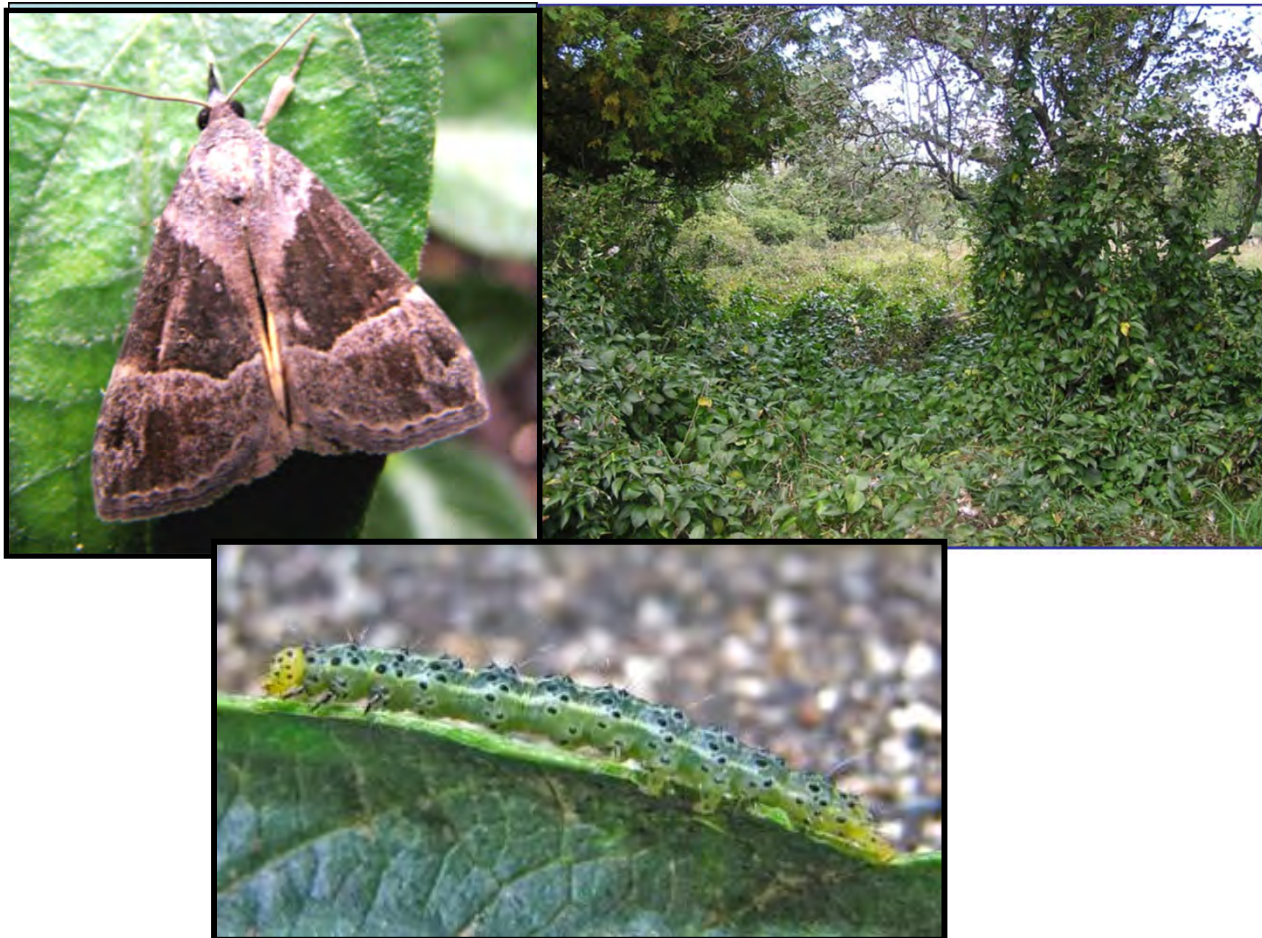


# On the Horizon: Biological Control of Swallow-worts

Lisa Tewksbury

Dept. of Plant Science and Entomology, URI







## Non-native Swallow-worts

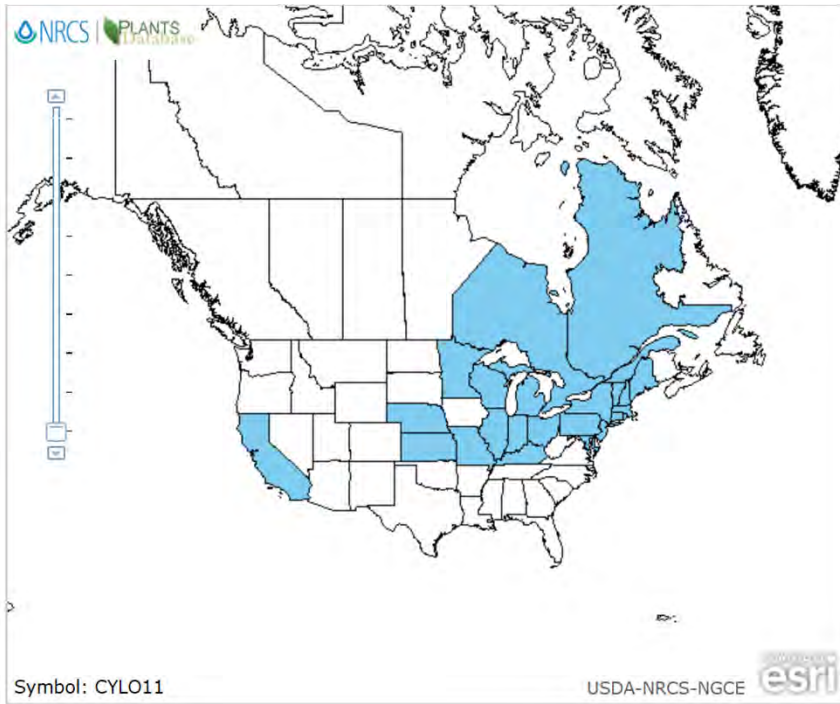


Black Swallow-wort  
(*Vincetoxicum nigrum*)  
