Baculentulus xizangensis sp. nov. from Tibet, China (Protura: Acerentomata, Berberentulidae) with a Key to the Group of Baculentulus SPP. with Foretarsal Sensillum B'

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BACULENTULUS XIZANGENSIS SP. NOV. FROM TIBET, CHINA (PROTURA: ACERENTOMATA, BERBERENTULIDAE) WITH A KEY TO THE GROUP OF BACULENTULUS SPP. WITH FORETARSAL SENSILLUM B'

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ABSTRACT

Baculentulus xizangensis sp. nov. from Tibet Autonomous Region, China is described. The new species is characterized by the presence of sensillum b' on foretarsus, short sensillum a', one pair of A-setae (A5) on tergite VII, one pair of P-setae (P1) on sternite I, and comb with few teeth and straight hind margin. It is similar to Baculentulus ogawai (Imadaté, 1965) from Thailand, but differs in the length of sensilla a' and b', shape of maxillary gland and comb, and in the chaetotaxy on sternite I. The key to the group of Baculentulus spp. with foretarsal sensillum b' present is provided.

Key Words: Protura, taxonomy, chaetotaxy, Tibet, sensillum

RESUMEN

Se describe Baculentulus xizangensis sp. nov. de la región autónoma del Tibet, China. La nueva especie se caracteriza por la presencia del sensilio b' sobre el tarsus anterior, el sensilio corto a', un par de setas-A (A5) en terguito VII, un par de setas-P en esternito I, y un peine con pocos dientes y margen posterior recto. Esta especie es similar a Baculentulus ogawai (Imadate, 1965) de Tailandia, pero difiere en la longitud de sensilio a', la posición de sensilio d, la forma de la glándula maxilar y el peine, y en la quetotaxia del esternito IX. Se provee una clave para los congéneres con sensilios completos sobre el tarsus anterior.

Palabras Clave: Protura, taxonomía, quetotaxia, Tibet, sensillum

The genus Baculentulus Tuxen, 1977 including 38 species distributed all over the world (Szeptycki 2007; Wu & Yin 2008; Nakamura & Likhittrakarn 2009; Shrubovych 2010; Rusek et al. 2012). Among them, 9 species have been reported from China (Yin 1999; Wu & Yin 2008). It is characterized by baculiform sensillum t1 on foretarsus, sensillum b' present (in 9 species) or absent (in 29 species), calyx of maxillary gland smooth, heart-shaped, the reduced striate band on abdominal segment VIII, and sternite VIII has 4 setae.

The Protura fauna of Tibet Autonomous Region of China have been studied by Yin (1981, 1982, 1983a, 1983b, 1990). Twelve species belong to the families Protentomidae, Berberentulidae, Eosentomidae and Antelientomidae have been recorded in this region so far (Yin 1999). In 2009, we investigated this region again and many proturan specimens were obtained. Among them, one new species of Baculentulus was found and described in the present paper. The key to the Baculentulus species with foretarsal sensillum b' was also provided.

MATERIALS AND METHODS

Specimens were extracted by means of the Tullgren funnels from soil samples. They were mounted on the slides using Hoyer’s solution and dried up in an oven at 45 °C. Specimens were identified and drawn with the aid of NIKON E600 phase contrast microscopes.

RESULTS

Baculentulus xizangensis sp. nov. (Figs. 1 -29, Table 1)

Material Examined

HOLOTYPE female (no. XZ-P09030) collected from bush forest, Sangduo town, Leiwuqi County, Changdu District, Tibet Autonomous Region (Xi-
Baculentulus xizangensis sp. nov. (holotype). Habitus. Scale bar: 100 μm.

Description

Adult body length 1050 μm (n = 2), pale yellow in color (Fig. 1).

Head. Elliptic, length 100 μm, width 75 μm. Setae sd4 and sd5 short and sensilliform, sd6 absent (Fig. 2). Pseudoculus length 8 μm, PR = 12.5 (Fig. 3). Maxillary gland length 16 μm, CF = 6.4 (Fig. 4). Maxillary gland with smooth, heart-shaped calyx. Posterior filament of maxillary gland 30 μm (Figs. 15 and 16). Length ratio of P1: P1a: P2 on mesonotum as 4.3: 1: 5.0. Seta P5 on mesonotum pin-shaped, on metanotum rudimentary (Fig. 10). Setae A2 and M2 on prosternum, A2 on meso- and metasternum sensilliform (Figs. 12-14). Mesonotum with pores al and sl, metanotum with pore sl only (Fig. 10). Pro-, meso- and metanotum without pores. (Figs. 12 and 13).

