Biocontrol potential of entomopathogenic nematodes (EPNs) against selected key insect pests of canola in AB

Briar, S. S. and P. Tiege
Olds College Centre for Innovation Olds, Alberta, Canada -T4H 1R6
E mail: sbriar@oldscollege.ca

Abstract

The economic impact of canola insect pests is substantial. Resistance to chemicals is a growing problem as the number of chemical control options is shrinking. Therefore, new and environmentally-benign control options are needed for the canola producers. Entomopathogenic nematodes (EPNs) are commercially available biocontrol agents for management of insect pests primarily in the turf grass and green house industry. The ability of foliar-applied infective, predatory nematodes is not been explored in the Prairies. Four EPN species (*Steinernema carpocapsae*, *S. kraussei*, *S. feltiae* & *Heterorhabditis bacteriophora*) were tested at different rates against foliar insect pests including adults of flea beetles (*Phyllotreta cruciferae*) and larval stages of diamondback moth (*Plutella xylostella*), lygus (Lygus sp.), and two below ground pest including cabbage root maggots (*Delia radicum*) and black cutworms (*Agrotis ipsilon*). Bioassays were performed under controlled laboratory conditions. Infective juveniles (IJs) of EPNs were inoculated into the petri dishes or plastic cups for performing bioassays. Mortality was assessed after 72 hours of exposure to the nematodes and observed under the microscope to confirm infection. *Steinernematid* species (*S. carpocapsae*, *S. kraussei* & *S. feltiae*) provided significant mortality of diamondback moth, cabbage root maggots and black cutworms. *H. bacteriophora* provided significant larval mortality of >80% for black cutworms and about 60% for diamond back moth. EPN species showed very low host penetration of flea beetles adults & therefore provided only low mortality. The results of this study demonstrate that EPNs may be a useful component of integrated pest management programs for western Canadian growers.

Introduction

- Insect pest resistance to chemical is a growing problem. More, & different options are needed for crop producers.
- Entomopathogenic nematodes (EPNs) also known as predatory nematodes are soil-dwelling round worms that specialize in parasitizing insects. Infective juveniles (IJs) enter the host & release symbiotic bacteria, resulting in septicemia that kills the insect 24-48 hrs later [1] (Fig 1).
- EPNs are commercial biocontrol agents for the management of insect pests. Below ground stages are more susceptible, recent studies have shown success against foliar insect pests [2].
- EPNs use against insect pests is unexplored in the Prairies.

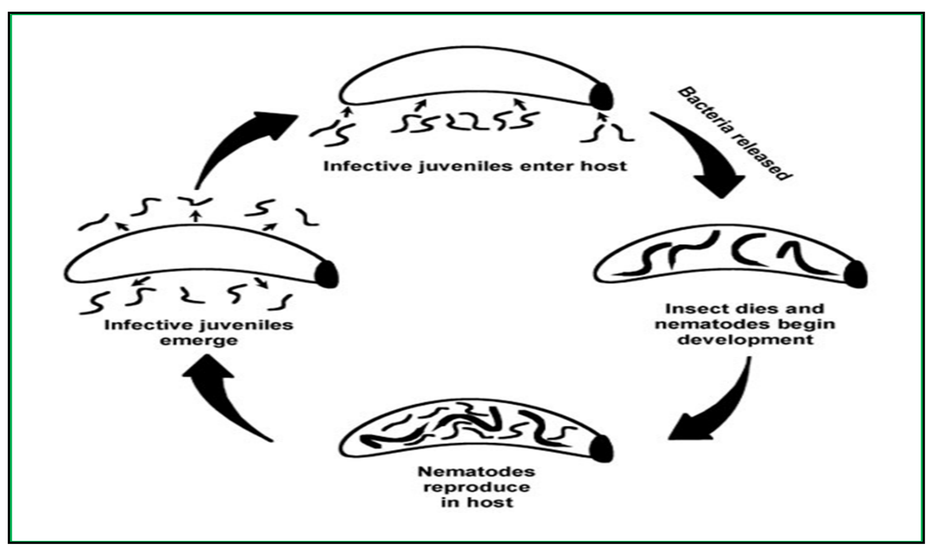

Figure 1: Life cycle of EPNs. (Credit David I. Shapiro-Ilan, USDA)

Objective

- Assess the biocontrol potential of commercial EPN species against canola foliar & below ground insect pests.

