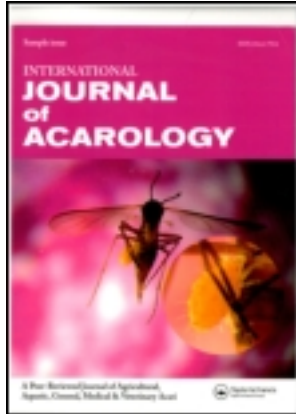


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Rogerzetes lacouturieri n. gen., n. sp., (Acari: Oribatida: Eremaozetidae) from Madagascar

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ROGERZETES LACOUTURIERI N. GEN., N. SP., (ACARI: ORIBATIDA: EREMAEOZETIDAE) FROM MADAGASCAR

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ABSTRACT – *Rogerzetes lacouturieri* n. gen., n. sp., collected from Manankaza Forest Station, Ambohitantely, Tananarive, Madagascar, is described and illustrated based on adult specimens. The new genus is distinguishable by the following combination of character states: body flattened; posterior part of lamellae fused, forming plate-like structure with rounded margin partially covering the bothridia; central posterior part plate-like, with tongue-like expansion surpassing dorsosejugal furrow; end of longitudinal fissure round-ovoid; large apical lamellae; naso and prodorsal sensory structures present; tube between *le* and sensory structure; *in* absent; prehumeral tecta prominent, partially covering the bothridia; 10 pairs of notogastral setae; anal plate ending in long spine; legs heterotridactylous. The new species is characterized by the following combination of characteristics cuticular microsculpture of foveate pattern; prodorsum with internal well-developed sensory structure; anterior part of notogaster, between dorsosejugal furrow and lenticulus, flat, semi-circular area, and at lower level than surrounding notogaster; prehumeral tecta ear-like; notogastral setae short and rod-like; epimeral setation (3-1-1-2). *Eremaeozetes betschi*, Fernandez and Cleva, 2009, is transferred to the new genus.

Key words – Acari, Oribatida, Eremaeozetoidea, Eremaeozetidae, *Rogerzetes lacouturieri*, new genus, new species, Madagascar.

INTRODUCTION

The family Eremaeozetidae Piffel, 1972, is represented by 33 species belonging to three genera and is known from the Oriental, Ethiopian, Neotropical, and Oceanian regions (Norton and Behan-Pelletier, 2009). These genera are *Eremaeozetes* Berlese 1913, with *Eremaeozetes tuberculatus* as type species; *Mahunkaia* Schatz, 2002, with *Eremaeozetes bituberculatus* (Mahunka, 1983) as type species; and *Seteremaeozetes* Balogh 1988 with *Eremaeozetes (Seteremaeozetes) obtectus* (Balogh 1988) as type species.

The main purpose of this article is to describe a new genus and species of Eremaeozetidae from Madagascar. A second objective is the transfer of *Eremaeozetes betschi*, Fernandez and Cleva, 2009, to the new genus.

MATERIALS AND METHODS

All specimens were collected from plant litter 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

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medium using the open-mount technique (cavity slide and cover slip) described by Grandjean (1949) and Krantz and Walter (2009). Drawings were made using an Olympus BHC compound microscope equipped with a drawing tube.

Specimens were also prepared for scanning electron microscopy (SEM). Ethanol-preserved specimens were carefully rinsed 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, after which the cerotegument was carefully removed using fine needles; all specimens were then dehydrated in a series of graded ethanols 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.

For a study of prodorsal sensory structure, specimens were monitored during the lactic acid maceration process (in warm 70% lactic acid) and stained with chlorazol black E.

Measurements taken are as follows: total length (tip of rostrum to posterior edge of notogaster); width (widest part of notogaster) in micrometers (μm). Setal formulae of the legs include the number of solenidia (in parentheses); tarsal setal formulae include the famulus (ε).

Morphological terminology – Morphological terms and abbreviations used herein are those developed by Grandjean (1928–1974) (cf. Travé and Vachon, 1975). As a number of specific morphological characters have not previously been described in detail, and no terminology or abbreviations exist, we have included the following in the text and on the figures for the sake of clarity: crest (*cre*); dark line (*I.ex*); fissure (*fi*); flat semi-circular area (*d.ap*); flat smooth areas (*z.a*); hyaline wall (*p.h*); lamellar tube (*t.le*); mushroom-like microtubercles (*mus*); naso (*na*); ovoid structure (*ovi*); prehumeral tecta (*e.a*); prodorsal sensorial structures (*s.s.p*); rounded anterior tip (*I.ex.a*); tongue-like expansion (*e.l.p*).

Family EREMAEOZETIDAE Piff, 1972
***Rogerzetes* n. gen.**

Etymology – The generic prefix “*Roger*” and the specific epithet are dedicated in posthumous homage to our friend Roger Lacouturière.

