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Protura from Yintiaoling National Nature Reserve, Southwest China (Arthropoda, Hexapoda)

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Abstract

The Protura from Yintiaoling National Nature Reserve, Southwest China, were investigated for the first time. In total, 19 species from four families were discovered. Two species are new to science: *Kenyentulus yintiaolingensis* **sp. nov.** and *Eosentomon wuxiense* **sp. nov.** Berberentulidae and Eosentomidae are dominant groups, with 15 species. The new species are described and illustrated, and the checklist of 19 species of Protura found in the reserve is also provided.

Key words: Berberentulidae, Chongqing, Eosentomidae, morphology, new species, taxonomy

Introduction

Protura is a class of minute soil-dwelling arthropods with 831 species described in the world (Galli, 2022). So far, there are 217 species belonging to 44 genera recorded in China (Bu *et al*. 2020). The Yintiaoling National Natural Reserve, located in the northeastern part of Chongqing Municipality, China, has diverse vegetation types, good protection status, and sustains a high diversity of arthropods. The biogeographic position of Yintiaoling National Natural Reserve is right on the margin of Palearctic and Oriental regions which has very unique fauna (Zhang & Zhang 2023). During the Invertebrate Resource Survey of Yintiaoling National Nature Reserve organized by Professor Zhi-Sheng Zhang in summer, 2022, the Protura fauna was investigated for the first time in that area; more than 400 proturan specimens were obtained. After slide-mounting and careful examination, 19 species were identified in total, including two new species of *Kenyentulus* Tuxen, 1981 and *Eosentomon* Berlese, 1908, as well as one undetermined species of genus *Zhongguohentomon* Yin, 1979. The new species are described and illustrated in the present paper. The checklist of all proturan species found in the reserve is provided.

Material and methods

Specimens were extracted by means of Tullgren funnels from soil and litter samples, and preserved in 75% ethanol. They were mounted in Hoyer's solution and dried in an oven at 50°C. Observations were made with a phase contrast microscope (Leica DM 2500) equipped with a Leica DMC 4500 digital camera. Photographs were taken with differential interference contrast or phase contrast. Line drawings were made using a drawing tube and digitally inked with SAI 2.0. All specimens are deposited in the collections of the Shanghai Natural History Museum (SNHM), Shanghai, China.

Abbreviations used in the text follow the paper by Bu & Yin (2007). Head setae and pores names follow Rusek *et al*. (2012), Bernard (1990), and Shrubovych (2014). The arrangement of the taxa is according to the system proposed by Yin (1999).

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Taxonomy

Descriptions of new species

Family Berberentulidae Yin, 1983

Genus *Kenyentulus* Tuxen, 1981

Type species: *Acerentulus kenyanus* Condé, 1948

Kenyentulus yintiaolingensis Bu & Gao, sp. nov.

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Figures 1–22, Table 1

Type material. Holotype. male (CQ-YTL-P2022055), China, Chongqing Municipality, Wuxi County, Shuangyang Town, Yintiaoling National Natural Reserve, Daqiaowan, 31°29'N / 109°49'E, elev. 1022 m, 11-VIII-2022, Yun Bu and Ya-Li Jin collected. **Paratypes.** 9 females (CQ-YTL-P2022029-1, CQ-YTL-P2022030-1, CQ-YTL-P2022030-2, CQ-YTL-P2022031, CQ-YTL-P2022032-2, CQ-YTL-P2022033-1, CQ-YTL-P2022034-1, CQ-YTL-P2022035-2, CQ-YTL-P2022051), 3 males (CQ-YTL-P2022029-2, CQ-YTL-P2022052, CQ-YTL-P2022053), same data as holotype. All types are deposited in the Shanghai Natural History Museum (SNHM).

Diagnosis. *Kenyentulus yintiaolingensis* sp. nov. is characterized by 6/18 chaetotaxy on tergites IV–VII, seta *P3a* present, sensillum *b* on foretarsus short, surpassing base of seta *γ2*, seta *M2* present on prosternum, maxillary gland with irregular protuberances on anterior part and two dilations on posterior part, and striate band only with sparse stripes laterally.

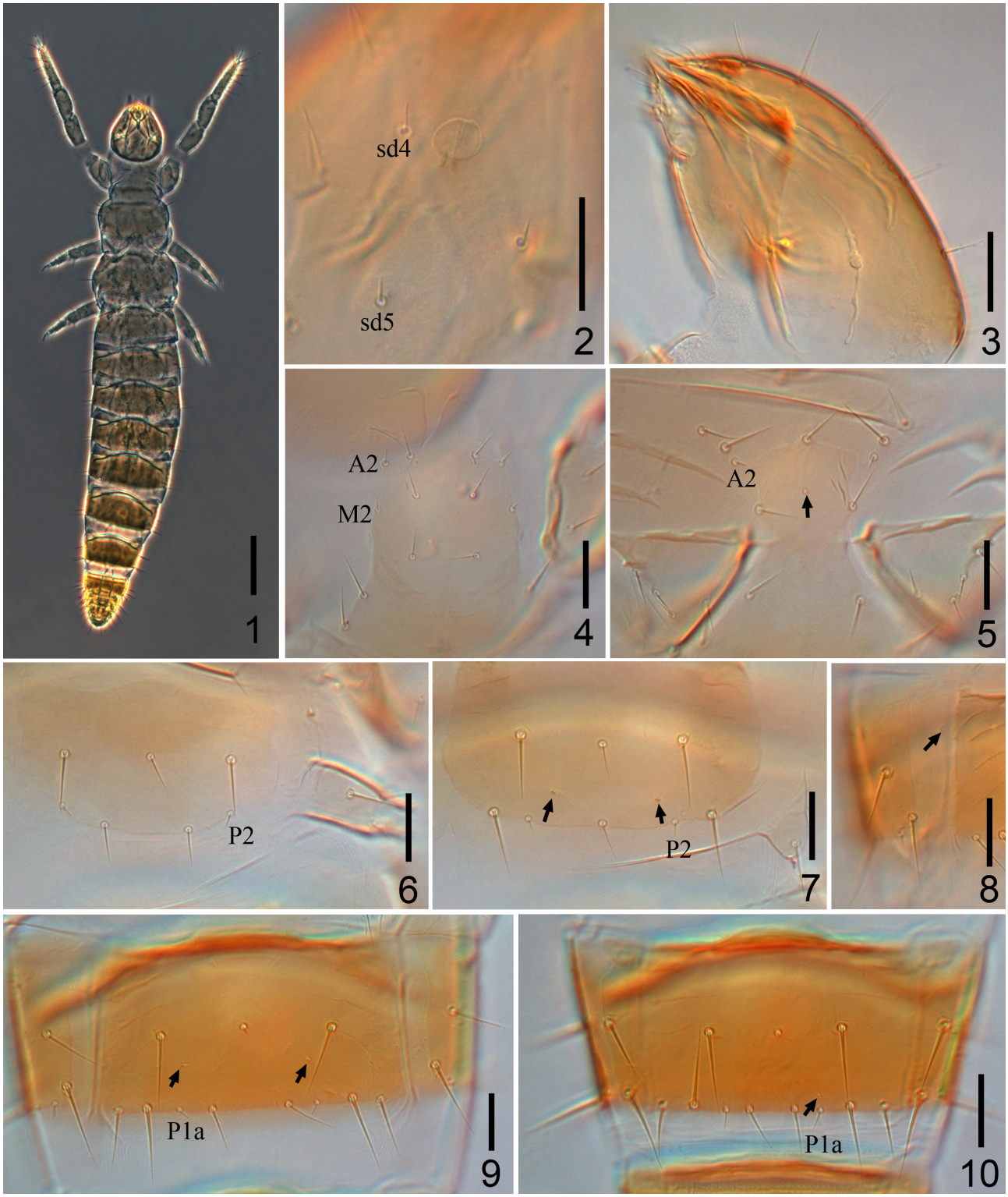
Description. Adult body length 800–950 μm (n=13). Yellow to brown in color (Fig. 1).

