



# Developing Insecticides with an Eye toward Beneficials Safety

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**(Dir. 2009/128/UE)**

Member States would have to create the necessary conditions for implementing **Integrated Pest Management (IPM)**, which would become mandatory as of 2014.





# Integrated Pest Management

## Origin

- Ever since man invented agriculture 10.000 years ago, he made use of IPM.
- After the 2<sup>nd</sup> World War men believed that pests could be controlled with the exclusive use of synthetic compounds.
- In late 50s, he then realized that the chemical control could not solve all the problems.
- **Economic Injury Level** (EIL - Stern *et al.* 1959): basis of most IPM programs in use today

# Integrated Pest Management



## definition

### 1. Prevention:

1. agronomy (sanitation, crop rotation, balanced nutrition)
2. crop varieties
3. good husbandry of crop in the ground & **conservation biocontrol**

### 2. Monitoring and forecasting:

1. timely and reliable detection of pest (qualitative & quantitative)
2. good forecasting and management information

### 3. Suppression:

interventions when the above measures have not been able to keep pest populations below the economic damage threshold.

1. **classical biological control**
2. **augmentative releases and inundative use of BCAs**
3. pheromones
4. sterile insect techniques
5. mechanical methods

All can be integrated with chemical pesticides

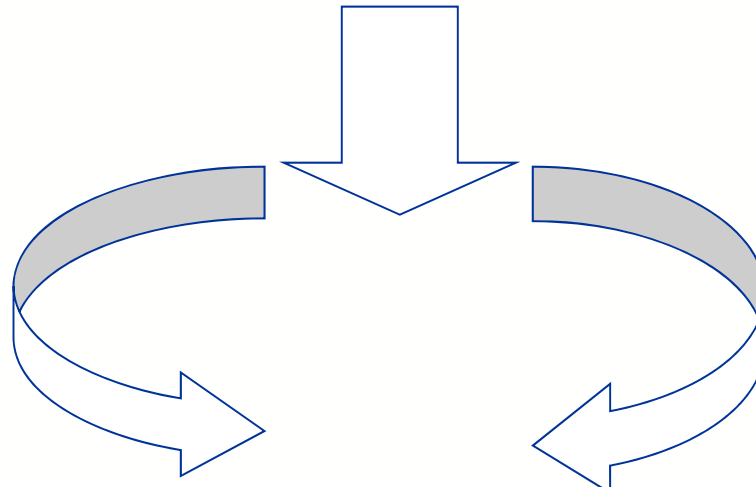




# Biodiversity of Entomofauna in the Agrarian Ecosystem

About 200 species of  
insects

2-10 (1-5%)  
Species  
**Permanently  
noxious**



10-40 (5-20%)  
Species  
**Occasionally  
noxious**

About 150-190 Species **not noxious** and **beneficial**  
(pollinators, entomophagus, acariphagus)

## **Classical Bio Control**



# Augmentative Biological Control

Today we have something like **150** different  
Predators and Parasitoids based products  
available for the so called

## Augmentative Biological Control



# Selectivity vs Beneficials

“Selectivity is the measure of the capacity of a treatment to spare natural enemies while destroying pests”  
(Bartlett, 1964).

## *Selectivity can be*

- **Physiologic**
- **Ecologic**
  - Spatial
  - Temporal

**Developing Insecticides  
with an Eye toward Beneficial Safety  
targeting the IPM market**

**REQUIEM™**



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A vertical strip on the left side of the slide contains several small images: a red tomato, a blue and white striped fabric, a cluster of red tomatoes, a yellow and black striped insect, a green leafy vegetable, a red tomato, a person's face, and a watermelon.

# REQUIEM<sup>®</sup>

REQUIEM is a sucking pest insecticide that protects high-value fruits, vegetables and perennials from the scarring, yield losses and viruses, these pests can cause.

REQUIEM works by:

- Directly killing adult and immature whiteflies, thrips, aphids, mites and other pests
- Preventing feeding thus reducing the spread of insect-transmitted viruses like TYLCV and WVD
- Offering a unique mode of action to help preserve valuable insecticide active ingredients already in the marketplace
- **Conserving beneficial insects and enlisting them as allies in the battle against these pests**

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## Negligible effect on beneficials

Lab studies and Field trials confirm safety on:

- Bees (*Apis mellifera*)
- Predatory mites (*Amblyseius fallacis*, *Phytoseilus persimilis*)
- Predatory thrips (*Scolothrips sexamaculatus*)
- Lady Beetle (*Stethorus punctum*)
- Mite predators (*Zetzellia mali*, *Neoseiulus fallacis*, *Typhlodromus pyri*)
- Syrphid flies
- Minute Pirate Bug (*Orius insidiosus*)
- Aphid Midge (*Aphidoletes*)
- Parasitic wasps (*Encarsia*, *Eretmocerus spp.*)
- Lacewing (*Chrysoperla carnae*)

