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Allogalumna rugata, a new species of oribatid mite from China (Acari, Oribatida, Galumnidae)

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ABSTRACT — The genus *Allogalumna* Grandjean, 1936 is reported for the first time from China, and a new species *Allogalumna rugata* n. sp. is described from Qinghai Province. This species is distinguishable from other species of the genus by the combination of the following character states: bothridial setae setiform, slightly barbed at the end, four pairs of oval notogastral porose areas present; surface of genital and anal plates with dense thin wrinkle; postanal porose area absent.

KEYWORDS — Oribatida; Galumnidae; *Allogalumna*; new species; new record; China

INTRODUCTION

The family Galumnidae (Acari: Oribatida) is one of the large groups of oribatid mites. This family includes 34 genera with more than 470 species and 33 subspecies. *Allogalumna* is a genus of Galumnidae that was proposed by Grandjean (1936) with *Galumna alamellae* Jacot, 1935 as type species. Currently, it comprises 34 species having a cosmopolitan distribution collectively (data summarized by Subías (2004, updated 2015)).

In the present work, we propose a new species of the genus *Allogalumna* collected from Qinghai Province (northwest China), based on adult specimens. In the Chinese fauna, this genus is reported for the first time. The main characters of the genus as given in Grandjean (1936), Balogh and Balogh (1992) and Ermilov *et al.* (2013) includes

the following: lamellar lines absent, sublamellar lines developed; notogastral setae represented by 10 (rarely 11) pairs of alveoli or microsetae; notogaster with porose areas, *Aa* represented by one pair; median pore usually present, represented by one alveolus (in females and males) or rarely absent (in females and males); notogastral tubercles behind level of pteromorphs absent; adanal lyrifissures located nearly to anal aperture; postanal porose area of normal form (not very long, semi-circular); leg tarsi with three claws.

According to characters of the genera *Acrogalumna* and *Allogalumna*, we should note that these two genera could be distinguished by presence of median pore or pores in males (if one pore – it is a genus *Allogalumna*, if several pores – it is a genus *Acrogalumna*). However the question has not been solved, for example the species having females and

males without median pore should be included in which genus? Until 2013, Ermilov *et al.* pointed out if males and females have one median pore or not to have median pore absolutely these species should be included in *Allogalumna*. It is logical and correct. Thus, for correct identification of the genera *Allogalumna* and *Acrogalumna* it is necessary to have and females and males of each species.

MATERIALS AND METHODS

The collection locality and habitat of the new species are given in the "Material examined" section. Specimens were mounted in lactic acid on temporary cavity slides for measurement and illustration, and then stored in vials in 75 % alcohol. Measurements are presented in micrometers. The 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. Lengths of body setae were measured in lateral aspect. Formulas for leg setation are given in parentheses according to the sequence trochanter-femur-genu-tibia-tarsus (femulus included). Formulas for leg solenidia are given in square brackets according to the sequence genu-tibia-tarsus. General terminology used in this paper follows that of Grandjean (summarized by Norton and Behan-Pelletier 2009).

Scanning Electron Microscope

Fresh specimens were cleaned with a fine brush in normal saline and placed in 5 % glutaraldehyde for 3 h, and then gently washed three times using phosphate buffer. Specimens were then dehydrated in a graded ethanol series of 70, 75, 80, 85, 90, 95, and 100 % with three changes at each concentration, and 10 min between steps. Finally, samples were placed in fresh 100 % ethanol for 30 min, and then critically point dried in CO₂ for 2h. After that, put specimens fixed on sample holder with double faced adhesive tape under TEM, and then dried in Vacuum Turbo Evaporator for 3 – 4h. Specimens were coated film by used rotation gold-plated — palladium alloy membrane with acceleration volt-

age of 20 keV, observed under the KYKY — 1000B scanning electron microscopy.

RESULTS

Description of species

Allogalumna rugata n. sp. (Figures 1-4)

Diagnosis — Body size 650 – (660) – 720 × 440 – (460) – 475. Body and legs covered by the microgranular cero-tegument. Rostral and lamellar setae setiform, smooth. Interlamellar setae longer than rostral and lamellar setae, setiform, slightly barbed. Bothridial setae slenderly setiform, slightly barbed. Anterior notogastral margin interrupted. Four pairs of porose areas small, oval, *Aa* largest, *A2* smallest. Median pore absent in females and males. Genital plates with some longitudinal stria. Postanal porose area absent. Legs monodactylous.

Measurement — Body length 660 (holotype: female), 650 – 720 (twelve paratypes, eight females, four males); width 460 (holotype), 440 – 475 (twelve paratypes).

Integument — Body colour brown to dark brown. Surface of body smooth, genital plates with dense longitudinal stria.

Prodorsum — Rostrum rounded in dorsal view. Rostral (*ro*, 40 – 45) and lamellar (*le*, 30 – 36) setae setiform, smooth; interlamellar (*in*, 53 – 57) setae setiform, slightly barbed. Bothridial setae (*ss*, 125 – 130) slenderly setiform, slightly barbed distally, pointed distally in lateral view. Exobothridial setae and their alveoli absent. Porose areas *Ad* small, elongate oval, transversally oriented (8 – 10 × 28 – 32). Sublamellar (*S*) lines distinct, curving backwards.

Notogaster — Anterior notogastral margin not developed medially. Dorso-phragmata of medium size. Notogastral setae represented by 10 pairs of alveoli. Four pairs of oval porose areas developed: *Aa* oval, 14 – 18 × 36 – 40; *A1* oval, 18 – 22 × 21 – 25; *A2* oval, 8 – 12 × 18 – 23; *A3* slightly elongate oval, 8 – 12 × 35 – 38. Lyrifissures *im* located antero-laterally to *A1*. Median pore absent in females and males.

