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New blind species of genus *Folsomia* (Collembola: Isotomidae) from Russia

Новые слепые виды рода *Folsomia* (Collembola: Isotomidae) из России

M.B. Potapov
М.Б. Потапов

Moscow Pedagogical State University, Kibalchicha Str. 6 build. 5, Moscow 129164, Russia. E–mail: mpnk@orc.ru
Московский педагогический государственный университет, ул. Кибальчича д. 6 корп. 5, Москва 129164, Россия.

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КЛЮЧЕВЫЕ СЛОВА: Collembola, Isotomidae, *Folsomia*, адаптивная морфология, новые виды.

ABSTRACT. *Folsomia arena, F. baida, F. bashkira, F. torpeda, F. paoinflata*, and *F. stebaevi* **spp.n.** are described from Russia. All new species have no ocelli. *F. baida, F. bashkira*, and *F. torpeda* **spp.n.** are middle and short–furcated members of '*inoculata*' group. Two species, *F. arena* and *F. paoinflata* **spp.n.**, are very specific and serve for erecting of a new species group ('*paoinflata*' gr.) which generally characterised by swollen postantennal organ, mid–tergal position of sensilla on tergites, and lateroventral setae on metathorax. *F. stebaevi* **sp.n.** belongs to '*fimetaria*' gr. and related to *F. sparsosetosa* Potapov & Stebaeva, 1997.

РЕЗЮМЕ. С территории России описываются *Folsomia arena, F. baida, F. bashkira, F. torpeda, F. paoinflata* и *F. stebaevi* **spp.n.**. Все новые виды не имеют глазков. *F. baida, F. bashkira* и *F. torpeda* **spp.n.** относятся к представителям группы '*inoculata*' со средней и короткой фуркой. Два вида, *F. arena* и *F. paoinflata* **spp.n.**, очень своеобразны и для них выделется новая группа видов ('*paoinflata*' gr.), которая в основном характеризуется вздутым постантеннальным органом, расположением сенсилл в середине тергитов и наличием латеровентральных хет на заднегруди. *F. stebaevi* **sp.n.** относится к группе '*fimetaria*' и близка к *F. sparsosetosa* Potapov & Stebaeva, 1997.

Considering the morpho-ecological radiation the genus *Folsomia* shows the first [after Chernova & Potapov, 2002] way of adaptive zone occupation. Among Isotomidae, this genus appears to be the most diverse in terms of adaptive morphology. All life forms of soil profile are presented in the genus, as: surface-dwelling intensively pigmented species, pale litter-dwellers, blind small soil species with pigmentation lost, and all intermediate forms between them. Particular morphological features considerably vary in the genus as well: the length of furca, cuticle granulation, number and length of body setae. During the course of our study of this genus of Russia we found six new blind species. According to Stebaeva [1970] all of them are to be considered within soil (=euedaphic) group of life forms because of ocelli missing. After Stebaeva's system two life forms — lower-soil (for smaller species with shortened furca or furca missing) and upper-soil (for larger species with normal furca) — combine the mentioned group. The following combinations of adaptive features have been seen by us in the frames of only six mentioned species of the genus:

— small body size and short furca. According to Stebaeva it corresponds to lower-soil life form. Only *F.arena* **sp.n.**, psammophilic species.
— small body size and long or middle-sized furca. No appropriate life form is in Stebaeva's system. *F.stebaevi* **sp.n.** and *F.paoinflata* **sp.n.**
— long, cylindrical body and short furca. No appropriate life form. *F. baida* **sp.n.**, *F. torpeda* **sp.n.** Within the family, such an adaptive morphology is known only for *F. tatarica* Martynova, 1964, all species of genera *Isotomodes* Linnaniemi, 1907 and *Pseudofolsomia* Martynova, 1967, and some species of *Pseudanurophorus* Stach, 1922 and *Dagamaea* Yosii, 1965.
— middle body size and middle-sized furca. Corresponds to upper-soil life form of Stebaeva. Only in *F. bashkira* **sp.n.**

System of life forms of Collembola calls probably for further development. In the present paper we give the description of these interesting species only and left explanation of strange combinations mentioned above for future publications.

Folsomia torpeda Potapov et Taskaeva, **sp.n.**

Figs 1, 5, 8–12.

MATERIAL. Holotype, ♀, Russia, south part of Krasnoyarskii Kray, mouth of Niznyaya Tunguska, nearby Turukhansk (64°48′ N 88°00′ E), litter of dry aspen wood, 27.07.2003, leg. A. Babenko. 10 paratypes from the same locality. 3 paratypes, Russia, Respublica Komi, NW of Syktyvkar, near vil. Yelya-Ty, birch-aspen wood, 30.06.2004, leg. A. Taskaeva. Kept in MSPU.

OTHER MATERIAL. Russia, Respublica Komi, North Ural Mts, Pechoro–Ilychskii Reserve, Yany-Pupu-N'yor Range, mountain spruce forest, leg. A. Taskaeva.

DESCRIPTION. Size 1.0–1.2 mm. Body clearly elongated (Fig. 1). No pigment on body. Cuticle slightly reticulated, so orthogonal granulation developed. No ocelli. PAO very long and slender, constricted; 1.6–1.9 as long as *Ant*.I and 2.3–2.8 of inner unguis length (Fig. 9). Maxillary outer lobe with 4 sublobal hairs, maxillary palp bifurcate. Labral formula as 4/5,5,4. Labium with 5 usual papillae (*A–E*), full set of guard setae, 3 proximal and 4 basomedian setae. Ventral side of a head with 4(5)+4(5) postlabial setae. *Ant*.1 with 3 basal microsensilla (*bms*) (2 dorsal and 1 ventral), and 2 ventral sensilla (*s*) (Fig. 9), *Ant*.2 with 3 *bms* and 1 latero–distal *s*, *Ant*.3 with 1 *bms* and 5 distal *s* (including 1 lateral). Sensilla on *Ant*.4 differentiated, moderately thickened.

Sensillar formula as 4,3/2,2,2,3,5 (*s*), 1,0/1,0,0 (*ms*) (Fig. 1). Medial sensilla on all tergites situated in mid–tergal position. Tergal sensilla vary in length depending on location: *Th*.II with 2 short and 2 long, *Th*.III with 2 short and 1 long, *Abd*.I and II each with 1 short and 1 long, *Abd*.III with 2 short, *Abd*.IV with 2 short and 1 middle–sized, *Abd*.V with 1 short and 4 equally long of which the most laterally positioned sensilla insignificantly thicker than others (Figs 1, 5). Long sensilla hardly differ from common setae. Macrosetae smooth and well differentiated, 2,2/3,3,3 in number, medial ones on *Abd*.V 2.2–2.8 as long as mucro and 1.1–1.3 times shorter than dens. *Th*.III with 2+2 ventral axial setae (more rarely with 1+2 or 2+3).

Unguis slightly curved, without inner and lateral teeth. Empodial appendage rather short, from 1.6 to 2.3 times shorter than unguis. Tibiotarsi 1–3 with full set of basic setae and some additional setae. Tibiotarsal tenent setae pointed. Spurs (*x* and B_5) on *Ti*.3 slightly longer and thinner than other setae. Some distal setae thickened (Fig. 12). Ventral tube with 4+4 laterod istal and 4 posterior setae. Tenaculum with 4+4 teeth and a setae. Anterior furcal subcoxae with 5–7, posterior one with 3 setae. Anterior side of manubrium with two or one pairs of distal setae (2+2 or 1+1, asymmetry often occurs, as 1+2) (Fig. 11), its posterior side with 3+3 laterobasal, 3+3 or 4+4 central, 2+2 distal, and 2 apical setae, and additionally with 1+1 setae on lateral edges (Fig. 10). Dens with 8 anterior setae. Posterior side of dens crenulated at the middle and with 3 setae (2 basal and 1 subapical) (Figs 8, 10–11). Mucro bidentate. Ratio manubrium : dens : mucro as 3.2–3.5 : 2.9–3.2 : 1.

TAXONOMIC REMARKS. Belongs to '*inoculata*' group sensu Potapov, 2001. From all species of the group *F. torpeda* **sp.n.** differs in mid–tergal position of sensilla on abdominal segments (see also the remarks to *F. baida* **sp.n.**).

DISTRIBUTION. Known from three localities (NE European part, N Ural, N West Siberia).

ETYMOLOGY. The species named after its body shape.

Folsomia baida Potapov **sp.n.**
Figs 2, 6, 13–15.

