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Fifth report on Symphypleona from Russia, and also a review of *Deuterosminthurus kaplini* Martynova, 1979 from Turkmenistan (Insecta, Collembola)

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Abstract

This study again deals with Collembola Symphypleona from Russia and the adjacent countries. Out of 33 slide preparations from Russia, remarks upon nine already known species are given and two new species are described. Also a new genus is proposed for *Deuterosminthurus kaplini* Martynova, 1979; a new genus is suggested for the species with characteristics of both the genera *Sminthurus* Latreille, 1802 sensu Betsch & Betsch-Pinot 1984 and *Spatulosminthurus* Betsch & Betsch-Pinot, 1984; and a new key is given to the *Sminthurus* species of the Palaearctic.

Key words: Taxonomy, geographic distribution, Sminthurus-key, *Janusius* n. g., *Karakumiella* n. g.

1. Introduction

Again, I had the opportunity to study slide preparations of Collembola Symphypleona from Russia (Part A). They contain whole mounts and had been send by S. Stebaeva, Moscow (30 slides from the Sayan and Tuva Mts., Krasnoyarsk and Tuva Reg.), A. Babenko, Moscow (two slides from the delta of Kolyma River, Yakutia Reg.), and M. Potapov, Moscow (one slide from the middle Ural Mts., Perm/Sverdlovsk Reg.). Out of these preparations I was able to determine 11 species, two of which are new to science (*Sminthurinus* n. sp. and *Sminthurus* n. sp.), five had been already known from Russia, three had been known only from Mongolia and one only from North America; there were another seven taxa, the species of which I was not able to identify.

It is years ago that I recognised that the description of *Deuterosminthurus kaplini* Martynova, 1979 shows characteristics which do not correspond with those of the genus *Deuterosminthurus* Börner, 1901. Thus, I was very glad that I had the opportunity to study several paratypes out of the collection of E. F. Martynova, St. Petersburg. The result is that I propose a new genus for this species (Part B). Also, a new description is added to confirm and to supplement the original one.

Already in a former paper on Russian Collembola (Bretfeld 2002), I discussed the taxonomic position of *Sminthurus sylvestris* Banks, 1899. This and the two related species *Sminthurus*

daisetsuzanus Uchida, 1957 and *Sminthurus sensibilis* Börner, 1909 sensu Yoshii 1992 have characteristics of both the genera *Sminthurus* Latreille, 1802 sensu Betsch & Betsch-Pinot 1984 and *Spatulosminthurus* Betsch & Betsch-Pinot, 1984. Now, I wish to solve the problem of the taxonomic position of these species by suggesting a new genus for them (Part C).

Since the publication of the Synopsis on Palaearctic Collembola, part Symphypleona (Bretfeld 1999) with its 20 *Sminthurus* species, seven new *Sminthurus* species have been described from Russia and the adjacent countries (four from Russia, two from Kazakhstan, one from the Ukraine) (Bretfeld 2000, 2002 and this paper). Therefore I compiled a new key to the *Sminthurus* species of the Palaearctic that replaces that in the Synopsis from 1999 (Part D).

The description follows my previous papers (Bretfeld 1996, 2000, 2002). For more information about taxonomy, characteristics, occurrence and biology of the already known species, see Bretfeld (1999).

All my new labels are added to the back sides of the original slide preparations.

The two slides with the type specimens of the new species are deposited at the Senckenberg Museum für Naturkunde, Görlitz, Germany[1]. The other slides have been given back into those collections the owners of which had lent or sent them to me, i. e. into the collection Martynova, St. Petersburg, and the collections Stebaeva, Babenko and Potapov, all Moscow.

2. Part A. Study of the slide preparations

List of the samples and their taxa

I. Russia, E of the Ural Mts., SE mountain localities

1. Krasnoyarsk Reg., West Sayan Mts., Oiskiy Mt. Range, near Olen'ya Rechka, from moss cover on stones along river in small forest with *Abies sibirica* at 1300 m altitude, 27. VI. 1990, leg. and prep. S. Stebaeva no. 11 (Bretfeld´s no. St IV P11) (*Sminthurinus* n. sp.).

2. As sample 1, but sweepnet sample from mossy tundra with *Betula rotundifolia* on border between tundra and forest belt at 1500 – 1600 m altitude, 10. VII. 1990, leg. and prep. S. Stebaeva no. 16 (St IV P16) (*Sminthurus cogsonzavi*).

3. As sample 1, but sweepnet sample from alpine moss-lichen tundra with *Carex* sp. and *Betula rotundifolia* at 1800 m altitude, 27. VI. 1990, leg. and prep. S. Stebaeva no. 14, 15 (St IV P14, P15) (*Sminthurus cogsonzavi*).

4. As sample 1, but sweepnet sample from alpine tundra with *Carex* sp., *Salix glauca* and *Betula rotundifolia*, 10. VII. 1990, leg. and prep. S. Stebaeva no. 17, 18 (St IV P17, P18) (*Sminthurus cogsonzavi*).

5. West Tuva Reg., SW part of West Sayan Mts., 10 km from lake Kara-Khol', in litter from tundra with *Betula rotundifolia* at 2300 m altitude, 14. VII. 2001, leg. and prep. S. Stebaeva no. 4 (St IV P4) (*Sminthurinus alpinus*).

6. As sample 5, but in moss from moss-lichen tundra at 2300 m altitude, 16. VII. 2001, leg. and prep. S. Stebaeva no. 1, 3 (St IV P1, P3) (*Arrhopalites principalis*, *Sminthurinus alpinus*).

7. West Tuva Reg., Alashskoye Plateau, near lake Sut-Khol', in moss from moss-lichen tundra at 2100 m altitude, 20. VII. 2001, leg. and prep. S. Stebaeva no. 5 (St IV P5) (*Sminthurinus alpinus*).

8. As sample 7, but in moss from mossy tundra, 20. VII. 2001, leg. and prep. S. Stebaeva no. 6 (St IV P6) (*Megalothorax* sp., *Sminthurinus alpinus*).

[1] I wish to announce that my complete collection of Collembola Symphypleona is now under the care of this museum.

9. South Tuva Reg., 10 km SW from Erzyn, dry steppe with *Stipa krylovii* and bushes of *Caragana bungei*, sweepnet sample from *Stipa*, 12. VII. 1993, leg. and prep. S. Stebaeva no. 8 (St IV P8) (*Kaszabellina minima*).

