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# Pterygosomatid mites from Cuba, with the description of a new species of *Bertrandiella* (Acari: Prostigmata: Pterygosomatidae)

## Ácaros pterigosomátidos de Cuba, con la descripción de una especie nueva de *Bertrandiella* (Acari: Prostigmata: Pterygosomatidae)

Ricardo Paredes-León[1]✉, Naomi Cuervo-Pineda[2] and Tila M. Pérez[1]

[1]*Colección Nacional de Ácaros, Departamento de Zoología, Instituto de Biología, Universidad Nacional Autónoma de México. Tercer circuito exterior s/n, anexo al Jardín Botánico Exterior, 04510 México, D. F., México.*
[2]*Colección Acarológica, Subdirección Colecciones Zoológicas, Instituto de Ecología y Sistemática, Carretera de Varona Km 3.5, Capdevila, Boyeros. Apartado postal 8029, 10800 Ciudad de la Habana, Cuba.*
✉ *rparedes@st.ib.unam.mx*

**Abstract.** *Bertrandiella griseldae*, new species is described based on specimens found on the gecko *Tarentola americana*. Additionally, the female of *Geckobiella javieri* is described for the first time, new data for larvae and deutonymphs are presented, and a summary of the leg chaetotaxy for *Geckobia tarentolae* is reported. A taxonomic identification key for the mite species of Pterygosomatidae ectoparasitic on lizards from Cuba is also provided.

Key words: *Geckobia*, *Geckobiella*, *Bertrandiella*, ectoparasitic, Phyllodactylidae, Gekkonidae, Iguanidae.

**Resumen.** Se describe a *Bertrandiella griseldae*, especie nueva con base en ejemplares recolectados sobre el gecko *Tarentola americana*. Adicionalmente, se describe por primera vez la hembra de *Geckobiella javieri*, se presentan nuevos datos para las larvas y deutoninfas, y se completan los datos de la quetotaxia de las patas para *Geckobia tarentolae*. Se presenta una clave de identificación taxonómica para las especies de ácaros de la familia Pterygosomatidae, ectoparásitos de lagartijas en Cuba.

Palabras clave: *Geckobia*, *Geckobiella*, *Bertrandiella*, ectoparásito, Phyllodactylidae, Gekkonidae, Iguanidae.

### Introduction

The family Pterygosomatidae Oudemans 1910 (Acari: Prostigmata) includes 162 species of mainly obligate ectoparasitic mites of lizards, although some species can be found on arthropods, and 2 species have been recorded occasionally on turtles and doves. The family has a worldwide distribution (Bochkov and OConnor, 2006). These mites feed on body fluids apparently without harming their host, but in some cases they can inflict some pathological disorders, including anemia and an intense skin itch (Baker, 1998; Walter and Proctor, 1999). Besides these, apparently, some species are vectors of protozoan that cause diseases in lizards (Goodwing, 1954; Newell and Ryckman, 1964; Walter and Shaw, 2002).

There are 4 species of pterygosomatid mites reported for Cuba. *Geckobia tarentolae* de la Cruz, 1973 was described based on females, males and nymphs (probably deutonymphs) that were collected parasitizing the geckonid lizard *Tarentola americana* (Gray, 1831) (Phyllodactylidae) from Villa Clara. Another species was collected on the same host, but from a different locality (La Habana), and it was erroneously determined as *Hirstiella otophila* Hunter and Loomis 1966 (now *Bertrandiella otophila*) by de la Cruz (1973). The third species was collected on the endemic iguana *Cyclura nubila nubila* (Gray, 1831) (Iguanidae) from Granma, and it was described as the type species of a new genus named *Cyclurobia javieri* de la Cruz, 1984 (now *Geckobiella javieri*). The taxonomic validity of the monotypic genus *Cyclurobia* was uncertain because the description of the type species was based only on males and immatures (deutonymphs and larvae), instead of females, as in the other genera of Pterygosomatidae. Currently, *Cyclurobia* is a junior synonym of *Geckobiella* (Paredes-León et al., 2012). The fourth species, *Geckobia hemidactyli* Lawrence 1936, was recorded at Bahía de Guantánamo on the introduced geckonid lizard *Hemidactylus mabouia* (Moreau de Jonnès, 1818); seemingly, *G. hemidactyli* arrived together with *H. mabouia* in Transatlantic dispersal events (Martínez-Rivera et al., 2003).

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Based on the analysis of type material of the above mentioned species, and specimens subsequently collected in Cuba, we describe a new species of *Bertrandiella,* from the specimens previously determined by de la Cruz (1973) as *Hirstiella otophila*. We also describe, for the first time, the female of *Geckobiella javieri*, and present new data of setation (idiosomal and leg) for immature stages, and describe the leg setation formula for *Geckobia tarentolae*.

## Materials and methods

Type material and voucher specimens of Cuban pterygosomatid mites from 2 acarological collections were examined: Colección Acarológica, Instituto de Ecología y Sistemática (IESCA), La Habana, Cuba; and Acarology Laboratory, Ohio State University (OSAL), Columbus, Ohio, USA. Specimens of closely related species deposited at The Natural History Museum (BM(NH)), London, UK and Colección Nacional de Ácaros (CNAC), Instituto de Biología, Universidad Nacional Autónoma de México were also analyzed for comparative purposes. Specimens of *Geckobia hemidactyli* from Cuba were not available but we carried out a diagnosis based on specimens from Brazil. Additional specimens of pterygosomatid mites were collected from 2 wild iguanas *Cyclura n. nubila* in Cuba, and from alcohol preserved iguanas deposited at herpetological collection of the Instituto de Ecología y Sistemática (IES). These latter mite specimens were deposited at CNAC and IESCA.

Fresh mites were cleared and mounted in microscope slides using Hoyer as preservation medium. All mites were observed under a Nikon Optiphot compound optical microscope (with phase contrast and differential interference contrast illumination). Figures were made with the aid of a camera lucida tube adapted to a microscope, and measurements were taken with an objective with a graduated rule. One specimen of *Geckobiella javieri* was prepared for scanning electron microscopy (SEM) following the protocol given by Alberti and Nuzzaci (1996), and micrographs were obtained using a Hitachi S-2460N SEM microscope. All measurements are given in micrometers.

