

Description of the second species of *Serraseius* (Acari: Mesostigmata: Phytoseiidae) and adjustments of the concept of the genus

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Original research

ABSTRACT

Until now, *Serraseius* Moraes, Barbosa & Castro was a monotypic genus represented by *Serraseius caicara* Moraes, Barbosa & Castro, found in a fragment of the Atlantic Forest of the state of São Paulo, southeastern Brazil. This paper describes the second species of the genus, *Serraseius nordestinus* Araújo & Oliveira **sp. nov.**, found in a fragment of the Atlantic Forest of the state of Pernambuco, northeastern Brazil. The examination of the specimens of this new species led to a need to adjust the morphological concept of the genus, changing the interpretation of one of the dorsal shield setae from *Z1* to *S2* (hence changing the idiosomal pattern to 10A:7F/JV-3:ZV-3), including trumpet-shaped as an additional type of spermathecal calyx for species of the genus and the possibility to have *S5* inserted in the unsclerotized cuticle.

Keywords Amblyseiinae; Predaceous mite; Biological control; Taxonomy; Atlantic Forest

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Introduction

The Atlantic Forest is a Brazilian biome located mainly along the eastern part of the country's coast between the states of Rio Grande do Norte (in the northeast) and Rio Grande do Sul (in the south). Despite the drastic reduction of the preserved area since the Brazilian colonization in the 16th century, this biome is considered one of the main global biodiversity hotspots (Myers *et al.* 2000; Tabarelli *et al.* 2010). In recent years, studies conducted in this ecosystem have demonstrated a high diversity of phytoseiid mites, with discoveries of new species and genera (Castro and Moraes 2010; Ferla *et al.* 2012; Mineiro *et al.* 2012; Gonçalves *et al.* 2013, 2015; Moraes *et al.* 2013; Rocha *et al.* 2013, 2014; Barbosa *et al.* 2014; Nuvoloni *et al.* 2015; Lofego *et al.* 2016). Mites of this family have been extensively studied worldwide for their importance as biological control agents of pest organisms (McMurtry *et al.* 2015).

The only species of *Serraseius* Moraes, Barbosa & Castro (Phytoseiidae), described from the Atlantic Forest, led to characterization of the genus as having 17 pairs of serrate and relatively long setae on the dorsal idiosoma; light sclerotization of the sternal shield, with indistinct anterior and posterior margins; fixed cheliceral digit with few teeth; absence of *J2*, *S2* and leg macrosetae; females without setae *JV3* and *ZV3*; and reduced ventrianal shield, bearing a single pair of pre-anal setae (*JV2*) (Moraes *et al.* 2013).

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The objective of this paper is to describe the second species of the genus, based on females collected in a fragment of the Atlantic Forest in northeastern Brazil, and to adjust the generic characterization, based on features of the new species.

Materials and methods

Towards the end of 2022, the mites considered in this study were collected from a fragment of approximately 1.157 ha that has been included as part of the Atlantic Forest Biosphere Reserve, established by the Pernambuco state government for preservation purposes (SEMAS 2022). According to the Köppen-Geiger classification system, the local climate is classified as tropical Monsoon (Am) (Beck *et al.* 2018), with monthly average temperature of 26 °C and annually average rainfall of 2.263 mm. The vegetation is classified as Dense Ombrophiles Forest, with canopies commonly reaching 20–30 m in height.

Extracted leaf samples were examined under a stereomicroscope in the laboratory, collecting the phytoseiid mites and mounting them in Hoyer's medium. These were later examined under a phase-contrast microscope (Olympus® BX41), and determined to belong to an unknown species of *Serraseius*, which is described herein. Illustrations were made using Adobe Illustrator® software, based on images captured with a Moticam Pro 285B digital camera. Measurements of taxonomic relevant structures were made using a graded eyepiece, and are shown in micrometers, with those of the holotype shown in bold and followed by the mean, minimum and maximum (in parentheses) of all specimens examined. The photographs were captured with a digital camera Nikon DS-L3 under the optics of a Nikon Eclipse Ni-U interference phase microscope.

The nomenclature of the dorsal idiosomal setae is that of Lindquist and Evans (1965), adapted by Rowell *et al.* (1978) for the phytoseiids; nomenclature of the ventral setae follows Chant and Yoshida-Shaul (1991). Pore and lyrifissure nomenclature is that of Athias-Henriot (1975). The proposed idiosomal setal pattern follows Chant and Yoshida-Shaul (1992).

