FINAL REPORT

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M 36

Mushrooms: Oviposition substrate selection in sciarid and phorid fly pests

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Project Title:	Mushrooms: Oviposition substrate selection in sciarid and phorid fly pests
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GROWER SUMMARY

Headline

This project has shown that within the mushroom growing system:

- Phorid flies are specifically attracted to fully spawned compost and as mycelial load of the compost increases, phorid fly oviposition increases
- Sciarid flies are attracted to all cultivation substrates and oviposition decreases with increasing mycelial load
- Fly emergence is highest for phorids in four day spawned compost and highest for sciarids in pasteurised compost.

The work has also identified three components within mushroom extracts, that could be used in the future as synthetic lures or baits to remove female phorids from mushroom crops, or be used in monitoring devices.

Background and expected deliverables

There is a requirement to develop alternatives to chemical insecticides for the mushroom industry, driven by consumer concerns about pesticide residues and the increasing withdrawal of chemicals available to growers. Identification of the volatile chemicals that attract sciarid and phorid flies to mushroom crops should lead to improved methods of monitoring fly populations or for controlling flies using baits impregnated with the attractant chemicals. However, little is known of the responses of phorids and sciarids to the volatiles produced during mushroom cultivation.

The overall aim of this project was to investigate the behaviour of sciarid and phorid flies in response to volatile chemicals produced during mushroom growing. The deliverables were:

- Development of a bioassay to measure the olfactory response of sciarids and phorids to mushroom growing substrates.
- Development of protocols to record electrical impulses from the antennae of sciarid and phorid flies in response to volatiles from cultivation substrates.
- Identification of two chemicals that cause an olfactory response in phorids: 6 methyl-hepten-2-one and 1-octen-3-ol.

Summary of project and main conclusions

An olfactometer was developed to measure the behavioural response of phorid and sciarid flies to mushroom (*Agaricus bisporus*) cultivation substrates in the laboratory. The olfactometer recorded the relative attractiveness of cultivation substrates and estimated the numbers of eggs laid on them. Four cultivation substrates were investigated: (1) Phase II compost; (2) 4-day spawned compost; (3) 14-day spawned compost; and (4) button mushrooms.

Attraction to compost

The response of phorid flies was found to vary significantly depending on the substrate: flies were most attracted to fully spawned compost and least to pasteurised compost, while 4-day spawned compost and button mushrooms gave intermediate responses.

Sciarid flies were found to be highly attracted to all cultivation substrates, with no significant differences in response between substrates. These results are consistent with the use of fungal volatiles by phorid and sciarid flies to detect egg-laying sites.

Oviposition site and adult emergence

The oviposition of phorid females was found to vary with the cultivation substrates, with oviposition increasing with the mycelial load of the compost. However, more adult phorids emerged from eggs laid in the 4-day spawned compost than the other substrates. Sciarid flies oviposited freely in all substrates, although more sciarids emerged from eggs laid on pastuerised compost than the other substrates. There was a negative relationship between the emergence of sciarids and the amount of mycelium in the compost.

Volatiles were sampled from three different compost batches and analysed to identify common volatiles in pasteurised, 4 day and 14 day spawned compost. However, in the

course of this study no such volatiles were identified, and the volatile profiles recorded were very complex, containing many components. Identification of biologically active substances from compost substrates was not possible using only analytical chemistry.

Electrophysiological methods were developed to measure the response of phorid and sciarid flies to the constituent components of volatiles produced by mushroom cultivation substrates. The response of phorid flies was examined and a positive olfactory response to button mushroom odour was observed. When exposed to the constituents of the mushroom odours, several elicited a response in phorids. Two of these components were identified as 6-methyl-hepten-2-one and 1-octen-3-ol. Responses to 4 and 14 day spawned compost odour did not provide consistent results and further experimentation is required.

Financial benefits

Although further work is required to confirm the role of 6-methyl-hepten-2-one and 1-octen-3-ol in phorid behaviour, these chemicals have potential to provide growers with improved methods of monitoring and trapping phorid flies. This should lead to improved crop yields and quality, as well as cost savings for pest control.

Action points for growers

This project is strategic in nature and was set up to identify alternative methods to chemical insecticides for managing sciarid and phorid flies on mushroom crops. The work has shown that two compounds - 6-methyl-hepten-2-one and 1-octen-3-ol – have potential uses for modifying the behaviour of phorid flies in mushroom houses. However, further research needs to be done before the results of this project can be fully utilised.