Palpal, idiosomal and leg setation follows Granjeans's nomenclature (Grandjean, 1939, 1944, 1946) as implemented for Pterygosomatidae by Bochkov and OConnor (2006), Bochkov et al. (2008) and Paredes-León et al. (2012). Abbreviations used in descriptions and figures are for gnathosoma: *n*: subcapitular ventral setae, *d:* dorsal setae on palps, *l*: anterolateral setae on palps, *v*: ventral setae on palps, *lT*: lateral setae on palpal tibia, $\omega$: basal solenidion on palpal tarsus; idiosoma: *1a:* innermost (first) pair of coxal-sternal setae associated with coxae of legs I, *1b*: second pair of coxal-sternal setae associated with coxae of legs I, *2a*: innermost (first) pair of coxal-sternal setae associated with coxae of legs II, *2b*: second pair of coxal-sternal setae associated with coxae of legs II, *3a:* innermost (first) pair of coxal-sternal setae located between coxae of legs III, *3b*: second pair of coxal-sternal setae associated with coxae of legs III, *3c*: third pair of coxal-sternal setae associated with coxae of legs III, *3d*: fourth pair of coxal-sternal setae associated with coxae of legs III, *4a:* innermost (first) pair of coxal-sternal setae located between coxae of legs IV, *4c*: third pair of coxal-sternal setae associated with coxae of legs IV, *vi*: internal pair of vertical setae on prodorsum, *ve*: external pair of vertical setae on prodorsum, *sci*: internal pair of scapular setae on prodorsum, *sce*: external pair of scapular setae on prodorsum, *c1:* innermost (first) pair of setae in first series or row (segment C) on hysterosoma, *c2*: second pair of setae in segment C on hysterosoma, *c3*: third pair of setae in segment C on hysterosoma, *d1*: innermost (first) pair of setae in second series or row (segment D) on hysterosoma, *d2*: second pair of setae in segment D on hysterosoma, *e1*: innermost (first) pair of setae in third series or row (segment E) on hysterosoma, *e2*: second pair of setae in segment E on hysterosoma, *f1*: innermost (first) pair of setae in fourth series or row (segment F) on hysterosoma, *f2*: second pair of setae in segment F on hysterosoma, *h1*: innermost (first) pair of setae in fifth series or row (segment H) on hysterosoma, *h2*: second pair of setae in segment H on hysterosoma, *ps1*: first pair of pseudanal setae, *ps2*: second pair of pseudanal setae, *ps3*: third pair of pseudanal setae, *g1*: genital seta, *ag1*: first pair of aggenital (pregenital) setae, *ag2*: second pair of aggenital (pregenital) setae, *ag3*: third pair of aggenital (pregenital) setae; legs: $\omega 1$: distal or medium solenidion on tarsus I, $\omega 2$: proximal solenidion on tarsus I, $\omega$: solenidia on tarsi II-III, *ft*: fastigial seta on tarsus I, *p*: proral setae on tarsi I-IV, *u*: unguinal setae on tarsi I-IV, *tc*: tectal setae on tarsi I-IV, *a*: antilateral setae on tarsi I-IV, *pl*: primilateral setae on tarsus I, *it*: iteral setae on tarsus I, *vs*: ventral subunguinal setae on tarsi I-IV, $\kappa$: minute specialized seta found distodorsally on genu I, *d*: dorsal seta on podomeres (trochanters to tibiae), *v*: ventral setae on podomeres (trochanters to tibiae), *l*: lateral setae on podomeres (trochanters to tibiae), the prime (') indicate the anterior seta of a pair, the second (") indicate the posterior seta of a pair, setae in brackets indicate both of a pair present. WVI: width between setal pair *vi* on prodorsal shield, WVE: width between setal pair *ve* on prodorsal shield, WSCI: width between setal pair *sci* on prodorsal shield, WC1: width between setal pair *c1* on prodorsal shield. For the numeration of tarsal solenidia we give the number 1 (*i.e.*, $\omega 1$) to the first appearing during

ontogeny and the second the number 2 (*ω2*) following Evans (1992).

**Descriptions**

***Bertrandiella griseldae*** Paredes-León, Cuervo-Pineda et Pérez, sp. nov. (Figs. 1, 2)

*Diagnosis*. Adult female with 2 solenidia on tarsi I (*ω1* and *ω2*); seta *ft* subequal in length to solenidion *ω1*; prodorsal shield shaped as an inverted equilateral triangle with posterior end acute.

*Description. Based on holotype female.* Gnathosoma (Figs. 1A, B): dorsal subcapitulum with broad anterolateral flange, and ventrally with pair of strongly barbed infracapitular setae (*n*); palps slightly longer than subcapitulum; hypostome tubular and short, as long as palps. Palpal femur and genu wider than long, with 1 seta *d* each, femoral seta longer, wider and pectinate, while genual seta sparsely barbed; palpal tibia slightly longer than wide and with 3 setae (*l'*, *lT* and *v*) shorter than those of femur and genu; *lT* short and simple, *l'* longest, broad and sparsely barbed and *v* with broad and nude stalk ending in thick brush-like structure; tibial claw simple, curved and long, as long as tibial length; tarsus very reduced and round with *ω* and 5 long thin setae, 2 of them sparsely barbed, and 3 simple. Chelicerae longer than palps, with basal part globose, and fivefold wider than distal part; fixed digit membranous and spiniform, movable digit robust and outward curved. Emergent peritreme short, never reaching femoral seta *d*. Idiosoma: oligotrichous and ovoid, longer than wide, maximal wide between setae *c2* and *d2*; cuticle striate except in prodorsal shield, setal platelets and part of anogenital area. Dorsum: prodorsal shield shaped as an inverted equilateral triangle with 3 pairs of long and peripectinate setae (*vi*, *ve* and *sci*); 1 pair of eyes located anteriorly, each eye associated with seta *sce* in a platelet; dorsal setae peripectinate and long, each transversal row of setae reaching next row; setae *c3* absent. Anal area located forward of posterior tip with setae *ps* arboriform (extensively peripectinate), subequal in length and shorter than rest of dorsal setae, particularly (*ps2-3*) (Fig. 1D). Venter: setae: coxal formula 2-2-4-2 (*1a*, *1b - 2a*, *2b - 3a*, *3b*, *3c*, *3d - 4a*, *4c*) on coxae I-IV respectively except for *3a* on intercoxal area and *4a* between coxae IV; *1a*, *2a* and *3b* simple, *3a* and *4a* sparsely barbed, *1b*, *2b*, *3c*, *3d* and *4c* thick and peripectinate. Setae *ag1-3* thick and peripectinate, slightly longer than coxal setae, (*ag3*) longest, *g1* peripectinate and subequal in length to (*ag1-2*) (Fig. 1E). Legs: longer than idiosoma, leg I longest. All setae on trochanter-tibia I-IV pectinate and long, some of them as long as each podomere. Seta *d* on tibiae I, III and IV with deep goblet-shaped base. Tarsi I-IV getting thinner from proximal to distal end, and with (*p*) bipectinate; tarsus I with (*tc*) smooth (eupathidia) subequal in length and short (not reaching tip of claw); tarsi II-IV with (*tc*) peripectinate and subequal in length, and longer than (*tc*) on tarsi I. Tarsi I with another pair of eupathidia (*it*) at base of pretarsus; (*vs*) on tarsi I-IV always present, peripectinate, long and subequal in length; (*a*) sparsely barbed, and (*u*) branched; *ω1* long and subequal in length with peripectinate *ft*, *ω2* on tarsi I present and very reduced (Fig. 1C); tarsi II-III with 1 *ω* shorter than *ω1* of tarsus I; pretarsi with paired claws bearing tenent hairs. Setal formula summary (legs I-IV, additional microseta *κ* and solenidia *ω* in brackets): trochanters 1-1-1-1, femora 5-4-3-3, genua 5(*κ*)-5-3-3, tibiae 5-5-5-5 and tarsi 14(*ω1*, *ω2*)-10(*ω*)-10(*ω*)-10.

