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Some Ceratozetoidea species (Acari: Oribatida: Ceratozetidae, Humerobatidae) from the Galapagos Islands

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Original research

ABSTRACT

A new species of oribatid mites from the Galapagos Islands, *Ceratozetes yupanqui* n. sp. is described and illustrated. It is morphologically most similar to two South American species, *Ceratozetes platyrhinus* and *C. platyrhinoideus*, in having a broadened rostrum without incisions, but the new species exhibits consistent morphological differences in comparison to these species which are discussed. Numerous specimens of *Ceratozetes yupanqui* n. sp. were found on western islands of the archipelago, in moister habitats at higher altitudes in leaf and grass litter, as well as in arid lowlands in dry leaf and cactus litter. In previous listings of Galapagos species, *Humerobates rostromellatus* was erroneously reported as "*Porozetes* sp." Additional morphological features of this species are presented, based on the record from the Galapagos Islands. Morphological differences between *H. rostromellatus* and *H. flechtmani* from Brazil are highlighted.

Keywords oribatid mites; systematics; morphology; Neotropical realm; new species; *Humerobates rostromellatus*; distribution

Zoobank <http://zoobank.org/BOB75F63-404D-41F2-9926-ACA5D7172324>

Introduction

The oribatid mite taxon Ceratozetoidea Jacot, 1925 is very rich in species, and representatives of this superfamily are found in all zoogeographical realms. They are organized in ten families (Schatz *et al.* 2011, updated): Ceratokalummidae Balogh, 1970; Ceratozetidae Jacot, 1925; Chamobatidae Grandjean, 1954; Euzetidae Grandjean, 1954; Humerobatidae Grandjean, 1971; Maudheimiidae Balogh & Balogh, 1984; Punctoribatidae Thor, 1937; Onychobatidae Luxton, 1985; Ramsayellidae Luxton, 1985; Zetomimidae Shaldybina, 1966. In the course of investigating oribatid mites on the Galapagos Islands (Schatz 1998) six Ceratozetoidea species have been recorded. Of these, two species of *Cultrobates* (Fam. Ceratokalummidae) were recently described (Schatz 2023), descriptions of further species in that family are in preparation.

On the Galapagos Islands, two species of the family Ceratozetidae were recorded, *Ceratozetes* sp. and *Porozetes* sp. Detailed morphological examinations revealed that the specimens of *Ceratozetes* sp. belong to an undescribed species of this genus, while the single specimen of the other species, previously incorrectly listed as "*Porozetes* sp." is *Humerobates rostromellatus* Grandjean, 1936 (Fam. Humerobatidae). Both species are presented respectively described here.


The genus *Ceratozetes* was proposed by Berlese (1908) with *Oribata gracilis* Michael, 1884 as type species. The distribution of the genus is cosmopolitan, the majority of the known species

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occur in the Holarctic realm. As Seniczak *et al.* (2017) stated, the definition for *Ceratozetes* is interpreted differently in the literature. The generic diagnosis proposed by Behan-Pelletier (1984) is formulated more broadly and includes (among other character states) species with 10 or 11 pairs of notogastral setae, rostrum with or occasionally without lateral teeth and median tooth, and with truncated or long lamellar cusps. In contrast, Pavlichenko (1994) and Subías (2022) consider *Ceratozetella* Shaldybina, 1966 as separate taxon for Ceratozetidae species with 10 pairs of notogastral setae, lamellar cusps with dens, and larvae with 3 large, segmentally arranged shields. The presence or absence of the notogastral seta c_3 in the context of the mosaic distribution of other morphological characters in the species of these taxa suggests a close relationship between these species, and like Seniczak *et al.* (2017), I follow the broader generic definition of *Ceratozetes* proposed by Behan-Pelletier (1984), as do Weigmann (2006); Behan-Pelletier and Eamer (2009); Seniczak *et al.* (2016) (see Remark #1).

The genus *Humerobates* was proposed by Sellnick (1928) with *Notaspis humeralis* (Hermann, 1804) as type species. Nevertheless, this was a misidentification by Sellnick. Grandjean (1936), after collecting in the surroundings of Strasbourg (where Hermann made his collections) considered the species of Hermann as *Diapterobates*, and *humeralis* in the sense of Sellnick and auct. as another species which he renamed *Humerobates rostrulamellatus*. The ICZN established *Humerobates rostrulamellatus* Grandjean, 1936 as the type species of *Humerobates* (Norton 1985; ICZN 1987). *Humerobates rostrulamellatus* is widely distributed and was recorded in the Palaearctic, Nearctic and Afrotropical realms as well as on Indomalayan islands in the Western Pacific Ocean and Polynesia. A previous finding of this species in the Neotropical realm is uncertain (see Remark #4).

Material and methods

Most of the material from the Galapagos Islands was collected during several expeditions to all the major and most of the minor islands of the archipelago by Heinrich and Irene Schatz in the years of 1985–1988 (Schatz 1998), supplemented by further collections by Sandra Abedrabbo, Harald E. Pehofer, and the group of Leon Baert, Konjev Desender, and Jean-Pierre Maelfait. The Galapagos material was collected more than 30 years ago. Due the age of the preserved material and the difficulty of obtaining suitable preservation fluid on the remote archipelago at that time, several individuals are now in bad condition or damaged. Although this allows morphological studies, it is questionable whether this material is still suitable for molecular analyses. Details of samples are given in the respective records of the species.

The soil and organic litter samples from the Galapagos Islands were extracted in the Charles Darwin Research Station in Galapagos with a modified Tullgren–Berlese extraction apparatus (details see Schatz 1998). For microscopic studies the specimens were mounted in lactic acid on temporary cavity slides for illustration, and subsequently preserved in ethanol. Drawings were made with a camera lucida attached to a transmission light microscope “Nikon Eclipse E400”. Each measured parameter was oriented to the particular optimal parallax-free perspective. Measurements of total body length was done in lateral view, from the tip of the rostrum to the posterior edge of the notogaster. Body width refers to the maximal width of notogaster in dorsal aspect. Measurements indicated are ranges between maximum and minimum value, mean in parentheses; all measurements are given in micrometers (μm). Females are recognizable by the presence of ovipositor and/or eggs, males by the small spermatopositor under the genital plates (Grandjean 1956). The terminology of morphological features used in this paper follows that of Grandjean (summarized by Travé and Vachon 1975; Travé *et al.* 1996; Norton and Behan-Pelletier 2009).

In the text and figures the following abbreviations were used: *Prodorsum*: rostral (*ro*), lamellar (*le*), interlamellar (*in*), bothridial (*bs*), exobothridial (*ex*) setae, genal tooth (*gt*), tutorium (*tu*), dorsosejugal porose area (*Ad*), dorsophragma (*Dp*), pleurophragma (*Pp*). *Notogaster*: porose areas (*Aa*, A_1 , A_2 , A_3), notogastral setae (c_2 , c_3 , *l*-, *h*-, *p*-series), lyrifissures (*ia*, *im*, *ip*,

ih, ips), opisthonotal gland opening (*gla*). *Gnathosoma*: subcapitular setae (*a, m, h*), axillary saccule (*as*), adoral setae (*or*), cheliceral setae (*cha, chb*), Trägårdh's organ (*To*), palp setae (*sup, inf, d, l, cm, acm, lt, vt, ul, su*), solenidion (ω), postpalpal seta (*pps*). *Epimeral, lateral podosomal regions*: pedotecta I, II (*PtI, PtII*), humeral porose areas (*Ah, Am, Ai*), custodium (*cus*), discidium (*dis*), circumpedal carina (*cp*), epimeral setae (*1a–1c, 2a, 3a–3c, 4a–4c*). *Anogenital region*: genital, aggenital, anal, adanal setae ($g_1–g_6, agg, an_1, an_2, ad_1–ad_3$), adanal lyrifissure (*iad*), preanal organ (*po*), postanal porose area (*Ap*). *Legs*: leg setae (*ft, tc, it, p, u, a, s, pv, pl, d, l, v, bv, ev*, parentheses refer to a pair of setae), solenidia ($\omega_1, \omega_2, \varphi, \varphi_1, \varphi_2, \sigma$), famulus (ε), porose area (*pa*).

