Attract and Kill: A New Management tool to control orchard pests?

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Talk Overview:

- Why/How attract and kill?
- Case Study: Oriental Fruit Moth
- Future Directions/Targets?

Why Attract and Kill

- Mating disruption functions by distracting males for a limited time
- e.g. Codling moth: 3 hrs of mating time per night 4 day life span each false approach might use 1/12 of a male's mating lifespan
- Attract and kill uses **all** of a male's remaining mating lifespan

What is Attract and Kill?

Attract-and-Kill

Sex pheromones or other lure

+

Insecticide or Physical Trapping System

Current attract-and-kill technology for fruit pests:

sex pheromones

+

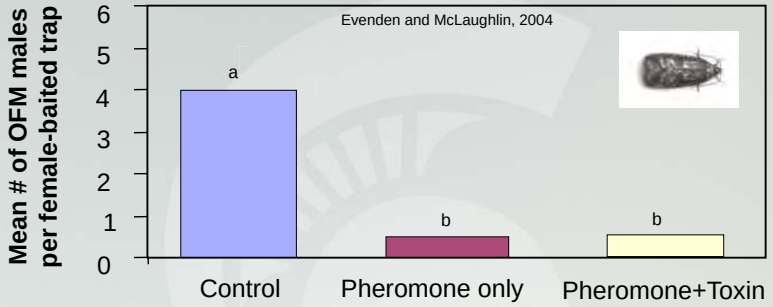
an insecticide

The Insect MUST contact the source/device:

- Plume has to attract insects from a distance
- Insect must land on and interact with the device
  - If the lure is too hot the insect may run
  - If the device is too small the insect may not touch it

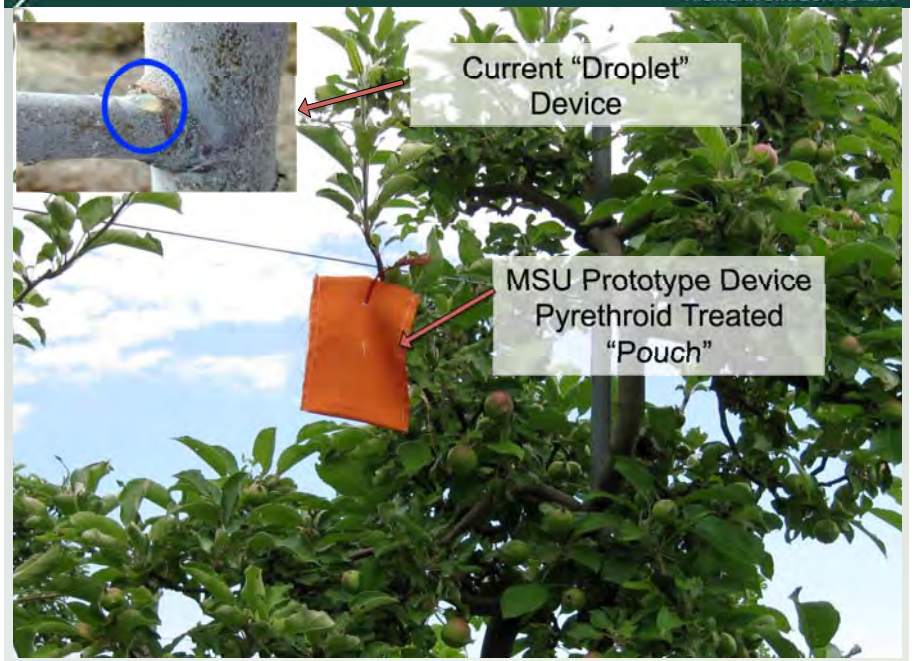
Current Attract and Kill Technology:

- Wax or polymer droplets with both pheromone and toxicant
- Moths have a very small surface to contact
- Moths have to contact sex pheromones and insecticides at the same time
- Increases the risk of moths overloading their sensory system and not touching the formulation



Unfortunately, Many A&K formulations developed to date have:

- Provided less or equivalent control compared to reservoir dispensers
- Many operate via disruption, not insecticide poisoning



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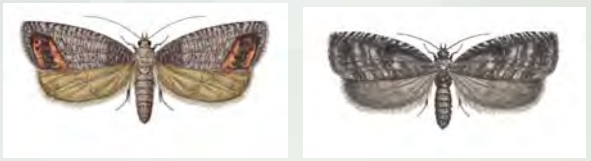
Case Study: Oriental fruit moth

- OFM is a relatively easy pest to disrupt
- Responds heavily to traps and low pheromone rates
- Lab work:
  - Will OFM contact our device sufficiently for knockdown?
  - Is there and optimum orientation of our device?
- Field work:
  - Will OFM contact device in the field?
  - Will our device "shut down" traps comparably to MD?



