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A new genus and species of Katiannidae (Collembola: Symphypleona) from Bolivia

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Abstract

The new genus *Borgesminthurinus* **gen. nov.** from Bolivia shares with *Sminthurinus* the presence of antennal segment IV undivided, antennal segment III with one papilla; sacs of ventral tube smooth; each tenacular rami with 3 teeth and a basal appendix. They also have dens with ventral chaetotaxy reduced and lack mucronal seta; but new genus clearly differs in having thick and barbulate setae on head and body, lacking neosminthuroid setae on abdomen and the presence of seta a0 on Abd. VI acuminate. The new genus differs from *Katianna* which has divided antennal segment IV, vertex of head with spine-like setae and setae of the body long and smooth.

Key words: Systematics, Neotropical species, La Paz, *Borgesminthurinus andinus* **sp. nov.**

Introduction

Bolivia is one of the countries from South American where Collembola are almost unknown. To our knowledge, only *Arlesia cochabambensis* Cassagnau & Rapoport, 1962 was described from Bolivia; *Dicranocentrus silvestri* Absolon, 1903 was cited by Cassagnau (1963); *Entomobrya pulchra* Schäffer, 1897 by Christiansen (1963); and *Seira brasiliania* Arlé, 1939 by Marcus (1949). Vacaflores-Argandoña (2013) did most recent contribution on the ecology of Collembola living in soils at different deeps of cauliflower cultures at La Paz.

Members of Katiannidae are very small and globular springtails. They usually have very bright or strong colors and are tinny animals living mainly in soil and litter but also in epiphytic plants such as moss and Bromeliaceae (Palacios-Vargas *et al*. 2012). Body segments are fused and three tagmata distinguished are: head, great abdomen (from first thoracic to fourth abdominal segment) with three pairs of trichobotria with a triangular pattern, and a lesser abdomen with abdominal segments V and VI, with one pair of trichobotria, except adults of *Sminthurinus* group *aureus* (Betsch 1980). Metatrochanter of legs with a clear trochanteral organ. Tenaculum with 3 teeth and one basal appendix on each ramus and a corpus tenaculum with 0-2 setae. The family has 216 species in 19 formally described genera (Bellinger *et al*. 1996–2019), *Sminthurinus* and *Katianna* being the most speciose genera very wide distributed, including South America, where also are represented *Arborianna, Katiannellina*, and *Stenognathellus,* which are monospecific genera. In the present contribution, we describe a new genus from Bolivia, which does not seem related of any of the last three. As noted by Betsch (1980) members of *Metakatianna* described from South America include several species which were described based on first instars of species of *Katianna*, *Sminthurinus*, *Pseudokatianna*, etc. and need revision.

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Materials and Methods

Professor Adilen Fernández from Limnology Department of the University Mayor de San Andres, La Paz, Bolivia collected specimens used for this contribution. They were first preserved in formaldehyde 4% (as well as all other material they collected), and later passed to ethanol 75%. After clearing up using cold potassium 10% and warm lactic acid, they were mounted in Hoyer's solution for study under phase contrast microscope. Drawings of the new taxa were done under a Carl Zeiss phase contrast microscope with aid of a camera lucida. Complete body measurements were taken from two specimens in a concavity glass slide in lactic acid. Three adult paratypes were complete slide mounted and seven paratypes were dissected for legs and antennae measurements.

For Scanning Electronic Microscope (SEM) study, specimens were dehydrated by ethanol graduate series and later dried up in a critical point dryer Baltec CPD030; and covered by gold in the ionizator Denton Vacuum Desk II.

Terminology for the description is based mainly on Betsch (1980), head chaetotaxy follows Silva *et al*. (2015), furcula Palacios-Vargas (2017).

Abbreviations used in the text and figures are: A–D—body trichobothria; A–E—head frontal setae; A–H—Omatidia; a–g—head setal rows; a—anterior row of setae; aa—anal appendix; Abd.—abdominal segment; Ant.—antennal segment; cx—coxa; m—median row of setae; m—microsensillum; m'—ventral microsensillum; p—posterior row of setae; pl—prelabral setae; pschia—pseudothrichia; s—ordinary seta; ss—sensillum; Sgv—ventral guard sensillum; Tita—tibiotarsus, tibiotarsi; tr—trocanther; Tra—trichobothrium, trichobothria; v—antennal vesicle; x—cuticular area with different granulation.

Systematics

Order Symphyleona Börner, 1901

Superfamily Katiannoidea Bretfeld, 1994

Family Katiannidae Börner, 1913

Borgesminthurinus gen. nov. Palacios-Vargas

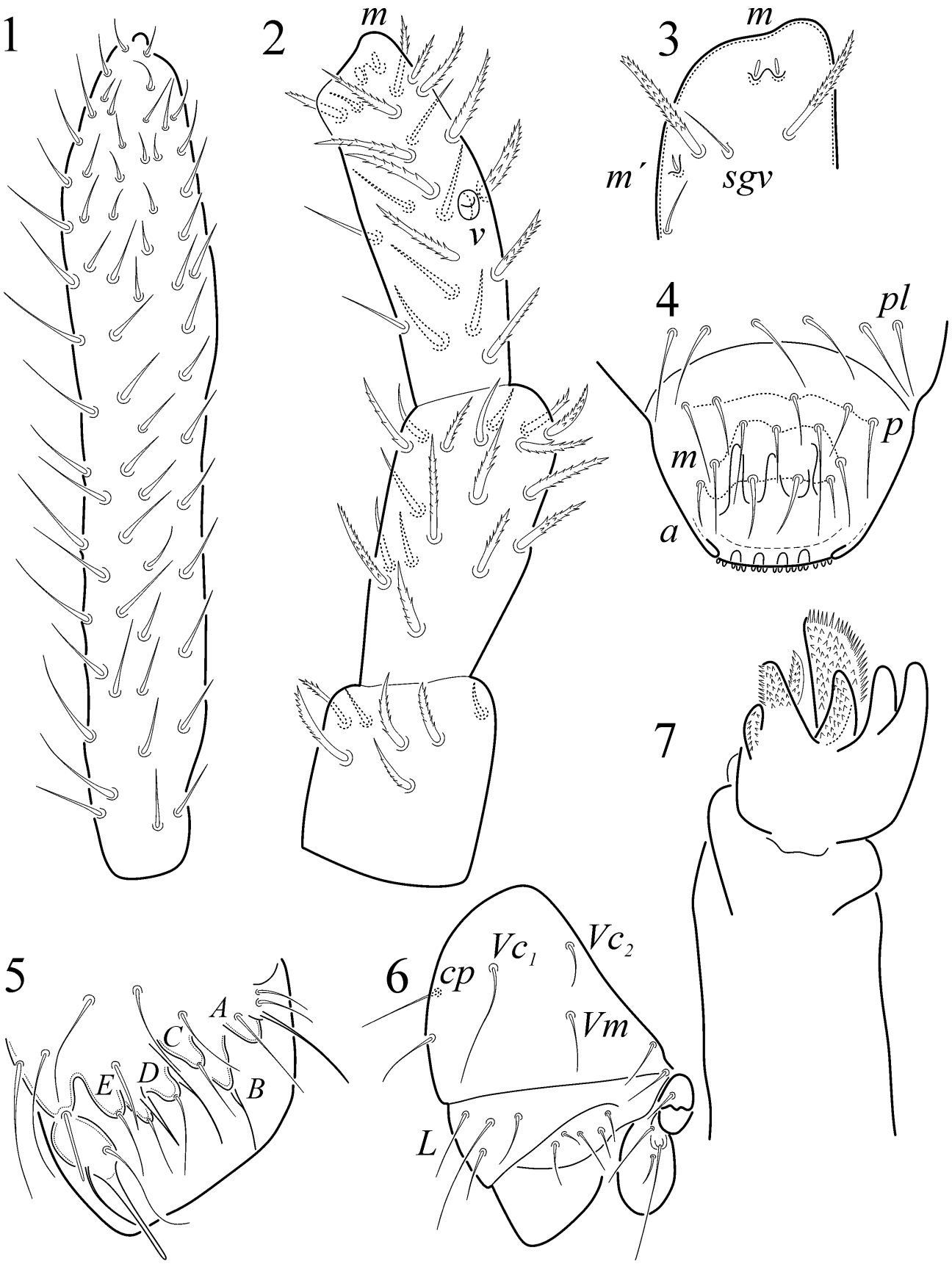
Diagnosis. Body globular, characterized by having thick, relatively long and slightly barbulate setae, very abundant on head and body; with full set of trichobothria present; A, B, C in a triangle on great abdomen and one pair of trichobothria on lesser abdomen (D); no neosminthuroid setae. Setae in large abdomen are thick but short. in singlets. Normal chewing mouth parts. Ant. IV undivided and longer than Ant. III; Ant. III with papilla divided in lobes. Tibiotarsi with 7 tenent hairs on distal whorl; unguis with pseudonychia and no tunica. Sacs of ventral tube smooth; tenacular rami with 3 teeth and basal appendix, corpus tenaculum with 2 setae. Metathoracic legs with trochanteral organ. Dens with ventral chaetotaxy reduced (formula 4, 2 … 1); mucro small, without seta, internal edge crenulate, external smooth. Seta a0 of Abdominal segment VI of females no furcate and no winged setae on lateral anal valves; subanal appendix of female palmate.

