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Revisiting the poorly known Chilean genus *Autostreptus* Silvestri, 1905 (Diplopoda, Spirostreptida, Spirostreptidae) with the description of a new species

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Abstract. The genus *Autostreptus* Silvestri, 1905, endemic to Chile, is revisited here with the description of *Autostreptus silvagonzalezi* sp. nov., and redescriptions of *A. chilensis* (Gervais, 1847) and *A. yanezi* Demange & Silva, 1971, based on freshly collected material. Pictures of general somatic and male sexual characters of all species are provided, and descriptions of secondary sexual characters are presented for the first time. Additionally, notes on the taxonomic assignment of the genus to the tribe Perustreptini Verhoeff, 1941 and novel records of *A. chilensis* and *A. yanezi* are included.

Keywords. New species, South America, Orthogoneptini, Spirostreptini, Perustreptini.

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Introduction

Spirostreptidae Brandt, 1833 is one of the most diverse families of Spirostreptida Brandt, 1833, comprising approximately 275 described species in 60 genera (Enghoff *et al.* 2015), predominantly found in the Neotropical and Afrotropical regions (Enghoff 2015). Although the taxonomy of the family has received some attention (see Hoffman 1980) including the most comprehensive taxonomic study conducted by Krabbe (1982), numerous species have remained undescribed worldwide. This trend is also true in Chile, where millipede fauna in general remains largely understudied, with new collections consistently revealing new species, thus reflecting the limited knowledge of species richness in the territory (Parra-Gómez 2022). To date, 71 native millipede species are known to Chile, with only two belonging to Spirostreptidae, in the genus *Autostreptus* Silvestri, 1905 (Krabbe 1982; Parra-Gómez 2022; Moritz & Parra-Gómez 2023; Parra-Gómez *et al.* 2023).

Autostreptus is endemic to Chile, distributed in the central region with a Mediterranean climate, ranging in altitude from 50 to 1500 m above sea level (Demange & Silva 1971; Parra-Gómez 2022). The genus was established by Silvestri (1905) to accommodate *Autostreptus chilensis* (Gervais, 1847), originally described as *Iulus chilensis* and later transferred to *Spirostreptus* by Humbert & de Saussure (1872). Attems (1903) described two additional species from Chile, *Spirostreptus collectivus* Attems, 1903, and *Kochliogonus novarae* Attems, 1950. These species were later synonymized with *Autostreptus chilensis* by Silvestri (1905) and Demange & Silva (1971), respectively. The latter authors also revised the genus and described a second species, *Autostreptus yanezi* Demange & Silva, 1971.

This work presents the description of a new species of *Autostreptus* based on freshly collected material from Chile. Additionally, new records and illustrated redescriptions of *A. chilensis* and *A. yanezi* are provided, including previously unknown secondary sexual characters, and notes on the position of the genus in the tribe Perustreptini Verhoeff, 1941.

Material and methods

The material examined is deposited in the following institutions: Museo Nacional de Historia Natural, Santiago, Chile (MNHNCL) (curator: Mario Elgueta) and Museo de Zoología de la Universidad de Concepción, Chile (MZUC) (curator: Laura Tavera Martínez).

High-resolution photographs of relevant morphological features were captured with an Olympus Tough TG-6 Camera and stacked in Zerene Stacker 1.04. The measurements were made directly in ImageJ software, and the values were rounded to one decimal place. The locality data were obtained from the examined material labels, original descriptions, and in the field using the free application All-In-One Offline Maps (http://www.offline-maps.net/). Distribution maps were made using the free software QGIS ver. 3.28.1. Gonopodal terminology follows Hoffman (2008) and Enghoff (2017).

List of abbreviations used in the figures:

atp = antetorsal process of telopodite
dmp = distolateral metaplica process
ltp = lamellar expansion of telopodite
map = mesoapical metaplica process
mp = metaplica
pfp = prefemoral process of first male leg-pair
pn = penes
pp = proplica
px = paracoxite
sg = seminal groove
sl = solenomere
tp = telopodite

Results

Taxonomy

Class Diplopoda Blainville, 1844
Order Spirostreptida Brandt, 1833
Family Spirostreptidae Brandt, 1833
Tribe Perustreptini Verhoeff, 1941

Genus ***Autostreptus*** Silvestri, 1905

Autostreptus Silvestri, 1905: 742. Type species: *Iulus* (recte: *Julus*) *chilensis* Gervais, 1847, by monotypy.

Diagnosis

Modified after Demange & Silva (1971: 709). Species of *Autostreptus* differ from other Spirostreptidae by the combination of the following characters: anterior margin of collum unmodified, not thickened (Figs 4A, 8C); body rings mostly smooth. Prefemoral process (pfp) of first pair of male legs prominent (Figs 5A, 7A, 9A). Gonopods with proplica (pp) subrectangular (Figs 5C, 7C, 9C); metaplica (mp) with mesoapical process (map) prominent; lateroapical metaplical process (dmp) elongated, directed ectad (Figs 5C–D, 7C–D, 9C–D). Telopodite (tp) with lamellar expansion (ltp); seminal groove (sg) running along ectal margin of ltp; long, pointed antetorsal process (atp) (Figs 5C, E, 7C, E, 9C, E); tip of telopodite (tp) not branched, solenomere (sl) acuminated, partially covered by ltp (Figs 5F, 7F, 9F).

Distribution

Known from Canela in Coquimbo Region to Constitución in Maule Region, Chile.

Composition

Autostreptus chilensis (Gervais, 1847), *A. yanezi* Demange & Silva, 1971, and *A. silvagonzalezi* sp. nov.

Remarks

While Spirostreptidae is well-defined morphologically within Spirostreptida, its internal classification remains uncertain as a result of the lack of phylogenetic studies. A preliminary subdivision was suggested by Enghoff (2023), carefully organizing the family into five tribes: Spirostreptini Brandt, 1833 (African genera); Trachystreptini Cook in Cook & Collins, 1895 (African genera); Orthogoneptini Chamberlin, 1941 (American genera); Perustreptini Verhoeff, 1941 (African and America genera); and Metriostreptini Krabbe, 1982 (African genera). Here, we follow this intrafamilial organization, discussing below the position of the Chilean *Autostreptus*.

Autostreptus chilensis (Gervais, 1847)
Figs 1–2, 4–5

Iulus chilensis Gervais, 1847: 193.
Spirostreptus collectivus Attems, 1903: 88, figs 17–19. Synonymized by Silvestri (1905: 743).
Kochliogonus novarae Attems, 1950: 246, figs 83–85. Synonymized by Demange & Silva (1971: 709).

