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Two new species of the family Scheloribatidae from China, with remarks on the genus *Annobonzetes* Pérez-Íñigo, 1983 (Scheloribatidae)*

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Abstract

Two new species of oribatid mites are described based on adult specimens from China. *Similobates linzhiensis* **sp. nov.** differs from *S. deficiens* Wallwork, 1977 by its lanceolate shaped bothridial setae, and it also differs from *S. staryi* Ermilov, 2018 and *S. demetororum* Mahunka, 1982 by shorter adanal setae ad_1 and ad_2. *Annobonzetes hamatus* **sp. nov.** differs from *A. sphaericus* Pérez-Íñigo, 1983 by barbed prodorsal setae. The genera *Annobonzetes* and *Similobates* are recorded in China for the first time. The updated description and an identification key for the genus *Annobonzetes* are given.

Keywords: oribatid mites, new species, *Annobonzetes*, *Similobates*, identification key

Introduction

The genus *Similobates* was proposed by Mahunka (1982) with *Similobates demetororum* Mahunka, 1982 as the type species. Currently, this genus comprises three species: *Similobates deficiens* Wallwork, 1977, *Similobates demetororum* Mahunka, 1982, and *Similobates staryi* Ermilov, 2019.

Annobonzetes was proposed by Pérez-Íñigo (1983) with *Annobonzetes sphaericus* Pérez-Íñigo, 1983 as the type species, and the author provided the main generic characters. Later, Subías (2004, updated in 2022) regarded *Oribata lata* and *Podoribates latissimus* as members of *Annobonzetes*.

During taxonomic identification of oribatid mites from China, we found one new species belonging to each genus. Both genera, *Annobonzetes* and *Similobates,* are recorded in China for the first time. The main goal of the paper is to describe these new species and discuss the genus *Annobonzetes* in reference to the new species.

Material and methods

Soil samples were collected by soil-corer and extracted using Tullgren funnels. Mite specimens were temporarily mounted in lactic acid on cavity slides for measurement and illustration. Body length was measured in lateral view, from the tip of the rostrum to the posterior edge of the ventral plate. Notogastral width was the measurement of maximum width in dorsal aspect. Lengths of body setae were measured in lateral aspect. All body measurements are presented in micrometers. Formulas for leg setation are given in parentheses according to the order trochanter-

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femur-genu-tibia-tarsus (famulus included). Formulas for leg solenidia are given in square brackets according to the order genu-tibia-tarsus. All specimens were examined under a differential interference contrast microscope (Nikon Eclipse Ni-U).

Morphological terminology used in this paper follows that of F. Grandjean (see Travé & Vachon, 1975 for references), Norton (1977) for leg setal nomenclature, and Norton & Behan-Pelletier (2009) for overview.

The following abbreviations are used: *lam*—lamella; *slam*—sublamella; *Al*—sublamellar porose area; *ro*, *le*, *in*, *bs*, *ex*—rostral, lamellar, interlamellar, bothridial and exobothridial setae, respectively; *D*—dorsophragmata; *c*, *la*, *lm*, *lp*, *h*, *p*—notogastral setae; *Sa*, *S1*, *S2*, *S3*—saccules; *ia*, *im*, *ip*, *ih*, *ips*—notogastral lyrifissures; *gla*—opisthonotal gland opening; *a*, *m*, *h*—subcapitular setae; *v*, *l*, *d*, *cm*, *acm*, *ul*, *sul*, *vt*, *lt*—palp setae; ω—palp and leg solenidion; *cha*, *chb*—cheliceral setae; Tg—Trägårdh's organ; Pd I, Pd II—pedotecta I, II, respectively; *1a*, *1b*, *1c*, *2a*, *3a*, *3b*, *3c*, *4a*, *4b*, *4c*—epimeral setae; *dis*—discidium; *cp*—circumpedal carina; *g*, *ag*, *an*, *ad*—genital, aggenital, anal and adanal setae, respectively; *iad*—adanal lyrifissure; *Tr*, *Fe*, *Ge*, *Ti*, *Ta*—leg trochanter, femur, genu, tibia, tarsus, respectively; σ, φ—leg solenidia; ε—leg famulus; *v*, *ev*, *bv*, *l*, *d*, *ft*, *tc*, *it*, *p*, *u*, *a*, *s*, *pv*, *pl*—leg setae.

