

NEW PTEROGASTERINE MITES FROM NIGERIA AND BRAZIL II. *PROTORIBATES*

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PROTORIBATIDAE
ORIBATIDA
NIGERIA
BRASIL
HAPLOZETIDAE

SUMMARY: Two new species of *Protoribates*, *P. osunensis* from southwestern Nigeria and *P. rioensis* from southeastern Brazil are described. The morphological differences between each of these two species, the type species *P. dentata* and the classical species *P. lophotrichus* are highlighted and the haplozetid traits common to all species were compared. Critical attention is drawn to the taxonomical value of the families of the Protoribatidae and Xylobatidae, which have to be incorporated into the Family Haplozetidae. The genus *Brasilobates* is considered a synonym of *Protoribates*.

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RÉSUMÉ : Deux espèces nouvelles du genre *Protoribates*, *P. osunensis* du sud-ouest du Nigeria et *P. rioensis* du sud-est du Brésil sont décrites. Les différences morphologiques entre ces deux espèces, l'espèce type *P. dentata* et l'espèce classique de *P. lophotrichus* sont accentuées, autant que les caractères de la famille des Haplozetidae, communs aux espèces comparées. Finalement, la valeur taxonomique des deux familles Xylobatidae et Protoribatidae est reconsidérée. Ces deux familles appartiennent à la famille des Haplozetidae et le genre *Brasilobates* est considéré synonyme du genre *Protoribates*.

INTRODUCTION

In continuation of our desire to increase the existing information on biogeographical distribution of oribatid mites and create basic data for an identification-key of tropical taxa (BADEJO *et al.*, 2001, 2002), we hereby describe two more pterogasterine species that were collected from secondary regrowth forests and agroecosystems in two tropical environments which belong to different zoogeographical regions in the world.

Protoribates osunensis sp. n.

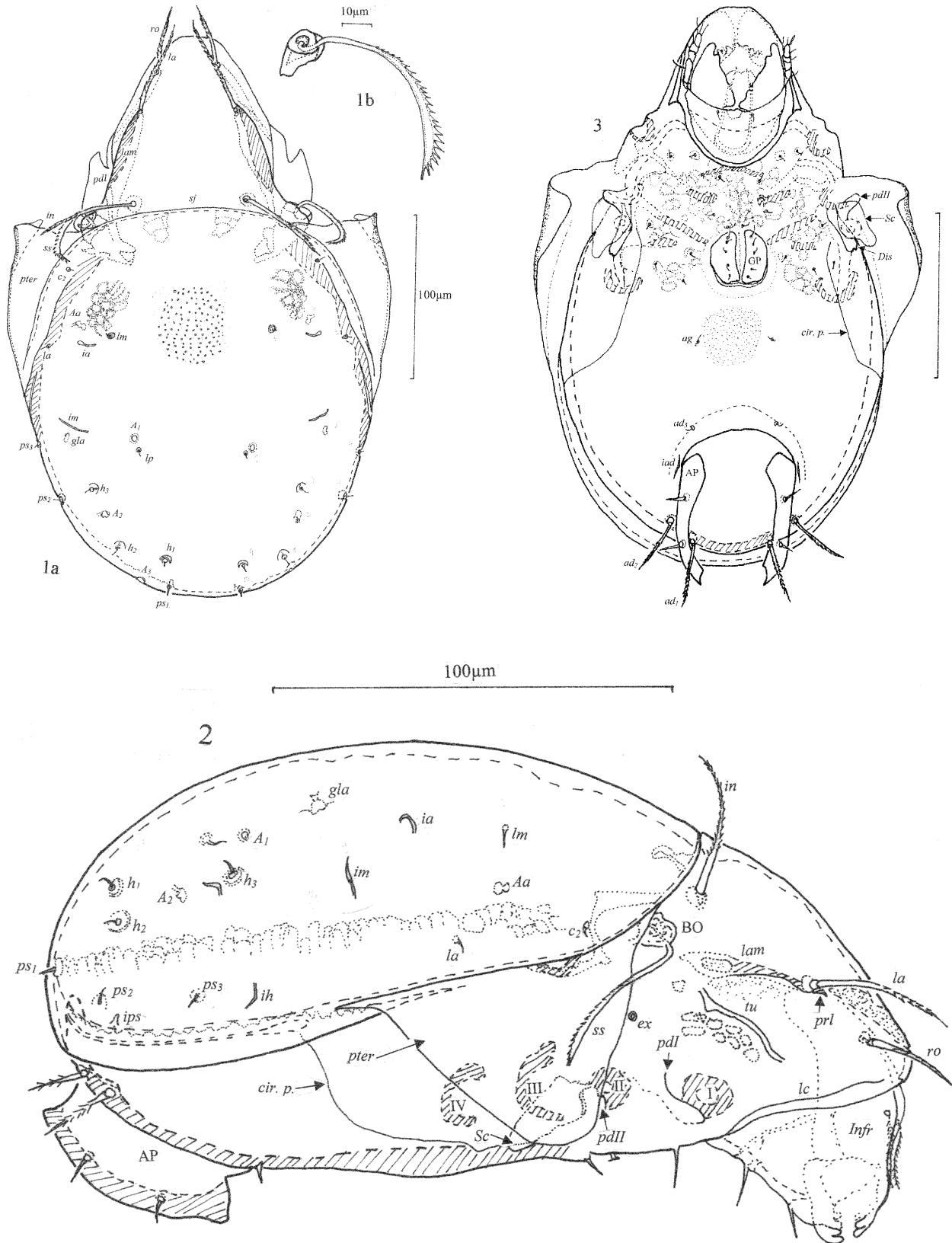
(Figs 1-6)

Material examined: 12 adults (5 males, 7 females) extracted from soil and litter cover from a secondary tropical rainforest floor in Osun State in southwest Nigeria.

