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## OCCURRENCE OF (*Dirofilaria immitis*) IN GRAY FOX (*Urocyon cinereoargenteus*) IN ALABAMA AND GEORGIA<sup>1</sup> <sup>2</sup> <sup>3</sup>

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**Abstract:** The occurrence of *Dirofilaria immitis* in gray fox (*Urocyon cinereoargenteus*) was determined by gross examination, blood samples, and filtered tissue sediments in a sampling of 149 gray foxes taken from Alabama and Georgia during the 1977-78 trapping season. Microfilariae were not found in blood samples obtained from 24 of these gray foxes. Three of 82 male foxes (3.7%) and 1 of 67 female foxes (1.5%) were infected with heartworm. *D. immitis* rate of infection was 1 of 19 (5.3%) and 3 of 130 (2.3%), respectively, in juvenile and adult gray foxes. Single sex infections with *D. immitis* occurred in 4 of the 6 foxes, with a maximum nematode burden of approximately eight. Two other infected foxes were encountered separate from this study.

### INTRODUCTION

Information obtained by a number of investigators indicates that *Dirofilaria immitis*, the canine heartworm, is found in a number of wild animals throughout North America. Although most of the work has involved wild Canidae, such as the coyote (*Canis latrans*),<sup>2,7,9,12,20</sup> timber wolf (*Canis occidentalis*),<sup>1</sup> red fox (*Vulpes fulva*),<sup>2,12,17,19</sup> and gray fox (*Urocyon cinereoargenteus*),<sup>2,12,14,15,18</sup> a few reports include positive findings in the beaver (*Castor canadensis*),<sup>5</sup> wolverine (*Gulo luscus*),<sup>22</sup> muskrat (*Ondatra zibethica*),<sup>8</sup> raccoon (*Procyon lotor*),<sup>6,10</sup> and black bear (*Ursus americanus*).<sup>3</sup>

In general, a low rate of heartworm infection has been reported for most free-ranging wild canid populations, however

infection rates of 28% (11 of 39) were reported in red foxes in Michigan<sup>19</sup> and eight percent (11 of 133) in Kansas and Colorado coyotes.<sup>9</sup> A search of the literature revealed reports of only nine specimens of gray fox infected with *D. immitis*. Microfilariae were not found in the blood of 48 gray foxes in a study at Fort Stewart, Georgia, in 1963.<sup>21</sup> In Minnesota, 26 gray fox carcasses were examined and no heartworms were found.<sup>4</sup> Kazacos and Edberg<sup>11</sup> found 3 of 81 (3.7%) gray foxes in Indiana infected with *D. immitis*. Crowell *et al.*<sup>2</sup> found heartworm infection in 2 of 20 gray foxes from Louisiana. Microfilariae were found in the blood of one and adult *D. immitis* were found in the heart of the other. Stone reported heartworms and microfilariae from a gray fox in New York,<sup>18</sup> and Miller and Harkema<sup>14</sup> found

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heartworms in 2 of 24 gray foxes collected in North Carolina, South Carolina and Georgia. Heartworm was found in a gray fox in Michigan during post-mortem examination (Stuht unpubl.).

The purpose of this study was to investigate the occurrence of heartworm infection in isolated populations of gray foxes in Alabama and Georgia. Gray fox carcasses were obtained from a region known to have a high prevalence of heartworm infection in dogs.

## MATERIALS AND METHODS

Gray fox carcasses were obtained primarily from trappers in Alabama and Georgia from 19 November 1977 through 28 February 1978. Counties involved were Chambers, Monroe, Lee, Coffee, Elmore, Barbour, Tallapoosa, Crenshaw, Russel and Macon in Alabama; and Troup and Meriwether in Georgia. Since most of the foxes were obtained from trappers, all but six examined during this study had been skinned and then frozen. A few of the foxes had been killed on roads. Gray fox population densities in the areas sampled are believed to be similar to those (3 to 4 per ha) reported for northern Florida<sup>13</sup> and found in current telemetry studies of the gray fox in eastcentral Alabama.

Blood samples from 24 locally trapped foxes were taken by cardiac puncture immediately following death. The modified Knott's<sup>12</sup> test was used to determine the presence of microfilariae in these samples.

Fox skulls were retained for age determination using a combination of skull suture closure and toothwear. Carcasses were classified as juvenile, less than one year of age, or adult.

Gross examination was made of internal organs with specific emphasis on the heart and major blood vessels. The atria, ventricles, and vessels were incised and examined for *D. immitis*. After gross examination the lungs and liver were incised, washed and the filtered sediment examined for parasites. The washings were filtered through a 149  $\mu$ m wire mesh sieve and the sediment examined with the aid of a dissecting microscope. All parasites found were preserved in 70% ethyl alcohol.

Nematodes suspected of being *D. immitis* were examined further after clearing in a 20% lactophenol solution for 24 h. Anterior portions of females were crushed and examined with the aid of a microscope to determine if microfilariae were present. These nematodes were considered to be *D. immitis* based on size, morphology and location.

TABLE 1. Prevalence of *Dirofilaria immitis* infection in carcasses of 149 trapped gray foxes.

Age class and sex	Number examined	Number positive (%)
<b>Adults</b>		
Male	75	2 (2.7)
Female	55	1 (1.8)
subtotal	130	3 (3.0)
<b>Juveniles</b>		
Male	7	1 (14.5)
Female	12	0 (0)
subtotal	19	1 (5.3)
Total	149	4 (2.7)

## RESULTS

Blood samples from 24 gray foxes were negative for circulating microfilariae. Nineteen of these foxes were examined at necropsy and also found negative for adult *D. immitis*.

Of 130 adult gray foxes examined, 3 (2%) contained adult *D. immitis* in the right ventricle and pulmonary arteries; an immature heartworm was found in the right ventricle in 1 of 19 (5%) juveniles.

Of the 149 gray foxes examined, 82 were male and 67 female. Three males (4%) and 1 female (1%) were infected with *D. immitis* (Table 1).

Two adult male gray foxes collected independently of this study contained six and eight *D. immitis*, respectively, in the right ventricle. One was dead on the road in Adams County, Mississippi (M.E. Ferriss, Pers. Comm.) and the other was trapped in Tallapoosa County, Alabama and held captive for 3 months (R.D. Powers, Pers. Comm.).

In this study the prevalence of infection was too low to statistically evaluate the significance of geographic distribution, sex or age.

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## DISCUSSION

All of the infections detected in this survey were single-sex infections. These data, and the rate of infection suggest that gray foxes presently are not reservoirs for *D. immitis* in Alabama and Georgia.

A high percentage of the dog population in this region is infected with *D. immitis*. Studies on dogs in animal shelters from Houston County, Alabama in 1973, indicated 73 of 98 (74%) infected; in 1978 14 of 33 (44%) from the same source were infected. (A.R. Dillon, Pers. Comm.).

Wild animals should not necessarily be considered as "dead end" hosts. *D. immitis* infection within wild mammal populations may have serious consequences that are as yet unknown. If the human population and their dogs continue their urban dispersion, the interaction of *D. immitis* in gray fox and dog populations possibly could become significant, perhaps to the detriment of one or both species (Stuht, unpubl.). If *D. immitis* is pathogenic to gray foxes, infection could be a detriment to survival of local populations of foxes.

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