Redescription of three species of the genus *Stenaphorurella* Luciáñez *et* Simon (Collembola, Onychiuridae, Tullbergiinae)

Guzel M. KHANISLAMOVA
Department of Biochemistry and Cytochemistry,
Bashkir Science Centre, Academy of Science of Russia,
69 Prospekt Oktyabrya, 450054 Ufa (Russia)

Maria STERZYNSKA
Museum and Institute of Zoology, Polish Academy of Sciences,
Wilcza 64, Pl-00 679 Warsaw (Poland)

Wanda M. WEINER
Institute of Systematics and Evolution of Animals,
Polish Academy of Sciences,
Slawkowska 17, Pl-31-016 (Poland)

KEY WORDS
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ABSTRACT
Three species of the genus *Stenaphorurella* Luciáñez *et* Simon, 1992 are redescribed (*S. quadrispina*, *S. lubbocki* and *S. denisi*). Their relationships are discussed.

MOTS CLÉS
Collembola,
Tullbergiinae,
taxonomie.

RÉSUMÉ
Trois espèces du genre *Stenaphorurella* Luciáñez *et* Simon, 1992 sont redécrites (*S. quadrispina*, *S. lubbocki* et *S. denisi*) et leurs caractères différentiels sont analysés.

INTRODUCTION

In 1992 Luciáñez & Simon created a new genus, *Stenaphorurella*, for *Stenaphorura quadrispina* Börner, 1901, *S. denisi* Bagnall, 1935, *S. parisi* Denis, 1943 and *S. gibsoni* Murphy, 1965. They restricted the genus *Stenaphorura* Absolon, 1900 to the type species, *S. japygiformis* Absolon, 1900, which has two dorsolateral sensory clubs in the antenna III-organ, whereas *Stenaphorurella* has three sensory clubs in this position. Following Gisin (1944), they treated *S. axelsoni* Bagnall, 1935, *S. lubbocki* Bagnall, 1935 and *S. absoloni* Bagnall, 1936 as synonyms of *S. quadrispina*. Stach (1954), Gisin (1960), Palissa (1964) and more recently Zimdars & Dunger (1994) accepted this synonymy. However, *S. denisi* and *S. parisi* were treated as separate species (Zimdars & Dunger 1994).

Among the material from our own field investigations, as well as in other materials from Byelorussia, Lithuania, Luxembourg, Poland and Russia, we have identified three species belonging to the genus *Stenaphorurella*: *S. quadrispina*, *S. lubbocki* and *S. denisi*. Having examined these material and the available types of *S. lubbocki*, *S. denisi* and *S. parisi*, we came to the conclusion that *S. lubbocki* is a good species and must be restored, while *S. parisi* should be synonymized with *S. denisi*.

Here we present redescriptions of *S. quadrispina*, *S. lubbocki* and *S. denisi*, using chaetotactic nomenclature after Rusek (1971), Luciáñez & Simon (1992), Zimdars & Dunger (1994).

Stenaphorurella quadrispina (Börner, 1901)

Stenaphorura quadrispina Börner, 1901: 699.

Stenaphorura absoloni Bagnall, 1936: 40.

Stenaphorura axelsoni Bagnall, 1935: 172.

MATERIAL EXAMINED. — **Lithunia.** Oak wood, 29.VII.1984, 7 specimens, 1.X.1984, 3 specimens. **Russia.** Archangielsk Region, spruce forest with *Vaccinium myrtylli*, 15.VIII.1980, 1 specimen. — Moscow Region, fields, 1982, 3 specimens, coll. G. Kapin. — Tatarstan, meadow, July 1982, 1 specimen, coll. T. Artemjeva (all specimens from the former Soviet Union are in the collection of the Moscow Pedagogical University).
Luxembourg. Am Partumka, cultivated soil, 16.IV.1991, 1 specimen, coll. A. Theves (collection of The Natural History Museum of Luxembourg).

DIAGNOSIS

Body elongated. Formula of pseudocelli 11/111/11111. Antennal segment IV with five sensilla, in antenna III-organ three sensory clubs. Postantennal organ with simple or bilobated vesicles in three rows. Unpaired seta m0 on abdominal tergite IV absent. In row m on abdominal tergite VI, setae m0 and m3 are present; setae m1 and m2 absent.

REDESCRIPTION

Body (without antennae) 0.8-1 mm. Colour white in alcohol. Granulation fine. Only in the lateral parts of tergites granulation slightly coarse, on the last abdominal tergite coarse.

Pseudocellar formula per half tergite: 11/111/11111. Pseudocelli on thoracic tergites II-III and abdominal tergites I-IV near the borderline between coarse and fine granulation.

Antennal segment IV with five thickened a-e sensilla, microsensillum, subapical organite and small globular apical vesicle. Antenna III-organ with four guard setae, two sensory rods protected by integumentary folds, with three thick, cylindrical sensory clubs, and thick long bent sensory club on ventral side of this segment (Fig. 2A). Antennal segments II and I with eleven and six setae respectively.

Postantennal organ 3.5 times longer than the nearest pseudocellus, with 40-50 vesicles, simple or slightly bilobate on the top, usually in three rows (Fig. 2B).

Chaetotaxy as in figures 1, 2C, D, with macrochaetae, mesochaetae and microchaetae. Dorsal chaetotaxy as in figure 1. Sensory setae (s) well marked only on thoracic tergites II and III (1.5 times longer than a2), on abdominal tergites IV and V very slightly marked. Microsensilla (ms) on thoracic tergites II and III present. On the head, seta p2 1.75-2 times longer than p1. Abdominal tergite VI with two pairs of anal spines on distinct papillae, with two unpaired setae (a0 and m0), without setae m1 and m2, with seta m3 in lateral position, behind papillae of anterior spines (Fig. 1).