Taxonomy

Family Phytoseiidae Berlese, 1916

Subfamily Amblyseiinae Muma, 1961

Genus *Serraseius* Moraes, Barbosa & Castro, 2013

Serraseius nordestinus Araújo & Oliveira sp. nov.

Zoobank: 71330D9A-8CAD-49E1-9B2D-3BC3FE7905D1

(Figures 1–2)

Diagnosis

All 17 pairs of dorsal idiosomal setae as well as *JV5* serrated; ventral setae smooth. Dorsal shield reduced, surrounded by a wide marginal band of unsclerotized cuticle; anterolaterally reticulate, up to the insertion of *S2*; smooth posteriad *S4-Z4* and of irregular ornamentation, including the presence of short arches, elsewhere; with distinct constriction at level of *R1*; seta *S5* inserted on unsclerotized cuticle next to dorsal shield. Dorsal setae longer than 20 µm, except *j1*, *J5* and *S5*. Peritreme extending to level of *j1*. In microscopic preparations, *JV5* is always on the posterodorsal region of idiosoma. Dorsal shield with four pairs of pores (*gd1*, *gd2*, *gd5*, *gd9*). Sternal shield smooth, lightly sclerotized, with three pairs of setae (*st1-st3*) and with region anteriad *iv1* (where *st1* is inserted) even less sclerotized; posterior margin with irregular incisions. With five pairs of opisthogastric setae on unsclerotized cuticle (*JV1*, *JV4*, *JV5*, *ZV1*, *ZV2*). Ventrianal shield reduced, ovoid, about 1.5 times as long as its largest width,

