

A new species of *Antennoseius* (*Vitzthumia*) Thor (Acari: Mesostigmata: Ascidae) from China, with a key to species of the genus recorded from China

Yun Long^{a,b}, Dao-Chao Jin^{a,b}, Jian-Jun Guo^{a,b}, Tian-Ci Yi^{a,b}

^a Institute of Entomology, Guizhou University; Guiyang, Guizhou 550025, P. R. China.

^b Guizhou Provincial Key Laboratory for Agricultural Pest Management of the Mountainous Region; Scientific Observing and Experimental Station of Crop Pest in Guiyang, Ministry of Agriculture and Rural Affairs of the People's Republic of China, Guiyang 550025, P. R. China.

Original research

ABSTRACT

The subgenus *Antennoseius* (*Vitzthumia*) Thor, 1930 is recorded from China for the first time by description of a new species, *Antennoseius* (*Vitzthumia*) *heterochaetus* Long & Yi **n. sp.** that was collected from leaf litter of subtropical forest in Sichuan Province, China. The new species can be distinguished from other members of the subgenus by podonotal shield with four pairs of spur-like setae (*j2-j4*, *z2*), *j1* short and barbed distally, setae *av1* on trochanters III and IV slightly swollen with fine distal tip. The holotype of *Antennoseius ningxiaensis* Bai & Ma, 2006 was examined and because the leg I avoid pretarsus and claws and also tibia III bear eight setae, the species distinguished as a member of the subgenus *Antennoseius* (*Antennoseius*). A key to Chinese species of the genus *Antennoseius* is given.

Keywords soil mites; Parasitiformes; Gamasina; Ascoidea; subgenus; Oriental Realm

Zoobank <http://zoobank.org/A2544523-707E-440C-9887-DDDAE85C97DA>

Introduction

The genus *Antennoseius* Berlese, 1916 includes 59 species in two subgenera, *Antennoseius* (34 species) and *Vitzthumia* (19 species), and six species without subgeneric status indicated (Kazemi 2018; Moraes *et al.* 2016). The tibia III usually bears eight setae and lack of pretarsus and claws on leg I in *Antennoseius*, while there are nine setae on tibia III and pretarsus and claws on leg I in *Vitzthumia* (Ryke 1962; Bregetova 1977, Lindquist & Walter 1989). Previous to this, three species have been reported from China, namely *A. ningxiaensis* Bai & Ma, 2006, *A. (A.) alexandrovi* Bregetova, 1977 and *A. (A.) sinicus* Guo & Gu, 1997, that the latter two species identified as junior synonyms of *A. (A.) avius* Karg, 1977 and *A. (A.) hispaniensis* Bernhard, 1963, respectively by Kazemi (2018) (Bai & Ma 2006; Guo & Gu 1997; Kazemi 2018; Ma & Yin 2006). Hosts/habitat and location of them are showed in table 1.

The species of *Antennoseius* have been found in different habitats, occur in soil, salt marshes, rotting plant, litter, moss, carabid beetles, as well as in nests of mouse, birds and ants (Bai & Ma 2006; Beaulieu *et al.* 2008; Faraji *et al.* 2017; Kazemi 2018). In a field survey of soil mites in southwest China, the specimens belonging to the subgenus *Vitzthumia* were found, representing the first record of the subgenus *Vitzthumia* from China and a new species to science. This paper aims to describe it as well as clearing the taxonomic status of *Antennoseius ningxiaensis* Bai & Ma 2006 by examining the holotype.

Received 10 September 2020

Accepted 13 January 2021

Published xx January 2021

Corresponding author

Tian-Ci Yi: tcyi@gzu.edu.cn

Academic editor

Faraji, Farid

DOI

10.24349/acarologia/20214416

ISSN 0044-586X (print)

ISSN 2107-7207 (electronic)

© Copyright

Long Y. *et al.*

Distributed under

Creative Commons CC-BY 4.0



How to cite this article Long Y. *et al.* (2021), A new species of *Antennoseius* (*Vitzthumia*) Thor (Acari: Mesostigmata: Ascidae) from China, with a key to species of the genus recorded from China. *Acarologia* 61(1): 46-54; DOI 10.24349/acarologia/20214416

Materials and methods

Mites were extracted from shed leaves samples using modified Tullgren funnels equipped with 40 Watt bulbs, and preserved in 75% alcohol. Mites were cleared in Nesbitt’s solution and then mounted on microscope slides in Hoyer’s medium (Krantz & Walter 2009). Line drawings were prepared with the aid of a drawing tube attached to a Nikon Ni E microscope and figures were edited with Adobe Photoshop CC 2018. All measurements were taken with the software (Nikon NIS Elements AR 4.50) and given in micrometres (µm).

Idiosoma lengths were measured along their midlines. Setae were measured from the bases of their insertion to their tips. Legs I–IV were measured from the base of coxa to the distal tip of the tarsus excluding the pretarsus (stalk, claws and pulvillus). The palps were measured from the base of the trochanter to the apex of the tarsus. The idiosomal setal nomenclature follows Lindquist & Evans (1965) with modifications for the posterior region as given by Lindquist (1994). Leg setal notation and palp chaetotaxy are based on Evans (1963a) and Evans (1963b). Distinction between gland pores and poroids (lyrifissures) follows Athias-Henriot (1971, 1975); notation for pore-like structures on the idiosoma mostly follows Kazemi *et al.*. (2014).