Descriptions

Similobates linzhiensis **sp. nov.**
(Figs 1–9)

Diagnosis
Body size 431–441 × 338–351. Rostrum projected. Prolamellar line present; incomplete translamellar line present. Rostral, lamellar and interlamellar setae setiform, slightly barbed. Bothridial setae long, lanceolate, the head barbed. Epimeral plate foveolate. Ten pairs of short notogastral setae, of which *c,* h_1, h_2 and h_3 represented by alveoli.

Description
Measurements. Body length 435 (holotype, female), 431–441 (four paratypes: one male, three females). Body width 340 (holotype), 338–351 (two paratypes).

Integument. Body colour light brown. Body surface punctate (visible under high magnification). Lateral parts of prodorsum with microgranulate cerotegument.

Prodorsum (Figs 1, 3, 19, 20). Rostrum projected. Lamellae located dorso-laterally. Prolamellae and sublamellae present. Translamellar line incomplete, transverse ridge absent. Rostral (*ro*, 74–82), lamellar (*le*, 160–169) and interlamellar (*in*, 118–126) setae setiform, slightly barbed. Exobothridial setae (*ex*, 31) thin, smooth. Bothridial setae (*bs*, 110–121) long, lanceolate, the head barbed.

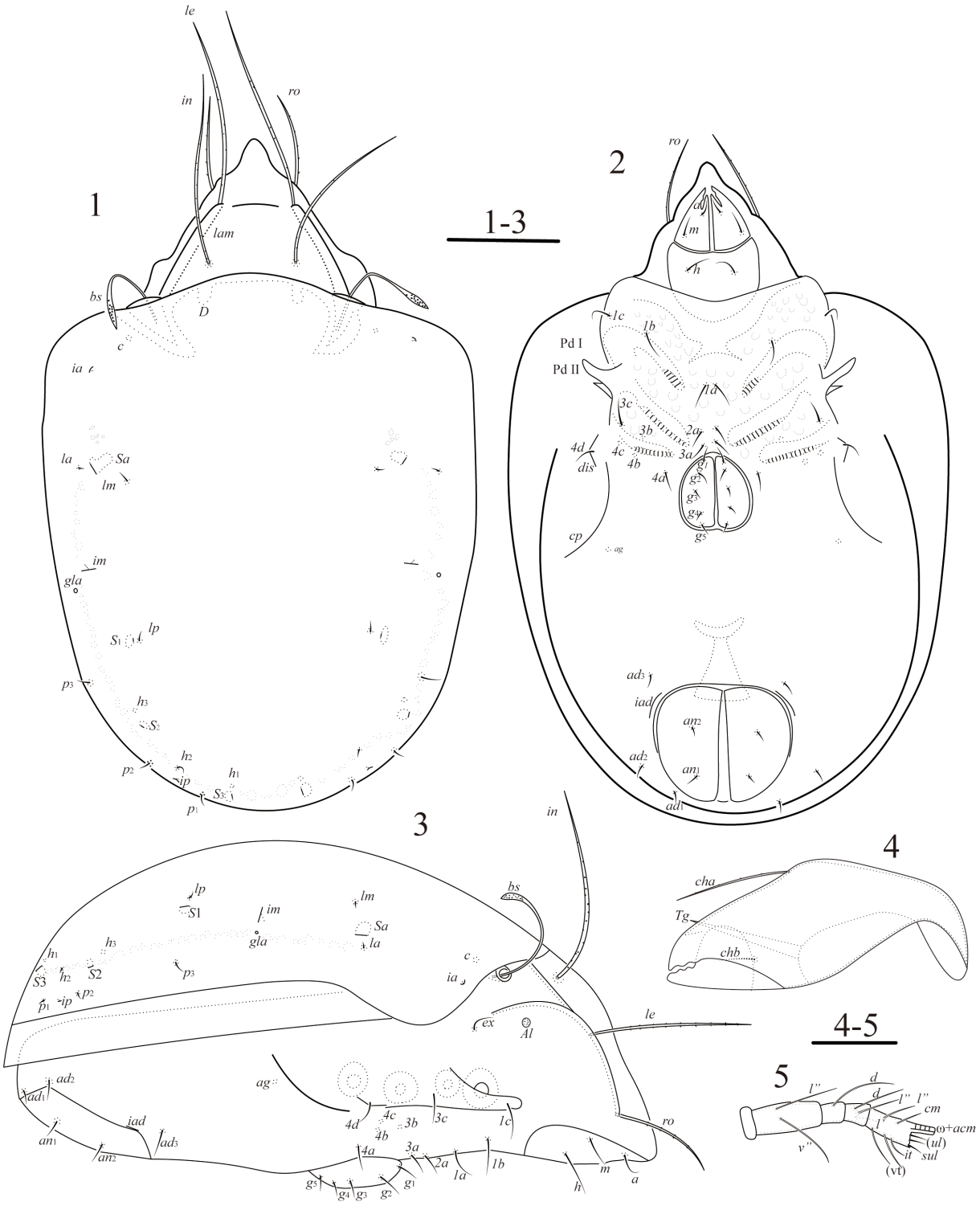
Notogaster (Figs 1, 3, 19). Anterior notogastral margin slightly convex. Dorsophragmata (*D*) rounded distally. Ten pairs of short notogastral setae, *c,* h_1, h_2 and h_3 represented by alveoli. Four pairs of saccules (*Sa*, *S1*, *S2*, *S3*) with small openings. Three pairs of lyrifissures (*ia*, *im*, *ip*) and opisthonotal gland openings (*gla*) clearly visible.

