

# Interactions between systemic neonicotinoids and hymenopteran parasitoids of the tobacco budworm

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## Justification & Description

The tobacco budworm, *H. virescens*, can reduce both yield and quality of harvested tobacco.



Photo C.E. Sorenson

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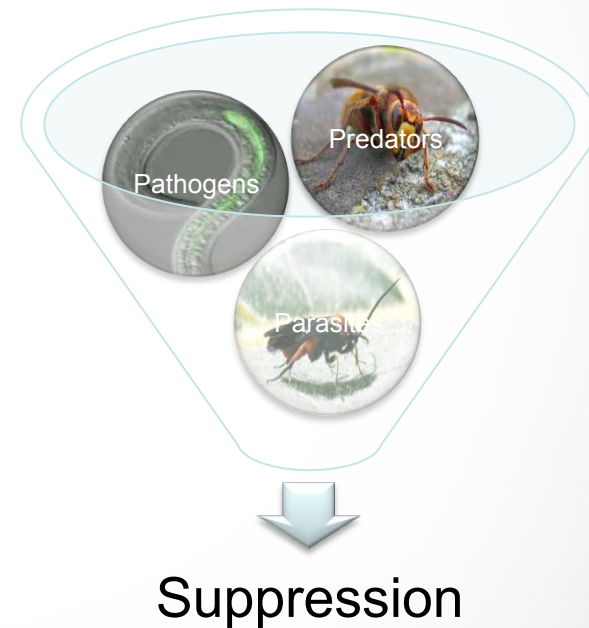
Chemical treatment of the tobacco budworm can be problematic.



Photo University of Georgia

# Justification & Description

Biological control is one of our most important tactics.



## Justification & Description

Natural enemies of the tobacco budworm include:



## Justification & Description

### *Cardiochiles nigriceps* (aka *Toxoneuron*)

- Can utilize any larval instar.
- Food consumption in host halts in 5-6 days.
- 14-21 days to emergence.



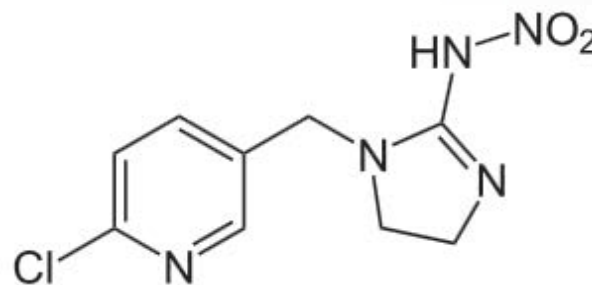
### *Campoletis sonorensis*

- Hosts past 3<sup>rd</sup> instar less suitable.
- Host growth and feeding significantly reduced immediately following parasitism.
- 7-9 days to emergence.



## Justification & Description

Imidacloprid is an insecticide that is used extensively in tobacco production. It has no activity against the tobacco budworm.



## Justification & Description

A potential drawback to the use of neonicotinoids is the threat that they pose to beneficial species such as hymenoptera including:

- Reduced foraging, activity and reproduction in honeybees (Decourtye 2004) and bumblebees (Mommaerts et al. 2010).
- Reduced host finding in parasitoids (Stapel et al. 2000).



## Justification & Description

Exposure route is different with endoparasitoids.



## Justification & Description

1. M. Bock (2010) shows an increase in budworm infestations among plots treated with Imidacloprid.
2. A. Dhammi (2010) shows the movement of Imidacloprid from the hemolymph of the hornworm to its parasitoid wasp.
3. A. Muhammad (2010) shows a decrease in whitefly parasitism in cotton planted using a neonicotinoid seed treatment.

## Objectives

1. Assess the possible effects of systemic imidacloprid on the instance of budworm infestations and budworm parasitism in flue-cured tobacco.
2. Quantify the toxicity of imidacloprid to both *C. nigriceps* and *C. sonorensis*.

## Objective 1: First-year field studies

1. Natural Infestations-Kinston, NC
2. Artificial Infestations-Rocky Mount, NC
  - 2 imidacloprid treatments (greenhouse spray and transplant water) and an untreated control.
  - Each treatment and the control contained 4 replications of 8 row plots

## Objective 1: First-year field studies

### 1. Natural infestations:

- Infestation numbers were recorded from May 24<sup>th</sup> through June 13<sup>th</sup>.
- Budworm larvae larger than second instar were collected from June 7-27<sup>th</sup>.
- Larvae were observed in laboratory until either pupation or wasp emergence.

