

## Two new species of *Neoribates* (*Neoribates*) Berlese, 1914 from China (Acari, Oribatida, Parakalummidae)

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**Abstract.** Two new oribatid mite species, *Neoribates* (*N.*) *cheni* and *Neoribates* (*N.*) *particula* spp. nov. are described from soil and litter of bamboo and under moss from China. *Neoribates* (*N.*) *cheni* sp. nov. is morphologically most similar to *Neoribates* (*N.*) *spindleformis* Ermilov, 2012 but differs from it in the number of leg claws and the position of epimeral setae. *Neoribates* (*N.*) *particula* sp. nov. is morphologically most similar to *Neoribates* (*N.*) *gracilis* Travé, 1972 but differs from it in the shape and size of rostral and lamellar setae, and the position of adanal setae *ad3*.

**Keywords.** Oribatid mites, Parakalummidae, *Neoribates*, new species, China.

### INTRODUCTION

The oribatid mite family Parakalummidae Grandjean, 1936 is the second biggest in the superfamily Galumnoidea consisting of 2 genera 3 subgenera 45 species and 1 subspecies (Subías 2004, online version 2012). The genus *Neoribates* was proposed by Berlese (1914) with the type species *Oribata roubali* Berlese, 1910. Currently, this genus comprises 2 subgenera 42 species and one subspecies and has a cosmopolitan distribution (Subías 2004, 2012). Previously only 5 species of this family; *Neoribates* (*N.*) *rotundus* Aoki, 1982, *Neoribates* (*N.*) *roubali* (Berlese, 1910), *Neoribates* (*Parakalumma*) *lydia* (Jacot, 1923), *Neoribates* (*N.*) *parvisetigerum* Aoki, 1965 and *Sandenia laiae* (Tseng, 1984), were known to be found in China (Chen 2010), of which three belong to the subgenus *Neoribates* (*Neoribates*).

Working on a material from Guizhou, Ningxia and Shanxi Province of China, two new species of the subgenus *Neoribates* (*Neoribates*): *Neoribates* (*N.*) *cheni* and *Neoribates* (*N.*) *particula* spp. nov. were discovered. Their morphological descriptions and illustrations are herewith presented.

### MATERIAL AND METHODS

Specimens were examined in lactic acid, mounted on temporary cavity slides for the duration of the study, and then stored in vials in 75% alcohol. All measurements are presented in micrometers. Body length was measured in lateral view, from the tip of the rostrum to the posterior edge of the ventral plate, to avoid discrepancies caused by different degrees of notogastral distension. Notogastral width refers to the maximum width in dorsal aspect. General terminology used in this paper follows that of Norton & Behan-Pelletier (2009).

Formulae of leg setation are given in order of trochanter-femur-genu-tibia-tarsus (famulus included). Formulae of leg solenidia are given (in parentheses) in order of genu-tibia-tarsus.

### TAXONOMY

#### *Neoribates* (*N.*) *cheni* sp. nov.

(Figures 1–7)

*Diagnosis.* Body size 475–570 × 385–430. Body surface smooth. Rostral, lamellar and inter-

lamellar setae long. Sensilli spindle-form. Four pairs of genital setae. All legs tarsi heterotridactylous.

*Material examined.* *Holotype* (female). South-western China, Guizhou Province, Chishui Bamboo National Forest Park, 27°52' N, 107°18' E, bamboo forest, litter of bamboo, 14. Aug. 2012, collected by Prof. Maofa Yang (GUGC).

*Paratypes* 5 (female), with same data as of the holotype; one (female), Southwest China, Guizhou Province, Kuankuoshui Natural Reserve, 28°22' N, 107°15' E, soil of under broad-leaved forest, 15. Aug. 2010, collected by Wenqin Liang (GUGC); 6 (female), Northwest China, Shanxi Province, Ziboshan National Forest Park, 33°40' N, 106°47' E, under the moss, 22. July 2010, collected by Wenqin Liang and Qiuxiao Tang (GUGC).