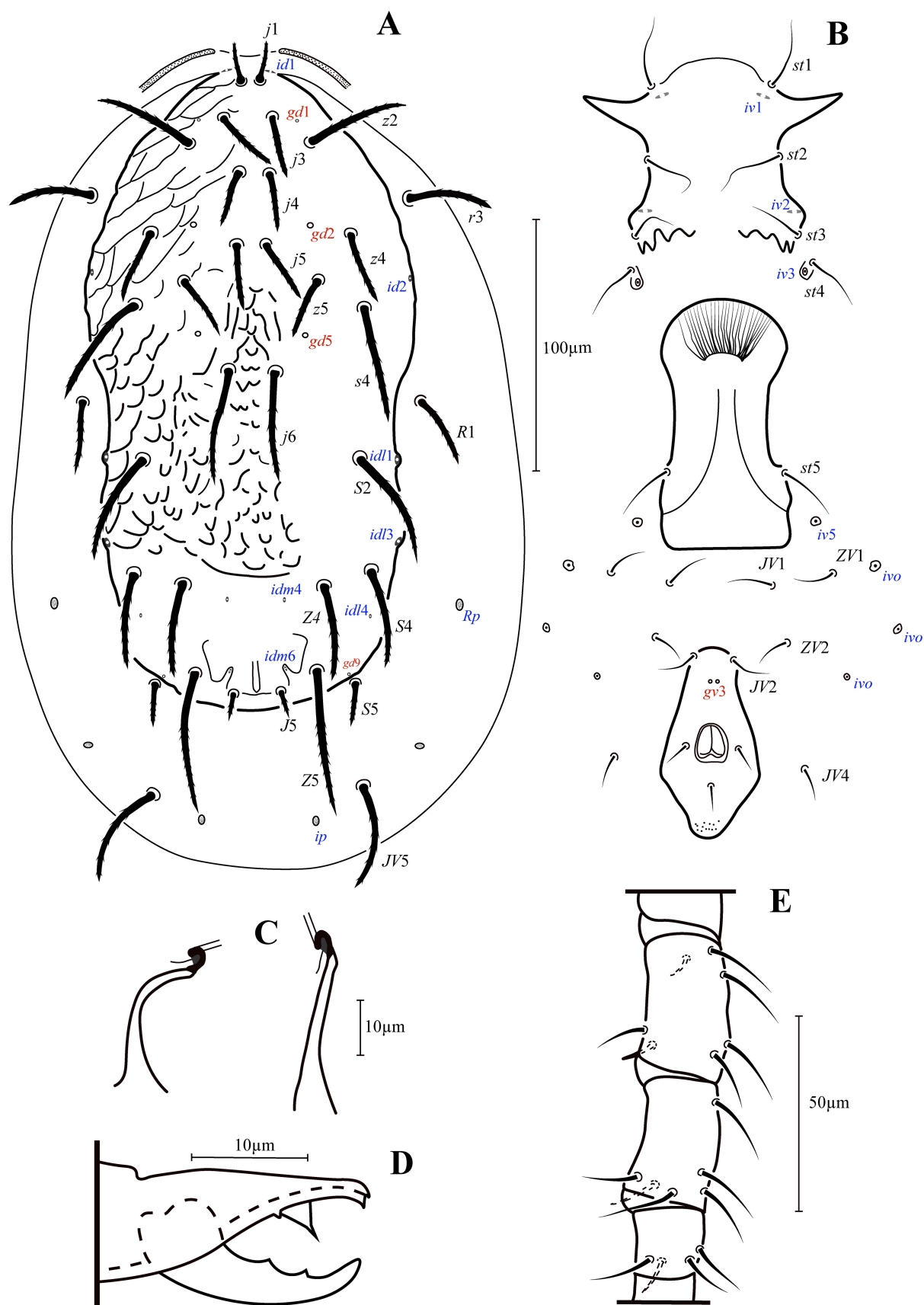


Figure 1 *Serraseius nordestinus* Araujo & Oliveira sp. nov., female: A – Dorsal idiosoma; B – Ventral idiosoma; C – Spermathecae; D – Chelicera; E – Genu, tibia and basitarsus of leg IV.

