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Contribution to knowledge of the oribatid mite genus *Idiozetes* (Acari, Oribatida, Idiozetidae), with description of a new sexually dimorphic species from Vietnam

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Original research

ABSTRACT

A new species of *Idiozetes* (Oribatida, Idiozetidae)—*I. schusteri* sp. n.—is described, based on adults (males and females) collected from litter, tree branches and tree bark in southern Vietnam. This species is characterized by the following morphological traits: sexually dimorphic males with two large tubercles posteriorly on the notogaster; tatoria fused dorsally on prodorsum forming bidentate structure; nine pairs of notogastral setae (*c*, *la*, *lm*, *h*₁–*h*₃, *p*₁–*p*₃); five pairs of notogastral sacculi; eight pairs of genital setae; monodactylous. The generic diagnosis is revised. An identification key, distribution and habitats to the known representatives of *Idiozetes* are provided.

Keywords taxonomy; morphology; sexual dimorphism; identification key; distribution; Oriental region

Zoobank <http://zoobank.org/F9C65DB0-4F91-4BCF-B961-25133F5ECE52>

Introduction

The oribatid mite family Idiozetidae (Acari, Oribatida, Eremaozetoidea) described by Aoki (Aoki 1976). Colloff (2012) synonymized Idiozetidae with Eremaozetidae, however, based on unique morphology of the notogaster within oribatid mites, we support the family status of Idiozetidae by following Aoki (1976), Norton and Behan-Pelletier (2009) and Schatz *et al.* (2011). Idiozetidae comprises only the type genus, *Idiozetes* Aoki, 1976, with *Idiozetes erectus* Aoki, 1976 as type species, and four other species described later, which are distributed collectively in the Afrotropical, Australasian, Oriental, and southern Palaearctic regions (Subías 2022, unpublished online version 2024).


During taxonomic identification of soil-litter and arboreal oribatid mites collected in Vietnam, we found one new species belonging to *Idiozetes*. The main goals of our paper are: to describe a new species based on males and females; to revise the generic diagnosis; to present an identification key to known species of *Idiozetes*; and to provide data on distribution and habitats of representatives of the genus.

Prior to this, one species of *Idiozetes* (*I. javensis* Hammer, 1979) has been registered in Vietnam (Corpuz-Raros and Ermilov 2020).

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Methods

Samples of litter of approximately the same volume were taken manually and placed in a zip package. The average weight of the dried sample is 36 grams. Mites were driven into alcohol, in Tullgren-Berlese eclectors with incandescent lamps for two days. Samples of tree branches and tree bark were collected via climbing *Dipterocarpus alatus* (using climbing spikes and other special equipment) at the height of 13–25 m in Cat Tien National Park, southern Vietnam. Mites were subsequently extracted by high-pressure flushing and further by heptane flotation in laboratory conditions. Detailed descriptions of arboreal acarofauna collection and extraction techniques are presented in Salavatulin (2019). The collection locality is given in the *Type material* section.

Specimens were mounted in lactic acid, on temporary 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 notogaster; notogastral width refers to the maximum width of the notogaster in dorsal view; 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 sequence trochanter-femur-genu-tibia-tarsus (femulus included); formulas for leg solenidia are given in square brackets, according to the sequence genu-tibia-tarsus. Drawings were made with a camera lucida using a Leica DM 2500 transmission light microscope.

Morphological terminology used in this paper mostly follows that of papers on Eremaeozetoidea (Ermilov and Salavatulin 2022); also, Norton (1977) for leg setal nomenclature and Norton and Behan-Pelletier (2009) for overview.

