

# The Serendipity worm (Nematoda; Protostrongylidae): A new parasite of caribou and other ungulates in high latitudes of North America

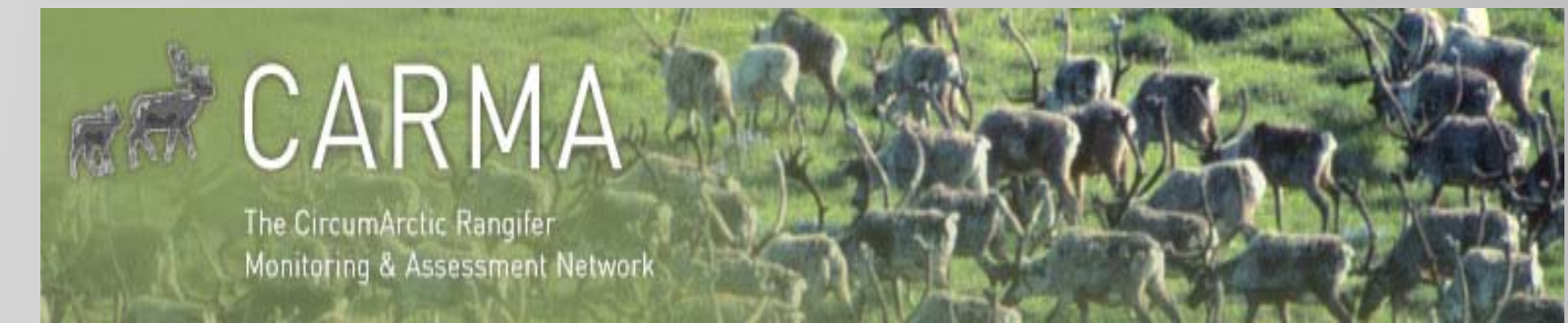


Guilherme G. Verocai<sup>1</sup>, Susan J. Kutz<sup>1</sup>, Manon Simard<sup>2</sup>, Eric P. Hoberg<sup>3</sup>

<sup>1</sup>Department of Ecosystem & Public Health, Faculty of Veterinary Medicine, University of Calgary., AB, Canada

<sup>2</sup>Makivik Corporation, Kuujuaq, QC, Canada

<sup>3</sup>United States Department of Agriculture, Agricultural Research Service, US National Parasite Collection, Beltsville, MD, USA



## Introduction

- Recently, an unknown Protostrongylidae species was documented in some populations of caribou, moose, and muskoxen from Alaska to Labrador
- Identification was based on ITS-2 of dorsal-spined first stage larvae (DSL) in feces (Kutz et al., 2007).
- No adult nematodes were isolated so no taxonomical description was done.
- Life-cycle details or pathological effects on definitive hosts remain unknown.

## Objectives

- Provide preliminary taxonomical description of the new lungworm species;
- Determine its occurrence in five additional caribou herds on mainland Canada.

## Methods

### Taxonomy

- In April, 2010 lungs of three muskoxen from Nunavik Region, Northern Quebec were examined for parasites
- Recovered intact nematodes and fragments were fixed in 70% ethanol.
- Larval stages were extracted from feces (DSL) or intermediate gastropod hosts (L3).
- Specimens were cleared and examined microscopically.

### Molecular Confirmation

- Genomic DNA was extracted from worm fragments of the three hosts. PCR was performed using the primers NC1 (5' -ACGTCTGGTTCAGGGTTGTT-3') and NC2 (5' -TTAGTTTCTTTTCCTCCGCT-3') .
- Sequences at the ITS-2 locus were compared with those from DSL of the undescribed protostrongylid in Kutz et al. (2007).

### Geographic distribution

- Dorsal-spined larvae were recovered from caribou fecal samples from CARMA IPY collections using the modified beaker Baermann technique.

- As a preliminary screening, larvae from animals from different herds were submitted to DNA extraction, PCR and sequenced using NC1 and NC2 primers and blasted with protostrongylid sequences available in GenBank.

