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A new species of *Lohmannia* (Acari: Oribatei: Lohmanniidae) from mangroves at Quintana Roo (Mexico)

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ABSTRACT — A new species of *Lohmannia*, *L. maya* **n. sp.**, from mangrove soils in Mexico is described and illustrated. It is morphologically similar to *L. similis* Balogh, 1962, *L. jornoti* Mahunka, 1985 and *L. lanceolata* Grandjean, 1950 but differs from these species in having lateral and posterior setae wide in their proximal half and thin in their distal half, ending in a sharp tip, and a continuous notogastral band S_8. It also has a smaller body size (727 µm) compared with the three aforementioned species (790, 810 and 840 µm respectively). The 11 species of the genus *Lohmannia* recorded from the Americas were compared, a key for them is included, and some ecological notes for the new species are also provided.

KEYWORDS — mites; taxonomy; mangrove fauna; key; Mexico

ZOOBANK — 2A1BAC59-9B03-438A-8C9C-02E66EEDDD00

INTRODUCTION

Data on taxonomy and ecology of oribatid mites from Mexico have been increasing in the last two decades (Palacios-Vargas & Iglesias, 2004) and ecological contributions have been published recently (García *et al*. 2014). Six genera of the family Lohmanniidae are known from Mexico, among which the genus *Lohmannia* is represented by three recorded species: *L. banksi* Norton *et al*., 1978 from Veracruz, Campeche and Hidalgo states; *L. juliae* Mahunka, 1984 from Veracruz and *L. lanceolata* Grandjean, 1950 from Quintana Roo (Vázquez, 2001).

Much later after the review of the Lohmanniidae by Granjean (1950), that of Sengbusch (1984) included the description of a new species from Micronesia and a comparison with most of the known taxa belonging to the genus *Lohmannia*. Recently, Norton and Ermilov (2014) did a historical review of immature oribatids where they include members of *Lohmannia*.

Lohmannia is a Cosmopolitan genus with 27 species, including two subgenera, *Lohmannia* (*Lohmannia*) and *Lohmannia* (*Carolohmannia*), as well as two subspecies, *Lohmannia* (*L.*) *javana javana* Balogh, 1961 and *Lohmannia* (*L.*) *javana interrupta* Choi, 1985 (Subías, 2004, online version 2016) but few have been recorded from the Americas until now.

From the Unites States of America, *L. texanus* Banks, 1910; *L.* (*Carolohmannia*) *carolensis* Norton *et al*., 1978; and *L. banksi* Norton *et al*., 1978 were described, the latter species occurs also in Mexico. From the Antilles (Marie-Galante, Guade-

loupe), *L. jornoti* Mahunka, 1985 was described, there are records of *L. lanceolata* Grandjean, 1950 from Panama and Peru. From South America, *L. bifoliata* Willmann, 1936 from Curaçao and part of the Antilles; *L. juliae* Mahunka, 1984 from Paraguay and *L.* (*lanceolata*) *turcmenica* Bulanova Zachvatkina, 1960 from Argentina are known. *Lohmannia vulcania* Schatz, 1993 was described from the Galapagos Islands and *L. similis* Balogh, 1962 was recorded from Peru and the Galapagos Islands.

In this contribution we describe a new species of *Lohmannia* from Mexico and a key for those known from the Americas is provided and some new ecological data for the new taxon is given.

Materials and methods

Mites were collected from mangrove soil and litter samples from Chetumal Island and fixed in 75% ethanol. Only 34 specimens of *Lohmannia* were found, and some were mounted under smooth slides in Hoyer's solution and other were kept in 75% ethanol. Four specimens were dissected and mounted. Observations and measurements were undertaken under a phase-contrast Carl Zeiss microscope Axiostar plus and drawings were done with the aid of a "*camera lucida*". In the description, all body measurements are in micrometers (µm) and indicated between parentheses after each morphological character. Setal nomenclature follows those of Grandjean (1950) and Norton (1977).

