

Development of an Attractant Lure for Monitoring the Small Hive Beetle, *Aethina tumida*, to Support Contingency Planning for Invasive Species in the UK

SUMMARY

Compounds that are attractive for adult small hive beetles (SHB), derived from natural sources, have been identified using laboratory based bioassays and electrophysiological techniques.

INTRODUCTION

The introduction of the small hive beetle (SHB), *Aethina tumida* (Figure 1), in North America and Australia has had a significant economic impact on the apiculture industry. A similar scale of impact is anticipated in the UK and the EU if SHB is imported into these regions. Contingency planning and risk-based surveillance for an exotic pest require both detailed biological information and tools that can provide reliable monitoring for the presence of the pest. Traps containing attractant lures may provide early warning of pest presence, and could also be used to assess efficacy of pest management strategies.

MATERIALS AND METHODS

Using laboratory based behavioural bioassays and electrophysiological techniques, we investigated volatiles from a number of naturally occurring attractant sources to establish the key volatiles required for attraction of SHB. Volatiles were collected using portable solid phase microextraction (SPME) samplers, or by aeration on to a porous polymer followed by solvent extraction. The behavioural effect of the volatiles was examined using a static air olfactometer, recording the behaviour of single beetles using the Ethovision recording system. Candidate attractant compounds in the volatile mixture were identified by gas chromatography-electroantennography (GC-EAG) and by gas chromatography-mass spectrometry (GC-MS). Individual compounds were tested to identify potential attractants using a static air two-chamber olfactometer. Compounds that were shown to be attractive were incorporated in a prototype trap and lure.

RESULTS

Preliminary behavioural bioassays using a static air olfactometer indicated the sources that were most attractive to adult SHB (Figure 2). GC-EAD studies (Figure 3) identified ten candidate compounds for further investigation in behavioural bioassays. Two of these compounds were found to be attractive to adult SHB, four compounds appeared to have a repellent effect and the remaining compounds had no observable effect on behaviour with the bioassay method used. A prototype lure was developed and was tested in a trap designed to allow access by both walking and flying beetles. There was a significant difference ($P < 0.001$) in the number of beetles caught when traps with and without a lure were compared in laboratory bioassays using confined beetles (Figure 4). Field trials to test the lure in South Africa and the USA have to date proven inconclusive. Further field studies are currently in progress.



Figure 1. Adult small hive beetle, *Aethina tumida*

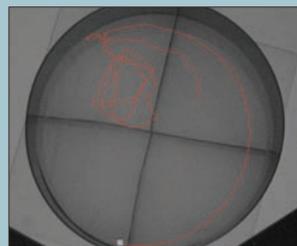


Figure 2. Movement of an adult SHB (red line) in an arena with an attractive odour source positioned in upper left hand quadrant

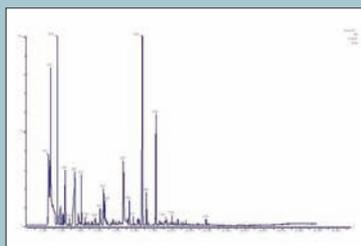


Figure 3. Typical trace illustrating number of compounds found in a hive-associated odour source. Only a few of these compounds may act as attractants for the SHB

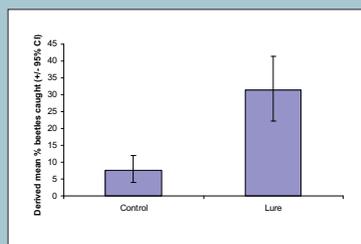


Figure 4. Derived mean % beetles caught after 24 hours in a trap with or without the prototype lure

CONCLUSIONS

The project has identified two compounds that are attractive to adult SHB. Further refinement of the lure and the trap is necessary; in particular studies on lure formulation and release rates are needed. The data obtained will be used to support the contingency planning for SHB in the UK and is applicable throughout the EU.



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