Life History of the Serendipity worm (Nematoda: Protostrongylidae): an undescribed parasite of ungulates in the Arctic and Subarctic

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Background

Parasites can act as drivers of ecological changes in their host populations. In the Arctic, where the effects of global climate change are already profoundly evident, dramatic alterations in host-parasite interactions are anticipated[1]. Limiting our understanding of the potential impacts of climate change on host-parasite interactions is lack of knowledge on parasite biodiversity. There is a need of a better understanding of parasite biodiversity in Arctic species, their distribution, and impacts on host species.

'Serendipity Worm' a new species of protostrongylid nematode in the Arctic

- In 2007, a previously unknown species of protostrongylidae nematode was serendipitously discovered in caribou, moose, and muskoxen across the Arctic[2].
- This novel parasite was molecularly characterized based on the ITS-2 sequence of larvae from the faeces of various host species, and was proven quite distinct from other species within the Family Protostrongylidae.
- No taxonomical description was provided because adult parasites were not isolated. The only natural infected intermediate host (IH) found was a single slug *Deroceras laeve* (Müller, 1774).

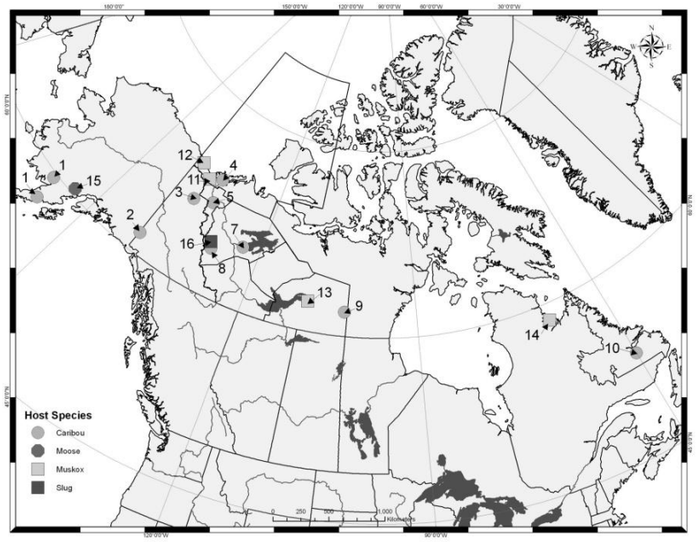

Figure 1 Current known range of distribution of Serendipity worm (Nematoda: Protostrongylidae) in different hosts throughout Arctic and Subarctic regions of North America (extracted from Kutz el al., 2007).

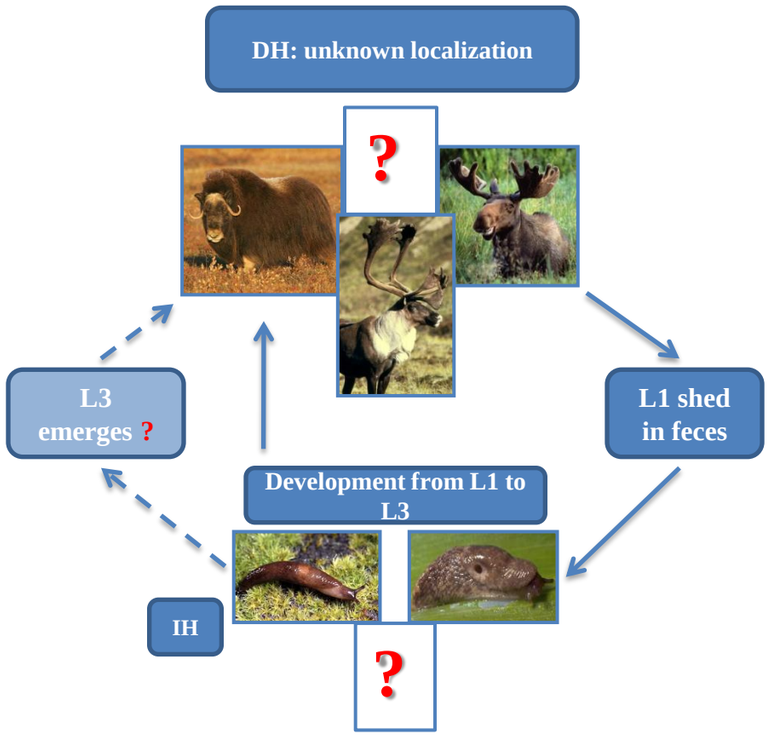

Figure 2. Proposed life-cycle of the Serendipity worm.
L1: First-stage larva, L3: Third-stage larva, IH: Intermediate Host, DH: Definitive Host.

Family Protostrongylidae

- Protostrongylid nematodes are pathogenic parasites of wild and domestic ruminants and lagomorphs.
- Most protostrongylid species live as adults in the respiratory tract of their definitive hosts (DH) leading to verminous pneumonia, respiratory distress, and secondary bacterial infection. Other species are found in muscles or central nervous system and can cause neurological and/or muscular disease[3].
- The life cycle is indirect, requiring gastropod intermediate hosts for development (Figure 2).
- Northern ungulates harbour at minimum nine protostrongylid species[2,3,4].

Objectives and Methods

Objective 1: Establish the lifecycle in captive reindeer and a muskox, and taxonomically describe adult worms:

- Larvae from Kuujjuaq muskoxen will be grown to the infective third stage in laboratory gastropods;
- L3 will be given to captive reindeer and a muskox at the University of Calgary wildlife research facility;
- Lifecycle parameters will be evaluated;
- Experimentally infected reindeer will be euthanized to recover adult nematodes for taxonomical description and to describe pathology.

Objective 2: Evaluate ecological aspects of the new species under field and laboratory conditions:

- Field surveys near Kuujjuaq, Quebec to evaluate which gastropods are present and naturally infected;
- Experimental infections of various gastropod species to assess (I) suitability as IH, and (II) effect on larval development and survival rates.

Objective 3: Determine definitive host species and geographic ranges throughout Arctic and Subarctic:

- Fecal samples of northern ungulates will be collected and protostrongylid L1 isolated;
- L1 will be molecularly identified based on ITS-2 sequence[2];
- Phylogeography will be elucidated.

Significance

- This study will contribute to a better understanding of the geographic and host range for Serendipity worm and other protostrongylids at high latitudes of North America.
- Although the implications of this parasite for wild ungulate populations is unknown, climate change is significantly altering host-parasite associations for other protostrongylids and it is likely that this parasite will also be impacted.
- Knowledge on its biology and ecology are essential to determine its potential role in host health and the implications of climate change on the host-parasite interactions.

References:. 1.Kutz et al., 2009. Vet Parasitol. 163:217-228, 2.Kutz et al., 2007. Can J Zool. 85:1143-1156 ,3. Anderson, 2000. Nematodes Parasites of Vertebrates. Their Development and Transmission, 4.Hoberg et al., 1995. Can J. Zool 73:2266-2282.