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## Pollinators



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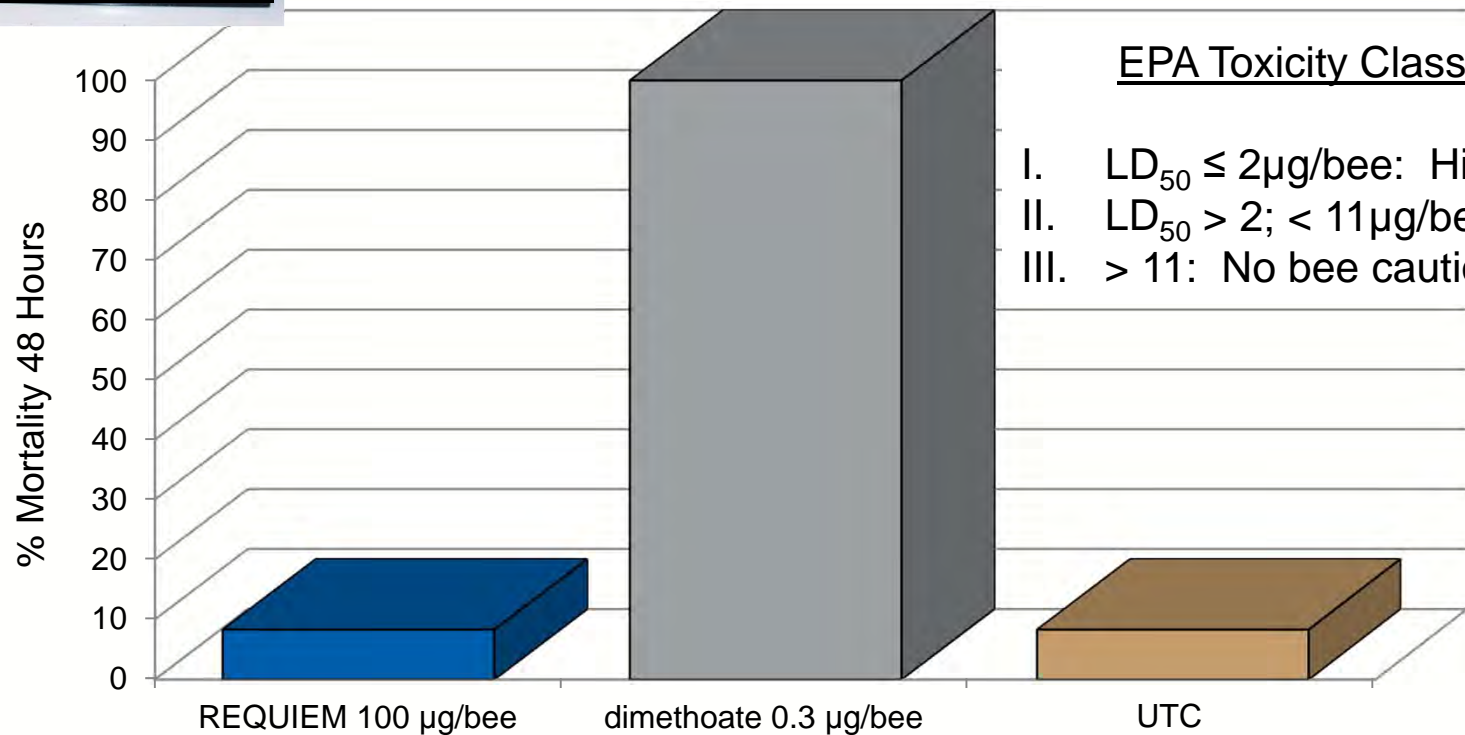


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Safe on important pollinators

like Honey Bees

Topical Application



Wildlife International Lab trial results  
2009

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**Predators: Pirate Minute Bag**

