



Infection of western flower thrips *Frankliniella occidentalis* (Thysanoptera:Thripidae) by entomopathogenic nematodes

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Introduction

Western flower thrips (WFT) is an economically important pest in protected and field crops.

- Direct damage to leaves, flowers and fruits.
- Indirectly by transmitting viral diseases.
- Chemical control of WFT is very difficult.
- High use of insecticides has led to the development of resistance.



Biological Control

- Efficient predators *Orius* and *Amblyseius* are currently used for foliar stages.
- These predators are less capable of entering flower buds.
- Pupation of WFT occurs in the soil.
- An advantage with entomopathogenic nematodes (EPNs) is their ability to target soil-inhabiting and foliar life stages.



Infection process

- *Steinernema* infective juveniles (IJs) enter the insect hosts through the mouth, anus or spiracles.
- *Heterorhabditis* IJs can penetrate through natural openings but also possess a tooth which enables them to enter the insects through the cuticle.



Hypotheses

- Different isolates of EPNs are not equally capable of infecting WFT.
- That *Steinernema* and *Heterorhabditis* have similar infection strategies on WFT pupae.



Objectives

- Test the efficacy of different EPNs on WFT.
- Assess the susceptibility of all life stages of WFT to EPNs infection.
- Observe the penetration of pupa by *S. abbasi* and *H. indica*.
- Investigate the development of *S. abbasi* and *H. indica* in WFT pupae.

General materials and methods



- WFT were reared on fresh bean pods and pot chrysanthemums

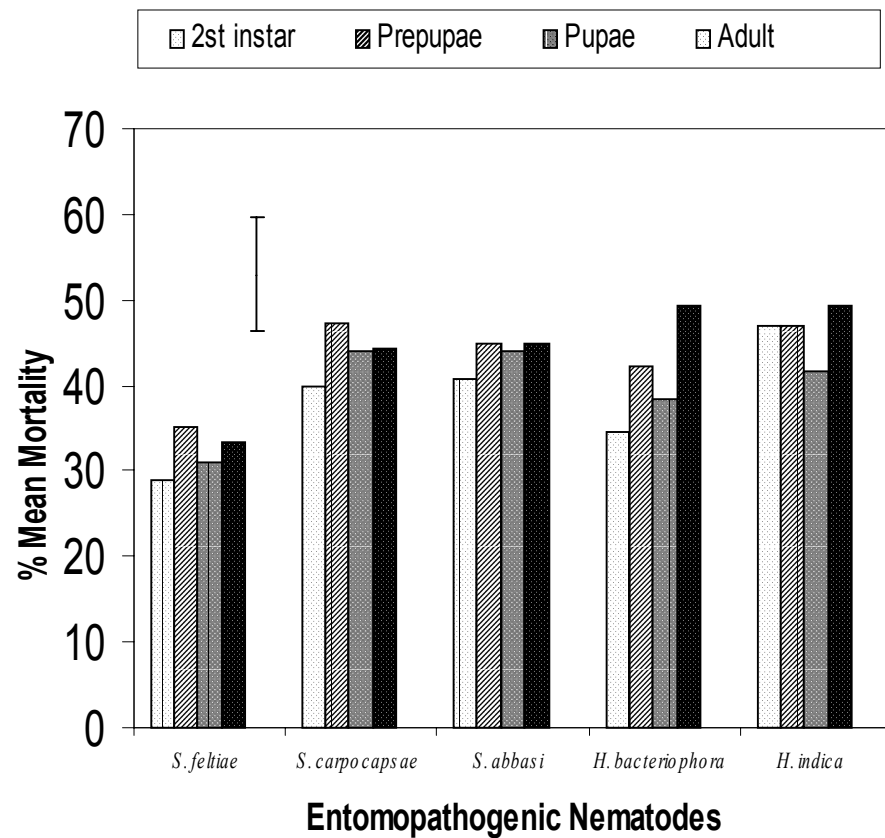


The susceptibility of WFT to different EPNs

- Second instar larvae, prepupae, pupae and adults were each treated with 180 IJs of *S. feltiae*, *S. carpocapsae*, *S. abbasi*, *H. bacteriophora* and *H. indica*.
- The experiment was conducted at $23 \pm 3^{\circ}\text{C}$ for 3 days.
- Dead second instar larvae, prepupae, pupae and adults were recorded.
- Data were corrected for control mortality (CM), transformed to arcsines and analysed using GenStat 7th edition.