Holotype: male from Ile-Ife, (Lat. 7 ° 29' Long. 4° 4'E), M.A. BADEJO col., June 2000 (specimen dissected for the description) deposited in the Museum of Natural History (MNH) at Obafemi Awolowo University, Ile-Ife, Nigeria.

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FIGS. 1-3: *Protoribates osunensis* sp. n.

1(a) Dorsal view; (b) Sensillum. — 2. Lateral view. — 3. Ventral view (male)

Paratypes: 2 males and 5 females deposited in MNH. 2 males and 2 females deposited at Staatliches Museum für Naturkunde, Karlsruhe (SMNK), Germany.

Measurements: Length: Males: 338-347 μm ; Width: 200-214 μm ; Females: 393-410 μm ; Width: 238-250 μm

Integument: Light brown, loosely foveolate.

Prodorsum: Anterior border truncate (FIG. 1a). Anterior half of all prodorsal setae (*ro*, *la*, *in*) ciliated, sensillus (*ss*) somewhat lanceolate, pectinate and reclinate (FIG. 1b). Prodorsal setae *la* and *in* equal in length, *ro* is about two-thirds of their length. Lamella (*la*) well developed, with a short prolamella (*prl*) and a conspicuous distal area porosa. (FIG. 2). Lamella extending posteriorly towards but separated externally from the bothridium (BO), which bulges out slightly at the posterior end of the prodorsum. Pedotectum I clearly visible from the dorsal view. Laterally, tutorium (*tu*) present as conspicuous ridge, lateral carina (*lc*) extending transversely along the edge of prodorsum merging with the edge just after the mid-lateral region (FIG. 2). Point of insertion of exobothridial seta (*ex*) visible just in front of the anterior edge of the pteromorph.

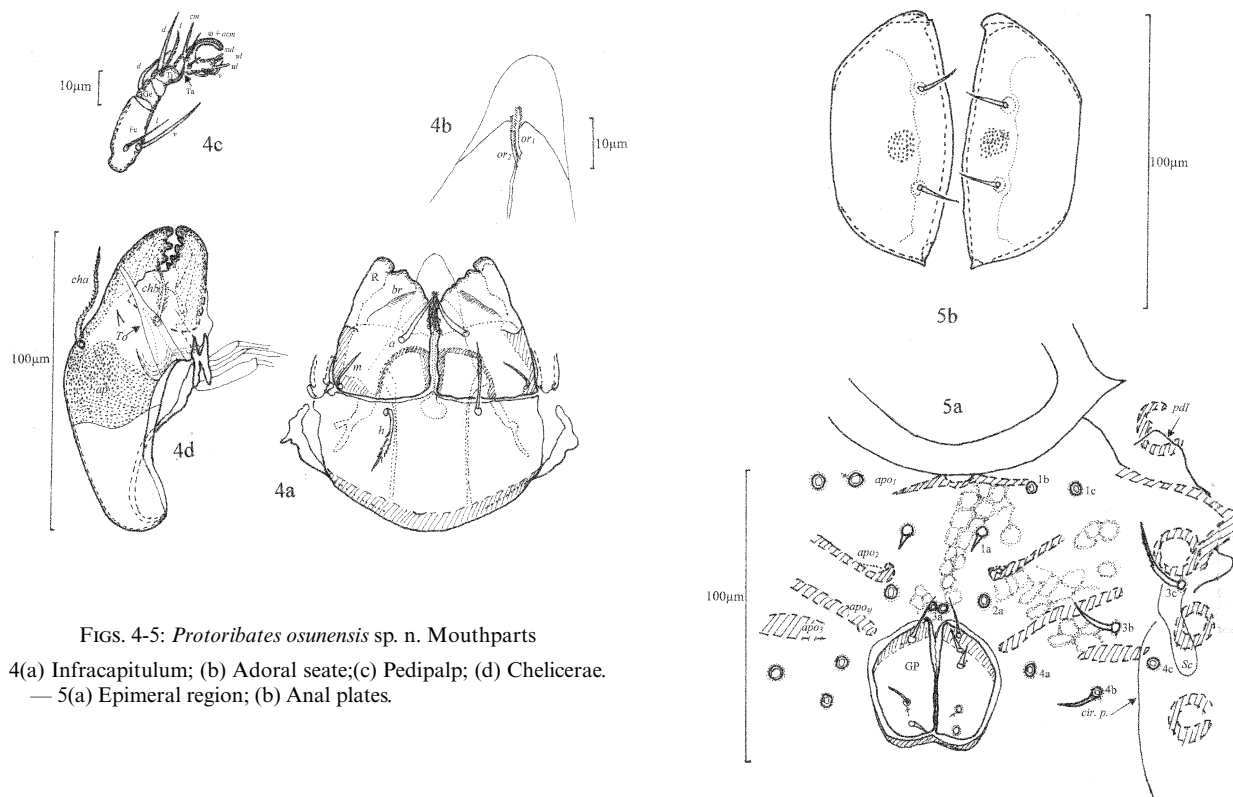
Notogaster: Surface foveolate, shape more or less oval with a nearly straight anterior boarder forming the anterior notogastral margin (*sj*). (FIG. 1). Pteromorph conspicuous with inwardly folding edge and conspicuous hinged suture articulating with the notogaster antero-laterally. The moveable pteromorph (*pter*) subtriangular in shape (FIG. 2). Ten pairs of very short and in a few cases, almost vestigial setae present on notogaster. Setae towards the posterior end more conspicuous than the ones located anteriorly, their insertion canals within the integument clearly visible (FIG. 1a). Four pairs of areae porosae (*Aa* *A*₁, *A*₂, *A*₃) present on the notogaster. Araeae porosae *Aa* situated very close to setae *c*₂, *lm* and *la* in the anterior region, *A*₁ situated in the uppermost median region of the slightly bulging notogaster. *A*₂ situated very close but posterior to seta *h*₃, *A*₃ at the posterior edge of the notogaster. Glandulae abdominalis (*gla*) situated on the same transverse axis as *A*₁ slightly anterior to it and closer to the lateral edge of the notogaster in dorsal view. Lyrifissures *ia* and *im*

