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# A redescription of the chigger *Hannemania achalai* Alzuet and Mauri, 1987 (Acariformes: Prostigmata: Leeuwenhoekiidae) in frogs from Sierra Grande, Cordoba, Argentina

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## ABSTRACT

We redescribe the endoparasitic chigger *Hannemania achalai* based on specimens collected from the type frog host (*Pleurodema kriegi*) and an additional host (*P. cordobae*) in the type locality of this mite (Pampa de Achala, Córdoba province, Argentina). *Hannemania achalai* is diagnosed by the following characters: palpal setal formula B/B/BBB/5B, palpal claw trifurcate, galeal seta B, parasubterminala I N, 2–4 genualae I, 1 genuala II–III, femorala III absent and coxa III with 1B. This redescription is accompanied by micrographs with scanning electronic microscopy and drawings.

**Keywords** Amphibia, endoparasites, *Pleurodema cordobae*, *Pleurodema kriegi*, Pampa de Achala
**Zoobank** http://zoobank.org/2B6FE32E-0057-41C1-A53B-232357AA41F9

## Introduction

Chigger mites of the genus *Hannemania* Oudemans, 1911 (Acariformes: Prostigmata: Leeuwenhoekiidae) are temporary and highly specialized endoparasites of frogs, toads and salamanders (Amphibia). To date, 27 species are recognized, almost all from United States to Argentina, and only one from New Caledonia (Jacinto-Maldonado *et al*. 2016, Silva-de la Fuente *et al*. 2016). Chiggers are parasites only in larval stage and the taxonomy of this genus is entirely based on characteristics of this instar. Moreover, some species from South America are poorly described and in some cases the specific identification is not possible. The genus *Hannemania* is especially in need of revision.

*Hannemania achalai* Alzuet and Mauri, 1987 was described parasitizing the frogs *Pleurodema kriegi* (Müller, 1926), *Odontophrynus occidentalis* (Berg, 1896), *Pleurodema* sp. and *Odontophrynus* sp. from Pampa de Achala, Córdoba, Argentina. Their brief original description lacks illustrations of idiosoma and legs, and details of leg and palp chaetotaxy.

The parasitic load by *H. achalai* in two frog species was analysed by Biolé *et al*. (2015). They found that *P. kriegi* has higher infestation by *H. achalai* than *Pleurodema cordobae* Valetti, Salas and Martino, 2009: prevalence (number of hosts infested with *H. achalai* divided by the number of hosts examined) 80.6% and 41.6%, mean intensity (average intensity of mites per infested frogs) 29.4 and 14.4, and the intensity range (minimum and maximum number of mites

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per infested frog in the sample) 1 – 444 and 1 – 49, respectively. The specimens examined by Biolé *et al*. (2015) for the analysis of infestation parameters are the same specimens examined here for taxonomic purposes.

In this paper, we give a redescription of *H. achalai* showing measurements, drawings and SEM micrographs of diagnostic morphological characters, based on specimens collected from the type host species *P. kriegi* and the additional host *P. cordobae* previously reported by Biolé *et al*. (2015), both collected in the type locality of the mite.

## Materials and methods

Mites were extracted from subdermal layer of five specimens of *P. cordobae* and three specimens of *P. kriegi*, collected from the type locality of the mite species, and surroundings. The frog hosts are housed in the Colección Herpetológica, Ecología, Departamento de Ciencias Naturales, Facultad de Ciencias Exactas, Físico-Químicas y Naturales, Universidad Nacional de Río Cuarto, Argentina. The collecting number of each frog inspected is indicated in brackets in material examined section.

Twenty-six mites randomly selected from each host specimen were cleared in lactophenol and mounted in Hoyer's medium. Drawings were made with a Nikon Optiphot 2 compound microscope (Tokyo, Japan) equipped with a camera lucida. Line drawings were edited using the GNU Image Manipulation Program (GIMP) (The GIMP team 2014). Six mite specimens were prepared for observing and illustrating with a Hitachi SU1510 scanning electron microscope (Tokyo, Japan), following the conventional SEM protocol provided by Alberti and Nuzzaci (1996).

