Grower Summary

PE 019

Feasibility of developing a Monitoring Trap for Detecting Pepper Weevil in the UK

Final 2016

Disclaimer

The results and conclusions in this report may be based on an investigation conducted over one year. Therefore, care must be taken with the interpretation of the results.

Use of pesticides

Only officially approved pesticides may be used in the UK. Approvals are normally granted only in relation to individual products and for specified uses. It is an offence to use non-approved products or to use approved products in a manner that does not comply with the statutory conditions of use, except where the crop or situation is the subject of an off-label extension of use.
Before using all pesticides check the approval status and conditions of use.
Read the label before use: use pesticides safely.

Further information

If you would like a copy of the full report, please email the AHDB Horticulture office (hort.info.@ahdb.org.uk), quoting your AHDB Horticulture number, alternatively contact AHDB Horticulture at the address below.

AHDB Horticulture,
AHDB
Stoneleigh Park
Kenilworth
Warwickshire
CV8 2TL

Tel – 0247 669 2051

AHDB Horticulture is a Division of the Agriculture and Horticulture Development Board.

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Project number:	PE 019
Project leader:	Dr Michelle Fountain East Malling Research, New Road, East Malling Kent ME19 6BJ
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Key staff:	Bethan Shaw, Madeleine Cannon (NIAB EMR) David Hall, Dudley Farman (NRI) Dr R J Jacobson, Director, RJC Ltd. rob.jacobson@tiscali.co.uk
Location of project:	NIAB EMR Natural Resources Institute
Industry Representative:	Neal Ward, Cantelo Nurseries Ltd., Bradon Farm, Isle Abbots, Taunton, Somerset, neal.ward@cantelo.co.uk Robert James, Thanet Earth robert.james@thanetearth.com
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GROWER SUMMARY

Headline

Significant progress was made in the establishment and maintenance of pepper weevils in a quarantine facility. Further studies of the pepper weevils responses to volatile compounds and analyses of the commercially available lure have indicated that it could be simplified, making it more cost effective.

Background

The pepper weevil, *Anthonomus eugenii,* originates from Mexico (Laborde and Pozo, 1984; Rodriguez-Leyva et al., 2007) and has spread throughout Central America (Andrews et al., 1986). Although not yet found in the UK, the first European finding in 2012 caused eradication measures in the Netherlands resulting in the destruction of four glasshouse crops of *Capsicum* (Baker et al., 2012). In addition, the pest was found for the first time attacking sweet pepper (*Capsicum annuum* L.; Solanaceae) in glasshouses and in fields in the coastal area of the Lazio Region of Italy in October 2013 (Speranza et al., 2014).

Damage is caused by both adult and larval feeding which results in bud drop and is the primary cause of yield loss. Adult *A. eugenii* also feed on leaves and blossoms and bore into fruits. Adult feeding punctures appear as dark specks or small holes in immature fruits (Figure 1) and small (2-5 mm) circular or oval holes in leaves. Damage is also caused by egg-laying females who deposit a single egg within a cavity they excavate. Larval feeding on seeds and other tissue in the developing fruits (Costello and Gillespie, 1993) is very damaging, causing the core to become brown, and often mouldy. The stem of pods infested by larvae turn yellow and the pod turns yellow or red prematurely.

Figure 1. Feeding hole caused by pepper weevil.

The UK needs an effective monitoring trap for pack houses which import fruits from affected countries. These pack houses are often adjacent to glasshouse crops grown in the UK, placing crops at risk. Hence, growers would benefit from monitoring and early detection of the pest in pepper crops.

An aggregation pheromone produced by male pepper weevils was identified by Eller et al. (1994) and six components were identified. Traps with the pheromone captured more pepper weevils of both sexes than unbaited traps but it is thought that this trap did not reach its full potential as one of the components, geranic acid, was not released properly.

In more recent work, Adesso et al. (2009, 2011) have shown that pepper weevils are attracted to volatiles from host plants. If the attractive components could be identified they might be used to increase the attractiveness of a lure containing the pheromone.

There is currently a lure commercially available from Trecé which is used in the USA. However, whether this contains all the pheromone components and/or host-plant volatiles was not known and its effectiveness has not been reliably tested.

