Black Swallowwort Biocontrol Research Update

Maine Invasive Species Network Meeting
March 23, 2023

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www.maine.gov/ipm

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Photo: Hillary Peterson

Come Work at the Plant Health Programs!

Are you interested in a job opportunity with lab work, field work, *and* outreach?

- **40 hour per week basis: starting this spring through the end of next winter**

- **Educating plant sellers about:**
  - invasive plants that may become hitchhikers
  - best management practices to prevent weeds
  - develop outreach and educational materials
  - plan, coordinate and implement in-person and online workshops

- **Mosquito trapping and testing activities**
  - assist in selecting sites and servicing mosquito traps weekly
  - assist in mosquito identification

- **Work will be based in Augusta, Maine**
  - some opportunity for telework
  - Some statewide travel

maine
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Scan to learn more and apply!

Thank you Mike Galli!

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MES Webinar Series: Using Hypena opulenta to control Black Swallowwart in Harpswell, Maine by Michael Galli

Thursday, February 9, 2023

7:00 PM – 8:00 PM

View Event →

Black Swallowwort Overview

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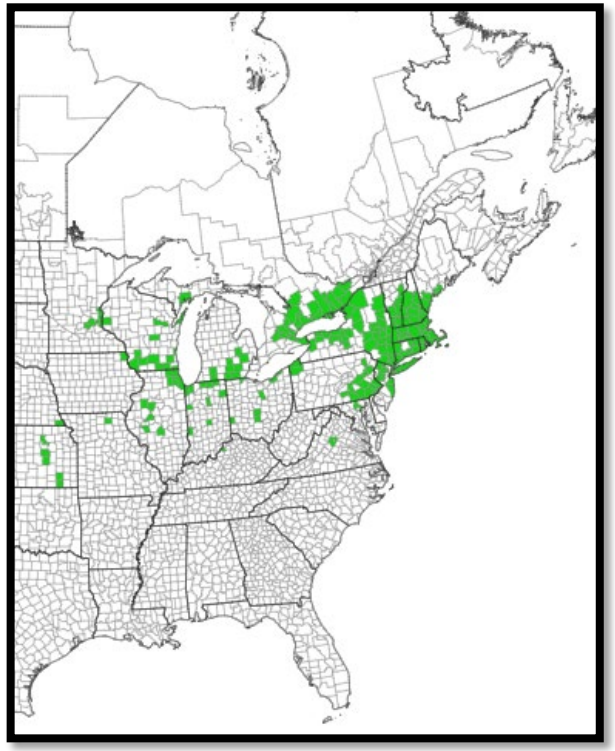
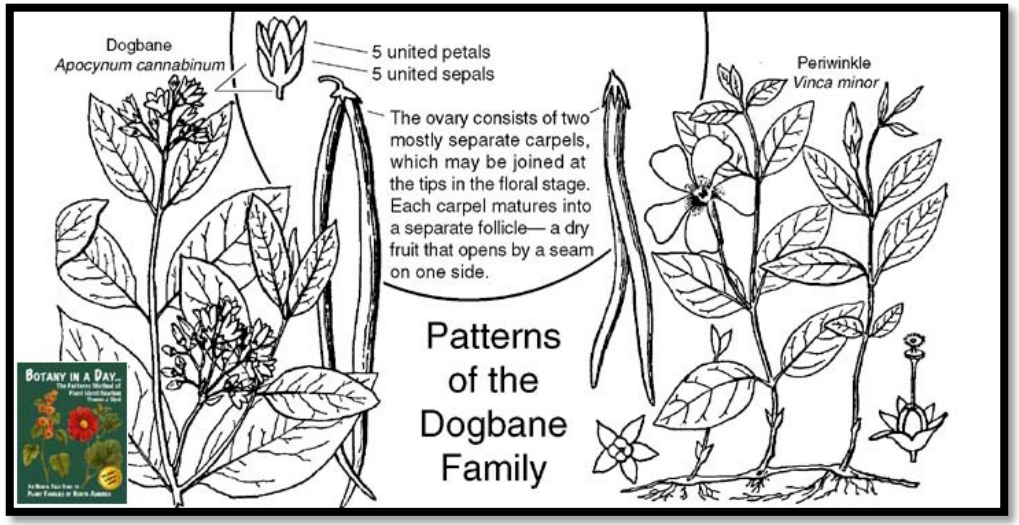
Black Swallowwort (*Vincetoxicum nigrum*)



Invasive species in 21 US states, Ontario, and Quebec

Pale swallowwort *V. rossicum* also invasive

Origin: Mediterranean region of France and Spain



Belong to the dogbane family (Apocynaceae)

Relatives of milkweed; important implications for monarch butterflies.

Difficult to control mechanically

Persistent rhizome and fibrous root.

Repeated cutting and digging needed.

Photos & Maps: Wildflowers and Weeds; EDDMapsS (generated 3/15/23); Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Black Swallowwort Life Cycle

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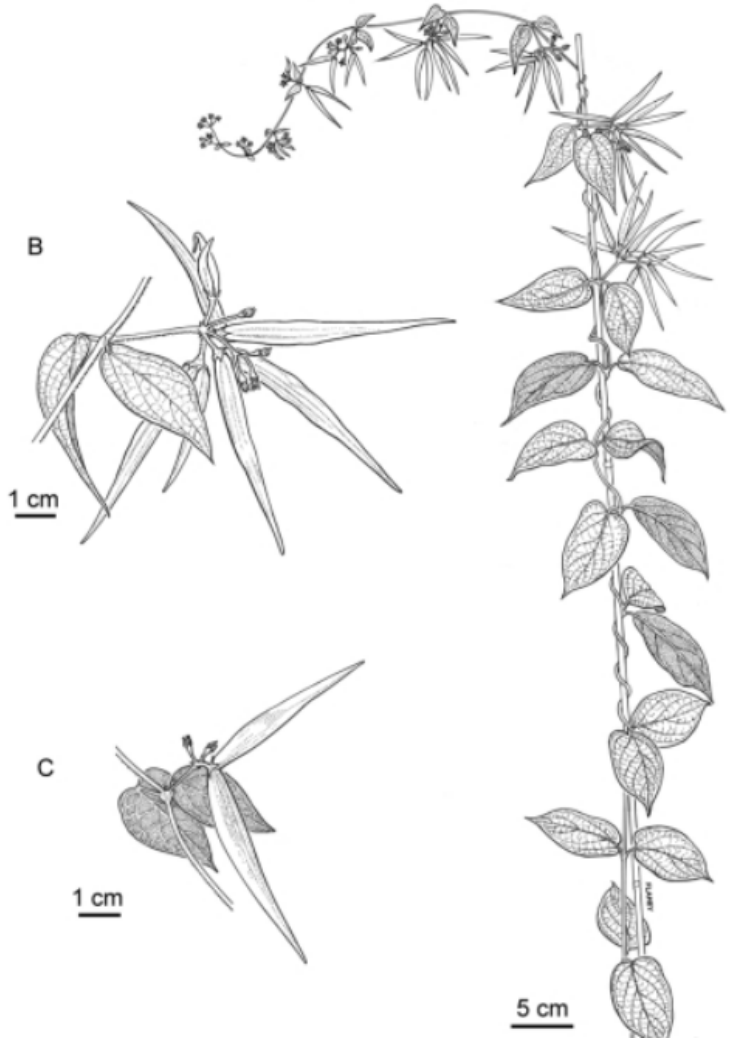
- Begins growing in April and flowering in May or June
- Fruits grow in July and into August
- Swallowwort can self pollinate but are often pollinated by unspecialized flies like blow flies
- Seed pods begin to open in September and the plant begins to die back



