A Practical Guide to Releasing & Monitoring *Hypena opulenta*, a Swallow-wort Biocontrol

Developed by the Swallow-wort Biocontrol Outreach Group with funding from USDA NIFA & NYS Department of Transportation

Project Background

Black and pale swallow-worts (*Vincetoxicum* spp.) are invasive plant species that have been negatively impacting agricultural fields and natural areas across New York State. Swallow-wort is expanding into rare plant communities in northern New York's unique alvar habitats, and evidence suggests they threaten species of federal concern, including the monarch butterfly, and the endangered hart's tongue fern. Encroachment on agricultural fields has negatively impacted hay farmers by reducing product value, due to suspected negative health effects in livestock when consumed.

Swallow-worts can thrive and develop monocultures in both open and forested habitats and have proven extremely difficult to control using mechanical and chemical methods. Despite these challenges, significant public and private funds are dedicated to control this species each year, often with no long-term population reduction.

After years of research, testing and review, a leaf-feeding moth, *Hypena opulenta*, was approved in August 2017 for release as a biocontrol agent in the United States. In this guide you will find resources and information to support you in your own release and monitoring.

With this project, we provide a framework for capturing information and baseline data for *H. opulenta* releases as they are continued in New York State and beyond.

Swallow-wort in flower. PC. Audrey Bowe

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Why Biocontrol?

Swallow-wort seed pods. PC. Laura Bailey

Biological control, or biocontrol, is the use of one species to control populations of another. Biocontrol programs are only started for those invasive species that are 1) widespread and 2) difficult to manage with other methods. Black and pale swallow-worts meet both of these requirements.

These perennial vines are highly invasive and well-documented negatively impact agricultural and natural lands. If you are exploring biocontrol as an option for managing swallow-wort, you are likely well familiar with its propensity to dominate forests and fields in the Northeast as well as its resistance to traditional management.

Biocontrol can be a long-term, sustainable solution. Biocontrol insects, often referred to as "agents" released into the United States have undergone strict safety testing to ensure they will not impact native wildlife. This testing has documented swallow-wort biocontrol agent *H. opulenta* feeds exclusively on black and pale swallow-wort.

However, a critical part of biocontrol success is allowing agents to establish in the introduced range. Effective agents may take years to become established and control the target invasive species.

Meet *Hypena opulenta*

Hypena opulenta is a leaf-feeding moth native to the Ukraine that exclusively consumes swallow-wort (both black and pale). Since its approval in 2017, there have been a handful of releases in New York State and the Northeast, and we continue to learn about the best way to promote its establishment in our area.

Currently, this moth is the only approved biocontrol agent for swallow-wort. *Hypena opulenta* has four distinct stages: egg, larvae, pupae, and adult. Moths can have up to two generations per year in our region, and are active from approximately mid-May to August. More information on this moth and its path to approval as a biocontrol can be found in Appendix IV.

At left, an adult Hypena opulenta. At right, pupae of H. opulenta before release. PC. Audrey Bowe, Laura Bailey

Why Monitor?

Monitoring is the key to answering questions such as “How did my insects establish in this area? Or “Have we improved conditions for native species now that we’ve introduced biocontrol?” and many more. Without it, we lack solid evidence for claims of success and miss opportunities to learn along the way.

Like other management practices, certain biocontrols may be effective and appropriate for some situations or less so in others. With newly approved biocontrol agents, such as *H. opulenta*, this is something that gets discovered and documented in real-time as the species establish in a new region. Insects, like many organisms, have preferences for the circumstances under which they can flourish. Initial studies suggest that *H. opulenta* will establish slightly better in forested areas as opposed to open fields. Documenting the conditions of a release as well as location characteristics will help us continue to determine the best conditions for biocontrol to thrive and effectively control swallow-wort.

Monitoring the plants in the area, both before and after *H. opulenta* is released allows us to assess change over time, to see if the biocontrol is controlling swallow-wort and allowing native species to re-establish. The data that you generate is invaluable to understanding how this management strategy works in different environments and benefits our ecosystems.

Above, preparing to use PVC square meter quadrats for monitoring vegetation at a field release site. PC. Lydia Martin

What to Monitor?