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Wind tunnel bioassay

- Attract-and-kill: 10X + lure
- Control: untreated surface + lure
- Male behavior compared

  Behavioral category: wing fanning, fly out (FO), upwind without source contact, source contact (SC), no response (NR)
- Duration of contact
- Moths contacted surface were recaptured for observation after 1 and 24 h

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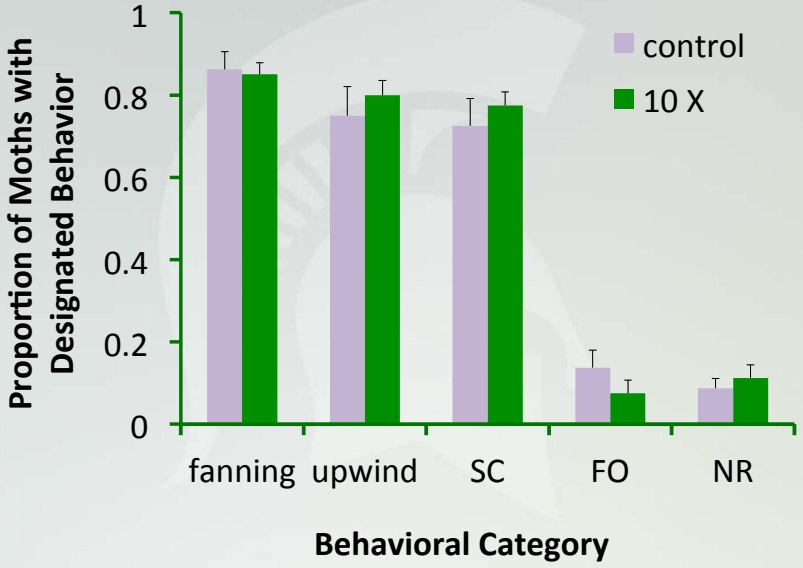
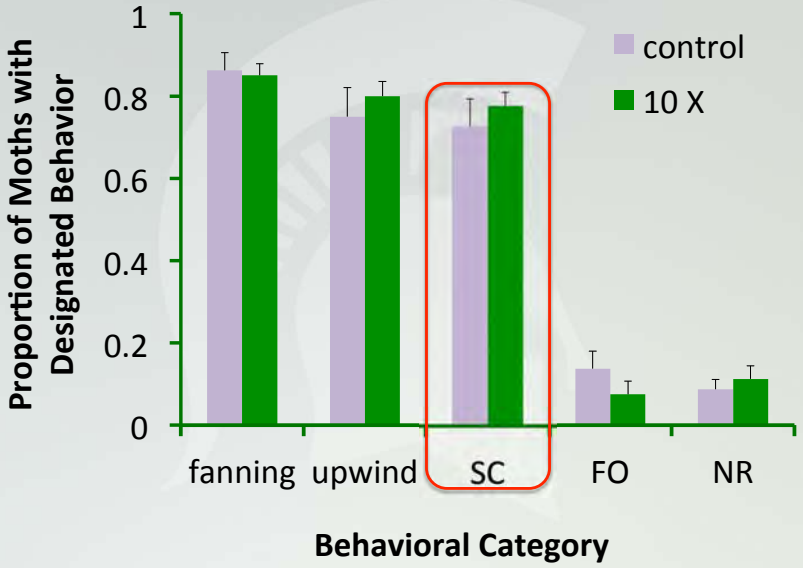
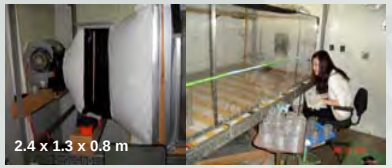
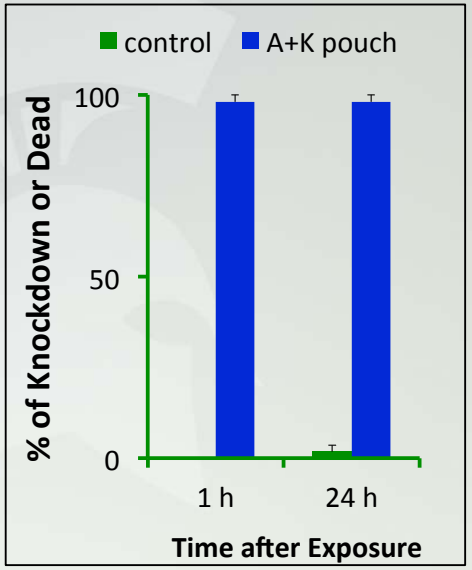