Taxonomy

Family Ceratozetidae Jacot, 1925

Genus *Ceratozetes* Berlese, 1908

Type species: *Oribata gracilis* Michael, 1884

Ceratozetes yupanqui n. sp.

Zoobank: [9A29CE80-4A9A-44AC-91F5-B6A3BBC3F664](https://zoobank.org/9A29CE80-4A9A-44AC-91F5-B6A3BBC3F664)

Ceratozetes sp.: Schatz 1998, p. 387.

(Figs 1–5)

Diagnosis

Adults of *Ceratozetes yupanqui* n. sp. differ morphologically from their congeners by the following combination of characters: Body size: 470–570 x 320–405. Rostrum flattened and broadened. Lamella broadened plate, without translamella, cusp triangular. Bothridial seta with clavate head. Tutorium with long free protruding tip. Exobothridial seta long. Pteromorph immovable. Ten to eleven pairs of notogastral setae, seta c_3 sporadically present as alveolus or as short seta, four pairs of small porose areas on notogaster, postanal porose area present. Circumpedal carina, custodium and triangular discidium present. Epimeral setal formula 3–1–3–3, genito-anal setal formula 6–1–2–3. Tarsi on legs heterotridactylous.

Description of adult

Measurements — Females (n=15): L 500–(520)–570, W 350–(380)–405, males (n=8): L 470–(490)–500, W 320–(345)–390.

Integument — Body colour light brown, notogaster, epimeral, ventral, genital, anal plates finely granulated. Distal surface of tutorium, pedotecta I and II striated. Pteromorphs longitudinally lightly striated.

Prodorsum — Rostrum flattened and broadened, laterally on both sides a mediad curved chitinous buckle. In lateral aspect, tip of rostrum forming a ventrally open tunnel. Lamella distally broadened, without translamella, cusp triangular, length ~60, with short lateral tooth adjacent to insertion of lamellar seta. Prodorsal setae setiform with small bristles, all directed anteriad, rostral seta (*ro*, 80–90) inserting underneath tip of tutorium. Lamellar seta (*le*, 80–85) inserting on inner edge of cusp. Insertion of interlamellar seta (*in*, ~130–140) on anterior margin of notogaster, distance between insertions 85–100. Bothridium cup-shaped, with three scales, medial scale pointed, directed anteromediad towards lamellar edge, bothridial seta (*bs*) of medium length (stem 40–50, head ~30), directed laterad or anterolaterad, head clavate, slightly thickened (width ~5–8), dorsally spoon-shaped indentation with small bristles. Tutorium long and narrow blade (*tu*, 110–130) with free protruding tip anterodistally (40–50). Genal tooth (*gt*) large, distally attenuating. Dorsosejugal porose area (*Ad*) posterior to insertion of *in*, small, oval (~20 x 6). Internal apophyses hardly visible, dorsophragmata (*Dp*) small, between

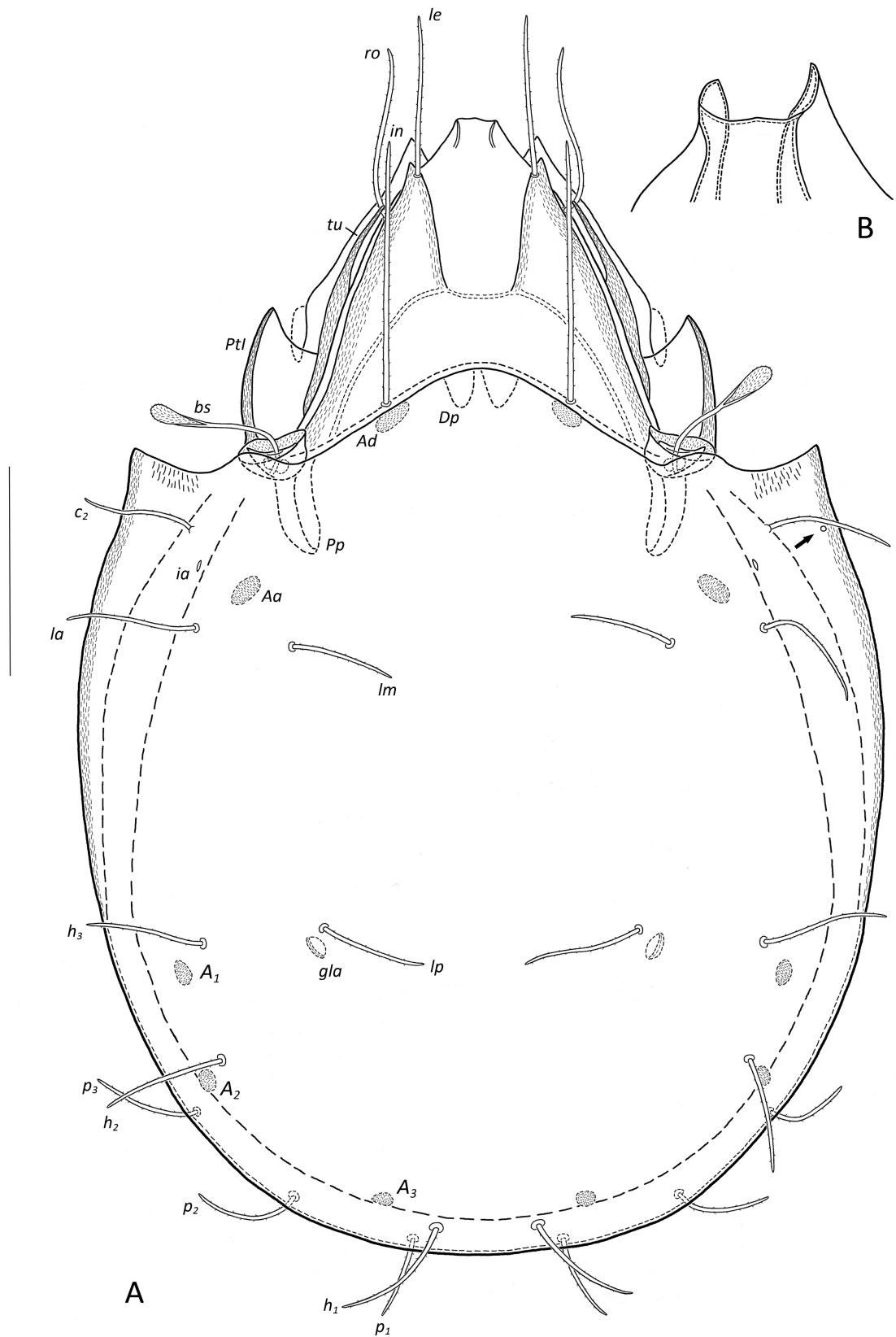


Figure 1 *Ceratozetes yupanqui* n. sp., adult: A – dorsal aspect. Scale bar 100 μ m. Arrow – occasional alveolus of seta c_3 . B – tip of rostrum, dorsolateral aspect, enlarged. Scale bar 20 μ m.