Type species. *Borgesminthururinus andinus* **gen. nov. sp. nov.**

Etymology. The new genus is dedicated to Jorge Luis Borges (Buenos Aires, August 24, 1899—Geneva, Switzerland, June 14, 1986), the Argentinean writer, author of the Manual of Fantastic Zoology, which included spherical animals as Symphypleona are.

Remarks. *Borgesminthurinus* **gen. nov.** differs from *Sminthurinus* by having thick and barbulate setae on head and body (versus thin and smooth), there are not neosminthuroid setae on abdomen; setae "a0" on Abd. VI acuminate (always furcated on *Sminthurinus*) and lacks lateral winged setae on the supranal valve and on each lateral anal valve.

Both genera share the presence of Ant. IV undivided, and Ant. III with one papilla; sacs of ventral tube smooth; tenacular rami with 3 teeth and a basal appendix, dens with ventral chaetotaxy reduced and lack of mucronal seta. Most setae are thick and barbulated in the new genus (Table 1).



FIGURES 1–7. *Borgesminthurinus andinus* **sp. nov.**: 1, Ant. IV; 2, Ant. I–III; 3, Ant. organ III; 4, labrum; 5, labial palp; 6, labium and maxillary palp; 7, maxilla.

TABLE 1. Comparison of *Borgesminthurinus* gen. nov. with the most similar genera of the family. Ant Ves—Antennal III vesicle; A den setae—number of setae on anterior surface of dente; Neo setae—setae neosminthuroid; Abd VI seta a0—seta a0 of abdominal segment furcate.

Genera / Character	Vertex spines	Thick setae	Ant IV divided	Ant Ves	A den setae	Neo setae	Abd VI a0 furcate
Borgesminthurinus **gen. nov.**	-	+	-	+	6	-	-
Vesicephalus Richards, 1964	-	+	-	-	0	-	-
Katianna Börner, 1906	+	+	+	+	± 6	-	-
Neokatianna Snider, 1989	+	+	+	+	12	+	+
Sminthurinus Börner, 1901	-	-	-	+	7	+	+

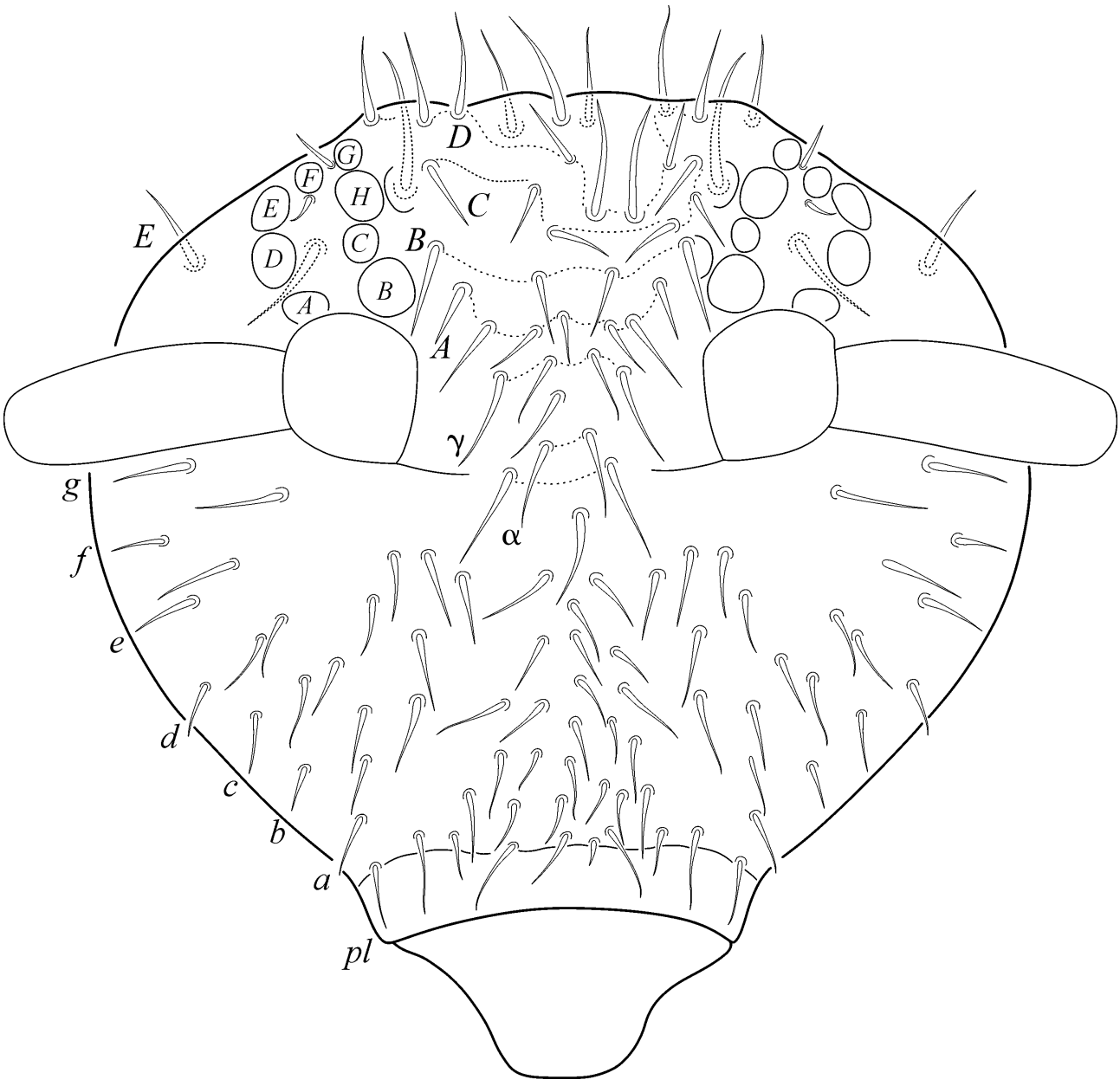
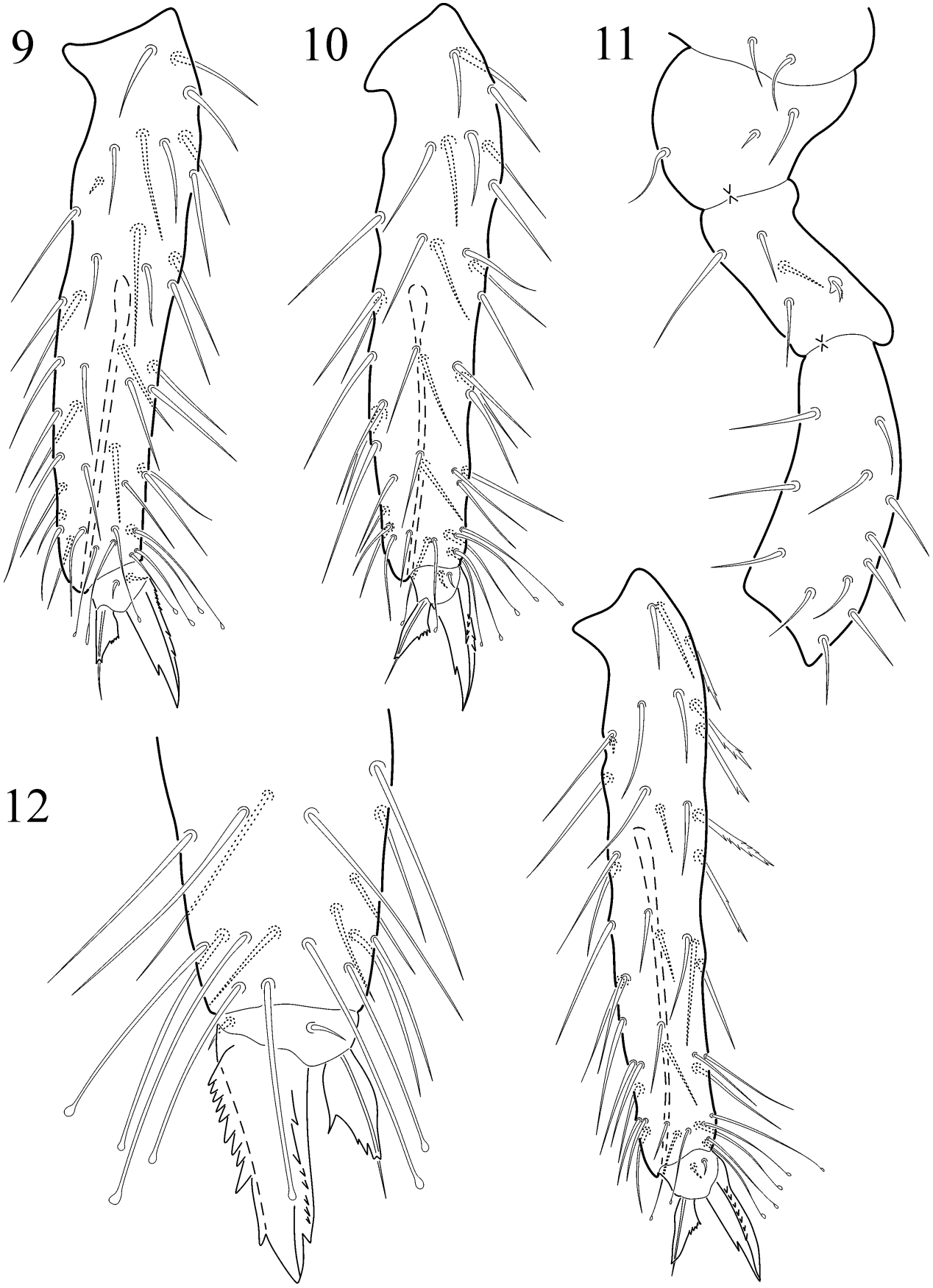