MATERIAL. Holotype, ♀, Russia, Sverdlovskaya area, flow of Serga River between Nizniye Sergi and Mikhailovsk, litter of larch forest, 05.07.2002, leg. M. Potapov. 1 paratype from the same place. 5 paratypes from the same locality, but in moist moss and litter on steep northern slope of rocks.

Material of *F. tatarica*: 4 paratypes, "Tatarskaya ASSR, Kuibyshevskii district, field, 15.IX.1957, Aleynikova". Tatarstan, lime-forest, leg. Orlov. Mordovia, leg. D. Simonov, Penza area, leg. Yu. Shveenkova.

DESCRIPTION. Size 1.0–1.2 mm, males and females of similar size. Body elongated (Fig. 2). No pigment on body. Cuticle as in *F. torpeda* **sp.n.**. No ocelli. PAO very long and slender, slightly constricted; 1.5–1.8 as long as Ant.I and 1.9–2.2 of inner unguis length (Fig. 13). Maxillary outer lobe with 4 sublobal hairs, maxillary palp bifurcate. Labral formula as 4/5,5,4. Labium with 5 usual papillae (*A–E*), full set of guard setae, 3 proximal and 4 basomedian setae. Ventral side of a head with 4+4 postlabial setae. *Ant*.1 with 3 basal microsensilla (*bms*) (2 dorsal and 1 ventral), and 2 ventral sensilla (*s*), *Ant*.2 with 3 *bms* and 1 latero–distal *s*, *Ant*.3 with 1 *bms* and 5 distal *s* (including 1 lateral). Sensilla on *Ant*.4 differentiated, moderately thickened, organit small, stick–like.

Sensillar formula as 4,3/2,2,2,3,5 (*s*), 1,0/1,0,0 (*ms*) (Fig. 2). Medial sensilla on all tergites situated in p–row of setae. Medial sensilla of *Abd*.III moved slightly from p–row on one or both sides in some specimens. Tergal sensilla vary in length depending on location: *Th*.II with 2 short and 2 long, *Th*.III with 2 short and 1 long, *Abd*.I and II each with 1 short and 1 long, *Abd*.III with 2 short, *Abd*.IV with 1 short and 2 long, *Abd*.V with 1 lateroventral short and 4 equally long of which the most laterally positioned sensilla a little thicker than others (Figs 2, 6). Long sensilla hardly differ from common setae. Macrosetae smooth and well differentiated, 2,2/3,3,3 in number, medial ones on *Abd*.V 2.2–2.7 as long as mucro and shorter than dens (ratio 1.1–1.4). Thorax with 2+2 ventral axial setae (more rarely with 1+2 or 2+3).

Unguis slightly curved, without inner and lateral teeth. Empodial appendage rather short, varies in length, from 2.1 to 3.0 times shorter than unguis. Tibiotarsi 1–3 with some additional setae, i.e. few more than 21–21–22 setae respectively. Tibiotarsal tenent setae pointed. Spurs (*x* and B_5) on *Ti*.3 in both sexes longer and thinner than other setae (Fig. 14). Some distal setae thickened. Ventral tube with 4+4 laterodistal and 5(6) posterior setae grouped as 4 in transversal row and a one more basally. Tenaculum with 4+4 teeth and 1 setae. Anterior furcal subcoxae with 6–7 (rarely 5 or 8), posterior one with 4 setae. Anterior side of manubrium with two pairs of distal setae (2+2) (Fig. 15), rarely one seta absent, its posterior side with 3+3 laterobasal, 5+5 central, 2+2 distal, and 2 or 1 apical setae, and with 1+1 setae on lateral edges. Dens with 9–10 anterior setae, arranged as 1,1,2,2,3 or 1,1,1,2,3,2. Posterior side of dens crenulated at the middle and with 3 setae (2 basal and 1 subapical) (Fig. 15). Mucro bidentate. Ratio of manubrium : dens : mucro = 2.7–3.2 : 2.9–3.2 : 1.

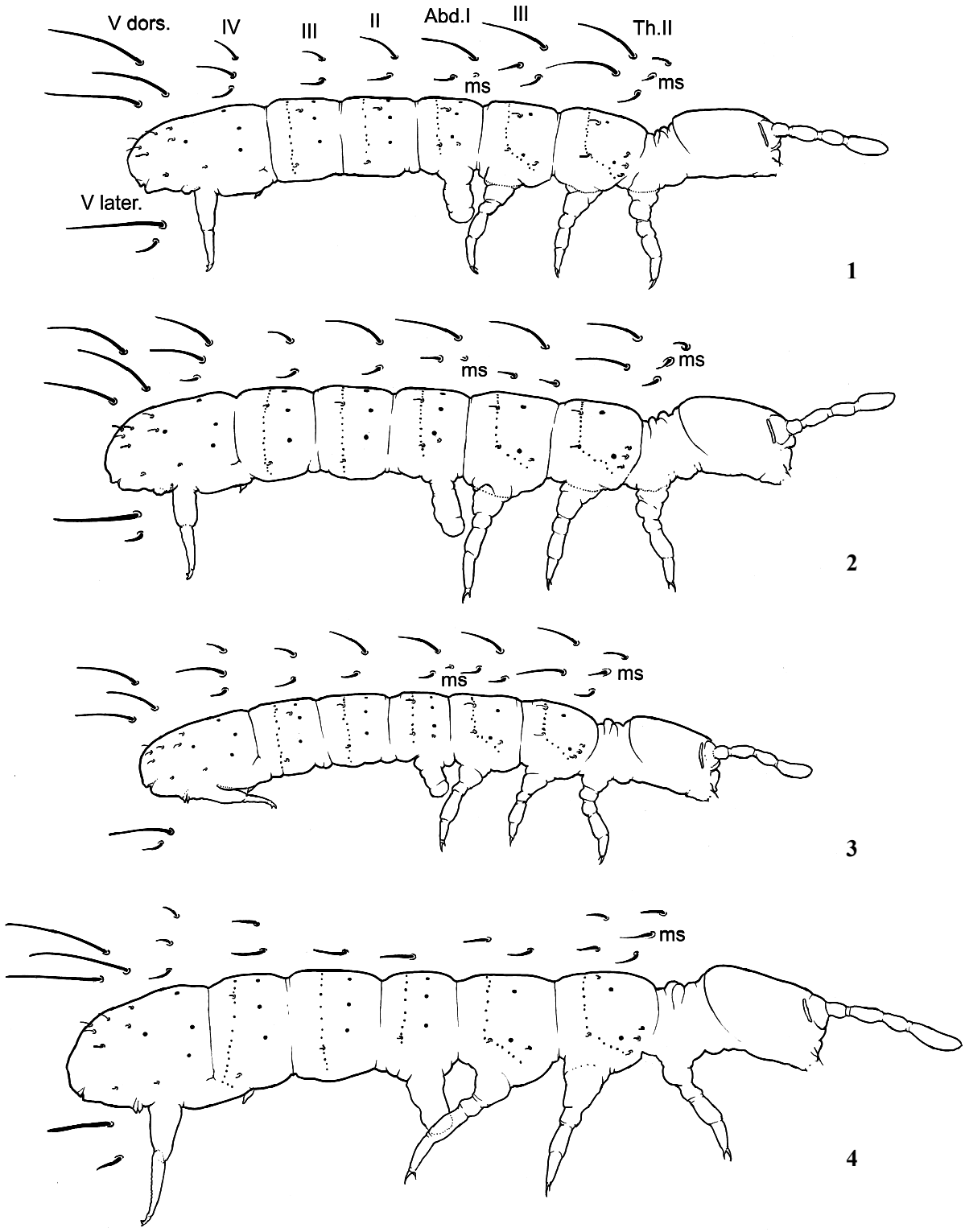
TAXONOMIC REMARKS. Three species, *F. tatarica, F. torpeda* **sp.n.** and *F. baida* **sp.n.**, belong to '*inoculata*' group and combine natural subgroup of short–furcated elongated species, distributed only in areas closed to Ural Mts. These species well differ from each other in position and differentiation of sensilla on body (Figs 1–3). *F. baida* **sp.n.** is characterised by medial sensilla situated in p–row on *Th*.II–*Abd*.III and the length of the most medially positioned sensilla on *Abd*.IV (see Figs 1–3, 5–6 for comparision). Besides, it differs from mentioned species by few more setae on appendages: ventral tube with 5–6 posterior setae (vs.4), dens with 9–10 anterior setae (vs. 8 in *F. torpeda* **sp.n.** and 6 in *F. tatarica*), posterior side of manubrium with 5+5 setae on central area (versus 3–4+3–4 in *F. torpeda and* 3+3 in *F. tatarica*). After more scrutinised study *F. tatarica* appears to have normal formula of body sensilla (4,3/2,2,2,3), in earlier publication the formula 4,3/2,2,2,2 was wrongly indicated by us [Potapov, 2001].