There are three different ways you can assess the "success" of a biocontrol treatment, and ideally all these aspects should be monitored in tandem.

A) Did your insects successfully establish? (survived and reproduced at a site)
B) Did the surviving insects eat enough to reduce populations of the target plant (swallow-wort)?
C) Did the impact on the target plant (swallow-wort) enhance conditions for native plants at your site?

Answering different questions requires looking at different aspects of the environment. We have developed protocols to allow for monitoring to monitor each of these avenues of success (A-C). Links to forms, which are available both in paper version and via Survey123 can be found in Appendix VI.

1) **Swallow-wort Biocontrol – Initial Release Form**

   This form collects information on releases of *H. opulenta*, including what stage insects are in (larvae, pupae, or adult), when releases took place, and how many were released.

2) **Swallow-wort Biocontrol – In-cage Monitoring Form**

   This form is designed for weekly visits to insect cages where releases took place and collects information on *H. opulenta* life stages and defoliation observed.

3) **Swallow-wort Biocontrol – Overwintering Survival Check Form**

   This form is designed for use in the spring of the year after a release to see if *H. opulenta* were able to overwinter by looking for evidence of feeding damage. ***Surveys should be performed before any new annual releases.*** It collects information on the amount of area searched, as well as the time spent searching to calculate approximate search effort.

4) **Swallow-wort & Native Vegetation Monitoring Form**

   This form is designed for use once a year to collect information on how vegetation around the site, including swallow-wort and native vegetation, is changing. Using this form requires setting up ten permanent 1 m^2 vegetation monitoring locations. Information should be collected in early summer once swallow-wort is in bloom.

Selecting a Release Site

Before you attempt to establish a release and monitoring site, you should consider whether your location is going to be a good location for *H. opulenta* to live. There are three important components to selecting an appropriate site – 1) What permissions are needed, 2) will this area be disturbed or managed with other techniques in the future, and 3) is there an adequate amount of swallow-wort?

1) Site Permits & Permissions

If you are conducting releases on public land, you will likely need to apply for and receive a permit to do so. If you release agents on private property, it's a good idea to clearly communicate about land use expectations (see "Disturbance" below). A template for a site owner agreement which outlines these expectations and other details is included in Appendix IX of this report.

2) Disturbance

Certain management activities will interfere with successful establishment of *H. opulenta* populations and vegetation monitoring. It is therefore critical that the following site management guidelines be implemented and followed for **at a minimum 5 years** in the project area:

1) No use of mechanical management activities (i.e., mowing, raking, digging, hand-pulling, cutting)

2) No use of chemical management practices (i.e., herbicides, pesticides, insecticides)

3) No use of prescribed/controlled burning as a management activity

4) No moving, disturbing, trampling or otherwise tampering with field release cages and permanent vegetation monitoring plots

A perimeter of 100 meters or more should be delineated around the initial release area. While release sites can be good opportunities for outreach, we have encountered incidences of equipment being stolen and recommend placing sites in less-traveled locations. Signage can be useful to limit foot-traffic.

3) Adequate Food Supply

Most well-established populations of swallow-wort will be big enough to support a population of *H. opulenta*, but smaller, more isolated populations might be more suited for different management approaches. While we have released agents at both field and forested sites, forested sites appear to be most suitable for *H. opulenta* establishment.

A field demonstration site in central New York for H. opulenta release. PC. Audrey Bowe

Vegetation Monitoring & Site Set-up

Once you've selected a good location for swallow-wort biocontrol, you'll need to set up your site. This will involve installing two things in advance:

1) Insect release cage

Mesh release cages (see Figure 1, and the "Placing Your Cage" section below) are available to borrow annually through our swallow-wort initiative (email nyisri@cornell.edu to submit a request) or can be purchased if cages are not available through our program. Cages should be secured to the ground with sod stakes or sand bags.

If your cage might be in view of the public, we recommend adapting or developing site signage to communicate with passersby (Appendix X).