*Measurements.* Body length 550, notogaster length 440 (holotype), 475–570 (five paratypes), width 420 (holotype), 385–430 (five paratypes).

*Integument* (Fig. 1). Body color brown to dark brown. Body surface smooth. Anterolateral parts of notogaster with radiate impressions and light spots. Epimeral region with some light spots.

*Prodorsum* (Figs. 1, 6). Rostrum protruding, rounded in dorsal view. Rostral (*ro*, 72–80) and lamellar (*le*, 95–106) setae setiform, distinctly barbed. Interlamellar (*in*, 120–133) and exobothridial (*ex*, 6–10) setae setiform, slightly or indistinctly barbed. Sensilli (*ss*, 131–148) spindle-form, smooth or indistinctly barbed, with long stalk (72–85), fusiform head (21–28) and thin apex (23–31). Porose areas *Ad* absent. Lamellae (*Lam*) thin.

*Notogaster* (Figs. 1, 5). Dorsosejugal furrow convex, conspicuous. Notogaster slightly ball shaped, long nearly equal to wide. Notogastral setae represented by 10 pairs of alveoli. Four pairs of sacculi (*Sa*, *S1–S3*) and all lyrifissures located as typical for the genus. Median pore absent.

*Gnathosoma* (Fig. 4). Morphology typical for *Neoribates* (e.g. Travé 1972, Grishina & Vladimirova 2009, Nakamura 2009).

*Epimeral region* (Figs. 2, 3). Epimeral setal formula: 3–1–3–3. All setae short, smooth, seti-

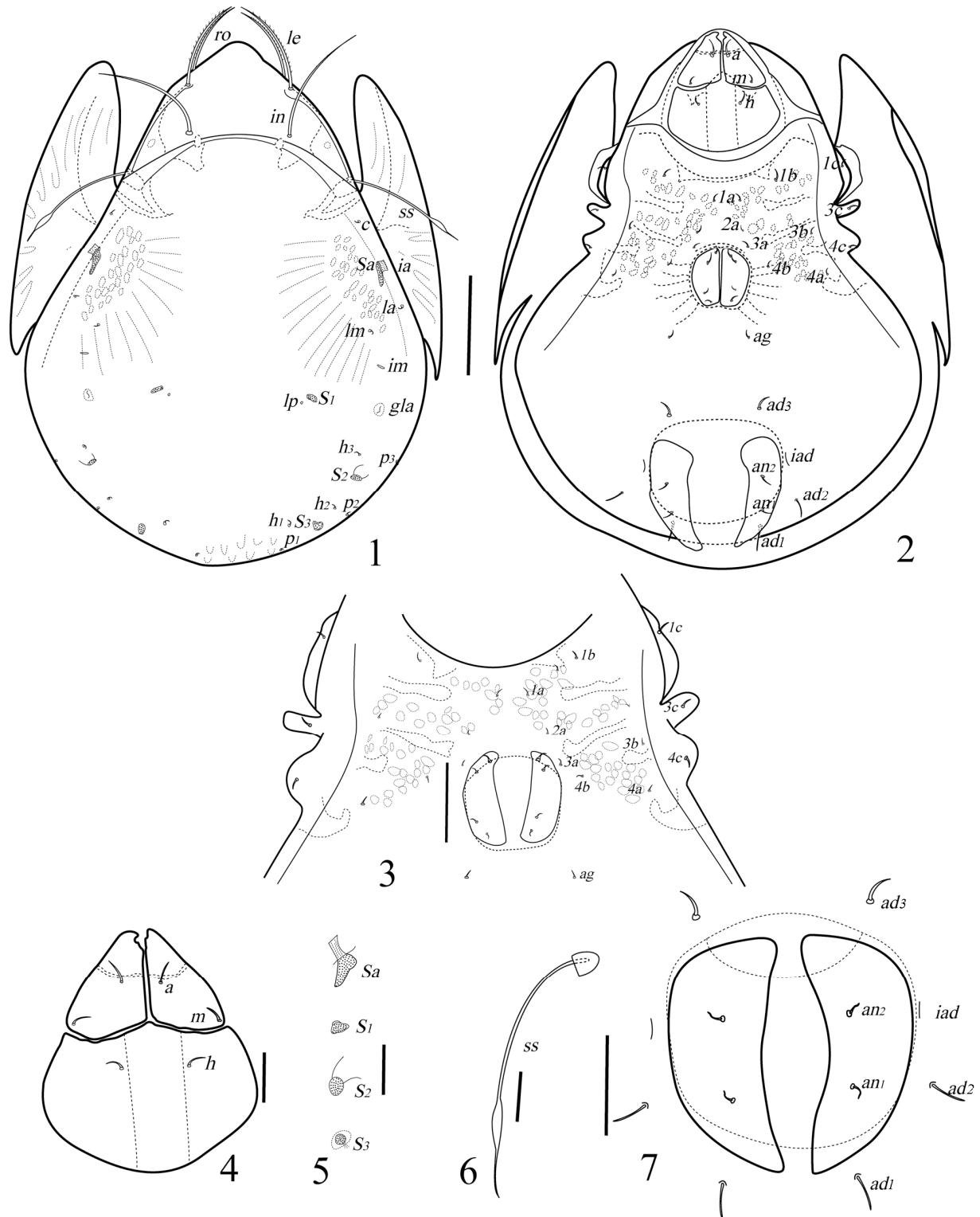
form. The distance of setae 3a–3a longer than 2a–2a, slightly wider than the genital pore.