visible in both dorsal and lateral views, lyrifissures *ih* and *ips* visible only in lateral view (FIGS 1a and 2). Laterally, pedotecta I and II (*pdI*, *pdII*) present in the regions of acetabula I and II respectively. A scale also present in the region of acetabula III, circumpedal line (*cir. p.*) extending from the edge of the notogaster into the region beneath the pteromorph.

Ventral Region

Mouthparts: Infracapitulum of diarthric type, labiogenal articulation at level of the base of pedipalp (FIG. 3) (Grandjean, 1957). After dissection, rutellum visible as large sclerotized structure with a broad and conspicuous tooth on outer free edge while the rest of the teeth tend towards being flattened (FIG. 4a). Brush (*br*) on the surface of the rutellum and setae *a* and *m* are conspicuous and smooth. Anterior half of setae *h* on mentum ciliate. Adoral sclerite with two pairs of adoral setae (*or*₁ and *or*₂) whose anterior half also ciliated (FIG. 4b). Pedipalp with relatively long femur, tarsus with big claw-like corne double ($\omega + acm$) borne on a big apophysis, three eupathids (*sul*, *ul*, *ul*) present. Setal formula of pedipalp 2-1-3-10 (FIG. 4c). Chelicerae robust with strong sclerotized teeth (FIG. 4d). Lateral seta (*cha*) finely ciliated throughout its entire length, dorsal seta (*chb*) ciliated only at the basal half. A conspicuous spine present on antiaxial surface, densely covered with porose areas (*ap*) up to the end of the free anterior end of the chelicerae. Trägürdh's organ (*To*) lies in position on the antiaxial surface.

Coxisternal region: Punctate epimeral surface with patterns ranging from circular to various polygonal shapes. Epimeral borders and apodemes weakly developed. Sejugal apodeme (*apo sj*) longer than other apodemes, almost reaching the genital plates. Epimeral setal formula 3:1:3:3. Seta 3a not visible in whole mounts unless after dissection and under high magnification (FIGS 3 & 5a). Insertion points of epimeral setae distinctly sclerotized. Pedotectum II visible in region of acetabulum II. A relatively large scale (*Sc*) covering acetabulum III and partially covering narrow discidium (*Dis*) with custodial tip concealed by adherent debris. Circumpedal line (*cir. p.*) originating from the region of acetabulum III (FIG. 5a).



FIGS. 4-5: *Protoribates osunensis* sp. n. Mouthparts
4(a) Infracapitulum; (b) Adoral seate; (c) Pedipalp; (d) Chelicerae.
— 5(a) Epimeral region; (b) Anal plates.

Ano-genital region: Genital plates (GP) with rooftop anterior portion and concave posterior. Each plate with at most 5 pairs of setae (FIGS 3 & 5a). When all the five present, three located anteriorly and two located posteriorly, all of them along a row situated closer to the inner than the outer edge of the plates. Most anterior pair longest. Insertion canals of some of the setae clearly visible. One pair of aggenital setae (*ag*) also with visible insertion canals present almost mid-way between the GP and anal plates (AP) (FIG. 3). Anal plates (AP) with rooftop anterior and convex posterior (FIG. 5b). Each plate with two pairs of smooth setae more conspicuous than epimeral and genital setae. Adanal region with 3 pairs of adanal setae. Setae *ad*₁ and *ad*₂ very long and ciliated, *ad*₃ very small and inconspicuous as the epimeral setae. One pair of lyrifissures (*iad*) present in adanal position at anterior lateral border of AP.