Diagnosis – **ADULT FEMALE** – Characterized by the following combination of character states: body flattened; cerotegument: ovoid–elongate reticulation, flat smooth areas and mushroom-like microtubercles; cuticle with ovate pattern; lamellae posterior part

fused to form a plate-like structure, rounded posterior margin partially covering the bothridia and central posterior zone with tongue-like expansion extending far behind dorsosejugal suture; longitudinal lamellar fissure with rounded to ovoid ending; naso vestigial; sensory structures well developed; tube between *le* and sensory structure; setae: *in* absent; *le*, inner lamellar margin; prehumeral tecta partially covering the bothridia; setation: notogastral 10 pairs; epimeric 3-1-1-2 or 3-1-1-3. Anal plate terminating in long spine. Legs heterotridactylous.

Type species – *Rogerzetes lacouturieri* (n. gen., n. sp)

***Rogerzetes lacouturieri* n. sp**
(Figs. 1–24)

Material examined – Holotype female and three paratype females, Madagascar, Province of Tananarive, Tompoketsa d’Ankazobe, Manankaza Forest Station, Ambohitantely, 1550 m, middle altitude dense humid forest. J. Gutierrez coll. 27 July 1967. Holotype and one paratype deposited in the collection of the Muséum National d’Histoire Naturelle, Paris, France, preserved in 70% ethanol; one paratype, same data as holotype, deposited in the Museum of Natural History, Geneva, Switzerland, preserved in 70% ethanol; one paratype, same data as holotype, deposited in the Natal Museum, Pietermaritzburg, South Africa, preserved in 70% ethanol.

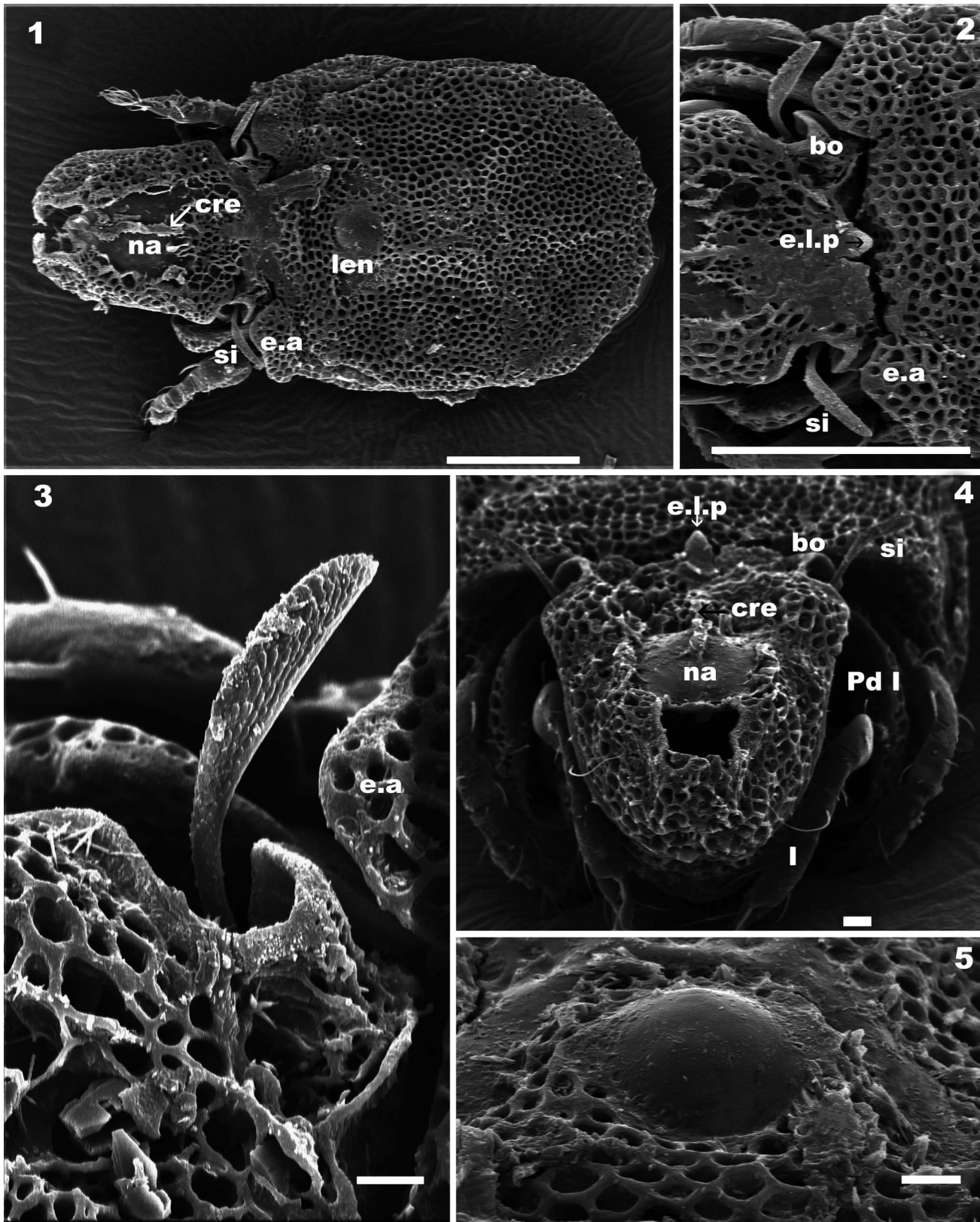
Diagnosis – **ADULT FEMALE** – Developed prodorsal sensory structures. Notogaster, between dorsosejugal furrow and lenticulus, flat semi-circular area, and at lower level than surrounding notogaster, covered by a thick cerotegumental layer; prehumeral tecta ear-like; notogastral setae rod-like; epimeric setae smooth with rounded tip; epimeric setation 3-1-1-2.