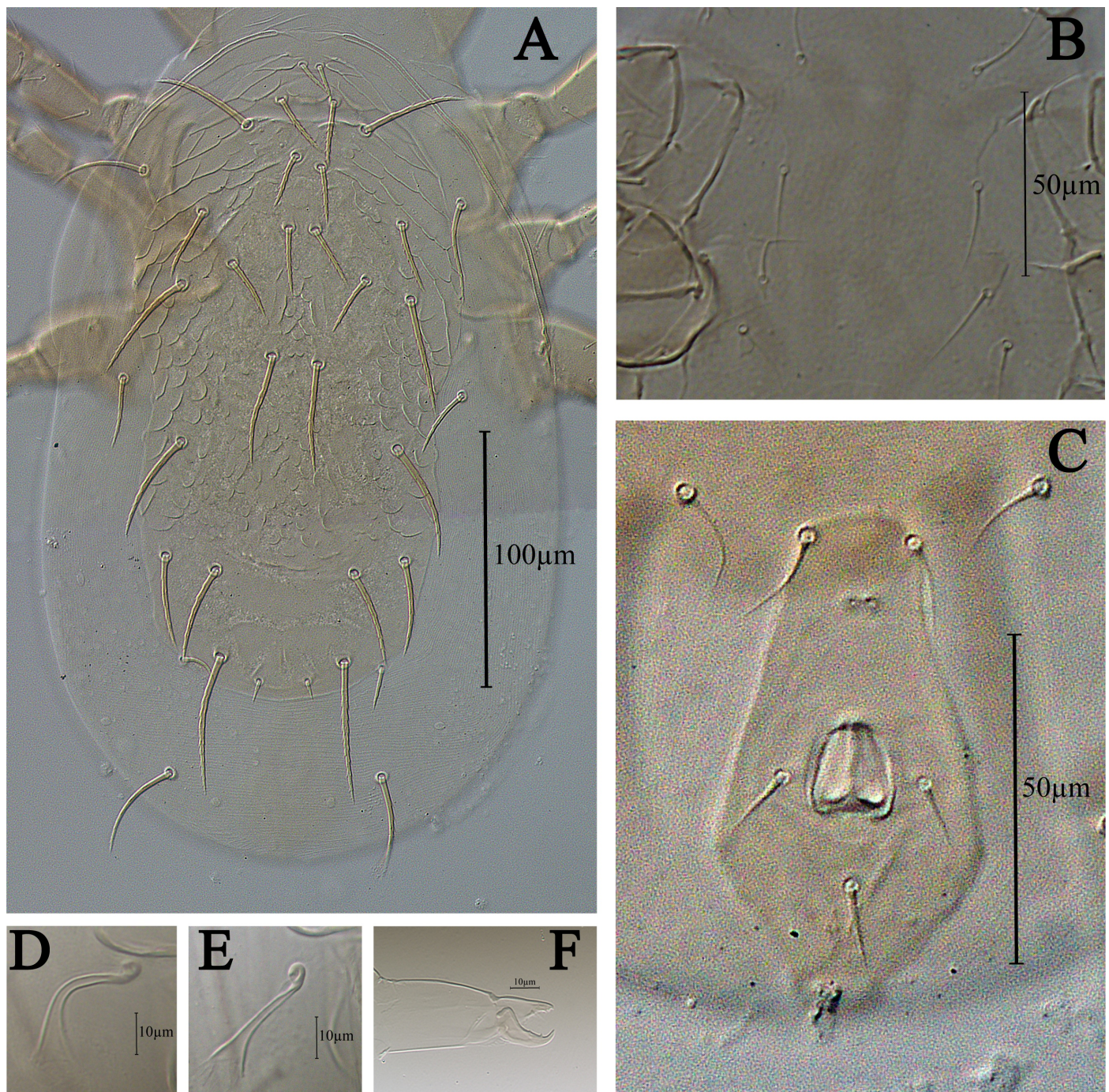


Figure 2 *Serraseius nordestinus* Araújo & Oliveira **sp. nov.**, female: A – Dorsal idiosoma; B – Sternal shield; C – Ventrianal shield; D and E – Spermathecae; F – Chelicera.

smooth, with only one pair of pre-anal setae (*JV2*); pre-anal pores (*gv3*) rounded and close together. Spermathecal calyx trumpet-shaped; atrium bulbous, c-shaped. Fixed cheliceral digit with a single tooth in addition to the apical tooth; *pilus dentilis* stout but discreet; movable digit with two teeth. Leg genu II with 8, III with 7 and IV with 7 setae; macrosetae absent in all legs.

Adult female (n = 10)

Idiosoma — (Figs. 1A, 2A) **329** 331 (306–341) long and **168** 168 (171–225) wide at level of *s4*. With 17 pairs of dorsal setae (*j1*, *j3–j6*, *J5*, *z2*, *z4*, *z5*, *Z4*, *Z5*, *s4*, *S2*, *S4*, *S5*, *r3*, *R1*) and 11 pairs of ventral setae (*st1–st5*, *JV1*, *JV2*, *JV4*, *JV5*, *ZV1*, *ZV2*) in addition to circumanal setae. All dorsal idiosomal setae and *JV5* serrate; ventral setae smooth.

Dorsal idiosoma — (Figs. 1A, 2A). Dorsal shield reduced, surrounded by a wide margin of unsclerotized cuticle; anterolaterally reticulate up to the insertion of *S2*; smooth posteriad *S4–Z4* and irregularly ornamented, including the presence of short arches, elsewhere; with distinct constriction at level of *R1*; seta *S5* inserted on unsclerotized cuticle, next to dorsal shield; with seven pairs of visible lyrifissures (*id1*, *id2*, *idl1*, *idl3*, *idl4*, *idm4*, *idm6*) and four pairs of pores (*gd1*, *gd2*, *gd5*, *gd9*); **254** 252 (247–254) long and **114** 123 (114–128) wide at the level of *s4*. Lengths of setae: *j1* **15** 15 (12–15), *j3* **25** 26 (25–27), *j4* **22** 23 (22–25), *j5* **25** 24 (22–25), *j6* **42** 42 (40–44), *J5* **10** 8 (7–10), *z2* **40** 41 (40–44), *z4* **27** 28 (27–30), *z5* **22** 24 (22–25), *Z4* **37** 38 (35–40), *Z5* **57** 57 (52–59), *s4* **47** 45 (42–47), *S2* **44** 45 (42–49), *S4* **37** 38 (37–42), *S5* **17** 16 (12–17), *r3* **37** 37 (35–42) and *R1* **27** 30 (27–33). Unsclerotized cuticle posterolaterad dorsal shield with three pairs of lyrifissures (*ip*, which usually occupies a posteroventral position on the idiosoma in other phytoseiids, *Rp* and an unidentified lyrifissure). Peritreme extending to level of *j1*.

Ventral idiosoma — (Figs. 1B, 2B–C). Sternal shield longer than wide, smooth, lightly sclerotized, with three pairs of setae (*st1–st3*) and two pairs of lyrifissures (*iv1*, *iv2*), with region anteriad *iv1* (where *st1* is inserted) even less sclerotized; posterior margin with irregular incisions; distances *st1–st3* **62** 62 (59–62) and *st2–st2* **54** 52 (49–54). Each *st4* seta inserted in a metasternal plate, together with a lyrifissure *iv3*. Genital shield smooth, bearing *st5*; distance *st5–st5* **49** 45 (42–49). Lyrifissure *iv5* in the unsclerotized cuticle, approximately in level with posterior shield margin. Ventrianal shield reduced, smooth and ovoid, with only one pair of pre-anal setae (*JV2*); **77** 74 (71–79) long, **37** 37 (35–39) wide at anus level; pre-anal pores (*gv3*) rounded and **2** 2 (2–3) apart. With five pairs of opisthogastric setae on unsclerotized cuticle (*JV1*, *JV4*, *JV5*, *ZV1* and *ZV2*), of which *JV5* **43** 43 (42–44) long, always occupying the posterodorsal region of the idiosoma in microscopic mounts, and three pairs of lyrifissures (*ivo*). Metapodal plates not visible.