FIGURE 1: *Allogalumna rugata* n. sp. (female): A – dorsal view; B – ventral view (legs not shown). Scale bar 100 µm.

FIGURE 2: *Allogalumna rugata* n. sp. (female): A – dorso-lateral view of prodorsum; B – posterior view of notogaster; C – pteromorph; D – subcapitulum; E – bothridial setae; F – palp; G – chelicera. Scale bar: (A-C) 100 μ m, (D-G) 50 μ m.

FIGURE 3: *Allogalumna rugata* n. sp. SEM micrographs of adult, macerated in lactic acid, some cero-tegument removed, some of the setae are broken. A – dorsal view; B – ventral view; C – lateral view.

FIGURE 4: *Allogalumna rugata* n. sp. SEM micrographs of adult, macerated in lactic acid, some cero-tegument removed, some of the setae are broken. A – detail of prodorsum in dorsal view; B – bothridial seta and part of pteromorph; C – inter-lamellar seta; D – adanal seta; E – detail of genital plates; F – detail of anal plates.

TABLE 1: Leg setation and solenidia of adult *Allogalumna rugata* n. sp.

Leg	Trochanter	Femur	Genu	Tibia	Tarsus
I	v'	$d, (l), bv''$	$(l), v', \sigma$	$(l), (v), \varphi_1, \varphi_2$	$(ft), (tc), (it), (p), (u), (a), s,$ $(pv), v', (pl), l'', e, \omega_1, \omega_2$
II	v'	$d, (l), bv''$	$(l), v', \sigma$	$(l), (v), \varphi$	$(ft), (tc), (it), (p), (u), (a), s,$ $(pv), \omega_1, \omega_2$
III	v'	d, ev'	l', σ	$l', (v), \varphi$	$(ft), (tc), (it), (p), (u), (a), s,$ (pv)
IV	v'	d, ev'	d, l'	$l', (v), \varphi$	$ft'', (tc), (p), (u), (a), s, (pv)$

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.

Gnathosoma — Morphology of subcapitulum, palps and chelicerae typical for Galumnidae (Engelbrecht 1972a; Ermilov and Anichkin 2011). Subcapitulum wider than long: $124 - 135 \times 115 - 125$. Hypostomal setae a, m, h setiform, thin, smooth. h (35–40) longer than a (28–32) and m (22–24). Two pairs of short adoral (5–10) setae, setiform, curved. Palp (length 143) with setation of 0-2-1-3-9 (+1 solenidion ω). All setae (except on tarsus) barbed. Chelicera (length 183) with few blunt teeth on fixed and movable digits. Cheliceral setae long, setiform, barbed: cha (56) longer than chb (35).

Epimeral region — Epimeres smooth. Four pairs of epimeral setae visible ventrally; $1a, 3a, 3b$ and $4a$ (18–26), thin, smooth. Discidia triangular, circum-pedal carinae distinct.

Anogenital region — Six pairs of genital setae present, anterior two setae ($g1, g2$, 18–24) longest; genital and anal plates with densely longitudinal stria. Two pairs of anal ($an1, an2$) setal alveoli, three pairs of adanal ($ad1-ad3$, 8–16), one pair of aggenital setae (ag) short, thin, smooth. Adanal lyrifissures iad short, thin, located anterior to adanal setae $ad3$. Postanal porose area (Ap) absent.

Legs — Morphology of leg segments, setae and solenidia generally typical for Galumnidae (Engelbrecht 1972; Ermilov & Anichkin 2011). All legs tridactylous, lateral claws slightly thinner than median claw. Formulae of leg setation and solenidia: I (1-4-3-4-20) [1-2-2], II (1-4-3-4-15) [1-1-2], III (1-2-

1-3-15) [1-1-0], IV (1-2-2-3-12) [0-1-0]; homology of setae and solenidia as indicated in Table 1.

Material examined — Holotype ♀, China: Qinghai Prov., Mutual Beishan National Forest Geological Park (36°50'59.76"N, 102°04'05.10"E), 2241 m a.s.l., 2 July 2010, coll. Maofa Yang (GUGC). Paratypes: 5♀♀4♂♂, with same data as holotype; 3♀♀, China: Qinghai Prov., Three Rivers' Headwaters Natural Reserve Area of Yushu Tibetan Autonomous Prefecture (32°33'48.65"N, 97°39'55.66"E), 3464 m a.s.l., from soil under the *Picea crassifolia*, 5 Aug. 2009, coll. Lixia Xie (GUGC).

Etymology — The specific name "*rugata*" is from Latin, and refers to the stria of the genital plates.

Types deposited — The type specimens are deposited in the Institute of Entomology, Guizhou University, Guiyang, Guizhou, China (GUGC).

Remarks — In having the combination of main morphological characters (bothridial setae setiform, slightly barbed; interlamellar setae setiform, longer than rostral and lamellar setae; anterior notogas-tral margin not developed; notogaster with four pairs of rounded porose areas; median pore absent in females and males), *Allogalumna rugata* n. sp. is similar to *Allogalumna ampla* Ermilov, 2013 from Ecuador (see Ermilov 2013), however it clearly differs from the latter by the smaller body size ($650 - 720 \times 440 - 475$ versus $448 - 464 \times 332 - 365$ in *A. ampla*), interlamellar setae setiform, longer than rostral and lamellar setae (versus represented by alve-

oli or minute in *A. ampla*), numbers of striae on genital plates (versus one longitudinal stria in *A. ampla*) and the absence of postanal porose area (versus present in *A. ampla*).

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