

## IDIOZETES MALGACHE, A NEW SPECIES OF IDIOZETIDAE (ACARI: ORIBATIDA) FROM MADAGASCAR

Nestor Fernandez<sup>1</sup>, Régis Cleva<sup>2</sup> and Pieter Theron<sup>3</sup>

1. National Council of Scientific and Technological Research (CONICET), Faculty Exact Sciences and Natural Sciences, University of la Pampa, Av Uruguay 151, Santa Rosa, (6300) La Pampa, Argentina (e-mail: nesfern@ yahoo.fr); 2. Museum National d'Histoire Naturelle, Direction des Collections, Case Postale 53, 57 rue Cuvier, 75231 Paris Cedex 05, France (e-mail: cleve@mnhn.fr); 3. School of Environmental Sciences, North-West University, Potchefstroom Campus, 2520, South Africa (e-mail: pieter.theron@nwu.ac.za).

(Received 4 November 2009; accepted 7 April 2010)

**ABSTRACT** – *Idiozetes malgache* n. sp., collected from Madagascar, is described and illustrated, based on adult specimens. This new species is distinguishable from the two other known species in the genus by the following set of characters: cerotegument thick; elongate-polygonal reticula on prodorsum and plicate smooth layer on notogaster; cuticle smooth; *ro* and *le* present; *in* absent; pteromorphs narrow with a pointed tip; discidium present; four pairs of sacculi; six pairs of gastronotic setae; five pairs of lyrifissures; epimeral setation (3-1-2-3); six pairs of genital setae; legs heterotridactylous, sockets incomplete on tibia I to IV and genu I and II; setal formula: I (0-4-3-4-17-3) (1-2-2); II (1-4-3-2-14-3) (1-1-2); III (1-2-1-3-13-3) (1-1-0); IV (0-2-2-3-13-3) (0-1-0). The genus is redefined.

**Key words** – Acari, Oribatida, Idiozetidae, *Idiozetes malgache*, new species, Madagascar.

### INTRODUCTION

Three research expeditions were conducted as part of the Recherche Coopérative Programme (RCP 225) established by the CNRS (Centre National de la Recherche Scientifique, France) between 1970 and 1973 for the study of montane ecosystems in Madagascar. The first expedition (1970–1971) was devoted to the Andringitra Massif located in the southern third of the main island, between latitudes 22°00' and 22°30' S, and longitudes 46°45' and 47°E (Paulian *et al.*, 1971). The second (1971–1972) focused on the Anosyennes range located about 50 km south-west of Antananrivo (Paulian *et al.*, 1973), and the third (1972–1973) focused on Itremo, Ibity (central Madagascar) and Marojezy (north-east Madagascar) (Guillaumet *et al.*, 1975). Sampling was conducted at hundreds of sites in soil and litter using the Berlese–Tullgren extraction funnels or by beating and sweeping the vegetation. As a specialist of soil microarthropods, particularly symphyleon Collembola, our

colleague Professor J.-M. Betsch of the Muséum National d'Histoire Naturelle participated in the project, providing us with hundred of samples containing extremely diversified oribatids. To our knowledge, this collection represents one of the world's largest from Madagascar.

The Oribatid mites of Madagascar have only been studied since the 1960s, and remain poorly known. Mahunka (2002) mentions 161 species belonging to 97 genera.

Up to now, the Idiozetidae, established by Aoki in 1976 based on the type species *Idiozetes erectus* (Aoki, 1976), contained only two known species: *I. erectus* and *I. javensis* (Hammer, 1980), one with an Oriental and Japanese distribution and the other from Java (Subías, 2004). The family Idiozetidae was originally placed in the superfamily Idiozetoidea (Aoki, 1976); later in the Unduloribatoidea (Kunst, 1971) by Subías (2004), and recently in the Eremaezetoidea (Piffel, 1972) by Norton and Behan-Pelletier (2009).

## MATERIALS AND METHODS

All specimens were collected from decaying plant debris using a standard Berlese–Tullgren funnel extractor, and preserved in 70% ethanol.

Specimens studied with a light microscope were macerated in lactic acid, and observed in the same medium using the open-mount technique (cavity slide and cover slip) described by Grandjean (1949; see also Krantz and Walter, 2009). Drawings were made using an Olympus BHC compound microscope equipped with a drawing tube.

Specimens were studied under a scanning electron microscope (SEM). Ethanol-preserved specimens were carefully rinsed in distilled water by sucking them several times into a Pasteur pipette. Specimens from which the cerotegument was to be removed were macerated in a warm 70% lactic acid solution for 7–15 days, then the cerotegument was carefully removed using fine needles; all specimens were then dehydrated in a graded ethanol series and dried in a critical-point apparatus. After mounting on aluminium stubs with double-sided sticky tape, specimens were gold coated in a sputter apparatus.

Measurements taken were: total length (from tip of rostrum to posterior edge of notogaster) and width (widest part of notogaster) in micrometers ( $\mu\text{m}$ ). The setal formulae of the legs include the number of solenidia (in parentheses); tarsal setal formulae include the famulus ( $\varepsilon$ ).

**Morphological terminology** – Morphological terms and abbreviations used are those developed by F. Grandjean (cf. Travé and Vachon, 1975) and also those used by Aoki (1976) in his description of the type species *Idiozetes erectus*. As a number of specific morphological characters have not been previously described in detail and no terminology and/or abbreviations exist, we have included the following in the text and on the figures for the sake of clarity: amorphous layer (*am.l*); anterior zone (*ant.z*); bridged (*bri*); cerotegumental layer (*c.l*); central zone (*c.z*); cerotegumental porous conical projections (*ce.po*)\*; cylindrical projection (*c.p*)\*; elongate-polygonal reticula (*e.p.r*); fovea (*fo*); irregular elongate-polygonal reticula (*i.e.r*); longitudinal furrow (*lo.f*); lateral zone (*l.z*); mediodorsal membranous ridge (*m.m.r*); membranous projection zone (*m.p.z*); membranous projection (*m.p*)\*; microtubercles like mushroom (*mus*); plate-like structure (*p.l.s*); porous layer (*po.la*); pteromorph zone (*pt.z*); thick cerotegumental layer (*t.c.l*); thin membranous layer (*t.m.l*); transversal anterior zone (*t.a.z*); tuft of barbules (*tu*). All terms indicated by asterisks have been used by Aoki (1976) without abbreviation.

## Family IDIOZETIDAE Aoki, 1976

### Genus *Idiozetes* Aoki, 1976

#### *Idiozetes malgache* n. sp.

(Figs. 1–40)