10. Southwest Tuva Reg., flood-plain of Kargy River 3 km from Mugur-Aksy, in moss from meadow with *Salix* and *Hordeum*, 22. VII. 1993, leg. and prep. S. Stebaeva no. 30 (St IV P30) (*Deuterosminthurus pallipes* f. *repanda*).

11. Southwest Tuva Reg., Mongun Taiga Mt. Range, 20 km from Mugur-Aksy, in moss-lichen of tundra at 2100 m altitude, 25. VII. 1993, leg. and prep. S. Stebaeva no. 28, 29 (St IV P28, P29) (*Sminthurinus alpinus*).

12. Tuva Reg., East Tannu-Ola Mt. Range, 10 km NW from Khol'-Oozhu, sweepnet sample in S exposure of mountain stony steppe at 1200 m altitude, 16. VII. 1993, leg. and prep. S. Stebaeva no. 25 (St IV P25) (*Sminthurus* n. sp.)

13. As sample 12, but pitfall trap in forest with *Pinus sibirica* and *Larix sibirica* at 1650 m altitude, 17. VI. 1995, leg. and prep. S. Stebaeva no. 9 (St IV P9) (Dicyrtominae g. sp., *Fasciosminthurus* cf. *obtectus*, *Sminthurus cogsonzavi*).

14. As sample 13, but from soil of same forest at 2100 m altitude, 16. VII. 1993, leg. and prep. S. Stebaeva no. 2, 7 (St IV P2, P7) (*Arrhopalites principalis*, *Kaszabellina variabilis*).

15. As sample 13, but pitfall traps in same forest at 2100 m altitude, 17. VI. 1995, leg. and prep. S. Stebaeva no. 23 (St IV P23) (*Sminthurus muscicolus*).

16. As sample 12, but pitfall trap in alpine tundra with *Polytrichum* at 2175 m altitude, 17. VI. 1995, leg. and prep. S. Stebaeva no. 19 – 22 (St IV P19 – P22) (*Sminthurus muscicolus*).

II. Russia, Ural Mts. and delta of Kolyma River

17. Perm/Sverdlovsk Reg., Middle Ural Mts., Denezhkin Kamen Mt. Massif, Shapinskaya Sopka, 1100 m altitude, from snow fields, 9. 6. 2002 leg. A. Ermakov, prep. and det. M. Potapov (*Sminthurus* sp.).

18. Yakutia Reg., delta of Kolyma River, 69°32´N 160°44´E, from sedge bog near river, 18.–19. VII 1994, leg. et det. Babenko no. 51/94 (Bretfeld´s no. Ba VII P1) (*Sminthurinus henshawi*).

19. As sample 18, but from *Dryas* association in river valley, 18. – 19. VII 1994, leg. et det. Babenko no. 52/94 (Ba VII P2) (*Sminthurinus henshawi*).

Description of the species

***Arrhopalites principalis* Stach, 1945**

Material: Russia (Tuva Reg.) sample 6: 1 female, 14: 1 female.

Chaetotaxy as usually described, but slight differences observed. The main characteristics are (differing normal ones in brackets): Head with 4 pairs of spines (4–6 pairs). Ratio of posterior setae of large abdomen to claw III = 1.5 (2). Claw and empodium I with one tooth each. Retinaculum with 1 seta (2). Circumanal setae thicker than normal ones but not winged. Appendices anales split into branches with long fringes.

A. principalis was found here in moss of a tundra at 2300 m and in a forest with *Pinus sibirica* and *Larix sibirica* at 2100 m altitude. It is a holarctic species and is already known from S Russia (Bretfeld 1999).

***Deuterosminthurus pallipes* f. *repanda* (Bourlet, 1842)**

Material: Russia (Tuva Reg.) sample 10: 5 specimens.

These yellow specimens show the species specific characteristics.

D. pallipes f. *repanda* was found here in moss of a flood-plain meadow. This palaearctic species is widespread in Russia and also known from Kazakhstan (Bretfeld 2000, 2002).

***Fasciosminthurus* cf. *obtectus* Bretfeld, 1992**

Material: Russia (Tuva Reg.) sample 13: 1 male.

This single male has more or less dense black pigment on head, body and all extremities whithout white pigment. Dens inner row J with 3 distal and 2 proximal setae as originally described.

F. cf. *obtectus* was found here in a forest with *Pinus sibirica* and *Larix sibirica* at 1650 m altitude. The determination is uncertain, as a completely dark pigmentation had been not yet observed in this species, always more or less white spots were present. Also, because of the whole mount of this male, only the chaetotaxy of the dens and no other chaetotaxic characteristics could be recognised. And as this species is only known from eastern steppe formations (Bretfeld 1996), the forest habitat of this specimen cannot support a correct determination.

***Kaszabellina minima* Betsch, 1977**

Material: Russia (Tuva Reg.) sample 9: 1 male.

Tibiotarsi I – III each with 3 spatulate distal setae, claws with small inner tooth, formula of anterior setae of dens 3+1,2,1...1 as originally described.

K. minima was found here in a dry steppe. It has been originally described from Mongolia and is already known from the Tuva Reg. (Bretfeld 2000).

***Kaszabellina variabilis* Betsch, 1977**

Material: Russia (Tuva Reg.) sample 14: 1 female.

With reservation, this female was already determined by S. Stebaeva. The determination is here confirmed after the original description: Abdominal segment VI with 7 furcated circumanal setae, appendices anales rather broad, each claw with large inner tooth, formula of anterior setae of dens 3,2...1.

K. variabilis was found here on the soil of a *Pinus sibirica* and *Larix sibirica* forest at 2100 m altitude. It has been originally described from Mongolia from a rocky desert steppe and was now recorded in an adjacent northern landscape from a forest soil.

***Sminthurinus alpinus* Gisin, 1953**

Material: Russia (Tuva Reg.) sample 5: 1 female, 6: 2 females, 7: 1 female, 8: 1 female, 11: 1 female, 1 male.

Claws shorter than usual (length of claw III < 0.5 of mucro), but the species specific chaetotaxy of dentes as originally described.

S. alpinus was found here in litter and moss of a tundra at 2100 m and 2300 m altitude. It is already known from the Tuva Reg. (Bretfeld 2000, 2002).

***Sminthurinus henshawi* (Folsom, 1896)**

Material: Russia (Yakutia Reg.) sample 18: 4 specimens, 19: 3 specimens.

