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LAELAPID MITES (PARASITIFORMES: GAMASIDA), PARASITES OF *AKODON PHILIPMYERSI* (RODENTIA: CRICETIDAE) IN THE NORTHERN CAMPOS GRASSLANDS, ARGENTINA, WITH THE DESCRIPTION OF A NEW SPECIES

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ABSTRACT: *Androlaelaps ulysespardinasi*, a new species of laelapid mite, is described based on specimens collected from the pelage of the akodontine rodent *Akodon philipmyersi* Pardiñas, D'Elía, Cirignoli and Suarez, 2005, which is endemic to the Northern Campos Grasslands in Misiones Province, Argentina. The formal taxonomic description, illustrations, and scanning electron micrographs of the new species are derived from female specimens; males and nymphs are unknown. *Androlaelaps ulysespardinasi* resembles *Androlaelaps rotundus* Fonseca, 1936 in general appearance, but it differs in having a more sclerotized, V-shaped and elevated ridge among *j4* and *j6* setae in the dorsal shield; the idiosoma is smaller (586–634 μm in length) and has a bilobed posterior margin. The sternal plate is 1.3 times broader than longer, the epigynial shield is 1.2 longer than broader, and an anal shield is almost as long as it is broad. Both species are close to *Androlaelaps misionalis* Lareschi, 2010 and *Androlaelaps maurii* Lareschi and Gettinger, 2009, but they differ in their larger size (586–650 μm), in having the distance between *j6* setae similar to the distance between *j5* setae (72–83 μm), 11 pairs of setae in opisthogaster, and lacking a pair of setae close to epigynal shield. In addition, *An. ulysespardinasi* n. sp. is unusual in having chelicerae with both digits with 2 teeth. An *An. rotundus* species group, which includes the new species, is proposed, and a key to identify the different species is provided. Host specificity of the different species with rodents from the *Akodon* division of the akodontines was observed, suggesting that cophylogeny between these mites and akodontines may have occurred.

The laelapids (Parasitiformes, Gamasida) have worldwide distribution and are one of the most speciose groups among gamasid mites, including species ranging from free-living predators to obligatory parasites (Radovsky, 1985; Dowling, 2006). Laelapid mites are ectoparasites most commonly associated with rodents; parasitism seems to have arisen multiple times (Dowling, 2006), and different species show a variety of degrees of dependence on their hosts. *Androlaelaps* Berlese, 1903 spp. have a cosmopolitan distribution (Radovsky, 1985). Six species of this genus are known from Argentina, and of them, 3 are host specific on akodontine rodents (Lareschi and Mauri, 1998; Lareschi and Gettinger, 2009; Lareschi, 2010; Lareschi and Barros-Battesti, 2010). The Akodontini tribe is one of the most diverse among sigmodontines (Rodentia, Cricetidae); 14 species have been recorded from Misiones Province in northeastern Argentina, which represent >50% of the sigmodontines from the area (Pardiñas et al., 2005, 2006). *Akodon philipmyersi* Pardiñas, D'Elía, Cirignoli and Suarez, 2005 is one of the latest species described from the tribe. This rodent is endemic to northern Campos in southern Misiones, where it is the most common prey item of the barn owl, *Tyto alba* (Gray, 1929) (Pardiñas et al., 2005).

When studying the series type of *Ak. philipmyersi*, Ulyses F. J. Pardiñas (Centro Nacional Patagónico, CENPAT, Argentina) collected 6 laelapid mites from the paratype CNP742, which were provided to the author. Three of these mites were identified as females of *Androlaelaps fahrenholzi* (Berlese, 1911). The other 3 represented a new species of *Androlaelaps*. Subsequently, successful trapping was conducted to obtain more specimens necessary for more detailed systematic analyses. Here, the new laelapid species is formally described. Information regarding abundance and prevalence of laelapids associated with *Ak. philipmyersi* also is provided.