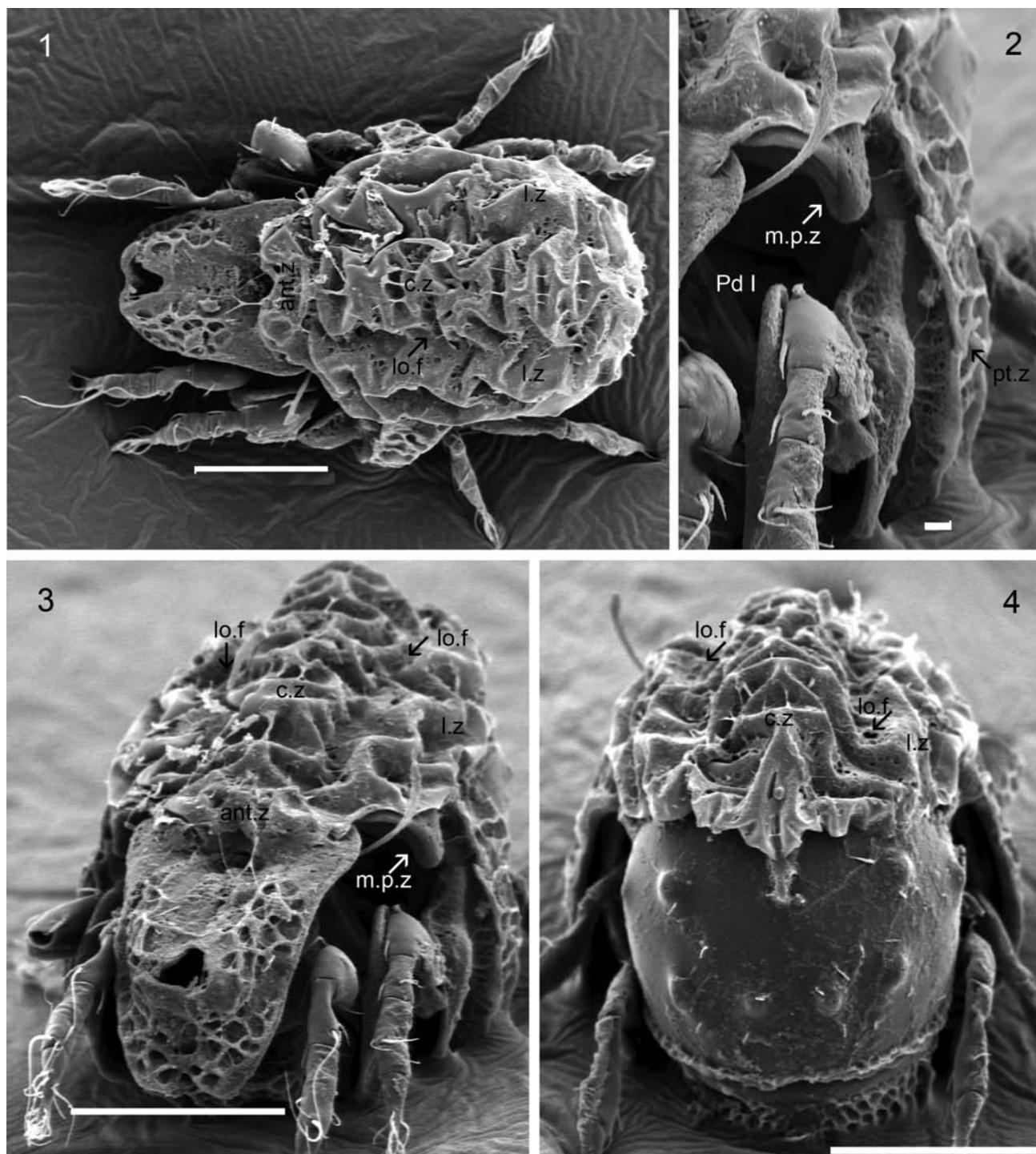
**Material examined** – Holotype – adult female, Madagascar, northeast of the Tamatave province, Antongil Bay, Nosy Mangabe Island, altitude 300 m, low altitude dense humid forest, J.-M. Betsch coll. 16 July 1967. Deposited in the Collection of the Muséum National d'Histoire Naturelle, Paris, France, preserved in 70% ethanol. Paratypes – three adults, same data as holotype, mounted on aluminium-stubs and coated with gold: one adult, Anjavidilava, dense sclerophyllous montane *Philippia* forest, 1650 m, 28 October 1970; one adult, central Antananarivo Province, Tapis pass, dense mid-altitude sclerophyllous *Uapaca bojeri* forest, 1300 m, soil (0–5 cm) and surface 13 April 1967, P. Montsarrat coll.; one adult, Ste Luce trail, coastal forest, altitude 10 m, 9 December 1971. All specimens are deposited in the Collection of the Muséum National d'Histoire Naturelle, Paris.

**Diagnosis (adult female)** – *Idiozetes malgache* n. sp. differs from other species of the genus by the following combination of characters. Total length: 386–415  $\mu\text{m}$ ; width: 178–192  $\mu\text{m}$ . Cerotegument: prodorsum covered by a thick cerotegumental layer with elongate-polygonal reticula with fovea; a pair of cerotegumental porous conic projections present between rostrum and lamellae; notogaster up to posterior third covered by smooth thick plicate layer.

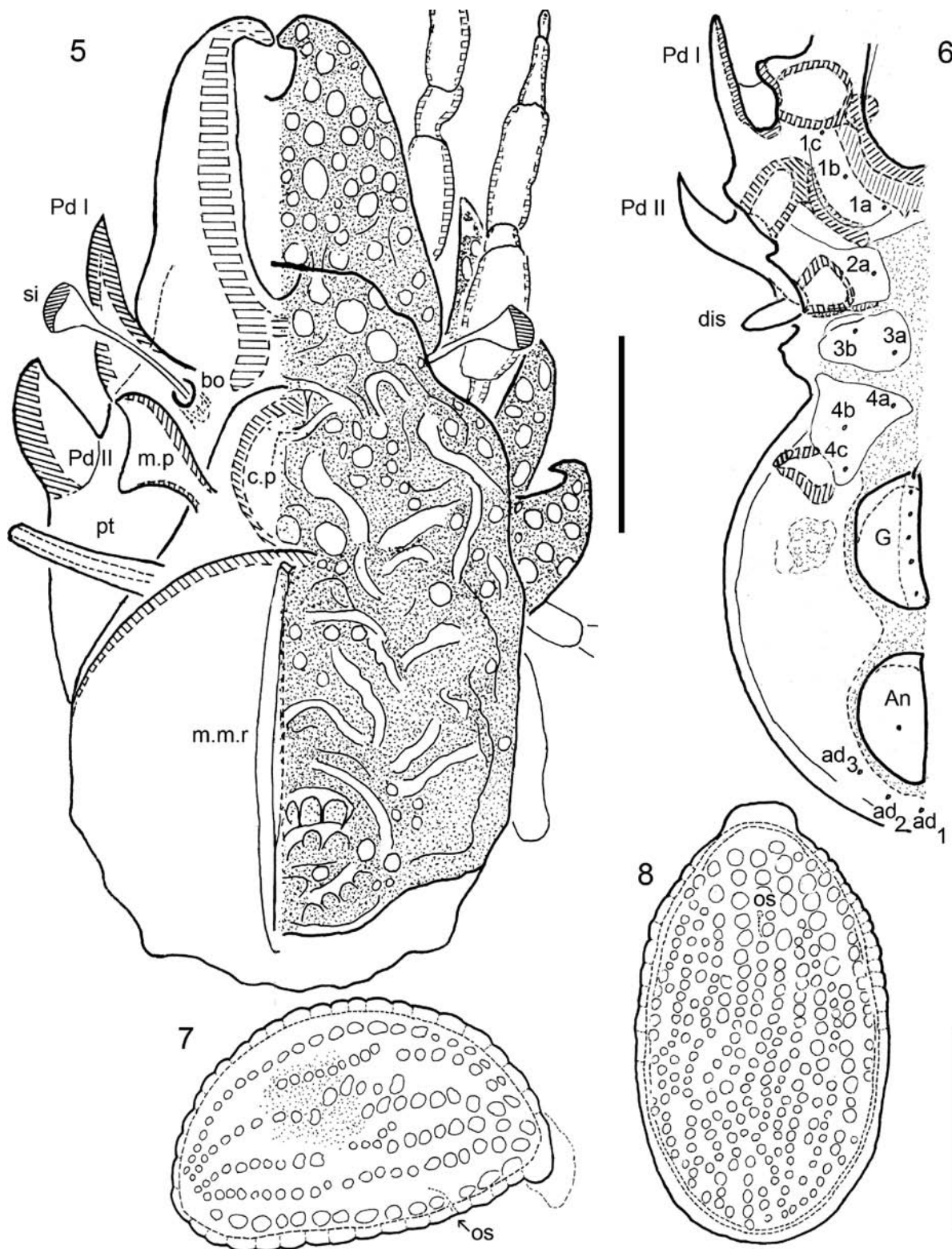
Cuticle smooth. Lamellae, posterior part fused, plate-like structure with rounded margin, hidden beneath bothridia. Setae *ro* and *le* present, *in* absent (no setal alveoli). Sensillus: pedicel long, minutely barbed; head clavate, flat, minutely barbed. Notogaster with cylindrical projection extending far anterior of dorsosejugal suture; mediodorsal membranous ridge between posterior zone of cylindrical projection and notogastral setae *la*; membranous projection flat, ear-shaped, lateral to cylindrical projection. Pteromorphs immovable, long, narrow, pointed at tip. Discidium present. Setation: notogastral, six pairs; genital, six pairs, in longitudinal row; epimeral (3-1-2-3); palp (0-2-1-3-9) (1).

Legs heterotridactylous, setal formula: I (0-4-3-4-17-3) (1-2-2); II (1-4-3-2-14-3) (1-1-2); III (1-2-1-3-13-3) (1-1-0); IV (0-2-2-3-13-3) (0-1-0).