Head elliptic, length 95–120 μm, width 85–90 μm, setae *sd4* and *sd5* short (5–6 μm) and sensilliform, *sd6* absent, *d6* present (12–15 μm), frontal pore (*fp*) and clypeal pores (*cp*) present on dorsal side of head (Fig. 11). Pseudoculus almost circular, length 7–8 μm. PR=14–18 (Figs. 2, 12). Maxillary gland with smooth, heart-shaped calyx, anterior part with some irregular protuberances, posterior filament length 18–25 μm, with two dilations (one close to base of calyx, one in the middle), CF=4.3–5.2 (Figs. 3, 13–14). Labial palpus reduced, with three setae and one parallel-sided sensillum (Fig. 15). Maxillary palpus with two subequal seta-like sensilla, 5–7 μm (Fig. 16).

Foretarsus length 70–80 μm, claw length 18–25 μm, TR=4.5–5.2. Empodium short, EU=0.21–0.25; Dorsal sensillum *t1* claviform, BS=0.48–0.55, *t2* long and thin, *t3* gemmiform. Exterior sensillum *a* broad, surpassing base of *d*; *b* short, surpassing base of seta *γ2*; *c* longer than *d*; *e* and *f* thin and long, reaching base of claw; *g* short (Fig. 17). One pore present between *g* and *t3* (Fig. 17). Interior sensillum *a′* robust, same level as *t1*, reach base of *b′*; *b′* and *c′* slim; *c′* surpassing base of claw (Fig. 18). Setae *β1* and *δ4* sensilliform (Fig. 18). Relative length of sensilla: $t3 < b < t1 = g < t2 < d = a' = c' < c < e = f = b' < a$.

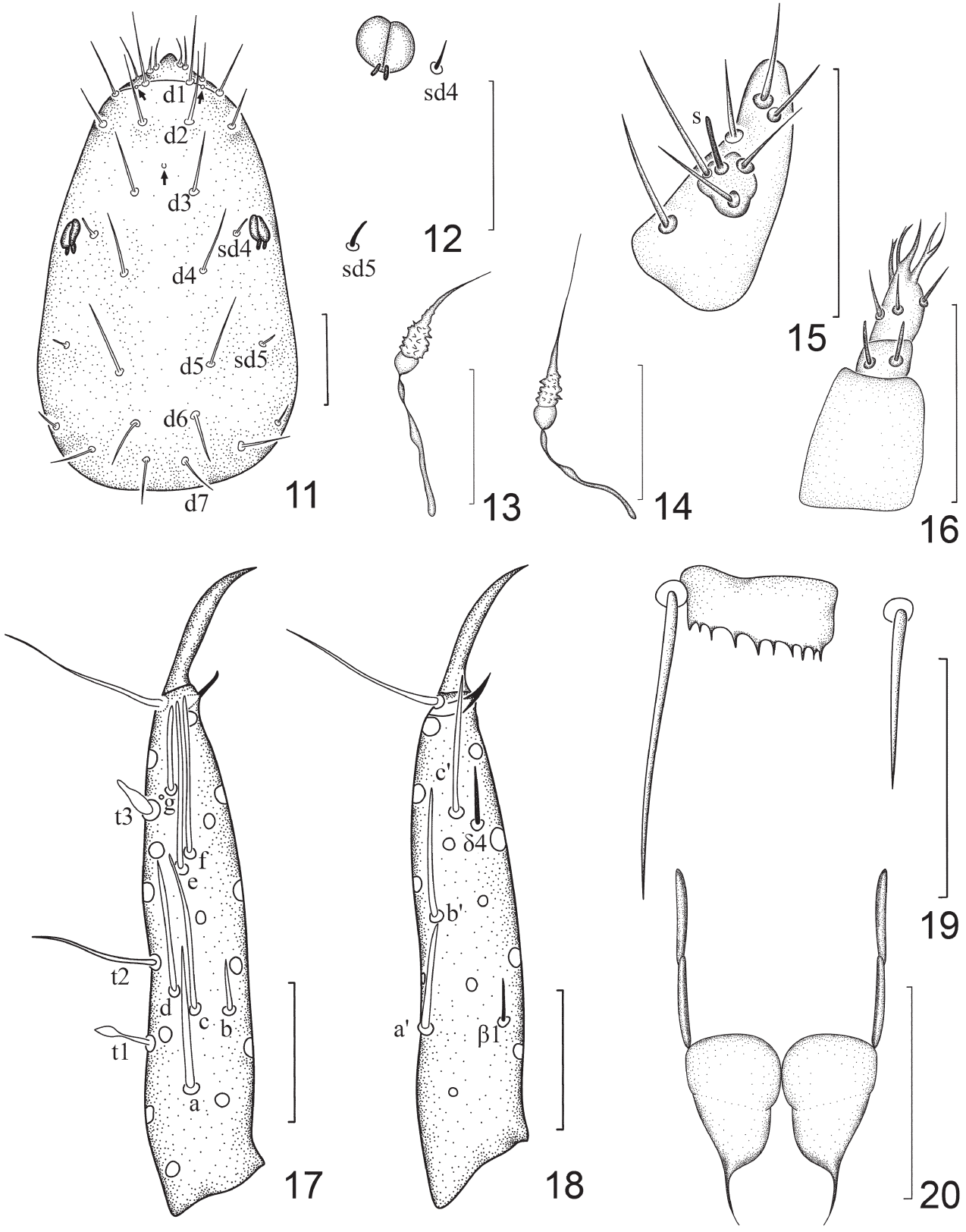
Thorax. Thoracic chaetotaxy formula given in Table 1. Setae *1* and *2* on pronotum 20–22 μm and 10–12 μm long, respectively. Accessory setae *P1a* and *P2a* on meso- and metanotum short and sensilliform. Setae *P1*, *P1a* and *P2* on mesonotum 16–18, 2 and 20–22 μm long. Seta *P5* on mesonotum pin-shaped, on metanotum rudimentary. Setae *A2* and *M2* on prosternum, *A2* on meso- and metasternum sensilliform, 3–5 μm in length (Figs. 4, 5). Length of middle tarsus 30–35 μm, claw length 13–15 μm. Length of hind tarsus 35–38 μm, claw length 15–18 μm. Empodium length 5–6 μm.

Abdominal chaetotaxy given in Table 1. Abdominal tergite I with 6/12 setae, *A5* short and sensilliform. Tergites II–III with three pairs of *A*-setae (*A1*, *A2* and *A5*), eight pairs of *P*-setae. Seta *P3* on tergites II–VI anterior to other *P*-row setae. Tergites IV–VII with three pairs of *A*-setae, nine pairs of *P*-setae (*P3a* present). Sternites IV–VII with chaetotaxy 3/8 (Figs. 9, 10). Accessory setae on tergites and sternites I–VII short, sensilliform, 5–7 μm in length (Figs. 6–10). Abdominal legs II and III each with two setae, subapical seta (16–18 μm) 2.3–2.5 times of length of apical seta (6–7 μm) (Fig. 7). Striate band on abdominal segment VIII with thick stripes laterally and sparse weak stripes medially (Figs. 21, 22). Comb on tergite VIII oblique rectangle, with 9–10 short teeth on hind margin (Fig. 19).