Description – **MEASUREMENTS** – SEM 450 μm (430–470) \times 245 μm (230–270). Light microscopy: 475 μm (420–520) \times 250 μm (220–280).

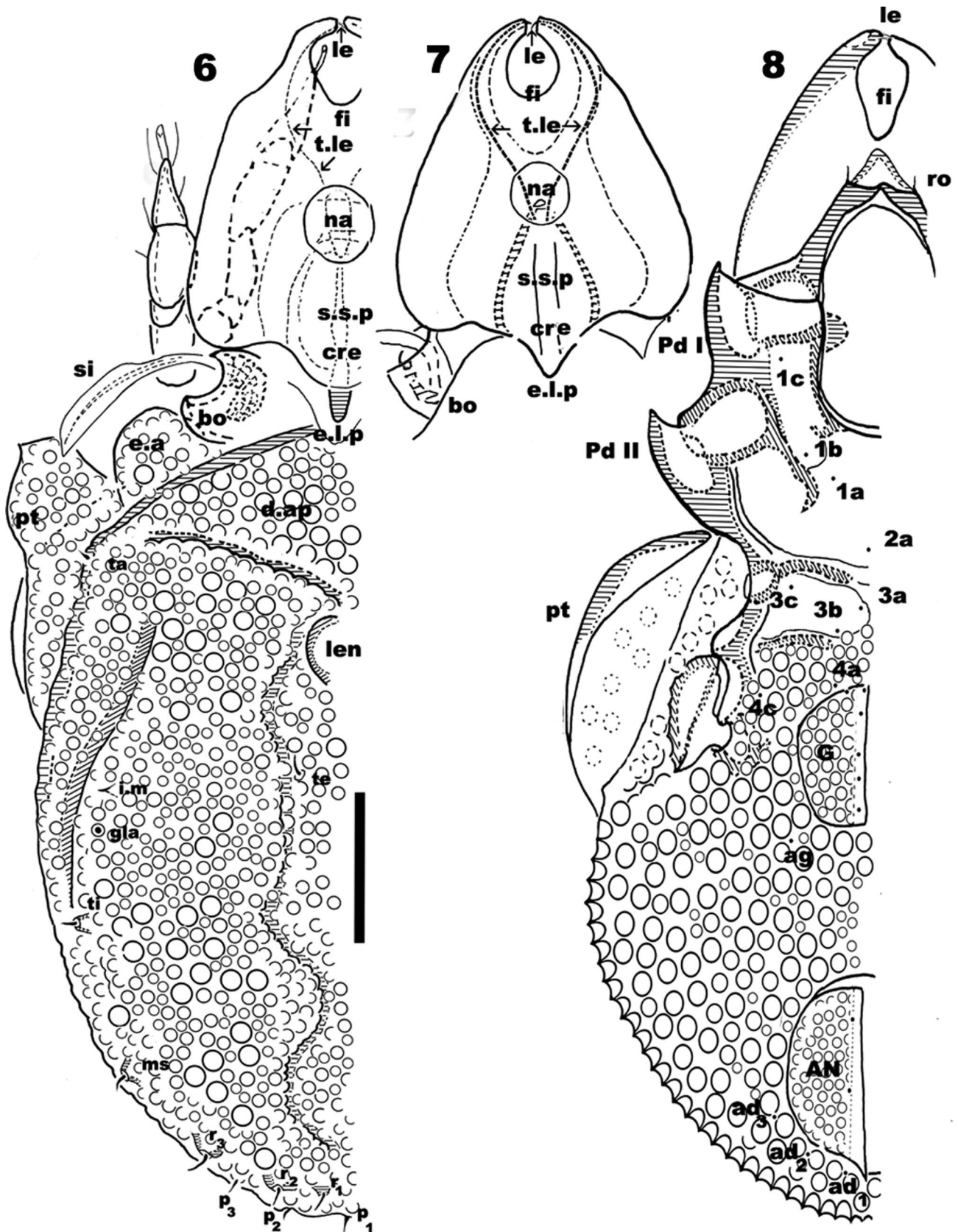
Shape – Elongate oval (Fig. 1) dorsal view; flat, lateral view (Figs. 9, 14). Sex ratio: all specimens were female.