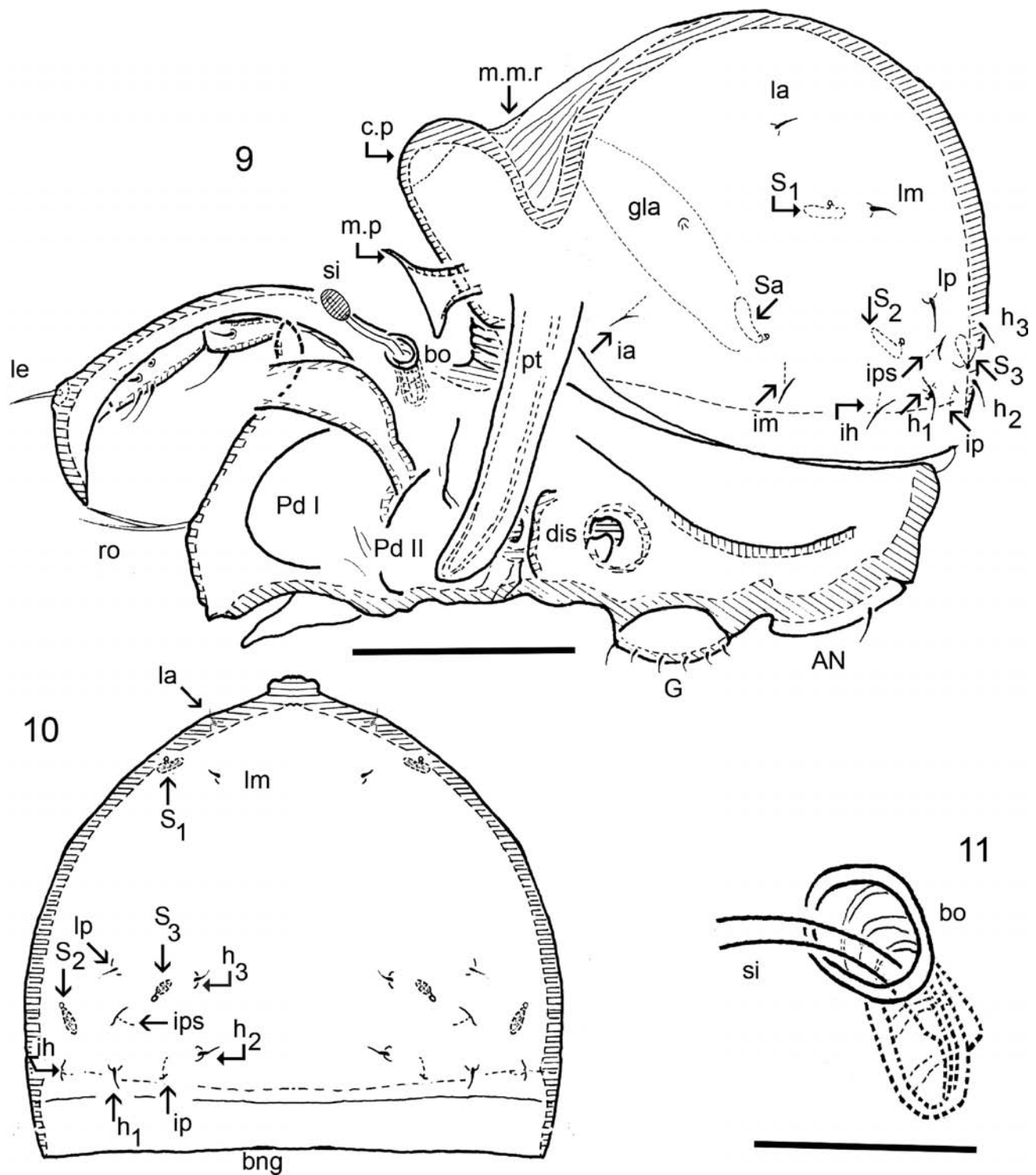
**Description** – Measurements on SEM: body length 391  $\mu\text{m}$  (386–395) width 182  $\mu\text{m}$  (178–185); measurements by light microscopy: body length 401  $\mu\text{m}$  (390–415) width 190  $\mu\text{m}$  (182–192). All specimens were female, one of which contained two prelarvae. Shape: elongate oval (Figs. 1, 3, 5, 6, 9, 10, 17, 22,



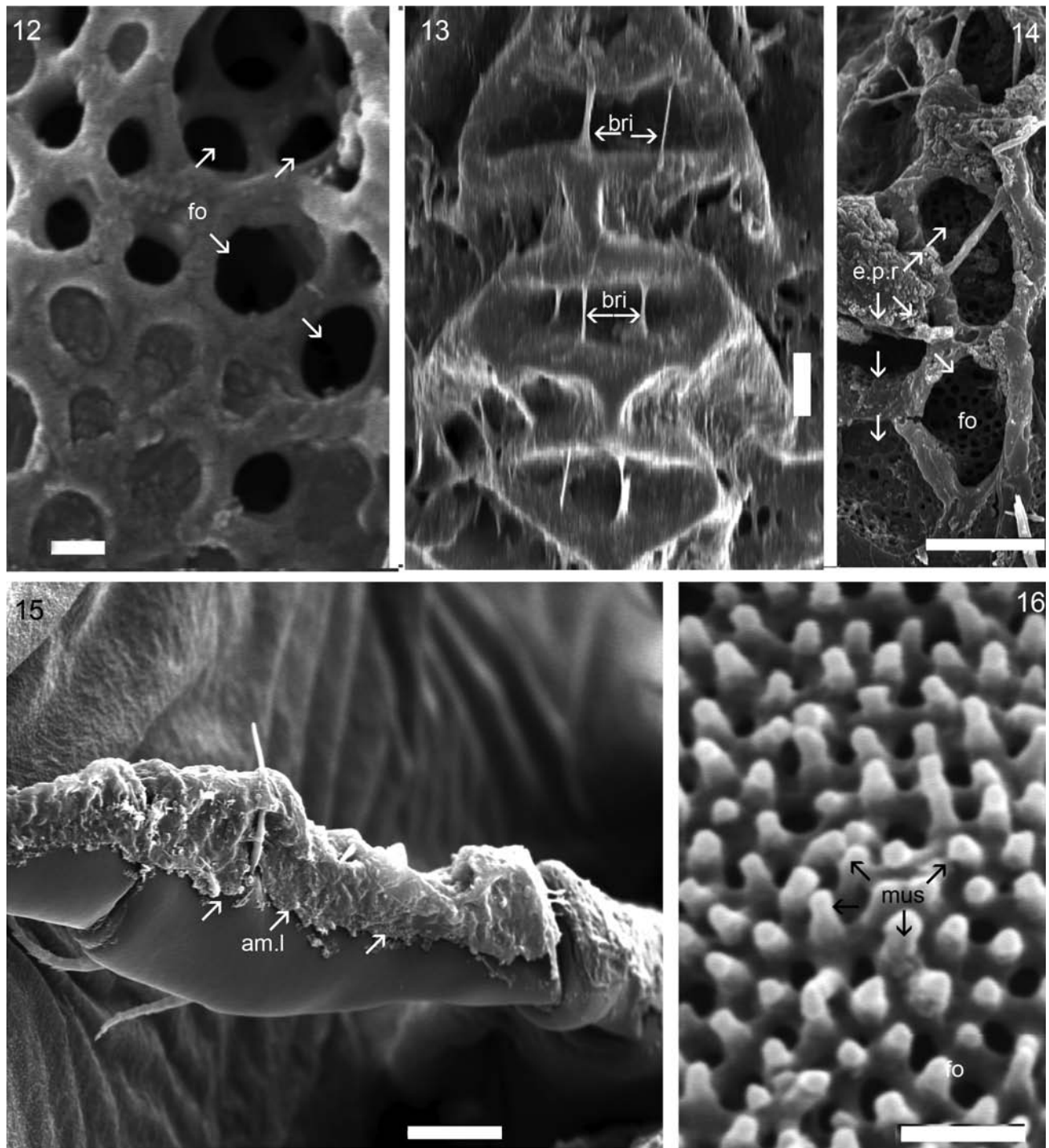
Figs. 1–4. *Idiozetes malgache* n. sp., adult, SEM: 1, dorsal view. 2, fronto-lateral view (in part). 3, frontal view. 4, posterior view. Abbreviations: see Materials and methods. Scale: 1, 3, 4 = 100  $\mu$ m; 2 = 10  $\mu$ m.