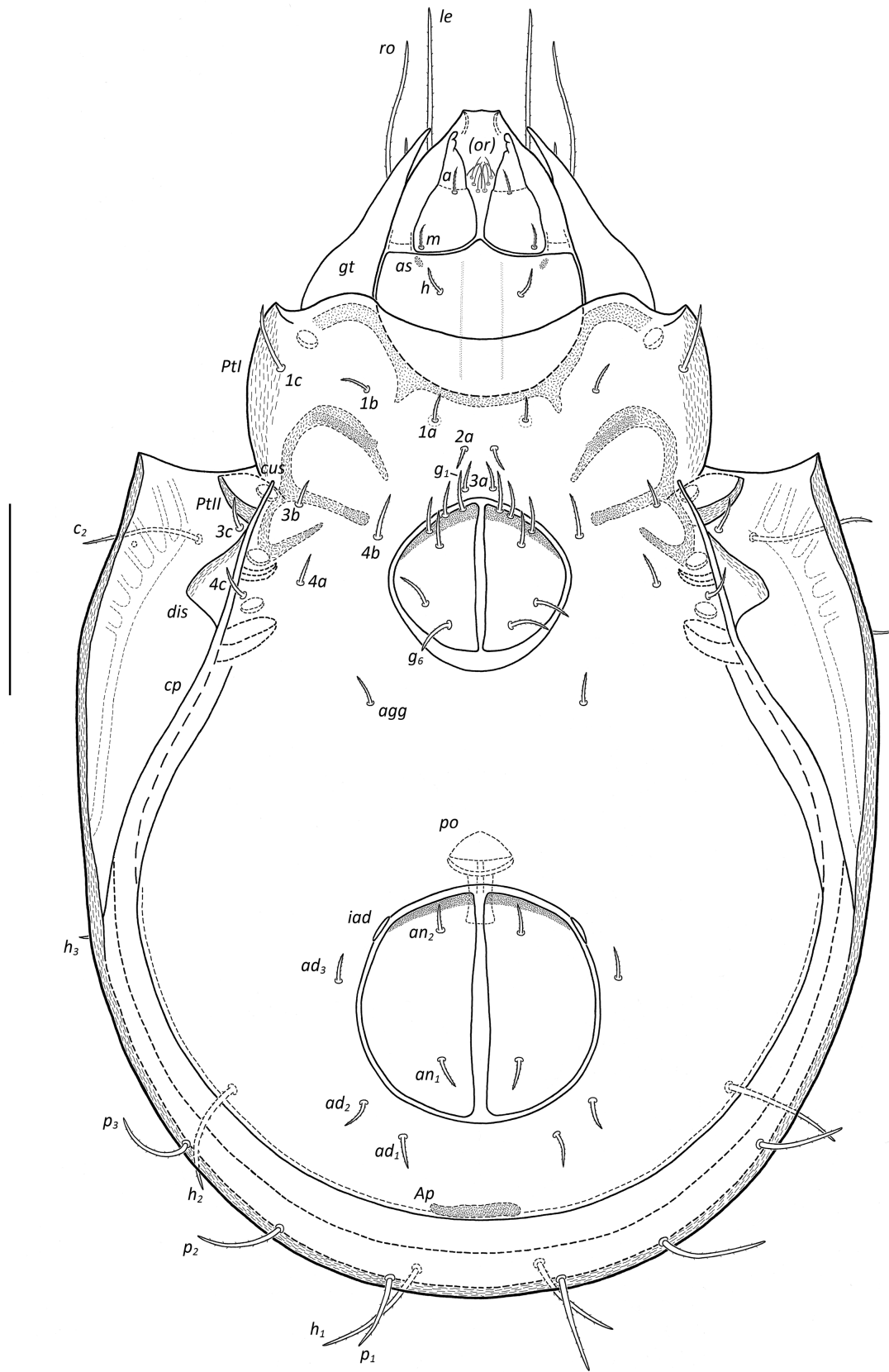


Figure 2 *Ceratozetes yupanqui* n. sp., adult: ventral aspect (legs not shown). Scale bar 100 μ m.

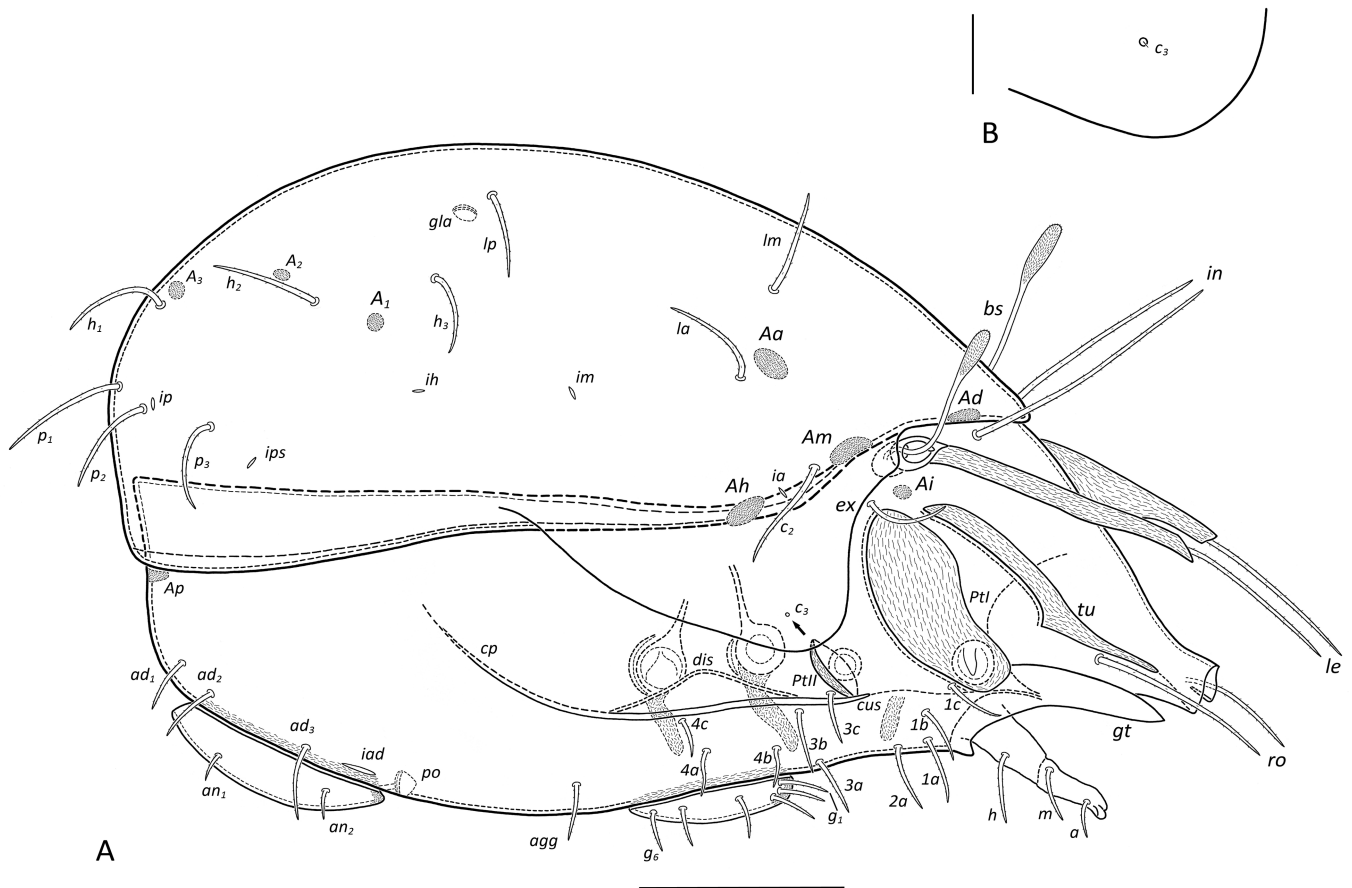


Figure 3 *Ceratozetes yupanqui* n. sp., adult: A – lateral aspect (legs not shown). Arrow – occasional alveolus of seta c_3 . Scale bar 100 μ m. B – vestigial seta c_3 on edge of pteromorph, enlarged. Scale bar 50 μ m.

dorsosejugal porose areas, pleurophragmata (*Pp*) larger, posterior to bothridia. Exobothridial seta long (*ex*, 40–50), ventral to posterior end of bothridium.

Notogaster — Oval, about 1.20–1.30 x longer than wide. Anterior margin projecting anteriorly. Pteromorph immovable, edge curved ventrad. Ten pairs of notogastral setae, setiform (~45–55, c_2 longest, 60–65) with short bristles. Additionally, alveolus of seta c_3 present in some specimens (Figs 1A, 3A), rarely evident as thin and short seta (5–8, Fig. 3B) (see Remark #1). Four pairs of small porose areas, *Aa* largest (15–20 x 7–10), oval, directed anterocentrally, *A1* oval (12–15 x 6–8), *A2*, *A3* round to oval (5–7). Lyrifissures distinct, best visible in lateral view, *ia* situated posterior to c_2 , *im* posterior to *la*, *ip* anterior to p_2 , *ih* lateral to h_3 , *ips* anterior to p_3 . Opisthonotal gland (*gla*) opening distinct, located near *lp*.