2) Vegetation monitoring locations

For monitoring vegetation, you'll want to establish 10 permanent vegetation monitoring locations (1x1 meters), each of which contain a minimum of 10 stems of swallow-wort. Vegetation monitoring locations can be marked at each corner with a 0.25 m PVC conduits (3/4 inch diameter). Each location should be assigned a unique number from 1 – 10 and labeled with greenhouse or paint marker so it can be identified. At sites with exposed bedrock where installing PVC was challenging, we marked corners with wire flags.

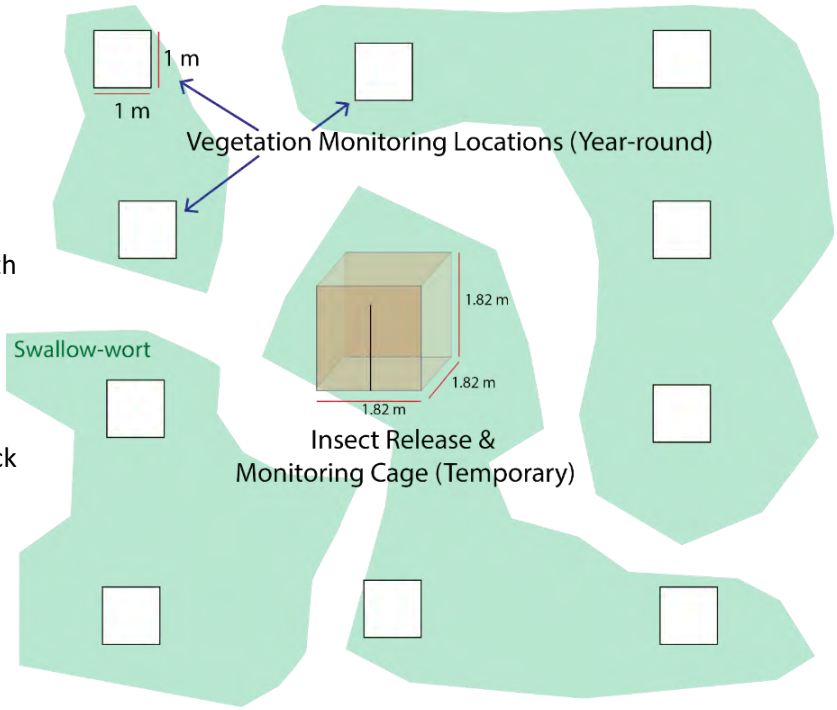


Figure 1. Site schematic for a release site, with a release cage and surrounding permanent vegetation monitoring locations.

PVC tubing can be purchased from your local hardware store (ex. Home Depot, Lowes) and cut to size. At some sites with exposed bedrock, we marked corners with standard wire flags as needed. When establishing these locations, it's helpful to have a meter square PVC frame or similar tool for delineating the area.

Distance between vegetation monitoring locations will be determined based on your site size, however the minimum recommended distance between each monitoring plot is 2 meters. Having a single transect (line) of vegetation monitoring locations also works well. If needed for visibility, consider using flagging tape to mark areas where you have put monitoring locations.

Once you've established your vegetation monitoring setup, you can collect data on the percent cover swallow-wort and native vegetation, swallow-wort stem density, leave % defoliation, and seed pod production at these plots before the biocontrol is released, and again at the site every year (see Appendices II & III).

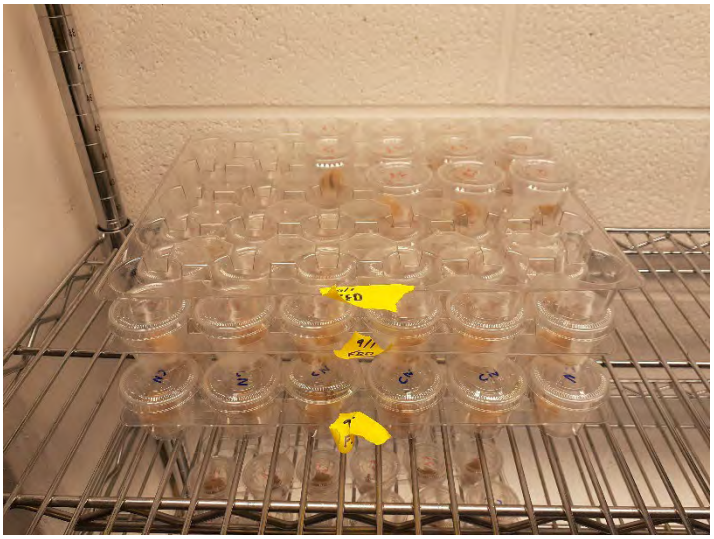
A full list of materials you will need to set up a site can be found in Appendix I.

