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Source: Florida Entomologist, 97(4) : 1718-1725

Published By: Florida Entomological Society

URL: <https://doi.org/10.1653/024.097.0447>

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NEW SPECIES OF *SENSILLONYCHIURUS* (COLLEMBOLA: ONYCHIURIDAE: ONYCHIURINAE) IN HEILONGJIANG PROVINCE, CHINA

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ABSTRACT

Two new species, *Sensillonychiurus pseudogeminus* **sp. nov.** and *Sensillonychiurus zhuajiensis* **sp. nov.**, are reported from Heilongjiang Province, China. *S. pseudogeminus* **sp. nov.** is very similar to the *S. geminus* Pomorski & Sveenkova 2006, but it can be recognized by shorter unguiculus, longer anal spines and presence of sternal parapseudocelli on Abd. II and Abd. IV instead of pseudocelli. *Sensillonychiurus zhuajiensis* **sp. nov.** can easily be distinguished from other known congeners by its peculiar dorsal pso formula (32/144/44453).

Key Words: taxonomy, Thalassaphorurini, *Sensillonychiurus zhuajiensis* **sp. nov.**, *Sensillonychiurus pseudogeminus* **sp. nov.**, Collembola

RESUMEN

Se informa de dos especies nuevas, *Sensillonychiurus pseudogeminus* **sp. nov.** y *Sensillonychiurus zhuajiensis* **sp. nov.** de la provincia de Heilongjiang, China. La especie *S. pseudogeminus* **sp. nov.** es muy similar a la especie *S. geminus* Pomorski & Sveenkova 2006, pero se puede distinguirla por el unguículo más corto, las espinas anales más largas y por la presencia de parapseudoceli esternales sobre los segmentos II y IV del abdomen, en lugar de pseudoceli. Se puede distinguir *S. pseudogeminus* **sp. nov.** de los otros congéneres conocidos por su fórmula pso dorsal peculiar (32/144/44453).

Palabras Clave: taxonomía, Thalassaphorurini, *Sensillonychiurus zhuajiensis* **sp. nov.**, *Sensillonychiurus pseudogeminus* **sp. nov.**; Collembola

The genus *Sensillonychiurus* Pomorski & Sveenkova 2006 belongs to the tribe Thalassaphorurini as having the furcal remnant with 4 small chaetae arranged in 2 rows posterior to a finely granulated area (Pomorski & Sveenkova 2006). It differs from other genera of the tribe by the following characters: d0 absent, postantennal organ with compound vesicles, guard chaetae in the Ant. III sensory organ as 3–4, Abd. III sternum not subdivided, Abd. V–VI clearly separated, furca reduced to a small area of fine granulations situated adjacent to the border between Abd. III and IV sterna, and tibiotarsi with 7 or 9 distal chaetae (Babenko et al. 2011). Until now, among the 12 known species all over the world, all 3 Chinese species are from Jilin Province (Sun & Wu 2012a; Sun & Wu 2012b; Bellinger et al. 1996–2014). During our recent investigations of Collembola from Heilongjiang Province (the highest latitudes and the northernmost region of China), 2 new species of the genus *Sensillonychiurus* are found. In the present paper, their descriptions

and the main diagnostic characters of all known Chinese species of this genus are given.

MATERIAL AND METHODS

Wu Donghui and colleagues collected the studied specimens by Berlese extraction, cleared them in lactic acid and then mounted them in Marc André II solution. They were studied by a Nikon Eclipse 80i microscope. The material is deposited in the Key Laboratory of Wetland Ecology and Environment, Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences, Changchun.

Labial types are named in accordance with Fjellberg (1999). Labium areas and chaetal nomenclature follow Massoud (1967) and D'Haese (2003). Chaetae on anal valves are named in accordance with Yoshii (1996). Chaetae on the furcal area are classified in accordance with Weiner (1996). Tibiotarsus chaetotaxy formula follows Deharveng (1983), and is expressed as: total

number of chaetae (number of chaetae in row C, number of chaetae in row B, number of chaetae in distal row A+T), for example 17 (1, 7, 9).

Abbreviations Used in Descriptions and Figures

Ant.—antennal segments, PAO—postantennal organ, Th.—thoracic segments, Abd.—abdominal segments, ms—microsensillum, pso—pseudocellus, psp—pseudopore, psx—parapseudocellus, AIII0—Ant. III sensory organ, Sp—posterior S-chaeta on Abd. V tergum, "—unpaired pseudopore, AS—anal spines.