Gnathosoma — Subcapitulum diarthric, mentum large (~100 x 70–80). Subcapitular setae *h* (30–35), *m* (25–30), *a* (~15), attenuating with very short bristles. Adoral setae on conical lips, smooth (*or*, 6–8). Axillary saccule posterior to seta *m*, oval elongated (*as*, 6–8 x 3). Chelicerae chelate-dentate, size (n=10) 130–140 x 45–50. Cheliceral setae attenuating with small bristles, *cha* (40–45) inserting paraxially near dorsal margin, directed anteriorly, *chb* (25–30) inserting abaxially. Length of movable digit ~35. Trägårdh's organ (*To*, 50) inserting paraxially. Palp (75–80) with long femur and long tarsus, setal formula 0–2–1–3–9 (+ solenidion ω), setae with short bristles. Length of ω 12, attached to eupathidial seta *acm*. Postpalpal seta spiniform (*pps*, 4).

Lateral aspect of podosoma — Pedotectum I (*PtI*) large, pedotectum II (*PtII*) small scale

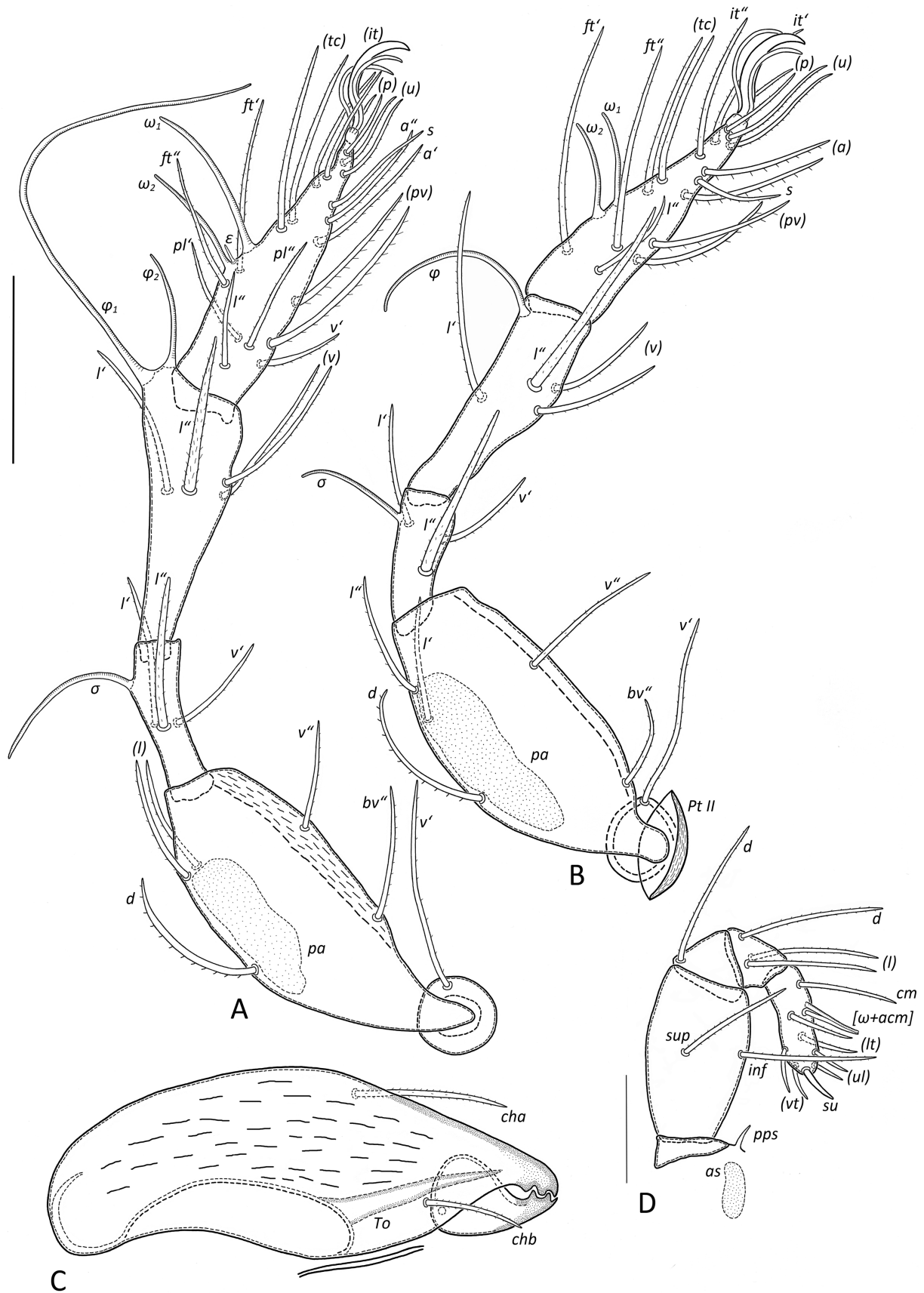


Figure 4 *Ceratozetes yupanqui* n. sp., adult: legs, Chelicera and palp, antiaxial aspect. **A** – Leg I, right. **B** – Leg II, right. **C** – right chelicera. Scale bar (A–C) 50 μ m. **D** –right palp. Scale bar 20 μ m.