DISTRIBUTION. Known only from type locality.

ETYMOLOGY. As the samples with new species were transported on a kayak by the river it was named after the "baida", short–cut Russian name of kayak.

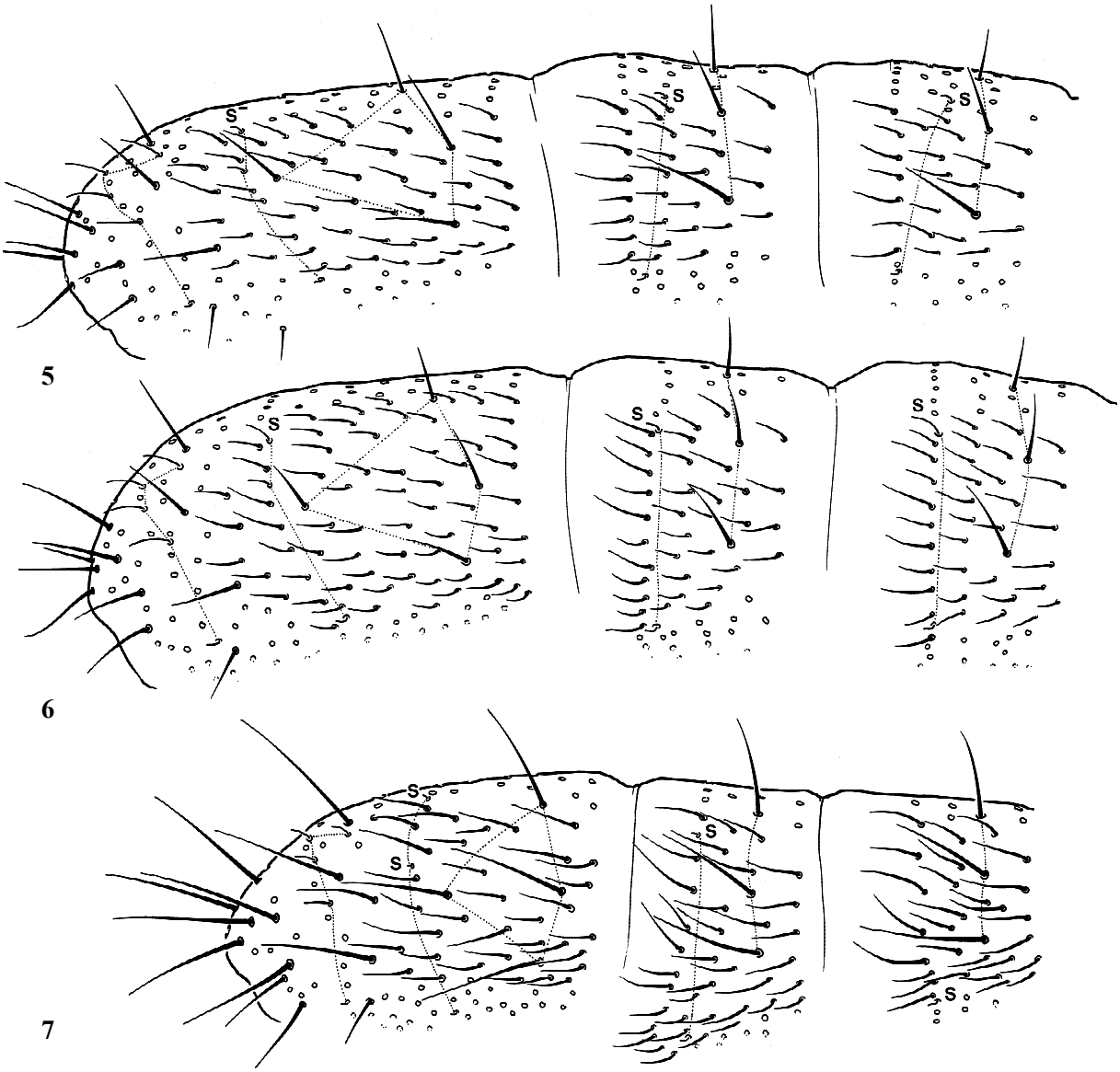
ABBREVIATIONS: PAO — postantennal organ; *Ant*.1–4 — antennal segments; *Th*.II–III — thoracic segments II and III; *Abd*.I–VI — abdominal segments I–VI; *s* — sensillum; *ms* — microsensillum; *bms* — basal microsensillum on antennal segments; Leg 1,2,3 — first, second and third pairs of legs.

MSPU — Moscow State Pedagogical University; ZISP — Zoological Institute in St.–Petersburg.



Figs 1–4. Habitus and chaetotaxy in *Folsomia* spp.: 1 — *F. torpeda* **sp.n.**; 2 — *F. baida* **sp.n.**; 3 — *F. tatarica*; 4 — *F. bashkira* **sp.n.**; large dots — macrosetae; small dots — setae of *p*–row; *ms* — microsensillum.

Рис. 1–4. Габитусы и хетотаксия *Folsomia* spp.: 1 — *F. torpeda* **sp.n.**; 2 — *F. baida* **sp.n.**; 3 — *F. tatarica*; 4 — *F. bashkira* **sp.n.**; крупные точки — макрохеты; мелкие точки — хеты *p*–ряда; *ms* — микросенсиллы.



Figs 5–7. Chaetotaxy of *Abd*.II–VI in *Folsomia* spp.: 5 — *F. torpeda* **sp.n.**; 6 — *F. baida* **sp.n.**; 7 — *F. bashkira* **sp.n.**; sensilla of more taxonomical importance are marked by *s*.

Рис. 5–7. Хетотаксия *Abd*.II–VI *Folsomia* spp.: 5 — *F. torpeda* **sp.n.**; 6 — *F. baida* **sp.n.**; 7 — *F. bashkira* **sp.n.**; сенсиллы, важные для таксономии, отмечены буквой *s*.

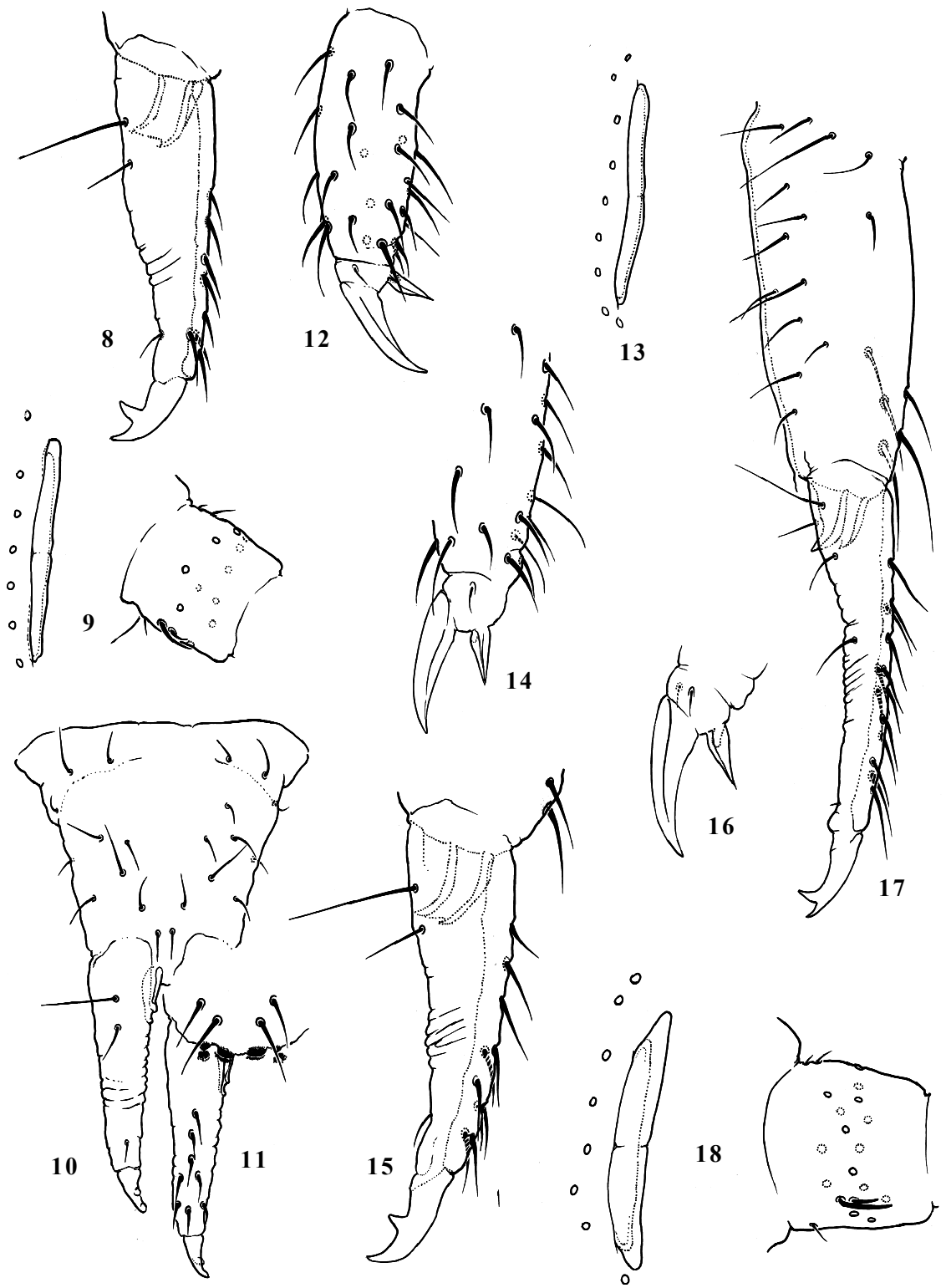
Folsomia bashkira Potapov et Kuznetsova **sp.n.**
Figs 4, 7, 16–18.