FIGURE 8. *Borgesminthurinus andinus* **sp. nov.**: head chaetotaxy.



FIGURES 9–12. *Borgesminthurinus andinus* **sp. nov.**: 9, Tita. I; 10, Tita. II; 11, leg III; 12, ungues and empodial appendage I, anterior view.

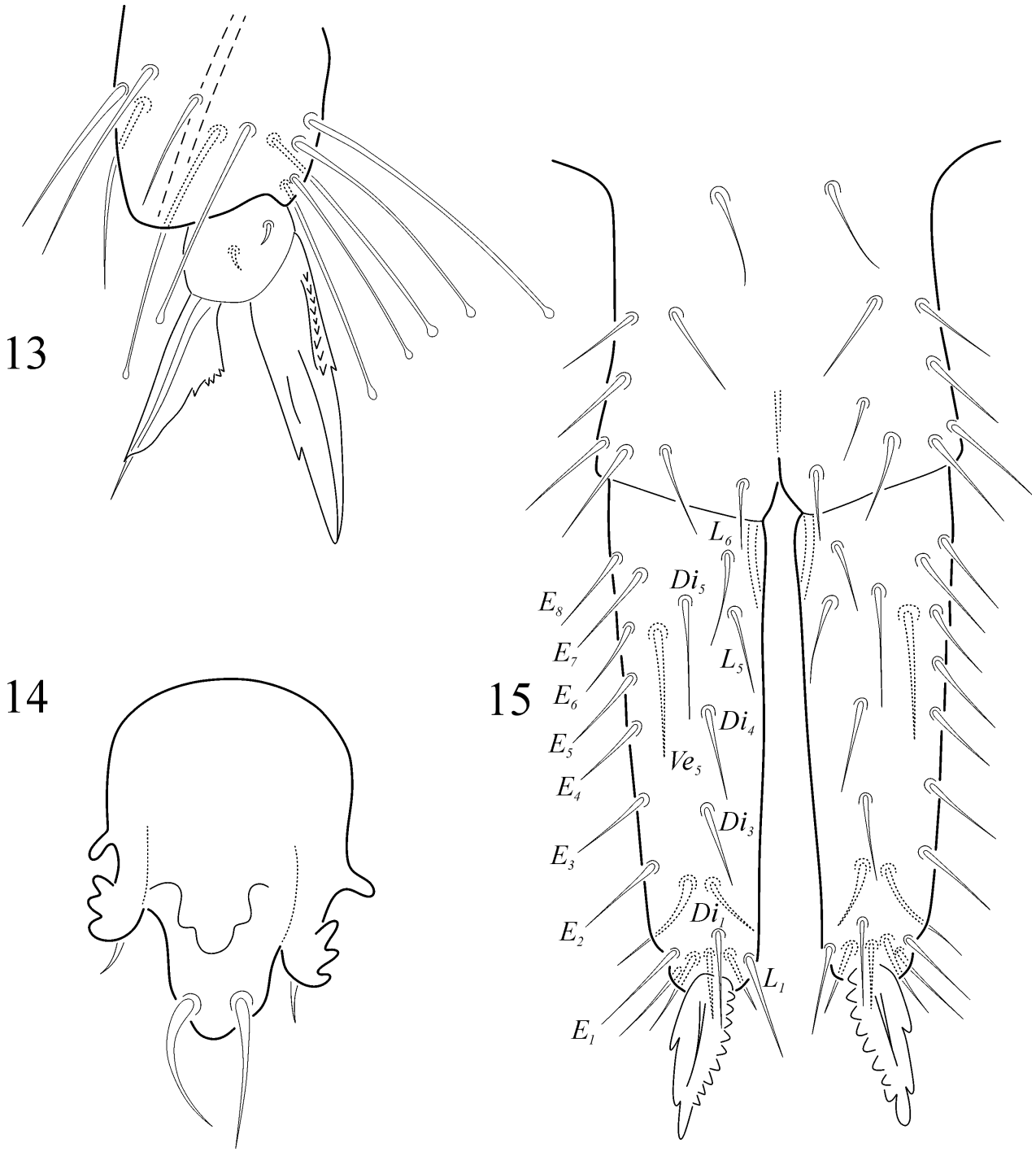


FIGURE 13–15. *Borgesminthurinus andinus* **sp. nov.**: 13, apex of Tita. III, ungues and empodial appendage; 14, retinaculum; 15, furcula.

Members of *Katianna* have 2+2 or 3+3 heavy spines on postocular lobes, and vertex of head with spine-like setae as illustrated by Delamare & Massoud (1963) in Neotropical species and remarked as generic character by Bernard (2014). This genus and the new one lack neosminthuroid seta and seta a0 on Abd. VI is simple, never furcate (Table 1). The head and body chaetotaxy in the new genus are much more abundant than in genera S*minthurinus* and like *Katianna,* besides, in these last two genera setae are smooth and thin. Another important difference is that antennal IV of members of *Katianna* are clearly subdivided and in the new genus is undivided. *Vesicephalus* Richards, 1964 in Delamare & Massoud (1964) has two vesicles on the head, the antennal segment IV is undivided and antennal segment III has several long and barbulate setae and lacks anterior setae on dens. The new genus lacks the cephalic vesicles, has not long setae on antennal segment III and has several setae on anterior dens.