Figs. 5–8. *Idiozetes malgache* n. sp.: 5, 6, adult; 7, 8, prelava. 5, dorsal aspect, right half with cerotegument, left half without cerotegument; without notogastral chaetotaxy. 6, ventral aspect. 7, lateral view, right forepart. 8, ventral view, anterior facing upward. Abbreviations: see Materials and methods. Scale: 5, 6 = 100  $\mu$ m; 7, 8 = 50  $\mu$ m.

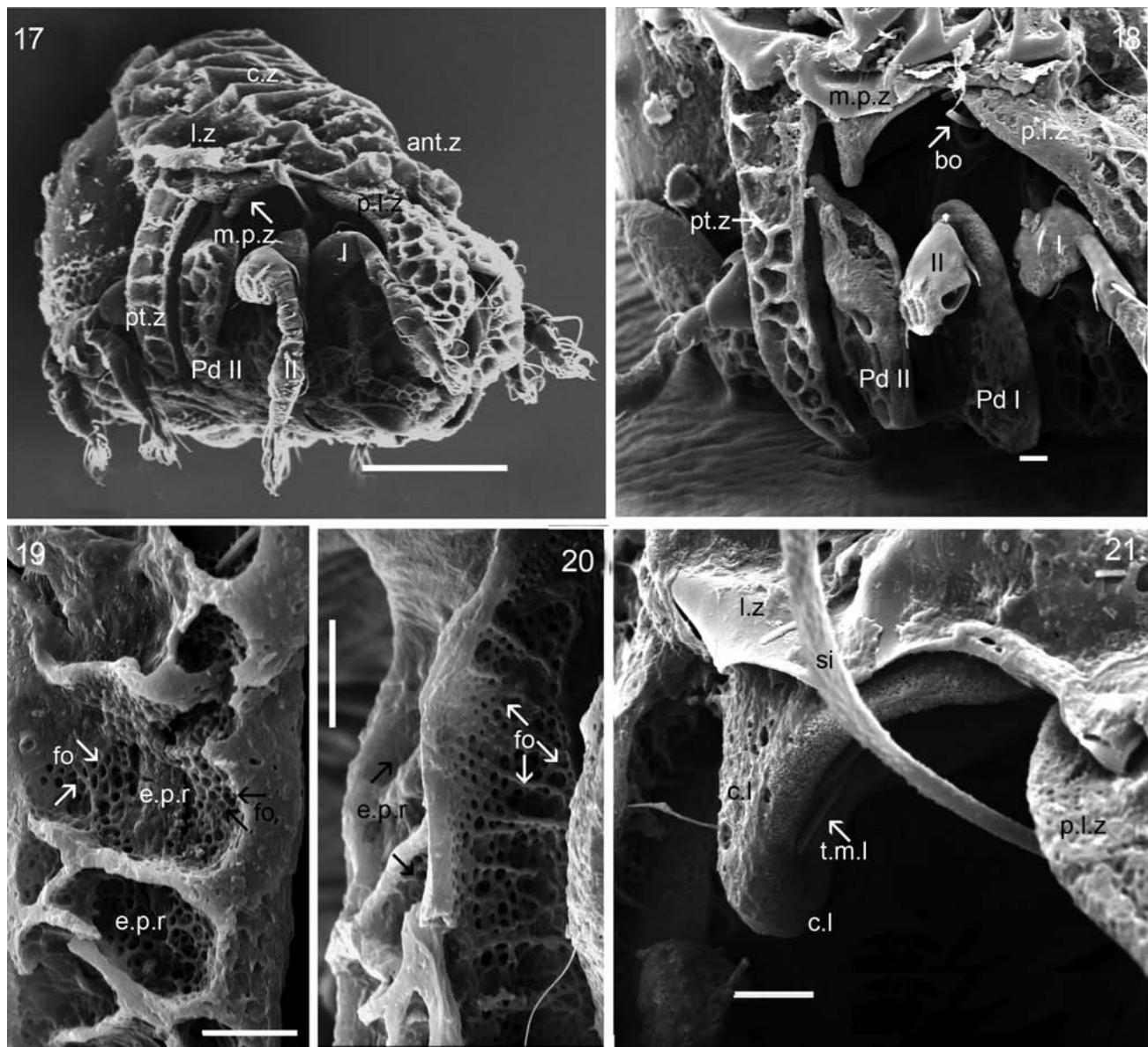


Figs. 9–11. *Idiozetes malgache* n. sp., adult – 9, lateral view. 10, notogaster, posterior view. 11, bothridium. Abbreviations: see Materials and methods. Scale: 9, 10 = 100  $\mu$ m; 11 = 20  $\mu$ m.



Figs. 12–16. *Idiozetes malgache* n. sp., adult, cerotegument. 12, fovea. 13, smooth plicate layer. 14, elongate-polygonal reticula, with fovea. 15, genua, tibiae, and tarsi of leg II (part). 16, group of mushroom-like microtubercles. Abbreviations: see Materials and methods. Scale: 12, 16 = 1  $\mu$ m; 13–15 = 10  $\mu$ m.





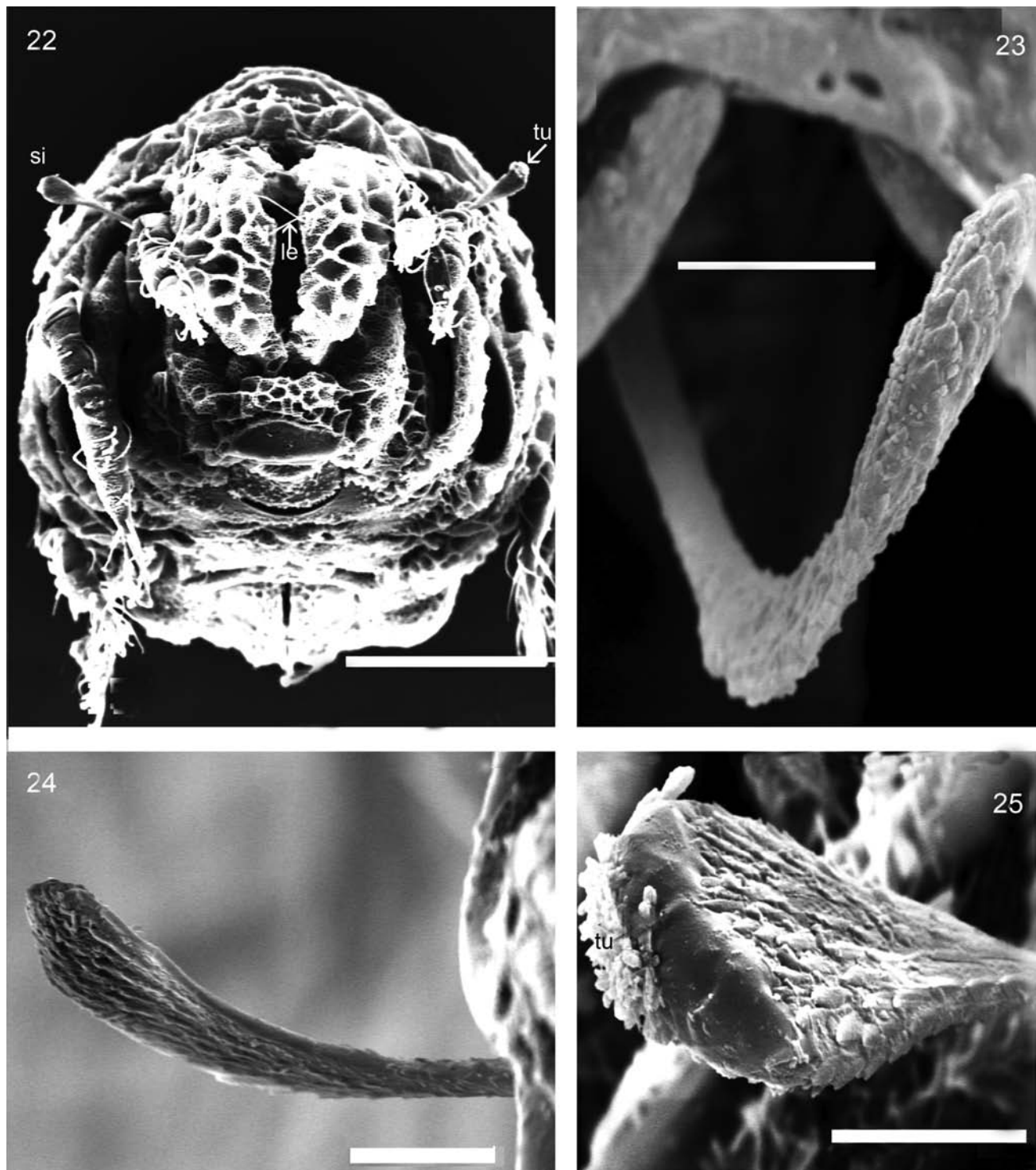
Figs. 17–21. *Idiozetes malgache* n. sp., adult, SEM. 17, lateral view. 18, pteromorph and membranous projection, lateral view. 19, elongated-polygonal reticula. 20, pteromorph, frontal view. 21, membranous projection, frontal view. Abbreviations: see Materials and methods. Scale: 17 = 100  $\mu$ m; 18–21 = 10  $\mu$ m.

