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PARASITES OF RED FOXES IN NEW BRUNSWICK AND NOVA SCOTIA

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Abstract: Sixty-one red foxes from New Brunswick and Nova Scotia were examined for helminths. *Alaria americana, A. arisaemoides, A. mustelae, Cryptocotyle lingua, Echinostoma revolutum* and *Metorchis conjunctus, Capillaria aerophila, Crenosoma vulpis, Toxocara canis, Uncinaria stenocephala* and *Taenia crassiceps* were found. Approximately 67% of the foxes examined were clinically affected with *Sarcoptes scabiei* mange.

INTRODUCTION

The red fox, *Vulpes vulpes,* is common throughout the Maritime Provinces of Canada (Maritimes). Little is known about parasites in foxes of this region except that Swales[22,23] reported *Cryptocotyle lingua, Alaria americana, Capillaria plica* and *Uncinaria (Dochmoides) stenocephala* from foxes in Prince Edward Island and Threlfall[24] found *Crenosoma vulpis* and *U. stenocephala* in one fox examined in Newfoundland. From time to time, red foxes have been submitted to the Animal Pathology Laboratory, Sackville, New Brunswick, for pathologic examination, particularly following the diagnosis of rabies in this region in 1966. Since 1960, the author has carried out parasitologic examination on 61 red foxes originating in New Brunswick and Nova Scotia. The results of this study are presented in this report.

MATERIALS AND METHODS

Most of the red foxes studied were submitted because they appeared sick or behaved abnormally. Parasitologic examinations were carried out upon completion of other laboratory examinations.

The lungs were examined by slitting the trachea, bronchi and bronchioles with fine scissors to expose worms on the tracheal, bronchial and bronchiolar mucosae. Direct examinations under a stereoscopic microscope were made of tracheal exudate or exudates expressed from the smaller bronchioles mounted on slides to detect worm eggs, larvae and worms.

The intestinal tract was examined by slitting with scissors, rubbing the mucosa vigorously in water and passing both washings and contents through a sieve with openings of 0.210 mm. The liver was examined by slicing into thin strips and washing in water. The washings were passed through a sieve with openings of 0.210 mm.

All parasites recovered were fixed in 70% alcohol containing 5% glycerin for later identification.

RESULTS

The helminths and prevalence of infection recorded in the 61 red foxes from New Brunswick and Nova Scotia are listed in Table 1. A total of six trematode, four nematode and one cestode species was identified. (Representative specimens have been deposited with the National Museums of Canada - Invertebrate Collections (Parasites) Ottawa. *Toxocara canis* - NMCIC-P 1978 Nos. 36-56; *Uncinaria stenocephala* - NMCIC-P 1978 Nos. 57-79; *Crenosoma vulpis* - NMCIC-P 1978 Nos. 80-86;

TABLE 1. The species of parasites and prevalence in 61 red foxes from New Brunswick and Nova Scotia.

PARASITE	NO. INFECTED	PERCENTAGE INFECTED
Trematoda		
Alaria americana	15	24.6
Alaria arisaemoides	1	1.6
Alaria mustelae	2	3.3
Cryptocotyle lingua	9	14.7
Enchinostoma revolutum	5	8.2
Metorchis conjunctus	3	4.9
Nematoda		
Capillaria aerophila	41	67.2
Crenosoma vulpis	33	54.1
Toxocara canis	43	70.5
Uncinaria stenocephala	43	70.5
Cestoda		
Taenia crassiceps	31	50.8

Capillaria aerophila - NMCIC-P 1978 Nos. 87-96; *Alaria americana* - NMCIC-P 1978 Nos. 97-106; *Alaria mustelae* - NMCIC-P 1978 Nos. 107-108; *Alaria arisaemoides* - NMCIC-P 1978 No. 109; *Cryptocotyle lingua* - NMCIC-P 1978 Nos. 110-117; *Echinostoma revolutum* - NMCIC-P 1978 Nos. 118-121; *Metorchis conjunctus* - NMCIC-P 1978 Nos. 122-124; *Taenia crassiceps* - NMCIC-P 1978 Nos. 125-132.)