Color – Specimens lacking cerotegument: light brown, slightly shiny when observed in reflected light.

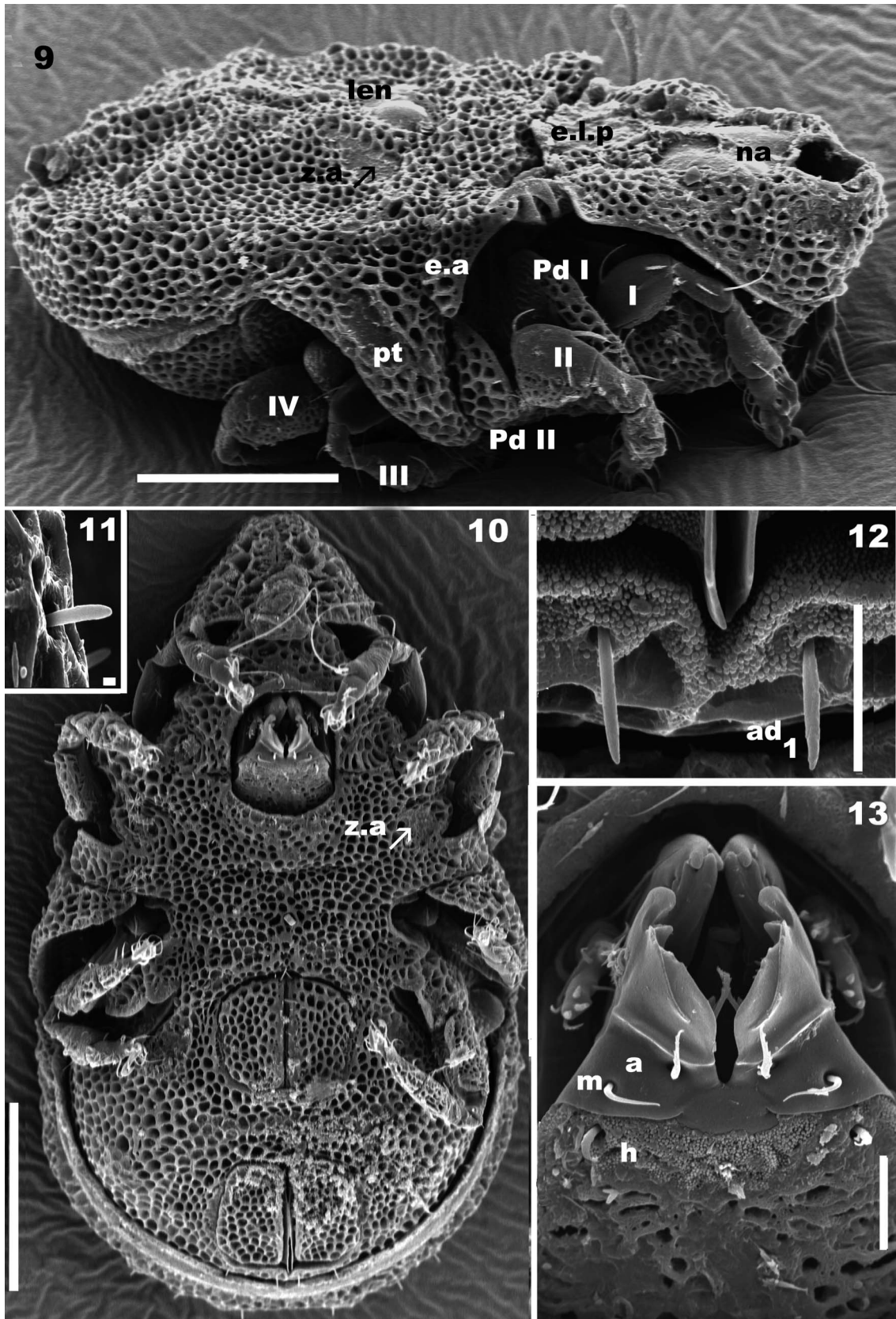
Cerotegument – Thin layer across the animal; thick only on flat semi-circular area (*d.ap*), situated between dorsosejugal furrow and lenticulus (*len*) (Fig. 6). Ovoid–elongate reticulation (Figs. 19–21) of varying size, alternating with flat smooth areas (*z.a*) (Fig. 9) and groups of microtubercles which appear mushroom-like (*mus*) (Fig. 22).



