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A new record of an *Arrenoseius* Wainstein species and a new species of *Chelaseius* Muma & Denmark (Mesostigmata: Phytoseiidae) from Brazil

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Original research

ABSTRACT

In an effort to understand the fauna of Gamasina (Mesostigmata) edaphic mites from Brazil, *Arrenoseius robertogonzalezi* Trincado & Martin, 2018, known only from the original description from Chile, was found. Complementary morphological information is provided for this species. Likewise, a new species, *Chelaseius pluridentatus* n. sp. was found and is here described; it is distinguished from other *Chelaseius* Muma & Denmark species mainly by having more teeth on the fixed cheliceral digit, seven instead of 2–5. A key to the world species of *Chelaseius* is also provided.

Keywords biological control; predatory mite; soil mite; taxonomy

Zoobank <http://zoobank.org/98875A01-4AF8-4708-A915-4D7902C65313>

Introduction

Phytoseiidae (Mesostigmata: Gamasina) is the most extensively studied family of predatory mites (McMurtry *et al.* 2015). These are mostly found on plants, although some species are less commonly found in the soil. Some species of this family are broadly used for the biological control of pests, especially mites and small insects (McMurtry *et al.* 2015; Knapp *et al.* 2018). About 2,560 valid species are presently placed in this family, divided into three subfamilies, namely Amblyseinae, Phytoseiinae and Typhlodrominae (Moraes *et al.* 2004; Demite *et al.* 2023).


The phytoseiids reported from the litter/soil include species of the genera *Arrenoseius* Wainstein and *Chelaseius* Muma & Denmark; these genera presently comprise respectively 25 and 11 valid species (Moraes *et al.* 2004; Demite *et al.* 2023). *Arrenoseius* has been mostly reported from the Americas, from Canada to Argentina, occasionally from litter. Five species of this genus have been reported from Brazil, namely *A. gaucho* Ferla, Silva & Moraes, 2010, *A. gloreus* (El-Banhawy, 1978), *A. lofegoi* Barbosa & Demite, 2023, *A. morgani* (Chant, 1957) and *A. urquharti* (Yoshida-Shaul & Chant, 1988), none from the edaphic environment (Demite *et al.* 2023; Barbosa and Demite, 2023). *Chelaseius* has also been mostly reported from the Americas, from Canada to Argentina, by far mostly from litter. Three species have so far been reported from Brazil, namely *C. braziliensis* Denmark & Kolodochka, 1990, *C. caudatus* Karg, 1983 and *C. lativentris* Karg, 1983, collected in hay, humus and bird nests, respectively (Moraes *et al.* 2004; Demite *et al.* 2023).

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In an effort to understand the fauna of Gamasina edaphic mites from Brazil, the aim of the study is to provide a new record of *Arrenoseius* and to describe a new species of *Chelaseius*, providing a key to world species of the latter genus.

Material and methods

Samples of litter/soil were collected in areas of the Brazilian states of Rio Grande do Sul (Pampa biome) and São Paulo (Atlantic Forest biome). In the laboratory, mites were extracted from the samples in a modified Berlese-Tullgren apparatus (Oliveira *et al.* 2001). All mites were mounted in Hoyer's medium for later examination under phase contrast (Leica, DMLB) and differential interference contrast (Nikon, Eclipse 80i) microscopes. The Mesostigmata were separated into families, based on Lindquist *et al.* (2009), and the Phytoseiidae were separated into genera, based on Chant and McMurtry (2007). The *Arrenoseius* and the *Chelaseius* specimens were compared with the original descriptions and redescrptions of the species presently affiliated to these genera.

Complementary information on the morphology of the *Arrenoseius* species collected is provided, based on the collected voucher specimens. The *Chelaseius* species was found to belong to a new species, herein described. Measurements were taken with a graded ocular attached to the phase contrast microscope. For each character, the average measurement is given first, followed (in parentheses) by the respective range, all in micrometers. Shield lengths were taken along the midline from the anterior to the posterior margins, and the width, at the widest level, except where otherwise specified.

