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Description of female and male of *Pygmephorus sylvilagus* n. sp. and male of *Pygmephorus erlangensis* KRCZAL, 1959 (Acari, Pygmephoridae)

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(With 18 figures)

Abstract

The female of a new species and males of two species of the genus *Pygmephorus* are described and illustrated. The species are: *P. sylvilagus* n. sp., found phoretic on the Eastern Cottontail, *Sylvilagus floridanus* (ALLEN) (Leporidae) in Iowa/USA, and *P. erlangensis* KRCZAL, 1959 found in the nest of a Garden Dormouse, *Eliomys quercinus* (LINNAEUS)(Gliridae) in Holland. It is the first description and illustration of males in the genus *Pygmephorus*.

Pygmephorus sylvilagus n. sp.

Female (Figs. 1-6)

Body of holotype: Length 570 µm, width 196 µm.

Gnathosoma directed anteriorly or anteroventrally 48 µm long, 46 µm wide, quadrangular in outline with three pairs of setae (Gd_1, Gd_2, pp) on dorsal side and one pair (Gv_2) on ventralside. Setae Gd_2 placed in the middle part of the gnathosoma posteromedially in relation to setae Gd_1. Setae pp rodlike, placed slightly anteriorly in relation to setae Gd_1. All gnathosomal setae (Gd_1, Gd_2, pp, Gv_2) similar in length. Chelicerae styletlike with bases 8 µm long. Palpi directed anteromedially, slightly longer than half the length of the gnathosoma, with two pairs of setae (Ged, Tid) and two pairs of solenidia, and ending in relatively strong straight claws. Three pharyngeal pumps beyond gnathosoma.

Idiosoma (Figs. 1, 2) with characteristic cuticular ornamentation formed by small regularly dispersed points and larger ones differing in size.

Dorsal side (Fig. 1): Stigmata and peritremes round, located anterolaterally in relation to setae v_1. Cupules (ia, im, ih) visible on tergites D, EF and H respectively. Length of setae in µm: v_1 63, v_2 27, sc_1 36, sc_2 78, c_1 76, c_2 74, d 82, e 31, f 80, h_1 80, h_2 10. Distances between setae in µm: v_1-v_1 43, v_2-v_2 74, sc_1-sc_1 84, sc_2-sc_2 97, v_1-v_2 21, v_2-sc_2 30, c_2-c_2 196, c_1-c_1 99, c_2-c_1 51, d-d 148, f-f 177, e-f 13, h_1-h_1 110, h_1-h_2 11. Setae v_1 barbed, with fine endings. Setae v_2, sc_2, c_1, c_2, d, f and h_1 barbed, stift, with more thick endings than setae v_1. Sensilli (sc_1) clublike, lemon shape head with fine numerous little spines. Setae e smooth, bladelike, ending sharply. Setae h_2 smooth, needlelike.

Ventral side (Fig. 2): Apodemes strong. Anteromedian apodeme connected with apodemes I, II and sejugal apodeme. Apo-

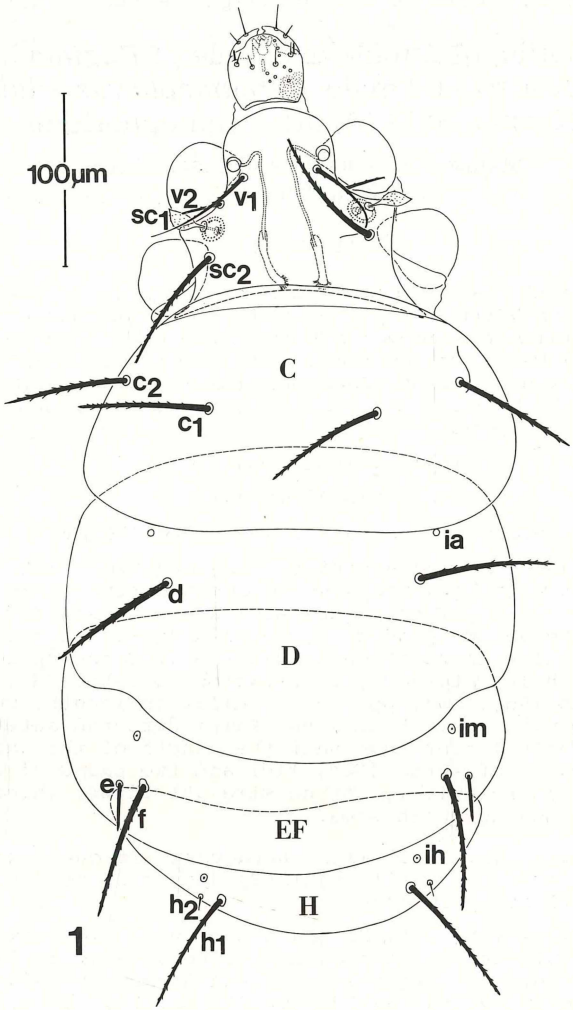


Fig. 1: *Pygmephorus sylvilagus* n. sp., female, holotype, dorsal view. [Nomenclature of segments, setae, cupuli etc. according to LINDQUIST (1977)].