With reservation, these specimens were already determined by A. Babenko. The determination is here confirmed after the description by Christiansen & Bellinger (1998):

Chaetotaxy of the dens with 4 (arranged as 2,2) anterior subapical setae, posterior setae:

4 proximal (2 inner, 1 median, 1 outer) and 3 outer and 3 median subapical setae, weak papilla of antennal segment III.

The antennal papilla and the anterior chaetotaxy of the dens resemble *Sminthurinus modestus* Yosii, 1970 from Japan. However, the dens in this species has two more setae: 4 (arranged as 2,2) anterior subapical setae, posterior setae: 5 proximal, 3 outer and 4 median subapical setae.

S. henshawi had been only known from the USA (but not yet from Alaska) and from Canada (Skidmore 1995, Christiansen & Bellinger 1998). It was now recorded from the low tundra vegetation of NE-Siberia.

***Sminthurinus oiskiyensis* n. sp.**

Holotype. Female (whole mount) of sample 1: Krasnoyarsk Reg., West Sayan Mts., Oiskiy Mt. Range, near Olen'ya Rechka, from moss cover on stones along river in small forest with *Abies sibirica* at 1300 m altitude, 27. VI. 1990, leg. and prep. S. Stebaeva no. 11 (Bretfeld´s no. St IV P11).

Paratypes. 2 males, collected together with the holotype and prepared on the same slide as the holotype.

Derivatio nominis. The new species is named after its locus typicus, the Oiskiy Mt. Range of the West Sayan Mts.

Diagnosis

A species of the *niger*-group of the genus *Sminthurinus* Börner, 1901 with 4 diagnostic characteristics:

– Body with postero-laterally interrupted dark lateral band,
– dens with 3 (arranged as 2,1) anterior subapical setae,
– some circumanal setae of female slightly winged (apomorphy),
– mucro slender, inner edge serrate, outer smooth.

Other characteristics: Papilla of antennal segment III flat and undivided.

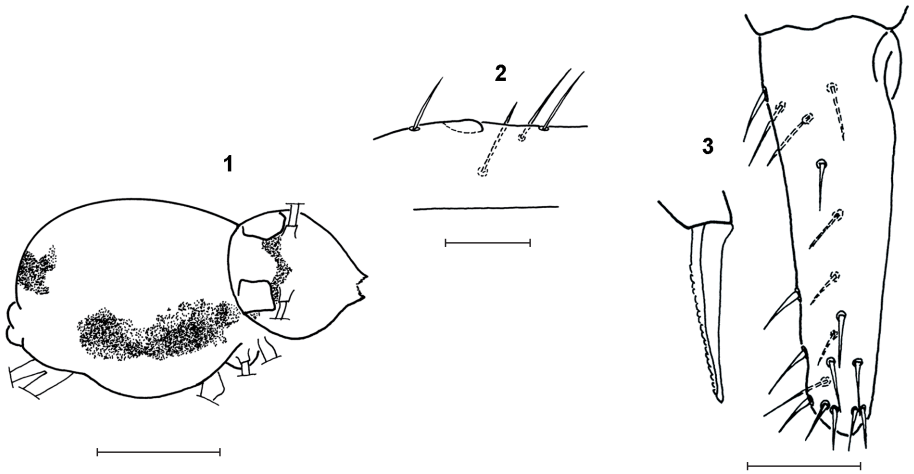
Description

Measurements and proportions. Total length of female 0.6 mm, of male 0.5 mm, mucro in both sexes 38 µm, appendices anales 24 µm. Antennal segments II : III : IV = 1 : 1.9 : 4.3 in female, 1 : 1.1 : 2.5 in one male, dens : mucro = 2.5 in female, 2.3 in males, claw III inner edge : mucro = 0.6, appendices anales : mucro = 0.6, appendices anales : claw III inner edge = 1.

Colour (Fig. 1)**.** Eye-patches black, head and body with dark blue band, head with small dark band between eye-patches, large abdomen with lateral broad band and posterior spot, i. e. lateral band interrupted postero-laterally.

Chaetotaxy and special structures. Setae of eye-patches and number of ommatidia obscured by the pigment. Antennal segment III with a large, flat and undivided papilla (Fig. 2). In female, circumanal seta a0 forked, lateral pairs slightly winged. Appendices anales split into 5–6 branches. Tibiotarsus with 5 spatulate distal setae (only observed in one leg). Claws without teeth, empodia without or with outer tooth. Dens (Fig. 3) with 3 (arranged as 2,1) anterior subapical setae, posterior setae: 4 proximal (2 outer, 1 median, 1 inner), 2 outer and 2–4 median subapical setae. Mucro (Fig. 3) slender, outer edge smooth, inner serrate. Only one neosminthuroid seta recognised in one male.

Remarks. The colour pattern of *Sminthurinus oiskiyensis* resembles that of *S. hygrophilus* Bretfeld, 2000 and *Sminthurinus* spec. A Bretfeld, 2000. But the papilla of antennal segment III differs and dentes with 3 anterior subapical setae, as found in the new species, have been not yet described.



Figs 1–3 *Sminthurinus oiskiyensis* n. sp.; 1: Colour pattern (bar = 200 µm). 2: Vesicle of antennal segment III (bar = 25 µm). 3: Dens, seen from anterior side and mucro, seen from outer side (bar = 25 µm).

***Sminthurus cogsonzavi* Betsch, 1977**

Material: Russia (Krasnoyarsk Reg.) sample 2: 1 male, 2 females, 3: 1 male, 1 subad., 4: 5 males, 6 females, 1 juv., (Tuva Reg.) sample 13: 8 juv.

Besides the pigmentation, which was bleached in the preparations, most characteristics as originally described, especially in leg III the length of tunica > ½ of claw and the mucro with a seta and both posterior edges with many teeth (Fig. 4).

Some further characteristics, important to the determination of the *Sminthurus* species, can be added to the original description of *S. cogsonzavi*: ventral tube with 2+2 setae, subcoxa III with 2+2 setae and abdominal segment V with 2+2 setae A1 and A2 above bothriotrichia D+D with the dorsal pair A1 rough and shorter than the ventral pair A2.

In the original description, some proportions were compared with *Sminthurus serratomucronatus* Grinbergs, 1962 which had been also found in the Tuva region, i. e. near to Mongolia where *S. cogsonzavi* had been found. These proportions were said to differ distinctly between these two species. In the adults studied here from West Sayan Mts., however, these proportions are intermediate: long body setae : mucro = 1.2–1.8 in female (instead of 1 in *S. cog.* and 2 in *S. serr.*), appendices anales : mucro = 0.3–0.4 (instead of 0.4 in *S. cog.* and 0.3 in *S. serr.*).