31, 33). Relative sizes of prodorsum, notogaster, and notogastral structures appear only after removal of cerotegument (see Figs. 1, 3, 5, 6, 9, 10).

Color: specimens without cerotegument light brown; with cerotegument, slightly shiny when observed in reflected light.

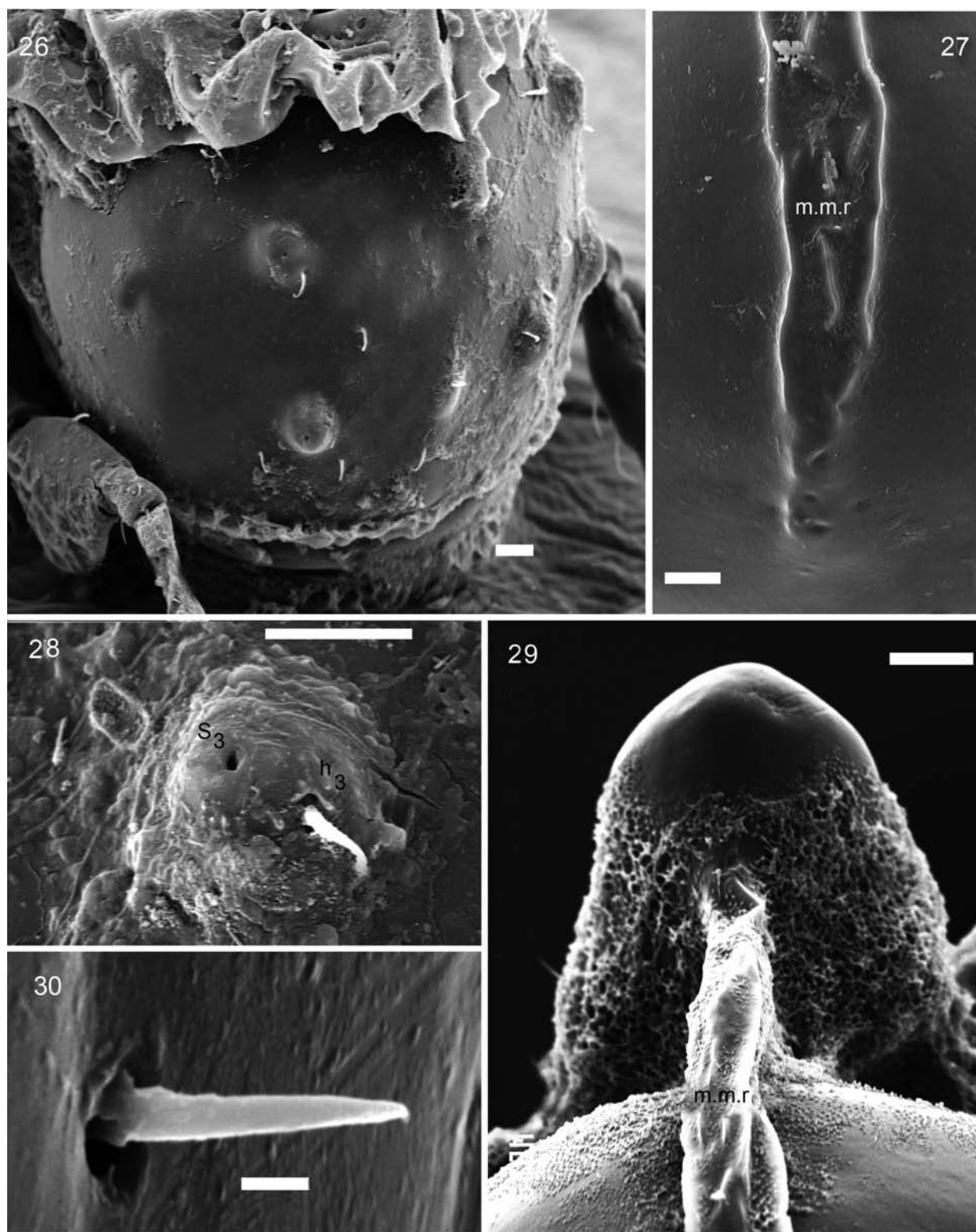
**ADULT** – *Cerotegument present* – Significant, thick, complex, lacking uniformity across the animal (Figs. 1, 3, 12–16, 17, 26, 31–33): Prodorsum covered by thick cerotegumental layer (Figs. 1, 3, 5, 17), flat

areas alternating with elongate-polygonal reticula (*e.p.r.*) with fovea (*fo*) at the base (Figs. 12, 14). Pair of cerotegumental projections (*ce.po*) present in space between lamellae and rostrum; porous structure, cone-shaped, more visible in ventral view (Figs. 31, 33). In *ro* setae zone groups of microtubercles exist which appear mushroom-like (*mus*) (Figs. 15, 31, 33). Notogaster covered up to posterior third (Figs. 1, 3, 4, 5, 17, 26) by smooth, thick, plicate layer, 1–1.5  $\mu$ m thick (Figs. 4, 13). Central zone (*c.z*) broad and