MATERIAL. Holotype, ♀, Russia, Respublica Bashkiria, Ural Mts, nearby Beloretck, Arvyakryaz' Mountain, pine forest with moss and bilberries, about 800 m alt., 06.07.1986. leg. N. Kuznetsova. 4 paratypes from the same locality.

DESCRIPTION. Size 1.2–1.3 mm. Body of shape normal for the genus (Fig. 4). No pigment on body. Cuticle looks smooth, but thin orthogonal granulation is possible to observe under high magnification. In addition, larger preliminary granules scattered among normal ones all over the surface. No ocelli. PAO long, constricted; about one and a half as long as *Ant*.I and 1.7–2.0 as long as inner unguis length (Fig. 18). Maxillary outer lobe with 4 sublobal hairs, maxillary palp bifurcate. Labral formula as 4/5,5,4. Labium with 5 usual papillae (*A–E*), full set of guard setae, 3 proximal and 4 basomedian setae. Ventral side of a head with 4+4 postlabial setae. *Ant*.1 with 3 basal microsensilla (*bms*) (2 dorsal and 1 ventral), and 2 ventral sensilla (*s*) (Fig. 18), *Ant*.2 with 3 *bms* and 1 latero–distal *s*, *Ant*.3 with 1 *bms* and 6 distal *s* in both sexes (including 2 lateral). Juvenile specimens with only 1 lateral *s* on Ant.3. Sensilla on *Ant*.4 differentiated, moderately thickened.

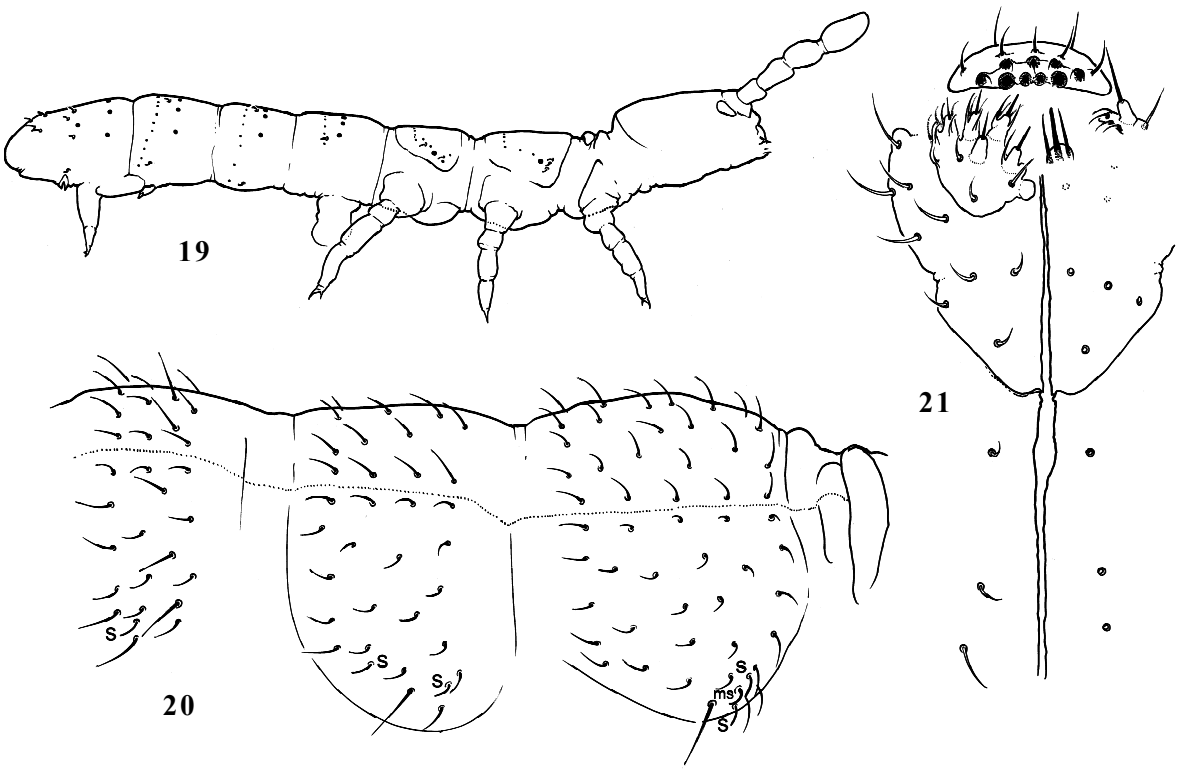
Sensillar formula as 4,2/1,1,2,3,5 (*s*), 1,0/0,0,0 (*ms*) (Fig. 4). Medial sensilla on *Th*.II well in front of p–row of setae, on *Abd*.III within p–row. Sensilla very short on most tergites, on *Abd*.V long (Figs 4, 7). The species lost medial sensilla on *Th*.III, *Abd*.I and *Abd*.II. Macrosetae smooth and long, 2,2/3,3,3 in number, medial ones on *Abd*.VI 3.3–3.6 as long as mucro and insignificantly shorter than dens (ratio 1.0–1.2). Thorax with 3+3 ventral axial setae (subadults with 2+2).

Unguis slightly curved, without inner and lateral teeth. Empodial appendage from 1.8 to 2.0 times shorter than unguis (Fig. 16). Tibiotarsi 1–3 with full set of basic setae. Tibiotarsal tenent



Figs 8–18. Morphology of new species of '*inoculata*' group: 8–12 — *F. torpeda* **sp.n.**; 13–15 — *F. baida* **sp.n.**; 16–18 — *F. bashkira* **sp.n.**; 8, 15 — dens and mucro laterally; 9, 18 — PAO and *Ant.*I; 10–11, 17 — furca (10 — posteriorly; 11 —anteriorly; 17 — laterally); 12, 14, 16 — distal part of Leg III; 133 — PAO.

Рис. 8–18. Морфология новых видов группы '*inoculata*': 8–12 — *F. torpeda* **sp.n.**; 13–15 — *F. baida* **sp.n.**; 16–18 — *F. bashkira* **sp.n.**; 8, 15 — денс и мукро латерально; 9, 18 — ПАО и первый членик антенн; 10–11, 17 — фурка (10 — сзади; 11 — спереди; 17 — сбоку); 12, 14, 16 — дистальная часть 3–ей пары ног; 13 — PAO.



Figs 19–21. *F. arena* **sp.n.**: 19 — habitus and chaetotaxy; 20 — chaetotaxy of *Th*.I–*Abd*.I; 21 — outer mouth parts, ventral view (on right side, hypostomal setae and maxillary outer lobe shown, distal half of labial palp not shown); *ms* — microsensillum, *s* — sensillum.

