

## The first New World species of the pseudoscorpion family Feaellidae (Pseudoscorpiones: Fealloidea) from the Brazilian Atlantic Forest

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**Abstract.** The first American species of the pseudoscorpion family Feaellidae is named from specimens collected in the Atlantic Rainforest biome of southern Brazil. The lack of specialized setae on the movable chelal finger suggests that it belongs to a new genus and new species, which we name *Iporangella* gen. nov. and *Iporangella orchama* sp. nov., respectively. The only known population of *I. orchama* is located near Iporanga, São Paulo, and juveniles of an unidentified species are recorded from Ilha da Queimada Grande.

**Keywords:** New genus, new species, Brazil, Serra do Mar, *Feaella*, morphology

Members of the pseudoscorpion family Feaellidae can be instantly recognized by their raptorial pedipalps with opposing processes on the trochanter and femur, large teeth on the chela, including some facing prolaterally, and two, four or six tubercles on the anterior margin of the carapace (e.g., Ellingsen 1906; Chamberlin 1931; Beier 1932, 1955, 1966; Harvey 1992, 2013). Feaellidae is one of the smallest pseudoscorpion families with only a single recognized genus, *Feaella* Ellingsen, 1906, and 12 described Recent species from Africa, the Indian region, the Seychelles Islands and north-western Australia (Harvey 2013), as well as a recently discovered fossil species from Eocene Baltic amber deposits (Henderickx & Boone 2014). A second genus has been found in southeast Asian caves which differs from *Feaella* in several ways including the morphology of the coxal region which is highly modified (Harvey unpublished data; M. Judson, in litt.). The genus *Feaella* is divided into three subgenera: *F. (Feaella)* for those species with six anterior carapaceal lobes, *F. (Tetrafeaella)* with four lobes, and *F. (Difeaella)* with two lobes (Beier 1955, 1966; Harvey 2013). An alternative generic classification was developed in an unpublished Ph.D. thesis by Mark Judson (1992) and will be published in his forthcoming review of the family.

The first record of an American feaellid was made by Andrade (2003) who reported specimens from the Serra do Mar ecoregion of the Atlantic Forest biome in southern Brazil. The Atlantic Forest region has been heavily cleared and is now highly fragmented, although the Serra do Mar ecoregion is the most intact of the Atlantic Forest (Ribeiro et al. 2009). The Serra do Mar is listed as Critical/Endangered by the World Wildlife Fund (<http://www.worldwildlife.org/coregions/nt0160>; accessed 7 January 2016).

The specimens reported by Andrade (2003) are the subject of the present study, and are found to differ from other feaellids in the lack of specialized setae on the movable chelal

finger. This difference is sufficient to warrant the formation of a new genus to accommodate the new species. We also record a population of the same genus from a nearby island, Ilha da Queimada Grande. These specimens cannot be identified to species level due to the lack of adult specimens.

The discovery of members of the family Feaellidae raises the number of pseudoscorpion families recorded from South America to 20, with only six families – Pseudogarypidae, Hyidae, Neobisiidae, Parahyidae, Larcidae and Sternophoridae – absent or not yet discovered from the region (Harvey 2013).

### METHODS

The specimens examined during this study are lodged in the Museu de Zoologia da Universidade de São Paulo (MZSP), and the Instituto Butantan, São Paulo (IBSP). They were examined by preparing temporary slide mounts by immersing the specimen in 75% lactic acid at room temperature for one to several days, and mounting them on microscope slides with 10 or 12 mm coverslips supported by small sections of nylon fishing line. Specimens were examined with a Leica MZ16 dissecting microscope, a Leica DM2500 or Olympus BH–2 compound microscope, and illustrated with the aid of a drawing tube. Measurements were taken in mm at the highest possible magnification using an ocular graticule. After study the specimens were rinsed in water and returned to 75% ethanol with the dissected portions placed in 12 × 3 mm glass genitalia microvials (BioQuip Products, Inc.). Some specimens (which have since been lost) were examined using a ZEISS DSM 940 scanning electron microscope located in the “Laboratório de Microscopia Eletrônica da Universidade de São Paulo”.

Terminology and mensuration largely follow Chamberlin (1931), with the exception of the nomenclature of the

pedipalps, legs and with some minor modifications to the terminology of the trichobothria (Harvey 1992), chelicera (Harvey & Edward 2007; Judson 2007) and faces of the appendages (Harvey et al. 2012).

## SYSTEMATICS

### Family Feaellidae Ellingsen, 1906

#### Genus *Iporangella* gen. nov.

<http://zoobank.org/?lsid=urn:lsid:zoobank.org:act:C15233BC-C021-4798-948A-8A992C94712E>

**Type species.**—*Iporangella orchama* sp. nov.

**Diagnosis.**—*Iporangella* differs from all other feaellids by the lack of specialized setae on the retrolateral face of the movable chelal finger.

**Description.**—*Adult*: most setae short, inconspicuous, slightly curved and acuminate.

*Chelicera* (Fig. 4D): hand with 5 large and several small setae; *is* and *ls* adjacent to each other; movable finger with 1 subdistal seta; with 2 dorsal and 1 ventral lyrifissures; rallum of 1 long, slender blade (Fig. 4E); lamina exterior absent; movable finger short.

