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LAELAPINAE MITES (ACARI: PARASITIFORMES: LAELAPIDAE) PARASITIC OF SIGMODONTINE RODENTS FROM NORTHERN PERU, WITH THE DESCRIPTION OF A NEW SPECIES FROM *AKODON AEROSUS* (RODENTIA: CRICETIDAE: SIGMODONTINAE)

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ABSTRACT: Laelapine mites are common parasites of sigmodontine rodents in the Neotropics. However, few species are reported from Peru as a result of the low number of mammal surveys that include ectoparasite collections. Herein we report 12 species of mites from northern Peru. From these, 8 are reported for the first time for the country, and 1 is new to science, *Androlaepaps aerosus* sp. nov., the latter associated exclusively with the sigmodontine *Akodon aerosus*. Most of the laelapine species were host specific. The new species, included in the *Androlaelaps rotundus* species group, resembles *An. rotundus* "sensu stricto" and *An. ulysespardinasi* in general appearance but is unique in the length of the hypostomal seta *h3* (>58 μm), which is 3 times as long as the gnathosomal seta, and its tip reaching or over-reaching the gnathosomal setal bases; dorsal seta *j2* is very long (>70 μm), almost reaching the point of *j3*.

The Alto Mayo basin is located on the eastern foothills of the Andes, in northern Peru, and is characterized by a mountainous terrain. The habitat is Humid Premontane Tropical Forest (Holdridge, 1967), which harbors a large variety of ecosystems that are inhabited by a high diversity of small mammals. During a recent survey of small mammals and their parasites in the Alto Mayo basin, 51 species of mammals were collected, 11 of which were sigmodontinae rodents.

Laelapine mites (Parasitiformes, Laelapidae) are common parasites of small mammals, mainly sigmodontines. Although these rodents are abundant, knowledge regarding their ectoparasites is scarce. However, a few mite species have been previously reported from Peru. Early work by Strandmann and Wharton (1958) mentioned the presence of *Androlaelaps rotundus* (Fonseca, 1935), *Androlaelaps fahrenholzi* (Ewing, 1925), *Haemolaelaps chinchillulae* (Strandtmann, 1948), and *Gigantolaelaps peruviana* (Ewing, 1933). In addition, Gettinger and Gardner (2005), when describing *Laelaps neacomydis* from Bolivia, commented on the presence of this mite in association with the rodent *Neacomys tenuipes* Thomas, 1900, in eastern Peru.

Herein, we contribute to knowledge regarding diversity of laelapine mites parasitic on rodents from northern Peru by increasing the number of known species in the area and by describing a new species of *Androlaelaps* associated with *Akodon aerosus* Thomas, 1913.

MATERIALS AND METHODS

Rodents were captured in May 2007 during an expedition to the Alto Mayo basin, Province of Moyabamba, Department of San Martín, Peru, using Victor rat traps or Sherman aluminum folding live traps. Mites were removed from host specimens in the field and stored in 96% ethyl alcohol. In the laboratory, mites were cleared in lactophenol, mounted in Hoyers medium, and studied by light microscopy. Mites were measured with a stage-calibrated ocular micrometer. The new species was drawn with the aid of a drawing tube; some specimens were dehydrated, to allow examination using a SEM (Jeol 6360 LV), and photographed. The main taxonomic characters were measured from the holotype and paratype specimens and presented in micrometers (μm). Measurements are presented in the text as the value from the holotype, followed by mean ± standard deviation and range values in parentheses. Evans and Till (1979) were followed for setal nomenclature, and Musser and Carleton (2005) and Weksler et al. (2006) for host taxonomy. Voucher specimens of hosts are housed at the Departamento de Mastozoología, Museo de Historia Natural de la Universidad Nacional Mayor de San Marcos, Lima, Peru (MUSM), and Division of Mammals, Field Museum of Natural History, Chicago, Illinois (FMNH); in addition, mites are housed at the Collection of División de Entomología, Museo de La Plata, La Plata, Argentina (MLP), and the Division of Insects, Field Museum of Natural History, Chicago, Illinois (FMNH). For comparative purposes, specimens of related species were studied. Mammal collecting was approved by the University of Illinois at Chicago Animal Care Committee.

