



Abh. Ber. Naturkundemus. Görlitz	Band 74 Heft 2	S. 159 – 191	2002
--	-------------------	--------------	------

ISSN 0373-7586

Fourth report on Symphypleona from Russia with descriptions of four new species (Insecta, Collembola)

GERHARD BRETTFELD

Zoological Institute, University of Kiel, Germany

Abstract

From Taimyr Peninsula, Putorana Plateau, Yenisey River, Altay-Sayan-Tuva Mts. and far eastern Primorskiy Region, 27 taxa of Collembola Symphypleona are described. Among these, 2 species are known from North America (*Sminthurus sylvestris*, *Sphyrotheca minnesotensis*), 2 from Japan (*Ptenothrix narumii*, *Ptenothrix* cf. *vinnula*) and 4 species are new to science (*Ptenothrix albosignata* n. sp., *Rusekianna sibirica* n. sp., *Sminthurus primorskiyensis* n. sp. and *Vesicephalus bellingeri* n. sp.).

Zusammenfassung

Vierter Bericht über Symphypleona aus Russland mit Beschreibung von vier neuen Arten (Insecta, Collembola) – Von der Taimyr Halbinsel, dem Putorana Gebirge, dem Jenissei, den Altai-Sayan-Tuva-Gebirgen und der fernöstlichen Primorskiy Region werden 27 Taxa der Collembola Symphypleona beschrieben. Davon sind 2 Arten bisher nur aus Nordamerika bekannt (*Sminthurus sylvestris*, *Sphyrotheca minnesotensis*), 2 von Japan (*Ptenothrix narumii*, *Ptenothrix* cf. *vinnula*) und 4 sind für die Wissenschaft neue Arten (*Ptenothrix albosignata* n. sp., *Rusekianna sibirica* n. sp., *Sminthurus primorskiyensis* n. sp. and *Vesicephalus bellingeri* n. sp.).

Introduction

I have had the opportunity to study 23 samples of Collembola Symphypleona collected from Russia. They were collected in the Taimyr Peninsula (9 samples), the Putorana Plateau (4 samples), near the Yenisey River (1 sample), in the West Sayan Mts. (all these sites in Krasnoyarsk Region), in the Altay Region (1 sample), in the Tuva Region (5 samples) and in the far eastern Primorskiy Region (2 samples). These samples contained 24 taxa, 4 of these are new to science. Most surprising, however, is that there are 2 species only known from North America and 2 from Japan. The occurrence of the latter is explained by the nearness of their collection site, the Primorskiy Region, to the Japanese isle of Hokkaido. The occurrence of species known only from North America shows that there are always further Holarctic species to be expected.

In order to verify some identifications, I was able to study the following species from the following collections: *Sminthurus arborealis* Itoh, 1985, ex coll. Itoh, Tokyo, Japan; *Sminthurus variegatus* Axelson, 1903, ex coll. Museum Helsinki, Finland; *Sphyrotheca minnesotensis* Guthrie, 1903, ex coll. Illinois Natural History Survey, Champaign, USA.

The preparation method and the presentation of the results follow my previous papers, in particular the first of this series (BRETFFELD 1996). For more information about taxonomy, characteristics, occurrence and biology of the known species see BRETFFELD (1999). The types are held in the author's collection. The description of the species follows their alphabetical order.

List of the samples and their taxa

A. Russia, E of the Ural Mts., northern localities

1. Krasnoyarsk Reg., W Taimyr, mouth of Uboinaya River, about 73°30'N – 82°20'E; sweepnet sample in meadow on river slope, 22.7.1985 leg. Babenko (coll. Bretfeld no. Ba VI/4) (*Sminthurus multipunctatus*).
2. Krasnoyarsk Reg., W Taimyr, upper current of Uboinaya River, Koso-Turku Lake on foothills of Byranga Mts., 73°11'N – 83°26'E; *Dryas* association on rocky outcrops, 30.7.1986 leg. Babenko (Ba VI/5) (*Sminthurus multipunctatus*).
3. Krasnoyarsk Reg., W Taimyr, Yeniseyskiy Bay, International Field Station »Medusa«, 73°21'N – 80°32'E, 18 km S of Dickson settlement; sweepnet sample from zonal spotted tundra, 20.7.2000 leg. O. Chruleva (Ba VI/9) (*Sminthurus multipunctatus*).
4. Krasnoyarsk Reg., E Taimyr, northern shore of Lake Taimyr, Ozhidaniya Bay, 74°36'N – 101°44'E; sweepnet sample in meadow of lower terrace, 22.7.1993 leg. Babenko no. L30/93 (Ba VI/6) (*Sminthurus multipunctatus*).
5. As sample 4, but pitfall traps in zonal spotted tundra, 30.7.1993 leg. Babenko no. L56/93 (Ba VI/7) (*Sminthurus multipunctatus*).
6. Krasnoyarsk Reg., S Taimyr, upper current of Nizhnyaya Agapa River, lake Ladannakh, about 100 km N of Norilsk, about 70°N – 98°E; pitfall traps in wet tundra with *Eriophorum vaginatum* tussocks, 14.7.1999 leg. Babenko no. R39/99 (Ba V/1) (*Heterosminthurus bilineatus*, *Heterosminthurus* spec., *Sminthurides malmgreni*, *S. parvulus*, *S. schoetti*, *Sminthurinus alpinus*, *Sminthurus sylvestris*, *Stenacidia violacea*).
7. As sample 6, but pitfall traps in snowbed, 17.7.1999 leg. Babenko no. R54/99 (Ba V/2) (*Sminthurides* cf. *aquaticus*, *S. malmgreni*, *S. schoetti*, *Sminthurus sylvestris*, *Sphaeridia leutrensis*).
8. As sample 6, but sweepnet sample in a meadow on southern slope of lake, 2.8.1999 leg. Babenko no. R104/99 (Ba V/3) (*Heterosminthurus bilineatus*, *H. chaetocephalus*, *Sminthurus sylvestris*).
9. As sample 6, same method and habitat as sample 8, but 9.8.1999 leg. Babenko no. R125/99 (Ba V/4) (*Heterosminthurus bilineatus*, *H. chaetocephalus*, *Sminthurus sylvestris*).

10. Krasnoyarsk Reg., Putorana Plateau S of Taimyr Peninsula, Dynkengda Mts., near Lake Yt-kyuel (Sobachye), 69°08'N – 91°50'E; mosses and boreal dwarf shrubs of wet fir-larch forest at 70 m altitude, 18.7.1997 leg. Babenko no. 20/97 (Ba VI/1) (*Rusekianna* n. sp., *Sminthurinus alpinus*).
 11. As sample 10, but lichen, mosses and *Vaccinium* of dry fir-larch forest at 60 m altitude, 18.7.1997 leg. Babenko no. 16/97 (Ba VI/2) (*Rusekianna* n. sp.).
 12. As sample 10, but in forest belt on lake shore under logs at 60 m altitude, 21.7.1997 leg. Babenko no. R27/97 (Ba VI/3) (*Dicyrtoma* cf. *christinae*).
 13. As sample 10, but sweepnet sample in fir-birch forest at 200 m altitude, 5.8.1997 leg. Babenko no. R90/97 (Ba VI/8) (*Heterosminthurus umbonicus*).
 14. Krasnoyarsk Reg., eastern shore of Yenisey River about 750 km N of Krasnoyarsk near Mirnoye; sweepnet sample from ruderal vegetation, 10.8.1993 leg I. Hahn, dedit M. v. Tschirnhaus no. X864 (44/94) (*Deuterosminthurus pallipes*, *Spatulosminthurus guthriei sibiricus*).
- B. Russia, E of the Ural Mts., far eastern locality
15. Primorskiy Reg., NE of Vladivostok about 135°E, Gornotayozhnoye, Mountain Taiga Station; yellow pan traps, 21. – 22.6.1999 leg. M. V. Michailovskaya, dedit P. F. Bellinger (Russia V/5) (*Bourletiella* spec., *Ptenothrix narumii*, *P.* cf. *vinnula*, *Ptenothrix* n. sp., *Sminthurus nigromaculatus*, *Sminthurus* n. spec., *Sphyrotheca minnesotensis*).
 16. As sample 15, but 26. – 28.6.1999 leg. M. V. Michailovskaya, dedit P. F. Bellinger (Russia V/6) (*Ptenothrix* cf. *vinnula*, *Sminthurus nigromaculatus*, *S. sylvestris*, *Sphyrotheca minnesotensis*, *Vesicephalus* n. sp.).
- C. Russia, E of the Ural Mts., SE mountain localities
17. Krasnoyarsk Reg., West Sayan Mts., Oisky Ridge, 5 km from Olen'ya Rechka; pitfall traps between moss on rocks, 27.6.1990 leg. S. Stebaeva (St III P4) (*Heterosminthurus linnaniemi*).
 18. Gorno-Altay Reg., Kurayskiy Ridge; sweepnet sample from upper limit of meadow tundra, 20.8.1962 leg. S. Stebaeva (St III P1) (*Heterosminthurus claviger*).
 19. West Tuva Reg., SW part of West Sayan Mts., northern shore of lake Kara-Khol'; sweepnet sample from bog with *Carex*, 14.7.2001 leg. S. Stebaeva (St III P7) (*Heterosminthurus* cf. *diffusus*).
 20. As sample 19, but 10 km from lake Kara-Khol'; tundra with moss and lichens in 2300 m altitude, sample from moss by Tullgren funnel, 16.7.2001 leg. S. Stebaeva (St III P2) (*Heterosminthurus claviger*).
 21. Same locality and method as sample 20, but from rocky tundra, 16.7.2001 leg. S. Stebaeva (St III P3) (*Heterosminthurus claviger*).
 22. West Tuva Reg., Alashskoye Plateau, 5 km from lake Sut-Khol'; mossy tundra in 2300 m altitude, sample from moss by Tullgren funnel, 20.7.2001 leg. S. Stebaeva (St III P9) (*Sminthurinus alpinus*).

23. As sample 22, but tundra with moss and lichens in 2300 m altitude, sample from moss by Tullgren funnel, 20.7.2001 leg. S. Stebaeva (St III T1) (*Heterosminthurus claviger*).

Description of the species

Bourletiella Banks, 1899 spec.

Material: Russia (Primorskiy Reg.) sample 15: 1 juvenile female.

Completely grey-black, without species-specific chaetotaxic characteristics.

Deuterosminthurus pallipes (Bourlet, 1842)

Material: Russia (Krasnoyarsk Reg.) sample 14: 42 specimens.

Pigment varies from yellow to bright red (var. *repanda*) and dark violet (var. *principalis*); males with spinelike setae of antennal segments I and II, both sexes with, rarely without, seta d7 of femora III (BRETFFELD 1999).

D. pallipes was found here in a ruderal vegetation. Both forms of this Palearctic species are already known from Siberia (BRETFFELD 1996, 2000).

I regret a lapsus in BRETFFELD (1996). The different colour forms of this species should not be summarised under *Deuterosminthurus repandus* (Ågren, 1903) but under *D. pallipes* (see NAYROLLES 1996).

Dicyrtoma cf. *christinae* Szeptycki, 1981

Material: Russia (Putorana Plateau) sample 12: 2 juveniles (in one slide, A. Babenko prep.).

With little pigment; setae of dentes as originally described (rough but without basal thickening). A final determination will only be possible with adults.

D. cf. *christinae* was found here in the forest belt on a lake shore under logs. It is only known from the type locality in N Poland, where it was found on decaying plants and also under decaying pieces of timber on a very wet soil.

Heterosminthurus bilineatus (Bourlet, 1842)

Material: Russia (S Taimyr) sample 6: 26 specimens with 1 male, 8: 4 females, 9: 8 females.

With only pale brown stripes; centre of head frons of male with 2 pairs of stout setae, both sexes with flank setae as 4/-.

H. bilineatus was found here in wet tundra and a meadow. It is mainly known from Europe, now confirmed from S Taimyr and may also occur in other regions of Siberia.

Heterosminthurus claviger (Gisin, 1958)

Material: Russia (Altay) sample 18: 1 male; (Tuva) sample 20: 1 male, 21: 1 female, 23: 1 female.

Male with typical broad head setae, both sexes with flank setae as 5/+.

H. claviger was found here in a high alpine low vegetation. It is known from Europe and already from Altay Reg. (BRETFFELD 1999), but is new to Tuva Reg.

Heterosminthurus cf. diffusus (Gisin, 1962)

Material: Russia (Tuva) sample 19: 2 females.

Flank setae as 5/+, appendices anales with fringes, pigment faded in these slide specimens.

H. cf. diffusus was found here in a high alpine *Carex* vegetation. This species is only known from the Austrian Alps.

Heterosminthurus linnaniemii (Stach, 1920)

Material: Russia (W Sayan Mts.) sample 17: 9 specimens with several adults of both sexes.

Some specimens darkly pigmented between eye-patches, no pigment on body (var. *decolorata*); males with typical long setae of dorsal head region, both sexes with flank setae as 4/-.

H. linnaniemii was found here in high alpine mosses. This Eastern Palaearctic species is already known from the mountains in SE Russia (BRETTFELD 2000).