*Measurements*. Holotype female (followed in parentheses by range of holotype and 2 paratype females). Gnathosoma length 170 (170-180), base of gnathosoma (subcapitulum) width 150 (130-190), seta *n* length 39 (35-39), chelicerae 150 (150-165) long and 29 (29-37) width at base, palp 145 (145-180) long and 40 (40-65) wide, palp-claw length 27 (27-43), peritreme length (complete) 165 (165-200); idiosoma 365 (365-910) long (gnathosoma excluded) and 265 (265-830) maximal width (at level of setae *sce*), prodorsal shield 115 (115-135) long and 180 (180-215) width (at anterior margin), WVI 46 (46-56), WVE 145 (145-175), WSCI 50 (50-59); setal lengths: *vi* 120 (120-

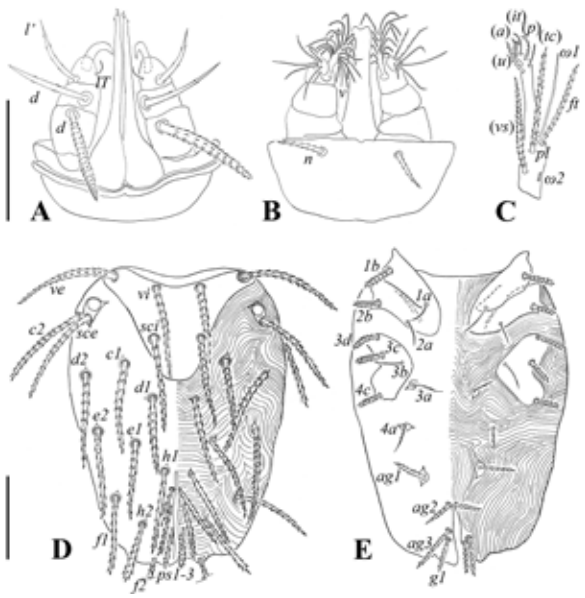


**Figure 1.** *Bertrandiella griseldae* new species, female. A, gnathosoma dorsal view; B, gnathosoma ventral view; C, tarsus of leg I lateral view; D, idiosoma dorsum; E, idiosoma venter. Scale bars= 100 μm. Brackets indicate paired setae.

130), *ve* 135 (135-140), *sci* 120 (115-120), *sce* 125 (125-135), *g1* 46 (46-52); legs length (excluding ambulacrum): leg I 500 (500-620), leg II 440 (440-555), leg III 405 (405-605), leg IV 425 (425-655); *ω1* on tarsus I length 72 (69-80), *ft* length 71 (68-77), *ω2* on tarsus I length 7 (5-7), *ω* on tarsus II length 21 (19-22), *ω* on tarsus III length 11 (8-11).

*Male.* Gnathosoma: with seta *d* short on palpal femur (as long as palpal femur length or shorter). Palpal setation same as in female. Idiosoma (Fig. 2): more tapered posteriorly; differing from female in shape of prodorsal shield being rectangular, wider than long, and with 4 setae (*vi*, *ve*, *sci* and *c1*) instead of 3 (Fig. 2A). Dorsal setae shorter, never reaching next transversal row of setae; dorsal setae *c3* absent; each *e1* and *e2* very close and grouped in single platelet; all setae peripectinate except for (*h1*), (*h2*), (*f2*) and (*ps1-3*) simple. Ventral setation same as female except for absence of (*4c*), (*ag2*), (*ag3*) and (*g1*); coxal setae thinner, and (*1a*), (*2a*) and (*3b*) sparsely barbed instead simple. Internal aedeagus directed backward, ending at genital-anal slit (Fig. 2A). Legs: *ω2* on tarsi I present and distinctly developed (longer than in female). Setal formula summary (legs I-IV, additional microseta (*κ*) and solenidia *ω* in brackets): trochanters 1-1-1-0, femora 5-4-3-2, genua 5(*κ*)-5-3-3, tibiae 5-5-5-5 and tarsi 14(*ω1*, *ω2*)-10(*ω*)-10(*ω*)-10.

*Measurements.* Range of 5 paratype males. Gnathosoma length 77-91, base of gnathosoma (subcapitulum) width 64-88, seta *n* 28-34 long, chelicerae 74-88 long and 16-20 wide at base, palp 74-85 long and 21-32 wide, palp-claw length 12-17, peritreme length (complete) 74-84; idiosoma 288-366 long (gnathosoma excluded) and 174-279 maximal width (at level of setae *sce*), prodorsal shield 62-69 long and 104-110 wide, WVI 28-37, WVE 62-71, WSCI 36-40, WC1 82-88; setae length: *vi* 60-64, *ve* 67-73, *sci* 74-83, *c1* 66-85, *sce* 64-75; aedeagus length 152-175; legs length (excluding ambulacrum): leg I 422-474, leg II 352-418, leg III 372-415, leg IV 434-465; *ω1* on tarsus I length 66-73, *ft* length 64-69, *ω2* on tarsus I length 30-33, *ω* on tarsus II length 34-39, *ω* on tarsus III length 15-16.

*Deutonymph.* Gnathosoma: palps, chelicerae and palpal setation as in female; deutonymph with (*n*) sparsely barbed, which strongly barbed in females. Idiosoma: prodorsal shield, shape and length of dorsal and ventral setae same as in female; deutonymph differing from female in absence of dorsal (*f2*) and absence of ventral (*4c*), (*ag3*) and (*g1*). Legs: setal formula summary (legs I-IV, additional microseta *κ* and solenidia *ω* in brackets): trochanters 1-1-1-0, femora 5-4-3-2, genua 5(*κ*)-5-3-3, tibiae 5-5-5-5, tarsi 14 (*ω1*)-10(*ω*)-10(*ω*)-10. Tarsi I with 1 solenidion (*ω1*) instead of 2 as in adults.