The following morphological abbreviations are used: *Prodorsum*: *lam* = lamella; *tu* = tutorium; *ro*, *le*, *bs* = rostral, lamellar and bothridial setae, respectively. *Notogaster*: *len* = lenticulus; *Pt* = pteromorph; *hp* = humeral process; *nr* = notogastral ridge; *nt* = notogastral tubercle; *c*, *la*, *lm*, *h*, *p* = setae; *Sa*, *S1*, *S2*, *S3*, *S4* = saccules; *ia*, *im*, *ip*, *ih*, *ips* = lyrifissures; *gla* = opisthonotal gland opening. *Gnathosoma*: *a*, *m*, *h* = subcapitular setae; *or* = adoral seta; *d*, *l*, *sup*, *inf*, *cm*, *acm*, *ul*, *su*, *vt*, *lt* = palp setae; ω = palp solenidion; *cha*, *chb* = cheliceral setae; *Tg* = Trägårdh's organ. *Epimeral and lateral podosomal regions*: *1a*, *1b*, *2a*, *3a*, *3b*, *4a*, *4b* = epimeral setae; *PdI*, *PdII* = pedotecta I, II, respectively; *Sa* = parastigmatic apophysis; *dis* = discidium. *Anogenital region*: *g*, *an*, *ad* = genital, anal and adanal setae, respectively; *iad* = adanal lyrifissure; *po* = preanal organ. *Legs*: *Tr*, *Fe*, *Ge*, *Ti*, *Ta* = trochanter, femur, genu, tibia, and tarsus, respectively; ω , ϕ , σ = solenidia; *d*, *l*, *v*, *bv*, *ev*, *ft*, *tc*, *it*, *p*, *u*, *a*, *s*, *pv* = setae; *pa* = porose area.

Taxonomy

Generic traits (adult) of *Idiozetes*

With character states of Idiozetidae (Aoki 1976; Norton and Behan-Pelletier 2009). *Sexually dimorphic species*: Absent or present. *Measurements*: Small (length less than 450). *Integument*: Surface without heavy sculpturing and ornamentation, covered by thick cerotegument. *Prodorsum*: Rostrum rounded. Lamella very long, distinctly protruding beyond rostrum, basal part broad, distal part narrowed, curved ventrad; lamellae separated mediodistally and partially fused basally; tutorium absent or present. Rostral and lamellar setae short or medium-sized, setiform, *ro* inserted on strong tubercle, close to each other, *le* on lamella; interlamellar and exobothridial setae absent; bothridial seta long, with small flattened head. Bothridium cup-shaped. *Notogaster*: Anterior margin of notogaster present. Pteromorph immovable, elongate, narrowed, curved ventrad. Octotaxic system with three to five pairs of saccules. With six up to 12 pairs of short, simple notogastral setae. *Gnathosoma*. Subcapitulum diarthric. Palp setation: 0–2–1–3–9(+ ω); solenidion bacilliform, mediodistally attached to tubercle bearing eupathidium. Axillary saccule absent. Chelicera chelate-dentate, with two setae. *Epimeral and lateral podosomal regions*: Epimeral setal formula: 3[2]–1–2–1[2,3]. Pedotecta I, II