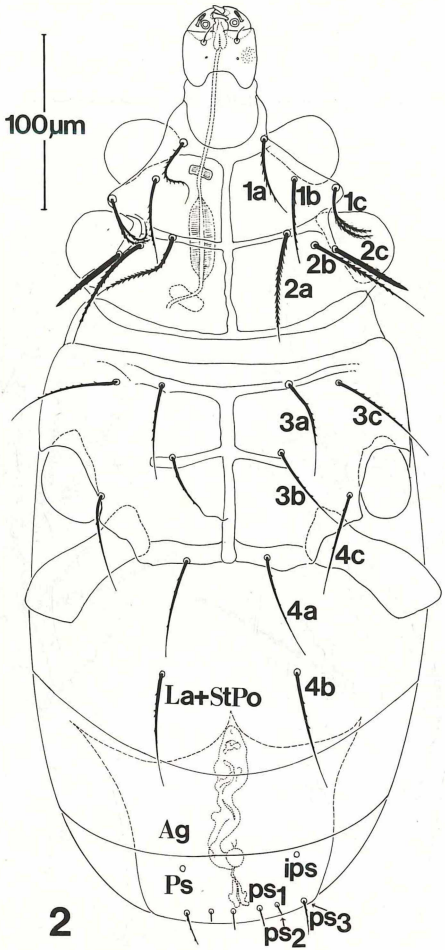
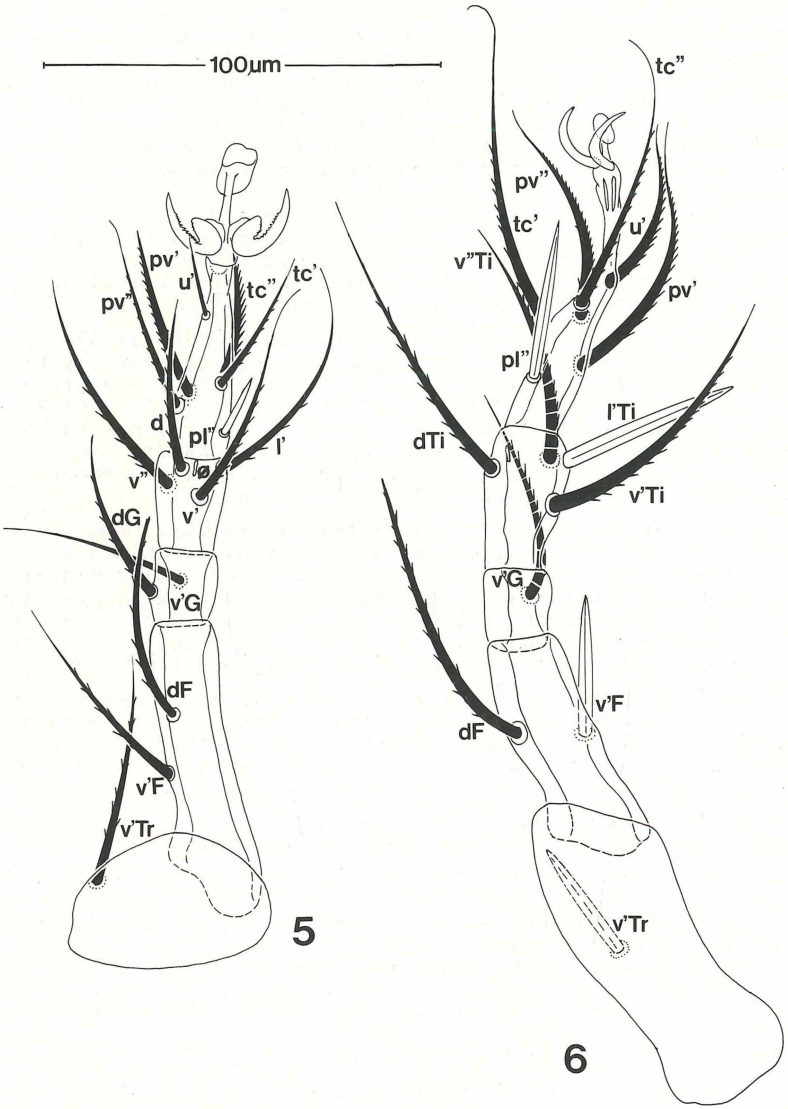


Fig. 2: *Pygmephorus sylvilagus* n. sp., female, holotype, ventral view.

Figs. 3-4: *Pygmephorus sylvilagus* n. sp., female, holotype, leg I (3) and leg II (4). [Nomenclature of setae according to LINDQUIST (1976)].