*Measurements*. Paratype deutonymph (1 specimen). Gnathosoma length 99, base of gnathosoma (subcapitulum) width 79, seta *n* length 26, chelicerae 82 long and 13 wide at base, palp 56 long and 23 wide, palp-claw length 25; idiosoma 279 long (gnathosoma excluded) and 245 maximal width (at level of setal pair *sce*), prodorsal shield 80 long and 101 wide (at anterior margin), WVI 35, WVE 80, WSCI 39; setal lengths: *vi* 98, *ve* 109, *sci* 104, *sce* 98; legs length (excluding ambulacrum): leg I 356, leg II 329, leg III 274, leg IV 336; *ω1* on tarsus I length 61, *ft* length 63, *ω* on tarsus II length 11, *ω* on tarsus III length 9.

*Larva, protonymph and tritonymph:* unknown.

*Taxonomic summary*

*Type locality:* Boca de Jaruco, Habana, Cuba.

*Type specimens:* female holotype IESCA10874; female paratype IESCA10877; male paratypes IESCA10873;75;79-81; deutonymph paratype IESCA10882. The type series corresponds to specimens recorded by de la Cruz (1973), and misidentified as *Hirstiella otophila* (now *Bertrandiella otophila*).

*Additional material examined:* female paratype OSAL0067359, ex *Tartola cubana* (sic), "gecko (lizard)" (should be *Tarentola americana*), Trinidad, Cuba, coll. J. D. Hardy Jr.

*Type host: Tarentola americana*, American wall gecko (Reptilia: Squamata: Phyllodactylidae).

*Site of infestation:* armpit and around ear (de la Cruz, 1973).

*Etymology:* this species is named in honor to Griselda Montiel-Parra, assistant curator of the Colección Nacional de Ácaros, Instituto de Biología, UNAM, for her support during the study of pterygosomatid mites.

*Geographic range:* known only from Cuba; *Bertrandiella griseldae* n. sp. is a monoxenous parasite of *Tarentola americana* from Cuba.

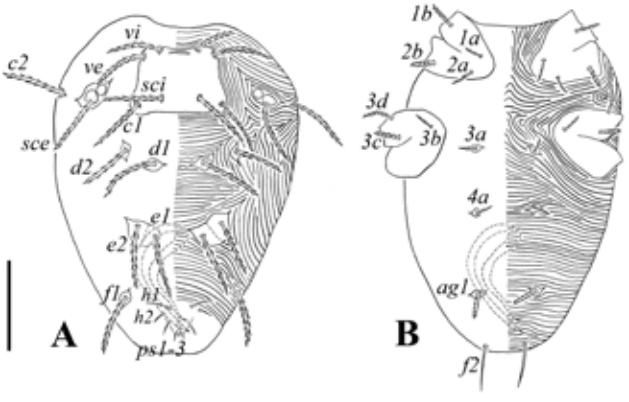


**Figure 2.** *Bertrandiella griseldae* new species, male. A, idiosoma dorsum; B, idiosoma venter. Scale bar= 100 µm. Internal aedeagus in dotted lines.

*Remarks. Bertrandiella griseldae* n. sp. is close to *B. jimenezi* and *B. chamelaensis*. In the females of these 3 species the prodorsal shield have the posterior end very acute. The female of *Bertrandiella griseldae* n. sp. differs from the other 3 females known in the genus (*B. otophila*, *B. jimenezi* and *B. chamelaensis*) as follows: *ω2* on tarsus I is present in *B. griseldae* n. sp., and it is absent in the other 3 species. Seta *ft* is subequal in length to *ω1* in *B. griseldae* n. sp., and it is clearly shorter than *ω1* in *B. jimenezi* and *B. chamelaensis*. Femur IV is complete in *B. griseldae* n. sp., and it is divided in 2 non-articulating podomeres in *B. chamelaensis*. The posterior margin of prodorsal shield in *B. griseldae* n. sp. is acuter than in *B. otophila*.

A small plate grouping each *e1* and *e2* is shared by the males of *B. griseldae* n. sp. and *B. otophila*. Males of *B. griseldae* n. sp. differs from males of *B. otophila* and *B. jimenezi* as follows: setae *ps1* are thin and simple in *B. griseldae* n. sp., while they are slightly thickened and blunt in *B. jimenezi*, or thicker as in *B. otophila* (the "anal spurs" sensu Hunter and Loomis, 1966). The prodorsal shield in males is longer in *B. otophila* (79) than in *B. griseldae* n. sp. (66). Setae *vi* and *ve* are longer in *B. otophila* (76) than in *B. griseldae* n. sp. (63 and 71). The setal pairs *sci* and *c1* are longer in *B. otophila* (85) than in *B. griseldae* n. sp. (71 and 75). The width between setal pair *sci* on prodorsal shield is greater in *B. otophila* (50) than in *B. griseldae* n. sp. (39).

Only the deutonymphs for *Bertrandiella tenuipes* (Hirst) and *B. jimenezi* are known. The deutonymph of *B. griseldae* n. sp. differs from that of *B. tenuipes* (based on holotype BM(NH)) in the width of prodorsal shield (101 versus 113), the width between setal pair *ve* on prodorsal shield is also different (80 versus 96) and the width between setal pair *sci* on prodorsal shield (39 versus 54). The setae *sce* are short in the deutonymph of *B. griseldae* n. sp. (98), while it is longer in deutonymph of *B. jimenezi* (122), *ω1* of tarsus I is longer in *B. griseldae* (63) than in *B. jimenezi* (42), and it is subequal in length with *ft*, while it is shorter in *B. jimenezi*, and *ω* on tarsus III is long in *B. griseldae* n. sp. (9), whereas it is short in *B. jimenezi* (5).

***Geckobiella javieri*** (de la Cruz) (Figs. 3, 4)
*Cyclurobia javieri* de la Cruz, 1984: 5; Figs. 1-3.
*Hirstiella javieri* Bochkov, 2008: 338
*Geckobiella javieri* Paredes-León, Klompen and Pérez, 2012: 11; Fig. 2F.
*Diagnosis.* Adult female with oligotrichous idiosoma; prodorsal shield shaped as inverted pear, length equals width, and with 2 pairs of setae (*vi* and *sci*); dorsal setae *h1* peripectinate and clavate (club-like); solenidion *ω2* on tarsus I short (26-27).