*Pedipalp* (Figs. 2H, 4F): trochanter with prolateral conical protuberance, femur without prolateral process, chela tubular. Fixed chelal finger and hand with 8 trichobothria, movable chelal finger with 4 trichobothria (Fig. 4G): *esb* and *est* situated midway on retrolateral face; *ib*, *isb* and *ist* situated basally in straight row; *eb* and *it* situated subdistally, very close to each other; *et* situated distally, much closer to diploid trichobothrium (*dt*) than to *it*; *dt* situated distally; *st* situated sub-basally; *t* slightly closer to *sb* than to *b*. Movable chelal finger without specialized setae. Venom apparatus absent. Chelal teeth large and diastemodontate.

*Carapace* (Figs. 1C, 2D, 2E, 4A): anterior margin with 2 broad lobes; with 2 pairs of eyes situated on tubercles away from anterior carapaceal margin; all eyes with tapetum; with posterior furrow; without postero-lateral processes.

*Coxal region* (Figs. 2I, 4B): median maxillary lyrifissure situated basally near clivus; posterior maxillary lyrifissure absent. Coxa I without depression, each with 1 small coxal spine, situated basally (Fig. 4C); coxa II without coxal spines.

*Legs* (Fig. 5A): patellae with shallow dorsal depression; femora III and IV shorter than patellae III and IV; femora III and IV not solidly fused with patellae III and IV, respectively; metatarsi and tarsi fused; subterminal tarsal setae acuminate; sub-ungual spine present; arolium slightly shorter than claws.

*Abdomen* (Figs. 1A, 1B, 1D, 2A–C): very broad, nearly circular; tergite XI and sternite XI fused (Fig. 3F); tergite XII and sternite XII (anal sclerites) strongly sclerotized; tergite XII with 2 setae; anal region with raised circular rim. Sternite II of female absent (Fig. 5C); sternite III of male and female slender (Figs. 5B, 5C). Pleural membrane with numerous sclerotized pleural platelets in two rows (Figs. 1D, 3G), most platelets with a single seta.

*Genitalia*: details not visible.

*Tritonymph*: Pedipalp: fixed chelal finger with 7 major trichobothria, plus diploid trichobothria (*dt*), movable chelal finger with 3 trichobothria (Fig. 4H); *isb* and *sb* absent; *esb* and *est* situated midway on retrolateral face; *ib* and *ist* situated basally; *eb* and *it* situated medially; *et* situated closer to diploid

trichobothrium (*dt*) than to *it*; *dt* situated distally; *t* situated closer to *st* than to *b*; movable finger without specialized setae. Carapace: with 2 anterior lobes; with 2 pairs of eyes.

*Protonymph*: Pedipalp: Fixed chelal finger with 2 major trichobothria, *eb* and *ist*, plus a single trichobothrium (*dt*); movable chelal finger with 1 trichobothrium, *t* (Fig. 4I); movable finger without specialized setae. Carapace: with 2 anterior lobes; with 2 pairs of eyes.

**Remarks.**—The new genus most closely resembles *Feaella* (*Difeaella*) *krugeri* Beier, 1966 from South Africa, the only species currently included in the subgenus *Difeaella*, due to the presence of two lobes on the anterior margin of the carapace, and the lack of a basal prolateral process on the pedipalpal femur (Beier 1966). *Iporangella orchama* differs from all other feaellids, including *F. (D.) krugeri*, by the lack of specialized setae on the retrolateral face of the movable chelal finger. Although the presence of these setae was not mentioned in the original description by Beier (1966), they were reported by Judson (1992). *Iporangella orchama* further differs from *F. (D.) krugeri* by the location of the trichobothria: *ist* is situated basal to *esb* in *F. krugeri* (Beier 1966, fig. 5), but is distal to *esb* in *Iporangella* (Fig. 4G).

**Etymology.**—The generic epithet is derived from the type locality Iporanga, which is a municipality in São Paulo. The name comes from the Brazilian Indian language Tupi and means ‘beautiful river’. The generic name is feminine in gender.

#### *Iporangella orchama* sp. nov.

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org:act:F0AB5DDE-31DD-4CC5-AB98-BB93ED21D327

Figs. 1–5

**Material examined.**—*Holotype male*. BRAZIL: São Paulo: Iporanga, Vale do Ribeira, 24°33'34"S, 48°40'02"W, 19 March 2002, Winkler extraction, “raízes e folhíço” (roots and leaf litter), R. Andrade (MZUSP 67821).

*Paratypes*: BRAZIL: São Paulo: 1 ♂, same data as holotype except 8 March 2002 (MZUSP 67822); 1 ♀, same data (MZUSP 67817); 1 tritonymph, same data (MZUSP 67818); 1 tritonymph, same data (MZUSP 67819); 1 protonymph, same data (MZUSP 67820).

**Diagnosis.**—As for genus.

**Description (adults).**—*Color*: all sclerotized portions deep red-brown (Figs. 1A–E). All sclerotized portions coarsely tuberculate and reticulate.

*Setae*: most setae short, inconspicuous, slightly curved and acuminate.

*Cerotegument*: most surfaces covered with conspicuous cerotegument.