Figs. 5-6: *Pygmephorus sylvilagus* n. sp., female, holotype, leg III (5) and leg IV (6).

demes III, IV and V almost transverse in relation to longitudinal body axis, connected with posteromedian apodeme. Lateral opisthosomatic plates (La) joined with posterior sternal plate (StPo), and their posterior edge forms regular curve line. Agenital plate with convex posterior edge. Tergite Ps with cupules (ips). Length of setae in µm: 1a 53, 1b 55, 1c 38, 2a 68, 2b 76, 2c 48, 3a 61, 3b 57, 3c 68, 4a 63, 4b 72, 4c 65, ps_1 10, ps_2 6, ps_3 21. Distances between setae ps in µm: ps_1-ps_1 16, ps_1-ps_2 10-11, ps_2-ps_3 15-17. Setae 1a, 1b, 1c, 2a and 2b distinctly barbed, whiplike, with fine endings. Setae 1c bifurcated. Setae 2c stift, slightly barbed, relatively thick. Setae on metapodosomatic plate similar to setae 2a but less barbed. Setae ps_1, ps_2 smooth needlelike. Setae ps_3 slightly barbed, with more fine endings than setae ps_1.

Legs (Figs. 3-6): Length in µm: Leg I 163, leg II 179, leg III 184, and leg IV 190. Leg I with very strong claw (44 µm long) with striation, forming together with spine s a prehensile complex. Leg II and III with strong paired claws of 11 µm length, with striation and small teeth on their inner surface and with characteristic thickenings at their bases. Leg IV with paired claws (19 µm long) without thickenings. Membranous empodia on stalks present on leg II, III and IV.

Formula of setae on leg I: 3-1-4-4-8(2)+14(2). Femur with small modified seta d. Tibiotarsus with four solenidia (ϕ_1 10 µm long and ϕ_2 11 µm long are placed in one third distal part of the segment, ω_1 11 µm long and ω_2 17 µm long are placed on the top of the segment), with tibial eupathidium k (36 µm long), six tarsal eupathidia (ft', ft'', tc', tc'', p', p''), 10 "normal" setae, and two spines prabably modified seta s.

Formula of setae on leg II: 3-1-3-3-5(1)-7(1). Femur with setae v' relatively thick and stift. Solenidion ϕ 6 µm long, placed on forth distal part of the tibia. Solenidion ω 13 µm long, placed slightly anterolaterally in relation to setae pl''. Seta u'' absent.

Formula of setae on leg III: 3-1-2-2-5(1)-6. Solenidion ϕ 4 µm long, placed in distal part of the segment. Tarsal seta pl'' relatively short (19 µm), smooth, bladelike. Seta u'' absent.

Formula of setae on leg IV: 2-1-2-1-5(1)-6. Solenidion ϕ 4 µm long, placed in distal part of the tibia. Tarsal setae pl'' 44 µm long, smooth, bladelike. Seta u'' absent.

Male (Fig. 7-12)

Body: Length 390 µm, width 167 µm.

Gnathosoma reduced to small tubiform structure, 34 µm long, 15 µm wide. With two pairs of solenidia (ϕ_1 10 µm long, ϕ_2 10 µm long, perhaps homolog to palpal solenidia of the female), and three pairs of "normal" setae (Gd_1, Gd_2, Gv_2).

Idiosoma (Figs. 7-8): Covered with smooth or regulary granulated cuticular plates and shields.

Dorsal side (Fig. 7): Propodosoma covered with six granulated shields: first located posteriorly to gnathosoma and anteriorly to setae v_1, second and third placed between trochanteres I and II (they are connected with coxae I), forth and fifth very small, placed laterally to setae sc_1, sixth covering medial part of propodosoma (it bears setae v_1,v_2,sc_1, sc_2, and in its posterior part there is a characteristic sclerotization). Tergite C joined with tergite D. On shield CD characteristic sclerotizations in the medial part between setae c_2, two pairs of cupuli (ic and ia), characteristic round cuticular thickenings between cupuli ic and ia, and a furrow located posteromedially in relation to setae d. Tergite CD in its posteromedial part, in relation to this furrow, smooth (cuticula without granulation). Tergite EF quadrangular, with cupuli im and with setae e and f placed in its posterolateral part. Tergite H weakly sclerotized, in its posterior part with at least six cavities. Tergites H and Ps form together on ventral side the genital capsule. Length of setae in µm: v_1 15, v_2 40, sc_1 15, sc_2 49, c_1 34, c_2 46, d 42, e 17, f 49, h_1 4, h_2 10. Distances between setae in µm: v_1-v_1 17, v_2-v_2 29, sc_1-sc_1 61, sc_2-sc_2 70, v_1-v_2 13, v_2-sc_1 17, sc_1-sc_2 11, c_2-c_2 167, c_1-c_1 76, d-d 91, c_2-c_1 48, d-c_1 82, d-c_2 79, f-f 44, e-f 6, h_1-h_1 29, h_1-h_2 6. Setae v_1, v_2, sc_1, sc_2, c_1, c_2, d and f barbed, with relatively stift endings. Setae e smooth, bladelike. Setae h_1 small, needle-shaped, h_2 smooth, rodlike, with rounded ends.