The pseudocelli, parapseudocelli and pseudopores formulae are the number of corresponding structures by half-tergum (dorsally) or half-sternum (ventrally) as follows: head anterior; head posterior/Th. I-III/Abd. I-V (for instance: 32/144/44453).

SENSILLONYCHIURUS PSEUDOGEMINUS SP. NOV.
(Figs 1-10; Table 1)

Material Examined

HOLOTYPE female, CHINA, Jiamusi City, Tongjiang country, Jiejinsan (N 47.92° E 132.85°), LD-10-472, 07-VIII-2010, litter and soil under *Quercus mongolica* Fisch. ex Ledeb. PARATYPES 7 females, LD-10-472, LD-10-486, LD-10-491, LD-10-492, same data as holotype.

Other materials: 3 females, Jiamusi City, Tongjiang country, Linjiang town (N 48.08° E 133.54°), LD-10-479, LD-10-483, 07-VIII-2010, litter and soil under *Betula costata* Trautv.; 2 females, Shuangyashan City, Raohe country, Zhenbao island (N 46.49° E 133.85°), LD-10-405, LD-10-406, 16-VIII-2010, litter and soil under *Pinus Koraiensis* Sieb. Et Zucc.; 1 female, Jiamusi City, Fuyuan country, Haiqing town (N 47.89° E 134.66°), LD-10-451, 01-VIII-2010, soil of farmland planted with soybean.

Description

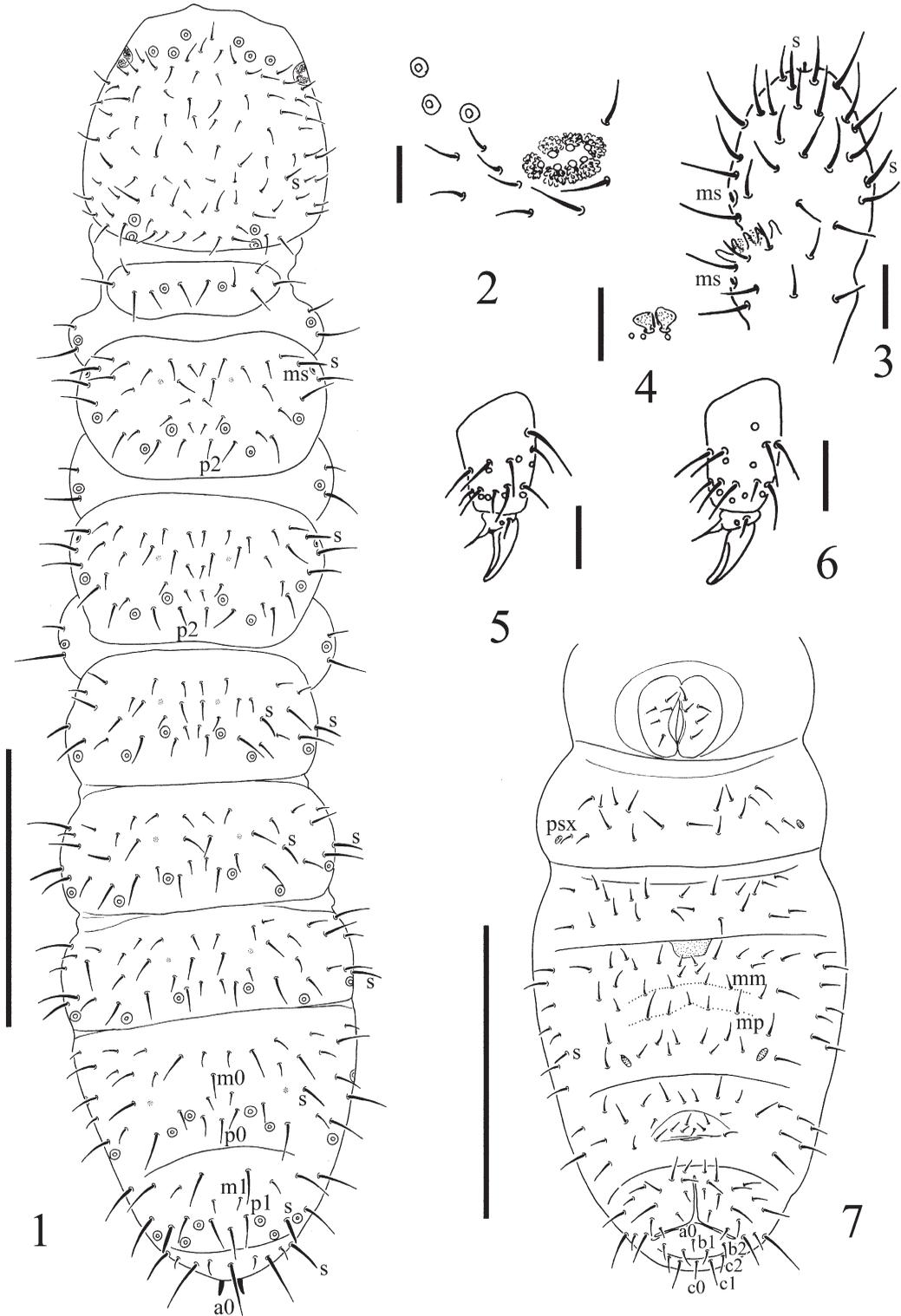
Body white in alcohol. Length of body 0.48-0.56 mm in females; holotype: 0.5 mm. Shape of body typical of the genus, i.e., subcylindrical with small anal spines. Anal spines 0.7 times as long as inner edge of unguis.

