

## Parasites of the Florida Panther (*Felis concolor coryi*)

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**ABSTRACT:** Between 1978 and 1983 12 Florida panthers (*Felis concolor coryi* Bangs) were examined for parasites. Seven were examined at necropsy and the other five were live animals examined during capture operations. Findings included 1 species of protozoan, 2 trematodes, 3 cestodes, 7 nematodes, 6 ticks, and 1 flea. All panthers were infected with at least six species of parasites. Intensities varied from 263 to 10,094 parasites per animal. The two most prevalent and abundant parasites were the diplostomatid trematode *Alaria marcianae* (LaRue, 1917) and the hookworm *Ancylostoma pluriidentatum* (Alessandrini, 1905).

Today the only documented population of the Florida panther exists in remote areas in southern Florida where there are an estimated 20-50 animals. In 1967 it was declared an endangered species by the U.S. Department of Interior (FR 48). Currently there is no published information on the parasites and diseases of this rare cat. In 1978 a study was undertaken to determine the parasite fauna of the Florida panther and a summary is presented herein.

### Materials and Methods

From March 1978 through December 1983 parasites were obtained from 12 different Florida panthers in southern Florida (Dade, Collier, and Glades counties). Seven of these animals were examined at necropsy (5 road-killed animals, 1 illegally killed animal, and 1 animal killed accidentally during capture operations) and five were animals from which ectoparasites and blood and fecal samples were obtained during a radio-telemetry project. Techniques for the recovery of ectoparasites, helminths, intestinal protozoans, and blood parasites were as described by Forrester et al. (1974) including the use of fine-mesh screens for obtaining small helminths. Samples of diaphragm (and in some cases other muscles) were examined for the presence of larvae of *Trichinella* sp. by tissue squash (three cats) or by both tissue squash and pepsin-HCl digestion (four cats). Serum samples were tested for antibodies to *Toxoplasma gondii* by the indirect hemagglutination test (Jacobs and Lunde, 1957) with titers  $\geq 1:256$  considered positive.

Representative specimens of the helminths have been deposited in the U.S. National Parasite Collection, USDA, Beltsville, Maryland 20705 (USNM Helm. Coll. Nos. 78380-78393) and specimens of the ticks have been deposited in the U.S. National Museum, Smithsonian Institution, Washington, D.C. 20560 (Accession Nos. RML 112157, 112391, 112392, 115550, 115551, 115581, 115582, 115897-115900, and 116845-116849).

### Results and Discussion

Twenty species of parasites were detected including 1 protozoan, 2 trematodes, 3 cestodes, 7 nematodes, 6 ticks, and 1 flea. Table 1 shows the locations within the host and prevalences and intensities of infection for each of these parasites. All panthers were infected with at least six species of parasites (mean, 9; median, 8; range, 6-12). The total number of parasites per cat varied between 263 and 10,094 (mean 3,388; median, 2,373).

The two most prevalent and abundant parasites were the diplostomatid trematode *Alaria marcianae* and the hookworm *Ancylostoma pluriidentatum*. *Alaria marcianae* has been reported previously from a mountain lion (*Felis concolor acrocodia*) in Paraguay and is a common parasite of a number of other felids such as the bobcat, *Felis rufus* (Schreber), and also several canids and mustelids (Johnson, 1968). In Florida it has been reported by Conti (1984) from gray foxes, *Urocyon cinereoargenteus* (Schreber), and coyotes, *Canis latrans* Say.

The hookworm (*Ancylostoma pluriidentatum*), however, never has been reported from free-ranging *Felis concolor*, but is known from a captive cougar in the New York Zoological Park (McClure, 1933) and from a number of wild feline hosts in Panama and Colombia (Thatcher, 1971). It has also been found in several captive felids originating from Central and South America that died in the National Zoological Park in Washington, D.C. (Schwartz, 1927). Although the parasites of bobcats in southern Florida have not been studied, we were able to examine the intestines of three bobcats trapped in Florida