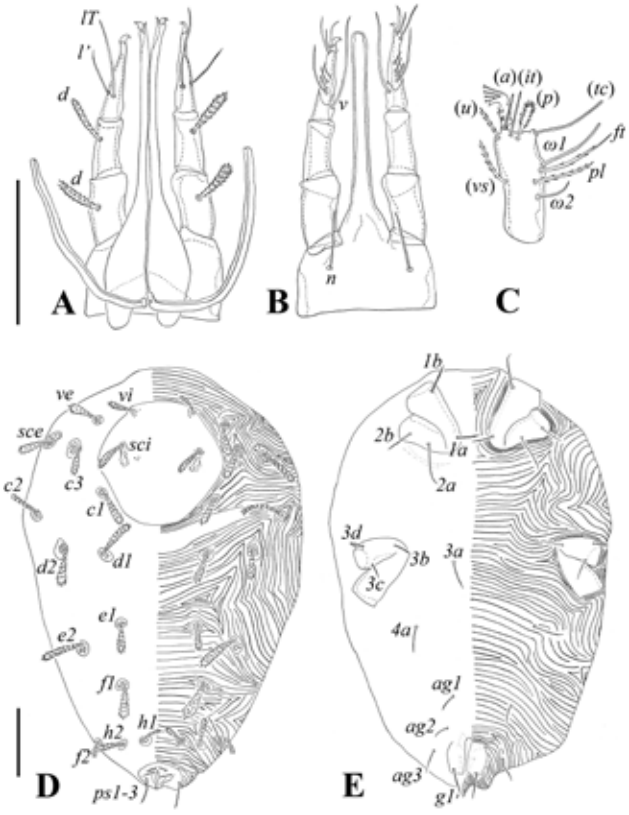


**Figure 3.** *Geckobiella javieri*, female. A, gnathosoma dorsal view; B, gnathosoma ventral view; C, tarsus of leg I lateral view; D, idiosoma dorsum; E, idiosoma venter. Scale bars= 100 µm. Brackets indicate paired setae.

*Description.* Female. Gnathosoma (Figs. 3A, B, 4A): subcapitulum simple with (*n*) simple and short (not reaching palpal genu), inserted behind palps. Palpal segments (femur to tarsus) longer than wide; femur and genu with 1 seta *d*, subequal in length (shorter than their respective podomere), subclavate and peripectinate; palpal tibia with 3 simple setae (*l'*, *lT* and *v*), slender than genual and femoral palpal setae; tibial claw simple, curved and short; palpal tarsi basally with longitudinal row of 1 proximal setae, *ω* and 2 short and simple setae; apically with 1 eupathid (*ζ*) and 2 subterminal simple setae. Chelicerae elongate, subequal in length to palps, and thin but with basal part globose; fixed digit membranous and spiniform, movable digit robust and outward curved. Emergent peritreme long, reaching palpal genua. Idiosoma (Figs. 3D-E, 4B): oligotrichous and ovoid, longer than wide, narrow part directed posteriorly and maximal width at the level of *c2*; cuticle striate except in prodorsal shield, setal platelets, anogenital area and space between (*c1*) and (*d1*). Dorsum: prodorsal shield oval in shape and slightly

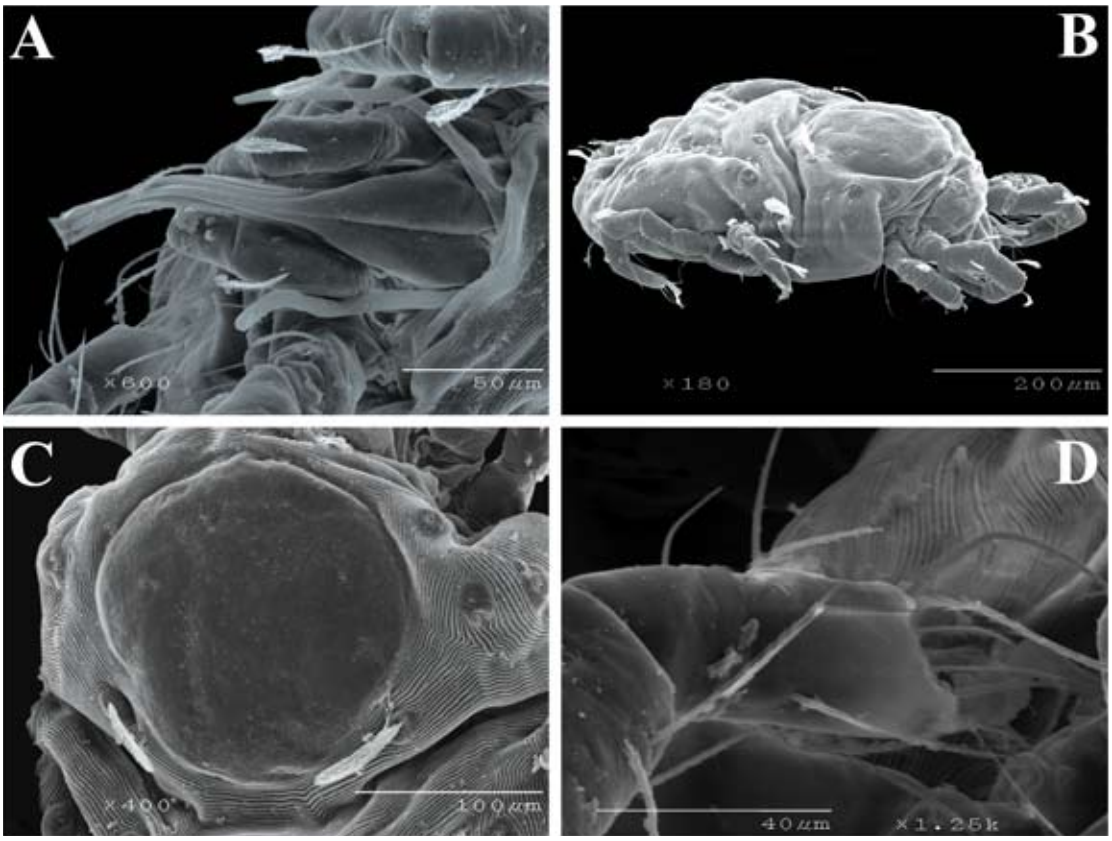


**Figure 4.** *Geckobiella javieri*, female, scanning electron microscopy. A, gnathosoma dorsal view; B, idiosoma dorsolateral view; C, prodorsal shield; D, tarsus of leg I lateral view.

