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A NEW SPECIES OF LINSTOWIA (CESTODA: ANOPLOCEPHALIDAE) FROM MARSUPIALS IN BOLIVIA

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ABSTRACT: A new species of cestode of the genus Linstowia (Cestoda: Anoplocephalidae) is described from marsupials of the genera Thylamys and Monodelphis. The new species (Linstowia schmidti) differs from Linstowia iheringi Zschokke, 1904, in having a much smaller strobila and reduced number of proglottids, and in the distribution of the eggs in gravid proglottids. In Bolivia, cestodes of the genus Linstowia appear to have a restricted geographic distribution, occurring in marsupials only in southeastern Bolivia near the western margin of the Chaco. This host–parasite association may represent an ecological–historical relict.

Cestodes of the genus Linstowia Zschokke, 1899, parasitic in didelphid marsupials in South America, have been little studied since the first works of Zschokke (1899, 1904a, 1904b) when the taxonomy and geographic distribution of these cestodes first were described. These cestodes occur in South American didelphid marsupials and Australian marsupials and monotremes (Zschokke, 1899, 1904a, 1904b; Janicki, 1906; Gomes, 1979; Beveridge, 1983). Up to the present time, 3 species of Linstowia have been reported from Australia, whereas only a single species, Linstowia iheringi Zschokke, 1904, has been described from marsupials in the neotropics. Since the first description of L. iheringi based on specimens collected in Brazil by von Ihering, only Gomes (1979) has reported these cestodes from South American marsupials, also from Brazil. At present, very little is known of the abundance, diversity, and geographic distribution of these cestodes in South American marsupials. Equally little is known of the helminth fauna of marsupials of the genera Thylamys and Monodelphis in the neotropics, and prior to our work in Bolivia almost no information was available concerning the ecological relationships of marsupials and their parasites in that biotically diverse country. In collaboration with individuals from the Zoo Santa Cruz, Fauna Sudamericana, the National Museum of Natural History, La Paz, the American Museum of Natural History, and the Museum of Southwestern Biology, we were able to analyze data on the endoparasites from a large series of marsupials collected from throughout Bolivia. In the present paper we describe a new species of Linstowia from species representing the didelphid genera Thylamys and Monodelphis collected in Bolivia.

We follow Schmidt (1986) in recognizing the Linstowiniae as a subfamily of Anoplocephalidae. Beveridge (1983) followed Baer (1927) in using 2 subgenera (Paralinstowia Baer, 1927, and Linstowia) for species of Linstowia. We consider the cestodes discussed in the present paper to represent a species of the genus Linstowia because of the presence of egg capsules (1 capsule around each egg) in the gravid proglottids and the fact that the terminal genital canals pass ventrally to the excretory canals. The new species is assigned to the subgenus Paralinstowia in that it has a small cirrus pouch and relatively few testes (Beveridge, 1983).

MATERIALS AND METHODS

Cestodes were obtained from marsupials from a single locality in the department of Chuquisaca, Bolivia, from 6 to 15 July 1983. The collection locality, in the vicinity of Porvenir, is a deciduous tropical woodland in the Andean foothills near the western margin of the Chaco thorn forest (Unzueta, 1975). Marsupials were collected in live-traps and examined for helminth parasites within a few minutes of death in most cases. Cestodes were collected from the small intestine, killed, and relaxed in distilled water and preserved in 10% formalin. Specimens were stained in either Grenacher’s carmine or Ehrlich’s hematoxylin, dehydrated in ethanol, cleared in terpineol and xylene, and permanently mounted on a slide in Canada balsam. All measurements are given in micrometers with means following in parentheses unless otherwise indicated.

DESCRIPTION

Linstowia schmidti n. sp.
(Figs. 1–5)