*Orius insidiosus*



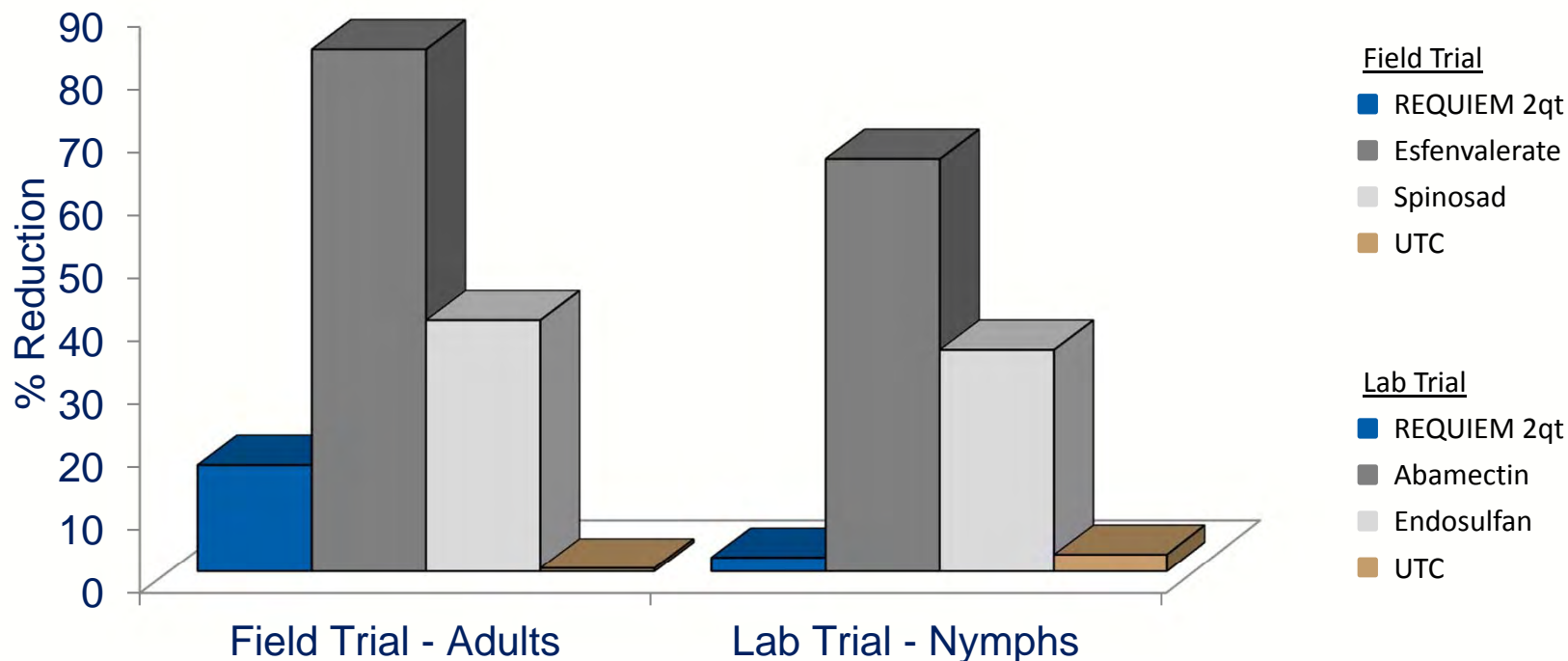


# REQUIEM<sup>®</sup>

## Negligible impact on all lifecycles of Minute Pirate Bugs



J. Funderburk, Univ. of Florida, FL – 2007.  
Three applications, 7D intervals. Tomato  
field trial.(70466)



1 Minute Pirate Bug/50 thrips = Control and no chemical applications are needed.  
1 Minute Pirate Bug/180 thrips = suppression

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## Predators: Coccinellids

*Coccinella septempunctata*



# REQUIEM<sup>®</sup>

No impact on Coccinellids



<i>Coccinella septempunctata</i> L.	Acute contact, 24hr	Requiem a.s.	LR <sub>50</sub> >200.00 L a.s./ha ER <sub>50</sub> > 200.00 L a.s./ha NOEC repro = 200.00 L a.s./ha	ESCORT method
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NOEC = No Observed Effect Concentration



# REQUIEM<sup>®</sup>

**Predators: *Chrisoperla carnea***



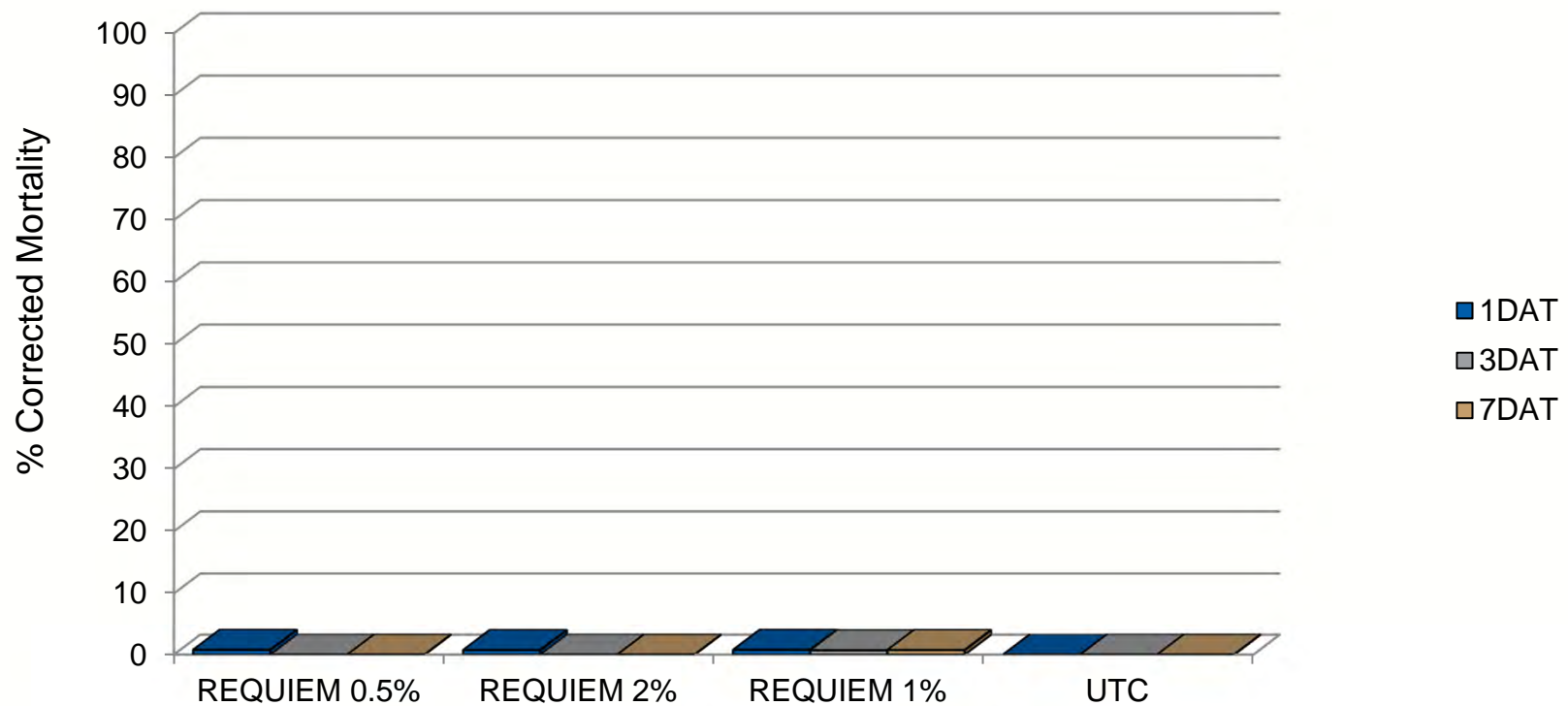
[http://commons.wikimedia.org/wiki/File:Chrysoperla\\_carnea\\_July\\_2008-1.jpg](http://commons.wikimedia.org/wiki/File:Chrysoperla_carnea_July_2008-1.jpg)