Pso formulae 32/133/33343 dorsally and 10/000/00000 ventrally (Figs. 1, 7, 9), subcoxa 1 of legs I-III with 1, 1 and 1 pso respectively. Psx formula 00/000/010100 ventrally (Figs. 1, 7, 9). Psp formulae 0/011/11110 dorsally and 00/111/00000 ventrally (Figs. 1, 7, 9).

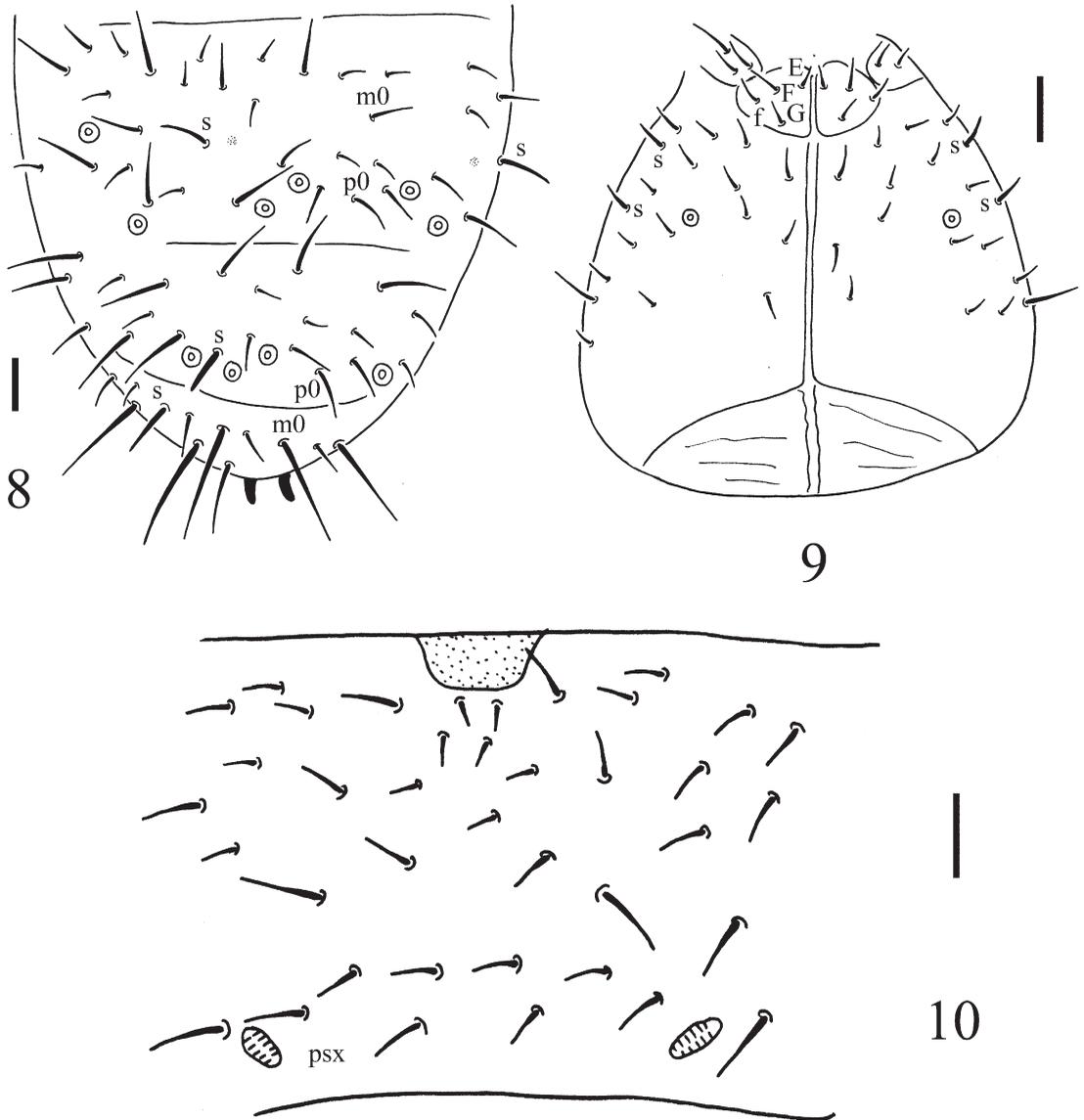
Head. Antennae as long as head. Length ratio of Ant. I: II: III: IV as about 1: 1.5: 1.5: 2. Ant. IV with 2 distinct thickened S-chaetae, subapical organelle with globular apex; basolateral ms at about ¼ length from base, above the proximal row of chaetae (Fig. 3). Ant. III sensory organ consists