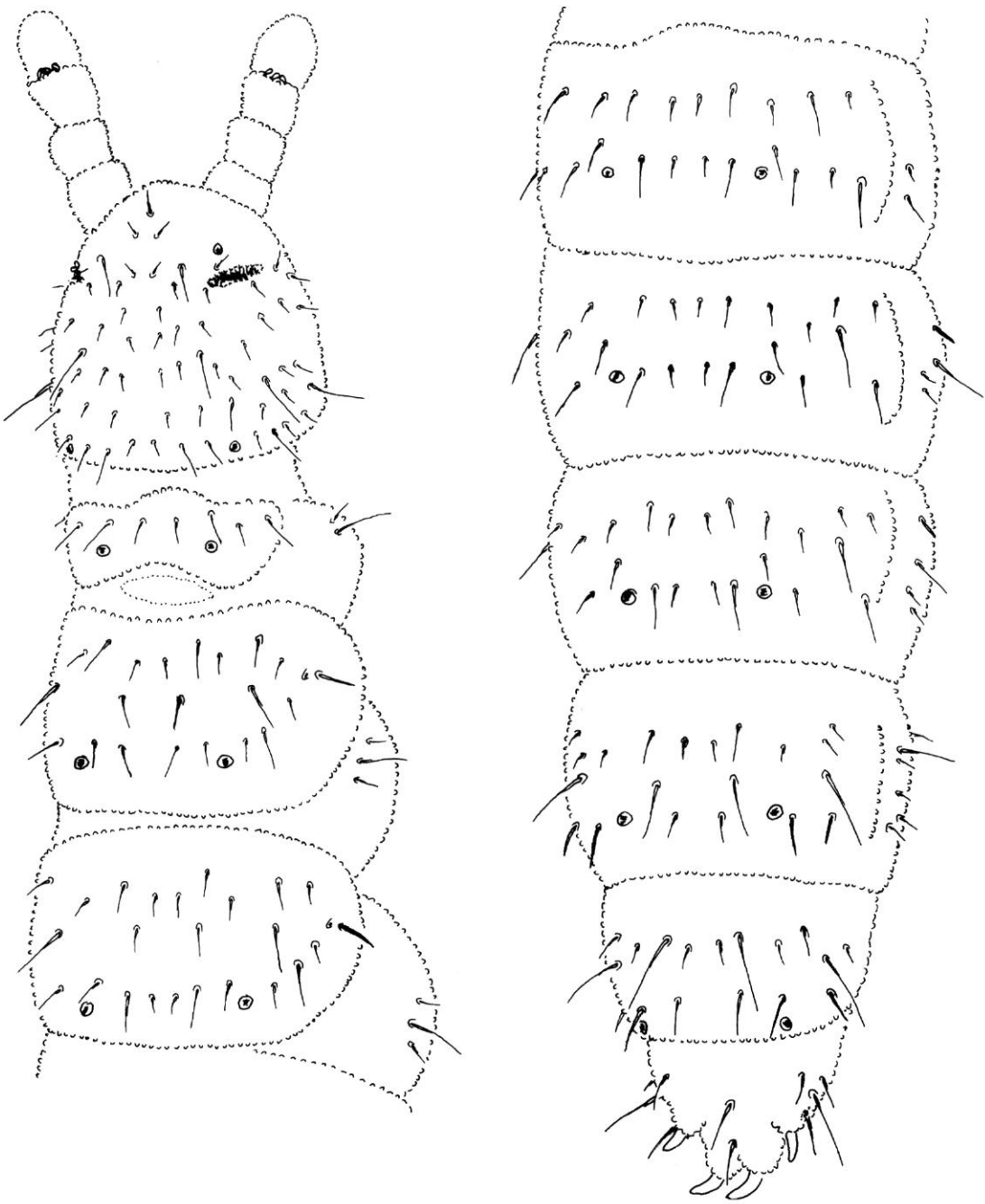

FIG. 1. — *Stenaphorurella quadrispina*. Dorsal chaetotaxy.

