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Source: Journal of Wildlife Diseases, 40(3) : 452-455

Published By: Wildlife Disease Association

URL: https://doi.org/10.7589/0090-3558-40.3.452

Journal of Wildlife Diseases, 40(3), 2004, pp. 452–455

PREVALENCE OF *SOBOLIPHYME BATURINI* IN MARTEN (*MARTES AMERICANA*) POPULATIONS FROM THREE REGIONS OF ALASKA, 1990–1998

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ABSTRACT: Marten (*Martes americana*) carcasses were collected from trappers in three regions of Alaska. Stomachs were examined for the nematode parasite *Soboliphyme baturini.* Both prevalence and intensity of infection exhibited an increase from north to south. Prevalence was higher in adults (compared with juveniles) from the two mainland study areas. Prevalences in these two age classes were similar for the southeastern region. There were no sex-specific differences in prevalence. No pathologic changes were observed in the gastrointestinal tract. Impact of the parasite on either individual animals or populations was not detected.

Key words: Alaska, marten, *Martes americana, Soboliphyme baturini.*

INTRODUCTION

The nematode *Soboliphyme baturini* is a common parasite of mustelids from both Nearctic and Palearctic ecosystems. Natural hosts include ermine (*Mustela erminea*; Schmidt and Kinsella, 1965); mink (*Mustela vison*; Swartz, 1968); marten (*Martes americana*; Bezdek, 1942); fisher (*Martes pennanti*; Morgan, 1943); and wolverine (*Gulo gulo*; Price, 1930; Bezdek, 1942).

Adult *S. baturini* live in the host's stomach. Adults produce eggs that are shed in host feces (Karmanova, 1963). Soil-dwelling Oligochaeta (family Enchytraeidae) serve as intermediate hosts for larval stages (Karmanova, 1963). A second intermediate or paratenic host may be involved (Karmanova, 1986; Rausch, pers. comm.). Rodents and/or amphibians have been proposed as species that could fill this role (Rausch, pers. comm.).

Adverse effects on body weight and female productivity have been reported for sable (*Martes zibellina*) from Russia (Nina Tranbenkova, pers. comm.). Additional signs include anemia, bloody vomit, bloody feces, and ulcers at the point of attachment to the stomach wall (Karmanova, 1986). There have been no similar reports of negative health impacts for marten from North America.

Short-term investigations of the parasite have been conducted in several areas of North America (Price, 1930). In Alaska, prevalence ranged from less than 1% in the Arctic (Scranton, 1986) to 24% in the southeastern portion of the state (Johnson, 1981).

The purpose of the current study was to assess the effect of the following host parameters on *S. baturini* prevalence in marten: 1) sex, 2) age, 3) location of collection, and 4) year of collection.

MATERIALS AND METHODS

Skinned carcasses were submitted by trappers from three major study areas (Fig. 1) during the period 1990–98. Carcasses were not collected at random from the respective study areas. Primary consideration was the distribution of trappers who were willing to donate carcasses. Independent studies of marten ecology were being conducted in these three areas.

Age categories were determined by means of skull characteristics (Poole et al., 1993). This technique only distinguishes young of the year from animals >1 yr of age. An incisor was extracted from each of 82 skulls from the southwestern study area. Cementum annuli were counted to provide a more precise age (Matson's Laboratory, Milltown, Montana, USA).

Stomachs of marten were examined for the presence of *S. baturini.* When necessary, contents were placed on a mesh screen and washed with water to separate contents. Worms were identified according to Cheng (1964), and voucher specimens were deposited in the University of Alaska Museum (Fairbanks, Alaska; accession 2004:019). Presence or absence of *S. baturini* was recorded for each carcass. Intensity (number of parasites per infected marten)