RESULTS

Twelve species of laelapine mites were identified parasitizing 10 sigmodontine species from northern Peru (Table I). Of these, 1 of the species collected exclusively from *Akodon aerosus* is new to science and is described below.

DESCRIPTION

Androlaelaps aerosus sp. nov.

(Figs. 1–8)

Diagnosis (only females were collected): Dorsum (Figs. 1, 4): Dorsal shield reticulate about 1.3 times longer than wide, covering more than 90% of total idiosoma, with a slightly *V*-shaped sclerotized ridge among setae *j4* and *j6* (Fig. 1). Thirty-seven pairs of setae simple; *j*/*J* and *z*/*Z* series complete; dorsal seta *j2* very long (>70 μm), almost reaching point of *j3*; central setae about 25–28 μm, with setae *j5* about 1/3 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, rounded posteriorly, about 1.3 as long as wide; posterior margin rounded. Gnathosoma (Figs. 2, 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*, which is 3 times as long as the others (58–63 μm), with its tip reaching insertion of gnathosomal seta (Figs. 2, 5–6). Chelicerae (Figs. 3, 7), chelate-dentate; movable digit (md) with hooked tip; fixed digit (fd) 20% shorter than movable digit, with 2 small teeth and long setiform pilus dentilis (pd); arthrodial corona of shortened