All the mites obtained (n = 63), including those prepared for SEM (n = 6), mounted in microscope slides (n = 26) and specimens preserved in ethanol (n = 31) were examined for qualitative characters to carry out the redescription. Those preserved in ethanol were previously and temporally mounted in a drop of lactic acid on cavity slides. Nomenclature of measured morphological structures follow Goff *et al*. (1982) and Stekolnikov (2013), all measurements are in micrometers (μm) and were taken from 26 specimens preserved in Hoyer's medium. All the mite specimens analysed are deposited in the Colección Nacional de Ácaros (CNAC) kept at the Instituto de Biología, Universidad Nacional Autónoma de México in Mexico City, Mexico.

## Results and discussion

### *Hannemania achalai* Alzuet and Mauri, 1987 (Figures 1–3)

*H. achalai* Alzuet and Mauri, 1987: 114

Diagnosis — SIF = 5B–B–3–2111.0000; fPp = B/B/BBB. Pc = 3; Gn = 2; fSc = PL > AL ≥ AM; PL/SB; fCx = 2.1.1; fSt = 0.1; DS = 53 – 75; VS = 49 – 69; NDV = 132; Ip = 765 – 865; AW = 50 – 60; PW = 65 – 80; SB = 20 – 30; ASB = 45 – 55; PSB = 20 – 25; SD = 75 – 80; AP = 15 – 20; AM = 30 – 40; AL = 30 – 40; PL = 60 – 70; S = 75 – 115; H = 40 – 45; $D_{min}$ = 30 – 45; $D_{max}$ = 50 – 65; $V_{min}$ = 30 – 35; $V_{max}$ = 35 – 45; pa = 280 – 320; pm = 240 – 275; pp = 250 – 290.

Emended description (larva, n = 63)

Idiosoma — 950 – 1215 long and 450 – 600 wide (Figures 1A–B). Eyes 2 + 2, total number of idiosomal setae range from 102 to 144. Scutum with naso, 70 – 80 long and 70 – 85 wide (Figure 1E); diameter of sensillary bases 7 – 9, AMW = 9 – 11. Ventrally with only one pair of posterior sternal setae (Figure 1B).

Gnathosoma — 95 – 110 long and 60 – 70 wide (Figures 1C–D, 3A). Palp, five-segmented with following setal distribution: trochanter without setae, femur and genua with one branched