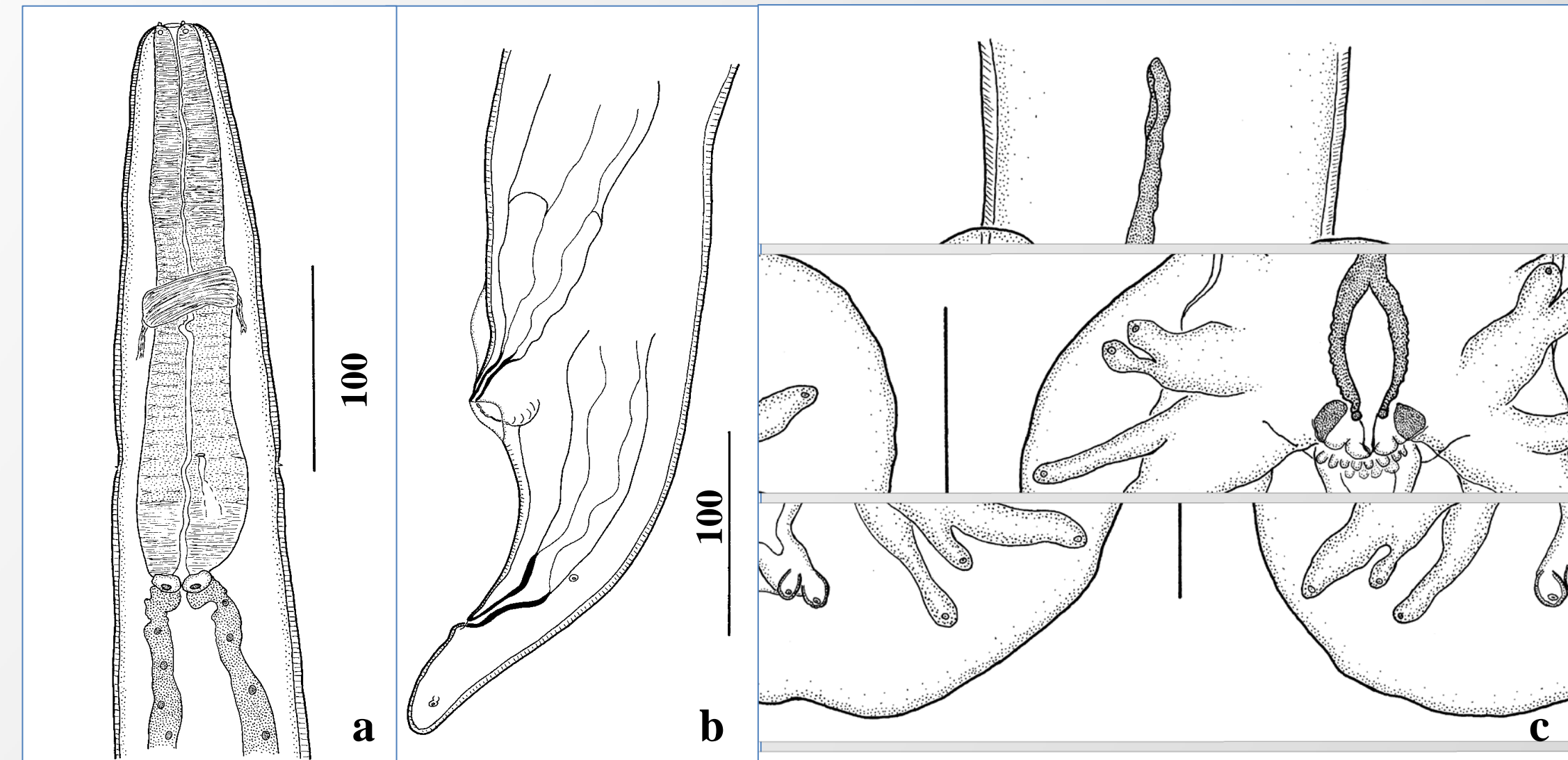


Plate 1. Cephalic extremity (a); lateral view of female tail showing membranous provagina (b); ventral view of male posterior end showing bursa, bursal rays and gubernaculum (c).