*Anogenital region* (Figs. 2, 3, 7). Four pairs of genital (*g1–g4*, 3–8), one pair of aggenital (*ag*, 3–5), three pairs of adanal (*ad1–ad3*, 10–12) and two pairs of anal (*an1*, *an2*, 8–10) setae thin and smooth. Lyrifissures *iad* located in inverse apopanal position. Adanal setae *ad3* positioned anterior to anal opening. Postanal porose area absent.

*Legs.* Morphology of leg segments, setae and solenidia typical for *Neoribates* (e.g. Travé 1972, Grishina & Vladimirova 2009, Nakamura 2009). All legs tridactylous, with strong median and slender lateral claws. Formulae of leg setation and solenidia: I (1–5–3–4–19) [1–2–2], II (1–5–3–4–15) [1–1–2], III (2–3–1–3–15) [1–1–0], IV (1–2–2–4–12) [0–0–0]; homology of setae and solenidia indicated in Table 1.

*Remarks.* *Neoribates* (*N.*) *cheni* sp. nov. is most similar to *Neoribates* (*N.*) *spindleformis* Ermilov, 2012 described from Southern Vietnam, but clearly differs from it by the following characters: rostral and lamellar setae with distinct barbs (*versus* indistinct in *N.* (*N.*) *spindleformis*); all legs tridactylous (*versus* leg tarsi I with one claw, leg tarsi II–IV with two claws); the distance of epimeral setae 3a–3a longer than 2a–2a, slightly wider than the genital pore (*versus* distinctly shorter than genital pore in *N.* (*N.*) *spindleformis*); 1a far from 2a (*versus* close in *N.* (*N.*) *spindleformis*).

This new species is also similar to *Neoribates* (*N.*) *gracilis* Travé, 1972 from Southern Europe, but clearly differs from the latter by being the epimeral setal distance 3a–3a slightly wider than the genital pore (*versus* distinctly shorter in *N.* (*N.*) *gracilis*); genital plates with four pairs of genital setae (*versus* five pairs in *N.* (*N.*) *gracilis*). *Neoribates cheni* sp. nov. is easily distinguishable from other species reported from China: *Neoribates* (*N.*) *rotundus* Aoki, 1982 and *Neoribates* (*N.*) *roubali* (Berlese, 1910) by the fusiform sensilli, possessing thin and long apex (*versus* setiform in *Neoribates* (*N.*) *rotundus*, its head shortly fusiform and provided with barbs in *N.* *roubali*).