S. cogsonzavi was found here in the West Sayan Mts. in an alpine moss-lichen tundra with *Betula rotundifolia* at 1500 – 1800 m altitude and in the Tuva Reg. in a forest with *Pinus sibirica* and *Larix sibirica* at 1650 m altitude. It had been only known from Mongolia and was now found in the adjacent northern mountains.

Fig. 4 *Sminthurus cogsonzavi* Betsch , 1977. Mucro of female (left) and of juvenile (left bar = 50 µm, right bar = 25 µm).

***Sminthurus montanus* n. sp.**

Holotype. Male (whole mount) of sample 12: Russia (Tuva Reg.), East Tannu-Ola Mt. Range, 10 km NW from Khol'-Oozhu, sweepnet sample in S exposure of a mountain stony steppe at 1200 m altitude, 16. VII. 1993, leg. and prep. S. Stebaeva no. 25 (Bretfeld´s no. St IV P25).

No further specimen known.

Derivatio nominis. The name of this new species reminds of its mountaineous type locality.

Diagnosis

A large species of the genus *Sminthurus* Latreille, 1802 sensu Betsch & Betsch-Pinot 1984 with 5 diagnostic characteristics:

- Abdominal segment V with 2+2 setae A1 and A2 above bothriotrichia D+D (apomorphy; plesiomorphy: with only 1+1 setae),
- upper setal pair A1 of abdominal segment V short and ciliate (apomorphy, plesiomorphy: long and smooth),
- subcoxa III with 1 seta (plesiomorphy; apomorphy: two setae),
- ventral tube with 2+2 setae (apomorphy; plesiomorphy: 1+1 setae),
- claws with short pseudonychia, tunica missing.

Other characteristics: Postantennal setae short, slender and ciliate, one furcate. Posterior edges of mucro with few round teeth, seta missing.

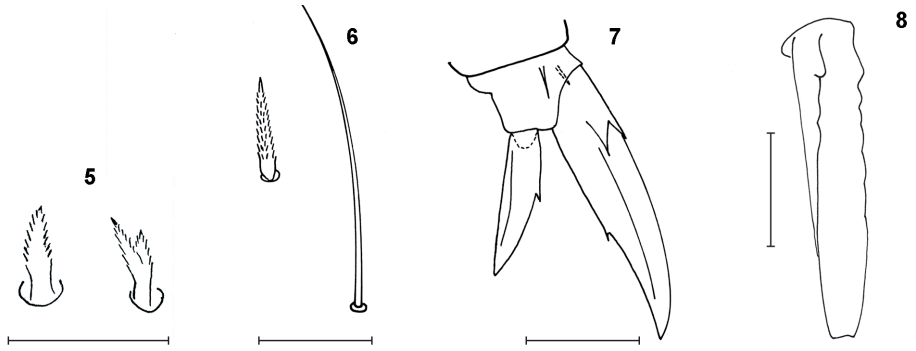
Description

Measurements and proportions. Total length of body 1.2 mm, of head 0.4 mm, claw III inner edge 60 µm, mucro 100 µm, whole antenna : head length = 1.9, antennal segments I : II : III : IV = 1 : 2.3 : 3.4 : 8.1, dens : mucro = 3, mucro : claw III inner edge = 1.7.

Colour. Eye-patches black, other pigment bleached by preparation.

Chaetotaxy and special structures. Cuticula of head and of posterior parts of large abdomen with only primary granules. Head with blunt apical setae, postantennal setae (Fig. 5) short, slender, pointed and rough, one furcate, oval organs not recognised.

Antennal segment II besides the normal setae with 4 short ventral ones, segment III with the longest setae only slightly longer than the diameter of the segment, segment IV with 14–15 subsegments, basal whorl with 4 setae.



Figs 5–8 *Sminthurus montanus* n.sp.; 5: Both postantennal setae (bar = 25 µm). 6: Abdominal segment V, setae A1 (left) and A2 (bar = 25 µm). 7: Claw and empodium III, seen from anterior side (bar = 25 µm). 8: Mucro, obliquely seen from posterior side (bar = 25 µm).

Large abdomen with most setae long and acuminate, antero-dorsal part also with blunt ones, also thin normal setae present. Posterior setae longest, their ratio to mucro up to 1.8. Ventral tube with 2+2 setae, setae of retinaculum not recognised.

Small abdomen segment V with 2+2 setae A1 and A2 above bothriotrichia D+D, dorsal pair A1 short, pointed and ciliate (Fig. 6).

Legs. Subcoxa III with 1 distal seta (observed only on one side), tibiotarsi outer setae slightly longer than the diameter of tibiotarsus, each with 4+1 oval organs; tibiotarsus III with only acuminate setae, row p with 8 setae, seta Vi normal; chaetotaxy of tibiotarsi I and II not distinct. Claws (Fig. 7) broad without a tunica, with inner tooth and 3 teeth of the short pseudonychia (length < ½ claw); empodia (Fig. 7) broad and blunt, with outer tooth, without apical filament.

Furca. Dens row J with 6 setae, row P with additional seta P5, formula of anterior setae 3+1,3,3,2,2,1,1; mucro (Fig. 8) of even width, both posterior edges wavy, i. e. with few round teeth, seta missing.

Remarks. Some characteristics of *S. montanus* resemble *S. muscicolus* Betsch, 1977: pseudonychia of claws < ½ of claw, both posterior edges of mucro wavy or notched and mucronal seta missing. But other characteristics differ: *S. montanus* has broad claws (in *S. muscicolus* slender), the postantennal setae are short and slender (instead of short and broad) and especially in abdominal segment V seta A1 is rough and < A2 (instead of smooth and > A2). Thus, *S. montanus* can be clearly separated from other species.

Sminthurus muscicolus Betsch, 1977

Material: Russia (Tuva Reg.) sample 15: 2 females, 16: 4 males, 11 females.

