

**Bumble bees as vectors of the microbial antagonist
Clonostachys rosea for management of *Botrytis
cinerea* in wild blueberry**



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**WG2
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Control to Management

- Evolution of pest control:
 - Chemical pesticides to IPM
 - Eradication to Management
 - New Methods (SIR, Mating disruption, Parasites)
- Sustainability – naturally occurring agents



<http://haltonhelps.org/Egardening/DDT.jpg>

Insects as Vectors

- Malaria (ca. 1900), *Botrytis* (ca. 1935)
- Agricultural translocation coincidental



<http://www.wimbledon-bees.co.uk/images/bumblebee.jpg>



http://1.bp.blogspot.com/_KMIT-iVv-bo/Sbl_ixDtnzI/AAAAAAAABlw/OJSvlwfeTrc/s400/noble-rot.jpg



<http://www.tristaterestores.com/images/Types%20of%20Mold%20Images/Botrytis.jpg>

Bees as vectors of biopesticides

- Managed pollinators

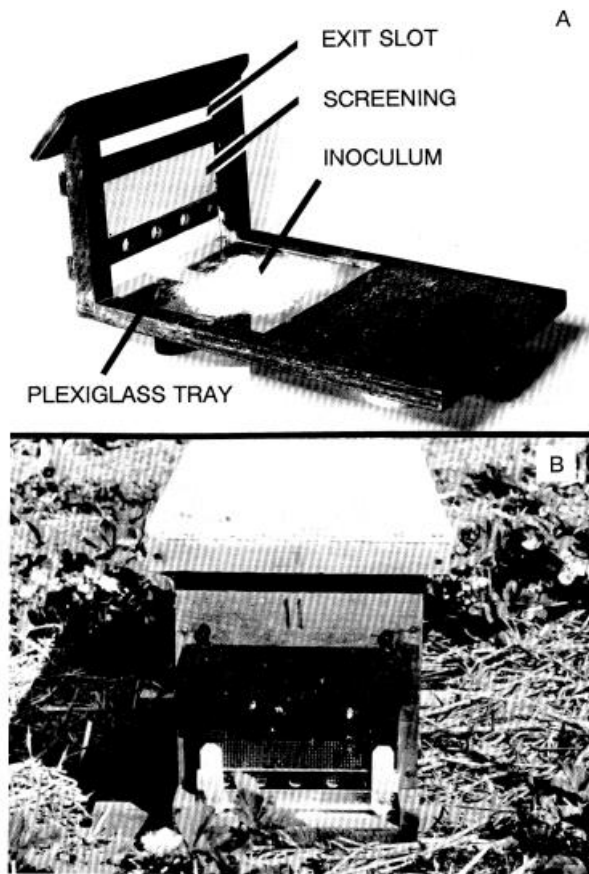


Figure 1. An inoculum disseger shown A) separately and B) attached to a half-sized hive in a strawberry plot.

Peng, Sutton and Kevan (1992)



Shipp (2009), based on Yu & Sutton (1997)

Does it work?

- Efficacy for disease and pest control in:
 - Greenhouse (tomato and sweet pepper, strawberry)
 - Field (strawberry, raspberry, rabbit eye blueberry, oilseed rape)
 - Apples
- Benefits:
 - Concurrent pollination/disease management
 - Target delivery/minimize waste

Wild Blueberry

- Economically important
- Dependent on pollinators (mostly managed)
- Sensitive habitats
- Affected by variety of diseases
- 3 commonly used pollinators