Iulus chilensis – Gervais 1849: 61, figs 3a–f; 1854: figs 3–3f; 1859: 24.
Spirostreptus chilensis – Humbert & de Saussure 1872: 174. — Porat 1876: 41.
Autostreptus chilensis – Silvestri 1905: 742, figs 23, 35–46. — Porter 1912: 49, fig. 22. — Chamberlin 1957: 39. — Demange 1970: 379. — Demange & Silva 1971: 709, figs 1–4. — Urzua & Silva 1981: 271. — Krabbe 1982: 290, fig. 203. — Mauriès *et al.* 2001: 581. — Parra-Gómez 2022: 456, figs 2, 11c.
Autostreptus collectivus – Attems 1914: 122. — Moritz & Fischer 1974: 358. — Weidner 1960: 102.

Diagnosis

Males of *A. chilensis* differ from those of other species of the genus by having lamellar expansion of telopodite (ltp) with protruding serrated zone (arrow in Fig. 5F) just before the solenomere (sl); apex of metaplica (mp) slightly subtriangular; dmp pointed (Fig. 5C–E). First leg-pair with subtriangular and medially slightly bent outwards pfp (Fig. 5A).

Material examined

CHILE – **Valparaíso Region** • 2 ♂♂, 5 ♀♀; Parque Natural Cerro Los Pinos; 33.08° S, 71.43° W; 23 Oct. 2018; J. Contreras leg.; under rocks; e-8 (field code); MNHNCL • 2 ♂♂, 1 ♀; Parque Natural Gómez Carreño; 32.9904° S, 71.5204° W; 180 m a.s.l.; 6 Jul. 2023; A. Parra-Gómez and J. Contreras leg.; under a rock; PG-34-VAL (field code); MNHNCL • 1 ♂, 1 ♀, 1 juv.; near El Salto; 33.05° S, 71.51° W; 62 m a.s.l.; 8 Jul. 2023; A. Parra-Gómez, J. Contreras and Matías Sáa; under a rock; PG-49-VAL (field code); MNHNCL.

Redescription

Based on the examined specimens to supplement the original description and illustrate certain morphological features.

Measurements. Males. Length ca 5.5–6.2 cm, vertical diameter 3.7–3.9 mm, width 3.5–3.7 mm. 59–61 podous rings, no apodous ring in front of telson. Females. Length ca 5.6–6.1 cm, vertical diameter 4–4.1 mm, width 3.9–4 mm. 58–60 podous rings, no apodous rings in front of telson.

Color. Recently fixed in alcohol. Head, antennae, and collum brownish to ruddy; body rings brownish in general; metazonites in anterior rings with one anterior band brownish and one posterior band ruddy, in posterior rings anterior band progressively fading to whitish and posterior band to brownish; telson whitish, faded (Fig. 4A–D).

Head. Eyes each with ca 41–45 ommatidia in seven horizontal rows (Fig. 4A). Antennae short, reaching back to ring 3 when stretched; fifth and sixth antennomere with distodorsal patch of short sensilla basiconica, seventh antennomere with distal margin covered by tiny conical setae; last two antennomeres densely setose (Fig. 4C). Mandibles with small stipital lobes, marginally swollen in males. Gnathochilarium with stipites slightly swollen distally in males; mentum heptagonal, with deep concavity; long setae marginally on apical part of lamellae linguales and stipites.

Collum. Smooth, with only one lateral diagonal furrow, more pronounced and longer in female; unornamented and without lateral lobes (Fig. 4A).

Body rings. Mostly smooth, without carinae or granulation (Fig. 4A–B). Prozonites with usual fine ring furrows in anterior part. Metazonites striated, but striation not reaching ozopore level, dorsally smooth. Ozopore situated at mid-length of metazonite. No sigilla. Stigmatal grooves not extended.

Telson. Preanal ring without process. Anal valves smooth, marginal lips not developed. Subanal scale broad triangular (Fig. 4B).

Legs. Midbody legs short, ca ½ of body maximum vertical diameter. Males with adhesive pads only on tibia from leg-pair 3 on, absent in females; pads gradually smaller towards posterior rings (Fig. 4D). First male leg-pair (Fig. 5A): coxosternum oval-shaped, with lateral groups of few short setae, surface scattered with tiny setae. Prefemoral process (pfp) long, but not as long as prefemur, subtriangular, medially slightly bent outwards, surface scattered with tiny setae. Prefemur almost subtriangular, surface scattered with tiny setae, distally with few short setae. Femur, postfemur, tibia, and tarsus with long setae ventrally. Second male leg-pair (Fig. 5B): coxosternum short, bearing long setae marginally. Prefemur compressed dorsoventrally, with distal row of large setae; remaining podomeres with long setae ventrally; tarsal claw present. Penes (pn) located at proximal region of second leg-pair, composed of two entirely separate parts with subtriangular tips extended in laminar linguiform processes; gonopore positioned distally, not setose.

Gonopod. Sternum short, trapezoidal. Proplica (pp) ca as long as metaplica (mp) (Fig. 5C–D), parallel-sided; pp distally swollen, rounded, with short setae (Fig. 5C). Metaplica (mp) not complex (Fig. 5C–D); mesal margin thickened, laterally in contact with pp almost along its entire length; mp excavated distally, where antetorsal process (atp) emerges (Fig. 5C); mesoapical metaplica process (map) swollen, subtriangular, with diagonal shallow furrows (Fig. 5C–D); distolateral metaplica process (dmp) extended