Spermatheca — (Figs. 1C, 2D–E). Calyx trumpet-shaped, **30** 28 (26–30) long; atrium bulbous, c-shaped, attached to the calyx without neck.

Chelicera — (Figs. 1D, 2F). Fixed digit **20** 20 (19–20), with a subapical tooth in addition to the apical tooth; *pilus dentilis* stout but discreet. Movable digit **17** 18 (17–19), with two teeth well separated, in addition to the apical tooth.

Legs — (Fig. 1E). Macrosetae absent. Chaetotaxy: genu II, 2-2/1,2/0-1; genu III, 1-2/1,2/0-1.

Etymology

The epithet *nordestinus* is a Portuguese adjective meaning “from the northeast”, the Brazilian region where the types were collected.

Remarks

Serraseius nordestinus Araújo & Oliveira **sp. nov.** is the second species of the genus. The new species can be separated from *Serraseius caicara* Moraes, Barbosa & Castro, 2013 by having setae *j5*, *z2*, *Z4*, *S2*, *S4* and *S5* over 40% shorter; longer and trumpet-shaped calyx of spermatheca, instead of short and funnel-shaped; seta *S5* inserted on the unsclerotized cuticle in the new species, instead of on the dorsal shield; and pre-anal pores almost touching each other, instead of well apart and closer to lateral shield margin.

Male

Unknown.

Type material

Holotype female and nine paratype females collected by I.F. Araújo on 25 August 2022 from leaves of *Ficus gomelleira* Kunth (Moraceae) in Recife (8°00'33.8"S, 34°56'45.0"W), Pernambuco state, Brazil, deposited in the mite collection of Universidade Federal Rural de Pernambuco - UFRPE; four paratype females collected on 3 October 2022, other data the same as for the holotype, but deposited in the mite collection of Departamento de Entomologia e Acarologia da Escola Superior de Agricultura "Luiz de Queiroz", Universidade de São Paulo (ESALQ-USP), Piracicaba, São Paulo state, Brazil; three paratype females collected on 25 August 2022 and 9 November 2022, other data the same as for the holotype, deposited in the mite collection of Universidade Estadual de Santa Cruz – UESC, Ilhéus, Bahia state, Brazil. Types collected with license 83232-1, issued by Sistema de Autorização e Informação em Biodiversidade – SISBIO/ Instituto Chico Mendes de Conservação da Biodiversidade – ICMBio e Ministério do Meio Ambiente do Brasil.

Note

The analysis of the new species led to the conclusion that the dorsal setae interpreted by Moraes *et al.* (2013) as *Z1* is actually *S2*. This conclusion was based on the location of the setae in relation to the position of the pores and lyrifissures on the dorsal shield. According to Athias-Henriot (1975), the setae next to lyrifissure *idl1* (not clearly distinguishable in the original description of the genus) is *S2*, instead of *Z1*, as noted in Figures 1A and 2A of this publication. With this change, the idiosomal setal pattern for *Serraseius* needs to be changed from 10A:7D/JV-3:ZV-3 to 10A:7F/JV-3:ZV-3, the same pattern reported by Barbosa *et al.* (2014) for *Ingaseius* Barbosa, Rocha & Ferla. Other features common to these genera are the absence of leg macrosetae, chelicerae with few teeth, and ventrianal shield longer than wide and with only one pair of setae (*JV2*). However, *Ingaseius* differs from *Serraseius* by having *j3–j6*, *J5*, *z4*, *z5*, *S4*, *S5*, *R1* and *JV5* short and smooth, dorsal shield without a distinct waist at the level of *R1*, posterior margin of the sternal shield concave, with *st3* inserted in a separate plate (Barbosa *et al.* 2014). The analysis of the new species also showed that the calyx of the spermatheca in *Serraseius* can be trumpet-shaped and that *S5* of species of this genus can be inserted off the dorsal shield, differently from what was reported in the type species of this genus.

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