The most relevant taxonomic structures of the new species were photographed using a digital camera connected to the differential interference contrast microscope. Illustrations were made using Adobe Illustrator®. Dorsal setal nomenclature is based on Lindquist and Evans (1965), as adapted by Rowell *et al.* (1978); ventral nomenclature is based on Chant and Yoshida-Shaul (1991); idiosomal setal pattern, on Chant and Yoshida-Shaul (1992); and notation of pore-like structures, on Athias-Henriot (1971, 1975).

The key provided for the separation of the *Chelaseius* species was prepared based on the original descriptions and available redescrptions. The species included were those whose adult females have been described and that were reported in Demite *et al.* (2023). In the key, only the country of original description is mentioned.

Taxonomy

Family Phytoseiidae Berlese

Genus *Arrenoseius* Wainstein

Arrenoseius Wainstein, 1962: 12.

Arrenoseius, Moraes *et al.* 2004: 55.

***Arrenoseius robertogonzalezi* Trincado & Martin, 2018**

Arrenoseius robertogonzalezi Trincado & Martin, in Trincado *et al.* 2018: 324.

Adult female

(n = 8)

Idiosomal setal pattern — 10A:9B/JV-3:ZV.

Dorsal idiosoma — Dorsal shield 355 (350–360) long and 280 (275–293) wide. Measurements of setae: *j1* 13 (11–14); *j3* 19 (18–21); *j4* 8 (7–9), *j5* 8 (7–9); *j6* 7 (6–8); *J2* 8 (7–9); *J5* 9 (8–10); *z2* 17 (16–19); *z4* 19 (18–20); *z5* 8; *Z1* 9 (8–10); *Z4* 63 (61–64); *Z5* 85 (84–88); *s4*

45 (44–46); *S2* 19 (18–21); *S4* 15 (13–17); *S5* 15 (14–16); *r3* 15 (13–16); *R1* 13 (11–15); all aciculate and smooth.

Ventral idiosoma — Sternal shield 55 (52–58) long and 75 (73–77) wide at level of *st2*; distances between *st1–st3* 60 (59–61) and *st2–st2* 65 (64–66). Genital shield 110 (108–112) long (including hyaline flap) and 125 (124–129) wide at level of posterior margin; distance between *st5–st5* 85 (84–86). Ventrianal shield 125 (121–131) long, 165 (162–166) wide at level of *ZV2* and 130 (129–133) wide at anus level. Measurements of setae: *st1* 25 (23–26), *st2* 28 (27–30), *st3* 28 (26–29), *st4* 28 (27–29), *st5* 30 (29–31), *JV1* 23 (22–25), *JV2* 25 (23–26), *JV4* 13 (12–14), *JV5* 50 (47–51), *ZV1* 30 (29–32), *ZV2* 25 (23–26), *ZV3* 10 (9–11); all aciculate and smooth.

Peritreme — Extending forward to level of *j1*.

Chelicera — Fixed cheliceral digit 35 (34–36) long, with eight teeth; movable cheliceral digit 33 (32–34) long, with two teeth.

Spermatheca — Calyx saccular, 18 (17–19) long.

Leg macroseta — Present only on tarsus IV, 60 (59–61) long.

Specimens examined

Eight adult females collected from litter/soil of a soybean plantation [*Glycine max* (L.) Merrill] at Aceguá (31°45'11"S, 54°3'22"W; 204 m above sea level), Rio Grande do Sul state, Brazil, in October 2021. All voucher specimens were collected by A.F. Duarte and deposited in the Mite Reference Collection of Departamento de Entomologia e Acarologia, Escola Superior de Agricultura “Luiz de Queiroz” (ESALQ), Universidade de São Paulo (USP), Piracicaba, São Paulo state, Brazil.

Remarks

This is the first record of this species in Brazil. It was recently described from Chile, based on the holotype and five paratype females collected on *Festuca* sp. [Poaceae], *Viburnum tinus* L. [Adoxaceae] and *Passiflora incarnata* L. [Passifloraceae]. Despite the extensive effort dedicated to the edaphic fauna of Mesostigmata in representative sites of all Brazilian ecosystems, this species was only found in the southernmost region of the Brazilian territory, at the border with Uruguay. This is compatible with the relatively high latitude of the type localities of this species, in Chile (Santiago and O’Higgins Regions). According to the original description, the types of *A. robertogonzalezi* are slightly larger than the specimens collected in this study (dorsal shield length and maximum width respectively 389 (360–407) and 320 (300–330)), and consequently some of their setae are slightly longer: *j3* 25 (24–26), *z4* 24 (23–25) and *s4* 54 (50–57). These differences are here considered to be intraspecific variations.