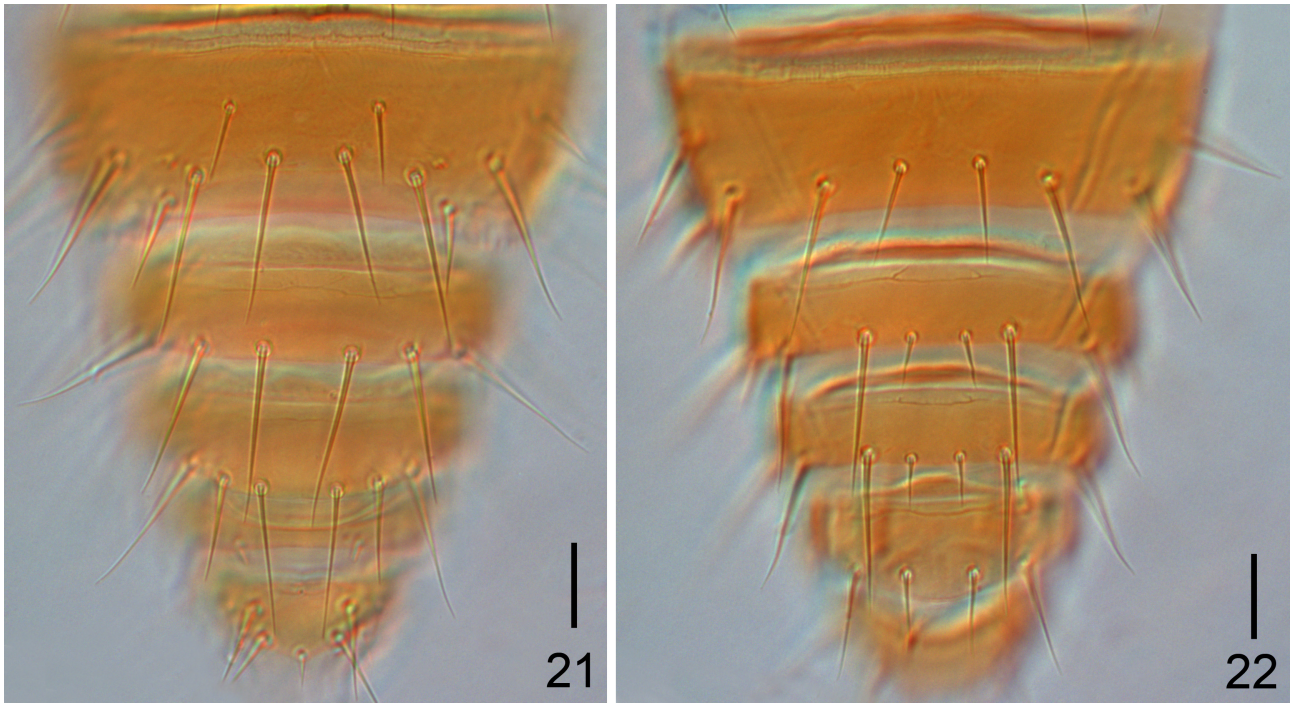


FIGURES 1–10. *Kenyentulus yintiaolingensis* **sp. nov.** (Holotype) 1, habitus, dorsal view; 2, pseudoculus, right side; 3, head, lateral view, shows maxillary gland; 4, prosternum; 5, metasternum; 6, sternite I; 7, sternite II; 8, ventral side of tergite VI; 9, sternite VI; 10, sternite VII. Arrows indicate pores. Scale bars: 100 µm in Figure 1, 20 µm in Figures 2–10.

Pores absent from pronotum, mesonotum with pores *sl* and *al*, metanotum with pore *sl* only, pro- and mesosternum without pores (Fig. 4), metasternum with 1 pore (Fig. 5). Tergite I with pore *psm*, other pores absent. Tergites II–VI with pores *al* and *psm*, VII with pores *al*, *psm* and *psl.* Tergite VIII with pores *psm* accompanied by teeth. Tergites



FIGURES 11–20. *Kenyentulus yintiaolingensis* **sp. nov.** (Holotype) 11, head, dorsal view, arrows indicate pores; 12, pseudoculus, left side; 13–14, maxillary gland; 15, labial palpus; 16, maxillary palpus; 17, foretarsus, exterior view; 18, foretarsus, interior view; 19, comb; 20, female squama genitalis. Scale bars: 20 μm.



FIGURES 21–22. *Kenyentulus yintiaolingensis* **sp. nov.** (Holotype) 21, tergites VIII–XII; 22, sternites VIII–XII. Scale bars: 20 µm.

TABLE 1. Adult chaetotaxy of *Kenyentulus yintiaolingensis* **sp. nov.**

		Dorsal		Ventral	
		Formula	Setae	Formula	Setae
Segment					
Th.	I	4	1, 2	$\frac{4-4}{6}$	A1, 2, M1, 2 P1, 2, 3
	II	$\frac{6}{16}$	A2, 4, M P1, 1a, 2, 2a, 3, 4, 5, 5a	$\frac{7-2}{4}$	Ac, 2, 3, 4, M P1, 2
	III	$\frac{6}{16}$	A2, 4, M P1, 1a, 2, 2a, 3, 4, 5, 5a	$\frac{7-2}{4}$	Ac, 2, 3, 4, M P1, 2
Abd.	I	$\frac{6}{12}$	A1, 2, 5 P1, 1a, 2, 2a, 3, 4	$\frac{3}{4}$	Ac, 2 P1, 2
	II–III	$\frac{6}{16}$	A1, 2, 5 P1, 1a, 2, 2a, 3, 4, 4a, 5	$\frac{3}{5}$	Ac, 2 Pc, 2, 3
	IV–VII	$\frac{6}{18}$	A1, 2, 5 P1, 1a, 2, 2a, 3, 3a, 4, 4a, 5	$\frac{3}{8}$	Ac, 2 P1, 1a, 2, 3
	VIII	$\frac{6}{16}$	A1, 4, 5 M1, 2, 3, 4, P2, 3, 4, 5	$\frac{4}{0}$	A1,2
	IX	14	1, 1a, 2, 2a, 3, 3a, 4	4	1, 2
	X	12	1, 1a, 2, 2a, 3, 4	4	1, 2
	XI	6	1, 2, 3	6	1, 2, 3
	XII	9		6	

IX–XI without pores, XII with a single middle pore. Sternite I without pores (Fig. 6). Sternites II–VI each with a pair of *spm* pores (Figs. 7, 9), VII with a *spm* pore asymmetrically (Fig. 10), VIII–XI without pores, XII with a pair of pore *al*. Membrane between tergites and sternites IV–VI each with one anteromembranal (*amb*) pore on each side (Fig. 8).

Female squama genitalis with pointed acrostyli (Fig. 20). Male squama genitalis with three pairs of dorsal setae and one pair of ventral setae.

Etymology. The new species is named after the type locality Yingtiaoling National Nature Reserve.

Distribution. Southwest China (Chongqing). Only known from the type locality.