Results

Family Ascidae Voigts & Oudemans, 1905

Genus *Antennoseius* Berlese, 1916

Subgenus *Antennoseius* Berlese, 1916

Type species *Antennoseius delicatus* Berlese, 1916

Antennoseius (Antennoseius) ningxiaensis Bai & Ma, 2006

Antennoseius. ningxiaensis Bai & Ma, 2006: 555

Specimens examined — Holotype, female, from ant *Myrmos* sp. nest, Zhongwei County (37°5' N, 105°1' E), Ningxia Hui Autonomous Region, China, by Xue-Li Bai, 29 July 1989. Deposited at Institute of Microbial Epidemiology, Academy of Military Medical Sciences, China.

Remarks — *Antennoseius ningxiaensis* was originally described by Bai & Ma (2006) based on one female from Ant *Myrmos* sp. nest in Ningxia Hui Autonomous Region, China, but the subgeneric status of the species was not clear. Here, we examined the holotype of the species and observed the absence of pretarsus and claws on leg I and tibia III with eight setae. Therefore, we consider it a species belong to the subgenus *Antennoseius*.

Subgenus *Vitzthumia* Thor, 1930

Type species *Vitzthumia oudemansi* Thor, 1930

Antennoseius (Vitzthumia) heterochaetus Long & Yi n. sp.

(Figures 1–4)

Table 1 Hosts/ habitat and locations of species of *Antennoseius* Berlese, 1919 from China.

Species	Hosts/Habitat	Locations	References
<i>A. (A.) ningxiaensis</i> Bai & Ma, 2006	Ant <i>Myrmos</i> sp. nest	Ningxia, China	Bai & Ma 2006
<i>A. (A.) avius</i> Karg, 1977	leaf litter	Heilongjiang and Jilin, China	Ma & Yin 2006
<i>A. (A.) hispaniensis</i> Bernhard, 1963	nests of <i>Eothenomys miletus</i> Thomas	Yunnan, China	Guo & Gu 1997
<i>A. (Vitzthumia) heterochaetus</i> Long & Yi n. sp.	leaf litter	Sichuan, China	this study

Specimens examined

Holotype, female (slide No. 2019050923A), from leaf litter of subtropical forest, Tangjiahe National Nature Reserve (32°35'41" N, 104°49'37" E), altitude 1,444 m, Sichuan Province, China, by Yun Long, 9 May 2019. Paratypes, one female (slide No. 2019050923B), the same date as the holotype. All types are deposited at the Institute of Entomology, Guizhou University, Guiyang, P. R. China (GUGC).

Diagnosis

Dorsal shield with reticulate ornamentation. Podonotal shield with 20 pairs of setae, of which *j2–j4*, *z2* short, strongly thickened and spur-like, *j1* short and barbed distally. Opisthonotal shield with 15 pairs of setae, of which *J3–J5*, *Z3–Z5*, *S2–S5* barbed distally, *Z5* about twice as long as others. Anterior margin of sternal shield slightly convex, postero-laterally eroded, with median process, *st1*, *st3*, *iv3* and *st4* in soft cuticle. Setae *st5* on epigynal shield. Deutosternum with seven rows of denticles, each with 6–12 denticles, and first to sixth rows connected with lateral margins of deutosternal groove. Seta *pc* greatly swollen with fine distal tip. Anterior margin of epistome slightly convex and denticulate, dorsal surface of epistome with a transverse row of denticles. Setae *av* and *pv* on coxa I and *pv* on coxa II obviously swollen with fine distal tip. Tibia III with eight setae (*pl2* absent).

Description

Female (Figures 1–4) (n = 2)

Dorsum — (Figure 1A, 4A). Idiosoma oval, length 568–576, width 322–331 at level of seta *r5*, dorsal shields with reticulate ornamentation. Podonotal shield length 309–314, width 286–293 at level of seta *r2*, with 20 pairs of setae (*j1–j6*, *z1–z6*, *s1–s6*, *r2*, *x*), of which *j2–j4*, *z2* short, strongly thickened and spur-like (Figure 4A), *j1* short and barbed distally, and nine pairs of discernable pores-like structure (four pairs of gland pores and five pair of poroids). Opisthonotal shield length 291–302, width 260–268 at level of setae *J1*, with 15 pairs of setae and 12 pairs of discernable pore-like structures (three pairs of gland pores and nine pairs of poroids), of which *J3–J5*, *Z3–Z5*, *S2–S5* barbed distally and *Z5* about twice as long as others. Three pairs of *r* setae (*r3–r6*), six pairs of *R* setae (*R1–R6*) and one unpaired seta (*Rx*) located on lateral soft cuticle (only one specimen with *RX*) (Figures 1A). Length of setae: *j1* (16–17), *j2* (12–13), *j3* (12–13), *j4* (12–13), *j5* (33–36), *j6* (36–37), *z1* (15–17), *z2* (11–12), *z3* (34–35), *z4* (34–35), *z5* (35–36), *z6* (36–37), *s1* (29–30), *s2* (26–28), *s3* (28–30), *s4* (33–34), *s5* (34–35), *s6* (34–36), *x* (32–33), *r2* (23–24), *r3* (19–20), *r4* (19–22), *r5* (20–21), *r6* (16–18), *J1* (36–38), *J2* (34–35), *J3* (35–36), *J4* (36–37), *J5* (38–39), *Z1* (34–35), *Z2* (34–35), *Z3* (35–36), *Z4* (36–37), *Z5* (66–68), *S1* (31–33), *S2* (34–35), *S3* (33–34), *S4* (37–39), *S5* (43–46), *R1* (14–15), *R2* (16–17), *R3* (15–17), *R4* (15–16), *R5* (16–17), *R6* (16–17), *UR* (14–18), *Rx* (16).