Results

Description of species

Lohmannia maya n. sp. (Figures 1-3)

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Diagnosis — Body length (n = 10) 727 (690–751), width 342 (320–358). Color light to medium brown. *Lohmannia maya* **n. sp.** differs from its congeners by the combination of smallest size; body surface homogeneously finely punctated; evenly covered with fine spots; posterior exopseudostigmatic setae (*exp*) dilated but elongated, about twice as long as its width; transverse bands S_3 – S_7 and S_9 medially interrupted; all prodorsal and all 16 pairs of gastronotic setae phylliform, with serrated margins; setae p_1 and p_2 of different length and width, setae p_1 directed dorsal; 2 pairs of subcapitular setae phylliform; epimeral setae strongly dilated; all medial genital setae setiform and smooth, lateral setae dilated and ciliate; all adanal setae phylliform and slightly ciliate; legs with 2 kind of setae, setiform and ciliate, and broadly phylliform with serrated margins.

Type-specimen — Holotype (length: 740; width: 347) female mounted on slide and deposited in the acarological collection of Laboratorio de Ecología y Sistemática de Microartrópodos, Facultad de Ciencias, UNAM, Mexico. Original label 04/sep/2011, *ex* mangrove litter on littoral marine, A. García col.

Paratypes — All specimens are females, 15 on slide and 18 stored in 75% ethanol. Original labels. 04/sep/2011, *ex* mangrove litter of littoral marine sand, A. García col. All the material will be deposited in the acarological collection of Laboratorio de Ecología y Sistemática de Microartrópodos, Facultad de Ciencias, UNAM.

Prodorsum — (Figure 1A) slightly elongated, anterior part wide, almost membranous. Lateral margin weakly bisinuate anterior to setae *exa*. Transverse band *Sb* between interlamellar setae distinct, straight, clearly situated anterior to gastronotic tectum.

Setae *ro* slightly phylliform, with serrated margins, length 105 (86–111), with sharp tip, reaching anteriad of the rostrum. Setae *le* 94 (81–101), similar to *ro* but shorter; setae *exa* phylliform, with serrated margins, 48 (39–64); setae *exp* dilated and elongated, about twice long its width, 47 (42–53), with serrated margins and finely spinose surface (Figures 1A, D). Sensillus (*ss*) with 11 branches, distally increasing in length 91 (81–99), with four to six small spines opposite to branches (Figure 1A, D). Setae *in* 95 (83–104), phylliform with serrated margins.

Notogaster — (Figure 1A) Lateral margins parallel in anterior half, posteriorly rounded. Transverse bands weekly developed, bands S_3- S_7 and S_9 incomplete and interrupted medially; S_6 incomplete

