

New Frontiers in the Biological Control of Insects

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Challenges, Impacts and Solutions



Production Agriculture



Small-Scale Agriculture

New challenges to deploying biological control –

- Regulations increasing domestic and international restrictions on the movement of beneficial agents
- Improved nutritional value of plants reduces the effectiveness of beneficial agents

The projected impact of these challenges on the use biological control –

- Less reliance on classical biological control
- More emphasis on conservation biological control
- Greater exploitation of natural processes to enhance biological control

Our approaches to these challenges -

- Enhance specific traits to improve production and performance of native beneficial agents
- Weaken the defenses of pest insects and increase susceptibility to biological control agents

Eulophid parasitoid



Predatory
Pentatomid



Research to enhance specific traits of parasitoids, predators and pathogens

Selection of economically useful traits is needed. The genetic and phenotypic variability of beneficial agents support this selection. Breeding these agents to enhance traits that confer economic usefulness may be possible without detrimental tradeoffs. Genes responsible for those traits can be characterized and used as biomarkers.

Our approach to breeding native beneficial agents:

- Apply classical genetic methods
- Select and develop lines for improved economic usefulness
- Find biotype-sensitive molecular markers

Baculovirus



Corn earworm



Traits of parasitoids and predators that will enhance economic usefulness:

- Increased fecundity
- extended storage-life
- Increased cold-tolerance
- Controlled host range
- Reduced developmental time
- Sex ratio favoring females

Pathogen traits that will enhance economic usefulness:

- Increased virulence
- Extended persistence
- Increased speed of kill
- Controlled host range

Research to impair the defenses of pest insects

A key agricultural implication of robust insect immunity is that insect immune systems limit the usefulness of some beneficial agents, such as bacteria, viruses, fungi and parasitoids. Weakening pest insect immune defenses will leverage the efficacy of these agents. This line of research will be directed to pest insects without effective biological control agents.

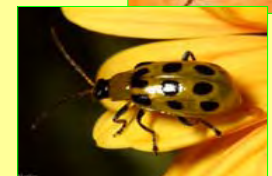
Our approach to impairing critical immune processes in pest insects:

- Gene silencing that will impair immune surveillance systems:
 - Scolexin
 - Peptidoglycan recognition protein
 - Hemolin
 - Gram-negative binding protein
- Gene silencing that will impair immune signaling systems:
 - Phospholipase A₂
 - Cyclooxygenase



Nodulation: immune
response to infection

Squash
Bug



Cucumber Beetle