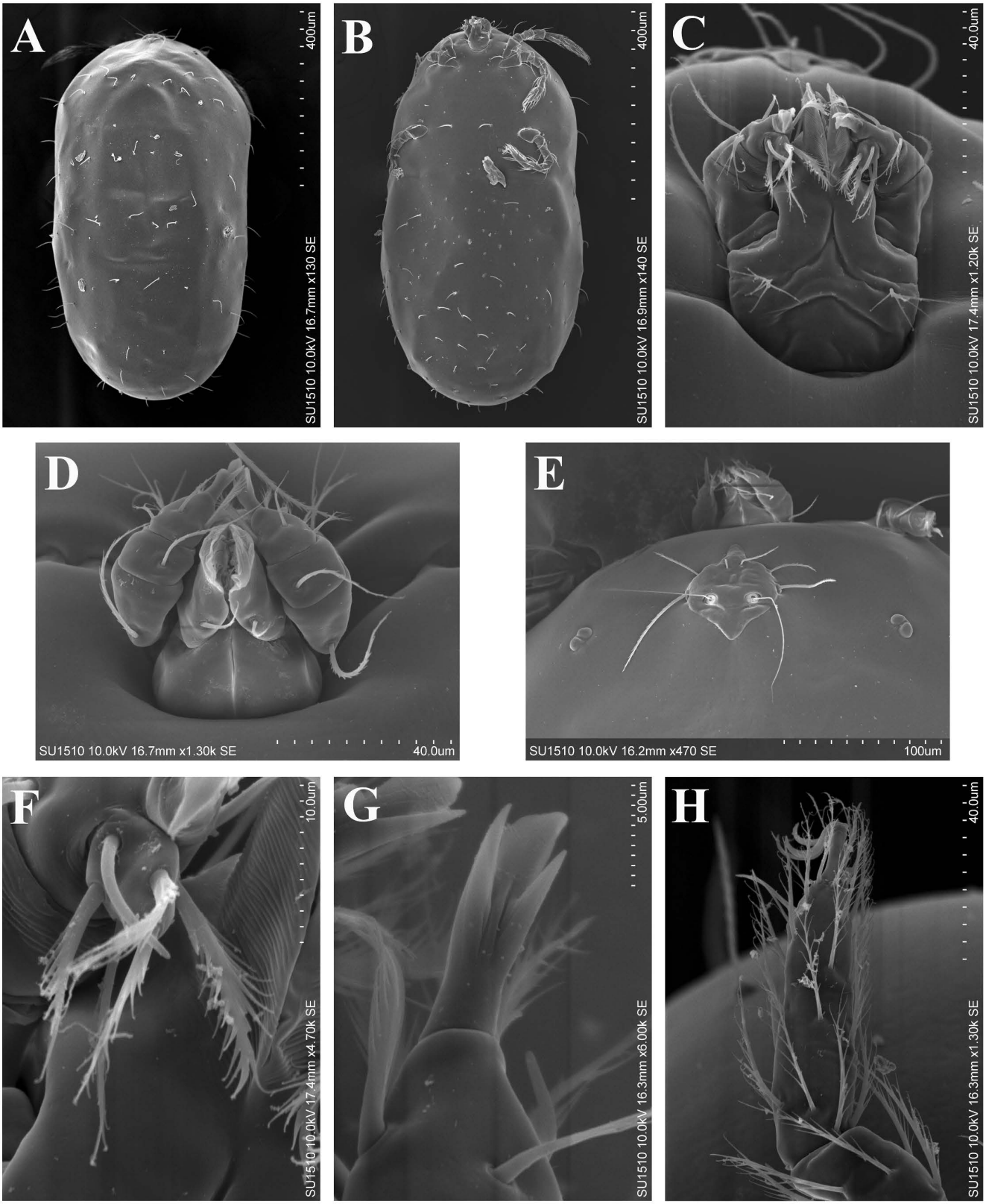



**Figure 1** *Hannemania achalai* Alzuet and Mauri, 1987 (larva): A – dorsal aspect of idiosoma, B – ventral aspect of idiosoma, C – ventral aspect of gnathosoma, D – dorsal aspect of gnathosoma, E – prodorsum showing scutum and eyes, F – palpal tarsus, G – palpal claw, H – lateral aspect of tarsus I.