TABLE 1. MAIN DIAGNOSTIC CHARACTERS OF THE KNOWN CHINESE SPECIES OF *SENSILLONYCHIURUS*.

	<i>S. zhuajiensis</i> sp. nov.	<i>S. pseudogeminus</i> sp. nov.	<i>S. changchunensis</i>	<i>S. pseudoreductus</i>	<i>S. reductus</i>
Dorsal pso	32/144/44453	32/133/33343	32/133/33343	32/033/33343	32/133/33343
Ventral psx	00/000/112100	00/000/010100	invisible	invisible	invisible
Sublobal hair on maxillary palp	2	2	2	2	1
Papillae/guard chaetae of AIII0	4/3	5/3	5/3	4/3	4/3
Number of chaetae on Th. I tergum	6-7+6-7	5+5	6+6	5+5	5+5
Chaeta p2 on Th. II-III terga	+, +	+, +	+, +	-, -	+(-), -
Chaetae ms on Th. III tergum	-	+	-	-	-
Chaeta b2 on the upper anal valve	+	+	+	-	+
Chaetae on subcoxa 1 of legs I-III	3, 4, 4	3, 4, 4	3, 4, 4	3, 3, 3	3, 3, 3
Unguiculus/unguis ratio	0.6	0.5	0.5	0.15	0.15
Anal spines	-	+	-	-	-



Figs. 1–7. *Sensillonychiurus pseudogeminus* sp. nov. 1. Dorsal chaetotaxy of body; 2. PAO and anterior cephalic pseudocelli; 3. Ant. III–IV; 4. Sensory rods and sensory clubs on antennal sensory organ; 5. Distal part of leg II; 6. Distal part of leg III; 7. Chaetotaxy of Abd. I–VI sterna. Scale bars: 0.1 mm (Figs. 1, 7), 0.01 mm (Figs. 2–6).



Figs. 8–10. *Sensillonychiurus pseudogeminus* sp. nov. 8. Chaetotaxy of Abd. IV–VI terga; 9. Ventral chaetotaxy of head; 10. Central part of Abd. IV sternum. Scale bars: 0.01 mm (Figs. 8–10).

of 5 papillae, 3 guard chaetae, 2 sensory rods, 2 smooth sensory clubs, and lateral ms (Fig. 3–4). Ant. II with 13 chaetae. Ant. I with 8 chaetae. Antennal base not marked (Fig. 1). PAO with 6–7 compound vesicles (Fig. 2). On head 4+4 p-chaetae present between 2 posterior pso, p4 anterior to p1, p2 and p3 (Fig. 1). Mandible with strong molar plate and 4 apical teeth. Maxilla bearing 3 teeth and 6 lamellae. Maxillary palp simple with 1 basal chaeta and 2 sublobal hairs. Labral formula 2/322; Labium with 6 proximal, 4 basomedian (E, F, G, f) and 5 basolateral (b, c, d, e, e') chaetae (Fig. 9); labial type AC, papillae A–E

with 1, 4, 0, 3 and 3 guard chaetae respectively. Head ventrally with 3+3 postlabial chaetae along ventral groove (Fig. 9).