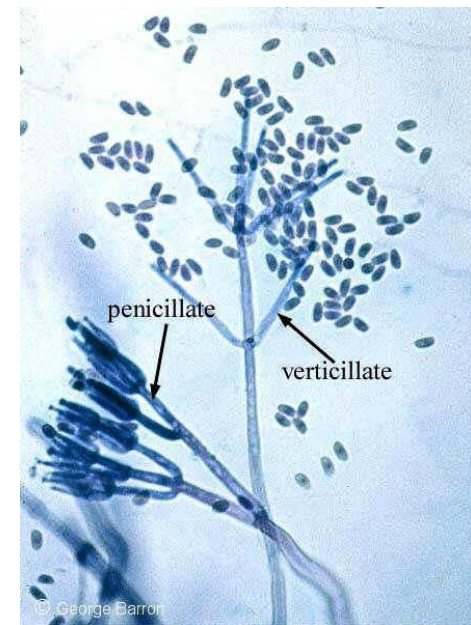
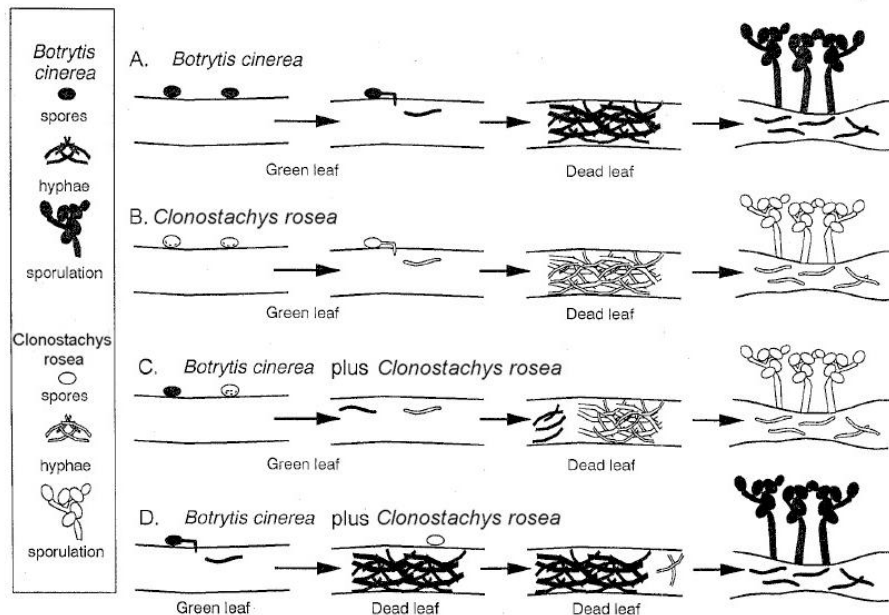
Eastern Bumblebee (*B. impatiens*)



- Comparable pollination (despite size)
- Activity in inclement weather
- Sonication