Heterosminthurus chaetocephalus Hüther, 1971

Material: Russia (S Taimyr) sample 8: 13 specimens with 3 males, 9: 37 specimens with several males.

Males as originally described and easily recognised at low magnification.

H. chaetocephalus was found here on a lake meadow. It is known from northern Germany, from Poland, Hungary, Western Russia and previously from Siberia (BRETTFELD 1996).

Heterosminthurus umbonicus Bretfeld, 2000

Material: Russia (Putorana Plateau) sample 13: 4 males, 8 females.

Males with yellowish-brown background colour and few bluish-brown spots: A longitudinal spot between eye-patches and antennae, a crossband below antennae, a crossband on abdominal segment V and 1+1 incomplete »eyes« on abdominal segment VI; tip of dorsal anal valve dark (see Fig. 1), legs and furca unpigmented. Compared with the original description of the holotype male, the pigmentation is more intense; the species specific clypeal protuberance with its small setae is identical. Females have not been found until now and are described as follows.

Description of females: Measurements and proportions of 2 females. Total length 0.8 mm, head 0.3 mm, mucro 23 µm, appendices anales 74 µm; whole antenna : head length = 2.1, antennal segment I : II : III : IV = 1 : 2 : 3.5 : 6.9, mucro : dens : manubrium = 1 : 3.2 : 3.6, mucro : claw III inner edge = 2.9, appendices anales : mucro = 0.8, appendices anales : claw III inner edge = 2.3.

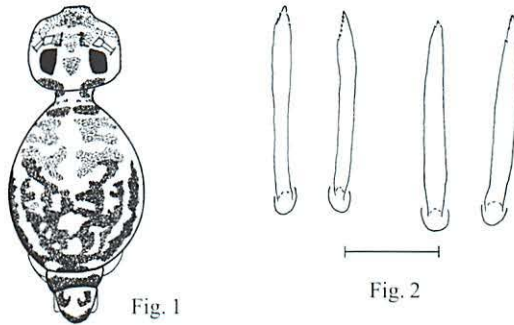
Colour (Fig. 1): Eye-patches black; background colour white with a dark and pale blue pattern: Head and small abdomen as described above for the males, large abdomen with marblings and postero-lateral longitudinal stripes.

Chaetotaxy without peculiarities, also circumanal setae normal. Some characteristics compared with the males are: Clypeus row e with only 1 median seta and median part not shifted dorsally, region M also with 11 setae, antennal segment II also without seta 2/1,

antennal segment III with a normal dorso-distal seta, tibiotarsus I row p also with 7 setae, flank setae also as 4/–, genital papilla with 9 – 11 setae, circumanal setae long, $av1' < av1 < av2$, appendices anales slender and tip with few small teeth (Fig. 2).

Remarks: Whereas only one male of *H. umbonicus* was originally described, here the description is completed with that of males from another locality and with the females. These differ considerably from the males in their intense pigmental pattern, only the head and small abdomen are similar. The specimens studied doubtlessly belong to the same species, as they were collected together not being mixed with other *Heterosminthurus* species.

H. umbonicus was found here in a fir-birch forest. It was only known from the type locality, a moist mountain taiga in Russia, E Yakutia.



Heterosminthurus umbonicus Bretfeld, 2000

Fig. 1 Colour pattern of female. Total length of body 0.8 mm

Fig. 2 Appendices anales of 2 females (bar = 25 μ m)

Heterosminthurus Stach, 1955 spec.

Material: Russia. (S Taimyr) sample 6: 1 juvenile.

This small, yellow juvenile cannot be identified.

Ptenothrix albosignata n. sp.

Holotype: Male (in 3 slides, head and antennae unbleached) of sample 15: Russia, Primorskiy Reg., NE of Vladivostok about 135°E, Gornotayozhnoye, Mountain Taiga Station; yellow pan traps, 21. – 22.6.1999 leg. M. V. Michailovskaya, dedit P. F. Bellinger (coll. Bretfeld no. Russia V/5). No further specimens known.

Derivatio nominis: This new species is named after the striking colour pattern of its head.

Diagnosis: A dark species of the genus *Ptenothrix* Börner, 1906 with 7 diagnostic characteristics:

- Head and body brown with white frons and clypeus,
- head apex with 7+7 spinelike setae (number apomorphic),
- clypeus with spinelike middle setae of uniform shape,

- most ventral row of spinelike setae of clypeus with 3 setae (apomorphy; plesiomorphy: only one median spinelike seta),
- dorsal parts of small abdomen with 9 thick setae,
- setae a0 and sa of small abdomen setaceous (plesiomorphy; apomorphy: spinelike),
- outer seta E1 of dens almost smooth (plesiomorphy; apomorphy: toothed).

Description: Measurements and proportions. Total length 1.2 mm, head 0.6 mm, mucro 170 μm ; whole antenna : head length = 2.5, antennal segment I : II : III : IV = 1 : 5.5 : 6.1 : 1.7, manubrium : dens : mucro = 2.6 : 3 : 1, mucro : claw III inner edge = 2, length of setae of antennal segment II : mucro up to 0.6, ratio of outer setae E1 : E2 : E3 : E4 of dens = 1 : 0.7? : 1.7 : 2.4.

Colour: Eye-patches black; background colour whitish, head and body with dark brown pigment. Head (Fig. 3) with dark lateral parts, dorsal parts spotted, back side unpigmented, frons and clypeus with unpigmented Y-shaped pattern. Dorsal and ventral parts of large abdomen dark, antero-dorsal part lighter; small abdomen reddish brown with light dorsal cross stripe, anal valves and genital papilla unpigmented. Antennae brown but distal part of segment III and whole segment IV unpigmented; femora and tibiae with longitudinal brown stripes, other parts unpigmented; furca with little pigment in distal part of dentes.

Chaetotaxy and special structures (chaetotaxy of antennae and legs not studied): Head (Figs. 4, 5). Eye-patches with 2+2 setae, dorsal ones spiny and longer than ventral (number and shape of ommatidia obscured by pigment), setal pair 1 of dorsal head-back large but fallen out, apex with 1+1 colourless vesicles (with additional retinae? see JORDANA et al. 2001), head apex and frons with 5+5 slender spinelike setae, length of setae b3 > a4, frons with 5+5 very short setae, clypeus with 1,1,2,2+1 (anomaly?), 1,3 spinelike, uniform setae.

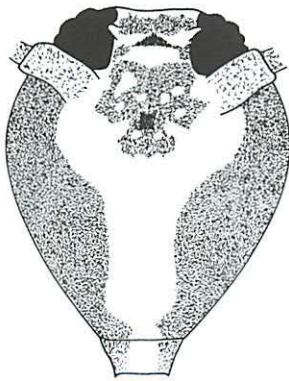


Fig. 3

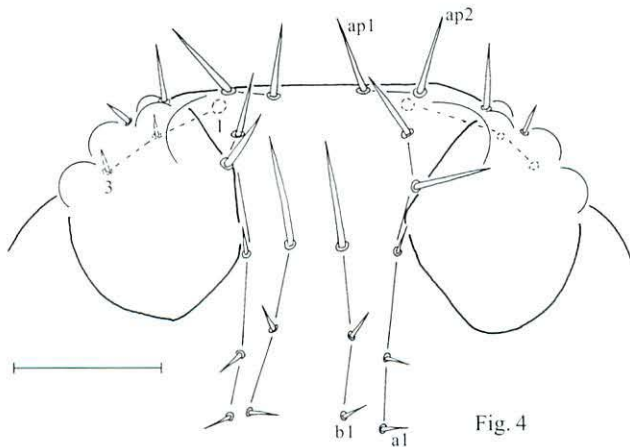


Fig. 4

Ptenothrix albosignata n. sp.

Fig. 3 Colour pattern of head. Total length about 0.6 mm

Fig. 4 Dorsal parts of head (bar = 100 μm)

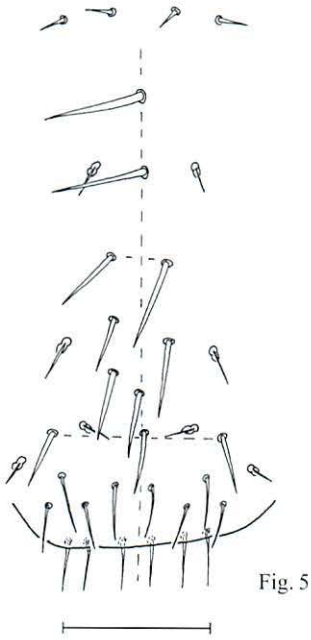


Fig. 5

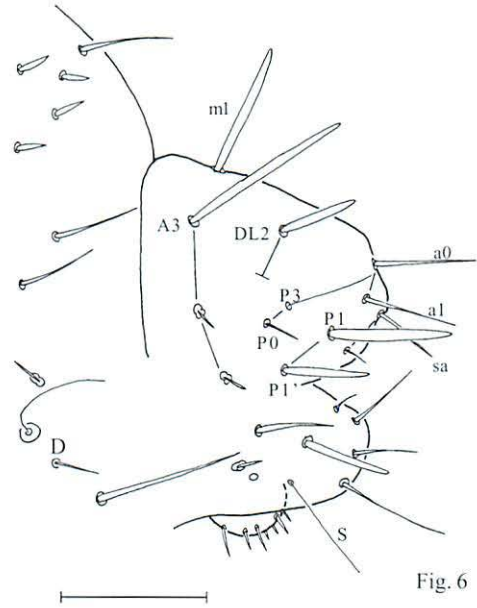


Fig. 6

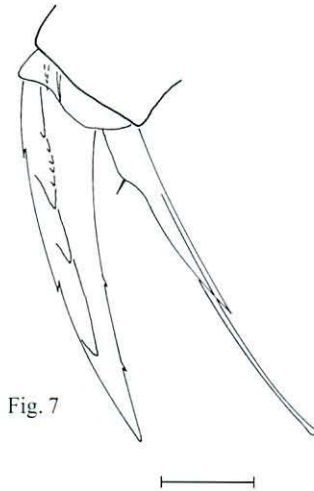


Fig. 7

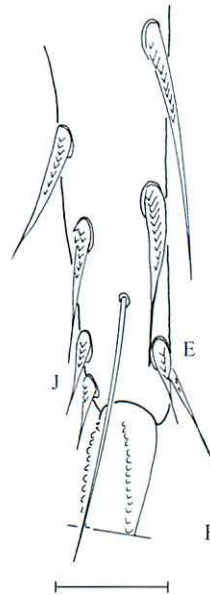


Fig. 8

Ptenothrix albosignata n. sp.

Fig. 5 Middle part of head clypeus (bar = 100 μ m)

Fig. 6 Posterior part of large abdomen and small abdomen (bar = 100 μ m)

Fig. 7 Claw II seen from anterior (bar = 25 μ m)

Fig. 8 Parts of dens and mucro (bar = 50 μ m)

Antennae: Segment II with about 9 thick setae of median length, segment III with about 6 distal subsegments, segment IV also subsegmented.

Large abdomen: Long setae of anterior part fallen out, posterior part with many short thickened setae (Fig. 6) surrounded by normal ones, furca base with only normal setae; segment V with 1 long seta behind bothriothrix D (Fig. 6).

Small abdomen: Dorsal part (Fig. 6) with 9 thickened setae m1, A3, DL2, P1', P1 (M', M, N, T, H after YOSH 1969), setae A3 the longest, DL2 and P1' shorter than other thick ones, setae a0 and sa setaceous, length of a0 > sa >> sa', seta P2 (G) is generally missing in males (BRETTFELD 1994); ventral parts of small abdomen with 1+1 thickened setae.

Legs: Most setae of tibiotarsi rough; posterior side of tibiotarsus III with 2 straight, coarsely toothed setae; claws (Fig. 7) slender with toothed pseudonychia, 2 outer and 2 inner teeth, empodia (Fig. 7) also slender with filaments long, thin, slightly knobbed and exceeding claws.

Furca (Fig. 8): Formula of anterior setae of dens as 3,2,1,1...1, outer row E with 8, inner row J with 9, posterior row P with 5 and with 1 postero-external seta PE, outer and most inner setae basally toothed, but most distal outer seta E1 smooth or only with few small basal teeth, tip of both setae E2 broken off; mucro without seta, both posterior edges serrate.

Remarks: This male of *P. albosignata* n. sp. with its striking head pigmentation does not fit into the key in BRETTFELD (1999). It has, however, the three following chaetotaxic characteristics which are shared with 9 species of the Eastern Palaearctic, the Ryukyu Islands and North America: Most ventral row of spinelike setae of clypeus with 3 setae, seta E1 of dens almost smooth and setae a0 and sa of small abdomen setaceous. These 9 species are compared in Table 1, which shows that several characteristics have not been described in all species, and thus the head pigmentation is the main feature to separate *P. albosignata* n. sp. from the related species. The female should be searched for to confirm and complete this description.

Ptenothrix narumii Uchida, 1940

Material: Russia (Primorskiy Reg.) sample 15: 1 juvenile.

Colour pattern as originally described with a white background and 2 black longitudinal bands on head and 3 black cross bands on large abdomen.

This pattern seems to be very characteristic, although the original specimens from NE China, Manchuria, were described as dark and pale purple.