# REQUIEM<sup>®</sup>



Corrected % mortality of *Chrysoperla carnea* following topical application via micropipette



Pacific Ag Research, San Luis Obispo, CA – 2008  
(80811)





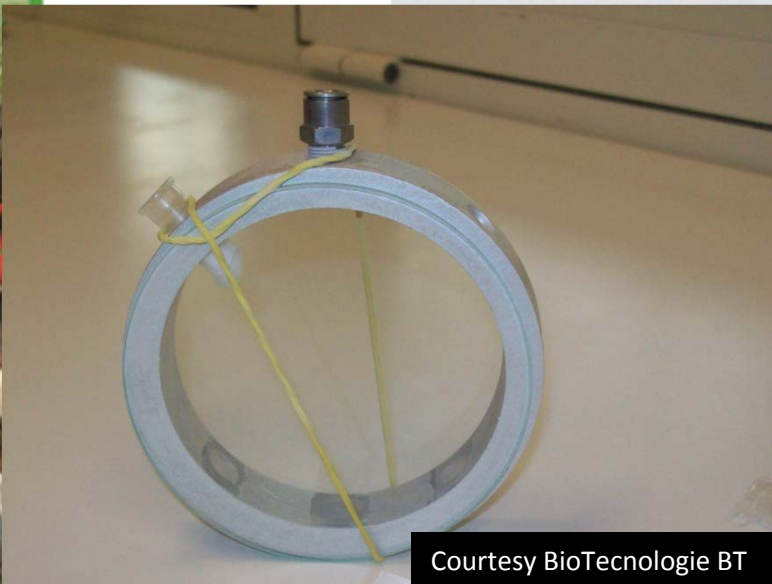
# REQUIEM

## Parasitoids: *Aphidius colemani*, *A. rhopalosiphii*

Courtesy BioTechnologie BT



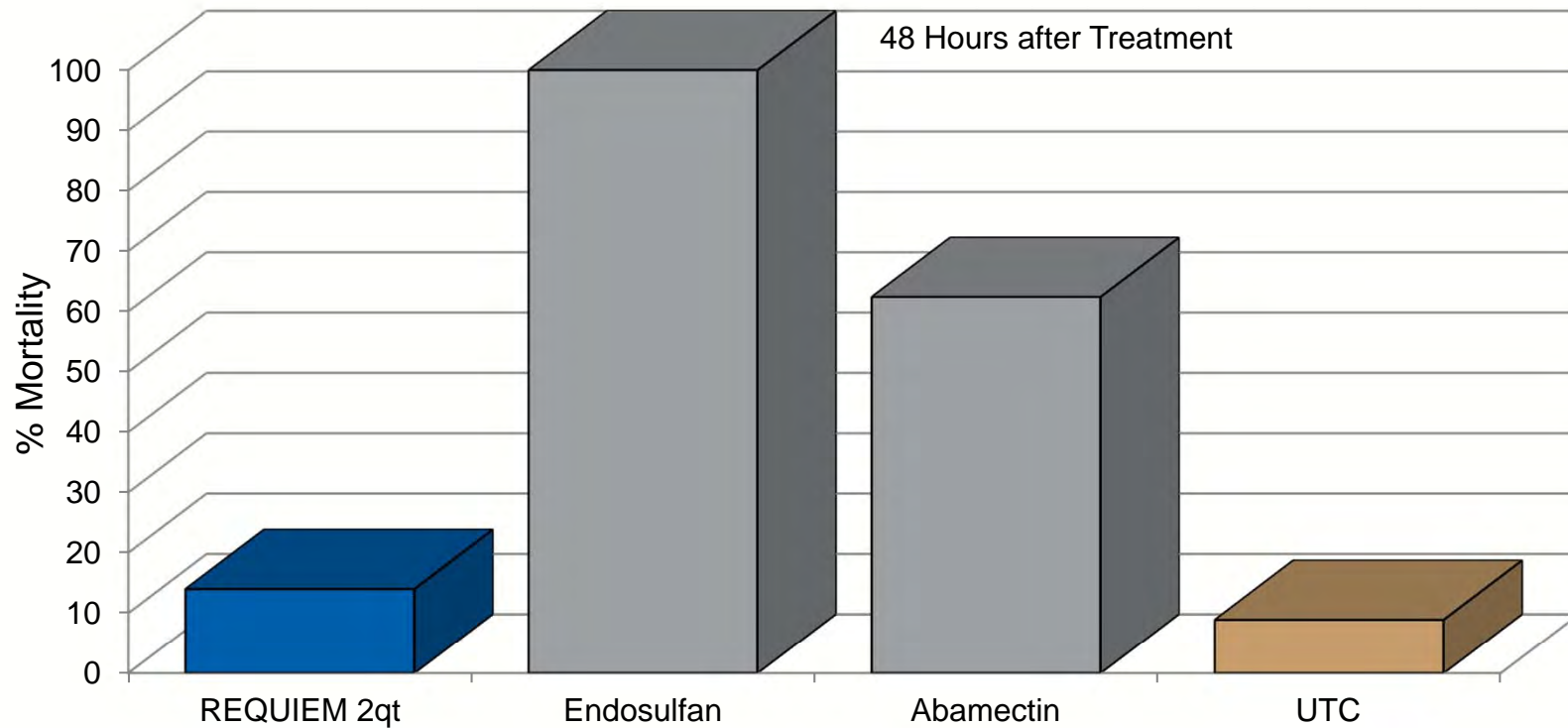
Courtesy BioTechnologie BT