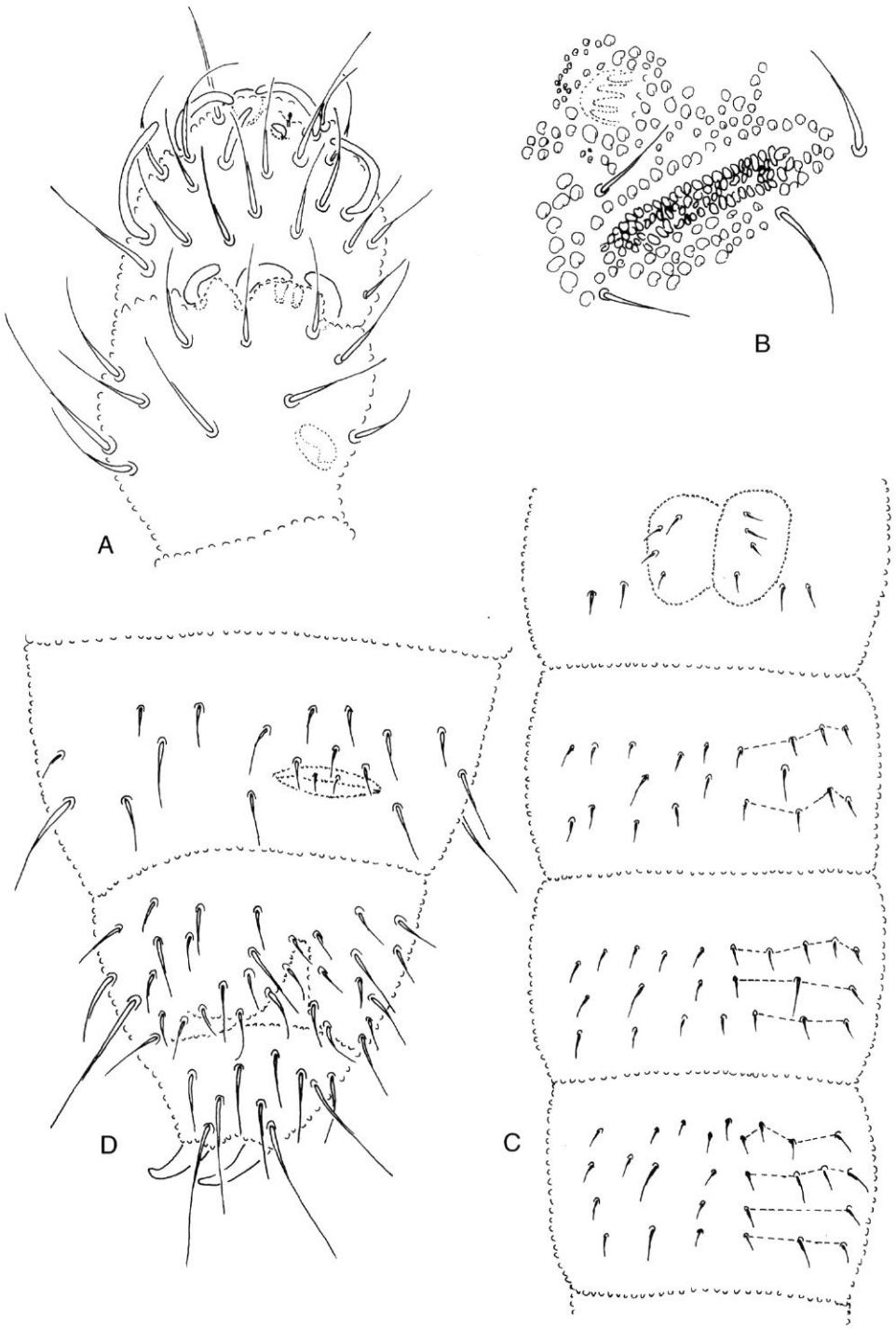

FIG. 2. — *Stenaphorurella quadrispina*. **A**, antennal segments III and IV; **B**, postantennal organ with pseudocellus; **C**, abdominal sternites I-IV; **D**, abdominal sternites V-VI.

Formula of dorsal chaetotaxy as below:

	th. I	th. II	th. III	abd. I
a	-	10 (1)	10 (1)	10 (4)
m	-	6 (2)	6 (2)	-
p	8	10 (3)	12	12 (5)

	abd. II	abd. III	abd. IV	abd. V
a	12	12	10 (8)	10 (11)
m	2 (6)	2 (6)	4 (9)	2 (6)
p	10 (7)	10 (7)	6 (10)	6 (12)

(**1**), a4 absent; (**2**), m1/2 (= m1 for abdominal tergite III) = microchaeta, m5 = mesochaeta, m7 = seta s present, microsensilla (ms) in position of m6; (**3**), p1 absent; (**4**), a4 absent, a5 = mesochaeta; (**5**), p2 = macrochaeta; (**6**), only m5 = macrochaeta present; (**7**), p2 = macrochaeta, p5 absent; (**8**), a3 absent; (**9**), m2 = mesochaeta, m5 = macrochaeta present; (**10**), p2, p4 = seta s, p5 = seta s present; (**11**), a2 = macrochaeta, a5 absent; (**12**), p2, p3 = seta s, p5 = seta s present.

Subcoxae I, II, III with respectively 2, 3, 3 setae, pleurites of abdominal segments I-V with 2, 4, 4, 6 (7), 1 setae. On abdominal pleurites II and III, anterior setae as small sensory setae (s).
Ventral chaetotaxy as in figure 2C, D. Ventral tube with 4 + 4 setae and with 2 + 2 basal setae. Abdominal sternite IV with four rows of setae; row m with 4 + 4 setae. Seta a0 present.
Tibiotarsi I, II, III with 13, 13, 12 setae respectively. Claw without teeth. Empodium triangular in shape, empodial appendage absent.

DISCUSSION
See under *S. lubbocki*.

Stenaphorurella lubbocki (Bagnall, 1935) comb. nov.

Stenaphorura lubbocki Bagnall, 1935: 173.

MATERIAL EXAMINED. — **England.** Danes Dyke, near Flamborough, E. Yorks, 4\s (sic!), August 1934 (lectotype from the Natural History Museum of London, Bagnall collection, designed by J. Rusek in 1976).
Poland. Belsk near Grojec, orchard, 10.III.1983, 2 specimens, coll. M. Sterzynska. — Wroclaw-Pawlowice, sugar beet field, 15.IV.1988, 15.V.1988, 2 specimens, coll. M. Hurej. — Pieniny Mts., Polana Wyrobek, "Pieniny meadow", 30.IV.1972, 3 specimens, coll. W. M. Weiner.
Byelorussia. Villages Griniova, meadow, 10.VIII.1982, 4 specimens (collection of the Moscow Pedagogical University).
Russia. Kazachstan, Narzumskij Reserve (295), 1977, 3 specimens, coll. E. Tiereszkowa (collection of the Moscow Pedagogical University).