Venter — (Figures 1B, 4B). Base of tritosternum approximately columnar (15–16 long, 13–14 wide), with paired plumose laciniae (fused basally for 12–13 long, free for 77–79). Presternal with irregularly transverse line and one pair of weak sclerotized platelets. Sternal shield length 122–127 (along the midline, including the postero-median process), width 100–103 at level of seta *st2*, bearing setae *st2* and two pairs of lyrifissures (*iv1*, *iv2*) and one pair gland pores *gvb*, anterior margin slightly convex, postero-laterally eroded, with median process, posterior edge sinuous and anticlinal (one specimen) or truncate (one specimen), with weak lineate pattern; *st1* inserted on soft cuticle anterior to sternal shield, *iv3*, *st3* and *st4* on streaked soft cuticle. Epigynal shield spatulate, with weak lineate pattern, length 133–139, width 42–45 at level of seta *st5*, posterior margin rounded; *st5* on and *iv5* off epigynal shield. With two pairs endopodal strips, anterior pair between coxae II and III, posterior pair between coxae III and IV parallel to epigynal shield. Opisthosomatic venter with two pairs of metapodal platelets, one smaller pairs close to posterior edge of peritrematal plate, the larger pairs approximately

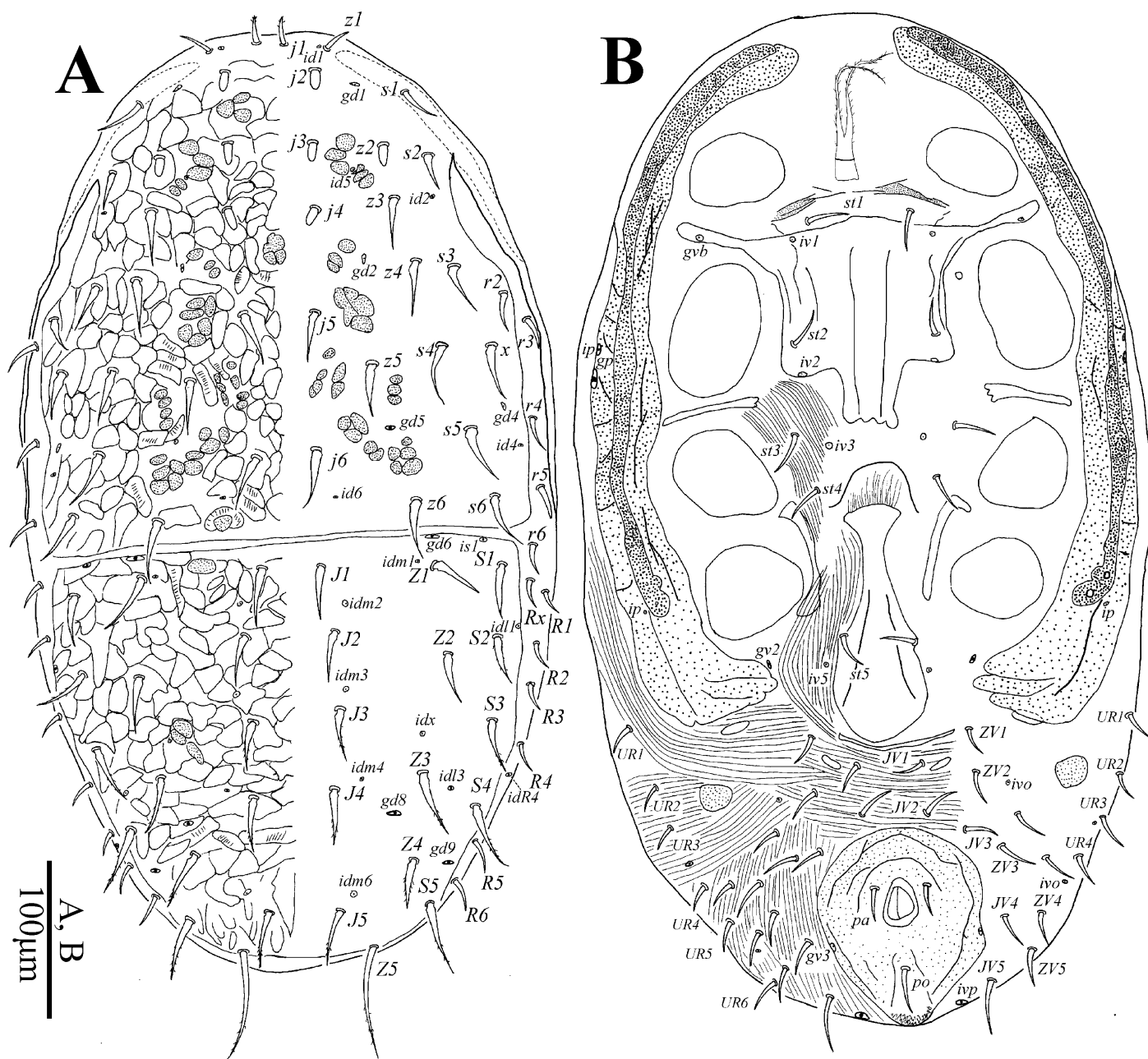


Figure 1 *Antennoseius (Vitzthumia) heterochaetus* Long & Yi n. sp., female, A – dorsal idiosoma; B – ventral idiosoma.