Clonostachys rosea

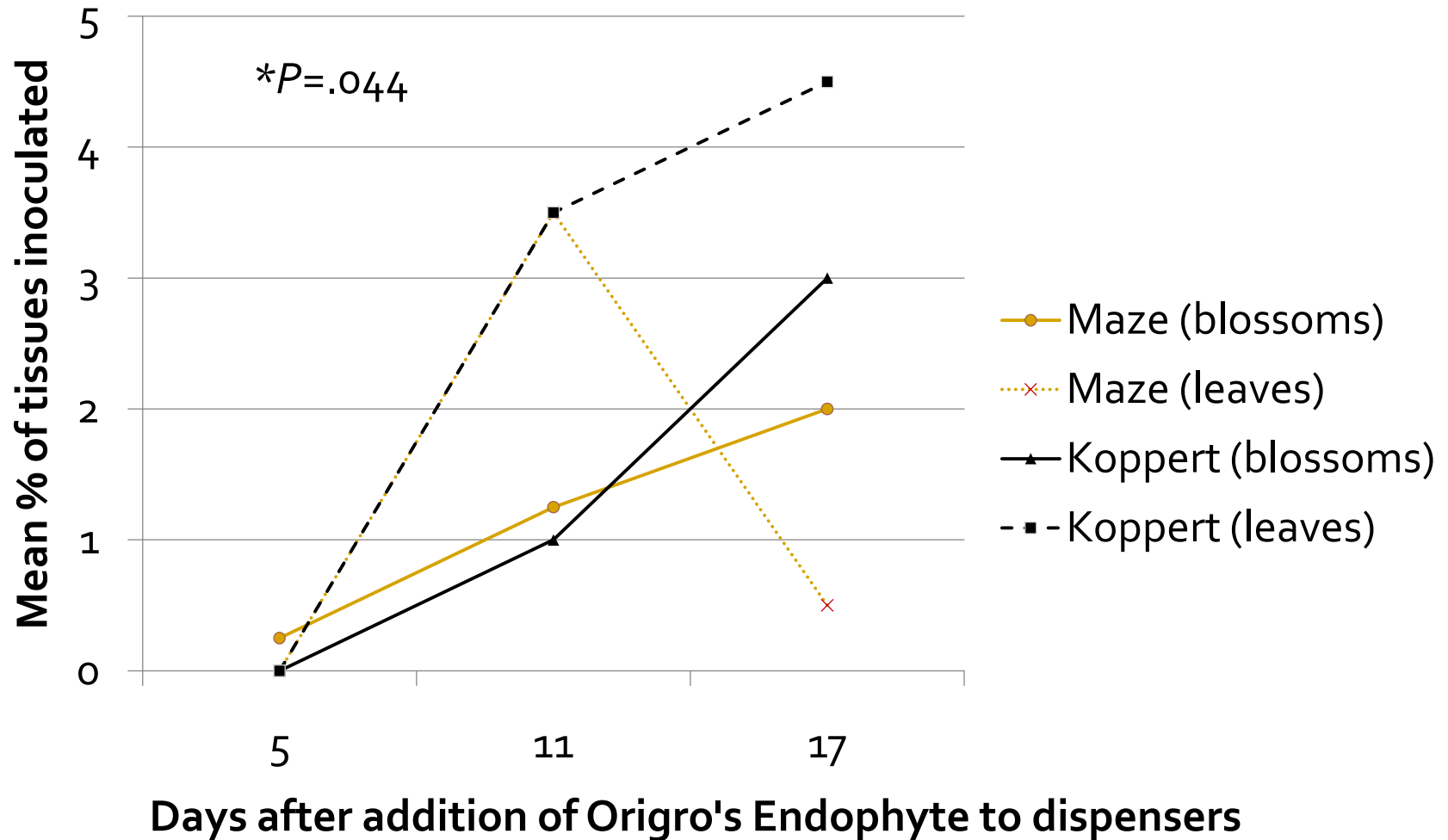
- Produced by a variety of biocontrol companies
- Previously *Gliocladium roseum* (many syn.)
- Shown to be effective against *Botrytis cinerea*
- Limited evidence of entomopathogenicity