Body chaetotaxy. S-chaetae subcylindrical, distributed on half body as 10/011/221111 (dorsally) and 11/000/000100 (ventrally) (Figs. 1, 7, 9). Subcoxae 2 of legs I, II and III with 0, 0, 1 S-chaeta respectively. Tiny and blunt lateral ms present on both Th. II and III (Fig. 1). Ratio Sp: m1: p1 on Abd. V tergum = 1: 0.5: 1. Th. I tergum with 5+5 chaetae. Th. II–III terga with 3+3 chaetae and Abd. I–III terga with 2+2 chaetae along axis respectively (Fig. 1). Abd. IV tergum with 2

unpaired chaetae m0 and p0, Abd. V tergum with chaeta p0, Abd. VI tergum with chaeta m0 (Fig. 8). Sterna of Th. I, II, and III without chaetae.

Appendages. Subcoxae 1 of legs I–III with 3, 4 and 4 chaetae, subcoxae 2 with 1, 4 and 4 chaetae respectively. Coxae of legs I, II and III with 3, 10 and 12 chaetae, trochanters with 8 chaetae each and femora with 13, 13 and 12 chaetae. Tibiotarsi of legs I, II and III with 17 (1, 7, 9), 17 (1, 7, 9) and 16 (1, 6, 9) chaetae (Figs. 5–6). Unguis without teeth. Unguiculus about 0.5 times as long as inner edge of unguis, with inner basal lamella (Figs. 5–6). Ventral tube with 5–6+5–6 distal chaetae, without anterior or basal chaetae (Fig. 7). Furca reduced to a small area of fine granulations situated adjacent to the border between Abd. III and IV sterna, with 4 small dental chaetae arranged in 2 rows posteriorly and 2 manubrial rows of chaetae (Fig. 10).

Female genital plate with 8–10 chaetae. Anal valves with numerous acuminate chaetae; each lateral valve with a0, 2a1; upper valves with chaetae a0, 2b1, 2b2, c0, 2c1, 2c2 (Fig. 7).

Etymology

Named to recognize the similarity with *Sensillonchiurus geminus* Pomorski & Sveenkova, 2006.

Distribution.

Known only from the type locality.

Remarks

The new species is very similar to *S. geminus* Pomorski & Sveenkova, 2006 from Russia (Primorskyi Krai, the easternmost part of Russia) as having the same dorsal pso formula (32/133/33343), number of papillae and guard chaetae in AIII (5 and 3), chaetae on Th. I tergum (5+5) and on subcoxae 1 of legs I–III (3, 4, 4), as well as ms on Th. III tergum. The most notable difference between these species is the presence of sternal parapseudocelli on Abd. II and Abd. IV in *S. pseudogeminus* **sp. nov.**, whereas true pseudocelli are developed at the same positions in *S. geminus*. Apart from this, *S. pseudogeminus* **sp. nov.** is characterized by shorter unguiculus (unguiculus/unguis ratio is 0.5 in *S. pseudogeminus* **sp. nov.** and 0.75 in *S. geminus*) and longer and stronger AS (AS/unguis ratio is 0.7 in *S. pseudogeminus* **sp. nov.** and 0.33 in *S. geminus*).

SENSILLONYCHIURUS ZHUAJIENSIS **SP. NOV.**
(Figs. 11–21; Table 1)

Material Examined

HOLOTYPE male, CHINA, Heilongjiang Province, Jiamusi City, Fuyuan county, Zhuajitown

(N 48.15° E 134.56°), LD-10-466, 05-VIII-2010, litter and soil under *Populus davidiana* Dode. PARATYPES 8 females and 1 male, same data as holotype.