DIAGNOSIS
Body elongated. Formula of pseudocelli 11/111/11111. Antennal segment IV with five sensilla, three sensory clubs in antenna III-organ. Postantennal organ 5-6 times longer than diameter of the nearest pseudocellus, elongated, narrow, slightly S-curved, with 50-70 simple vesicles in two rows. Seta p0 of abdominal tergite IV present. Row m on abdominal tergite VI with setae m0 and m1 between anterior pair of anal spines.

REDESCRIPTION
Body (without antennae) 1-1.4 mm. Colour white in alcohol. Granulation rather fine, on the medial parts of tergites more coarse, on the last abdominal tergite coarse.
Pseudocelli per half tergite: 11/111/11111. Pseudocelli on thoracic tergites II-III and abdominal tergites I-IV some distance from the borderline between coarse and fine granulation (3-4 rows of fine grains).
Antennal segment IV with five thickened sensilla a-e, one microsensillum, subapical organite and globular apical vesicle. Antenna III-organ with four guard setae, two small sensory rods protected by integumentary fold, with three thick, cylindrical, sensory clubs, and thick long bent sensory club on ventral side of this segment (Fig. 4A). Antennal segments II and I with eleven and six setae respectively.
Postantennal organ 5-6 times longer than diameter of the nearest pseudocellus, elongated, narrow, slightly S-curved with 50-70 simple vesicles in two parallel rows. One or two simple vesicles between them (Fig. 4B).
Chaetotaxy as in figures 3, 4C, D, with well differentiated macrochaetae, mesochaetae and microchaetae. Dorsal chaetotaxy as in figure 3. Sensory setae (s) well marked on thoracic tergites II and III (1.5 times longer than a2), slightly marked on abdominal tergites IV and V. Microsensilla (ms) on thoracic tergites II and III

present. On the head, seta p2 3 times longer than p1. Unpaired seta m0 present on abdominal tergite IV. Abdominal tergite VI with two pairs of anal spines on distinct papillae, with unpaired setae (a0 and m0), with setae m1 between anterior spines, without m2 and m3 (Fig. 3).

Formula of dorsal chaetotaxy as below:

	th. I	th. II	th. III	abd. I
a	-	10 (1)	10 (1)	10 (4)
m	-	6 (2)	6 (2)	-
p	8	10 (3)	12	12 (5)

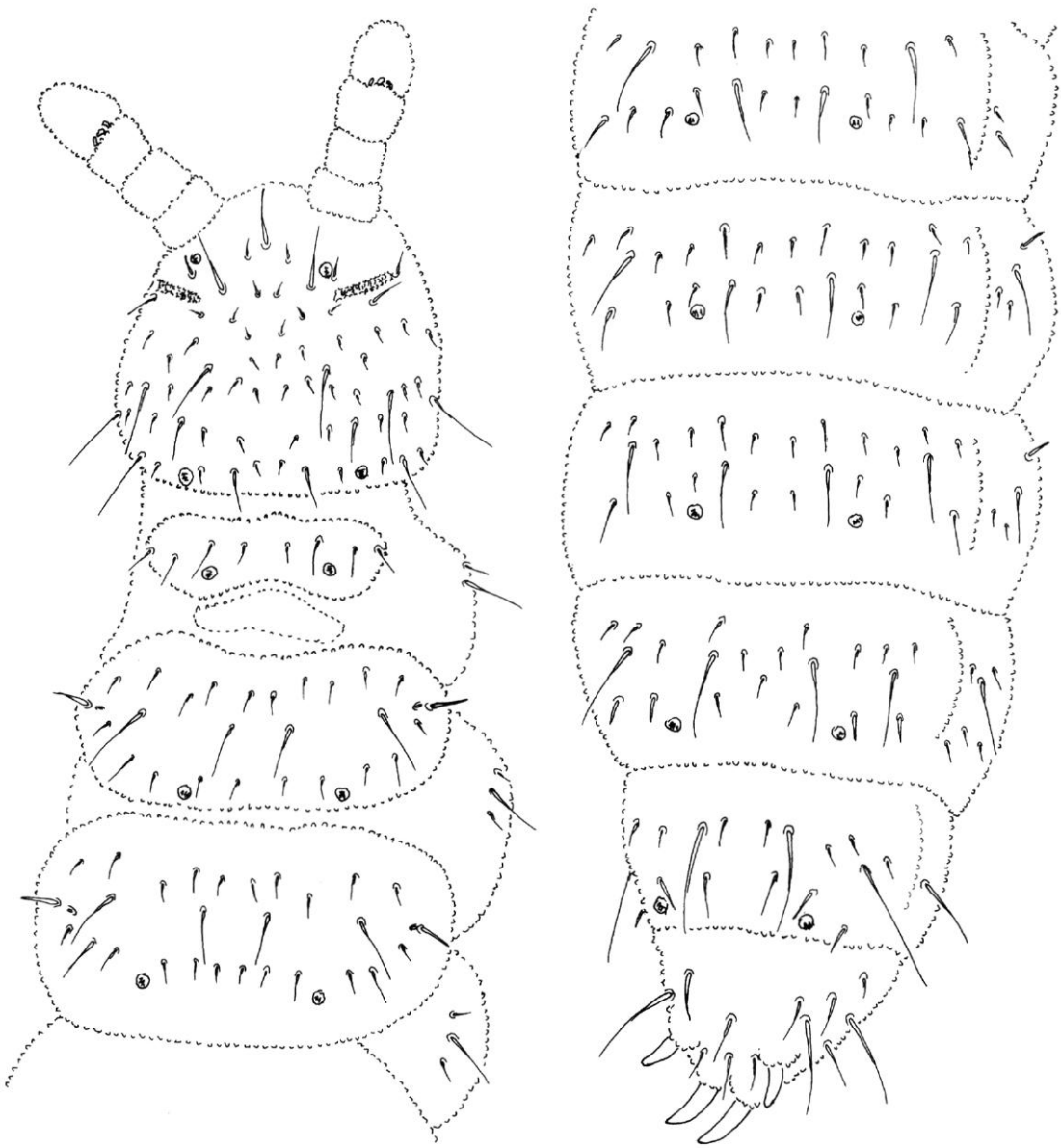

FIG. 3. — *Stenaphorurella lubbocki*. Dorsal chaetotaxy.