Gnathosoma (Figs 2, 4, 5). Subcapitulum longer than wide (103–112×72–81). Subcapitular setae *h* (23), *m* (13), and *a* (17) setiform, sparsely barbed. Palps (length 70–77) with setation 0-2-1-3-9(+ω). Chelicerae (length 97–104) with two barbed setae, *cha* (37) longer than *chb* (16). Trägårdh's organ tapered.

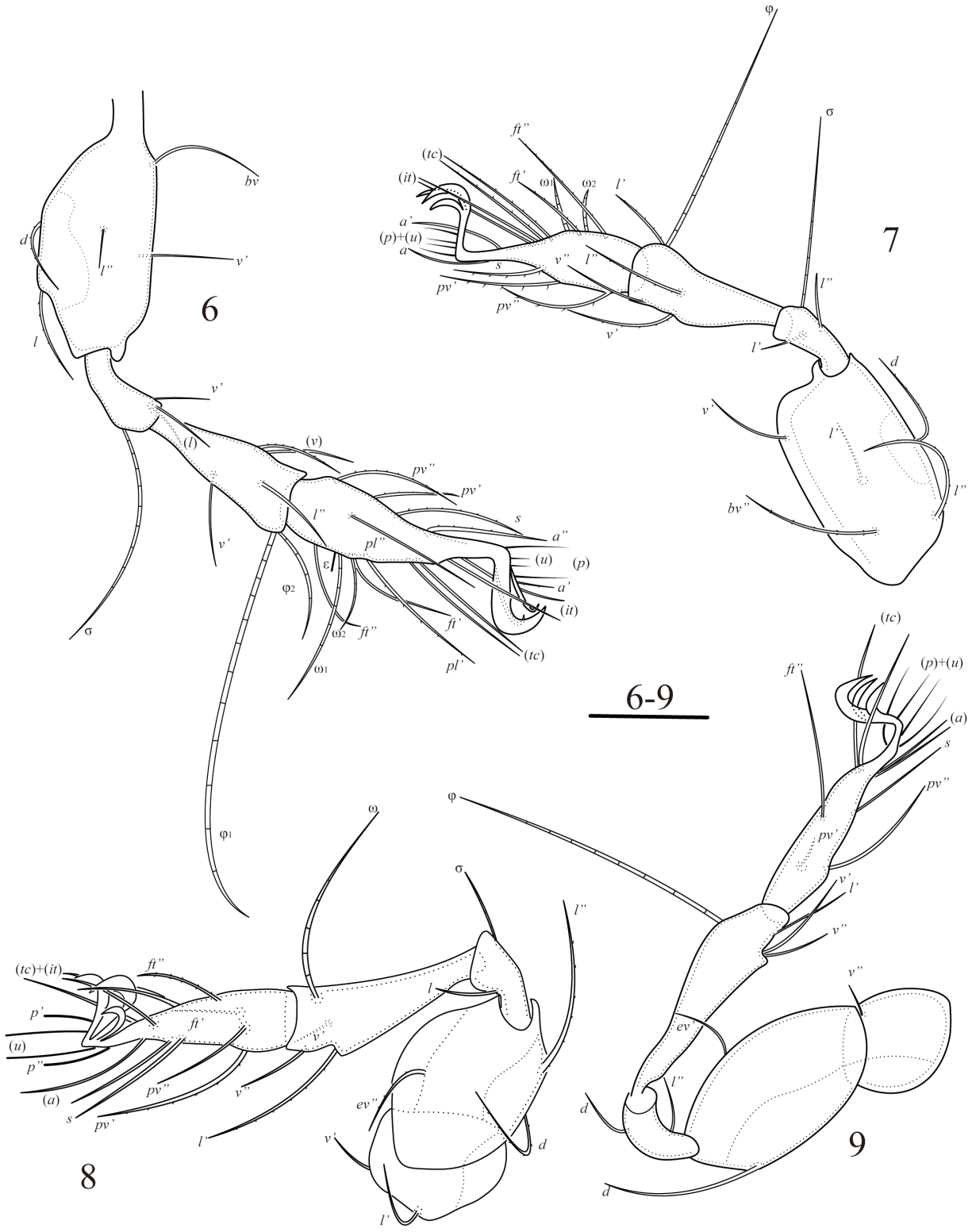
Epimeral and lateral podosomal regions (Figs 2, 3). Epimeral plate alveolate. Epimeral setal formula: 3-1-3-4. Epimeral setae (9–11) setiform. Pedotecta II rounded distally. Discidia elongate triangular, rounded distally. Circumpedal carinae distinct.

