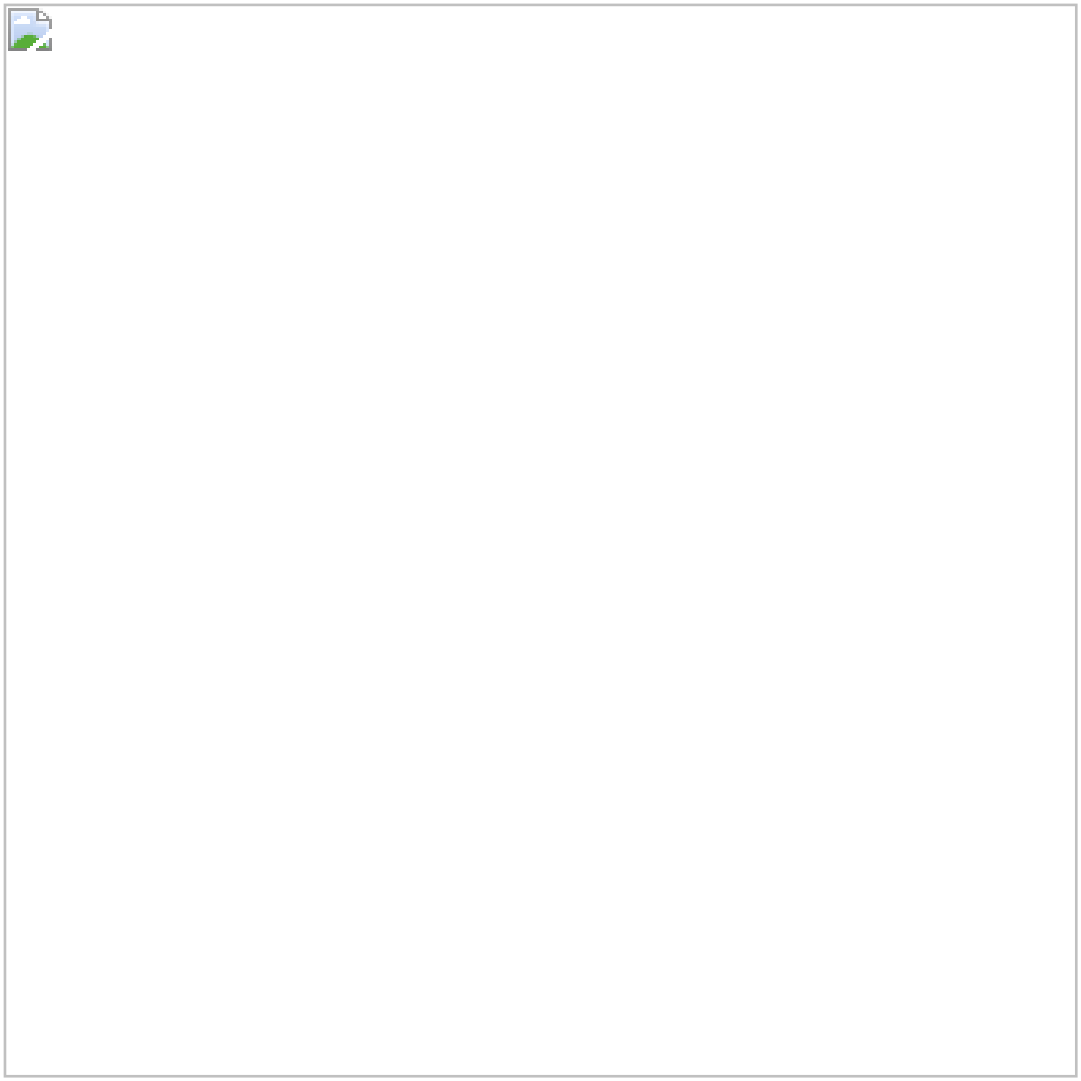

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HELMINTH PARASITES OF PINE MARTEN, *MARTES AMERICANA* (TURTON), FROM MANITOBA, CANADA