Photos: Ditommaso et al.; MNAP Factsheet

Black Swallowwort Overview

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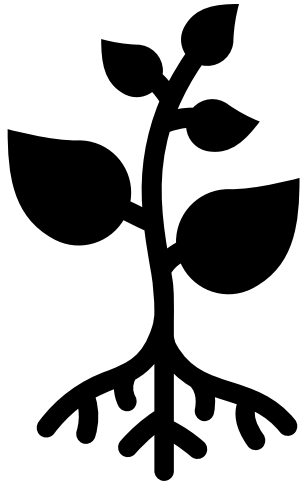
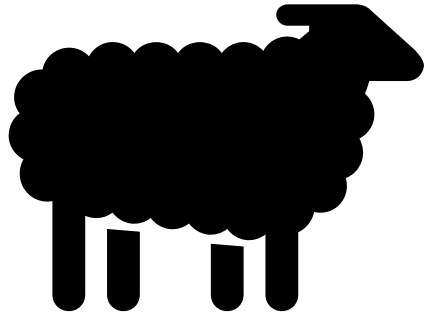
Black Swallowwort (*Vincetoxicum nigrum*)

perennial herbaceous plants & problematic



compete with native vegetation

confuse monarch butterflies



toxic to livestock & damage fencing

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Black Swallowwort (*Vincetoxicum nigrum*)

perennial herbaceous plants & problematic

In a field with a proportion of:

77% Common milkweed
23% Black Swallowwort

15.4% of Monarch eggs were found on Black Swallowwort.

confuse monarch butterflies

Table 3. Monarch eggs found on *A. syriaca* and *V. nigrum* stems, as well as stem density, coverage, and relative coverage in three southern Rhode Island pasture fields

Field	Plant	Year	Stems/ 100 m^2	Eggs/ 100 m^2	Coverage (%)	Relative coverage
A	*A. syriaca*	2001	151	14	—	—
	V. nigrum	2001	281	3	—	—
	A. syriaca	2002	310	0	8.6	0.85
	V. nigrum	2002	565	0	1.5	0.15
B	*A. syriaca*	2001	109	11	—	—
	V. nigrum	2001	405	2	—	—
	A. syriaca	2002	168	2	5.3	0.75
	V. nigrum	2002	209	0	1.8	0.25
C	*A. syriaca*	2001	178	19	—	—
	V. nigrum	2001	243	3	—	—
	A. syriaca	2002	156	5	3.9	0.72
	V. nigrum	2002	157	0	1.1	0.28

Casagrande, R. A., & Dacey, J. E. (2007). Monarch butterfly oviposition on swallow-worts (vincetoxicum spp..).

Black Swallowwort & Biocontrol Timeline

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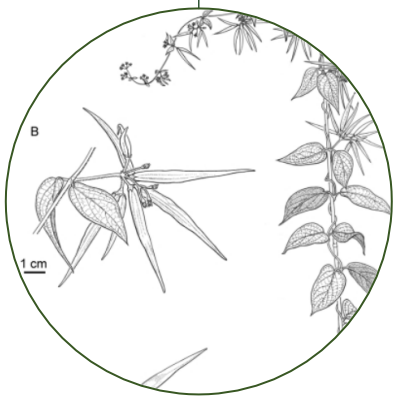
1864

Cultivated in greenhouses in Massachusetts *"escaping from the botanic garden where it is a weed and promising to become naturalized."*



2006

Hypena opulenta collected on black swallowwort in Ukraine and analyzed as a classical biological control agent

Photos: ***Ditommaso et al.; Wikimedia Commons; Bourchier et al 2019; URI Lab Website; Joan Griswold***
Citations: ***Weed & Casagrande (2010); Bourchier et al 2019; 2017 RI Approval and Release***

Hypena opulenta life cycle

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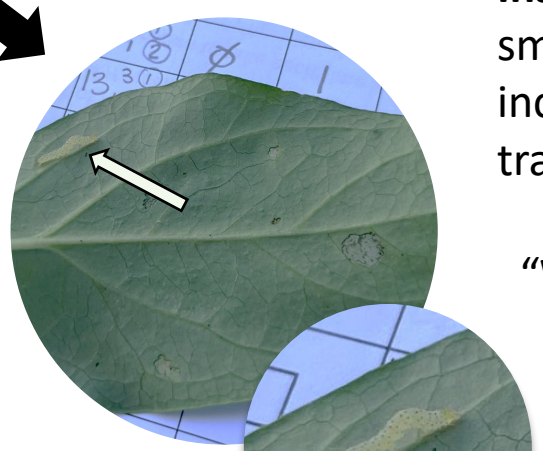
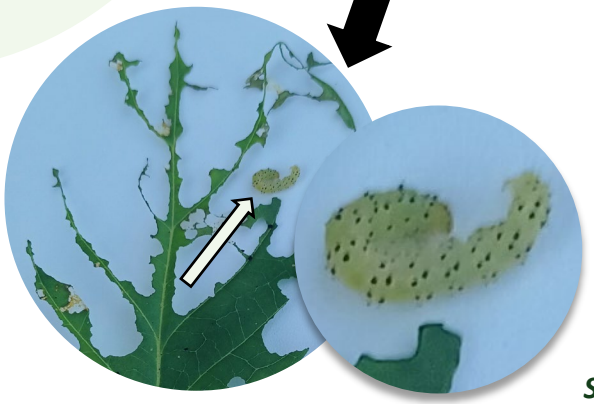
Eggs hatch after 3 to 4 days



Instars 1 to 3 are smaller than ½ an inch long and translucent green.

"Windowpaning" damage

Instars 3 to 5 are larger, between ½ inch and an inch long



Pupae attach to the underside of leaves. Pupa will overwinter under leaves and soil

Adults will produce approximately 600 eggs over a 15-day lifespan

Life cycle takes 5 to 6 weeks between June and October

Can overlap and be multivoltine depending on daylength

Slide & Photos – Mike Galli; Jones et al 2020

Black Swallowwort & Biocontrol Timeline

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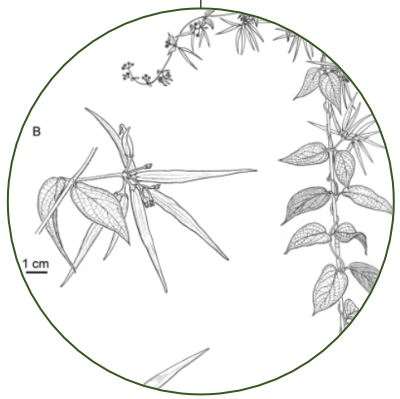
Cultivated in greenhouses in Massachusetts *"escaping from the botanic garden where it is a weed and promising to become naturalized."*

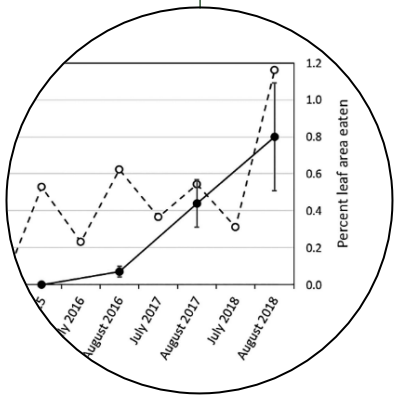


2006

Hypena opulenta collected on black swallowwort in Ukraine and analyzed as a classical biological control agent