Methods

Bioassays: were performed under controlled laboratory conditions. EPNs were inoculated into 47 mm dia. filter paper lined petri dishes for foliar while 30 ml plastic cups filled sterilized air-dried sand were used for performing bioassays for the below ground pests. Larval mortality was assessed after 72 hours of exposure to the nematodes and observed under the microscope to confirm larval infection.

Data Analysis: Mean percent mortality was assessed and lethal concentration for each EPNs specie was calculate using Probit analysis.

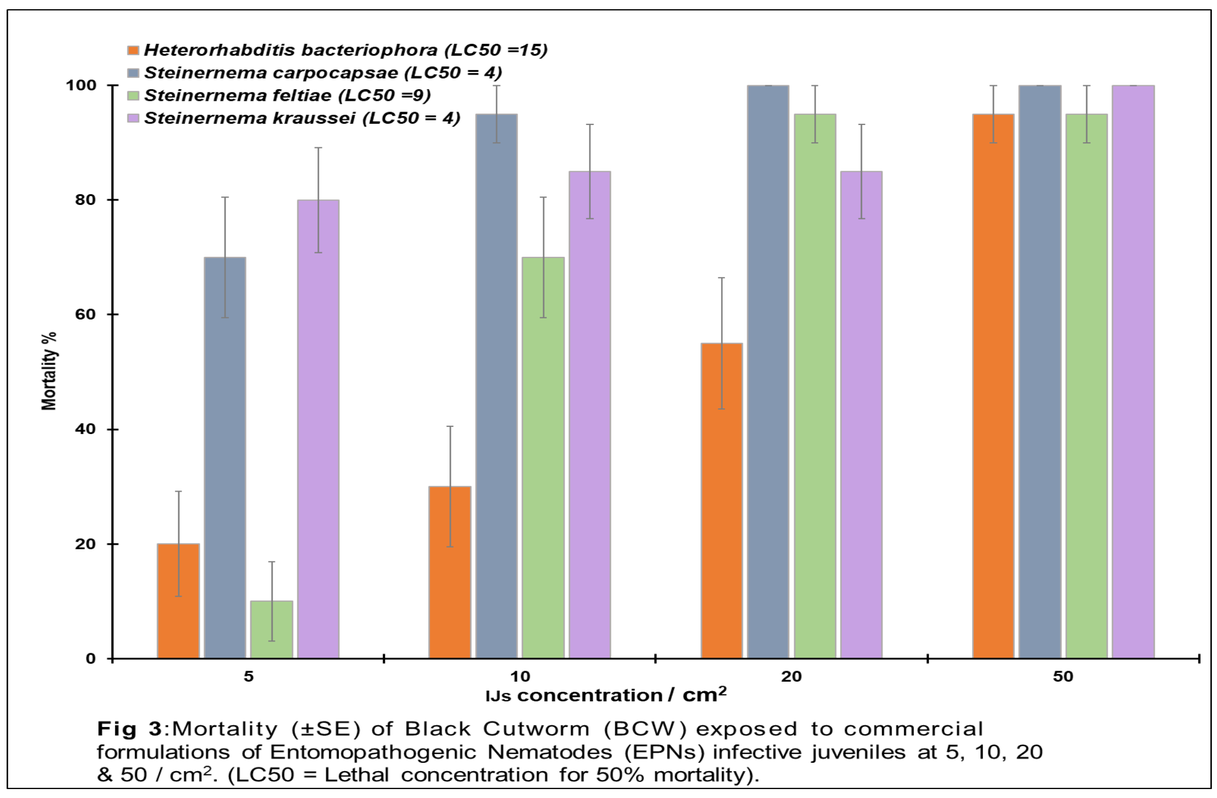

Fig 3:Mortality (±SE) of Black Cutworm (BCW) exposed to commercial formulations of Entomopathogenic Nematodes (EPNs) infective juveniles at 5, 10, 20 & 50 / cm². (LC50 = Lethal concentration for 50% mortality).