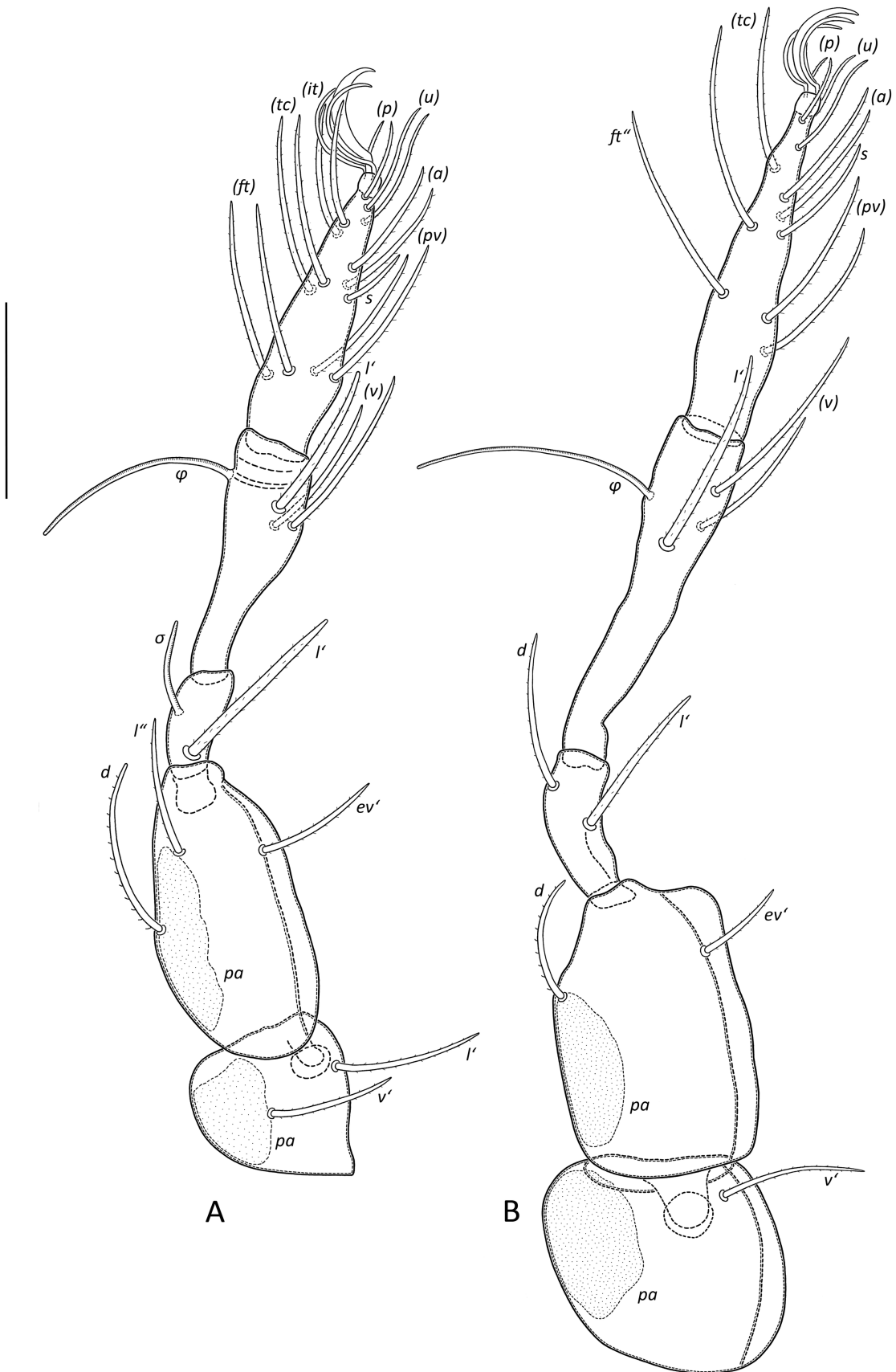


Figure 5 *Ceratozetes yupanqui* n. sp., adult: legs, antiaxial aspect. A – Leg III, left. B – Leg IV, left. Scale bar (A–B) 50 μ m.

posterior to trochanter II. Discidium (*dis*) triangular, projecting laterally. Circumpedal carina (*cp*) merging into custodium. Custodium (*cus*) with long free acute tip extending anterior of pedotectum II. Humeral porose areas *Am* (~20 x 10), *Ah* (~15–20 x 10) indistinct, oval to round, *Ai* small (~10–12 x 8), ventral to bothridium.

Epimeral region — Apodemes I complete and fused medially, apodemes II and III as well as sejugal apodemes medially incomplete. Epimeral setal formula 3–1–3–3, all setae setiform with very short bristles, length 25–35.

Anogenital region — Genito-anal setal formula 6–1–2–3, all setiform, roughened or with very short bristles. Three pairs of anterior genital setae situated side by side on anterior thickening of genital plates, genital and anal setae ~20. Aggenital and adanal setae ~30. Anterior adanal setae *ad*₂, *ad*₃ situated in paraanal, *ad*₁ in postanal position. Adanal lyrifissure (*iad*) short, adjacent and parallel to anal plates, level with their anterior third. Postanal porose area small, elongate (*Ap*, ~45–50 x 8).

Legs — Legs of medium length (50–65% of body size), length (with claws) of leg I 280–330, II 280–320, III 270–310, IV 300–350. All legs heterotridactylous, with stronger median and thin lateral claws. Setal formula of legs (trochanter to tarsus, famulus included, solenidia in parentheses): leg I 1–5–3(1)–4(2)–20(2), leg II 1–5–3(1)–4(1)–16(2), leg III 2–3–1(1)–3(1)–15, leg IV 1–2–2–3(1)–12. All femora thickened ventrally, trochanters III and IV with a dorsal blade each. Setae *l*'' on genua and tibia of setae I and II as well as setae *l*' on setae III and IV thicker than other setae, rather spiniform (40–55) with short bristles. Other setae setiform with short bristles, setae (*pv*) and (*a*) on tarsi I–IV with longer bristles. Setae *d* on femora unilaterally ciliate. Solenidium ϕ_1 on tibia I 120–140, ϕ on tibia II 80–100, σ on genu I ~40, on genu II ~30. Position, length and designation of setae and solenidia as indicated in Figs 4 and 5. Large porose areas (*pa*) on all femora in paraxial position (40–55 x 10–15, ~40–60% of femur length) and on trochanters III, IV.

Immatures

Unknown.

Sexual dimorphism

Females larger than males, ranges slightly overlapping. Length of female genital plates (n=15) 60–75. Most females with internal ovipositor, two specimens with six or seven large eggs, size of eggs (n=13) 135–160 x 60–90, shape oval. Length of male genital plates (n=8) 55–60, longitudinal cross section of spermatopositor 20–25. Apart from differences in body size and size of genital plates, no external sexual dimorphism could be observed.

Type locality – Material examined

Galapagos Islands, Isabela Island, Sierra Negra, west of Villamil, near the site of the “muro de las lagrimas”, arid zone, open bushland with *Opuntia insularis*, *Zanthoxylum fagara*, *Croton scouleri* var. *scouleri*, *Heliotropium angiospermum*, in dry to moist decayed cactus litter under *Opuntia insularis* (8 Feb. 1987, 30 m a.s.l., 0°57.96' S, 91°00.88' W, leg. H. Schatz). Holotype female, six paratypes (two females, four males). Additionally, several specimens from other sites and islands were used for measurements and morphological analyses.

Type deposition

The holotype and six paratypes from the type locality, preserved in ethanol, are deposited in the collection of the Senckenberg Museum, Görlitz, Germany (SMNG). Additional material is deposited in the collection of the author, which will finally also be placed in the Senckenberg Museum, Görlitz.

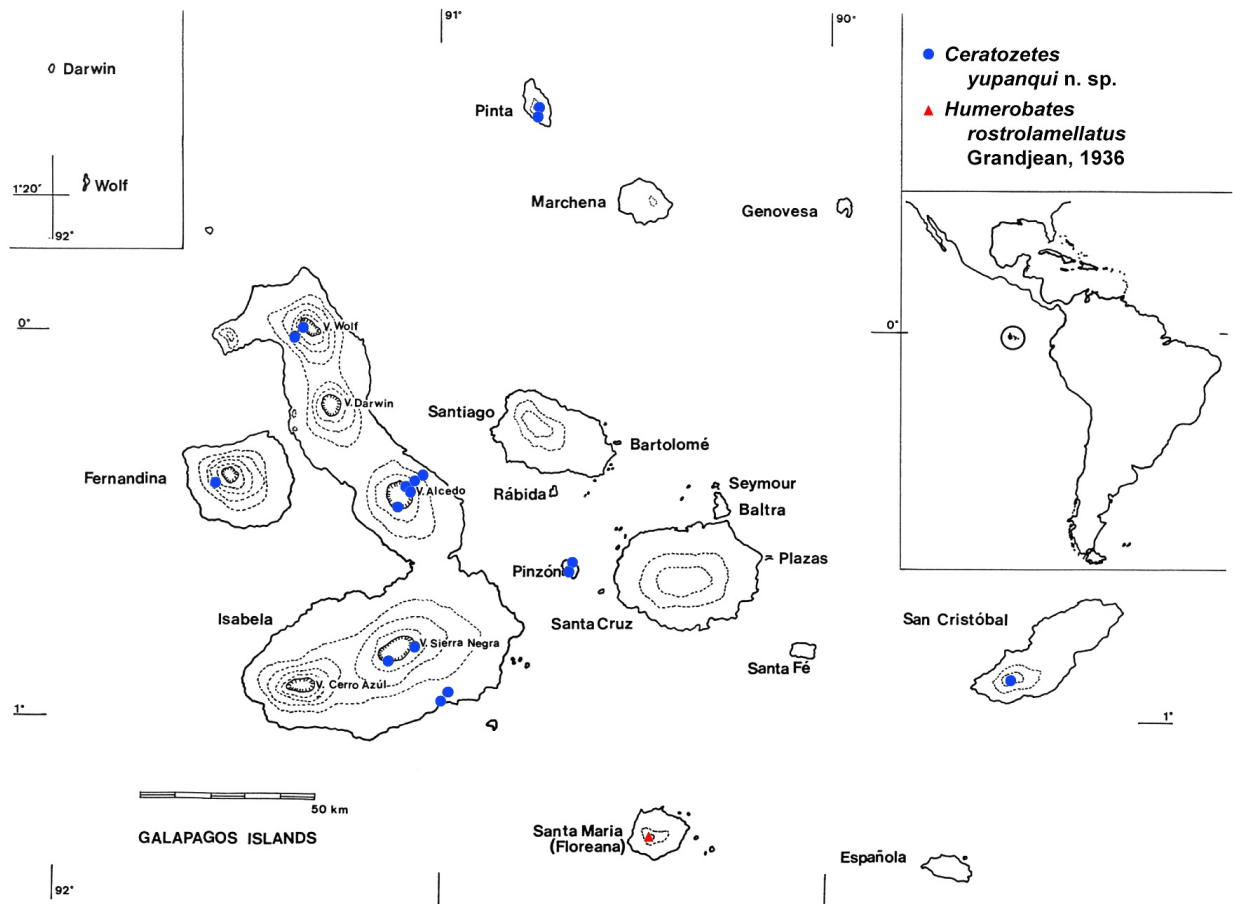


Figure 6 Records of *Ceratozetes yupanqui* n. sp. and *Humerobates rostromellatus* from the Galapagos Islands.