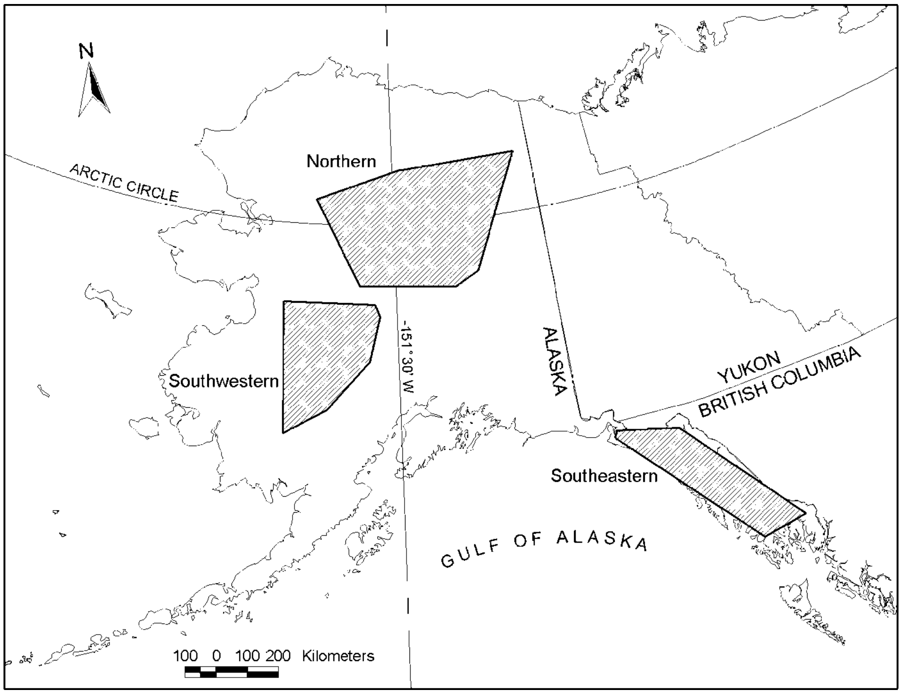

FIGURE 1. Study areas where marten (*Martes americana*) were examined for *Soboliphyme baturini.*

was recorded for the Southwestern and Southeastern study areas.

A generalized linear model (McCullagh and Nelder, 1989) with repeated measures was used to determine if there was significant dependence of parasite prevalence on the following variables: 1) age, 2) sex, 3) year, and 4) geographic area. Samples taken from the same trapline within a year were considered as repeated measurements with equal correlation. The generalized linear model used a logit link with a binomial distribution. Test result is a binary response variable. Year was treated as a continuous variable and centered so that year 1995 was year 0. Age was treated as a categorical variable with two classes—juvenile and adult. All marten <1 yr of age were considered juveniles. Sex and geographic area were treated as categorical variables. All main and interaction effects of these variables were examined. During the modeling process, all higher order terms were removed from the model if they did not substantially ($P>0.05$) increase the fit of the model based on the deviance function compared with a χ^2 distribution (McCullagh and Nelder, 1989). The GENMOD procedure of version 6.12 SAS statistical software package (SAS Institute, Cary, North Carolina, USA) was used to fit the model with maximum likelihood parameter estimates. Logistic regression was used to determine the relationship between age and prevalence of the parasite for a subset of the data where the exact age of the animal was known.

RESULTS

Prevalence of the parasite was relatively stable for the Northern and Southwestern study areas throughout the duration of this study (Fig. 2). This stability was also evident at the level of the individual trapline. Prevalence for the Southeastern study area varied widely during the study.

There was a geographic pattern of increasing prevalence from north to south. Overall prevalence was 19% (416/2,166) for the Northern study area; 30% (321/1,058) for the Southwestern; and 47% (1,430/3,028) for the Southeastern.

Prevalence was 0% (0/139) in the northeastern portion of the Northern study area, and 52% (75/145) in the north-central portion of the Northern study area. Based on small collections from individual trappers, a demarcation line between these two extremes was located at approximately 151°30′W longitude. *Soboliphyme baturini* were not present in marten east of this line. Prevalence increased west of