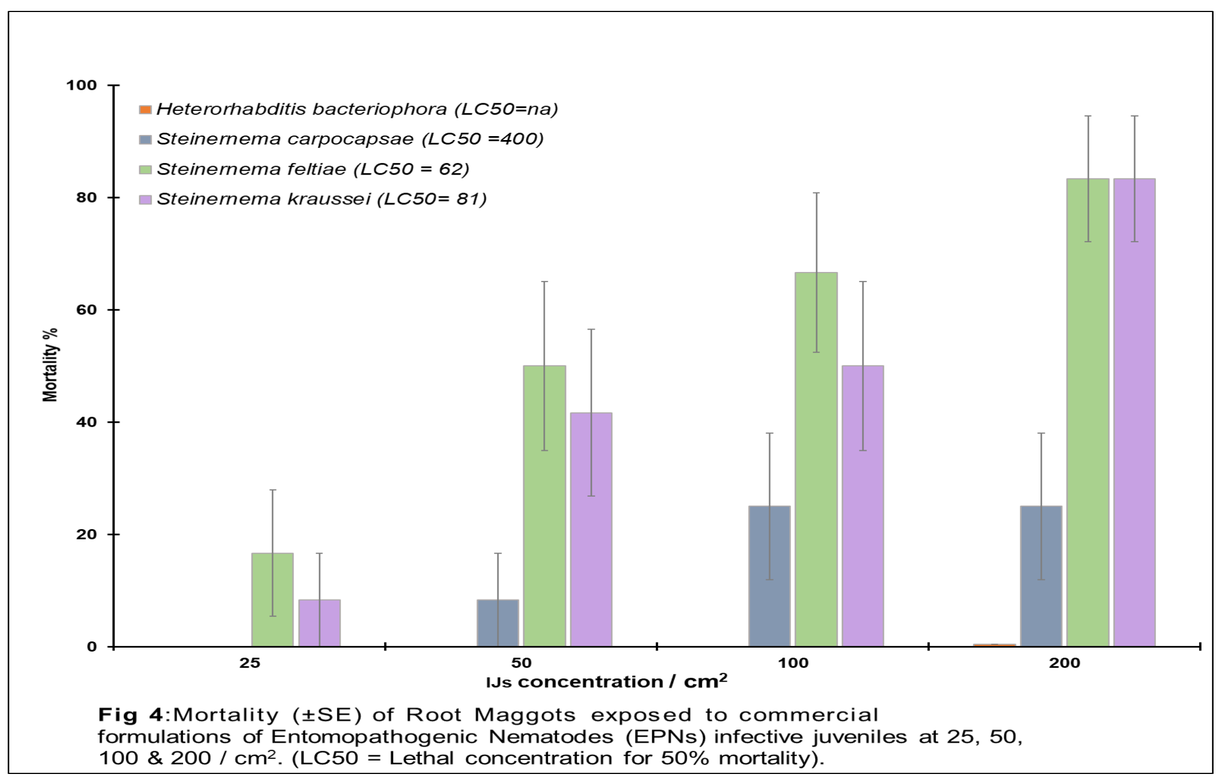

Fig 4:Mortality (±SE) of Root Maggots exposed to commercial formulations of Entomopathogenic Nematodes (EPNs) infective juveniles at 25, 50, 100 & 200 / cm². (LC50 = Lethal concentration for 50% mortality).