Forty-one of the 61 foxes were clinically affected with the mange mite, *Sarcoptes scabiei*. Multiple infections were common with 59% of the foxes infected with five or more species of parasites, including mites. For the most part, the number of helminths present was low although occasionally very large numbers of one or more species were present. With regard to cestodes, the numbers present were usually very low; often the scolices were not recovered.

DISCUSSION

The findings suggest that a high proportion of red foxes from New Brunswick and Nova Scotia is infected with *C. aerophila, C. vulpis, T. canis* and *U. stenocephala*. However, since many of the foxes were submitted because of suspected rabies or other diseases, the parasitologic findings may not necessarily be representative of all foxes from this region.

It was surprising that *Toxascaris leonina* was not recovered since Smith[19] found 140 of 234 foxes in Iowa and Erickson[7] found 67.5% of red foxes in Minnesota were infected with this species. The prevalence of lungworms in maritime red foxes agrees with Goble and Cook's finding in New York State.[10] On the other hand, the prevalence of *U. stenocephala* in maritime red foxes is in marked contrast to Erickson's findings in Minnesota where only 1.6% of foxes were infected.[7]

With regard to trematodes, the number of animals infected with the various species was much lower than was the case for the various nematodes. Nevertheless, three species of *Alaria* were identified with *A. americana* present in about 25% of the maritime foxes examined. Previously, *A. americana* was reported from red foxes in

Ontario,[15] Quebec[22] and Prince Edward Island,[22] and dogs in Michigan.[11] On the other hand, *A. arisaemoides* and *A. mustelae* were found only in one and two foxes, respectively. *A. arisaemoides* has been reported from red foxes in Massachusetts,[2] Minnesota[9] and Ontario[15,18] and dogs in New York[12] and Saskatchewan,[1] indicating a wide distribution in North America. In contrast to the findings in this study, 17 of 18 foxes examined from Dakota County, Minnesota were infected with *A. arisaemoides*.[9] It is interesting to note that the two red foxes infected with *A. mustelae* came from the same area in eastern Nova Scotia. This species has been reported from mink in Ontario[15] and coyotes in Minnesota.[7]

Cryptocotyle lingua, a trematode originally of European origin and carried by salt water fish[5] was found in about 15% of the foxes, suggesting that fish probably form an important part of the diet of foxes in the maritime area. Also that an appreciable proportion of salt water fish presumably carry metacercariae of this species. The author also has found *C. lingua* in a bald eagle, herring gull and a red throated loon[20] further indicating its prevalence in the maritime area. It appears that *C. lingua* also is widely distributed along the Atlantic coast of North America.[5,14]

The finding of *Metorchis conjunctus* in the Maritimes extends easterly the known distribution of this species in Canada. Cameron[4,5,6] has described the distribution as roughly an area of 1,942,500 sq. km. from the Laurentian Mountains to the height of land in Saskatchewan and from the border as far north as Moosonee on Hudson's Bay. In 1968, Holmes and Podesta[13] reported this species from Alberta. The white sucker, *Catostomus commersoni* is the second intermediate host with many different fish-eating mammals including cats, dogs, red fox, mink, raccoon, wolves, coyotes and man as final hosts.[3,4,6,13,22] The author also has found this parasite in two cats (unpublished data) further indicating that *M. conjunctus* may be prevalent in the Maritimes.

Echinostome trematodes have been reported infrequently in red foxes[7,15,16,22,23] yet five of 61 foxes in this study had low numbers of *Echinostoma revolutum*. Since a large number of birds and mammals may serve as definitive hosts,[17] the finding of this parasite suggests that it may have a wide distribution in this region with foxes occasionally serving as hosts.

Only one species of tapeworm, *Taenia crassiceps* was identified in Maritime red foxes based on morphologic descriptions of Verster.[25] The 50% prevalence of infection in the foxes examined suggests that it is widely distributed in this area. Freeman[8] also showed that this species was common in red foxes of southern Ontario but not from areas of the Laurentian Shield in Ontario.

The 67% prevalence of sarcoptic mange recorded in Maritime red foxes is in marked contrast to 7.4% rate of infection reported for red foxes in New York.[21] The prevalence of infection observed may not be indicative of the actual rate of infection as many of the foxes had generalized mange lesions and perhaps most were submitted because of clinical signs. Nevertheless, sarcoptic mange is common and, undoubtedly, many foxes succumb to the disease.

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