

THALASSOZETES BARBARA N. SP. (ACARI, ORIBATIDA), A NEW INTERTIDAL SPECIES FROM THE COAST OF BARBADOS

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(Received 22 May 2013; accepted 26 June 2013; published online 19 December 2013)

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ABSTRACT — The new intertidal oribatid mite species *Thalassozetes barbara* n. sp. is characterised by a specific gastronomic cuticular reticulate pattern, 14 pairs of very short and blunt notogastral setae and long lamellar ridges. The occurrence on the island of Barbados represents the first record of the genus *Thalassozetes* in the Atlantic Ocean.

KEYWORDS — Selenoribatidae; Lesser Antilles; morphology; biogeography; *Rhizophobates*

INTRODUCTION

The Selenoribatidae represent a truly intertidal oribatid mite family. These mites dwell exclusively in the littoral zone of tropical and subtropical coasts (Schuster 1989, Procheş and Marshall 2001). This family includes seven genera, *Arotrobates* Luxton, 1992, *Carinozetes* Pfingstl and Schuster, 2012, *Pseudonobates* Luxton, 1992, *Rhizophobates* Karasawa and Aoki, 2005, *Schusteria* Grandjean, 1968, *Selenoribat*es Strenzke, 1961 and *Thalassozetes* Schuster, 1963, whereas all of these genera are not very species rich. *Pseudonobates* and *Rhizophobates* are monotypic and the most diverse genus *Schusteria* contains five species. However, a recent study (Pfingstl and Schuster 2012) demonstrated that certain taxa are much wider distributed than formerly supposed and that the diversity of Selenoribatidae may exceed known numbers considerably as there are still many uncharted geographic areas in respect of intertidal arthropods. The same may apply to the genus *Thalassozetes*. Since the description of the

type species *Thalassozetes riparius* (Schuster 1963) from the Mediterranean Sea this genus has long been monotypic. Talker *et al.* (1981) reported *Thalassozetes* from the Philippines but these specimens have never been determined nor officially described as a new species. So, nearly thirty years later, Bayartogtokh and Chatterjee (2010) discovered the second named species, *T. tenuisetosus* in the Arabian Sea. Now, a third species was found on the Island of Barbados in the Caribbean Sea, revealing the presence of this genus in the Western Atlantic Ocean.

The present paper describes this new species in detail and discusses the taxonomy and the geographic distribution of the genus *Thalassozetes*.

MATERIALS AND METHODS

Patches of intertidal algae growing on rocks were collected on the Island of Barbados and afterwards put in a Berlese-Tullgren apparatus for the extraction of mites. For investigation in transmitted light

all animals were stored in pure ethanol, then heated in lactic acid (80 °C for about 20 minutes) and afterwards embedded in BERLESE mountant. Observations, photographs and drawings were made with an Olympus BH-2 Microscope equipped with a drawing attachment. Image stacks were obtained by an Olympus E1 digital camera and layered with the Combine ZP software. Inscriptions of drawings were done according to Grandjean (1966, 1968).

RESULTS

Family Selenoribatidae Schuster, 1963

Genus *Thalassozetes* Schuster, 1963

Small sized (259 – 346 µm body length) intertidal mites. Cerotegument granular. Interlamellar setae short or minute. Lamellar ridges always present. Sensillus clavate. Notogaster with 13-14 pairs of setae. Epimeral setation 1-0-1-1/2. Genital setae 3 pairs. Three pairs of adanal setae and 2 pairs of anal setae. Claws with one proximoventral tooth. Famulus very short or knob-like. Juveniles plicate with large centrodorsal plate.

Thalassozetes barbara n. sp.

Type locality — Barbados, Bathsheba Beach, 13°12'50"N, 59°31'18"W, upper eulittoral zone, *Bostrychia tenella* and other algae growing on rocks, 29 August 2012.

Type specimen — Holotype: male, preserved in pure ethanol, deposition: Naturhistorisches Museum Wien, collection nr. NHMW 21887.

Paratypes — 2 males; Barbados, Enterprise Beach near Oistins, 13°03'36"N, 59°32'20"W, upper eulittoral zone, diverse algae growing on rocks, 25 August 2012; deposition: Senckenberg Museum für Naturkunde Görlitz, collection Nr. 12/48679.