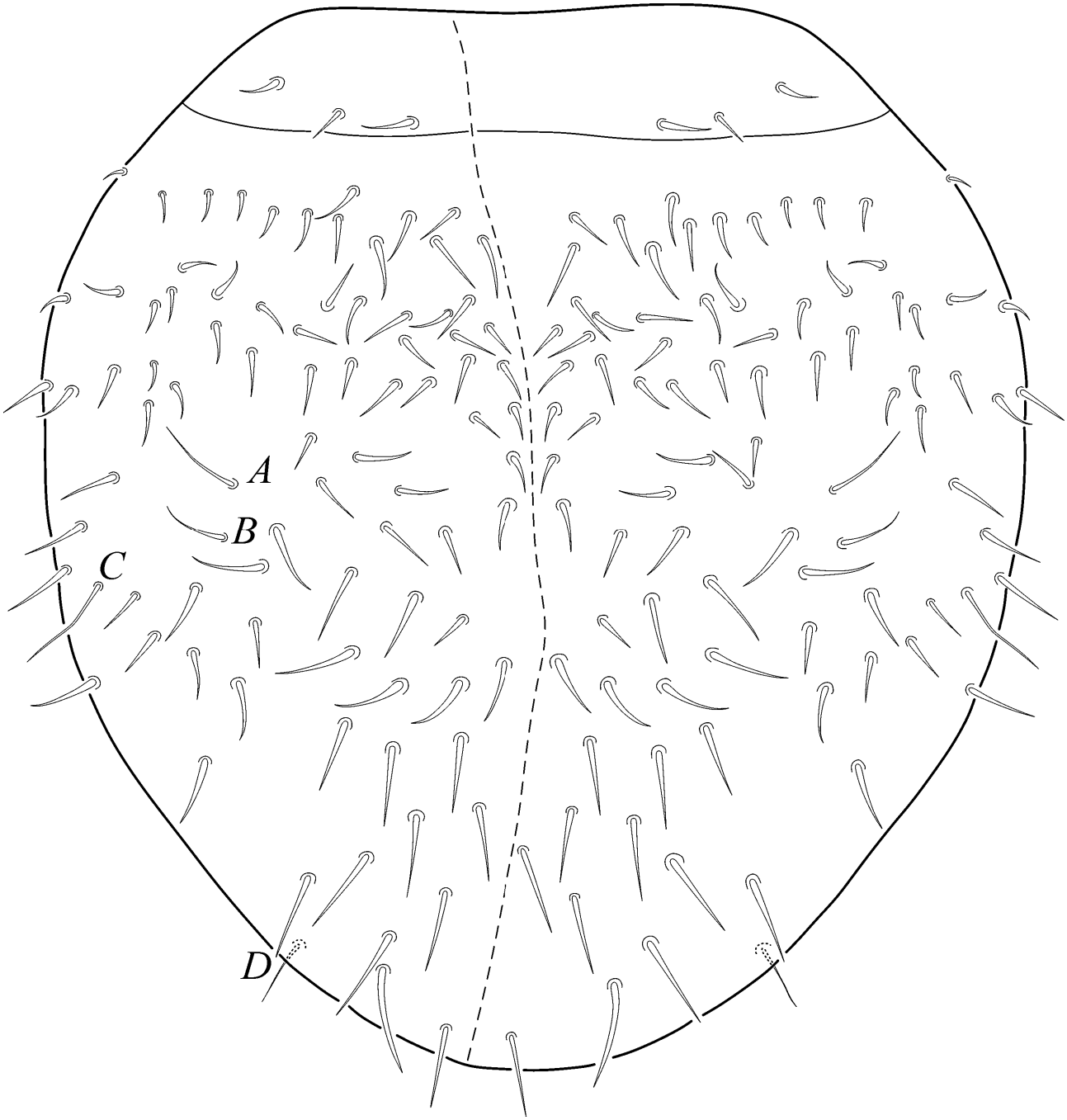
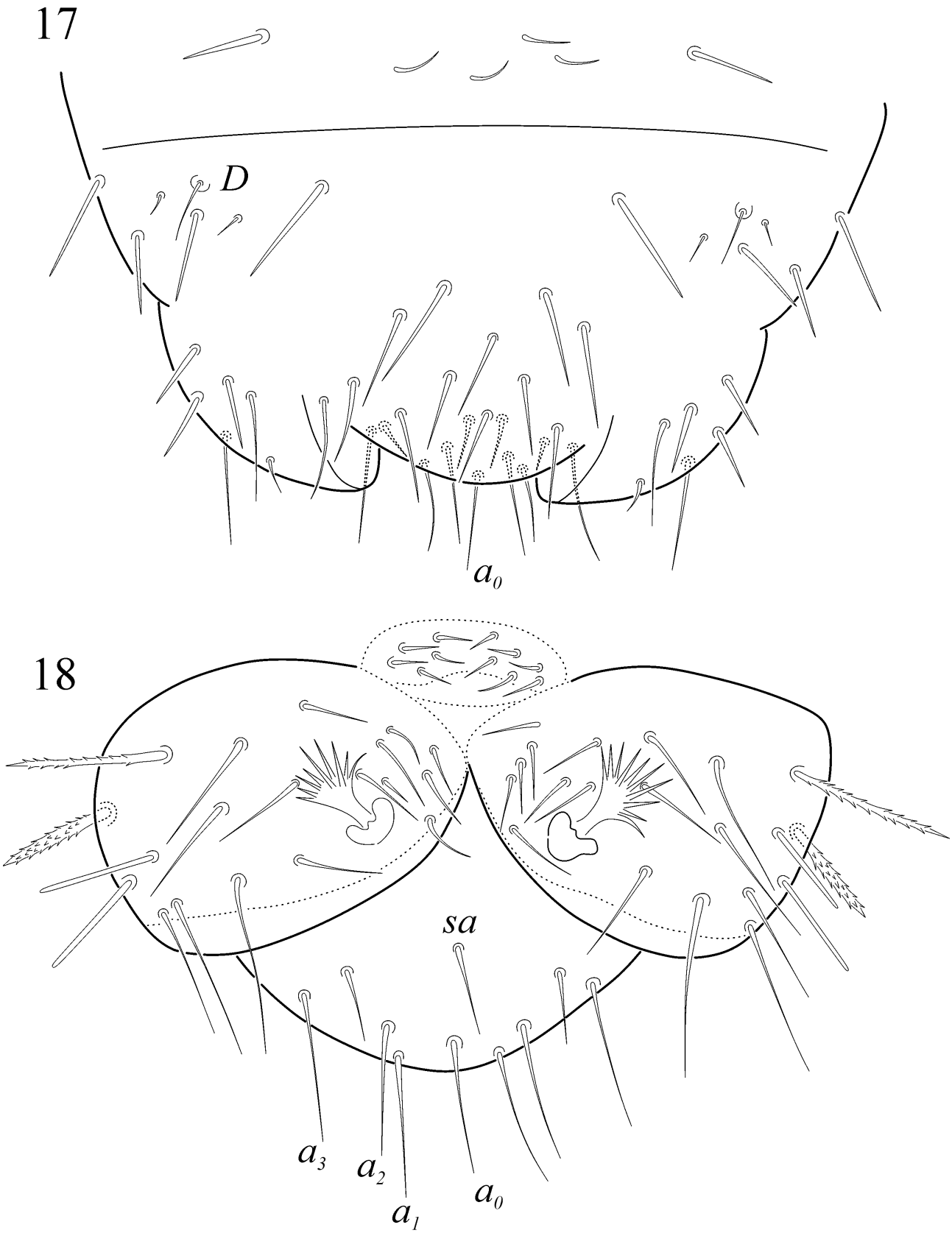


FIGURE 16. *Borgesminthurinus andinus* **sp. nov.**: great and lesser abdomen chaetotaxy.

