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Larval Nematodes (*Ascarops* sp.) in Stomach Granulomas of the Sagebrush Lizard, *Sceloporus graciosus*

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ABSTRACT: Wild populations of the sagebrush lizard (*Sceloporus graciosus*) are reported as paratenic hosts for third stage larvae of *Ascarops* sp. Larvae were found in stomach submucosal granulomas which averaged 350 μm in diameter and consisted of histiocytes and layers of fibrocytes. Prevalence of infection was 16% (27 of 170 infected); mean intensity was 3 (1 to 8 nematodes/host). Prevalence was significantly higher in male than female lizards.

Key words: Larval nematode, *Ascarops* sp., *Sceloporus graciosus*, sagebrush lizard, granuloma, stomach, pathology.

Animals from all vertebrate classes can be paratenic hosts, especially those that habitually feed on insects (Alicata, 1935; Olsen, 1974). Unfortunately, most of the information about paratenic hosts is limited to a discussion of occurrence. The purpose of this note is to report, for the first time, the occurrence of larvae of the nematode *Ascarops* sp. (Spirurida, Spirocercidae) in the sagebrush lizard (*Sceloporus graciosus*, Iguanidae). Data on prevalence and histopathology of lesions associated with the infection also are described.

One hundred seventy adult sagebrush lizards were collected by noosing during May 1988 on the Windy Gap Trail (elevation 1,889 m; 34°21′N, 117°48′W) in the Crystal Lake area of the San Gabriel Mountains, Los Angeles County, California. Infected stomachs were fixed in neutral buffered 10% formalin, embedded in paraffin, sectioned at 5 μm and stained with hematoxylin and eosin. Individual nematode larvae were dissected from formalin fixed granulomas and mounted in Hoyer's solution for taxonomic identification. A specimen was deposited in the U.S. National Parasite Collection (Beltsville, Maryland 20705, USA; accession number 80564). In addition, livers of 86 adult sagebrush lizards collected in 1986 and 36 adults from the 1987 and 1988 samples were examined for the presence of larval *Ascarops* sp.

At necropsy, granulomas containing encysted nematode larvae were grossly visible as whitish nodules embedded in the stomach wall. The granulomas (Fig. 1) were thin-walled and consisted of fibrocytes and histiocytes. They were approximately 350 μm in diameter and were located in the stomach submucosa. An inflammatory response was not seen. Occasional masses of cellular debris, cells with pyknotic nuclei, histiocytes with foamy cytoplasm and heterophils were observed within the granulomas. Some, presumably older, granulomas were undergoing mineralization.

Each granuloma contained a third stage *Ascarops* sp. Larvae were approximately 1.9 mm long and 80 μm wide. The distinguishing differential features of the third stage larva of *Ascarops* sp. are (1) the right and left anterolateral body walls are prolonged into dorsoventral liplike projections and (2) the tip of the tail possesses a smooth knoblike process. We observed both features in larvae taken from stomach granulomas of sagebrush lizards. Fourth stage larvae or mature worms were not found.

Prevalence of *Ascarops* sp. larvae was 16% (27 infected of 170 hosts examined). Mean intensity was 2.9 (1 to 8 nematodes/host). There was a significant difference in prevalence between males and females (21 of 91 and 6 of 79, respectively; $\chi^2 = 7.9$, 1 df, $P < 0.001$). Mean intensity for males was 3.3 (1 to 8); it was 2.3 (1 to 4) for females. We found no externally visible characteristics that would allow detection of living lizards with granulomas.

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FIGURE 1. Larval *Ascarops* sp. within a granuloma in the submucosa of a sagebrush lizard. H&E.

Two of the 86 lizards collected in 1986 had larval *Ascarops* sp. in liver granulomas (prevalence of 2%, one granuloma in each of two livers). Liver granulomas were not found in sagebrush lizards collected in 1987 or 1988. Liver granulomas containing *Ascarops* sp. have been observed in the western fence lizard (*Sceloporus occidentalis*) where prevalence may reach 37% (Goldberg and Bursey, 1988). It is not known why larval *Ascarops* sp. establish in the stomach wall of sagebrush lizards, but only rarely invade the liver.