Ventral side (Fig. 8): Apodemes strong. Anteromedian apodeme connected with very short apodemes I, arched apodemes II and sejugal apodeme. Posteromedian apodeme connected with arched apodemes III and almost straight apodemes IV. Under cuticular surface, posteromedian apodeme bifurcated in posterior part. Posterior sternal plate almost quadrangular. Genital capsule (65 µm long, 61 µm wide) subtriangular with rigid pipe, bend in posterior and anterior part, sharply terminated. Penis (40 µm long) connected with capsule (X), this connected with structures (Y and Z). Laterally to the posterior part of the penis bladelike structures (13 µm long), probably homologous to setae ps_1 of the female. Genital capsule rounded posteriorly. Lengths (in µm) of the setae on ventral side: 1a 17, 1b 17, 1c 21, 2a 21, 2b 21, 2c 17, 3a 27, 3b 25, 3c 23, 4a 21, 4b 34, 4c 21, ps_2 16, ps_3 19. Distances between setae ps in µm: ps_2-ps_2 29, ps_2-ps_3 10. Setae 1a, 1b, 1c, 2a, 2b, 2c, 3a, 3b, 3c, 4a, ps_3 relatively stift, smooth or slightly barbed, sharply ended. Setae 4b distinctly barbed, sharply ended. Setae ps_2 smooth, with rounded ends.

Legs (Figs. 9-12): Leg II (133 µm long) and leg III (129 µm long) distinctly shorter than leg I (150 µm long) and longer than leg IV (108 µm long). Leg I with single claw of 19 µm length, without empodium. Leg II and III with paired claws (15-16 µm long) and membranous empodia. Leg IV with one curved claw (16 µm long) and a second spinelike claw of 29 µm length, without empodium.

Formula of setae on leg I: 3-1-4-4-8(2)-15(2). Tibial solenidia Φ_1 10 µm and Φ_2 11 µm long, placed on third distal part

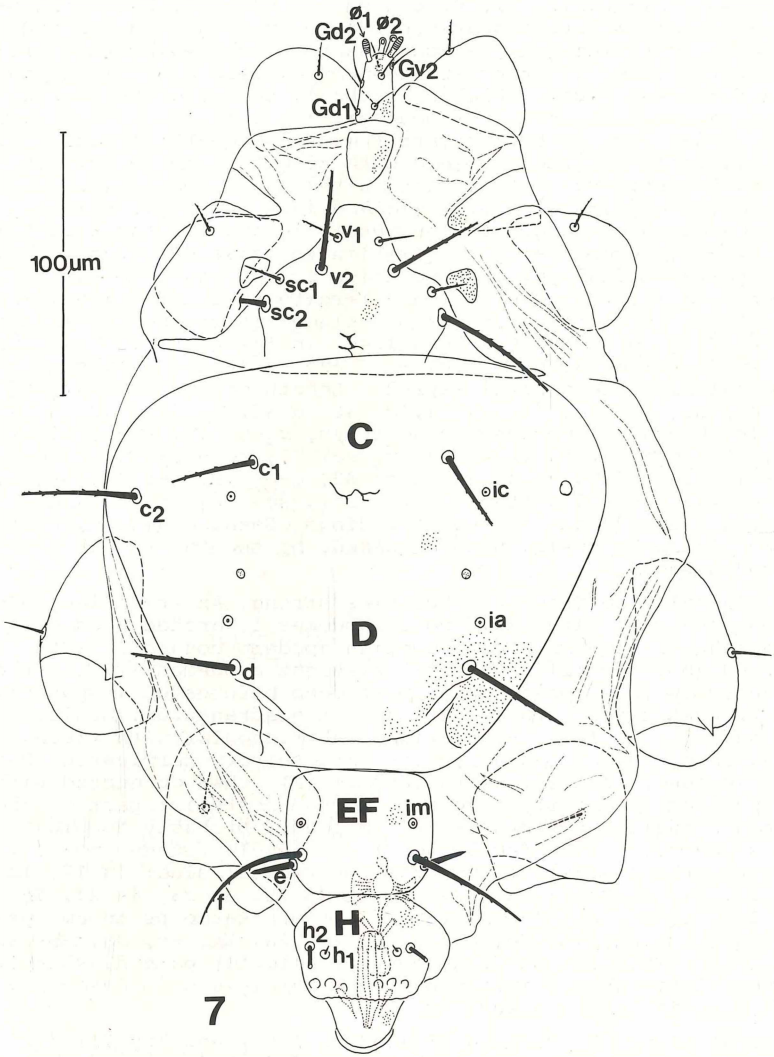


Fig. 7: *Pygmephorus sylvilagus* n. sp., male, paratype, dorsal view.