Рис. 19–21. *F. arena* **sp.n.**: 19 — габитус и хетотаксия; 20 — хетотаксия *Th*.I–*Abd*.I; 21 — наружные ротовые органы с вентральной стороны (справа гипостомальные хеты и наружная доля максиллы показаны, дистальная часть лабиальной пальпы не показана); *ms* — микросенсилла, *s* — сенсилла.

setae pointed. Shape of male spurs on *Ti*.3 unknown (only subadult males were found). Ventral tube with 4+4 laterodistal and 7 posterior setae. Tenaculum with 4+4 teeth and 1 setae. Anterior furcal subcoxae with 9–11, posterior one with 4 setae. Anterior side of manubrium with 2+2 (subadult specimens), in adults with one additional weaker seta on one side (2+3) (Fig. 17). Posterior side of manubrium with 4+4 laterobasal, 5+5–6+6 central, 2+2 distal, and 2 or 1 apical setae, and with 1+1 setae on lateral edges. Dens with 13–15 anterior setae, posterior side of dens crenulated and with 5 setae (3 in basal part, 1 at the middle, and 1 tiny subapical) (Fig. 17). Sometimes subapical seta hardly visible. Mucro bidentate. Ratio of manubrium : dens : mucro = 3.6–4.9 : 3.3–4.2 : 1.

TAXONOMIC REMARKS. Belongs to *'inoculata'* group. From all species of the group *F. bashkira* **sp.n.** differs in loosing of medial sensilla on three segments at the middle part of body, so Th.III, Abd.I and II bear 2,1,1 sensilla on one side (vs. 3,2,2). The new species is closely related to *Folsomia brevisensilla* Potapov & Babenko, 2000 (NE Asia). Apart from sensillar set it differs in posterior chaetotaxy of dens and anterior chaetotaxy of manubrium.

DISTRIBUTION. Known only from type locality.

ETYMOLOGY. The species was named after the Bashkir, the main nationality of the Bashkir Republic.

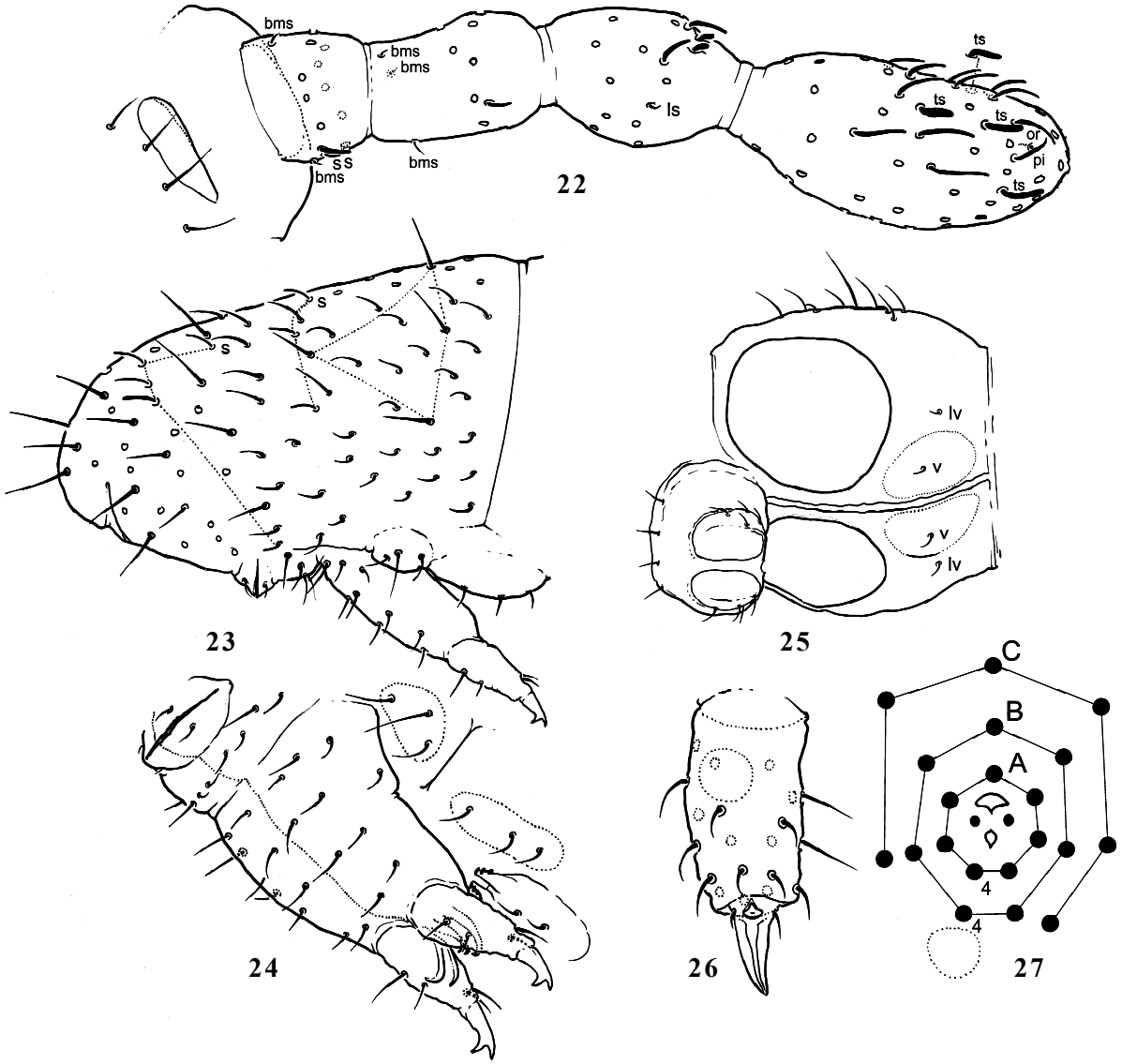
Folsomia arena Potapov et Babenko, **sp.n.**
Figs 19–27.

Material: Holotype, ♀, Russia, Krasnoyarsky Kray, nearby Turukhansk, mouth of Niznyaya Tunguska, (65°48′ N, 88°00′ E), floodland, in sand on river bank. 02.VIII.2003. leg. A. Babenko. 6 paratypes from the same locality. 5 paratypes from Krasnoyarsky Kray, NW Taimyr, Ragozinka River, sandy river bed, flotation of plant roots, 11.VII.1990. leg. A. Fjellberg. Kept in MSPU (holotypes and 8 paratypes) and ZISP (3 paratypes).

OTHER MATERIAL. NW Taimyr, Ragozinka River, wet drift debris on clay river bank, 11.VII.1990. leg. A.F jellberg.

DESCRIPTION. Size 0.4–0.6 mm. Habitus as on Fig. 19. No pigment on body. Cuticle loooks smooth, with preliminary granulation only all over the surface. No ocelli. PAO droadly elliptical; swollen in upper part, its length about as *Ant*.I width and 1.7–2.3 times longer than inner unguis length (Fig. 22). Maxillary outer lobe with 4 sublobal hairs, maxillary palp simple. Labral formula as 2/5,5,4, two lateral setae of distal row thicker (Fig. 21). Labium with 5 usual papillae (*A–E*), and full set of guard setae, 3 proximal and 4 basomedian setae. Ventral side of a head with 3+3 postlabial setae (Fig. 21). *Ant*.1 with 2 basal microsensilla (*bms*) (1 dorsal and 1 ventral), and 2 ventral sensilla (*s*), *Ant*.2 with 3 *bms* and 1 latero–distal *s*, *Ant*.3 without *bms* and with 5 distal *s* (including 1 lateral). Sensilla on *Ant*.4 differentiated, four of which moderately thickened. Organit small, pin–seta large, equal to sensilla (Fig. 22).