Courtesy BioTechnologie BT

# REQUIEM<sup>®</sup>

## Negligible impact on Parasitoids



Laboratory trial part of regulatory submission to EPA. \*Species *Aphidius colemani* (Hymenoptera braconidae).

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**Predators: Predatory mite**

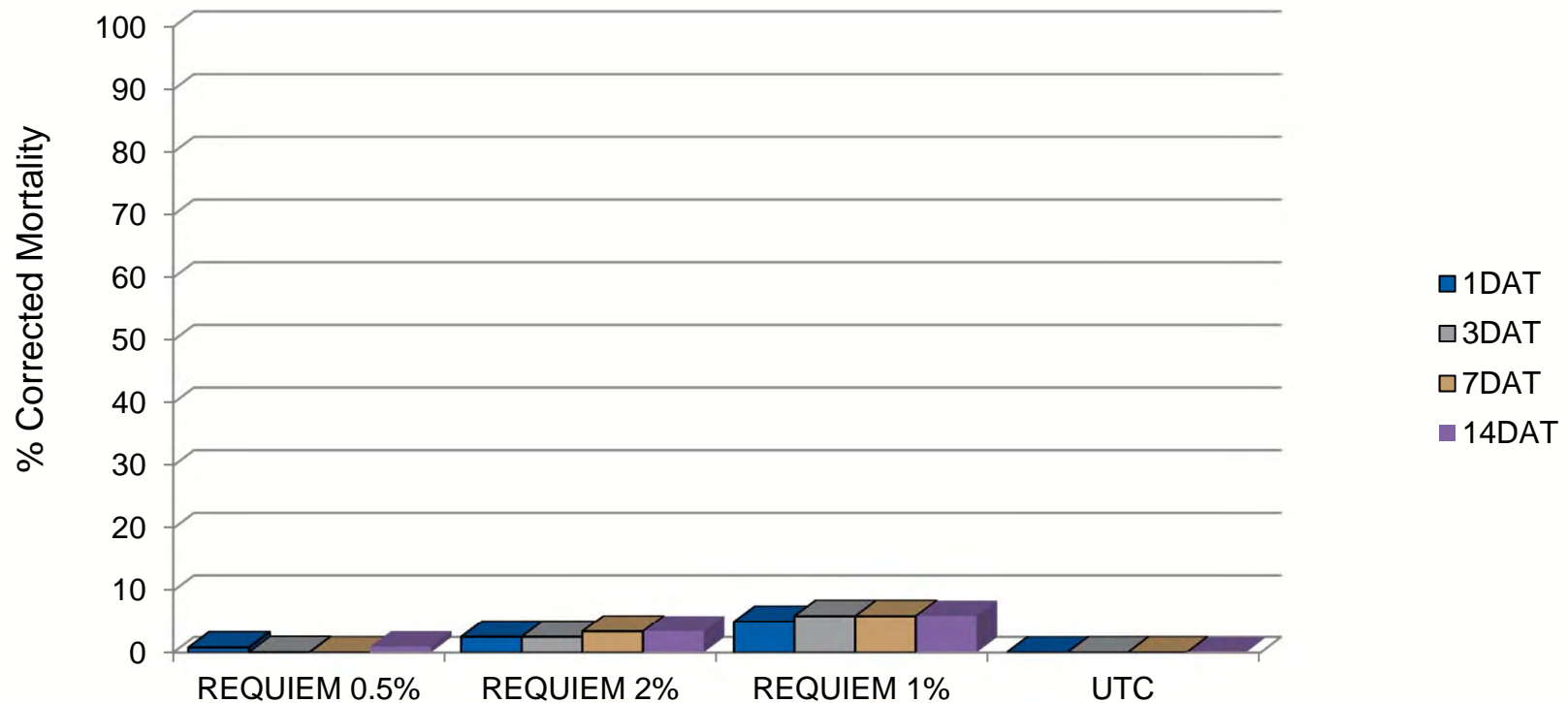
*Phytoseiulus persimilis*, *Typhlodromus pyris*, *Zetellia mali*