MATERIALS AND METHODS

Rodents were captured alive in Estancia Santa Inés (Misiones Province, Argentina) between 15 and 18 May 2009. Mites were removed from host specimens in the field and then stored in 96% ethyl alcohol. In the laboratory, mites were cleared in lactophenol, mounted in Hoyers medium, and studied by light microscopy. Drawings were made with the aid of a drawing tube. Some specimens were dehydrated, examined using scanning electron miscroscopy (SEM; model 6360 LV; JEOL, Tokyo, Japan), and photographed. Mites were measured with a stage-calibrated ocular micrometer. The main taxonomic characters were measured from the holotype and paratype specimens and are presented in micrometers. Measurements are presented in the text as the value from the holotype, followed by mean ± SD and range values in parentheses. Evans and Till (1979) were followed for setal nomenclature.

Rodents were identified by U.F.J. Pardiñas and Carlos Galliari (CEPAVE, La Plata, Argentina). Pardiñas et al. (2005) was followed for host taxonomy. Voucher specimens of mites are housed at Collection of División de Entomología, Museo de La Plata (MLP), La Plata, Argentina, and Annexes of Colección de Mamíferos del Centro Nacional Patagónico (CNP), Puerto Madryn, Chubut, Argentina, and voucher specimens of rodents are housed in the Colección de Mamíferos del CNP. Some specimens still maintain field number of collection (LTU). Mean abundance (MA) and prevalence (P) were calculated according to Bush et al. (1997). For comparisons, type specimens of the following species were examined: *An. rotundus*, IBSP251a/d (from Instituto Butantán, Brazil); *An maurii*, MLP-LER403-1-7; and *An. misionalis*, MLP-CNP1925-1/9) (with *An maurii* and *An. misionalis* both from MLP).

RESULTS

Thirteen individuals of *Ak. philipmyersi* were captured, and all were parasitized with laelapids. Two hundred and sixteen female mites were collected (MA = 16.6). Twelve specimens key out in Furman's (1972) key to *An. fahrenholzi* (MA = 0.92; P = 38.5) because of the seta *ad1* of femur I not elongated, pilus dentilis broadly inflated basally, and setae of dorsal plate large and relatively coarse. The remaining 204 specimens were identified as the new species described bellow.

DESCRIPTION

Androlaelaps ulysespardinasi n. sp.

(Figs. 1–7)

Diagnosis (only females were collected): Dorsum (Figs. 1, 4): Dorsal shield reticulate approximately 20–25% longer than wide, covering approximately 85% of total idiosoma, with V-shaped sclerotized raised ridge among setae *j4* and *j6* (Fig. 1). Thirty-seven pairs of setae simple; *j*/*J*