Etymology

The specific epithet *yupanqui* is a noun in apposition and refers to the tenth Inca emperor Túpac Inca Yupanqui (governing 1471–1493). According to an unconfirmed legend he led a voyage of exploration into the Pacific around 1480. He is said to have visited islands he called Niñachumbi (“Island of Fire”) and Auachumbi (“Outer Island”), perhaps two of the Galapagos Islands, but other authors suggest that the voyage went as far as Easter Island or islands in French Polynesia (Bericat 2020). The voyage is mentioned in the *History of the Incas* by Pedro Sarmiento de Gamboa (1572), but some historians are skeptical that the voyage ever took place (https://en.wikipedia.org/wiki/Topa_Inca_Yupanqui).

Records from the Galapagos Islands

H. and Irene Schatz coll., unless other collector names given.

A total of 147 adult specimens of *Ceratozetes yupanqui* n. sp. was found on five islands of the Galapagos archipelago (Fig. 6). No morphological differences between the populations on different islands and sites were observed.

Isla Fernandina — Western part of the island, moist (*Psychotria*) zone – Elfin Forest / Fern-sedge zone: at “Green crater”, in dry to moist leaf litter and pieces of wood under *Tournefortia pubescens* (15 March 1985, 550 m a.s.l., 1 adult).

Isla Isabela – Volcano Wolf — Moist (*Psychotria*) zone – Elfin Forest / Fern-sedge zone: open forest with *Bursera graveolens*, *Psidium galapageium*, *Zanthoxylum fagara*, in moist

decayed leaf litter and humus (23 March 1988, 800 m a.s.l., 15 adults, L. Baert, K. Desender, J.P. Maelfait coll., their loc. #71); *ibid.*, open forest with of *Opuntia insularis*, *Scalesia microcephala*, *Lantana peduncularis*, *Zanthoxylum fagara*, various fern species and grasses, in moist grass and leaf litter, pieces of wood and soil (23 March 1988, 1425 m a.s.l., 4 adults, L. Baert, K. Desender, J.P. Maelfait coll., their loc. #74).

Isla Isabela – Volcano Alcedo — Arid zone: Northeastern base of the volcano, dry forest with *Bursera graveolens*, *Waltheria ovata*, *Lantana peduncularis*, *Castela galapageia*, mixed with *Opuntia insularis*; under *Bursera* and *Waltheria*, in dry leaf litter (26 March 1988, 290 m a.s.l., 5 adults); northeastern slope of the volcano, upper Arid zone (at “first shade tree” *Pisonia floribunda*), open woodland with *Waltheria ovata*, *Macraea loricifolia* (Fig. 7B); under *Waltheria*, *Trema micranta*, in dry grass, leaf litter and soil (25 March 1988, ~350 m a.s.l., 6 adults). Moist (*Psychotria*) zone – Elfin Forest / Fern-sedge zone: Northeastern slope of the volcano, open forest with *Darwiniothamnus lancifolius* and *Scalesia microcephala*, in litter under *Darwiniothamnus*, (25 June 1991, 700 m a.s.l., 51 adults, S. Abedrabbo coll., her loc. #8); *ibid.*, under *Pisonia floribunda*, *Tournefortia pubescens*, *Mentzelia aspera*, ferns, in dead leaves (25 June 1991, 850 m a.s.l., 5 adults, S. Abedrabbo coll., her loc. #6, 7); eastern base of crater, open forest with *Bursera graveolens*, under *Pisonia floribunda*, in moist thin moss layer and soil from ground (25 March 1988, 880 m a.s.l., 2 adults); at southern crater rim, Elfin Forest with *Scalesia microcephala*, *Tournefortia rufo-sericea* (Fig. 7C), in litter under *Scalesia* (25 June 1991, 1125 m a.s.l., 6 adults, S. Abedrabbo coll., her loc. #4); *ibid.*, open bushland above fumarole, Elfin Forest with *Psychotria rufipes*, *Scalesia microcephala*, *Zanthoxylum fagara*, *Cordia leucophlyctis*, *Tournefortia rufo-sericea*, *Panicum glutinosum*, *Axonopus compressus*, *Commelina diffusa*, *Heliotropium* sp. (Fig. 7D), under *Pteridium aquilinum*, in moist decayed fern litter and humus (21 March 1988, 1060 m a.s.l., 1 adult).

Isla Isabela – Volcano Sierra Negra — Arid zone: West of Villamil, near “muro de las lagrimas”, open bushland with *Opuntia insularis*, *Zanthoxylum fagara*, *Croton scouleri* var. *scouleri*, *Heliotropium angiospermum* (Fig. 7A), in dry to moist decayed cactus litter (8 Feb. 1987, 30 m a.s.l., 29 adults); *ibid.*, near Quinta Playa, under *Scalesia cordata* and *Pisonia floribunda*, in moist partially-decayed leaf litter (8 Feb. 1987, 30 m a.s.l., 5 adults). Moist (*Psychotria*) zone – Pasture zone/Pampa: on northeastern crater rim above Volcano Chico, under *Darwiniothamnus lancifolius* and *Zanthoxylum fagara*, in dry to moist leaf litter and soil under *Sida hederifolia* (11 Feb. 1987, 950 m a.s.l., 1 adult); *ibid.*, on southwestern crater rim, *Psidium guajava*, *Borreria laevis*, *Cyperus brevifolius*, *Centella asiatica*, *Sida hederifolia*, in moist decayed leaf litter with pieces of wood and soil (11 Feb. 1987, 940 m a.s.l., 1 adult).

Isla Pinta — Upper Arid zone: southern part of the island, forest of *Bursera graveolens* and *Croton scouleri* var. *scouleri* (Fig. 7E), in dry leaf litter, pieces of wood and soil under *Darwiniothamnus tenuifolius* (2 April 1988, 200 m a.s.l., 3 adults); near eastern crater, open forest with *Macraea loricifolia*, *Darwiniothamnus tenuifolius*, *Opuntia galapageia* var. *galapageia*, in dry leaf and needle litter under *Macraea* (31 March 1988, 380 m a.s.l., 1 adult).

Isla Pinzón — Arid zone: Eastern part of the island, under *Croton scouleri* and *Cordia lutea*, in moist partially-decayed leaf litter (31 Jan. 1987, 100 m a.s.l., 1 adult); *ibid.*, in dry leaf litter and humus (3 Feb. 1987, 140 m a.s.l., 2 adults); Upper Arid zone, western part of the island, Central valley, *Croton scouleri* forest with *Lantana peduncularis*, *Acacia macracantha*, *Cordia leucophlyctis*, in dry to moist dead grass litter and humus under *Acacia* (30 Jan. 1987, 270 m a.s.l., 1 adult); *ibid.*, in dry to moist decayed litter and fine humus under *Croton* (2 adults); *ibid.*, in dry to moist lichens from barks of *Croton* (1 adult); *ibid.*, in moist decayed cactus litter under *Opuntia galapageia* var. *macrocarpa* (30 Jan. 1987, 290 m a.s.l., 1 adult); southern crater rim of main caldera near summit, *Scalesia* zone, open bush forest of *Scalesia incisa*, *Croton scouleri*, *Lantana peduncularis* (Fig. 7F), in moist leaf litter and pieces of wood under rock (31. Jan. 1987, 310 m a.s.l., 2 adults).