wider than long, widest part at level of setal pair *sci*, with 2 pairs of short, peripectinate and subclavate setae (*vi* and *sci*) (Fig. 4C). Dorsal setae short, peripectinate and clavate; (*c3*) present; 1 pair of eyes located anteriorly, each eye associated with *sce* in a platelet. Anal area located at the tip of posterior margin with (*ps1-3*) short, thin and sparsely barbed, increasing in length, *ps3* longest (length equals dorsal setae length). Venter: setae: coxal formula 2-2-4-1 (*1a*, *1b - 2a*, *2b - 3a*, *3b*, *3c*, *3d - 4a*) on coxae I-IV respectively except for *3a* which is on intercoxal area, and for *4a* which is behind coxae IV; all these coxal setae short, thin and simple, except for *2b* which sparsely barbed, and *3d* which pectinate; (*4c*) absent. Setae (*ag1-3*) thin and simple; (*g1*) short, thin and simple, and on lobes. Legs: relatively short, shorter than idiosoma length. Detailed leg chaetotaxy as follows, leg I: trochanter with *v* pectinate; femur with *d* club-like, (*l*) subclavate, (*v*) slightly pectinate; genu with *d* and (*l*) club-like, (*v*) slightly pectinate, with microseta $\kappa$; tibia with *d* thin and finely branched in its distal half, with deep goblet-shaped base, (*l*) subclavate, (*v*) slightly pectinate; tarsus with 1 short basal $\omega 2$, distal $\omega 1$ longer than $\omega 2$ and on bulge in close association with *ft* which sparsely barbed and slightly longer than $\omega 1$, *pl'* slightly pectinate, dorsal (*tc*) smooth (eupathidia) on bulge at point where tarsus blunt, (*p*) feather-like, (*it*) eupathidia, (*a*) simple, (*u*) branched, (*vs*) slightly pectinate (Figs. 3C, 4D). Leg II: trochanter with *v* slightly pectinate; femur same as in femur I but *v'* absent; genu with *d* club-like, (*l*) subclavate and 1 seta *v* (difficult to define if it is *v'* or *v"* because it is located at the middle of the podomere) slightly pectinate; tibia same as in tibia I but *d* with simple base; tarsus with short $\omega$, *tc'* longer than *tc"*, both barbed, (*a*) barbed, (*u*), (*p*) and *vs'* same as in tarsus I. Leg III: trochanter same as in trochanter II; femur same as in femur I but *l"* absent; genu same as in genu II but *l"* absent and *v'* present; tibia same as in tibia I; tarsus same as in tarsus II but with $\omega$ shorter than those found on tarsi I-II. Leg IV: trochanter same as in trochanter I; femur same as in femur I but *l"* and (*v*) absent; genu same as in genu III; tibia as in tibia I; tarsus same as in tarsus I but $\omega$ absent. Setal formula summary (legs I-IV, additional microseta $\kappa$ and solenidia $\omega$ in brackets): trochanters 1-1-1-1, femora

5-4-3-2, genua 5(*κ*)-4-3-3, tibiae 5-5-5-5 and tarsi 14(*ω1*, *ω2*)-9(*ω*)-9(*ω*)-9.

*Measurements.* Range of 4 females. Gnathosoma length 170-217, base of gnathosoma (subcapitulum) width 84-91, seta *n* length 42-45, chelicerae 177-197 long and 28-29 wide at base, palp 170-198 long and 22-26 wide, palp-claw length 12-15, peritreme length (complete) 233-273; idiosoma 544-659 long (gnathosoma excluded) and 333-416 maximal width (at level of setae *sce*), prodorsal shield 164-189 long and 183-195 wide (at level of setal pair *sci*), WVI 85-93, WVE 183-205, WSCI 105-118; setal length: *vi* 39-43, *ve* 40-45, *sci* 48, *sce* 60-65, *g1* length 38-42; legs length (excluding ambulacrum): leg I 334-429, leg II 279-317, leg III 294-326, leg IV 344-381; *ω1* on tarsus I length 45, *ft* length 50-55, *ω2* on tarsus I length 26-27, *ω* on tarsus II length 13-15, *ω* on tarsus III length 4-6.

*Deutonymph.* Gnathosoma: setation on palps and subcapitulum same as in female; chelicerae and palps slightly shorter than those from the female. Idiosoma: prodorsal shield and setation as in female, except for the dorsal club-like setae which are more expanded; (*f2*), (*ag3*), (*g1*) and (*4c*) are absent. Legs: setal forms as in female; chaetotaxy as in female, except for *v* that is absent on trochanter IV, *ω* on tarsi III very reduced (vestigial). Setal formula summary (legs I-IV, additional microseta *κ* and solenidia *ω* in brackets): trochanters 1-1-1-0, femora 5-4-3-2, genua 5(*κ*)-4-3-3, tibiae 5-5-5-5 and tarsi 14(*ω1*, *ω2*)-9(*ω*)-9(*ω*)-9.

*Measurements*. Deutonymph (1 specimen available). Gnathosoma length 153, base of gnathosoma (subcapitulum) width 68, seta *n* length 31, chelicerae 144 long and 22 wide at base, palp 127 long and 23 wide, palp-claw length 9, peritreme length (complete) 217; idiosoma 373 long (gnathosoma excluded) and 260 maximal width (at level of setae *sce*), prodorsal shield 133 long and 127 wide (at anterior margin), WVI 54, WVE 134, WSCI 74; setal length: *vi* 26, *ve* 30, *sce* 40; legs length (excluding ambulacrum): leg I 250, leg II 186, leg III 192, leg IV 243; *ω1* on tarsus I length 31, *ft* length 45, *ω2* on tarsus I length 10, *ω* on tarsus II length 9, *ω* on tarsus III length 1.

*Larva*. Gnathosoma: relatively long, slightly shorter than idiosoma length; setae *n* absent; chelicerae and palps slightly shorter than those from female; setation on palps and subcapitulum same as those found on female. Idiosoma: prodorsal shield with pointed anterior margin and without setae. All dorsal setae club-like; (*c3*), (*f2*), (*ps1-3*) absent. Ventral setae on coxa I (*1a*, *1b*) and on coxa III (*3b*) simple, the rest of ventral setae (*2a*, *2b*, *3a*, *3c*, *3d*, *4a*, *4c*, *ag1-3*, *g1*) are absent. Legs: seta *v'* on femur I, (*v*) on genu I, *d* and *v"* on genu II, *d* and *v'* on genu III, (*tc*) and *ω2* on tarsus I, and *ω* on tarsus III absent; seta *p'* barbed and *p"* feather-like on tarsus I; (*it*) on tarsus I not aligned horizontally; seta *vs* on tarsus II and III in middle of podomere making difficult to determine if it is *vs'* or *vs"*; setal formula summary (legs I-III, additional microseta *κ* and solenidia *ω* in brackets): trochanters 0-0-0, femora 4-4-3, genua 2(*κ*)-2-1, tibiae 5-5-5 and tarsi 12(*ω1*)-9(*ω*)-9.