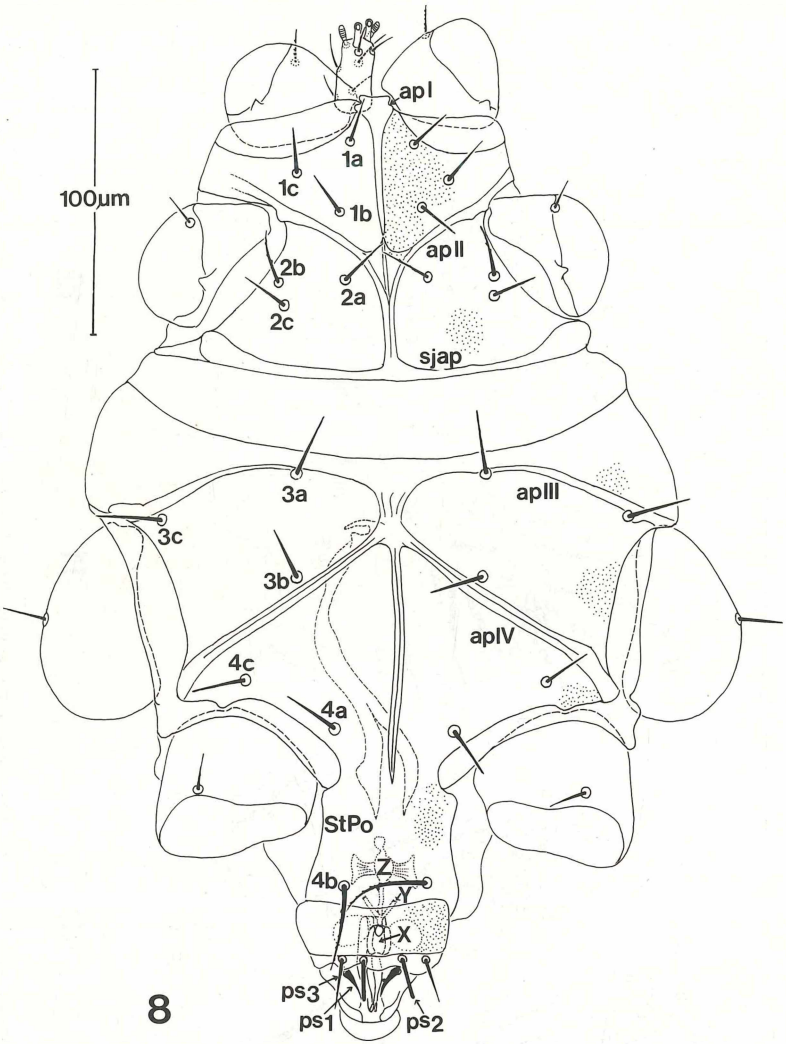
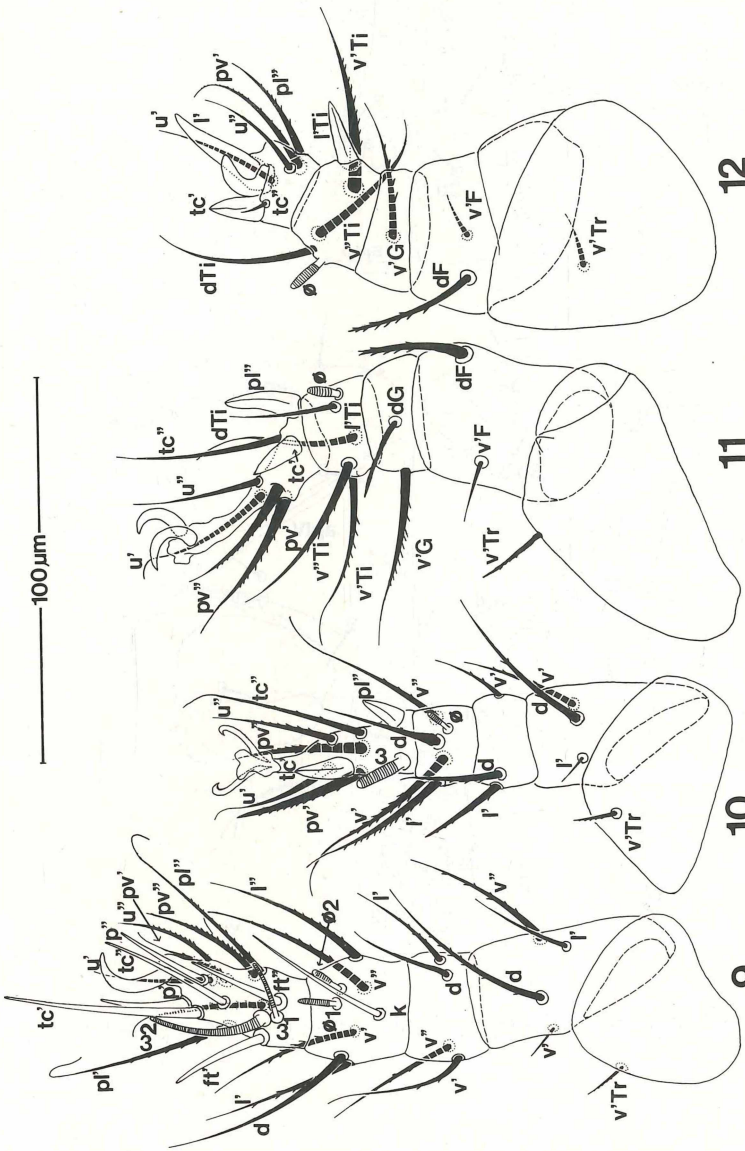


Fig. 8: *Pygmephorus sylvilagus* n. sp., male, paratype, ventral view.



Figs. 9–12: *Pygmephorus sylvilagus* n. sp., male, paratype, leg I (9), leg II (10), leg III (11), and leg IV (12).

of segment. Eupathidium k 44 µm long, placed third proximal part of the tibia. Tarsus with two solenidia (ω_1 17 µm long and ω_2 31 µm long placed in proximal part of the segment), six eupathidia (ft', ft '', tc', tc'', p', p'') and seven "normal" setae.