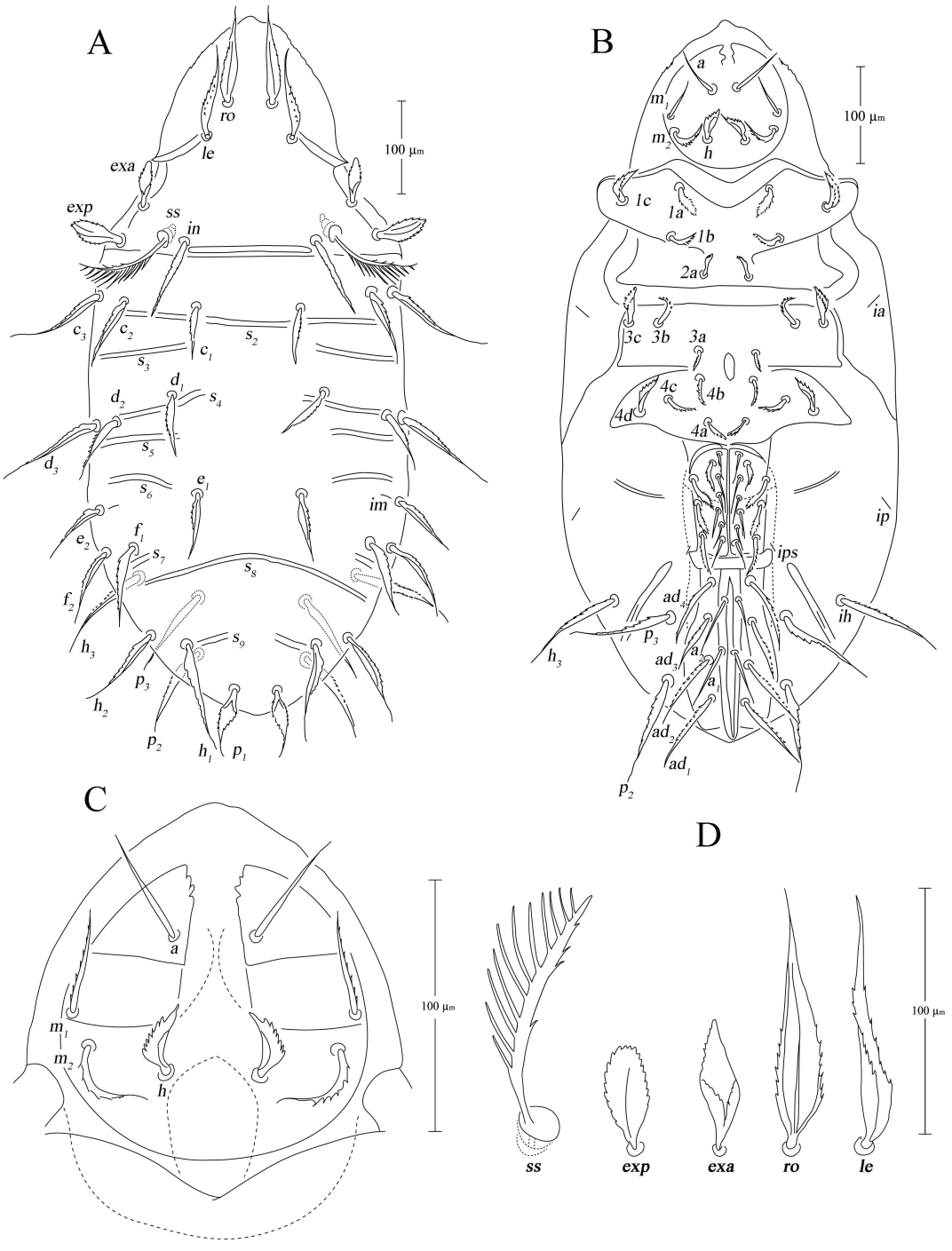

FIGURE 1: *Lohmannia maya* **n. sp.** ♀: A – dorsal chaetotaxy; B – ventral chaetotaxy; C – subcapitulum setae; D – prodorsal setae: *ss* = sensillus, *exp* = posterior exopseudostigmatic, *exa* = anterior exopseudostigmatic, *ro* = rostral, *le* = lamelar.

on each side. Band S_8 complete. Lyrifissures hardly discernible: *ia* located laterally, at the level epimeral setae *3c*; *im* located dorsally, next setae e_2; *ip* laterally, in the middle part of notogaster; *ips* ventrally, next to preanal plate and *ih* between setae h_3 and p_3 (Figures 1A-B).

Sixteen pairs of gastronotic setae present, all phylliform, with serrated margins. Setae of inner rows c_1, c_2, d_1, d_2, e_1, shorter and thinner than those of margins. Setae p_1 strongly dilated, constantly erected dorsally; making it much shorter than p_2 in dorsal aspect (Figure 1A-B). Measurements of setae (n=10): c_1 60 (47-72), c_2 74 (62-91), c_3 105 (94-120), d_1 62 (47-74), d_2 66 (49-76), d_3 103 (89-114), e_1 67 (49-81), e_2 73 (64-81), f_1 89 (72-101), f_2 95 (76-104), h_1 103 (79-111), h_2 90 (76-106), h_3 105 (91-114), p_1 70 (59-77), p_2 107 (94-116), p_3 105 (94-111).

