The diversity, densities and functional roles of soil-living nematodes in mature stands of White Spruce and Subalpine Fir at Aleza Lake Research Forest: a preliminary report for 2005.

INVESTIGATOR.

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PURPOSE.

Undertake a preliminary study of the species diversity and functional roles of soil-living nematodes found in the soils of White spruce (*Picea glauca*) and Subalpine fir (*Abies lasiocarpa*) old-growth forest at Aleza Lake Research Forest.

RATIONALE.

Soil-living nematodes (= roundworms) are a functionally diverse and numerically abundant component of the invertebrate soil fauna of western Canadian conifer forests (Procter 1994). Various species parasitize the roots of the trees, feed on the ecto- and endomycorhhizae of the roots, and on the fungi and bacteria in the soil, and prey on various soil animals, including other nematodes. Because of these diverse trophic roles, nematodes have the potential to significantly affect conifiers in a variety of ways, ranging from the strictly economic to general community functioning. However, despite the presumed importance of nematodes, their taxonomic composition and precise ecosystem roles in these forests are poorly known, partly because of their diversity and abundance, partly because of their microscopic habit, and partly because there are few nematologists available to study them.

Old-growth forests are particularly interesting and valuable to study because they probably have relatively high biological diversity and, at the very least, represent a relatively primal, undisturbed forest condition. Thus, a comprehensive knowledge of their ecological structure and function provides a basis for evaluating the effects of forestry activities, and for understanding the functioning of exploited forests. Nematodes, as an undoubtedly important component of the soil fauna of old-growth forests, deserve more attention than they are normally given.

Procter (1994) outlined a number of research questions relating to the potential impacts of nematodes in Lodgepole pine (*Pinus contorta*) forest at Kananaskis, Alberta. These questions are equally applicable to the interactions between nematodes and other important Western conifer species, including White spruce and Subalpine fir. The proposed study will set the stage for investigating some of these questions.

PRELIMINARY OBJECTIVES.

1. Determine the number of soil-living nematodes in an old-growth forest characterized by White spruce and Subalpine fir.

METHODS.

Nematodes were collected by taking soil cores from which the nematodes were then extracted. A stainless steel corer 5cm in diameter with a working length of 10cm were used to take 100cc cores at 0-5cm and 5-10cm depth. The cores were taken within 3m of the base of individual trees. The soil cores were individually stored in small plastic bags and immediately transported to the laboratory for extraction.

Modified Baermann Funnels [= the "modified tray method" of Whitehead & Hemming (1900)] were used to extract the nematodes from the soil samples. The nematodes were extracted in the trays for 24 hours.

Imhoff settling cones were used to concentrate the nematode distillate (about 500ml) obtained from the Baermann Funnels into a manageable volume (10ml).

The nematodes were then heat-relaxed and killed with a hot 5% formaldehyde/glycerine solution (the nematodes can be stored indefinitely in this condition). The collection and extraction process took approximately three days for the 24 samples.

The samples were counted under a stereo dissecting microscope at 30x magnification. No preliminary identifications have yet been made. Later, specimens will mounted on permanent microslides for final identification, descriptions of new species, and for archival purposes.

PRELIMINARY OUTCOME.

Twenty-four samples were collected on July 17, 2005. Twelve samples were taken from beneath White spruce trees, and 12 from beneath Subalpine fir. The 12 samples in each case were divided between six taken at 0-5 cm depth, and six taken immediately below at 5-10 cm depth.

One pair of samples from beneath White spruce has been cleaned and counted at this point. The sample counts were converted to a m^2 standard using the conversion factor 'x

510’, which is the number of times the volume of a 5 cm deep soil core goes into the volume of 1 m x 1m x 5 cm (50,000 cc). The counts at the two depths are also combined to express them in terms of the volume 1 m x 1 m x 10 cm (100,000 cc). Finally, the results were adjusted to reflect a 50% nematode extraction efficiency, a likely value for the modified tray method. These preliminary estimates are presented below.

RESULTS.

Table 1. Estimates of nematode numbers m^{-2} for two samples taken beneath *Picea glauca*. Included are the numbers adjusted assuming 50% extraction efficiency.

	0-5 cm depth	5-10 cm depth	0-10 cm depth
Raw numbers	1,247,500	2,861,100	4,108,600
Adjusted numbers	2,495,000	5,722,200	8,217,200

Note that the number at 5-10 cm depth were more than twice the number at 0-5 cm depth.

DISCUSSION.

Panesar et al. (2001) estimated that there were 7,490,000 nematodes m^{-2} in the top 10 ccm of soil in an old-growth Douglas fir forest on southern Vancouver Island. In a preliminary analysis of the soil-living nematode fauna of a mature Lodgepole pine (*Pinus contorta*) stand in Kananaskis, Alberta, Procter (1994) obtained an uncorrected count of 4,238,000 nematodes per m^2 in the top 10 cm of soil. This figure included 3,087,500 nematodes in the top 5 cm, and 1,150,500 nematodes at 5-10 cm soil depth. Further afield, Sohlenius and Bostrom (2001), studied the soil-living fauna of old Scots pine (*Pinus sylvestris*) forest in the middle of Sweden, and obtained an uncorrected average annual count of 4,016,000 nematodes per m^2 in the top 10 cm of soil. The numbers of nematodes were far higher in the uppermost litter and intermediate humus layers than in the bottom mineral soil layer.

The three old conifer forest studies cited, and my results in the current study, are remarkably uniform in producing corrected counts of approximately 8 million nematodes per m^2 in the top 10 cm of soil. These densities are high by world standards (Procter 1984), and are consistently exceeded only by the densities found in temperate grasslands, such as the Canadian prairies. One consequence of the high density of nematodes found in the Aleza Lake Research Forest is that nematodes are like to dominate soil invertebrate biomass and production. Moreover, nematode (and total invertebrate) production may even exceed that of above-ground vertebrates.

One noteworthy feature of the Aleza Lake samples is the relatively high proportion (66%) of nematodes in the 5-10cm soil depth. This result contrasts with those of other studies in which nematodes are most numerous in the top 5cm of soil. Note that at 5-10cm depth the substrate is dominated by mineral soil, with litter and humus dominating the 0-5cm depth, which is a common distribution in northern forests. Before speculating, however, the remaining samples need to be counted.

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