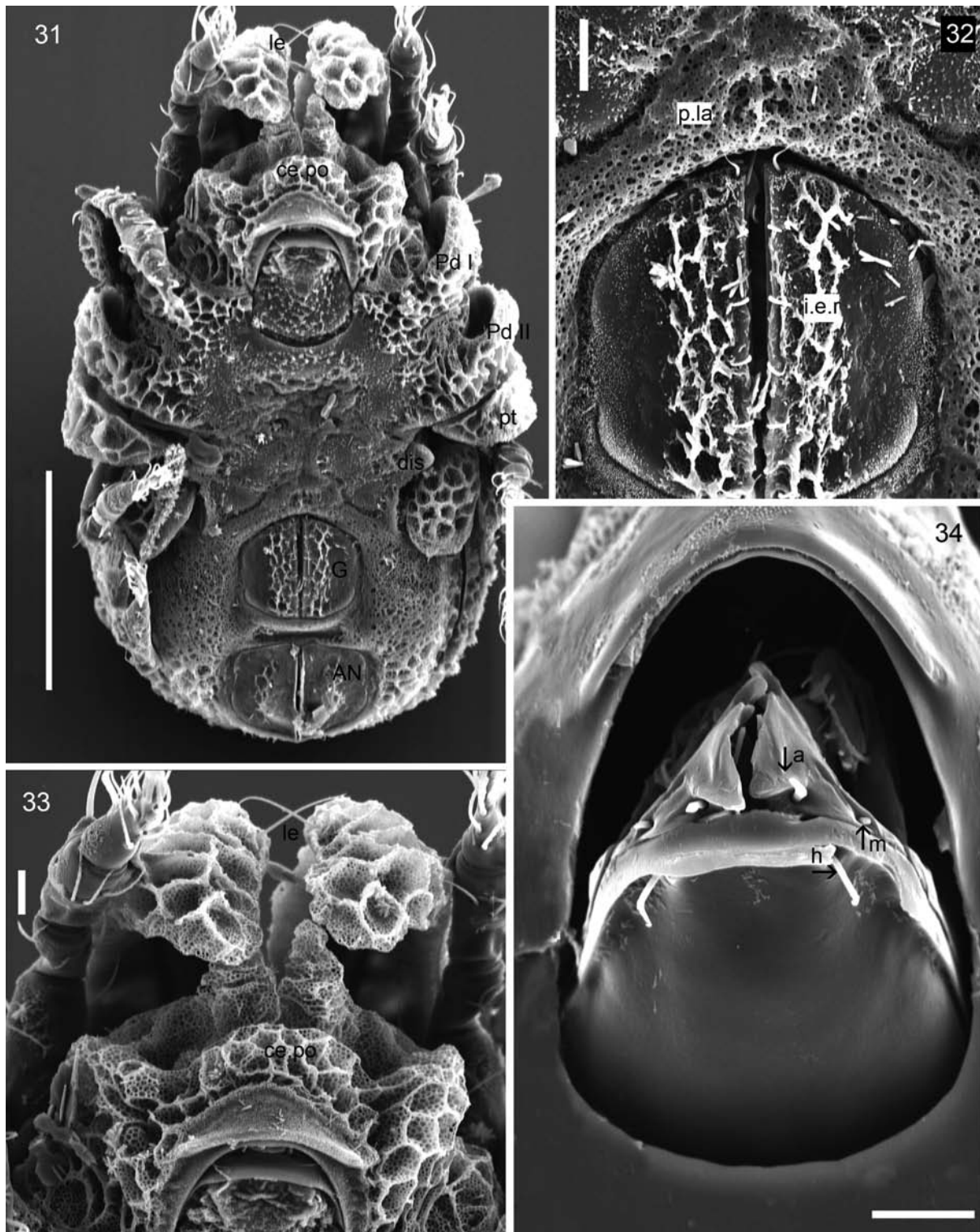


Figs. 22–25. *Idiozetes malgache* n. sp., adult. 22, frontal view. 23, sensillus, frontal view. 24, sensillus, lateral view. 25, sensillus, apical region. Abbreviations: see Materials and methods. Scale: 22 = 100  $\mu$ m; 23–25 = 10  $\mu$ m.

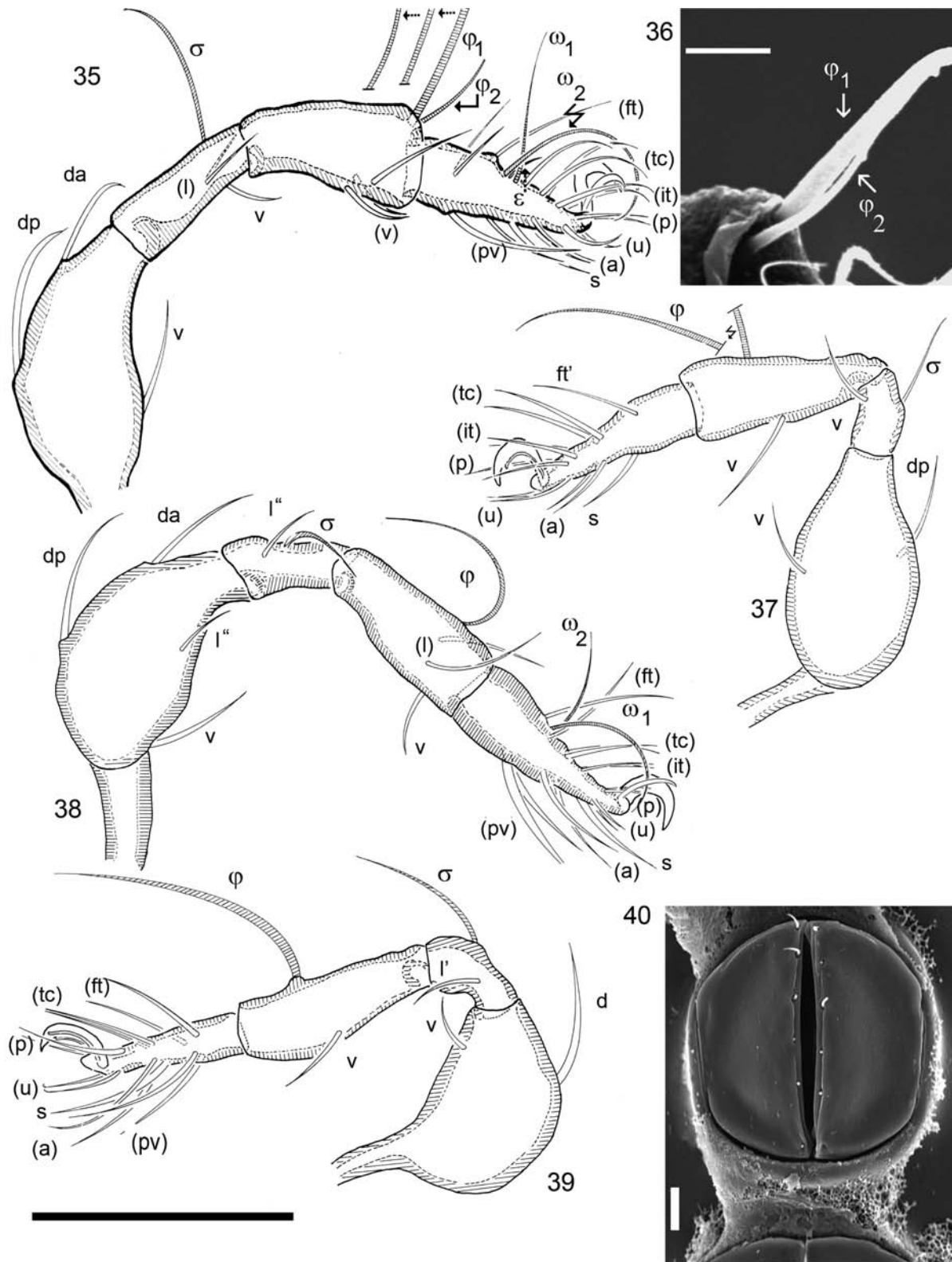




Figs. 26–30. *Idiozetes malgache* n. sp., adult, sem 26, posterior notogastral region. 27, crest near posterior region of notogaster, dorsal view. 28, notogastral aperture of saccule. 29, cylindrical projection of notogaster and crest. 30, notogastral setae. Abbreviations: see Materials and methods. Scale: 26–29 = 10  $\mu$ m; 30 = 1  $\mu$ m.



Figs. 31–34. *Idiozetes malgache* n. sp., adult, sem 31, ventral view. 32, genital plates. 33, anterior region, ventral view. 34, infracapitulum, ventral view. Abbreviations: see Materials and methods. Scale: 31 = 100  $\mu$ m; 32–34 = 10  $\mu$ m.



Figs. 35–40. *Idiozetes malgache* n. sp., legs of adult female, antiaxial view: 35, leg I. 36, solenidia  $\varphi_1$ ,  $\varphi_2$ , leg I (SEM). 37, leg IV. 38, leg II. 39, leg III. 40, genital plate, macerated specimens (SEM). Abbreviations: see Material and methods. Scale: 35, 37–39 = 40  $\mu$ m; 36, 40 = 10  $\mu$ m.

elevated (Figs. 1, 3, 4, 17, 22), limited on each side by longitudinal furrow (*lo.f*) and anteriorly by the anterior zone (*ant.z*). Numerous prominent folds present. In some specimens bridged (*bri*) between two successive folds. This area covering mediodorsal membranous ridge (*m.m.r*) (Figs. 4, 5).

Lateral zone (*l.z*) on both sides of the longitudinal furrow (*lo.f*): smooth plicate; in some specimens with elongate-polygonal reticula (*e.p.r*); never bridged (Figs. 1, 3, 17). Pteromorph zone (*pt.z*): elongate-polygonal reticula (*e.p.r*) with fovea at base (*fo*) (Figs. 2, 18, 19). Thick porous layer visible (20 µm) in lateral view (Fig. 20).

Membranous projection zone: thick porous cerotegumental layer (*t.c.l*), totally covering thin membranous projection (*m.p*) (Fig. 19); transversal anterior zone (*t.a.z*): thick smooth layer, weakly plicate (Figs. 1, 3, 17).