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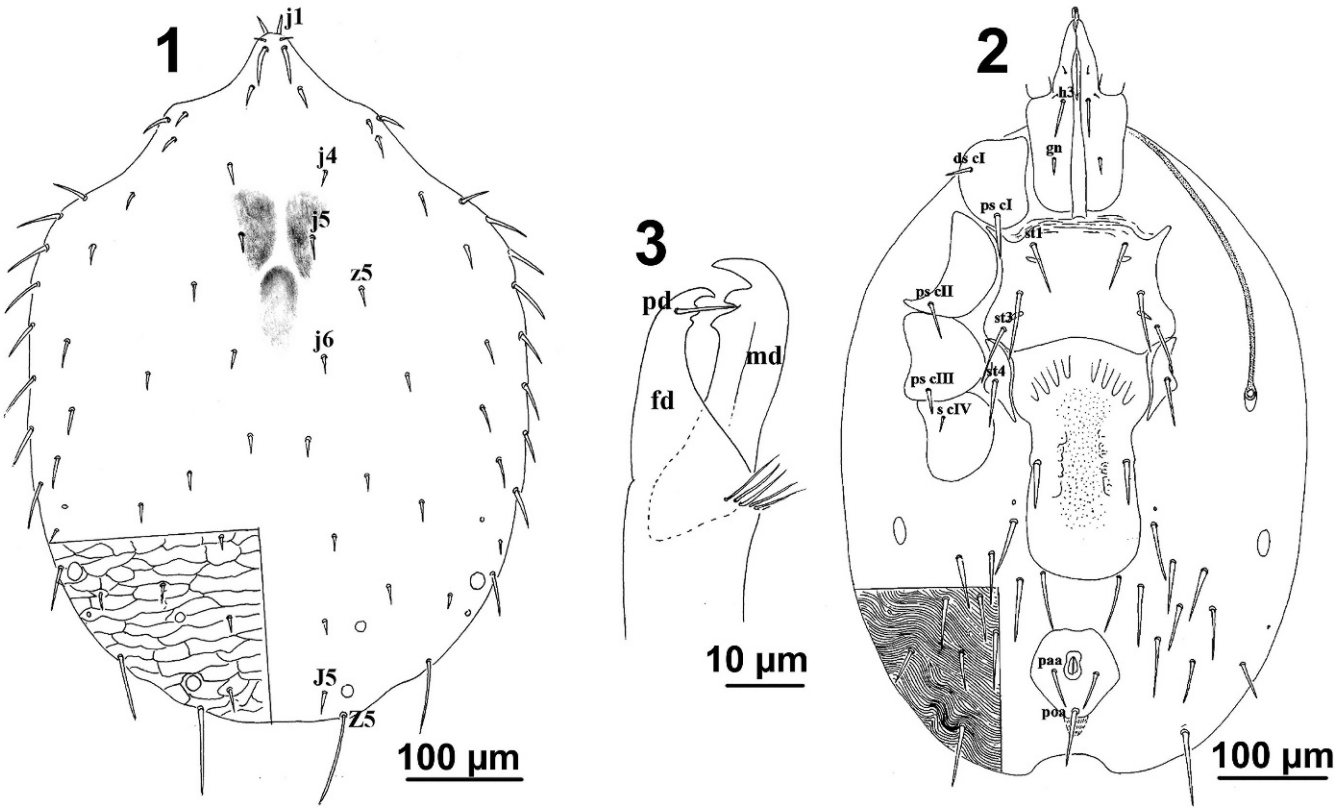
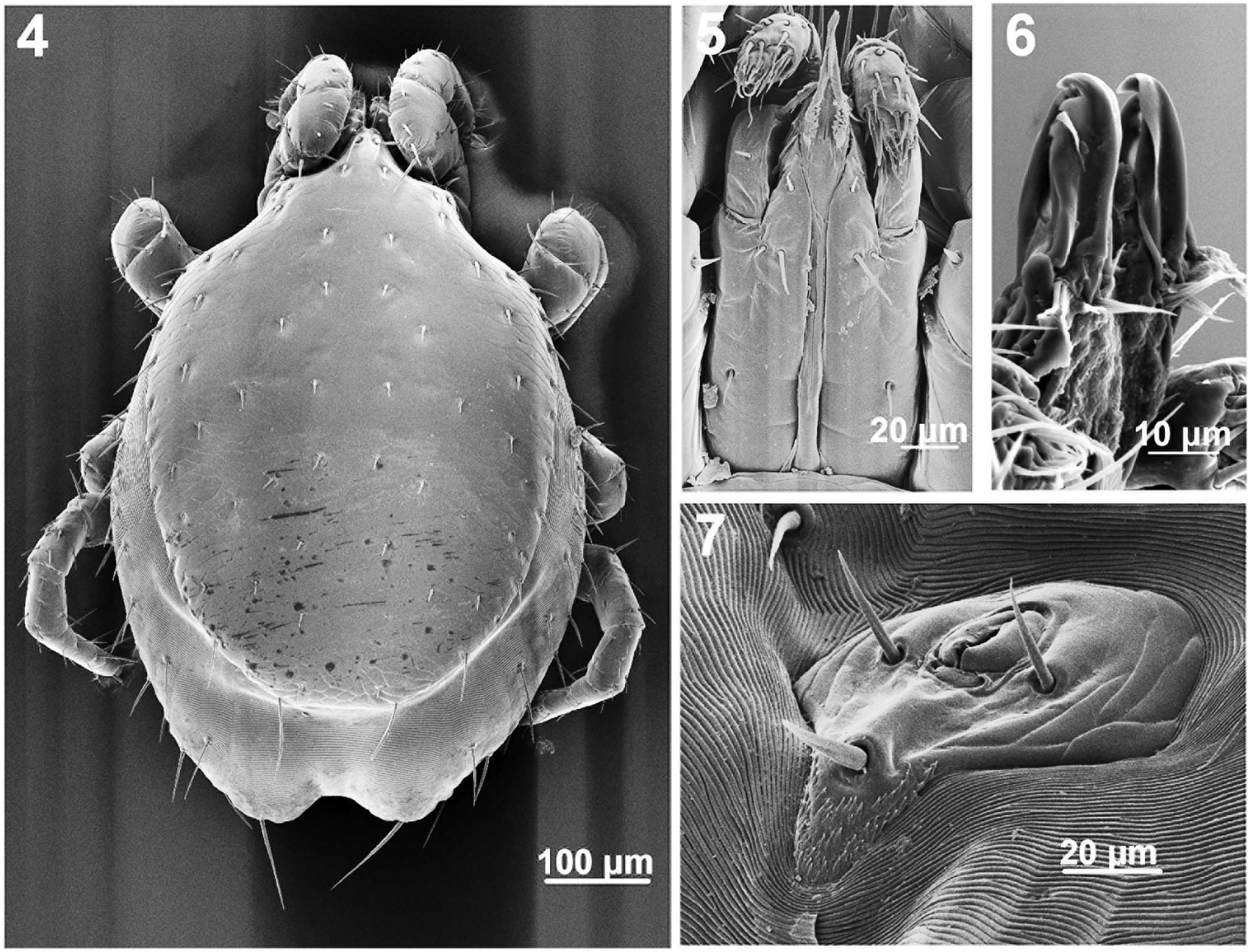