P. narumii was found here in a mountain taiga. It was only known from the type locality.

Ptenothrix cf. *vinnula* Uchida, 1957

Material: Russia (Primorskiy Reg.) sample 15: 9 adults, 16: 10 adults.

Colour reddish brown to black with a light pattern of symmetrical cross stripes as originally described but with 3 exceptions: Head with 3 longitudinal dark bands (instead of only a median one), posterior part of large abdomen dark (instead of light as in Uchida's figure, but as mentioned in the text as a possible variation) and small abdomen segment VI dark (instead of light).

Tab. 1 Differences between *Ptenothrix* species

		Length of dorsal head setae	Thick ventral clypeus setae	Abd VI thick setae	Seta a0 setaceous	Seta sa setaceous	Other characteristics
1.	<i>P. albosignata</i> n. sp.	median	3	+	+	+	head with white Y-figure
2.	<i>P. californica</i> Chr. & Bell., 1981	long	—	—	+	+	—
3.	<i>P. corynophora</i> Bör., 1909	median	?	+	+	+	head with 2 dark cross stripes
4.	<i>P. deLONGI</i> Chr. & Bell., 1981	?	?	+	+	?	head with spots or 3 stripes
5.	<i>P. leucostriigata</i> Stach, 1957	long	?	—	+	+	seta sa on large papilla
6.	<i>P. marmorata</i> (Pack., 1873)	long	?	+	+	+	clypeus with 2 thick upper median setae
7.	<i>P. quadrangularis</i> Mills, 1934	?	—	—	+	+	dens setae E. smooth
8.	<i>P. shibanaii</i> Yosii, 1955	short	3	+	+	+	a bright median stripe
9.	<i>P. tsutsuii</i> Yosii, 1955	short	3?	+	+	+	abd with thin pale longitudinal stripes
10.	<i>P. yakushimana</i> Yosii, 1965	short	3?	+	+	+	abd with 3 cross stripes

P. cf. vinnula was found here in a mountain taiga. This species was only known from the type locality, a pond side on Hokkaido, Japan.

In addition to the short original description some further characteristics are added here. Measurements and proportions of 1 female (and 2 males). Total length of female up to 1.4 mm (male 1.1 mm); antennal segment I : II : III : IV = 1 : 4.6 (5) : 5 (5.5) : 1.2 (1.6), outer setae of dens E1 : E2 : E3 : E4 = 1 : 1 : 1.7 (1.5) : 3.6 (2.7 – 3.8), ratio of 5+5 long setae of anterior part of large abdomen of both sexes to mucro up to 1.3, appendices anales : mucro = 0.6. Chaetotaxy and other characteristics mostly as in *P. setosa* (Krausbauer, 1898) sensu STACH (1957) and *P. janthina* Börner, 1909 sensu YOSH & LEE (1963), i. e. with long and thick setae of head apex, median setae of clypeus as 1,1,2 > 2,1,1; antennal segment II with 5 long and 4 short and thick setae; abdominal segment VI with 5 long and thick dorsal setae, setae P0 (G') setaceous, P1', P1, P2 (T, H, G) long and thick (P1 > P2), a0 long and setaceous, sa setaceous and length of a0 > sa > sa', appendices anales long and setaceous; claws slender with 2 inner teeth, empodial filaments thin, pointed and exceeding claws, with that of leg I the broadest; outer setae of dentes basally serrate, both posterior edges of mucro serrate.

Remarks: Judging from the chaetotaxy, *P. vinnula*, the present specimens, *P. janthina* Börner, 1909 from Japan and *P. cf. setosa* Bretfeld, 1996 from Lake Baykal apparently belong to a group related to *P. setosa* (Krausbauer, 1898) sensu STACH (1957) known from Central Europe.

The colour of these species is either more or less uniformly red to brown (*P. janthina*, *P. cf. setosa*, *P. setosa*) or shows a light symmetrical pattern (*P. vinnula* and the present specimens).

There are also differences in the ratio of the long setae of anterior part of large abdomen to mucro. It is 1.0 in *P. setosa*, 1.3 in the present specimens and in *P. cf. setosa* and 1.5 in *P. janthina*, but their ratio is not described in *P. vinnula*.

Other differences are in the form of empodial filaments which in *P. vinnula* are thin and knobbed, in *P. cf. setosa* strong and blunt and in *P. janthina*, *P. setosa* and the present specimens, pointed.

Thus, there is no clear trend between the characteristics of these species and specimens, which means that at present one cannot make final conclusions about their relationship.

Since the types of *P. vinnula* are not present in the Uchida collection in the Aomori Museum, Japan, only the comparison of new specimens from the type locality can help.

It is possible, on the other hand, that the specimens studied here really belong to *P. vinnula* because of the neighbourhood of the sample site in Russia with the isle of Hokkaido.

Rusekianna sibirica n. sp.

Holotype: Female (in one slide, bleached, together with 1 specimen of *Sminthurinus alpinus*, A. Babenko prep.) of sample 10: Russia, Krasnoyarsk Reg., Putorana Plateau S of Taimyr Peninsula, Dynkengda Mts., near Lake Yt-kyuel (Sobachye), 69°08'N – 91°50'E; mosses and boreal dwarf shrubs of wet fir-larch forest at 70 m altitude; 18.7.1997 leg. Babenko no. 20/97 (coll. Bretfeld no. Ba VI/1).

Paratype: 1 male (in one slide, bleached, A. Babenko prep.) of sample 11: same locality as the holotype but lichen, mosses and *Vaccinium* of dry fir-larch forest at 60 m altitude; 18.7.1997 leg. Babenko no. 16/97 (coll. Bretfeld no. Ba VI/2).

Diagnosis: A small species of the genus *Rusekianna* Betsch, 1977 with 2 diagnostic characteristics:

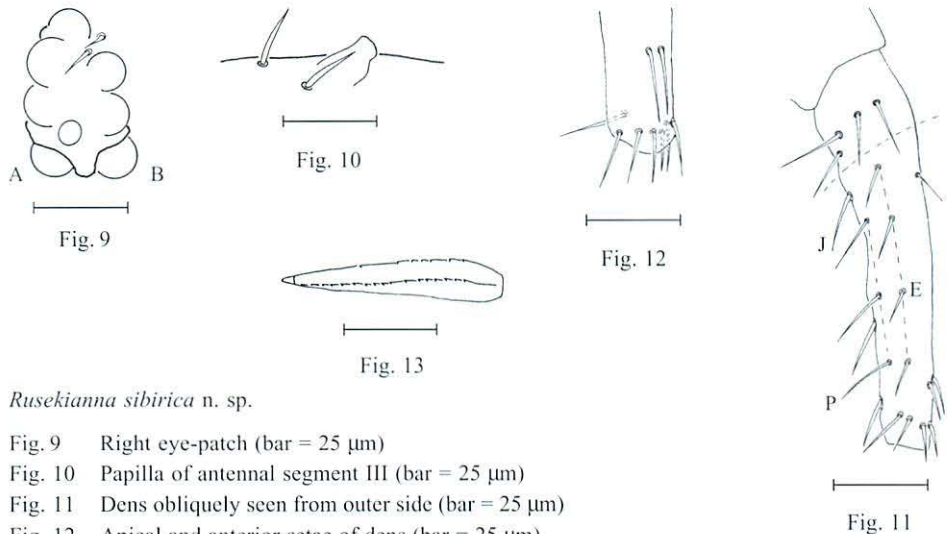
- Dens with 2 anterior, 4 outer and 2 inner subapical setae,
- mucro with outer edge notched.

Description: As the 2 specimens had already been bleached and mounted before my study, some features are not visible.

Measurements and proportions of female: Total length 0.66 mm, head 0.25 mm, mucro 60 μm ; whole antenna : head length = 1.9, antennal segment I : II : III : IV = 1 : 1.8 : 2.9 : 7.5.

Colour: Probably light brown without a striking pattern (Babenko in litt.).

Chaetotaxy and special structures (mostly only the differences from the type species are noted): Head and abdomen with short normal setae. Eye-patches with 8+8 ommatidia, D smallest, with 2+2 setae (Fig. 9). Antennal segment III with protruding papilla (Fig. 10), oblique subsegments of segment IV not visible. Sacs of ventral tube retracted and vesicles not visible. Appendices anales distally branched. All tibiotarsi with basal cuticular pores, rough tibiotarsal setae not visible, distal-inner setae strong, spatulate setae present but number uncertain; claw III with minute inner tooth, empodium III without filament (claws I and II uncertain). Dens (Figs. 11, 12) with 7 apical, 2 anterior subapical and posterior setae: 4 proximal, 4 outer, 2 inner and 3 median subapical setae; mucro (Fig. 13) slender and pointed, inner edge with small teeth, outer edge notched.



Rusekianna sibirica n. sp.

- Fig. 9 Right eye-patch (bar = 25 μm)
 Fig. 10 Papilla of antennal segment III (bar = 25 μm)
 Fig. 11 Dens obliquely seen from outer side (bar = 25 μm)
 Fig. 12 Apical and anterior setae of dens (bar = 25 μm)
 Fig. 13 Mucro (bar = 25 μm)

Remarks: The strange tibiotarsal pores show that these specimens belong to the genus *Rusekianna*, which was described from Mongolia with a single species *R. mongolica* Betsch, 1977. The new specimens differ from the type species mainly by the chaetotaxy of their dentes which have 3 additional setae (1 anterior, 1 outer, 1 inner seta; the number of dens setae is also a species specific characteristic of

several species of *Sminthurinus* Börner, 1901), and also the claws and the mucro differ slightly. Thus, the present specimens differ distinctly from the type species and have to be put into a new species, *Rusekianna sibirica*.

Sminthurides cf. *aquaticus* (Bourlet, 1842)

Material: Russia (S Taimyr) sample 7: 1 juvenile.

Pale yellowish green with a broad mucro.

This small juvenile was found in a snowbed of wet tundra. I was not able to determine the identity of this juvenile definitely. *S. aquaticus* is a Holarctic species and already known from N and E Russia (BRETTFELD 2000).

Sminthurides malmgreni (Tullberg, 1876)

Material: Russia (S Taimyr) sample 6: numerous, 7: 14 specimens.

Antennae and mucro of both sexes as usually described.

S. malmgreni was found here in a wet tundra and a snowbed. It is a Holarctic species and already known from N Russia (BRETTFELD 2000).

Sminthurides parvulus (Krausbauer, 1898)

Material: Russia (S Taimyr) sample 6: numerous.

Antennae and gutterlike mucro as usually described.

S. parvulus was found here in a wet tundra. It is a Palearctic species and already known from N Russia (BRETTFELD 2000).

Sminthurides schoetti Axelson, 1903

Material: Russia (S Taimyr) sample 6: numerous, 7: 1 male.

Antennae and trough-shaped mucro as usually described.

S. schoetti was found here in a wet tundra and a snowbed. It is a Palearctic species and already known from N and E Russia (BRETTFELD 2000).

Sminthurinus alpinus Gisin, 1953

Material: Russia (S Taimyr) sample 6: 46 specimens; (Putorana Plateau) sample 10: 1 specimen; (Tuva) sample 22: 2 specimens.

Chaetotaxy of dentes as originally described. Colour usually dark blue but sometimes yellow-brown (Babenko, in litt.).

S. alpinus was found here in a wet tundra and a wet fir-larch forest of the northern localities and in a mossy tundra in a southern alpine locality at 2300 m altitude. It is a Palearctic species and already known from N Russia (BRETTFELD 2000).

Sminthurus multipunctatus Schäffer, 1896

Material: Russia (W Taimyr) sample 1: 10 specimens, 2: 1 female, 3: 24 specimens; (E Taimyr) sample 4: 4 juveniles, 5: 2 males.

Background colour varies from green in juveniles to yellow or darker in adults. These often have a dark median stripe on anterior part and 3 brown-violet longitudinal bands on posterior part of large abdomen. Chaetotaxy as formerly described (BRETTFELD 1999, 2000).

S. multipunctatus was found here in the low vegetation near water and on spotted tundra. In Taimyr Peninsula, it occurs in a wide range of biotopes in typical and arctic tundra subzones where it prefers the warmest sites (meadows on southern slopes) and avoids the wettest (moss and sedge bogs) and the coldest (nival slopes) (Babenko in litt.). This Palaearctic species is already known from N and SE Russia (BRETTFELD 2000).

Sminthurus nigromaculatus Tullberg, 1871

Material: Russia (Primorskiy Reg.) samples 15, 16: 2 females.

White with black-violet points and patches, abdominal segments V and VI with a dark median stripe each. Chaetotaxy as described by BRETTFELD (1999, 2000) but length of whole antennae to head = 2.2 (instead of 1.9 in Europe) and antennal segments IV : I = 6.7 (instead of 8).

S. nigromaculatus was found here in a mountain taiga. It is a Holarctic species and already known from W and E Russia and from the Ukraine (BRETTFELD 2000).

Sminthurus primorskiyensis n. sp.

