



The level of infection with gastro-intestinal nematodes in Svalbard reindeers from Hornsund area, Spitsbergen

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Abstract: Eighty five faecal samples of the Svalbard reindeer inhabiting the coastal terrace of the northern side of Hornsund were collected in July 2005 and analyzed coprologically. The standard flotation method revealed a 97.6% prevalence of infection at an average intensity of 20 eggs in a single subsample. The quantitative, modified McMaster method helped to estimate the mean number of eggs in a gram of faeces (EPG) at 134.7. In the studied samples eggs of nematodes representing two species, i.e. *Ostertagia gruehneri* (97.6%, on average 20 eggs in a sample) and *Marshallagia marshalli* (2.3%, single eggs), were identified.

Key words: Arctic, Spitsbergen, faecal analysis, gastro-intestinal nematodes.

Introduction

The Svalbard reindeer is the only one of three land mammals inhabiting the area of the high Arctic Svalbard Archipelago and the only wild ruminant of the region (Aanes 2005). Like other “continental” ruminants, this species is also a host of parasites transmitted through the digestive tract. Earlier research on the parasitofauna of reindeer indicates that it originally included 7 species of gastro-intestinal nematodes of direct transmission and simple life-cycle, belonging to one family, namely the Trichostrongylidae (Bye *et al.* 1987). Nowadays, five of them are known to be only morphological forms of three species (Halvorsen and Bye 1999). Such a relatively poor species composition may be compensated by high, often

even massive, intensity of invasion, which is characteristic of the fauna of polar regions (Halvorsen and Bye 1999). Besides, invasions of these parasites clearly reduce the condition and reproductiveness of reindeer (Stein *et al.* 2002), which, in turn, affects the population dynamics (Albon *et al.* 2002). Within the area of the Svalbard Archipelago, reindeer occur in subpopulations, which are separated one from another by the sea, glaciers or mountain ranges, but still in some contact. According to Bye *et al.* (1987) and Halvorsen and Bye (1999), the differences in abundance of parasites or their species composition may be dependent on sampling sites. Considering the conservation status of these animals that is in force, parasitological studies by section on a larger scale are practically impossible here and thus rarely pursued. Therefore, coproscopic analysis, and especially estimation of the amount of parasite eggs in faecal samples are a convenient, and often the only accessible means to assess the level of invasion or to investigate the ecology of the parasites in these free-living ruminants (Irvine *et al.* 2001). The hitherto conducted investigations have been concentrated on the area of Nordenskiöldland near Longyearbyen. The herein presented report concerns a subpopulation of reindeer living on the coastal terraces of Hornsund, the southernmost fjord of Spitsbergen.

Materials and methods

Eighty five faecal samples of the Svalbard reindeer were collected on the transect between the Polar Station of the Institute of Geophysics, Polish Academy of Sciences and the Station of Wrocław University on the northern side of the entrance to Hornsund in July 2005. The territory, made up by coastal terraces, is wet, cut by numerous watercourses and almost totally covered by fens (peat-bogs). The collected faeces were fresh (immediately after defecation or, approximately, not older than 1 day) and preserved in 4% formalin. Under laboratory conditions two methods of coprological analysis were used. The first, qualitative, is a standard flotation procedure with saturated NaCl as a flotation mixture, which gives two kinds of results: prevalence of infections (ratio of samples infected to samples examined) and mean intensity of infection (mean number of eggs in a single sample). The second method, quantitative, estimated the intensity of parasite infections as a measure of the number of eggs per gram of faeces (EPG). In this case, the modified McMaster technique (Whitlock 1948) was used.

Results and discussion

A coprological analysis by the flotation method showed that of the 85 examined samples, 83 contained eggs of gastro-intestinal nematodes. The general prev-



Fig. 1. *Ostertagia gruehneri*, egg with granular contents. Scale bar = 50 μ m

alence measured by this method was thus very high, amounting to 97.6%. The intensity of infection measured by the flotation method ranged from 1 to 68 eggs in a single subsample, and 20 on an average. The number of positive samples, examined with the use of the modified McMaster method, proved to be decidedly lower, equaling merely 36 (42.3%), whereas egg counting revealed an average of 134.7 eggs in a gram of faeces of the animals studied.