Legs: All legs well developed. Legs II and III shorter than legs I and IV, leg IV longest. All legs mono-

dactyl, setal formula: I (5-4-6-21-1), II (5-3-5-17-1), III (2-3-2-4-13-1), IV (1-2-2-4-12-1) including solenidia (FIG. 9). Solenidiotaxy: I (1-2-2), II (1-1-2) III (1-1-0), IV (0-1-0). Ventro-lateral ridge present on femur I, femur II, III & IV rugose each with ventral lamellar carina with rounded edge. All dorsal setae on femora relatively long and ciliate. Porose areas (*ap*) present on all femora as well as on trochanter of legs III & IV. Tarsus I most robust, followed by tarsus II. Tarsus III not as robust as tarsus II, tarsus IV elongated. Lyrifissure (*lf*) present on each tarsus paraxially at the joint between tarsus and tibia. Solenidion ω_1 on leg I blunt at the tip, ω_2 setiform and acute. Short bacilliform famulus posterior to ω_2 . Three ventral setae (*ad*, *pv*, *a*) distinctly pectinate, *a* most conspicuous, being big and flattened. Terminal claw with rough dorsal edge. Solenidia φ_1 much longer than φ_2 , both of them on a not very distinct apophysis. Genua solenidion (*gs*) not as long as φ_1 , also setiform. On leg II, the two tarsal solenidia both



FIG. 6: *Protoribates osunensis* sp. n.; Legs.

bacilliform, three ventral setae distinctly pectinate and flattened as they are on tarsus I, III & IV. Tibial and genual solenidia relatively long and setiform. Tibial solenidium on Leg III longer than the short and bacilliform genual solenidium. Solenidium on Leg IV (φ) relatively long and setiform.

Protoribates rioensis sp. n.

(FIGS 7-12)

Material examined: 104 adults (57 Males, 47 females) extracted from Plots of *Arachis pintoi* in Seropedica in the state of Rio de Janeiro in southeast Brazil.

Measurements: Length: males: 333-369 μ m; Width: 188-226- μ m; females: 381-405 μ m; Width: 231-245- μ m

Holotype: female from Seropedica, (Lat. 22 ° 45'S, Long. 43 ° 42'W), M.A. BADEJO col., April, 1998 (specimen dissected for the description) deposited in the Museum of Natural History (MNH) at Obafemi Awolowo University, Ile-Ife. Nigeria.

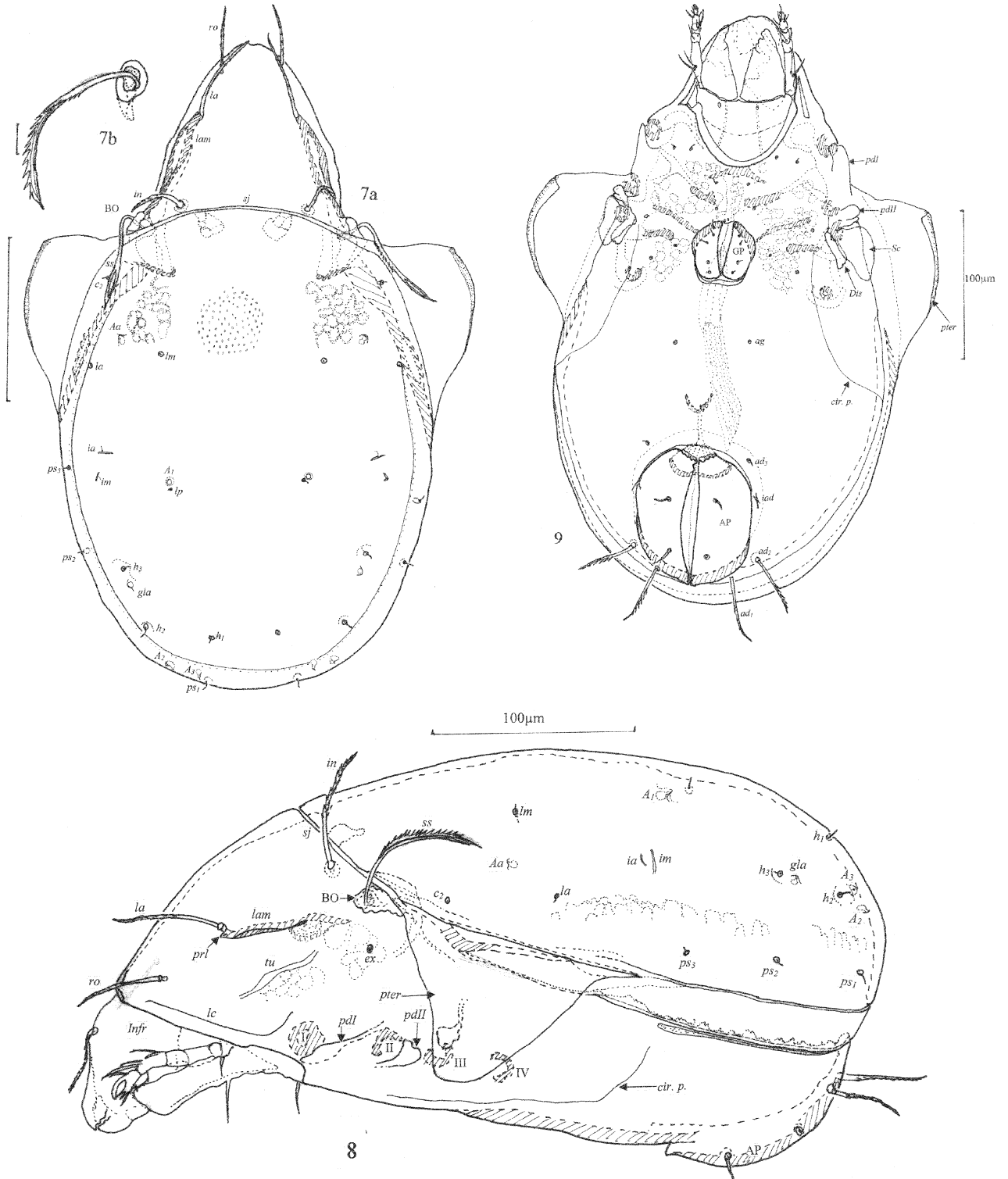
Paratypes: 25 males and 25 females deposited in the Department of Soil Fauna, EMBRAPA-AGROBIOLOGIA, Seropedica, RJ., Brazil. 20 males