Holotype: Female (unbleached, in 4 slides) of sample 15: Russia, Primorskiy Reg., NE of Vladivostok about 135°E, Gornotayozhnoye, Mountain Taiga Station; yellow pan traps, 21. – 22.6.1999 leg. M. V. Michailovskaya, dedit P. F. Bellinger (coll. Bretfeld no. Russia V/5). No further specimens known.

Derivatio nominis: This new species is named after the far eastern Primorskiy Region of Russia where it was collected.

Diagnosis: A bright species of the genus *Sminthurus* Latreille, 1802 with 6 diagnostic characteristics:

- Head and thorax with 1+1 longitudinal bands of small violet spots,
- abdominal segment V with 2+2 setae above bothriotrichia D+D (apomorphy; plesiomorphy: with only 1+1 setae),
- upper setal pair of abdominal segment V short and ciliate (apomorphy; plesiomorphy: long and smooth),
- subcoxa III with 2 distal setae (apomorphy; plesiomorphy: one distal seta),
- ventral tube with 2+2 setae (apomorphy; plesiomorphy: one pair of setae),
- claws with a large tunica.

Other characteristics: Postantennal setae slender, pointed and rough; appendices anales bandlike with large apical teeth; mucronal edges notched.

Description: General aspect of body and chaetotaxy as usual in *Sminthurus*.

Measurements and proportions. Total length 1.3 mm, head 0.53 mm, mucro 105 μm , appendices anales 56 μm ; whole antenna : head length = 2.1, antennal segment I : II : III : IV = 1 : 2 : 3 : 7.2, manubrium : dens : mucro = 4.3 : 3.7 : 1, appendices anales : mucro = 0.5, appendices anales : claw III inner edge = 1, mucro : claw III inner edge = 1.8.

Colour: Eye-patches black; background colour white with 1+1 longitudinal bands of small violet spots on head and thorax (Fig. 14), lateral parts of large abdomen with few spots, dorsal and ventral parts only white; abdominal segment V with 3 black spots in a cross row, segment VI with 2 median spots, i. e. small abdomen with 3 median spots; antennae brown, legs and furca unpigmented.

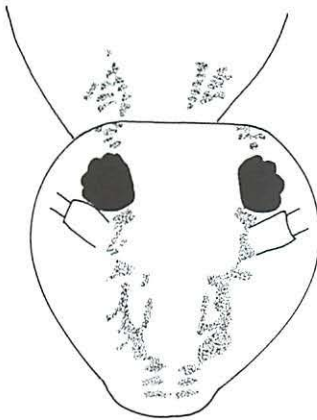


Fig. 14

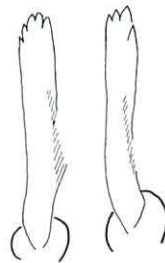


Fig. 15

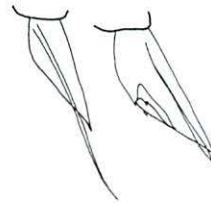


Fig. 16

Sminthurus primorskiyensis n. sp.

Fig. 14 Pigmental pattern of head and thorax. Length of head 0.53 mm

Fig. 15 Appendices anales (bar = 25 μm)

Fig. 16 Empodium I (left) and III (bar = 25 μm)

Chaetotaxy and special structures: Head with postantennal setae slender, acuminate and ciliate, clypeus with 2+1, ventral head-back with 3+3 oval organs. Antennal segment II with 4 short ventral setae, segment III with 5 long setae of proximal part, segment IV with 4 setae of basal whirl and about 17 subsegments. Large abdomen with dorsal setae mostly rough and blunt, but also with some acuminate and some short, normal setae; ratio of length of dorsal setae to mucro up to 1.36. Ventral tube with 2+2, retinaculum with 5 setae. Small abdomen segment V with 2+2 setae (A1 and A2) above bothriotrichia D+D, dorsal pair A1 short, acuminate and ciliate; appendices anales (Fig. 15) bandlike with large apical teeth and short fringes in middle part. Legs with subcoxa III with 2 distal setae, femur III with antero-proximal seta p4; tibiotarsi with only acuminate setae and each with 4+1 oval organs, tibiotarsus III seta Vi normal, its row p with 8 setae.; claws broad with inner tooth,

several small basal outer teeth and toothed pseudonychia, tunica present, empodia I smooth with long filaments exceeding claws (Fig. 16), empodia II and III with 2 – 3 outer teeth each, filament II of median length, filament III short (Fig. 16), both not exceeding claws. Furca with dens row J with 7 setae, row P with additional seta P5, formula of anterior setae 3+1,3,3,3,2,1,1; both posterior edges of mucro slightly notched, seta present and length less than 0.3 of mucro.

Remarks: In the key in CHRISTIANSEN & BELLINGER (1998), *Sminthurus primorskiyensis* n. sp. comes close to *S. sylvestris* which, however, has clavate distal setae of the tibiotarsi (see below). It appears in the key in BRETFFELD (1999) near *S. leucomelanus* Nayrolles, 1995 and also resembles *S. osmeryzskensis* Bretfeld, 2000 but differs from both species by its white and blue colour and by chaetotaxic features: *S. primorskiyensis* n. sp. differs from *S. leucomelanus* in the setae of subcoxa III (2+2 instead of 1+1) and tibiotarsus III row p (8 instead 7); it differs from *S. osmeryzskensis* in the appendices anales (rather broad with large apical teeth instead of slender with short teeth) and in the empodia II and III (with 2 – 3 outer teeth instead of only 1 tooth each).

Although there is only one female known, the above comparisons show that *Sminthurus primorskiyensis* n. sp. differs from other known species.

Sminthurus sylvestris Banks, 1899, Christiansen & Bellinger, 1998

Syn.: *Sminthurus variegatus* Axelson, 1903 n. syn.

Sminthurus facialis Banks, 1903 (see CHRISTIANSEN & BELLINGER 1998)

Material: Russia (S Taimyr) sample 6: 1 female, 1 male, 7 juveniles, 7: 1 male, 1 juvenile, 8: 1 male, 9: 1 female, 2 males; (Primorskiy Reg.) sample 16: 1 female.

Colour varies individually from dark grey to green, brown or dark blue, in juveniles only green, mostly homogeneous, but also spotted; posterior part of large abdomen darkest, head (Fig. 17) palest with dark and pale cross stripes between antennae.

The 3 spatulate setae of the distal part of each tibiotarsus, which can be seen easily at low magnification, are the main chaetotaxic characteristic. They are accompanied by several long setae with thinner clavate tips (number uncertain, some tips apparently broken off) (see Fig. 2L in BETSCH & BETSCH-PINOT 1984).

Since the description in CHRISTIANSEN & BELLINGER (1998) is not complete, some characteristics are added here. Total length up to 2.4 mm in female, 1.6 mm in male, head up to 0.95 mm in female, 0.65 mm in male, length of appendices anales : mucro about 0.6, mucronal seta < 0.3 of mucro. Head with postantennal seta slender, pointed and rough, clypeus with 2+2, ventral head-back with 2+2 or 3+3 oval organs. Antennal segment II with 4 short ventral setae, segment IV with 4 setae of basal whirl and 23 – 26 subsegments. Ventral tube with 2+2, retinaculum 3, ventral side of large abdomen 3+3 setae. Abdominal segment V with 2+2 setae (A1 and A2) above bothriotrichia D+D, dorsal pair A1 thick with minute fringes, length of A1 < A2 (Fig. 18); genital papilla of males with short cuticular points (as in the whole genus *Sminthurus*, contrary to flat primary granules in *Spatulosminthurus*, see BETSCH & BETSCH-PINOT 1984); appendices anales (Fig. 19) long and slender with few or numerous fringes and short apical teeth. Subcoxa III with 2 setae, femur III with basal seta, tibiotarsus III row p with 8 setae and seta Vi normal, tip of tibiotarsi, claws and empodia as figured by BETSCH & BETSCH-PINOT (1984). Dens with anterior setae as 3+1,3,3,2,2,1,1, posterior seta P5 present; mucro slender, edges smooth, seta present.

S. sylvestris was found here in meadows and a snowbed of the wet tundra, and in the mountain taiga. It is a rare species (SNIDER 1967), which is known from Northeastern and Eastern USA and Eastern Canada (CHRISTIANSEN & BELLINGER 1998).

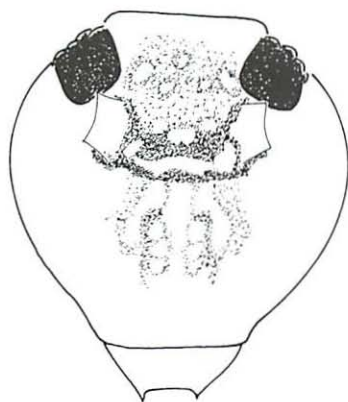


Fig. 17



Fig. 18

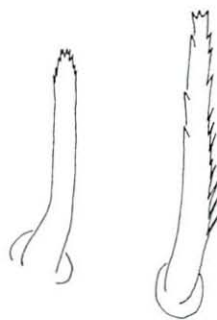


Fig. 19

Sminthurus sylvestris Banks, 1899

Fig. 17 Pigmental pattern of male head. Total length about 0.6 mm

Fig. 18 Setae A1 and A2 of abdominal segment V (bar = 50 μ m) and minute fringes of thick seta A1 enlarged

Fig. 19 Appendices anales of 2 females (bar = 50 μ m)

Remarks: The variable colour without a clear pattern and the 3 spatulate and several clavate tibiotarsal setae show that these Russian specimens most probably belong to *S. sylvestris* (see CHRISTIANSEN & BELLINGER 1998 and BETSCH & BETSCH-PINOT 1984, respectively). But there is a difference: The American specimens have shorter appendices anales than the Russian, the ratio to mucro being 0.3 – 0.38 and 0.55 – 0.6 respectively. A similar difference is also found between populations of *Sminthurus viridis* Linnaeus, 1758 from Central Europe (0.6) and Spain (0.4) (NAYROLLES 1995, BRETTFELD 1999), which both have identical chaetotaxic characteristics and thus belong to the same species. Therefore, in spite of the slight differences between both populations of *S. sylvestris*, they are supposed to belong to the same species.

One further Russian species has 3 spatulate tibiotarsal setae, *Sminthurus variegatus* Axelson, 1903. It had been found in N Siberia as have most specimens of the present collection, and the question was whether it also belongs to *S. sylvestris*. I was able to study 2 females out of the collection Axelson/Linnaniemi of the Museum Helsinki and prepared one in 4 slides. The colour of the 2 specimens is similar to the Russian in their spots on large abdomen mainly on posterior and lateral sides, but the pigmentation is less intense and there is a pigmented median stripe on the anterior part of large abdomen in one female; the female prepared shows the cross stripes between antennae as in the Russian specimens. Each tibiotarsus has 3 long, spatulate setae as already described by Axelson, and also several long ones as in *S. sylvestris* (their clavate tips not visible), the abdominal segment V also has the same 2+2 setae A1 and A2, the appendices anales are slender and smooth with a small tooth below the tip, the subcoxa III has 2+2 setae, the ratio of appendices anales to mucro = 0.5, the length of mucronal seta

= 0.3 of mucro. I am sure, therefore, that these taxa are identical and that *S. variegatus* Axelson is a synonym of *S. sylvestris*.

There are two other Palaearctic species from Japan with spatulate tibiotarsal setae, *Sminthurus sensibilis* Börner, 1909 sensu YOSHII 1992 (syn. *Sminthurus arborealis* Itoh, 1985, see BRETTFELD 1999) and *Sminthurus daisetsuzanus* Uchida, 1957.

Each tibiotarsus of *S. sensibilis* has 3 spatulate setae, but the other distal setae are shorter than these, the inner posterior edge of mucro has rough teeth and the mucronal seta is missing. This species, therefore, differs clearly from *S. sylvestris*. I was able to study some specimens of *S. arborealis* from Japan and can supplement the original description: Antennal segment II with 4 short ventral setae, each with enlarged basis, segment IV with 4 setae of basal whirl and 21 – 22 subsegments. Ventral tube with 1+1 setae, large abdomen with 3+3 ventral setae. Abdominal segment V with 1+1 normal setae above bothriotrichia D+D, female with 1+1 distinct vesicle-like receptacula seminis near genital papilla (Fig. 20), genital papilla of male with short cuticular points (as in the whole genus *Sminthurus*, see above), appendices anales (Fig. 21) short and ciliate, their length to mucro = 0.4. Subcoxa III with 2 distal setae, femura III with antero-proximal seta p4, tibiotarsus III seta Vi long and normal, its row p with 5 setae, each tip of tibiotarsi with 3 long spatulate setae and several short normal ones as originally described, empodium I with short filament (Fig. 22), other empodia without filaments as originally described.

There are only small differences between *S. arborealis* and *S. sensibilis*, the latter species perhaps having claws with larger pseudonychia and empodia with a small outer tooth each (the description of the empodial teeth by BÖRNER 1909 is contradictory and YOSHII 1992 does not mention or figure such a tooth). These differences are probably infraspecific, related to different populations. It is also unlikely, that in Japan two different species occur with such a small difference and such a striking similarity as the spatulate setae.