# Objective 1: First-year field studies

## 1. Natural infestations:

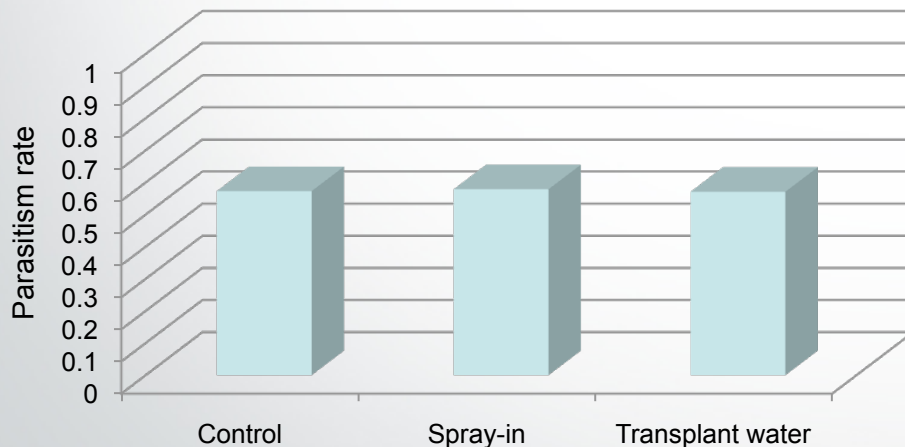
- Infestations in all three plots were approximately 35% the week of June 7<sup>th</sup>.
- By the end of larval collections, per plant:
  - 1.1148 2<sup>nd</sup> instar larvae were collected from the transplant water treatment
  - .9523 from the greenhouse treatment
  - .8837 from the untreated control.

# Objective 1: First-year field studies

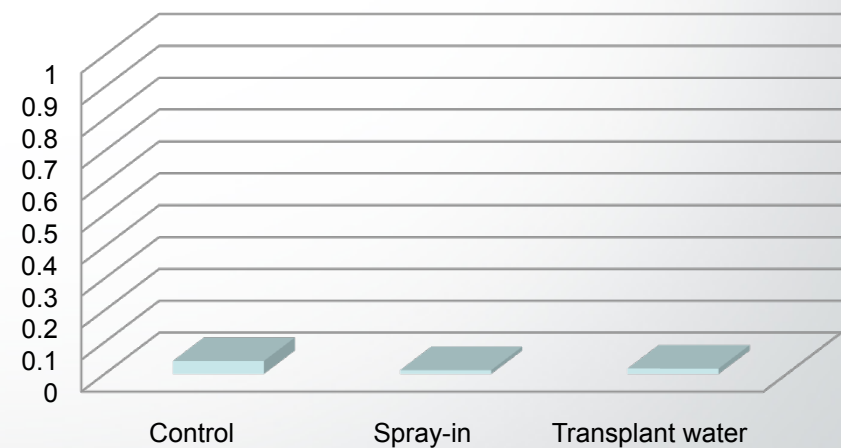
## 1. Natural infestations:

- Overall parasitism rates & parasitism rates by *C. nigriceps* showed no difference among treatments.
- The parasitism rate for *C. sonorensis* was higher in the control.

Rate of Parasitism by *C. nigriceps*



Rate of Parasitism by *C. sonorensis*



# Objective 1: First-year field studies

## 1. Artificial infestations:

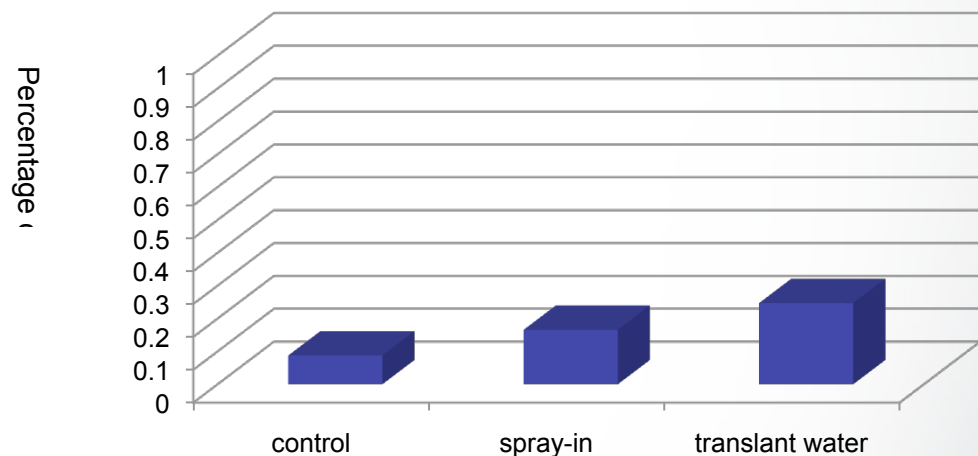
- 80 early second instar larvae were placed in each plot. They were collected for observation after 5 days of field exposure.