Obtaining *Hypena opulenta* Agents

One of the key steps in a successful biocontrol program is the transition to mass production (or rearing) of insect agents. For researchers, this involves shifting from keeping a small colony of insects alive to rearing and releasing thousands as well as providing them to land managers. For *H. opulenta*, this transition is in progress. There are several labs in the US and Canada that maintain colonies of this insect and rear them for release. However mass rearing for wide-scale distribution can pose challenges.

In the case of swallow-wort, *H. opulenta* is currently limited in supply. While insects as a group have a reputation for incredible boom and bust population capabilities, certain insects, have limits to when they can reproduce based time of year and other factors. *H. opulenta* is sensitive to photoperiod and is therefore limited to at most two generations per year in our region. This means that for most of the year (over winter), these insects will be resting in their pupal state. Additionally, rearing has been challenged by pathogen outbreaks in lab populations, which decimate numbers and require additional work and attention from researchers to mitigate impacts.

It can be a frustrating experience to not be able to get agents for your site or project. At this point, however, agents are rarely guaranteed. We are hopeful that with rearing advancements, *H. opulenta* will become more available in the next few years. Contact nyisri@cornell.edu if you are interested in being connected with potential agent providers.



Left, H. opulenta larvae rearing set-up at a research laboratory. Each larva is raised individually on specially formulated artificial diet. At right, H. opulenta adults being released into a cage. PC. Audrey Bowe

Placing Your Cage

In preparation for releasing agents, it's highly recommended that you install an insect release cage. These cages, which are approximately 6 x 6 x 6 feet and made of mesh (pictured left), will keep insects safe from some predators, and more importantly, keep them together temporarily. Keeping the moths all in one place after initial release is beneficial for several reasons.

Having a limited area that the insects inhabit makes it easier for them to find each other and successfully mate. It also is much easier to assess whether you have achieved establishment (seeing feeding and agents) within the first few weeks.

We typically locate insect release cages in a central location at each site and temporarily secure them the ground using metal sod stakes. Choose a location with a maximum amount of swallow-wort (food for the insects) and minimum amount of trampling. Our experience suggest that insects do better in cages that are shaded. If on public land, try to avoid placing cages in plainly visible site to avoid tampering. We have had cages in high-traffic areas disappear (an expensive mystery!).

Assembling the Insect Release Cage

Cage frames are made up of 16 interlocking metal pipes, 4 corner pieces, and 4 ground plates.

A team constructing an insect release cage. PC. Melissa Rivelis

To create the cage frame, connect sixteen metal pipes (in sets of two) to create eight 6-foot-long sections. These will create the four edges of the top, and the four sides on the cage. Use the four corner pieces for the top corners and the ground plates for putting the side pipes into and securing to the ground. Make sure to tighten the eye bolts well on the corner pieces. It's helpful to have multiple people to assist with frame assembly.

Once you have the frame assembled and in place, slide the mesh cage over it, making sure the zippered entrance faces your desired direction. Secure to the ground by pressing sod stakes through the grommet holes in the mesh as well as through the holes the base plates.

We strongly recommend setting up your cage in advance of insect release, so that it is prepared when agents arrive. If your site is in a well-trafficked area, we also recommend placing signage about the project to reduce disturbance from curious passers-by (Appendix X). You might also consider placing a stepping stone behind the zippered entryway to create a space to stand inside the cage without the danger of stepping on pupae or larvae that may be on the ground.

For an idea of what cage-set up looks like in the field, check out the "*Releasing and Monitoring Swallow-wort Biocontrol in New York State*" video linked in Appendix VII.