Summary

In Year 1 (2014) a laboratory culture of pepper weevils was established and maintained at EMR under quarantine conditions (Licence No: 6996/211707/2) and were grown on an artificial diet identified from the scientific literature. As the weevils did not lay eggs in the artificial substrate they were switched to peppers grown in a glasshouse at NIAB EMR. Cultures were maintained for several weeks but gradually the numbers fell and the culture crashed.

Volatiles were collected from weevils in groups either with or without a food source. In analyses of these by gas chromatography coupled to mass spectrometry (GC-MS), no trace of the expected components of the aggregation pheromone could be detected. A paper published while this work was in progress suggested that weevils fed on an artificial diet produce much less pheromone than those fed on natural host material.

Volatiles were also collected from pepper fruits, flowers, leaves and buds. Analysis of these by GC-MS showed most material in collections from fruits. The major component was (E)-β-ocimene with much smaller amounts of some sesquiterpenes, and these may be responsible for the observed attraction of pepper weevils to their host plants.

In order to investigate these compounds further, electroantennographic (EAG) recordings were made from pepper weevil antennae to determine whether pepper weevils can detect the host plant volatiles and all of the proposed pheromone components. EAG responses were recorded to the synthetic pheromone when this was puffed over the antenna, but only very

weak responses were recorded when the same material was delivered through the GC. This may have been because the insects were not in good condition.

In the second year of the project (2015) pepper weevils were successfully reared on peppers at NIAB EMR.

Extensive Y-tube bioassays (a laboratory bioassay where an insect has a choice of two arms to orientate to; one of which would candidate a candidate attractive component) at NIAB EMR did not show convincing responses to synthetic pheromone with or without ocimene, the main component of pepper volatiles. Because the weevils did not successfully respond to the pheromone in this bioassay this does not rule out there may be attraction to ocimene in the field.

Volatiles were collected from male pepper weevils reared on peppers at EMR and analysis of the collections at NRI showed the presence of components of the aggregation pheromone which were not detected from weevils reared on artificial diet during the first year of the project.

Pheromone components detected were *E*- and *Z*-isomers of Grandlure II and (*E*)-geranic acid. No geraniol could be detected and only tiny traces of Grandlures III and IV. It is probable that only the *E*- and *Z*-isomers of Grandlure II and (*E*)-geranic acid are required for attraction rather than the six reported previously.

In GC-EAG work at NRI a good EAG response was obtained to the two Grandlure II compounds in contrast to results obtained during the first year of the project. However, no consistent EAG responses to synthetic ocimene and copaene or the collections of pepper volatiles were observed, even after concentration.

Release rate studies on dispensers for geranic acid showed emission from Trece dispensers lasted for < 8 d at 27°C. Geranic acid is attractive to pepper weevil and hence a long lasting release rate could improve the capture of weevils in traps. Release from other types of polyethylene dispenser was more persistent but non-linear and needs improvement.

Financial Benefits

Economic damage by *A. eugenii* to peppers is reported to occur with adult populations of only 0.01 adult per plant. Current control measures in the Americas are based on broad spectrum insecticides which are extremely disruptive to IPM. This can lead to secondary problems with other pests and associated diseases, which must also be controlled with chemical insecticides. The disruption and termination of the IPM programme means that growers would lose an important marketing advantage over their overseas competitors.

The full economic implications of the arrival of *A. eugenii* have not yet been determined for UK growers. However, initial observations suggest that losses due to direct damage, secondary pest problems and the loss of goodwill with retail customers could be very substantial.

Action Points

- Monitoring in pack houses which import fruits from affected countries could intercept the pest arrival within infested crops. These pack houses are often adjacent to glasshouse crops grown in the UK, placing crops at risk.
- Adult *A. eugenii* are attracted to yellow sticky traps and can be placed through the pack house and should be checked regularly.
- Currently the easiest available and most effective monitoring traps can be obtained from Trece, Inc. www.trece.com (PEW kits).
- See also AHDB Horticulture report by R J Jacobson 'Peppers and aubergines: A desk study to identify IPM compatible control measures for *Nezara viridula* and *Anthonomus eugenii* (2013) Final report PE 014.