**Figures 1–7.** *Neoribates* (*N.*) *cheni* sp. nov. 1 = dorsal view, 2 = ventral view, 3 = anterior of ventral plate, 4 = hypostome, 5 = saccules, 6 = sensillus, 7 = anal plate with adanal setae *ad1*, *ad2*, *ad3* and lyrifissure *iad*. Scale bars (1, 2) 100  $\mu$ m, (3, 7) 50  $\mu$ m, (4, 5, 6) 25  $\mu$ m.

*Etymology.* The new species is named in honour of the Chinese oribatid mite experts, Dr. Jun Chen, Institute of Zoology, Chinese Academy of Sciences.

*Type deposition.* All examined specimens are deposited in the collection of the Institute of Entomology, Guizhou University, Guizhou, China (GUGC).

***Neoribates* (*N.*) *particula* sp. nov.**

(Figures 8–15)

*Diagnosis.* Body size 475–500 × 330–360 (male), 520–570 × 380–400 (female). Body surface smooth. Rostral, lamellar setae shorter than half of the interlamellar setae, setiform, smooth or indistinctly barbed. Interlamellar setae setiform, smooth, not extended to the margins of rostrum. Sensilli spindle-form. Five pairs of genital setae. All legs tarsi heterotridactylous.

*Material examined.* *Holotype* (male). Northwestern China, Ningxia Hui Autonomous region, Jingyuan County, 35°21' N, 106°20' E, pine needles, 8. July 2009, collected by Tianci Yi (GUGC).

*Paratypes* 4 (male), 3 (female), with same data as of the holotype.

*Measurements.* Body length 480, notogaster length 385 (holotype, male), 475–500 (four paratypes, male), 520–570 (three paratypes, female); width 335 (holotype), 330–360 (four paratypes, male), 380–400 (three paratypes, female).

*Integument* (Fig. 8). Body color light brown. Notogaster with lots of particles. Anterolateral parts of notogaster with radiate impressions, around of notogaster with some light spots. Epimeral region smooth.

*Prodorsum* (Figs. 8, 11, 12). Rostrum protruding, rounded in dorsal view. Rostral (*ro*, 34–40), lamellar (*le*, 31–44), interlamellar (*in*, 67–90) and exobothridial (*ex*, 6–8) setae setiform, slightly or indistinctly barbed. Sensilli (*ss*, 122–140) spindle-form, smooth or indistinctly barbed, with well developed stalk (71–92), oblong head (28–31) and

thin apex (16–19). Porose areas *Ad* absent. Lamellae (*Lam*) thin, end of lamellar lines extended within a short distance.

*Notogaster* (Figs. 8, 10, 13). Dorsosejugal furrow convex, conspicuous. Notogaster oval, distinctly longer than wide. Notogastral setae represented by 10 pairs of alveoli. Four pairs of sacculi (*Sa*, *S1–S3*) and all lyrifissures located as typical for the genus, *S1–S3* indistinct. Median pore absent.