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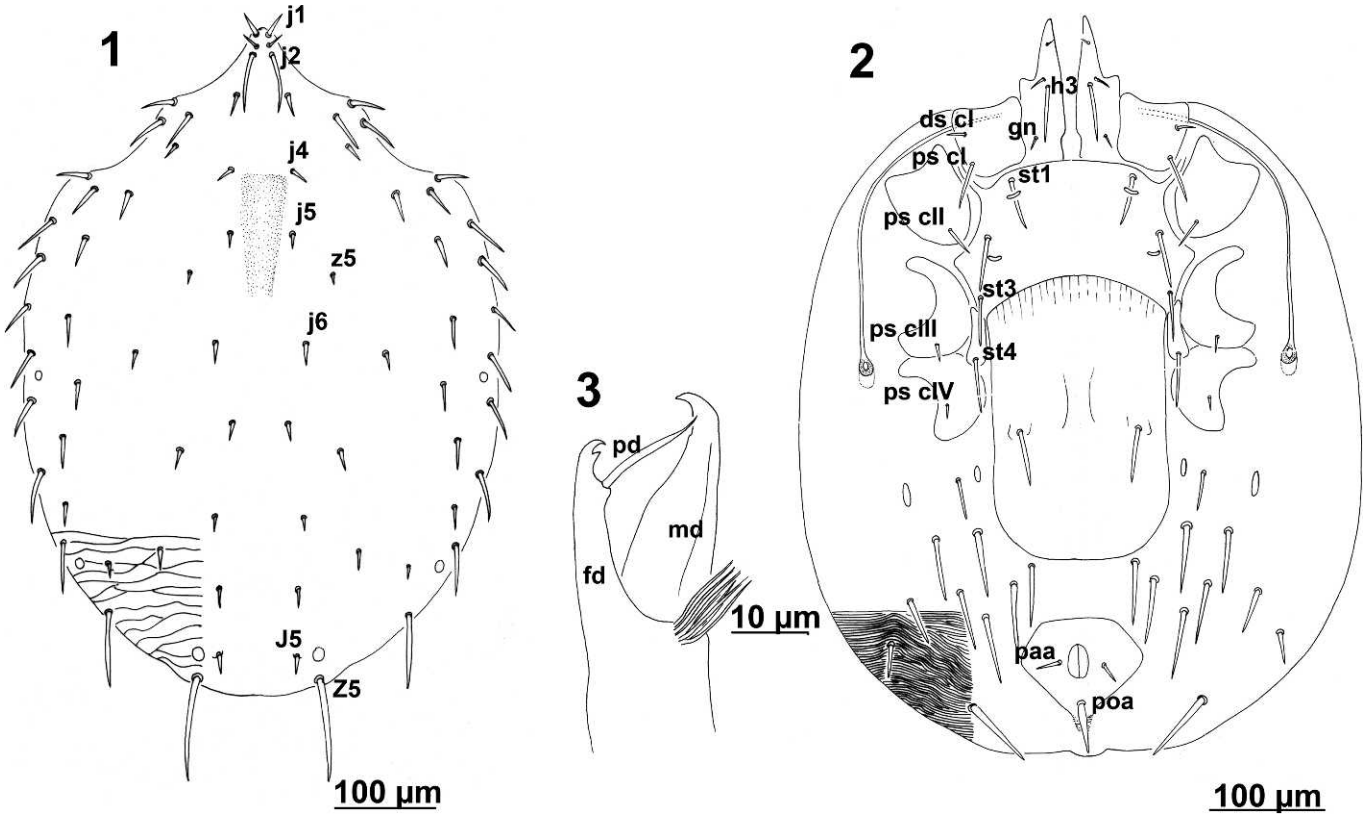
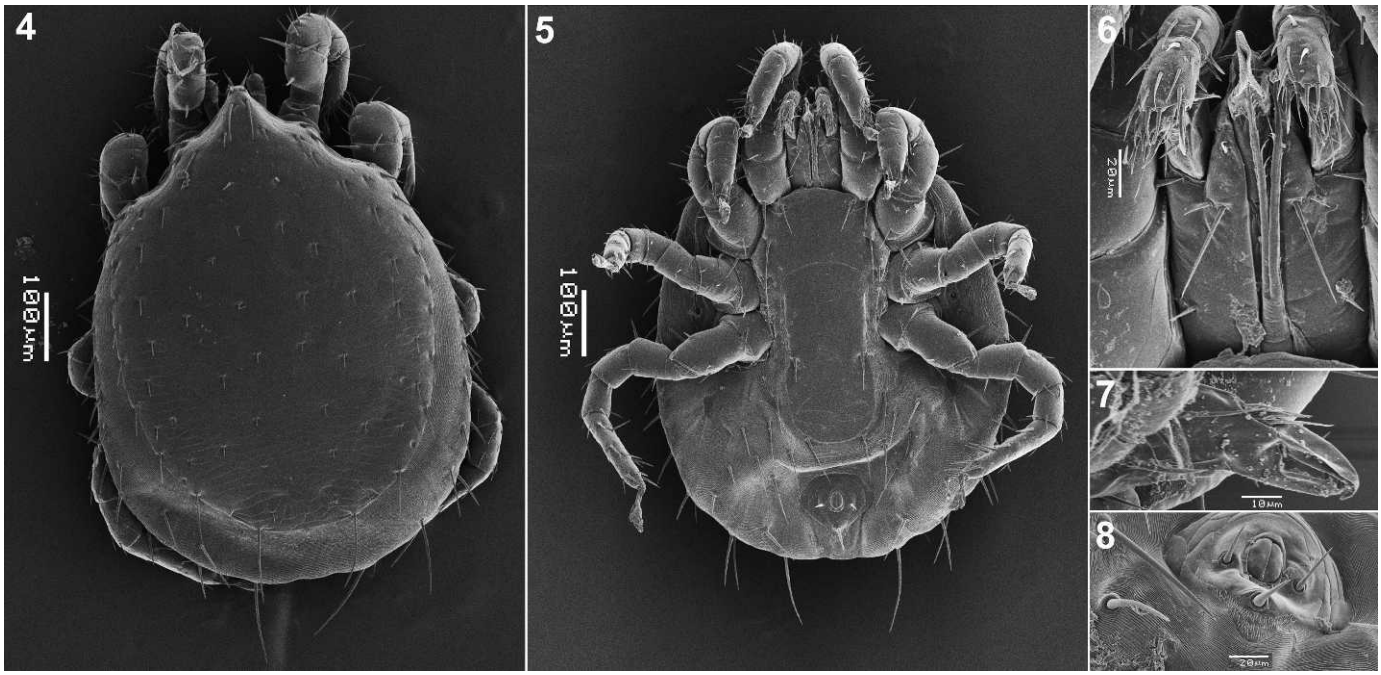
Table 1. Mite species collected from every rodent species from northern Peru.