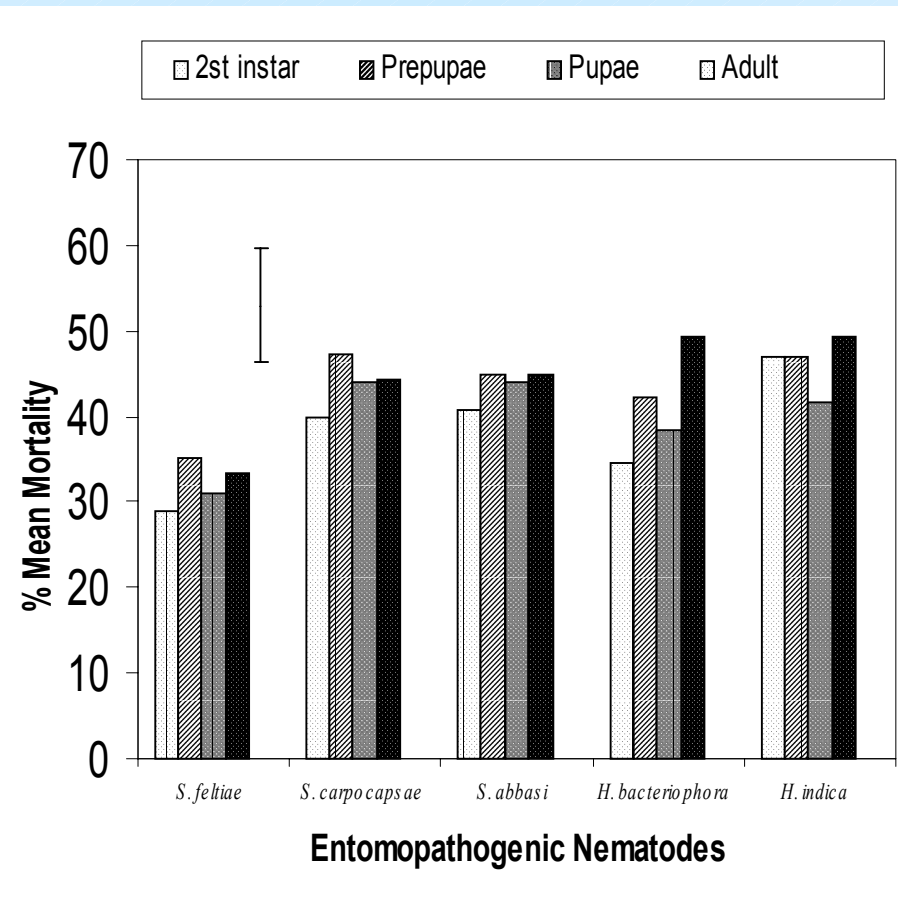
Results – 2nd instar larvae

- The highest CM was with *H. indica*.
- All nematodes killed 2nd instar larvae



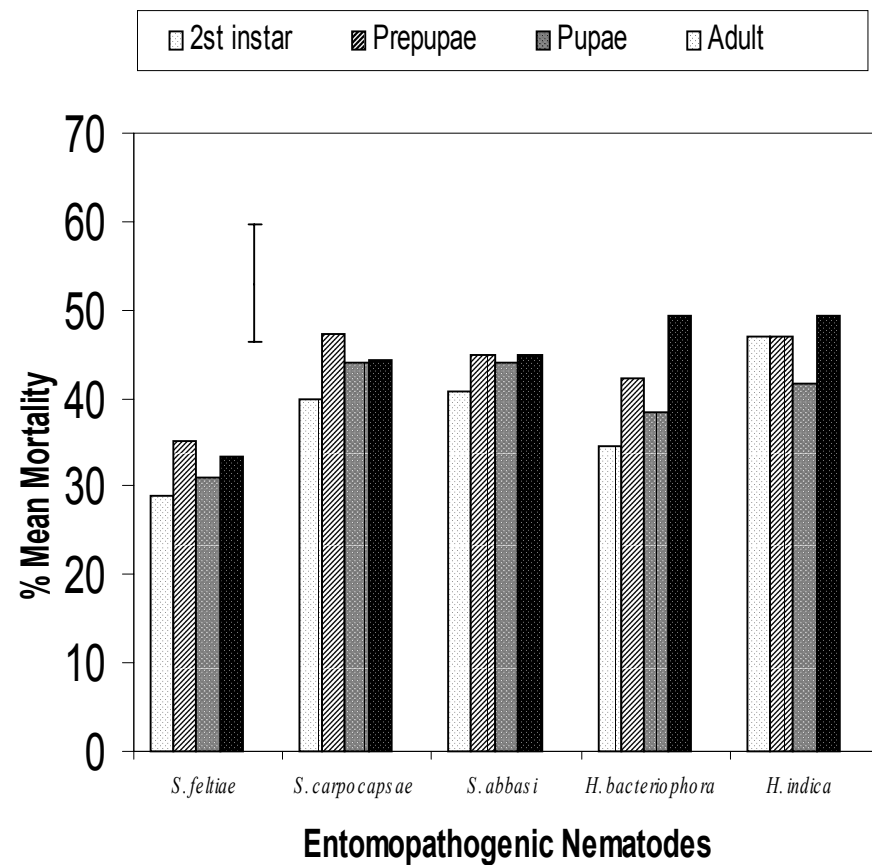
Results -prepupae

- The highest CM was with *S. carpocapsae*.



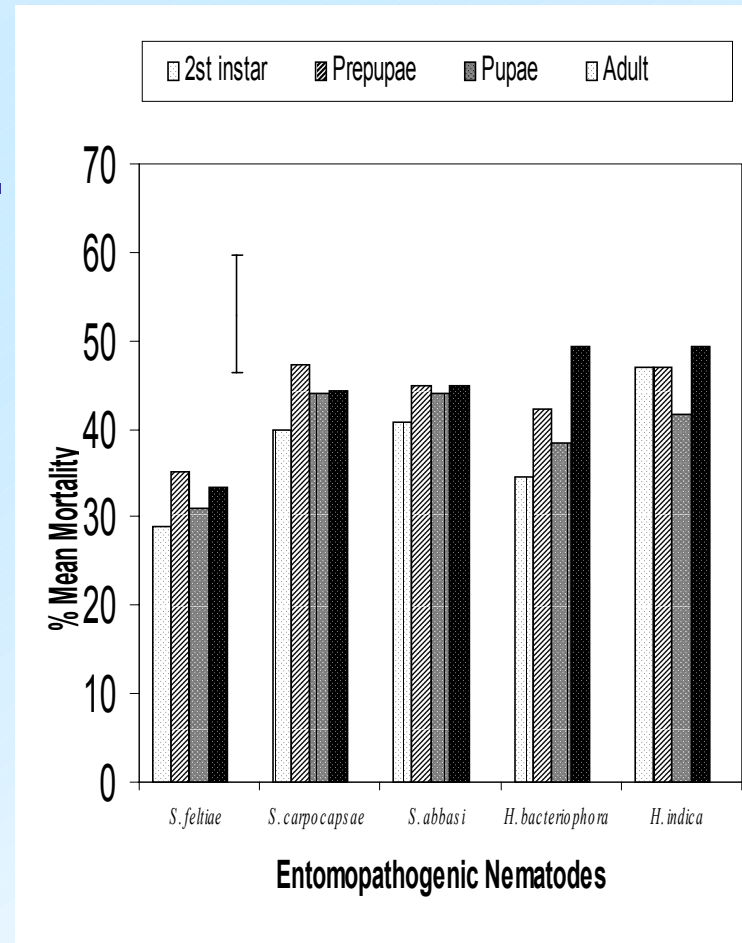
Results - pupae

