Update on microbial control of arthropod pests of strawberries

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Available microbial pesticides

- *Beauveria bassiana* strain GHA
  - BotaniGard 22 WP (2X10^{13} viable conidia/lb)
  - BotaniGard ES (2X10^{13} viable conidia/qrt)
  - Mycotrol-O ES (2X10^{10} viable conidia/g of ai)
- Soilborne fungus and pathogenic to several arthropod pests
- Can be used alone or in combination with other pesticides
- *Metarhizium anisopliae* strain F52 will be available in the near future

Objective

- Integrating microbial control with other pest management options to
  - i) improve the pest management potential,
  - ii) reduce the usage of chemical pesticides and
  - iii) extend the life of available pesticides

Experiments conducted

- Endophytic colonization of *Beauveria bassiana* (strains GHA and SfBb1) and *Metarhizium anisopliae* (strains GmMa1 and F52) in greenhouse studies

- Using *B. bassiana* with reduced rates of chemical pesticides for lygus control in laboratory assays

- Field evaluation of *B. bassiana* for lygus, whitefly, thrips and aphid control

Endophytic colonization-*B. bassiana*

- **Objectives**
  - What is an ideal method of inoculation?
  - Does *B. bassiana* colonize strawberry plants?
  - If it does, how long does it persist in the plant?
  - Does the colonized fungus protect the plant from herbivore damage?

Endophytic colonization-*B. bassiana*

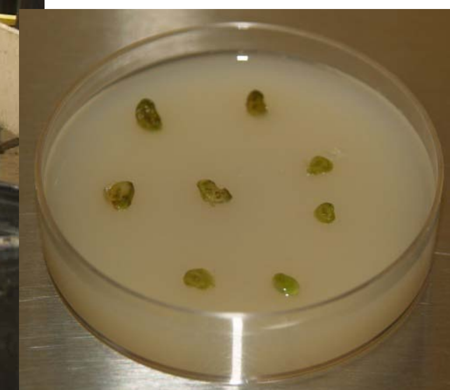
- **First experiment: Inoculation methods**
  - Mix 1X10^7 viable conidia/gram of vermiculite
  - Dip roots in a suspension of 10^7 conidia/ml
  - Apply a 100 ml suspension of 10^7 conidia/ml at the plant base

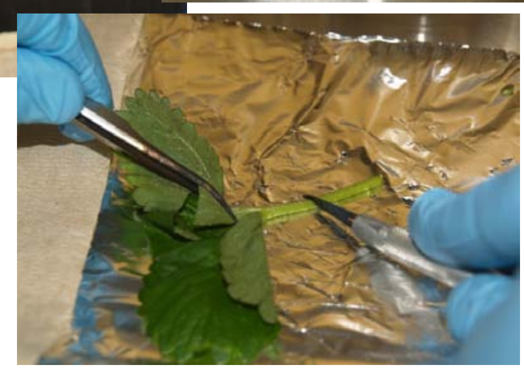
- **Fungal isolates**
  - Commercial isolate, GHA
  - California isolate, SfBb1

- **Sampling**
  - 1, 3 and 6 weeks after inoculation

Endophytic colonization-*B. bassiana*

- Rinsed, surface-sterilized and rinsed the plant material
- Plated plant tissue on selective medium
- Plated rinsate on medium to verify contamination