Diagnosis — Dark brown sclerotized mites. Mean length 274 µm, mean width 174 µm. Cuticle of notogaster showing specific obvious reticulate pattern. Lamellar ridges conspicuous and long. A pair of short longitudinal ridges on anterior part of notogaster. Fourteen pairs of very short and blunt notogastral setae. Median depression on epimeron

I present. Three pairs of genital setae. Three pairs of adanal and two pairs of anal setae. Legs monodactylous with large claw. No porose areas on femora discernable. Leg setation (trochanter to tarsus, chaetome, solenidia):

Leg I 0-3-2-3-18, 1-2-2;

leg II 0-3-2-3-15, 1-1-1;

leg III 1-2-1-2-13, 1-1-0;

leg IV 1-2-1-3-12, 0-1-0.

Description — Adult: females (n=4), length: 274 – 286 µm (mean 279 µm), width: 184 – 186 µm (mean 185 µm); males (n=7), length: 259 – 278 µm (mean 272 µm), width: 160 – 179 µm (mean 168 µm).

Integument — Colour dark brown. Cuticle of notogaster with irregular circular depressions forming a reticulate pattern. Cerotegument thick and basically granular.

Prodorsum — Cerotegument slightly granular. Rostrum rounded in dorsal view, but slightly projecting anteroventrally in lateral view. Rostrum clearly demarcated from remainder of prodorsum by a transverse ridge. Rostral setae (*ro*) minute, hardly discernable. Lamellar setae (*le*) very short and blunt, interlamellar setae (*in*) exiguous. One pair of minute exobothridial setae (*ex*). Lamellar ridges conspicuous and long, surmounting lamellar setae anteriorly. Bothridia large and thick cuticular cups, laterally opened. Sensilla clavate and short (ca. 35 – 40 µm), proximal part completely smooth, distal head densely spinose. A lighter area between bothridia reaching from lamellar ridges to dorsose-jugal suture.

Gnathosoma — Pedipalp pentamerous 0-2-1-3-9 (including solenidion) (Fig. 1A). Solenidion ω on palptarsus erect, not associated with eupathidium *acm*. Chelicerae chelate, each digit with two teeth. A large porose area on proximodorsal part of fixed digit. Seta *cha* and *chb* robust, dorsally dentate, both approximately the same length. Trägårdh's organ normal. Rutellum triangular, distal part developed as thin curved inward membrane, medially incised (Fig. 1B). Seta *a* and *m* long and dentate. Mentum regular, seta *h* long and smooth.

Notogaster — (Figs. 2A, 2C and 3A). Rounded in dorsal view, convex in lateral view. Dorsose-jugal suture complete but medially weakly devel-

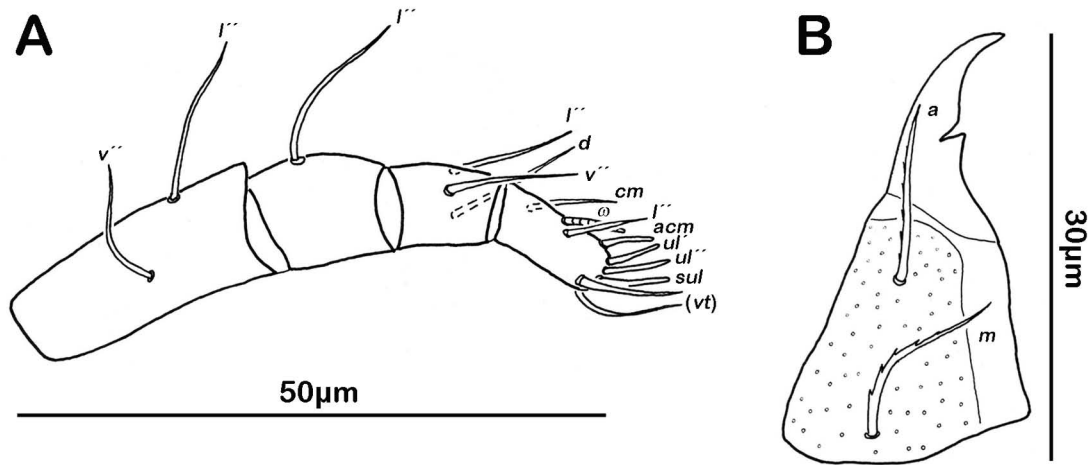


FIGURE 1: *Thalassozetes barbara* mouthparts. A – right pedipalp antiaxial view; B – right rutellum ventral view.