*Measurements.* Range of 2 larvae. Gnathosoma length 145-150, base of gnathosoma (subcapitulum) width 48-50, chelicerae 125-140 long and 16-19 wide at base, palp 125-130 long and 12 wide, palp-claw length 7-8, peritreme length (complete) 135-140; idiosoma 170 long (gnathosoma excluded) and 115-135 maximal width (at level of setal pair *sce*), prodorsal shield 80-86 long and 23-28 wide (at level of setae *sci*), WVI 8-11, WVE 30-32, WSCI 34-38; setal length: *vi* 14-16, *ve* 14-15, *sci* 14, *sce* 14-18; legs length (excluding ambulacrum): leg I 175, leg II 135-140, leg III 150; *ω1* on tarsus I length 24, *ft* length 59-60, *ω* on tarsus II length 6-7.

*Taxonomic summary*

*Type locality:* Cabo Cruz, Niquero, Granma, Cuba (de la Cruz, 1984).

*Type specimens:* male holotype, deutonymphs and larvae paratype IESCA, probably lost.

*Material examined:* 3 females CNAC007043-45, ex *Cyclura n. nubila* (IES12729), Guanahacabibes, Pinar del Río, Cuba, 21 February 1985. One female, 1 deutonymph and 2 larvae CNAC007046-49, ex *Cyclura n. nubila*, 1km SE from Hotel María La Gorda, María La Gorda, Mpio. Sandino, Pinar del Río, Cuba, 21°41'55.34" N, -84°29'32.57" W, 10 m asl, 02 November 2011, coll. L. Márquez-Llauger.

*Type host: Cyclura nubila nubila*, Cuban iguana (Reptilia: Squamata: Iguanidae).

*Site of infestation:* head near the ears.

*Geographic range:* known only from Cuba. *Geckobiella javieri* is a monoxenous parasite of the iguana *Cyclura n. nubila* from Cuba.

*Remarks.* Recently, Paredes-León et al. (2012) revised the genera *Hirstiella* and *Cyclurobia*. They concluded, based on a phylogenetic analysis of morphological characters (mainly of females), that these genera were junior synonyms of *Geckobiella*. Previously, *Cyclurobia* was synonymized under *Hirstiella* by Bochkov (2008), however, no additional evidence on the relationship of those genera was contributed. In addition, the close relationship between *Cyclurobia javieri* and members of *Hirstiella* (particularly *H. diolii*) was highlighted by Baker (1998) and Walter and Shaw (2002), and posteriorly these were corroborated as sister species (Paredes-León et al., 2012) Both mite species are associated to iguanids of the genus *Cyclura*.

The finding of immature mite specimens, together with

adult females parasitizing the same host species, allowed us to associate them with great certainty as *Geckobiella javieri*; and even though that these specimens were analyzed by Paredes-León et al. (2012) to corroborate the taxonomic status of *Cyclurobia*, the description of the adult female had not been carried out. Furthermore, we can assure that the morphological characters of these females are in agreement with the diagnosis of the genus *Geckobiella*, and that they seem to be very closely related to those oligotrichous species in the genus that parasitize iguanid lizards.

The leg chaetotaxy of immature specimens was analyzed and corrected. We have noticed some differences in number of setae between our own observations and those reported by de la Cruz (1984), but we consider that these discrepancies might be due to the difficulty of the observation of some small setae. Two types of larvae (named "male" and "female" larvae) were proposed and described by de la Cruz (1984); however, in our samples we found only one type, which based on their small size, and the setal form of dorsal idiosomal setae correspond to the "male" larvae.

***Geckobia tarentolae*** de la Cruz

*Geckobia tarentolae* de la Cruz, 1973: 1

*Diagnosis.* Adult female with hypertrichous idiosoma; prodorsal shield present, and with 4 pairs of thick and short setae, with distal half peripectinate; 1 pair of ocular platelets each adjacent to anterolateral margin, including 1 eye and 2 or 3 setae subequal in shape as those in prodorsal shield; setation of trochanters-tibiae of legs I-IV corresponding to group 4: 1-1-1-1, 3-2-2-2, 1($\kappa$)-0-0-0, 5-5-5-5; tarsal setation of legs I-IV corresponding to group A: 14($\omega$)-10($\omega$)-10-10; setation on coxae I-IV: 2-2-2-3.

*Taxonomic summary*

*Type locality:* Cueva del Gato, Sagua La Grande, Villa Clara, Cuba.

*Type specimens:* female holotype and paratypes (females, males and deutonymphs) IESCA.

*Material examined:* 3 females, 2 males and 2 deutonymphs paratypes (IESCA10783-84; 10789;107 95; 10798; 10804; 10807).

*Type host: Tarentola americana* (Gray), American wall gecko (Reptilia: Squamata: Phyllodactylidae).

*Site of infestation:* on toe lamellae of the adhesive pad (de la Cruz, 1973).

*Geographic range:* known only from Cuba; *Geckobia tarentolae* is a monoxenous parasite of the gecko *Tarentola americana* from Cuba.

*Remarks.* The leg setation of *Geckobia tarentolae* female was not fully described by de la Cruz (1973), and for the males, some leg setae, notably on femur I, tibiae I-IV, and tarsi I-IV were omitted. Some groups of species were proposed in the genus on the basis of leg chaetotaxy, groups 1-4 from the trochanter to the tibia (Jack, 1964; Bochkov and Mironov, 2000), and 2 sorts of tarsal chaetotaxy (A or B) were identified (Jack, 1964). Our own observations placed *G. tarentolae* in the group 4 of trochatera-tibial chaetotaxy whereas the tarsal chaetotaxy corresponds to the Jack's model A. Leg setation of females, males and deutonymphs is identical, except on coxae IV that has 2 setae in deutonymphs, and 2, 3 or 4 setae in males. Measurements and detailed leg chaetotaxy, according with the nomenclature proposed by Grandjean (1944), are not provided because the specimens analyzed are poorly preserved.

Adult females of *Geckobia tarentolae* differs from the other 2 species in the group 4 by the poor number of setae on prodorsal shield (4 pairs *versus* 18-20 in *G. indica* Hirst, 1917 and 16-22 in *G. anocellatus* Bochkov and Mironov, 2000), by the presence of eyes (eyes absent in *G. anocellatus*), and position of eyes which are located on platelets adjacent to the prodorsal shield in *G. tarentolae* whereas in *G. indica* the eyes are located directly on the prodorsal shield.

***Geckobia hemidactyli*** Lawrence

*Geckobia hemidactyli* Lawrence, 1936: 14; Jack 1961: 253

*Diagnosis.* Adult female with hypertrichous idiosoma; prodorsal shield present with cuticle weakly striated, and with 15-17 pairs of thick, short and peripectinate setae; 1 pair of eyes located on the antero-lateral margins of prodorsal shield; setation of trochanters-tibiae of legs I-IV corresponding to group 1: 1-1-1-1, 3-2-2-2, 1($\kappa$)-0-0-1, 5-5-5-5; tarsal setation of legs I-IV corresponding to group A: 14($\omega$)-10($\omega$)-10-10; setation on coxae I-IV: 2-2-2-3.

