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Trichinella sp. in Wolves from Interior Alaska

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ABSTRACT: Tongue samples were collected from 148 wolf (*Canis lupus*) carcasses during 1993 and 1994 near Fairbanks (Alaska, USA). A standard peptic digestion procedure was used to detect *Trichinella* sp. larvae. Larvae were found in 54 of 148 (36%) samples. There was no significant difference in sex-specific prevalence. Prevalence was significantly related to age. There was no relationship between the number of larvae/g of host tissue and the age or sex of the host. *Trichinella* spp. infection may cause illness in individual wolves. However, there was no indication the parasite had any impact on the population.

Key words: Alaska, *Canis lupus*, survey, *Trichinella* sp., wolves.

Trichinella sp., are nematode parasites which are capable of infecting virtually all warm-blooded animals (Dick, 1983). *Trichinella* sp. are transmitted by ingestion of infected muscle tissue from another host (Bailey and Schantz, 1990). Therefore, strictly carnivorous host species generally have higher infection rates than omnivorous species (Franchimont et al., 1993; Oivanen and Oksanen, 1993). Impacts of infection on individual animals are not well understood. Impacts on populations of free-ranging host species are believed to be minimal (Forrester, 1976).

The objectives of this project were to determine (1) the prevalence of *Trichinella* sp. in a wolf (*Canis lupus*) population living in Interior Alaska (USA) and (2) the relationship between prevalence of the parasite and sex and age of the host.

The 14,325-km^2 study area was located south of Fairbanks (Alaska, USA). The corners of the collection area were located at 64°45′N, 147°30′W; 63°30′N, 146°15′W; 63°30′N, 149°15′W; and 64°32′N, 149°W.

One hundred twenty-two wolf carcasses were collected in conjunction with a state-sponsored population control program. This program was conducted during the winter of 1993–1994 (n = 91) and early winter 1994 (n = 31). Twenty-six additional carcasses were purchased from private trappers who captured wolves in this same area.

Tongue specimens were collected during post-mortem examinations of wolves. Sex of each carcass was recorded at that time. Age was determined by counting cementum annuli of an extracted premolar tooth (Ballard et al., 1996). A standard peptic digestion procedure was used to detect *Trichinella* sp. (Worley et al., 1991). A minimum of 25 g of tongue tissue was tested from each animal.

A generalized linear model with a logit link function and binomial distribution (McCullagh and Nelder, 1989) was used to determine if prevalence was related to age or sex of the host. Age was treated as a continuous variable up to a quadratic term. Sex was treated as a categorical variable. All main and pair-wise interactions were considered in the model. Effects that were not significant ($\alpha > 0.05$) were removed until the most parsimonious model was obtained. The final model contained only those effects, and possible interactions, which were significant with a log-likelihood ratio statistic at $\alpha \leq 0.05$. Multiple linear regression (Snedecor and Cochran, 1980) was used to determine if the number of larvae/g of tissue (LPG) was related to age or sex for those wolves that were infected.

Wolves ranged in age from 0.5 to 8.5 yr. Larvae were detected in 54 of 148 (36%) tissue samples. Sex-specific prevalence was 23 of 64 (36%) for males and 31 of 84 (37%) for females. These values were not significantly different ($P = 0.902$). Prevalence was significantly ($P < 0.0001$) related to age (Table 1). The logit model estimat-

TABLE 1. Age-specific prevalence and density of *Trichinella* sp. in wolves (*Canis lupus*) from Interior Alaska, 1993–1994.

Wolf age	Prevalence (%)	Mean density (SE)[a]
0[b]	17/84 (20)[c]	2.9[d] (0.7)
1	17/31 (55)	10.6 (4.2)
2+	20/33 (61)	2.3 (0.6)

[a] SE = standard error.
[b] Years of age.
[c] Number positive/number tested (%).
[d] Mean number of larvae/g tongue tissue.