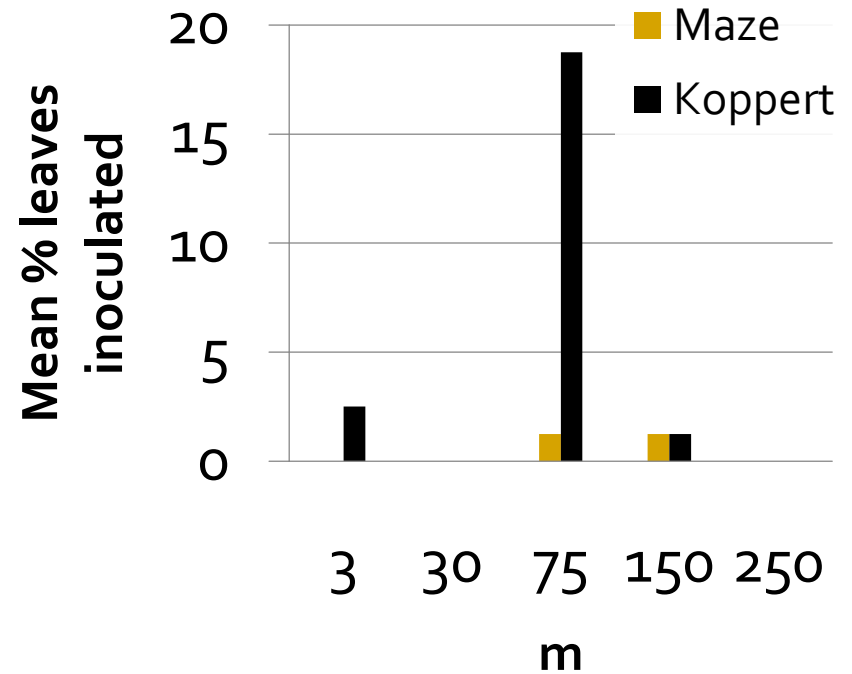
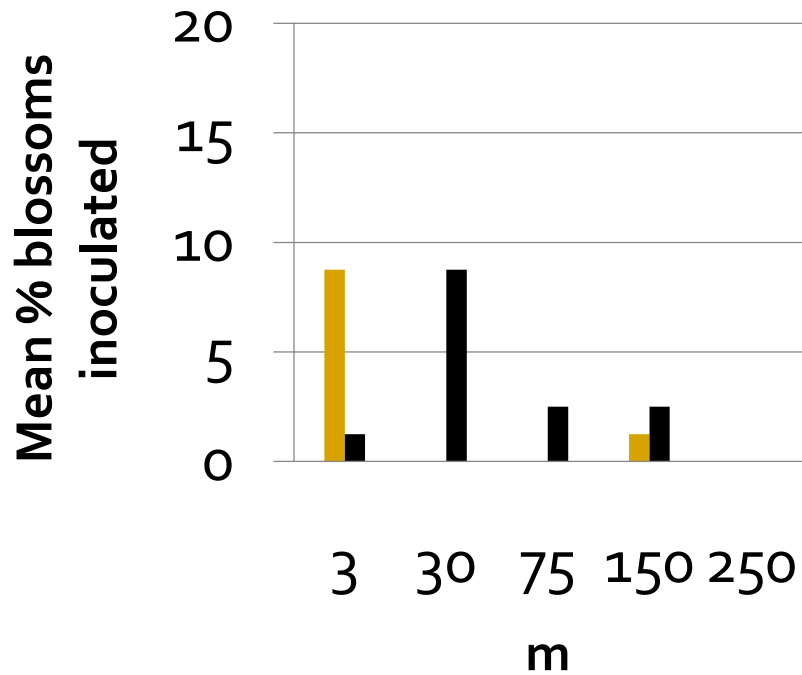
M.Sc. Research Objectives

1. Effects of dispenser design on product distribution, bee foraging and behaviour
2. Evaluation for effective *Botrytis* management in the field
3. Determine capability of agent to grow in wild blueberry and in the presence of common fungicides