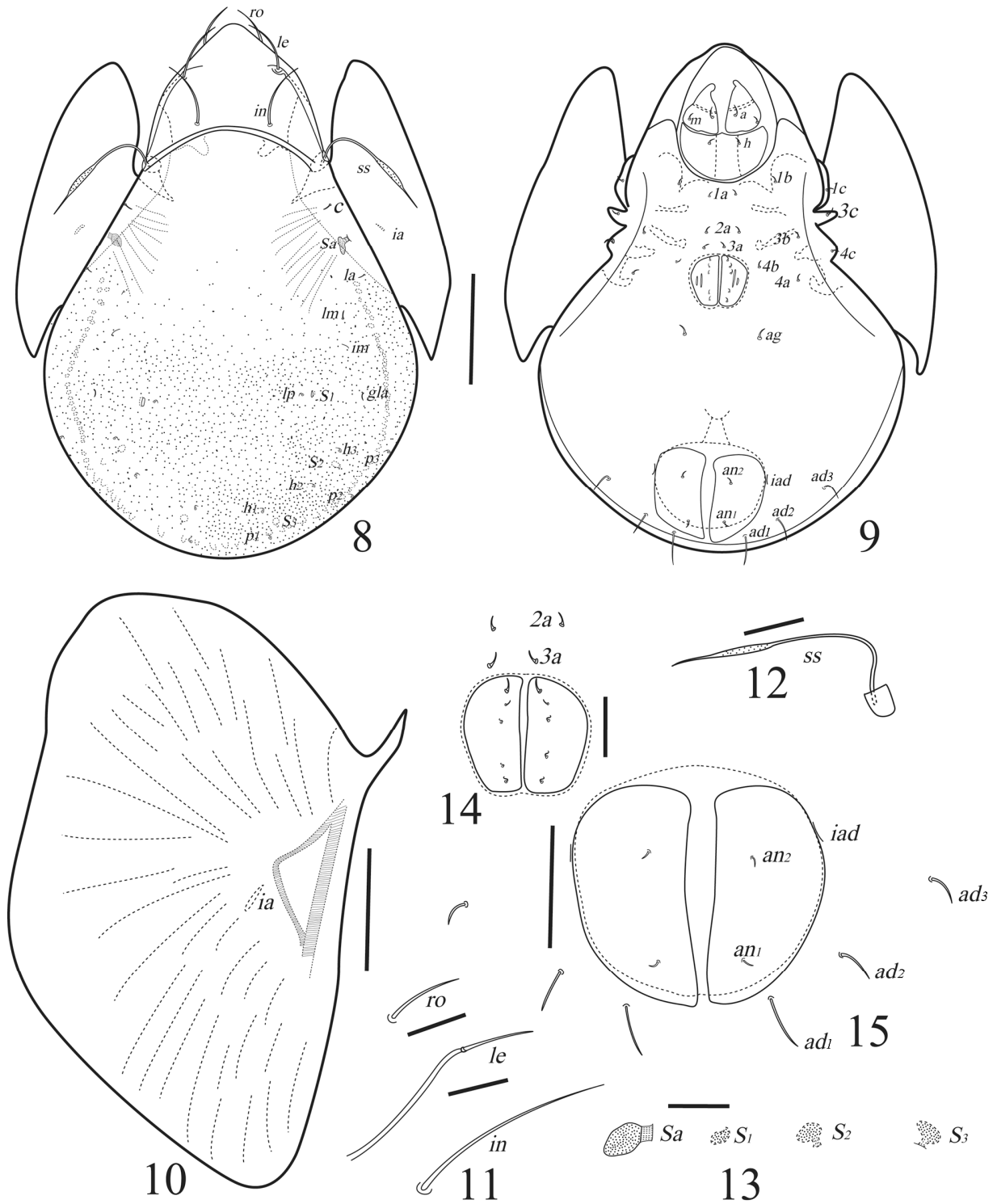
*Gnathosoma.* Morphology typical for *Neoribates* (e.g. Travé 1972, Grishina & Vladimirova 2009, Nakamura 2009).

*Epimeral region* (Fig. 9). Epimeral setal formula: 3–1–3–3. All setae short, smooth, setiform. The distance of setae 3a–3a shorter than 2a–2a, and shorter than half width of the genital pore.