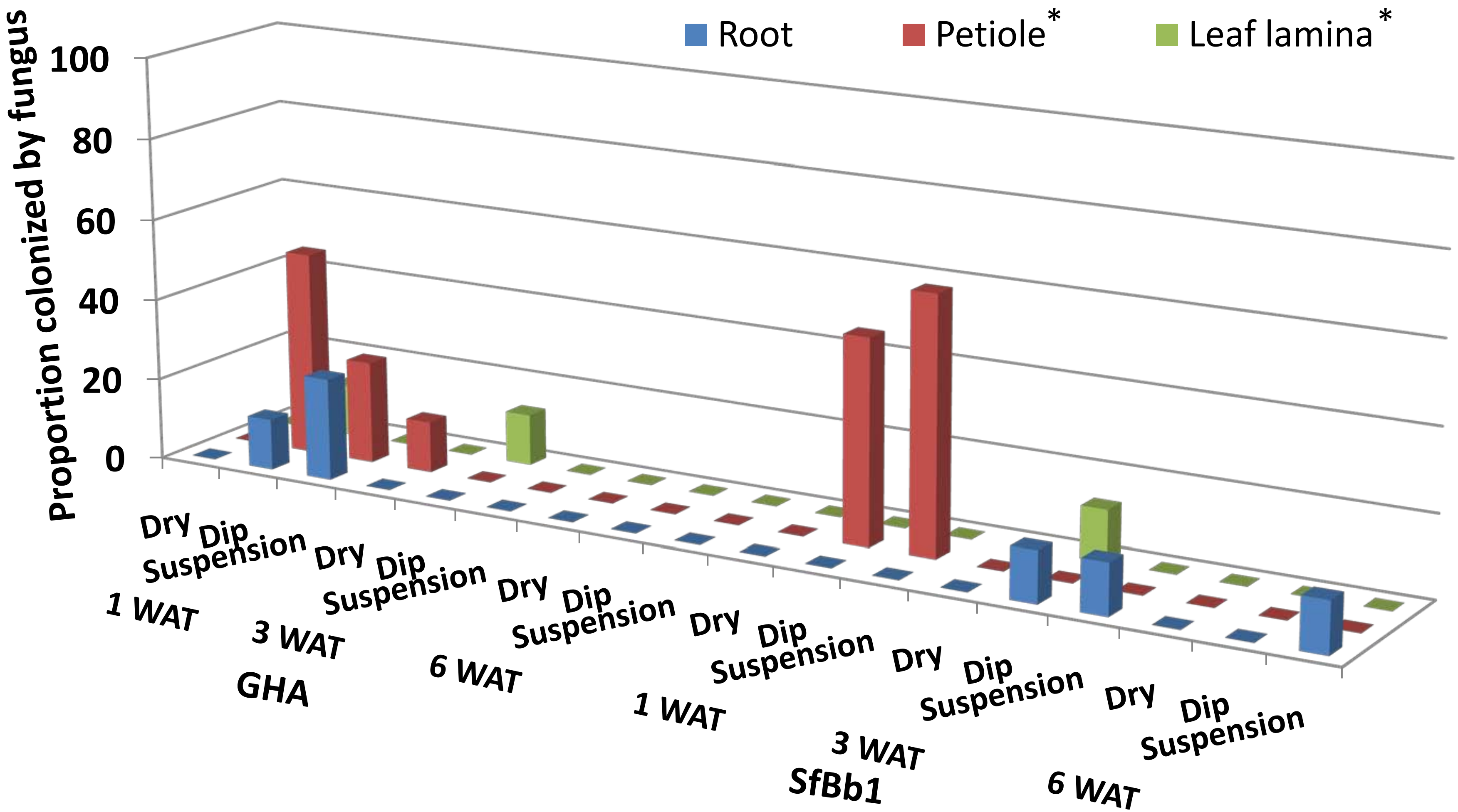


Endophytic colonization-*B. bassiana*

Emergence of colonized *B. bassiana* from treated plant tissue

No *B. bassiana* detected in controls

Endophytic colonization-*B. bassiana*

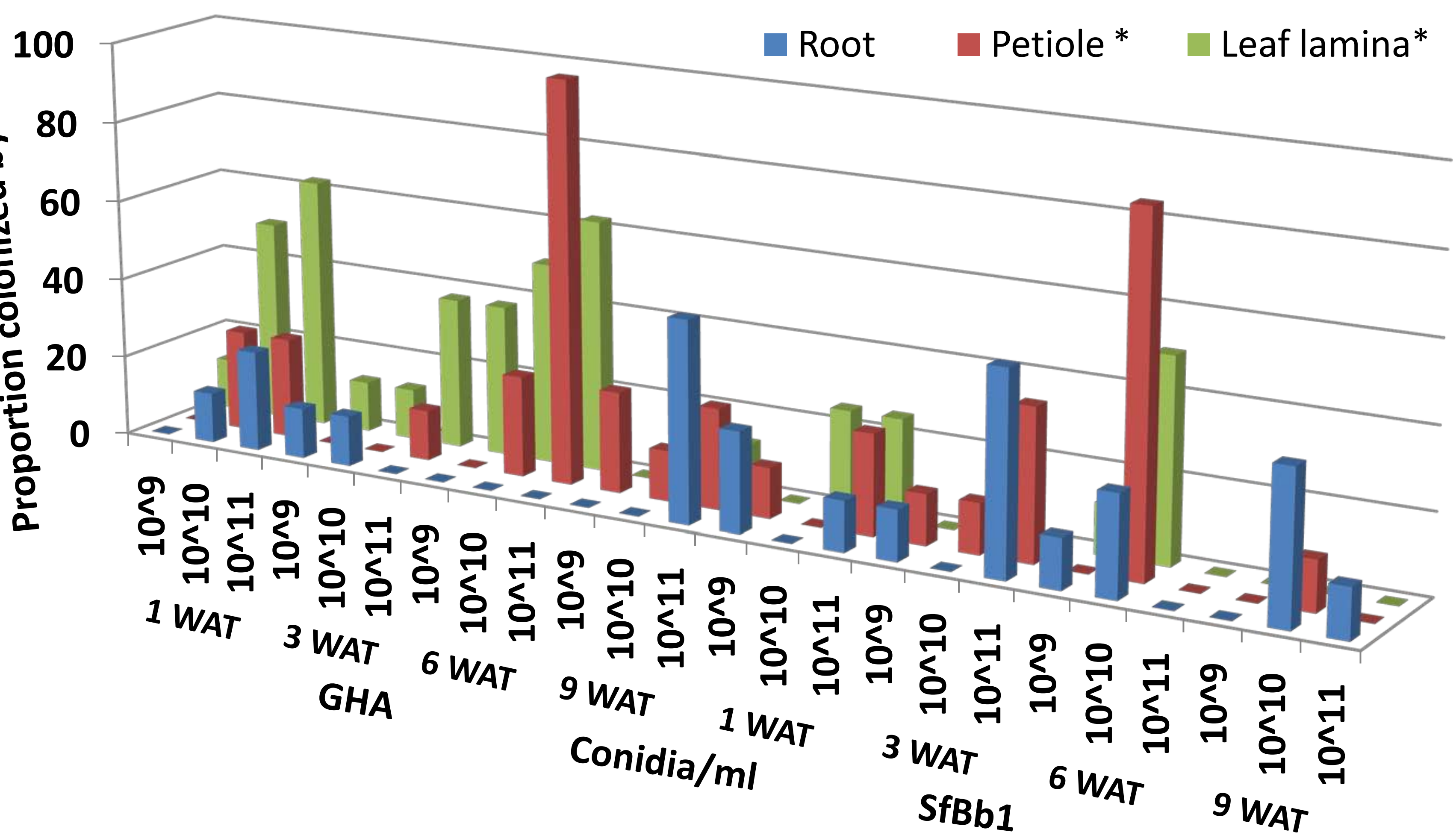


*Petioles include pedicels and leaf lamina includes sepals

Endophytic colonization-*B. bassiana*

- **Second experiment: Different concentrations**
  - 200 ml suspension of $1X10^9$, $1X10^{10}$ or $1X10^{11}$ conidia by applying at the plant base
- **Fungal isolates**
  - Commercial isolate, GHA
  - California isolate, SfBb1
- **Sampling**
  - 1, 3, 6 and 9 weeks after inoculation

