



Agriculture & Horticulture
DEVELOPMENT BOARD



Grower Summary

TF 196

Investigation of the effects of commonly used insecticides on earwigs, important predators in apple and pear

Final 2014

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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.

HDC is a division of the Agriculture and Horticulture Development Board.

Project Number: TF 196

Project Title: Investigation of the effects of commonly used insecticides on earwigs, important predators in apple and pear

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Contractor/(s): East Malling Research

Industry Representative: Peter Checkley, Howard Chapman Ltd, Kent

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Year 2 annual report

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Further information

If you would like a copy of this report, please email the HDC office (hdc@hdc.ahdb.org.uk), alternatively contact the HDC at the address below.

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GROWER SUMMARY

Headline

Earwig 'compatible' spray programmes can increase earwig numbers in orchards.

Background and expected deliverables

Earwigs are very important generalist predators in both apple and pear orchards. They play a **key** role in regulating populations of several highly damaging pests including woolly aphid and other aphid pests, mussel scale, codling moth and pear sucker. Recent laboratory tests and field experiments at EMR and in other European countries indicate that several very commonly used insecticides including Calypso (thiacloprid), Steward (indoxacarb), Equity (chlorpyrifos) and Tracer (spinosad) have harmful effects on earwigs and could be, at least partly, responsible for the low populations of these important predators in some orchards. This project further investigated the lethal and sub-lethal effects of these and other commonly used insecticides on different earwig life stages in laboratory and field studies with a view to devising earwig compatible spray programmes for UK orchards.

Summary of the project and main conclusions

In laboratory tests in year 1 (2011), chlorpyrifos was the most toxic of the insecticides tested to earwigs with most dying within a couple of days of exposure in Petri dishes. In order of decreasing toxicity Tracer (spinosad) > Calypso (thiacloprid) > Runner (methoxyfenozide) > Steward (indoxacarb)/Envidor (spiroadclofen)/Gazelle (acetamaprid) were also harmful. Runner significantly reduced nymph growth, but showed no effects on adult earwigs. Agrimec (abamectin), Coragen (chlorantraniliprole), Mainman (flonicamid) and a coded product were not deemed toxic in the laboratory study.

Based on the findings from the laboratory experiment and other researchers, Pyrinex (chlorpyrifos), Mainman (flonicamid), Runner (methoxyfenozide), Envidor (spiroadclofen), Calypso (thiacloprid) and two novel plant protection products were selected to test in a small plot (six trees) field study at the recommended field dose (in 2012). Earwigs exposed to chlorpyrifos on trees were less affected by the pesticide product than in laboratory studies in Petri dishes. However, numbers of adults decreased over time in trees treated with it in the spring compared to the untreated control. Calypso was the most detrimental of the tested products, to earwig adult and nymph numbers in the canopy of the trees. In addition, small

numbers of dead earwigs were found in the feeding bottles on trees treated with this product. Mainman also reduced earwig numbers in trees. In laboratory experiments, nymphs exposed to Runner had a significantly reduced body weight, but in field tests the product had no effect on nymph numbers.

In the final year of the project, a large scale, whole orchard, trial was done to investigate 'earwig compatible' spray programmes. Orchards were divided into two; one half received the growers conventional spray programme and the other half avoided using any products known to be harmful to earwigs. Insecticides screened in years 1 and 2 and those of other researchers (Table 1) deemed as most toxic to earwigs, were omitted from the earwig compatible programme at key stages of the earwig lifecycle (notably females feeding in trees in spring and nymphs in trees in the summer). These included; chlorpyrifos, cypermethrin, spinosad, thiacloprid, deltamethrin, indoxacarb, methoxyfenozide (in the summer), and spiroticlofen. Sprays were applied according to the label recommendations (dose and max number) using the grower's standard air assisted sprayers. Populations were monitored in the spring, early summer and late summer. Whilst earwig numbers increased in the halves of the orchards with the 'earwig compatible' programme, populations were significantly negatively affected by products incorporated into programmes and known to be detrimental. One or two sprays of an earwig harmful product (chlorpyrifos) between April and July had detrimental effects on earwig numbers.

Table 1. Summary of data from this project and data published by other researchers on the safety of active ingredients to earwigs

a.i.	Data from this project	Other researchers	Reference*
Abamectin	Safe	Harmful	1
Acetamiprid	Safe	-	
<i>Bacillus thuringiensis</i>	-	Safe	9
chlorantraniliprole	Safe	Safe to adults	10,12
Chlorpyrifos	Harmful	Harmful	1,2
Cypermethrin	-	Harmful (nymphs), knockdown	1,8
Deltamethrin	-	Harmful, knockdown	1,4,7,8
Diflubenzuron	-	Harmful	9,11
Dimethoate	-	Harmful	1,8
Flonicamid	Safe (lab) (nymphs, field)	harmful Safe, harmful	1,3,5
Indoxacarb	Harmful knockdown	(males), Harmful, knockdown	1,3,4,5,10
methoxyfenozide	Harmful to nymphs	Safe to adults	4, 10
Pirimicarb	-	Safe	1,8
potassium bicarbonate	-	Safe	12
Spinosad	Harmful, knockdown	Harmful	1,2,3,5,6, 10
Spirodiclofen	Harmful nymphs (lab), safe (field)	-	
Thiacloprid	Harmful	Harmful	1,3,5,10

*1 Peusens and Gobin 2008; 2 Cisneros *et al.* 2002; 3 Vogt *et al.* 2010; 4 Peusens *et al.* 2010; 5 Vogt *et al.* 2009; 6 Peusens *et al.* 2009; 7 Colvin and Cranshaw 2010; 8 Ffrench-Constant and Vickerman 1985; 9 Maher *et al.* 2006; 9 Sauphanor *et al.* 1993; 10 Shaw and Wallis 2010, 11 Ravensberg 1981, 12 Beliën 2012.

Financial benefits

- Growers will be able to use the information in Table 1 to make decisions on which insecticides to use to control codling moth, aphids, mussel scale and pear sucker whilst avoiding using insecticides which harm the key life stages of earwigs.
- The resulting increase in earwig numbers in commercial orchards will lead to greater natural predation of these pests, reducing reliance on costly crop protection products.

Action points for growers

- Growers should make considered choices of pesticide products based on the knowledge of important predators in the orchard at the time of spraying.
- Growers can consult Table 1, when selecting products for pest control and take into consideration the time of year the application is being made and the potential harm to earwig populations.