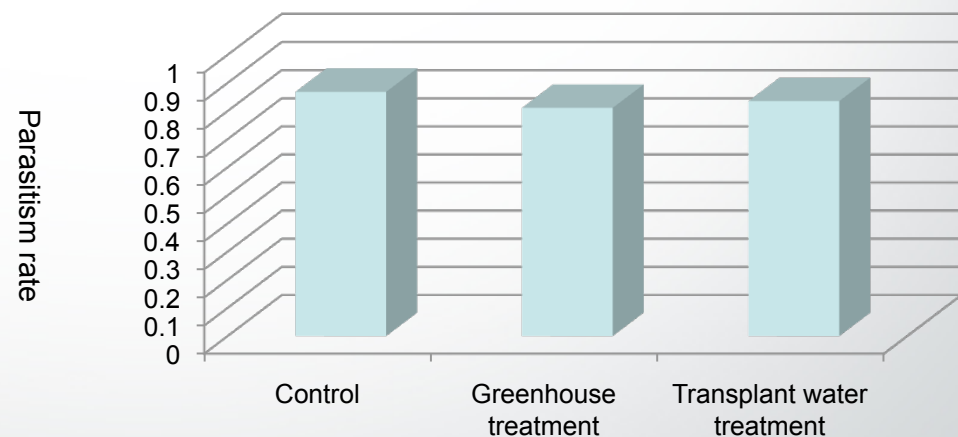
# Objective 1: First-year field studies

1. Artificial infestations:
  - Higher numbers of larvae were recovered in the treated plots
  - Parasitism rate was higher in the control, but not significantly.

### Larval Recovery Rate



### Artificial Infestation Parasitism Rates



# Objective 1: First-year Greenhouse Studies

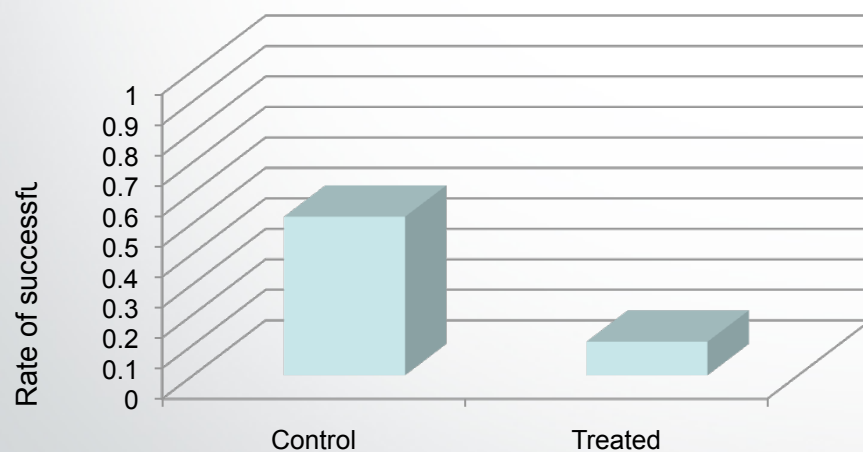
- Budworm larva were reared on either treated or untreated plants.
- Budworm larva were parasitized at the 2<sup>nd</sup> instar age and observed daily.



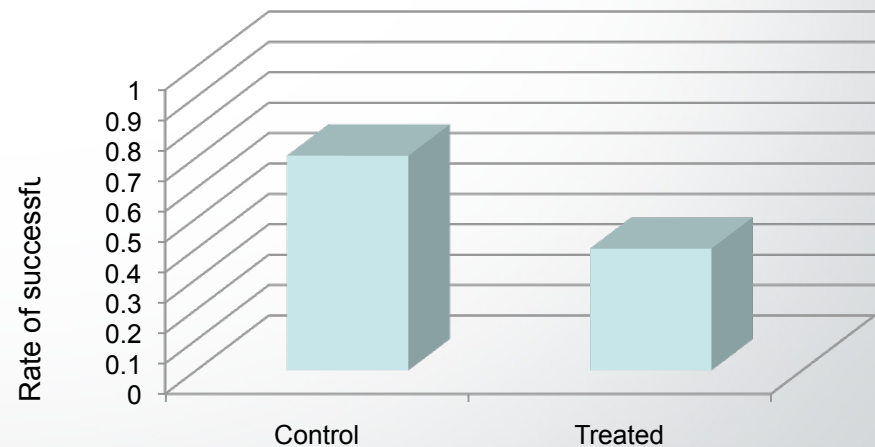
# Objective 1: First-year Greenhouse Studies

- Rates of successful parasitism were significantly higher in the untreated controls for each species.

Successful Parasitism by *C. nigriceps*



Successful Parasitism by *C. sonorensis*



## Objective 2: First-year laboratory Studies

- Topical LD50s were determined for each species.



## Objective 2: First-year laboratory Studies

### *C. nigriceps*

- LD50=.8926 ug per insect  
(95%CI .77-1.15)
- ~54.179 mg/kg
- Hazard ratio=146.2  
(50-2,500 Slightly to moderately toxic)

### *C. sonorensis*

- LD50=.00238 ug per insect  
(95%CI .002-.0029)
- ~.9056 mg/kg
- Hazard ratio=54,674  
(>2,500 Dangerous)

## Objectives for second year studies

1. Repetitions of greenhouse studies.
2. Determination of insecticide titer in plants and budworms.
3. Quantify the season-long level of budworm infestation.

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### References:

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# Questions?