and 15 females deposited in MNH. 12 males and 6 females deposited at Staatliches Museum für Naturkunde, Karlsruhe (SMNK), Germany.

Integument: Light brown, loosely foveolate.

Prodorsum: Anterior boarder emarginate (FIG. 7a). All prodorsal setae (*ro*, *la*, *in*) spiniform and ciliated, sensillus (*ss*) somewhat lanceolate, distinctly pectinate and reclinate (FIG. 7b). Rostral setae (*ro*) about two-thirds of the length of *la*, equal in length to *in*, rather appearing shorter because it is stout and curved. Lamella (*la*) well developed, with short prolamella and one conspicuous area porosa in the sublamella region. Lamella extends towards the edge of the bothridium (BO) which bulges out at each corner of the posterior end of the prodorsum. Tutorium (*tu*) in lateral view is a conspicuous ridge. Lateral carina (*lc*) extends transversely near the edge of the prodorsum curving upwards towards the tutorium just before acetabulum I (FIG. 8). Point of insertion of exobothridial seta (*ex*) located between tutorium and anterior edge of pteromorph.

Notogaster: Surface foveolate, shape oval, anterior notogastral margin (*sj*) slightly convex (FIG. 7a). Pte



FIGS. 7-9: *Protoribates rioensis* sp. n.
7(a) Dorsal view; (b) Sensillus. — 8 Lateral view — 9 Ventral view (female)