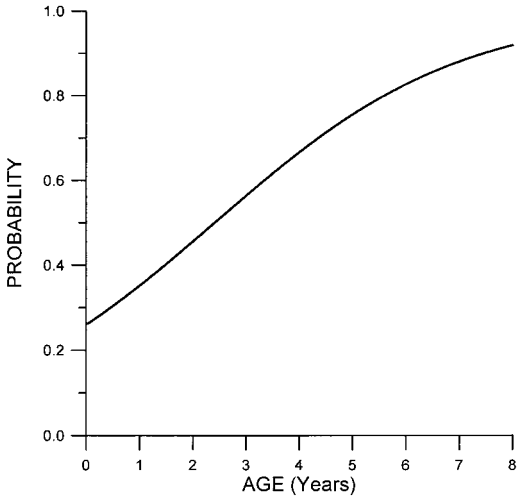

FIGURE 1. Relationship between wolf (*Canis lupus*) age and predicted probability of *Trichinella* sp. in a wolf from Interior Alaska.

ed prevalence as a function of age (Fig. 1) according to the following formula: Probability of infection = $\exp(-1.0465 + 0.4347 \cdot \text{age})/1 + \exp(-1.0465 + 0.4347 \cdot \text{age})$. Density ranged from 0.02 to 52.9 LPG ($\bar{x} \pm \text{SE} = 5.11 \pm 1.42$). There was no relationship between LPG and age or sex of the host ($P = 0.629$), for those animals which were infected. The absence of any correlation between age and LPG may be due to (1) annual variation in host exposure to the parasite and/or (2) repeated exposure leading to higher larval numbers in younger wolves.

Trichinella nativa is believed to be the only member of the genus found in mainland Alaska (Zarnke et al., 1997; Pozio et al., 1992; Dick, Campbell, 1983). However, the nematodes collected from wolves in the current study were not identified to the species level. There was no evidence that the wolves were infected with more than one species of *Trichinella*. Therefore, these nematodes will be referred to as *Trichinella* sp.

A prevalence of 33% (51/154) was reported for wolves in Alaska during the 1950's (Rausch et al., 1956). Collection areas were not indicated. Results of the current survey are in close agreement to this previously-reported value.

More recent surveys of other host species have been conducted in or near the current study area. Serum antibody prevalence was 22% (22/99) for grizzly bears (*Ursus arctos*) (Zarnke et al., 1997). Prevalence of larvae in lynx (*Felix lynx*) tongue tissue was 19% (63/328) (Zarnke et al., 1995). Obviously, prevalence in wolves is much higher than these two species.

Grizzly bears are omnivores. Vegetation represents a major portion of their diet during certain annual periods (Craighead and Mitchell, 1982). Wolves are more strictly carnivorous than bears. Results of the current survey concur with the observation that prevalence of trichinosis is higher in strictly carnivorous species compared with omnivorous species (Franchimont et al., 1993; Oivanen and Oksanen, 1993).

Lynx prey primarily on snowshoe hares (*Lepus americanus*). Hares are strongly herbivorous. Prevalence of trichinosis in hares is very low (Rausch et al., 1956). Therefore, they are not considered a major source of *Trichinella* sp. Obviously, lynx are exposed via alternate prey species. The relative positions of wolves and lynx in the food chain is reflected in their respective prevalences of trichinosis.

The source of infection for wolves in this survey is unknown. Wolves prey and scavenge on a variety of mammals. Snowshoe hares (*Lepus americanus*), beaver (*Castor canadensis*), red squirrels (*Tamiasciuris hudsonicus*), muskrat (*Ondatra zi-*

bethicus), and numerous microtine rodent species are potential sources for *Trichinella* sp. (Rausch et al., 1956). However, prevalences in these species are very low. Therefore, their role in the epizootiology of sylvatic trichinosis in Alaska is probably minimal. More likely, potential sources of exposure for wolves include lynx, red fox (*Vulpes vulpes*), black bear (*Ursus americanus*), grizzly bear, and other wolves. Wolves may intentionally kill and consume these species. Alternatively, wolves also may scavenge carcasses of animals which died by other means.

The impact of infection on individual wolves is unknown. Severity of symptoms in domestic dogs can range from inapparent to severe clinical disease (Madsen, 1961; Soulsby, 1965). The LPG values are low in red foxes, coyotes (*Canis latrans*), and wolves (Zimmermann, 1971; Worley and Greer, 1982). *Trichinella* sp. infections in most free-ranging canids are believed to be subclinical (Zimmermann, 1971). All wolves in the current survey were apparently active, functional members of the population. There was no evidence that *Trichinella* sp. infection had any measurable impact on either individual wolves or the population.

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