Formula of setae on leg II: 3-1-3-3-5(1)-8(1). Solenidion φ 6 µm long, placed in the middle part of the tibia. Solenidion ω 15 µm and spine pl'' 13 µm long, placed on the segment base. Spine tc' 17 µm long, placed distally in relation to solenidion ω in the middle of the tarsus.

Formula of setae on leg III: 3-1-2-2-5(1)-7. Solenidion φ 10 µm long, placed in the middle part of the tibia. On the tarsus base are placed two spines: tc' 17 µm and pl'' 21 µm long.

Formula of setae on leg IV: 2-1-2-1-5(1)-6. Femur with strong, barbed seta d 38 µm, and smooth seta v' 13 µm long. Tibia with solenidion φ 13 µm, spinelike seta l' 21 µm long, and three "normal" setae (dTi, v'Ti, v''Ti). Tarsus with seta tc' spinelike (15 µm long), short (10 µm) seta tc'' and four setiform setae (u', u'', pv', pl''), similar in length.

Larva unknown

Type material: Female, holotype (slide No. A125/84) and two paratypes (male slide No. A126/84, female slide No. A127/84) were found on March 18th 1975 phoretic on *Sylvilagus floridanus* (ALLEN) (Leporidae) in Terre Haute, Iowa, USA by E. SPICKA, F. S. LUKOSCHUS ded. All types in the collection of Zoologisches Institut und Zoologisches Museum der Universität Hamburg.

Diagnosis: The female of *Pygmephorus sylvilagus* n. sp. is similar to *Pygmephorus designatus* MAHUNKA, 1973, and differs from ist by following features:

P. sylvilagus ♀	*P. designatus* ♀
1. Setae h_2 needlelike, three times shorter than bladelike setae e	1. Setae h_2 bladelike, slightly longer than 3/4 of setae e, similar in structure
2. Setae ps_1 and ps_2 smooth, distinctly shorter than barbed setae ps_3	2. Setae ps_1, ps_2, ps_3 barbed, similar in length
3. Setae v' on genu II thinner than seta v' on femur II, with much more fine endings.	3. Seta v' on genu II thicker than seta v' on femur II, both with very fine endings.

The male of *P. sylvilagus* can be compared with the second *Pygmephorus* male, described in this paper, *P. erlangensis* KRCZAL, 1959. The males of these two species can be distinguished, among others, by the following features:

P. sylvilagus ♂	*P. erlangensis* ♂
1. Setae e on tergite EF smooth, bladelike, sharply ended (Fig. 7)	1. Setae e on tergite EF barbed, bluntly ended (Fig. 13)
2. Apodemes IV straight (Fig. 8)	2. Apodemes IV bend in characteristic way (Fig. 14)
3. On leg II spine p1'' approximately equal 3/4 length of spine tc'	3. On leg II spine p1'' approximately equal 1/2 length of spine tc'
4. On leg III spine tc' shorter than spine p1''	4. On leg III spine tc' longer than spine p1''
5. Femur IV with smooth seta v' shorter than 1/2 of length of seta dF	5. Femur IV with barbed seta v' longer than 1/2 length of seta dF
6. Tibia IV shorter than its width.	6. Tibia IV longer than its width.

Pygmephorus erlangensis KRCZAL, 1959

Male (Figs. 13-18)

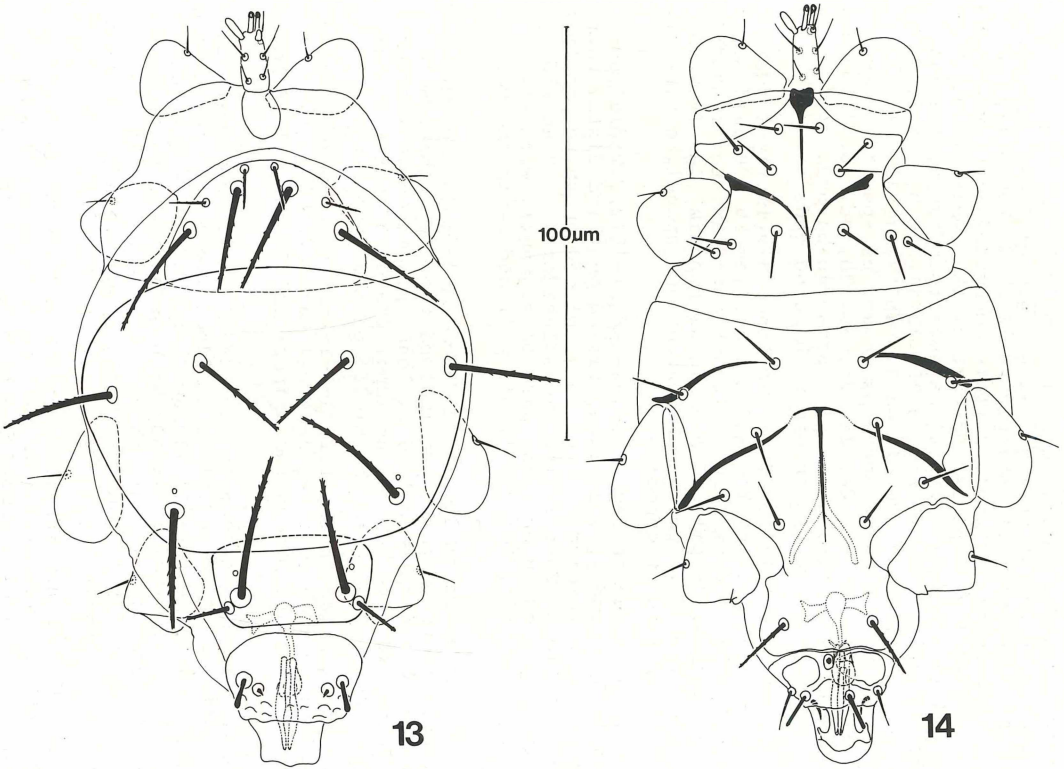
Body length 186 µm, width 86 µm.