FIGURES 1–3. *Androlaelaps ulysespardinasi* n sp. (**1**) Dorsal plate. (**2**) Venter. (**3**) Chelicera.

and *z*/*Z* series complete; central setae short (19–26 µm), with setae *j5* approximately one-third to one-fourth as long as distance from base of *j5* to *z5*. Pairs along posterolateral margin longer and stronger posteriorly; *Z5* longest. Gland pores as illustrated. Margin of opisthosoma with single series of strong, simple setae, progressively longer and stronger posteriorly. Idiosoma ovoid, approximately 1.4 as long as wide; posterior margin bilobed, with soft cuticle strongly indented on either side of anal plate (Figs. 2, 4). Gnathosoma (Figs. 2, 3, 5, 6): Hypognathal groove with 6 rows of teeth; strong tritosternum with unornamented base and thick laciniae. Gnathosomal (gn) and 3 pairs of hypostomal setae present; minute with exception of hypostomal seta *h3*, twice as long as the others (46 µm vs. <19 µm) (Figs. 2, 5). Chelicerae (Figs. 3, 6) chelate-dentate; movable digit (md) with hooked tip and 2 teeth; fixed digit (fd) 20% shorter than movable digit, with 2 teeth and long setiform pilus dentilis (pd); arthrodial corona of shortened processes. Ventral (Fig. 2): Sternal shield ≥1.3 times broader than long; broadest at lateral angles between coxae II and III. Reticulate presternal region anterior to sternal shield. Anterior margin slightly convex and slightly expanded at level of sternal seta *st1*; posterior margin and lateral margins concave; with 3 pairs of sternal setae: *st1*, *st2*, and *st3* long, tips reaching or over-reaching the following setal bases. Sternal seta *st1* 25% shorter than *st3*; with 2 pairs of elongate/lyriform pores on shield. Metasternal seta *st4* subequal in length with *st1*. Epigynal reticulate shield broad, linguiform, almost parallel sided and rounded posteriorly; anterior margin convex, with short anterior flap of radiating lines, bearing single pair of setae (*st5*), shorter than sternal seta *st1*, *st3*, and metasternal *st4*. Peritrematic shield well sclerotized, extending 24 µm posterior to stigma. Metapodal shields weakly sclerotized, longer (34 µm) than wide (12 µm). With pair of small shields situated at each side of epigynal shield. Opisthogaster reticulate with 11 pairs of strong setae. Anal shield (Figs. 2, 7) triangular, almost as long as broad; greatest width posterior level of the anus. Paranal (paa) setae setiform 70% length of postanal (poa), inserted immediately posterior level of mid-anus, reaching to insertion of longer, stronger postanal seta. Cribrum well developed, composed of 3 rows of teeth. Anal opening about half its length from anterior margin of anal shield. Legs (Fig. 2): All legs thick and subequal in length; proximal seta of coxa I (ps CI) strong and setiform; distal seta (ds cI) shorter. Posterior seta of coxa II (ps cII) and III (ps cIII) strong but not spinose; seta of coxa IV (s cIV) minute. Long seta *ad1* in femur I, with length subequal to width of femur at level of the seta; long seta *ad3* in genu I. Leg chaetotaxy normal for *Androlaelaps* (sensu Till, 1963) (from coxa to tarsus, omitting tarsus I): leg I: 2, 6, 13, 13, 13; leg II: 2, 5, 11, 11, 10, 16; leg III: 2, 5, 6, 9, 8, 16; leg IV: 1, 5, 6, 10, 10, 16.

