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Development of Third-stage *Physaloptera* Larvae from *Crotalus viridis* Rafinesque, 1818 in Cats with Notes on Pathology of the Larvae in the Reptile. (Nematoda, Spiruroidea)*

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Abstract

The prairie rattlesnake, *Crotalus viridis,* was found to be commonly infected with third-stage *Physaloptera* larvae. A total of 112 larvae were fed to 3 laboratory raised cats. Adult worms recovered 42 and 59 days postinfection were identified as *P. rara*. Observations were made on the pathology of the larvae in the snake.

Introduction

Considerable descriptive taxonomic information is available for the genus *Physaloptera* but few life cycles have been determined. Partially complete cycles are available for *P. turgida* by Alicata[1] and *P. maxillaris* by Hobmaier.[5] Complete life cycles have been studied for *P. rara* and *P. praeputialis* by Petri and Ameel[8] and *P. hispida* by Schell.[9] These studies utilized orthopteran and coleopteran insects as intermediate hosts.

Natural infections of third-stage physalopterid larvae have been reported from both vertebrate and invertebrate hosts. The earliest report of a natural infection in an invertebrate was the earwig, *Labidura reparia,* by Basir.[2] Zago Filho[11,12] found the field cricket, *Gryllulus assimilus,* harboring infective *P. praeputialis* larvae and showed that the grasshoppers, *Orphulella punctata, Eutryxalis filata filata* and *Dichroplus punctulatus,* were natural intermediate hosts for *P. praeputialis* and *P. turgida.*

Dixon and Roberson[4] in their report of *Physaloptera* larvae in the quail, *Colinus virginianus,* reviewed previous reports of infections in birds but omitted the observation of encysted *Physaloptera* larvae in the ruffed grouse, *Bonasa unbellus,* by Boughton.[3] The observation of third-stage *Physaloptera* larvae in the stomach of the prairie rattlesnake, *Crotalus viridis,* by Widmer [10] was a new host record.

The presence of third-stage larvae in these vertebrates suggests the possibility of a paratenic host in the life cycle for at least some species of this genus.

The purpose of this paper is to report studies on species identification of the third-stage *Physaloptera* larvae obtained from *C. viridis* and to suggest a paratenic role for this host in the life cycle of *P. rara.*

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Material and Methods

The snakes used in these experiments were captured in Weld County, Colorado. Techniques in killing and examination were described by Widmer.[10]

Microdissection scissors and minuten teasing needles aided in mechanical removal of the larvae. Parasites not used for experimental purposes were killed and fixed in hot 70% alcohol, cleared slowly in glycerine-alcohol and mounted in glycerine.

Sections of the stomach taken from points of larval attachment, were fixed in Bouin's solution and stained in hematoxylin and eosin.

Laboratory raised cats were used in the experiment and controls were established by using 2 control animals (#4 and 5). Ether - formalin concentration technique of the feces 30 days before exposure and during the experimental period was routine for all experimental cats. Infections were obtained by force-feeding of the larvae.

Specific infection and necropsy procedures for the 3 experimental cats (#1, 2, and 3) varied as follows: cat #1, fed 16 larvae in a single dose, was killed 7 days after infection; cat #2 was given 40 larvae, 10 initially and 10 at weekly intervals extending over a 3 week period, — necropsy performed 42 days after the initial feeding; cat #3, fed 56 larvae in a single dose, was killed 59 days after exposure.

Results

Host reaction to third-stage Physaloptera *larvae.*

Mechanical removal of the third-stage *Physaloptera* larvae from the stomach mucosa left small macroscopic lesions. Sections of attachment sites showed a cephalic penetration to the muscularis mucosae (327.6μ). Lymphocytes, monocytes and plasma cells are located above and below the muscularis mucosae and a concentration of these cells exists near vessels in the submucosa (Fig. 1). Oral glands (Fig. 2) are apparently used in the liquefaction of host tissue prior to ingestion (Figs. 3, 4).

Development in the definitive host.