Ventral region (Figure 1B-C)

Gnathosoma — Chelicerae and palps are very similar in appearance to those of *L. lanceolata* Grandjean, 1950. Subcapitulum with setae *h* (29) phylliform, strongly dilated with serrated margins, m_2 (37) longer and thinner than *h* and both setae have spiculate surface, setae m_1 (42) setiform and slightly ciliate, setae *a* (50) setiform and smooth. Three pairs of adoral setae, or_1 (26) more or less triangular; or_2 (40) long, setiform, thick and smooth; or_3 (33) setiform, smooth and pointed, shorter than or_2 (Figure 2A). Palptarsus with solenidion longer than segment (Figure 2B). Cheliceral setae *chb* (43), long, setiform, slightly serrated; seta *cha* (5) very short and thin (Figure 2C).

Epimeral region — Apodeme 1 complete, with two sternal extensions medially; apodeme II incomplete medially; apodeme III complete with short central extension directed posteriorly; apodeme IV complete, uniform. Epimeral formula: 3-1-3-4, all setae strongly dilated with spiculate surface; setae of median row (*1a* to *4a*) shorter and smaller than those of the lateral rows.

Anogenital region — Genital region with 6 pairs of medial setiform and smooth setae, 4 pairs of lateral setae phylliform and ciliate. The anterior lateral setae inserted close to median row. Measurements of setae: Medial g_1 = 27, g_2 = 27, g_3 = 27, g_4 = 32, g_5 = 32, g_6 = 30; lateral g_1 = 32, g_2 = 32, g_3 = 35, g_4 = 37. Preanal plate wide, width equal to that of genital plate. Adanal setae phylliform with serrated margins tapering distally. The 4th pair of adanal setae slightly thinner. Measurements of setae: ad_1 = 79, ad_2 = 81, ad_3 = 81, ad_4 = 79. Anal setae setiform and smooth; the second pair of anal setae reaching the insertion first pair. Measurements of anal setae: a_1 = 49, a_2 = 59. One additional adanal seta was observed in one specimen.

Legs — (Figure 3A-D). All legs monodactylous, short and stout. Femora I and II with ventral ridge. Claws without any ventral tooth. Legs of adults with two different kinds of setae: wide phylliform with serrate margins and spiculate surface, setiform and ciliate. Setal formulae of adult legs from trochanter to tarsus (solenidia between parenthesis) as follows: leg I 0-5-3(2)-5(1)-15(2+ε); leg II 0-6-3(1)-4(1)-13(1); leg III 2-3-2(1)-3(1)-12, leg IV 2-3-2(1)-2-12 (Figure 3A-D, Table 1).

Material Examined — Type-locality: Mexico: Quintana Roo: Isla Cozumel: 20°16′26.75″N, 86°59′11.69″W; *ex* mangrove litter *Rhyzophora mangle* and *Avicennia germinans* on littoral marine sand, in September, November of 2011 and March 2012, A. García col.

Etymology — The species is named after the Maya region, the area where it was found.

Distribution — Known only from the type locality, at Cozumel, Quintana Roo, México.

Ecology — It seems that species of this genus are quite well adapted to salinity, as several specimens of *L. similis* Balogh, 1962 were collected from mangrove in Bermuda Islands (Schatz & Schuster, 2012) and Galápagos (Schatz, 1993), *L. jornoti* Mahunka, 1985 described from Marie-Galante (Antilles), was collected from the beach pebbles and *L. maya* **n. sp.** comes from Laguna Chuc Chacaab, Cozumel, Quintana Roo, in mangrove litter close to marine littoral where *A. germinans* tree was dominant. It may be a quite rare species as it was only found in three of the four months sampled: March, September and November but not in April. Relative humidity was 59 and 91 % during dry and rainy season, respectively. Temperature was 29.69 – 24.67 °C at noon; soil salinity was 36.8 – 32.3%, while pH very alkaline (7.5-8.7). A total of 200 samples were col-