Releasing Your Insects

In New York State, *H. opulenta* can have two generations per year. Adult moths from the first generation emerge in late May or early June, and the second emerge in July. We recommend timing your release of *H. opulenta* with these natural cycles.

There are pros and cons to releasing different life stages of *H. opulenta*.

Adult moths have usually already mated and females can immediately lay eggs, improving odds of a next generation establishing in the cage. In our releases, we have preferred using adults for this reason, placing 40 adults of *H. opulenta* (20 males, 20 females) in each cage, and recommend releasing no fewer than this number for optimal establishment. However, adult moths can be difficult to transport and are sensitive to environmental changes. Moths must be kept cool and have access to moist gauze to avoid mortality during transport.

Pupae are another option for release, however depending on conditions may have variable survival rates. This stage is particularly vulnerable to predation, as moths don't have many defenses from predators. Moths may emerge from their pupal stage at different times, so mating may not occur, further limiting establishment. We conducted one year of our releases this way and had mixed results, with *H. opulenta* establishing at only one out of six sites.

Releasing larvae is yet another option. Larvae are fairly easy to transport and ship compared to adults, and can rapidly consume swallow-wort. However this stage is also vulnerable to predation and staggered emergence times.

Bottom, Adult H. opulenta being transported for release. Top, honey water in an insect release cage. PC: Audrey Bowe, Lydia Martin

Adult moths or larvae can be gently placed onto swallow-wort within the cage. If needed, you can leave the open container within the cage for the first week to allow for natural dispersal. Paintbrushes can also be useful for gently moving larvae onto leaf material. For pupal releases, you may consider a specialized holding container. Whatever stage you are able to release, information should be documented in our Survey123 monitoring form (Appendix VI).

Honey water should be placed within the cage as a food source for adult moths. A jar with a wick can be hung in the corner of the cage. Instructions for mixing honey water can be found in Appendix VII.

Insect Monitoring & Cage Removal

Once *H. opulenta* have been released into your cage, we recommend visiting every week to make observations and record data. Honey water (Appendix VII) should also be replaced on a weekly basis, wherever possible. There are two ways to record data on your insects weekly. You can use our insect monitoring Survey123 form (Appendix V) or print out a paper copy (Appendix V). Our Meet *Hypena* pocket guide (Appendix IV) provides a quick-guide for monitoring. Spiders can predate *H. opulenta* and we recommend removing any spider webs that may be present in the corners of the cage to improve odds of survival of adult moths.

We recommend monitoring establishment and defoliation within cages on a bi-weekly basis until we observed significant (>50% defoliation of more than half of the leaves sampled) at which point we carefully removed the cage to allow moths to be free to disperse across the landscape.

As you remove insect cages, take care not to trample vegetation that was inside the cage. If swallow-wort has already started producing seeds, be conscious not to spread them. Either shaking cage covers off in a nearby area or enclosing them in a contractor bag and removing seeds in an enclosed area, such as a garage, is recommended before wrapping them up for storage.

How to Use the Monitoring Forms

We have developed four protocols and datasheets to help you monitor your site and determine success of releases. The data you collect with the project will provide valuable information in assessing *H. opulenta*'s effectiveness as a biocontrol agent.

Each are available online via Survey123 (links in Appendix VI), or via printable datasheets. If you have any questions or issues entering data, please get in touch. If paper datasheets are utilized, please save, scan, and email them to Audrey Bowe (aeb286@cornell.edu) for this valuable data to be added to our database.

Appendices

Materials List

For setting up a single forested or field site

Insect Cage

- ☐ Cage cover
- ☐ Cage frame (16 metal poles – 3 ft sections; 4 corner connectors; 4 base plates)
- ☐ 30-40 sod stakes (for staking cage skirt and securing base plates)

Vegetation Monitoring

- ☐ Data sheets (multiple copies) – Field, Forest, or both
- ☐ Clipboards
- ☐ 1 square meter quadrat (more if multiple people monitoring)
- ☐ Pencils (for recording data)
- ☐ 2-3 Sharpies/Greenhouse markers for labeling or relabeling conduits