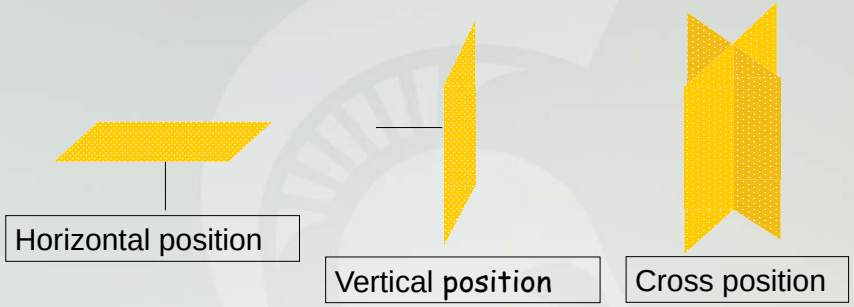


Wind tunnel Screening

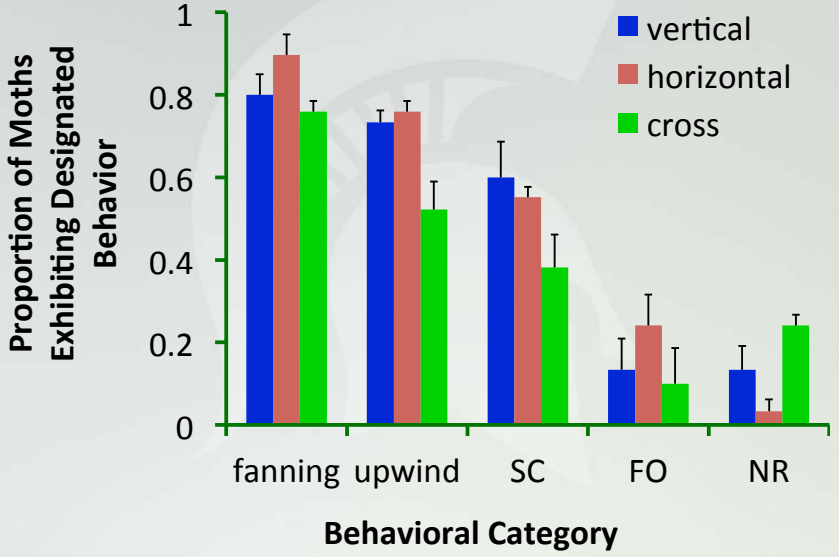


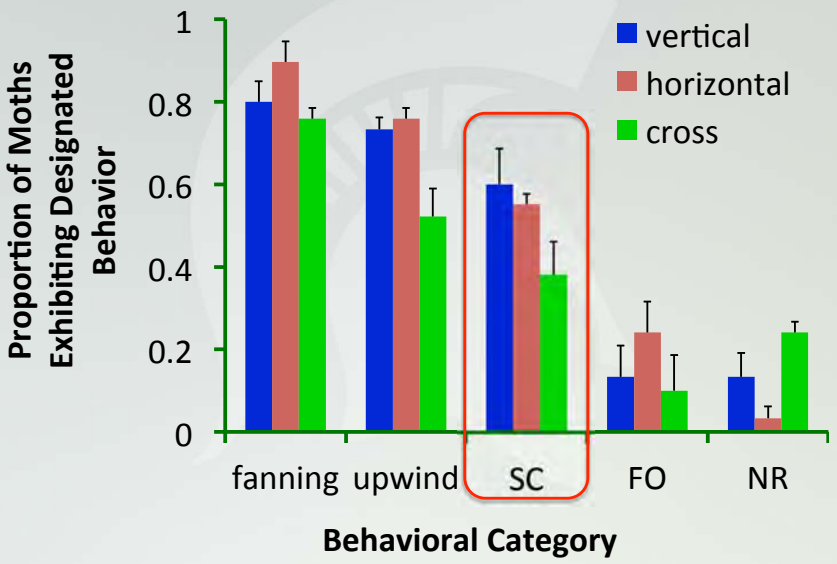


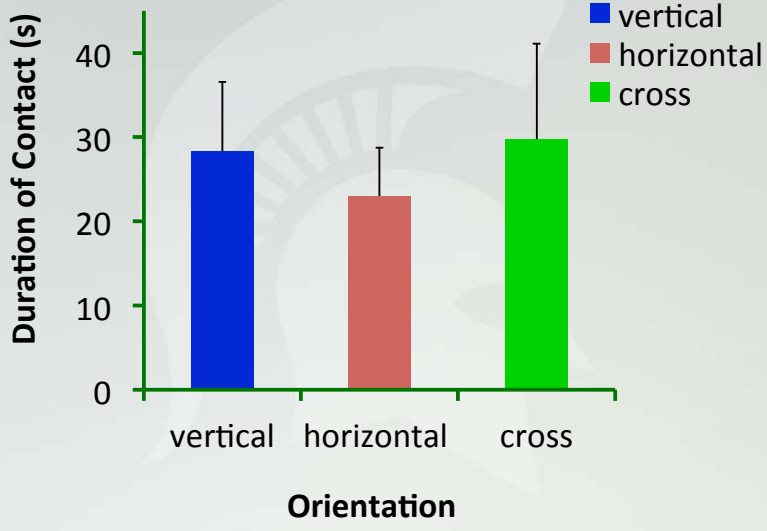
Spatial orientation: Three positions



- Male's behaviors were compared in the wind tunnel