Native to Spain, France,  
and Italy

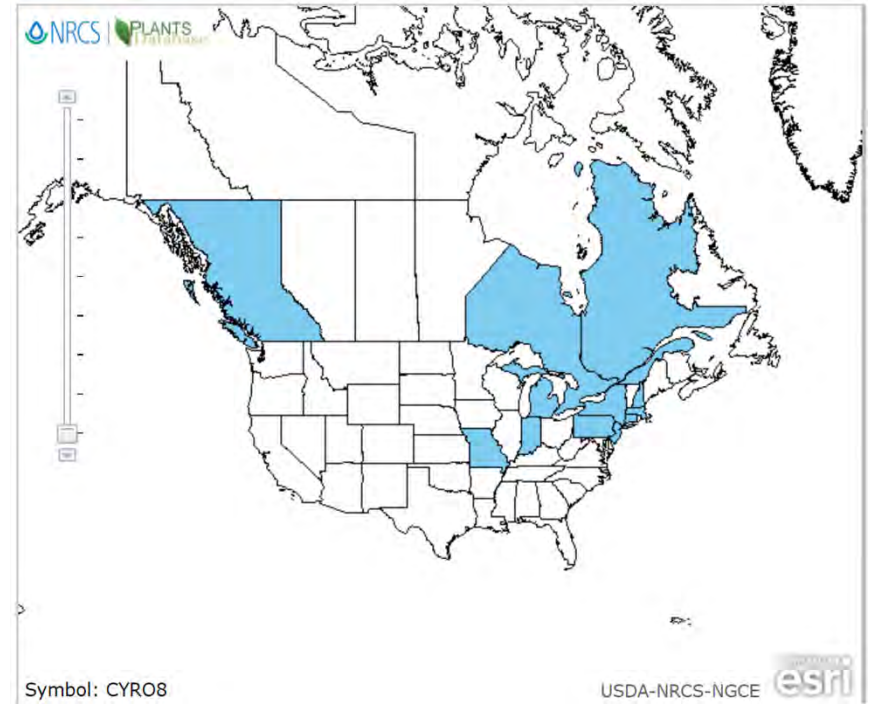


Pale Swallow-wort  
(*V. rossicum*)  
Native to southwest  
Russia and Ukraine

# North American Distribution



*Vincetoxicum nigrum* distribution in North America. USDA Plants database, Downloaded 2018.



