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ABOMASAL NEMATODES OF THE SVALBARD REINDEER (*RANGIFER TARANDUS PLATYRHYNCHUS* VROLIK)

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ABSTRACT: Six species of abomasal nematodes were recovered from Svalbard reindeer. *Marshallagia marshalli* and *Ostertagia grühneri* were more prevalent than *Skrjabinagia lyrata*, *Teladorsagia circumcincta*, *Ostertagia occidentalis* and *Ostertagia trifurcata*. Of 24 reindeer examined all harbored adult abomasal nematodes. There was no significant difference in intensity of infection between winter (April) and autumn (October) for either adult males or females. In winter, intensity of infection of adult males was significantly higher than that of females. In calves, during the autumn, intensity of infection was low.

INTRODUCTION

The number of reindeer on the Norwegian arctic islands of Svalbard (74–81°N, 10–35°E) was estimated to be about 10,000 to 12,000 animals in 1973–1974 (Alendal and Byrkjedal, 1976). The present investigation was carried out on the subpopulation of reindeer living on Nordenskiöld Land, West-Spitsbergen. The size of this subpopulation was estimated to be about 3,200 animals in 1980 (Øritsland and Alendal, pers. comm.).

The reindeer is the only naturally occurring mammalian herbivore on the islands. The arctic fox (*Alopex lagopus*) and polar bear (*Ursus maritimus*) are the only terrestrial mammalian carnivores. The invertebrate fauna consists of few species.

In addition to these native species which may be involved in the life cycle of reindeer parasites there are a number of introduced species. These include semidomesticated reindeer (*R. tarandus tarandus*) brought to Svalbard from the European mainland by expeditions which have used them for transport and meat purposes. Cattle, pigs and horses have been kept by several mining communities on Spitsbergen Island where the Russian settlements still maintain a number of these animals.

The Svalbard reindeer has been protected from hunting since 1925. Polar bear very occasionally kill reindeer. The arctic fox is mainly a scavenger although it is known to attack newborn calves (Tyler, pers. comm.). Thus, in the absence of hunting and predation on young and adult animals, it was hypothesized that parasites would play an important part in the population dynamics of the reindeer. This probability is strengthened by the lack of seasonal, extensive migration of the reindeer of Svalbard. The subpopulations appear to stay within a small area throughout the entire year, only undergoing some local migration. The reindeer density is comparatively high on Svalbard. The density of 3.3 animals per km² in 1980 on the 976-km² large pasture area of Nordenskiöld Land (Alendal and Byrkjedal, 1976) is higher than that of wild populations in southern Norway and on Canadian islands (Reimers, 1977). The situation therefore is likely to promote parasitic infections.

This investigation of the effects of parasitism on the reindeer is part of a project on the biology of the Svalbard reindeer. This paper presents observations of abomasal nematodes in reindeer examined in 1978 and 1979 and discusses implications of these observations relevant to the aspects of the biology of the Svalbard reindeer pointed out above.

MATERIALS AND METHODS

The abomasa from 24 reindeer were examined during 1978 and 1979. Eighteen of the reindeer were shot in the field especially for the purpose of abomasal sampling. In addition abomasa were collected from six animals that had died from other causes. The latter group consisted of five adult (>2 yr) males which were obtained at the following times: one in October 1978, one in January, two in February, and one in June 1979. In addition one adult female was sampled in October 1979. The remaining animals were shot in April and October 1978. In April, four adult females, four adult males, and one young (1 yr, 10 mo) female were sampled. The sample collected in October consisted of two adult females, three adult males, and four calves.

The ages of 15 of the animals were determined from sections of the mandibles. Ages of the others were estimated by inspection of teeth, body size and antler development.

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TABLE 1. Prevalence and intensity of infection of abomasal parasites in the Svalbard reindeer.

Parasite	Percent infection	Intensity[a]			Accession number[b]
		Mean	Median	Range	
Marshallagia marshalli	100	1,958	4,990	210-10,190	C 3162
Ostertagia grühneri	83	6,662	8,230	1,070-17,530	C 3161
Skrjabinagia lyrata	75	312	965	40-1,970	C 3163
Teladorsagia circumcincta	54	218	875	30-1,780	C 3164
Ostertagia occidentalis	29	113	240	10-490	C 3165
Ostertagia trifurcata	25	63	105	20-230	C 3166

[a] No. parasites/infected animal.
[b] Voucher specimens deposited in The Zoological Museum, Oslo, Norway.

Within 4 hr after death of the shot animals, the abomasa were removed from the animals and frozen at about −18 C for storage. In order to examine the abomasa for parasites they were thawed at room temperature for about 18 hr. The abomasal contents were then strained with tap water using a sieve of mesh size 75 μm. The sieve content was weighed and a sample of 10%, but not less than 10 g, was removed and split into subsamples of about 1 g each. All subsamples were suspended in tap water and examined using a stereomicroscope at 16× magnification.