- Duration of contact was also recorded

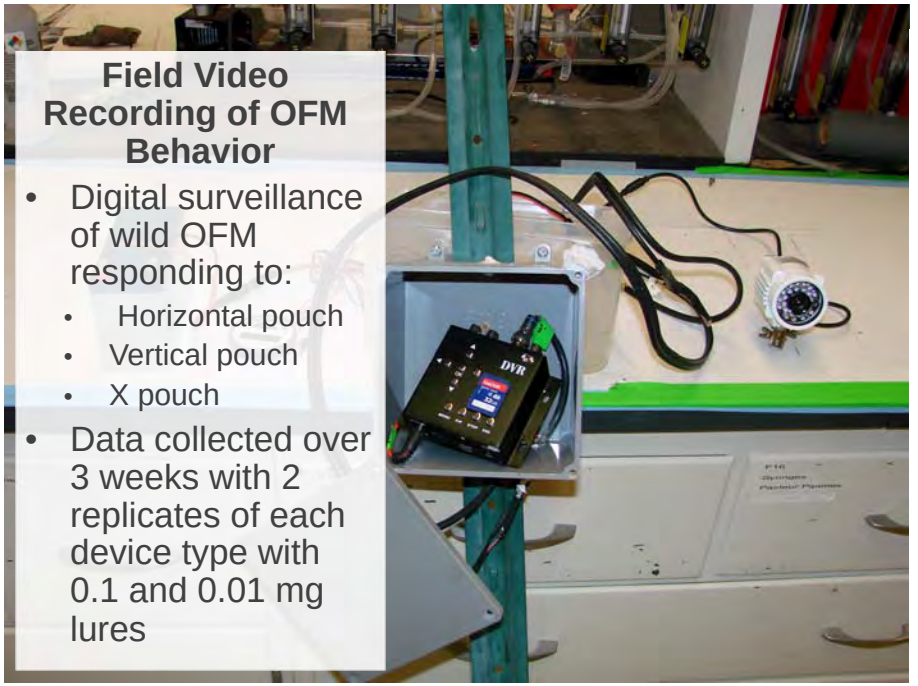






Lab Study Conclusions

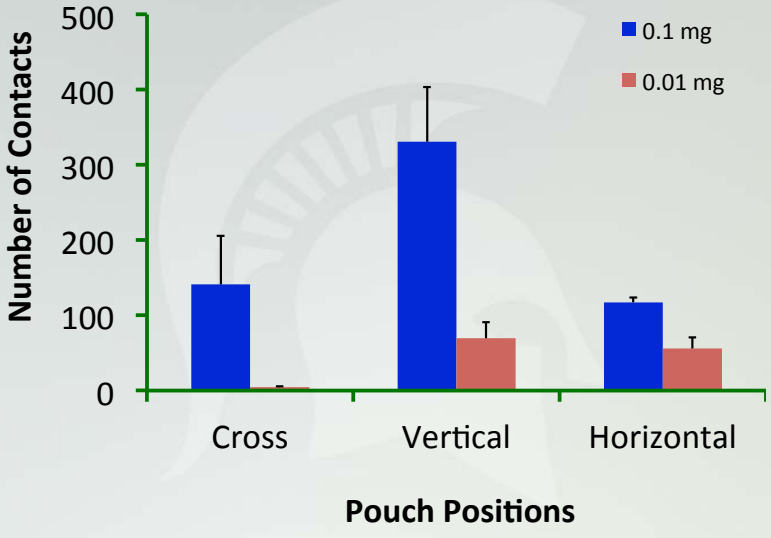
- Toxicant **is not** repellant
- Contact with our device results in near 100% mortality
- No difference in response based on device orientation