roundness; with one pairs platelets between genital and anal shield. Anal shield peach shaped, length 116–118 and width 95–98 at level of seta *pa*, with faintly lineate ornamented, bearing three simple circum-anal setae and one pair gland pores *gv3*, of which para-anal setae (*pa*) almost at level of anterior margin of anal opening, slightly shorter than post-anal seta (*po*). Opisthogaster setae number unequal on left and right of soft cuticle beside anal shield, 20 setae on left and 16 setae on right (Figures 1B, 4B). Length of setae: *st1* (20–24), *st2* (17–20), *st3* (17–20), *st4* (17–18), *st5* (18–19), *JV1* (13–16), *JV2* (20–21), *JV3* (22–23), *JV4* (20–21), *JV5* (29–30), *ZV1* (16–18), *ZV2* (20–21), *ZV3* (19–20), *ZV4* (20–22), *ZV5* (19–20), *pa* (16–17), *po* (21–22); other setae 14–18 long.

Peritreme — (Figure 1B). Elongate, extending from stigma almost to *z1* level near to

anterior end of dorsum. Peritrematal shield broad, fused with exopodal shield along coxae I–IV, with one pair gland pore *gp* and two pairs of poroid *ip* (Figure 1B).

Legs — (Figures 2A–2E, 4C, 4D). Leg lengths: leg I (619–623), leg II (388–392), leg III (374–375), leg IV (485–497). Tarsus I with four long and slender apical setae, with small pretarsus and claws (Figure 2B). Trochanters I with one, femur I with three and genu I with one spur-like setae (Figures 2A, 4C). Tibia III with eight setae (*pl2* absent). Pretarsi II–IV each with a pair of claws, anterior pulvilli terminally rounded (Figures 2C–2E). Setae *av* and *pv* on coxae I and *pv* on coxae II greatly swollen with fine distal tip (Figures 2A, 2C, 4D). Seta *av1* on trochanters III and IV also obviously swollen, with fine distal tip (Figures 2D, 2E). Most dorsal setae, some antero-lateral and postero-lateral setae on legs II–IV sparsely barbed. Chaetotaxy of legs I–IV, respectively: coxae 2, 2, 2, 1; trochanters 6 (1 1/3 1), 5 (1 0/3 1), 5(1 1/3 0), 5(1 1/3 0); femora 12 (2 5/3 2), 11 (2 5/3 1), 6 (1 3/1 1), 6 (1 4/1 0); genua 13 (2 6/3 2), 11 (2 5/2 2), 9 (2 4/2 1), 9 (2 5/1 1); tibiae 13 (2 6/3 2), 10 (2 4/2 2), 8 (2 3/2 1), 10 (2 4/2 2).

Gnathosoma — (Figures 3A–3D, 4D). Hypostomal setae *h1*–*h3* simple and smooth, *h1* (34–35) significantly longer than *h2* (18–19) and *h3* (16–17), *h3* slightly anterior to *h2*; palpcoxal seta *pc* (15–16) significantly swollen and with fine distal tip (Figures 3A, 4D). Corniculi slightly stout, hornlike, parallel, slightly beyond tip of internal malae. Deutosternum moderately wide, with seven rows of denticles, each row with 6–12 denticles, of which first to sixth rows connected by lateral margins of deutosternal groove (Figure 3A). Anterior margin of epistome slightly convex and denticulate, dorsal surface of epistome with a transverse row of denticles (Figure 3C). Second segment of chelicera 69–71 long, width 29–31 at basal level of second segment of chelicera; fixed digit (47–48) with 12 teeth in addition to apical hook, and setiform pilus dentilis; dorsal cheliceral seta relatively long and thickened; movable digit (46–47) with two teeth in addition to apical hook and fringe-like processes at the base, with a paraxial ridge leading to a ventral projection; antiaxial lyrifissure and dorsal lyrifissure evident (Figure 3D). Palp length 173–176, trochanter with simple setae *v1* and *v2*, femur with five simple setae (*d1*, *d2*, *d3*, *pl* and *al*), genu with six setae (*d1*, *d2*, *d3*, *al1*, *al2* and *pl1*); palp apotele two-tined (Figure 3B).

Etymology

The species name *heterochaetus* refers to the dorsal shield with several different types of setae.