Remarks. *Kenyentulus yintiaolingensis* **sp. nov.** is similar to *K. dolichadeni* Yin, 1987, *K. yaanensis* Tang & Yin, 1987, *K. sakimori* (Imadaté, 1977), and *K. monticola* Nakamaura, 1990 in the chaetotaxy on tergites IV–VII (Yin, 1999), but can be easily distinguished by the chaetotaxy of tergites II and III (6/16 in *K. yintiaolingensis* **sp. nov.** vs 6/18 in the other species), prosternum (*M2* seta present in *K. yintiaolingensis* **sp. nov.** vs *M2* setae absent in the others). It also differs from *K. dolichadei* in the shape of maxillary gland, comb and striate band, from *K. yaanensis* in the shape of the female squama genitalis, maxillary gland and the chaetotaxy of tergite VIII, from *K. sakimori* in the shape of maxillary gland, sensilla *a'*, *a* and *b* on foretarsus, and the chaetotaxy of tergite VIII, and from *K. monticola* in the length of sensilla *a'* and *b*, shape of striate band and comb on tergite VIII.

Family Eosentomidae Berlese, 1909

Genus *Eosentomon* Berlese, 1908

Type species: *Eosentomon transitorium* Berlese, 1908

Eosentomon wuxiense Bu & Gao, sp. nov.

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Figures 23–45, Table 2

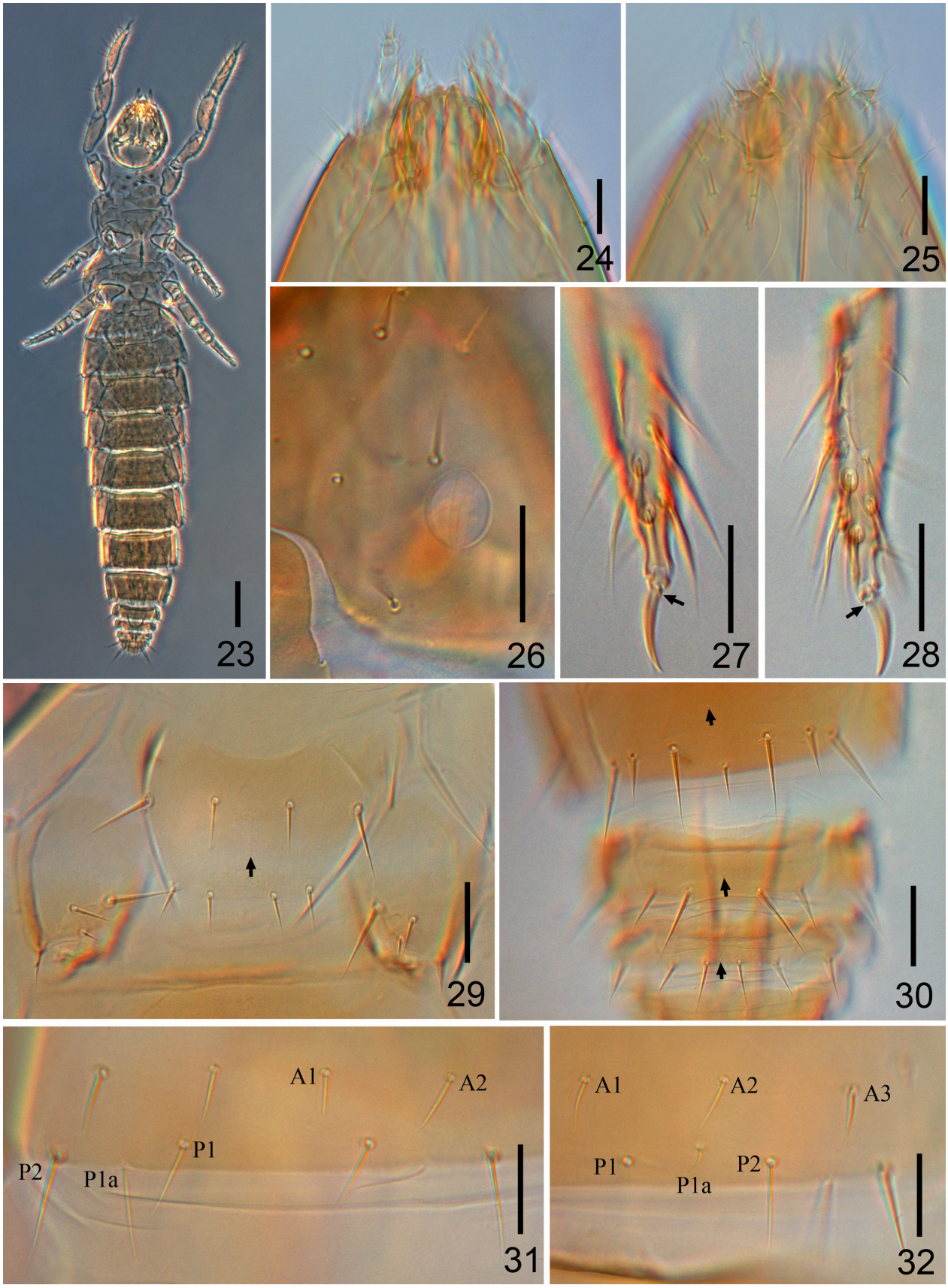
Type material. Holotype male (CQ-YTL-P2022105-1), China, Chongqing Municipality, Wuxi County, Yintiaoling National Natural Reserve, Lanying Grand Canyon, 31°26'N / 109°48'E, elev. 662 m, 16-VIII-2022, Yun Bu and Ya-Li Jin collected. **Paratypes** (16 females and 18 males): 5 females (CQ-YTL-P2022106-1, CQ-YTL-P2022107, CQ-YTL-P2022109-1, CQ-YTL-P2022110), 4 males (CQ-YTL-P2022105-2, CQ-YTL-P2022106-1, CQ-YTL-P2022108, CQ-YTL-P2022109-2), same data as holotype; 3 females (CQ-YTL-P2022058, CQ-YTL-P2022063), 3 males (CQ-YTL-P2022064, CQ-YTL-P2022065), China, Chongqing Municipality, Wuxi County, Shuangyang Town, Yintiaoling National Natural Reserve, Daqiaowan, 31°29'N / 109°49'E, elev. 1022 m, 11-VIII-2022; 3 females (CQ-YTL-P2022078–CQ-YTL-P2022080), 4 males (CQ-YTL-P2022081– CQ-YTL-P2022084), China, Chongqing Municipality, Wuxi County, Yintiaoling National Natural Reserve, Linkouzi, 31°28’N / 109°52’E, elev. 1250 m, 14-VIII-2022; 2 females (CQ-YTL-P2022112, CQ-YTL-P2022113-1), 2 males (CQ-YTL-P2022113-2, CQ-YTL-P2022114), Lanying Grand Canyon, 31°26’N / 109°50’E, elev. 894 m, 19-VIII-2022; 3 females (CQ-YTL-P2022128, CQ-YTL-P2022135), 5 males (CQ-YTL-P2022129, CQ-YTL-P2022130, CQ-YTL-P2022132, CQ-YTL-P2022134), China, Chongqing Municipality, Wuxi County, Yintiaoling National Natural Reserve, Shizhuzi, 31°32’N / 109°42’E, elev. 2154 m, 20-VIII-2022; All specimens were collected by Yun Bu and Ya-Li Jin. All types are deposited in Shanghai Natural History Museum (SNHM).

Diagnosis. *Eosentomon wuxiense* **sp. nov.** is characterized by the presence of foretarsal sensillum *b'-2*, *b* longer than *c*, both empodial appendages of middle and hind tarsi short, tergite V lacking seta *A3*, tergites VI and VII lacking setae *A1–A3*, sternites VIII–XI with chaetotaxy 0/7, 4, 4, 8 respectively, and seta *D2* on hind tarsus of normal shape.