# REQUIEM<sup>®</sup>

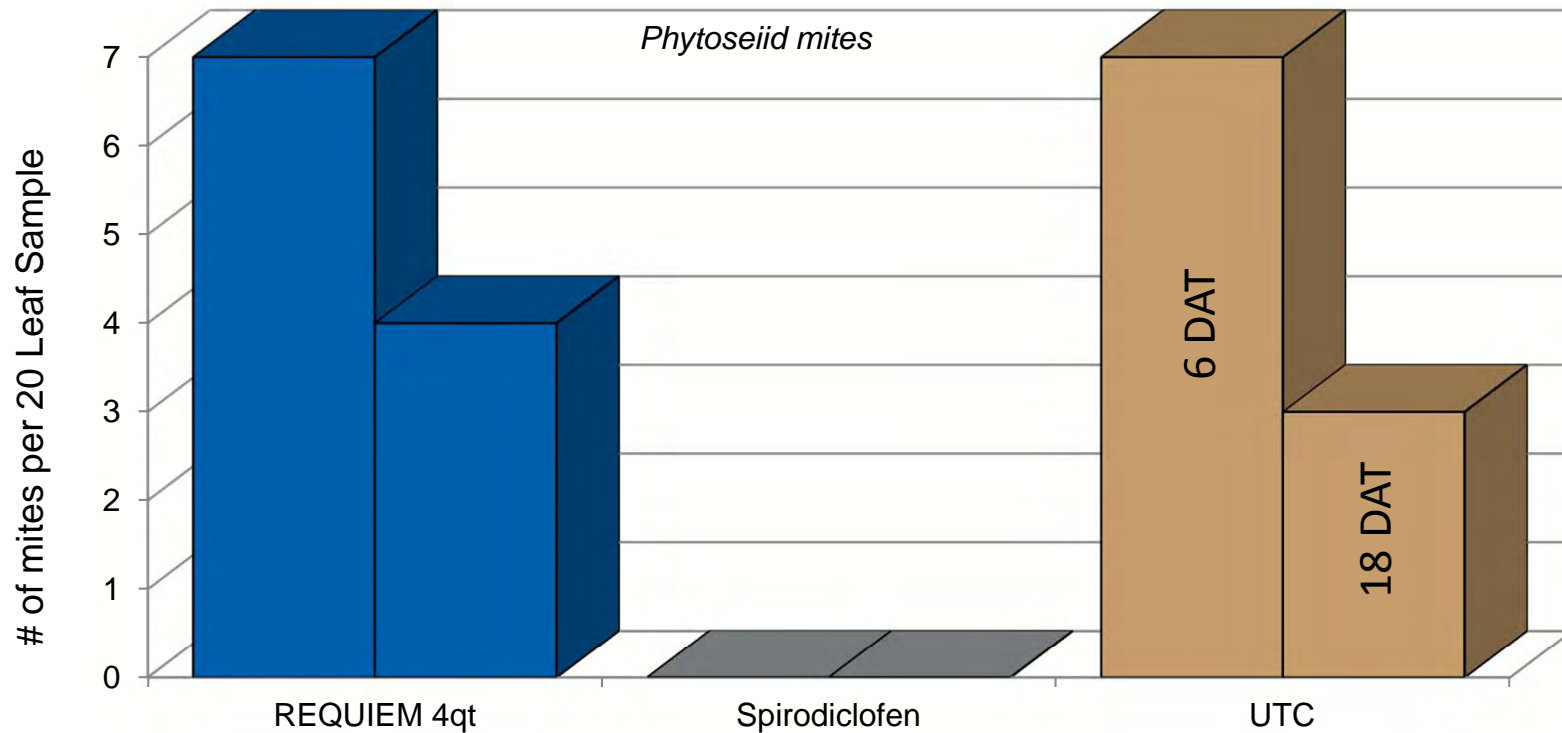
## Corrected % mortality of *Phytoseiulus persimilis* following topical application via micropipette