Isla San Cristóbal — Moist (*Miconia*) zone / Fern-Sedge zone: shore of lake El Junco (Fig. 7G), in mud among rushes (*Eleocharis acutangula*) (1. Jan. 1987, 630 m a.s.l., 1 adult, H. E. Pehofer coll.).

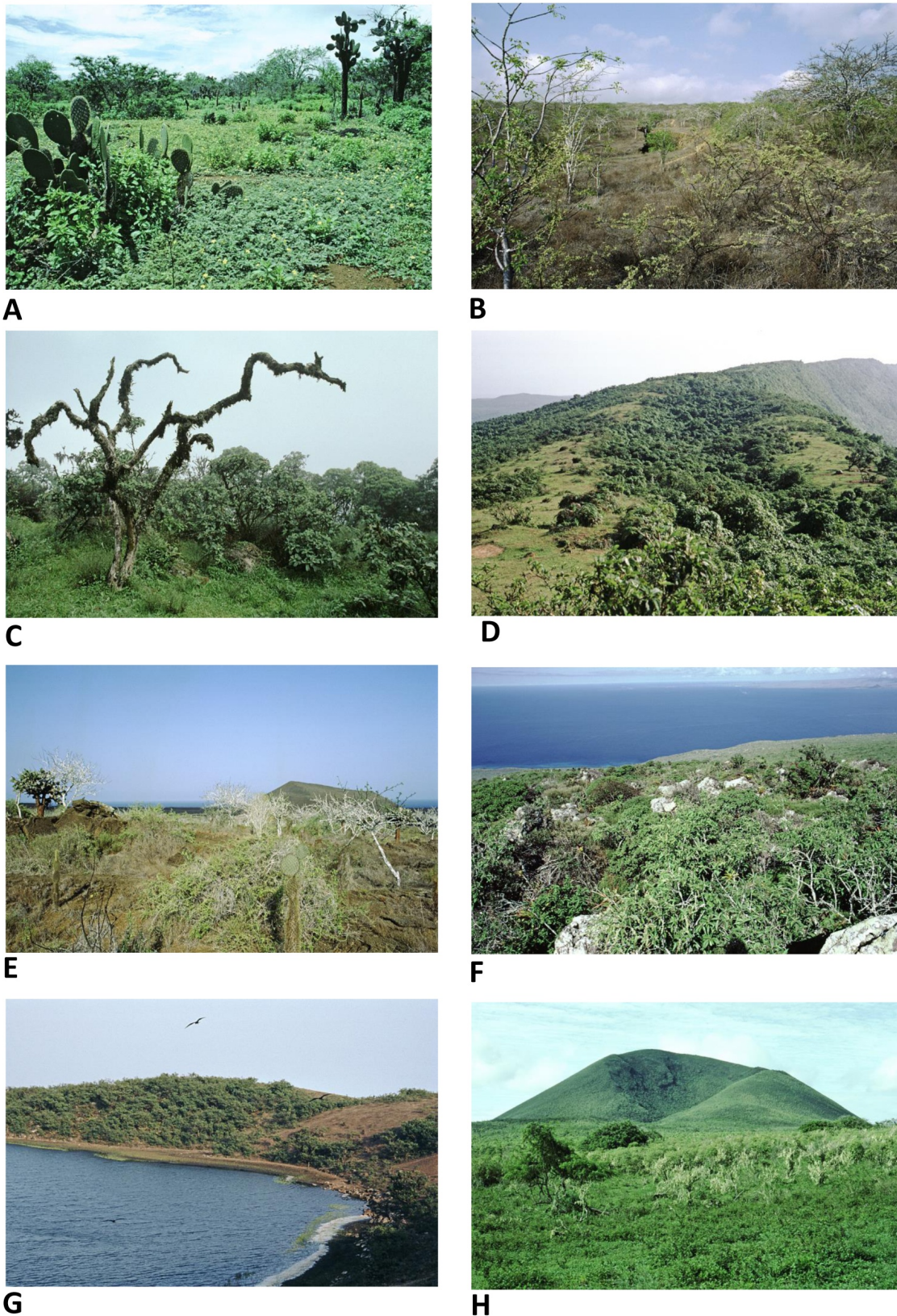


Figure 7 Some sampling localities of *Ceratozetes yupanqui* n. sp. and *Humerobates rostroramellatus* in the Galapagos Islands (all photos Irene and Heinrich Schatz). **A** – Isabela Island, southern slope of Volcano Sierra Negra, open bushland with *Opuntia insularis* near “muro de las lagrimas”, type locality of *Ceratozetes yupanqui* n. sp. (8 Feb. 1987, vegetation unusually green during El Niño). **B** – Isabela Island, northeastern slope of Volcano Alcedo, dry forest (26 March 1988). **C** – ibid., Volcano Alcedo, southeastern part of the crater rim, Elfin Forest (23 March 1988). **D** – ibid., Volcano Alcedo, southern part of the crater rim, open bushland with *Chelonoidis vandenburghi* (20 March 1988). **E** – Pinta Island, arid forest (30 March 1988). **F** – Pinzón Island, bushland on summit (22 Feb. 1987). **G** – Laguna El Junco, San Cristóbal Island (28 March 1985). **H** – Cerro Pajas, Floreana, finding location of *Humerobates rostroramellatus* (21 Jan. 1987).

Distribution and microhabitats of *Ceratozetes yupanqui* n. sp.

With one exception, all records of the new species are from the western islands of the archipelago, most from three volcanoes of Isabela Island (V. Wolf, V. Alcedo, V. Sierra Negra), from Pinzón and Pinta. It was found in moister habitats of higher altitudes of the volcanoes in decayed leaf litter and humus, in grass litter, also in the arid lowlands where the species occurs in dry leaf litter of open forests and in decayed cactus litter.

The finding of a single specimen in the mud of the only freshwater lake of Galapagos in the highlands of the easternmost island of San Cristobal is remarkable. One possible explanation for this record is an epizoochorous dispersal by magnificent frigate birds (*Fregata magnificens*), which constantly come to the lake to preen their feathers and bathe in the lake (own observation, Gerecke *et al.* 1995). The oribatid mite could have adhered to the plumage of the bird from a nest on the western islands. Transport of mites by birds has been reported at several occasions (e.g. Krivolutsky and Lebedeva 2002, Lebedeva 2012, Lebedeva and Poltavskaya 2013).

Family Humerobatidae Grandjean, 1971**Genus *Humerobates* Sellnick, 1928**

Type species: *Humerobates rostromellatus* Grandjean, 1936 (*Notaspis humeralis* Hermann sensu Sellnick 1928)

***Humerobates rostromellatus* Grandjean, 1936**

Humerobates humeralis Sellnick 1928: p. 11, fig. 13. *Humerobates rostromellatus* Grandjean 1936: p. 77, fig. 8 b; Sellnick 1959: p. 124, fig. 5 a, b; Pérez-Íñigo 1993: p. 162, figs 61 a-c; Weigmann 2006: p. 396, figs 211 h, i. *Porozetes* sp. Schatz 1998: p. 387.

The species is frequently cited in distribution lists, including studies on arbicolous mites, especially on fruit trees (De Giosa and Barretto 2022), and is used as bioindicator of air pollution (e.g., André *et al.* 1984). However, few descriptions exist. The single specimen examined from Galapagos is morphologically consistent with the descriptions by Grandjean (1936); Pérez-Íñigo (1993) and Weigmann (2006). Additional morphological features based on the Galapagos specimen are presented here.

Body size — (female). 670 x 450.