Sensilla slightly thicker than common setae and well marked. Sensillar formula as 2,2/1,2,2,3,5 (*s*), 1,0/0,0,0 (*ms*) (Figs 19–20). The species lost two pairs of sensilla on *Th*.II and a pair on each *Th*.III and *Abd*.I. Medial sensilla on *Abd*.II–III well in front of p–row of setae. On *Abd*.IV lateral sensilla in nearly the same distance as that between two medial sensilla. On *Abd*.V lateral sensilla slightly thickened (Fig. 23). Macrosetae smooth and short, 1,1/3,3,3 in number, medial ones on *Abd*.VI 2.2–3.0 as long as mucro and longer than dens (ratio dens : macrosetae as 0.6–0.9). Foil setae not differentiated. *Th*.III with a pair (1+1) of

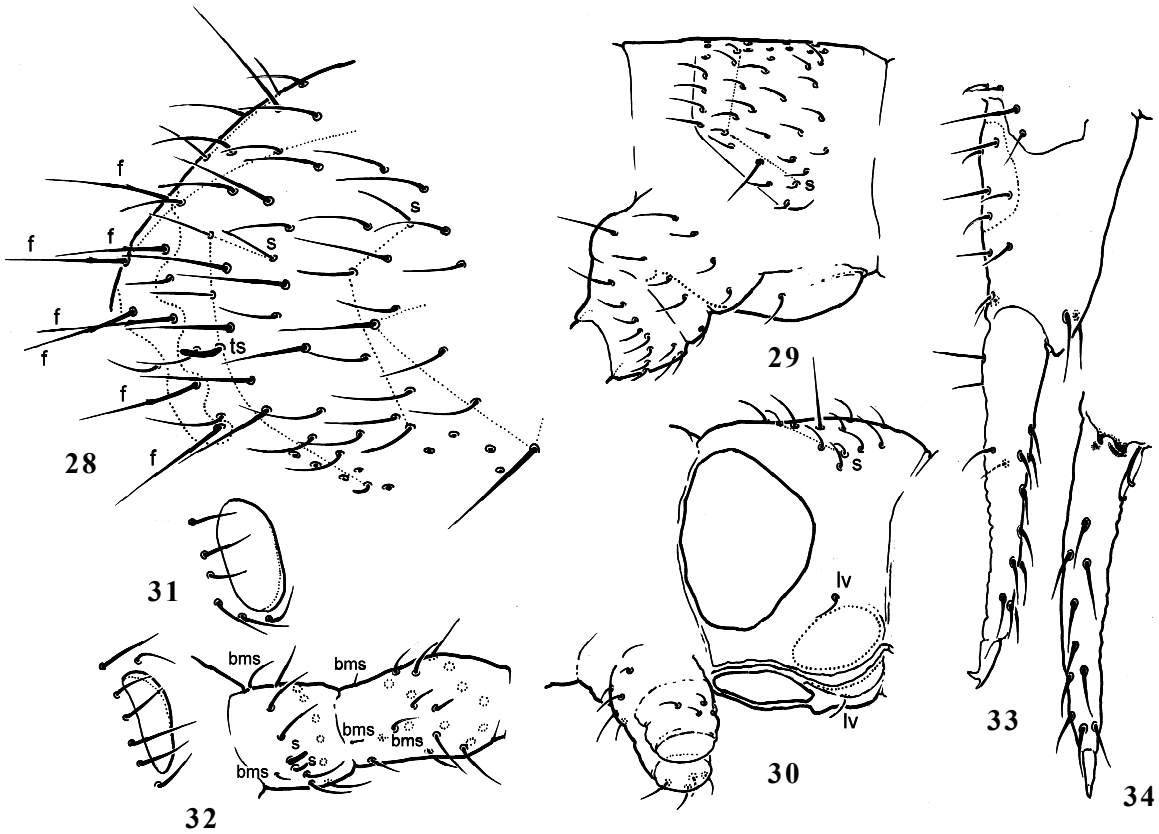


Figs 22–27. *F. arena* **sp.n.**: 22 — PAO and antenna; 23 — posterior part of abdomen; 24 — furcal area (furcal subcoxae encircled); 25 — *Abd.*III and ventral tube; 26 — tibiotarsus of Leg 2; 27 — scheme of tibiotarsus of Leg 2; *A, B, C* — bundles of setae; *bms* — basal microsensillum; *ls* — lateral sensillum; *lv* — lateroventral seta; *or* — organit; *pi* — pin seta; *s* — sensillum; *ts* — thickened sensillum; *v* — ventral seta. On Fig. 26 and 27 area of seta C_4 encircled by dotted line.

Рис. 22–27. *F. arena* **sp.n.**: 22 — ПАО и антенна; 23 — задняя часть брюшка; 24 — фуркальная область (фуркальные субкоксы обведены); 25 — *Abd.*III и вентральная трубка; 26 — тибиотарзус 2–ой пары ног; 27 — схема тибиотарзуса 2–ой пары ног; *A, B, C* — ряды хет; *bms* — базальная микросенсилла; *ls* — латеральная сенсилла; *lv* — латеровентральна хета;, *or* — органит; *pi* — pin–хета; *s* — сенсилла, *ts* — утолщённая сенсилла; *v* — вентральная хета. На Рис. 26 и 27 область расположения хеты C_4 обведена точечной линией.

ventral axial setae (notated as *v*) and a pair more laterally (notated as *lv*) (Fig. 25). Unguis without inner and lateral teeth. Empodial appendage 1.8–2.3 times shorter than inner margin of unguis. Tibiotarsi 1, 2, 3 with 20, 20, 22 setae, respectively. Tibiotarsi 1 and 2 lost setae C_4 (Figs 26, 27), tibiotarsi 3 with full set of setae. Tibiotarsal tenent setae pointed. Male spurs (*x* and B_5) on Leg 3 slightly modified, a little longer than other setae and curved at apex. Ventral tube with 4+4 laterodistal and 4 posterior setae arranged in transversal row (Fig. 25). Tenaculum with 3+3 teeth and 2 (more rarely 3) setae. Anterior furcal subcoxae with 3–4, posterior one with 3 setae. Anterior side of manubrium without setae, its posterior side with 10+10 setae (from which 4+4 in laterobasal area), no lateral setae in main part. Number of anterior setae on dens varies from 2+2 to 1+1 (variants with 2+1 often occur), posterior side of dens not crenulated and with 2 setae (Fig. 24). Mucro bidentate. Ratio of manubrium : dens : mucro = 3.0–4.7 : 1.4–2.1 : 1.

TAXONOMIC REMARKS. *F. arena* **sp.n.** shows many exceptional characters, as: prelabral group lost two setae, maxillary palp simple (versus bifurcate), three postlabial setae (versus four or more), one (versus two) dorsal basal microsensillum on *Ant.*1, *Th.*II, III and *Abd.*I lost 2, 1, and 1 sensilla, respectively, no microsensilla on *Abd.*I, reduced chaetom of tibiotarsi 1 and 2, many setae of furca lost (anterior setae on manubrium lost are especially remarkable). Other differentiated features are: two lateral setae of labrum thickened, the most lateral sensilla positioned dorsally (versus venrally) on *Abd.*IV, increased number of setae on tenaculum, unusual position of



Figs. 28–34. *F. paoinflata* **sp.n.**: 28 — posterior part of abdomen, foil–setae, macrosetae and sensilla marked; 29 —*Abd.*III and basal parts of legs, lateral view; 30 — *Abd.*III and ventral tube, lateroventral view, Leg 3 not shown; 31 — PAO; 32 — PAO and basal part of antenna; 33 — furca, lateral view; 34 — dens, anterior view; *bms* — basal microsensillum; *f* — foil–seta; *lv* — lateroventral seta; *s* — sensillum; *ts* — thickened sensillum.

Рис. 28–34. *F. paoinflata* **sp.n.**: 28 — задняя часть брюшка, хеты–шпаги и сенсиллы помечены; 29 — *Abd.*III и базальные части ног, сбоку; 30 — *Abd.*III и вентральная трубка, сбоку и снизу, 3–я пара ног не показана; 31 — ПАО; 32 — ПАО и базальная часть антенны; 33 — фурка, сбоку; 34 — денс, спереди; *bms* — базальная микросенсилла, *f* — хета–шпага, *lv* — латеровентральная хета, *s* — сенсилла, *ts* — утолщённая сенсилла.

ventral setae on *Th.*III. Small body size and the most morphological features mentioned above indicate inhabiting narrow soil passages, among the grains of sand in the present case.

DISTRIBUTION. Known only from two localities.

ETYMOLOGY. The species is mostly recorded in sandy places.

Folsomia paoinflata Potapov et Stebaeva, **sp.n.**
Figs 27–34.

Material: Holotype, ♀, Kazakhstan, Alma–Ata area, ca 35 km SE Issyk, Chin–Turgenskoye Canion, (43 12 N, 77 45 E), 2100 m alt., meadow. 21.VIII.1991. leg. M. Potapov. 10 paratypes from the same locality. Kept in MSPU (holotypes and 7 paratypes) and ZISP (2 paratypes).