2013

H. opulenta first released in Ottowa in Canada. Establishment confirmed in 2018.



2017

H. opulenta first released in the US in RI and MA by the Tewksbury lab

2018 & 2021

H. opulenta released in Maine (Ogunquit; Joan Griswold)

Photos: Ditommaso et al.; Wikimedia Commons; Bourchier et al 2019; URI Lab Website; Joan Griswold
Citations: Weed & Casagrande (2010); Bourchier et al 2019; 2017 RI Approval and Release

Releases in Ogunquit Maine

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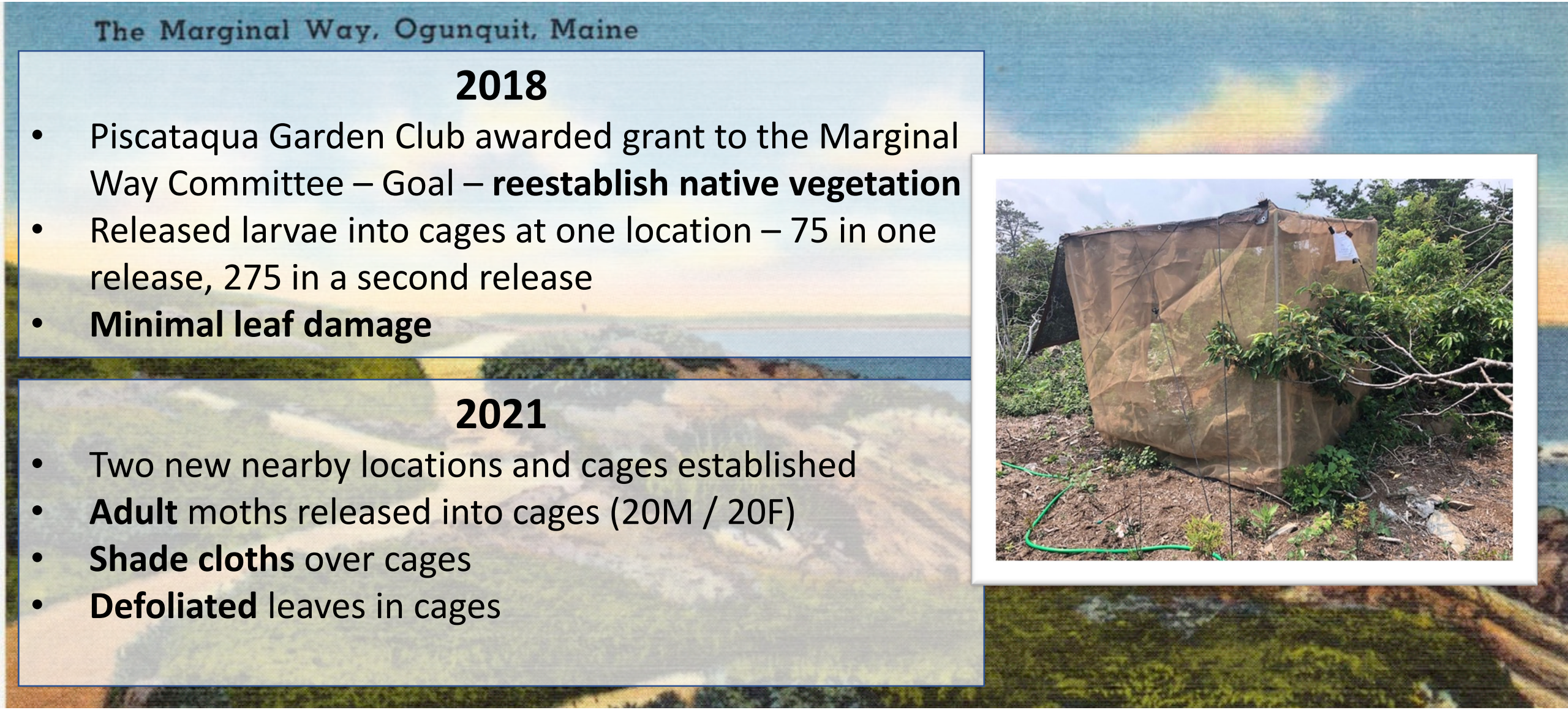

2018

- Piscataqua Garden Club awarded grant to the Marginal Way Committee – Goal – **reestablish native vegetation**
- Released larvae into cages at one location – 75 in one release, 275 in a second release
- **Minimal leaf damage**

2021

- Two new nearby locations and cages established
- **Adult** moths released into cages (20M / 20F)
- **Shade cloths** over cages
- **Defoliated** leaves in cages

Photos: Boston Public Library; Joan Griswold

A Note on Mechanical Control – Pick pods Before Seeds Open

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- Pod-Picking volunteer day – annual since 2012
- Many repeat “pod pickers”
- Joan Griswold – blog posts (links below) with details on how to organize an event like this

Photos: Joan Griswold; Blog Posts: 2015, 2021

Objectives of our Study – Two-Part Investigation

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1

Investigate if populations of *H. opulenta* **established** in Ogunquit from 2017 & 2021 releases.

2

Release *H. opulenta* in **new locations** and determine which environmental factors relate to success in establishment.

Photo:

1 Investigation of Establishment of *H. opulenta* Populations in Ogunquit, Maine

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Method

5-minute visual surveys for *H. opulenta* damage conducted at six locations along release sites (1 mile)

Results

No caterpillars or evidence of damage found

Photo: Hillary Peterson

1 Investigation of Establishment of *H. opulenta* Populations in Ogunquit, Maine

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Method

Blacklight sampling to look for adult *H. opulenta* from dusk until 11:00PM

All moths examined under a petri dish.

Results

No adults found.