Key to species of the genus *Antennoseius* Berlese, 1916 from China (female)

1. Leg I with pretarsus and claws – subgenus *Vitzthumia* – Podonotal shield with four pairs of setae strongly thickened, short, smooth and spur-like; *st1*, *st3* off sternal shield *A. (Vitzthumia) heterochaetus* n. sp.
— Leg I lacking pretarsus and claws – subgenus *Antennoseius* – Most setae of podonotal shield similar in length and shape, without spur-like setae; *st1*, *st3* on sternal shield 2
2. Opisthonotal shield with five unpaired setae *Jx*, and *S* series more than 5 pairs of setae *A. (A.) ningxiaensis* Ma & Yin 2006
— Opisthonotal shield without unpaired setae *Jx*, and *S* series 5 pairs of setae 3
3. Anterior margin of tectum with three wide serrate protrusions; setae *j1* fan-shape, considerably wider than other dorsal setae, *j1* width more than half of its length; fixed digit of chelicerae with several small denticles *A. (A.) avius* Karg, 1977
— Anterior margin of tectum convex, finely denticulate, without distinct protrusions; setae *j1* leaf-like, slightly wider than other dorsal setae, *j1* width at most one third of its length; fixed digit of chelicerae with a small subapical tooth and a chitinized edge on the inner margin, devoid of denticles *A. (A.) hispaniensis* Bernhard, 1963

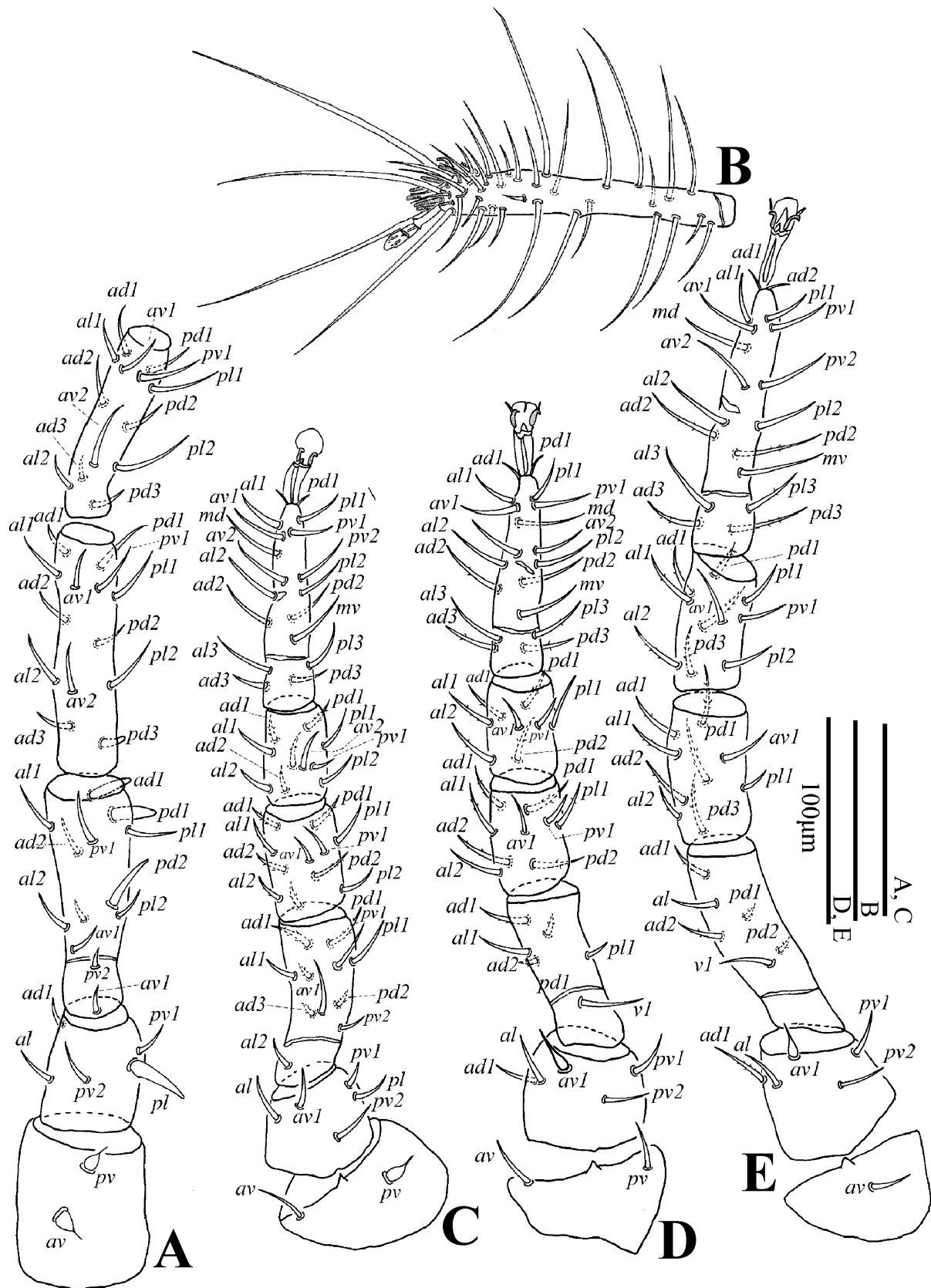


Figure 2 *Antennoseius (Vitzthumia) heterochaetus* Long & Yi n. sp., female, A – Leg I (coxa–tibia); B – Tarsus I; C – Leg II; D – Leg III; E – Leg IV.