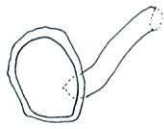


Fig. 20



Fig. 21

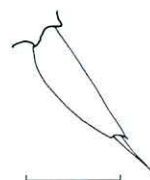


Fig. 22

Sminthurus sensibilis Börner, 1909

Fig. 20 Receptaculum seminis (bar = 25 μ m)

Fig. 21 Appendix analis (bar = 25 μ m)

Fig. 22 Empodium I (bar = 25 μ m)

Therefore, *Sminthurus arborealis* is most likely a synonym of *Sminthurus sensibilis*.

Each tibiotarsus of *S. daisetsuzanus* has 5 – 6 spatulate setae, the posterior edges of the mucro are smooth and a mucronal seta is present. All these characteristics resemble *Sminthurus sylvestris*. *S. daisetsuzanus* differs, however, in the colour pattern of head and body (small white and black spots) and in the eye-patches (pale with black ommatidia only). As the types are not present in the Uchida collection in the Aomori Museum, Japan, a new study needs new specimens. In spite of the few features known, I consider *S. daisetsuzanus* to be a good species.

All three species mentioned have long and slender appendices anales in contrast to species of *Spatulosminthurus*, which have more or less broad and thin ones. These three species were not included in *Spatulosminthurus* by BETSCH & BETSCH-PINOT 1984, but BRETTFELD (1999) put them into that genus (except for *S. variegatus* Axelson). Now the status can be revised. *S. sylvestris* and *S. sensibilis* belong to the genus *Sminthurus* because of the cuticula of their male genital papilla, *S. daisetsuzanus* probably belongs there too because of its slender appendices anales.

These three species, *Sminthurus daisetsuzanus*, *S. sensibilis* and *S. sylvestris* with their spatulate tibiotarsal setae, may form, if not a new genus, a *sylvestris*-group within the genus *Sminthurus*. This group differs from *Spatulosminthurus*, which also has spatulate setae, by its slender appendices anales and the cuticular points of its male genital papilla.

Spatulosminthurus guthriei sibiricus Bretfeld, 1996

Material: Russia (Yenisey River) sample 14: 16 specimens.

Males with 2 dark purple dorsolateral stripes and a dark small abdomen as originally described; females greenish and more or less purple up to a male-like pattern, juveniles only greenish; postantennal setae slender.

S. guthriei sibiricus was found here in a ruderal vegetation. This subspecies is known from the whole SE Russia from the Omsk to the Amur Reg. (BRETTFELD 1999, 2000).

Sphaeridia leutrensis Dunger & Bretfeld, 1989

Material: Russia (S Taimyr) sample 7: 13 specimens (including 3 males).

Males and females as originally described.

S. leutrensis was found here in a snowbed. Besides the type locality in Central Germany, it is only known from N Russia (BRETTFELD 2000).

Sphyrotheca minnesotensis (Guthrie, 1903)

Material: Russia (Primorskiy Reg.) sample 15: 1 female, 1 male, 16: 1 male.

Since this species has been only known from the eastern parts of North America and has been incompletely described (MAYNARD 1951, CHRISTIANSEN & BELLINGER 1998), a new description is given here based upon some specimens from the collection of the Illinois Natural History Survey (INHS) and the new ones.

S. minnesotensis was found here, in the south of far eastern Russia, in the low vegetation of a mountain taiga.

These are the specimens from the Illinois Natural History Survey.

1. INHS Insect Collection no. 4603: 1 tube with 1 juvenile, total length 0.9 mm, labelled »*Sphyrotheca minnesotensis* Guthrie, 24 May 1950, Acc. no. 49668«.
2. INHS Insect Collection no. 4604: 1 tube with 1 juvenile, total length 0.4 mm, and 1 male, total length 0.7 mm, labelled »*Sminthurus minnesotensis* Guth., Urbana, Illinois, Sept. 29/33, H. H. Ross, humus«.
3. INHS Insect Collection no. 4605: 1 tube with 1 female, total length 1.1 mm (body dirty, compressed, many setae lost), labelled »*Sminthurus minnesotensis* Guth., Ames, Iowa, Aug. 8-1929-Mills«.

4. INHS Insect Collection no. 4606: 1 tube with 1 juvenile, total length 0.7 mm, 1 male (head missing) and 1 female, total length 0.9 mm, labelled »*S. minnesotensis* G., May-June-1901, J. E. G. Redwing Minn.« (I dissected the rather well preserved female, 3 legs were missing, and mounted it in 3 slides labelled as the tube and added 'Bretfeld prep. 2002').

Description (mainly of 1 female and 1 male from Russia, differences compared with American specimens, especially to the mounted female, mentioned when observed): Measurements and proportions. Total length up to 1.1 mm in female, 0.7 mm in male, head 0.3 mm in female, 0.26 mm in male, mucro up to 84 μm in female, 70 μm in male, appendices anales up to 86 μm ; whole antenna : head length = 1.6 in female, 1.8 in male, antennal segment I : II : III : IV = 1 : 2 (1.7) : 3 (2.7) : 4.7 (5) in female (and male), dens : mucro up to 3 in female, 2.5 in male, appendices anales : mucro = 1, appendices anales : claw III inner edge = 2.3, mucro : claw III inner edge = 2.3 in both sexes; ratio of dorsal head setae to mucro up to 1.3, of dorsal setae of large abdomen to mucro up to 2, ratio of setae of head frons a4 : a5 = 2 – 3 (America) or 4 – 5 (Russia), ratio of dorsal setae of thorax row 2 : row 3 = 2.4 (in both populations).

Colour: Head, abdomen and extremities black, except white parts or spots of antennal segments II and III; dorsal side of large abdomen also dark (1 male from Russia) or head with white spots and large abdomen with white spotted cross stripes.

Chaetotaxy and special structures (applied to both sexes if not otherwise stated): Dorsal parts of head and body (Figs. 23, 28) with long, rough, tubelike setae as well as setae of other shapes (in Russia long setae more tubelike than in America); ventral parts of head with short and normal setae; large abdomen also with rough short setae and normal ones; 1 pair of neosminthuroid setae present.

Head (Fig. 23): Eye-patches with 8+8 ommatidia, A and B larger than others, 2+2 setae (upper pair shorter than lower); dorsal part of head with 10 long, rough and blunt setae (a3+a3, a4+a4, b2+b2, m2, apm, pair no. 1 of dorsal head-back, pair a4 thick and scaled like a corn-cob in Russia or more slender and rather smooth in America, ratio to other setae see above); dorsal part of head also with 6 short setae (a5+a5 and ap1+ap1 are blunt, ap2+ap2 are pointed) and normal rough and blunt setae; ventral parts of head with cross rows a – g as usual, all setae normal, rows a without lateral hooklike setae and without cuticular protuberances, region M with 9 – 11 setae, ventral head-back with 2+2 oval organs.

Antennae (Figs. 24 – 27): Segment I with 7 short, normal setae; segment II with normal setae and 2 oval organs of postero-distal side; segment III with 3 rough basal, 1 rough distal and several normal setae, antennal organ with 2 short and 1 normal setae, basal and distal parts of posterior side with 1 oval organ each; segment IV with about 10 subsegments, with whorls of normal setae and 6 dorso-anterior sensilla, 7 dorso-posterior sensilla (including 1 large distal one) and 3 ventral sensilla within normal ventral setal rows (the 2 distal sensilla in the same whorl close together), tip sensilla not analysed.

Large abdomen (Figs. 28, 29): With long, rough, tubelike setae, as well as rough short setae and normal ones, all setae directed towards the posterior. Thorax setal row 1, 2, 3 in front of bothriotrichia A+A with 2+2, 3+3, 1+1 setae respectively, those of rows 1 and 2 long and tubelike, those of row 3 also rough but shorter and thinner (ratio see above); furca base with normal setae and 1+1 rough neosminthuroid setae with long basis. Ventral

tube with 1+1, retinaculum with 4 and ventral region of large abdomen with 1+1 normal setae.

Small abdomen: Segment V among normal setae with 2+2 long, rough, tubelike setae (1 pair dorsal and 1 pair ventral of bothriotrichia D+D) and 1+1 shorter rough setae ventral to the long setae; genital papilla of female with 7, in male with 12+12 setae. Segment VI without tubelike setae, all circumanal setae normal, in female (Fig. 30) setae a1 and a2 the longest, seta sa longer than sa' and setae sa2 longer than sa1 and sa3; appendices anales (av5) long, acuminate and fringed. Chaetotaxy of male not analysed.

Legs: Most setae normal with few exceptions. Trochanter I and II with knobbed outer spinelike seta (in female thicker than in male), trochanter III with thick, knobbed posterior spine; femur I with 1 seta directed towards the posterior, all femora with 1 antero-distal pore; tibiotarsus I–III rows p with 5, 4, 4 setae respectively, each tibiotarsus with 2 oval organs 2pe, 4pe and seta Vi thin and short; all claws of same shape (Fig. 31), with or without tunica, inner, outer and lateral teeth present (pseudonychia on posterior side larger than anterior), empodia (Fig. 31) with outer tooth, filaments thin and acuminate, length of filament I > II > III, not exceeding claws.

Furca: All setae normal. Manubrium with 8+8 setae; dens outer row E with 4, inner row J with 2, postero-external row PE with 1, posterior row P with 8–9 setae, formula of anterior setae 3+1...1; mucro (Fig. 32) with inner edge notched or with small teeth, tip with incision and apex rounded, without a seta.

Remarks: *S. minnesotensis* belongs to the *Sphyrotheca* species without subapical setae on anterior side of dens. Their differences in the head chaetotaxy have already been discussed by BRETfeld (2000), who considered that *S. minnesotensis* resembles *S. multifasciata*. Since I was able to study the specimens from Russia and America, the differences between these species have become more distinct and their separation is confirmed. There are three main differences (see Table 2).

Tab. 2 Differences between *Sphyrotheca* species

	<i>Sphyrotheca multifasciata</i>	<i>Sphyrotheca minnesotensis</i> (North America)	<i>Sphyrotheca minnesotensis</i> (Russia)
Colour	white stripes	white stripes or dark	white stripes or dark
Dorsal setae of head and abdomen	long, slender	long, slender	long, tubelike
Head setae a4 : a5	2–3	2–3	4–5
Thorax setae row 2 : row 3	1	2,4	2,4
Dens setae row E + J	7+6	4+2	4+2
Dens : mucro	2.8–3.4	2.5–2.9	2.5
App. anal. : mucro	?	1	1
Mucro : claw II or III	1.9	2.3	2.2