Measurements (10 specimens): Dorsal shield length, 614, 618 ± 18.9 (586–653); dorsal shield width, 470, 476 ± 19.9 (461–509). Length of *j5* = 22, 22 ± 2.2 (19–24); *z5* = 22, 24 ± 1.8 (22–26); *J5* = 14, 13 ± 1.0 (12–14); *Z5* = 106, 106 ± 2.5 (101–110). Distance between *j5* setae = 65, 63 ± 3.0 (58–65); *z5* setae = 134, 139 ± 4.3 (134–146); *j6* setae = 74, 76 ± 2.8 (72–82); *j5*-*z5* setae = 65, 62 ± 4.4 (55–68); *J5* setae = 82, 83 ± 1.9 (79–86); *Z5* setae = 125, 126 ± 4.3 (120–132). Length of gnathosomal seta = 19, 18 ± 1.1 (17–19). Distance between gnathosomal setae = 60, 61 ± 2.4 (55–64). Length of hypostomal seta *h3* = 46, 44± 2.5 (41–46); distance between gnathosomal and hypostomal setae *h3* = 48, 48±1.3 (46–50). Sternal shield length = 122, 120 ± 7.4 (110–127); sternal shield width = 161, 162 ± 3.1 (156–166). Length of sternal seta *st1* = 67, 62 ± 3.4 (58–67); sternal seta *st3*, 77, 81 ± 3.3 (77–86). Distance between sternal setae *st1* = 96, 97 ± 1.7 (94–98); between sternal setae *st3* = 149, 152 ± 2.0 (159–154). Length of metasternal seta *st4*, 67, 63 ± 3.8 (55–67). Epigynal shield length = 118, 123 ± 5.3 (115–130). Greatest width of epigynal shield, 110, 107 ± 3.9 (103–115); epigynal seta = 55, 57 ± 2.1 (53–60). Distance between epigynal setae = 89, 86 ± 2.6 (82–89). Greatest width anal shield = 96, 95 ± 7.2 (89–108). Distance from postanal seta to anterior midline of anal shield = 84, 86 ± 2.9 (82–91). Length of paranal seta = 50, 49 ± 2.1 (46–53); postanal seta = 70, 71 ± 3.7 (65–77). Distance between paranal setae = 38, 37 ± 1.0 (36–38). Length of proximal seta coxa I = 58, 57 ± 2.0 (53–60); distal seta coxa I = 36, 36 ± 1.5 (34–38); posterior seta coxa II = 50, 52 ± 3.3 (48–57); posterior seta coxa III = 34, 33 ± 2.5 (29–36); seta coxa IV = 19, 23 ± 2.9 (19–26). Length of seta *ad1* in femur I = 67, 61 ± 4.8 (56–67); *ad3* in genu I = 53, 53 ± 2.4 (48–58).



FIGURES 4–7. Scanning electron micrographs of *Androlaelaps ulysespardinasi* n sp. (**4**) Dorsum. (**5**) Gnathosoma. (**6**) Chelicera and pilus dentilis. (**7**) Detail of anal shield and cribrum.

Taxonomic summary

Type host: Akodon philipmyersi Pardiñas, D'Elía, Cirignoli and Suarez, 2005 (Sigmodontinae: Akodontini), CNP742. This voucher specimen is a paratype collected by U.F.J. Pardiñas on 16 March 2001 and is housed at CNP.

Type locality: Argentina, Province of Misiones, Department of Posadas, Estancia Santa Inés, Ruta No. 105 km 10 (27°31′32″S, 55°52′19″W, 95 m).