*Vincetoxicum rossicum* distribution in North America. USDA Plants database. Downloaded 2018.

# Swallow-wort Biology

- Milkweed family (Apocynaceae)
- Perennial, herbaceous plants
- Vining growth habit
- Insect and self-pollinated
- Coma-bearing seeds
- High tolerance and good plasticity to envir. conditions



# Negative Ecological Effects of Swallow-worts in North America

- Disruption of plant successional patterns (Lawlor 2000)
- Threatens habitat of endangered plants (Lawlor 2000)
- Monocultures shade out background vegetation
- Monocultures decrease arthropod diversity and community composition (Ernst and Cappuccino 2005)
- Toxic to livestock





# Potential Negative Effects on Monarch Butterflies

- Swallow-wort may have greater indirect impact on monarchs by competing with milkweed species



Monarch laying eggs on black swallow-wort



*Asclepias syriaca* (common milkweed) entangled in the twining vines of *V. nigrum* (black swallow-wort)

[Journal of Chemical Ecology](#)

May 1998, Volume 24, [Issue 5](#), pp 891–904 | [Cite as](#)

# Identification and Distribution of Oviposition Stimulants for Monarch Butterflies in Hosts and Nonhosts

Authors

[Authors and affiliations](#)

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Meena Haribal, J. A. A. Renwick

In laboratory experiments – Haribal and Renwick (1998) demonstrated that monarch butterflies oviposited on sponges treated with volatile extracts from the non-host plant *V. nigrum*.

Suggested that this might “represent a threat to natural populations of monarch butterflies” as the invasive plant species increased its distribution in North America

# **A comparison of the host preference of monarch butterflies (*Danaus plexippus*) for milkweed (*Asclepias syriaca*) over dog-strangler vine (*Vincetoxicum rossicum*)**

Heather R. Mattila & Gard W. Otis

*Department of Environmental Biology, University of Guelph, Guelph, ON, Canada, N1G 2W1*

Accepted: 6 March 2003

“Given a choice between hosts over 24 h, 92% of larvae moved to milkweed leaves and consumed 3.94 cm<sup>2</sup> of milkweed leaves compared to 2% of larvae that moved to dog-strangler vine and consumed negligible amounts of leaf material (0.01 cm<sup>2</sup>).”

Did not see *V. rossicum* as a threat to monarch populations.

# Oviposition preference and larval performance of monarch butterflies (*Danaus plexippus*) on two invasive swallow-wort species

Antonio DiTommaso , John E. Losey

“Findings from this research indicate that *V. rossicum* and *V. nigrum* are not viable hosts of monarch butterflies and are likely to pose little direct threat to their populations as oviposition sinks. The ability of these highly aggressive plants, however, to out-compete and displace the native host of monarchs, *A. syriaca*, may pose a more serious threat. ”

# Monarch Butterfly Oviposition on Swallow-Worts (*Vincetoxicum* spp.)

R. A. Casagrande , J. E. Dacey

*Environmental Entomology*, Volume 36, Issue 3, 1 June 2007, Pages 631–636, [https://doi.org/10.1603/0046-225X\(2007\)36\[631:MBOOSV\]2.0.CO;2](https://doi.org/10.1603/0046-225X(2007)36[631:MBOOSV]2.0.CO;2)



- In Field Cage trials monarchs given a choice between *V. nigrum* (black swallow-wort) and *Asclepias syriaca* (common milkweed) laid 24.5% of their eggs on *V. nigrum*.
- In a survey of pastures in RI where relative coverage of *A. syriaca* was more than 3 times that of *V. nigrum*, 15.4% of monarch eggs were found on *V. nigrum* plants.
- Flavonol glycosides have been identified from both *A. syriaca* and *V. nigrum*, and have been identified as initiating oviposition in monarch butterflies (Haribal and Renwick 1998)
- No larvae that hatched from eggs laid on *V. nigrum* survived.