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ABSTRACT: Five species of helminths were recovered during a survey of 139 North American pine marten (*Martes americana*) from three areas of Manitoba: *Alaria taxideae* in 75 marten; *Taenia* sp. (cf. *martis martis*) in 16; *Taenia mustelae* in nine; *Baylisascaris devosi* in one; *Trichinella* sp. larvae in one. *Taenia mustelae* and *Taenia* sp. (cf. *martis martis*) were found in two different areas of the province, *Taenia* sp. (cf. *martis martis*) being isolated from the more northerly regions. *Alaria taxideae*, the most prevalent parasite in the survey, was common to all three areas. The intensity of infection and prevalence level of *A. taxideae* was significantly higher ($P < 0.05$) in the southern region of this study. Altogether, male marten had a significantly higher intensity of *A. taxideae* compared to females, although there was no significant difference in prevalence level. When data for *A. taxideae* was combined for sexes and for regions a significantly higher prevalence level in young-of-the-year marten was noted compared to juveniles or adults, but no significant difference in intensities among the three age classes was found. No significant differences were detected in the prevalence of *A. taxideae*, *Taenia* sp. (cf. *martis martis*), or *T. mustelae* between sexes or among age classes from any of the three areas.

INTRODUCTION

Few published reports are available on the parasite fauna of the pine marten (*Martes americana*) in North America, particularly the north-central part of its range. Most of these studies dealt with one species of parasite (Goble and Cook, 1942; Sprent, 1952; Cowan, 1955; Pearson, 1956), with only one study reporting multiple species infection from the gastrointestinal tract of marten in the Northwest Territories (Holmes, 1963). The objectives of this study were to determine the helminth parasites of marten in Manitoba, their distribution within the province, and to statistically analyze where possible the helminth prevalence and intensity based on host age, sex, and region.

MATERIALS AND METHODS

One hundred thirty-nine marten were collected in 1978–1979 from three study areas: 70 from Southern Indian Lake (56°00'N, 99°00'W); 62 from Duck Mountains (51°35'N, 101°05'W); and seven from Porcupine Mountains (52°30'N, 101°40'W). Frozen carcasses were obtained from trappers and the Manitoba Wildlife Branch. At necropsy, skulls, canine teeth, and baculum were removed, and the skulls cleaned by enzyme digestion. Canine teeth were decalcified, sectioned, and the number of annuli counted to determine age of each marten. The length and weight of baculum, and the degree of suture closure on females were also used for ageing purposes. Each animal was classified as young-of-the-year (<1 yr old), juvenile (1–2 yr old), or adult (>2 yr old).

The entire gastrointestinal tract, lungs, heart, liver, kidney, spleen, gall bladder, and urinary bladder were removed for examination. Diaphragms were examined for the presence of *Trichinella* sp. larvae with the aid of a trichinoscope. The gastrointestinal tract was divided into three major sections: esophagus-stomach, small intestine, and large intestine. Each section was slit, the mucosa scraped off, and the intestinal contents and mucosa diluted in water, stirred, and examined under a Wild M3 dissecting microscope. All stomach contents were recorded. Skulls were sectioned for the presence of *Skrjabingylus nasicola* in the nasal cavity (Goble and Cook, 1942).

Parasites were removed, washed in water, fixed in FAA, and stored in 70% ethanol. The single nematode specimen was cleared in glycerin and an en face preparation made. The anterior end of the worm was embedded in wax, sectioned, mounted and stained prior to examination for cuticular struts (Sprent, 1968). Cestodes and trematodes were stained with acetocarmine.

Chi square tests were used to determine significant differences in prevalence levels between sexes and among age classes within each study area, and for combined study areas for *A. taxideae*, *Taenia* sp. (cf. *martis martis*), and *T. mustelae*. Significant differences in prevalence levels between study areas were also tested. Intensity levels of *A. taxideae* were normalized by transformation ($x = \log_{10} x$) (Elliot, 1977) and a Student's *t*-test employed to test for overall significant differences in intensity levels between sexes, among age classes, and between study areas. Values with a probability ($P < 0.05$) were considered significant. Small sample sizes of *Taenia* sp. (cf. *martis martis*) and *T. mustelae* prevented any valid statistical analysis on intensity levels. Statistical analyses were not performed on the lone specimens of *B. devosi* or *Trichinella* sp. larvae.