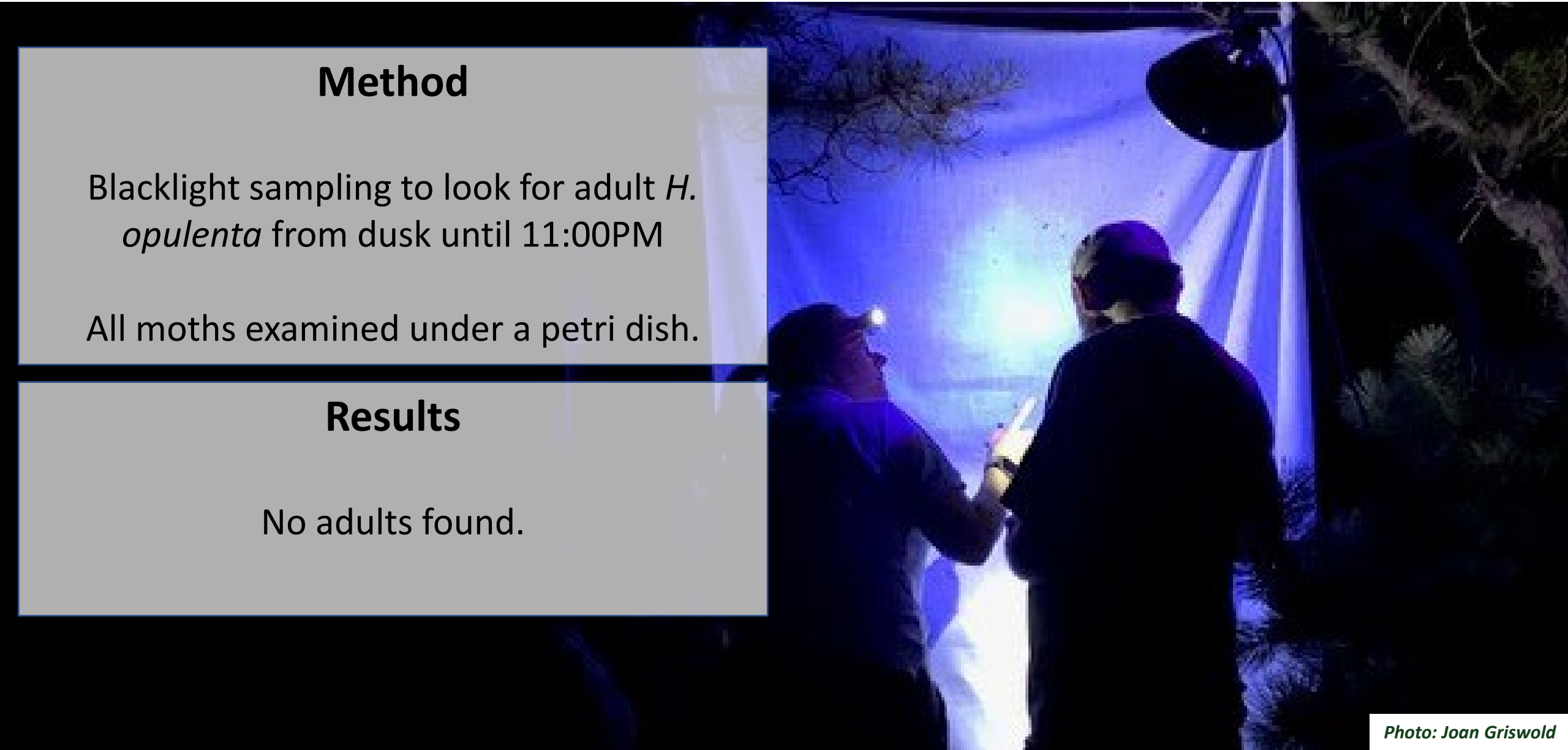

Photo: Joan Griswold

Plenty of other moths and insects were attracted...

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Photos: Hillary Peterson

Excellent opportunity for outreach!

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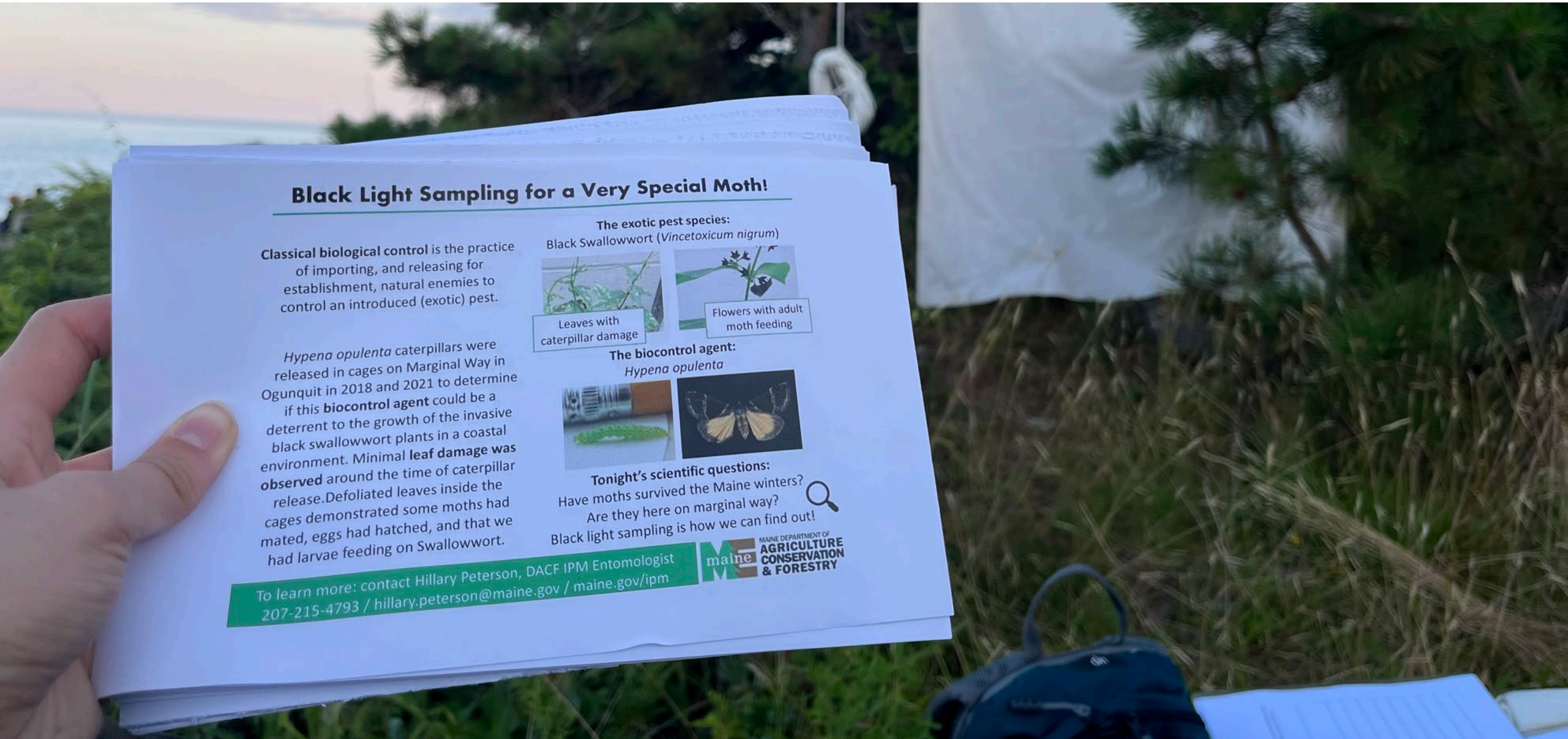