oped. Median rectangular light spot adjacent to anterior border of notogaster. Cuticle in centre of notogaster with irregular small circular depressions forming an irregular reticulate overall pattern (Fig. 4A). This pattern fades into a uniform granulation in lateral areas of gastronic region (Fig. 4B). A pair of concave and parallel ridges on anterior part of notogaster. Laterally of these ridges, elliptical cavities showing fine granular surface. Fourteen pairs of very short and blunt notogastral setae, c_{1-2} , da , dm , dp , la , lm , lp , h_{1-3} , p_{1-3} (approximate length 2 – 5µm); c_3 absent. Porose areas or distinct pores absent. Five pairs of notogastral lyrifissures present; ia next to notogastral ridges and nearly parallel to anterior notogastral border; im obliquely, next to seta c_2 ; lyrifissure ih next to seta lp ; ips anterior to seta p_3 and ip between setae p_2 and p_1 . Orifice of opisthonotal gland (gla) posterior and close to lyrifissure im .

Lateral aspect — (Fig. 2C). Cerotegument generally finely granular, larger granules in areas surrounding acetabula. Pedotectum I small, pedotectum II absent. Lateral parts of sejugal furrow broad and deep, showing conspicuous granules. Next to lateral border of bothridium triangular protrusion orientated caudally. Lateral enantiophyse present, anterior projection triangular, well developed, posterior protrusion triangular and small. Discidium developed as strongly projecting triangular bulge between acetabula III and IV.

Ventral region of idiosoma — (Figs. 2B, 3B). Cuticle basically granular, larger granules and darker colouration next to acetabula, anterior and posterior of genital orifice and laterad of anal opening. Epimeral setation 1-0-1-1, seta $1b$ long reaching trochanter III, setae $3b$ and $4a$ short and thin. Internal borders of all epimera well visible, sternal apodemes II, sejugal and III well developed. A densely granulated median sternal cavity on epimeron I, lateral borders slightly concave. Three pairs of short and fine genital setae, arranged in longitudinal rows. Insertion of tendon β next to anterior corners of genital orifice. Aggenital setae absent. Anal valves triangular. Preanal organ triangular in ventral view. Two pairs of short anal setae, an_{1-2} , arranged in a longitudinal row. Three pairs of short and simple adanal setae, ad_{1-2} flanking anal orifice, ad_3 posterior of anal valves. Lyrifissure iad slightly oblique and adjacent to anterior corners of anal opening.

Legs — (Fig. 5). Monodactylous. Long hook-like claws with one small proximoventral tooth. Cuticle granular, larger granules and darker colouration on all trochanters, femora and genua. Femora with slightly projecting ventral carinae. Proximal lyrifissure present on all tarsi. No porose areas on femora discernible. Antiaxial lateral seta of genu robust and blunt. Ventral setae of tarsus dentate. Famulus ϵ developed as a short broad knob. Solenidia φ_1