Representative specimens have been placed in the National Museum of Canada, Invertebrate Collection (Parasites). Accession numbers are as follows:

Received for publication 9 April 1982.

TABLE 1. Prevalence and intensity of helminth parasites of 139 marten from three areas in Manitoba, Canada (1978–1979).

Parasite	Study area		
	Duck Mountain (n = 62)	Porcupine Mountain (n = 7)	Southern Indian Lake (n = 70)
Alaria taxideae Swanson and Erickson, 1946	73 (30 ± 34)[1–128][a]	57 (24 ± 15)[2–34]	36 (10 ± 13)[1–45]
Taenia sp. (cf. *martis martis*) (Zedes, 1803) Wahl, 1967	0	0	23 (2 ± 3)[1–13]
Taenia mustelae Gmelin, 1790	15 (15 ± 24)[1–77]	0	0
Baylisascaris devosi Sprent, 1952	0	0	1 (1)[1]
Trichinella sp. larvae Railliet, 1895	0	0	1 (0.008, 0.70)[b]

[a] Prevalence (intensity ± SD) [range].
[b] Prevalence (larvae/g in whole carcass except head, larvae/g in tongue and masseters).

Alaria taxideae (NMCIC(P) 1982-0604, -0605, -0606); *Taenia mustelae* (NMCIC(P) 1982-0607, -0608); *Taenia* sp. (cf. *martis martis*) (NMCIC(P) 1982-0609); *Baylisascaris devosi* (NMCIC(P) 1982-0610, -0611).

RESULTS

Helminths were recovered from 89 of 139 marten and results are summarized in Table 1. *Alaria taxideae* was the most prevalent parasite at 54%. No significant differences in prevalence between sexes or among age classes were determined for *A. taxideae* in any of the study areas. Significant differences in intensity levels were not tested within each area due to the small sample size. Although combined intensities of *A. taxideae* from the three study areas showed significantly higher levels in male marten (29 ± 33) compared to females (12 ± 16), no significant differences were found in combined prevalence levels. Also, no significant differences were found in combined intensity levels among age classes, although young-of-the-year marten had a significantly higher prevalence value of 55% for *A. taxideae* than either juveniles (29%) or adults (36%).

Intensities of *A. taxideae* varied among the three study regions: 11 ± 13 in Southern Indian Lake, 30 ± 34 in Duck Mountains, and 24 ± 15 in Porcupine Mountains. Significant differences were noted between the lower intensity levels of *A. taxideae* from Southern Indian Lake compared to the higher levels in Duck Mountain marten. The small sample size of marten from Porcupine Mountains prevented a comparison of intensities of *A. taxideae* with the other areas. Prevalences of *A. taxideae* were also statistically higher in Duck Mountain marten (73%) compared to those from Southern Indian Lake (36%), but not from marten from Porcupine Mountains (57%).

Taenia sp. (cf. *martis martis*) was the second most prevalent parasite recovered (12%) in this study, but was common only to marten from Southern Indian Lake, the northern-most region. There was no significant difference in prevalence levels of *Taenia* sp. (cf. *martis martis*) between sexes or among age classes.

Taenia mustelae was found only in marten examined from the more southerly region, Duck Mountains, at a prevalence of 7%. There were no significant differences in prevalence between sexes or among age groups of marten infected with *T. mustelae*. There was also no significant difference observed between overall prevalence levels of *Taenia* sp. (cf. *martis martis*) and *T. mustelae* in this study.

Trichinella sp. larvae and only one specimen of *B. devosi* were each found in a single marten from the Southern Indian Lake region. The presence of larval *Trichinella* in the diaphragm of one marten led to the complete digestion of the remaining host flesh, revealing an intensity of 0.008 larvae/g in the whole carcass (less the head) and 0.70 larvae/g in the tongue and masseters.

Skrjabingylus nasicola was not found in the nasal cavity nor was damage to the cranium in this region noted.

There was no evidence of lesions or hemorrhaging associated with any of the organs, including those from which parasites were recovered, although no histopathology was done.

DISCUSSION

This study reports on the largest survey for parasites of the North American pine marten. Small sample sizes have restricted any detailed analysis of data to date.