Diagnosis: Total length (n = 7) 7.17–12.20 mm (9.64 mm); maximum width (n = 8) 690–1,010 (830), attained in late mature proglottids. Strobila consists of 24–38 (29) craspedote proglottids. Mature proglottids wider than long (about half as long as wide), with length-to-width ratio of 0.43–0.49 (n = 3) in last mature proglottid. Increase in relative length beginning in prox-
mal gravid proglottids results in tapering toward the last proglottid, which is always longer than wide. Scolex 496-845 (690) long by 745-1,042 (891) wide. Suckers 294-407 (350) x 298-414 (351). Genital pores irregularly alternating. Genital atrium with delicate musculature, opening on anterior lateral margin of proglottid. Genital ducts pass ventrally to paired longitudinal osmoregulatory canals. Dorsal excretory canal 4-10 in diameter, external to ventral canal. Ventral canal fenestrated, 18-60 in diameter, connecting with ventral canal in the opposite side of the proglottid by anastomosing branches. Cirrus sac ovoid, 83-160 (130) x 55-71 (64), extending to level of ventral osmoregulatory canal. Cirrus spinose, coiled within cir-
FIGURES 4, 5. Characteristics of gravid proglottids of *Linstowia schmidti* n. sp. from Bolivian marsupials. 4. Dorsal view of penultimate gravid proglottid showing distribution of eggs through proglottid. 5. Detail of eggs, indistinct egg shell, and egg capsule from ultimate gravid proglottid. Eggs illustrated were located in uncrowded marginal region of proglottid.

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ringi, presently the only species of the genus Linstowia known from mammals in the neotropics.

These cestodes do not resemble any previously described from marsupials in the neotropics. Linstowia schmidtii n. sp. can be recognized as distinct from L. iheringi in having a much smaller strobila (mean length of 9.6 mm for L. schmidtii vs. about 46 mm for L. iheringi) and fewer proglottids (24–38 vs. about 84–200 in L. iheringi). In addition, the terminal gravid proglottids of L. schmidtii are much longer than wide, which is a sharp contrast to the wide and short terminal gravid proglottids in L. iheringi. However, an increase in relative length of gravid proglottids occurs in both species. In L. schmidtii, the eggs are distributed relatively evenly throughout the parenchyma of the terminal gravid proglottids, whereas in L. iheringi the eggs are distributed primarily in the lateral margins of the gravid proglottids.

A clarification of the correct specific name of L. iheringi is necessary as many authors are using jheringi instead of iheringi. The cestode was named by Zschokke (1904a) after H. von Ihering. However, it appears that the name was mistyped in the paper by Zschokke (1904a), where on page 51 he states "...; ich selbst setze das freundliche und sehr verdankenswerte Zuvorkommen H. v. Iherings in Sao Paolo in den Stand, einen Cestoden aus Peramys americana zu beschreiben." In another paper written later, Zschokke (1904b) used the correct spelling of H. von Ihering and used the correctly spelled specific name where he states, "H. v. Ihering übergab mir in sehr verdankenswerter Weise einen Cestoden aus Peramys americana, den ich an anderer Stelle beschreiben werde," and "...; Peramys americana beherbergt Linstowia iheringi Zsch.; in Delphys bistriata wohnt L. brasiliensis Janicki." We consider the second paper by Zschokke (1904b) to represent a "justified emendation." This explicitly follows the International Code of Zoological Nomenclature (Ride et al., 1985), article 33b, i and ii (p. 73) and example therein.

**DISCUSSION**

Although collections of marsupials were made from throughout Bolivia, individuals infected with Linstowia cestodes were recorded only from the region of Porvenir in southeastern Bolivia (Fig. 6). In this area, the life cycle of cestodes parasitic in small opossums of the genera Thylamys and Monodelphis still is intact; the intermediate host(s), unknown in this case, must occur in intimate association with the definitive host. These tapeworms have been reported also from Brazil (Zschokke, 1904a, 1904b; Janicki, 1906; Gomes, 1979); however, no information is available on the ecological associations of L. iheringi and its marsupial hosts in this region. Because of the apparent age of this host–parasite association (a trans-Antarctic land mass connection between South America and Australia is thought to have persisted only into the early Eocene [see review by Raven and Axelrod, 1974]), we propose that current species of Linstowia in the neotropics represent ecological–historical relics. Furthermore, the area in southeastern Bolivia may represent an ecologically old region where the life cycle of Linstowia currently is being maintained, perhaps due to the presence of suitable intermediate hosts. This idea is supported by the absence of Linstowia from other regions of Bolivia, despite extensive collections of marsupials (including Thylamys and Monodelphis) from other areas, and by the work of Sarmiento (1976), who provided evidence that the Chaco habitat-type may represent one of the oldest biotic associations in the neotropics, second in age only to the rain forests.

The paucity of information concerning the distribution and general ecological associations of linstowiid cestodes and their hosts in other areas of South America hampers efforts to understand biogeographic patterns in this genus. The recognition of L. schmidtii from Bolivian marsupials, nearly a century after the original description of L. iheringi, is a further indication of how little is known of the helminth fauna of mammals in the neotropics.

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**LITERATURE CITED**