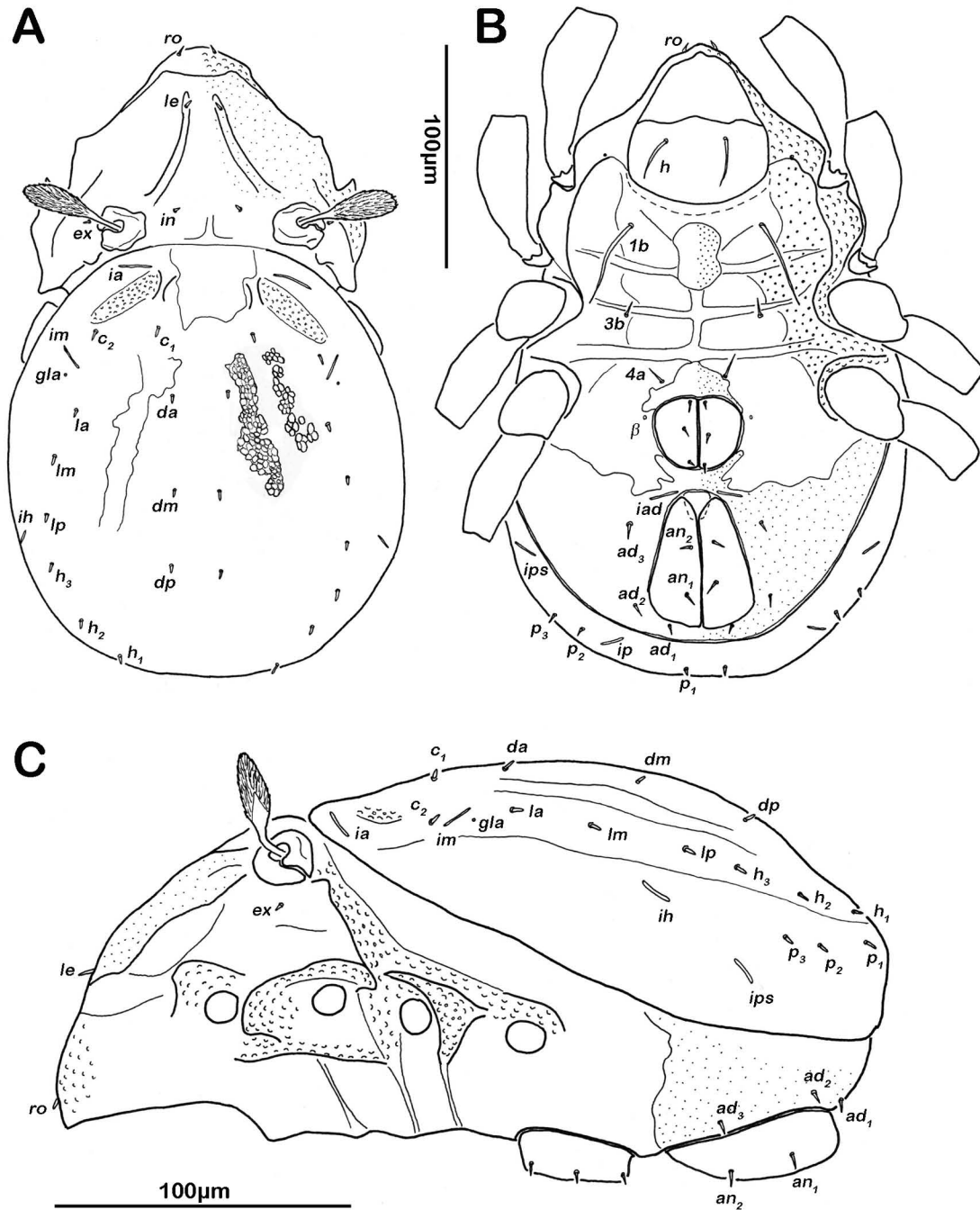


FIGURE 2: *Thalassozetes barbara* adult. A – dorsal view; B – ventral view; C – lateral view.