Endophytic colonization-*B. bassiana*



*Petioles include pedicels and leaf lamina includes sepals

Endophytic colonization-*B. bassiana*

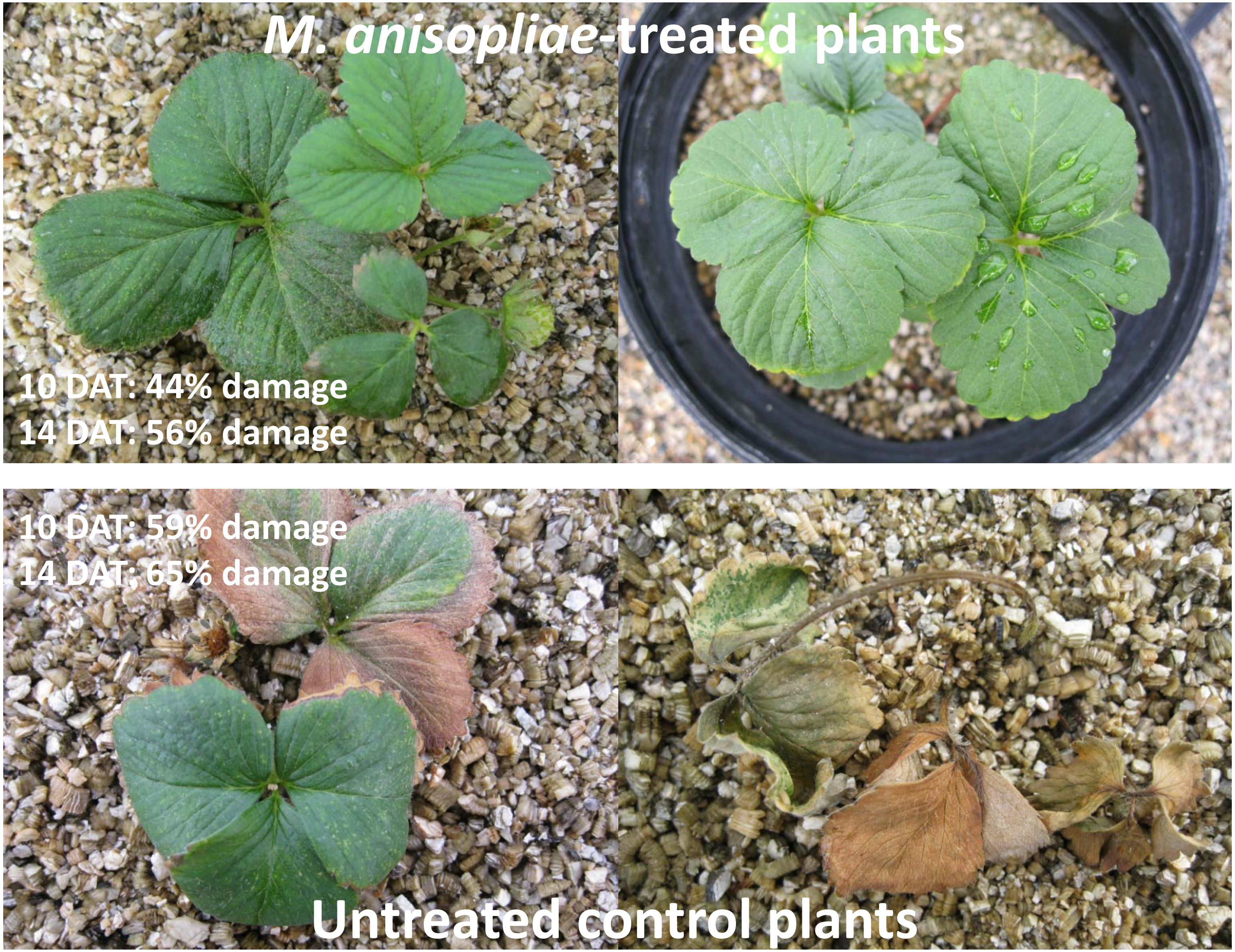
- **Conclusions**
  - *B. bassiana* successfully colonized various strawberry plant parts especially those preferred by lygus bug for feeding and oviposition.

  - Persistence of colonized fungus in the plant for 9 weeks after inoculation has a good potential for pest management.

Endophytic colonization-*M. anisopliae*

- **Conclusions**
  - It could not be detected in the strawberry plant tissue.
  - *M. anisopliae*-treated plants appeared to withstand spider mite damage to some extent.

Endophytic colonization-*M. anisopliae*

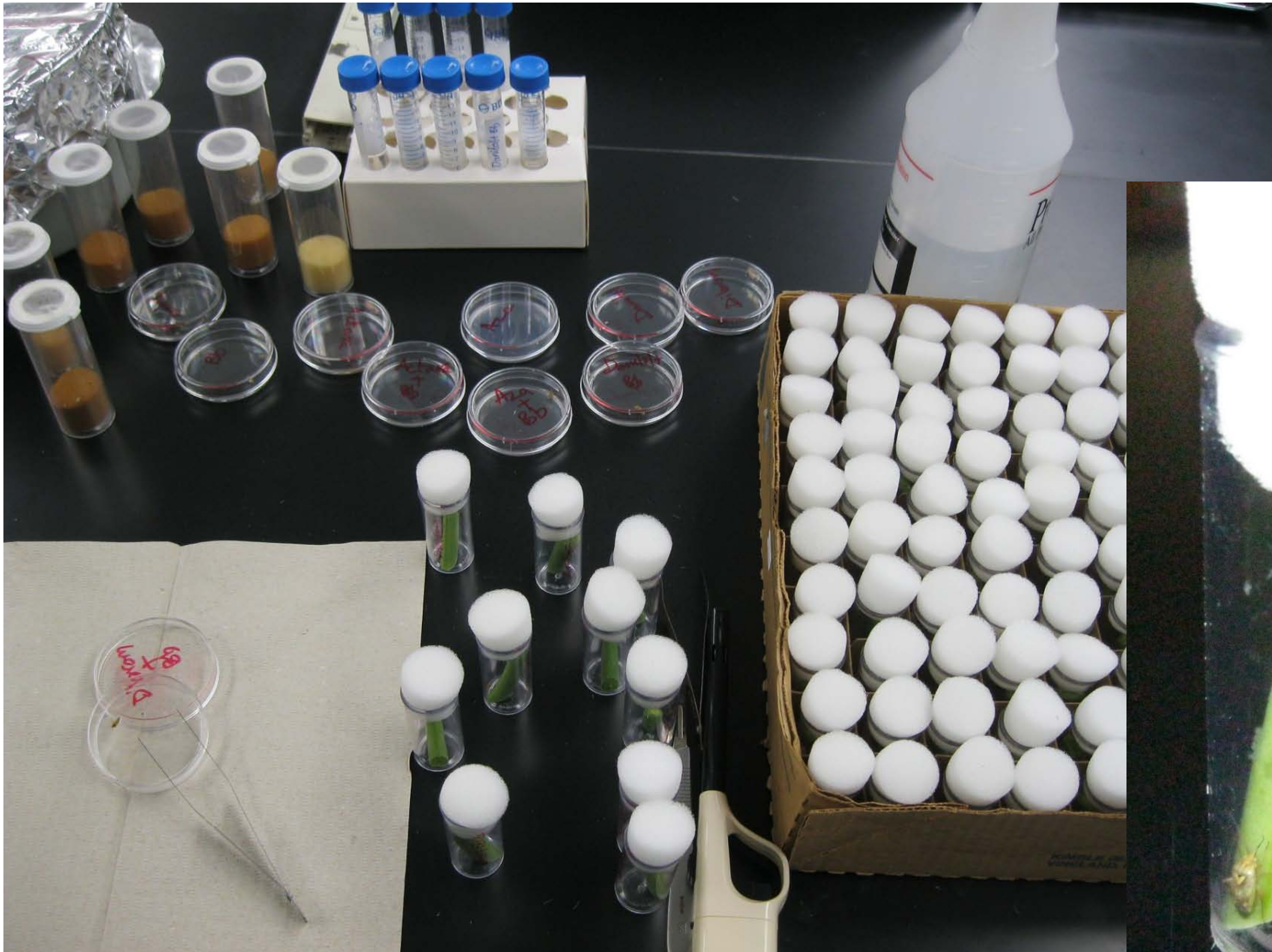


Synergy: fungus and chemicals

- **Objectives**
  - Improve the efficacy of *B. bassiana*
  - Reduce the usage of chemicals