Gnathosoma reduced to small tubiform structure, 19 µm long, 8 µm wide, with two pairs of solenidia (Φ_1 6 µm, Φ_2 8 µm long), and with three pairs of "normal" setae (Gd_1, Gd_2, Gv_2)(On examined specimen seta Gv_2 on the left side of the gnathosoma undeveloped or broken, solenidion Φ_1 on the right side of gnathosoma much shorter than on the right side - undeveloped or broken).

Idiosoma (Figs. 13-14) covered with smooth or regulary granulated cuticular plates and shilds.

Dorsal side (Fig. 13): Propodosoma covered with two plates: first small located posteriorly to gnathosoma and anteriorly in relation to setae v_1, second covering most of the propodosoma with setae v_1, v_2, sc_1, sc_2. Tergite C joined with tergite D, with cupules ia. Tergite EF quadrangular with cupuli im. Tergite H weakly sclerotized, in its posterior part with cavities. Tergites H and Ps form together on ventral side the genital capsule. Lengths of the setae in µm: v_1 11, v_2 28, sc_1 10, sc_2 30, c_1 29, c_2 29, d 30, e 11, f 31-38, h_1 2, h_2 8. Distances between setae in µm: v_1-v_1 8, v_2-v_2 13, sc_1-sc_1 30, sc_2-sc_2 39, v_1-v_2 6, v_2-sc_1 9, sc_1-sc_2 10, c_2-c_2 86, c_1-c_1 38, d-d 54, d-c_1 36, d-c_2 35, f-f 26, e-f 5, h_1-h_1 17, h_1-h_2 5. Setae v_1, v_2, sc_1, sc_2, c_1, c_2, d, e and f barbed, stift, relatively bluntly ended. Setae h_1 in form of small, sharp thorns. Setae h_2 smooth, with rounded ends.

Ventral side (Fig. 14): Apodemes moderately strong. Anteromedian apodeme broken in its medial part, connected with short



Figs. 13-14: *Pygmephorus erlangensis* KRCZAL, 1959, male, dorsal (13) and ventral (14) view. Designation of setae see figs. 7-8.

apodemes I; arched apodemes II not connected with sejugal apodeme. Apodemes III arched, not connected with posteromedian apodeme. Apodemes IV bend in characteristic way, connected with posteromedian apodeme. Posteromedian apodeme bifurcated under cuticular surface in its posterior part. Posterior sternal plate subquadrangular. Genital capsule 36 µm long, 38 µm wide, subtriangular in outline, with rigid pipe, bend in posterior and anterior part, sharply terminated. Penis (25 µm long) connected with capsula X. This connected with structures Y and Z. Laterally to posterior part of the penis bladelike structures (7 µm long). Genital capsula rounded posteriorly. Lengths (in µm) of the setae: 1a 10, 1b 11, 1c 9, 2a 12, 2b 11, 2c 8, 3a 13, 3b 13, 3c 14, 4a 11, 4b 19, 4c 12, ps_2 10, ps_3 10. Distances between setae ps in µm: ps_2-ps_2 11, ps_2-ps_3 8. Setae 1a, 1b, 1c, 2a, 2b, 2c, 3a, 3b, 3c, 4a, 4c, and ps_3 smooth, stift, ending sharply. Setae 4b barbed, stift, ending sharply. Setae ps_2 smooth with round ends.

Legs (Figs. 15-18): Leg I (87 µm long) distinctly longer than leg II (72 µm), leg III (72 µm) and leg IV (70 µm). Leg I with single claw (10 µm long), without empodium. Leg II and III with paired claws (6 µm) and membranous empodia. Leg IV with one curved claw of 10 µm, and second arched spinelike claw of 19 µm length, without empodium.

Formula of setae on leg I: 3-1-4-4-8(2)-15(2). Tibial solenidia Φ_1 8 µm and Φ_2 7 µm long, placed on third distal part of segment. Eupathidium k 23 µm long, placed on third proximal part of the tibia. Tarsus with two solenidia (ω_1 10 µm and ω_2 21 µm long, placed in proximal part on segment), with six eupathidia (ft', ft'', tc', tc'', p', p'') and seven "normal" setae.