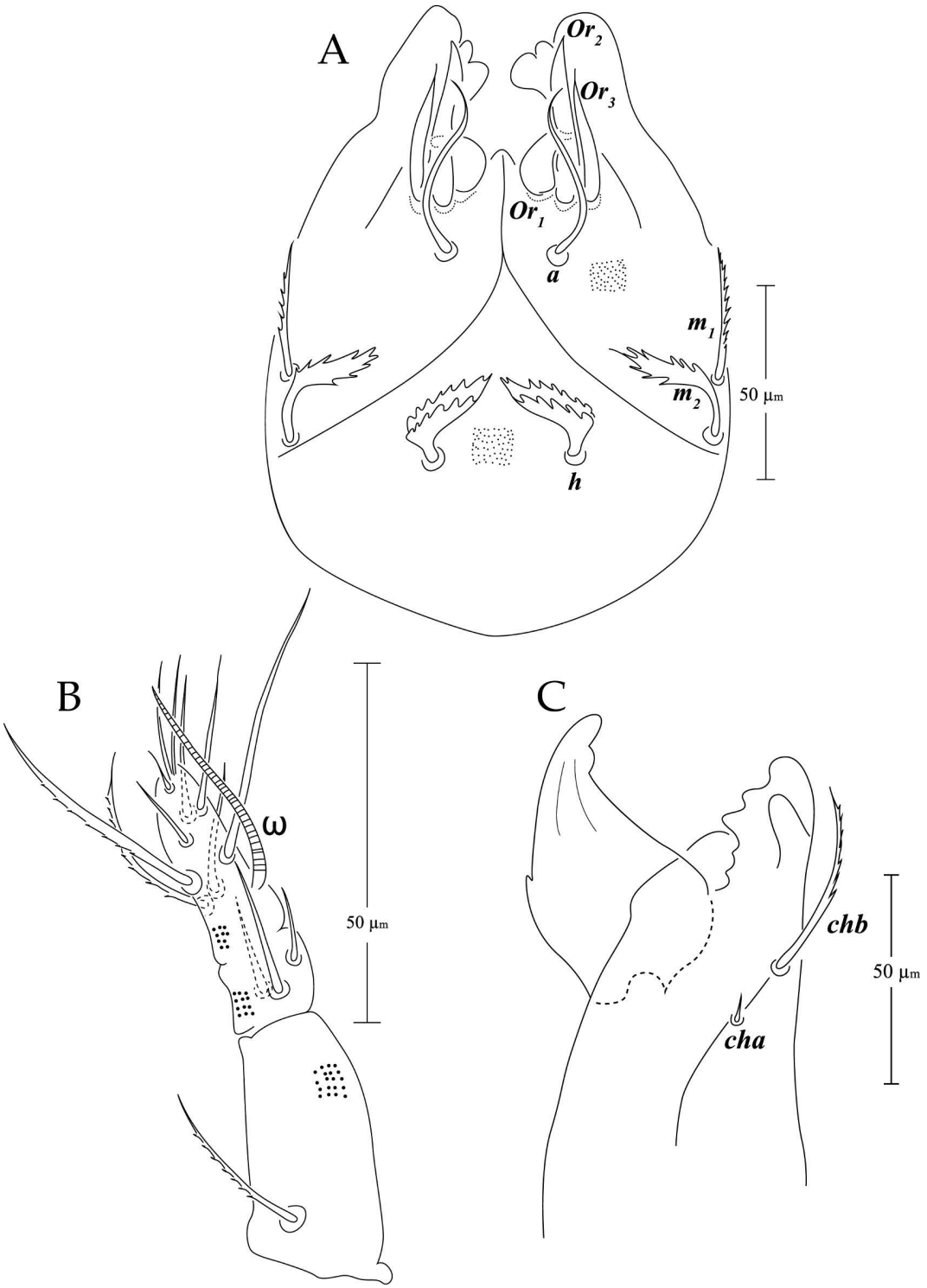

FIGURE 2: *Lohmannia maya* **n. sp.** ♀: A – subcapitulum; B – Palp; C – chelicera.