Most characteristics as originally described but postantennal seta, appendices anales, claw, empodium and mucro figured here again for slight differences (Figs 9–12). Some further characteristics, important for the determination of the *Sminthurus* species, can be added to the original description: strong basal setae of antennal segment III only slightly longer than diameter of segment, antennal segment IV with 17–18 subsegments, ventral tube with 2+2 setae, abdominal segment V with 2+2 setae A1 and A2 above bothriotrichia D+D, both smooth,

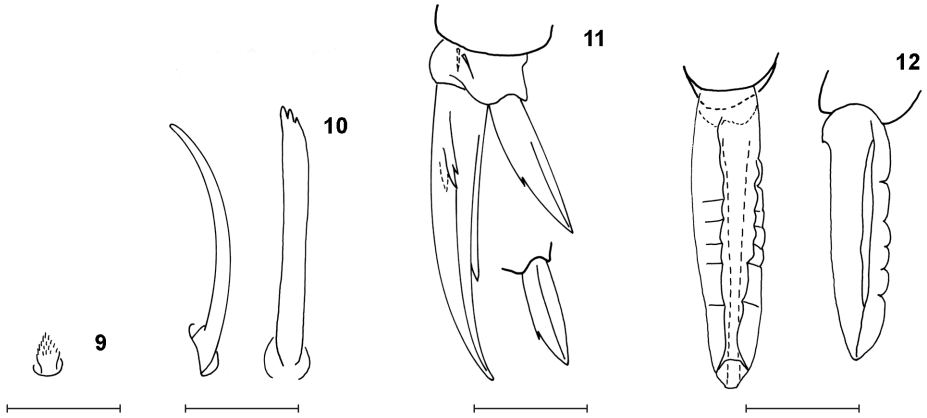


Fig. 9–12 *Sminthurus muscicolus* Betsch, 1977. 9: Postantennal seta (bar = 25 µm). 10: Appendices anales, seen from lateral and from posterior side (bar = 25 µm). 11: Claw and empodium III and empodium I (bar = 25 µm). 12: Mucro, seen from posterior side (left) and obliquely seen from inner side (bar = 50 µm).

the dorsal pair A1 longer than the ventral pair A2, subcoxa III with 1 short seta, tibiotarsus III row p with 4 setae, seta Vi of this tibiotarsus is a normal seta.

S. muscicolus was found here on the soil of a *Pinus sibirica* and *Larix sibirica* forest at 2100 m altitude and of an alpine tundra at 2200 m altitude. It had been only known from Mongolia and was now found in the adjacent northern mountains.

Specimens not completely determined

***Arrhopalites* Börner, 1906 sp.**

Material: Russia (Krasnoyarsk Reg.) near sample 1: 1 juv., found on large stones under small *Abies sibirica* at 1500 m altitude, leg. and prep. S. Stebaeva no. 13 (Bretfeld´s no. St IV P13).

Dicyrtominae Richards, 1968 g. sp.

1) Material: Russia (Krasnoyarsk Reg.) near sample 1: 1 juv., found in moss and lichen on a destroyed tree at 1300 m altitude, leg. and prep. S. Stebaeva no. 10 (Bretfeld´s no. St IV P10).

2) Material: Russia (Southwest Tuva Reg.) near sample 11: 1 juv., found in the litter of *Betula rotundifolia* at 2100 m altitude, leg. and prep. S. Stebaeva no. 26 (Bretfeld´s no. St IV P26).

3) Material: Russia (Tuva Reg.) near sample 13: 4 juv., found in a forest with *Pinus sibirica* and *Larix sibirica* at 1650 m altitude.

***Heterosminthurus* Stach, 1955 sp.**

Material: Russia (Krasnoyarsk Reg.) near sample 1: 2 juv., found in a forest with *Betula rotundifolia*, leg. and prep. S. Stebaeva no. 12 (Bretfeld´s no. St IV P12).

***Megalothorax* Willem, 1900 sp.**

Material: Russia (Tuva Reg.) sample 8: 3 specimens, found in a mossy tundra at 2100 m altitude.

***Sminthurinus* Börner, 1901 sp.**

Material: Russia (Southwest Tuva Reg.) near sample 11: 2 juv., found in the litter of *Betula rotundifolia* at 2100 m altitude, leg. and prep. S. Stebaeva no. 27 (Bretfeld´s no. St IV P27).

***Sminthurus* Latreille, 1802 sensu Betsch & Betsch-Pinot 1984 sp.**

1) **Material:** Russia (Tuva Reg.) near sample 15: 2 juv., found in the soil of a dry larch forest at 1200 m altitude, leg. and prep. S. Stebaeva no. 24 (Bretfeld´s no. St IV P24).

*) No species specific charakteristic observed.

2) **Material:** Russia (Perm/Sverdlovsk Reg.) sample 17: 1 female.

Head and body with dark brown pigment which allows to observe only few characteristics. Postantennal setae short, broad, pointed and rough. Antennal segment II besides the normal setae with 4 short ventral setae, antennal segment III with the longest setae only slightly longer than the diameter of the segment, antennal segment IV with 16–17 subsegments. Abdominal segment V with 2+2 setae A1 and A2 above bothriotrichia D+D, both pairs A1 and A2 are long, normal setae. Tibiotarsi with only pointed setae. Claws slender, without a tunica, with distinct inner tooth, pseudonychium with lateral teeth, length ≤ ½ claw, empodia like knife-blades. Appendices anales narrow and pointed, distal 1/3 ciliate. Mucro smooth, seta missing.

This female appears in the key in Bretfeld (1999) near *S. stachi*, in the new key in this paper near *S. wahlgreni* and *S. wutaii*. But the characteristics, including the pigmentation, did not allow the determination of this female with certainty; it may belong to a new species.

Sminthurus sp. was found here in the Middle Ural Mts. on a snow field at 1100 m altitude.

***Sphaeridia* Linnaniemi, 1912 sp.**

Material: Russia (Southwest Tuva Reg.) near sample 11: 3 females, found in the litter of *Betula rotundifolia* at 2100 m altitude, leg. and prep. S. Stebaeva no. 27 (Bretfeld´s no. St IV P27).

3. Part B. Review of *Deuterosminthurus kaplini* Martynova, 1979 from Turkmenistan

***Karakumiella* n. g.**

Type species: *Deuterosminthurus kaplini* Martynova, 1979, in Martynova et al. (1979).

No further species know.

Diagnosis

A genus of the family Bourletiellidae Börner, 1913 sensu Betsch 1980 (or monophylum Bourletiellida Bretfeld, 1986) with the following characteristics:

Head roundish, mouthparts normal. Head frons in male with only thin normal setae. Some inner setae of tibiotarsi flattened or obliquely truncate. All posterior setae of tibiotarsus III smooth and acuminate. All empodia strong, without lamella, filament or basal point each. Anterior setae of dens longer than the spaces between the rows. Both posterior edges of mucro smooth.