Chelaseius Muma & Denmark

Chelaseius Muma & Denmark 1968: 232.

Chelaseius, Denmark & Kolodochka 1990: 219; Moraes *et al.* 2004: 56.

Chelaseius pluridentatus n. sp.

Zoobank: [1E6AA830-1630-4063-A05B-A8AE07381936](https://doi.org/10.1111/zoobank.1E6AA830-1630-4063-A05B-A8AE07381936)

Diagnosis

Setae *J5*, *Z4* and *Z5* smooth; seta *s4* about 20 times as long as *z4*; seta *Z4* about 12 times as long as *S4*; ventrianal shield smooth, with a lateral constriction at level of *ZV2*; fixed cheliceral digit with seven teeth; spermatheca trumpet-shaped, calyx about 45 long.

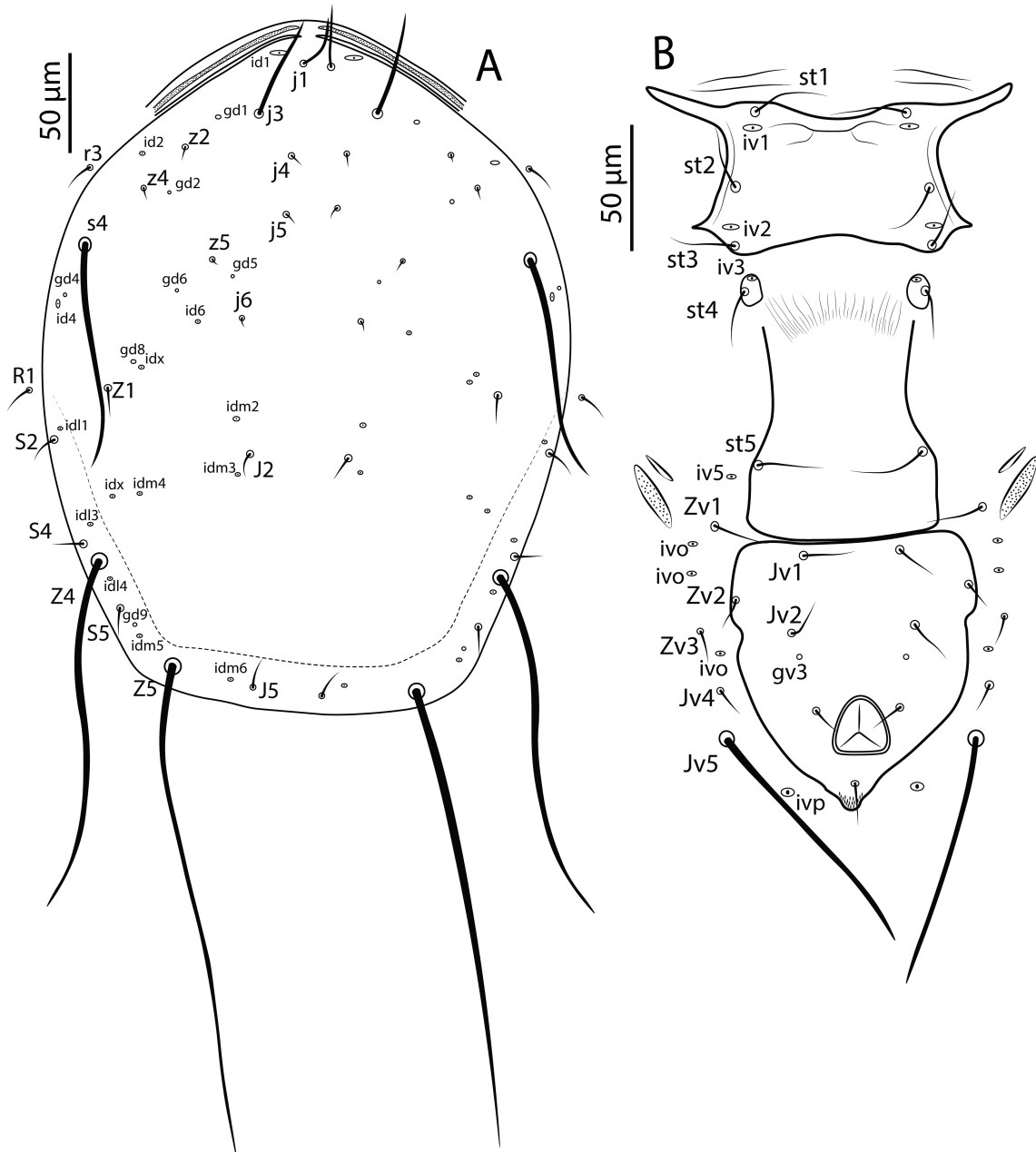


Figure 1 *Chelaseius pluridentatus* n. sp. Female. A – Dorsal view of idiosoma; B – Ventral view of idiosoma.

Morphological characterization

Adult female

(n = 4) (Figures 1–2).

Idiosomal setal pattern — 10A:9B/JV-3:ZV.

Dorsal idiosoma — (Figure 1A). Dorsal shield smooth; 360 (350–370) long and 273 (265–290) wide; podonotal region with nine pairs of setae (*j1*, *j3*–*j6*, *z2*, *z4*, *z5* and *s4*), four pairs of distinguishable lyrifissures and five pairs of distinguishable gland pores; opisthonotal region with eight pairs of setae (*J2*, *J5*, *Z1*, *Z4*, *Z5*, *S2*, *S4* and *S5*), eight pairs of distinguishable lyrifissures and two pairs of distinguishable gland pores. Unsclerotized cuticle along lateral margins of dorsal shield with two pairs of setae (*r3* and *R1*). Measurements of setae: *j1* 36

(35–38); *j3* 56 (55–58); *j4* 6 (5–7), *j5* 6 (5–7); *j6* 6 (5–7); *J2* 11 (10–12); *J5* 13 (12–15); *z2* 6 (5–8); *z4* 6 (5–7); *z5* 6 (5–8); *Z1* 15; *Z4* 158 (157–162); *Z5* 250 (230–275); *s4* 119 (118–120); *S2* 14 (13–15); *S4* 13 (12–14); *S5* 16 (15–18); *r3* 13 (12–14); *R1* 12 (10–13); all aciculate and smooth.