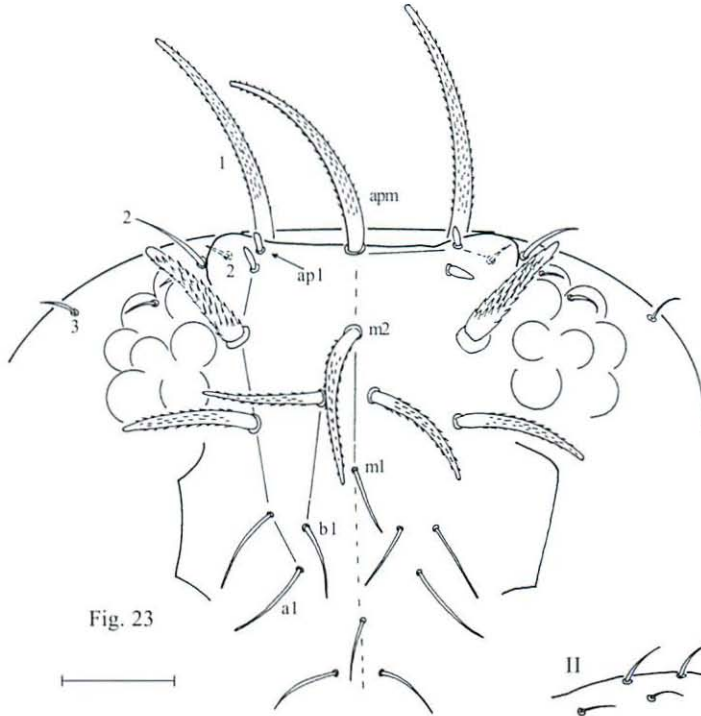


Fig. 23

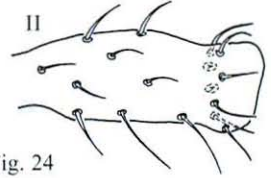


Fig. 24

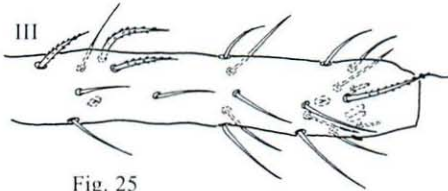


Fig. 25

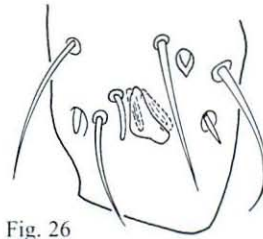


Fig. 26

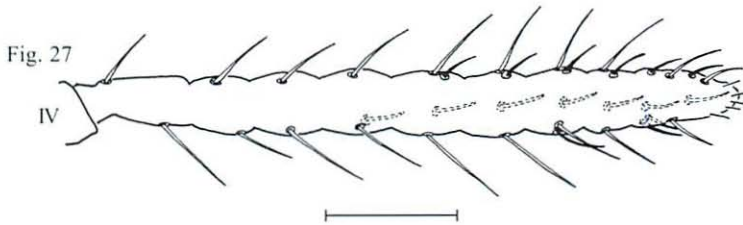


Fig. 27

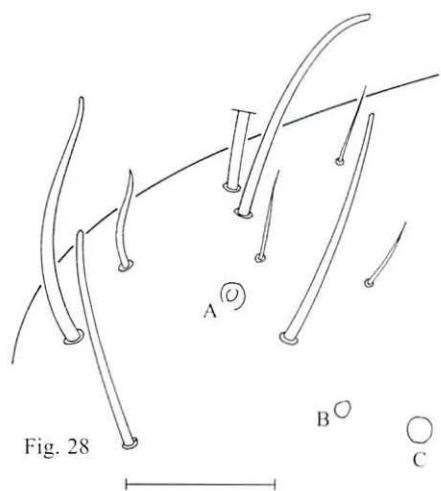


Fig. 28

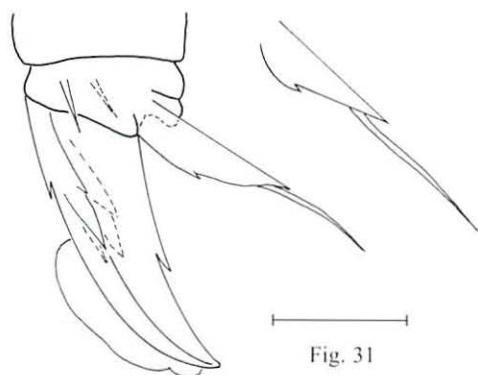


Fig. 31

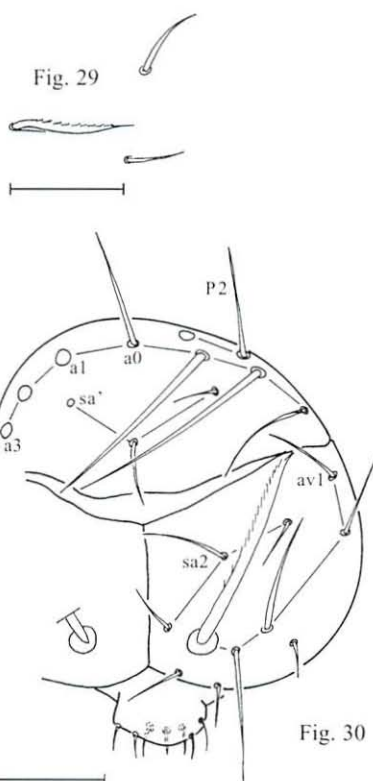


Fig. 30

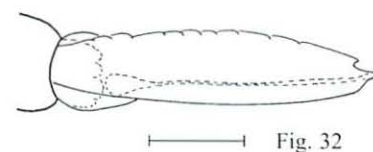
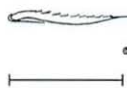


Fig. 32

Fig. 29

*Sphyrotheca minnesotensis* (Guthrie, 1903)Fig. 23 Dorsal parts of head (bar = 50 μ m)Fig. 24 Antennal segment II (bar = 50 μ m)Fig. 25 Antennal segment III (bar = 50 μ m)Fig. 26 Antennal organ III (bar = 20 μ m)Fig. 27 Antennal segment IV (bar = 50 μ m)Fig. 28 Some long and short, rough, and normal setae of antero-dorsal part of large abdomen (bar = 100 μ m)Fig. 29 Neosminthuroid seta of left side and surrounding ones (bar = 50 μ m)Fig. 30 Female abdominal segment VI and genital papilla (bar = 50 μ m)Fig. 31 Claw and empodium III and empodium I (bar = 20 μ m)Fig. 32 Mucro (bar = 25 μ m)

1. The long setae of thorax row 1 – 3 are of equal length in *S. multifasciata*, but those of row 3 are shorter in *S. minnesotensis*,
2. the rows E and J of dentes have 7 and 6 setae respectively in *S. multifasciata*, but only 4 and 2 respectively in *S. minnesotensis*,
3. the mucrones are relatively short in *S. multifasciata*, but longer in *S. minnesotensis*.

It is surprising that *Sphyrotheca minnesotensis* also occurs in East Russia. The differences between this Holarctic species and the Western Palaearctic *Sphyrotheca multifasciata* are now confirmed and more distinct (contrary to the synonymy proposed by BRETTFELD 1999). The differences between the Russian and American specimens of *Sphyrotheca minnesotensis* appear as that of populations of large geographical distance. The question remains whether this species only occurs in the eastern parts of the continents or also in the more western.

Stenacidia violacea (Reuter, 1881)

Material: Russia (S Taimyr) sample 6: 1 male, females uncertain (juvenile?).

Red violet, adults quite large, especially males with several characteristic sets of long setae (BETSCH & MASSOUD 1970, BRETTFELD 2000).

S. violacea was found here in a wet tundra. It is a Holarctic species and already known from N and SE Russia (BRETTFELD 2000).

Vesicephalus bellingeri n. sp.

Holotype: Female (no. 2, in 4 slides) from sample 16: Russia, Primorskiy Reg., NE of Vladivostok about 135°E, Gornotayozhnoye, Mountain Taiga Station; yellow pan traps, 26. – 28.6.1999 leg. M. V. Michailovskaya, dedit P. F. Bellinger (coll. Bretfeld, Russia V/6).

Paratype: 1 female (no. 1, in 1 slide) and 2 males (one in 3 slides, one in alcohol) together with the holotype.

Derivatio nominis: This new species is named in honour and memory of the late Prof Dr Peter F. Bellinger, Northridge, California, USA (15.6.1921 – 20.11.2000), one of our great collembologists.

Diagnosis: A species of the genus *Vesicephalus* Richards in Delamare Deboutteville & Massoud, 1964, with 6 diagnostic characteristics:

- Head and abdomen with brown spots and regions,
- pigment of eye-patches brown (apomorphy; plesiomorphy: black pigmented),
- tibiotarsi with 11 clavate setae (number apomorphic; plesiomorphy: fewer clavate setae)
- empodial filaments slender (plesiomorphy; apomorphy: filaments broad),
- posterior side of dens with 2 long, knobbed setae (apomorphy; plesiomorphy: acuminate setae),
- ventral circumanal setae av1' short, av1 broad (apomorphy; plesiomorphy: normal setae).

Description: Measurements and proportions of 2 females (and 1 male). Total length 1.6 mm in female (1.4 in male), head 0.6 (0.45) mm, mucro 110 (95) μ m, claw III inner edge 50 (47) μ m, appendices anales about 75 μ m; whole antenna : head length = 1.7 (1.8), antennal

segment I : II : III : IV = 1 : 3.6 : 2.8 : 5 (in both sexes), manubrium : dens : mucro = 4.7 (4) : 3.5 (3.2) : 1, mucro : claw III inner edge = 2.2 (2), appendices anales : mucro about 0.7, appendices anales : claw III inner edge about 1.5, setae of head apex : mucro up to 2.4 (2), setae of large abdomen : mucro up to 3 (in both sexes), outer setae of dens E2 : E1 = 4.2 (4).

Colour: Eye-patches brown; background colour yellowish, head and body with more or less intense brown pigment in irregular spots and marblings; posterior and lateral parts of large abdomen dark, thorax and ventral side of large abdomen and ventral tube pale, other extremities, including mucro, brown.

Chaetotaxy and special structures: Habitus like a species of *Sminthurus* with long, rough setae on head apex and large abdomen. Head (Figs. 33, 34). Eye-patches with 8+8 ommatidia, C and D the smallest, with 2+2 setae (upper pair may be reduced to a small cuticular cone), inner margins of eye-patches with 1+1 large colourless vesicles (with additional retinal structures, see JORDANA et al. 2001); setal pair 1 of dorsal head-back short, rough and blunt, pairs 2 and 3 short and spiny, head apex seta apm very long and rough, lateral 2+2 setae short and thin and partially hidden behind the colourless vesicles, frons with setae a1-5 and b1-5 present, setae a3 - a5 very short, b3 and b4 very long, b5 spiny, clypeus with rows a - g as usual, with row a: 6-m-6, b: 4+4, c: 4+4, d: 2+2 (and 1+1 oval organs), e: 6+6 (and 1+1 oval organs), f: 7+7 (and 2+2 oval organs), g: 3+3 (hidden as usual behind a clypeal bulge); seta a/m long and region M with 8 - 11 setae; labral rows a, m, p with 4, 5, 5 setae respectively, without any peculiarity.

Antennae: Segment I (Figs. 33, 34) with short setae except strong no. 4, no. 1 missing; basal half of segment II (Fig. 35) with 3 long and rough setae, distal half with 1 smooth and 2 rough setae of median length, whole segment also with 5 normal setae, 2 minute ones on posterior side and 1 ventro-distal sensillum-like seta (marked by arrow in Fig. 35); basal part of segment III (Fig. 36) with 2 long and rough setae and 4 short ones, distal half with several normal setae, 1 minute one and 3 sensilla as usual; segment IV (Fig. 37) undivided with 10 - 11 setal whorls and 3 rows of dorsal sensilla: 4 - 5 dorso-anterior ones (including 2 long distal), 2 - 3 mid-dorsal ones and 7 - 8 dorso-posterior ones (including 1 long distal), ventral sensilla missing, 12 tip sensilla present.

Large abdomen: Dorsal part with long and rough setae (Fig. 38), lateral parts also with short, rough and short, normal setae; bothriotrichia ABC forming an angle opening towards the anterior, distance of AB < BC; cuticula with a conical secondary granulation. Ventral tube with 2+2 short setae, retinaculum with 4+4 teeth and 2 setae (Fig. 39) and ventral region of large abdomen without setae.

Small abdomen: Segment V (Fig. 38) with 1 long, rough dorsal, 3 normal and 2 short pairs of setae around bothriotrichia D+D; genital papilla in female with 8 - 10, in male 12+12 setae. Segment VI (Fig. 40) with most setae rough; dorsal anal valve in female with seta a0 thin and smooth, a1 and a2 rough and winged, a3 rather smooth and basally winged, sa rough blunt, sa' small and thin, dorsal setae not studied; dorsal anal valve in male with m1, A1-3, DL1, P1, a0, a1, a2, sa and sa' setae; ventral anal valves in female (male not analysed) with seta av1' short, thick and pointed, av1 long and flattened with distal fringes, av2 - av4 long and thin, appendices anales (av5, Fig. 41) deeply split into about 12 fringes, setae sa1 short and thin, sa2 rough as sa, sa3 long and thin, ventral setae not analysed; cuticula of anal valves in both sexes with a minute primary granulation.