# MONARCH JOINT VENTURE

Partnering across the U.S. to conserve the monarch migration

[www.monarchjointventure.org](http://www.monarchjointventure.org)

The Monarch Joint Venture is a partnership of federal and state agencies, non-governmental organizations, and academic programs that are working together to protect the monarch migration across the lower 48 United States.

## PARTNERS

U.S. Forest Service  
U.S. Fish and Wildlife Service  
U.S. Geological Survey  
Natural Resources  
Conservation Service  
Iowa Department of

## Invasive Species Alert:

Black swallow-wort (*Cynanchum louisea*) and pale swallow-wort (*Cynanchum rossicum*)

### Monarchs and Swallow-wort

Monarch butterflies (*Danaus plexippus*) need milkweed plants (*Asclepias* species plus a few species in closely related genera) to survive; their caterpillars cannot feed on other host plants. Female monarchs have evolved to lay eggs on milkweed, ensuring that their offspring have adequate resources for development. Females find the milkweed plants using a combination of visual and chemical cues.

An alien invader is jeopardizing this process by confounding female monarchs during the egg laying process. Black swallow-wort (*Cynanchum louisea*)

has heart shaped leaves and white flowers, and is native to North America.

### Environmental Effects

Swallow-wort species reduce local biodiversity of native plants, invertebrates, and vertebrates. Studies show a decrease in arthropod biodiversity in areas covered by swallow-wort, when compared to similar old fields vegetated by native plants (DiTommaso et. al. 2005). Swallow-worts can take over open areas, which in turn leads to reduced grassland bird breeding and nesting. As the former Latin name, *Vincetoxicum*, implies, swallow-wort species are

# Control of Swallow-worts

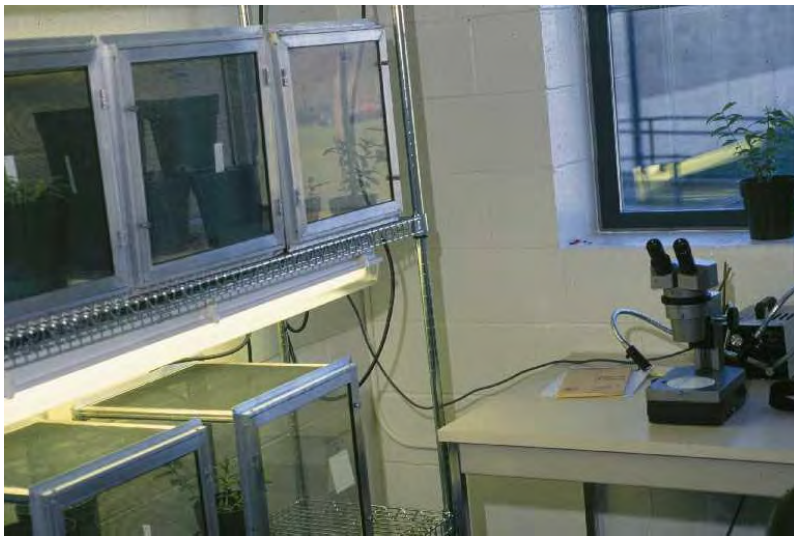
- Dependent on size of infestation
- Physical removal okay at low densities
- Grazing and cutting causes vigorous regrowth
- Chemical herbicides
- NO control that permanently works and that isn't costly or environmentally damaging







## University of Rhode Island Biological Control Lab and Quarantine Facility



# Classical Biological Control

- **Locate natural enemies in pest's native range**
- **Determine impact on host population**
- **Determine host specificity (abroad)**
- **Return good candidates to N.A. quarantine**

# CHANGING STANDARDS

**Gypsy moth**

**biocontrol**

*Compsilura conccinata*



# *Rhinocyllus conicus*

- Native to Eurasia
- Released against musk thistle in USA in 1969
- Host range testing showed it to use many *Cirsium* species