2 Establish new location of *H. opulenta* Populations in Harpswell, Maine

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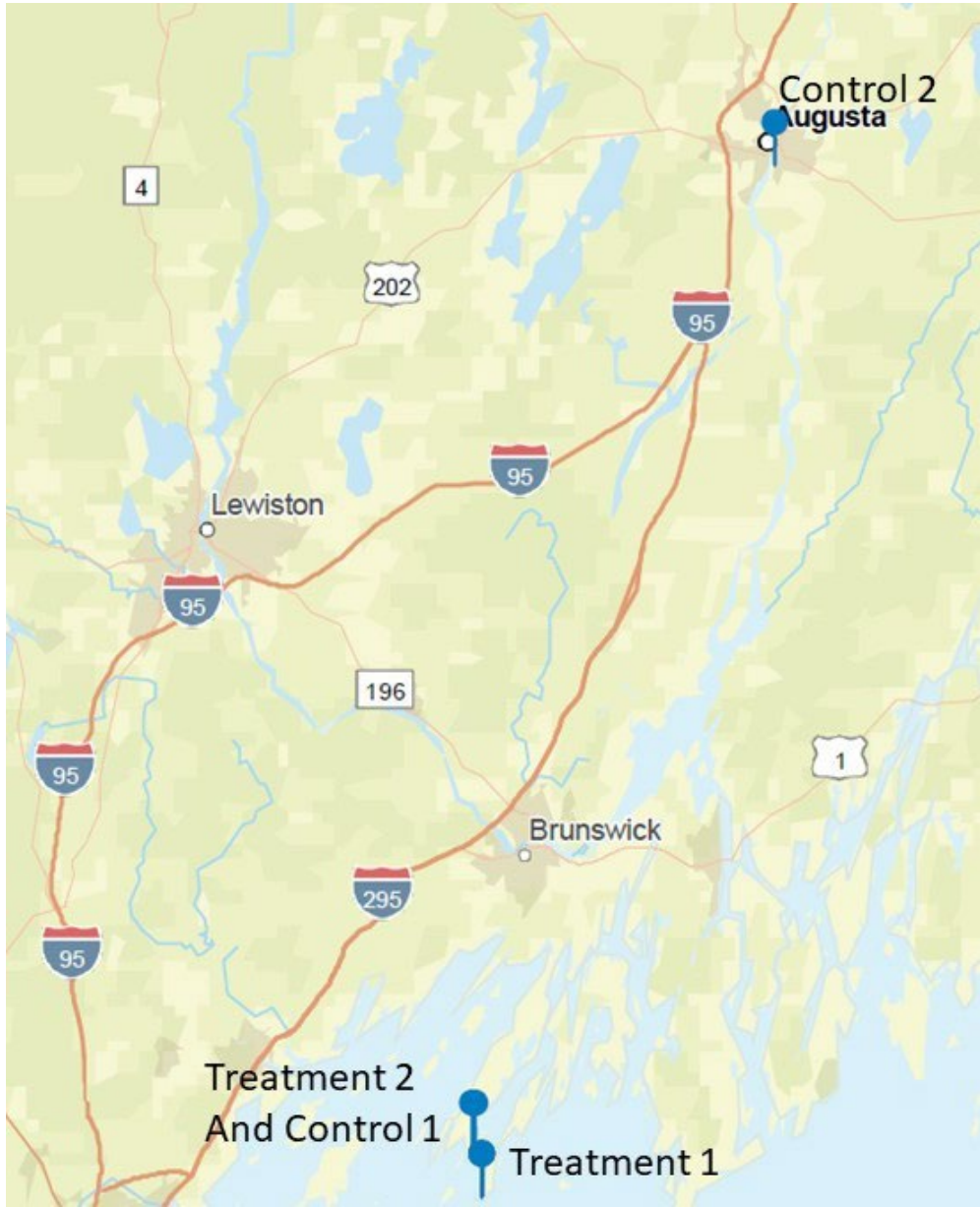
Picking Site Locations

- Large amounts of swallowwort
- Significant amounts of shade as pupa
- Four locations – 2 treatment, 2 control



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THANK YOU MARY YURLINA!

2 Establish new location of *H. opulenta* Populations in Harpswell, Maine

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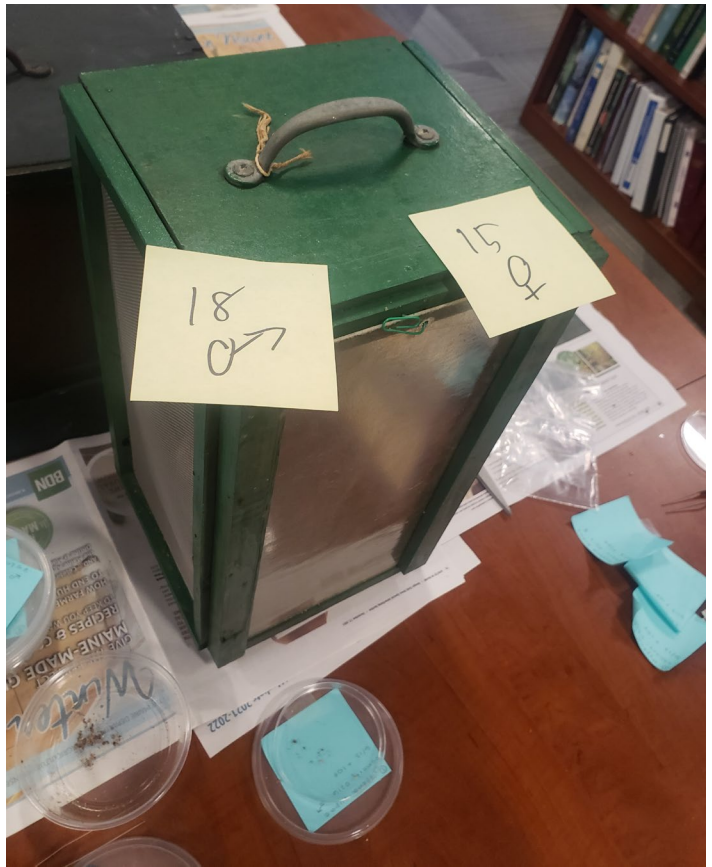
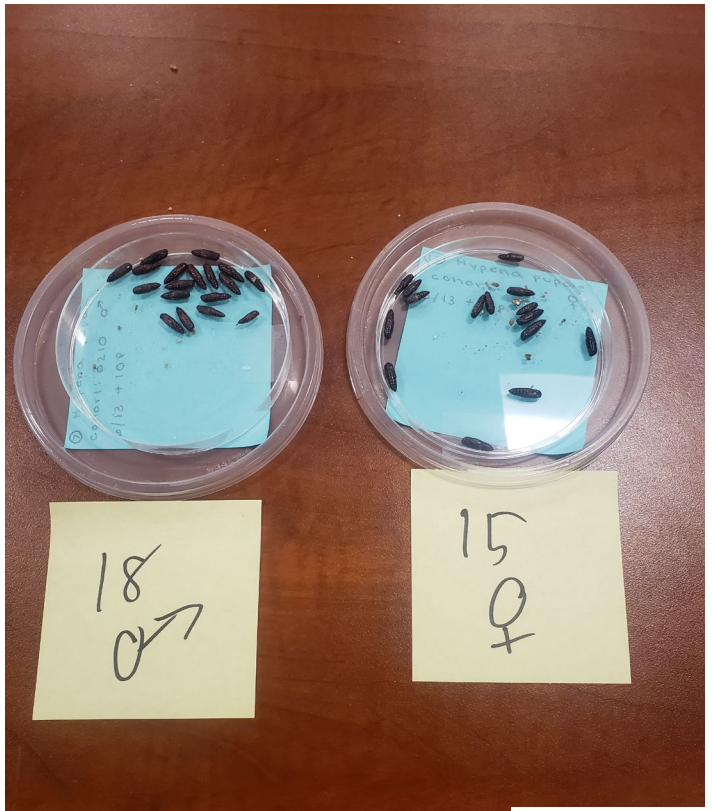
- Pupa were unpacked from the cooler on June 14th when they arrived from Tewksbury lab
- Each group contained 18 males and 15 females
- These groups were placed in bug dorms for three days before being released