The abomasal mucosa was examined using a stereomicroscope and visible nematodes removed prior to pepsin–hydrochloric acid digestion of the mucosa. After digestion the suspension was treated as described above for the abomasal contents.

All the nematodes in the 10% sample and in the suspension after digestion were counted. The intensity of the different species was estimated after identification of the male specimens. The relation between number of males and females was assumed to be linear for each species and sample.

Nematodes were stored in 10% formalin before being stained in Horen's Trichrome Stain and mounted in Polyvinyl-Lactophenol. Student's *t*-test was used to test recorded differences for statistical significance.

RESULTS

All the reindeer were parasitized by abomasal nematodes belonging to the following six species: *Marshallagia marshalli* (Ransom, 1907) Travassos, 1937; *Ostertagia grühneri* Skrjabin, 1929; *Skrjabinagia lyrata* (Sjøberg, 1926) Andreeva, 1957; *Teladorsagia circumcincta* (Stadelmann, 1894) Drozdz, 1965; *Ostertagia occidentalis* Ransom, 1907 and *Ostertagia trifurcata* Ransom, 1907.

Table 1 shows the prevalence and intensity of each species. The prevalence of *O. grühneri* in adult animals was 100%. The four calves shot in October were infected with *M. marshalli* only. Only the most prevalent species, *M. marshalli* and *O. grühneri*, were found in the abomasal mucosa. Only 5 (21%) of the animals did not have nematodes in the mucosa.

There were no relationships between the prevalence of the various nematode species and the age or sex of the reindeer or with season. Furthermore there were no significant relationships between age, sex, season or the total numbers of abomasal nematodes in each reindeer and the presence of nematodes in the mucosa.

The total number of nematodes in the abomasum was estimated for each reindeer and the results from 1978 were grouped according to sex and age of the host and the season (Fig. 1). Both in April and October the intensity of infection (mean number of worms) was higher for adult males than adult females. The means were 12,965 and 4,943 for the two groups in April and 13,193 and 8,850 in October. The difference was statistically significant in April ($P < 0.02$) but not in October ($P > 0.1$). The differences in intensity from April to October were not statistically significant for either of the sexes ($P > 0.1$ for both). Calves had much fewer nematodes (mean, 381) than adults (mean, 10,548) in October ($P < 0.01$).

DISCUSSION

Since the diversity of biotas decreases with increasing latitude, the geographical location of Svalbard would in itself lead to the expectation that the parasite fauna of reindeer on Svalbard would reveal only a small number of species. This expectation is very much strengthened by the fact that Svalbard also is a group of oceanic islands with a distance of about 650 km to the nearest mainland (Norway).

Six species of abomasal nematodes were found in the Svalbard reindeer. These are fewer species than recorded in cervids in subarctic and tem-

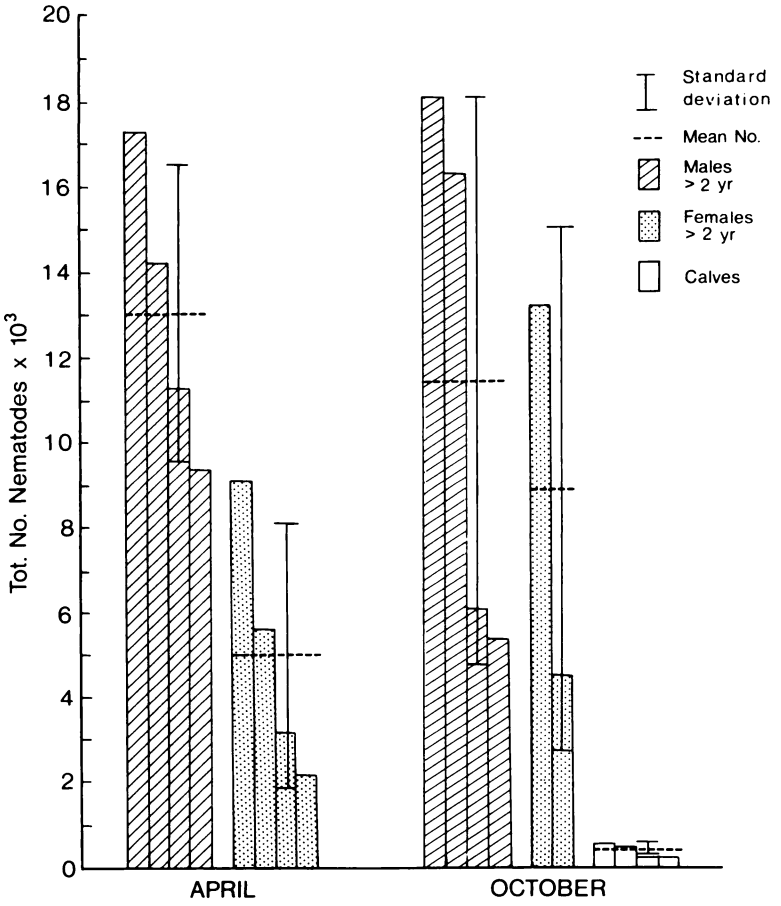

FIGURE 1. Total number of abomasal nematodes in individual Svalbard reindeer shot in 1978.

perate regions (Eve and Kellogg, 1977; Rehbinder and Christensson, 1977), but more than found in reindeer in Canada and the Antarctic (Bergerud, 1971; Low, 1976; Leader-Williams, 1980). There are few detailed investigations available on the parasites of reindeer in selected localities, but the number of species of abomasal nematodes found in the subpopulation of Svalbard reindeer examined in the present study appears comparatively higher than would be expected in the light of Svalbard's geographical situation and the general low diversity of its fauna.