Formula of setae on leg II: 3-1-3-3-5(1)-8(1). Solenidion Φ 5 µm long, placed on third proximal part of the tibia. Solenidion ω 8 µm and spine pl'' 6 µm long, placed on the tarsus base. Spinelike seta tc' (13 µm long) placed distally in relation to solenidion ω in the middle part of the tarsus.

Formula of setae on leg III: 3-1-2-2-5(1)-7. Solenidion Φ 3 µm long, placed on third proximal part of the tibia. At the tarsus base are placed two spines: tc' 10 and pl'' 8 µm long.

Formula of setae on leg IV: 2-1-2-1-5(1)-6. Femur with two barbed setae: d 16 µm and v' 11 µm long. Tibia with solenidion Φ (4 µm), spinelike seta L' (10 µm long) and three "normal" setae (dTi, v'Ti, v''Ti). Tarsus with spinelike seta tc' (8 µm), short seta tc'' (5 µm), three almost equal in length setae u', u'' and pv', and distinctly longer seta pl'', placed on the tarsus base.

Material: Three females (slides No. A128/84 till A130/84) and one male (slide No. A131/84) were found April 4th, 1978 in the nest of a Garden Dormouse, *Eliomys quercinus* (LINNAEUS)(Gliridae), in St. Geertruid, Holland, by A. G. W. WOELTJES; F. S. LUKOSCHUS ded. All slides in the collection of Zoologisches Institut und Zoologisches Museum der Universität Hamburg.

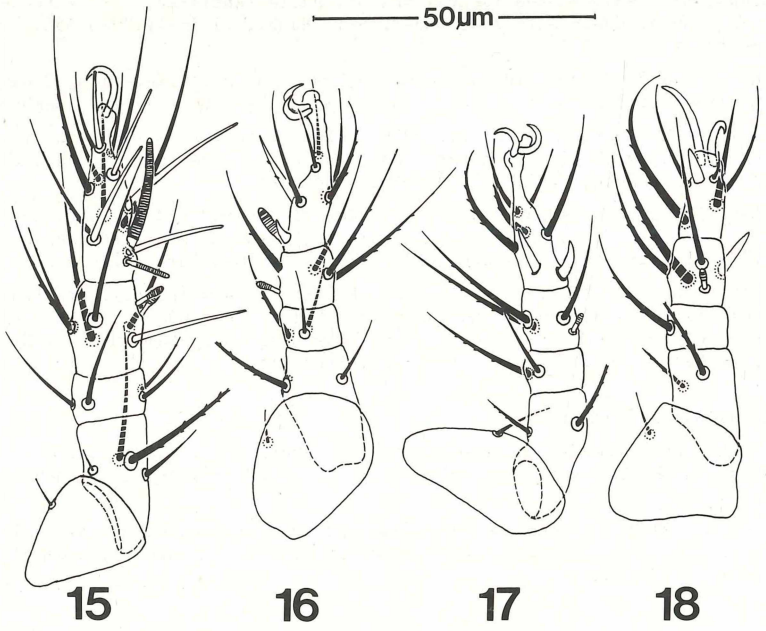
Discussion: It is difficult to find a proper place for the genus *Pygmephorus* based only on phoretic females, because this group, together with closely related groups, shows many plesiomorphic features and only a few apomorphic characteristics. In most cases these apomorphic features are adaptations to phoresy, which is a common phenomenon in many evolutionary lines of Tarsonemina (KALISZEWSKI in press), and are connected with convergent adaptations or autapomorphic characteristic.

However, based on cladistic analysis of phoretic females of Pygmephoroidea (KALISZEWSKI in prep.), the genus *Pygmephorus* appears to be a sister group to the evolutionary line containing such groups as *Luciaphorus* MAHUNKA, 1981, *Mahunkania* RACK, 1972, the *Pediculaster*-complex and part of *Siteroptes* AMERLING, 1861, all of which have three setae on the genu II [This is also the case for the genus *Triroptes* KALISZEWSKI and *Lindquistiroptes* KALISZEWSKI (in prep.)].

Females of *Pygmephorus* can be distinguished from those of their sister group through two autapomorphic features: the characteristic ornamentation of the cuticula and the enlargement of the tibiotarsus I (The width of the tibiotarsus is two or more times greater than the width of the base of the tibia I).

Males of *Pygmephorus* have such autapomorphic features as: a penis distally curved, and on leg IV curved claw, which is only half as long as the enlarged spine-like or slightly bend second claw.

Males from the sister group of *Pygmephorus* (*Triroptes, Luciaphorus, Pediculaster*) have following synapomorphic features distinguishing them from *Pygmephorus*:



Figs. 15-18: *Pygmephorus erlangensis* KRCZAL, 1959, male, leg I (15), leg II (16), leg III (17) and leg IV (18). Designation of setae see figs. 9-12.

1. Cavities present on more than half the surface of the tergite H.
2. Penis completely covered from ventral side by tergite Ps.
3. Setae ps_2 and ps_3 placed on the posterior end of the genital capsule.
4. Setae ps_1 absent.

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