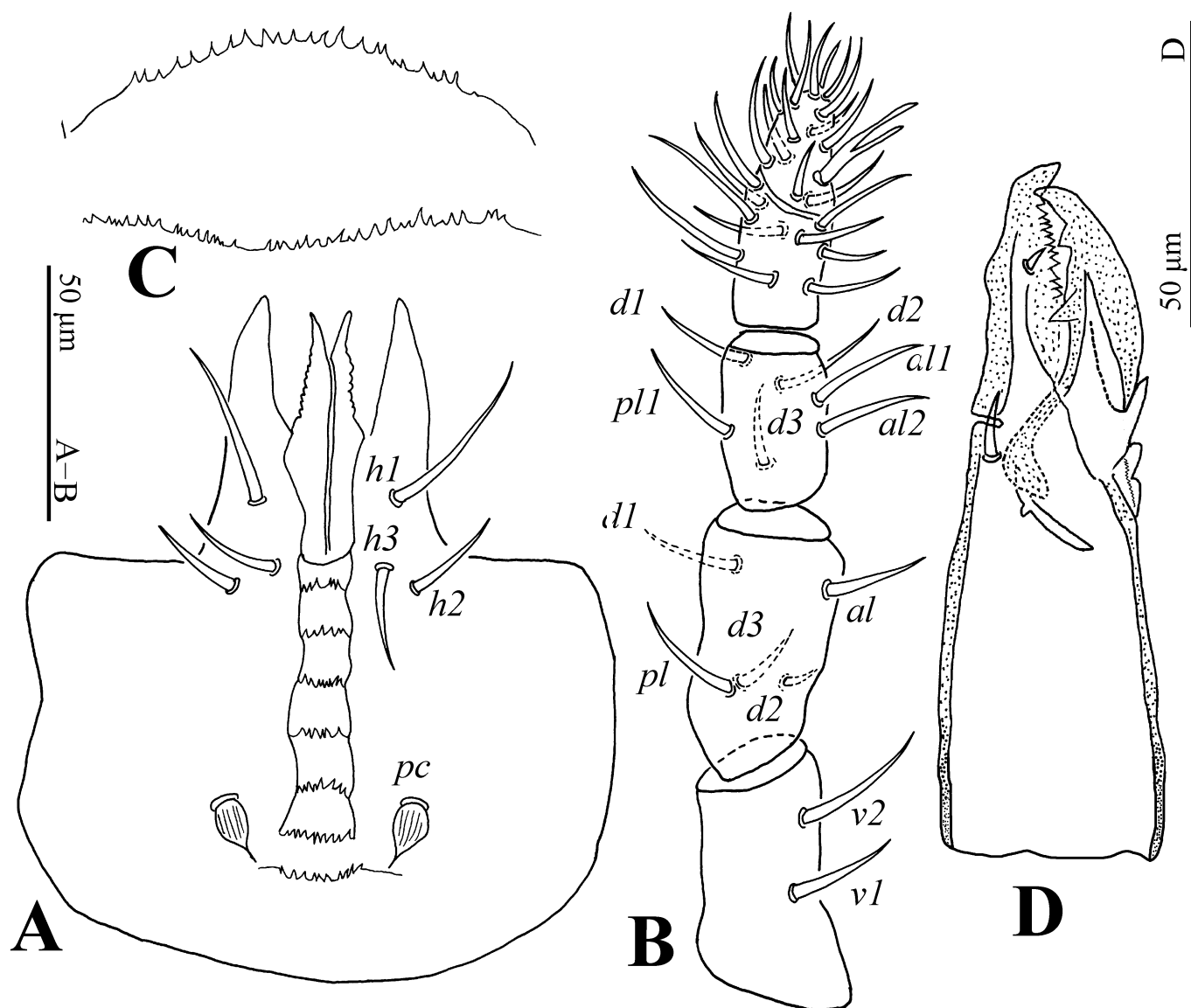


Figure 3 *Antennoseius (Vitzthumia) heterochaetus* Long & Yi n. sp., female, A – Hypostome; B – Palpus; C – Epistome; D – Chelicera.

Differential diagnosis

Antennoseius (Vitzthumia) heterochaetus Long & Yi n. sp. resembles *A. perseus* Beaulieu, 2008 (smooth morph) in the shape of setae *ad1*, *pd1* on genu I, *pd2* on genu I (spine-like) and seta *pc* (greatly swollen and with fine distal tip), sternal shield (postero-laterally eroded and with median process), seta *st3* location (on soft cuticle), dorsal shield smoothly reticulate, number of setae on tibia III (eight setae, *pl2* absent) and podonotal shield (20 pairs). The new species can be differentiated from *A. perseus* by the following characters. In the new species, *j2–j4*, *z2* spur-like, one spine-like setae on genu I, setae *av* and *p_v* on coxae I greatly swollen with fine distal tip, seta *av1* on trochanters III and IV also obviously swollen with fine distal tip, and *j1* barbed distally; while in the latter setae *j2–j5*, *z2* spur-like, two spine-like setae on genu I with, setae *av* or *p_v* on coxae I evidently swollen and with fine distal tip, setae *av1* on trochanters III and IV normal, and *j1* acicular and smooth. *Antennoseius heterochaetus* also resembles *A. bregetovae* Chelebiev, 1984. Both of them have four pairs of spur-like setae of