# European Exploration: Leaf feeders on swallow-worts (Aaron Weed)

*Chrysolina a. asclepiadis*



No longer under consideration:  
feeds on native milkweeds

*Abrostola asclepiadis*

Found in open field sites



Host specificity testing almost completed

*Hypena opulenta*

Found in forests and on forest edge



Submitted a petition for field release

# Host specificity

- Test plant list
  - Entire approved TAG list (82 spp.)
  - 48 species of Apocynaceae
    - Minus unavailable rare species
  - Included additional taxa with close phylogenetic relationship to herbivores
    - *Artemisia* spp./*Chrysolina a. asclepiadis*
    - Urticaceae/*Abrostola* and *Hypena*

# Swallow-wort Biocontrol



*Hypena opulenta*

TAG recommended release 9/4/2013  
Released in Ottawa Canada 9/20/2013  
Toronto and Ottawa in 2014  
US release 2017



*Abrostola asclepiadis*

Host range testing complete

# *Hypena opulenta*



Found in wooded ravines on pale swallow-wort in southeastern Ukraine, host plants previously unknown.



# *Hypena opulenta* (Christoph)

## Background

- Noctuidae: Hypeninae
- Recorded from Ukraine, Turkmenistan, Turkey, and Iran
- Host plants prev. unknown



# Biology

- Life cycle:
  - 5-6 weeks (20°C)
  - 5 instars
- Multiple generations a year
- Overwinter as pupae in leaf litter or soil



# Summary

- *Hypena opulenta* larval host range restricted to genus *Vincetoxicum*
- Multiple generations per year
- Larvae target young foliage
- Similar development between target weeds
- High reproductive output that occurs quickly

**TAG (Technical Advisory Group on Biological Control of Weeds)** is an outside groups of experts with whom APHIS consults to help determine the “danger of plant pest dissemination into the United States” (7 CFR 330.202) TAG evaluation includes addressing the **Endangered Species Act**.

### **Mission**

To facilitate biological control of weeds in North America by providing guidance to researchers and recommendations to regulating agencies for or against the release of nonindigenous biological control agents, based on considerations of potential non-target impacts and conflicts of interest.

### **Duties of TAG Members**

b. Review each petition to **evaluate risk** to agriculture, human health, and the environment, **compared with expected benefits**.

Bob Tichenor  
USDA APHIS Plant Health Protection  
Pest Permitting Branch  
[www.aphis.usda.gov/plant\\_health/permits/tag/downloads/flowchart.pdf](http://www.aphis.usda.gov/plant_health/permits/tag/downloads/flowchart.pdf)

# Regulatory Issues

- **Plant Protection Act** – BC agent must not be a plant pest - **APHIS**
- **National Environmental Protection Act** – or risk to the environment
- **Endangered Species Act** – or any risk to a threatened or endangered species - **USFWS**

**US T&E List: 1590 (692 animals, 898 plants)**



## Letter of Concern

**TO:** Mr. Gary Frazer  
Assistant Director for Endangered Species, USFWS

Mr. Kevin Shea, Esq.,  
Administrator, USDA-APHIS

**FROM:** Membership of Regional Research Projects:  
**NE1332** – Biological Control of Arthropod Pests and Weeds  
**S1058** – Biological Control of Arthropod Pests and Weeds  
**W3185** – Biological Control in Pest Management Systems of Plants

**RE:** Delays in permitting of weed biological control agents

**DATE:** February 23, 2015

The membership of the regional research projects on biological control wish to express their concern about regulatory delays in the processing of release permits for biological control agents of weeds. There are presently eight petitions that have passed the stringent requirements for approval by the USDA-APHIS Technical Advisory Group for Biological Control Agents of Weeds (TAG). These petitions, which were recommended for field release by TAG, have been pending for as long as four years ([http://www.aphis.usda.gov/plant\\_health/](http://www.aphis.usda.gov/plant_health/)

# Swallow-wort Biological Control Research

CABI Switzerland    USDA-ARS and    Agriculture and Agri-Food Canada

Continuing to Evaluate:

*Chrysochus asclepiadeus* – root feeding beetle  
Host range testing two different populations  
Ukraine and Western Europe



*Euphranta connexa* - seed feeding fly (Tephritidae)



Ontario *Hypena opulenata* release July 2014







Forested and open field sites of black swallow-wort on Naushon Island.