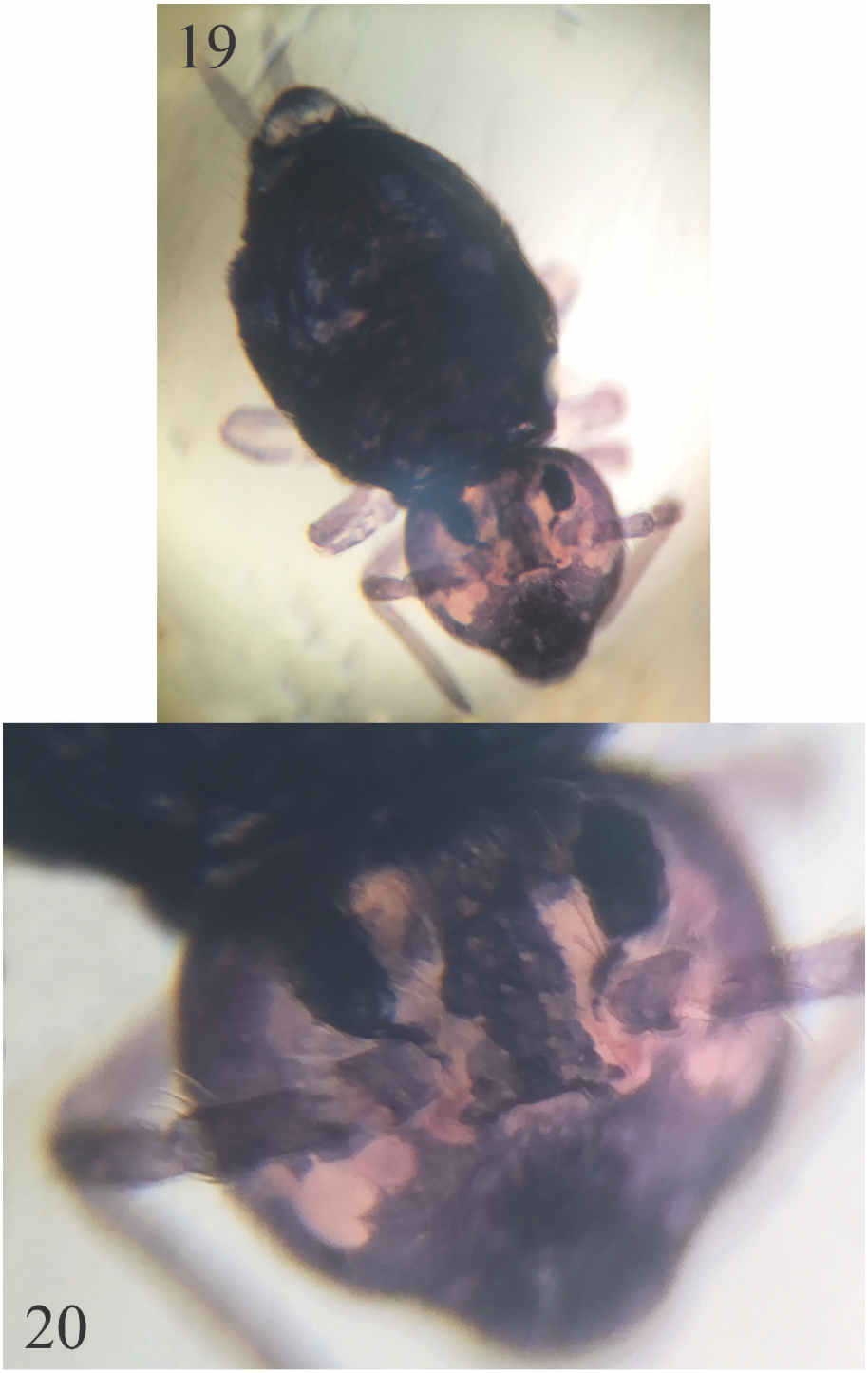
Borgesminthurinus andinus **gen. nov., sp. nov. Palacios-Vargas et Vacaflores-Argandoña**
Figs. 1–32

Type locality: Bolivia, Department of La Paz, Province Los Andes Location Pucarani-Condoriri, River Palcoco, sample taken with surfer in the river, with riverside vegetation corresponding to ecological floor of PUNA, geographical coordinates of sampling 16°30'01" S and 68°35'08" W to 4,139 m. a.s.l. Collection date corresponding to the end of the wet season in the region 21/iv/2017, Adilen Fernández coll.

Type material. Holotype female and 9 paratypes will be kept at senior author institution. Two paratypes will be deposited at Bolivian Wildlife Collection, Institute of Ecology, Universidad Mayor de San Andrés, La Paz, Bolivia.



FIGURES 17–18. *Borgesminthurinus andinus* **sp. nov.**: 17, lesser abdomen chaetotaxy; 18, genital and anal plates of female.

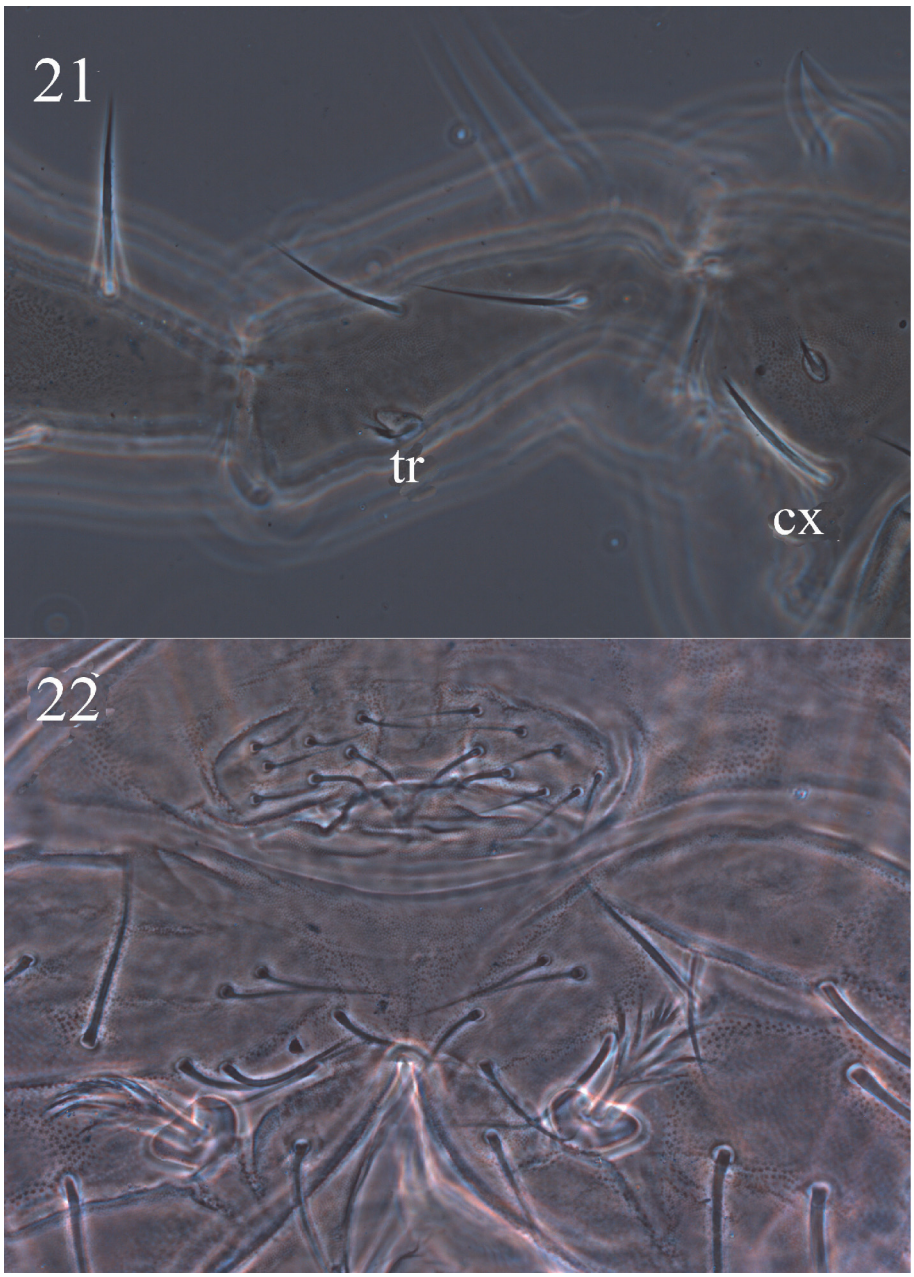


FIGURES 19–20. *Borgesminthurinus andinus* **sp. nov.**: 19, habitus; 20, head.

