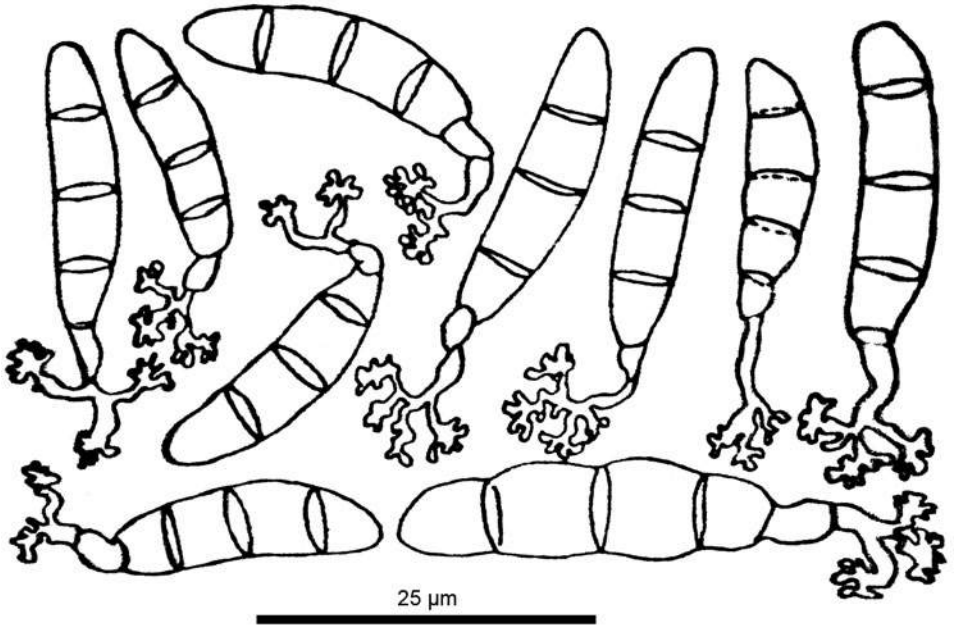

Fig. 167. The spores with special outgrowths (after Bałazy et al. 1987).

Occasionally several spores of fungi can be found on the bodies of mites, which attach to the bodies of mites by means of a sticky substance or by means of a special mycelium called a haptor. It is by one of these methods in which fungi disperse (Gwiazdowicz 2007). Bałazy et al. (1987b) reported a fungus from the order Mucorales called *Mortierella camargensis* W. Gams et Moreau on the body of *Celaenopsis badius*. The same authors, studying a dead, fairly damaged male of *Celaenopsis badius* reported, and described, a new to science species *Tarichium verruculosum* Bałazy, Wiśniewski et Kaczmarek, 1987 from the order Entomophthorales (Fig. 166). Moreover, Bałazy et al. (1987b) found unidentified fungal spores on the surface of *Sejus togatus*. This type of fungous spore, obviously adapted to zoochory, merits peculiar consideration (Fig. 167).

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