# Permit for Field Release – August 2017

## Naushon, MA Release

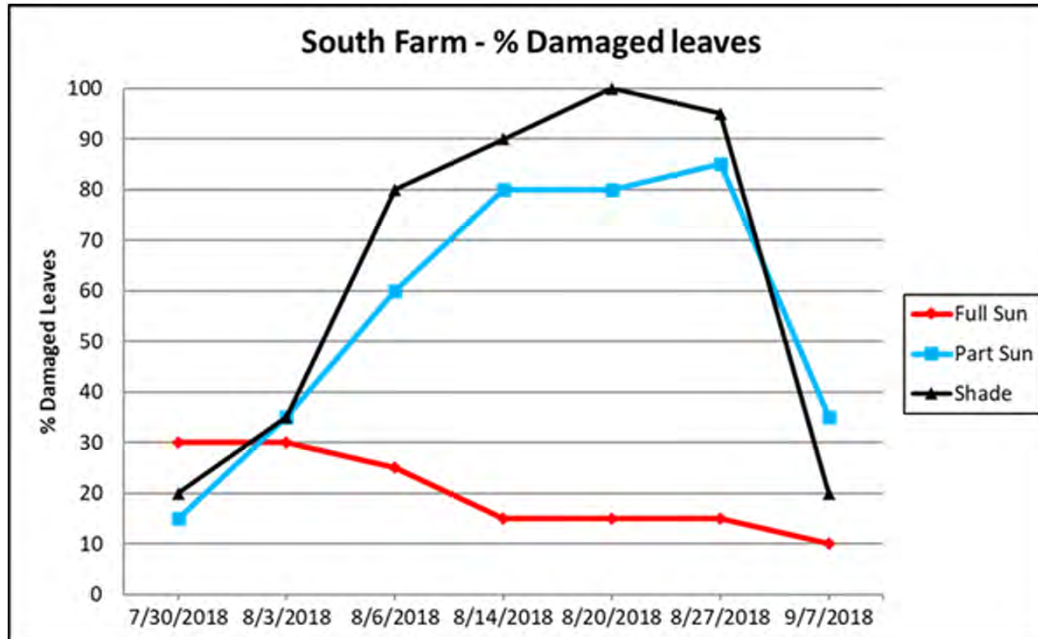


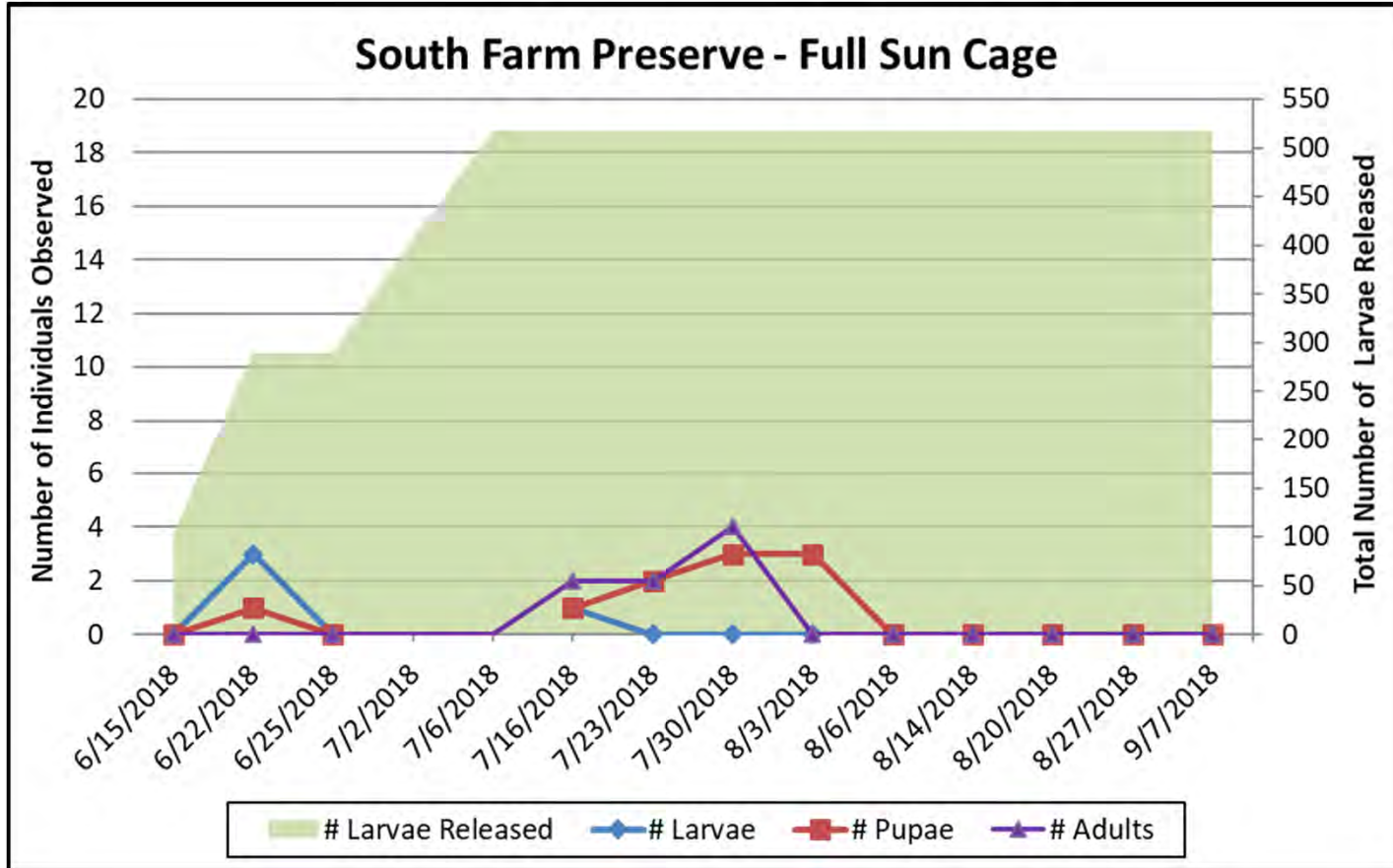


Charlestown, RI – Sept. 2017

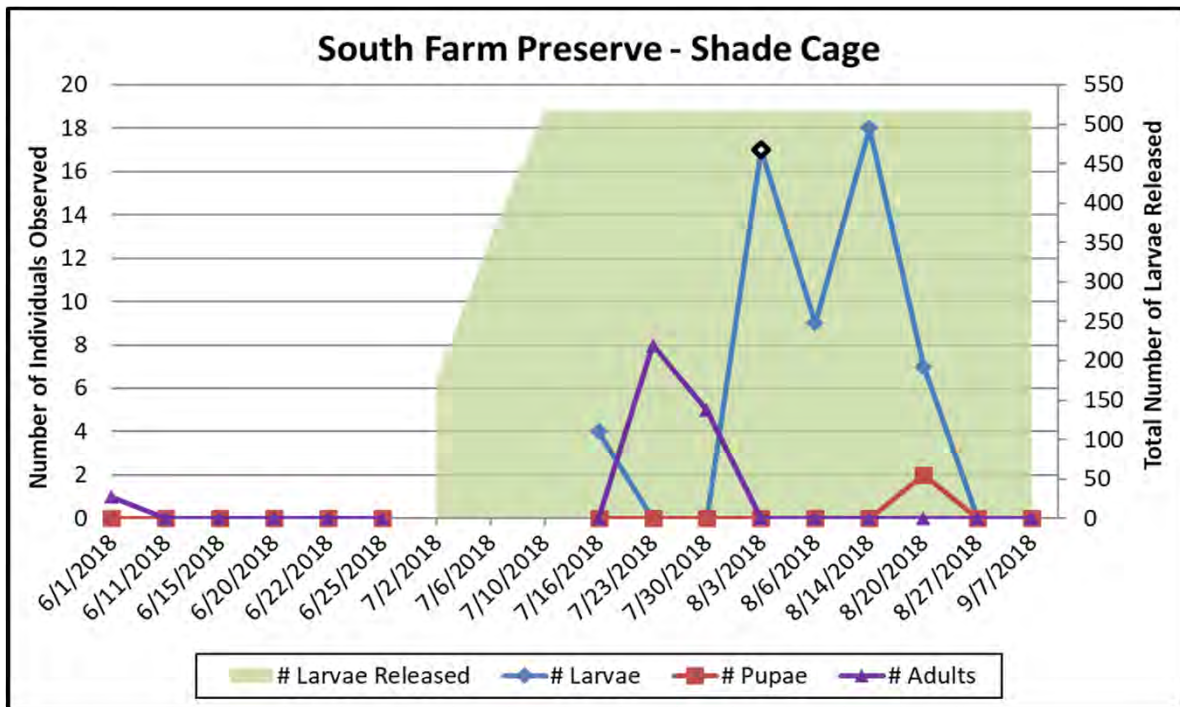
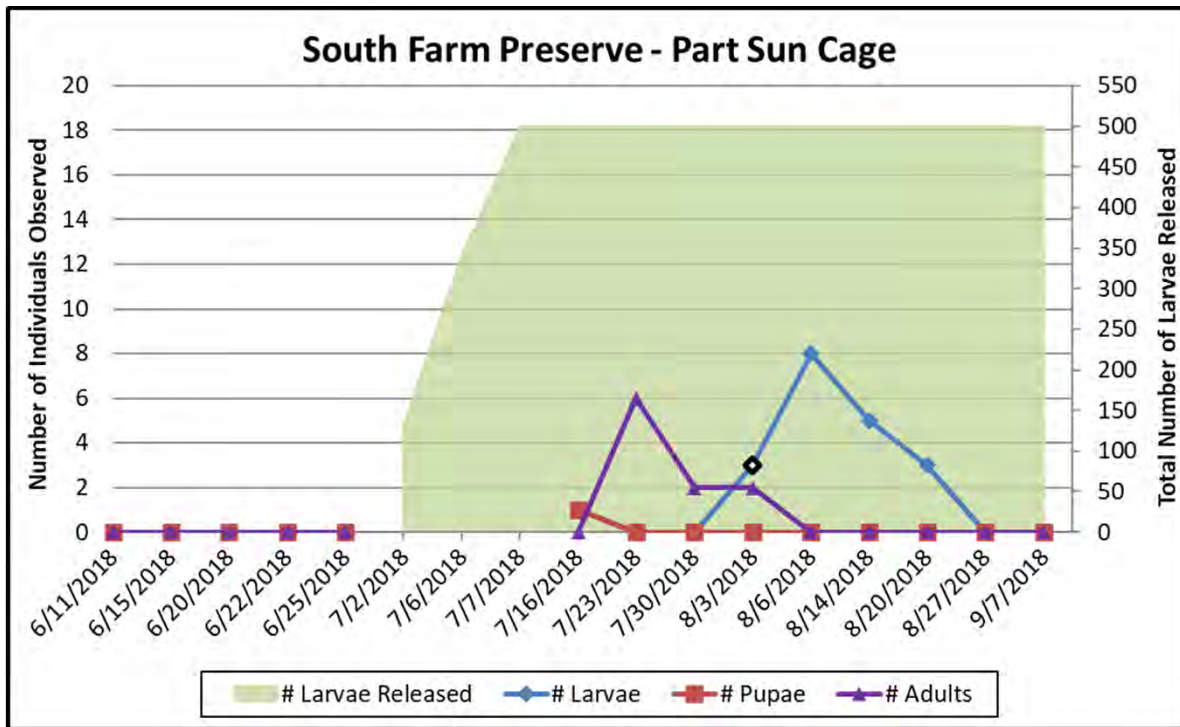












## Unidentified Pathogen in RI/MA



## Plant Pathogens of *Vincetoxicum* spp.

- Leaf anthracnose (*Colletotrichum lineola*) identified in Russia
  - a *Colletotrichum* isolate recovered from two sites in Charlestown, RI
- Leaf spot (*Cercospora bellynckii*)
  - a *Cercospora* isolate recovered from RI
- *Phoma* sp. recovered from Charlestown RI

# Thank You!



Acknowledgements: Aaron Weed, Richard Casagrande, Alex Hazlehurst, Elwood Roberts, Rebecca Donegan, Robert Healey, Courtney Graham

Funding: USDA APHIS PPQ Biological Control