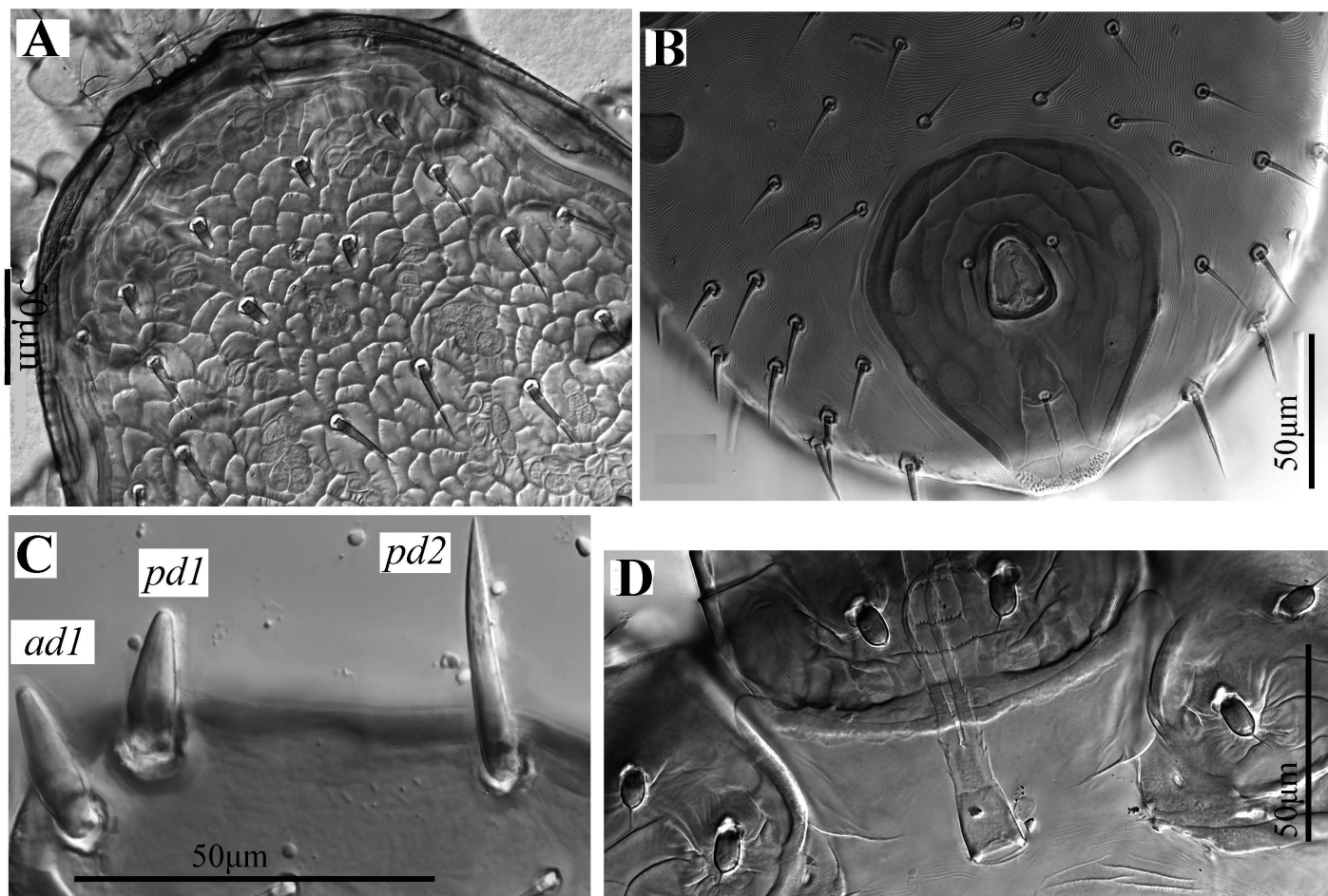


Figure 4 *Antennoseius (Vitzthumia) heterochaetus* Long & Yi n. sp., female photographs, A – showing podonotal shield spur-like setae; B – showing opisthogaster setae number inconsistent on left and on right; C – showing femur I with three spine-like setae; D – showing setae *pc* and coxae I setae similarly swollen basally, with fine, hair-like tip.

the *j* and/or *z* series on podonotal shield, three circum-anal setae on anal shield, and smoothly reticulate on dorsal shield. The new species can be differentiated from *A. bregetovae* by the following characters. The new species has 20 pairs of setae on podonotal shield, of which *j2–j4*, *z2* are spur-like, three spine-like setae on femur I, and setae *st3* locate on soft cuticle, sternal shield postero-laterally eroded, with median process; while the latter has 18 pairs (*j3–j5*, *z3* are spur-like), one spine-like seta on femur I, and setae *st3* locate on sternal shield, sternal shield normal.

Discussion

Most of species of the genus *Antennoseius* are associated with carabid beetles. However, there is no relevant research in China. The future research should be focused on different habitats in China.

Acknowledgements

We express our thanks to two reviewers and Shahrooz Kazemi (Department of Biodiversity, Institute of Science and High Technology and Environmental Sciences, Graduate University

of Advanced Technology, Kerman, Iran) for their insightful comments on the manuscript, to Dr. Bruce Halliday (Australian National Insect Collection, Canberra, Australia) offered the helps for references, and to Xue-Li Bai (Ningxia Hui Autonomous Region Center for Disease Control and Prevention, China), Tong-Yan Zhao and Ming-Yu Wu (Institute of Microbial Epidemiology, Academy of Military Medical Sciences, China) for their helps in checking the type of *A. (A.) ningxiaensis*. Tian-Ci Yi's work was supported by the Provincial Science Fund for Distinguished Young Scholars, [2017]5641.