- **Treatments**
  - 0.19 lb/ac or 1X10^7 conidia/ml of BotaniGard 22 WP (label rate 1/2-2 lb/acre)
  - 1/5 the label rate of
    - Actara (1 pt/ac),
    - Aza-Direct (2 qrt/ac),
    - Danitol (11 oz/ac) and
    - Dibrom (1 pt/ac)

Synergy: fungus-chemicals vs. Lygus



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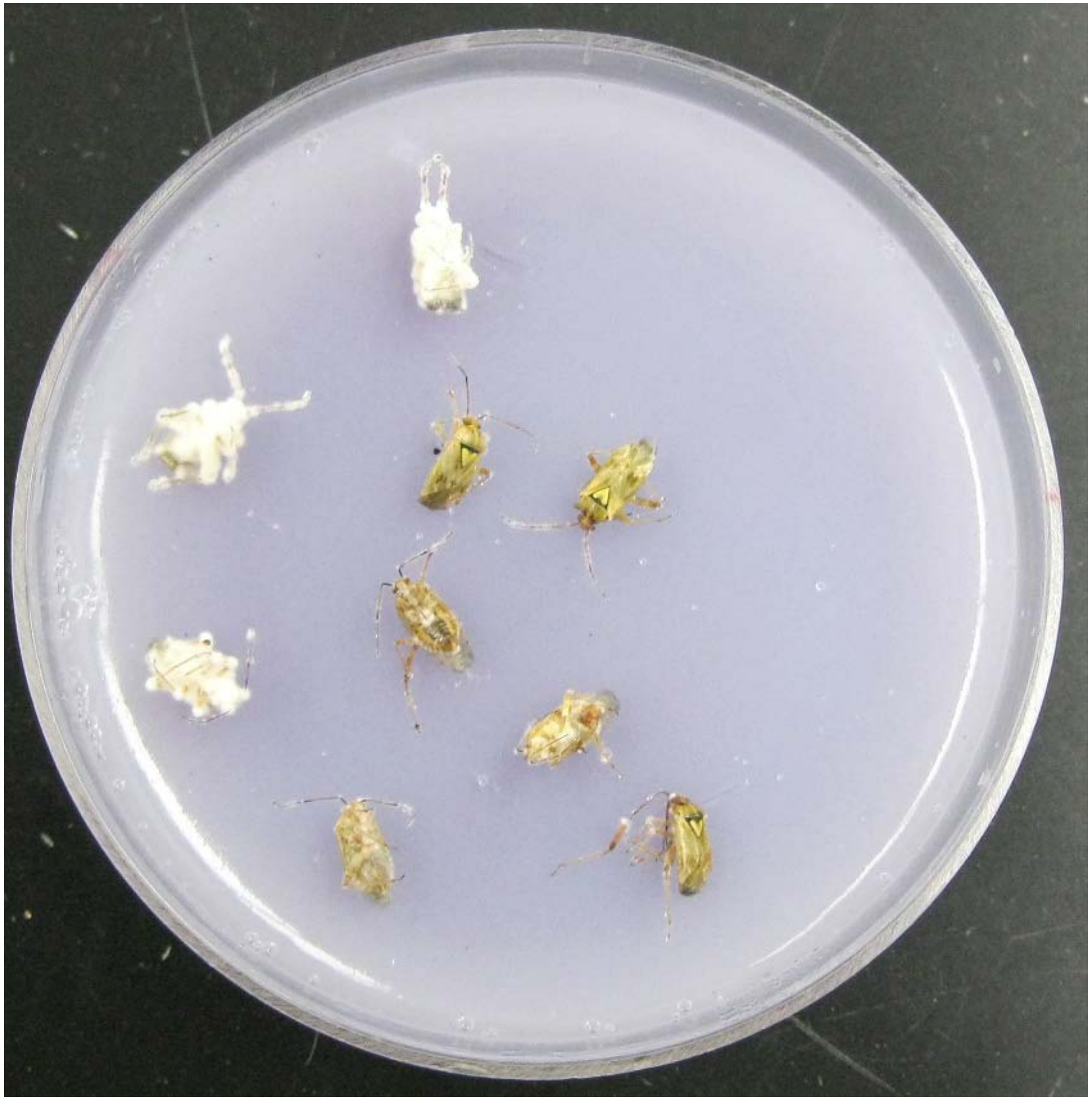