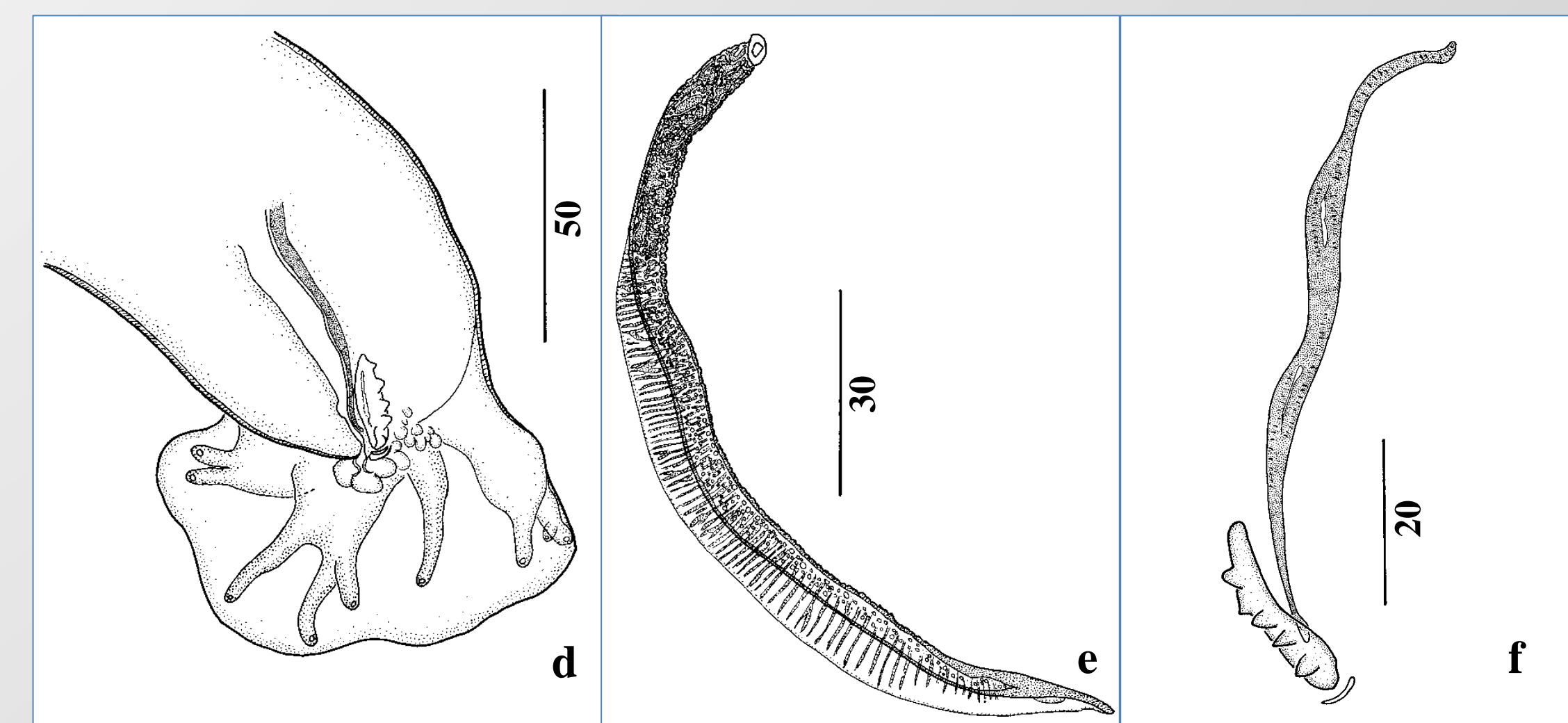


Plate 2. Ventro-lateral view of male posterior end (d); lateral view of male spicule (e); lateral view of male gubernaculum and its denticulate crura (f).



Plate 3. Third-stage larva (L3) and dorsal-spined first-stage larva (DSL).