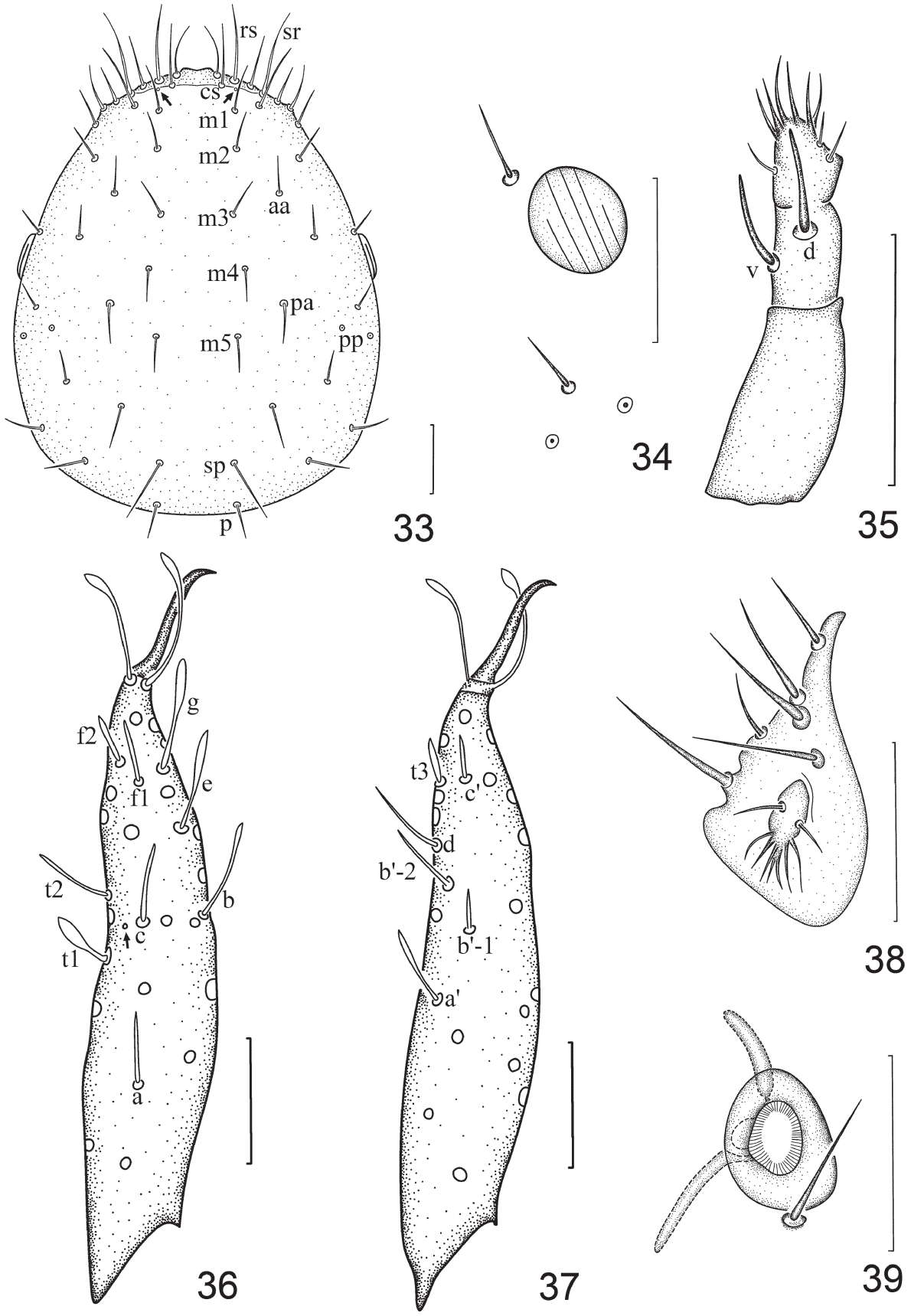
Description.

Adult body length 1250–1300 μm (n=20), yellow in color (Fig. 23).

Head oval, length 120–135 μm, width 100–115 μm. Head setae short, *sp* about 1.8–2.2 times length of *p*. Setae *aa* and *pa* present, sensilla *pp* distinct (Fig. 33). Rostral seta shorter than subrostral seta (Fig. 33). Pseudoculus



FIGURES 23–32. *Eosentomon wuxiense* **sp. nov.** (Holotype) 23, habitus, dorsal view; 24, head, ventral view, shows maxillary palpus; 25, head, ventral view, shows labial palpus; 26, pseudoculus, right side; 27–28, middle and hind tarsus, arrows indicate empodial appendages; 29, sternite I, arrow indicates pore; 30, sternite VIII–X, arrows indicate pores; 31, tergite I, middle part; 32, tergite II, right side. Scale bars: 100 µm in Figure 23, 20 µm in Figures 23–32.



FIGURES 33–39. *Eosentomon wuxiense* **sp. nov.** (Holotype) 33, head, dorsal view, arrows indicate pores; 34, pseudoculus, left side; 35, maxillary palpus; 36, foretarsus, exterior view, arrow indicates pore; 37, foretarsus, interior view; 38, labial palpus; 39, spiracle and tracheal camerae on mesonotum. Scale bars: 20 μm.

circular, length 13–15 µm, with three long lines and two short lines on surface (Figs. 26, 34). PR=8.7–10. Clypeal apodeme distinct. Labial palpus with tuft of setae (Figs. 25, 38). Maxillary palpus with two sensilla, dorsal sensillum same length as lateral one, 8–9 µm (Figs. 24, 35). Mandible with three small distinct apical teeth. Digits of galea well-developed, median and inner equal, shorter and thicker than outer (Fig. 24).

Foretarsus length 100–105 µm, claw length 18–23 µm, TR=4.8–5.2; empodium same length as claw, EU=1.0; S-shaped seta shorter than claw. Dorsal sensillum *t1* short and claviform, close to α3', BS=1.0–1.1, *t2* slender and *t3* short. Exterior sensilla *a* and *c* short, subequal, *b* longer than *c*, with broad apex, *d* slender, *e* and *g* spatulateand long, *f1* slender, *f2* short (Fig. 36). One pore present between *c* and *t1* (Fig. 36). Interior sensillum *a′* with proximal half broad, surpassing base of rod-like *b′-1*, *b′-2* filiform, *c′* short, rod-like (Fig. 37).

Thoracic chaetotaxy given in Table 2. Setae *1* and *2* on pronotum subequal, 17–20 µm in length. Spiracle diameter 8 µm. Tracheal camerae long and slender, 13–15 µm (Fig. 39). On mesonotum and metanotum, *P1a* situated posterior to the row of *P1* and *P2*. Setae *P1*, *P1a* and *P2* on mesonotum length 17–21, 20–24 and 22–25 µm, respectively. Metanotum with very short *P5a* adjacent to *P5*. Middle tarsus length 50–55 µm, claw length 13–15 µm (Fig. 27). Hind tarsus length 60–65 µm, claw length 15–17 µm (Fig. 28). Empodial appendages of middle and hind tarsi both short, 3–4 µm (Figs. 27, 28). Basal seta (seta *D2*) of hind tarsus of normal shape.