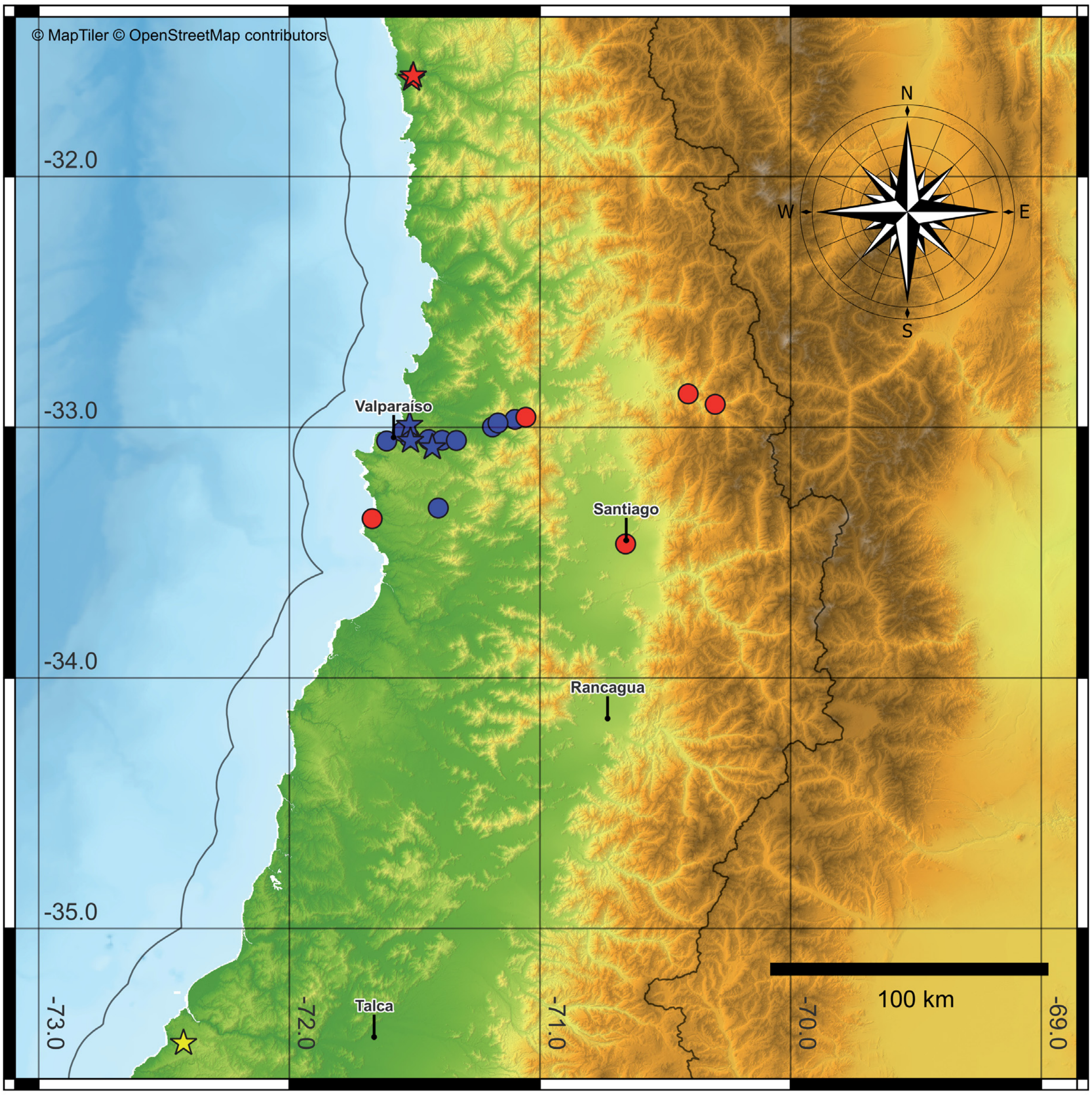

Fig. 1. Known and new records of *Autostreptus* Silvestri, 1905. Blue = *Autostreptus chilensis* (Gervais, 1847); red = *Autostreptus yanezi* Demange & Silva, 1971; yellow = *Autostreptus silvagonzalezi* sp. nov.; circle = known record from the literature; star = new record reported herein.

Fig. 2. Collecting sites and living specimens of *Autostreptus chilensis* (Gervais, 1847). **A**. *Jubaea chilensis* (Molina) Baill. palm groves with undergrowth of sclerophyllous forest near El Salto. **B**. Coastal sclerophyllous forest in Parque Natural Gómez Carreño. **C**. A couple mating. **D**. Male in ventral view, showing inflated gonopod pouch during mating. **E**. Habitus of a living male specimen.

from mp excavation, thickened, pointed, directed ectad (Fig. 5C–E). Telopodite (tp) long, reaching in length pp when stretched, with torsion of 360° basally (Fig. 5C–E); tp with broad, lamellar branch (ltp) covering distally solenomere (sl); ltp smooth, slightly wrinkled, marginally thickened, with swollen serrated zone hidden by lamellar expansion (arrow in Fig. 5F); antetorsal process (atp) thin, pointed, half as long as post-torsal part of telopodite (Fig. 5C, E); sl S-shaped, pointed, emerging just after swelling of ltp (Fig. 5F).

Distribution

Valparaíso Region: Parque Nacional La Campana (300 m a.s.l.); Valparaíso; El Salto; Viña del Mar; Parque Natural Gómez Carreño; near El Salto; Parque Natural Cerro Los Pinos; Quilpué; Villa Alemana; Olmué; El Granizo; Peña Blanca; Casablanca (Attems 1903; Porter 1912; Demange & Silva 1971a; Urzua & Silva 1981) (Fig. 1).

Remarks

The lectotype (male) and the paralectotypes (two males and at least four females) deposited at the Muséum national d'Histoire naturelle, Paris, France (MNHN), were not examined during this study. For more details on these types, see Demange & Silva (1971: 709) and Mauriès *et al.* (2001: 581).

Autostreptus chilensis appears to be very common in the xeric areas of sclerophyllous forests near the Chilean coast, where several individuals of the species may be found under a single stone. Unfortunately, the locality of El Salto, one of the areas where this species is recorded, was severely impacted by wildfires in February 2024. An expedition to this area is essential to assess any potential decline in the population following this disturbance. Additionally, the Parque Natural Gómez Carreño, another region where the species occurs, lacks state protection. Given this context, the combination of these factors could put the species at risk.

Capdeville Celis (1945: 233–234) incorrectly identified the species as an agricultural pest, describing it as an 8 mm long millipede, with a dark green coloration and reddish legs. This description is inconsistent with the morphology of *A. chilensis* and clearly corresponds to a misidentification.

Autostreptus yanezi Demange & Silva, 1971
Figs 1, 3, 6–7

Autostreptus yanezi Demange & Silva, 1971a: 71, figs 5–9.

Autostreptus yanezi – Urzua & Silva 1981: 271. — Krabbe 1982: 292. — Parra-Gómez 2022: 456, fig. 2.

Diagnosis

Males of *A. yanezi* differ from those of other species of the genus by having lamellar expansion of telopodite (ltp) with a distally bifurcated process (arrow in Fig. 7F) just before the solenomere (sl); apex of metaplica (mp) thickened, not subtriangular; dmp elongated, apically rounded (Fig. 7C–E). Proplica (pp) with mesoapical dentiform process (arrow in Fig. 7C). First leg-pair with subrectangular pfp widening at distal end (Fig. 7A).

Material examined

CHILE – **Coquimbo Region** • 3 juvs; Canela; 31.6105° S, 71.5129° W; 4 Sep. 2023; J.A. Morales leg.; under a rock; e-56 (field code); MNHNCL • 1 ♂, 3 ♀♀, 2 juvs; same data as for preceding; 31.5966° S, 71.5057° W; e-57 (field code); MNHNCL.

Redescription

Based on the examined specimens to supplement the original description and illustrate morphological features.

Measurements. Male. Length ca 6.6 cm, vertical diameter 3.7 mm (without legs), width 3.5 mm. 74 podous rings, one apodous ring in front of telson. Females. Length ca 7.2–7.5 cm, vertical diameter 4.3–4.5 mm (without legs), width 4–4.3 mm. 69–74 podous rings, no apodous rings in front of telson.

Color. After recent fixation in alcohol. Head, antennae, and collum blackish; body rings brownish in general, slightly faded by alcohol; posterior margin of metazonites brownish to yellowish; telson blackish (Fig. 6A–D).