Androlaelaps fahrenholzi Ewing, 1925	*Euryoryzomys macconnelli* (Thomas, 1910), *Oecomys bicolor* (Tomes, 1860), and *Hylaeamys yunganus* (Thomas, 1902)
Gigantolaelaps goyanensis Fonseca, 1939	*Nectomys rattus* (Pelzeln, 1883)
Gigantolaelaps mattogrossensis (Fonseca, 1935)	*Holochilus sciureus* Wagner, 1842
Gigantolaelaps oudemansi Fonseca, 1939 type I	*E. macconnelli*, *Hylaeamys perenensis* (Allen, 1901), and *H. yunganus*
Gigantolaelaps tiptoni Furman, 1971	*Oe. bicolor* and *Oligoryzomys destructor* (Tschudi, 1844)
Laelaps furmani Gettinger, 1992	*Oe. bicolor*
Gigantolaelaps intermedia Furman, 1971	*Neacomys spinosus* Thomas, 1882
Laelaps boultoni Furman and Tipton, 1961	*N. spinosus* Thomas, 1882
Laelaps neacomydis	*N. spinosus* Thomas, 1882
Laelaps paulistanensis Fonseca, 1936	*Oligoryzomys microtis* Allen, 1916
Mysolaelaps parvispinosus Fonseca, 1936	*O. destructor*
Androlaelaps aerosus sp. nov.	*Akodon aerosus* Thomas, 1913

processes. Venter (Figs. 2, 5): Sternal shield about 1.4 times broader than long; broadest at lateral angles between coxae II and III. Anterior margin 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* 20% shorter than *st3* with 2 pairs of elongate/lyriform pores on shield. Metasternal seta *st4* subequal in length with *st1*. Epigynal hardly 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*), subequal in length to sternal seta *st1*, *st3*, and metasternal *st4*. Peritrematic shield well sclerotized, extending 30 μm posterior to stigma. Metapodal shields well sclerotized, more than twice longer than wide. With pair of small shields situated at each side of epigynal shield. Opisthogaster reticulate with 10 pairs of setae. Anal shield (Figs 2, 5, 8) triangular, almost as long as broad; greatest width posterior level of anus. Paranal (paa) setae setiform about 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. 5): All legs thick and subequal in length; proximal seta of coxa I (ps CI) strong and setiform; distal seta (ds cI) shorter.



Figures 1–3. *Androlaelaps aerosus* sp. nov. (**1**) Dorsal plate. (**2**) Venter. (**3**) Chelicera.



FIGURES 4–8. Scanning electron micrographs of *Androlaelaps aerosus* sp. nov. (**4**) Dorsum (some setae are missing). (**5**) Venter. (**6**) Gnathosoma. (**7**) Chelicera. (**8**) Detail of anal shield and cribrum.

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.