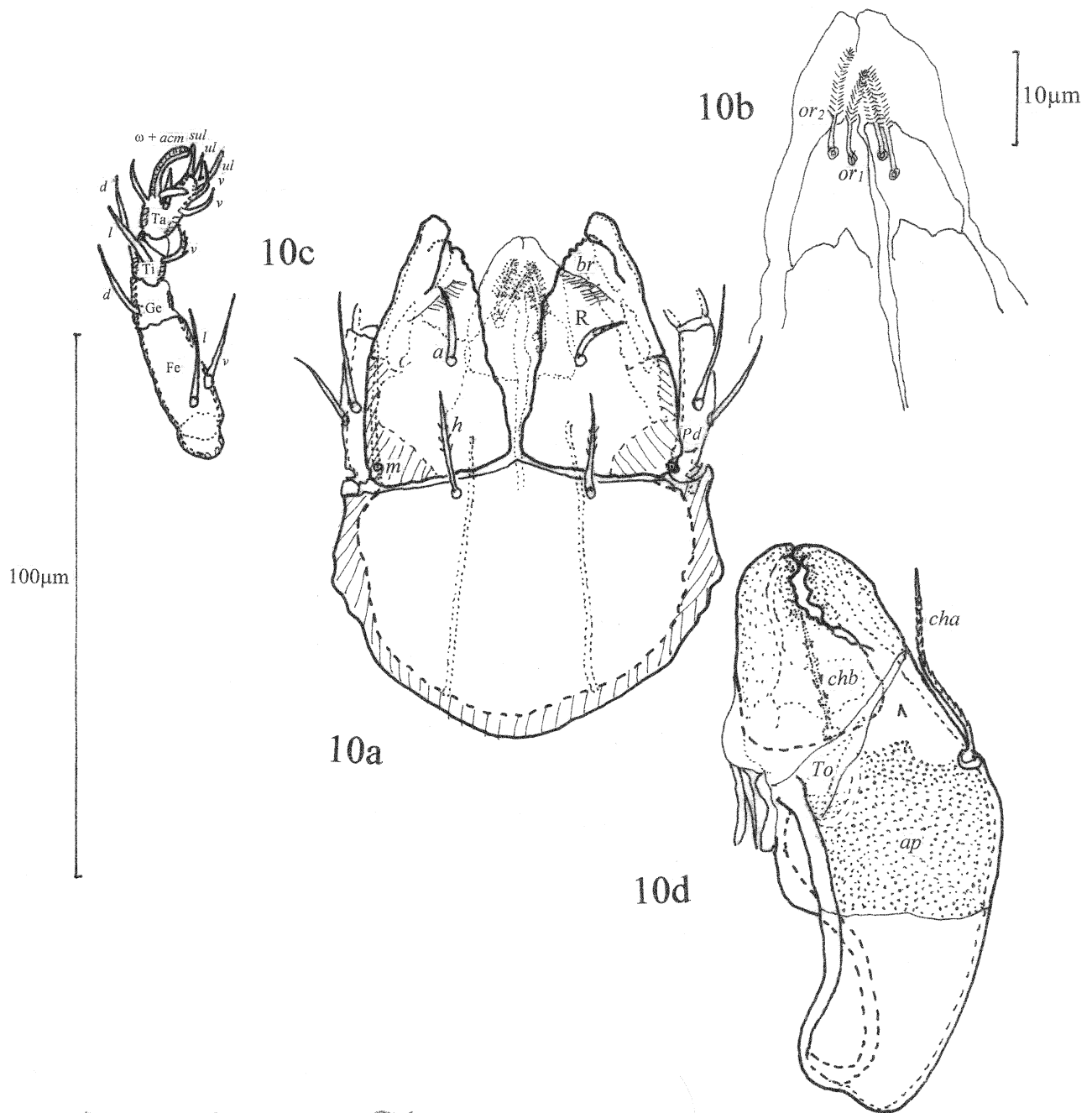


FIG. 10: *Protoribates rioensis* sp. n.; Mouthparts
(a) Infracapitulum; (b) Adoral setae; (c) Pedipalp; (d) Chelicerae



FIG. 11(a) *Protoribates rioensis* sp. n.; Epimeral region; (b). *Protoribates rioensis* sp. n.; Anal plates

romorph conspicuous, moveable, shape subtriangular (*pter*) (FIG. 8) with a thin inwardly folding edge (FIG. 7a) and a conspicuous hinged suture articulating with the notogaster antero-laterally. Ten pairs of very short and setae present on notogaster. Only the insertion canals of some anterior setae visible unlike the more conspicuous posterior setae. Four pairs of area porosae (Aa , A_1 , A_2 , A_3) present on the notogaster. A_1 situated in the uppermost median region of the slightly bulging notogaster, A_2 and A_3 located at the posterior edge. Glandulae abdominalis (*gla*) situated slightly posterior to seta h_3 . Lyrifissures *ia* and *im* present and visible from both dorsal and lateral views. Pedotecta I and II present in regions of acetabula I and II respectively. A scale located slightly anterior to acetabula III (FIG. 8). Circumpedal line (*cir. p.*) extending from a point close to the edge of the notogaster towards the anterior and terminating beneath the pteromorph.

Ventral Region

Mouthparts: Infracapitulum of diarthric type, labiogenal articulation at level of the base of pedipalp (FIGS 9 & 10) (Grandjean, 1957). All component parts similar in shape, form and structure to the infracapitulum of *P. osunensis* with the exception of

seta *a* which is ciliated (see FIGS 4a, b & 7a,b). Pedipalps and chelicerae (FIGS 10c,d) also similar to the pedipalps of *P. osunensis* (see FIGS 4c,d).

Coxisternal region: Epimeral surface also punctate and drawn into patterns ranging from circular to various polygonal shapes as in *P. osunensis*. Epimeral borders and apodemes weakly developed, sejugal apodeme (*apo sj*) longer than other apodemes. Epimeral setal formula 3:1:3:(2)3, with seta 4c either absent or represented by the insertion point (FIGS 9 & 11a). Insertion points of the epimeral setae distinctly sclerotized. A bi-lobed pedotectum II visible in the region of acetabulum II, a relatively large scale (*Sc*) present in the region of acetabulum III, partially covering a narrow discidium (*Dis*) whose custodial tip is concealed by adherent debris. Circumpedal line (*cir. p.*) originating from the region of acetabulum III.

Ano-genital region: The genital plates (GP) have a rooftop anterior portion and a concave posterior as in *P. osunensis*. In all specimens observed, each genital plate with 5 pairs of setae, arranged along a row closer to the inner than the outer edge of the plates (FIG. 11a). Three of the pairs of setae in anterior half, two in posterior half. Inner extensions of the insertion points of some of the setae clearly visible. One pair of aggenital setae present almost mid-way