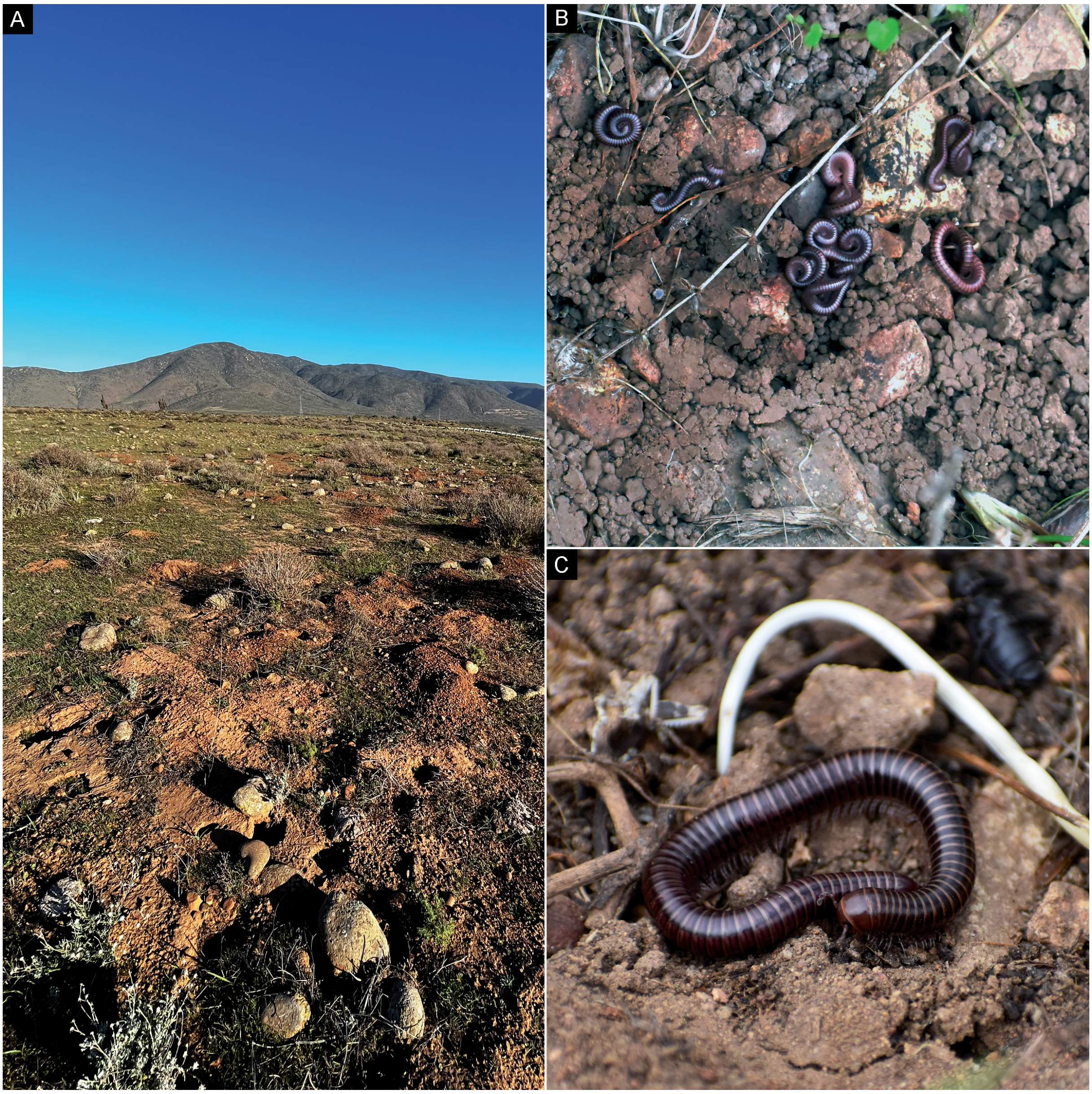

Fig. 3. Collecting sites and living specimens of *Autostreptus yanezi* Demange & Silva, 1971. **A**. Xerophilous scrubland in Canela, Coquimbo region. **B**. Living specimens found under a rock. **C**. Habitus of a living specimen.

Head. Eyes each with ca 53–56 ommatidia in seven horizontal rows. Antennae very short, reaching back to ring 2 when stretched; fifth and sixth antennomere with distodorsal patch of short sensilla basiconica, seventh antennomere with distal margin covered by tiny conical setae; last two antennomeres densely setose (Fig. 6B). Mandibles with small stipital lobes, marginally swollen in males. Gnathochilarium with stipites slightly swollen distally in males; mentum heptagonal, with deep concavity; short setae marginally on apical part of lamellae linguales and stipites (Fig. 6A).

Collum. Smooth, with only one lateral diagonal furrow; unornamented, slightly concave on lateral margins in males, straight in females.

Fig. 4. *Autostreptus chilensis* (Gervais, 1847), ♂ (PG-34-VAL, MNHNCL). **A**. Head, collum and anterior rings, lateral view. **B**. Posterior rings and telson, lateral view. **C**. Antenna. **D**. Midbody ring in posterior view. Scale bars: A = 0.9 mm; B = 1 mm; C = 0.6 mm; D = 0.7 mm.