Abdomen. Abdominal chaetotaxy given in Table 1. Tergites I-VI with 3 pairs of anterior setae (Figs. 15 and 16), VII with one pair of anterior setae (Fig. 17). Seta P3 on tergites II-VI anterior to other P-row setae (Fig. 16), and the same level with other P-row setae on tergites I and VII (Figs. 15 and 17). Sternite I with one pair of P-setae (Fig. 19). Accessory setae on tergites and sternites I-VII short, sensilliform (Figs. 18 and 21), 4-5 μm in length.

Tergite I with pores psm (Fig. 15). Tergites II-VI with pores psm and al (Fig. 16), VII with pores psm, ps1 and al (Figs. 17 and 24). Pore psm on tergite VIII with several surrounding teeth (Fig. 26). Tergites IX-XI without pores, XII with single median pore on serrate line (Fig. 26). Setae I-IV without pores (Figs. 19, 20 and 22). Membrane between tergites and sternites IV-VI each with 1+1 anteromembranal (amb) pore (Figs. 22 and 23). Sternites V-VI with a pair of pores close to P1 (Fig. 23), sternite VII with single asymmetrical pore close to one of P1 (Fig. 24), sternites VIII-XI without pores (Fig. 25). Sternite XII with 1+1 anterolateral pores (Fig. 25).

Abdominal appendages with 4, 2, 2 setae, 2 glands and 2 pores present on each of abdominal appendage I (Figs. 19 and 20). Length ratio of subapical and apical seta of second and third appendages as 1.9:1 (Figs. 20). Striate band on abdominal segment VIII reduced (Figs. 25 and 26). Comb on abdomen VIII rectangular, with 6 short teeth (Fig. 29). Lateral and posterior margins of tergites and sternites VIII-XI smooth. Hind mar-

Fig. 1. Baculentulus xizangensis sp. nov. (holotype). Habitus. Scale bar: 100 μm.
Figs. 2-11. *Baculentulus xizangensis* sp. nov. (holotype). 2. head, dorsal view (*d1–d7* = dorsal setae; *sd2–sd7* = subdorsal setae; *fp* = frontal pore); 3. pseudoculus; 4. canal of maxillary gland; 5. maxillary palp; 6. labial palp; 7. foretarsus, exterior view; 8. foretarsus, interior view; 9. foretarsus, dorsal view show the position of *t1* and *a’*; 10. nota, left side (*sl* = sublateral pore; *al* = anterolateral pore); 11. accessory setae *P1a* and *P2a* on meso- metanotum. Arrows show pores. Scale bars: Fig. 11, 10 μm, others, 20 μm.
Figs. 12-22. *Baculentulus xizangensis* sp. nov. (holotype). 12. prosternum; 13. mesosternum; 14. setae A2 and M2 on prosternum and mesosternum; 15. tergite I, left side (psm = posterosubmedial pore); 16. tergite IV, left side (al = anterolateral pore); 17. tergite VII, left side (psl = posterosublateral pore); 18. accessory setae *P1a* and *P2a* on tergites I-VII; 19. sternite I; 20. sternite II; 21. accessory setae *P1a* on sternites II-VII; 22. sternite IV (amb = anteromembranal pore); Arrows show pores, Scale bars: 20 μm.
Etymology.

The species name was derived from Tibet Autonomous Region (Xizang) where the species were collected.

Distribution.

China (Tibet Autonomous Region).

Diagnosis.

*Baculentulus xizangensis* sp. nov. is characterized by the presence of sensillum *b’* on foretarsus, short sensillum *a’,* one pair of *A*-setae (*A*5) on tergite VII, one pair of *P*-setae (*P*1) on sternite I, and comb with few teeth and straight hind margin.

Remarks.

*Baculentulus xizangensis* sp. nov. is similar to *B. ogawai* (Imadaté 1965) from Thailand, *B. numatai* (Imadaté 1965) from Nepal, *B. africanaus* (Nosek 1976), *B. evansi* (Condé 1961) and *B. nyinabifuliensis* (Condé 1961) from Africa in having foretarsal sensilla *b’* present and only one pair of *A*-setae on tergite VII. It differs from *B. ogawai* in having one pair *P*-setae on sternite I (2 pairs in *B. ogawai* respectively), in the short sensillum *a’,* not reaching base of *b*’ (*a’* surpassing base of *b*’ in *B. ogawai*), in the length of sensillum *b’,* not reaching base of *c’* (*b’* surpassing base of *c*’ in *B. ogawai*), and in the comb with few teeth.
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and straight hind margin (comb with 14 teeth and hind margin oblique in B. ogawai). It differs from B. numatai in one pair of P-setae on tergite I and 8 pairs of P-setae on tergites II-VI (2 and 9 pairs in B. numatai respectively), in the presence of A1 seta on tergite VIII (A1 absent in B. numatai). It differs from B. africanus, B. evansi and B. nyinabitabuensis in having 3 pairs of A-setae on tergite VIII (2 pairs in those 3 species), and in the 7 pairs of setae on tergite IX (6 pairs in those 3 species). It also differs from B. africanus in the short sensillum a', not reaching base of b' (a' reaching base of b' in B. africanus), from B. evansi and B. nyinabitabuensis in the short posterior filament of maxillary gland (posterior filament of maxillary gland long in B. evansi and B. nyinabitabuensis), and in the sensillum a' situated at same level to t1 (posterior to t1 in B. evansi, anterior to t1 in B. nyinabitabuensis).