**Table 1. Prevalence and intensity of parasites from Florida panthers (*Felis concolor coryi*), 1978-1983.**

Parasite	No. panthers		Intensity <sup>a</sup>		
	Examined	Positive	Mean	Median	Range
<b>Protozoa</b>					
<i>Toxoplasma gondii</i> (Nicolle and Manceaux, 1908) (1) <sup>b</sup>	5 <sup>c</sup>	1 <sup>d</sup>	—	—	—
<b>Trematoda</b>					
<i>Alaria marcianae</i> (LaRue, 1917) (2)	7	7	2,972	1,090	238-9,689
<i>Heterobilharzia americana</i> Price, 1929 (3)	7	5	4	3	1-7
<b>Cestoda</b>					
<i>Mesocestoides</i> sp. (2)	7	4	212	6	1-833
<i>Spirometra mansonoides</i> (Mueller, 1935) (2)	7	4	13	8	4-33
<i>Taenia omissa</i> Lühe, 1910 (2)	7	4	7	6	1-15
<b>Nematoda</b>					
<i>Ancylostoma pluridentatum</i> (Alessandrini, 1905) (2)	7	6	254	160	36-744
<i>Trichinella</i> sp. larvae (4)	7	4 <sup>e</sup>	—	—	—
<i>Dirofilaria striata</i> (Molin, 1858) (4) <sup>f</sup>	7	4	3	2	1-7
<i>Capillaria aerophila</i> (Creplin, 1839) (5)	7	2	2	2	1-3
<i>Strongyloides</i> sp. (2)	7	2	9	9	1-16
<i>Toxocara cati</i> (Schrank, 1788) (2)	7	1	2	2	2
<i>Toxocara</i> sp. larvae (2)	7	1	25	25	25
<i>Molineus barbatus</i> Chandler, 1942 (2)	7	1	2	2	2
<b>Arthropoda</b>					
<i>Dermacentor variabilis</i> (Say, 1821) (6)	12	9	8	4	1-26
<i>Ixodes scapularis</i> Say, 1821 (6)	12	7	49	39	3-222
<i>Ixodes affinis</i> Neumann, 1899 (6)	12	4	5	5	1-10
<i>Amblyomma americanum</i> (Linnaeus, 1758) (6)	12	1	8	8	8
<i>Amblyomma maculatum</i> (Koch, 1844) (6)	12	1	2	2	2
<i>Dermacentor nitens</i> Neumann, 1897 (6)	12	1	1	1	1
<i>Ctenocephalides felis</i> (Bouché, 1835) (6)	12	1	1	1	1

<sup>a</sup> Number of parasites per infected or infested host.

<sup>b</sup> Numbers in parentheses indicate site in host: (1) blood, (2) small intestine, (3) blood vessels of liver and lungs, (4) connective tissue between muscles, (5) lungs, and (6) skin and pelage.

<sup>c</sup> Information on *Toxoplasma* is based on serologic studies. Data on one of these negative serum samples were given in an earlier paper (Burrige et al., 1979).

<sup>d</sup> The titer on this animal was 1:256.

<sup>e</sup> Intensity of infection was determined for one panther that had <1 larva per gram of diaphragm and psoas muscle.

<sup>f</sup> Values for *Dirofilaria striata* are based on adults found at necropsy. The prevalence of this filariid is probably greater than indicated because the adult forms are difficult to locate.

panther habitat (Collier County). Two of the three bobcats had infections of *A. pluridentatum*.

The other species of helminths except *Strongyloides* sp. have been reported previously from other subspecies of *Felis concolor* (Lee, 1962; Stone and Pence, 1978; Anderson, 1983; Rausch et al., 1983). *Trichinella* has been reported several times from the puma in western North America (Anderson, 1983). In Florida it is known from foxes (species not given), opossums (*Didelphis virginiana* Kerr), raccoons (*Procyon lotor* (L.)), and skunks (species not given) (Scholtens and Norman, 1971). In 1982 and 1983 we digested samples of diaphragm and/or tongue from 26 wild hogs (*Sus scrofa* L.) from Collier County

where Florida panthers occur and found larvae of *Trichinella* sp. in one hog. Wild hogs are one of the main food items of the Florida panther (Belden, 1984) and it is probable that infections of panthers are acquired from these animals.

Although one of five panthers examined serologically was found to have antibodies to *Toxoplasma gondii*, no oocysts were detected in fecal samples taken from eight different panthers including the seropositive animal. *Toxoplasma* infections have been found to be widespread among wildlife in Florida, especially among armadillos (*Dasypus novemcinctus* L.), raccoons, and roof rats (*Rattus rattus* (L.)) (Burrige et al., 1979). No blood protozoans were found in blood films

examined from five panthers although microfilariae were found in all five. Three of the five cats with microfilariae were examined at necropsy and adults of *Dirofilaria striata* were found in each. No other filarial worms were detected and we presume, therefore, that these microfilariae are *D. striata*.

Of the six species of ticks found on panthers only two (*Dermacentor variabilis* and *Amblyomma americanum*) have been reported previously from *Felis concolor* (Bishopp and Trembley, 1945; Anderson, 1983). With the exception of *Dermacentor nitens*, which is a parasite of horses in southern Florida (Strickland et al., 1976), the ticks found on the Florida panther also occur in Florida on wild hogs (Greiner et al., 1984) and/or on white-tailed deer (*Odocoileus virginianus* (Zimmermann)) (Smith, 1977).