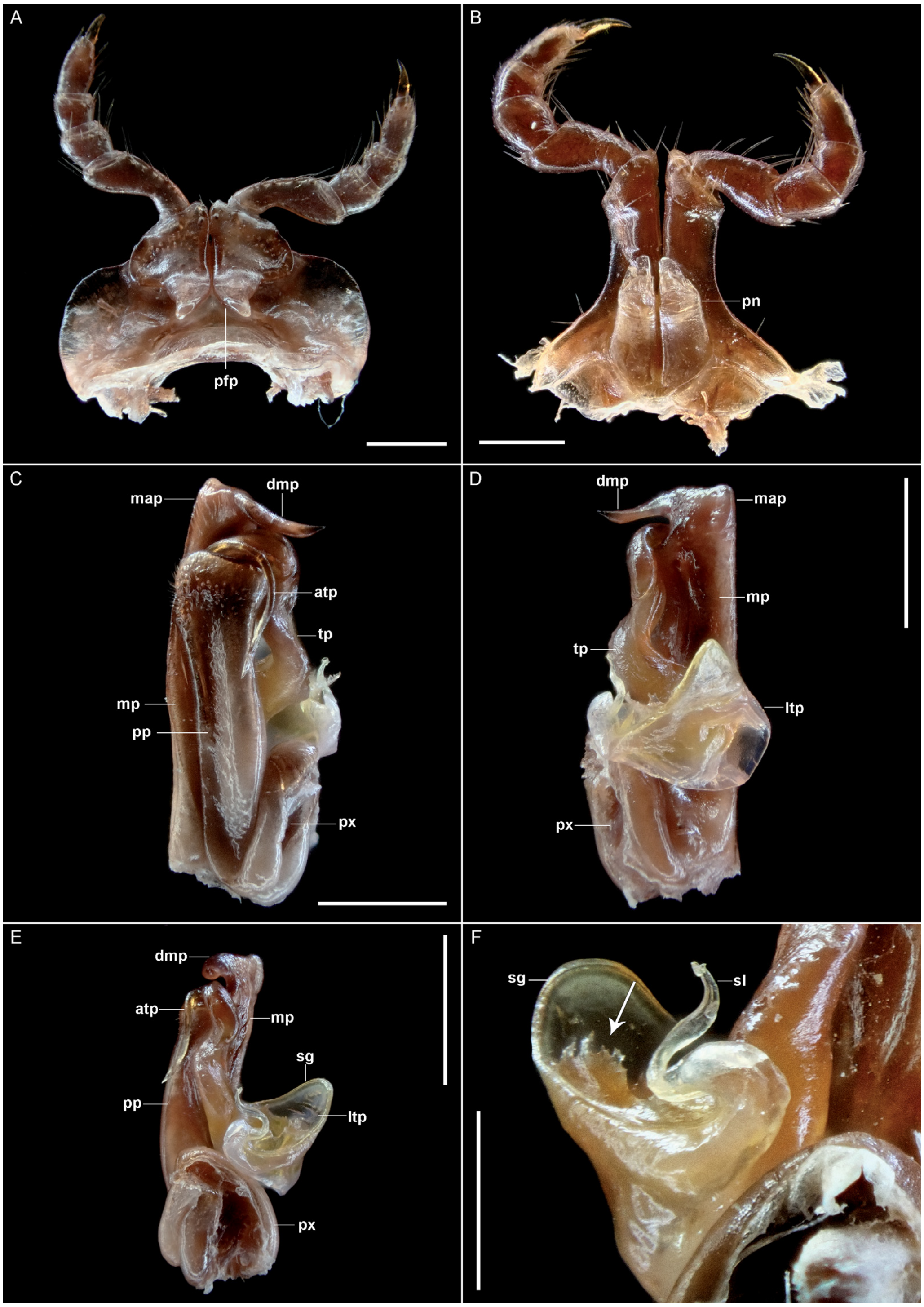

Fig. 5. *Autostreptus chilensis* (Gervais, 1847), male sexual characters. **A, C–E**. PG-34-VAL (MNHNCL). **B, F**. e-8 (MNHNCL). **A**. First leg-pair, anterior view. **B**. Second leg-pair, posterior view. **C–F**. Left gonopod. **C**. Anterior view. **D**. Posterior view. **E**. Lateral view. **F**. Detail of the distal region of telopodite, lateral view (arrow indicating the protruding serrated zone). Abbreviations: atp = antetorsal process of telopodite; dmp = distolateral metaplica process; ltp = lamellar expansion of telopodite; map = mesoapical metaplica process; mp = metaplica; pfp = prefemoral process of first male leg-pair; pn = penes; pp = proplica; px = paracoxite; sg = seminal groove; sl = solenomere; tp = telopodite. Scale bars: A, F = 0.6 mm; B = 0.5 mm; C = 0.8 mm; D = 1 mm; E = 1.2 mm.

Body rings. Mostly smooth, without carinae or granulation (Fig. 6C–D). Prozonites with usual fine ring furrows in anterior part. Metazonites striated, but striation not reaching ozopore level, dorsally smooth. Ozopore situated at mid-length of metazonite. No sigilla. Stigmatal grooves not extended.

Telson. Preanal ring without process. Anal valves smooth, marginal lips not developed. Subanal scale broad triangular (Fig. 6D).

Legs. Midbody legs short, ca ⅓ of body maximum vertical diameter. Males with postfemoral and tibial adhesive pads from leg-pair 3 on, absent in females; pads gradually smaller towards posterior rings (Fig. 6C). First male leg-pair (Fig. 7A): coxosternum ellipse-shaped, with lateral groups of few short

Fig. 6. *Autostreptus yanezi* Demange & Silva, 1971, ♂ (e-57, MNHNCL). **A**. Gnathochilarium, ventral view. **B**. Antenna. **C**. Midbody ring in oral view. **D**. Posterior rings and telson, lateral view. Scale bars: A = 0.7 mm; B = 0.4 mm; C = 1 mm; D = 1.2 mm.

