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# DIROFILARIA IMMITIS IN GRAY FOXES IN ILLINOIS

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## ABSTRACT

The prevalence of *Dirofilaria immitis* in gray foxes (*Urocyon cinereoargenteus*) in Illinois was determined by gross examination of 136 animals harvested during the 1978-79 and 1979-80 hunting and trapping seasons. Heartworms were found in 1 of 65 (1.5%) male and 2 of 67 (3.0%) female gray foxes; overall infection rate was 2.2%. The average heartworm burden per fox was 1.3. The documentation of *D. immitis* infections in gray foxes from Bond, Edgar, and Jasper counties represent new distributional records for the state.

The wide distribution (Otto 1969) and pathogenicity (Kotani et al. 1975, Winter 1959) of *Dirofilaria immitis*, the canine heartworm, in the domestic dog have stimulated studies of the relationship of this parasite with several wild mammals (Otto 1975b). Much of the work in the United States has involved the wild Canidae, including the gray fox (*Urocyon cinereoargenteus*). In spite of the fact that canine heartworm disease has been recognized with increasing frequency in the Midwest since about 1965 (Otto 1975a), only three post-1965 investigations of *D. immitis* in midwestern gray foxes have been reported (Kazacos 1977, Kazacos and Edberg 1979, Stuht 1978). *D. immitis* specimens were recovered from 5 of 86 gray foxes examined in Indiana and Michigan. In two pre-1965 Minnesota studies, carcasses of 35 gray foxes were examined, but no heartworms were found (Erickson 1944, Schlotthauer 1964). Dyer and Klimstra (1982) found *D. immitis* in the hearts of 3 of 267 gray foxes collected in three southern Illinois counties in 1962. In contrast, domestic canine infections have been documented from every county (Todd and Mark 1974), and infected red foxes (*Vulpes vulpes*) have been collected from at least four counties in that state (Hubert et al. 1980). The objective of this study was to determine the prevalence of heartworm in gray foxes throughout Illinois.

## MATERIALS AND METHODS

Gray fox carcasses were obtained from fur buyers during December 1978, January and December 1979, and January 1980. These buyers were located in Clay,

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Clinton, DeKalb, Edgar, Jasper, Moultrie, Richland, and Vermilion counties. Although exact capture locations were not available for many animals, all were captured in Illinois within the following radii of the various furhouses where collected: Clay and Richland counties, 100 km; DeKalb, Edgar, and Vermilion counties, 80 km; Jasper County, 32 km; and Moultrie County, 24 km. Additional gray fox hearts from specimens caught during December 1978 in Bond County and during December 1979 in Carroll, Ford, Mason, and Sangamon counties were supplied by cooperating trappers.

Some carcasses were frozen when received and subsequently thawed for heart removal. Hearts collected by cooperating trappers were frozen; these were also thawed prior to inspection. Ventricles, atria, and pulmonary arteries were examined macroscopically for the presence of heartworms. All worms found were identified and sexed employing the criteria of Yorke and Maplestone (1969). *D. immitis* specimens were submitted to the National Parasite Museum, Beltsville, Maryland, and are cataloged as 75550.

## RESULTS

Specimens of *D. immitis* were collected from the right ventricles and pulmonary arteries of 3 of the 136 (2.2%) gray foxes examined (Table 1). One male (1.5%) and two female (3.0%) gray foxes were infected with heartworms. There was no difference in the rate of infection for male foxes compared with female foxes ($p>0.20$). One adult male and one adult female *D. immitis* were found in the positive male gray fox from Jasper County. The infected female foxes from Bond and Edgar counties contained a single immature and one adult female heartworm, respectively.

## DISCUSSION

Our data indicate the prevalence of heartworm infection in gray foxes from Illinois is similar to other northern states and has not changed significantly since the early 1960's. Three post-1965 surveys in New York (Monson et al. 1973) and Indiana (Kazacos 1977, Kazacos and Edberg 1979) revealed the presence of *D. immitis* in 5 of 265 (1.9%) gray foxes. Dyer and Klimstra (1982) reported an infection rate of 1.1% for southern Illinois in 1962.

The maximum *D. immitis* burden reported for the gray fox is 13 (Miller and Harkema 1968). Kazacos and Edberg (1979) recovered nine heartworms from a single gray fox. Parasitic burdens ranged from 2 to 8 worms for three gray foxes from southern Illinois (Dyer and Klimstra 1982). Based on 12 published records of heartworm infections in this species, the average parasite load is 4.9 (Crowell et al. 1977, Kazacos 1977, Kazacos and Edberg 1979, Miller and Harkema 1968, Monson et al. 1973, Simmons et al. 1980, Stone 1974, Stuht 1978). Our observations were lower; the average heartworm burden for the three positive gray foxes we encountered was 1.3.

Several investigators have considered the gray fox to be an incidental host of *D. immitis* and therefore an unimportant reservoir of heartworm infection (Crowell et al. 1977, Dyer and Klimstra 1982, Kazacos and Edberg 1979, Otto 1975b, Simmons et al. 1980). However, certain reports indicate gray foxes may also contribute to the perpetuation of this parasite in nature (Crowell et al. 1977, Stone 1974). Although most data suggest the gray fox is not a reservoir host of *D. immitis*, we concur with

Franson et al. (1976) and Stuht et al. (1978) that infectivity trials and studies of microfiliarial development and transmission are necessary to clearly define the status of any wild canid in the epidemiology of heartworm infection.

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Table 1. Prevalence of *Dirofiliaria immitis* in gray foxes collected in Illinois, December 1978-January 1979 and December 1979-January 1980.

| County | Male | Female | Sex unknown | Totals |
|---|---|---|---|---|
| Bond | 0/18[b] | 1/27 | 0/1 | 1/46 |
| Carroll | 0/1 | 0/1 | — | 0/2 |
| Clay[a] | 0/5 | 0/4 | — | 0/9 |
| Clinton | 0/1 | — | — | 0/1 |
| Coles | 0/1 | — | — | 0/1 |
| DeKalb[a] | 0/2 | 0/5 | — | 0/7 |
| Edgar[a] | 0/4 | 1/11 | — | 1/15 |
| Ford | — | 0/1 | — | 0/1 |
| Jasper[a] | 1/3 | 0/4 | 0/2 | 1/9 |
| Jefferson | 0/3 | — | — | 0/3 |
| Marion | 0/5 | 0/5 | 0/1 | 0/11 |
| Mason | 0/6 | 0/1 | — | 0/7 |
| Moultrie[a] | 0/3 | — | — | 0/3 |
| Richland[a] | 0/1 | 0/1 | — | 0/2 |
| Sangamon | 0/2 | 0/1 | — | 0/3 |
| Vermilion[a] | 0/3 | 0/3 | — | 0/6 |
| Washington | 0/7 | 0/3 | — | 0/10 |
| Totals | 1/65 | 2/67 | 0/4 | 3/136 |

[a]Origin uncertain; county indicates location of furhouse where animal was examined.
[b]Number infected/number examined.