Photos: Mike Galli

2 Establish new location of *H. opulenta* Populations in Harpswell, Maine

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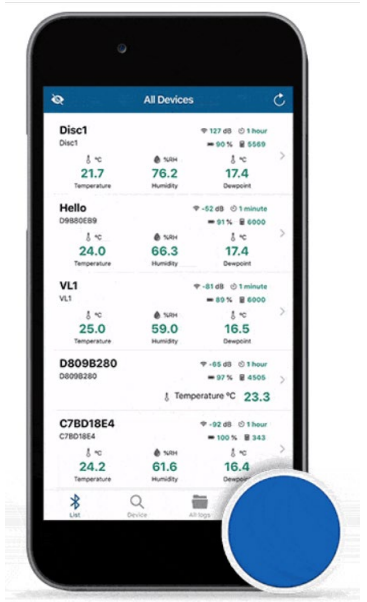
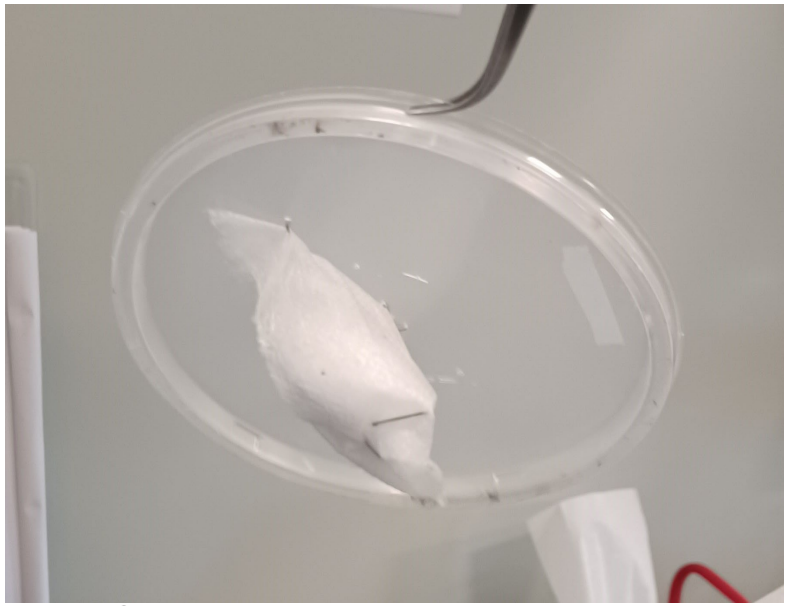
Site Visits

Weekly or biweekly from July 7 to October 5

Environmental data collected from Tempo Disc into the Blue Maestro app.

Hourly Measure:
temperature, humidity, dewpoint, pressure





Date	HOBO?	Photo Taken?	# larvae/ instar	# pupae	# moths	# eggs	Damage rating	# damaged leaves/20	Damage rate SQUARE	Comments
7/7	☑	☑	∅	∅	1	∅	Low	10/20 (2H/8W)	∅	Leaves investigated for eggs
7/13	☑	☑	2 (2nd)	∅	∅	∅	MED	11/20 5W (6H)	∅	Some plants adjacent to Cage w/ damage
07/22	☑	☑	1 (2nd)	∅	∅	∅	MED	12/20 2W 10H	∅	Plants adjacent have Dmg

2 Establish new location of *H. opulenta* Populations in Harpswell, Maine

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Site Visits

Photo taken inside of cage for visual comparison of changes in swallowwort density

Date	HOBO?	Photo Taken?	# larvae/ instar	# pupae	# moths	# eggs	Damage rating	# damaged leaves/20	Damage rate SQUARE	Comments
7/7	☑	☑	∅	∅	1	∅	Low	10/20 (2H/8W)	∅	Leaves investigated for eggs
7/13	☑	☑	2 (2nd)	∅	∅	∅	MED	11/20 (5W) (6H)	∅	Some plants adjacent to Cage w/ damage
07/22	☑	☑	1 (2nd)	∅	∅	∅	MED	12/20 2W 10H	∅	Plants adj. to cage more Dag

2 Establish new location of *H. opulenta* Populations in Harpswell, Maine

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Site Visits

5-minute visual survey conducted to search for *H. opulenta* life stages in cage

Date	HOBO?	Photo Taken?	# larvae/ instar	# pupae	# moths	# eggs	Damage rating	# damaged leaves/20	Damage rate SQUARE	Comments
7/7	☑	☑	∅	∅	1	∅	Low	10/20 (2H/8W)	∅	Leaves investigated for eggs
7/13	☑	☑	2 (2nd)	∅	∅	∅	MED	11/20 (5W) (6H)	∅	Some plants adjacent to Cage w/ damage
07/22	☑	☑	1 (3rd)	∅	∅	∅	MED	12/20 2W 10H	∅	Plants adjacent more Dag

2 Establish new location of *H. opulenta* Populations in Harpswell, Maine

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Site Visits

None = no damage on leaf
Low = holes in a few scattered leaves
Med = holes in many leaves
High = extensive damage on most leaves

Random selection

Compared damage - holes vs. window panes

Date	HOBO?	Photo Taken?	# larvae/ instar	# pupae	# moths	# eggs	Damage rating	# damaged leaves/20	Dama rate SQUA
7/7	☑	☑	∅	∅	1	∅	Low	10/20 (2H/8W)	∅
7/13	☑	☑	2 2nd	∅	∅	∅	MED	11/20 5W 6H	∅
07/22	☑	☑	1 3rd	∅	∅	∅	MED	12/20 2W 10H	∅

2 Establish new location of *H. opulenta* Populations in Harpswell, Maine

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Site Visits

1-meter comparison square outside of cage with 5-minute visual

	damaged eaves/20	Damage rate SQUARE	Comments
1	/20 (4 W 8 N)	Ø	Leaves investigated for eggs
1	/20 (W Cntl)	Ø	Some plants adjacent to Cage w/ damage
0	2/20 (2 W 10 H)	Ø	Plants adj accnt more Dag

2 Establish new location of *H. opulenta* Populations in Harpswell, Maine

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Treatment 1 "Land's End"

Enclosure was placed on Harpswell island road in Harpswell, ME

Photos: Mike Galli & Hillary Peterson

2 Treatment 1: Lands End Location

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Bug dorms placed in cages on June 17th and removed on June 28th

- Between July 7th and July 29th: Significant damage to swallowwort
- Almost all leaves showing some damage by July 29th

Photos: Mike Galli

2 Treatment 1: Lands End Location

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8/10/2022: Multiple adult moths were found inside the enclosure as well as 2 pupa.

Photos: Mike Galli

2 Treatment 1: Lands End Location

Moths found outside the enclosure!

Damage outside of the cage had been observed but it was unclear if larvae would be able to safely pupate and grow into adults outside the cage.

Photos: Mike Galli

2 Treatment 1: Lands End Location

- **August 18** larvae from this generation had begun to hatch and eat swallowwort
- By **September 1** almost all swallowwort leaves consumed

Photos: Mike Galli

2 Treatment 1: Lands End Location

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- **September 15 - October 5** Larva pupated and prepared for winter. Seed pods open and swallowwart plants died

- Some pupa were attached to the bars of the enclosure, these pupa were removed and placed under leaf litter.

Photos: Mike Galli

2 Establish new location of *H. opulenta* Populations in Harpswell, Maine

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Treatment 2

Enclosure set up on Harpswell neck road in Harpswell, ME

2 Treatment 2: Harpswell Neck Road

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- July 14th Significant damage seen outside of enclosure
- July 29th Swallowwort within enclosure is completely defoliated and the enclosure must be removed.
- When removing enclosure several 5th instar larva were found.

larva compared to swallowwort leaf on July 22

Photos: Mike Galli

2 Treatment 2: Harpswell Neck Road

- Before the enclosure was removed there was some damage to the surrounding Swallowwort
- After removing the enclosure damage was seen much farther from original footprint
- **August 10** – two adult *H. opulenta* were observed
- **August 26** – damage was not noticeably decreasing but the tips of swallowwort in the original footprint began to die.

2 Treatment 2: Harpswell Neck Road

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August 18 – 26

Foliage began to grow into the empty space left by the swallowwort including golden rod and Rubus spp.