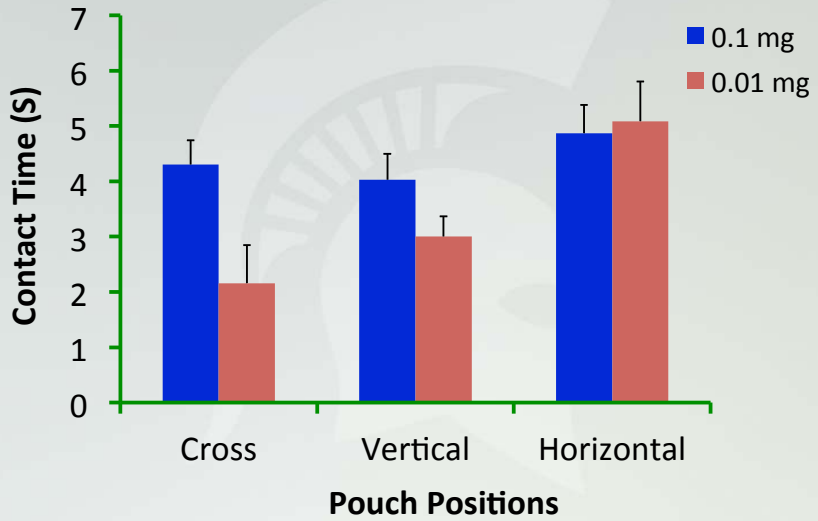


Field Video Recording of OFM Behavior

- Digital surveillance of wild OFM responding to:
  - Horizontal pouch
  - Vertical pouch
  - X pouch
- Data collected over 3 weeks with 2 replicates of each device type with 0.1 and 0.01 mg lures