OTHER MATERIAL. Russia, Samara area, Bol'shechernigovka district, near Fitali, steppe meadow with *Phragmites* in lower part of slope of Kirilov Dol gully, (52°03′ N, 51°20′ E), leg. I.Smelyanskii. Russia, West Siberia, south–western part of Novosibirsk area (subzone of meadow steppes with kolkis), 17 km W of Karasuk, katena of north bank of Krotovaya Lyaga lake, steppe meadow on second terrasse, about 400 m alt., leg. S. Stebaeva. Russia, Bashkiria, Ishimbai district, Ischeevskaya–1 Cave, leg. V. Kniss.

DESCRIPTION. Size 0.4–0.5 mm. No pigment on body. Cuticle loooks smooth, with preliminary granulation only all over the surface. No ocelli. PAO droadly elliptical; swollen in upper part, its length about as *Ant.*I width about twice longer than inner unguis length (Figs 31–32), with 5–6 setae along posterior edge. Maxillary outer lobe with 4 sublobal hairs, maxillary palp simple. Labral formula as 2/5,5,4, two lateral setae of distal row thicker. Labium with 5 usual papillae (*A–E*), and full set of guard setae, 3 proximal and 4 basomedian setae. Ventral side of a head with 4+4 postlabial setae. *Ant.*1 with 2 broaden ventral sensilla (*s*) and 2 basal microsensilla (*bms*) (small ventral and large seta–like dorsal). *Ant.*2 with 3 *bms* and 1 latero–distal *s*, one of the common setae set closed to outer *bms* (so, it can be fourth *bms*) (Fig. 32). *Ant.*3 without *bms* and with 5 distal *s* (including 1 lateral). Sensilla on *Ant.*4 differentiated, four of which moderately thickened (similar as on Fig. 22). Organit small, pin–seta of normal size.

Axial setae on *Th.*III–*Abd.*III as 4/3,3,3. *Th.*III with about 14 *p*–setae. Sensilla equal to or slightly shorter than common setae, hardly marked. Sensillar formula as 4,3/2,2,2,3,5 (*s*), 1,0/0,0,0 (*ms*). Medial sensilla on *Th.*II–*Abd.*–III well in front of p–row of setae. On *Abd.* II lateral sensilla set ventrally. On *Abd.* IV lateral sensilla in normal position. On *Abd.*V lateral sensilla considerably thickened, well marked, latero–ventral one short and thickened (Fig. 28). Macrosetae smooth and short, 1,1/3,3,3 in number, medial ones on *Abd.*VI 2.2–2.9 as long as mucro and much shorter than dens (ratio dens : macrosetae about as 1.7). Foil setae well differentiated, 9 in

number, 6 in anterior and 3 in posterior row, sometimes an additional pair of foil setae can be distinguished latero–ventrally (all marked as *f* on Fig. 28). *Th*.III with a pair of latero–ventral setae (notated as *lv*) and without ventral axial ones (Figs 29–30). Unguis without teeth. Empodial appendage about half as long as inner margin of unguis. Tibiotarsi with full set of setae, i.e. basal 21–21–22 setae and few additional ones present. Upper and lower subcoxa of Leg 1 and 2 with 1, 5 and 4, 5–6 setae, respectively. Tibiotarsal tenent setae pointed. Male spurs on Leg 3 unmodified. Ventral tube with 4+4 laterodistal and usually 5 posterior setae (Fig. 30). Tenaculum with 4+4 teeth and a seta. Anterior furcal subcoxae with 7–9, posterior one with 6 setae. Anterior side of manubrium without a pair of setae, its posterior side with 4+4 laterobasal, 5+5 central, 2+2 distal and 1+1 apical setae, no lateral setae in main part (Fig. 33). Dens with 10 (more rarely with 9) anterior setae, posterior side of dens crenulated and with 2 setae in basal part and 2 at the middle, no subapical seta (Figs 33–34). Mucro bidentate. Ratio of manubrium : dens : mucro = 3.6–4.9 : 4.3–5.8 : 1.

TAXONOMIC REMARKS. *F. paoinflata* **sp.n.** share many exceptional characters with *F.arena* (see the taxonomical remarks to the latter) and differs in number of chaetotaxy of ventrum of *Abd*.III, postlabial setae, sensilla on tergites, chaetom of tibiotarsi, chaetotaxy of furca, position of lateral sensilla on *Abd*.IV, increased number of setae on tenaculum, unusual position of ventral setae on *Th*.III, foil–setae, and other features.

Two species, *F. arena* and *F. paoinflata* **spp.n.**, are very specific and serve for erecting of a new species group, the '*paoinflata*' group. In these species medial sensilla are located at the middle of tergites and between *Mac*1 and *Mac*2 on *Abd*.I–III, corner sensilla of *Th*.III present. Such a sensillar chaetotaxy is rather common for the genus and shared with '*quadrioculata*', '*alpina*', '*spinosa*', and '*heterocellata*' groups. Foil–setae (in *F. paoinflata* **sp.n.**) and broad postantennal organ (in both species) indicate the similarity with '*fimetaria*' and '*sensibilis*' groups only. Simple maxillary palp was found only in all species of '*heterocellata*' group and two species of '*sensibilis*' group. To our opinion, the most important differentiated character of '*paoinflata*' group is appearance of ventro–lateral setae on metathorax which are not homologous to common ventral setae and, so can be considered as apomorphic for the new group.

DISTRIBUTION. Probably widely distributed along the steppe zone in eastern part of European part of Russia, Western Siberia, and Kazakhstan.

ETYMOLOGY. Due to swollen postantennal organ.

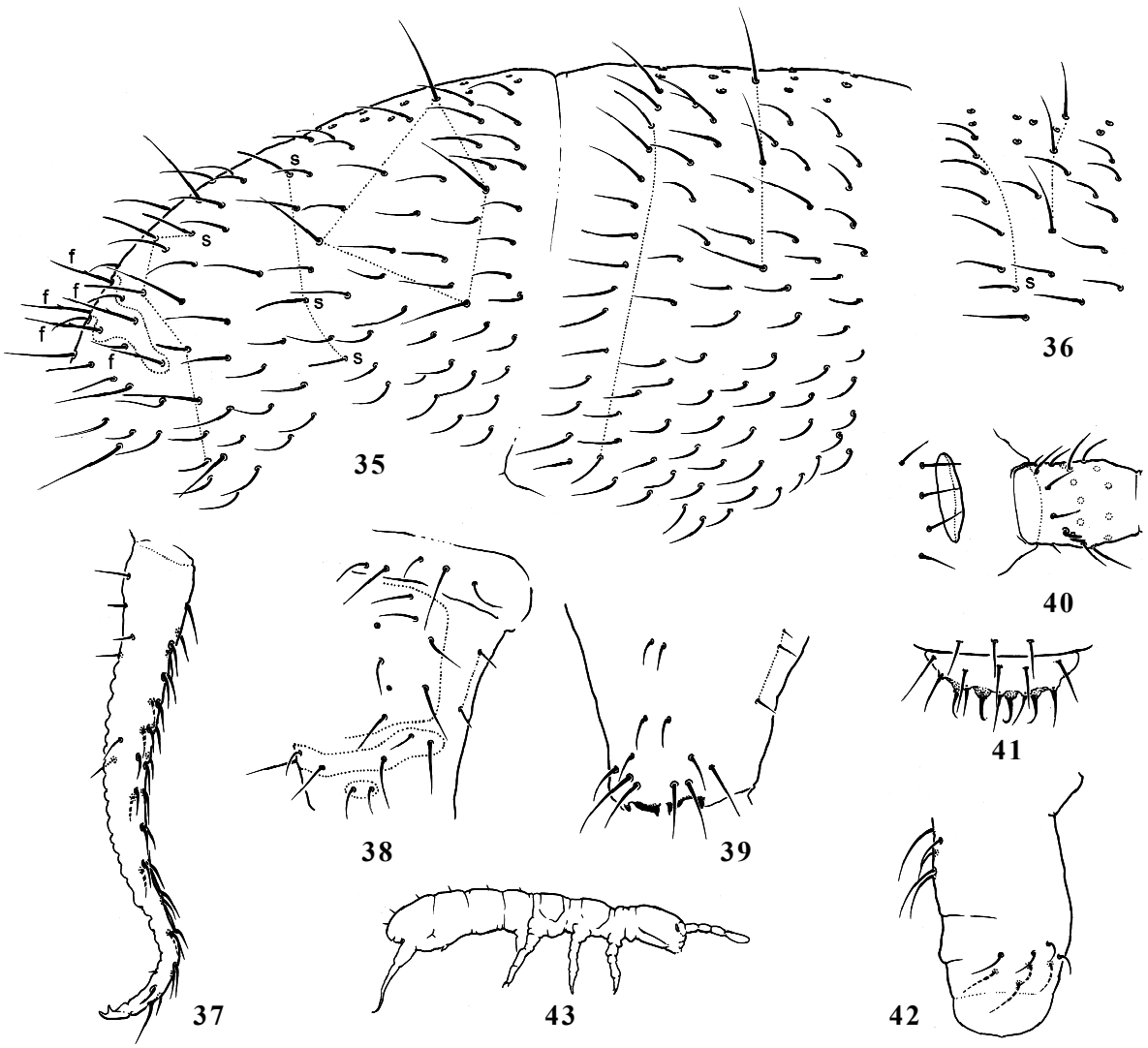
Folsomia stebaevi Potapov et Stebaeva, **sp.n.**
Figs 35–43.