*Chelicera* (Fig. 4D): hand with 5 large and several small setae; *is* and *ls* adjacent to each other; movable finger with 1 subdistal seta; galea very thick, without rami; hand coarsely tuberculate, except for finger and basal third; fingers without teeth; rallum with 1 long, thin blade (Fig. 4E); serrula exterior with ca. 18 blades; lamina exterior absent.

*Pedipalp* (Figs. 2H, 4F): trochanter with long, curved prolateral conical protuberance, 1.78–2.06 (♂), 1.90 (♀), femur very robust, without triangular process on prolateral corner, 2.02–2.05 (♂), 1.97 (♀), patella conical 2.91 (♂), 2.73 (♀), chela tubular, chela (with pedicel) 3.88–4.00 (♂), 3.75 (♀),

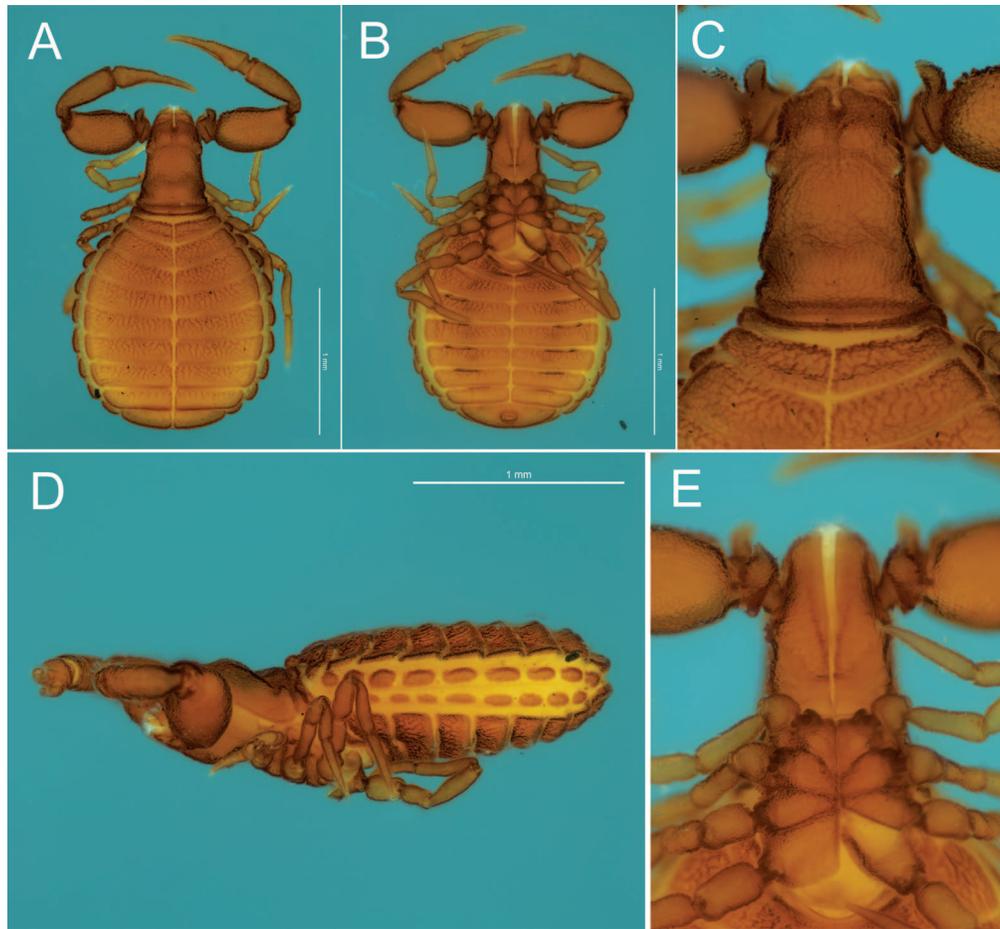


Figure 1.—*Iporangella orchama* sp. nov., holotype male (MZUSP 67821): A, body, dorsal view; B, body, ventral view; C, cephalothorax, dorsal view; D, body, lateral view; E, cephalothorax, ventral view.

chela (without pedicel) 3.58–3.73 ( $\delta$ ), 3.56 ( $\text{♀}$ ), hand (without pedicel) 0.43–0.45 ( $\delta$ ), 0.42 ( $\text{♀}$ ) x longer than broad, movable finger 5.80–6.31 ( $\delta$ ), 6.27 ( $\text{♀}$ ) x longer than hand. Fixed chelal finger and hand with 8 trichobothria, movable chelal finger with 4 trichobothria (Fig. 4G): *esb* and *est* situated midway on retrolateral face; *ib*, *ish* and *ist* situated subbasally in straight row; *eb* and *it* situated subdistally, very close to each other; *et* situated distally, much closer to diploid trichobothrium (*dt*) than to *it*; *dt* situated distally; *st* situated sub-basally; *t* slightly closer to *sb* than to *b*. Venom apparatus absent. Chelal hand very small; retrolateral condyle small and rounded; with dorsal protuberance at base of finger. Chelal teeth large, retrorse and diastemodontate: fixed finger with 12 ( $\delta$ ), 13 ( $\text{♀}$ ) retrorse marginal teeth, 12 ( $\delta$ ,  $\text{♀}$ ) prolateral, 16 ( $\delta$ ), 18 ( $\text{♀}$ ) retrolateral teeth, and 6–7 distal teeth; movable finger with 10 ( $\delta$ ,  $\text{♀}$ ) curved, marginal teeth and 12 ( $\delta$ ,  $\text{♀}$ ) prolateral teeth. Movable chelal finger without specialized setae.

