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The Prevalence of *Trichinella* sp. in Arctic Foxes (*Alopex lagopus*) in Svalbard

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ABSTRACT The prevalence of *Trichinella* sp. in arctic foxes (*Alopex lagopus*) from Svalbard was studied from 1983 to 1989. Diaphragms of 697 foxes were examined for larvae; 59 foxes (8.5%) were infected. The prevalence of *Trichinella* sp. increased from 4% in juveniles to 36% in foxes aged more than 6 years of age. There were no significant correlations when condition and body weight each were correlated to the occurrence and number of larvae of *Trichinella* sp. More foxes were infected in the northern than in the central part of Svalbard. There were only minor differences in prevalence among years.

Key words: Arctic fox, *Alopex lagopus*, Svalbard, Norway, *Trichinella* sp.

The nematode *Trichinella* sp. occurs in both marine and terrestrial mammals throughout the circumpolar Arctic (Rausch, 1970). The parasite was first reported in arctic foxes (*Alopex lagopus*) in Canada by Parnell (1934), and later detected in fox populations in Alaska (Rausch et al., 1956), Greenland (Thorborg et al., 1948) and Svalbard (Larsen and Kjos-Hansen, 1983). In these areas the prevalence in foxes varied between 1.4% and 13%.

In red foxes (*Vulpes vulpes*) and wolves (*Canis lupus*) from arctic North America the prevalence of *Trichinella* sp. is reported to be 33% and higher (Rausch et al., 1956). Similarly, in polar bears (*Ursus maritimus*) the prevalence is reported to vary between 25% and 59% (Rausch et al., 1956; Rausch, 1970; Larsen and Kjos-Hansen, 1983). In seals and walruses (*Odobenus rosmarus*) the prevalence of *Trichinella* sp. is generally considered to be low (Fay, 1960; Rausch, 1970).

In this study, we report the prevalence of *Trichinella* sp. counted larvae in arctic foxes from Svalbard in relation to age, geographical origin of the animals and year of sampling. Moreover, condition and body weight of infected and non-infected animals are compared.

Diaphragms from carcasses of skinned arctic fox, caught by professional and recreational trappers in central and northern Svalbard (74°N to 80°N, 10°E to 30°E; Fig. 1), were collected from 1983 through 1989. The animals were trapped primarily between November and April. Carcasses were frozen for 2 to 8 mo before sampling. A piece of diaphragm was stored in small plastic bags at −20 C between 5 mo and 4 yr prior to parasitological examination.

From each diaphragm 12 rice grain sized pieces (in total 0.3 g to 0.4 g) were cut and examined for *Trichinella* sp. larvae according to Framstad's (1978) procedures using a trichinoscope compressor and a Leitz Trichinoscope IXQ (Ernst Leitz, GMBH, Wetzlar, Germany). The number of larvae counted was recorded.

The animals were subdivided in two groups according to site of trapping (Fig. 1). One group consisted of foxes caught north of Isfjorden (Areas 3, 4 and 5) and the other of animals caught south of Isfjorden (Areas 1 and 2). Isfjorden was chosen because the main food item of foxes south of this fiord is reindeer (*Rangifer tarandus*), while it is sea birds north of the fiord (Prestrud, unpubl.).

Age of the foxes was determined by counting the annuli in the cementum of a sectioned canine tooth from 684 of the foxes (Grue and Jensen, 1976). Six hundred fifteen foxes were weighed by the trappers to the closest 100 g. Condition was determined by measuring the thickness of subcutaneous fat on the rump (RFT = rump fat thickness) as described by Prestrud and Nilssen (1992).

Statistical analyses followed Zar (1984).

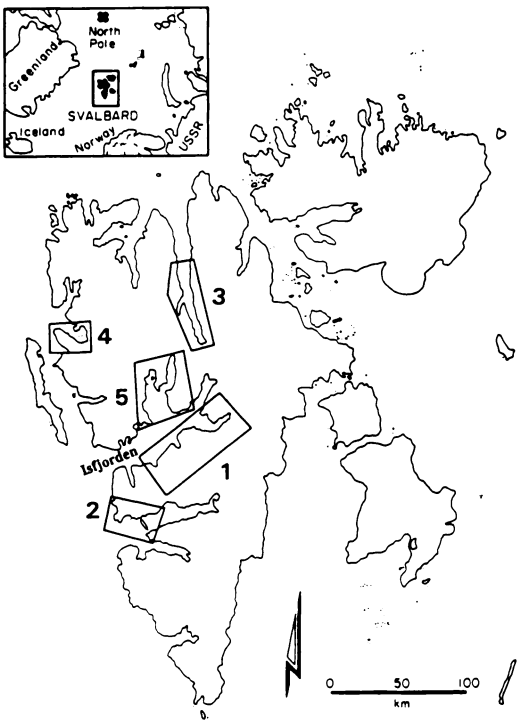

FIGURE 1. Location of Svalbard and the five areas where foxes were caught (1, Longyearbyen; 2, Fridtjofhamna; 3, Austfjordneset; 4, Ny Ålesund; 5, Kapp Wijk).

Differences in the occurrence of *Trichinella* sp. in relation to sex, trapping areas and year of capture were tested with contingency tables and a Chi-square test. Students *t*-test was used to test for differences in body weight and condition between foxes with and without *Trichinella* sp. infection. The relationship between age, body weight and condition, and the number of larvae in positive specimens were tested by simple correlation analyses. A simple linear regression analysis was used to test for differences among age-classes. The accepted significance level was 0.05.