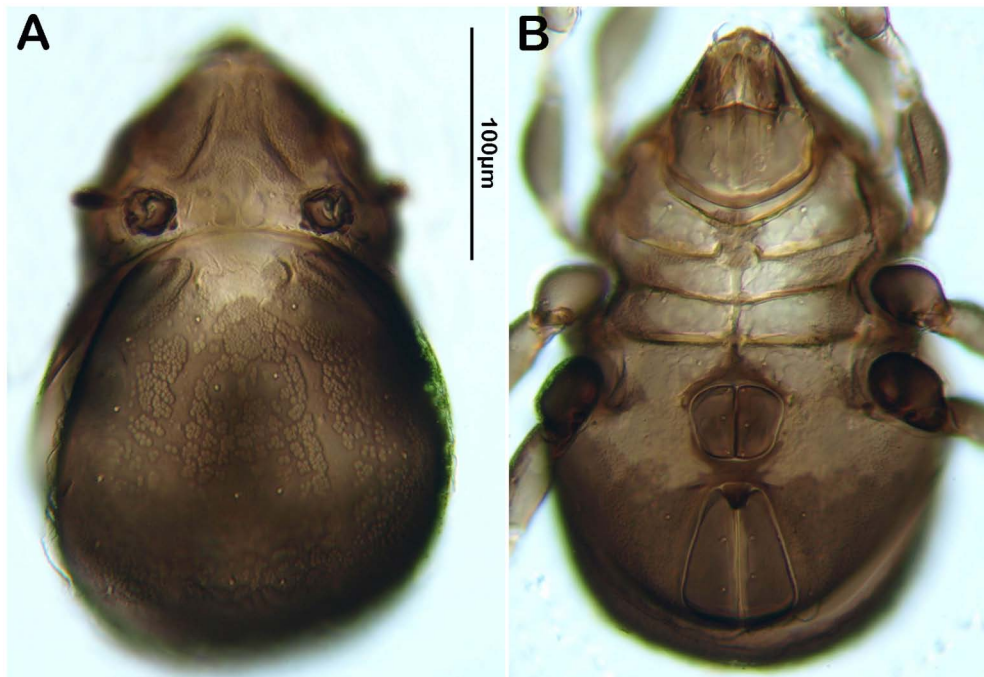


FIGURE 3: *Thalassozetes barbara* adult micrographs layered from 5-10 sequentially focused images. A – dorsal view; B – ventral view.

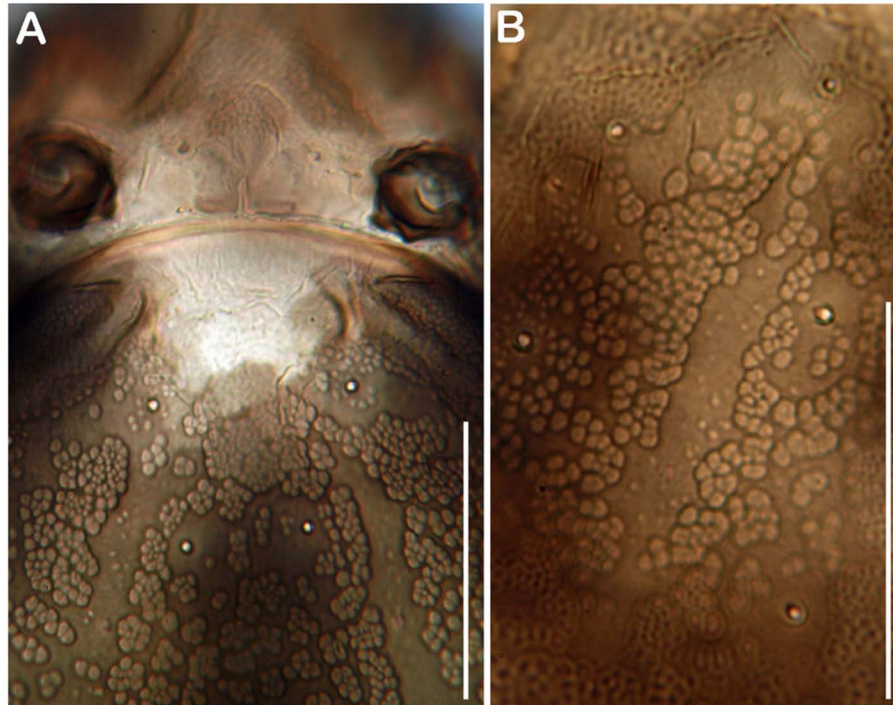


FIGURE 4: *Thalassozetes barbara* adult micrographs. A – cuticular structures on gastronomic region; B – detailed view on cuticular gastronomic structures. Scale bars = 50 µm.