Abdominal chaetotaxy given in Table 2. Tergite I with two pairs of *A*-setae, six pairs of *P*-setae, *P1a* (22–23 µm) subequal to *P1*, situated posterior to the row of *P1* and *P2* (Fig. 31), *P3a* and *P4a* short, sensilliform. Seta *A3* on tergite V absent (Fig. 42). Setae *A1*, *A2* and *A3* absent on tergites VI and VII (Figs. 43, 44). Seta *P1a* on tergites II–VII short, 7–8 µm, sensilliform, situated anterior to level of *P1-P2* or same level with *P2* (Figs. 32, 40–44); *P2a* as same length and shape as *P1a* on tergites I (Figs. 40, 41). *P1a′* and *P2a* on tergite VIII short, 4–5 µm, sensillform. Sternite VIII with seven posterior setae (Fig. 30). Sternites IX–X each with two pairs of setae (Fig. 30). Abdominal legs on sternites I–III typical of the genus (Fig. 29).

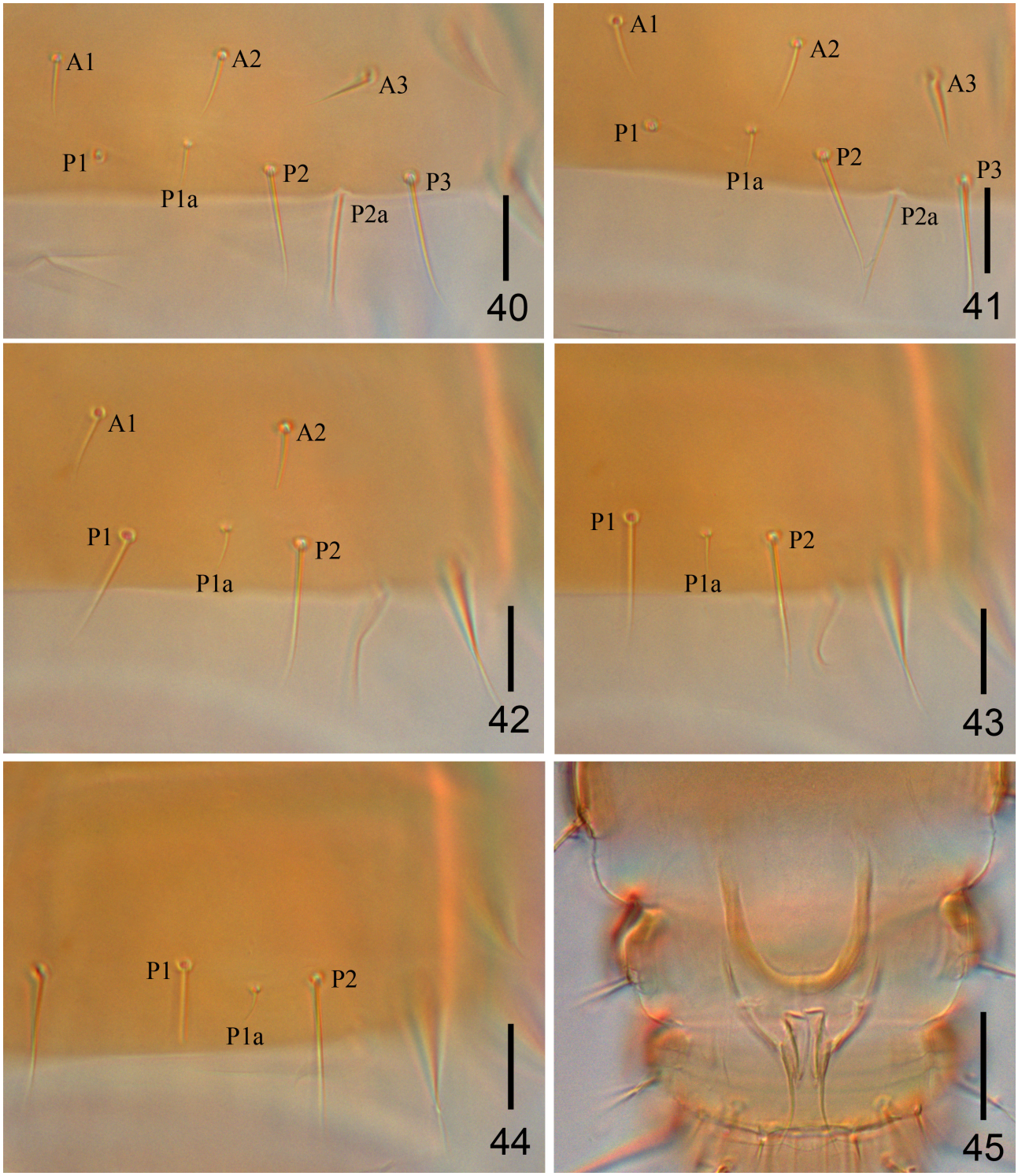
TABLE 2. Adult chaetotaxy of *Eosentomon wuxiense* **sp. nov.**

Segment		Dorsal		Ventral	
		Formula	Setae	Formula	Setae
Th.	I	4	1, 2	$\frac{6-2}{6}$	A1, 2, 3, M P1, 2, 3
	II	$\frac{6}{16}$	A2, 4, M P1, 1a, 2, 2a, 3, 3a, 4, 5	$\frac{6-2}{6}$	A1, 2, 3, M P1, 2, 3
	II	$\frac{6}{18}$	A2, 4, M P1, 1a, 2, 2a, 3, 3a, 4, 5, 5a	$\frac{6-4}{8}$	A1, 2, 3, M1, 2 P1, 1a, 2, 3
Abd.	I	$\frac{4}{12}$	A1, 2 P1, 1a, 2, 3, 3a, 4a	$\frac{4}{4}$	A1, 2 P1, 2
	II–III	$\frac{10}{16}$	A1, 2, 3, 4, 5 P1, 1a, 2, 2a, 3, 4, 4a, 5	$\frac{6}{4}$	A1, 2, 3 P1, 2
	IV	$\frac{10}{16}$	A1, 2, 3, 4, 5 P1, 1a, 2, 2a, 3, 4, 4a, 5	$\frac{6}{10}$	A1, 2, 3 P1, 2, 2a, 2a', 3
	V	$\frac{8}{16}$	A1, 2, 4, 5 P1, 1a, 2, 2a, 3, 4, 4a, 5	$\frac{6}{10}$	A1, 2, 3 P1, 2, 2a, 2a', 3
	VI–VII	$\frac{4}{16}$	A4, 5 P1, 1a, 2, 2a, 3, 4, 4a, 5	$\frac{6}{10}$	A1, 2, 3 P1, 2, 2a, 2a', 3
	VIII	$\frac{6}{9}$	M2, 3, 4 Pc, 1a, 1a', 2, 2a	$\frac{0}{7}$	Pc, 1, 1a, 2
	IX	8	1, 2, 3, 4	4	1, 2
	X	8	1, 2, 3, 4	4	1, 2
	XI	8	1, 2, 3, 4	8	1, 2, 3, 4
	XII	9		12	

Mesonotum and metanotum both with pores *sl* and *al*. Sterna of thorax without pores. Tergites I–VII with pore *psm*, VIII without pores, IX and X each with two medial and four large membranal pores, IX with one medial pore, XII with two anterior medial pores. Sternites I–X each with one medial pore (Figs. 29, 30), XI without pores, XII with one medial pore.

On female squama genitalis, caput processus pointed and curved towards the median edge of stylus, filum processus slim and long (Fig. 45). Male squama genitalis with three pairs of dorsal setae and two pairs of ventral setae.

Distribution. Southwest China (Chongqing). Only known from the type locality.



FIGURES 40–45. *Eosentomon wuxiense* **sp. nov.** (Holotype) 40, tergite III, right side; 41, tergite IV, right side; 42, tergite V, right side; 43, tergite VI, right side; 44, tergite VII, right side; 45, female squama genitalis. Scale bars: 20 µm.