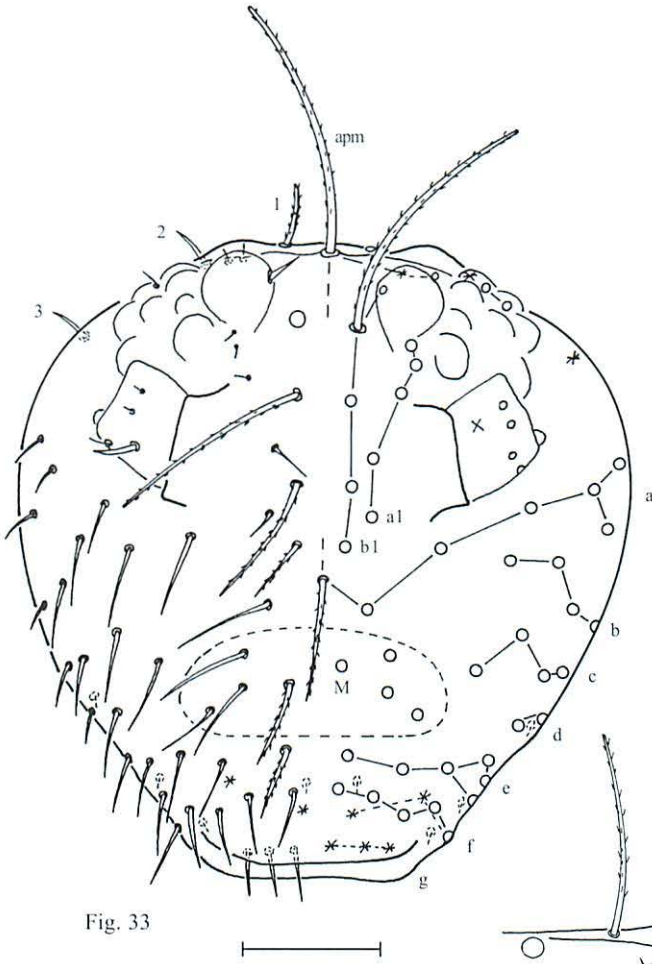


Fig. 33

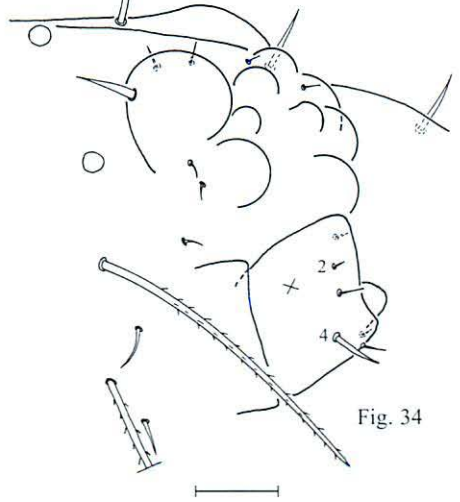
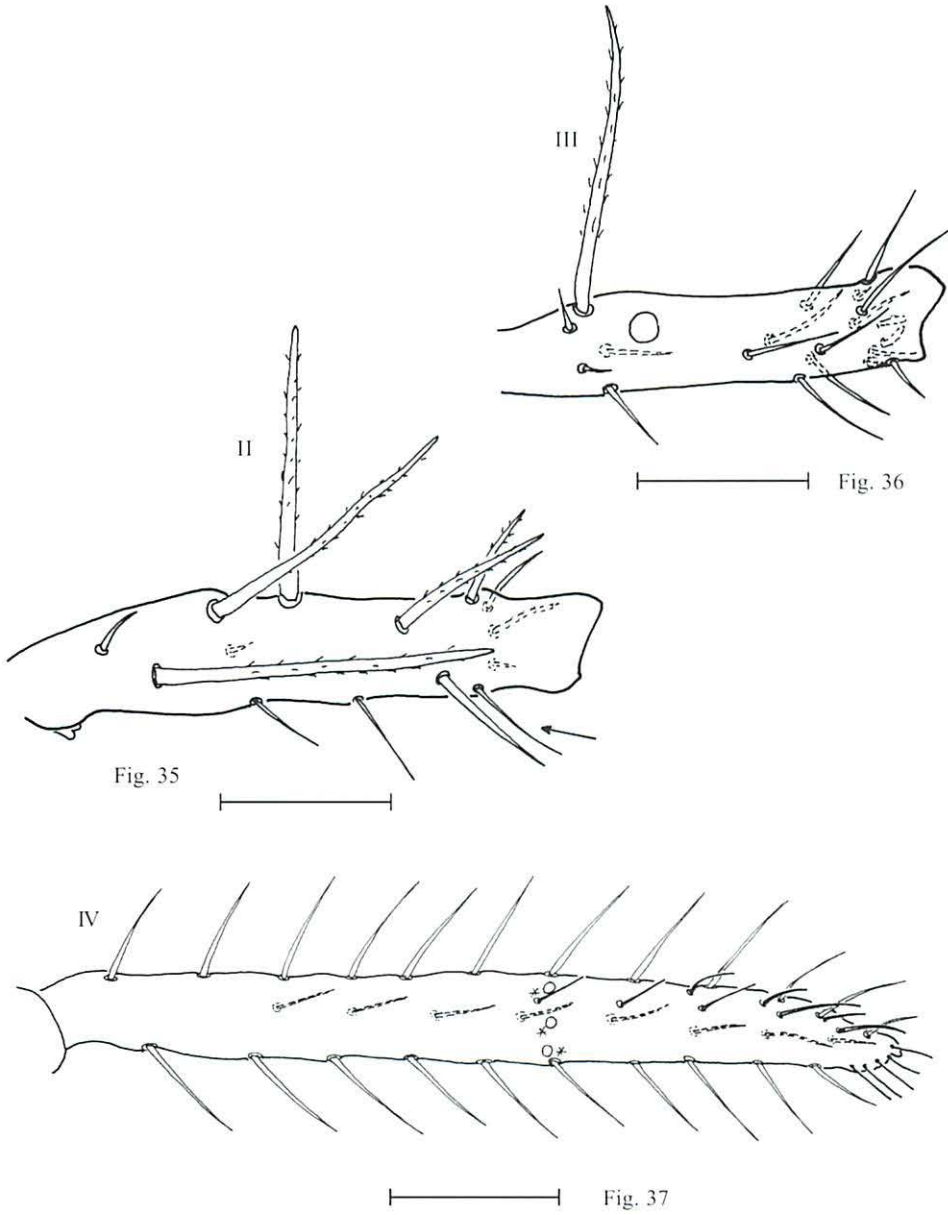


Fig. 34

Vesicephalus bellingeri n. sp.

Fig. 33 Head (bar = 100 μ m)

Fig. 34 Left dorsal parts of head and antennal segment I (bar = 50 μ m)

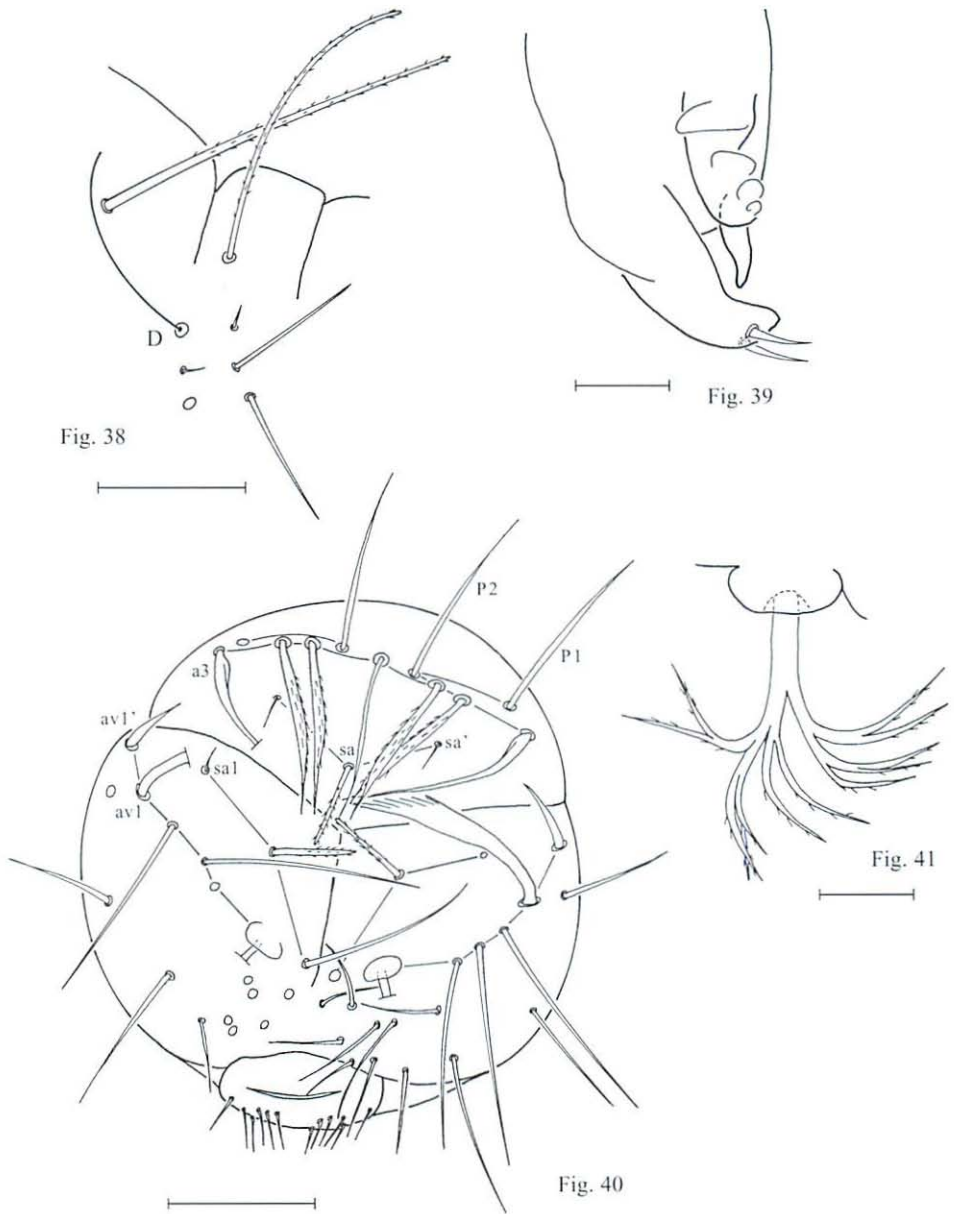


Vesicephalus bellingeri n. sp.

Fig. 35 Antennal segment II (bar = 50 μ m)

Fig. 36 Antennal segment III (bar = 50 μ m)

Fig. 37 Antennal segment IV (bar = 50 μ m)



Vesicephalus bellingeri n. sp.

Fig. 38 Long seta of large abdomen and abdominal segment V (bar = 100 μ m)

Fig. 39 Retinaculum (bar = 25 μ m)

Fig. 40 Female abdominal segment VI and genital papilla (bar = 100 μ m)

Fig. 41 Appendix analis (bar = 25 μ m)

Legs: Basal segments (Fig. 42) with coxa I – III with 1, 3, 3 setae respectively, coxa II and III with an additional cuticular cone each, trochanter I – III with 4 setae each, oval organs not observed, femur I – III with 11, 13, 12 setae respectively and 1 oval organ each; tibiotarsus I – III (Figs. 43 – 45) with long and acuminate setae (length up to 3x diameter of tibiotarsus), also with minute ones and with distal clavate setae, tibiotarsus II and III each with seta FSai and a secondary seta 4pi, tibiotarsus I – III row p with 5, 4 (IVp missing), 3 (IVp, Vp missing) setae respectively and with several minute ones (Fig. 44) distributed as 2 (Vai, Vpi), 5 (IIIp, 4pi, Vai, Vpi, Vp), 5 (IIp, IIIp, 4pi, Vai, Vpi) respectively, distal parts of tibiotarsus I – III (Figs. 43, 45) with 9 clavate setae of whorl I and additional clavate setae Ka, Kp; all claws (Fig. 45) of same shape, with tunica, 1 inner and several lateral teeth; all empodia (Fig. 45) slender with short point and thin filament with acuminate tip, filaments slightly exceeding claws.

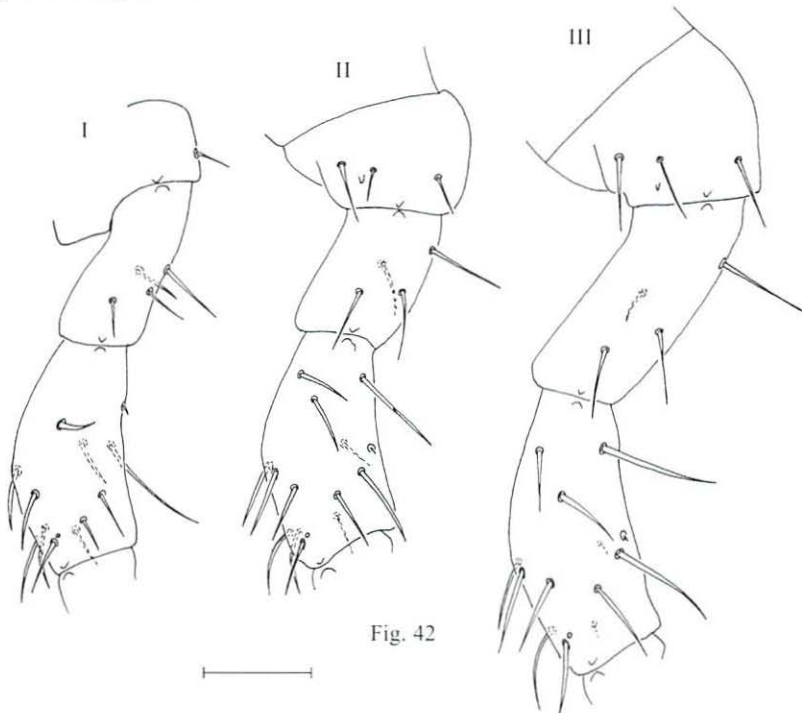


Fig. 42

Vesicephalus bellingeri n. sp.

Fig. 42 Basal segments of legs I – III (bar = 100 μ m)

Furca: Manubrium not analysed; dens (Figs. 46, 47, in both sexes) with most setae basally thickened, outer row E with 7 (E1 much shorter than E2 and abruptly thinned), postero-outer row PE with 1, posterior row P with 6 (P1 and P3 long and knobbed), inner row J with 2 setae, formula of anterior setae 3+1...1; dens setae formulated as in *Sminthurinus* (BRETZFELD 1999): apical whorl with 7 setae, without anterior subapical setae and with posterior setae: 6 (2, 1, 1, 2) proximal, 4 outer and 3 median subapical setae);

muero (Fig. 48) directed laterally as in *Sminthurinus*, with outer posterior edge smooth, inner with coarse teeth, tip with 2 blunt teeth, seta absent.