Preliminary Results

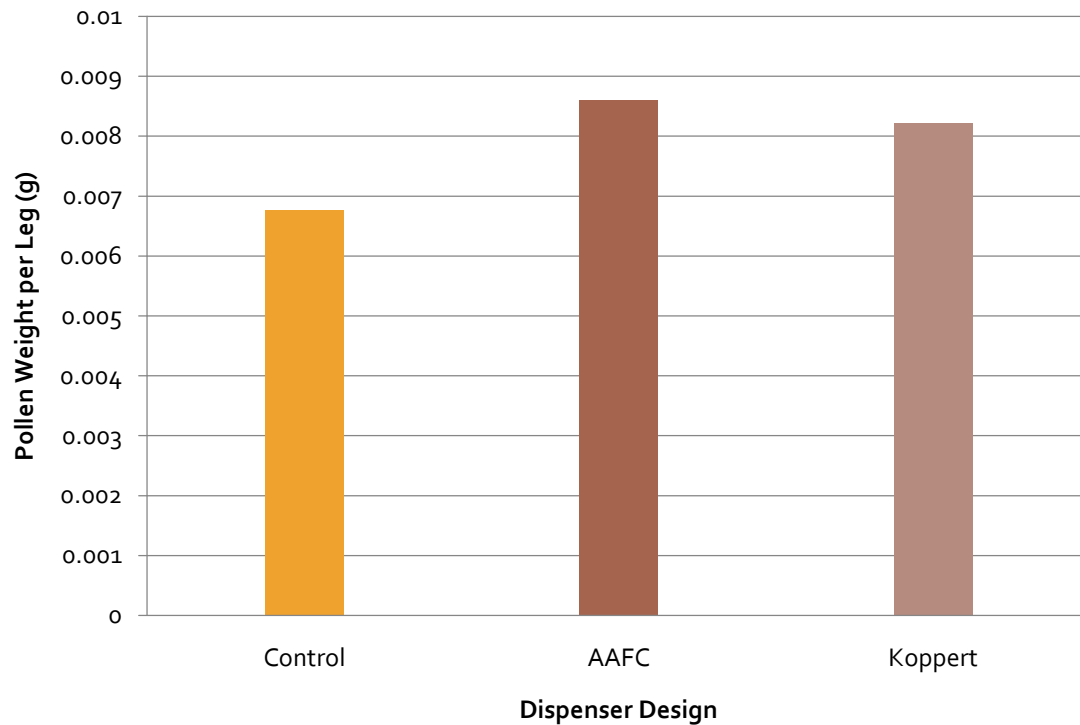


Distribution by Distance – Day 17



Foraging

- Foraging: Pollen Weight (n=8)



Behaviour

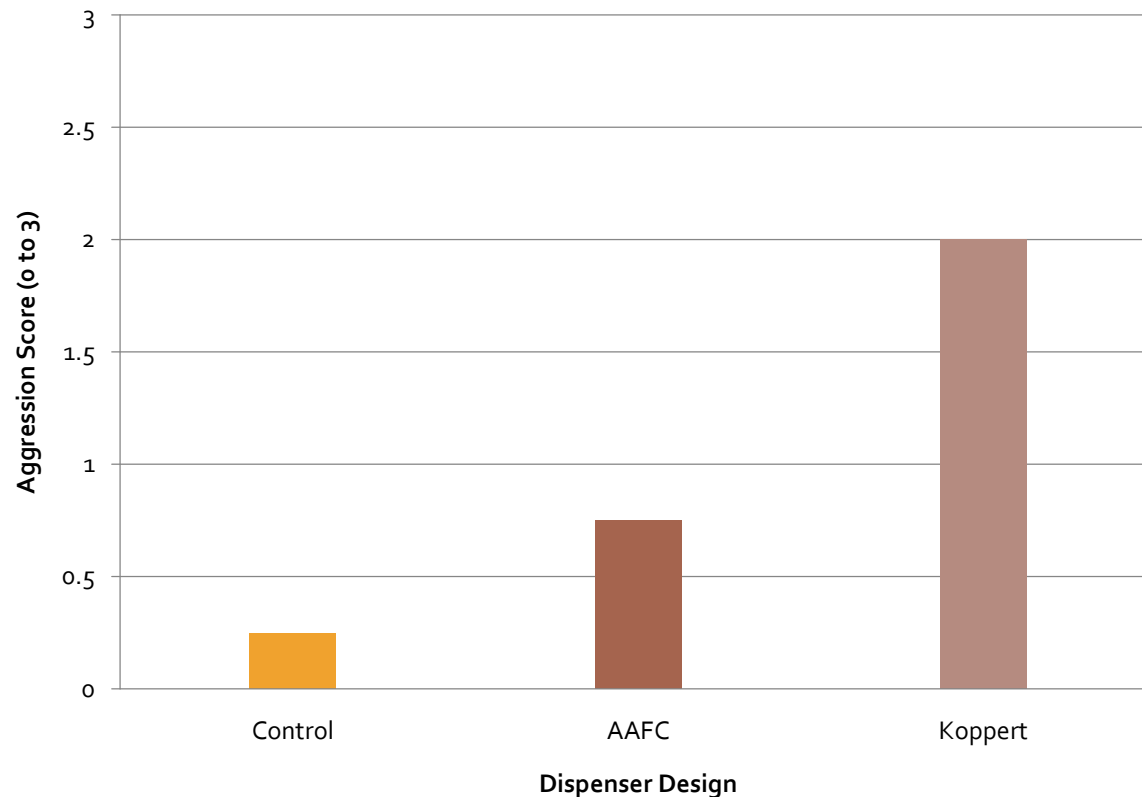
■ Agnostic Behaviour during product re-load