Description. Body length (n=10): 1,250 µm; head 640 µm. Cuticle finely granulated. Setae thin and smooth on Ant. IV, labrum, labium and furcula (Figs 1, 4, 5, 6, 15); thick and finely barbulate on Ant. I–III; head, body, and legs (Figs 2, 3, 24, 25, 31), except 4 pair of setae at posterior part of Abd. IV. Ventrally without barbulate setae (Fig. 23). Colour very dark purple almost black, with a pattern of several circular or elliptical sepia patches on head (Fig. 20); eyes patch black. Body very dark purple, almost black, with irregular pattern of circular or elliptical patches, and four constant bands, 2 on Th. I, 1 on Th. II and III, and one between the greater abdomen and lesser abdomen (Fig. 19).

Ant. I and II very dark, III and IV lighters. Legs and furcula paler than body. Body globular; Abd. V distinctly from furcal and anal segment (Fig. 17). Head clothed with abundant moderately long and thick barbulate setae,

those on top of head longer and thicker than those of anterior part (Figs 8, 24). Three short trichobothria (A-C) on each side of greater abdomen, arranged in a triangle (Fig. 31), B, closer to A. Lesser abdomen with a short trichobothria D (Fig. 17) between 2 microsetae. Antennae about 1.2-1.4 times longer than the diameter of the head. Relative lengths of Ant. I: II; III; IV are as 1: 2.4; 2.9; 7.5 (Figs 1, 2). Ant. I with 5 thick barbulate setae and 2 smooth thin and short ventrals. Ant. II with 16 thick barbulate setae and 2 ventral smooth. Ant. III with 17 thick barbulate setae (not longer than the width of Ant.) and 4 smooths; in middle part with a papilla subdivided into four vesicles (Figs 2, 25). Ant. organ III with 2 exposed, short elliptical sensilla, two guard sensilla smooth thin and shorter than setae and one short ventral microsensillum (Fig 3). Ant. IV simple, without subdivisions, about 1.5 times the size of Ant. III, with 14-15 irregular whorls of setae, which are in 8 longitudinal rows; 2 rows of short sensilla and one subapical pit (Figs 1, 26).

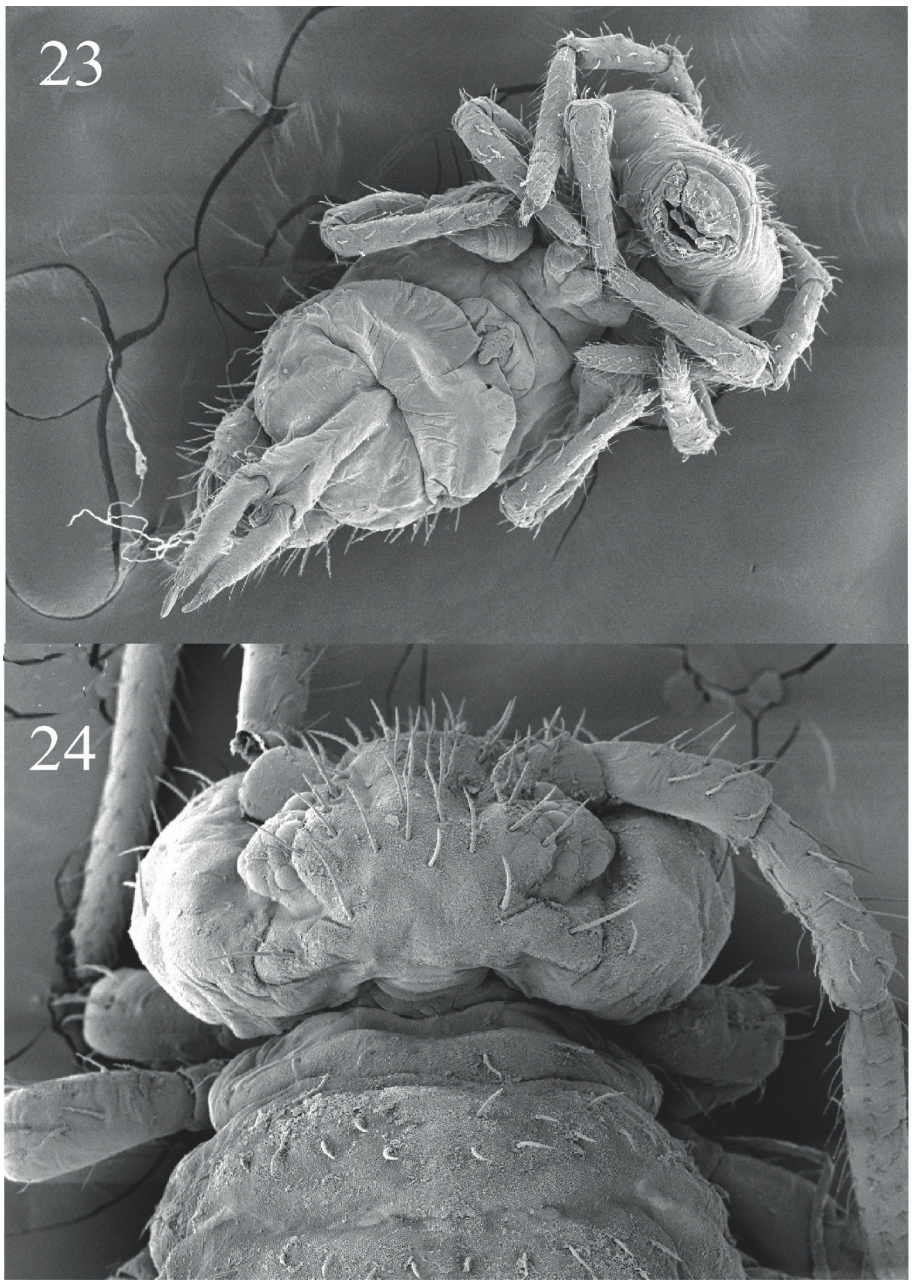


FIGURES 21–22. *Borgesminthurinus andinus* **sp. nov.**, Contrast phase microscope photos: 21, metathoraxic coxa, trochanter and throcanteral organ; 22, female genital plate and anal appendices.

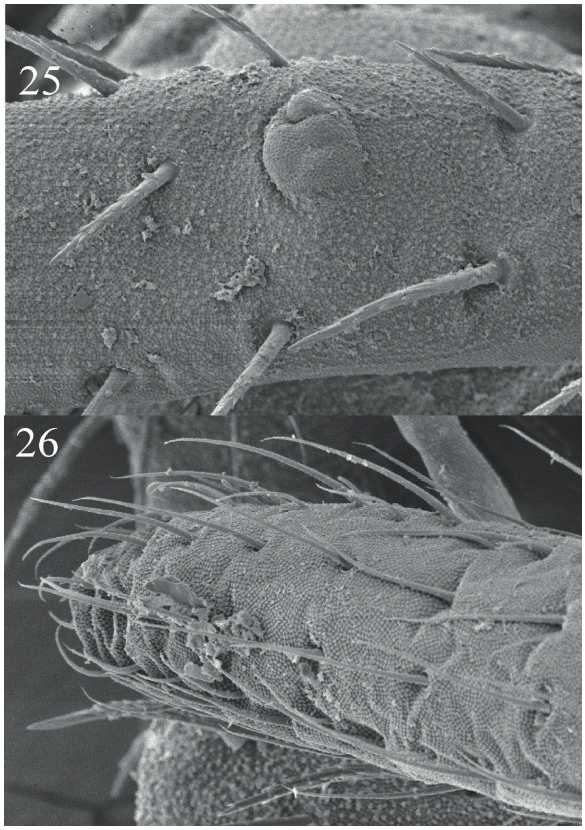
Labrum with 6 prelabral setae; 5 p, 5 m and 4 a, those lateral thicker than other (Figs 4, 28). Mandible well developed, with molar-plate and apically with 5 teeth. Head of maxilla globular with 2 teeth and six lamellae (Fig. 7). Eight eyes on each side of the head, cornea C, D and G smaller than others (Figs 8, 27). Interocular setae short

and close to cornea G. Two small cuticular lobulations on central part of head close to eye-patch (Fig. 24). Labium (Fig. 6) with 7 pairs basal setae (5 V and 2 Cp) 4 distal medial (L), 5 centro distal and two pairs of postlabial (in parenthesis chaetotaxy following Baquero *et al*. 2006). Labial papilla with tubercles A-E (*sensu* Fjellberg 1999).