Derivatio nominis. The new genus is named after the Karakum desert in Turkmenistan where the specimens had been collected.

Justification. Already the original figures show, that both the shape of the empodia and the long anterior setae of the dentes do not correspond with those of the genus *Deuterosminthurus* Börner, 1901 sensu Stach, 1955. In the key in Bretfeld (1999), the strong empodia lead to the genus *Nasosminthurus* Stach 1955 from Australia. However, that genus has mucrones with round posterior teeth and the head frons of the male shows a patch of curved spines after which Stach named this genus. Both these characteristics are not present in the specimens studied. Therefore, for this species of the Karakum desert a new genus must be proposed.

Remarks. The three slides which I was able to study out of the collection Martynova, St. Petersburg, contain the whole mounts of 11 paratypes of *Deuterosminthurus kaplini* Martynova, 1979 (eight females, two males and one juvenile).

In the following, a description of these paratypes is given to confirm the original description and to add some characteristics not mentioned there.

***) *Karakumiella kaplini* (Martynova, 1979)**

Description

Measurements and proportions in females (and males). Total length in female 1.1 mm (in male 0.85 mm), head in both sexes 0.3 mm, mucro 87–110 µm (75–90 µm), inner edge of claw III 30 µm (25 µm), appendices anales 50–56 µm. Antennal segment I : II : III : IV = 1 : 2.4 : 3.3 : 6.7 (1 : 2.3 : 3.2 : 6), whole antenna : head length = 1.9 in female, manubrium : dens : mucro = 2.6 – 3.3 : 2.2 – 2.9 : 1 (3 : 2.5 : 1), mucro : inner edge of claw III = 3.1 (3.5), appendices anales : mucro = 0.5, appendices anales : inner edge of claw III = 1.7.

Colour. Background of head and body yellow, eye-patches black. Bluish pigment on back of the head, in antennal segments III and IV, as a lateral stripe on the large abdomen and as bluish patches on the dorsal and lateral sides of the small abdomen. Some specimens have bluish spots on the small abdomen only.

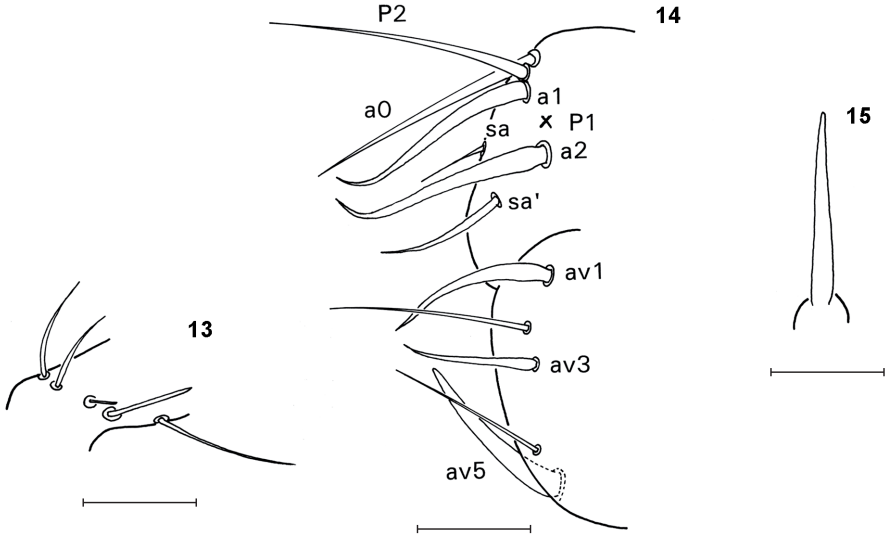
Chaetotaxy and special structures. In both sexes setae of head and body of normal shape, males without secondary sexually modified setae. Head frons with short setae, those of apex and clypeus longer, setae of the anterior parts of the large abdomen shorter than of the posterior parts.

Head. Shape round and mouthparts normal. Eye-patches with 8+8 ommatidia and 2+2 setae. Setae of the head apex ap 2-m-2, frons rows a 5+5 (sometimes 6), middle part of frons with 13–17 setae, ventral part of posterior side with 2+2 oval organs, setae of clypeus not analysed.

Antennae. Total length shorter than body. Besides the normal setae, segment II with 2 short and spiny setae on the dorso-distal part and segment III with 1 strong and blunt seta in the basal half. Segment IV in the most proximal whirl P1 with 5 setae including 2 sensilla (Fig. 13), whorl P2 with 4–7, region T with 7–11, whorl P3 with 8 setae, distal whorls d1–d6 with 8 normal setae each as usual, the most distal whorls with 3 rows of sensilla: 4 dorso-anterior ones (including 2 long distal sensilla), 2–3 dorso-posterior ones (including 1 long distal sensilla) and 2 ventro-posterior ones in whorl d3 and d4, tip besides the normal setae with 11 sensilla.

Large abdomen with normal setae and bothriotrichia A, B, C in a straight line as usual. Retinaculum with 3+3 teeth and 3 setae. The setae of ventral tube and the ventral setae of abdominal segment IV not recognised.

Small abdomen with normal dorsal and lateral setae. Segment VI with setae A1–3, DL1+2, m1+2, P1+2; dorsal circumanal setae in female in the a-row arranged as 2-1-2 (Fig. 14): a0 long but of normal shape, a1 and a2 (originally marked a2 and a4) thicker and curved, setae P1 and P2 near to the a-row and thus pretending 4-1-4 circumanal setae (in the original