Measurements (10 specimens): Dorsal shield length, 639, 649 ± 18.8 (630–675); dorsal shield width, 504, 506 ± 20 (486–540). Length of *j5* = 25, 26 ± 1.5 (25–28); *z5* = 25, 26 ± 1.3 (25–28); *J5* = 18, 17 ± 2.2 (13–18); *Z5* = 120, 127 ± 4.5 (120–133). Distance between *j5* setae = 70, 72 ± 1.8 (70–75); *z5* setae = 158, 158 ± 3.8 (153–162); *j6* setae = 98, 98 ± 3.9 (95–105); *j5 z5* setae = 63, 65 ± 2 (63–68); *J5* setae = 18, 17 ± 2.2 (13–18); *Z5* setae = 120, 127 ± 4.5 (120–133). Length of gnathosomal seta = 18, 20 ± 2.2 (18–23). Distance between gnathosomal setae = 63, 61 ± 4.4 (53–65). Length of hypostomal seta *h3* = 63, 60 ± 1.8 (58–63); distance between gnathosomal and hypostomal setae *h3* = 60, 57 ± 3.1 (50–60). Sternal shield length = 148, 141 ± 5.1 (135–148); sternal shield width = 200, 197 ± 4.4 (188–200). Length of sternal seta *st1* = 75, 76 ± 2.8 (73–80); sternal seta *st3*, 93, 95 ± 4.3 (93–103). Distance between sternal setae *st1* = 110, 113 ± 2.0 (110–115); between sternal setae *st3* = 185, 188 ± 2.8 (185–193). Length of metasternal seta *st4*, 70, 75 ± 5.1 (70–85). Epigynal shield length = 140, 145 ± 4.7 (138–150). Greatest width of epigynal shield, 138, 137 ± 1.3 (135–138); epigynal seta = 70, 72 ± 2.3 (70–75). Distance between epigynal setae = 110, 112 ± 3.2 (110–120). Greatest width anal shield = 96, 95 ± 7.2 (89–108). Distance from postanal seta to anterior midline of anal shield = 120, 121 ± 4.3 (115–130). Length of paranal seta = 58, 61 ± 2.8 (58–65); postanal seta = 80, 84 ± 3.3 (80–88). Distance between paranal setae = 48, 46 ± 2.2 (43–48). Length of proximal seta coxa I = 60, 62 ± 1.5 (60–63); distal seta coxa I = 40, 39 ± 1.0 (38–40); posterior seta coxa II = 58, 58 ± 1.9 (55–60); posterior seta coxa III = 38, 38 ± 2.0 (35–40); seta coxa IV = 25, 27 ± 2.1 (25–30). Length of seta *ad1* in femur I = 70, 66 ± 4.2 (60–70); *ad3* in genu I = 58, 57 ± 3.0 (50–60). Leg chaetotaxy coincides with the ordinary for the genus.

Taxonomic summary

Type host: Akodon aerosus (Sigmodontinae: Akodontini), FMNH 203654. This voucher specimen is a scrotal male collected by one of the authors (PMV) on 20 May 2007 and housed at the Division of Mammals, Field Museum of Natural History, Chicago, Illinois.

Type locality: Peru, Department of San Martín, Province of Moyobamba, Tingana (05°54′38.4″S, 77°06′43.3″W; 815 m).

Type material: The type series was deposited in the following collections: Collection of División de Entomología, Museo de La Plata, La Plata, Argentina (holotype MLP203654-1, and 5 paratypes: MLP203654-2/6); Division of Insects, Field Museum of Natural History, Chicago, Illinois, USA (4 paratypes: FMNH203654-7/10).

Other specimens studied: Orquidiario Waqanki (06°04′30.2″S, 76°58′33.5″W; 970 m): FMNH203652 (4 mites), FMNH203466 (6 mites), and FMNH203651 (1 mite); Tingana: FMNH203467 (18 mites), FMNH203655 (6 mites), FMNH203654 (14 mites).

Etymology: Aerosus, the specific epithet of the rodent host, is used as a nom in apposition.

Biology: Two of the 10 specimens 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.

Remarks

Androlaelaps aerosus sp. nov. is included in the *Androlaelaps rotundus* species group (Lareschi, 2011) because of the enlarged *ad1* seta in femur I with length subequal to width of femur at level