**Carapace** (Fig. 1C, 2D, 2E, 4A): anterior margin with 2 broad lobes and deep antero-median depression; with 2 dorsal lobes on level with eyes; lateral margins nearly parallel; broadest basally; 1.26–1.27 ( $\delta$ ), 1.25 ( $\text{♀}$ ) x longer than broad; with 2 pairs of well-developed eyes situated on tubercles away from anterior carapaceal margin; all eyes with tapetum; with numerous inconspicuous setae; posterior furrow present.

**Coxal region** (Figs. 1E, 2I, 4B): pedipalpal coxa: tuberculate lateral processes situated near pedipalpal foramen; with scattered small setae; manducatory process with 2 stout, long acuminate setae; median manducatory lyrifissure basal, situated near clivus; posterior manducatory lyrifissure absent. Coxa I without depression, and each with 1 small, anteriorly directed coxal spine situated basally (Fig. 4C); coxa II without coxal spines; coxa III meeting in mid-line.

**Legs** (Fig. 5A): patellae I and II slightly shorter than femora I and II; femora III and IV shorter than patellae III and IV, respectively; all patellae with shallow dorsal depression; metatarsi and tarsi fused; tarsi long and slender, without tactile seta; subterminal tarsal setae acuminate; sub-ungual spine present; claws smooth (Figs. 2K, 2L); arolium about same length as claws, with fimbriate distal margin (Figs. 2K, 2L).

**Abdomen** (Figs. 1A, 1B, 1D, 2A–C): broadly ovate; tergites II–X and sternites IV–X with distinct median suture lines; most tergites gently curved; tergite XI and sternite XI fused (Fig. 3F); tergite XII and sternite XII (anal sclerites) strongly sclerotized; most segments with several setae, generally arranged in a single irregular row along posterior margin of sclerite; tergite XII and sternite XII each with 2 setae; anal region with raised circular rim. Tergites and sternites with