Supplementary description — Color chestnut brown, surface smooth. Rostrum rounded and slightly protruding in dorsal aspect. Prolamella well visible, anterior tips of prolamellae forming small attenuating teeth laterally. Lamellar cusp short, broader than insertion of lamellar seta. Translamella narrow, continuous. Prodorsal setae setiform with very short bristles, rostral (*ro*, 130) and lamellar setae (*le*, 180) directed anteromediad, interlamellar setae longer (*in*, 200), inserting on anterior margin of notogaster, directed anterolaterad. Bothridial seta (*bs*) short, with small stem, head almost round (diameter 15–18), spoon-shaped. Tutorium long and small blade (*tu*, 150), laterally rounded and protruding, anterodistal edge rounded with small tip dorsally (Remark #3). Exobothridial seta long (*ex*, 60), with very short bristles, insertion posterolateral to bothridium, partially hidden under pedotectum I. Humeral porose area *Ai* small, oval (15 x 10), anterolateral to bothridium. Notogaster very broad, almost round, convex, anterior margin slightly projecting anteriorly. Pteromorph well developed, movable, triangular, radially striated. Notogastral setae very short (6–10), attenuating, inserting in small indentations. Four pairs of oval porose areas, *Aa* very small and long (10–15 x 50). Postanal porose area small, elongate (*Ap*, ~10 x 110), hidden under posterior notogastral tectum. Length of epimeral, genital, aggenital, anal setae ~20–30. Epimeral setal formula 3–1–3–3. Setal formula of legs (trochanter to tarsus, famulus included, solenidia in parentheses): leg I 1–5–3(1)–4(2)–20(2), leg II 1–5–3(1)–4(1)–15(2), leg III 2–3–1(1)–3(1)–15, leg IV 1–2–2–3(1)–12. Solenidion ϕ_1 on tibia I 200, σ on genu I 120. Two eggs, size 220 x 130, 180 x 80, shape oval.

Record from the Galapagos Islands

H. and Irene Schatz coll.

Isla Floreana — Cerro Pajas, southwestern crater rim, moist highland (Fig. 7H): in moist partially-decayed leaf litter from ground in bushy forest under *Zanthoxylum fagara*, *Croton scouleri* var. *brevifolius* (19. Jan. 1987, 550 m a.s.l., 1 adult). (see Remark #4).

Remarks

1. Number of notogastral setae in *Ceratozetes yupanqui* n. sp.

The occasional presence of the alveolus of seta c_3 in some specimens, even rarely as a thin vestigial seta, supports the generic definition proposed by Behan-Pelletier (1984) which includes species with 10 and 11 notogastral setae in the genus *Ceratozetes*. To ensure this relationship, a total of 54 individuals (randomly selected from samples with this species from all islands and vegetation belts) were checked for the presence or absence of c_3 . The presence of this alveolus (or seta) in the populations of *Ceratozetes yupanqui* n. sp. on different islands in Galapagos does not show any correlation with occurrence on islands, altitude, vegetation belt, or sex (Table 1). There is no indication of a possible species splitting on the Galapagos Islands.

2. Morphological differences of *Ceratozetes yupanqui* n. sp. compared to *C. platyrhinus* and *C. platyrhinoides*

Among all *Ceratozetes* (and “*Ceratozetella*”) species previously known only two species have a broadened rostrum without incisions, both reported from South America. Hammer (1958) described *Ceratozetes platyrhinus* from Bolivia. In 1961, Hammer published an additional record of this species with variations of another specimen from Peru; in the same study she described *C. platyrhinoides* Hammer, 1961 from Peru, based on a single specimen. The latter species was meanwhile recorded from Antigua, Cuba, Ecuador, Venezuela, but without any further description; *Magellozetes mahnerti* Mahunka, 1984, described from Paraguay, is considered to be a synonym of *Ceratozetes platyrhinoides* (Balogh and Balogh 1990; Subías 2022).

Both findings of *C. platyrhinus* (Hammer 1958, 1961) show morphological differences to *C. yupanqui* n. sp.: Lamellar cusp triangular and much broader; lamellar seta shorter in the new

Table 1 Presence of notogastral seta c_3 in *Ceratozetes yupanqui* n. sp. (n = 54). (* Seta at least on one side).

	specimens checked	no c_3	with c_3	alveolus / seta*
Island				
Fernandina	1		1	0 / 1
Isabela S. Negra	13	6	7	4 / 3
Isabela Alcedo	16	7	9	5 / 4
Isabela Wolf	10	7	3	3 / 0
Pinta	3	1	2	2 / 0
Pinzón	10	6	4	3 / 1
San Cristóbal	1		1	1 / 0
Vegetation belt				
arid	18	8	10	6 / 4
arid to moist	14	6	8	4 / 4
moist	22	13	9	8 / 1
altitude (m a.s.l.)				
low (30 - 150)	14	6	8	5 / 3
medium (200 - 400)	20	10	10	5 / 5
high (500 - 1425)	20	11	9	8 / 1
sex				
females	39	19	20	14 / 6
males	15	8	7	4 / 3

species; bothridial seta rounded at distal end (vs. smaller and pointed at the tip in *C. platyrhinus*, see Hammer 1961, her fig. 108c); tutorium with long free protruding tip (vs. short tip in *C. platyrhinus*, although the free tip in the specimen from Peru is slightly longer, Hammer 1961: p. 113); notogastral setae considerably longer; notogastral porose areas smaller, *Aa* oval in *C. yupanqui* **n. sp.** (vs. almost round in *C. platyrhinus*).

Compared to *C. platyrhinoides*, the new species differs morphologically by following species-specific characters: lamellar cusp shorter and broader; lamellar seta shorter; bothridial seta round at distal end in *C. yupanqui* **n. sp.** (vs. pointed in *C. platyrhinoides*, Hammer 1961, her fig. 109a; in the possible synonym *Magellozetes mahnerti* the bothridial seta is also round distally but with more broadened head, Mahunka 1984, his fig. 87); notogastral setae considerably longer; notogastral porose areas smaller and oval, never framed by a chitinous ring in *C. yupanqui* **n. sp.** (vs. larger and round in *C. platyrhinoides*; larger and round and framed by a thick chitinous ring in *Magellozetes mahnerti*). Noticeable common features of the new species with “*Magellozetes mahnerti*” are the shape of the rostrum tip with downward curved sides and the long free tip of the tutorium (Mahunka 1984, displayed in his fig. 87).

3. Tutorium *Humerobates*

Sellnick (1959) and Pérez-Íñigo (1993) accentuate the differences in the shape of the tutorium. The distal front and its small tip can be used as species (subspecies) specific character. Ohkubo (1982) points out that this character can also exhibit individual variations within a species. The specimen from Galapagos generally shows the usual shape of the tutorium of *Humerobates rostromellatus*, with very faint tip representing the anterior end of a chitinous thickening in the tutorium.

4. *Humerobates* species in the Neotropical Realm

From the Neotropical realm only one questionable record of *Humerobates rostromellatus* has been reported so far from Mexico (Hammer 1969, sub *Humerobates* sp. *?fungorum*, found at a plant quarantine station in the U.S.A. and brought with orchids from Mexico). Another species of the genus (*Humerobates flechtmanni* Pérez-Íñigo & Pérez-Íñigo jr., 1993) is known from Brazil and Venezuela.

Humerobates rostromellatus differs from *H. flechtmanni* by the broader shape of the notogaster (almost round, ratio length/width 1,08 vs. smaller in *H. flechtmanni* – ratio 1,25, Pérez-Íñigo and Pérez-Íñigo jr. 1993, their fig. 1), translamella (continuous in *H. rostromellatus* from Galapagos vs. interrupted in *H. flechtmanni* - albeit, in other populations of *H. rostromellatus* the translamella is very faint to interrupted), by the shorter tip of the tutorium, by the shape of notogaster (nearly round vs. much narrower), by the presence of notogastral setae (very short vs. presented only as alveoli in *H. flechtmanni*), by the shape of the porose area *A*₁ (oval vs. irregular formed in *H. flechtmanni*).

The origin of *Humerobates rostromellatus* on the Galapagos Island of Floreana is uncertain. One possible explanation is the introduction by European settlers with agricultural products in the first half of the 20th century (Treherne 1983).

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