Arctic Adaptation? – Larval Inhibition in *Ostertagia gruehneri* Infections of Caribou

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Ostertagia gruehneri

- Directly transmitted abomasal (stomach) nematode
- Most common gastrointestinal nematode in caribou and reindeer (*Rangifer tarandus)*
- Causes decreased food intake, weight loss, and reduced pregnancy rates in reindeer[1-4]
- Drives host population cycles[4]

[1]Albon *et al*. 2002; [2]Arneberg and Folstad 1999; [3]Arneberg *et al*. 1996; [4]Stien *et al.* 2002

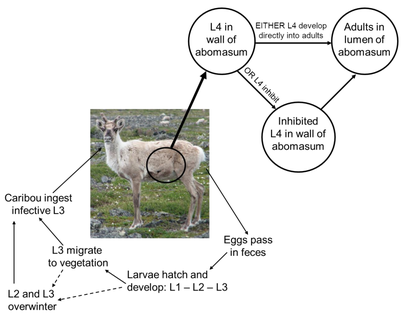

Figure 1: Life cycle of *Ostertagia gruehneri*. Eggs are shed by adult worms in the abomasa of the host and are passed in the feces. Larvae hatch and go through three larval stages (L1-L3) and L3 are the infective stage. What happens once the L3 are ingested by the host is the focus of this study.

Larval Inhibition

- Cessation of development at a particular point in the nematode life cycle
- Increases survival and transmission of the parasite in varying environments[1,2]
- Synchronizes host and parasite in time and space[3]

Flexibility in transmission strategies is important for parasites of animals because of the matrix of environments in which the host lives, many of which are not suitable for the development, survival, and/ or transmission of the parasite[4]. Transmission also relies upon the presence of susceptible hosts at the proper time during development and larval inhibition can synchronize host and parasite[4]. Time of year, environmental conditions, age and immune status of the host, and behavioural characteristics of the host may all determine when and how many larvae inhibit[1,2].

[1] Sommerville and Davey 2002; [2] Eysker 1993; [3] Deter *et al*. 2007; [4] Cattadori *et al.* 2005

Experimental Infections of Captive Reindeer

Twelve captive reindeer were infected with *O. gruehneri* in June and July of 2009 to investigate larval inhibition. Fecal samples from individual reindeer were collected weekly and analyzed for the presence of *O. gruehneri* eggs (patency).

- No *O. gruehneri* eggs were recovered from reindeer fecal samples in 2009
- All reindeer became patent in mid-late March 2010 – **obligate larval inhibition?**
  - obligate inhibition: ingested larvae always undergo inhibition, irrespective of prevailing conditions
- True obligatory inhibition has not been previously confirmed in Trichostrongylidae

O. gruehneri L3 - Meghan Logie

O. gruehneri adult male - Jesse Invik

Ostertagia gruehneri Infections in the Bathurst Caribou Herd

A total of 150 caribou were harvested from the Bathurst caribou herd as part of four scientific collections from September 2007 to March 2009. The abomasa from these animals were collected and analyzed for parasitic nematodes and the adult male worms were morphologically identified to species.

- Highest intensities of infection of *O. gruehneri* were in the spring
- Adult *O. gruehneri* were not recovered from calves until the spring following birth
- These results support the hypothesis of obligate larval inhibition in *O. gruehneri*
  - all larvae undergo inhibition and do not develop to adults until the following spring

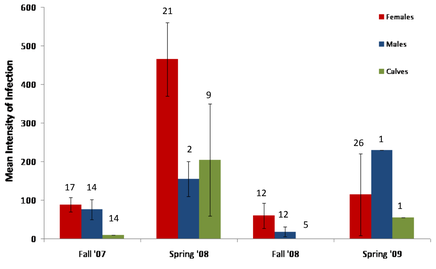

Figure 2: Mean intensity of *O. gruehneri* infection in individual caribou. Overall, intensities were higher in the spring than the fall and adult worms were not recovered from calves until the spring. Sample sizes indicated on the graph.

Discussion and Significance

- Experimental infections of reindeer and abomasal collections from the Bathurst caribou herd support the hypothesis of obligate inhibition in *O. gruehneri*
- Possibly the first and only Trichostrongylidae nematode to undergo obligate inhibition
- Obligate larval inhibition could be an arctic adaptation – it increases transmission of *O. gruehneri* by:
  1) concentrating egg production within the short arctic growing season
  2) limiting loss of early developmental stages (egg-L1) during the winter
  3) synchronizing development to infective stage of the parasite with the influx of naïve hosts following calving

Table 1: Experimental design of the 2009 infection study. The reindeer were divided into equal groups to assess the impact of the environment (infection date), the host (age), and the parasite (larval treatment) on the propensity of *O. gruehneri* larvae to enter inhibition.

	Age (n)	Larval Treatment	Date Patent
Group A	Adult (2)	20ºC	23 March 2010
(Infected on	Calf (2)	20ºC	17 March 2010
17 June 2009)	Adult (2)	5ºC	17 March 2010
Group B	Adult (2)	20ºC	23,31 March 2010
(Infected on	Calf (2)	20ºC	17,23 March 2010
16 July 2009)	Adult (2)	5ºC	17,23 March 2010

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