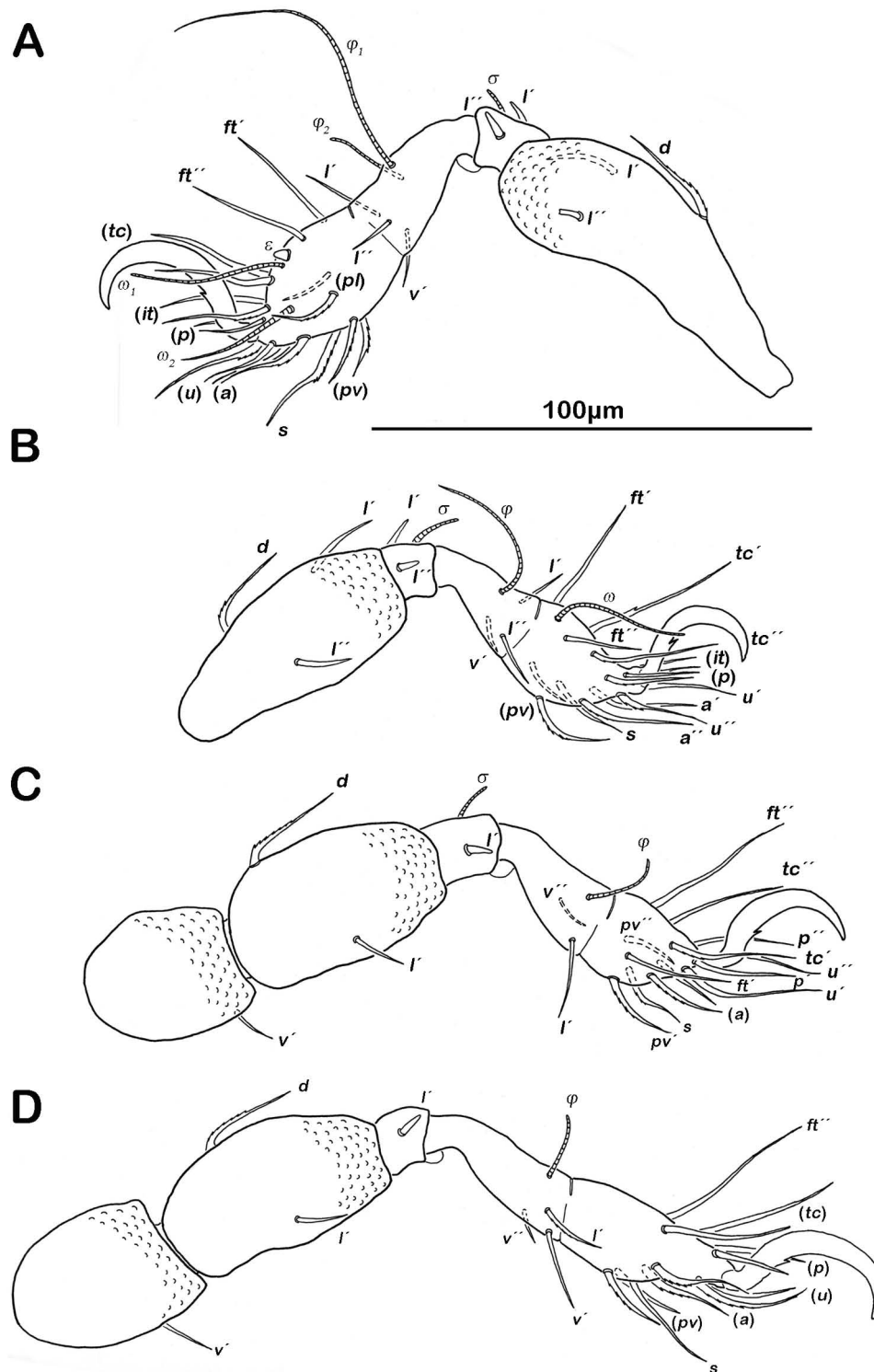


FIGURE 5: *Thalassozetes barbara* adult legs antiaxial view. A – left leg I; B – right leg II; C – left leg III; D – left leg IV.

TABLE 1: Comparison of taxonomically important characters shown in *Thalassozetes* species.

