INVESTIGATING NEMATODE DOSE RATES AGAINST SHB LARVAE

Nematodes versus Small Hive Beetle

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Small hive beetle, *Aethina tumida*, remains a major threat to the UK beekeeping industry (Cuthbertson, et al, 2010). This bee pest is making advances across the globe, having recently now been recorded in Italy. This is the first European recording of the beetle which has the potential to cause serious disruption to UK beekeeping should it arrive here.

As outlined by Cuthbertson, et al (*Bee Craft*, February 2014, pp 30–31) entomopathogenic nematodes have shown great potential (under laboratory conditions) to act as control agents against pupating larvae of small hive beetle (Figure 1). Two species in particular have shown much promise: *Steinernema kraussei* and *S. carpocapsae* (Cuthbertson, et al, 2012).

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Figure 1. Pupating small hive beetle larva (Cuthbertson, et al, 2013a)

The aim of the following work was to investigate dose rates of nematodes required to cause mortality of beetle larvae in order to make treatments as economically viable as possible.

Insect Rearing and Control Agents

Aethina tumida were cultured and maintained as described by Cuthbertson, et al (2008) under strict quarantine conditions (Marris, et al, 2010). Final instar (wandering) larvae were used for all experimental trials. The two nematode species investigated (*S. kraussei* and *S. carpocapsae*) are commercially available products in the UK and across Europe.

Dose Response of Nematodes against SHB Pupating Larvae

Following the method of Cuthbertson, et al (2012), 7 cm diameter by 15 cm tall plastic containers were filled with sand (4% moisture content). 50 ml of control product (500,000 nematode Infective Juveniles [IJs]) were added over the surface of the sand at the required dose rate. Dose rates investigated were: 10,000, 5000 and 2500 per ml.

Once the solution had soaked down into the sand, ten wandering larvae (Figure 2) were added to the surface. The containers were then sealed and maintained at 20 °C, 65% relative humidity, in the dark. There were ten containers per treatment (dose rate). Controls consisted of wandering larvae added to containers in which the sand had been treated with 50 ml of water. Treatments were maintained for six weeks in order to allow adult beetles to emerge.

Mortality was calculated as the number of beetles that failed to emerge. In order to confirm the fate of those individuals that did not emerge as adult beetles, at the end of each trial the sand substrate was sieved and searched for

Figure 2. Wandering larvae on the sand surface

An update on the possible use of nematodes to control small hive beetle

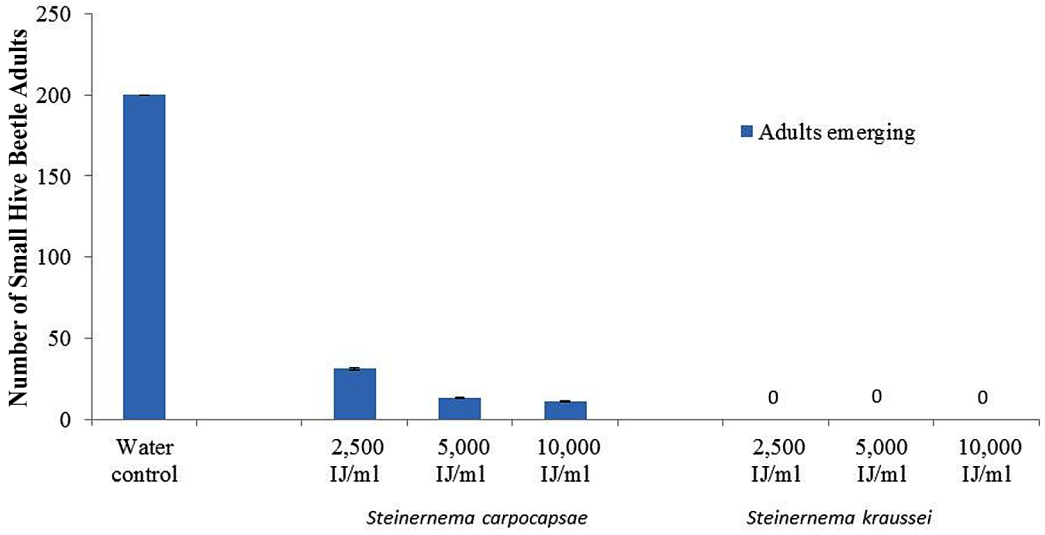

Figure 3. Number of small hive beetle adults emerging from sand pots following treatment with nematodes

insect debris (Cuthbertson, et al, 2012).

Results

Excellent control of pupating larvae was obtained with all dose rates of *S. kraussei* tested (Figure 3). A dose rate of 2500 IJ/ml caused total mortality of beetle larvae in the sand. Reducing the dose rate of *S. carpocapsae* would appear to reduce its efficacy.

On dissecting dead larvae, nematodes readily emerged proving their ability to infect and multiply within a small hive beetle pupating larva (Figure 4).

Conclusion

Our trials further demonstrate that the two species of commercially available entomopathogenic nematodes can infest and kill *A. tumida* wandering/pupating larvae. From our trial it would appear that *S. kraussei* is the most economically effective treatment as a dose rate of 2500 IJs/ml still provided complete mortality of larvae.

Given that *A. tumida* has now expanded its host range into Europe (Italy), there is an ever increasing risk of it reaching the UK. To date, the use of nematodes is potentially the only readily available option that UK beekeepers could use against SHB larvae in an outbreak situation (Cuthbertson, et al, 2013b). Ongoing work at Fera would seek to investigate the compatibility of the nematodes with available chemical pesticides and soil drenches to determine the potential of direct tank mixing of products.

Figure 4. Dissected Aethina tumida *larva releasing the entomopathogenic nematode* Steinernema kraussei

Further Reading

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Further Information

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