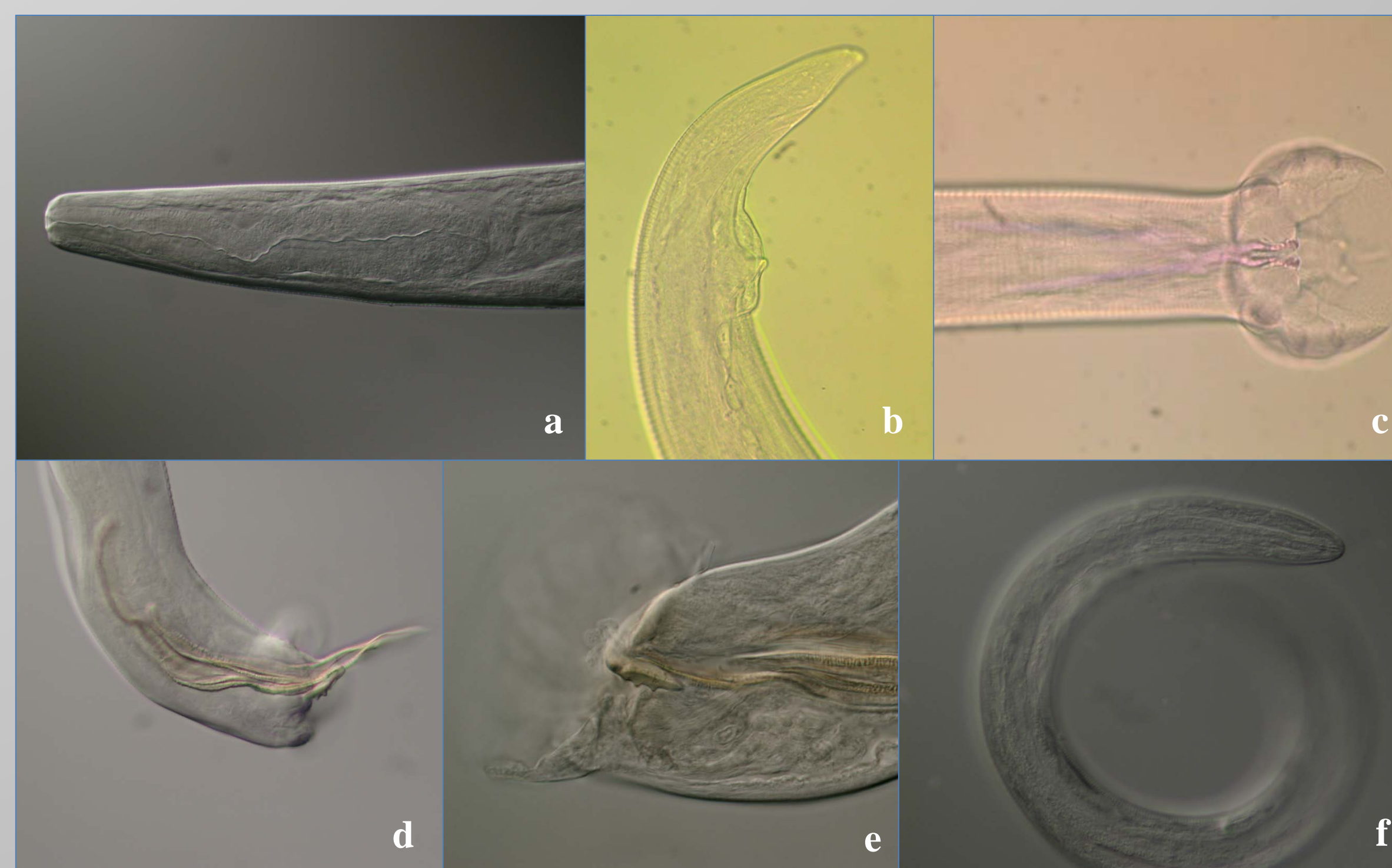


Figure 1. Cephalic extremity (a); lateral view of female tail, showing membranous provagina (b); ventral aspect of male posterior end showing copulatory bursa (c); lateral view of male tail showing protruded spicules (d); lateral view of male tail showing denticulate crura (e); third-stage larva (L3) (f).

## Results and Discussion

- The new species was assigned to the genus *Varestrongylus* Bhalerao, 1932 based on molecular and morphological character data, and phylogenetic context for the genus. Specific description is being finalized (Plates 1, 2, 3; Figure 1).
- Sequences from adults were 100% similar to those from DSL found by Kutz et al. (2007). confirming identity.
- *Varestrongylus* sp. n. was found in three additional barrenground (Bathurst, Ahlak, Qamanirjuaq) and two migratory woodland (Rivière-aux-Feuilles and Rivière George) caribou herds in mainland Canada, broadening its geographic range in the Nearctic. (Figure 2).
- Other larvae identified as *Parelaphostrongylus andersoni* have an overlapping distribution in caribou but have not been found in muskoxen or moose.