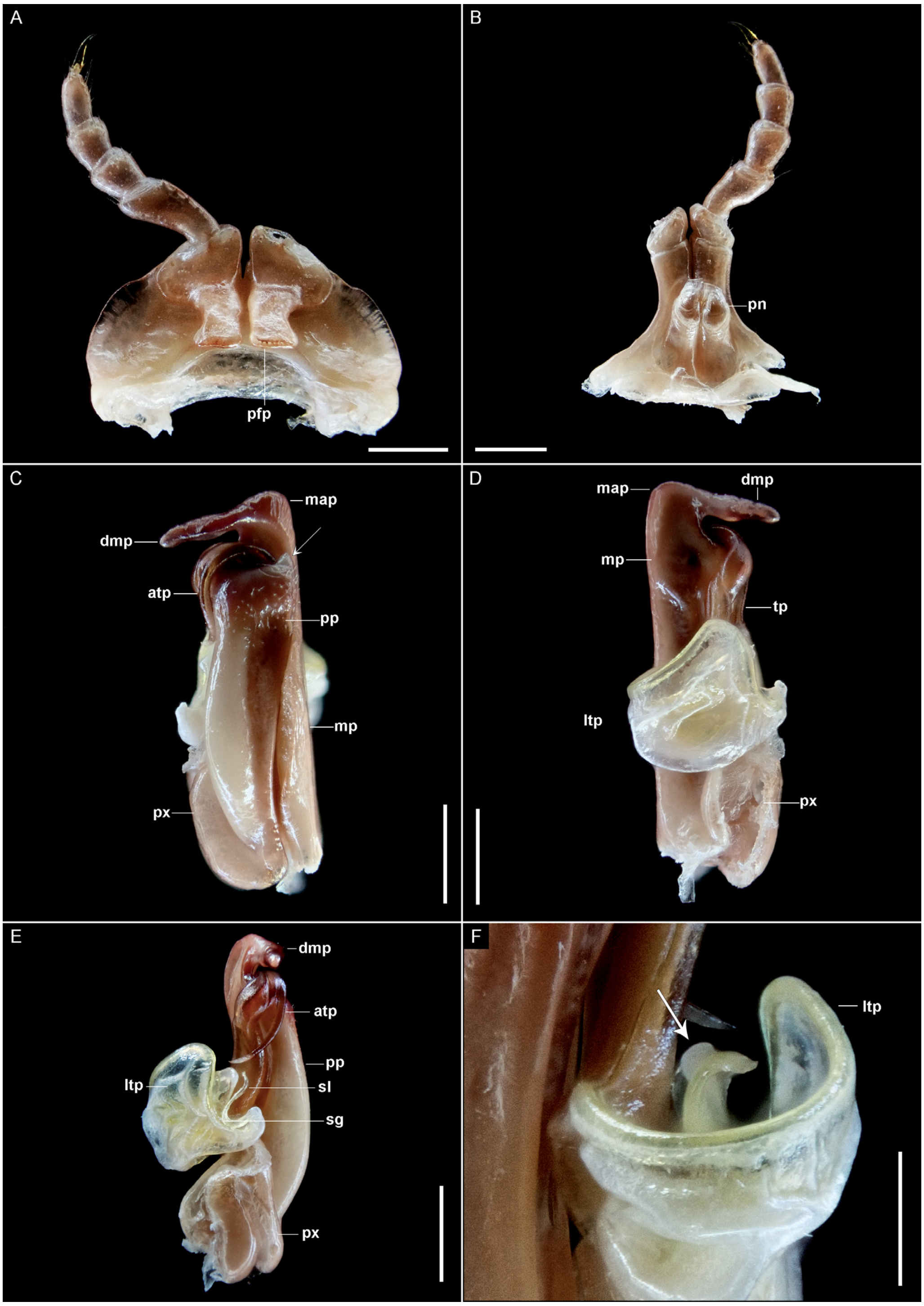

Fig. 7. *Autostreptus yanezi* Demange & Silva, 1971 (e-57, MNHNCL), male sexual characters. **A**. First leg-pair, anterior view. **B**. Second leg-pair, posterior view. **C–F**. Left gonopod. **C**. Anterior view (detail of arrow indicating the mesoapical dentiform process on proplica). **D**. Posterior view. **E**. Lateral view. **F**. Detail of distal region of telopodite, medial view (arrow indicating bifurcated process). Abbreviations: atp = antetorsal process of telopodite; dmp = distolateral metaplica process; ltp = lamellar expansion of telopodite; map = mesoapical metaplica process; mp = metaplica; pfp = prefemoral process of first male leg-pair; pn = penes; pp = proplica; px = paracoxite; sg = seminal groove; sl = solenomere; tp = telopodite. Scale bars: A–B = 0.5 mm; C–E = 0.7 mm; F = 0.3 mm.

setae, surface scattered with tiny setae. Prefemoral process (pfp) long, almost as long as prefemur, subrectangular, widening at distal end, surface scattered with tiny setae. Prefemur almost subtriangular, surface scattered with tiny setae, distally with few distinct very short setae. Femur, postfemur, and tibia with few short setae distally, tarsal distal setae longer. Second male leg-pair (Fig. 7B): coxosternum short, bearing short setae marginally and distally. Prefemur compressed dorsoventrally, with paramedian row of short setae; remaining podomeres with few short setae distally, except tarsus; tarsal claw present. Penes (pn) located at proximal region of second leg-pair, composed of two entirely separate parts with truncated tips extended in laminar processes also truncated distally; gonopore positioned distally, not setose.

Gonopod. Sternum short, trapezoidal. Proplica (pp) ca as long as metaplica (mp) (Fig. 7C–D), parallel-sided, mesal margin curved; pp distally swollen, rounded, with short setae, and a mesoapical dentiform process (arrow in Fig. 7C). Metaplica (mp) not complex (Fig. 7C–D); mesal margin thickened, laterally in contact with pp almost along its entire length; mp deeply excavated distally, where antetorsal process (atp) emerges (Fig. 7C); mesoapical metaplica process (map) swollen, rounded, rugose (Fig. 7C–E); distolateral metaplica process (dmp) extended from mp excavation, thickened, not pointed, directed almost diagonally, slightly swollen at half-length (Fig. 7C–E). Telopodite (tp) long, reaching in length pp when stretched, with torsion of 360° basally (Fig. 7C–E); tp with broad, lamellar branch (ltp) covering distally solenomere (sl); ltp smooth, translucid and wrinkled in general, marginally thickened, with distally bifurcated process hidden by lamellar expansion, its proximal end swollen, outer end arched outwards (arrow in Fig. 7F); antetorsal process (atp) thin, pointed, half as long as post-torsal part of telopodite (tp) (Fig. 7C, E); sl S-shaped, pointed, emerging just after swelling of ltp (Fig. 7C–F).

Distribution

Coquimbo Region: Canela. Valparaíso Region: Los Quilos (type locality); Río Blanco (ca 1420 m a.s.l.) (exact locality not found, Fig. 1 shows an approximate position); Parque Nacional La Campana (ca 1300 m a.s.l.); Algarrobo (ca 100 m a.s.l.). Santiago Metropolitan Region: Santiago (Demange & Silva 1971a; Urzua & Silva 1981; Krabbe 1982) (Fig. 1).

Remarks

The male holotype, from Los Quilos, Valparaíso, and the male paratype, from Río Blanco, Valparaíso, both deposited at the Muséum national d'Histoire naturelle, Paris, France (MNHN), were not examined during this study. For more details on these types and additional material, see Demange & Silva (1971: 711).

An additional record from Navarino Island, Magallanes, by Krabbe (1982: 292), located more than 2000 km from the species' type locality, is unlikely to pertain to *A. yanezi* and could potentially be a labelling error of the true locality (Parra-Gómez 2022). *Autostreptus yanezi* appears to inhabit more xeric zones under rocks in the dry scrublands of central Chile and can be found at higher altitudes than other congeneric species.

Autostreptus silvagonzalezi sp. nov.
urn:lsid:zoobank.org:act:4439984B-190F-4D12-A09E-55D5812AF75D
Figs 1, 8–9

Diagnosis

Males of *A. silvagonzalezi* sp. nov. differ from those of other species of the genus by having telopodite (tp) with lamellar branch (ltp) thickened (Fig. 9C–F), but narrower than those in *A. chilensis* (Fig. 5F) and *A. yanezi* (Fig. 7F), and an acuminate, arched solenomere (sl); antetorsal process (atp) thickened, almost as long as the tp (Fig. 9C–F). First leg-pair with subtriangular pfp (Fig. 9A).

Etymology

The species epithet honours Francisco Silva González (1933–1990), the only Chilean millipede specialist in history.

Material examined

Holotype

CHILE – **Maule Region** • ♂; south of Constitución; 35.4563° S, 72.4229° W; 238 m a.s.l.; 12 Jul. 2012; G. Valenzuela D. leg.; MNHNCL 8449.

Paratypes

CHILE – **Maule Region** • 1 ♀; same data as for holotype; MNHNCL 8450 • 1 ♂; same data as for holotype; MZUC-CCC 48107 • 1 ♀; same data as for holotype; MZUC-CCC 48108.

Description (male holotype, MNHNCL 8449)

Measurements. Length ca 4.3 cm, vertical diameter 3.2 mm, width 3.3 mm. 46 podous rings, no apodous ring in front of telson.

Color. After recent fixation in alcohol. Head, antennae, and collum blackish (Fig. 8A–C); body rings blackish in general, posterior margin of metazonites with brownish to amber colored; telson blackish (Fig. 8D), slightly faded; legs blackish, also faded by alcohol (Fig. 8C–D).