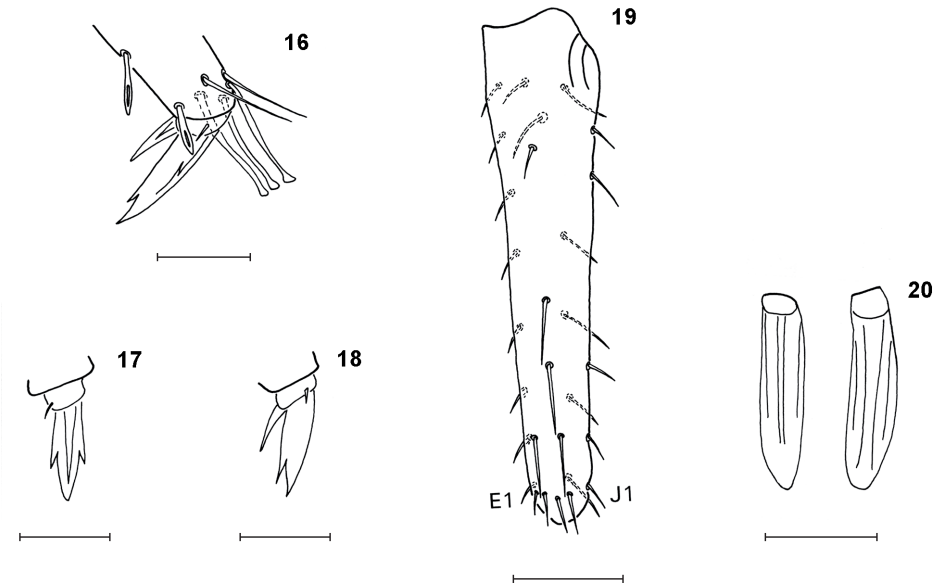
Figs 13–15 *Karakumiella kaplini*; 13: Antennal segment IV, basal sensilla (bar = 25 µm). 14: Circumanal setae, seen from right side, x marks missing seta P1 in this female (bar = 25 µm). 15: Appendix analis, seen from posterior (bar = 25 µm).

description setae P1 and P2 are marked a3 and a1 respectively), the more dorsal seta P2 is longer and thicker than the more ventral seta P1. Ventral circumanal setae av1 and av3 also thicker and more curved than the normal setae av2 and av4. Males show the same setal pattern but the circumanal setae are not thickened. Appendices anales (av5, Figs 14, 15) long, strong and smooth, slightly curved to the anterior. Genital papilla in females with 15–20, in males with 5+5 and 8+8 setae.

Legs. Basal parts not analysed. Tibiotarsi (Fig. 16) with some inner-distal setae thicker than others and flattened or obliquely truncate, the longest outer setae as long as the diameter of the segment. Tibiotarsus I seta Ja not appressed, tibiotarsi II and III row p with 6 and 3–5 setae respectively, 2 oval organs observed in row PE of one leg. Tibiotarsi I–III with 3, 3, 2 distal clavate setae respectively. Claws (Figs 16–18) broad with strong inner and 1+1 strong and straight lateral teeth, in some specimens inner teeth smaller; empodia (Figs 16, 18) strong, straight and blunt, without a tooth or filament each, length slightly > ½ claw.

Furca. Manubrium not analysed. Most setae of dens (Fig. 19) short and normal, outer row E with 8, postero-outer row PE with 1, posterior row P with 6, inner row J with 5 setae (arranged as 3 distal, 2 proximal), formula of anterior setae 3+1,2,1,1...1 (middle setae longer than the spaces between the rows). Both posterior edges of mucro (Fig. 20) smooth, anterior furrow of median width.

Occurrence and ecology. The specimens had been collected by G. V. Kaplin in the Repetek Nature Reserve, East Karakum Desert, Turkmenistan, in 1973. They occurred from March to June with the highest density in April and were mainly collected from several species of Chenopodiaceae and of annual salt plants by shaking and sweeping the vegetation. For more and detailed information of the different habitats in this part of the Karakum desert, see the original description.



Figs 16–20 *Karakumiella kaplini*; 16:Tip of tibiotarsus II, claw and empodium of female (bar = 25 µm). 17: Claw II of female, seen from outer side (bar = 25 µm). 18: Claw and empodium III of male (bar = 25 µm). 19: Dens of female, seen from anterior (bar = 50 µm). 20: Two mucrones of female, seen from anterior (bar = 50 µm).

4. Part C. Suggestion of a new genus of the family Sminthuridae, subfamily Sminthurinae

***Janusius* n. g.**

Type species:

Sminthurus sylvestris Banks, 1899, Christiansen & Bellinger, 1998, Bretfeld, 2002, from N-America and N-Siberia

syn.: *Sminthurus variegatus* Axelson, 1903, Bretfeld, 2002
Sminthurus facialis Banks, 1903, Christiansen & Bellinger, 1998

Further species belonging to this new genus:

Sminthurus sensibilis Börner, 1909, Yoshii, 1992, Bretfeld, 2002, from Japan

syn.: *Sminthurus arborealis* Itoh, 1985, Bretfeld, 1999, 2002
Sminthurus daisetsuzanus Uchida, 1957, Bretfeld 1999, 2002, from Japan.

Diagnosis

A genus of the family Sminthuridae Börner, 1903, Betsch, 1980 (or monophylum Sminthurida Bretfeld 1986) with the following diagnostic characteristics:

Base of the furca with only normal setae, i. e. neosminthuroid setae missing, and dens with 9–15 anterior setae (= subfamily Sminthurinae Betsch, 1980). Trochanter III with only normal setae. Tip of tibiotarsi with several long spatulate setae, may be also with long clavate ones. Appendices anales strong setalike. Genital papilla in male with short cuticular points.

Derivatio nominis. The new genus is named after the Roman god Janus, who, with his two faces, looks in opposite directions like the three species of this genus, the characteristics of which resemble two different genera.

Justification. The three species united here are real species inter sedis as they show characteristics of both the genera *Sminthurus* Latreille, 1802 sensu Betsch & Betsch-Pinot 1984 and *Spatulosminthurus* Betsch & Betsch-Pinot, 1984.

They resemble *Sminthurus* species because of their setalike appendices anales and the short cuticular points of the genital papilla of their males (in *Spatulosminthurus* the appendices anales are more or less broadened and the genital papilla of their males show normal cuticular granules) and they resemble *Spatulosminthurus* species because of their spatulate or clavate tibiotarsal setae (in *Sminthurus* species these setae are acuminate).

In consequence of this mixture of characteristics, these species had been given different taxonomic postions:

- They were not included into the genus *Spatulosminthurus* by Betsch & Betsch-Pinot (1984) but remained in the genus *Sminthurus*,
- they were included into the genus *Spatulosminthurus* by Bretfeld (1999),
- they were considered as a separate *sylvestris*-group within the genus *Sminthurus* by Bretfeld (2002).

With the suggestion of the new genus *Janusius*, I hope these three species will have an adaequate taxonomic position within the family Sminthuridae and its subfamily Sminthurinae.