2 Treatment 2: Harpswell Neck Road

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- After August Swallowwort began to regrow and some of the damaged Swallowwort regrew entire stalks

- Almost no new damage is seen, only pre-existing damage

2 Establish new location of *H. opulenta* Populations in Harpswell, Maine

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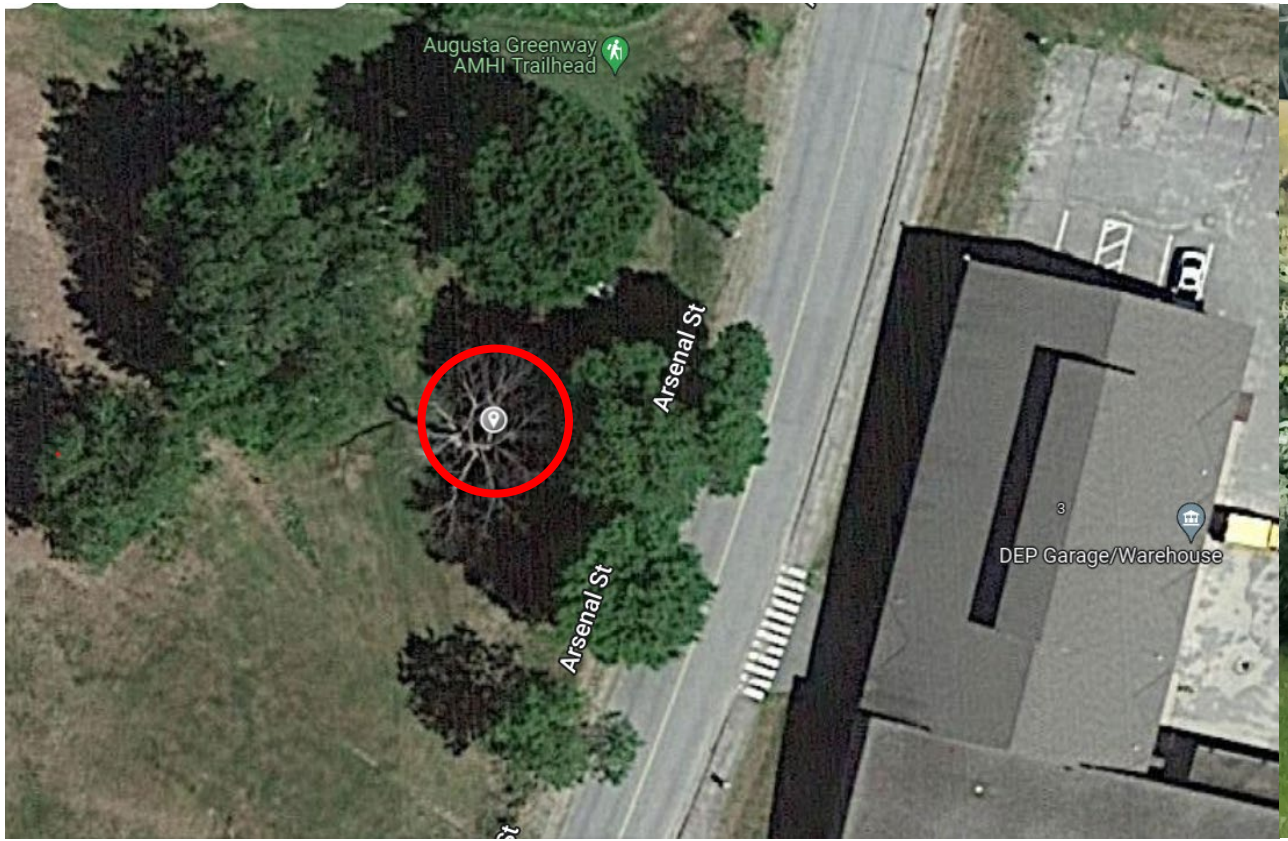
Control 1

Control 1 was placed across the street of treatment 2 site.

No damage was seen there. Swallowwort in the enclosure seemed to be heavily competing against the other plants at the site.

Control 2

Control 2 was located in Augusta on arsenal street a short walk from the Deering building. It contains swallowwort even though it is not close to the other changes.



Control 2 has shown no signs of damage even though most of the foliage around the swallowwort shows significant insect damage.

2 Establish new location of *H. opulenta* Populations in Harpswell, Maine

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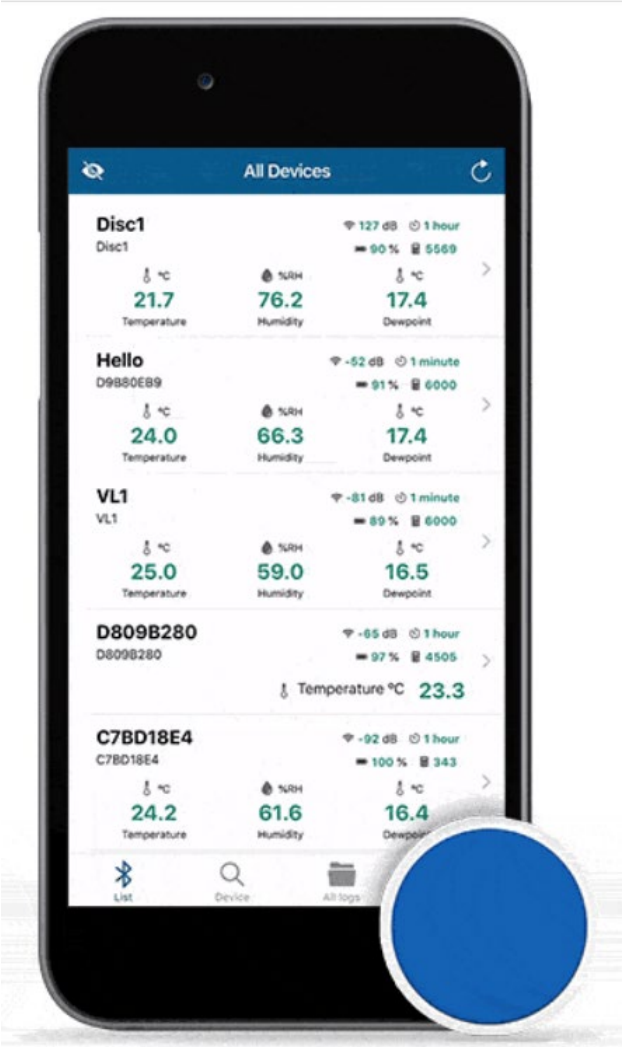

Average of temperature (Celsius) at Time of Day				
Time of Day	12 AM	6 AM	12 PM	6 PM
Control 1	16.6	16.5	27.8	24.7
Control 2	15.5	14.7	23.3	21.9
Treatment 1	15.4	14.8	20.5	17.4
Treatment 2	16.0	14.8	20.2	20.8