Third-stage larvae when fed to cats develop to maturity as noted in Table 1. Mean lengths and widths of worms varied with the duration of infection. Female and male juvenile worms from cat #1 had a mean length of 8.5 and 7.4 mm respectively as compared to 8.0 and 6.2 mm for the third-stage larvae. The sex of these juveniles could be easily determined due to the increase in size of the genital primordia.

In cat #1 the 12 worms were located in the stomach while in cats #2 and 3, 8 and 6 worms respectively were recovered from the duodenum. Control cats #4 and 5 were negative for infection.

For cat #3 eggs of the genus *Physaloptera* were recovered from the feces 35 days after feeding. In cat #2 no eggs were recovered before necropsy, but

TABLE 1. *Results of feeding third-stage* Physaloptera *larvae to laboratory raised cats. All measurements are given in mm.*

Identification of Host	No. of Larvae Fed	Length of Infection in Days	No. of Worms Recovered: Females	No. of Worms Recovered: Males	Mean Size: Length: Females	Mean Size: Length: Males	Mean Size: Width at Base of Esophagus: Females	Mean Size: Width at Base of Esophagus: Males
#1	16	7	7	5	8.5	7.4	.236	.203
#2	40	42	8	3	27.8	23.2	.599	.489
#3	56	59	10	11	33.8	24.0	.808	.613

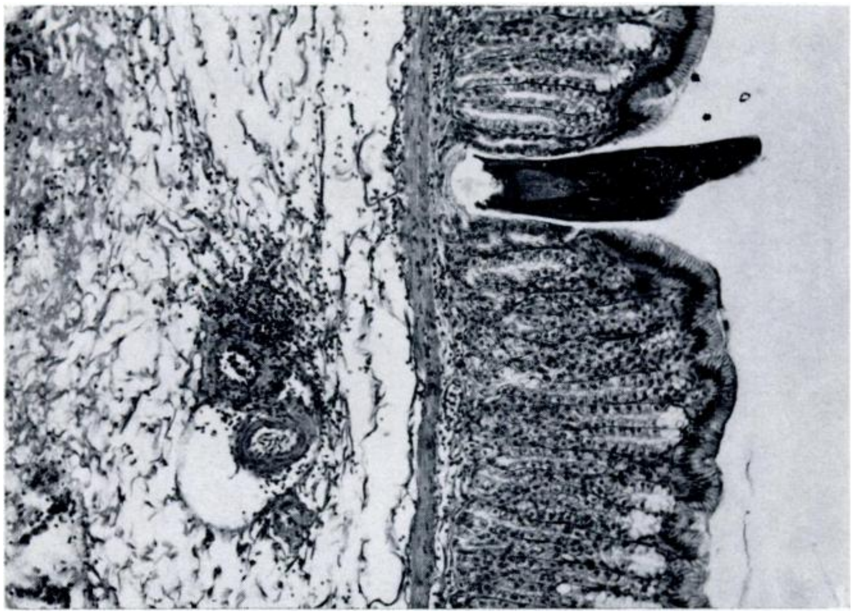

FIGURE 1. *Third-stage* Physaloptera *larva attached to stomach mucosa. x 120. (Photographs shown in Figures 1-4 are of longitudinal sections).*

FIGURE 2. *Third -stage* Physaloptera *larva at edge of tubular mucosal lesion. Note oral glands (arrow) anterior to the nerve ring (N). x 425.*