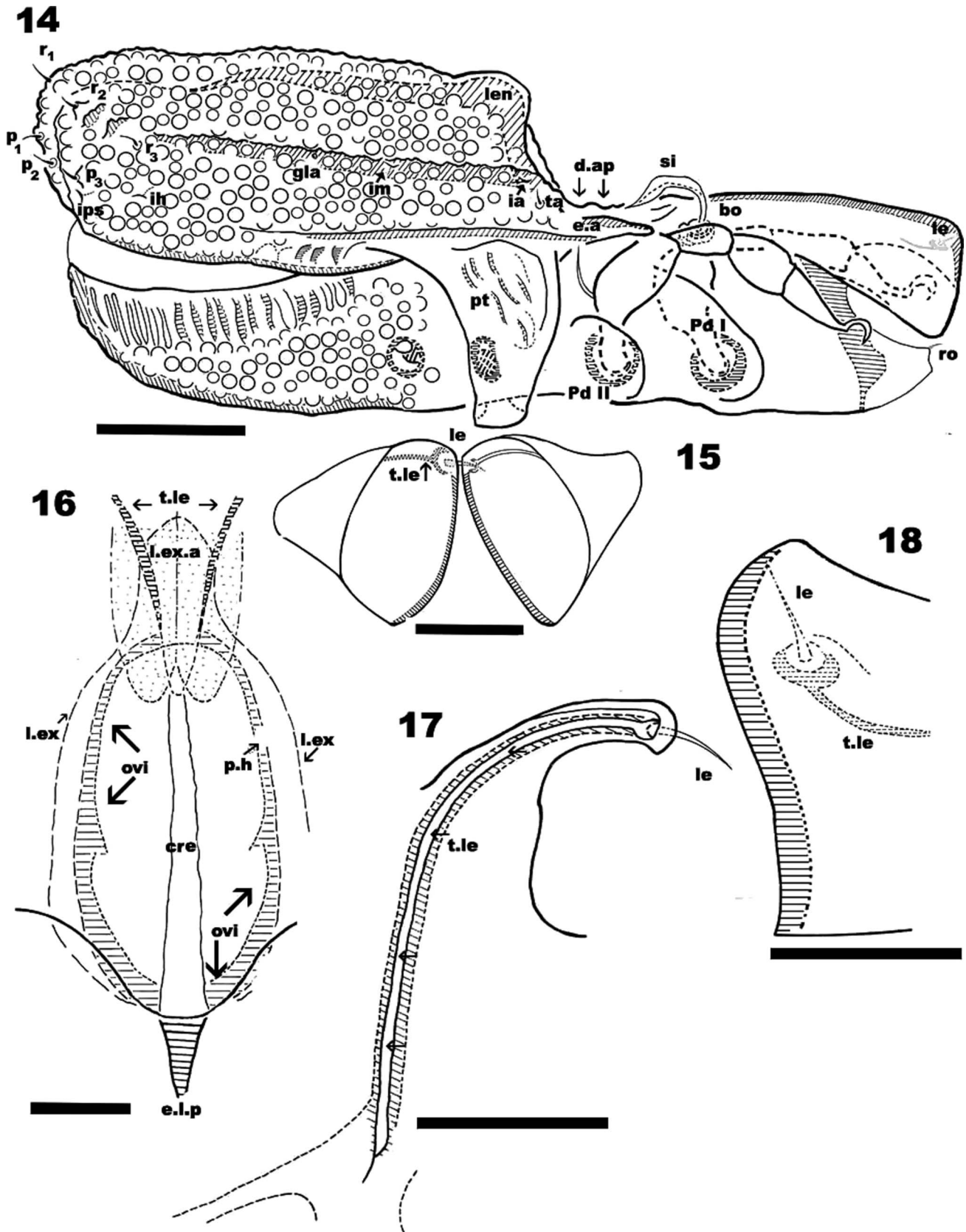
Figs. 1–5. *Rogerzetes lacouturieri* n. gen., n. sp., adult, scanning electron micrographs – 1. dorsal view; 2. dorsosejugal furrow zone; 3. bothridia and sensillus; 4. prodorsum, frontal view; 5. lenticulus. Abbreviations: see MATERIALS AND METHODS. Scale bars: 1, 2 = 100 μ m; 3–5 = 10 μ m.