Anogenital region (Figs 10, 11, 12, 21). One pair of aggenital setae replaced by alveoli, five pairs of genital (g_1–g_5, 16–29), two pairs of anal (an_1, an_2, 25) and three pairs of adanal (ad_1–ad_3, 18–21) setae setiform. Adanal lyrifissures (*iad*) long, located close to anal plates.

Legs (Figs 14–17). Tridactilus, median claw distinctly thicker than lateral ones. All claws smooth. Dorsoparaxial porose areas on femora I–IV and on trochanters III, IV well visible. Formulas of leg setation and solenidia: I (1-5-3-4-19) [1-2-2], II (1-5-2-4-15) [1-1-2], III (2-3-1-3-15) [1-1-0], IV (1-2-2-3-12) [0-1-0]. Homology of setae and solenidia indicated in Table 1.



FIGURES 1–5. *Similobates linzhiensis* **sp. nov.**, adult. **1.** Dorsal view of body. **2.** Ventral view of body (legs not shown). **3.** Lateral view (legs not shown). Scale bar 100μm. **4.** Chelicera. 5. Palp. Scale bar 20μm. Scale bar 20μm.



FIGURES 6–9. *Similobates linzhiensis* **sp. nov.**, adult. **7.** Leg I. **8.** Leg II. **9.** Leg III. **10.** Leg IV. Scale bar 100μm.

TABLE 1. Leg setation and solenidia of adult *Similobates linzhiensis* **sp. nov.**

leg	Tr	Fe	Ge	Ti	Ta
I	*v'*	*d*, (*l*), *bv"*, *v"*	(*l*), *v'*, σ	(*l*), (*v*), φ_1, φ_2	(*ft*), (*tc*), (*it*), (*p*), (*u*), (*a*), *s*, (*pv*), (*pl*), ε, ω_1, ω_2
II	*v'*	*d*, (*l*), *bv"*, *v"*	(*l*), σ	(*l*), (*v*), φ	(*ft*), (*tc*), (*it*), (*p*), (*u*), (*a*), *s*, (*pv*), ω_1, ω_2
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'*	*l'*, (*v*), φ	*ft"*, (*tc*), (*p*), (*u*), (*a*), *s*, (*pv*)

Note: Roman letters refer to normal setae, Greek letters to solenidia (except ε = famulus). Single prime (*'*) marks setae on the anterior and double prime (*''*) setae on the posterior side of a given leg segment. Parentheses refer to a pair of setae.

Material examined

Holotype (female) and four paratypes (three females, one male): China, Tibet Autonomous Region, Linzhi City, Linji county, 29°24'2"N, 94°24'29"E, 3000 m, tree moss, 12 August 2017, collected by Guo-Ru Ren.

Etymology

The species is named after the region, Linzhi in China, from where the type specimens were collected.

Remarks

Similobates linzhiensis **sp. nov.** clearly differs from *S. deficiens* Wallwork, 1977 by its lanceolate shaped bothridial setae, and it also differs from *S. staryi* Ermilov, 2018 and *S. demetororum* Mahunka, 1982 by shorter adanal setae ad_1 and ad_2.

Annobonzetes hamatus **sp. nov.**

(Figs 10–18)

Diagnosis

Body size: 407–422 × 294–321. Rostrum projected with rounded tip. Prolamellae absent, incomplete translamellar line present. Rostral, lamellar and interlamellar setae setiform, barbed. Bothridial setae spindle-form, barbed. Notogaster with nine pairs of setae, eight of these setae represented by alveoli. Four pairs of sacculi with small openings. Setae *pv*', *pv*" and *s* of tarsus II with longer barbs.