Description

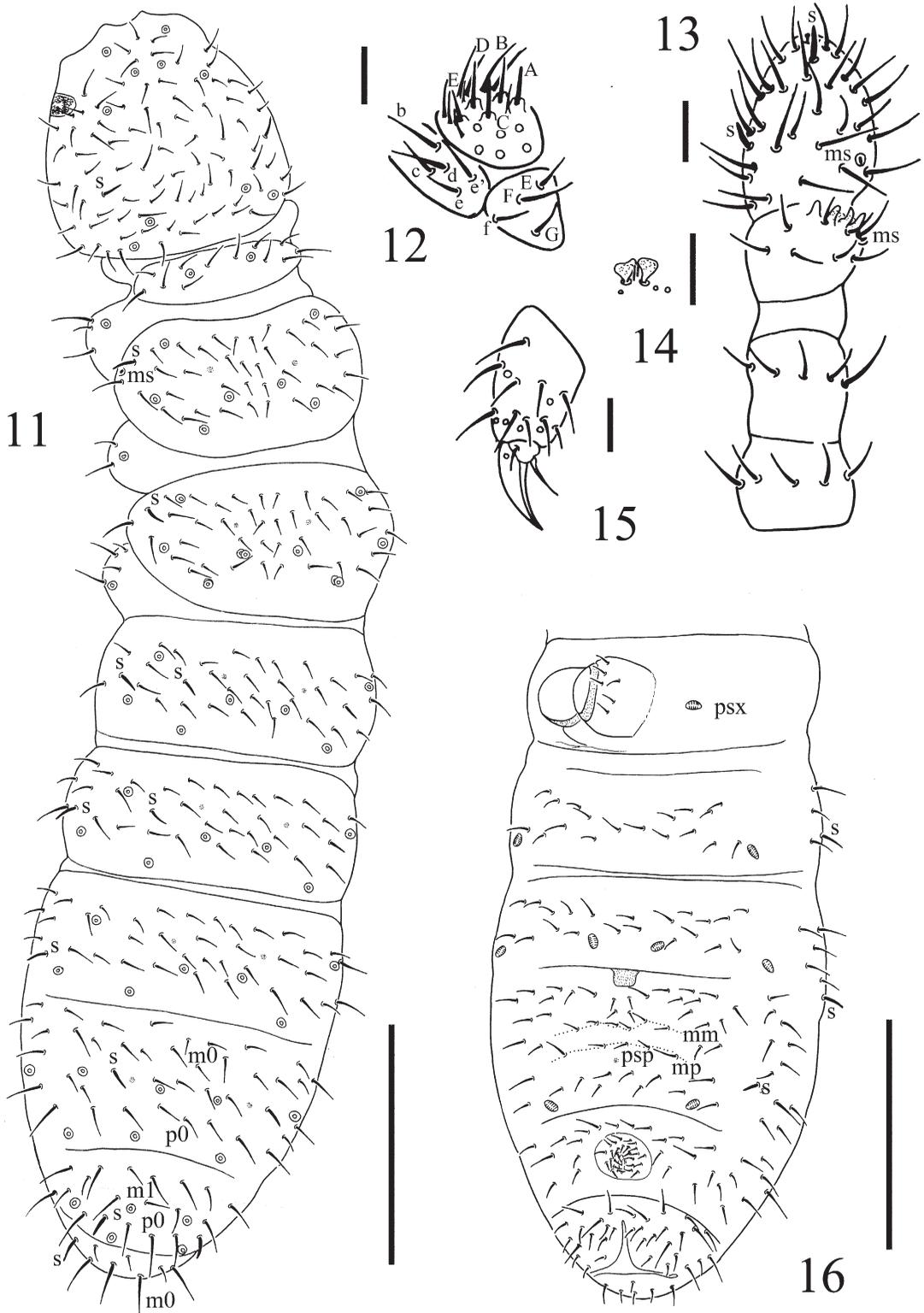
Body white in alcohol. Length of body 0.6–0.66 mm in females, 0.58–0.6 mm in male; holotype: 0.6 mm. Shape of body typical of the genus: subcylindrical without anal spines.

Pso formulae 32/144/44453 dorsally and 10/000/00000 ventrally (Figs. 11, 16, 18), subcoxae 1 of legs I–III with 1, 1 and 1 pso respectively. Psx formula 00/000/112100 ventrally (Figs. 11, 16, 18), subcoxae 1 of legs I–III with 1, 1 and 1 psx respectively. Psp formulae 0/011/11110 dorsally and 00/111/0001⁰ ventrally (Figs. 11, 16, 18).