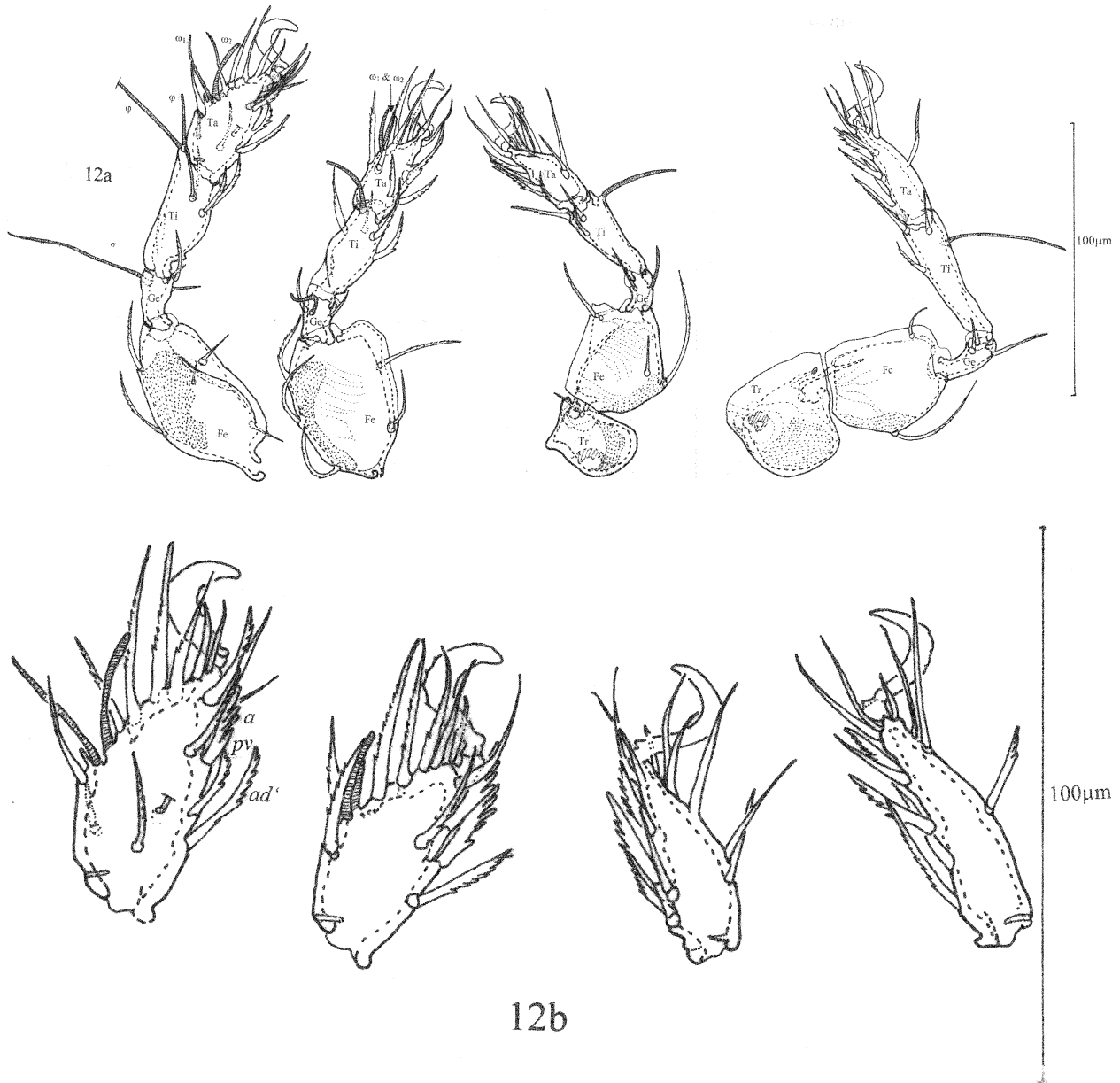


FIG. 12(a) *Protoribates rioensis* sp. n.; Legs; (b) *Protoribates rioensis* sp. n.; Tarsi of legs I-IV.

between the GP and anal plates (AP) (FIG. 9). Anterior edge of AP wavy, appearing concave, posterior edge convex (FIGS 9 & 11b). Each plate with two pairs of setae having conspicuous inner insertion points. Adanal setae ad_1 and ad_2 very long and ciliated, ad_3 very small and inconspicuous. Lyrifissures iad situated at the anterior lateral border of AP appearing incompletely divided into two parts (FIG. 9). A calyx-like structure formed by the internal pre-anal sclerite

(*pas*) and connected by muscles to a more anterior semi-circular internal sclerite present at the anterior region of AP.

Legs: Legs similar to legs of *P. osunensis* in relative lengths and general organisation. All monodactyl, setal formula: I (5-4-6-20-1), II (5-3-5-14-1), III (1-3-2-4-11-1), IV (1-2-2-4-11-1) including solenidia (FIG. 12a). Solenidiotaxy: I (1-2-2), II (1-1-2) III (1-1-0), IV

(0-1-0). Femur I with a ventro-lateral ridge, femora II, III & IV with rugose surfaces and ventral lamellar carina, femur III with spur-like ventral lamellar carina, all femora with relatively long and ciliate dorsal setae and porose areas (*ap*), trochanter of legs III & IV with porose areas, tibia II with a ventro-lateral ridge, the proximal part of tibia I and II with a small dens, each tarsus with lyrifissure (*lf*) and big, flattened and distinctly pectinate ventral setae (FIG. 12b). Solenidia of similar shape and relative lengths as the solenidia of *P. osunensis*.

REMARKS

WEIGMANN *et al.* (1993) redescribed the type species, *P. dentatus* (Berlese, 1883) in BERLESE's collection as well as fresh specimens collected from Slovakia. MIKO *et al.* (1994) also redescribed *P. lophotrichus* (Berlese, 1904) from BERLESE's collection as well as from fresh specimens collected from Italy and Slovakia. These two recent comprehensive works have removed all doubts on the morphological traits and taxonomic position of *Protoribates*.

Protoribates is indeed an haplozetid genus whose typical haplozetid traits include the following characteristics: the lamellar complex, the presence of a tutorial ridge, distinct discidium, moveable pteromorph and five pairs of genital setae (GRANDJEAN, 1953). MIKO *et al.* (1994) identified the principal morphological differences between *P. dentatus* and *P. lophotrichus* as body size, sensillus form, length and form of adanal and exobothridial setae, form and size of custodium and shape of femur II. These differences and others that have been considered not to be of generic value are highlighted in TABLE 1. This table also compares the differences in morphological traits between *P. osunensis* and *P. rioensis*. These differences which include the relative lengths of the prodorsal setae, shape of notogaster, relative position of area porosa *A*₂ and the glandula abdominalis (*gla*), presence of lyrifissures *ih* and *ips*, and shape of femur II, tibia I and tibia II. These differences are also not of generic value but they are enough to give each species a separate identity. There are also enough morphological differences between each of these two newly described species and *P. dentatus* on the

one hand as well as *P. lophotrichus* on the other. In *Protoribates osunensis* and *P. rioensis* both males and females are present, the males being generally smaller than the females as it is the case in *P. dentatus*. Occurrence of males is not common in *Protoribates*. Only females of *P. lophotrichus*, *P. capunicus*, *P. robustior* and *P. oblongus* have been recorded (MIKO *et al.*, 1994).