	<i>T. riparius</i>	<i>T. tenuisetosus</i>	<i>T. barbara</i>
length (µm)	298-318	334-346	274-286
lamellar ridges	present	present	present
sensilla	clavate	clavate	clavate
in	short	normal	short
ex	minute	vestigial	minute
gastronotic ridges	present	absent	present
notogastral setae	13 (h1 missing)	14	14
epimeral setation	1-0-1-1	1-0-1-2	1-0-1-1
epimeral cavity	present	absent	present
genital setae	3	3	3
adanal setae	3	3	3
anal setae	2	2	2

on tibia I long and orientated backwards at base.

Etymology — The species name refers to the name of my spouse Barbara, who always supported me and my interest in research. She has tolerated my passion for the little mites for many years and moreover she accompanied me on my research trip to the beautiful island of Barbados, where the new species was found. The name is given as noun in apposition.

DISCUSSION

The diagnosis of the genus *Thalassozetes* has been solely based on the morphological features of the type species *T. riparius* for a long time. With the description of the second species *T. tenuisetosus* (Bayartogtokh and Chatterjee 2010) this diagnosis was slightly widened and included for example the possession of two setae on epimeron IV, 13-15 pairs of notogastral setae and 2-3 adanal setae. The new species *T. barbara* clearly shows the typical characteristics of the genus, whereas it conforms in most morphological features to *T. riparius*. These two species share anterior gastronotic ridges, the epimeral cavity on epimeron I and the short knob-like famulus on tarsus I (Table 1). Therefore these species are supposed to be closer related to each

other than to *T. tenuisetosus*. In the genus diagnosis given by Bayartogtokh and Chatterjee (2010) morphological features of *Rhizophobates shimojanai*, *Schusteria melanomerus* and *S. ugraseni* were also included, as Subías (2004, update 2013), prior to this, had transferred these species to *Thalassozetes*. Pfingstl and Schuster (2012) already stated that this taxonomic act was not justified because these species clearly diverge from the *Thalassozetes* specific morphology and therefore should be retained in their original genera. Accordingly the possession of 15 pairs of gastronotic setae and two pairs of adanal setae, shown in the respective species, are not typical for the genus *Thalassozetes* and should be removed from the diagnosis.

Grandjean (1968) compared the genera *Thalassozetes*, *Selenoribates* and *Schusteria* and stated that anterior notogastral foveae separated by longitudinal ridges are only shown in *Selenoribates* species. Meanwhile Pfingstl and Schuster (2012) demonstrated that similar structures are present in the selenoribatid genus *Carinozetes* and now *T. barbara* also exhibits this morphological feature. This trait may have evolved convergently within these respective taxa and may represent an adaptation to the intertidal lifestyle, whereas neither a functional nor an ecological correlation could yet be detected.

However, another trait which is clearly related to the littoral environment is the strongly granular surface of selenoribatid mites. Pfingstl and Schuster (2012) demonstrated that the obvious granulation of certain body surfaces in *Carinozetes* species retains a layer of air during tidal inundation and allows the animals to breathe underwater. Although there are no in vitro observations of *T. barbara*, it is assumable that the strongly granulated areas surrounding the acetabula and certain other body regions are involved in the formation of a respiratory plastron system.

The known distribution pattern of the genus *Thalassozetes* is based on only a few scattered and distant records. Schuster (1977) reported *T. riparius* from the Adriatic coast and the Black Sea, Talker *et al.* (1981) found an undetermined *Thalassozetes* species on the Philippines in the Indo-Pacific and *T. tenuisetosus* was recorded from the Indian coast in the Arabian Sea. The discovery of *T. barbara* from the island of Barbados is the first record of a *Thalassozetes* species from the Atlantic Ocean. The large distributional gaps among all of the records indicate the incompleteness of sampling activities and a much wider distribution of *Thalassozetes* species along coasts of the Atlantic, Caribbean and Indo-Pacific Ocean should be assumed.

ACKNOWLEDGEMENTS

I want to thank Susan Mahon Director of McGill Bellairs Research Institute for showing great hospitality and providing the lab and accommodation on Barbados. I am also grateful to Wolfgang Sterrer for his advices concerning appropriate research locations in the Caribbean. Thanks to Reinhart Schuster for supporting my research on intertidal mites. The research was funded by the Austrian Science Fund (FWF): [J3150].

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