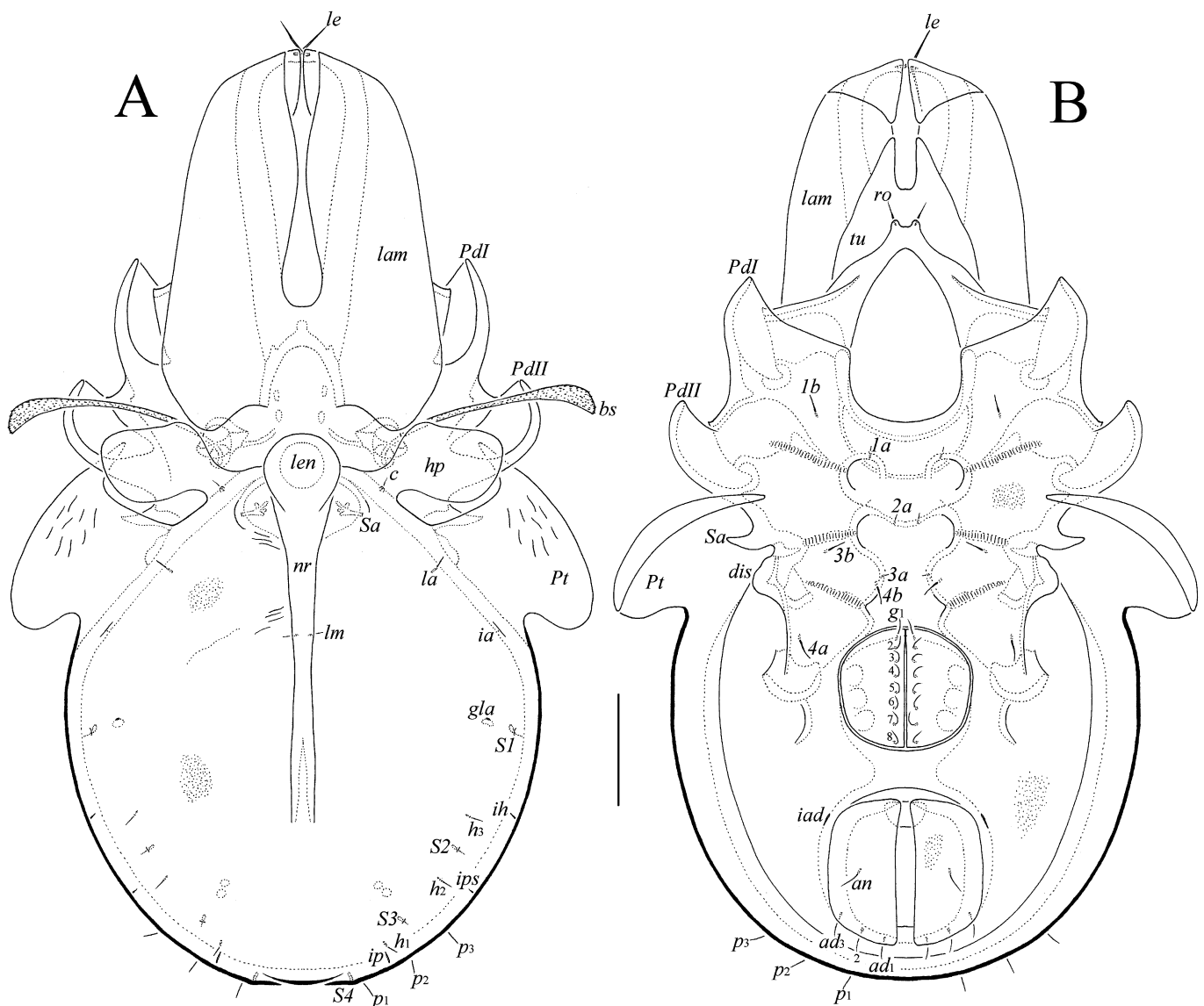


Figure 1 *Idiozetes schusteri* sp. n., adult, female (gnathosoma and legs not shown): A — dorsal view; B — ventral view. Scale bar 50 µm.

represented by large lamina. Parastigmatic apophysis *Sa* and discidium present. Circumpedial carina absent. *Anogenital region*: Six to eight pairs of genital, one or two pairs of anal and three pairs (posterior to anal plate) of adanal setae; aggenital setae absent. *Legs*: All legs mono- or tridactylous. Porose area present on femora I–IV and on trochanters III, IV. Leg tarsus IV with setae *it*.

***Idiozetes schusteri* sp. n.**

Zoobank: [8E07C15D-0400-48F5-9965-6BC34FE12CE1](https://doi.org/10.24349/2zt3-2r2t)

(Figures 1–3)

Type material

Holotype (male) and six paratypes (three males and three females): Vietnam, Dong Nai Province, Dong Nai Biosphere Reserve, Cat Tien National Park, litter under *Dipterocarpus*