Ventral idiosoma — (Figure 1B). Sternal shield smooth; 59 (55–60) long and 89 (88–93) wide at level of *st2*; with three pairs of setae and two pairs of lyrifissures; distances between *st1–st3* 58 (57–60) and *st2–st2* 81 (80–83). Metasternal plates roundish, bearing seta *st4* and lyrifissure *iv3*. Genital shield smooth; 111 (108–113) long (including hyaline flap) and 83 (82–85) wide at level of posterior margin; bearing seta *st5*; distance between *st5–st5* 73 (72–75); posterior margin slightly convex. Lyrifissure *iv5* posteromesad *st5*, on the unsclerotized cuticle. Ventrianal shield pentagonal, with a slight constriction posteriad *ZV2* and smooth; 112 (110–118) long, 104 (100–105) wide at level of *ZV2* and 75 (73–76) wide at anus level; with three pairs of setae (*JV1*, *JV2* and *ZV2*) in addition to three circumanal setae, and a pair of distinguishable pores; cribrum composed of 2–3 irregular rows of spicules along posterior margin of the shield. Unsclerotized cuticle along margins of ventrianal shield with four pairs of setae (*JV4*, *JV5*, *ZV1* and *ZV3*) and four pairs of distinguishable lyrifissures. Two pairs of ellipsoidal metapodal plates, the anterior smaller. Measurements of setae: *st1* 31 (30–33), *st2* 29 (28–30), *st3* 29 (28–30), *st4* 26 (25–28), *st5* 29 (28–30), *JV1* 24 (22–26), *JV2* 24 (23–25), *JV4* 13 (12–14), *JV5* 109 (107–110), *ZV1* 25 (23–27), *ZV2* 13 (12–15), *ZV3* 13 (12–15); all aciculate and smooth.