- *S. abbasi* and *S. carpocapsae* gave the highest CM of 44 %



Results - adults

- Mortality ranged from 49% for *H. bacteriophora* and *H. indica* to 33% for *S. feltiae*.



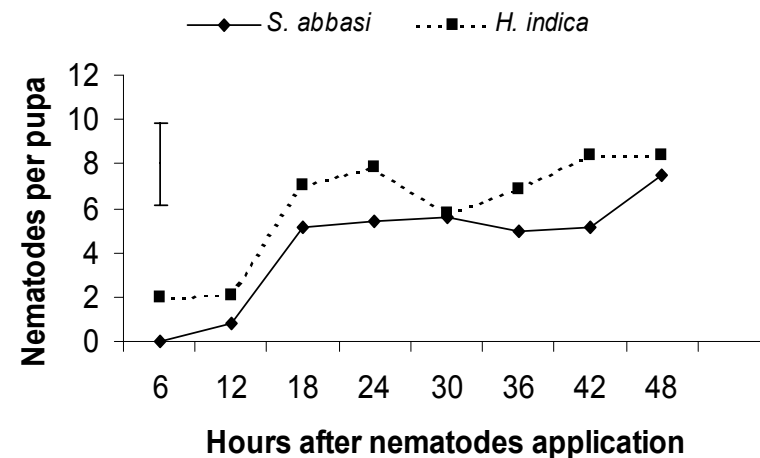
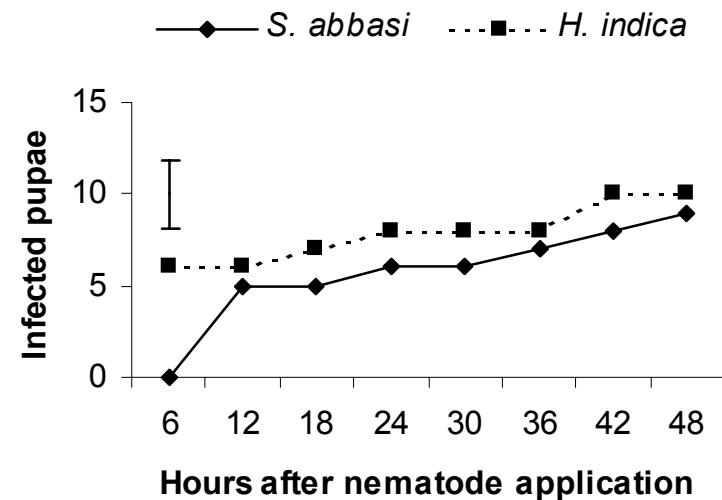
Development of *S. abbasi* and *H. indica* in WFT pupae