Photos: Mike Galli

2 Establish new location of *H. opulenta* Populations in Harpswell, Maine

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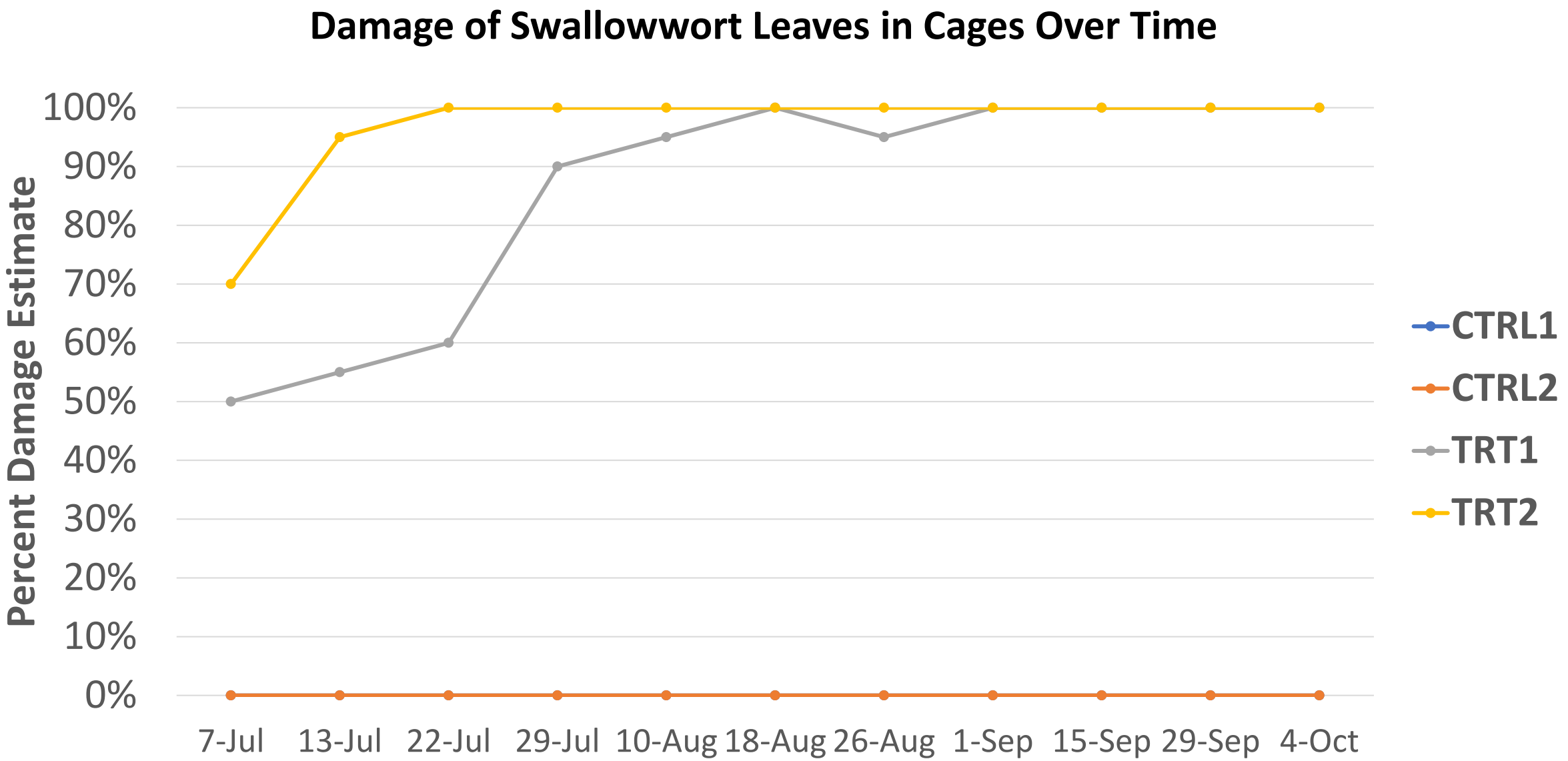

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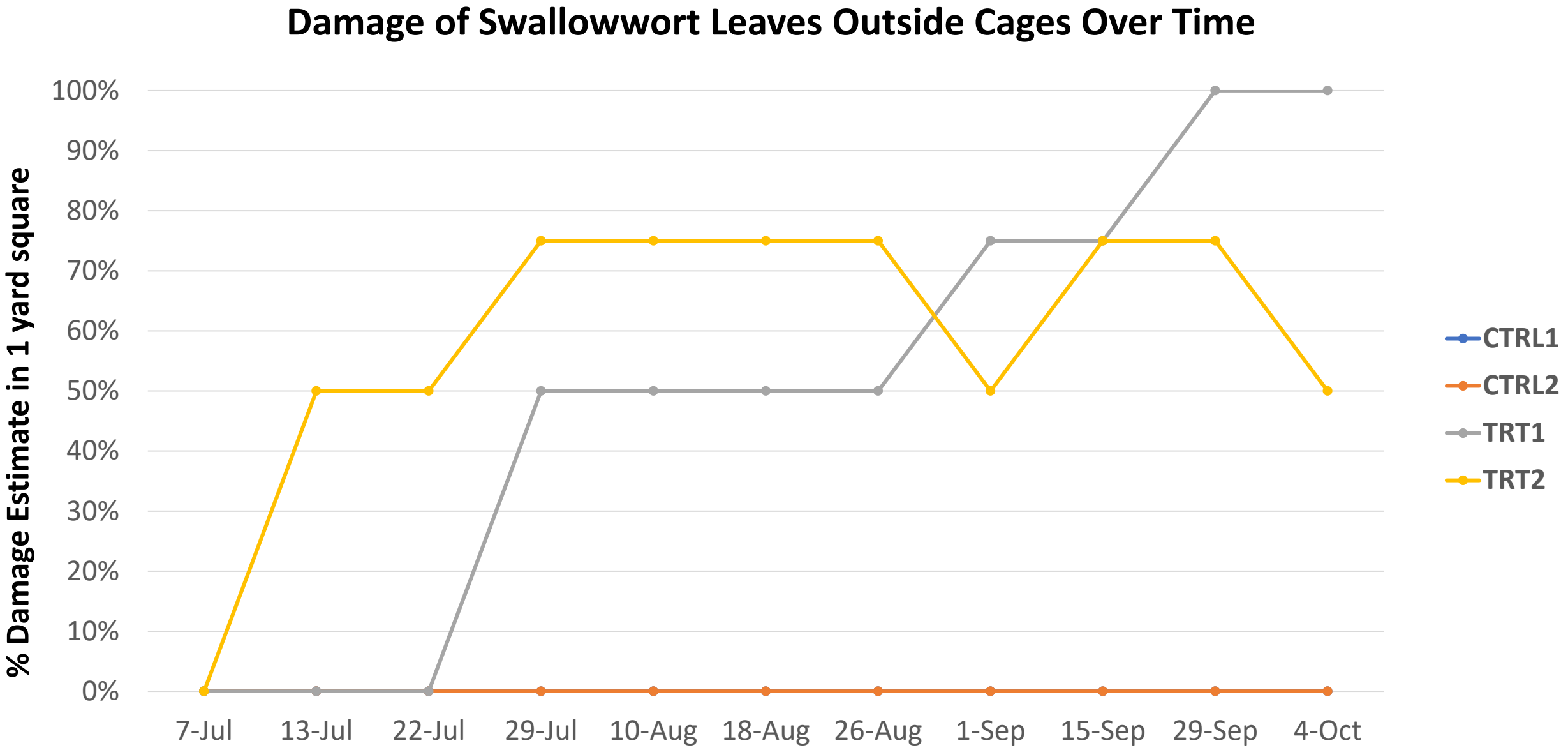

Conclusions

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1

Investigate if populations of *H. opulenta* **established** in Ogunquit from 2017 & 2021 releases.

No evidence seen for establishment, however, mechanical control yielding decreased swallowwort

2

Release *H. opulenta* in **new locations** and determine which environmental factors relate to success in establishment

Pupal rearing and adult release into shaded cages led to second generation.

Need to revisit to determine establishment.