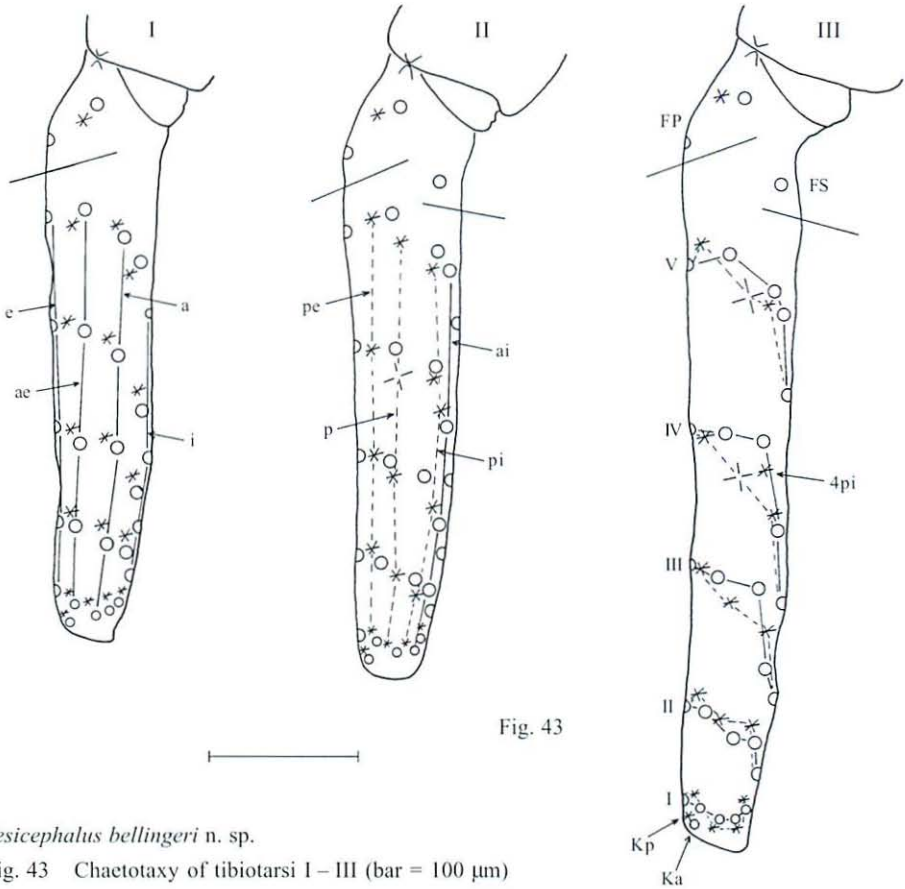


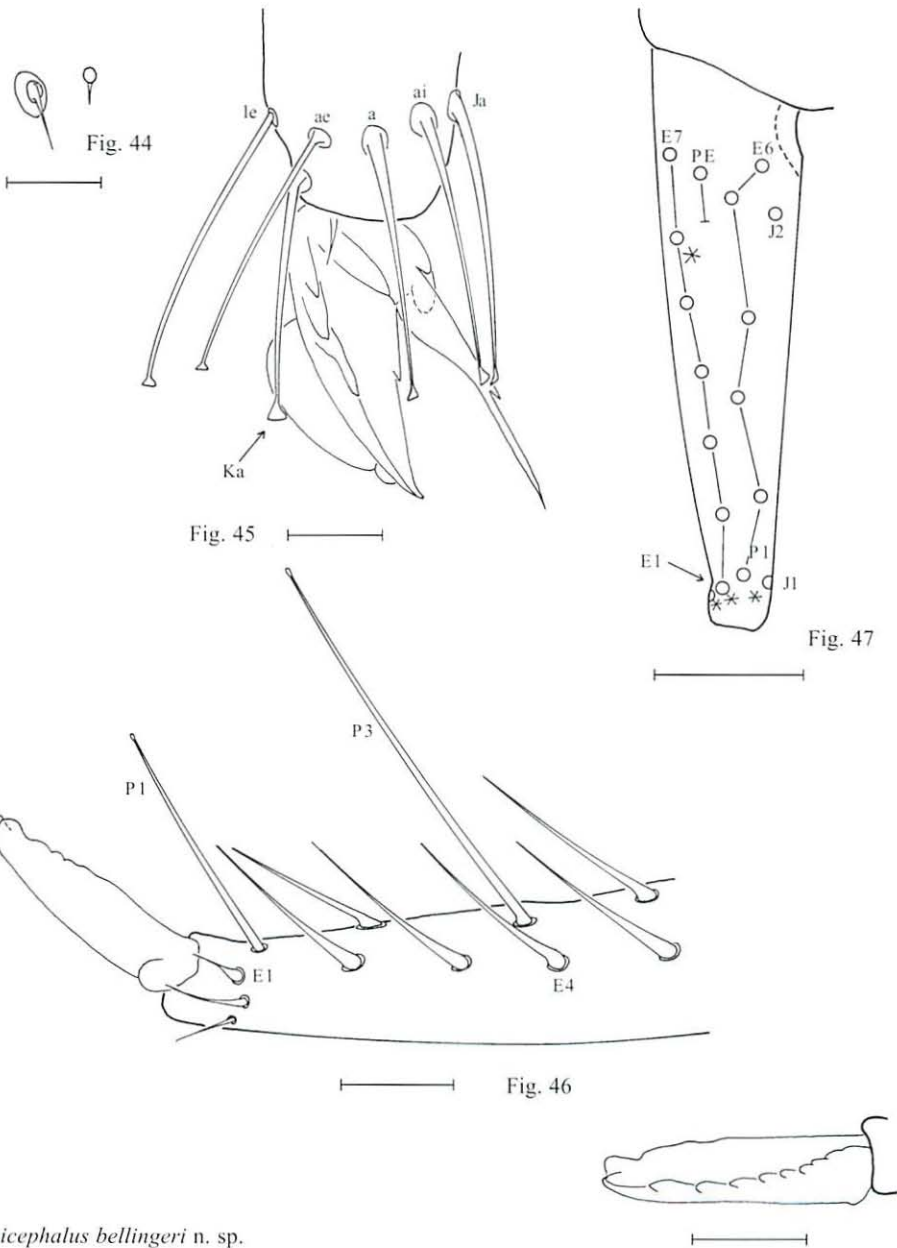
Fig. 43

Vesicephalus bellingeri n. sp.

Fig. 43 Chaetotaxy of tibiotarsi I – III (bar = 100 μ m)

Remarks: In the key in SNIDER (1985), *Vesicephalus bellingeri* n. sp. comes close to *V. crossleyi* Snider, 1985, since the empodial filaments are narrow and there are 11 clavate tibiotarsal setae. These species differ, however, in the circumanal setae of the female: In *V. bellingeri* the ventral setae av1' and av1 are transformed (short, pointed and flattened with fringes, respectively) whereas in *V. crossleyi* all circumanal setae are setalike, only av1' has some fringes (JORDANA & BAQUERO, pers. comm.). *V. bellingeri* also differs from the other Palearctic species, *V. europaeus* Ardanaz & Pozo, 1986, in the empodial filament III (in *V. europaeus* it is broad) and also in the circumanal setae of the female: In *V. europaeus* the setae a2 – a4 are broadened, av1' and av1 have basal fringes and av2 is short (JORDANA & BAQUERO, pers. comm.).

There are now five known species of *Vesicephalus*: *V. longisetis* (Guthrie, 1903), *V. occidentalis* (Mills, 1935) and *V. crossleyi* from North America, *V. europaeus* from Spain and *V. bellingeri* n. sp. from Eastern Russia. This genus, therefore, is Holarctic but has not yet been found in the wide continental landscapes of Eurasia. *V. europaeus* seems to occur in a region that had not been covered by the glaciers



Vesicephalus bellingeri n. sp.

Fig. 44 Minute setae of tibiotarsi (bar = 25 μ m)

Fig. 45 Tip of tibiotarsus, claw and empodium (bar = 25 μ m)

Fig. 46 Distal part of dens and mucro seen from outer side (bar = 50 μ m)

Fig. 47 Chaetotaxy of dens (bar = 100 μ m)

Fig. 48 Mucro (bar = 50 μ m)

of the Pleistocene (BRETTFELD & ARBEA 2000), and a question is, whether the other species also occur under similar geographical conditions.

The genus *Vesicephalus* does not belong to an intermediate group between the Sminthuridae and Katiannidae (BETSCH 1980), nor does it belong to the Sminthuridae (CHRISTIANSEN & BELLINGER 1998), but undoubtedly belongs to the Katianniformia Bretfeld, 1986 (appendices anales directed towards the genital opening) and to the family Katiannidae (or monophylum Katiannida) (tibiotarsi with 2 distal setae Ka and Kp, which is the strong synapomorphy of this family, see BRETTFELD 1999).

Acknowledgements

For sending specimens or information, my thanks are due to A. Babenko and S. Stebaeva, Moscow, Russia; C. Favret and K. Zeiders, Champaign, USA; R. Itoh, Tokyo, Japan; P. Vilkamaa, Helsinki, Finland; R. Jordana and E. Baquero, Pamplona, Spain; H. Tamura, Mito, Japan; S. Yamauchi, Aomori-shi, Japan and the late P. F. Bellinger, Northridge, USA. I acknowledge the valuable comments on my manuscript by W. Dunger, Görlitz/Germany and A. Fjellberg, Tjøme/Norway. I thank S. Hopkin, Reading/Great Britain, for helping with my English.

References

- BETSCH, J.-M. (1980): Éléments pour une monographie des Collemboles Symphypléones (Hexapodes, Aptérygotes). – Mém. Mus. Nat. Hist. Natur., NS A, Zoologie **116**: 1 – 227
- BETSCH, J.-M. & M.-C. BETSCH-PINOT (1984): Contribution à l'étude des *Sminthurus* (Collembola, Symphypleona). – Anns Soc. r. Belg. **114**: 71 – 81
- & Z. MASSOUD (1970): Études sur les Insectes Collemboles I. – Systématique, ultrastructure externe et écologie du genre *Jeannenotia* Stach, 1956 (Symphypléones, Sminthurididae n. comb.). Description de deux Collemboles nouveaux (*Proisotoma* et *Sminthurides*). – Rev. Ecol. Biol. Sol **7**: 153 – 225
- BÖRNER, C. (1909): Japans Collobolenfauna (Vorläufige Mitteilung). – Sitz.-Ber. Ges. naturf. Freunde Berlin (1909): 99 – 135
- BRETTFELD, G. (1994): The chaetotaxy of the small abdomen of the Symphypleona (Insecta, Collembola) and its phylogenetic interpretation. – Acta Zool. Fenn. **195**: 13 – 17
- (1996): Report on two collections of Symphypleona (Insecta, Collembola) from Russia and Kazakhstan, with the description of new taxa. – Senckenberg. Biol. **75**: 207 – 228
- (1999): Synopses on Palaearctic Collembola (W. DUNGER, ed.), Vol. II, Symphypleona. – Abh. Ber. Naturkundemus. Görlitz **71** (1): 1 – 318
- (2000): Third report on Symphypleona from Russia, and also from Georgia, Kazakhstan, Kirghizia, and the Ukraine (Insecta, Collembola). – Abh. Ber. Naturkundemus. Görlitz **72** (1): 1 – 57
- & J. I. ARBEA (2000): *Navarella apicalis*, a new genus and species of the monophylum Bourletiellidae from northern Spain. (Insecta: Collembola: Bourletiellidae) – Senckenberg. Biol. **80**: 127 – 133
- CHRISTIANSEN, K. & P. BELLINGER (1998): The Collembola of North America north of the Rio Grande, Part 4, Families Neelidae, Sminthuridae and Mackenziellidae, glossary, bibliography, index. – Grinnell Coll., Grinnell Iowa: 1175 – 1520
- JORDANA, R., E. BAQUERO & L. M. MONTUENGA (2001): A new type of arthropod photoreceptor. – Arthropod Structure & Development **29** (2000): 289 – 293
- MAYNARD, E. A. (1951): A monograph of the Collembola or springtail insects of New York State. – Ithaca, N. Y., 339 pp.

- NAYROLLES, P. (1995): A standardized description of European Sminthuridae (Collembola, Symphypleona) 3: Description of seven species of *Sminthurus*, including four new to science. – Bijdr. Dierkunde **64**: 215 – 237
- (1996): Contribution to the knowledge of European Bourletiellidae (Collembola, Symphypleona). III. Description of some species of *Heterosminthurus* and *Deuterosminthurus*. – Rev. suisse Zool. **103**: 525 – 551
- SNIDER, R. J. (1967): An annotated list of the Collembola (Springtails) of Michigan. – Michigan Ent. **1**: 179 – 234
- (1985): *Vesicephalus crossleyi*, new species from the Savannah River Plant and Georgia (Collembola: Sminthuridae). – Florida Ent. **68**: 567 – 574
- STACH, J. (1957): The apterygotan fauna of Poland in relation to the world fauna of this group of Insects, Families Neelidae and Dicyrtomidae. – Kraków: 1 – 113, XIX pls.
- YOSHII, R. (1992): Identity of some Japanese Collembola. – Acta Zool. Asiae Orient. **2**: 97 – 110
- YOSHII, R. (1969): *Dicyrtomina* and *Ptenothrix* (Insecta: Collembola) of the Solomon Islands. – Zool. J. Linn. Soc. **48**: 217 – 236
- & C.-E. LEE (1963): On some Collembola of Korea, with notes on the genus *Ptenothrix*. – Contr. Biol. Lab. Kyoto Univ. **15**: 1 – 37

Manuscript accepted: 9 December 2002

Author's address:

Dr. Gerhard Bretfeld
Zoologisches Institut der Universität Kiel
Olshausenstr. 40
D-24098 Kiel, Germany