Type material: The type series was deposited in the following collections: Collection of División de Entomología, MLP (holotype MLP-CNP742-3 and 7 paratypes: MLP-CNP742-1/2, MLP-LTU722-3/7); CNP (2 paratypes: LTU722-1/2).

Other specimens studied: One hundred and ninety four females collected from individuals of *Ak. philipmyersi* captured in the type locality. Laelapids still maintain the field number of their hosts: LTU693-1/25, LTU694-1/25, LTU702-1/3, LTU703-1/29, LTU718-1/16, LTU719-1/14, LTU720-1/11, LTU722-8/13, LTU723-1/13, LTU724-1/15, LTU725-1/18, LTU728-1, and LTU729-1/18.

Etymology: The species epithet *ulysespardinasi* is used as a noun in apposition honoring my friend the mammalogist Ulyses F. J. Pardiñas, who provided me with the holotype and 2 paratypes of the new species. In honoring Dr. Pardiñas, I want to recognize not only his contribution to the knowledge of sigmodontines but also his special care in collecting and considering their parasites.

Biology: Six of the 10 laelapids of the type series were reproductive females, each carrying a single larva. Eggs were not observed in the slide preparations. Male, nymph, and larva unknown.

Prevalence and mean abundance: 100% and 16.

Remarks

Androlaelaps ulysespardinasi n. sp. resembles *Androlaelaps rotundus* Fonseca, 1936, *Androlaelpas misionalis* Lareschi, 2010 and *Androlaelaps maurii* Lareschi and Gettinger, 2009 in general appearance, but it is smaller than *An. rotundus* (586–634 µm in length and 461–509 µm in width vs. 650 and 510–550 µm, respectively, in *An. rotundus*) and larger than *An. misionalis* and *An. maurii* (477–538 µm in length and 366–462 µm in width). In addition, the new species differs from these species in having a more sclerotized V-shaped raised ridge among *j4* and *j6* setae in the dorsal shield, the idiosoma with bilobed posterior margin, and the chelicerae with 2 teeth in each digit (vs. only 1 in movable digit, and fixed digit edentate in *An. misionalis* and *An. maurii*; unknown in *An. rotundus*, bad conservation of the type series did not allow observation of this characteristic). *Androlaelaps ulysespardinasi* n. sp. resembles *An. rotundus* in having the distance between *j6* setae similar to the distance between *j5* setae (72–83 µm), whereas in *A. misionalis* and *A. maurii*, the *j6–j6* distance is greater than *j5–j5* (>103 µm); in having 11 pairs of seatae in opisthogaster (vs. 13 in *An. misionalis* and *An. maurii*), and lacking a pair of setae close to the epigynal shield.

DISCUSSION

The province of Misiones is situated at northeastern Argentina and is limited to the west by Paraguay; Brazil to the east, to the north, and to the south; and the Argentinean province of Corrientes to the southwest. Not only is *An. ulysespardinasi* n. sp. described from Misiones Province but also *An. fahrenholzi* is recorded for the first time from this area. Previously, only 2 laelapids were reported from the province, *Mysolaelpas parvispinosus* Fonseca, 1935 from *Oligoryzomys* sp. (Mauri, 1982) and *An. misionalis* from *Akodon montensis* Thomas, 1913 (Lareschi, 2010), but none from northern Campos grasslands. The results obtained increase to 4 lalapids present in Misiones Province.

In contrast, *An. ulysespardinasi* and *An. fahrenholzi* are the first parasites to be found in association with *Ak. philipmyersi.* Of the 13 rodents trapped, 2 females were pregnant and 6 males had scrotal testes, indicating that this population was actively breeding. Thus, high values of total laelapid prevalence (100%) and mean abundance (16.6) may be related to the breeding condition observed in most of the *Ak. philipmyersi* population, when contact among rodents is more frequent and the transmission, recruitment, or both of ectoparasites more probable. This rodent species is known to be reproductively active toward the end of the summer season (Pardiñas et al., 2005), suggesting reproduction extends at least until early autumn.