Additional Vegetation Monitoring Equipment for First Year

- ☐ 40 PVC pipe conduits (2 ft for forested sites; 2.5 ft tall for fields) – *optional spray painted*
- ☐ Hammer for establishing PVC vegetation monitoring
- ☐ Flagging tape or flags for marking locations (*optional*)

Swallow-wort Biocontrol Program: Vegetation Monitoring Form

Field Form

Name(s): _____ Date:_____

Site Name: _____

Place square meter quadrat over PVC stakes and measure the following:

	Vegetation Percent Cover				**Swallow-wort Density**			
Veg Monitoring Location # (written on stake)	% Cover swallow-wort*	% Cover other vegetation*	Other non-swallow-wort invasives present? (Y/N)	% Cover non-swallow-wort invasives (if present)	# Flowering Stems **(in m^2 area)**	# Non-flowering Stems > 10cm tall **(in m^2 area)**	# Non-flowering stems < 10 cm tall **(in 10 cm^2 area)**	Notes
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

*% Cover Classes: 0, <5, 5-20, 21-40, 41-60, 61-80, 81-100. Percent cover estimates should approximately total 100 (sum of swallow-wort and other vegetation cover)

Notes on this data form:

For other introduced plants, please list species and approximate cover below if known:

_____

_____

_____

_____

_____

_____

Percent cover reference:

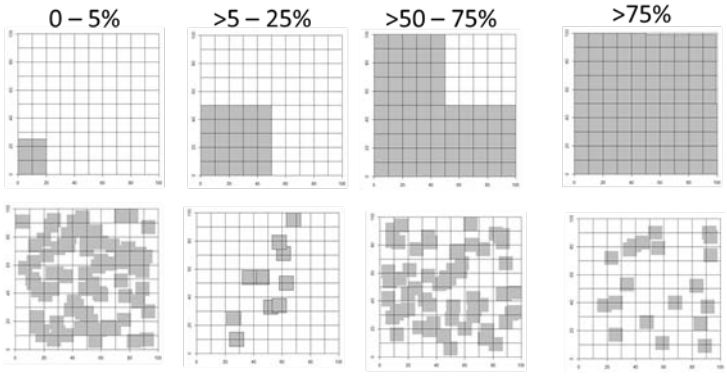


Figure 1. Cover classes (%) and spatial arrangement within a quadrat, clustered (top row), and at random (bottom row)

Swallow-wort Biocontrol Program: Vegetation Monitoring Form

Forest Form

Name(s): _____ Date:_____

Site Name: _____

Place square meter quadrat over PVC stakes and measure the following:

		Vegetation Percent Cover			Swallow-wort Density			
Veg Monitoring Location # (written on stake)	% Cover swallow-wort*	% Cover other vegetation*	Other non-swallow-wort invasives present? (Y/N)	% Cover non-swallow-wort invasives (if present)	# Flowering Stems **(in m^2 area)**	# Non-flowering Stems > than 10cm tall **(in m^2 area)**	# Non-flowering stems < 10 cm tall **(in m^2 area)**	Notes
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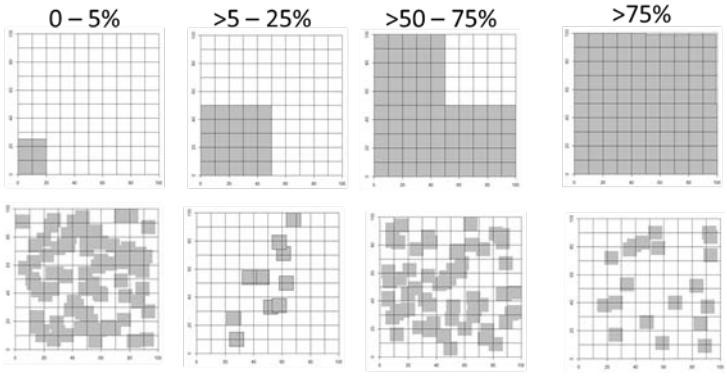


Figure 1. Cover classes (%) and spatial arrangement within a quadrat for reference, clustered (top row), and at random (bottom row)