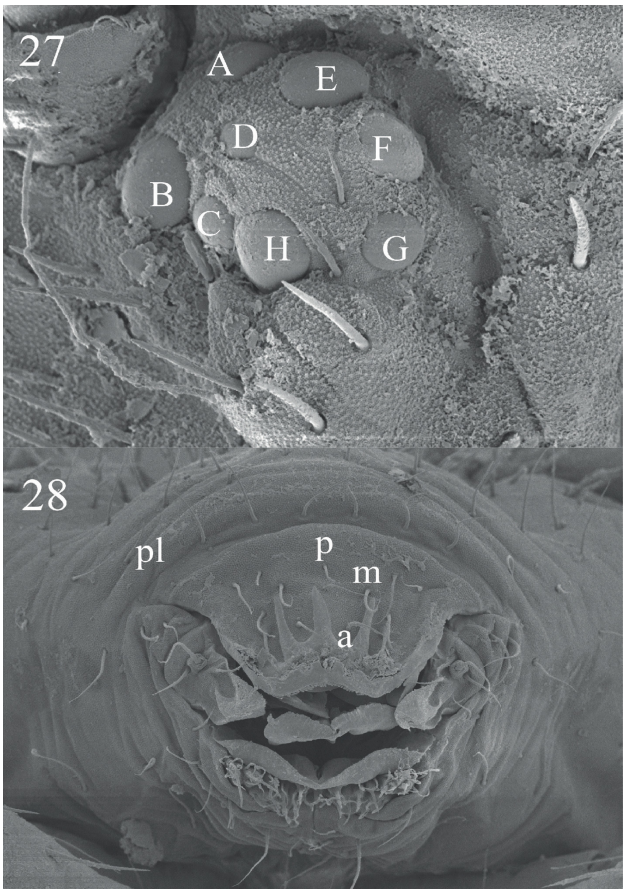
Metathoraxic trochanter with trochanteral organ (Figs 11, 21). Tibiotarsi I-III with 7 clearly capitate tenent hairs (Figs 9, 10, 12, 13). According to Nayrolles (1988), the setae would be named as: ka, kp; and setae from whorl I: a, ae, e, pe, p. Unguis moderately long with one inner tooth in the third apical (Figs 13, 34); dorsally with a big and long pseudonychia with about 9 teeth on each side (Figs 12, 13). No tunica. Ratio ungues/empodial appendage 1: 0.5. Empodial appendage lanceolate, lamellate, several corner-teeth and small subapical filament (Figs 9, 10, 12, 13), Tita. I, with subapical filament extending to tip of ungues (Fig. 29), on other Tita. they are shorter than unguis (Fig. 30).



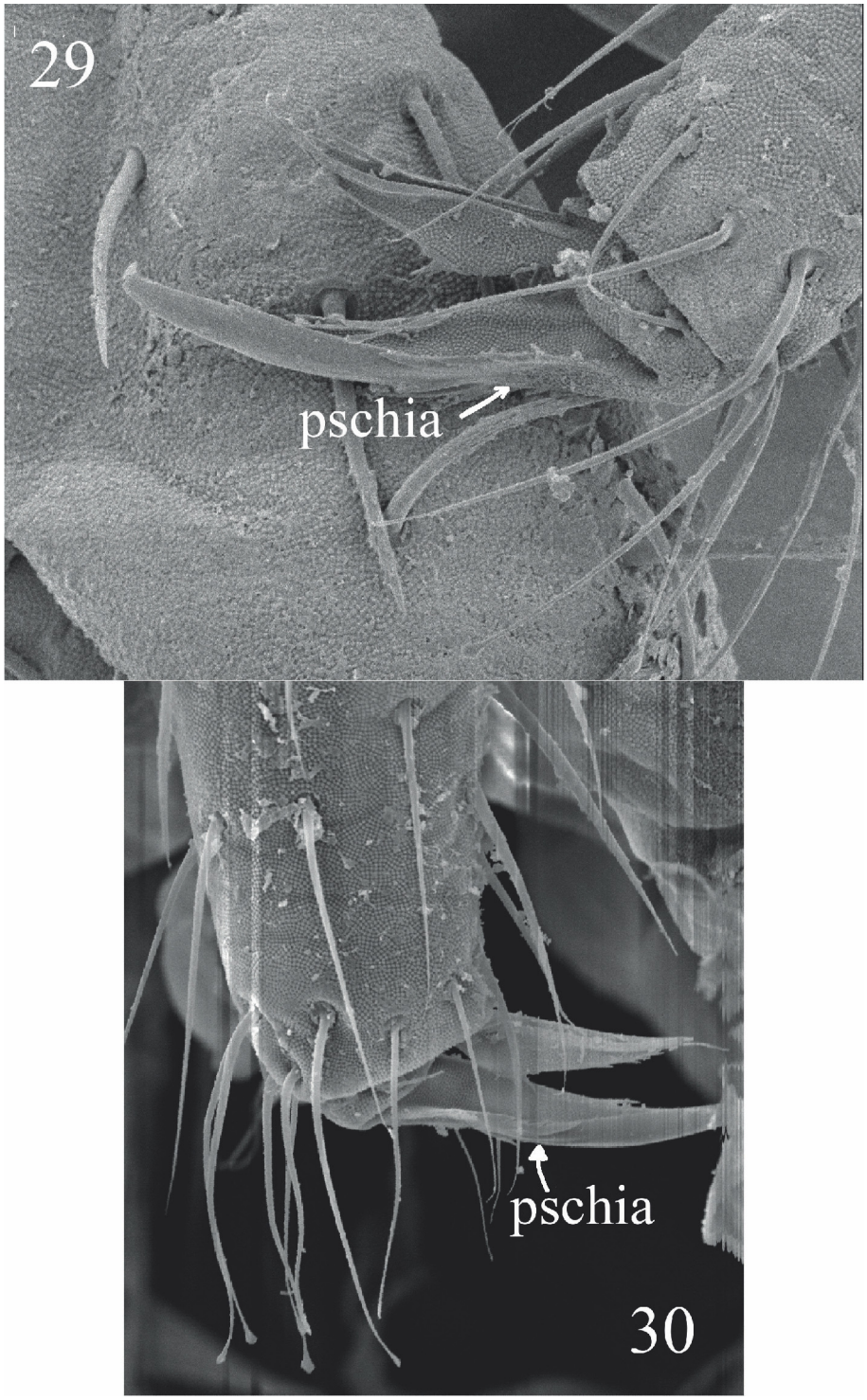
FIGURES 23–24. *Borgesminthurinus andinus* **sp. nov.**, SEM photo: 23, ventral view of complete body; 24, dorsal view of head and thorax I-III.



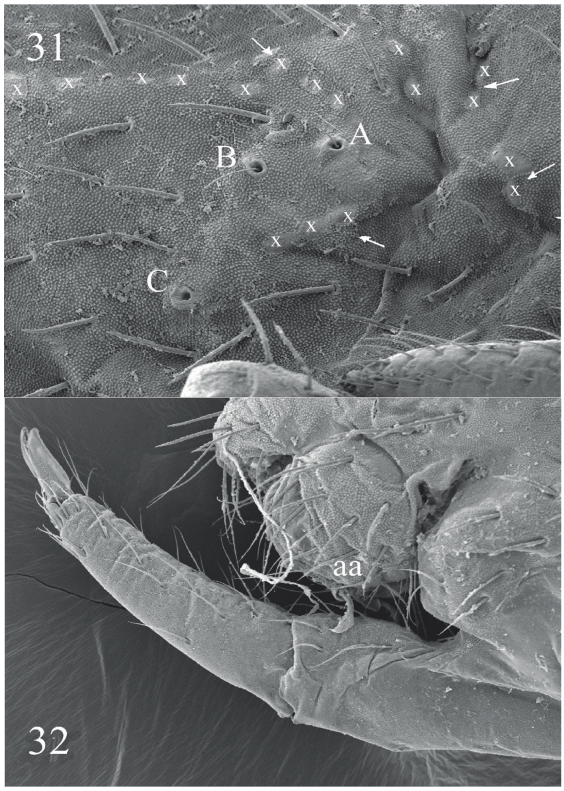
FIGURES 25–26. *Borgesminthurinus andinus* **sp. nov.**, SEM photo: 25, Ant. III papilla; 26, apex of Ant. IV.