Seven species of North American vertebrates have previously been reported as paratenic hosts of *Ascarops* sp. (Table 1).

TABLE 1. Paratenic hosts of *Ascarops* sp.

Species	Location in host	Collection site	Reference
Reptilia: Squamata			
Sceloporus graciosus	stomach wall	California	This study
Sceloporus occidentalis	liver	California	Goldberg and Bursey, 1988
Aves: Passeriformes			
Cyanocitta cristata	gastrointestinal wall	Alabama	Krahwinkel and McCue, 1967
Richmondena cardinalis	gastrointestinal wall	Alabama	Krahwinkel and McCue, 1967
Pipilo erythrophthalmus	gastrointestinal wall	Alabama	Krahwinkel and McCue, 1967
Molothrus ater	gastrointestinal wall	Alabama	Krahwinkel and McCue, 1967
Mammalia: Chiroptera			
Lasiurus borealis	stomach wall and mesentery	Washington, D.C.	Alicata and McIntosh, 1933
Mammalia: Edentata			
Dasypus novemcinctus	mesentery and cecal wall	Texas	Chandler, 1946

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TABLE 2. North American beetle intermediate hosts of *Ascarops* sp.

Species	Reference
Anomala flavipennis	Fincher et al., 1969
Aphodius granarius	Alicata, 1935
Aphodius lividus	Porter, 1939; Stewart and Kent, 1963; Fincher et al., 1969
Ateuchus lecontei	Fincher, 1979
Boreocanthon depressipennis	Fincher, 1979
Canthon chalcites	Fincher, 1979
Canthon pilularius	Stewart and Kent, 1963
Continus nitida	Stewart and Kent, 1963; Fincher et al., 1969
Copris minutus	Stewart and Kent, 1963; Fincher et al., 1969
Deltochilum gibbosum	Fincher, 1979; Fincher and Marti, 1982
Dyscinetus morator	Fincher et al., 1969
Hybosorus illigeri	Fincher et al., 1969
Onthophagus gazella	Fincher and Marti, 1982
Onthophagus hecate	Stewart and Kent, 1963; Fincher et al., 1969; Fincher, 1979
Onthophagus oklahomensis	Fincher, 1979
Onthophagus pennsylvanicus	Stewart and Kent, 1963; Fincher, 1979; Fincher and Marti, 1982
Onthophagus taurus	Fincher and Marti, 1982
Phanaeus vindex	Stewart and Kent, 1963; Fincher et al., 1969
Phyllophaga ephilida	Fincher et al., 1969
Trox suberosus	Stewart and Kent, 1963; Fincher et al., 1969

These insectivorous vertebrates presumably acquire *Ascarops* sp. through their diets. Within the insect intermediate host, first stage larvae are enclosed in thin-walled cysts and development to third stage takes place within the cyst (Olsen, 1974). In a paratenic host, a freed third stage larva migrates through the stomach wall and reencysts. No further development of the larval nematode occurs; although, normal development could resume should a paratenic host be eaten by a proper definitive host. Larvae have been found to survive as long as 1 yr in mice (Olsen, 1974), but survival time in the sagebrush lizard is not known.

About 20 species from 14 genera of beetles have been identified as intermediate hosts of *Ascarops* sp. (Table 2). The introduction of exotic species of dung beetles to the United States has increased the number of potential intermediate and paratenic hosts. Exotic beetles have become widespread since the initial releases in Texas in 1972 (Blume and Aga, 1978) and can now be found throughout most of Texas and in Louisiana (Fincher and Marti, 1982). Exotic dung beetles are also established in California (Anderson and Loomis, 1978). The specific insect host of *Ascarops* sp. eaten by the sagebrush lizard has not been determined.

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