Description

Measurements. Body length 414 (holotype, female), 407–422 (eleven paratypes: four males, seven females). Body width 305 (holotype), 294–321 (eleven paratypes).

Integument. Body colour yellowish brown. Body surface punctate (visible under high magnification). Lateral parts of prodorsum indistinctly reticulate.

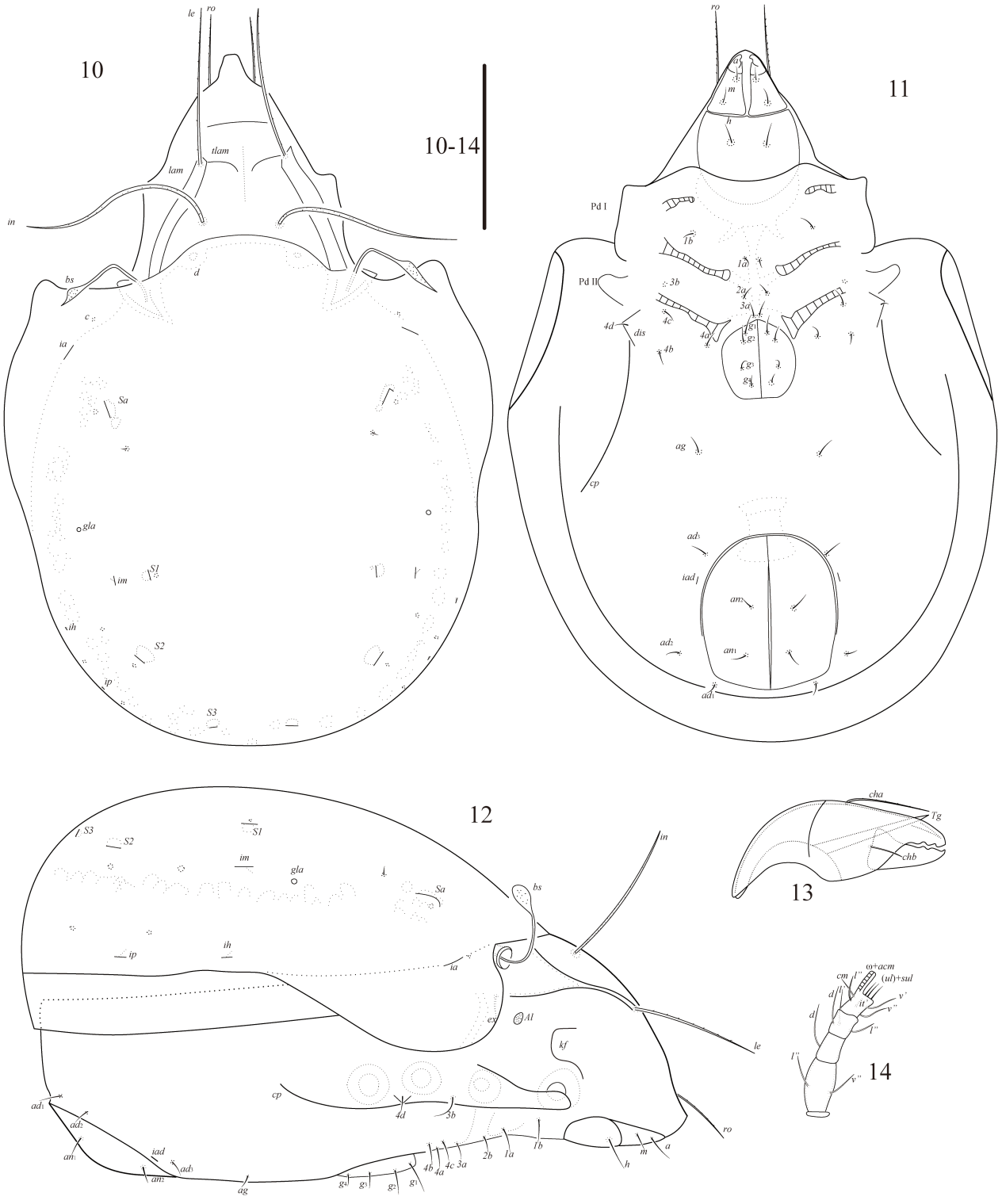
Prodorsum (Figs 10, 12, 22–26). Rostrum projected with rounded tip. Lamellae located dorso-laterally. Prolamellae absent. Sublamellae long. Translamellar line represented by two curving rudimentary parts near lamellae. Sublamellar porose areas (*Al*, 9×5) oval. Rostral (*ro*, 51–57), lamellar (*le*, 89–99) and interlamellar (*in*, 100–109) setae setiform, barbed. Transverse ridge (*r*) well visible. Exobothridial setae (*ex*, 23) thin, smooth. Bothridial setae (*bs*, 69–73) spindle-form (globular in lateral view), barbed.