	abd. II	abd. III	abd. IV	abd. V
a	12	12	10 (8)	10 (11)
m	2 (6)	2 (6)	5 (9)	2 (12)
p	10 (7)	10 (7)	6 (10)	6 (13)

(**1**), a4 absent; (**2**), m1/2 = macrochaeta, m5 = macrochaeta, m7 = seta s present, microsensilla (ms) in position of m6; (**3**), p1 absent; (**4**), a4 absent; (**5**), 2 = macrochaeta; (**6**), only m5 = macrochaeta present; (**7**), p2 = macrochaeta, p5 absent; (**8**), a3 absent; (**9**), m0, m2 = macrochaeta, m5 = macrochaeta present; (**10**), p2, p4 = seta s, p5 = seta s present; (**11**), a2 = macrochaeta, a5 absent; (**12**), only m5 = macrochaeta present; (**13**), p2, p3 = seta s, p5 = seta s present.

Subcoxae I, II, III with respectively 2, 3, 3 setae, pleurites of abdominal segments I-V with 2, 4, 4, 6 (7), 1 setae. On abdominal pleurites II and III anterior setae as small sensory setae (s).
Ventral chaetotaxy as in figure 4C, D. Ventral tube with 4 + 4 setae and with 2 + 2 basal setae. Abdominal sternite IV with four rows of setae; usually with unpaired seta a0 and with 3 + 3 setae in row m.
Tibiotarsi I, II, III with 13, 13, 12 setae respectively. Claw without teeth. Empodium triangular in shape, empodial appendage absent.

DISCUSSION
This species differs from *S. quadrispina* in many morphological characters. The postantennal organ has a different construction: *S. quadrispina* has three rows, with 40-50 vesicles (3.5 times longer than the nearest pseudocellus), whilst there are two rows in *S. lubbocki*, with 50-70 vesicles (5-6 times longer than the diameter of the nearest pseudocellus). The other distinguishing characters concern the chaetotaxy. Setae m2 on thoracic tergite III are mesochaetae in *S. quadrispina* and macrochaetae in *S. lubbocki*. On abdominal tergites II and III, setae p3 and p4 are mesochaetae in the first species and microchaetae in the latter. Seta m0 of abdominal tergite IV is only present in *S. lubbocki*. In *S. lubbocki*, two pairs of setae are transformed into thick and short sensory setae (s) on abdominal tergites IV-V. The most spectacular character is the presence of setae m1 on abdominal tergite VI, between the anterior pair of anal spines, in *S. lubbocki*, and their absence in *S. quadrispina*. In the latter, setae m3 are present behind papillae of the anterior spines. In the ventral chaetotaxy, row m of abdominal segment IV has four setae in *S. quadrispina*, but only three in *S. lubbocki*.

Stenaphorurella denisi (Bagnall, 1935)

Stenaphorura denisi Bagnall, 1935: 172.

Tullbergia Parisi Denis, 1943 syn. nov.: 29.

(= *Stenaphorurella parisi* after Luciáñez *et* Simon, 1992)

MATERIAL EXAMINED. — **England.** Speaton, E Yorkshire, 30.IX.1934 (holotype female in the Natural History Museum, Bagnall Coll., Brit. Mus. 1959-591).
France. Marsannay, Côte-d'Or, Combe du Pré, sous pierres (under stones), 14.XII.1941, 6 specimens, coll. J.-R. Denis. — Brunoy, 2.X.1973, 1 specimen, coll. J. Najt.
Luxembourg. Am Partumka, cultivated soil, 16.IV.1991, 1 specimen (L-91-0), coll. A. Theves. — Baschleiden, in garden, soil between red and white currant shrubs, 24.IV.1994, 4 specimens, coll. N. Stomp, W. M. Weiner.

DIAGNOSIS
Body elongated. Formula of pseudocelli 11/111/11121. Antennal segment IV with a swollen smooth area on the top, five sensilla a-e, three sensory clubs in antenna III-organ. Postantennal organ three times longer than the diameter of pseudocellus, elliptical with simple vesicles in two-three irregular rows. Abdominal tergite VI with two pairs of anal spines on distinct papillae and with a pair of cuticular protuberances with one seta on top.

REDESCRIPTION
Body 1-1.3 mm (1.26 mm for holotype). Colour white in alcohol. Granulation fine, only on the lateral parts of tergites slightly coarse, on the last abdominal tergite coarse.
Pseudocelli present: 11/111/11121.
Antennal segment IV with five thickened sensilla a-e, one microsensillum, subapical organite and swollen smooth area on top. Antenna III-organ with four guard setae, two small sensory rods protected by integumentary fold, with three