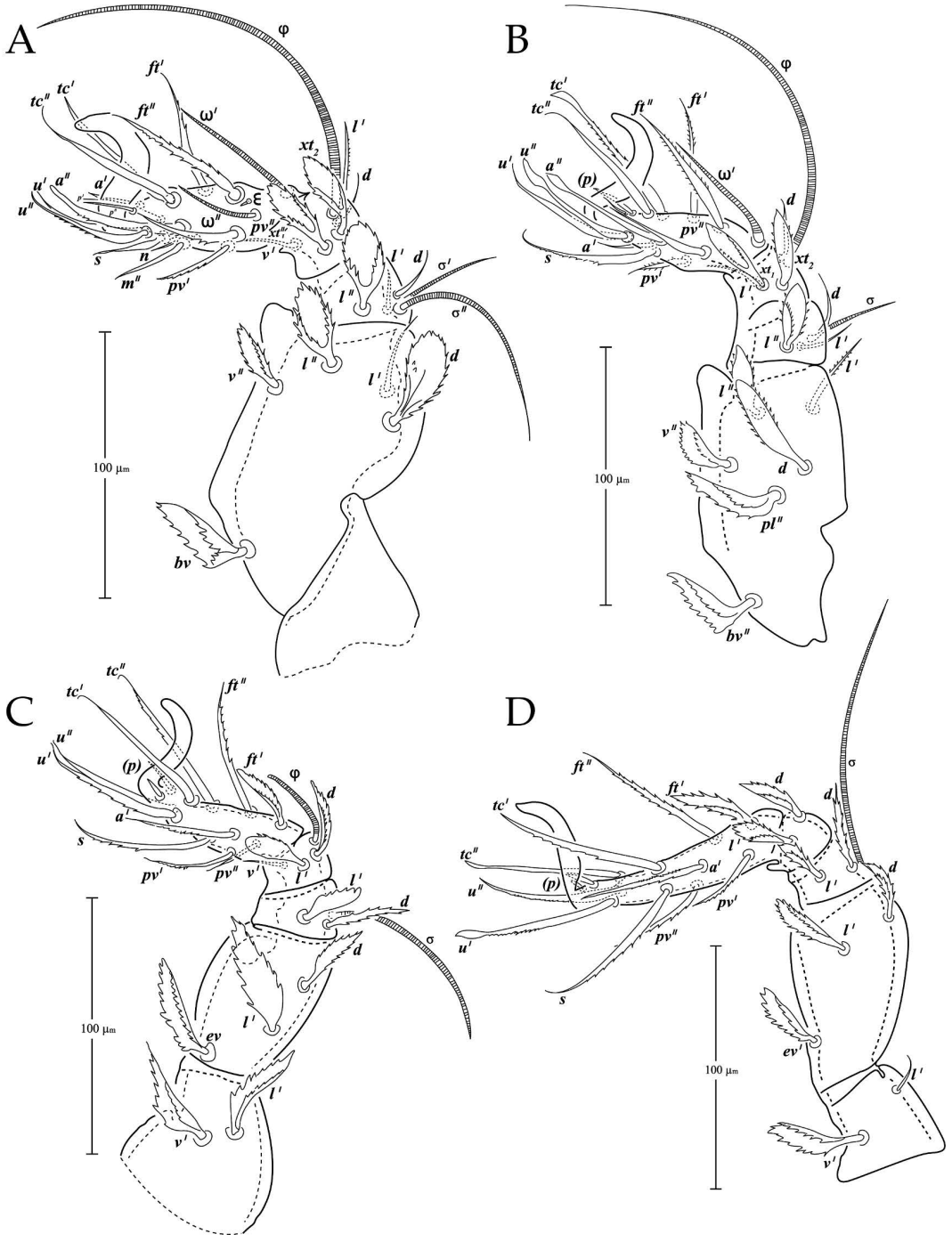

FIGURE 3: *Lohmannia maya* **n. sp.** ♀: A – chaetotaxy of first leg; B – chaetotaxy of second leg; C – chaetotaxy of third leg; D – chaetotaxy of fourth leg.