*Taxonomic summary*

*Type locality:* Driefontein, Southern Rhodesia (now known as Zimbabwe) (Lawrence, 1936).

*Type specimens:* probably Iziko Museums of Cape Town (formerly South African Museum) or Natal Museum, South Africa.

*Type host: Hemidactylus tasmani* Hewitt 1932, Tasmanian leaf-toed gecko (Reptilia: Squamata: Gekkonidae).

*Material examined:* 2 females OSAL0067340; 0067342, ex *Hemidactylus mabouia*, Sao Paulo, Brazil, 11 March 1977, coll. D. Baggio. No Cuban specimens were available.

*Site of infestation:* undetermined.

*Geographic range:* Africa (South) (Lawrence, 1936), Ascension Island (South Atlantic Ocean) (Jack, 1961), South America and the Caribbean (Martínez-Rivera et al., 2003). Introduced to Cuba. *Geckobia hemidactyli* is a stenoxenous parasite of the gecko genus *Hemidactylus.*

*Remarks. Geckobia hemidactyli* pertains to the "leg group" 1 and to the "tarsal group" B according with the number of setae on trochanter-tibia I-IV and tarsi I-IV, respectively (Jack, 1964). The adult female of this species was described by Lawrence (1936) from the gekkonid lizard *Hemidactylus tasmani* from Zimbabwe and including the additional record from *H. mabouia* in Democratic Republic of the Congo. Male, deutonymph and larva were described by Jack (1961) from *H. mercatorius* Gray 1842 from Ascension Island (Atlantic Ocean). Additional geographic data of *G. hemidactyli* parasitizing *H. mabouia* were recorded by Martínez-Rivera et al. (2003) for South America and the Caribbean, including 1 locality in Cuba (Guantanamo). This mite species has been also mentioned from the Mediterranean Region and Asia on *H. frenatus* and *H. mercatorius* by Martínez-Rivera et al. (2003) and Fajfer (2012) but without providing the original source of these records. The expansion of the lizard has certainly expanded the geographic area of the parasite.

Key for identification of adult females of pterygosomatid mites in Cuba.

1. Idiosoma subcircular to broadly oval, with numerous dorsal setae (more than 20 pairs); coxae III-IV with large thickened setae (spur-like) . . . . . *Geckobia* . . . . . 2
-. Idiosoma clearly longer than wide, with few dorsal setae (less than 20 pairs); coxae III-IV with simple and pectinate setae . . . . . 3
2. Prodorsal shield with 4 pairs of setae, eyes on ocular platelets located adjacent to anterolateral margin of prodorsal shield and with 2-3 pairs of setae; genua IV without setae . . . . . *Geckobia tarentolae* de la Cruz
-. Prodorsal shield with more than 15 pairs of setae; eyes located on prodorsal shield; genua IV with 1 seta (*v'*) . . . . . *Geckobia hemidactyli* Lawrence
3. Prodorsal shield shaped as inverted triangle and with 3 pairs of setae (*vi*, *ve* and *sci*); dorsal setae *c3* absent . . . . . *Bertrandiella griseldae* Paredes-León, Cuervo-Pineda and Pérez sp. nov.
-. Prodorsal shield oval and with 2 pairs of setae (*vi* and *sci*); dorsal setae *c3* present . *Geckobiella javieri* (de la Cruz)

**Discussion**

We provide an extended taxonomic diagnosis for the genus *Bertrandiella* which now includes females with 1 solenidion (*ω1*) on tarsus I (*i.e.*, *B. otophila*, *B. jimenezi* (Paredes-León and Morales-Malacara, 2009) and *B. chamelaensis* Paredes-León, Klompen and Pérez, 2012) as females with 2 solenidia (*ω1* and *ω2*) on tarsus I (*B. griseldae* n. sp.); however, the female of *B. tenuipes* (Hirst 1917) is unknown.

*Bertrandiella* is endemic to the Americas and its species display a high host-specificity including monoxenous (occurs on single host species) and stenoxenous (occurs on species of single host genus). *Geckobiella* also is endemic to the Americas and its species also displays a high host-specificity including monoxenous, stenoxenous and oligoxenous (occurs on hosts of 2 or more genera of the same family).

In *Geckobia*, that is the richest genus of the family Pterygosomatidae including 71 species with a worldwide distribution, the majority of the species are monoxenous (Fajfer, 2012; Paredes-León, 2013). One of the 2 species of *Geckobia* recorded in Cuba, *G. hemidactyli* is not native and has certainly expanded the geographic area alongside its host (Martínez-Rivera et al., 2003). Contrary, the native *Geckobia tarentolae* is the unique mite species recorded from New World geckos in the genus *Tarentola* (family Phyllodactylidae) that currently comprises 21 species. Eighteen species of *Tarentola* are distributed across the Mediterranean Basin as well as on many Macaronesian islands. In the Americas, 3 species occurs: *T. americana* from Cuba and the Bahamas; *T. crombiei* endemic to Cuba; and the probably extinct *T. albertschwartzi*, known from a single specimen from Jamaica (Rato et al., 2012). The gecko *Tarentola crombiei* was considered as a cryptic species resembling *T. americana* (Weiss and Hedges, 2007), and posteriorly was diagnosed and described by Díaz and Hedges (2008). *Tarentola americana* and *T. crombiei* are sympatric only at the southeastern coast, and the records of *Geckobia tarentolae* are from Central region of the Island, therefore correspond to the host *Tarentola americana*. In the genus *Tarentola*, the species *T. americana* is the most divergent lineage, not closely related of any of its congeners (Weiss and Hedges, 2007). Molecular clock analyses have suggested that *T. americana* diverged from the Old World species approximately 10.6-17 million years ago (Carranza et al., 2002). Regarding the Neotropical members of *Tarentola*, these seem to be the result of a post-Gondwanan dispersal by natural transmarine colonization from the Old World (Carranza et al., 2002; Rato et al., 2012).

The Cuban mite *Geckobia tarentolae* has a similar divergent history same as its host *Tarentola americana*, because this mite presents no modified ventral setae instead of ventral scale like setae present in the other species of *Geckobia* collected on the genus *Tarentola*

in Mediterranean Region. Additionally, *G. tarentolae* pertains to the "leg group" 4 unlike the other species of *Geckobia* collected on the genus *Tarentola* that are classed into the "leg group" 1 (Bertrand et al., 2012). The phylogenetic relevance of these and another characters need to be evaluated and a major effort in the study of geckobian mites is primary for a better understanding of the co-evolutionary history between *Geckobia* mites and *Tarentola* geckos.

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