Etymology. The new species is named after the type locality Wuxi County.

Remarks. *Eosentomon wuxiense* **sp. nov.** is similar to *E. yanshanense* Yin & Zhang, 1982, *E. chuxiongense* Yin, Xie & Imadaté, 1995, *E. huatingense* Yin, Xie & Imadaté, 1995 and *E. mizushimai* Nakamura, 2010 in the chaetotaxy of tergites and sternites, short empodial appendages on middle and hind tarsi. They can be distinguished by the shape of pseudoculus (three long and two short lines in *E. wuxiense* sp. nov., vs three long lines in *E. yanshanense*, three short lines with bubbles in *E. chuxiongense*, two long and three short lines and three bubbles in *E. huatingense*, and without inner structure in *E. mizushimai*), shape of seta *P1a* on tergites II–VI (short, sensilliform, situated anterior to level of *P1-P2* in *E. wuxiense* **sp. nov.**, vs long, similar to *P2a*, situated posterior to the level of *P1-P2* in the later four), as well as the shape of the female squama genitalis.

Checklist of Protura from Yingtiaoling National Nature Reserve

Family Hesperentomidae Price, 1960

Hesperentomon fopingense Bu, Shrubovych & Yin, 2011

Material examined. 6 females, 2 males, 1 prelarva, China, Chongqing Municipality, Wuxi County, Shuangyang Town, Yintiaoling National Natural Reserve, Daqiaowan, 31°29'N / 109°49'E, elev. 1022 m, 11-VIII-2022; 1 female, 1 male, 1 mj, China, Chongqing Municipality, Wuxi County, Yintiaoling National Natural Reserve, Linkouzi, Zhuanping 31°26'N / 109°54'E, elev. 1595 m, 15-VIII-2022; 1 female, 1 mj, China, Chongqing Municipality, Wuxi County, Yintiaoling National Natural Reserve, Shizhuzi, 31°32'N / 109°42'E, elev. 2154 m, 20-VIII-2022, Yun Bu and Ya-Li Jin, collectors.

Notes. This species was known previously only from Qinling Mountain. It is reported here from Yintiaoling for the first time. The specimens from Yintiaoling well match the characters of types, except for having 14 posterior setae on tergite I (12 in holotype).

Distribution. Chongqing, Shaanxi.

Hesperentomon pectigastrulum Yin, 1984

Material examined. 1 male, China, Chongqing Municipality, Wuxi County, Shuangyang Town, Yintiaoling National Natural Reserve, Hongqi, 31°31'N / 109°49'E, elev. 1263 m, 10-VIII-2022, Yun Bu and Ya-Li Jin, collectors.

Distribution. Chongqing, Shaanxi, Ningxia, Hebei, Shanxi.

Family Protentomidae Ewing, 1936

Condeellum ishiianum Imadaté, 1965

Material examined. 5 females, 6 mj, China, Chongqing Municipality, Wuxi County, Yintiaoling National Natural Reserve, Lanying Grand Canyon, 31°26'N / 109°48'E, elev. 662 m, 16-VIII-2022; 2 females, Lanying Grand Canyon, 31°26'N / 109°50'E, elev. 894 m, 19-VIII-2022, Yun Bu and Ya-Li Jin, collectors.

Distribution. Chongqing, Xizang, Qinghai, Yunnan, Sichuan; Thailand, Indonesia.

Condeellum regale (Condé, 1958)

Material examined. 12 females, China, Chongqing Municipality, Wuxi County, Shuangyang Town, Yintiaoling National Natural Reserve, Daqiaowan, 31°29'N / 109°49'E, elev. 1022 m, 11-VIII-2022, Yun Bu and Ya-Li Jin, collectors.

Distribution. Chongqing, Xizang; Nepal, Thailand, Reunion Island.

Family Berberentulidae Yin, 1983

***Kenyentulus chongqingensis* Tang & Yin, 1987**

Material examined. 1 female, China, Chongqing Municipality, Wuxi County, Yintiaoling National Natural Reserve, Linkouzi, Zhuanping, 31°26'N / 109°54'E, elev. 1595 m, 15-VIII-2022; 4 females, China, Chongqing Municipality, Wuxi County, Yintiaoling National Natural Reserve, Shizhuzi, 31°32'N / 109°42'E, elev. 2154 m, 20-VIII-2022, Yun Bu and Ya-Li Jin, collectors.

Notes. This species was originally described from Beibei district of Chongqing and was first found in Yintiaoling. The specimens from Yintiaoling have 8/18 chaetotaxy on both tergites V and VI, while types have 6/16 chaetotaxy on tergite V.

Distribution. Chongqing.

***Kenyentulus fanjingensis* Yin, 1992**

Material examined. 1 female, 1 male, 3 mj, China, Chongqing Municipality, Wuxi County, Yintiaoling National Natural Reserve, Tianchiba, 31°28'N / 109°47'E, elev. 2100 m, 12-VIII-2022; 1 male, China, Chongqing Municipality, Wuxi County, Yintiaoling National Natural Reserve, Linkouzi, 31°28'N / 109°52'E, elev. 1250 m, 14-VIII-2022, Yun Bu and Ya-Li Jin, collectors.

Distribution. Chongqing, Guizhou.

***Kenyentulus jinjiangensis* Tang & Yin, 1986**

Material examined. 1 female, 1 male, China, Chongqing Municipality, Wuxi County, Yintiaoling National Natural Reserve, Linkouzi, Zhuanping, 31°28'N / 109°52'E, elev. 1250 m, 14-VIII-2022; 1 female, China, Chongqing Municipality, Wuxi County, Yintiaoling National Natural Reserve, Linkouzi, 31°26'N / 109°54'E, elev. 1595 m, 15-VIII-2022, Yun Bu and Ya-Li Jin, collectors.

Distribution. Chongqing, Sichuan, Guizhou, Jiangxi.

***Kenyentulus jiuzhaiensis* Tang & Yin, 1986**

Material examined. 2 females, China, Chongqing Municipality, Wuxi County, Shuangyang Town, Yintiaoling National Natural Reserve, Daqiaowan, 31°29'N / 109°49'E, elev. 1022 m, 11-VIII-2022; 2 female, China, Chongqing Municipality, Wuxi County, Yintiaoling National Natural Reserve, Lanying Grand Canyon, 31°26'N / 109°48'E, elev. 662 m, 16-VIII-2022; 1 female, 1 male, China, Chongqing Municipality, Wuxi County, Yintiaoling National Natural Reserve, Shizhuzi, 31°32'N / 109°42'E, elev. 2154 m, 20-VIII-2022, Yun Bu and Ya-Li Jin, collectors.

Distribution. Chongqing, Sichuan.

***Kenyentulus sanjianus* (Imadaté, 1965)**

Material examined. 1 male, China, Chongqing Municipality, Wuxi County, Yintiaoling National Natural Reserve, Linkouzi, 31°28'N / 109°52'E, elev. 1250 m, 14-VIII-2022, Yun Bu and Ya-Li Jin, collectors.

Distribution. Chongqing, Zhejiang, Jiangxi, Hubei, Hunan, Yunnan; Brunei.

***Kenyentulus yintiaolingensis* Bu & Gao, sp. nov.**

Description. The description is given above.

Baculentulus xizangensis Bai & Bu, 2013

Material examined. 1 female, 1 male, 1 mj, China, Chongqing Municipality, Wuxi County, Yintiaoling National Natural Reserve, Linkouzi, Zhuanping, 31°26'N / 109°54'E, elev. 1595 m, 15-VIII-2022, Yun Bu and Ya-Li Jin, collectors.