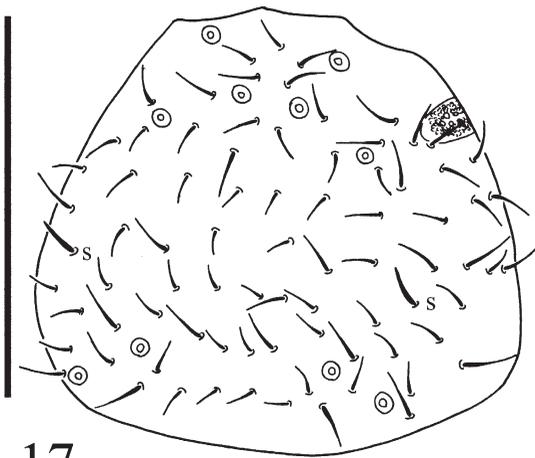
Head. Antennae as long as head. Length ratio of Ant. I: II: III: IV as about 1: 1.5: 1.5: 2. Ant. IV with 2 distinct thickened S-chaetae, subapical organelle with globular apex; basolateral ms at about 1/4 length from base, above the proximal row of chaetae (Fig. 13). Ant. III sensory organ consists of 4 papillae, 3 guard chaetae, 2 sensory rods, 2 smooth sensory clubs, and lateral ms (Fig. 13–14). Ant. II with 13 chaetae. Ant. I with 8 chaetae. Antennal base not marked (Fig. 11). PAO with 6 compound vesicles. On head 4+4 p-chaetae present between 2 posterior pso, p1 and p3 anterior to p2 and p4 (Fig. 17). Mandible with strong molar plate and 4 apical teeth. Maxilla bearing 3 teeth and 6 lamellae. Maxillary palp simple with 1 basal chaeta and 2 sublobal hairs. Labral formula 2/322; Labium with 6 proximal, 4 basomedian (E, F, G, f) and 5 basolateral (b, c, d, e, e') chaetae (Fig. 18); labial type AC, papillae A–E with 1, 4, 0, 3 and 3 guard chaetae respectively (Fig. 12). Head ventrally with 3+3 postlabial chaetae along ventral groove (Fig. 18).

Body chaetotaxy. S-chaetae subcylindrical, apically rounded, distributed on half body as 10/011/221111 (dorsally) and 11/000/000100 (ventrally) (Figs. 11, 16, 18). Subcoxae 2 of legs I, II and III with 0, 0, 1 S-chaeta respectively. Tiny and blunt ms, present on Th. II, absent on III (Fig. 11). Ratio Sp: m1: p1 on Abd. V tergum = 1: 1: 1.4. Th. I tergum with 6–7+6–7 chaetae. Th. II–III terga with 3+3 chaetae and Abd. I–III terga with 2+2 chaetae along axis respectively (Fig. 11). Abd. IV tergum with 2 unpaired chaetae m0 and p0, Abd. V tergum with chaeta p0, Abd. VI tergum with chaeta m0 (Fig. 19). Sterna of Th. I, II, and III without chaetae.

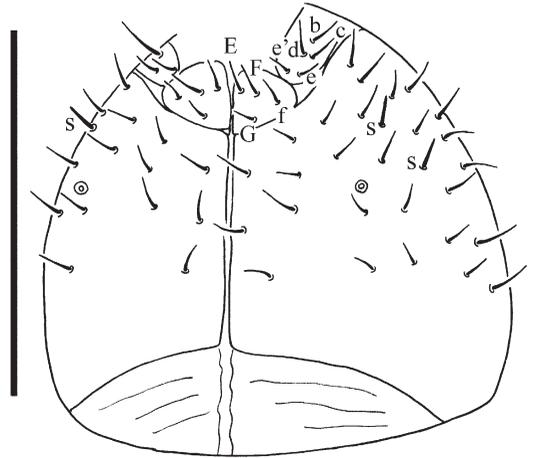
Appendages. Subcoxae 1 of legs I–III with 3, 4 and 4 chaetae, subcoxa 2 with 1, 4 and 4 chaetae respectively. Coxae of legs I, II and III with 3, 10 and 12 chaetae, trochanters with 8 chaetae each and femorae with 13, 13 and 12 chaetae. Tibiotarsi of legs I, II and III with 17 (1, 7, 9), 17 (1, 7, 9) and 16 (1, 6, 9) chaetae each (Fig. 15). Unguis



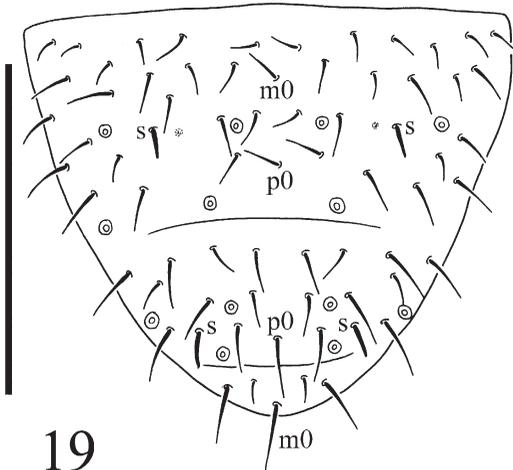
Figs. 11–16. *Sensillonychiurus zhuajiensis* **sp. nov.** 11. Dorsal chaetotaxy of body; 12. Labium; 13. Antenna; 14. Sensory rods and sensory clubs on antennal sensory organ; 15. Distal part of leg III; 16. Chaetotaxy of Abd. I–VI sterna. Scale bars: 0.1 mm (Figs. 11 and 16), 0.01 mm (Figs. 12–15).