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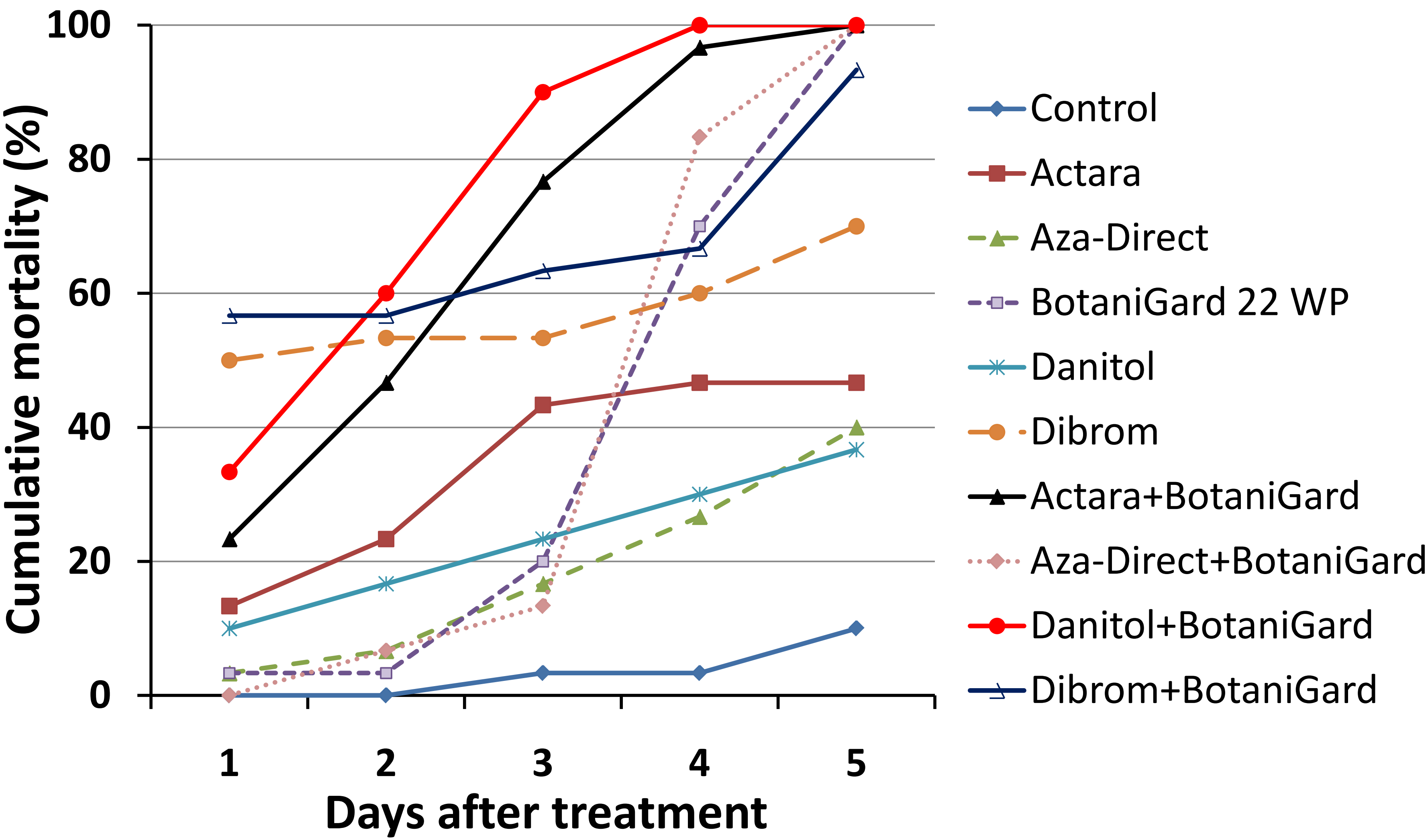


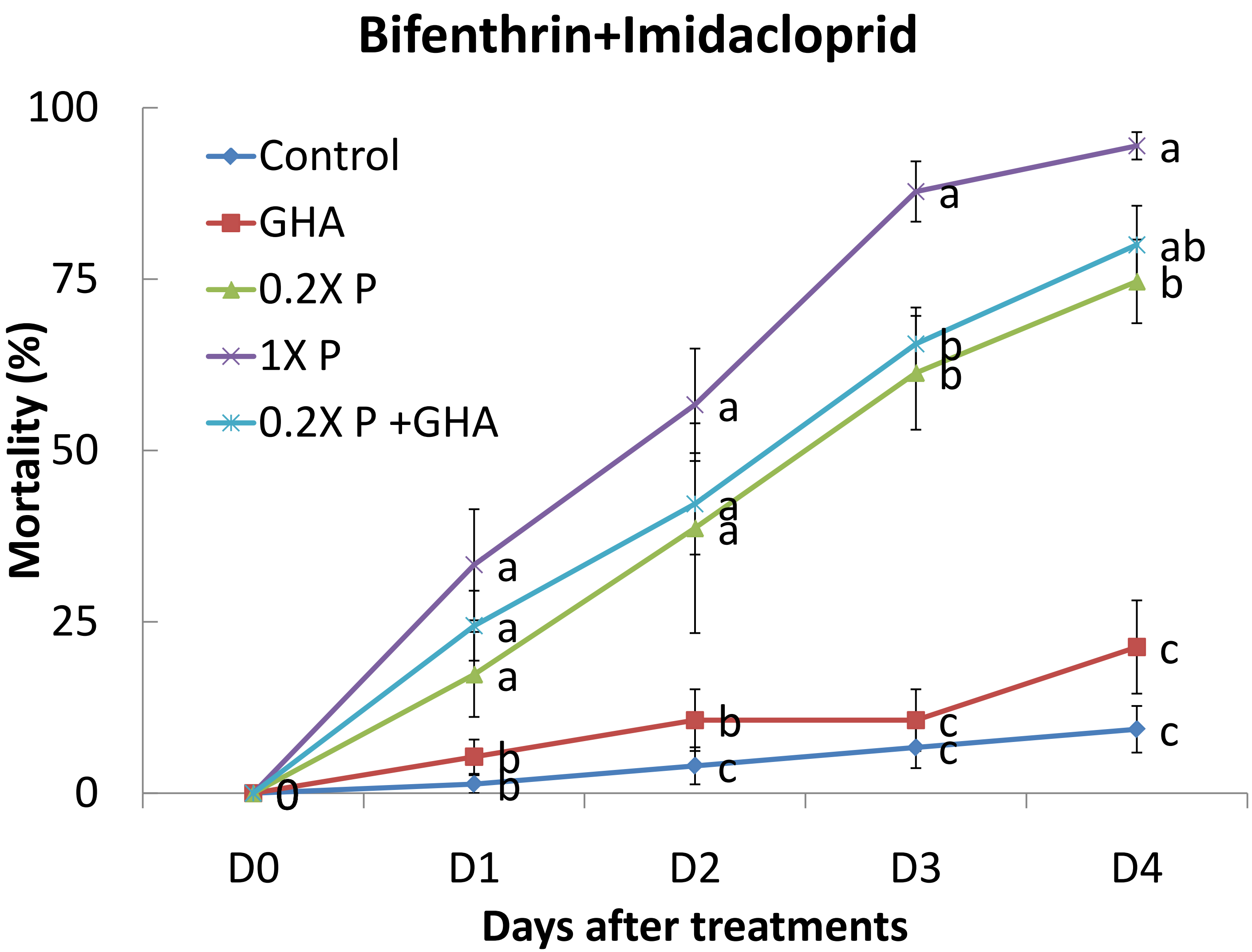
Synergy: fungus-chemicals vs. TSSM

- Collaborative study conducted by Dr. Jeong Jun Kim at the National Academy of Agriculture Science in South Korea