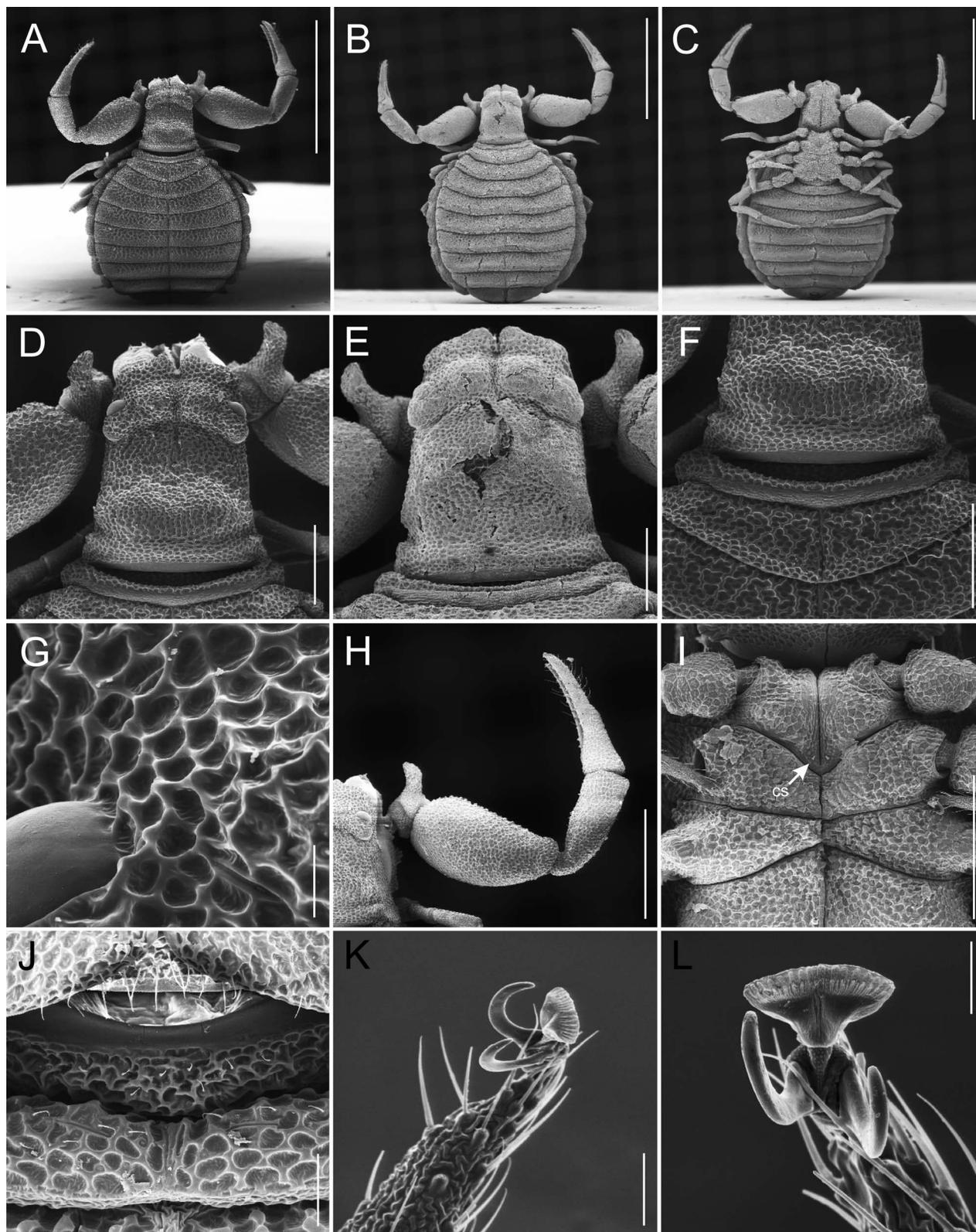


Figure 2.—*Iporangella orchama* sp. nov., scanning electron micrographs of adult specimens: A, body, dorsal view, specimen 1; B, body, dorsal view, specimen 2; C, body, ventral view, specimen 2; D, cephalothorax, dorsal view, specimen 1; E, cephalothorax, dorsal view, specimen 2; F, junction between cephalothorax and abdomen, dorsal view, specimen 1; G, detail of carapace near left anterior eye, specimen 1; H, right pedipalp, dorsal view, specimen 1; I, cephalothorax, ventral view, specimen 1; J, genital region, ventral view, male; K–L, tarsus, claws and arolium, unknown specimen. Scale lines = 1 mm (A–C); 0.4 mm (H); 0.2 mm (D–F, I); 0.04 mm (J); 0.02 mm (G, K); 0.01 mm (L).

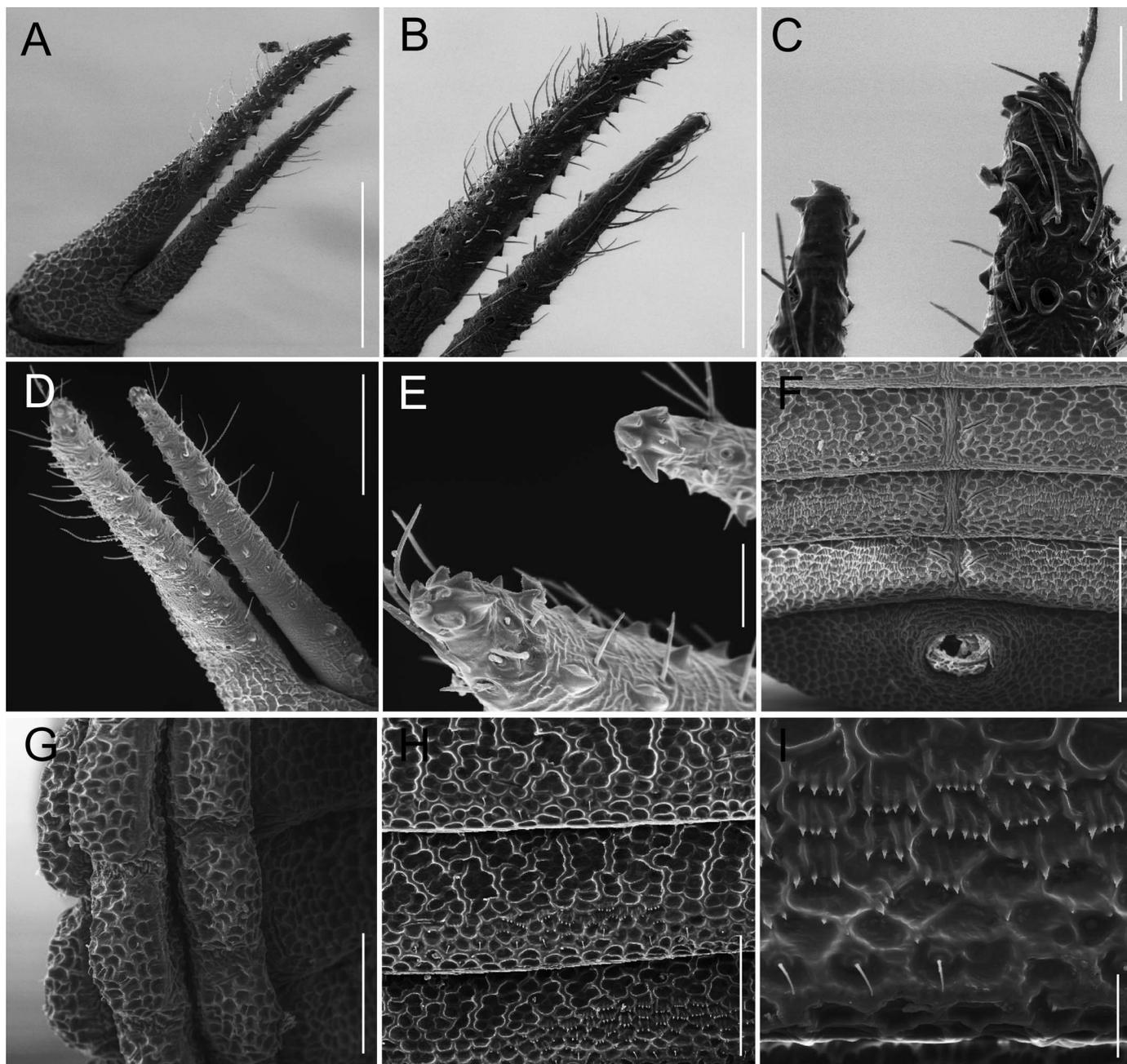


Figure 3.—*Iporangella orchama* sp. nov., scanning electron micrographs of adult specimens: A, right chela, retrolateral view; B, right chelal fingers, retrolateral view; C, left chela, tip of fingers; D, left chela, prolateral view; E, left chela, tip of fingers; F, abdominal sternites VII–XII, ventral view; G, pleural membrane; H–I, tergite, dorsal view. Scale lines = 0.2 mm (A, F); 0.1 mm (B, D, G, H); 0.02 mm (C, E, I).