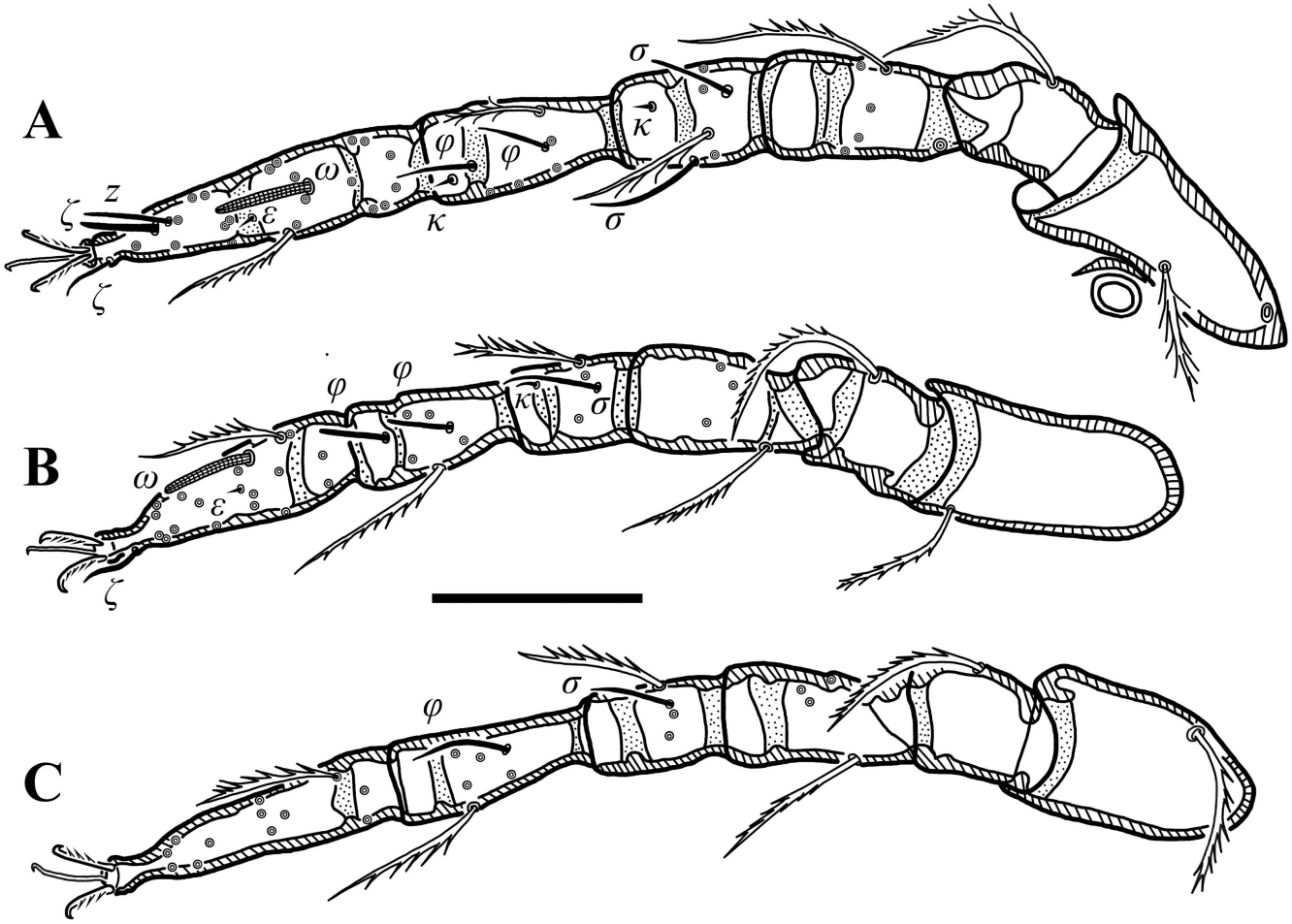



**Figure 2** *Hannemania achalai* Alzuet and Mauri, 1987 (larva): A – leg I, B – leg II, C – leg III. All the specialized setae and some representative non-specialized branched setae are illustrated. Scale bar 50 µm.

seta, tibia with dorsal, lateral and ventral setae branched, and tarsus with five branched setae and basal tarsala (Figures 1F, 3B); palpal claw trifurcate (Figures 1G, 3B); galeala branched; cheliceral blade expanded distally with a series of teeth (Figure 3C). Gnathobasal setae branched.

Legs — All six-segmented, with pair of claws and claw-like empodium, and with short thin onychotriches. Leg I: coxa with 2 non-specialized branched setae (2B); trochanter 1B; femur 6B; genu 4B, 2 genualae, microgenuala; tibia 8B, 2 tibialae, microtibiala; tarsus 24B, tarsala (21 – 24 long), microtarsala distal of tarsala, subterminala, parasubterminala, pretarsala (Figures 1H, 2A). Leg II: coxa 1B; trochanter 1B; femur 5B; genu 4B, 1 genuala, microgenuala; tibia 6B, 2 tibialae; tarsus 18B, tarsala (20 – 22 long), microtarsala slightly distal of tarsala, pretarsala (Figure 2B). Leg III: coxa 1B; trochanter 1B; femur 4B; genu 4B, 1 genuala; tibia 6B, 1 tibiala; tarsus 16B (Figure 2C).

Hosts — *Pleurodema* sp., *Odontophrynus* sp. and *O. occidentalis* (Alzuet and Mauri 1987), *P. kriegi* (Alzuet and Mauri 1987; Biolé *et al*. 2015), and *P. cordobae* (Biolé *et al*. 2015).

Material examined — 6 larvae (CNAC007184–007187) ex *Pleurodema cordobae* [847], ARGENTINA, Córdoba, Los Linderos, -32°01’04.9”, -64°56’22.9”, 2621 m a.s.l., 15 Dec.