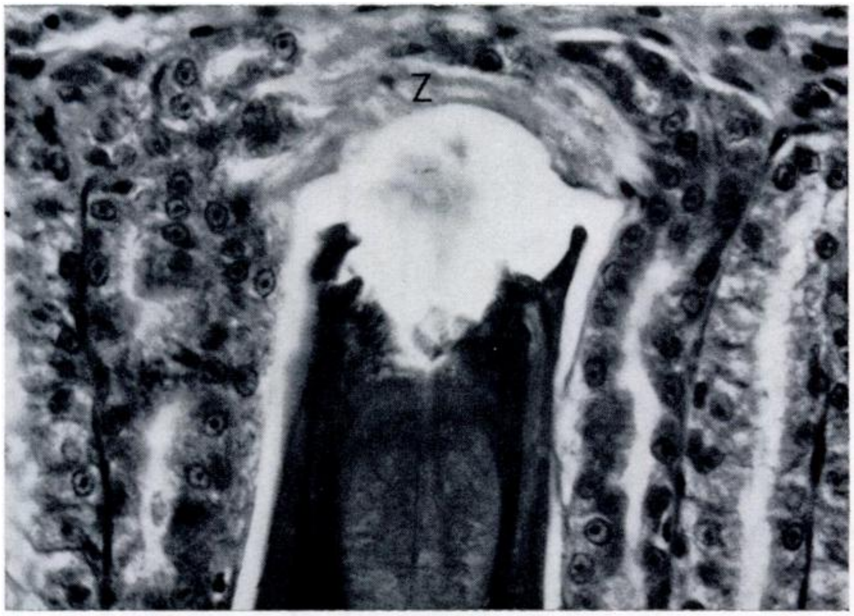

FIGURE 3. *Third-stage* Physaloptera *larva at base of tubular lesion. Zone of liquefaction at point of attachment (Z). x 600.*

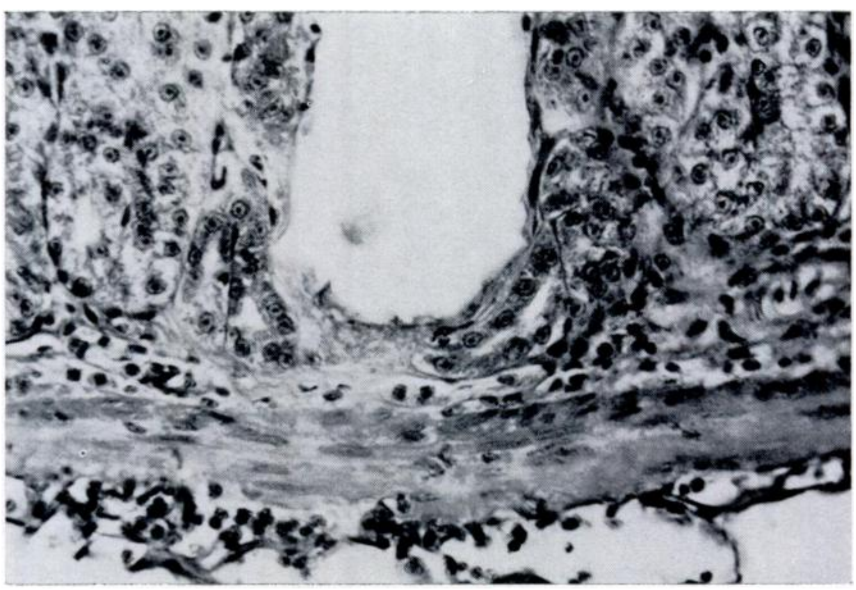

FIGURE 4. *Tubular lesion, without larva, extending to muscularis mucosae. Zone of liquefaction shows some cellularity. x 425.*

examination of the worms showed mature reproductive organs. Mature eggs were observed in the uteri of all female worms. Additional work needs to be done to determine a more precise prepatent period.

Mature worms from cats #1 and 2 were identified as *P. rara*.

Discussion

The role of arthropods as intermediate hosts for *Physaloptera turgida, P. maxillaris, P. rara, P. praeputialis,* and *P. hispida* have been reviewed by Lee[6] and Zago Filho.[11] In the original studies no mention was made of a possible paratenic host for any species of this genus. Dixon and Roberson[4] suggest that *C. virginiania* is not a likely normal intermediate host of *Physaloptera* and consider their findings as a case of an aberrant host.

The high incidence of third-stage larvae in *C. viridis* reported by Widmer[10] does not suggest an aberrant host role for this vertebrate. *P. rara* is a common parasite of cats, dogs, and coyotes.[7] The apparent ease of infection of cats with third-stage larvae from *C. viridis* suggests the role of a paratenic host of the snake for *P. rara*.

These observations suggest the necessity of further work to determine the role of these larvae in other vertebrate hosts.

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