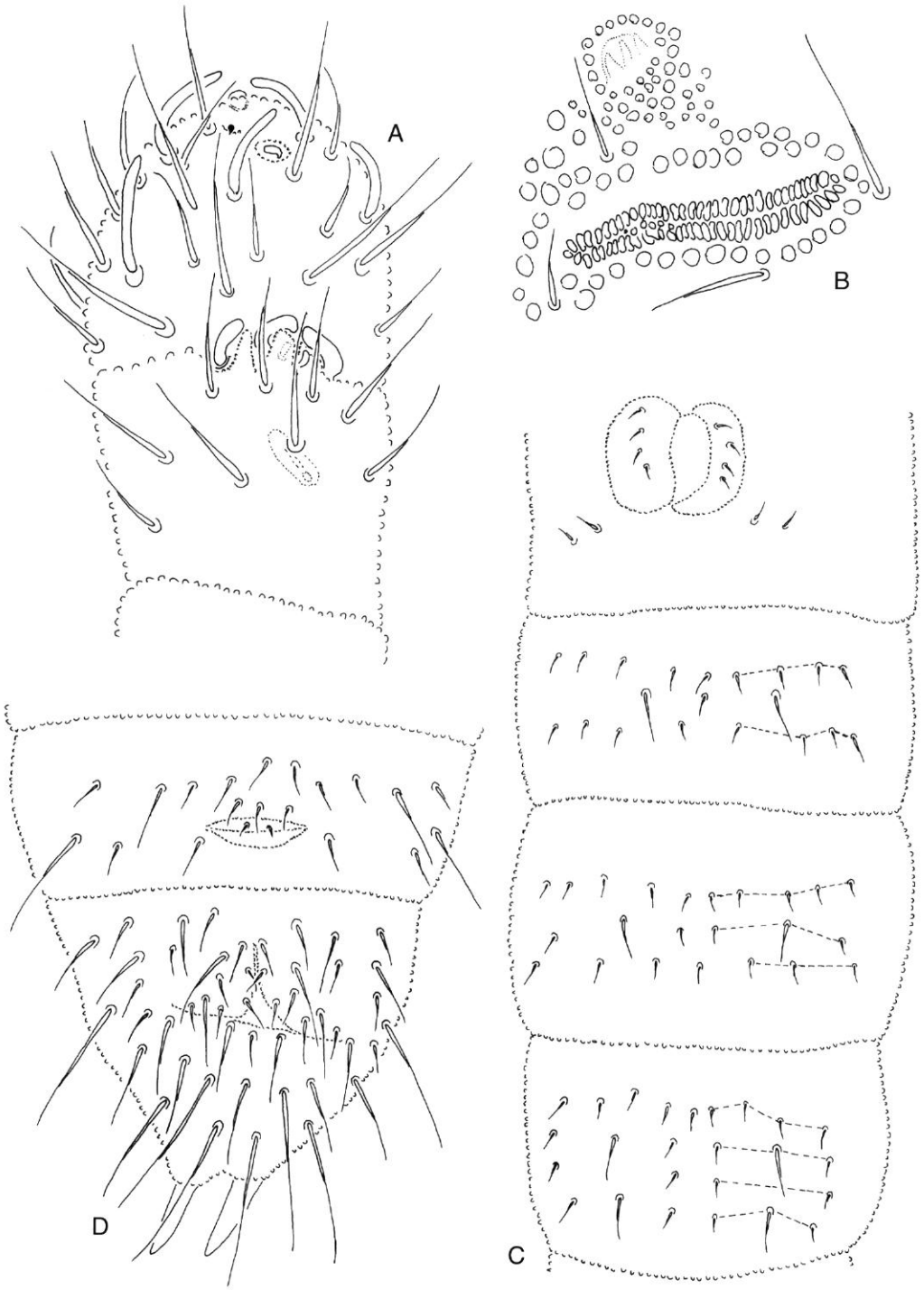

FIG. 4. — *Stenaphorurella lubbocki*. **A**, antennal segments III and IV; **B**, postantennal organ with pseudocellus; **C**, abdominal sternites I-IV; **D**, abdominal sternites V-VI.

thick, cylindrical sensory clubs, and thick long bent sensory club on ventral side of this segment (Fig. 6A). Antennal segments II and I with eleven and six setae respectively.

Postantennal organ elliptical, three times longer than the diameter of nearest pseudocellus. It consists of 50-60 simple vesicles in two or three rows (Fig. 6B).