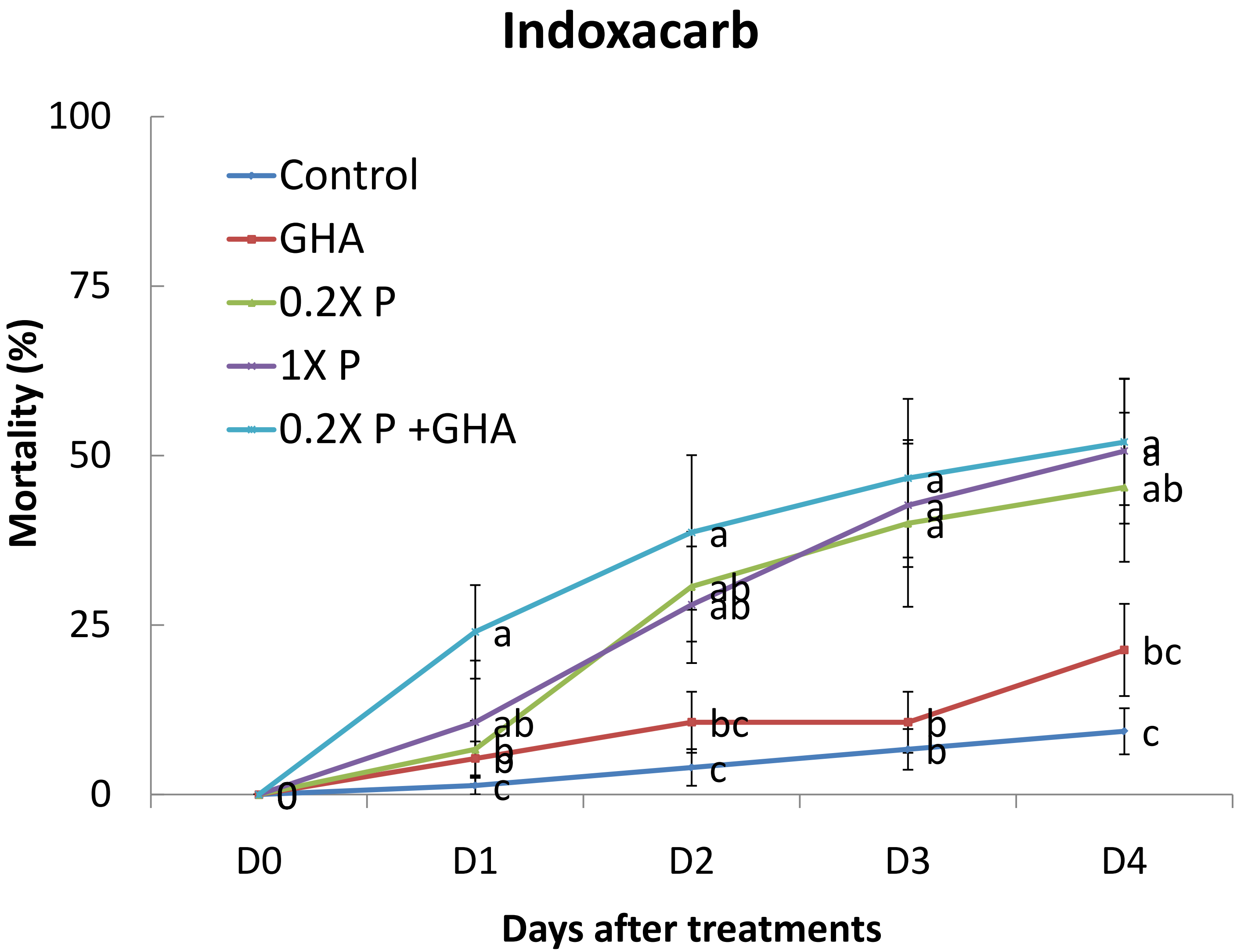
- Synergy between chemical *B. bassiana* and some miticides against twospotted spider mite on strawberries

- **Treatments**
  - *B. bassiana* 1X10^8 conidia/ml
  - Label rate and 1/5 the label rate of
    - Abamectin
    - Acrinathrin
    - Bifenthrin+Imidacloprid
    - Dinotefuran
    - Indoxacarb
  - 1/5 of the label rate of miticides + *B. bassiana*

Synergy: fungus-chemicals vs. TSSM



Synergy: fungus-chemicals vs. TSSM

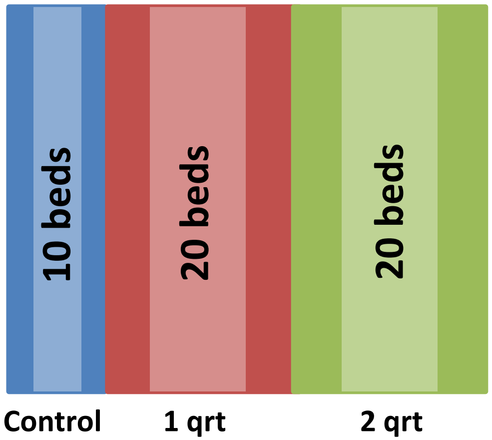


Synergy: fungus-chemicals vs. TSSM

- **Conclusions**
  - Laboratory studies indicate that there is a synergy between *B. bassiana* and certain chemical pesticides
  - Right combination can effectively manage pest populations and reduce chemical pesticide usage