posteriorly-directed micro-spinules (Fig. 3F, 3H, 3I). Most setae very small and inconspicuous; setae of male sternite II longer (Fig. 5B). Pleural membrane with 2 lateral rows each composed of 9 platelets, the dorsal ones larger (Fig. 1D); platelets with setae. First pair of spiracles connected to anterior margin of sternite IV, spiracular opening round and conspicuous; second pair of spiracles connected to anterior margin of sternite V, spiracular opening slit-like. Sternite II of male small and poorly sclerotized (Fig. 5B), of female absent (Fig. 5C). Sternite III of male (Fig. 5B) and female (Fig. 5C) slender and anteriorly curved.

*Genitalia*: details not visible.

*Dimensions (mm)*: Males: holotype, followed by other male (when measured): Body length 2.24 (2.15); abdomen width (without pleura) 1.25 (1.15). Pedipalp: trochanter 0.32/0.18 (0.32/0.155), femur 0.635/0.315 (0.625/0.305), patella 0.495/0.17 (0.48/0.165), chela (with pedicel) 0.64/0.165 (0.60/0.15), chela (without pedicel) 0.59 (0.56), hand (without pedicel) length 0.075 (0.065), movable finger length 0.435 (0.41). Chelicera 0.235/0.14; movable finger 0.085. Carapace 0.625/0.495 (0.615/0.485); anterior eye diameter 0.055, posterior eye diameter 0.06. Leg I: femur 0.30/0.08, patella 0.23/0.085, tibia