References

- Athias-Henriot C. 1971. La divergence néotaxique des Gamasides (Arachnides). Deuxième partie. Bulletin Scientifique de Bourgogne, 28: 93-106
- Athias-Henriot C. 1975. Nouvelles notes sur les Amblyseini. 2. Le relevé organotaxique de la face dorsale adulte (Gamasides, Protoadeniques, Phytoseiidae). Acarologia, 27: 20-29.
- Bai X.L., Ma Y. 2006. A new species of the genus *Antennoseius* from Ningxia (Acari, Ascidae). Acta Zootaxonomica Sinica, 31: 555-556.
- Beaulieu F., Déchéne A.D., Walter D.E. 2008. Phase morphs and phoresy: new species of *Antennoseius* (*Vitzthumia*) mites (Acari: Mesostigmata: Ascidae) associated with pyrophilous carabids (Carabidae: *Sericoda* spp.) in Alberta, Canada. Zootaxa, 1961: 37-57. doi:10.11646/zootaxa.1961.1.4
- Bernhard F. 1963. Die Familie Ascidae (Oudemans 1905) Bernhard nov. comb. Abschnitt III. In: Stammer H.J. (Ed.). Beiträge zur Systematik und Ökologie mitteleuropäischer Acarina. Band II. Mesostigmata I. Akademische Verlagsgesellschaft Geest & Portig K.-G.: Leipzig. pp. 33-177.
- Bregetova N.G. 1977. Family Antennoseiidae Karg, 1965. In: Ghilyarov M.S., Bregetova N.G. (Eds.). Key to the Soil-Inhabiting Mites. Mesostigmata. Nauka: Leningrad. pp. 244-253.
- Chelebiev K.A. 1984. Mites of the genus *Antennoseius* (Parasitiformes: Mesostigmata) from central Kazakhstan. Zoologicheskii Zhurnal, 63: 1629-1633.
- Evans G.O. 1963a. Some observation on the chaetotaxy of the pedipalp on the Mesostigmata (Acari). Journal of Natural History, 6: 513-527. doi:10.1080/00222936308651393
- Evans G.O. 1963b. Observation on the chaetotaxy of the legs in the free-living Gamasina (Acari: Mesostigmata). Bulletin of the British Museum (Natural History). Zoology, 10: 275-303. doi:10.5962/bhl.part.20528
- Faraji F., Dehelean S.B., Vuyk M., Bakker F. 2017. Four new species records of *Antennoseius* and *Anystipalpus* (Acari: Mesostigmata: Ascidae) phoretic on carabidae beetles from France. Acarologia, 57: 337-353. doi:10.1051/acarologia/20174159
- Guo X.G., Gu Y.M. 1997. The first record of *Antennoseius* in China with description of a new species (Acari: Ascidae). Acta Zootaxonomica Sinica, 22: 356-358.
- Karg W. 1977. Die Milbengattung *Antennoseius* Berlese, 1916 (Acarina, Parasitiformes) mit einer neuen Art aus dem Leutratl bei Jena (DDR). Abhandlungen und Berichte des Naturkundemuseums Görlitz, 50 (4): 1-7.
- Kazemi S., Rajaei A., Beaulieu F. 2014. Two new species of *Gaeolaelaps* (Acari: Mesostigmata: Laelapidae) from Iran, with a revised generic concept and notes on significant morphological characters in the genus. Zootaxa, 3861: 501-530. doi:10.11646/zootaxa.3861.6.1
- Kazemi S. 2018. Redescription of *Antennoseius* (*Antennoseius*) *avius* Karg (Acari: Mesostigmata: Ascidae), a senior synonym of *A. (A.) alexandrovi* Bregetova and *A. (A.) arvensis* Kalúz, with additional information for *Antennoseius* Berlese, and a key to the Iranian species of the genus. International Journal of Acarology, 44: 1-9. doi:10.1080/01647954.2018.1471101
- Krantz G.W., Walter D.E. 2009. Collecting, rearing, and preparing specimens. In: Krantz G.W., Walter D.E. (Eds.). A manual of acarology. Third Edition. Lubbock, Texas Tech University Press. pp. 83-94.
- Lindquist E.E., Evans G.O. 1965. Taxonomic concepts in the Ascidae, with a modified setal nomenclature for the idiosoma of the Gamasina (Acarina, Mesostigmata). Memoirs of the Entomological Society of Canada, 47: 1-64. doi:10.4039/entm9747fv
- Lindquist E.E. 1994. Some observations on the chaetotaxy of the caudal body region of gamasine mites (Acari: Mesostigmata), with a modified notation for same ventrolateral body setae. Acarologia, 35: 323-326.
- Lindquist E.E., Walter D.E. 1989. *Antennoseius* (*Vitzthumia*) *janus* n. sp. (Acari: Ascidae), a mesostigmatic mite exhibiting adult female dimorphism. Canadian Journal of Zoology, 67: 1291-1310. doi:10.1139/z89-184
- Ma L.M., Yin X.Q. 2006. Descriptions of male and larva of *Antennoseius alexandrovi* (Acari: Mesostigmata: Antennoseiidae). Entomological Journal of East China, 15: 171-173.
- Moraes G.J. de, Britto E.P.J., Mineiro J.L., Halliday R.B. 2016. Catalogue of the mite families Ascidae Voigts & Oudemans, Blattisociidae Garman and Melicharidae Hirschmann (Acari: Mesostigmata). Zootaxa, 4112: 1-299. doi:10.11646/zootaxa.4112.1.1
- Ryke P.A.J. 1962. The genus *Antennoseius* Berlese (Acarina: Rhodacaridae). Annals and Magazine of Natural History, 13 (4): 657-663. doi:10.1080/00222936108651190