of seta, and *j5* setae of dorsal plate minute, about 1/3 as long as distance from base of *j5* to *z5*. *Androlaelaps aerosus* sp. nov. resembles *An. rotundus* "sensu stricto" (Lareschi and Barros-Battesti, 2010) and *Androlaelaps ulysespardinasi* Lareschi, 2011, in general appearance, and differs from *Androlaelaps maurii* Lareschi and Gettinger, 2009, and *Androlaelaps misionalis* Lareschi, 2010, because of its greater size (dorsal shield > 600 μm in length) and the distance between *j6* setae similar to the distance between *j5* setae (bigger in the other species). The new species is similar in size to *An. rotundus* (549 μm length, and 506 μm width vs. 650 μm and 528 μm, respectively, in *An. rotundus*), but slightly larger than *An. ulysespardinasi* (615 μm and 476 μm, respectively). The new species and *An. ulysespardinasi* differ from *An. rotundus* by having a slightly *V*-shaped, more sclerotized ridge among *j4* and *j6* setae in the dorsal shield. In addition, *An. aerosus* sp. nov. differs from *An. ulysespardinasi* in having the posterior margin of the idiosoma rounded, opisthogaster with 10 pair of seta, and chelicerae with teeth only in the fixed digit. However, the new species differs from *An. rotundus* by having central dorsal setae longer (25–28 vs. 17–21); sternal shield 1.4 times wider than longer (vs. 1.60 in *An. rotundus*); and longer epigynal seta (70–75 vs. 59–64). In addition, *An. aerosus* sp. nov. is unique because of the length of the hypostomal seta *h3* (> 58), which is 3 times as long as gnathosomal seta, and its tip reaching or over-reaching the gnathosomal setal bases; dorsal seta *j2* very long (>70), almost reaching the point of *j3*.

DISCUSSION

Only 4 species of laelapines parasitic on vertebrates have been previously reported from Peru (Strandtmann and Wharton, 1958). Of the 12 mite species collected in this study, 8 are recorded for the first time in the country: *An. aerosus* sp. nov., *G. goyanensis, G. mattogrossensis, G. oudemansi, G. tiptoni, L. furmani, L. paulistanensis*, and *M. parvispinosus*. These findings increase to 13 the laelapine mites known to be parasitic on vertebrates from Peru. Compared to the biodiversity of vertebrates known for the country, the low number of these mites is related to the few studies and researchers in the area. Thus, the increment of researchers and field studies that include the collection of ectoparasites of vertebrates is necessary to better determine the diversity of mites in Peru.

Most of the laelapines collected show high host specificity. Nine of the mite species were associated with only 1 host species. *Androlaelaps fahrenholzi*, *Gigantolaelaps tiptoni*, and *G. oudemansi* were the exception. Furman (1972) described the morphological variation among specimens of these species. *Androlaelaps fahrenholzi* is known to be a composite of cosmopolitan species, with variations associated with different host species and locations (Strandtmann and Wharton, 1958; Furman, 1972). The latter author differentiated 3 distinct forms identified as *G. oudemansi* from Venezuela. Specimens from Peru belong to the type I. The specific association between *Laelaps furmani* and *Oecomys bicolor* was previously reported from the Amazon of Brazil (Gettinger et al., 2005). In addition, those between the mites *Gigantolaelaps intermedia*, *L. boultoni*, and *L. neacomydis* and the rodent *Neacomys spinosus* were previously reported from Bolivia; the latter association was also mentioned for southern Peru (Gettinger and Gardner, 2005). Species of *Gigantolaelaps* and *Mysolaelaps*, as well as *L. paulistanensis*, are specific to rodents of the Tribe Oryzomyini (Strandtmann and Wharton, 1958; Furman, 1972). Thus, reports in the present study are in accordance with previous studies.

Androlaelaps aerosus sp. nov. is associated exclusively with *Ak. aerosus*, the only akodontine captured in this field expedition. Host-specific association with species of akodontines is a characteristic of all the species belonging to the *An. rotundus* species group (Lareschi, 2011). Only females were collected, which is typical for this species group (Lareschi, 2011)

Akodon aerosus occurs in upper montane forests along eastern Andean slopes, 860 to 2,250 m, in Ecuador, Peru, and central Bolivia (Myers, 1990; Patton and Smith, 1992; Anderson, 1997; Tirira, 2007). The new mite species is described from the central area of *Ak. aerosus*'s geographical distribution. More collections along the distribution range of *Ak. aerosus* are needed to determine whether or not this parasite-host association occurs along the whole distribution of the host.

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