A survey of literature in the course of placing the newly described species, *P. osunensis* and *P. rioensis* in proper taxonomic perspective has revealed that certain families and genera of Oribatulidae should not have been created. The position of WEIGMANN *et al.* (1993) that the definitions of the Families Protoribatidae and Xylobatidae were not based on characters with phylogenetic value appears to be correct. The genera *Protoribates* and its synonym *Xylobates*, should both belong to the Family Haplozetidae. Moreover, a Xylobatid genus, *Brasilobates* that was created by Pérez-Iñigo and Baggio (1980) differs in definition from *Protoribates* in the possession of exclusively tridactylous legs. Although the original description of *Protoribates* s. str. by BERLESE (1908) was “Ungue pedum singulo” (i.e. monodactylous), BERLESE (1916) later changed this definition to “Ungue pedum terni” (tridactylous) when he found tridactylous tarsi in some specimens of *P. dentatus*. *Brasilobates* can therefore not be a separate genus from *Protoribates* on the basis of tridactylous legs for two reasons. The first is that the tridactylous condition also occurs in *Protoribates* and secondly, the number of claws on legs in this case does not have a generic value, moreso when it is not considered in combination with other distinct morphological characters. The redescription of *P. dentatus* by WEIGMANN *et al.* (1993) has revealed beyond doubts that there is a remarkable variability in the number of claws on the legs of *Protoribates*. This variability can actually be seen by a keen observer on the original illustration of *Oribates dentatus* Berlese, 1883, the type species of the genus *Protoribates* Berlese, 1908, which is now known as *P. dentatus* (WEIGMANN *et al.* 1993). The descriptions of all *Brasilobates* species in literature (e.g. *B. bipilis* Pérez-Iñigo and Baggio, 1980; *B. obtusus* Mihelcic, 1956; *B. maximus* Mahunka, 1988, *B. spinosus* Fujita, 1989; *B. durbanensis* van Pletzen, 1963; *B. punctata* Grobler, 1991) and a thorough

Morphological features	<i>P. dentatus</i> BERLESE, 1883	<i>P. lophotrichus</i> BERLESE, 1904	<i>P. osunensis</i> sp. n.	<i>P. rioensis</i> sp. n.
Size (l: length, w: width)	l = males: 470-520 μ m females: 545-555 μ m w = not provided	l = females: 525-565 μ m w = not provided	l = males: 338-347 μ m females: 393-410 μ m w = males: 200-214 μ m females: 238-250 μ m	l = males: 333-369 μ m females: 381-405 μ m w = males: 188-226 μ m females: 231-245 μ m
Prodorsum anterior border prolamella sublamella length of prodorsal setae lateral carina sensillus exobothridial setae	- rounded - absent - short - $la = in > ro$ - absent - lanceolate - comparatively long (30 μ m)	- indistinct biapical i.e. (emarginate) - absent - short - $la = in > ro$ - present - setiform - short (15 μ m)	- truncate - short - absent - $la = in > ro$ - present - lanceolate - only insertion points present	- emarginate - short - absent - $la > in = ro$ - present - lanceolate - only insertion points present
Notogaster anterior border areae porosae glandulae abdominalis lyrifissures	- slightly convex - A_1 lateral - A_2 between seta h_2 and h_3 - between A_1 and A_2 - ih and ips assumed to be present	- distinctly convex - A_1 dorsal - A_2 between seta h_2 and h_3 - between A_1 and A_2 - ih and ips present	- not convex - A_1 dorsal - A_2 between seta h_2 and h_3 - slightly anterior to A_1 - ih and ips present	- slightly convex - A_1 dorsal - A_2 at the posterior edge of the notogaster between seta h_2 nad ps_1 between A_1 and A_2 - ih and ips absent
Epimeral setation	3:1:3:3	3:1:3:3	3:1:3:3	3:1:3:(2)3
Legs Claws spur-like ventral carina on femur dens on tibia ventro-lateral ridge on Tibia	- Mono- or heterodactylous - present on femur II - small dens on tibia II - absent	- Mono- or heterodactylous - absent - inconspicuous dens on tibia I and II - absent	- all monodactylous - absent - inconspicuous dens on tibia I and II - absent	- all monodactylous - present on Femur III - small dens present on tibia I and II - present on Tibia II
Adanal setae	- ad_2 remarkably shorter than ad_1	- ad_2 almost of the same length as ad_1	- ad_2 almost of the same length as ad_1	- ad_2 almost of the same length as ad_1

TABLE 1: Morphological differences between *P. dentatus*, *P. lophotrichus*, *P. osunensis* sp. n. and *P. rioensis* sp. n.

examination of all the illustrations made by the authors have not revealed any trait of phylogenetic value that could be used to justify a separate generic status for *Brasilobates* in the Family Haplozetidae. Therefore it is our opinion that *Brasilobates* should be regarded as a synonym of *Protoribates*.

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