Notogaster (Figs 10, 12, 22). Anterior notogastral margin convex medially. Dorsophragmata (*D*) semioval. Four pairs of saccules (*Sa*, *S1*, *S2*, *S3*) with well visible openings. Nine pairs of notogastral setae, eight of these setae represented by alveoli. Four pairs of lyrifissures (*ia*, *im*, *ip*, *ih*) and opisthonotal gland openings (*gla*) clearly visible.

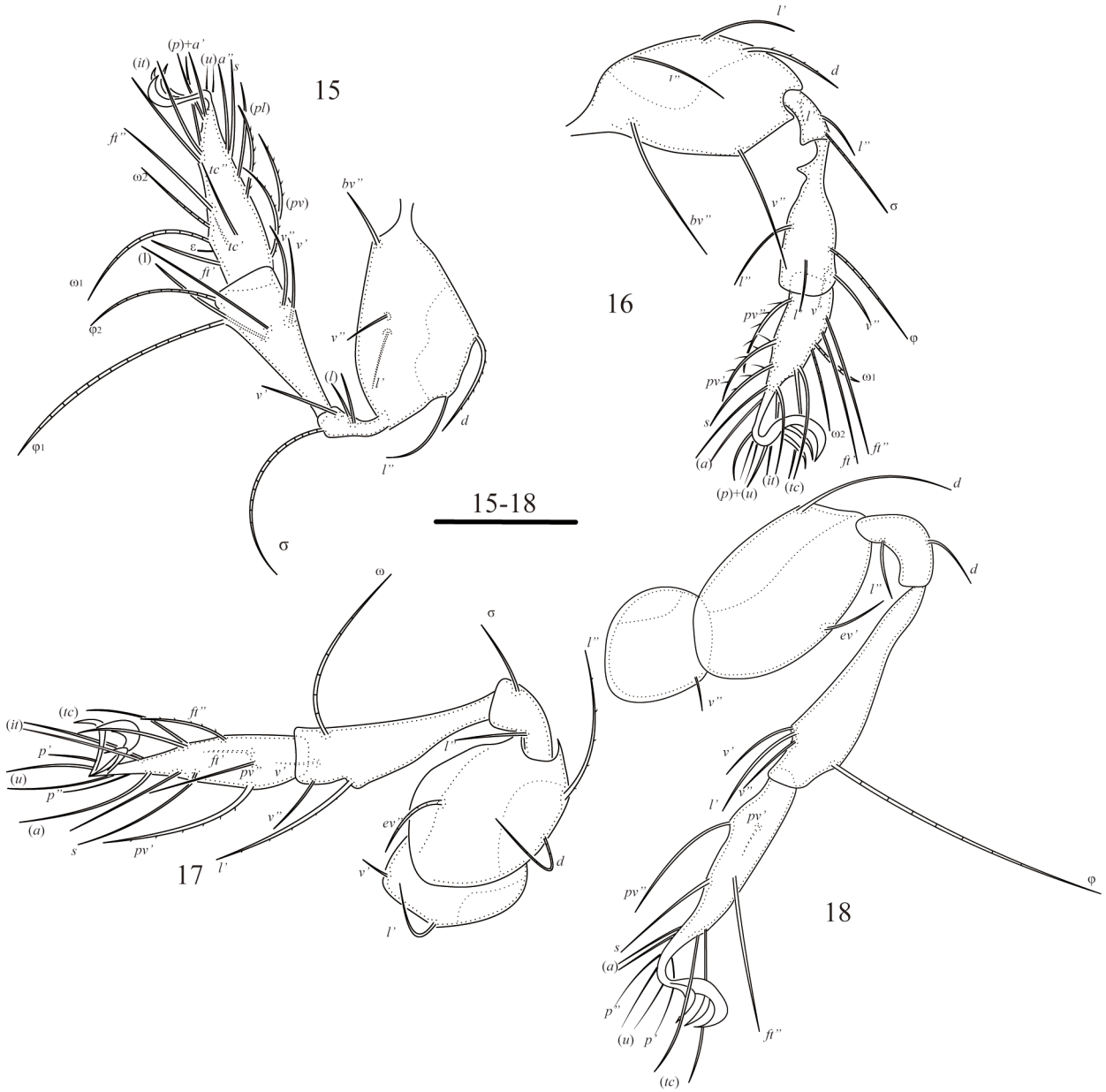
Gnathosoma (Figs 11–14). Subcapitulum longer than wide (102–108×64–65). Subcapitular setae (*h* 19, *m* 12, *a* 14) setiform, slightly barbed. Palps (length 61–62) with setation 0-2-1-3-9(+ω). Chelicerae (length 96–99) with two setae, *cha* (30) barbed, longer than *chb* (13). Trägårdh's organ tapered.