Peritreme — Extending forward to level of *j1*.

Chelicera — (Figure 2A). Fixed cheliceral digit 64 (63–65) long (from dorsal lyrifissure to tip of the digit), with three relatively large teeth followed proximally by four smaller teeth, in addition to the apical tooth, and a long and setiform pilus dentilis set on an ellipsoid tubercle, 22 (21–23) long, at the base; movable cheliceral digit 46 (43–48) long, without teeth; dorsal and antiaxial lyrifissures distinct, dorsal seta indistinct.

Spermatheca — (Figure 2B). Calyx trumpet-shaped, 45 (44–46) long.

Leg macrosetae — (Figure 2C). *Sge I* 41 (40–43), *Sge II* 43 (42–45), *Sge III* 60 (58–62), *Sti III* 55 (54–56), *Sge IV* 133 (130–135), *Sti IV* 101 (100–105), *St IV* 78 (75–79); all aciculate and smooth. Chaetotaxy: genu II 1–2/1, 2/0–1, genu III 0–2/1, 2/1–1.

Adult male

Not known.

Etymology

The name *pluridentatus* refers to the presence of more teeth on the fixed cheliceral digit of this species than in other *Chelaseius* species.

Specimens examined

Holotype female and one paratype female from litter/soil of a fragment of the Atlantic Forest biome at Embrapa Pecuária Sudeste (22°01'10"S, 47°53'38"W; 860 m above sea level), São Carlos, São Paulo state, Brazil, December 31, 2021 and January 28, 2022, respectively; two paratype females from litter/soil of an Integrated Crop-Livestock-Forestry (ICLF) area at same locality, March 4, 2022 and April 29, 2022. All types collected by V. Borges and deposited in the Mite Reference Collection of Departamento de Entomologia e Acarologia, Escola Superior de Agricultura “Luiz de Queiroz” (ESALQ), Universidade de São Paulo (USP), Piracicaba, São Paulo state, Brazil.

Remarks

Chelaseius pluridentatus n. sp. differs from other known *Chelaseius* species by having seven teeth (instead of 2–5 in other species, according to Denmark & Kolodochka, 1990; Chant & McMurtry, 2004). It is most similar to *C. austrellus* (Athias-Henriot, 1967), but females of the

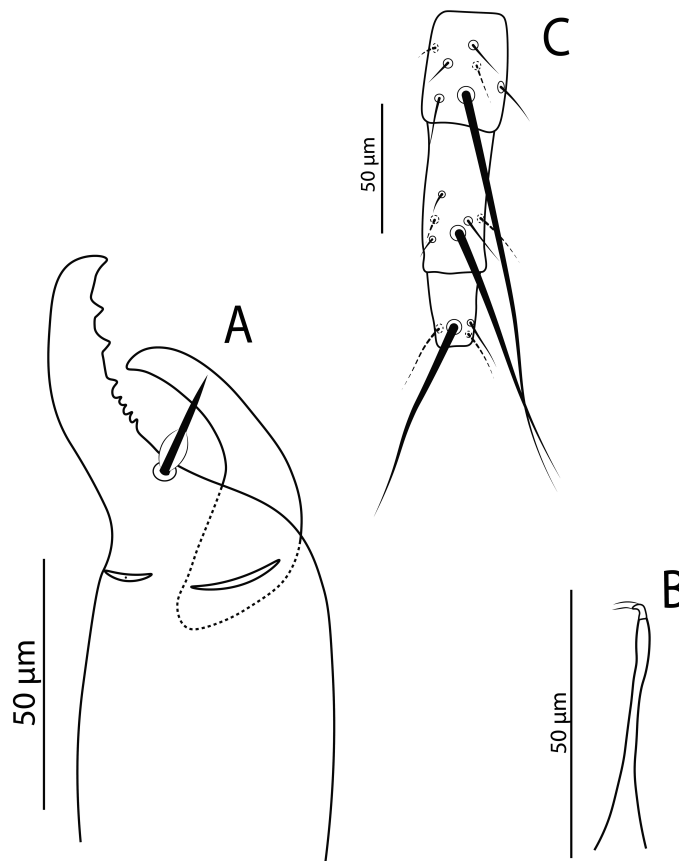


Figure 2 *Chelaseius pluridentatus* n. sp. Female. A – Chelicera; B – Spermatheca; C – Genu, tibia and basitarsus of leg IV.

