



INTRODUCTION

- The increasing use of agrochemicals has led to pesticide residues and resistance problems in the control of the grey mould *Botrytis cinerea*.
- An alternative to chemical spraying is to use bees as entomovectors to disperse biological control agents.
- **Prestop Mix** is a biofungicide that contains spores of the parasitic fungus *Gliocladium catenulatum* J1446, which has been successfully used in the control of *B. cinerea* in different countries and is also approved for organic production.

OBJECTIVES:

- Conduct a field experiment to study whether using honey bees in dispersing the Prestop Mix preparation to control *B. cinerea* in strawberry would be efficient in Estonian conditions, where the landscape is very heterogeneous with many competing flowers.
- Conduct laboratory experiments to test the effect of Prestop Mix on the respiration rate of bumble bees, since there is no data about the safety of *G. catenulatum* to the physiology of bees.

METHODS

1. Field experiment

• Carried out in 2010 in two strawberry plantations of Tartu County, Estonia; the strawberry variety was 'Sonata'.

• Honey bee hives were placed at the edge of strawberry fields (2 hives/ha); to each hive we attached a dispenser (Fig.1) containing the Prestop Mix preparation.



Fig.1. Dispensers attached to the hives.

• Exiting the hive honey bees walked through the preparation powder and carried it onto the strawberry flowers.

• We compared the bee-disseminated biocontrol with untreated control, the control plots were covered with exclusion cages (Fig. 2)



Fig.2. Exclusion cages on control plots.

• The proportion of healthy and botrytis infected berries were evaluated.

2. Laboratory experiments

• Conducted with commercially produced bumble bees

• **Feeding test:** bumble bee colonies were fed for three weeks:

- Test bumble bees with pollen and a mix of sugar solution and the Prestop Mix preparation (7,5 g L⁻¹).
- Control bumble bees with pollen and sugar solution only.

• **Contact test:**

- Test bumble bees dusted with the Prestop Mix powder
- Control bumble bees untreated

• Infrared gas analyser (Infralyt-4, VEB, Junkalor, Dessau) was used to measure the respiration rate of the test and control bees by recording the amount of CO₂ release (VCO₂ ml h⁻¹).

RESULTS

1. Field experiment

• Treating strawberry plants with the bee-dispersed Prestop Mix significantly reduced the proportion of infected berries compared with the control ($F_{(1;236)}=5,14$; $p=0,02$) (Fig.3).

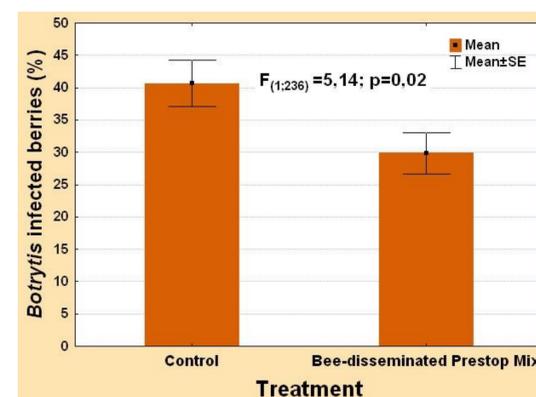


Fig.3. The proportion of *Botrytis* infected strawberries in the untreated and treated plots.

2. Laboratory experiments

• Feeding test

Feeding bumble bees with the Prestop Mix preparation had no effect on the respiration rate of treated bumble bees ($F_{(1;56)}=0,004$; $p=0,95$) (Fig.4).

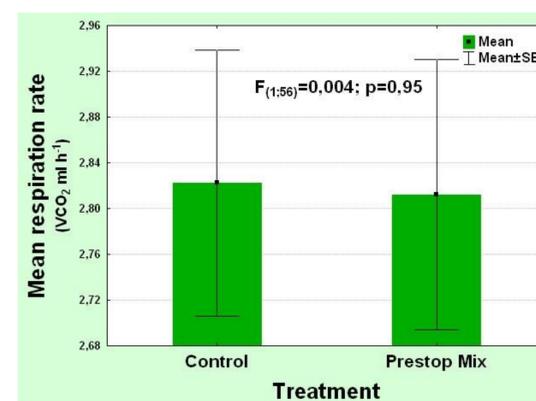


Fig.4. Mean respiration rate of untreated and treated bumble bees after feeding of Prestop Mix.

• Contact test

Dusting bumble bees with the Prestop Mix Powder lowered somewhat the respiration rate of treated bees, but no significant effect was found ($F_{(1;43)}=2,51$; $p=0,12$) (Fig.5).

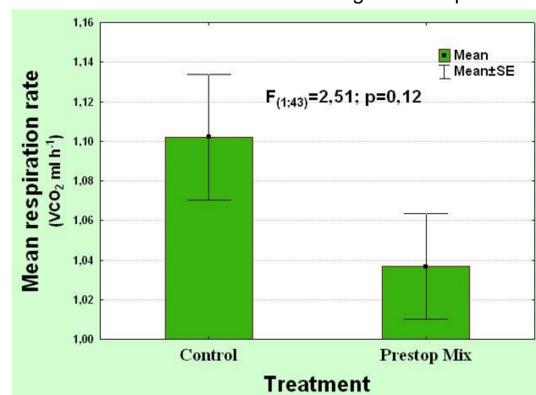


Fig.5. Mean respiration rate of untreated and treated bumble bees after contact with Prestop Mix.

CONCLUSIONS

- Using honey bees to disseminate *G. catenulatum* J1446 to strawberries for control of *B. cinerea* is effective in Estonian conditions.
- *G. catenulatum* J1446 doesn't have a negative impact on the respiration rate of bumble bees.
- This is a pilot study and further research is needed, since different climatic conditions may influence the development of the pathogen and the antagonist or influence the behaviour of honey bees.
- Using honey bees to disseminate *G. catenulatum* J1446 in the biocontrol of *B. cinerea* a promising alternative for estonian organic farmers and for use in organic and integrated pest management to gain effective control of grey mould in an environmentally friendly manner.