A qualitative analysis of the eggs enabled to distinguish two types of nematode eggs, whose both morphology and measurements suggest they represent the genera *Ostertagia* and *Marshallagia*. The eggs of the first type, oval in shape, with a thin transparent or milky white envelope, were 80 μ m long and 40 μ m wide. They were at three phases of development. Most of them were poorly developed and filled with granular content (Fig. 1). The remaining eggs contained a dozen or so small blastomeres or a well-developed larva (Fig. 2). Eggs of *Ostertagia* were found in all positive samples examined by the two methods applied. The other type of eggs was characterized by considerably larger size (100 \times 70 μ m) and presence of a few large blastomeres located in the central part. Two single eggs of *Marshallagia* were detected only in 2 out of 85 samples (2.3%) examined with the use of the floatation method.

According to older literature data (e.g. Bye and Halvorsen 1983; Bye *et al.* 1987), Svalbard reindeer were hosts of seven species of gastro-intestinal nematodes: *Ostertagia gruehneri*, *Skrjabinagia arctica*, *Marshallagia marshalli*, *Gros-piculagia occidentalis*, *Teladorsagia circumcincta*, *T. trifurcata* and *T. davtiani*. However, in the light of subsequent research, only three of them, namely *O.*



Fig. 2. *Ostertagia gruehneri*, egg with larva. Scale bar = 50 μ m

gruehneri, *M. marshalli* and *T. circumcincta*, proved to be di- and trimorphic species while the remaining ones were only morphotypes (Halvorsen and Bye 1999; Dallas *et al.* 2000, 2001). According to Irvine *et al.* (2000) the nematofauna of Svalbard reindeer is practically dominated by only two species, i.e. *O. gruehneri* and *M. marshalli*, which account for over 90% of the nematode parasites harboured by these ruminants. The morphology of the eggs found in our research confirms that both types belong to the two above mentioned species.

One of more important factors affecting the character and level of infection by parasites is seasonality, which explains, for instance, such a significant disproportion in the quantitative ratio of eggs of the two nematode species found. As pointed out by Irvine *et al.* (2000), the maximum load of *O. gruehneri* eggs in the faeces of reindeer falls on the summer season, whereas eggs of *M. marshalli* appear mainly in wintertime.

The level of intensity (134.7 EPG) revealed in our research is comparable, for instance, with data of van der Val *et al.* (2000) obtained with the application of a slightly different method. These authors, having studied the diet of reindeer and the load of eggs in their faeces, provide results for the summer seasons of 1997 (241.4 EPG) and of 1998 (124.9 EPG), interpreting the differences found as dependent on the level of precipitation, soil moisture, temperature and – to a smaller extent – the species composition of the plant community in a given area. The sampling site are wet fens of coastal terraces (Brázdil *et al.* 1993) covered by a network of streams, which are situated on the northern side of the Hornsund fjord entrance, and, in the opinion of van der Val *et al.* (2000), the breeding success of the nema-

todes that infect reindeer is positively correlated with soil moisture, assuming the highest values at the wettest places. Considering this fact, the value (134.7 EPG) obtained in own research by the McMaster method seems to be relatively low. The more so that the average level of precipitation in summer 2005 in the Hornsund area, reaching 47.02 mm, did not diverge from data for other years (meteorological data from the Polish Polar Station at Hornsund). And thus this result does not correspond with the data obtained by van der Val *et al.* (2000), who attribute the difference in the EPG value as related to the study of 1998 to the exceptionally low precipitation (13.5 mm).

The discrepancies noted may have stemmed from the choice of slightly different methods employed for estimation of the number of nematode eggs in a gram of faeces or from different conditions of mountain valleys and coastal terraces that prevail in the summer season.

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