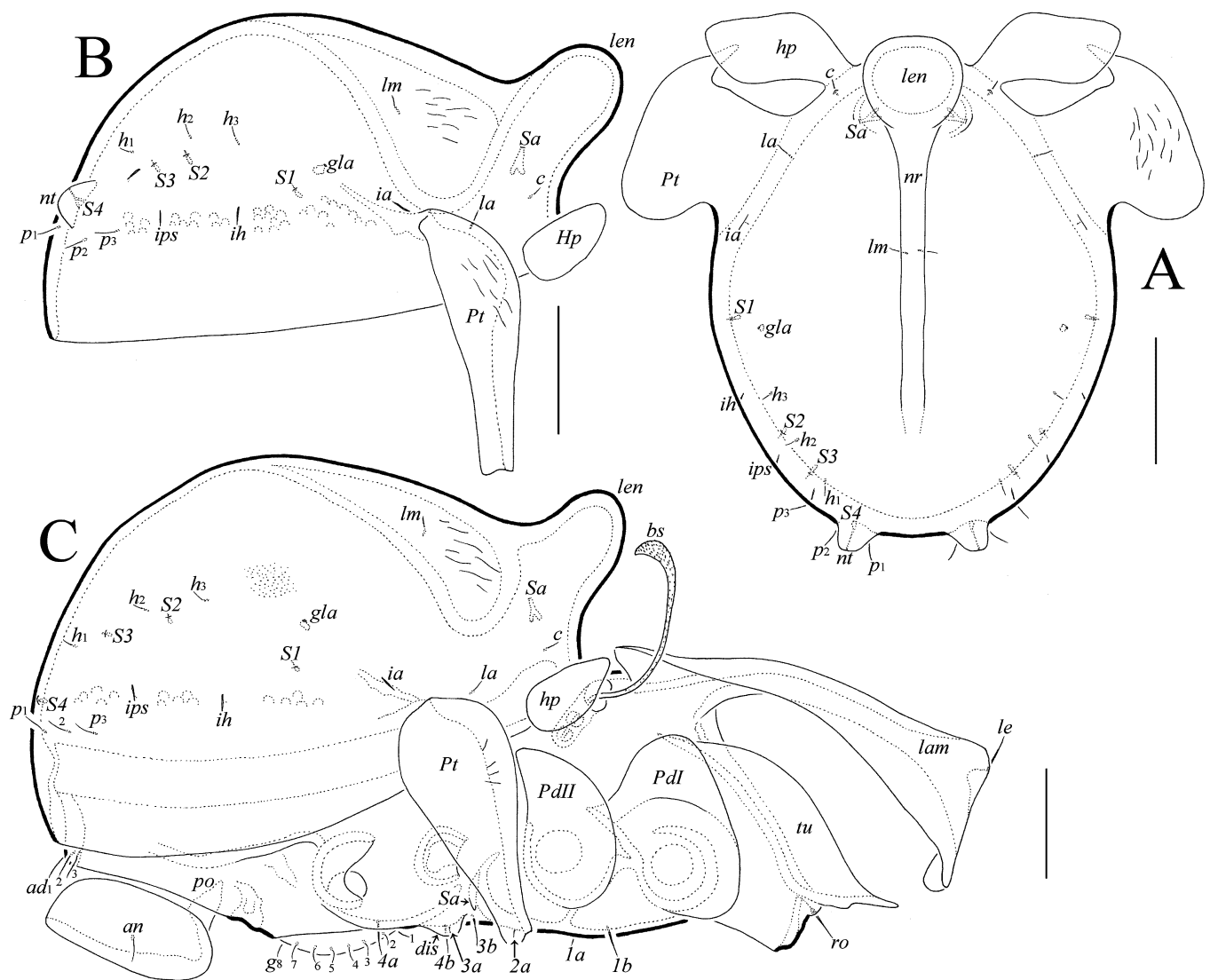


Figure 2 *Idiozetes schusteri* sp. n., adult, male (A, B) and female (C) (gnathosoma and legs not shown): A — dorsal view of notogaster; B — right lateral view of notogaster; C — right lateral view. Scale bars 50 μ m.

alatus and *Haldina cardifolia*, 20.XI.2022–10.XII.2022 (collected by V.M. Salavatulin and A.A. Kudrin).

Additional (non-type) material: six specimens (three males and three females): same data as for the type material but from bark (at the height of 13 m) and branches (at the height of 25 m) of *Dipterocarpus alatus*.

The holotype is deposited in the collection of the Senckenberg Museum of Natural History, Görlitz, Germany; six paratypes and non-type material are deposited in the collection of the Tyumen State University Museum of Zoology, Tyumen, Russia. All specimens are preserved in 70% solution of ethanol with a drop of glycerol.