Wild OFM on Vertical Device and 0.1 mg lure



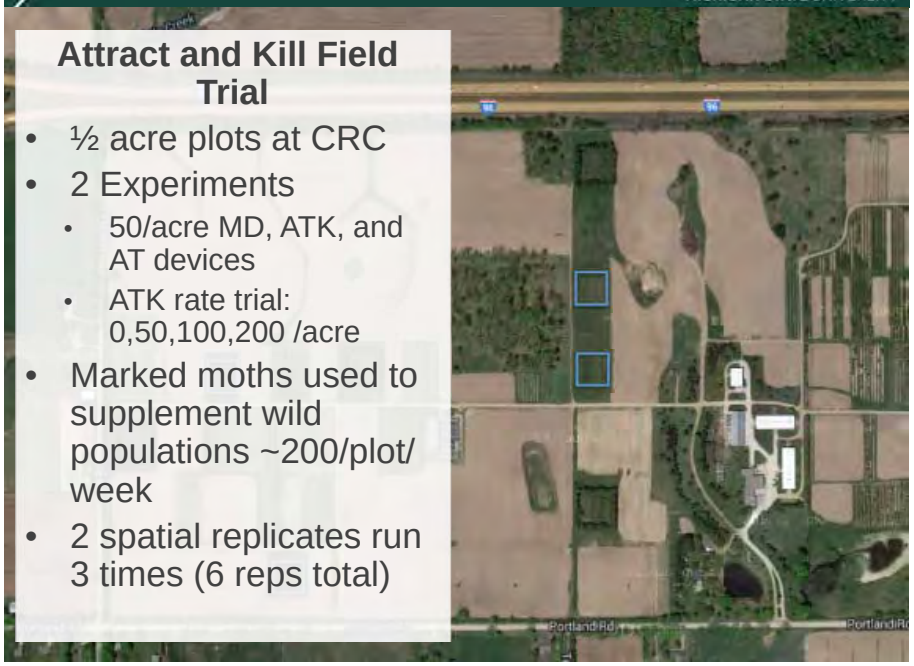


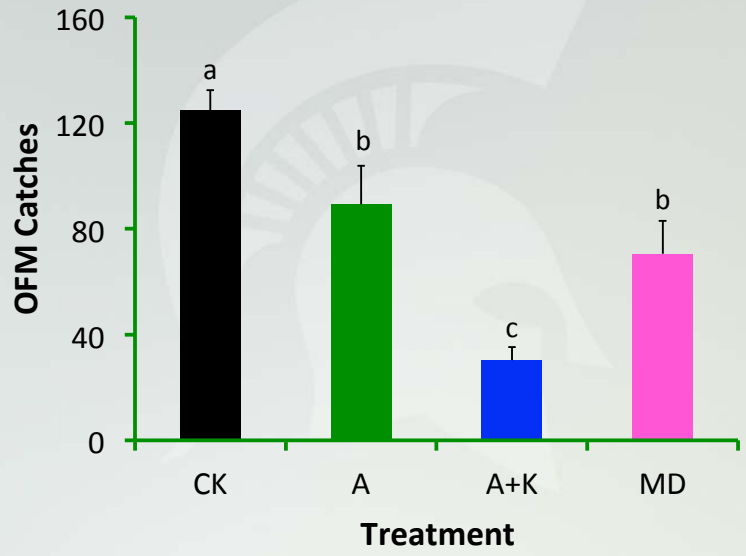
Video Study Conclusions

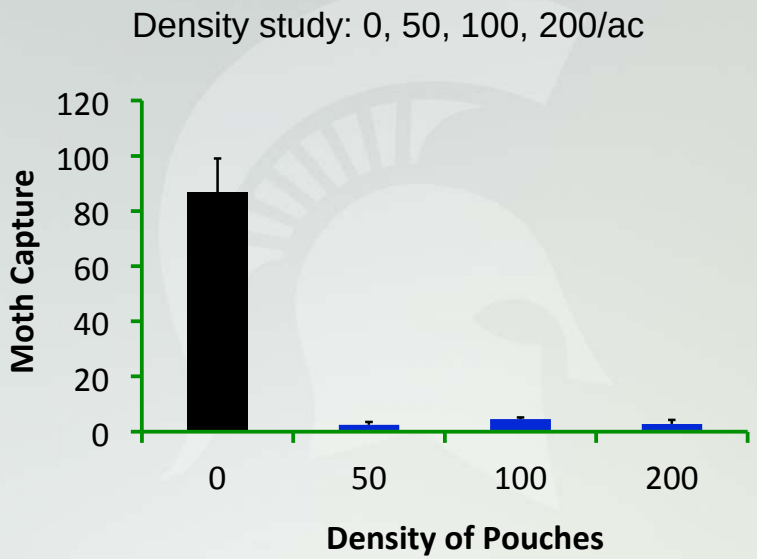
- Vertically oriented device provides the most source contacts
- 0.1 mg lure provided more contacts than 0.01 lure

Attract and Kill Field Trial

- ½ acre plots at CRC
- 2 Experiments
  - 50/acre MD, ATK, and AT devices
  - ATK rate trial: 0,50,100,200 /acre
- Marked moths used to supplement wild populations ~200/plot/ week
- 2 spatial replicates run 3 times (6 reps total)

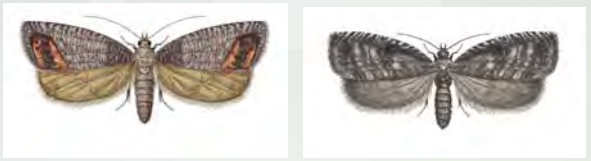






Field Study Conclusions

- Attract and kill device provides disruption beyond MD and compared to an MD standard
- 50 Devices provide equivalent disruption to 200 devices!



Potential Benefits of our attract-and-kill pouch

- No insecticide residues on the fruits/ vegetables
- Low rates of pheromone, reduce the cost (>1000 fold less compared to MD)
- Highly selective, safer for natural enemies and non-targets
- Fewer dispensers needed compared to MD?

Next Steps/Future Targets

- Large scale field trials utilizing wild OFM
- Commercialization of device for OFM
- Exploration of device for additional pest species
  - Must have a strong pheromone/ semiochemical
  - Must exhibit contact behavior in response to semiochemical

Future Target: Obliquebanded leafroller

Additional Future Targets

- Japanese Beetle ~ Preliminary work underway
- Codling moth ~ will it contact our device?
- Spotted wing drosophila ~ can we identify a good semiochemical?

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Project GREEEN

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GREAT LAKES, GREAT FLAVORS