Results and Discussion

- Steinernematid species (*S. carpocapsae*, *S. kraussei* & *S. feltiae*) provided significant mortality of diamondback moth, and black cutworms (Figs. 2 & 3). *S. feltiae* & *S. kraussei* were more effective on root maggots as compared to *S. carpocapsae* (Fig. 4).
- *H. bacteriophora* provided significant mortality of diamond back moth and black cutworms only at the highest dose levels (Figs. 2 & 3) but not effective on root maggots (Fig. 4).
- All EPN sp. showed very low or no host penetration of flea beetle (FB) adults & provided very low or no mortality (Fig. 5).
- Larval stages of FB, not explored in this study, may be a better target to consider for higher efficacy of EPNs.

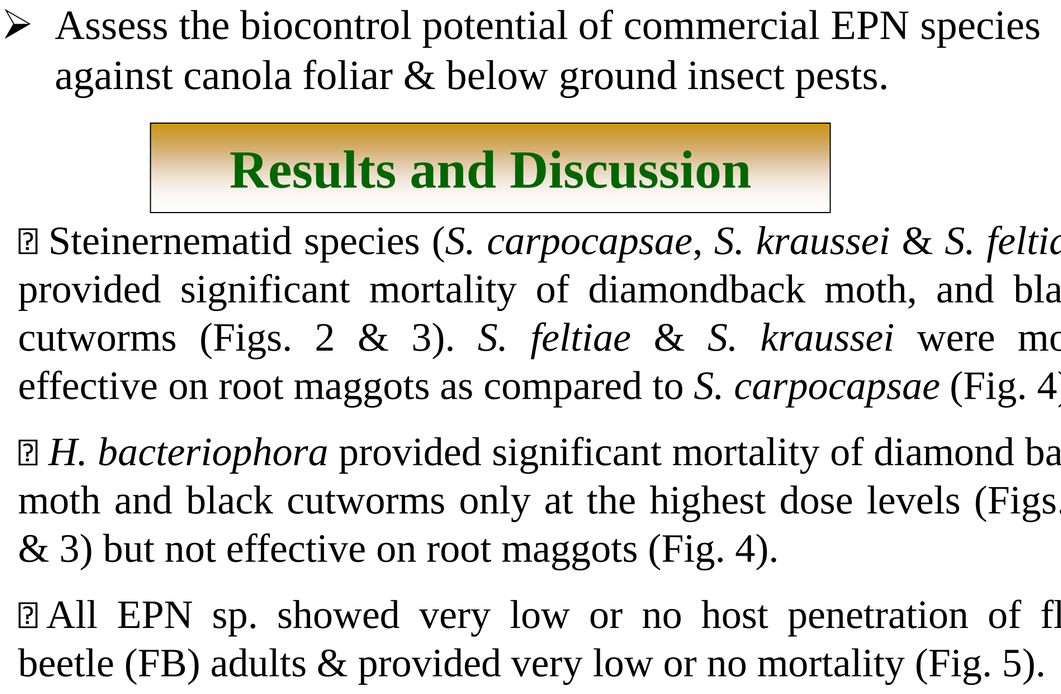

Fig 2:Mortality (±SE) of Diamondback moth (DBM) exposed to commercial formulations of Entomopathogenic Nematodes (EPNs) infective juveniles at 25, 50, 100 & 200 / insect larva. (LC50 = Lethal concentration for 50% mortality).

Fig 5:Mortality (±SE) of Flea beetle (FB) exposed to commercial formulations of Entomopathogenic Nematodes (EPNs) infective juveniles at 200, 400, 1000 & 2000 / FB adult.

Conclusions

- EPNs especially Steinernematid spp. were effective against canola insect pests, except for FB adults, under lab conditions.
- Results of this project provided basic information for long-term studies & exploration of EPNs for canola insect pests mgmt. under field conditions.

Research Funding

ALBERTA INNOVATES

ALBERTA CANOLA PRODUCERS COMMISSION

References

1: Grewal, P.S., Ehlers, R.U., Shapiro-Ilan, D.I., (Eds.) 2005. CABI Publishing, 2: Dito, D.F., Shapiro-Ilan, D.I., Dunlap, C.A., Behle, R.W., Lewis, E.E. (2016). Biocont. science and Tech, 26:835-848. 3: Canola Council of Canada.