Diagnosis

Body length: 307–360. Pteromorphs and notogaster posterolateral to lenticulus partially striate. Tutoria fused dorsally on prodorsum forming bidentate structure. In males, posterior part

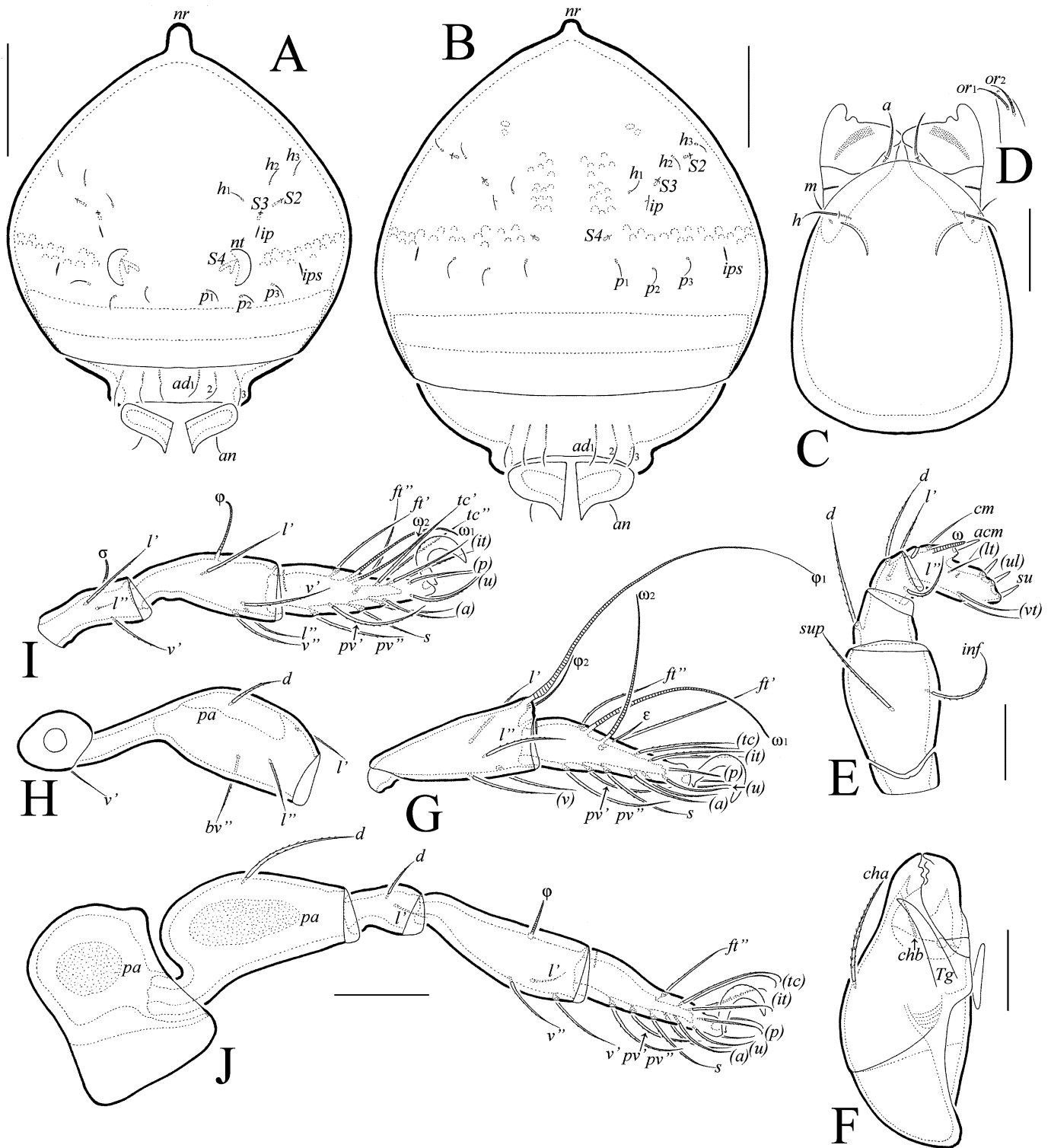


Figure 3 *Idiozetes schusteri* sp. n., adult, male (A) and female (B–J): A, B — posterior view; C — subcapitulum (dissected), ventral view; D — left lip with adoral seta, ventral view; E — palp, right, antiaxial view; F — chelicera, left, paraxial view; G — tibia and tarsus of leg I, right, antiaxial view; H — trochanter and femur of leg I, left, paraxial view; I — tibia and tarsus of leg II, left, paraxial view; J — leg IV, right, paraxial view. Scale bars 50 μ m (A, B), 25 μ m (G–J), 20 μ m (C, D, F), 10 μ m (E).

of notogaster with two large tubercles (versus tubercles absent in females). Nine pairs of notogastral setae. Five pairs of saccules. Epimeral setal formula: 2–1–2–2. Eight pairs of genital setae. Monodactylous.