Epimeral and lateral podosomal regions (Figs 11, 12). Epimeral setae difficult to discern, visible epimeral setal formula: 2-1-2-4, *3b* replaced by alveoli. Pedotecta II rounded distally. Discidia elongate triangular, rounded distally. Circumpedal carinae distinct.

Anogenital region (Figs 11, 12). Four pairs of genital (g_1–g_4, 9–24), one pair of aggenital (*ag*, 14–16), two pairs of anal (an_1, an_2, 16) and three pairs of adanal (ad_1–ad_3, 15–19) setae setiform. Adanal lyrifissures (*iad*) located close and parallel to anal plates.



FIGURES 10–14. *Annobonzetes hamatus* **sp. nov.**, adult. **11.** Dorsal view of body. **12.** Ventral view of body (legs not shown). **13.** Lateral view (legs not shown). **14.** Chelicera. **15.** Palp. Scale bar 100μm.



FIGURES 15–18. *Annobonzetes hamatus* **sp. nov.**, adult. **16.** Leg I. **17.** Leg II. **18.** Leg III. **19.** Leg IV. Scale bar 20μm.

Legs (Figs 15–18). Tridactylus, median claw distinctly thicker than lateral ones. Claws smooth. Dorsoparaxial porose areas on femora I–IV and on trochanters III, IV well visible. Setae *pv*', *pv*" and *s* of tarsus II with longer barbs. Formulas of leg setation and solenidia: I (1-5-3-4-19) [1-2-2], II (1-5-2-4-15) [1-1-2], III (2-3-1-3-15) [1-1-0], IV (1-2-2-3-12) [0-1-0]. Homology of setae and solenidia indicated in Table 2.

TABLE 2. Leg setation and solenidia of adult *Annobonzetes hamatus* **sp. nov.**

leg	Tr	Fe	Ge	Ti	Ta
I	*v'*	*d*, (*l*), *bv"*, *v"*	(*l*), *v'*, σ	(*l*), (*v*), φ_1, φ_2	(*ft*), (*tc*), (*it*), (*p*), (*u*), (*a*), *s*, (*pv*), (*pl*), ε, ω_1, ω_2
II	*v'*	*d*, (*l*), *bv"*, *v"*	(*l*), σ	(*l*), (*v*), φ	(*ft*), (*tc*), (*it*), (*p*), (*u*), (*a*), *s*, (*pv*), ω_1, ω_2
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'*	*l'*, (*v*), φ	*ft"*, (*tc*), (*p*), (*u*), (*a*), *s*, (*pv*)

Note: Roman letters refer to normal setae, Greek letters to solenidia (except ε = famulus). Single prime (') marks setae on the anterior and double prime (") setae on the posterior side of a given leg segment. Parentheses refer to a pair of setae.

Material examined

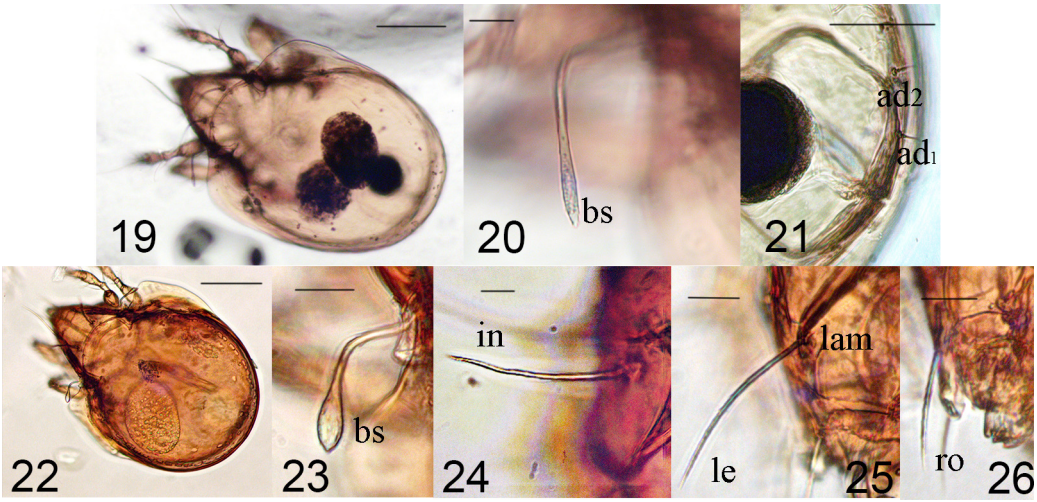
Holotype (female) and three paratypes (two females, one male): China, Hubei Province, Shennongjia Forestry District, 31°30’22”N, 110°20’49”E, 1768 m a.s.l., grass, litter and soil, 18 July 2020, collected by Guo-Ru Ren.