Head. Eyes each with ca 29 ommatidia in five horizontal rows (Fig. 8C). Antennae very short, reaching back to ring 2 when stretched; fifth and sixth antennomere with distodorsal patch of short sensilla basiconica, seventh antennomere with distal margin covered by tiny conical setae; last three antennomeres setose (Fig. 8B). Mandibles with stipital lobes evident. Gnathochilarium with stipites slightly swollen distally (Fig. 8A); mentum heptagonal, with deep concavity; long setae marginally on apical part of lamellae linguales and stipites.

Collum. Smooth, with only one lateral diagonal furrow; unornamented and very slightly extended in an anterior lateral lobe (Fig. 8C).

Body rings. Mostly smooth, without carinae or granulation (Fig. 8C–D). Prozonites with usual fine ring furrows in anterior part. Metazonites striated, but striation not reaching ozopore level, dorsally smooth. Ozopore situated at mid-length of metazonite. No sigilla. Stigmatal grooves not extended.

Telson. Preanal ring without process. Anal valves smooth, marginal lips not developed. Subanal scale broad triangular (Fig. 8D).

Legs. Midbody legs short, ca ¼ of body maximum vertical diameter. With postfemoral and tibial adhesive pads from leg-pair 3 on; pads gradually smaller towards posterior rings. First leg-pair (Fig. 9A): coxosternum subrectangular, with lateral groups of few short setae, surface scattered with tiny setae. Prefemoral process (pfp) long, but not as long as prefemur, subtriangular, surface scattered with tiny setae. Prefemur subrectangular, surface scattered with tiny setae, distally with few short setae. Femur, postfemur, tibia, and tarsus with long setae ventrally. Second leg-pair (Fig. 9B): coxosternum short, smooth. Prefemur slightly compressed dorsoventrally, with paramedian row of large setae; remaining podomeres setose, with long setae ventrally; tarsal claw present. Penes (pn) located at proximal region of second leg-pair, composed of two entirely separate parts with markedly rounded tips extended in short laminar processes also rounded distally; gonopore positioned distally, not setose.

Gonopod. Sternum short, trapezoidal. Proplica (pp) ca as long as metaplica (mp) (Fig. 9C–D), parallel-sided, mesal margin curved; pp constricted basally, swollen and rounded distally, with few very short distal setae (Fig. 9C). Metaplica (mp) not complex (Fig. 9C–D); mesal margin thickened, laterally in contact with pp almost along its entire length; mp excavated distally, where antetorsal process (atp) emerges (Fig. 9C); mesoapical metaplica process (map) swollen, rounded (Fig. 9C–D); distolateral metaplica process (dmp) extended from mp excavation, thickened, pointed, directed diagonally ectad (Fig. 9C–E). Telopodite (tp) long, reaching in length pp when stretched, thickened, with torsion of 360° basally (Fig. 9C–D); tp distally diverging in lamellar branch (ltp) and in seminal branch where solenomere (sl) is located (Fig. 9E); ltp curved over seminal branch, not broad, smooth; seminal groove (sg) running marginally on seminal branch (Fig. 9E); antetorsal process (atp) thickened (Fig. 9C, E),

Fig. 8. *Autostreptus silvagonzalezi* sp. nov., holotype, ♂ (MNHNCL 8449). **A**. Gnathochilarium, ventral view. **B**. Antenna. **C**. Head, collum and anterior rings, lateral view. **D**. Posterior rings and telson, lateral view. Scale bars: A = 0.8 mm; B = 0.5 mm; C = 1.4 mm; D = 1.5 mm.

Fig. 9. *Autostreptus silvagonzalezi* sp. nov., holotype, ♂ (MNHNCL 8449), sexual characters. **A**. First leg-pair, anterior view. **B**. Second leg-pair, posterior view. **C–F**. Left gonopod. **C**. Anterior view. **D**. Posterior view. **E**. Lateral view. **F**. Detail of distal region of telopodite, posterior view. Abbreviations: atp = antetorsal process of telopodite; dmp = distolateral metaplica process; ltp = lamellar expansion of telopodite; map = mesoapical metaplica process; mp = metaplica; pfp = prefemoral process of first male leg-pair; pn = penes; pp = proplica; px = paracoxite; sg = seminal groove; sl = solenomere; tp = telopodite. Scale bars: A, E = 0.6 mm; B–C, F = 0.5 mm; D = 0.7 mm.

curved over telopodite (tp) and directed posteriorly (Fig. 9E); atp as long as tp; sl arched, pointed, not covered by ltp.

Distribution

Known only from Constitución, Maule Region (Fig. 1).

Remarks

A large difference in the number of body rings has been observed among species of *Autostreptus*. *Autostreptus silvagonzalezi* sp. nov. presents 46 rings, while *A. chilensis* has 58–61, and *A. yanezi* has 69–74 rings. Although this difference is considerable (almost 30 rings between *A. silvagonzalezi* and *A. yanezi*), especially for an endemic, short-range genus, it is based on only a few adults of the former species. In this context, we expect to collect additional specimens, particularly from regions beyond the type locality, to better assess the variation among species of *Autostreptus*.

Key to males of Autostreptus

1. Telopodite (tp) with a broad, lamellar expansion (ltp) (Figs 5D–E, 7D–E); ltp covering distally the solenomere (sl), and with its margin thickened (Figs 5F, 7F) 2
– Telopodite (tp) with a thick, but not broad lamellar expansion (ltp) (Fig. 9C–F) ....
....***A. silvagonzalezi*** sp. nov.

2. First leg-pair with subtriangular prefemoral process (pfp) (Fig. 5A); ltp with a protruding serrated zone, hidden by lamellar expansion (Fig. 5F) .... ***A. chilensis*** (Gervais, 1847)
– First leg-pair with subrectangular prefemoral process (pfp) (Fig. 7A); ltp with a distally bifurcated process, hidden by lamellar expansion (Fig. 7F) ....***A. yanezi*** Demange & Silva, 1971

Discussion

In males of Helminthomorpha Pocock, 1887, the gonopods are used for the transfer of the seminal fluid from the male gonopore to the female receptacle (Koch 2015). In Spirostreptidae, the telopodite (traditionally also known as 'gonotelopodite') emerges from the gonocoel (an incompletely closed space between the proplica and metaplica), usually carries and consists of an antetorsal process (varying in shape and size at genus level), followed by a region of torsion (torsotope) and continues as an axial branch, where the seminal groove runs out until ending into the solenomere (see gonopodal description in Hoffman 2008). Even though there is no study focusing on the homology of parts of the telopodite in a phylogenetic context to date, different genera of Spirostreptidae are partially diagnosed based on the presence of spines, processes, expansions, and on the overall shape of the telopodite branch. In the widely distributed genus *Orthoporus* Silvestri, 1897, with ca 80 species, the telopodite is characterized by a broad, lamellar expansion starting at its mid-length, known as 'calyx' or caliciform lamina (Hoffman 1996). In other South American genera, as *Calathostreptus* Schubart, 1959 (two species from Rio de Janeiro, Brazil), *Tubostreptus* Schubart, 1950 (monotypic, *T. teres* Schubart, 1950, also from Rio de Janeiro) and *Exallostreptus* Hoffman, 1988 (monotypic, *E. vanzolinii* Hoffman, 1988, from Rondonia and Mato Grosso, Brazil), the telopodite also has a lamellar expansion, but varies in form and size in comparison to that in *Orthoporus* (Schubart 1950: fig. 11, 1959: fig. 6; Hoffman & Knight 1970: figs 10–11; Hoffman 1988: figs 5–6; Iniesta *et al.* 2022: figs 4b, 5). In this context, Hoffman (1988: 324) suggested a superficial similarity between these three genera based on the gonopod telopodite, although he did not infer the presence of the lamella as a putative homology.