0= no aggression

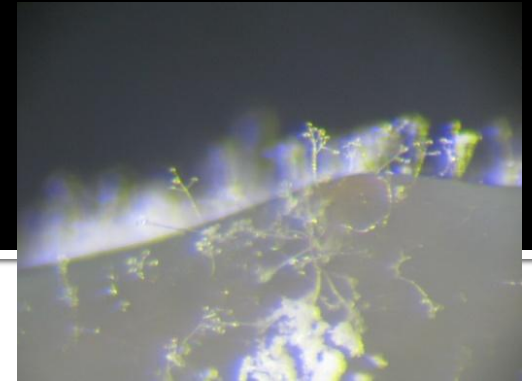
1=limited aggression

2=moderate aggression

3=extreme aggression



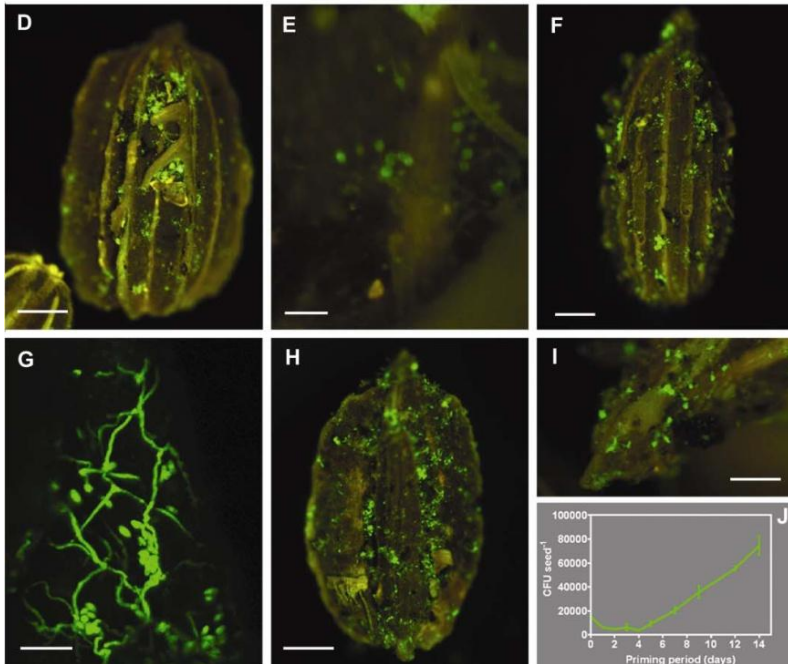
Experiments for 2011



- Susceptibility of *C. rosea* to fungicides used in Wild blueberry (*in vitro*)
 - Media amended with field rates of Switch[®] (cyprodinil/fludioxinil), Pristine[®] (pyraclostrobin/boscalid), and Captan
 - Plate serial dilutions and compare Colony-forming-units

Greenhouse Experiment

- Colonization of *V. angustifolium* by *C. rosea* in Greenhouse



- Colonization assumed (Verma *et al.* 2006)
- 3 year old *V. angustifolium* in 3" pots (4 reps)
- Spray to drip

Field Experiments 2011



- Field-cages
 - Maintain pollinator density, consistent disease pressure (1×10^7 spores), 2 dispenser designs
 - *Botrytis cinerea* – leaves/berries at harvest, yield
 - Handling time – 3 bees/hive, first 5 flowers

Field continued...

- Separate hives
 - Various dispensers (3-4)
 - Compare preening frequency, biocontrol loads (CFUs), and distribution on bees exiting hive
 - Timing of experiment flexible

