Grower Summary

PE 005

Protected edible crops: biological control of plant diseases using insect pathogenic fungi with dual activity against plant pathogens

Final 2013

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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 HDC office (hdc@hdc.ahdb.org.uk), quoting your HDC number, alternatively contact the HDC at the address below.

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Headline

Mycotal, Naturalis L and a coded bioinsecticide (HDC F123) have been shown to have the potential to control tomato powdery mildew in experimental systems. The coded bioinsecticide (HDC F123) also has potential to control cucumber powdery mildew. Cultures from the biocontrol agents Naturalis L and HDC F123 gave a small but significant level of control of Pythium on tomato when applied to seed.

Background

Plant pathogens are a significant constraint on the production of protected edible crops. At the same time, growers are under considerable pressure to reduce their use of synthetic chemical fungicides as a result of new legislation plus the increasing demand from supermarkets for produce with zero detectable pesticide residues. However, alternative control agents are currently in short supply. The overall aim of this project was to investigate commercial biocontrol agents based on insect pathogenic fungi as potential control agents of plant pathogens. A number of biopesticides, based on insect pathogenic fungi, are being sold in the UK and / or mainland Europe for insect pest control as part of Integrated Pest Management (IPM) programmes. However, research done outside the UK has suggested that some insect pathogenic fungi can also have activity against plant diseases. We wanted to find out whether insect pathogenic fungi available as commercial biopesticides have potential for biocontrol of powdery mildew and damping off diseases.

Summary

Laboratory experiments were done to evaluate three commercial bioinsecticides against tomato powdery mildew. These were: the fungal species *Lecanicillium muscarium* strain 19.79, which was used as the commercial product Mycotal (Koppert BV), *Beauveria bassiana*, ATCC 74040 which was used as the product Naturalis L (Belchim) and two biological products not yet approved for use on protected tomatoes HDC F122 and HDC F123. In addition, we evaluated three other agents: (i) the bacterial biopesticide Serenade ASO (based on *Bacillus subtilis* QST 713, Agraquest Ltd); (ii) HDC F124 (also not yet approved for protected tomatoes); (iii) Thiovit Jet (800 g/kg sulphur, Syngenta). All the agents were used at the manufacturers' recommended concentrations. Two sets of experiments were done. In the first, Mycotal was evaluated alongside Serenade ASO, HDC F124 and Thiovit Jet. In the second, Mycotal was compared against HDC F123 and Naturalis L. All of the tested agents controlled tomato powdery mildew in the laboratory experiment. For the first set of experiments, the treatments reduced the sporulation of powdery mildew by 77% (Mycotal), 63% (Serenade ASO), 94% (HDC F124) and 98% (Thiovit Jet). In the second

set of experiments, the treatments reduced the sporulation of powdery mildew by 94% (Mycotal), 75% (HDC F122), 93% (Naturalis) and 92% (HDC F123). An experiment was then done to measure the effect of Mycotal, HDC F122, Naturalis L, HDC F123, and the biofungicide AQ10, against tomato powdery mildew applied to whole tomato plants. In this case, the treatments reduced the sporulation of powdery mildew by 65% (Mycotal), 94% (HDC F122), 76% (Naturalis L), 70% (HDC F123) and 73% (AQ10). A laboratory experiment was also conducted to evaluate commercial bioinsecticides against cucumber powdery mildew. Here, HDC F123 reduced the sporulation of cucumber powdery mildew by 82%, but the other treatments tested (Mycotal, HDC F122, and Naturalis L) did not give significant control. An experiment was done to determine whether applying a drench of the bioinsecticides to the roots of tomato plants gave control of tomato mildew inoculated on the leaves. In this case, none of the treatments gave control (HDC F122, Naturalis L, Mycotal, HDC F123).

Research was also done to develop a laboratory method to evaluate the effect of insect pathogenic fungi against *Pythium*, and to develop a method for coating tomato seed with spores of insect pathogenic fungi. Two of the treatments (HDC F123 and Naturalis L) gave a small (15%) but statistically significant amount of control of Pythium when applied this way.

The results obtained with biocontrol of tomato and cucumber powdery mildew are encouraging, and suggest that using bioinsecticides sprayed onto the leaf surface have potential as a new form of control. Additional research will be required to determine the best timing of application, to evaluate the control agents under conditions that more closely reflect commercial production, and to investigate their use as part of Integrated Pest and Disease Management.

Financial Benefits

It is difficult to comment on the financial benefits given that this work was done mainly as a set of laboratory experiments. However any new method that would allow growers to reduce their reliance on synthetic chemical fungicides for the control of powdery mildew and damping off diseases would be financially beneficial at a time when the availability of chemical pesticides is declining, and when growers are under increasing pressure to produce crops with zero detectable pesticide residues.

Action Points

The biopesticides investigated here are approved for use on protected crops, or are undergoing evaluation through SCEPTRE. It is too early to recommend using them now as control agents of powdery mildew, but growers should be aware that these products have potential as a new type of control agent.