TABLE 1: Leg formula of *Lohmannia maya* **n. sp.** (Phylliform setae are noted in bold).

	Trochanter	Femur	Genua	Tibia	Tarsus
Leg I	-	***d*, *bv*, *l´*, *l´´*, *v´´***	*d*, *l´*, ***l´´*** σ^{I}, σ^{II}	*d*, *l´*, *v´*, ***xt*^{1}**, ***xt*^{2}**, ϕ	(*ft*), (*tc*), (*p*), (*u*), (*a*), *s*, *m*, (*pv*), ε, ω_1, ω_2
Leg II	-	***d*, *bv´´*, *l´*, *l´´*, *v´´*, *pl´´***	*d*, *l´*, ***l´´***, σ	*d*, *l´*, ***xt*$_1$ *xt*$_2$**, ϕ	(*ft*), (*tc*), (*p*), (*u*), (*a*), *s*, (*pv*), ω
Leg III	***v´*, *l´***	***d*, *ev´*, *l´***	***d*, *l´***, σ	***d*, *l´***, *v´*, ϕ	***ft´***, *ft´´* (*tc*), (*p*), (*u*), *a´*, *s*, (*pv*)
Leg IV	***v´***, *l´*	***d*, *ev´*, *l´***	***d*, *l´***, σ	***d*, *l´***	***ft´***, *ft´´*, (*tc*), (*p*), (u), a', *s*, (*pv*)

TABLE 2: Comparison of species of *Lohmannia* occurring in America.

	Prodorsal setae						Gastronotic setae	Subcapitulum setae				Genital setae		Anal and Adanal setae		Dimensions (μm)	
	ro	*le*	*exa*	*exp*	*ss*	*in*		*a*	m_1	m_2	*h*	medial	lateral	anal	adanal	max length	max width
L. banksi Norton *et al*., 1978	II	II	II	V	VIII	II	IX	VI	VI	II	II	VI	II	VI	II	886	443
L. juliae Mahunka, 1984	II	II	II	V	VIII	II	II	?	II	II	II	II	VI	VI	VI	898	422
L. lanceolata Grandjean, 1950	II	II	II	V	VIII	II	II	?	?	II	II	?	?	?	?	880	?
L. similis Balogh, 1962	II	II	II	VII	VIII	II	II	III	I	I	II	I	I	III	III	930	390
L. jornoti Mahunka, 1985	II	II	II	V	VIII	II	II	III	I	II	II	VI	II	I	II	826	410
L. vulcania Schatz, 1993	II	II	II	V	VIII	II	II	III	I	II	II	I	II	I	II	1125	500
L. (*Carolohmannia*) *carolensis* Norton *et al*., 1978	IV	IV	II	II	VIII	IV	IV	III	I	II	II	I	I	I	IV	1025	631
L. maya **n.sp.**	II	II	II	VII	VIII	I	II	III	I	II	II	III	II	III	II	751	358
L. bifoliata Willmann, 1936	II	II	II	VII	VIII	II	II	?	?	?	?	?	?	?	?	840	405
L. (*lanceolata*) *turcmenica Bulanova-Zachvatkina, 1960*	II	II	II	V	VIII	II	II	?	?	?	?	I	I	I	I	800	440
L. texanus Banks, 1910	IX	IX	IX	V	III	IX	IX	?	?	?	?	?	?	IX	IX	?	?

Explanation of symbols:
I= Setiform and ciliate; II= phylliform with margin ciliate; III= setiform and smooth ; IV= elongated, flattened; V= dilated, almost circular; VI= lanceolate and ciliate; VII= dilated and elongated; VIII= pectinate; IX= Phylliform, broad. Information from original descriptions.

lected and processed using by Berlese funnels. Only 34 specimens of *Lohmannia* were found, which represent a very low percentage among the Oribatid mites (García *et al*. 2014).