Trichinella sp. larvae were detected in 59 (8.5%) of the 697 foxes examined. The prevalence of *Trichinella* sp. increased significantly with age ($r = 0.80$, $P < 0.05$, slope of linear regression = 0.04, arcsin transformed data). The sample sizes were: juveniles, 389; yearlings, 98; 2-yr-old, 59; 3-yr-old, 34; 4-yr-old, 30; 5-yr-old and 6-yr-old, 19 each; and ≥7 yr, 36.

Seven percent of the females ($n = 334$) and 10% of the males ($n = 363$) were infected, but the difference was not significant ($\chi^2 = 2.39$, $P = 0.12$, with Yates correction).

The differences in mean (SD) total body weight (3,147 g (699) vs. 3,308 g (743) and mean RFT (4.7 mm (5.6) vs. 5.8 mm (6.6)) between foxes with and without *Trichinella* sp. were not significant (weight: $t = 1.53$, $P = 0.13$; RFT: $t = 1.3$, $P = 0.19$).

The mean (SD) number of larvae in the selected rice grains from each fox was 40 (43). There were no significant correlations between the number of *Trichinella* sp. larvae counted and body weight ($r = -0.10$, $P = 0.47$), RFT ($r = -0.09$, $P = 0.54$) or age ($r = -0.13$, $P = 0.33$).

The difference between prevalence of *Trichinella* sp. in foxes caught north (14%, $n = 238$) and south (5%, $n = 440$) of Isfjorden was significant ($\chi^2 = 13.5$, $P < 0.05$, with Yates correction). The age distributions in the samples from the two areas were not significantly different ($\chi^2 = 2.4$, $P = 0.12$, with Yates correction) and cannot account for the difference in prevalence of *Trichinella* sp. between the two groups.

The difference in prevalence of *Trichinella* sp. among years (1983, 6%; 1984, 7%; 1985, 8%; 1986, 11%; 1987, 10%; 1988, 9%; and 1989, 7%) was not significant ($\chi^2 = 1.86$, $P = 0.93$).

The systematic status of the *Trichinella* larvae we found in arctic foxes in Svalbard was not determined. However, because *Trichinella nativa* is characterized by an arctic and subarctic distribution and has a high resistance to freezing (Rosa et al. 1990), we assume that the larvae we found were of this species. The tolerance to freezing was, however, not determined.

The prevalence of *Trichinella* sp. larvae in arctic foxes in Svalbard corresponds to that found in arctic foxes from other parts of the Arctic (1.4% to 13%) (Rausch, 1970). The prevalence of *Trichinella* sp. infection generally is higher in other arctic carnivores such as polar bears (25 to 59%)

(Rausch et al., 1956; Larsen and Kjos-Hansen, 1983), wolves (33%) and red foxes (41%) (Rausch et al., 1956) than it is in arctic foxes.

Madsen (1961) suggested that the short life-span of arctic foxes was the main cause of the low prevalence of *Trichinella* sp. in this species. Although this explanation is plausible, and is supported by the increase in prevalence with age documented in the present study, there is no difference in longevity between red and arctic foxes (Prestrud, unpubl. data from Svalbard compared to data on red foxes from Sweden in Lindström (1982)). Moreover, Larsen and Kjos-Hansen (1983) found no relationship between age and prevalence in polar bears. Hence, short life-span alone cannot completely explain the low prevalence of *Trichinella* sp. in arctic foxes compared to other arctic carnivores. Thus, differences in food habits or distribution between the species might be of importance.

Microtine rodents constitute the main source of food for arctic fox in most of their distribution area. In Svalbard, however, microtine rodents are lacking, and the principal diet is reindeer, different sea birds and ptarmigan (*Lagopus mutus*) (Prestrud, unpubl.). None of these species are likely to be infected with *Trichinella* sp., in contrast to some microtine rodents such as the brown lemming (*Lemmus sibiricus*) and northern vole (*Microtus oeconomus*) (Rausch, 1970).

Arctic foxes are opportunistic feeders and the most likely source of infection in Svalbard is other foxes. Polar bear carcasses and the marine food chain also may transfer *Trichinella* sp. larvae to arctic foxes. Larsen and Kjos-Hansen (1983) concluded that a change in the availability of polar bear carcasses in Svalbard was the most likely explanation for the large difference in prevalence of *Trichinella* sp. infection in foxes before (67%) and after (3%) polar bears were protected in 1973. However, we found significant differences locally in Svalbard, and the conclusion of Larsen and Kjos-Hansen (1983) is not consistent with the low occurrence of *Trichinella* sp. in arctic foxes in Alaska, Canada and Greenland, where polar bears are still hunted.

We cannot explain the difference in occurrence of *Trichinella* sp. in foxes caught north and south of Isfjorden, but a difference in diet probably is a major cause. The density of reindeer is lower north of Isfjorden than it is south of it. Hence, reindeer constitute a lesser portion of the arctic fox diet in the north of the islands than in the south (Prestrud, unpubl.). We have no data to determine whether foxes north of Isfjorden eat more carrion of sea mammals and polar bears than they do south of Isfjorden, but polar bears are more abundant in the north.

The proportions of juvenile animals in most arctic fox populations vary considerably from year to year due to fluctuations in the small mammal populations. Thus, it is crucial to know the age distribution when comparing the prevalence of *Trichinella* sp. infection in different years. However, in most reports the age distribution has not been given. In Svalbard there are no large, short-term fluctuations in numbers of foxes (Prestrud, unpubl.). This might explain why the prevalence of *Trichinella* sp. infection did not vary significantly between different years.

The body weight of arctic foxes infected with *Trichinella* sp. was not significantly lower than in non-infected animals, and no difference in condition could be demonstrated between the two groups. Similarly, the number of *Trichinella* sp. larvae did not seem to affect these parameters. Consequently, infection of *Trichinella* sp. appears not to have any pathogenic significance in arctic foxes.

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