Ventral region: epimeres 1, 2, 3 and 4, laterally with elongate polygonal reticula (*e.p.r*) (Fig. 31); middle of epimeres, amorphous layer (*am.l*). Ventral plate and genitoanal furrow (Figs. 26, 40), porous layer (*po.la*). Genital and anal plates (Figs. 31, 32) with irregular elongate polygonal reticula (*i.e.r*). Legs: femora covered by elongate polygonal reticula (*e.p.r*). Dorsal zone of genua, tibiae, tarsi (Fig. 15), with amorphous layer (*am.l*).

*Cerotegument absent* – On posterior part of the notogaster (Fig. 4), and ventral zone of genua, tibiae and tarsi (Fig. 15).

*Integument* – Smooth (Figs. 26–29, 34); tubercles on posterior half of notogaster (Figs. 26, 28) and mediodorsal membranous ridge (*m.m.r*) between posterior part of cylindrical projection (*c.p*) to posterior part of notogaster (Figs. 5, 9, 20, 27).

*Setation* – Prodorsum: (*le*) filiform, short (12–20 µm) on specimens macerated in lactic acid (Fig. 9), and filiform and long (50–75 µm) on specimens studied under SEM (Figs. 22, 33); (*ro*) filiform, long (35–50 µm) (Fig. 9). Notogaster: six pairs of small (4–7 µm), spiniform and smooth setae (Fig. 30).

*Prodorsum* – Nearly as long as notogaster. Covered by large lamellae; rostrum better observed in ventral view by transparency. Lamellae, long broad blades, projecting far beyond anterior tip of rostrum and curving inward apically (Figs. 9, 22, 31, 33); posterior part of lamellae fused, plate-like structure with rounded margin (*p.l.s*) just covering the bothridia (Figs. 3, 5, 9, 18, 21); lamellae allowing for legs I to be hidden. Cusps narrowly rounded apically. Rostrum rounded, not incised (Figs. 9, 31, 33), better seen in ventral view. A pair of cerotegumental porous coniform projections (*ce.po*) in space between the rostrum and the lamellae (Figs. 31, 33).

Lamellar setae (*le*) filiform (see setation), easily discernible, positioned on inner lamellar margin close

to tip of cusps (Fig. 9), and crossing each other medially (Figs. 22, 31, 33). Rostral setae (*ro*), long, smooth, spiniform (Fig. 9), only visible in ventral or lateral view of macerated specimens. No interlamellar setae (*in*), nor exostigmatal (*ex*) setae. Bothridia (*bo*) bowl-like, oblique, directed dorsal to dorsolateral (Fig. 5), not far from median plane (Fig. 1). Bothridial rim not incised.

Sensillus with long minutely barbed pedicel, horizontal at base then turning dorsally beyond the lamellae (Figs. 21, 23); head clavate, flat, minutely barbed, but smooth apically (Fig. 25) with tuft of barbules (*tu*) unilaterally (Figs. 22, 25).

*Notogaster* – Only readily visible in macerated specimens, after removal of cerotegument. Bell-shaped, highly convex (Fig. 10). Anterior part of notogaster with strikingly peculiar cylindrical projection (*c.p.*) (see Remarks), *c.p.* extending forward and largely anterior of dorsosejugal suture. Prominent mediodorsal membranous ridge (*m.m.r*) present between posterior part of cylindrical projection (*c.p.*) and posterior third of notogaster (Figs. 4, 5, 29). Ridge *m.m.r.* forming prominent crest at level of cylindrical projection (Figs. 9, 29).

Pair of membranous projections (*m.p*) present, on anterior part of notogaster, lateral to the cylindrical projection. Membranous projection, flat, ear-shaped (Figs. 5, 9, 21); consisting of very thin membranous layer (*t.m.l*) (Fig. 21) covered on both sides by thick cerotegumental layer (*c.l.*) (Fig. 21). After removal of cerotegument membranous layer losing rigidity.

Pteromorphs immovable, long narrow blades, pointed anteriorly, about as wide as long, slightly tapered distally, tip rounded. Pteromorphs completely covering acetabulum III, aspect variable depending on presence of cerotegument (Figs. 17–21).

Six pairs of short and spiniform notogastral setae (Fig. 30); that we named *la*, *lm*, *lp*, *h<sub>1</sub>*, *h<sub>2</sub>*, *h<sub>3</sub>* (Fig. 3) using the lyrifissures as guide. Posterior notogastral setae (*lp*, *h<sub>3</sub>*, *h<sub>2</sub>*, *h<sub>1</sub>*) outside the zone covered with cerotegument (Figs. 4, 26). Four pairs of sacculi (*Sa*–*S<sub>3</sub>*) present (Figs. 4, 9, 10, 26): *Sa*, *S<sub>1</sub>* and *S<sub>2</sub>*, large, of even size; *S<sub>3</sub>*, small; *S<sub>2</sub>* and *S<sub>3</sub>* open onto tubercles (Figs. 4, 26). Five pairs of lyrifissures (*ia*, *im*, *ih*, *ip*, *ips*) (Figs. 9, 10), *ip* small.

Opening of opisthosomal gland (*gla*) at level of seta *lm*; gland positioned obliquely (Fig. 9).

*Ventral region* – Pedotectum I large, forming broad scale, covering acetabulum I. Pedotectum II slightly smaller, covering acetabulum II. Discidium large, easily visible (Fig. 6).

Epimeral region flat. Epimeral furrows very flat (Fig. 6); only *bo.4* deeper (Figs. 31, 32). Only apodemes I, II, and *sj* observable; apodeme I fused medially; apodemes II, *sj*, medially incomplete (Fig. 6).

Epimeral setation hardly visible. Setal formula (3-1-2-3). All setae setiform to spiniform and of equal size. Setae 3a close to the acetabulum I.

Genital and anal opening contiguous and joined by genitoanal furrow. Genital plates slightly smaller than anal plates. Genital setation, six pairs of setae, in longitudinal row (Fig. 40); setae short, smooth, and spiniform (Fig. 7). Aggenital setae absent. Anal setae, one pair; one specimen had two pairs on each side. Three pairs of small, spiny, and smooth adanal setae (Fig. 6); one other specimen having two pairs instead of three.

*Lateral region* – Leg I often hidden under the lamella. Notogaster bell-shaped, strongly convex (Fig. 10); cylindrical projection (*c.p*) extending largely beyond the dorsosejugal suture. Mediodorsal membranous ridge (*m.m.r*) at level of cylindrical projection (*c.p*) forming crest (Figs. 9, 29) almost imperceptible posteriorly (Fig. 27). Membranous projection (*m.p*) inserted near edge of cylindrical projection and at base of pteromorphs (Fig. 5).

Notogastral setae clearly visible, all short and spiniform (Fig. 5).

Five pairs of lyrifissures: *ia* close to pteromorphs; *im*, *ih*, *ips*, normal shape and normal; *ip* small and hardly discernible (Fig. 5). Saccules *Sa*, *S<sub>2</sub>*, *S<sub>3</sub>*, located very low, *S<sub>1</sub>* between setae *1a* and *1m* (Fig. 9). Notogastral tectum present, prominent between lambda and *bng* (Fig. 10).

*Posterior aspect* – Opisthosoma slightly oblong. Notogastral tectum prominent, between line *bng* and  $\lambda$  line (Fig. 10). Notogastral setae clearly visible (Fig. 6).

*Gnathosoma* – Subcapitulum diarthric (Fig. 34). Subcapitular setae *a*, *m*, and *h*, minutely barbed, subequal in size. Rutellum pantelebasic; teeth heavily sclerotized.

Palp setal formula (0-2-1-3-9) (1); solenidion  $\omega$ , baculiform, joined with *acm*; *sul* (*ul*) and *acm* eupathidia.

*Legs* – Heterotridactylous; medial claw strong; lateral claws thin and hyaline. Legs I and II of the same size and slightly bigger than III and IV. Genua I and II, much larger than and of a different form than genua III and IV (Figs. 35, 37–39).

Incomplete sockets (only ventral) on tibia and genu I, II and tibia III, IV.

Setal formulae (trochanter to tarsus): I (0-4-3-3-15-3) (1-2-2); II (1-4-1-3-13-3) (1-1-2); III (1-2-1-1-13-3) (1-1-0); IV (0-2-2-1-12-3) (0-1-0).