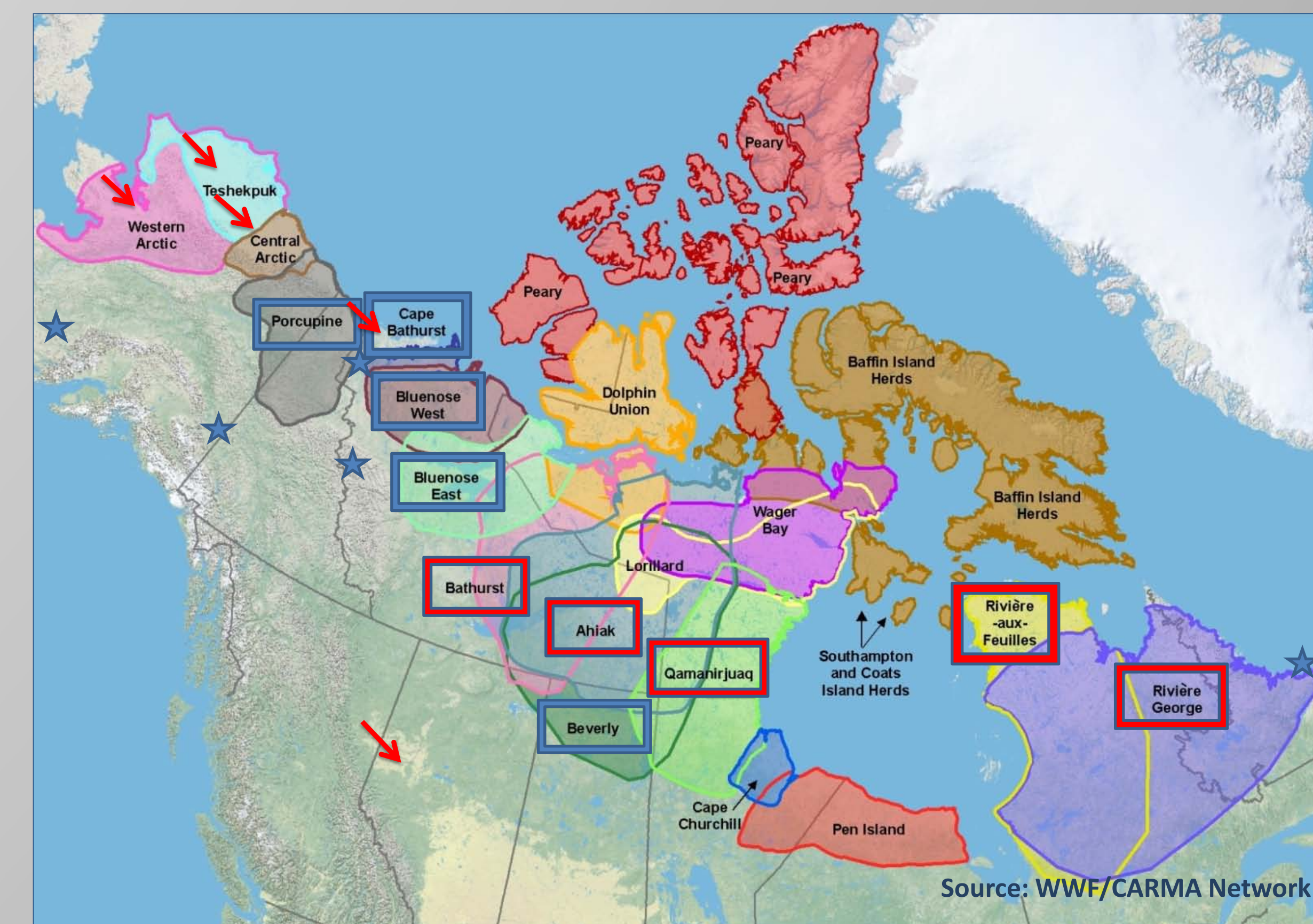


Figure 2. Occurrence of *Varestrongylus* sp. n. in caribou in North America. Blue rectangles and stars correspond to previous findings as per Kutz et al. (2007). Red rectangles represent new herds records for the species. Red arrows represent herds with DSL yet to be molecularly characterized.

## Conclusion and Future Directions

- A new species of *Varestrongylus* occurs in caribou, muskoxen and moose in high latitudes of North America.
- Other barrenground and woodland caribou herds and other Northern ungulate populations will be assessed in order to precisely delineate its geographic and host range.
- Further studies on its biology and ecology are required to investigate its impact on host health and dynamics.
- Population structure will be investigated using nuclear and mitochondrial markers to develop insights about patterns of life-history, historical biogeography and coevolution with an assemblage of ungulate hosts.