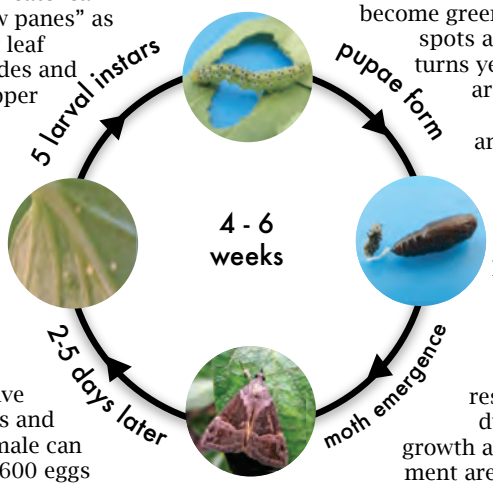
Hypena opulenta – a pocket guide

When invasive plants like black and pale swallow-wort take over, they harm our natural areas. *Hypena opulenta*, a European moth, feeds exclusively on black and pale swallow-wort leaves– giving it potential as a biocontrol agent for the invasive plant. The goal of biocontrol is to reacquaint invasive species with their native predators, which restores a more natural mechanism of long-term control. After 10+ years of safety research, the USDA approved the moth's release in 2017, and ongoing research is assessing the effectiveness of *H. opulenta* in controlling swallow-wort.

Larvae create leaf "window panes" as they eat leaf undersides and leave upper surface intact

Eggs laid at leaf base

Adult moths live ~17 days and each female can lay 400-600 eggs



As **larvae** develop, they become green with black spots and the head turns yellow. **Pupae** are reddish to dark brown and about 1.2 cm long

Part of each generation undergoes pupal diapause, a resting period during which growth and development are suspended

Adult Moth. Lindsey Milbrath

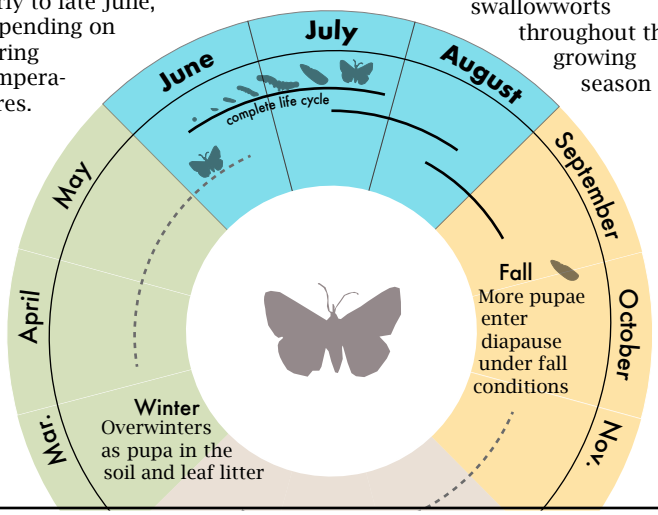
"Window pane" damage. Lindsey Milbrath

A moth of many months

Adults may emerge early to late June, depending on spring temperatures.

2nd generation adults may emerge in late July

The moth's multiple, overlapping generations are expected to continuously stress swallowworts throughout the growing season



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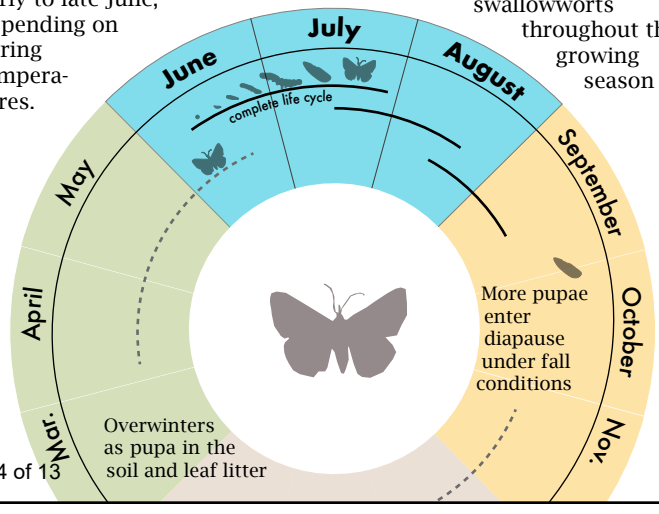

Monitoring Checklist

☑ **Replace your honey water** once a week. If you have more than one jar, make your mixture at home, then hang your fresh jar in the corner. Be sure to replace the wick each week to prevent mold.