Distribution. Chongqing, Xizang.

Family Eosentomidae Berlese, 1909

Zhongguohentomon sp.

Material examined. 1 male, China, Chongqing Municipality, Wuxi County, Yintiaoling National Natural Reserve, Linkouzi, Zhuanping, 31°26'N / 109°54'E, elev. 1595 m, 15-VIII-2022, Yun Bu and Ya-Li Jin, collectors.

Notes. *Zhongguohentomon* Yin, 1979 is an endemic genus to China with only two described species (Yin, 1999). The present taxon is characterized by the presence of posterior central setae *Pc* on tergites II–VII with 10/17 chaetotaxy, and 0/9, 4, 4 setae on sternites VIII–X, which are different from the two congeners and apparently be a new species. Its chaetotaxy for adults was given in Table 3. Only one male has been collected up to now and is not well preserved. Additional specimens will be needed to clarify its status.

Distribution. Chongqing.

TABLE 3. Adult chaetotaxy of *Zhongguohentomon* sp.

	Th. I	II	III	Abd. I	II–III	IV–VII	VIII	IX	X	XI	XII
Dorsal	4	$\frac{6}{18}$	$\frac{6}{18}$	$\frac{6}{13}$	$\frac{10}{17}$	$\frac{10}{17}$	$\frac{6}{9}$	10	10	8	9
Ventral	$\frac{6-2}{6}$	$\frac{6-2}{6}$	$\frac{6-4}{8}$	$\frac{4}{4}$	$\frac{6}{4}$	$\frac{6}{10}$	$\frac{0}{9}$	4	4	8	12

Eosentomon megalenum Yin, 1990

Material examined. 2 females, China, Chongqing Municipality, Wuxi County, Shuangyang Town, Yintiaoling National Natural Reserve, Daqiaowan, 31°29'N / 109°49'E, elev. 1022 m, 11-VIII-2022, Yun Bu and Ya-Li Jin, collectors.

Distribution. Chongqing, Shaanxi, Ningxia, Gansu, Jiangsu, Shanghai, Hubei, Hunan, Sichuan, Guizhou, Yunnan.

Eosentomon orientale Yin, 1965

Material examined. 1 female, 1 mj, China, Chongqing Municipality, Wuxi County, Shuangyang Town, Yintiaoling National Natural Reserve, Daqiaowan, 31°29'N / 109°49'E, elev. 1022 m, 11-VIII-2022; 1 male, China, Chongqing Municipality, Wuxi County, Yintiaoling National Natural Reserve, Tianchiba, 31°28'N / 109°47'E, elev. 2100 m, 12-VIII-2022; 1 female, China, Chongqing Municipality, Wuxi County, Yintiaoling National Natural Reserve, Shizhuzi, 31°32'N / 109°42'E, elev. 2154 m, 20-VIII-2022, Yun Bu and Ya-Li Jin, collectors.

Distribution. Chongqing, Liaoning, Shaanxi, Ningxia, Gansu, Qinghai, Jiangsu, Shanghai, Anhui, Zhejiang, Hubei, Jiangxi, Hunan, Guangdong, Hainan, Guangxi, Sichuan, Guizhou.

Eosentomon jinxiuense Yin, 1965

Material examined. 4 females, 1 mj, China, Chongqing Municipality, Wuxi County, Shuangyang Town, Yintiaoling National Natural Reserve, Daqiaowan, 31°29'N / 109°49'E, elev. 1022 m, 11-VIII-2022, Yun Bu and Ya-Li Jin, collectors.

Distribution. Chongqing, Guangxi, Sichuan, Guizhou, Yunnan.

Eosentomon chishiaensis Yin, 1965

Material examined. 1 female, 1 male, China, Chongqing Municipality, Wuxi County, Yintiaoling National Natural Reserve, Tianchiba, 31°28'N / 109°47'E, elev. 2100 m, 12-VIII-2022, Yun Bu and Ya-Li Jin, collectors.

Distribution. Chongqing, Shaanxi, Gansu, Jiangsu, Shanghai, Anhui, Zhejiang, Hubei, Hunan, Guangdong.

Eosentomon commune Yin, 1965

Material examined. 2 females, 1 male, China, Chongqing Municipality, Wuxi County, Shuangyang Town, Yintiaoling National Natural Reserve, Daqiaowan, 31°29'N / 109°49'E, elev. 1022 m, 11-VIII-2022, Yun Bu and Ya-Li Jin, collectors.

Distribution. Chongqing, Jiangsu, Shanghai, Anhui, Zhejiang, Jiangxi, Hubei, Hunan, Sichuan, Guizhou, Yunnan.

Eosentomon sakura Imadaté & Yosii, 1959

Material examined. 4 females, 1 mj, China, Chongqing Municipality, Wuxi County, Shuangyang Town, Yintiaoling National Natural Reserve, Daqiaowan, 31°29’N / 109°49’E, elev. 1022 m, 11-VIII-2022; 2 females, China, Chongqing Municipality, Wuxi County, Yintiaoling National Natural Reserve, Lanying Grand Canyon, 31°26’N / 109°48’E, elev. 662 m, 16-VIII-2022; 3 females, 4 mj, Lanying Grand Canyon, 31°26’N / 109°50’E, elev. 894 m, 19-VIII-2022; 1 male, 1 mj, China, Chongqing Municipality, Wuxi County, Yintiaoling National Natural Reserve, Shizhuzi, 31°32’N / 109°42’E, elev. 2154 m, 20-VIII-2022, Yun Bu and Ya-Li Jin, collectors.

Distribution. Chongqing, Shaanxi, Jiangsu, Shanghai, Anhui, Zhejiang, Jiangxi, Hubei, Hunan, Fujian, Taiwan, Guangdong, Hainan, Xianggang, Guangxi, Sichuan, Guizhou, Yunnan; Japan.

Eosentomon wuxiense Bu & Gao, sp. nov.

Description. The description is given above.

Discussion

Nineteen species of Protura were found in the Yintiaoling National Nature Reserve, including 16 oriental realm species and three palaearctic realm species. Among them, only *Kenyentulus chongqingensis*, *Eosentomon megaglenum*, *Eosentomon commune* and *Eosentomon orientale* were previously recorded in Chongqing Municipality (Yin, 1999; Chen *et al*. 2011); the other 15 species are reported from Chongqing for the first time. The present study raises the number of known proturan species in Chongqing to 30. The dominant groups in Yintiaoling are families Berberentulidae and Eosentomidae, containing 15 species, which are similar to the proturan fauna of Zhejiang Province (Bu *et al*. 2020). Interestingly, two species of the family Hesperentomidae, *H. fopingense* and *H. pectigastrulum* were also found in Yintiaoling. Most species of Hesperentomidae belong to Palaearctic elements, which further indicate a special geographical position of Yintiaoling.

Other surveyed nature reserves have relatively fewer known proturan species: 15 species of proturan in Liupan Mountain (Bu & Yin, 2010), three in Helan Mountain (Bu & Yin, 2013), 27 in Tianmu Mountain (Bu & Yin, 2014b), 10 in Qingliangfeng (Bu & Yin, 2014a), 14 in Lishan (Bu, 2018), 22 in Qinling Mountain (Bu & Yin, 2018) and 14 in Jiulong Mountain (Bu & Gao, 2021). In comparison, the diversity of Protura in the Yintiaoling National Nature Reserve is relatively high. Comprehensive investigation is needed in Chongqing in the future to reveal the real diversity of Protura.

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