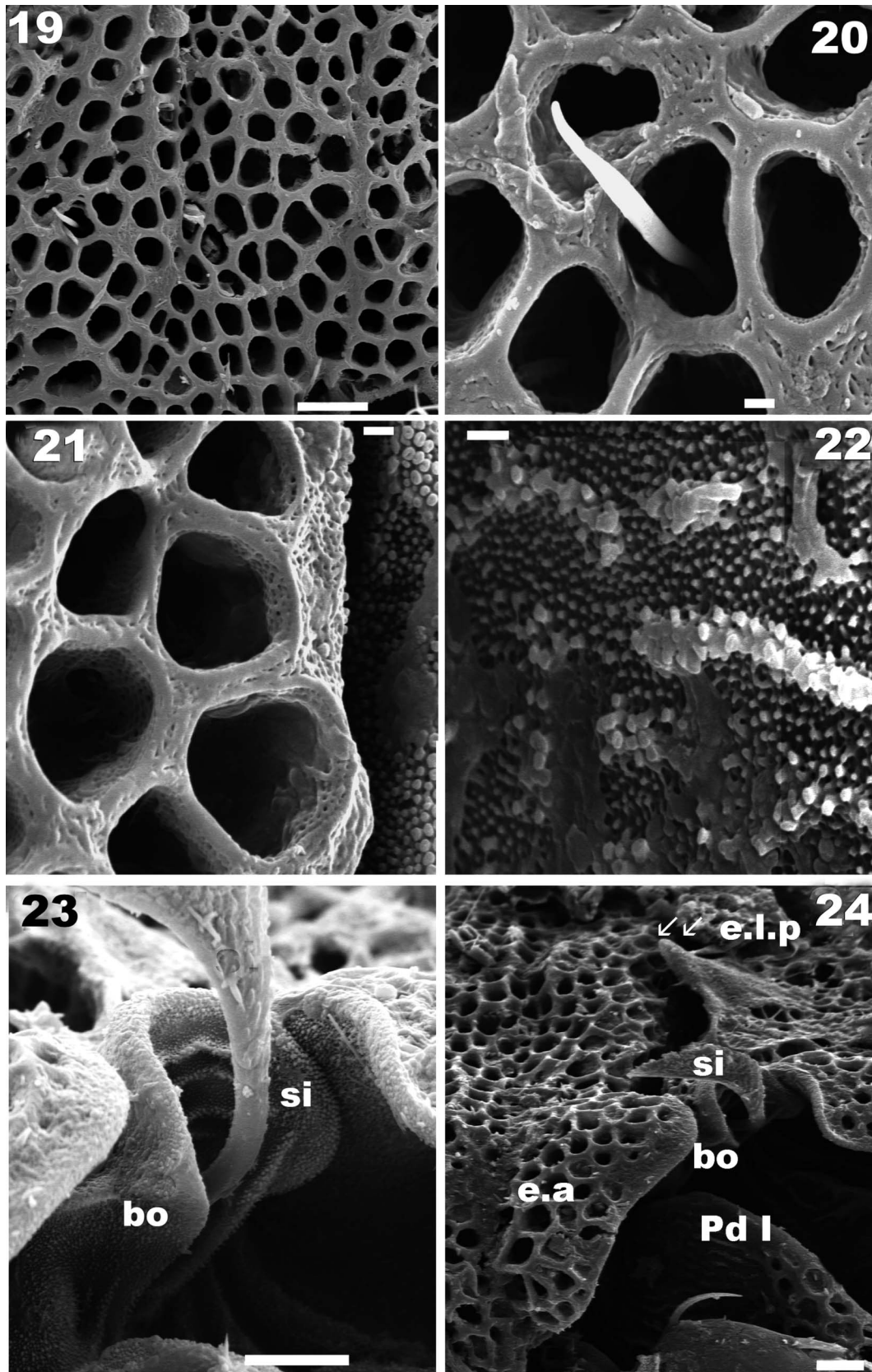
Figs. 6–8. *Rogerzetes* spp. – 6, 8. *Rogerzetes lacouturieri* n. gen., n. sp., adult – 6. dorsal aspect; 8. ventral aspect; 7. *Rogerzetes betschi* (new combination) (Fernandez and Cleva, 2009), adult – dorsal aspect, prodorsum, showing the relative position of the naso. Abbreviations: see MATERIALS AND METHODS. Scale bars: 6–8 = 50 μ m.



Figs. 9–13. *Rogerzetes lacouturieri* n. gen., n. sp., adult female scanning electron micrographs – 9. laterodorsal view; 10. ventral view; 11. notogastral setae; 12. anal plate, adanal setae; 13. infracapitulum. Abbreviations: see MATERIALS AND METHODS. Scale bars: 9, 10 = 100 μ m; 11–14 = 10 μ m.



Figs. 14–18. *Rogerzetes lacouturieri* n. gen., n. sp., adult – 14. lateral view; 15. lamellae, apical view; 16. prodorsal sensory structure; 17. lamellae and tube le setae; 18. lamellae lateral view, tube setae le . Abbreviations: see MATERIALS AND METHODS. Scale bars: 14 = 80 μ m; 15 = 20 μ m; 16–18 = 25 μ m.



Figs. 19–24. *Rogerzetes lacouturieri* n. gen., n. sp., adult, scanning electron micrographs – 19. cerotegument, ovoid–elongate reticulation (*o.e.r.*); 20. cerotegument and epimeric seta; 21. cerotegument high magnification; 22. mushroom-like microtubercles; 23. bothridia and sensillus; 24. lateral view, dorsosejugal furrow area. Abbreviations: see MATERIALS AND METHODS. Scale bars: 19, 23, 24 = 10 μm ; 20–22 = 1 μm .