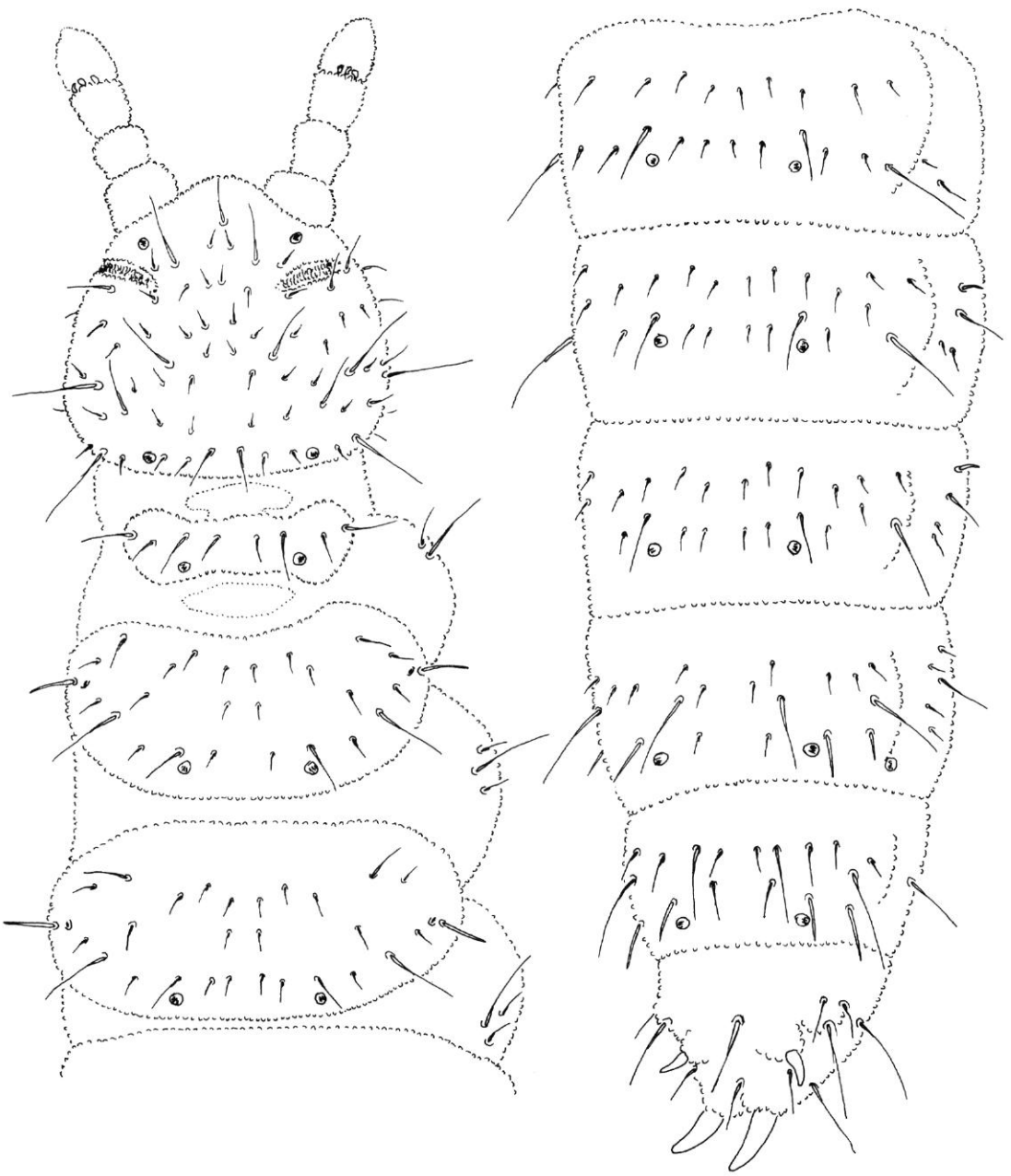

FIG. 5. — *Stenaphorurella denisi*. Dorsal chaetotaxy.

Chaetotaxy as in figures 5, 6C, D, with macrochaetae and microchaetae well differentiated. Dorsal chaetotaxy as in figure 6A. Sensory setae (s) weakly marked on thoracic II-III and on abdominal tergites IV-V. Microsensilla (ms) on thoracic tergites II and III present. On the head, seta p1 two times longer than p2. On abdominal tergite VI, two pairs of anal spines on distinct papillae and a pair of cuticular protuberances with one seta on the top and with two setae above them. Seta a0 almost two times longer than m0, setae m1 and m2 absent, setae m3 in lateral position under papillae of anterior anal spines (Fig. 6A).

Formula of dorsal chaetotaxy as below:

	th. I	th. II	th. III	abd. I
a	-	10 (1)	10 (1)	10 (5)
m	-	6 (2)	6 (2)	-
p	8	10 (3)	12 (4)	12 (6)

	abd. II	abd. III	abd. IV	abd. V
a	12	12	10 (9)	10 (12)
m	2 (7)	2 (7)	4 (10)	2 (13)
p	10 (8)	10 (8)	6 (11)	6 (14)

(**1**), a4 absent; (**2**), m1 = microchaeta, m4 = microchaeta, m7 = seta s present, microsensilla in position of m6; (**3**), p1 absent, p5 = macrochaeta; (**4**), p5 = macrochaeta; (**5**), a4 absent, a5 = microchaeta (rather than mesochaeta); (**6**), p2 = microchaeta, p3 = mesochaeta, p6 = macrochaeta; (**7**), m5 = microchaeta present; (**8**), p3 = mesochaeta, p6 = macrochaeta; (**9**), a3 absent; (**10**), m2 = macrochaeta, m5 = macrochaeta present; (**11**), p2 = microchaeta, p4 = mesochaeta (seta s), p5 = microchaeta (seta s) present; (**12**), a2 = macrochaeta, a5 absent; (**13**), only m5 = macrochaeta present; (**14**), p2, p3 = seta s, p5 = seta s present.

Subcoxae I, II, III with respectively 2, 3, 3 setae, pleurites of abdominal segments I-V with 2, 4, 4, 6, 1 setae. On abdominal pleurites II and III anterior setae as sensory setae (s).

Ventral chaetotaxy as in figure 6C, D. Ventral tube with 4 + 4 setae and with 2 + 2 basal setae. Abdominal sternite IV with four rows of setae; row m with 3 + 3 setae, seta a0 absent.

Tibiotarsi I, II, III with 13, 13, 12 setae respectively. Claw without teeth, empodium triangular in shape, empodial appendage absent.

Discussion

Stenaphorura denisi differs from *S. quadrispina* and *S. lubbocki* by its different pseudocellar formula (11/111/11121 in *S. denisi* and 11/111/11111 in the other two species); by the presence of a swollen, finely granulated area at the tip of antennal segment IV; and by the presence of a pair of cuticular protuberances on abdominal tergite VI. Further distinguishing characters are found in the chaetotaxy. On the head of *S. quadrispina* and *S. lubbocki* seta p1 < p2, whereas in *S. denisi* p1 > p2. Setae in row m on thoracic tergites II-III and abdominal tergites II-III are microchaetae in *S. denisi*, but are macrochaetae in *S. lubbocki* and micromesochaetae in *S. quadrispina*. Abdominal tergites I-III have setae p2 < p3 in *S. denisi* and p2 > p3 in the other two species.