In the Chilean genus *Autostreptus*, males of *A. yanezi* and *A. chilensis* exhibit a broad lamellar expansion on the telopodite (Figs 5D–F, 7D–F). In *A. silvagonzalezi* sp. nov. the lamellar expansion is not so broad, and it does not cover the solenomere (Fig. 9F). It is not clear whether these lamellae in *Autostreptus* are homologous to those found in *Orthoporus*, *Calathostreptus*, *Tubostreptus*, or *Exallostreptus* (or in only one of these genera). The presence of lamellae may suggest an evolutionary relationship among these South American genera, even though it could also be a result of a homoplastic scenario. However, due to the paucity of studies on the Spirostreptidae fauna in southern South America and its biogeographical history, only potential relationships can currently be inferred. A significant diversity of Spirostreptidae in the Americas is concentrated mainly in Argentina, Brazil, and Paraguay (Krabbe 1982), with the genus *Orthoporus* being the only one extending up to North America (Krabbe 1982; Hoffman 1999).

The tribal assignment of *Autostreptus* is challenging given the lack of phylogenetic studies on Spirostreptidae. Krabbe (1982) initially placed the genus within Spirostreptini, along with other American and African genera. The preliminary subdivision suggested by Enghoff (2023) organized the American Spirostreptidae into two tribes: Orthogoneptini, proposed by Chamberlin (1941) as a subfamily to accommodate the genus *Orthogoneptus* Chamberlin, 1941 from Peru (now junior synonym of *Urostreptus* Silvestri, 1897), characterized by "freely exposed posterior gonopods and the spike-like caudal process from the last tergite", i.e., the telson (Chamberlin 1941: 481); and Perustreptini, proposed by Verhoeff (1941) also as a subfamily to accommodate initially the Peruvian genera *Andenostreptus* Verhoeff, 1941 (= *Anethoporus* Chamberlin, 1918) and *Perustreptus* Verhoeff, 1941 (= *Nanostreptus* Silvestri, 1897), characterized in general, by the telopodite (= exospermite of Verhoeff) slender, without extensions and telson without a process (see full description in Verhoeff 1941: 13). Complementary to these superficial characterizations, Schubart (1968: 7) gave a brief description to Orthogoneptinae (misspelled as "Orthogoneptidae" by Schubart) and Perustreptinae in a dichotomous key, highlighting the "completely free telopodite" (= "Exospermito completamente livre", in Portuguese) in the former subfamily, and the "paracoxite complex, with a aculeiform process" (= "Coxito com "ktenon", grande processo aculeoforme do próprio coxito, situado do lado aboral", in Portuguese) of the latter.

In Enghoff (2023), the name Perustreptini was adopted as a replacement for Spirostreptini sensu auctorum, nec Brandt, 1833, expanding its taxonomic concept beyond that originally assigned by Verhoeff (1941). Within this context, and disregarding Orthogoneptini due to the absence of any process on the telson, *Autostreptus* is tentatively placed within Perustreptini here. Nonetheless, all discussions on the tribes presented here should be considered provisional due to the lack of phylogenetic analyses. Further research on the homologies of gonopodal parts, such as the lamellar expansion of the telopodite, is needed to advance the systematics of Spirostreptidae.

The discovery of a new species of *Autostreptus* and the new records of *A. chilensis* and *A. yanezi* reinforce the biogeographical importance of Chile regarding the millipede fauna. Spirostreptidae is distributed in South and Central America, with marginal presence in North America; in Africa, marginally in North and Northeast Africa, and in Madagascar (Enghoff 2015), suggesting a relictual Gondwanan distribution pattern for the family. Currently, South America is considered a heterogeneous biogeographic unit, with its southernmost portion (particularly the Andean region of Chile) suggested to be more biogeographically connected with West Antarctica since the Late Cretaceous (100.5–66 Ma), at least as evidenced by terrestrial vertebrates (Reguero & Goin 2021). For instance, the ancestral range of the harvestman family Pettalidae Simon, 1879 (Arachnida), with a temperate Gondwanan distribution, is estimated to be Chile + New Zealand + South Africa (Baker *et al.* 2020). The freshwater genus *Boeckella* De Guerne & Richard, 1889 (Copepoda), widespread in the southern Hemisphere, has some of its southern South America taxa phylogenetically related to groups from maritime Antarctica and from Sub-Antarctic islands (Maturana *et al.* 2021). For millipedes, the family Dalodesmidae Cook, 1896 (Polydesmida) also presents a similar pattern of distribution, occurring in southern South America (Chile and Andean parts of Argentina), southern Africa and Madagascar, New Caledonia, New Zealand, and Australia (Enghoff *et al.* 2015).

In Spirostreptida, the suborder Cambalidea Cook, 1895 has a monotypic genus endemic to Chile, viz. *Zinagon chilensis* (Silvestri, 1903), morphologically closely related to members of the families Iulomorphidae Verhoeff, 1924 and Cambalidae Bollman, 1893 (distributed in southern Africa, Australia, New Zealand, Iran, and marginally in USA) rather than the Central-South American family Pseudonannolenidae Silvestri, 1895 (Jeekel 1985, 2004; Kórsos & Read 2012; Mesibov 2019; Iniesta *et al.* 2020). The taxonomic placement of *Zinagon* Chamberlin, 1957 is still under discussion, with the genus being placed either within Iulomorphidae (Kórsos & Read 2012) or Cambalidae (Jeekel 1985, 2004; Mesibov 2019).

For species of *Autostreptus*, it is not surprising that all known records are concentrated along the coast of the South Pacific Ocean (Fig. 1). This region has a complex structural and lithological origin that differs from the coastal area along the Atlantic Ocean in South America, where most of the South American Spirostreptidae fauna has been recorded. Additionally, the region is partially bordered by the Andes in the eastern portion, which could act as a geographical barrier that may isolate most millipede lineages in Chile from the rest of southern South America.

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