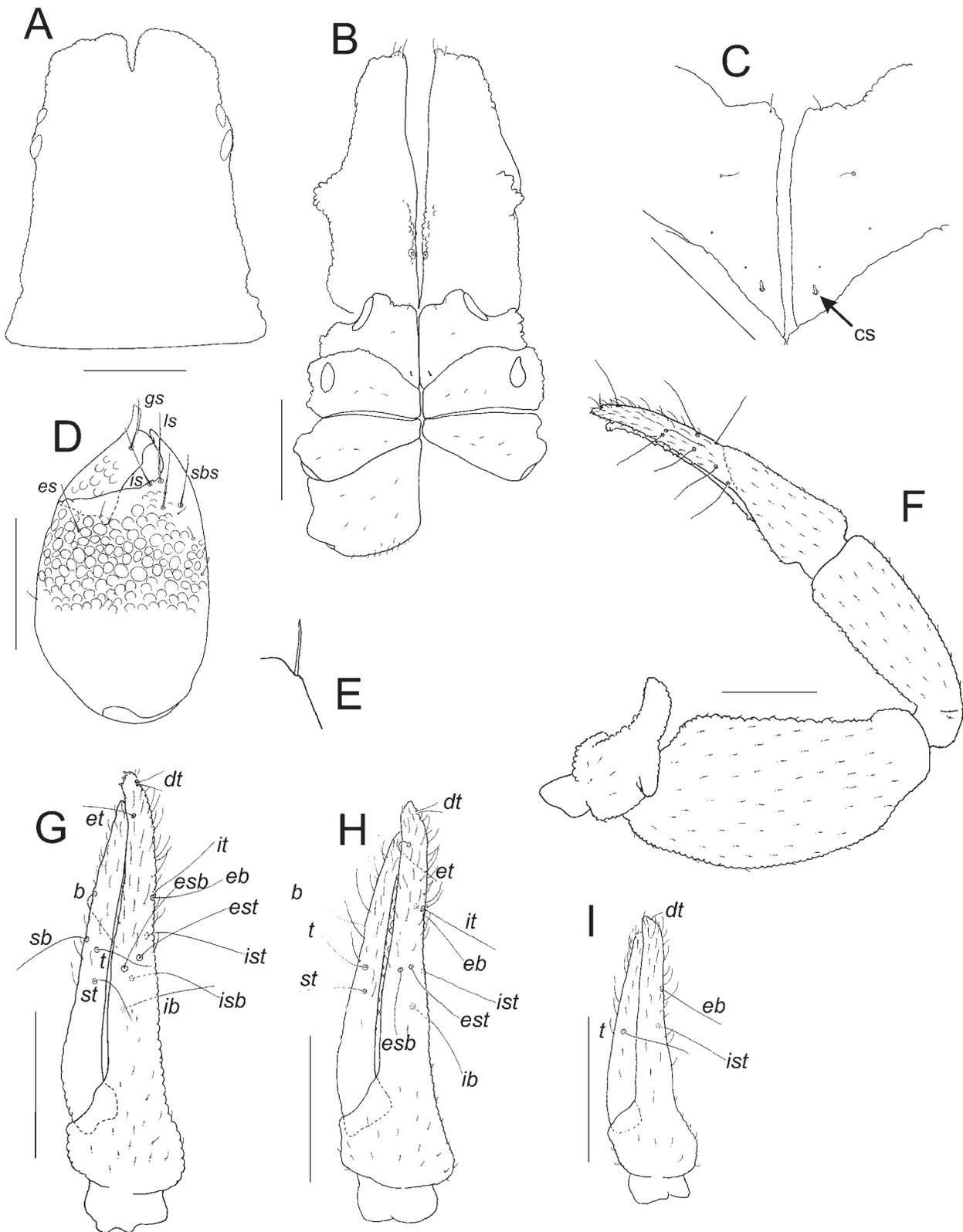


Figure 4.—*Iporangella orchama*, sp. nov., male holotype (MZUSP 67821), unless stated otherwise: A, carapace, dorsal view; B, cephalothorax, ventral view; C, coxae I, ventral view (cs = coxal spine); D, left chelicera, dorsal view; E, left rallum; F, right pedipalp, dorsal view; G, left chela, lateral view; H, left chela, lateral view, tritonymph paratype (MZUSP 67818); I, left chela, lateral view, protonymph paratype (MZUSP 67820). Scale lines = 0.2 mm (A, B, F–I); 0.1 mm (C, D).

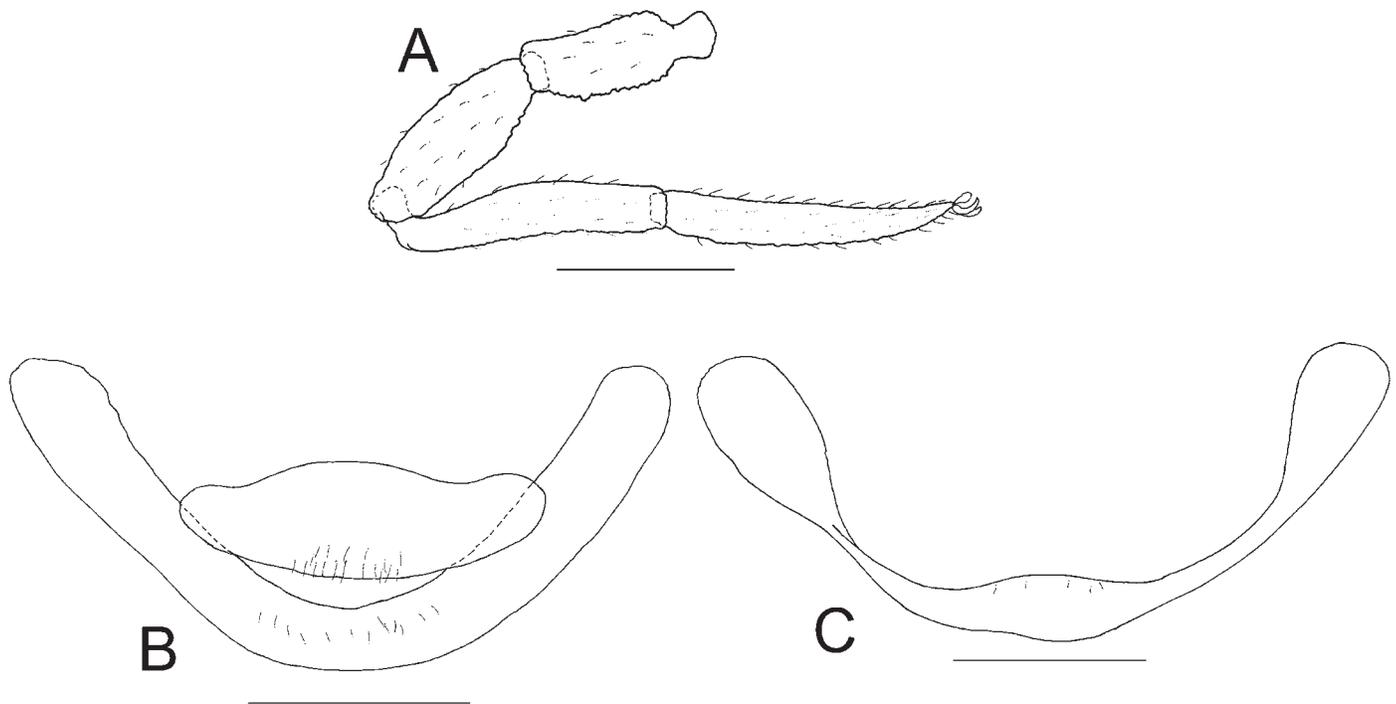


Figure 5.—*Iporangella orchama* sp. nov., male holotype (MZUSP 67821), unless stated otherwise: A, left leg IV, lateral view; B, genital sclerites (sternites II and III), ventral view; C, genital sclerite (sternite III), ventral view, female paratype (MZUSP 67817). Scale lines = 0.25 mm (A); 0.2 mm (B, C).

0.21/0.065, tarsus 0.33/0.055. Leg IV: femur 0.28/0.10, patella 0.32/0.115, tibia 0.425/0.075, tarsus 0.425/0.06.