On prodorsum – Covered by thin cerotegumental layer, ovoid–elongate reticulation alternating with some flat smooth areas (*z.a*) (Fig. 9), Naso (*na*), (Figs. 1,4), prodorsal sensorial structures (*s.s.p*) and tongue-like expansion (*e.l.p*) (Figs. 2, 4, 6, 7), without cerotegument or with transparent layer only (Norton et al., 1997) (Figs. 1, 4, 5). Bothridia, covered by mushroom-like microtubercles (*mus*) (Fig. 22).

On notogaster – Thick cerotegumental layer on flat semi-circular area (*d.ap*); ovoid–elongate reticulation all over (Figs. 1, 9); flat smooth areas (*z.a*), irregular distribution: surrounding dorsosejugal furrow; lateral to lenticulus (*len*); antiaxial on prehumeral tecta (*e.a*); on pteromorph and notogastral posterior antiaxial zone up to *ms* setae level (Figs. 1, 6). Mushroom-like microtubercles (*mus*), on anal plate posterior zone, and surrounding *ad₁* setal area (Fig. 12).

A high magnification of ovoid–elongate reticulation reveals two layers: superficial layer (0.8–1.5 µm thickness) surface rough; and inner layer (25–40 µm thickness) (Figs. 20, 21). Lenticulus (*len*), without cerotegument or with a transparent layer only, similar type on naso (*na*), prodorsal sensory structures (*s.s.p*), and tongue-like expansion (*e.l.p*).

On podosoma and ventral region – Ovoid–elongate reticulation all over, uniform in size (Fig. 10), slightly smaller on genital and anal plates (Fig. 10); *z.a* in center of epimere 1 on border of camerostome, antiaxial epimere 2, genital plates paraxial zone (Fig. 10); *mus*, anal plates, paraxial posterior zone (Fig. 12). Pedotecta I and II, dorsal zone with ovoid–elongate reticulation and *mus* (Fig. 9).

On legs – Femora II, IV, ventral zone (Fig. 9), and palp: femora, dorsal zone, with ovoid–elongate reticulation.

Cerotegument only absent on legs I, III; genua, tibiae, and tarsi of legs II, IV, and palp.

Integument – Cuticle with conspicuous microsculpture: foveate pattern on notogaster, prodorsum, and ventral region; smooth, infracapitulum, epimeric zone, and legs (Figs. 6, 8).

Setation – Setae small, hardly discernible. Smooth, spiny: *ro*, *le* (Figs. 14, 17, 18); rod-like, notogaster (Fig. 11); epimeric setae smooth with rounded tip (Fig. 20); barbed, subcapitular *a*, *h*, *m* (Fig. 13).

Prodorsum – Covered by large lamellae, long broad blades, projecting far beyond anterior tip of rostrum (Figs. 9, 10, 14) and curving inward and apically enlarged (Figs. 9, 14, 15, 18); posterior part of lamellae fused, plate-like structure with rounded margin (*p.l.s*) just covering the bothridia (Figs. 1, 4, 9); central posterior region with tongue-like expansion (*e.l.p*) surpassing dorsosejugal furrow (suture) (Figs. 2, 4, 9, 24); lamellae allowing for legs I to be concealed; fissure (*fi*) with round–ovoid ending (Figs. 6, 8); lamellar setae

(*le*) positioned on inner lamellar margin and crossing each other medially. Rostrum rounded, not incised. No interlamellar setae or their insertions present.

Naso (*na*), vestigial, present as a small ovoid-shaped elevation in the center of prodorsum, better visible in frontal view (Figs. 4, 6). Complex prodorsal sensory structures (*s.s.p*) occur between the naso and the tongue-like expansion *e.l.p* (Figs. 4, 6, 9).

At cuticular level, middle zone of *s.s.p* with a small crest (*crt*) covered or not by cerotegumental layer (Figs. 1, 4, 6, 16).

Prodorsal sensory structure (Fig. 16): large hyaline wall (*p.h*), delimiting ovoid structure (*ovi*), with constriction on central zone; weak paraxial linear zone on ovoid structure, cuticular crest hampering observation.

Externally, parallel to *p.h* a dark line (*I.ex*), with rounded anterior tip (Fig. 16) (*I.ex.a*); at level of *I.ex.a*, a tube originates from each lamella (*t.le*) (Fig. 6), with dark brown wall and hyaline middle zone (Fig. 17). The *t.le* becomes cup-shaped at the base of each *le* seta (Figs. 15, 17, 18), and terminates (Fig. 17) on anterior part of *p.h*, hyaline line without the tubular structure (Fig. 16). Figure 6 is a diagram to illustrate the position of *s.s.p*, *na* and *t.le*.

Rounded margin of plate-like structure barely covering bothridia anteriorly and prehumeral tecta (*e.a*), partially covering bothridia posteriorly (Figs. 2, 9). Bothridia lateral (Fig. 9); bothridial rim, paraxial semi-circular shape, rectilinear laterally (Fig. 23). Sensillus, with minutely barbed pedicel and flattened fusiform head, barbed (Fig. 3).

Setae *ro*, placed laterally close to margin of rostrum (Fig. 14). No *le* and *ex* setae or their insertions present.