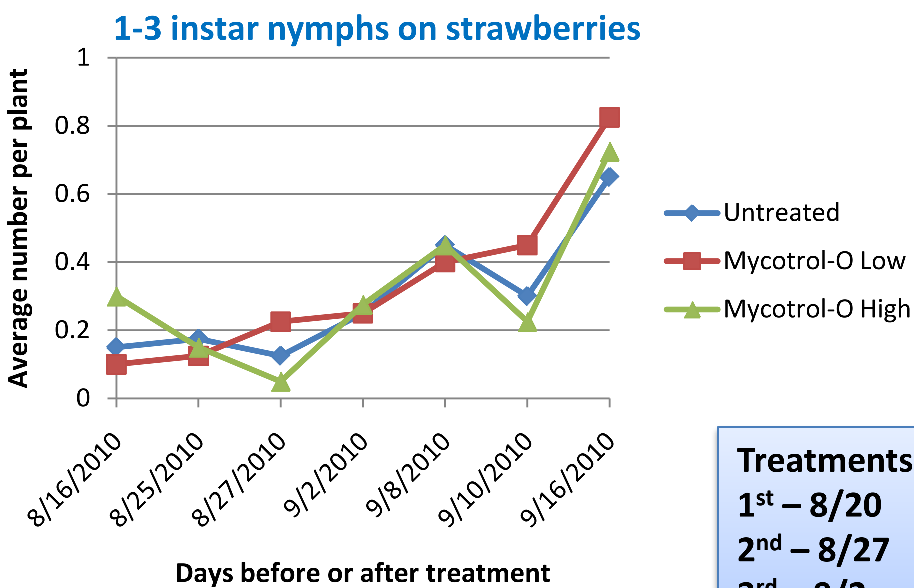
Field efficacy of *B. bassiana*

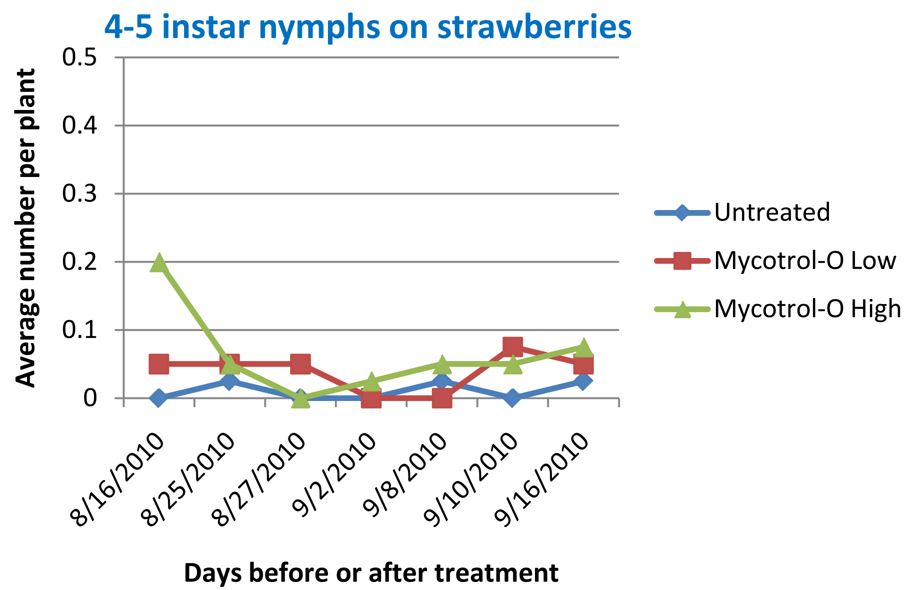
- **Treatments applied weekly for 4 weeks**
  - Untreated control
  - Mycotrol-O at 1 qrt/acre
  - Mycotrol-O at 2 qrt/acre



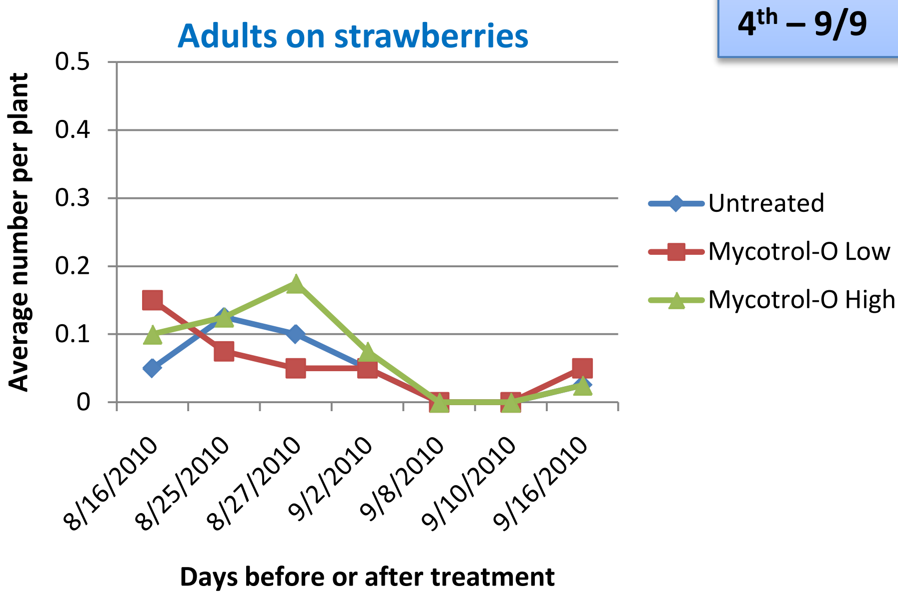
- **Sampling**
  - Untreated control – 40 plants from the middle 4 beds
  - Mycotrol-O at 1 qrt/acre – 40 plants from the middle 10 beds
  - Mycotrol-O at 2 qrt/acre – 40 plants from the middle 10 beds