**Females:** paratype: Body length 2.38; abdomen width (without pleura) 1.42. Pedipalp: trochanter 0.38/0.20, femur 0.74/0.375, patella 0.52/0.19, chela (with pedicel) 0.675/0.18, chela (without pedicel) 0.64, hand (without pedicel) length 0.075, movable finger length 0.47. Chelicera 0.25/0.155; movable finger 0.09. Carapace 0.675/0.54; anterior eye diameter 0.055, posterior eye diameter 0.05. Leg I: femur 0.31/0.09, patella 0.25/0.09, tibia 0.23/0.07, tarsus 0.35/0.06. Leg IV: femur 0.325/0.10, patella 0.35/0.12, tibia 0.45/0.075, tarsus 0.435/0.095.

**Description (tritonymph).**—*Chelicera:* movable finger with 1 seta.

*Pedipalp:* femur 2.04, patella 2.75, chela (with pedicel) 4.21, chela (without pedicel) 3.89, hand 0.68 x longer than broad. Fixed chelal finger with 7 major trichobothria, plus diploid trichobothria (*dt*), movable chelal finger with 3 trichobothria (Fig. 4H); *isb* and *sb* absent; *esb* and *est* situated midway on retrolateral face; *ib* and *ist* situated basally; *eb* and *it* situated medially; *et* situated subdistally; *dt* situated distally; *t* situated closer to *st* than to *b*; movable finger without specialized setae.

*Carapace:* 1.23 x longer than broad; with 2 anterior lobes; with 2 pairs of eyes.

*Coxal region:* coxa I without depression, and each with 1 small coxal spine situated basally.

*Legs:* much as in adult.

**Dimensions (mm):** Body length 2.28. Pedipalp: femur 0.57/0.28, patella 0.11/0.16, chela (with pedicel) 0.59/0.14, chela

(without pedicel) 0.545, hand length 0.095, movable finger length 0.39. Carapace 0.57/0.465.

**Description (protonymph).**—*Chelicera:* movable finger without seta.

*Pedipalp:* femur 2.06, patella 2.77, chela (with pedicel) 3.67, chela (without pedicel) 3.43, hand 0.62 x longer than broad. Fixed chelal finger with 2 major trichobothria, *eb* and *ist*, plus a single trichobothrium (*dt*); movable chelal finger with 1 trichobothrium, *t* (Fig. 4I); movable finger without specialized setae.

*Carapace:* 1.06 x longer than broad; with 2 anterior lobes; with 2 pairs of eyes.

*Coxal region:* coxa I without depression, and each with 1 small coxal spine situated basally.

*Legs:* much as in adult.

**Dimensions (mm):** Body length 1.25. Pedipalp: femur 0.35/0.17, patella 0.36/0.13, chela (with pedicel) 0.385/0.105, chela (without pedicel) 0.36, hand length 0.065, movable finger length 0.265. Carapace 0.365/0.345.

**Remarks.**—The type series of *Iporangella orchama* consists of two adult males, a female and three nymphs. All were collected using Winkler extraction methods from leaf litter among the tangled thin roots of a tree. The site is situated near the lower slope of a mountain within the Serra do Mar ecoregion within the Atlantic Forest biome of southern Brazil. The Atlantic coastal forest has been heavily cleared since European settlement with only 11–16% of the original forest remaining (Ribeiro et al. 2009). The remaining forest is highly fragmented and only 9% is situated in protected areas (Ribeiro et al. 2009). The Serra do Mar ecoregion has been less heavily

cleared, probably due to its hilly topography, with an estimated 36.5% of the original forest remaining.

The scanning electron micrographs were obtained from specimens that have since been lost, and which are not regarded as part of the type series.

**Etymology.**—The specific epithet refers to this species being the first described from the New World (*orchamos*, Greek, first) (Brown 1956).

*Iporangella* sp. indet.

**Material examined.**—BRAZIL: *São Paulo*: 2 protonymphs, Ilha da Queimada Grande, Itanhaém Municipality, 24°29'S, 46°41'W, 30 April 2003, in pitfall traps, R. Indicati, C. Souza (IBSP 1620, 1623).

**Description (protonymph).**—*Chelicera*: movable finger without seta.

*Pedipalp*: femur 1.85, patella 2.09, chela (with pedicel) 3.80, chela (without pedicel) 3.50, hand 0.75 x longer than broad. Fixed chelal finger with 2 major trichobothria, *eb* and *ist*, plus a single trichobothrium (*dt*); movable chelal finger with 1 trichobothrium, *t*; movable finger without specialized setae.

*Carapace*: 1.20 x longer than broad; with 2 anterior lobes; with 2 pairs of eyes.

*Coxal region*: coxa I without depression, and each with 1 small coxal spine situated basally.

*Legs*: much as in adult.

*Dimensions (mm)*: Body length 1.11. Pedipalp: femur 0.305/0.165, patella 0.23/0.165, chela (with pedicel) 0.38/0.10, chela (without pedicel) 0.35, hand length 0.075, movable finger length 0.255. Carapace 0.365/0.305.

**Remarks.**—Although these two protonymphs were collected only 125 km from the type locality of *I. orchama*, it is not possible to confirm whether they are conspecific with *I. orchama* until adult specimens are collected from Ilha da Queimada Grande.

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