Notogaster – Shape: ovoid dorsally; laterally flat, slightly convex (Figs. 9, 14). Between lenticulus and dorsosejugal suture, flat semi-circular area (*d.ap*), and at lower level than surrounding notogaster (Figs. 6, 14) (see Remarks). Zone posterior to lenticulus elevated, with small crest (Fig. 9). Near dorsosejugal furrow, small tongue-like depression (Figs. 1, 2, 4, 9), with or without cerotegumental layer, to accommodate the tongue-like expansion (*e.l.p*). Tongue-like depression better visible on some specimens.

Prehumeral tecta ear-like (*e.a*) (Fig. 9); on macerated specimens, rounded (Fig. 6), covering bothridia partially (Figs. 23, 24), clearly visible in contracted specimens.

Lenticulus: ovoid in dorsal view and convex, extends forward in lateral view (Fig. 14); placed far from dorsosejugal furrow (Figs. 1, 6, 9) and near border of flat semi-circular area (*d.ap*).

Pteromorphs, immovable, long blades, pointed anteriorly, tip rounded (Figs. 9, 14).

Ten pairs of small, rod-like, and hardly discernible notogastral setae (*ta*, *te*, *ti*, *ms*, *r*₁, *r*₂, *r*₃, *p*₁, *p*₂, *p*₃) (*Domatorina* nomenclature) (Figs. 6, 11).

Lyrifissures: five pairs (*ia*, *im*, *ih*, *ip*, *ips*), shape and position normal.

Ventral region – Pedotecta I, II, and discidium easily discernible (Fig. 8). Epimeral region flat. Epimeral furrows very flat (Fig. 8); on specimens with cerotegument studied under SEM, only sejugal furrow clearly visible (Fig. 10).

Apodemes 1, 2, *sj*, and 3 (Fig. 8), medially incomplete. Epimeral setation hardly visible, with formula (3-1-3-2). Anal plate ending with long spine. Genital setation, six pairs. Aggenital setae, one pair. Anal setae two pairs. Adanal setae, three pairs (Fig. 8).

Lateral region (Figs. 9, 14) – Lamellae large. Pteromorphs immovable, tip rounded, turning toward epimeric zone. Prehumeral tecta (*ea*) well visible, covering partially the bothridia. Pedotectum I large, forming broad scale. Pedotectum II slightly smaller.

Gnathosoma – Subcapitulum diarthric (Fig. 10). Subcapitular setae *a*, *m*, and *h*, minutely barbed, subequal in size (Fig. 13). Rutellum pantelebasic; teeth heavily sclerotized.

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

Legs – Heterotridactylous; medial claw strong; lateral claws thin and transparent. Setal formulae (trochanter to tarsus): 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). Solenidion φ_1 very long and tactile; φ_2 in paraxial position.

Remarks – Under light microscopy, in *R. lacouturieri*, the flat semi-circular area (*d.ap*) is dark brown; the thick cerotegumental layer having the appearance of a sclerite.

In a follow-up study, the naso, prodorsal sensory structure, and the tube-like structure of lamellar setae on *R. lacouturieri* will be examined and compared with that of other specimens in the family Eremaeozetidae: *Eremaeozetes chancani* Fernandez and Cleva, 2000; *Eremaeozetes araucana* Monetti *et al.*, 1994, and specimens from Gabon, Martinique, Guadeloupe, and Argentina.

Rogerzetes betschi (new combination) (Fig. 7) presents similar structures to those of *R. lacouturieri*, but less developed. *E. chancani*, however, has only *t.le*; *E. araucana* has a small *na*.

It should be noted that all these structures are barely visible on specimens macerated for an extended period.

DISCUSSION

The genera *Eremaeozetes* and *Mahunkaia* together with the new genus *Rogerzetes* can without a doubt be placed in the family Eremaeozetidae on account of a clear set of shared characters. However, the genus *Seteremaeozetes*, with eight pairs of notogastral setae, seven to eight pairs of genital setae, and a labiogenual articulating suctorial does not fit in with the Eremaeozetidae as presently defined.

Subsequent to the study of *Rogerzetes*, we conducted a study on *Idiozetes malgache* (Fernandez *et al.* 2011) which exhibits a long tube on each lamella, with the same structure as that in the new genus. The prodorsal photoreceptor structures do not exist but a particular modified structure, possibly related to the prodorsal sensorial structure of *Rogerzetes*, occurs.

Another common feature shared between *Rogerzetes* and *Idiozetes* is the shape of the prodorsum, and the occurrence of a plate-like structure with a rounded posterior margin partially covering the bothridia.

We fully support the inclusion of the families Idiozetidae and Eremaeozetidae in the superfamily Eremaeozetoidea as proposed by Norton and Behan-Pelletier (2009), as many characters are shared by these two families. These are enhanced by those found in the new genus *Rogerzetes*, confirming the relationship between these two families.

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