Androlaelaps fahrenholzi is a species complex, with a great range of variation in its morphology across its cosmopolitan distribution and variety of hosts (including rodents, marsupials, bats, and birds) (Strandtmann and Wharton, 1958; Till, 1963; Furman, 1972). Three of the 6 mites taken from the rodent CNP742, and 12 specimens collected by the author were identified as females of *An. fahrenholzi*. Individuals of *Necromys lasiurus* (Lund, 1840), captured in sympatry with *Ak. philipmyersi*, also were parasitized with *An. fahrenholzi*. In contrast, *An. ulysespardinasi* seems to be specific for *Ak. philipmyersi*, because it has not been collected from any other sympatric rodent. Moreover, the new species was present in both male and female rodents, independently of their reproductive condition and age. The presence of only females of *An. ulysespardinasi* is in accordance with the literature, because males and immatures of most *Androlaelaps* species are infrequently recovered except in the nest (Radovsky, 1985). Because rodent hosts were captured alive while foraging, probably the presence of only female mites just starting to initial reproduction may be related to their necessity of dispersion.

Substantial intraspecific variation in *An. rotundus* was reported (Furman, 1972) related to different host species, suggesting that it is a composite species (Gettinger and Owen, 2000). This assumption was corroborated by examining specimens deposited at the Acari Collection of the Instituto Butantan ([IBSP], São Paulo, Brazil) and in my collection (Lareschi and Barros-Battesti, 2010). A lectotype and series of paralectotypes of *An. rotundus* were designated, *N. lasiurus* was proposed as probable type host, and new morphological details were given that contribute to the recognition of *An. rotundus* "sensu stricto" (Lareschi and Barros-Battesti, 2010) and help to describe new species previously erroneously identified as *An. rotundus* (such as *An. maurii*) (Lareschi and Gettinger, 2009). Here, the inclusion of *An. rotundus*, *An. maurii*, *An. misionalis*, and *An. ulysespardinasi* in a species group ("*An. rotundus* species group") is postulated on the basis of the following unique and shared characters: enlarged *ad1* seta in femur I with length subequal to width of femur at level of seta, and *j5* setae of dorsal plate minute, approximately one-third to one-fourth as long as distance from base of *j5* to *z5*. Moreover, host specificity of the different species with rodents from the *Akodon* division of the akodontines (Pardiñas et al., 2006) was observed (*An. rotundus* on *N. lasiurus*; *An. maurii* on *Deltamys kempi* Thomas, 1917; *An. misionalis* on *Ak. montensis*; and *An. ulysespardinasi* on *Ak. philipmyersi*), suggesting that cophylogeny between these mites and akodontines may have occurred. Further examination of *Androlaelaps* spp. of all remaining species of the *Akodon* division should shed further light in this point.

Key to species included in *Androlaelaps rotundus* species group

1. Dorsal shield <540 μm; distance between *j6* setae greater than the distance between *j5* setae (>103 μm); 13 pairs of seatae in opisthogaster, with a pair of setae close to the epigynal shield . . . . . 2.
– Dorsal shield >580 μm; distance between *j6* setae similar to the distance between *j5* setae (<83 μm); 11 pairs of setae in opisthogaster, without a pair of setae close to the epigynal shield . . . . . 3.
2. Dorsal shield length >510 and <540 μm; sternal setae with tips not extending beyond the following setal base; sternal shield with a strongly convex posterior border; epigynal shield with a slightly concave posterior border; short epigynal setae (<35% of total epigynal shield length) . . . *Androlaelaps misionalis* Lareschi, 2010
– Dorsal shield length <500 μm; sternal setae with tips extending beyond the following setal base; sternal shield with a slightly convex posterior border; epigynal shield with a strongly concave posterior border; epigynal setae 50% of total epigynal shield length . . . . . *Androlaelaps maurii* Lareschi and Gettinger, 2009
3. Dorsal shield with a V-shaped more sclerotized raised ridge in its center; idiosoma bilobed posteriorly with soft cuticle strongly indented on either side of the anal plate; sternal plate 1.3 times broader than longer; epigynial shield 1.2 longer than broader; anal shield triangular, almost as long as it is broad . . . . . *Androlaelaps ulysespardinasi* n. sp.
– Dorsal shield without a more sclerotized raised ridge in its center; idiosoma rounded posteriorly; sternal plate 1.5 times broader than longer; epigynial shield as long as broad; anal 1.5 times longer than wider in . . . . . *Androlaelaps rotundus* Fonseca, 1936

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