Several factors relating to the nematode species, the Svalbard reindeer, and human activities on Svalbard may have influenced the formation of the abomasal nematode fauna of the Svalbard reindeer.

One of the recorded nematode species, *O. grühneri*, appears mainly to be a reindeer parasite. The species occurs in Eurasia and North America (Pryadko, 1976) and South Georgia (Leader-Williams, 1980). Bergerud (1971) found *O. grühneri* as the only abomasal parasite in seven of nine (78%) caribou examined on Newfoundland (the other 2 animals had no abomasal parasites). On South-Georgia *O. grühneri* is also the only abomasal parasite of reindeer and fecal samples indicate a prevalence of almost 100% (Leader-Williams, 1980).

The other five nematode species have all been found in many ruminant species and they have a wide geographical distribution. All of them have previously been recorded in cervids (Drozdz, 1965; Becklund and Walker, 1968; Dunn, 1968; Nilsson, 1971; Kotrly and Kotrla,

1972; Irgashev and Oripov, 1973; Low, 1976; Kotrla and Kotrly, 1977) and four of them, *M. marshalli*, *S. lyrata*, *T. circumcincta* and *O. trifurcata*, have previously been found in reindeer (Dikmans, 1939; Low, 1976; Pryadko, 1976; Rehbinder and Christensson, 1977).

The origin of the reindeer of Svalbard is uncertain, but the most favored hypothesis seems to be that the founder animals arrived on ice from Novaja Semlja via Frans Josefs Land (Hoel, 1916; Norderhaug and Reimers, 1976). The reindeer of Svalbard has developed to a distinct form with little genetic variation (Banfield, 1961) and is now known as Svalbard reindeer.

The relative richness of the abomasal nematode fauna of the Svalbard reindeer would favor a hypothesis of repeated arrivals of groups of animals to Svalbard, but our results do not indicate whether this may have happened from the palearctic or nearctic. Alternatively the parasites now found in the Svalbard reindeer may have been brought to the islands with imported reindeer and/or cattle.

Importations of semidomesticated reindeer from the mainland of Norway have taken place on three known occasions since 1872 consisting of about 68 animals in all (Parry, 1828; Kjellmann, 1875; Staxrud and Wegener, 1914). Some of these reindeer covered large distances on Svalbard with expeditions, and some escaped from captivity and may have distributed parasites to the Svalbard reindeer over a large area. However, reindeer on South Georgia, which are descendants of semidomesticated reindeer imported from Norway, only harbor one species of abomasal nematodes, i.e., *O. grühneri* (Leader-Williams, 1980).

Cattle have traditionally been kept for milk production in the mining settlements on Spitsbergen. Especially during winter some reindeer tend to stay near the settlements and they may also browse close to the cattle houses. In this way the reindeer may have picked up parasites from the cattle. At the time when this investigation was conducted cattle were not being kept in the Norwegian settlements, but about 100 animals were being kept in the Russian settlements on Svalbard.

Sheep and cattle have been shown to tolerate abomasal nematode burdens far exceeding those found in Svalbard reindeer without showing clinical signs (Connan, 1969; Michel, 1970; Taylor and Cawthorne, 1972). Subclinical burdens of trichostrongylids have, on the other hand, been shown to alter the gastrointestinal function, sometimes with severe consequences (Sykes, 1978; Coop and Angus, 1981).

Comparable data from reindeer are lacking, but both maximum and mean abomasal worm burdens are very high in the Svalbard reindeer compared to recordings from white-tailed deer (*Odocoileus virginianus*) in the southeasern United States (Eve and Kellogg, 1977). The low intensity of abomasal nematodes in calves, in October, may be due to the low intake of vegetation after birth (Kastnes, 1977) and hence a low intake of freeliving, infective parasitic stages. In some districts of the USSR *Marshallagia* spp. cause one of the most common helminthoses in domestic sheep (Oripov, 1970; Irgashev and Oripov, 1973) and experimentally infected lambs dying of marshallagiosis had worm burdens (adult and juvenile) from 306 to 21,430 *M. marshalli* (Oripov, 1970). Most of the reindeer examined in the present study appeared to be healthy when collected. The two animals with highest worm burdens (22,300 and 18,100 nematodes) were, however, in poor condition. The intensity of infection with abomasal nematodes in the Svalbard reindeer extends to a level where influence on host performance and life expectancy may be expected. With the high prevalence of infection this may be an important factor in the population dynamics of the host.

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