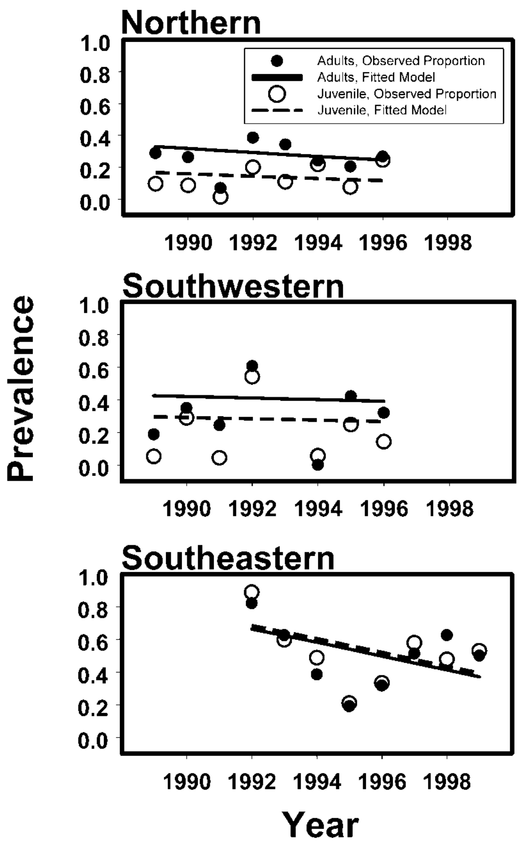

FIGURE 2. Age-specific and chronologic prevalence (both observed and predicted) for *Soboliphyme baturini* in marten from three regions of Alaska, 1990–98.

this line, up to the maximum of 52%. No east-to-west pattern of prevalence was observed in the remainder of the Northern study area south of the Arctic Circle.

Intensity of infection also exhibited a north-to-south progression. For the southwest Interior area, the maximum intensity was 151 worms per marten. Eleven animals (1%) had >20 worms. Maximum intensity for the southeastern study area was 257 worms. Two hundred seventy-nine (9%) had >20 worms. Intensity was not recorded for martens from the northern study area.

Prevalence of the parasite was substantially higher in adults as compared with juveniles for the Northern (25% [287/1,133] vs. 12% [129/1,033]) and Southwestern (37% [180/478] vs. 24% [141/580]) study areas. The discrepancy in prevalence between adults and juveniles was minimal for the Southeastern study area (48% [812/1,680] vs. 47% [601/1,286]).

Cementum ages were known for 82 animals from the Southwestern study area. For these animals, prevalence of the parasite increased directly with age. However, sample sizes are small (especially for older-aged animals), and the relationship was not statistically significant (P=0.2540).

The fitted model for prevalence included three of the covariates: geographic area, age, and year. In addition, there were significant interactions: geographic area by age and area by year interaction. The fitted model is

$$\mu = \tau_{ij} + \beta_i \times \text{year}, \qquad (1)$$

where τ_{ij} is −1.0613 if the animal was an adult from the Northern study area, −1.9652 if the animal was a juvenile from the Northern study area, −0.4228 if the animal was an adult from the Southwestern area, −0.9922 if the animal was a juvenile from the Southwestern area, −0.3538 if the animal was an adult from the Southeastern area, or −0.2638 if the animal was a juvenile from the Southeastern area; β_j is −0.0595 if the animal was from the Northern study area, −0.0204 if the animal was from the Southwestern area, or −0.1716 if the animal was from the Southeastern area. See Figure 2 for a comparison of all models. Because the model is on the logit scale, the predicted value is

$$p(\mu) = \frac{\exp(\mu)}{1 + \exp(\mu)}. \qquad (2)$$

For example, if an animal were an adult from the Northern study area in 1994, then μ=−1.0026. Thus, the prevalence probability is predicted to be $p(\mu)$=0.27. The significance of age by geographic area in the model was P<0.0001. The significance of year by geographic area in the model was P<0.0001. The significance of year in the model was P=0.0309. Sex was not significant (P=0.2161), nor were any other higher level interactions. The modeled probability of parasite prevalence, as a function of year for each study area and season, is presented in Figure 2.

DISCUSSION

There is no readily apparent explanation for the disparity between stable prevalence for the two mainland study areas and variable prevalence for the Southeastern study area (Fig. 2). Differing food habits between the study areas may have been a factor. However, the identity of the secondary intermediate host(s) is unknown. Thus, it is difficult to evaluate the role of food habits.