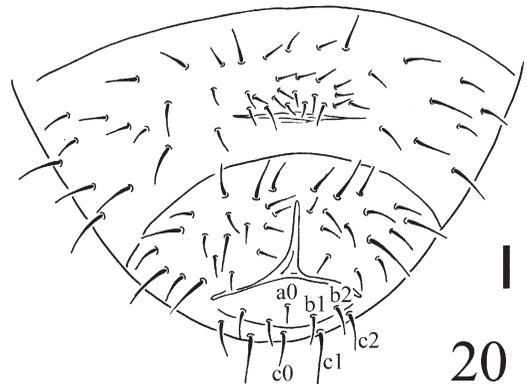
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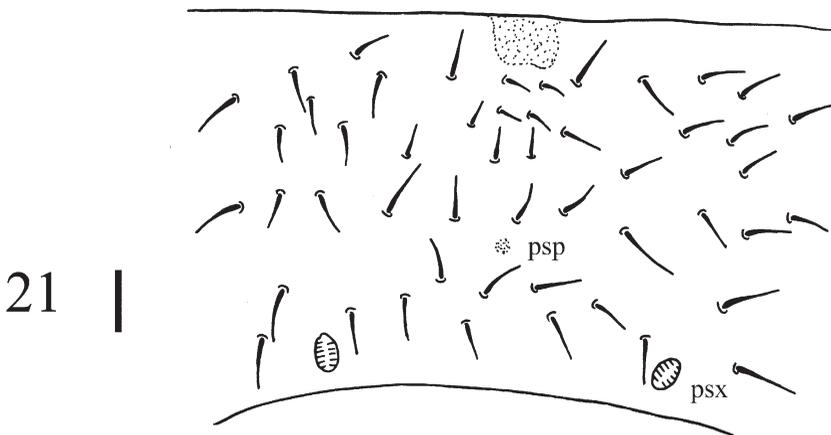
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Figs. 17–21. *Sensillonychiurus zhuajiensis* sp. nov. 17. Dorsal chaetotaxy of head; 18. Ventral chaetotaxy of head; 19. Chaetotaxy of Abd. IV–VI terga; 20. Female Abd. V–VI sterna; 21. Central part of Abd. IV sternum. Scale bars: 0.1 mm (Figs. 17–19), 0.01 mm (Figs. 20–21).

without teeth. Unguiculus about 0.6 times as long as inner edge of unguis, without inner basal lamella (Fig. 15). Ventral tube with 6+6 distal chaetae, without anterior or basal chaetae (Fig. 16). Furca reduced to a small area of fine granulations situated adjacent to the border between Abd. III and IV sterna, with 4 small dental chaetae arranged in 2 rows posteriorly and 2 manubrial rows of chaetae (Figs. 16, 21).

Female genital plate with 14–18 chaetae and male with 26–30 chaetae. Male ventral organ absent. Anal valves with numerous acuminate chaetae; each lateral valve with a0, 2a1; upper valves with chaetae a0, 2b1, 2b2, c0, 2c1, 2c2 (Fig. 20).

Etymology

Named after the town of the type locality.

Remarks

The new species is similar to the 6 known species (*S. changchunensis* Sun & Wu, 2012, *S. eisi* (Rusek, 1976), *S. minusculus* Pomorski & Sveenkova, 2006, *S. pseudoreductus* Sun & Wu, 2012, *S. reductus* Sun & Wu, 2012, and *S. virginis* Pomorski & Sveenkova, 2006), and has no anal spines. But it can be easily distinguished by its peculiar dorsal pso formula (32/144/44453). The main diagnostic characters of 5 species known from the Chinese territory are shown in Table 1.

ACKNOWLEDGMENTS

We thank the 4 anonymous reviewers for their valuable comments. The present study was supported by the National Natural Sciences Foundation of China (31301862, 31311130106, 31370532), the Fund for Excellent Young Scholars of Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences (DLSYQ13003), and the Chinese Academy of Sciences

Visiting Professorships for Senior International Scientists.

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