#### Acknowledgments

We thank Drs. George Healy (CDC, Atlanta, Georgia) and J. M. Carroll (Kissimmee Diagnostic Laboratory, Kissimmee, Florida) for serologic testing for antibodies to *Toxoplasma*. We also thank the following individuals for assistance with taxonomic studies on cestodes (Dr. Robert L. Rausch, Univ. Washington, Seattle), filariids (Dr. Cheryl M. Bartlett, Univ. Guelph, Ontario) and ticks (Dr. Harry Hoogstraal, U.S. Naval Medical Research Unit No. 3, Cairo, Egypt, and Drs. Carleton M. Clifford and James E. Keirans, Rocky Mountain Laboratories, Hamilton, Montana). This work was supported in part by Grant Nos. 1270 and 1270G from the Florida Game and Fresh Water Fish Commission's Federal Aid to Wildlife Restoration Program, Florida Pittman-Robertson Project W-41, and by the Federal Aid to Endangered Species Program, Florida Endangered Species Project E-1. Published as Florida Agricultural Experiment Stations Journal Series No. 5889.

#### Literature Cited

- Anderson, A. E. 1983. A critical review of literature on puma (*Felis concolor*). Colo. Div. Wildl. Spec. Rep. No. 54. 91 pp.
- Belden, R. C. 1984. Florida panther recovery plan implementation. A 1983 progress report. Proc. Int. Cat Symp. (In press.)
- Bishopp, F. C., and H. L. Trembley. 1945. Distribution of hosts of certain North American ticks. J. Parasitol. 31:1-54.
- Burridge, M. J., W. J. Bigler, D. J. Forrester, and J. M. Hennemann. 1979. Serologic survey for *Toxoplasma gondii* in wild animals in Florida. J. Am. Vet. Med. Assoc. 175:964-967.
- Conti, J. A. 1984. Helminths of foxes and coyotes in Florida. Proc. Helminthol. Soc. Wash. 51:365-367.
- Forrester, D. J., A. O. Bush, L. E. Williams, Jr., and D. J. Weiner. 1974. Parasites of greater sandhill cranes (*Grus canadensis tabida*) on their wintering grounds in Florida. Proc. Helminthol. Soc. Wash. 41:55-59.
- Greiner, E. C., P. P. Humphrey, R. C. Belden, W. B. Frankenberger, D. H. Austin, and E. P. J. Gibbs. 1984. Ixodid ticks on feral swine in Florida. J. Wildl. Dis. 20:114-119.
- Jacobs, L., and M. N. Lunde. 1957. A hemagglutination test for toxoplasmosis. J. Parasitol. 43:308-314.
- Johnson, A. D. 1968. Life history of *Alaria marcianae* (LaRue, 1917) Walton, 1949 (Trematoda: Diplostomatidae). J. Parasitol. 54:324-332.
- Lee, H. F. 1962. Susceptibility of mammalian hosts to experimental infection with *Heterobilharzia americana*. J. Parasitol. 48:740-745.
- McClure, G. W. 1933. Nematode parasites of mammals from specimens collected in the New York Zoological Park, 1931. Zoologica (N.Y.) 15:29-47.
- Rausch, R. L., C. Maser, and E. P. Hoberg. 1983. Gastrointestinal helminths of the cougar, *Felis concolor* L., in northeastern Oregon. J. Wildl. Dis. 19:14-19.
- Scholtens, R. G., and L. Norman. 1971. *Trichinella spiralis* in Florida wildlife. J. Parasitol. 57:1103.
- Schwartz, B. 1927. Description of *Ancylostoma pluridentatum*, hookworm of carnivores, and a review of the genus *Ancylostoma*. Proc. U.S. Nat. Mus. 72:1-9.
- Smith, J. S. 1977. A survey of ticks infesting white-tailed deer in 12 southeastern states. M.S. Thesis, Univ. Georgia, Athens. 60 pp.
- Stone, J. E., and D. B. Pence. 1978. Ecology of helminth parasitism in the bobcat from west Texas. J. Parasitol. 64:295-302.
- Strickland, R. K., R. R. Gerrish, J. L. Hourigan, and G. O. Schubert. 1976. Ticks of veterinary importance. APHIS-USDA Agr. Handbook No. 485. Washington, D.C. 122 pp.
- Thatcher, V. E. 1971. Some hookworms of the genus *Ancylostoma* from Colombia and Panama. Proc. Helminthol. Soc. Wash. 38:109-116.