*Anogenital region* (Figs. 9, 14, 15). Five pairs of genital (*g1–g5*, 3–6), one pair of aggenital (*ag*, 6–8), three pairs of adanal (*ad1–ad3*, 14–25) and two pairs of anal (*an1*, *an2*, 5–7) setae thin and smooth. Lyrifissures *iad* located in inverse apopanal position. Adanal setae *ad3* located on the lateral border of anal pore, positioned from *iad* at a large distance. Postanal porose area absent.

*Legs.* Morphology of leg segments, setae and solenidia typical for *Neoribates* (e.g. Travé 1972, Grishina & Vladimirova 2009, Nakamura 2009). All legs tridactylous with strong median and slender lateral claws. Formulae of leg setation and solenidia: I (1–5–3–4–20) [1–2–2], II (1–5–3–4–15) [1–1–2], III (2–3–1–3–15) [1–1–0], IV (1–2–2–4–12) [0–0–0]; homology of setae and solenidia indicated in Table 1.

*Remarks.* *Neoribates* (*N.*) *particula* sp. nov. is most similar to the other new species *Neoribates* (*N.*) *cheni* sp. nov. but clearly differs from it by the following characters: rostral and lamellar setae smooth or indistinctly barbed, interlamellar setae not extended to the margins of rostrum (*versus* rostral and lamellar setae with distinct barbs, interlamellar setae long, extended more than the margins of rostrum in *N.* (*N.*) *cheni* sp. nov.); the distance of epimeral setae 3a–3a shorter than 2a–2a (*versus* longer in *N.* (*N.*) *cheni* sp. nov.); genital plates with five pairs of genital setae (*versus* four pairs in *N.* (*N.*) *cheni* sp. nov.); adanal se-



**Figures 8–15.** *Neoribates particula* sp. nov. 8 = dorsal view, 9 = ventral view, 10 = pteromorph, 11 = rostral, lamellar and interlamellar setae, 12 = sensillus, 13 = saccules, 14 = genital plates with epimeral setae 2a and 3a, 15 = anal plate with adanal setae *ad1*, *ad2*, *ad3* and lyrifissure *iad*.  
Scale bars (8, 9) 100  $\mu$ m, (10, 15) 50  $\mu$ m, (11–14) 25  $\mu$ m.

tae *ad3* located on the lateral border of anal pore, positioned from *iad* at a large distance (*versus* anterior to anal opening in *N. (N.) cheni* sp. nov.).

This new species is also similar to *Neoribates (N.) gracilis* Travé, 1972, but differs from it in the shape and size of rostral, lamellar and interlamellar setae and the position of adanal setae *ad3*.

*Etymology.* The specific epithet “*particula*”

refers to the notogastral surface possessing lots of particles.

*Type deposition.* All examined specimens are deposited in the collection of the Institute of Entomology, Guizhou University, Guizhou, China

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**Table 1.** Leg setation and solenidia of *Neoribates (N.) cheni* sp. nov. (same for *Neoribates (N.) particula* sp. nov.)

Legs	Trochanters	Femora	Genua	Tibiae	Tarsi
I	v'	d, (l), bv'', v''	(l), v', σ	(l), (v), φ <sub>1</sub> , φ <sub>2</sub>	(ft), (tc), (it), (p), (u), (a), s, (pv), v', (pl), l'', e, ω <sub>1</sub> , ω <sub>2</sub>
II	v'	d, (l), bv'', v''	(l), v', σ	(l), (v), φ	(ft), (tc), (it), (p), (u), (a), s, (pv), ω <sub>1</sub> , ω <sub>2</sub>
III	l', v'	d, l', ev'	l', σ	l', (v), φ	(ft), (tc), (it), (p), (u), (a), s, (pv)
IV	v'	d, ev'	d, l'	d, l', (v)	ft'', (tc), (p), (u), (a), s, (pv)

\*Roman letters refer to normal setae (e–famulus), Greek letters refer to solenidia. A prime (') marks anterolateral setae and a double prime (") posterolateral setae of the given leg segment. Parentheses refer to a pair of setae.

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