Except those 5 species mentioned above, B. celisi (Condé, 1955) from Congo, B. tuxeni (Nosek & Hüther 1974) and B. becki (Tuxen 1976) from Brazil, and B. chiangmaiensis Nakamura & Likhitrakarn, 2009 from Thailand also have foretarsal sensilla b' present. The 10 species of Baculentulus with sensillum b' on foretarsus can be distinguished by the following key.

**KEY TO BACULENTULUS SPP. WITH FORETARSAL SENSILLUM B’**

1. Tergite VII with one pair of A-setae ......................................................... 2
—. Tergite VII with 2 to 4 pairs of A-setae ............................................. 7
2. Tergites I-VI with seta P1a' ...................................................... B. numatai (Imadaté, 1965); Nepal
—. Tergites I-VI without seta P1a' .................................................. 3
3. Tergite VIII with 3 pairs of A-setae .................................................. 4
—. Tergite VIII with 2 pairs of A-setae ............................................. 5
4. Sternite I with one pair of P-setae, sensillum a' not reaching base of b' ................................................. B. xizangensis sp. nov.; China (Tibet)

**TABLE 1. ADULT CHAETOTAXY OF BACULENTULUS XIZANGENSIS SP. NOV.**

<table>
<thead>
<tr>
<th>Segment</th>
<th>Dorsal</th>
<th>Ventral</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Formula</td>
<td>Setae</td>
</tr>
<tr>
<td>Th. I</td>
<td>4</td>
<td>1, 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II-III</td>
<td>6</td>
<td>A2, 4, M</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>P1, 1a, 2, 2a, 3, 3a, 4, 5</td>
</tr>
<tr>
<td>Abd. I</td>
<td>6</td>
<td>A1, 2, 5</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>P1, 1a, 2, 2a, 3, 4</td>
</tr>
<tr>
<td>II-III</td>
<td>6</td>
<td>A1, 2, 5</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>P1, 1a, 2, 2a, 3, 4, 4a, 5</td>
</tr>
<tr>
<td>IV-VI</td>
<td>6</td>
<td>sA1, 2, 5</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>P1, 1a, 2, 2a, 3, 4, 4a, 5</td>
</tr>
<tr>
<td>VII</td>
<td>2</td>
<td>A5</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>P1, 1a, 2, 2a, 3, 3a, 4, 4a, 5</td>
</tr>
<tr>
<td>VIII</td>
<td>6</td>
<td>A1, 4, 5</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>M1, 2, 3, 4, P2, 3, 4, 5</td>
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<tr>
<td>IX</td>
<td>14</td>
<td>1, 1a, 2, 2a, 3, 3a, 4</td>
</tr>
<tr>
<td>X</td>
<td>12</td>
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<td>XI</td>
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<td>1, 3, 4</td>
</tr>
<tr>
<td>XII</td>
<td>9</td>
<td></td>
</tr>
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</table>
—. Sternite I with 2 pairs of P-setae, sensillum a' surpassing base of b' ........................................... B. ogawai (Imadate, 1965); Thailand
5. Foretarsal sensillum a reaching base of seta γ3 ........................................ B. africanaus (Nosek, 1976); Rwanda
—. Foretarsal sensillum a not reaching base of seta γ3 ........................................... 6
6. Small body size (800 μm), accessory setae on tergites about 1/4 length of principal setae ........................................... B. evansi (Condé, 1961); Uganda
—. Large body size (1050 -1400 μm), accessory setae on tergites about 1/9 length of principal setae ................ B. nyinabitabuensis (Condé, 1961); Uganda
7. Tergite I-VI with seta P1a’ .................................................. B. chiangmaiensis Nakamura & Likhittrakarn, 2009; Thailand
—. Tergite I-VI without seta P1a’ ........................................... 8
8. Tergite VII with 4 pairs of A-setae ........................................... B. tuxeni (Nosek & Hüther, 1974); Brazil
—. Tergite VII with 3 pairs of A-setae ........................................... 9
9. Foretarsal sensillum b short, not reaching base of seta γ2 ........................................... B. becki (Tuxen, 1976); Brazil
—. Foretarsal sensillum b long, surpassing base of f ........................................... B. celisi (Condé, 1955); Congo

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