Solenidion  $\varphi_1$  very long and tactile, not inserted on distal projection; solenidion  $\varphi_2$  below  $\varphi_1$  (Fig. 36).

**PRELARVAE** – Oval. Total length 110  $\mu$ m; width: 60  $\mu$ m. Cuticle covered by aligned small bumps (Figs. 7, 8). Anteriorly, with more or less rectangular expansion. Only vestiges of the mouth (*os*).

## REMARKS

Using SEM we were able to better understand the shape of the specimens; the structure and distribution of cerotegument and the particularities of the lamellae, pteromorphs, lamellar setae (*le*), sensillus, cuticle, pedotecta I and II, discidia, notogastral epimere, and genital setation. The open-mount technique revealed that, on account of the shape of the body, the specimen's position in the preparations can vary from one moment to the next, as can the relative proportions of the various body parts in the drawings.

Being able to monitor the specimen during the lactic acid maceration process (macerating in warm 70% lactic acid for removal of the cerotegument) has proven fundamental; we were able to observe that the seta *le* poorly withstands maceration (it shrinks) and that certain characteristics described and illustrated for *I. javensis* as belonging to cuticular structures (anterior part of the cusps and lateral projection of pedotectum II, for instance) most likely relate instead to the cerotegument covering them (Hammer, 1980). The presence in *I. malgache* n. sp. of a smooth plicate cerotegument that stops at a specific point on the notogaster is one of the particularities of this species.

The clavate head of sensillus with tuft of unilateral barboles is very typical.

Apically, the cylindrical projection of the notogaster presents a paler zone resembling the lenticulus or clear spot of Eremaozetidae. This type of structure is probably involved in light reception (Alberti and Fernandez, 1988, 1990). Incomplete sockets on tibia and genua I and II; tibiae III and IV, are not of the usual type, but more open.

The three species of the genus *Idiozetes* present similarities and numerous differences, Table 1 gives a comparison of these species based on previous descriptions and figures of *I. erectus* Aoki, 1976 and *I. javensis* Hammer, 1980.

Considering the new insight acquired from the comparative study of the three species, the genus *Idiozetes* Aoki, 1976, can be re-defined as follows.

Thick cerotegumental layer significant, complex. Prodorsum nearly as long as notogaster; lamellae close together, projecting far beyond rostrum and curving inward; posterior part of lamellae fused. Bothridia situated dorsal to dorsolateral, considerably close to each other. Bothridial rim not incised. Sensillus long, club-shaped. Notogaster strongly convex, bell-shaped, or not, with cylindrical projection anteriorly, extending beyond the dorsosejugal suture. Notogaster mediodorsal with membranous ridge between posterior part of cylindrical projection and posterior third of the notogaster. Membranous projection on each side, anterior part, between cylindrical projection



Table 1. Comparative table based on previous descriptions and figures of *Idiozetes erectus* Aoki, 1976 and *Idiozetes javensis* Hammer, 1980.

Characters	<i>Idiozetes erectus</i>	<i>Idiozetes javensis</i>	<i>Idiozetes malgache</i> n. sp.
Cerotegument: body covering	Entirely	Partially	Partially, smooth, plicate
Posterior part: lamellae	Not hidden beneath bothridia	Hidden beneath bothridia	Hidden beneath bothridia
Lamellar setae	Absent	Present	Absent
Rostral setae	Present	Absent	Present
Notogaster: shape	Bell-shaped	Flat	Bell-shaped
Pteromorpha	Attenuating toward the tip	Tapering, rounded	Narrow pointed at tip
Membranous projection	Rounded, with veins	Like butterfly wings	Flat, ear-shaped
Mediodorsal membranous ridge	Between posterior part of cylindrical projection and posterior part of notogaster	?	Between posterior part of cylindrical projection and notogastral setae <i>la</i>
Saccules	Three pairs	Three pairs	Four pairs
Lyrifissures	<i>im</i>	<i>im</i>	<i>ia, im, ih, ips, ip</i>
Notogastral setae	Nine pairs	Eight pairs	Six pairs
Genital setae	Eight pairs	Seven pairs	Six pairs
Adanal setae	Three pairs	?	Three pairs
Legs	Monodactyle	Monodactyle	Heterotridactyle
Sockets	Absent	?	Incomplete, Tibia I, II, III, IV; Genu I, II
Discidium	Present	?	Present

?Not reported by Hammer.

and pteromorphs. Pteromorphs long, immovable. Three or four pairs of sacculi present. One to five pairs of lyrifissures. Pedotecta I and II present; discidium present or absent. Six to eight pairs of genital setae; one pair of anal setae; three pairs of adanal setae; legs mono- or tridactylous.

#### ACKNOWLEDGEMENTS

We are grateful to Dr. Valerie Behan-Pelletier, Ottawa, Ontario, Canada, for her very constructive criticism and recommendations.

#### REFERENCES

- Alberti, G. and N. Fernandez. 1988. Fine structure of a secondarily developed eye in the freshwater moss mite *Hydrozetes lemnae* (Coggi, 1899) (Acari: Oribatida). *Protoplasma* 146: 106–117.
- Alberti, G. and N. Fernandez. 1990. Aspect concerning the structure and function of the lenticulus and clear spot of certain Oribatids (Acari: Oribatida). *Acarologia* 31: 65–72.
- Aoki, J. 1976. Oribatid mites from the IBP study area, Pasoh Forest Reserve, West Malaysia. *Nat. Life SE Asia*. 7: 39–59.
- Grandjean, F. 1949. Observation et conservation des très petits arthropodes. *Bull. Mus. Natl. Hist. Nat.* 21: 363–370.
- Guillaumet, J.-L., J.-M. Betsh., C. Blanc., P. Morat and A. Peyrieras. 1975. Etude des écosystèmes montagnards dans la région malgache. III. Le Marojezy. IV. L'Itremo et l'Ibity. Géomorphologie, climatologie, faune et flore. *Bull. Mus. Natl. Hist. Nat.*, 3 ser, no. 309. (Ecol. Gén.) 25: 29–67.
- Hammer, M. 1980. Investigations on the oribatid fauna of Java. *Biol. Skrift Danske Vidensk. Selskab*. 22(9): 1–79; 47 plates.
- Krantz, G. W. and D. E. Walter. 2009. A Manual of Acarology. 3rd ed. Texas Tech University Press, Lubbock (TX). 816 pp.

- Kunst, M. 1971. Nadkohorta Pancirnici – Oribatei. pp. 531–580. *In*: Daniel, M. and V. Cerny, (Ed.). Klic Ziverny CSSR IV. Academia, Praha.
- Mahunka, S. 2002. Survey of the Oribatida fauna of Madagascar (Acari: Oribatida). *Folia Entomol. Hung.* 63: 5–16.
- Norton, R. and V. Behan-Pelletier. 2009. Suborder Oribatida. pp. 430–564. *In*: Krantz, G. W. and D. E. Walter, (Eds.). *A Manual of Acarology*. 3rd ed. Texas Tech University Press, Lubbock, TX.
- Paulian, R., J.-M. Betsh, J.-L. Guillaumet, C. H. Blanc and P. Griveaud. 1971. Etudes des Ecosystemes montagnards dans la région malgache. *Bull. Soc. Ecol.* II(2–3): 189–266.
- Paulian, R., C. H. Blanc, J.-L. Guillaumet, J.-M. Betsh, P. Griveaud and A. Peyrieras. 1973. Etude des écosystèmes montagnards dans la région malgache. II. Les chaines Anosyennes. Geomorphologie, climatologie et groupements végétaux. *Bull. Mus. Natl. Hist. Nat.*, 3 sér. 118: 1–40.
- Piffel, E. 1972. Zur Systematik der Oribatiden (Acari). *Khumbu Himal.* 4: 269–314.
- Subías, L. 2004. (database updated 2010) Listado sistemático, sinonímico y biogeográfico de los Ácaros Oribatidos (Acariformes: Oribatida) del Mundo (excepto fósiles). *Graellsia.* 60: 3–305. Available from: <http://www.ucm.es/info/zoo/Artropodos/Catalog.pdf>
- Travé, J. and M. Vachon. 1975. François Grandjean 1882–1975 (notice biographique et bibliographique). *Acarologia* 17(1): 1–19.