Description

Measurements – Body length: 307 (holotype), 307–330 (male paratypes), 345–360 (female paratypes); notogaster width: 150 (holotype), 150–165 (male paratypes), 195–210 (female paratypes).

Integument – Body color brown. Body covered by thick cerotegument including black dirt and debris forming blocky structure. Surface densely microporose (visible only under high magnification in dissected specimens); pteromorph and notogaster posterolateral to lenticulus partially striate.

Prodorsum (Figures 1A, B; 2A, C) – Rostrum broadly rounded. Lamella distally triangular. Tutoria broad, fused dorsally on prodorsum forming bidentate structure. Rostral (13–15) and lamellar (22–26) setae setiform, roughened; bothridial seta (86–94) with long, roughened stalk and short, unilaterally dilated, flattened, barbed head.

Notogaster (Figures 1A, B; 2A–C ; 3A, B) – Five pairs of saccules, with small opening and bacilliform (often furcate) channel. In males, posterior part of notogaster with two large tubercles (versus tubercles absent in females), bearing opening of sacculus *S4*. Nine pairs of notogastral setae, posterior setae (p_1 – p_3) longer than others (13–15 versus 7–9), all setiform, roughened. Opisthonotal gland opening and all lyrifissures distinct.

Gnathosoma (Figures 3C–F) – Subcapitulum size: 73–82 × 49–53; subcapitular setae (*a*: 15; *m*: 9–11; *h*: 11–13) setiform, roughened; *m* thinnest, *a* thickest; both pairs of adoral setae (9–11) setiform, barbed. Small depression located posterior to *h*. Palp length: 45–49; postpalpal seta (7) spiniform, roughened. Chelicera length: 73–82; setae (*cha*: 26–28; *chb*: 11–13) setiform, barbed.

Epimeral and lateral podosomal regions (Figures 1B, 2C) – Sejugal region concave. Epimeral setal formula: 2–1–2–2; setae *1a*, *2a*, *3a* (4) spiniform smooth, others (13–15) setiform, roughened. Parastigmatic apophysis *Sa* thorn-like. Discidium broadly rounded.

Anogenital region (Figures 1B; 2C, 3A, B) – Genital (7–9), anal (13–15), adanal (13–15) setae setiform, roughened; eight pairs of genital setae; left anal plate of the holotype with two setae. Adanal lyrifissure close and parallel to anterior half of anal plate.

Legs (Figures 3G–J) – Monodactylous; claw strong, slightly barbed dorsally. Lateroparaxial porose area on femora I–IV and on trochanters III, IV well visible. Formulas of leg setation and solenidia: I (1–4–3–4–16) [1–2–2], II (1–4–3–4–15) [1–1–2], III (0–2–1–3–15) [1–1–0], IV (0–1–2–3–14) [0–1–0]; homology of setae and solenidia indicated in Table 1. Famulus medium-sized, rod-like. Solenidion ϕ_1 on tibia I subflagellate; ω_1 and ω_2 on tarsi I and II, and ϕ_2 on tibia I rod-like; other solenidia slightly bacilliform.

Table 1 Leg setation and solenidia of adult *Idiozetes schusteri* sp. n.

Leg	Tr	Fe	Ge	Ti	Ta
I	v'	d, (l), bv''	(l), v', σ	(l), (v), ϕ_1, ϕ_2	(ft), (tc), (it), (p), (u), (a), s, (pv), $\epsilon, \omega_1, \omega_2$
II	v'	d, (l), bv''	(l), v', σ	(l), (v), ϕ	(ft), (tc), (it), (p), (u), (a), s, (pv), ω_1, ω_2
III	–	d, ev'	l', σ	l', (v), ϕ	(ft), (tc), (it), (p), (u), (a), s, (pv)
IV	–	d	d, l'	l', (v), ϕ	ft'', (tc), (it), (p), (u), (a), s, (pv)

Note: Roman letters refer to normal setae, Greek letters to solenidia (except ϵ = famulus); single quotation mark (') designates setae on the anterior and double quotation mark (") setae on the posterior side of a given leg segments; parentheses refer to a pair of setae.