Etymology

The specific name “*hamatus*” refers to barbed prodorsal setae.

Remarks

Annobonzetes hamatus **sp. nov.** is morphologically similar to *A. sphaericus* Pérez-Íñigo, 1983, but differs from the latter by barbed prodorsal setae. It also differs from other known species of *Annobonzetes* by longer barbs of tarsus II setae *pv*’, *pv*” and *s.*



FIGURES 19–26. Microscopic images. 19. *Similobates linzhiensis* **sp. nov.**, adult. Dorsal view of body. Scale bar 100µm. 20. Bothridial seta. Scale bar 20µm. 21. Anal region. 22. *Annobonzetes hamatus* **sp. nov.**, adult. Dorsal view of body. Scale bar 100µm. 23. Bothridial seta. 24. Interlamellar seta. 25. Lamellar seta. 26. Rostral seta. Scale bar 20µm.

Discussion

The genus *Annobonzetes* now comprises 3 species: *A. sphaericus* Pérez-Íñigo, 1983, *A. latus* Warburton, 1912 and *A. latissimus* Berlese, 1916. Subías (2004, updated in 2022) regarded *Oribata lata* and *Podoribates latissimus* as members of *Annobonzetes*. On the basis of the original description of *A. latissimus*, we assume the reason is that both these species have spherical notogaster. There is very little information available in the original description of *P. latissimus,* with no description of prolamellae and sublamellae, which are essential characteristics of this genus; so we would not consider *P. latissimus* a member of *Annobonzetes. Scheloribates acutirostrum* Ermilov, 2011 and *Scheloribates helenensis* Wallwork, 1977 have spherical notogaster, prolamella absent and notogastral setae very short or represented only by alveoli, so we consider these two species as members of *Annobonzetes.*

Based on the characters of new species, we updated the description of the genus *Annobonzetes* as follows: Pteromorphs large, immovable, curved ventrad. Dorsosejugal suture complete. Lamellae without cusps or with very slight blunt cusps, sublamella present, prolamella absent or replaced by faint ridge. Notogaster spherical, four pairs of sacculi, eight to ten pairs of visible notogastral setae very short or represented by alveoli. Legs tridactylous.

Key to known species of *Annobonzetes*

1. Lamellae with very slight blunt cusps, bothridial setae baculiform, notogaster with two or three longitudinal striae in the median anterior portion, prolamella replaced by faint ridge. Body size: length ca. 85mm . . . . . .*Annobonzetes latus* Warburton, 1912
   Distribution: Seychelles.
– Lamellae without cusps, heads of bothridial setae spherical or spindle-form, notogaster without longitudinal striae, prolamella absent. 2

2. Bothridial setae spherical, rostrum rounded. Body size: 660–798×440–523. . . . . *Annobonzetes helenensis* Wallwork, 1977
Distribution: Saint Helena
– Bothridial setae spherical or spindle-form, rostrum pointed 3
3. All prodorsal setae smooth, tutorium weakly developed. Body size: 1380×900. . `*Annobonzetes sphaericus* Pérez-Íñigo, 1983
Distribution: Equatorial Guinea.
– All prodorsal setae barbed, tutorium absent. 4
4. Rostrum sharply pointed, notogastral setae p_1 present, thin, relatively long; other notogastral setae (nine pairs) represented by alveoli. Body size: 614–697×448–481. . . . . *Annobonzetes acutirostrum* Ermilov, 2011
Distribution: Ethiopia.
– Rostrum rounded at tip, notogastral setae *lm* persent, short; other notogastral setae (eight pairs) represented by alveoli. Body size: 407–422×294–321 . . . . . *Annobonzetes hamatus* **sp. nov.**
Distribution: China.

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