- A small amount (0.25 g) of multi purpose compost was put in 1.5 cm diameter x 1 cm deep plastic chamber.
- A WFT pupa was placed in the plastic chamber and was exposed to 30 IJs of either *S. abbasi* and *H. indica* and the chamber was covered by Nescofilm.



Results

- *H. indica* entered pupae within 6 h of application whilst *S. abbasi* entered within 12 h.
- Invasion of pupae was followed rapidly by the death of the insects.
- The number of pupae infected and killed increased over time.
- After 18 h pre-adult stages of both nematodes developed and the first adults were found after 42 h in *H. indica* and 48 h in *S. abbasi*. No further development of either nematode was observed.



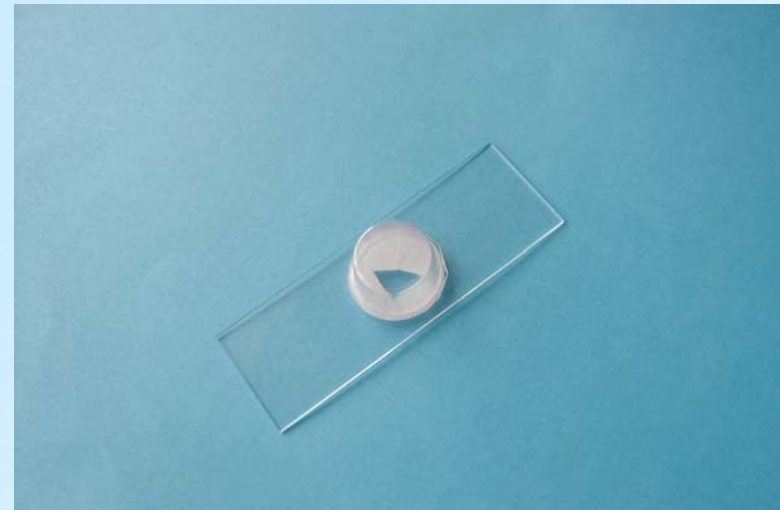


Results

- Some pupae disappeared in this experiment, in *H. indica* the loss of pupae was noticed 24 h after nematode application while in *S. abbasi* the disappearance of pupae was noticed after 42 h.
- Bacteria (*Photorhabdus* sp) was isolated from the *H. indica* treatments but no bacteria were found in the *S. abbasi* treatment.

Host penetration by *S. abbasi* and *H. indica*

- Two slides were prepared, one for *S. abbasi* and the other for *H. indica*. A 21 mm diameter Whatman glass microfiber filter was cut to serve as an arena which was placed in the middle of each slide.
- A pupa was placed in the centre of that arena. The arena was covered by 1.5 cm diameter x 1 cm deep plastic chamber to maintain the humidity.





30-11-00
12:35:20





Conclusions

- All isolates of EPN were capable of infecting the different stages WFT.
- *S. feltiae* was the least effective isolate, possibly the experimental conditions were less favourable for this temperate species.



Conclusions

- *S. abbasi* IJs penetrated WFT pupae through the mouth.
- *H. indica* penetrated WFT pupa through the cuticle.
- In *H. indica* - the infected pupa disintegrated within 2 hours as seen in the video.



Conclusions

- This work has shown that the disappearance of infected pupae in soil may be due to the destruction of the cadaver by the invasion and feeding behaviour of the nematodes.



Acknowledgements

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