Few helminth species with relatively low prevalence and intensity values were found in this study. *Alaria taxideae* was the most common parasite in all three study areas, although its numbers were lower in the Southern Indian Lake region, the northern-most sample site. The prevalence of *A. taxideae* in marten from Southern Indian Lake was only about half that from Duck Mountain marten. This may be related to a smaller sample of young-of-the-year marten from the Southern Indian Lake area, although an equal sample of males from both areas showed a significantly higher prevalence in the Duck Mountain area. Lower intensity and prevalence of *A. taxideae* in marten from the northerly sample sites in this and Holmes' (1963) study is probably related to a reduction in the numbers of intermediate hosts, planorbid snails and tadpoles, and paratenic hosts such as snakes, frogs, rodents, and possibly birds. Few reptiles and amphibians extend their range into northwestern Canada. The boreal chorus frog (*Pseudacris triseriata maculata*), and northern leopard frog (*Rana pipiens*), and the wood frog (*Rana sylvatica*) are near the northern limit of their ranges in the District of Mackenzie in the Northwest Territories and in the region of Southern Indian Lake, Manitoba (Conant, 1975).

Prevalences of *A. taxideae* between male and female marten and among age classes did not differ within areas. However, intensity levels showed that male marten harbored greater numbers of *A. taxideae* compared to females when the three areas were pooled. This suggests that even though both sexes fed on the appropriate intermediate and paratenic hosts of *A. taxideae*, male marten consumed infected reptiles and amphibians more often. Similarly, more young-of-the-year marten must have encountered these food items than juveniles or adults, since higher prevalences of *A. taxideae* were most evident in this age class.

The identification of *T. mustelae* was based on small and large hook size, shape, and number as described by Freeman (1956). Unfortunately, adequate specimens of the other taeniid were limited. Based on a few hooks, we have tentatively identified it as *T. martis martis*, but for purposes of this study we have referred to it as *Taenia* sp. (cf. *martis martis*). Wahl (1967 in Verster, 1969) separated the *T. martis* complex into *T. martis martis* and *T. martis americana*. Holmes (1963) reported *T. mustelae* and *T. martis* in marten from the District of Mackenzie, Northwest Territories. Hair and bones of small mammals were the most common food items indicating the ease with which a taeniid life cycle could be completed since several species of rodents have been suggested as intermediate hosts for *T. m. martis* (Verster, 1969) and *T. mustelae* (Freeman, 1956).

Based on the presence of cuticular bars in the cervical alae region (Sprent, 1968) and the denticles of the dentigerous ridges having the base about equal to the length (Sprent, 1952), the single female nematode was tentatively identified as *Baylisascaris devosi*. Sprent (1952) in his description of *B. devosi* from marten and fisher in Ontario designated the latter as type host because the worms in fisher attained a greater size, the number of worms per animal was greater, and the prevalence of infection was higher. deVos (1952) reported *B. devosi* in 9% of the marten from a study in Ontario, while Dick and Leonard (1979) found *B. devosi* present in 12% of the fisher from Porcupine Mountains. The 1% prevalence of *B. devosi* in this study suggests that the marten is a less important host in the circulation of this parasite.

The finding of larvae of *Trichinella* sp. in marten is a new host and North American record. Its recovery has increased the list of wild carnivore hosts for *Trichinella* in Manitoba (Dick and Leonard, 1979; Chadee and Dick, 1982). Since only a single young-of-the-year from Southern Indian Lake was infected with larvae of *Trichinella* sp., the importance of marten in the circulation of *Trichinella* appears to be limited in this region of North America.

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CORRECTION

The captions for Figs. 2A and 2B in the article:

Calle, P. P., R. J. Montali, D. J. Janssen, M. K. Stoskopf and J. D. Strandberg. 1982. Distal extremity necrosis in captive birds. J. Wildl. Dis. 18: 473–479.

were printed incorrectly. They should read:

Figure 2A. Female Marabou stork with advanced case of primary DEN of toes. Healed stage.

Figure 2B. Female Marabou stork with advanced case of primary DEN of toes. Acute stage.