Pacific Ag Research, San Luis Obispo, CA – 2008  
(80813)

# REQUIEM<sup>®</sup>

## Impact on Predatory Mites in Pecan field trials

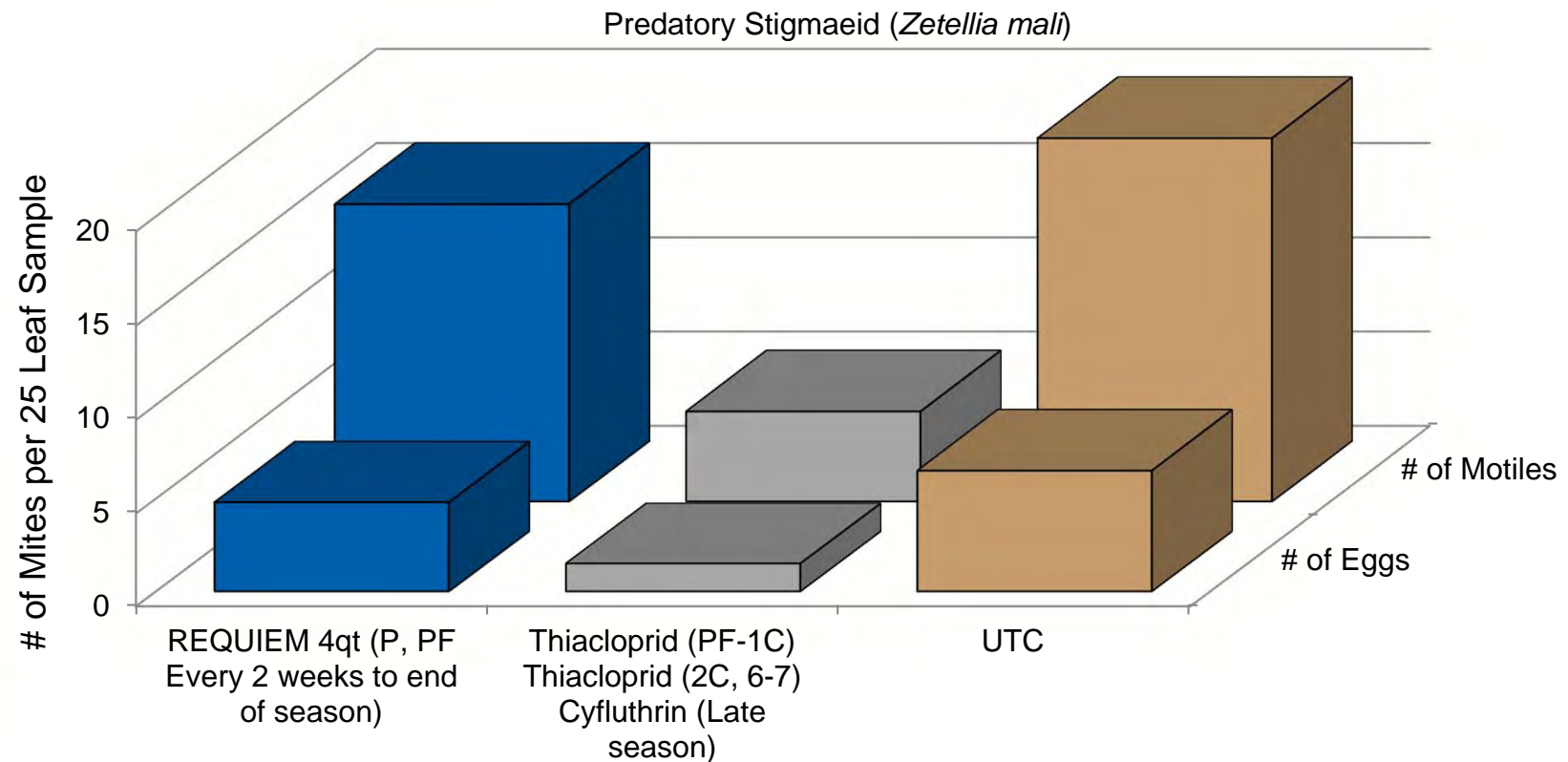


J. Dutcher, Univ. of GA, 2008. Pecan field trial. Counts taken 6 & 18 DAT (Days after treatment). (80436)



# REQUIEM<sup>®</sup>

## Negligible Impact on Predatory Mites in Apples



P. Jentch, Cornell Univ, 2007. Apple field trial. (70483)

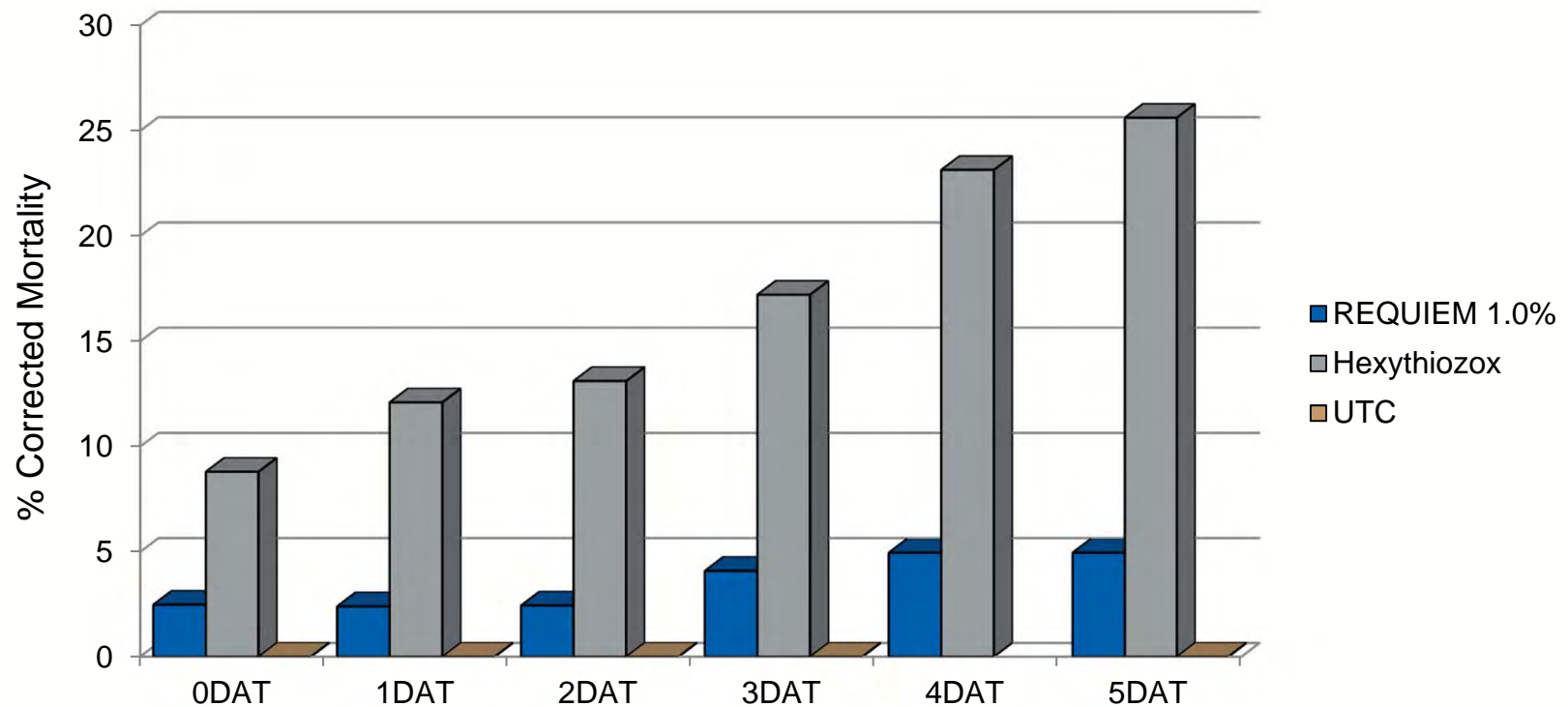
# REQUIEM<sup>®</sup>

**Predators: Six-spotted thrip: *Scolothrips sexmaculatus***



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## Negligible impact on Six-spotted Thrips\*



Pacific Ag Research, San Luis Obispo, CA – 2009. \**Scolothrips sexmaculatus* Following topical applications via micropipette (0901064)

A vertical strip on the left side of the slide contains several small images: a red tomato, a green leaf, a blue and white striped pattern, a cluster of red tomatoes, a yellow and black striped pattern, a green leaf, a red tomato, a green leaf, and a blue and white striped pattern.

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## Why it is safe to beneficials?

- Beneficials are not present during sprays - Persistence
- Beneficials are usually bigger
- Beneficials have usually harder cuticle
- Beneficials usually are less in contact with the vegetable tissues (more mobile)
- Beneficials do not eat vegetable tissue



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## KEY BENEFITS

- Controls whiteflies, aphids, mites, thrips and other sucking pests in high-value fruits and vegetables
- Flexible use rates and application timing put growers in control
- Active against all lifecycle stages – eggs to adults
- An excellent choice for best practices programs, Requiem is safe to workers, the environment, and neighbors
- Multiple modes of action help growers manage resistance
- 0-day Pre-Harvest Interval (PHI) and 4-hour Restricted Entry Interval (REI)
- **Is among the least damaging to beneficials of all available insecticides → IPM programs**



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THANK YOU



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The SONATA and BALLAD products are covered by U.S. Patent Nos. 6245551, 6586231, and 6635245 and by patents in numerous other countries.

The REQUIEM product is described in pending patent applications worldwide.

AgraQuest owns the following product registrations: SERENADE MAX - EPA Reg. No. 69592-11; SERENADE ASO - EPA Reg. No. 69592-12; SERENADE SOIL - EPA Reg. No. 69592-13; SONATA - EPA Reg. No. 69592-13. REQUIEM - EPA No. 69592-22. These products are also registered in numerous other countries worldwide.