Both the original descriptions and figures of *S. denisi* (Bagnall, 1935) and *S. parisi* (Denis, 1943) contain several mistakes.

In the description of Bagnall (1935) the other pseudocellar formula is given as 1 + 1 pseudocelli on abdominal tergite IV, while the type material shows the formula 2 + 2. In figure 6 (Bagnall 1935) three setae of anterior row of abdominal tergite VI are figured. In reality, these setae are not situated on the tergite of the holotype, being in fact the setae of sternite VI, visible through the tergite by transparency.

Denis (1943) noticed that the postantennal organ appears to have four rows of vesicles, but on the lectotype of *S. parisi* (Muséum national d'Histoire naturelle, Paris) the postantennal organ has 2-3 rows, exactly as in *S. denisi*.

Denis (1943, fig. 4) illustrated setae p2 on abdominal tergite V as being absent. In reality they are present in the slide-mounted specimens. Also seta a0 on abdominal tergite VI is drawn too short: this seta is twice as long as seta m0 on the lectotype. Denis also indicated (in the description and in figure 3), that a small, clear empodial appendage was present. In fact, this is due to a misinterpretation of one of the pretarsal setae.

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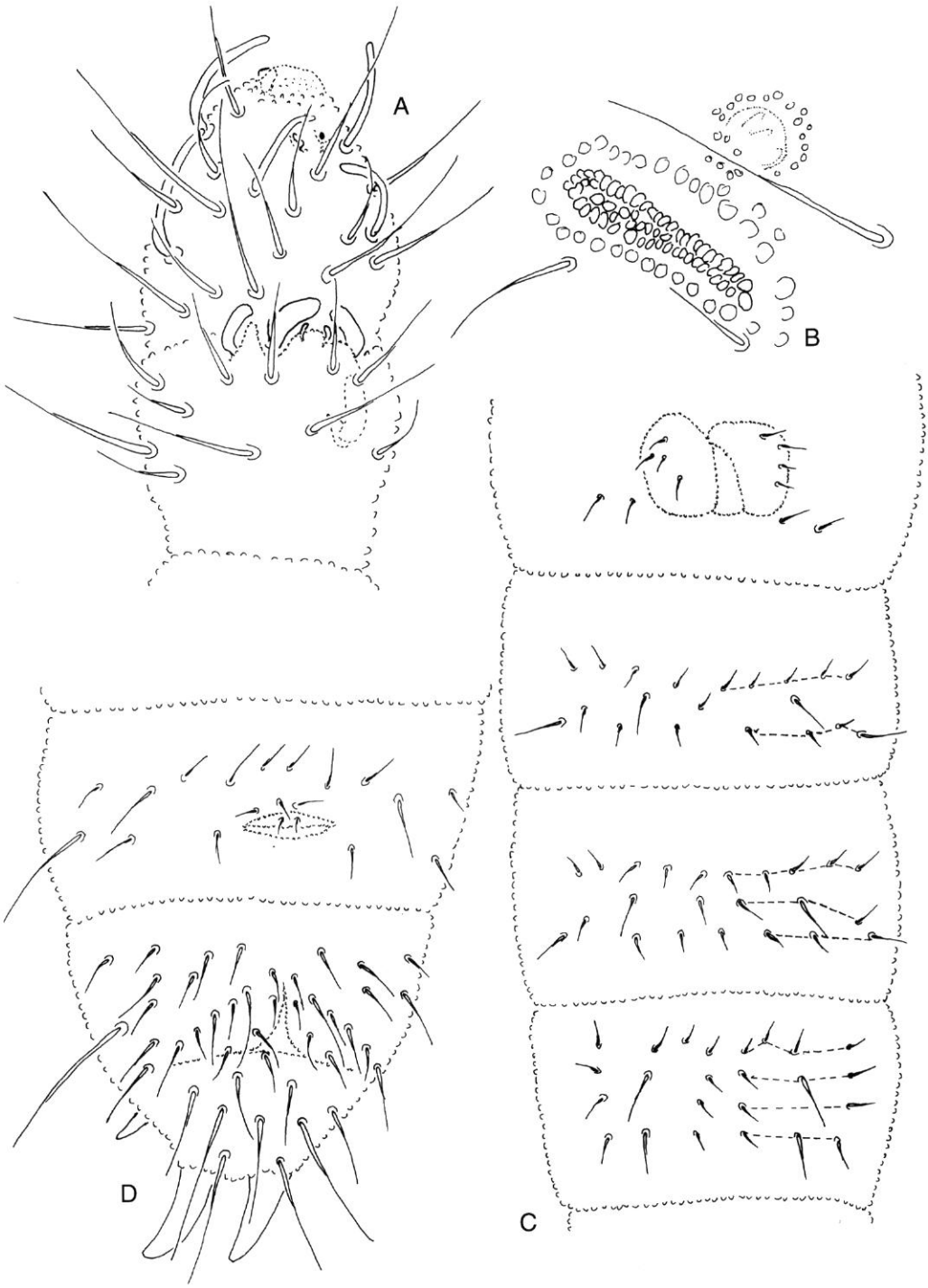

FIG. 6. — *Stenaphorurella denisi*. **A**, antennal segments III and IV; **B**, postantennal organ with pseudocellus; **C**, abdominal sternites I-IV; **D**, abdominal sternites V-VI.

Judith Najt and Jean-Marc Thibaud (Muséum national d'Histoire naturelle, Paris). We also used material from collections deposited in the Moscow Pedagogical University (Moscow) and the Musée national d'Histoire naturelle (Luxembourg).

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