5. Part D. New key to the Palaearctic species of *Sminthurus* Latreille, 1802 sensu Betsch & Betsch-Pinot 1984

1 Antennal segment IV with at most 25 subsegments **2**
– Antennal segment IV with 27 – 30 subsegments ..... *variegatus* Tullberg, 1876, sensu Bretfeld 2000
2 Both posterior edges of mucro smooth **3**
– One or both posterior edges of mucro not smooth, but wavy, notched or denticulate **20**
3 Mucronal seta present **4**
– Mucronal seta missing **16**
4 Dorsal side of head and abdomen with dark band ..... *maculatus* Tömösvary, 1883 sensu Stach 1956
= Only abdominal segment VI with 3 dark spots ..... *bozoulensis* Nayrolles, 1995
– Colour with other pattern **5**
5 Body only with small violet spots ..... *rubidipunctatus* Bretfeld, 2000
– Body with other colours and pattern **6**
6 Abdominal segment V with 1+1 setae above bothriotrichia D+D **7**
– Abdominal segment V with 2+2 setae above bothriotrichia D+D **13**
7 Subcoxa III with 1 short, distal seta **8**
– Subcoxa III with 2 (short and long) setae **10**
8 Abdominal segment V with dark cross stripes, postantennal setae short ..... *orientalis* Bretfeld, 2000
– Abdominal segment V with other pigment, postantennal setae long **9**
9 Ventral tube with 1+1 setae, tibiotarsus III row p with 7 setae ..... *viridis* Linnaeus, 1758 sensu Nayrolles 1995
– Ventral tube with 2+2 setae, tibiotarsus III row p with 8 setae ..... *bourgeoisi* Nayrolles, 1995
10 (7) Tibiotarsi inner setae acuminate **11**
– Tibiotarsi inner setae blunt ..... *nigrinus* Bretfeld, 2000
11 Abdominal segment V without cross stripes, postantennal setae long **12**
– Abdominal segment V with dark cross stripes, postantennal setae short ..... *orientalis* Bretfeld, 2000
12 Ventral tube with 1+1 setae, appendices anales short (≤ ½ mucro) ..... *multipunctatus* Schäffer, 1896 sensu Stach 1956, Nayrolles 1995
– Ventral tube with 2+2 setae, appendices anales long (> ½ mucro) ..... *nigromaculatus* Tullberg, 1871 sensu Nayrolles 1995
13 (6) All inner setae of tibiotarsus III long, thick and acuminate **14**
– Some inner setae of tibiotarsus III long, stout, rough and abruptly pointed ..... *pardalinus* Betsch, 1977
14 Ventral tube with 1+1 setae, abdominal segment V with setae A1 ≥ A2 ..... *hispanicus* Nayrolles, 1995
– Ventral tube with 2+2 setae, abdominal segment V with setae A1 < A2 ..... **15**
15 Subcoxa III with 1+1 setae, tibiotarsus III row p with 7 setae ..... *leucomelanus* Nayrolles, 1995

– Subcoxa III with 2+2 setae, tibiotarsus III row p with 8 setae..... ..... *osmeryzskensis* Bretfeld, 2000
16 (3) Pseudonychia of claws < ½ claw or missing..... **17**
– Pseudonychia of claws > ½ claw **19**
17 Antennal segment IV with 17 subsegments..... **18**
– Antennal segment IV with 21 subsegments..... *wahlgreni* Stach, 1920 sensu Stach 1956
18 Claws slender, claw III with weak inner tooth..... *stachi* Betsch, 1977
– Claws broad, claw III with distinct inner tooth..... *wutaii* Uchida, 1948
19 (16) Claws with tunica, subcoxa III with 1+1 setae, ventral tube with 2+2 setae .... *bourgeoisi* Nayrolles, 1995
– Claws without or with small tunica, subcoxa III with 2+2 setae, ventral tube with 1+1 setae..... *multipunctatus* Schäffer, 1896 sensu Stach 1956, Nayrolles 1995
20 (2) Mucronal seta present..... **21**
– Mucronal seta missing **29**
21 Body with small blue spots ..... *coeruleus* Strebel, 1938
– Body with other colours or pattern **22**
22 Abdominal segment V with dark cross stripes..... *orientalis* Bretfeld, 2000
– Abdominal segment V with other pigment **23**
23 Mucro with few notches..... *primorskiyensis* Bretfeld, 2002
– One or both posterior edges of mucro with many teeth..... **24**
24 Mucronal seta as long as mucro..... **25**
– Mucronal seta shorter than mucro..... **26**
25 Ratio of dens : mucro = 3.5, dens with 3,3,3 distal anterior setae, large abdomen with several dark, narrow longitudinal stripes ..... *serrulatus* Börner, 1909 sensu Yosii 1970
– Ratio of dens : mucro = 5, dens with 3,2,2 distal anterior setae, large abdomen brown mottled with black..... *abei* Yoshii, 1992
26 Ratio of dens : mucro ≤ 3..... **27**
– Ratio of dens : mucro > 3..... **28**
27 Pseudonychia of claws short and smooth, sides of large abdomen with 1 pair of large, dark spots ..... *cogsonzavi* Betsch, 1977
– Pseudonychia of claws toothed, large abdomen yellow with violet tints .... *serratomucronatus* Grinbergs, 1962
28 Dens with 3,2,2 distal anterior setae, antennal segment IV with 17 subsegments, large abdomen with 1 pair of violet, longitudinal bands ..... *ghilarovi* Stebaeva, 1966
– Dens with 3,3,3 distal anterior setae, antennal segment IV with 22 subsegments, dark pigment on posterior part of large abdomen ..... *denticulatus* Bretfeld, 2000
29 (20) Claws slender, postantennal setae short and broad, abdominal segment V with setae A1 smooth and > A2 ..... *muscicolus* Betsch, 1977
– Claws broad, postantennal setae short and slender, abdominal segment V with setae A1 rough and < A2..... *montanus* Bretfeld (see this paper, part A)

Remarks. This new key replaces that in the Synopsis on Palaearctic Collembola (Bretfeld 1999) as it also contains the seven new species described since then (Bretfeld 2000, 2002 and this paper) and also *Sminthurus variegatus* Tullberg, 1876 (see Bretfeld 2000). The species *S. bourgeoisi*, *S. multipunctatus* and *S. orientalis* appear in the key twice each as some of their characteristics vary.

Not included in this key are six doubtful species, the data of which are listed in Bretfeld (1999). Also not

included is *Sminthurus melanonotus* Uchida, 1938, which species belongs to another genus (postantennal setae missing, long body setae with tip cut and toothed, dens with 2 knobbed posterior setae).

The *Sminthurus* species with spatulated or clavate tibiotarsal setae are now included in the new genus *Janusius* (see above, part C).

6. Acknowledgement

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