Apparently, some unknown environmental factor lessens transmission and/or survival of the parasite in the northern latitudes within Alaska. However, one of the highest prevalences for an individual trapline was 52% (75/145) from the north-central portion of the Northern study area. Geographic distribution of intermediate hosts may be discontinuous in the northern portion of the Northern study area. Cold winter weather may be a factor in the distribution pattern of all intermediate hosts.

These data suggest that environmental conditions in southeast Alaska favor survival and transmission of *S. baturini.* The extremely large number of worms reported from the Southeastern study area could theoretically cause a physical blockage and/or disrupt the normal function of the host's gastrointestinal tract.

Present results concur with a previous study of marten from the Southeastern area (Johnson, unpubl. data) where prevalence was identical in juveniles (44/180=24%) and adults (21/86=24%). Perhaps the opportunity for exposure is limited in the northern area. As animals grow older, there is a greater likelihood that they have been exposed. Conversely, opportunities for exposure are apparently numerous in the Southeastern area. Nearly half of the marten have been exposed by the time trapping season opens in December of their birth year. The similarity of prevalences for juveniles and adults suggests that this level of exposure is maintained throughout their lives.

During the current study, no lesions were observed in marten parasitized by *S. baturini.* The current study was not designed to investigate these aspects of the epizootiology. Negative health implications for either individual marten or marten populations remain unknown.

ACKNOWLEDGMENTS

We are indebted to the innumerable trappers who so willingly supplied marten carcasses throughout the duration of this investigation, especially K. and B. Deardorff of McGrath and J. Mattie and N. Piispanen of Fairbanks.

LITERATURE CITED

BEZDEK, H. 1942. Studies on the nematode *Soboliphyme baturini* Petrow, 1930. Transactions of the American Microscopic Society 61: 398–403.

CHENG, T. C. 1964. The biology of animal parasites. W. B. Saunders Company, Philadelphia, 727 pp.

JOHNSON, L. 1981. Otter and marten life history studies. Alaska Department of Fish and Game, Federal Aid in Wildlife Restoration, Final research report, projects W-17-10, W-17-11, and W-21-1, study 7.10R. Juneau, Alaska, 29 pp.

KARMANOVA, E. M. 1963. The development of *Soboliphyme baturini* Petrov, 1930, in the intermediate host. Helminthological Laboratory of the Academy of Sciences—USSR 2814: 241–243.

———. 1986. Dioctophymidea of animals and man and diseases caused by them. *In* Fundamentals of nematology, Vol. 20. Amerind Publishing Company Pvt. Ltd., New York, 383 pp.

MCCULLAGH, P., AND J. A. NELDER. 1989. Generalized linear models. 2nd Edition. Chapman and Hall, London, UK, 511 pp.

MORGAN, B. B. 1943. New host records of nematodes from Mustelidae (Carnivora). Journal of Parasitology 29: 158–159.

POOLE, K. G., G. M. MATSON, M. A. STRICKLAND, A. J. MAGOUN, R. P. GRAF, AND L. M. DIX. 1993. Age and sex determination in American martens and fishers. *In* Biology and conservation of martens, sables and fishers, S. W. Buskirk, A. S. Harestad, M. G. Raphael, and R. A. Powell, (eds.). Cornell University Press, Ithaca, New York, 484 pp.

PRICE, E. W. 1930. The occurrence of *Soboliphyme baturini* in North America. Journal of Parasitology 17: 57.

SCHMIDT, G. D., AND J. M. KINSELLA. 1965. Contribution to the morphology of *Soboliphyme baturini* Petrow, 1930 (Dioctophymoidea: Nematoda). Transactions of the American Microscopic Society 84: 413–415.

SCRANTON, C. R. 1986. Parasites of pine marten, *Martes americana,* in northeastern Alaska. Thesis, Montana State University, Bozeman, Montana, USA, 40 pp.

SWARTZ, L. G. 1968. A new natural definitive host, and morphometry of *Soboliphyme baturini* Petrow, in interior Alaska. Canadian Journal of Zoology 49: 691–693.

Received for publication 4 September 2001.