Remarks

Idiozetes schusteri **sp. n.** differs from the other species of the genus in combination of the following morphological traits: sexually dimorphic (males smaller and with two large tubercles in posterior part of notogaster); tutoria fused dorsally on prodorsum forming bidentate structure; nine pairs of notogastral setae (*c*, *la*, *lm*, *h*₁–*h*₃, *p*₁–*p*₃); five pairs of notogastral sacculae; eight pairs of genital setae; monodactylous. Distinctive characters of the new species from the other species of the genus *Idiozetes* can be found in the identification key below.

Etymology

This species is named in honor the well-known acarologist Reinhart Schuster (1930–2023), Professor Emeritus of Karl-Franzens-University Graz, Austria (Krisper *et al.* 2023).

Discussion

At present, about 80 species of brachypylina oribatid mites with distinct sexual dimorphism are known (e.g., Behan-Pelletier 2015; Bayartogtokh *et al.* 2017; Ermilov *et al.* 2022, 2023).

Sexual dimorphism in *I. schusteri* involving two large tubercles posteriorly on the notogaster in males (versus absent in females) is the first report on of this phenomenon in *Idiozetes*.

Cases of sexual dimorphism both in the family Idiozetidae and in the superfamily Eremaozetoidea was not reported previously. Females of *Idiozetes malgache* Fernández, Cleva and Theron, 2010 have three pairs of large tubercles posteriorly on the notogaster, however, data on males are absent (Fernández *et al.* 2010).

Key to known species of *Idiozetes*

1. All leg tarsi with three claws; notogaster with six pairs of setae; epimere IV with three pairs of setae; body length: 386–415 *Idiozetes malgache* Fernández, Cleva et Theron, 2010.
— All leg tarsi with one claw; notogaster with seven to 12 pairs of setae; epimere IV with one or two pairs of setae 2
2. Notogaster with 12 pairs of setae; genital plate with six setae; anal plate with two setae; body length: 384 *Idiozetes hagenensis* Colloff, 2012.
— Notogaster with seven to 10 pairs of setae; genital plate with more than six setae; anal plate with one seta 3
3. Notogaster with eight pairs of setae and three pairs of sacculae; genital plate with seven setae; body length: 243 *Idiozetes javensis* Hammer, 1979.
— Notogaster with seven or nine pairs of setae and four or five pairs of sacculae; genital plate with eight setae 4
4. Notogaster with seven pairs of setae and four pairs of sacculae; tutorium absent; body length: 260–325 *Idiozetes erectus* Aoki, 1976.
— Notogaster with nine pairs of setae and five pairs of sacculae; tutorium present (distal parts of tutoria fused dorsally on prodorsum forming bidentate structure); body length: 307–360 *Idiozetes schusteri* **sp. n.**

Distribution and habitat of *Idiozetes*

Species of *Idiozetes* are collectively known from the Oriental region, Japan, New Guinea, and Madagascar (Subías 2022, unpublished online version 2024).

Idiozetes erectus has been described from Malaysia (without habitat; Aoki 1976); later, the species has been recorded from Japan, Taiwan, China (in forests or without habitat; Aoki

1987; Wang *et al.* 2003). *Idiozetes javensis* was found from Java (in forest with ferns, *Zingiber* sp., shrubs, dead trunks, mosses, dead leaves, debris; Hammer 1979); later, the species has been reported from Taiwan (without habitat; Wang *et al.* 2003) and Vietnam (mostly, in litter, soil and leaf litter in tropical forests; also, in epiphytic roots of trees; sugarcane litter and rhizosphere in sugarcane field; decaying pine cone etc.; Corpuz-Raros and Ermilov 2020). *Idiozetes hagenensis* has been registered from New Guinea (without habitat; Colloff 2012). *Idiozetes malgache* has been collected from Madagascar (in decaying plant debris in humid, coastal and mid-altitude sclerophyllous forests; Fernández *et al.* 2010). The new species (*I. schusteri*) has been recorded from Vietnam (in litter, tree bark and canopy branches in tropical forest; data of this paper).

According to the summarized data, representatives of *Idiozetes* inhabit mostly forests in tropical and subtropical zones preferring soil-litter but can live in different microhabitats including arboreal and ground substrata.

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