FIGURES 27–28. *Borgesminthurinus andinus* **sp. nov.**, SEM photo: 27, ocular area, with cornea and intraocular setae taken from obtuse angle; 28, mouth in frontal view, with labrum, mandible, maxillary palps, labium and labial palps.



FIGURES 29–30. *Borgesminthurinus andinus* **sp. nov.**, SEM photo: 29, apex of tibiotarsus I; 30, apex of tibiotarsus III.



FIGURES 31–32. *Borgesminthurinus andinus* **sp. nov.**, SEM photo: 31, lateral view of great abdomen with trichobothria; 32, lateral view of Abd. IV to VI and furcula.

Tenaculum with tridentate rami (sometimes with an apical filament on one or both rami), and one small appendage at the base of each rami (Fig. 14); corpus tenaculum with 2 setae. No neosminthuroid seta. Manubrium with 9 pairs of setae (Fig. 15). Ratio manubrium: dens; mucro as 1: 1.3; 4.2. Dens with a total of 22 setae (Fig. 15), 8 external setae ($E_{1–8}$), four dorso-internal setae (Di_1, $Di_{2–5}$) and three lateral setae (L_1, $L_{5–6}$); three ventro-distal, two ventro-subapical (Ve_2), one ventro-proximal (Ve_5)—ventral formula: 4, 2 … 1. Dens about 3 times length of mucro. Mucro serrated only in inner edge, and with two notches in outer edge (Fig. 15). Mucronal seta absent.

Subanal appendage of female thick, palmate with 7–11 branches (Figs 18, 22). Ratio mucro: subanal appendage: 1.2. Female genital plate with 7–15 setae (Figs 18, 22). Seta A0 acuminate (Fig. 18). Anal valves of females without winged setae or basally broadened. Males not found.

Variation. Ant. III papilla seems to have 3 or 4 vesicles depending on the position. Number of branches of female anal appendage from 7 to 11.

Derivatio nominis: The name of the new species is locative, for Los Andes.

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References

Absolon, K. (1903) Untersuchungen über Apterykgoten. *Annalen des K.K. Naturhistorischen Hofmuseums*, 18, 91−111.

Arlé, R. (1939) Collembola. Anexo No. 2, Ao relatorio de excursao cientifica do Instituto Oswaldo Cruz realizasa na zona de E.F.N.O. B., em outubre de 1938. *Boletim do Biologia, São Paolo*, New Series, 4, 295–300.

Baquero, E., Snider, R. & Jordana, R. (2006) A revision of the springtail genus *Vesicephalus* Richards (Collembola, Symphypleona, Sminthurinae). *Systematic Entomology*, 31, 633−647.
https://doi.org/10.1111/j.1365-3113.2006.00337.x

Bellinger, P.F., Christiansen, K.A. & Janssens, F. (1996–2019) Checklist of the Collembola of the World. Available from: http://wwwcollembolaorg (accessed 30 November 2019)

Bernard, E.C. (2014) Katianna maryae n. sp. Collembola: Katiannidae), a southern Appalachian species of a Gondwanan genus. *Zootaxa*, 3754 (2), 148−158.
https://doi.org/10.11646/zootaxa.3754.2.4

Betsch, J.-M. (1980) Éléments pour une monographie des Collemboles Symphypleones (Hexapodes, Aptérygotes). *Mémoires du Muséum National d'Histoire Naturelle, Nouvelle Série*, Série A, Zoologie, 116, 1−227.

Börner, C. (1901) Zur Kenntnis der Apterygoten-Fauna von Bremen und der Nachbardistrikte. Beitrag zu einer Apterygoten-Fauna Mitteleuropas. *Abhandlungen des Naturwissencshaftlichen Vereins zu Bremen*, 17 (1), 1−140 + 233.
https://doi.org/10.5962/bhl.part.18332

Börner, C. (1906) Das system der Collembolen nebst Beschreibung neuer Collembolen des Hamburger Naturhistorschen Museum. *Mitteilungen aus dem Naturhistorschen Museum in Hamburg*, 23 (2), 147−188.

Börner, C. (1913) Die Familien der Collembolen. *Zoologischer Anzeiger*, 41, 315–322.

Bretfeld, G. (1994) *Sturmius epiphytus* n. gen. n. spec. from Colombia, a taxon of the Symphypleona (Insecta, Colembola) with an unexpected character combination. Description and position in non-Linnean and Linnean classifications of the Symphypleona. *Journal of Zoological Systematics and Evolutionary Research*, 32, 264−281.
https://doi.org/10.1111/j.1439-0469.1994.tb00487.x

Cassagnau, P. (1963) Collemboles d'Amérique du Sud. II. Orchesellini, Paronellinae, Cyphoderinae. *Biologie de l'Amerique Australe*, 2, 127−148.

Cassagnau, P. & Rapoport, E.H. (1962) Collemboles d'Amérique du Sud. I. Poduromorphes. *Biologie de l'Amérique Australe*, 1, 139−184.

Christiansen, K.A. (1963) Preliminary notes on the genus *Entomobrya* in South America with special reference to Patagonia. *Biologie de l'Amérique Australe*, 2, 149−168.

Delamare Deboutteville, C. & Massoud, Z. (1963) Collemboles Symphypléones. *Biologie de l'Amérique Australe*, 2, 169−289.

Delamare Deboutteville, C. & Massoud, Z. (1964) Le genre Vesicephalus Richards de la sous-famille des Vesicephalinae Richards nov. com., avec une discussion de la position du genre Papirinus Yosii (Ins. Collembola Symphypleona). *Ecologie et Biologie du Sol*, 1 (1), 73−83.

Fjellberg, A. (1999) The labial palp in Collembola. *Zoologischer Anzeiger*, 237, 309−330.

Marcus, H. (1949) Observaciones sobre el Orden Collembola. *Folia Universitaria de Cochabamba*, 3, 61−69.

Nayrolles, P. (1988) Chétotaxie tibiotarsal des collemboles Symphypléones. *Travaux du laboratoire d'Écobiologie des Arthropodes Édaphiques, Toulouse*, 5 (4), 1−19.

Palacios-Vargas, J.G. (2017) Primer registro del género *Sminthurinus* (Collembola: Katiannidae) de Chile con descripción de una nueva especie. *Dugesiana*, 24 (2), 159−164.

Palacios-Vargas, J.G., Hornung-Leoni, C.T. & Garrido, I. (2012) Collembola in epiphytic bromeliads (*Tillandsia imperialis*: Bromeliaceae) from Hidalgo, Mexico and description of a new *Sminthurinus* (Collembola: Katiannidae). *Brenesia*, 78, 58−64.

Schäffer, C. (1897) Apterygoten. *Hamburger Magalhaensische Sammelreise*, 1879, 1–48.

Silva, D.S., Palacios-Vargas, J.G. & Cavalcante Bellini, B. (2015) A new genus and a new species of Sminthuridae (Collembola : Symphypleona) from Atlantic forest of Brazil. *Zootaxa*, 3990 (3), 410−418.
https://doi.org/10.11646/zootaxa.3990.3.5

Snider, R.J. (1989) Link between Sminthurinus and Katianna collected from Alabama (Collembola: Katiannidae). *Florida Entomologist*, 72 (3), 541–547.
https://doi.org/10.2307/3495194

Vacaflores-Argandoña, M.R. (2013) *Densidad de colémbolos bajo cultivo de repollo, a tres profundidades del suelo, durante una campaña agrícola, en la localidad de Huaricana, Municipio Mecapaca (La Paz—Bolivia)*. Tesis de licenciatura. Carrera de Biología. Facultad de Ciencias Puras y Naturales, Universidad mayor de San Andrés, La Paz, 83 pp.