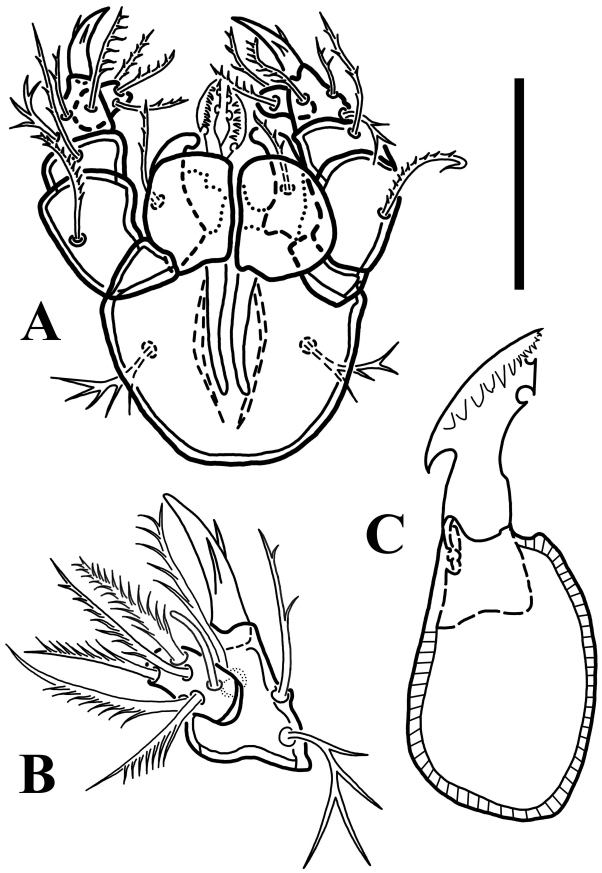



**Figure 3** *Hannemania achalai* Alzuet and Mauri, 1987 (larva): A – gnathosoma, B – palpal tibia and tarsus, C – cheliceral blade. Scale bar 50 µm (A), and 25 µm (B and C).

2009, coll. A. L. Martino, P. R. Grenat and M. Otero. 5 larvae (CNAC007188–007191) ex *Pleurodema cordobae* [884], ARGENTINA, Córdoba, Mal Paso, Pampa de Achala, -31°49’52”, -64°51’40”, 2308 m a.s.l., 16 Feb. 2010, coll. A. L. Martino, J. A. Valetti, P. R. Grenat, M. Otero and F. G. Biolé. 11 larvae (CNAC007192–007197) same data except host [885]. 5 larvae (CNAC007198–007201) ex *Pleurodema cordobae* [898], ARGENTINA, Córdoba, Cerro Negro, -31°57’26.2”, -64°54’59.7”, 2323 m a.s.l., 5 Nov. 2011, coll. M. Otero. 12 larvae (CNAC007202–007206) ex *Pleurodema cordobae* [905], ARGENTINA, Córdoba, Los Tabaquillos, -32°23’58.4”, -64°55’35.1”, 2113 m a.s.l., 22 Nov. 2011, coll. J. A. Valetti, P. R. Grenat, M. Otero and A. L. Martino. 6 larvae (CNAC007207–007210) ex *Pleurodema kriegi* [759] ARGENTINA, Córdoba, La Posta, -31°36’43.7”, -64°52’26.7”, 2159 m a.s.l., 4 Dec. 2008, coll. J. A. Valetti, J. Marquez and M. Ammann. 6 larvae (CNAC007211–007213) ex *Pleurodema kriegi* [862], ARGENTINA, Córdoba, Pampa de Achala, La Trinidad, -31°44’13”, -64°50’58”, 2318 m a.s.l., 5 Jan. 2010, coll. J. A. Valetti, A. L. Martino and C. Casale. 12 larvae (CNAC007214–007217) ex *Pleurodema kriegi* [1633], ARGENTINA, Córdoba, Pampa de Achala, El Cóndor, -31°36’23”, -64°52’06”, 2178 m a.s.l., 16 Dec. 1981, coll. R. Martori.

Remarks — All the specimens with 2 genualae I, except one specimen (CNAC007207) with 2 genualae on right leg and 1 genuala on left leg, and one specimen (CNAC007186) with 2 genualae on right leg and 3 genualae on left leg. All the specimens with 1 genuala III, except one specimen (CNAC007184) with 1 genuala on left leg and 2 genualae on right leg.

We find that our specimens are conspecific with *H. achalai* based on the palpal setal

formula, the palpal claw, and the number of specialized nude setae on legs: genualae I–III, tibialae I–III, tarsalae and pretarsalae I–II, and subterminala I.

However, the specimens analysed in this study differ from the original description by Alzuet and Mauri (1987) in the following characters: 1) the shape of galeala which is sparsely branched instead nude as mentioned by Alzuet and Mauri (1987), and 2) the presence of 2 genualae I constantly, whereas in the type specimens the number of genualae I range 2–4 (Alzuet and Mauri 1987). These differences are considered here as intraspecific variation until type material can be examined.

According to Alzuet and Mauri (1987) and Salazar Martínez *et al*. (2004) the type material is deposited at Museo de La Plata (MLP), Argentina, however, types were not seen for this study.

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