MATERIAL. Holotype, ♀. Russia, Respublica Tuva, Southern macroslope of Eastern Tannu−Ola Mountain Range, left bank of Shevelig−Khem river, dry mountain larch forest with *Larix sibirica* on nothern slope, about 1500 m alt. Litter and moss. 14.07.1978. leg. S. Stebaeva. 20 paratypes from the same locality. Kept in MSPU (holotypes and 15 paratypes) and ZISP (5 paratypes).

OTHER MATERIAL. Russia, Respublica Tuva, Sangelen Plateau, about 30 km to N from Erzyn, right bank of Erzyn river, stone slope of second above flood terrace, under petrophytic vegetation, about 1100−1200 m alt. Ibidem, southern macroslope of Eastern Tannu−Ola Mountain Range, left bank of Shevelig−Khem river, dry mountain larch forest with *Larix sibirica* on nothern slope, about 1500 m alt. Ibidem, Tuvinskaya Basin, Chagytai Lake, mountain steppe. Russia, south part of Krasnoyarskii Kray, Kurtushibinskii Mountain Range, 15 km from vil. Shivelig, mountain petrophytic steppe with *Caragana* and *Spiraea*, about 1400 m alt. Russia, Respublica Khakasia, about Uchum lake, middle part of southern kuesta slope, herb−grass steppe in local lowland, about 500 m alt. All samples from Tuva and Krasnoyarskii Kray collected by S. Stebaeva. Respublica Khakasia, Tashtypskii district, Manysh Range, nearby Bol'shoi On, meadow with *Calamagrostis*. leg. S. Jordanskii. Central Altai, Sal'dzar Range, between Verkhnyaya Karasu River and second left tributary of Bezlyn River, forest with *Pinus sibirica*, 1800 m alt. Central Altai, northern slope of Aygulakskii Range, upper flow of second left tributary of Ulyuston River, forest with *Pinus sibirica*, 1600 m alt. All collected by A. Matalin.

DESCRIPTION. Size 0.5–0.7 mm. Habitus as on Fig. 43. No pigment on body. Cuticle smooth all over the body. No ocelli. PAO elliptical; about as long as *Ant*.I width and 1.6–1.8 times longer than inner unguis length, without constriction and inner denticles (Fig. 40). Maxillary outer lobe with 4 sublobal hairs, maxillary palp bifurcate. Labral formula as 3/5,5,4 (Fig. 41). Labium with 5 usual papillae (*A–E*), and full set of guard setae, 3 proximal and 4 basomedian setae. Ventral side of a head with 4+4 postlabial setae. *Ant*.1 with 2 basal short microsensilla (*bms*) (dorsal and ventral, one long dorsal *bms* probably also present but hardly distinguishable), and 2 ventral sensilla (*s*) (Fig. 40), *Ant*.2 with 3 *bms* and 1 latero–distal *s*, *Ant*.3 with 1 *bms* and with 5 distal *s* (including 1 lateral). Sensilla on *Ant*.4 weakly differentiated, organit small.

Common setae of body smooth and short. Axial chaetom of *Th*.II–*Abd*.III as: 7–9,6/4(5),4(5),4(5). *Th*.III with 15–18 p–setae. Sensillar formula as: 4,3/2,2,2,3,5 (*s*), 1,0/0,0,0 (*ms*). On *Th*.II–III medial sensilla just in front of p–row of setae, on *Abd*.II–III in p–row. Sensilla almost as long as common setae and hardly marked. On thorax dorsal sensilla shorter. On *Abd*.IV distance between lateral and medio–lateral sensilla shorter than distance between medial and medio–lateral sensilla (Fig. 35). On *Abd*.V all 4 dorsal sensilla thin, the most lateral of which shorter, the firth (latero–ventral) sensilla equal to the forth lateral one. In some specimens three long dorsal sensilla slightly thickened in proximal half, so look somewhat narrow flame–shaped. Macrosetae smooth and short, 1,1/3,3,3 in number, hardly marked in median areas of three first abdominal segments. Medial macrosetae on *Abd*.VI about 3.5 as long as mucro (high value of this index reflects small size of mucro). Ratio dens : macrosetae at the end of abdomen as 4.3–5.0. *Abd*.VI with 9 foil–setae, 6 in anterior and 3 in posterior row. Thorax without setae on ventrum. Unguis without inner and lateral teeth. Empodial appendage about half as long as unguis. Tibiotarsi 1, 2, 3 with many setae (basal set present). Tibiotarsal tenent setae pointed. Male spurs (*x* and B_5) on *Ti*.3 not modified. Upper and lower subcoxa of Leg 2 with 2–3 and 4–6, Leg 3 with 4–5 and 6 setae, respectively. Ventral tube with 4+4 latero–distal and 5, rarely 6, posterior setae (Fig. 42). Tenaculum with 4+4 teeth and a seta. Anterior furcal subcoxa with 12–16, posterior one with 6–8 setae. Furca long (Fig. 43). Anterior side of manubrium normally with 6–7+6–7 (whole variation as 11–14) setae, their arrangement can be described as 3+3, 1+1 (or 2+2), 1+1, 1+1 (Fig. 39). In the second–fourth rows one (more rarely two) seta lost (1+0) or with additional seta (1+2) in some specimens. The first row invariable (3+3). Posterior side of manubrium with 5+5 laterobasal, 7–8+7–8 central, 3+3 distal, and 1+1 apical setae (Fig. 38). On each of lateral sides with 3 (rarely 2) setae (Figs 33, 39). Dens continuously narrowed, crenulated, with 27–32 anterior setae, subapical seta longer. Posterior side of dens with 4 setae in basal third, 2 medial, and 1 small subapical (Fig. 37). Mucro small, bidentate. Ratio of manubrium : dens : mucro as 7–9 : 16–18 : 1.



Figs. 35–43. *F. stebaevi* **sp.n.**: 35 — posterior part of abdomen; 36 — *Abd.*I, lateral view; 37 — dens; 38–39 — manubrium (38 — posterior; 39 —anterior views); 40 — PAO and basal part of antenna; 41 — labrum and prelabral setae; 42 — ventral tube; 43 — habitus; *f* — foil-seta; *s* — sensillum.

Рис. 35–43. *F. stebaevi* **sp.n.**: 35 — задняя часть брюшка; 36 — *Abd.*I, сбоку; 37 — денс; 38–39 — манубрий (38 — сзади, 39 — спереди); 40 — ПАО и базальная часть антенны; 41 — лабрум и прелабральные хеты; 42 — вентральная трубка; 43 — габитус; *f* — хета-шпага; *s* — сенсилла.

TAXONOMIC REMARKS. After the general arrangement of sensilla on body and chaetotaxy of furca *F. stebaevi* **sp.n.** appears to be closed to *F. sparsosetosa* Potapov & Stebaeva, 1997. The new species differs from the latter one by 3 prelabral setae, microsensilla on *Abd.* I missing, peculiar arrangement of sensilla on *Abd.* IV, shorter macrosetae and other characters of less importance. As a matter in fact, three first mentioned characters are very rare for the genus. After more traditional character, the furca, the new species *F. stebaevi* **sp.n.** is similar with rather unrelated species, as *F. tianshanica* Martynova, 1969, *F. nivalis* (Packard, 1873), species of group '*sensibilis*'. Sensillar chaetotaxy of these species is unlike in *F.stebaevi* **sp.n.**.

DISTRIBUTION. Known from mountainous part of South Siberia (Sajany, Altai, Tuva).

ETYMOLOGY. Igor Vasilyevich Stebaev is an outstanding researcher of soil biota in the extreme conditions, who obviously "met" the new species during his scientific trips in South Siberia.

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