Remarks — Schatz (1993) made a comparison of several neotropical species from the "lanceolate" group and studied the variation of specimens of *L. lanceolata* from two localities: Peru and Galapagos Islands. *Lohmannia maya* **n. sp.** is very close to *L. lanceolata* Grandjean, *L. jornoti* Mahunka, and *L. similis* Balogh, as they share the following characteristics: they have similar shape and length of rostral setae, lateral margins of notogaster in the anterior part are parallel; both, rostral setae and marginal setae on notogaster are phylliform; however, these last setae are very thin on the second half of notogaster of the new species. Differences to other species are that the length of setae *exp* in *L. maya* **n. sp.** is twice its width, lateral setae of notogaster are wider and bent at the proximal half and are very thin in distal half; first half of setae p_1 is wide and thin at the end, the band S_8 is continuous; from subcapitulum, seta m_2 is setiform and thinner than seta *h*, besides that the new species is the smallest in length among all *Lohmannia* known from Americas (table 2). Also, other members that occur in Americas are compared in table 2 and a key to the *Lohmannia* species from Americas is presented herein.

Key to the American species of *Lohmannia*

1. Setae *exp* dilated, almost circular or elongated; gastronotic setae phylliform or dilated; two pairs of anal setae 2
— Setae *exp* phylliform with serrate margin; all gastronotic setae elongated, flattened and serrate; a single pair of anal setae. Maximum length: 1025 μm; maximum width: 631μm. .....
L. (*Carolohmannia*) *carolensis* Norton *et al*., 1978 U.S.A

2. Setae *exp* dilated but elongated 3
— Setae *exp*, almost circular 5

3. Setae *ro* much longer than *le;* setae *in* no reaching insertion of setae *c1* 4
— Setae *ro* only slightly longer than *le;* setae *in* reaching insertion setae c_1. Maximum length: 751 µm; maximum width: 351 µm .... *L. maya* **n. sp.** Mexico

4. Setae p_1 phylliform and straight; marginal setae of notogaster sparsely cilate. Maximum length: 930 µm; maximum width: 390 µm ..... *L. similis* Balogh, 1962 Peru, Galápagos Islands
— Setae p_1 phylliform and curved; marginal setae of notogaster unilaterally densely ciliate. Maximum length: 840 µm; maximum width: 405 µm..... *L. bifoliata* Willmann,1936. Curaçao

5. All gastronotic setae broadly dilate 6
— All gastronotic setae phylliform..... 7

6. With grooves running longitudinaly on prodorsum; sensillus bristle- shape; setae *le* as long as *ro*. Maximum length: 400 µm ... *L. texanus* Banks, 1910 U.S.A.
— Without grooves on prodorsum; sensillus pectinate; setae *le* shorter than *ro*. Maximum length: 886 µm; maximum width: 443 µm..... *L. banksi* Norton *et al.*, 1978 U.S.A., Mexico

7. Setae p_1 phylliform and narrow 8
— Setae p_1 phylliform but dilate 9

8. Setae *le* longer than *ro*; gastronotic median setae phylliform, long and narrow. Maximum length: 880 µm ..... *L. lanceolata* Grandjean, 1950 Panama, Peru
— Setae *le* shorter than *ro*; gastronotic median setae phylliform, short and dilated. Maximum length: 898 µm; maximum width: 422 µm..... *L. juliae* Mahunka, 1984 Paraguay

9. Anal setae 2 no reaching insertion anal setae 1..... 10
— Anal setae 2 reaching insertion anal setae 1. Maximum length: 826 µm; maximum width: 410 µm..... *L. jornoti* Mahunka, 1985 Antilles (Marie-Galante, Guadeloupe)

10. Solenidia of tibia I not so long, less long than the leg; setae *le* strongly phylliform, with serrated margins, curved, slightly funnel-shaped. Maximum length: 1125 µm; maximum width: 500 µm..... *L. vulcania* Schatz, 1993 Galápagos Islands
— Solenidia of tibia I very long, longer than leg; setae *le* narrowly phylliform. Maximum length: 800 µm; maximum width: 440 µm..... *L.* (*lanceolata*) *turcmenica* Bulanova-Zachvatkina, 1960 Argentina

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