latter have setae *J5*, *Z4* and *Z5* barbed, seta *s4* about eight times as long as *z4*; seta *Z4* about 12 times as long as *S4*; and calyx of spermatheca about 20 long. It is similar to *C. brazilensis* Denmark & Kolodochka, concerning the higher number of teeth on the fixed cheliceral digit (five teeth in *C. brazilensis*, lower number in other species) and an ellipsoid tubercle at the base of the pilus dentilis (this feature may not have been given full attention in the description or redescription of some other species), but the latter differs by having spermathecal calyx cup-shaped.

Key to world species of *Chelaseius*

1. Seta *s4* shorter than distance *s4-Z1*; seta *Z4* about as long as distance *Z4-Z5* *C. vicinus* (Muma, 1965); USA
 — Seta *s4* at least as long as distance *s4-Z1*; seta *Z4* much longer than distance *Z4-Z5* 2
2. Spermatheca funnel- or trumpet-shape 3
 — Spermatheca not funnel- or trumpet-shaped 5
3. Fixed cheliceral digit with seven teeth; *s4* about 20 times as long as *z4*; calyx of spermatheca about 45 long *C. pluridentatus* n. sp.; Brazil
 — Fixed cheliceral digit with 2–3 teeth; *s4* at most 10 times as long as *z4*; calyx of spermatheca about 20 long 4

4. Fixed cheliceral digit with three teeth; *S2* about 2.5 times as long as *z5*; *Z4* about eight times as long as *S4* *C. austrellus* (Athias-Henriot, 1967); Argentina
 — Fixed cheliceral digit with two teeth; *S2* about 1.5 times as long as *z5*; *Z4* about 13 times as long as *S4* *C. valliculosus* Kolodochka, 1987; Crimea
5. Calyx of spermatheca at most 1.5 times as long as widest diameter 6
 — Calyx at least about twice as long as widest diameter 9
6. Calyx of spermatheca saccular, about 1.5 times as long as widest diameter; *Z1* about four times as long as *z5* *C. lativentris* Karg, 1983; Brazil
 — Calyx of spermatheca cup-shaped, at most as long as widest diameter; *Z1* at most twice as long as *z5* 7
7. Fixed cheliceral digit with five teeth of about uniform sizes; spermathecal atrium undifferentiated; *Z4* about eight times as long as *S4*
 *C. brazilensis* Denmark & Kolodochka, 1990; Brazil
 — Fixed cheliceral digit with less than five teeth; spermathecal atrium nodular; *Z4* at least 20 times as long as *S4* 8
8. Fixed cheliceral digit with two teeth; *S2* about 1.4 times as long as *z5*
 *C. schusterellus* (Athias-Henriot, 1967); Argentina
 — Fixed digit with three distal relatively large teeth and one small proximal tooth; *S2* about 2.8 times as long as *z5* *C. caudatus* Karg, 1983; Brazil
9. Ventrianal shield smooth; seta *S4* at least about four times as long as *Z1* 10
 — Ventrianal shield lightly imbricate; seta *S4* at most twice as long as *Z1* 11
10. Seta *Z4* at least about five times as long as *S4*; setae *Z4* and *Z5* slightly barbed
 *C. floridanus* (Muma, 1955); USA
 — Seta *Z4* at most about 3.5 times as long as *S4*; setae *Z4* and *Z5* smooth
 *C. arnei* Faraji & Karg, 2006; France
11. Setae *Z4* and *Z5* respectively about 0.3 and 0.4 as long as dorsal shield; seta *Z4* at most six times as long as *Z1*; calyx of spermatheca elongate bell-shaped, length < 10 long
 *C. freni* Karg, 1976; Chile
 — Setae *Z4* and *Z5* respectively about 0.4 and 0.7 as long as dorsal shield; seta *Z4* at least 10 times as long as *Z1*; calyx of spermatheca tubular to very slightly flaring next toward vesicle, length > 20 long *C. tundra* (Chant & Hansell, 1971); Canada

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