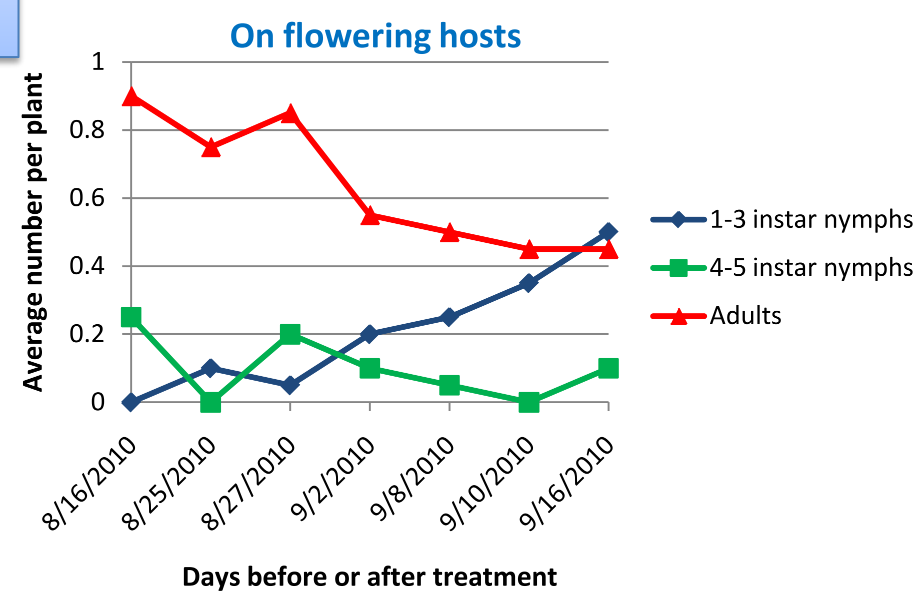
Field efficacy of *B. bassiana*-Lygus



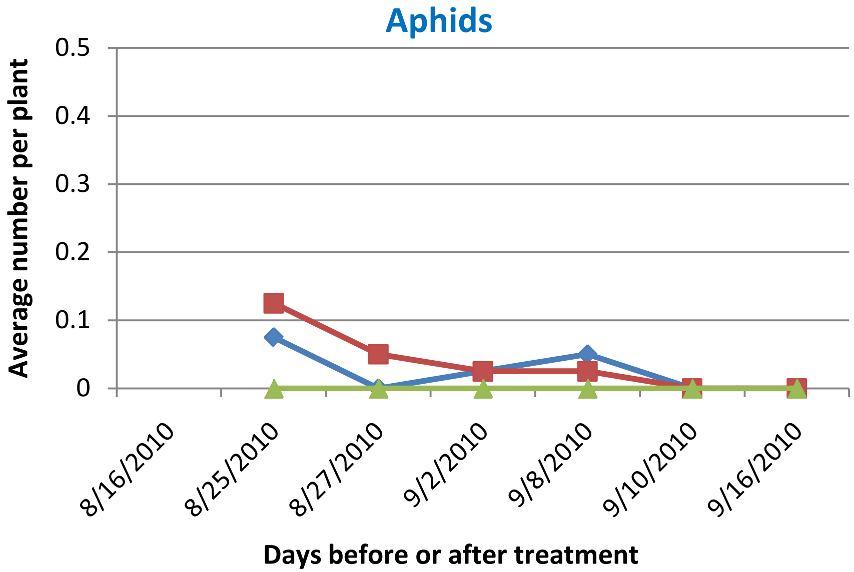


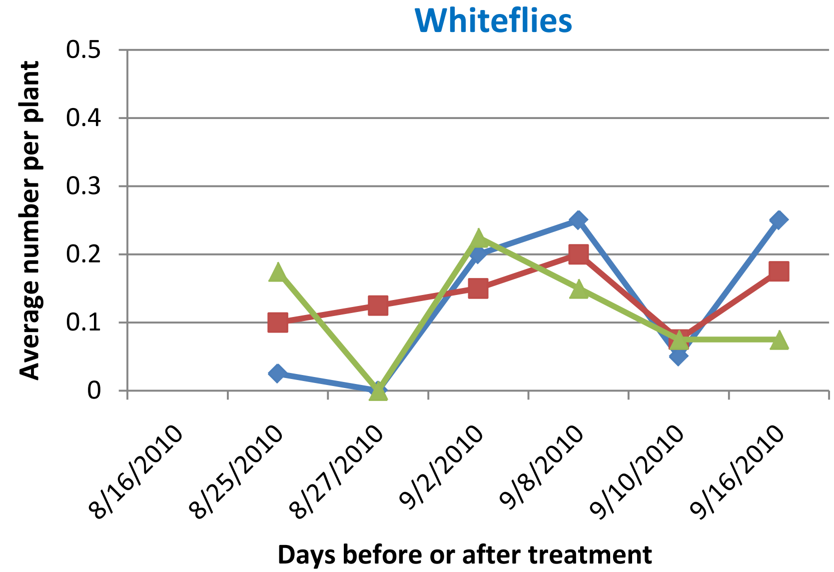
Treatments
1st – 8/20
2nd – 8/27
3rd – 9/2
4th – 9/9





Field efficacy of *B. bassiana*





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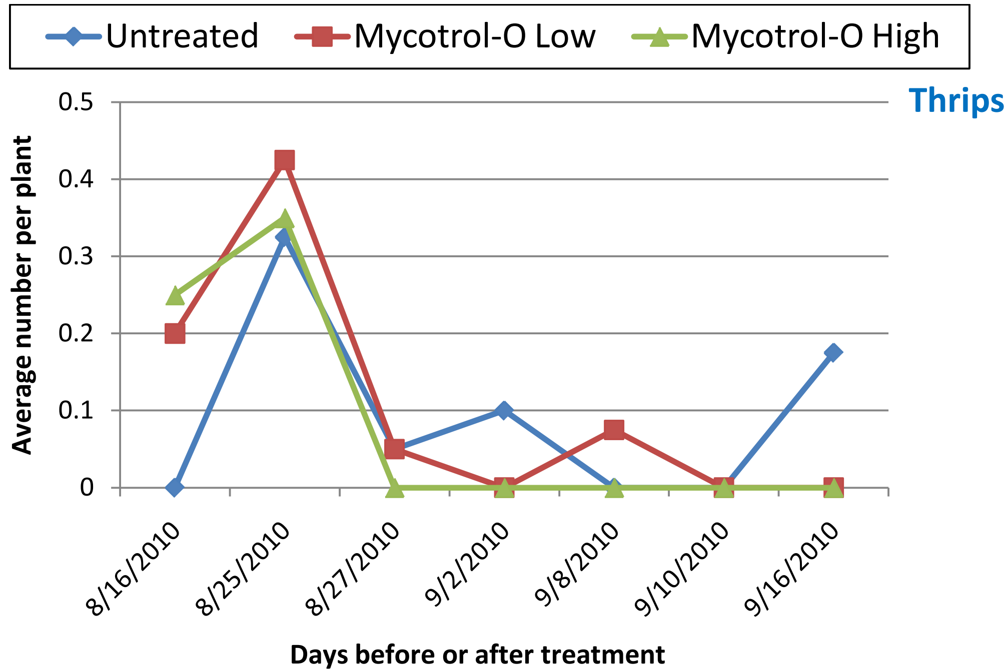

Field efficacy of *B. bassiana*

- **Observations**
    - Mobility of lygus adults
    - Strawberry canopy environmental conditions on inoculum persistence
    - Seemed to be a reduction in lygus adults, whiteflies and thrips from *B. bassiana* treatment

Experiments planned

- Use *B. bassiana* and Rimon for controlling adult and immature lygus
- Use *B. bassiana* and reduced rates of chemical pesticides
- Evaluate arthropod pest control potential with endophytically colonized *B. bassiana*
- Evaluate plant pathogen control with *B. bassiana* colonization

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Thank you

Questions?

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