☑ **Document site conditions** at the top of your monitoring form. List the date, approximate time, weather, location, and add any other special notes about your surroundings in the space at the bottom.

Swallow-wort in flower

☑ **Look for agents** and indicate them on your monitoring form.

Adult moths are most visible; look for them resting on cage sides and flying once you shake the foliage.
Larvae are harder to see; crouch to plant level to look for leaf damage, and watch them drop off plants when disturbed.
Pupae will be on the ground; avoid stepping into the cage more than necessary.
Eggs are almost impossible to see; single eggs may be laid near veins on the underside of leaves.

Replacing honey water

Feeding damge on swallow-wort

Hypena larvae

☑ **Look for feeding damage** on swallow-wort leaves. Randomly select 20 leaves within reach of the cage entrance and estimate the amount of leaf missing for each on your monitoring form.

Learn More

Email nyisri@cornell.edu
scan QR code or enter URL

bit.ly/swbiocontrol

Cornell University Cooperative Extension

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Cornell University Cooperative Extension

Hypena opulenta In-Cage Monitoring Form

Date:_____ Location:_____

Weather conditions:_____ Cage Type: Field or Forest (circle one)

Time: _____ Estimated Time Spent in Cage: _____

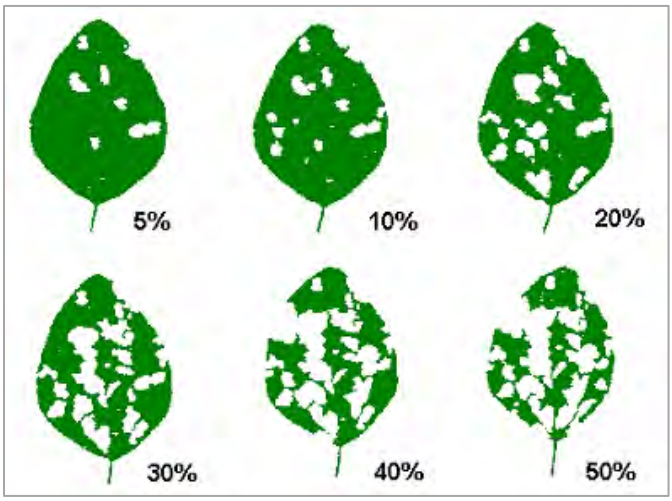
Any life stages visible (circle one)? Yes No

Larvae (instars)	Yes	No	approx. number of larvae observed:_____
Pupae	Yes	No	approx. number of pupae observed:_____
Adult moths	Yes	No	approx. number of adult moths observed:_____
Eggs	Yes	No	

Percentage of swallow-wort population defoliated:

Estimated percentage of plant leaf defoliated – randomly choose 20 leaves and estimate to the nearest 10 percent the amount of defoliation based on chart below:

Leaf #	% Defoliation	Leaf #	% Defoliation
1		11	
2		12	
3		13	
4		14	
5		15	
6		16	
7		17	
8		18	
9		19	
10		20	



Leaf defoliation estimation guide. Photo by University of Nebraska-Lincoln.

Notes:

Online Monitoring Forms

Use the links below to conduct monitoring through the Survey 123 App

Biocontrol Monitoring Form – Initial Hypena Release: https://arcg.is/0jaivm0

Biocontrol Monitoring – In Cage Search: https://arcg.is/1fSD0P1

Hypena Overwintering Survival Search: https://arcg.is/1bOWfe

Vegetation Monitoring Form: https://arcg.is/1W0Kuq0

10% Honey Water Solution Recipe

Scant Tablespoon Honey

4 oz (half cup) Water

Instructions

Add honey and water to 4 oz Mason jar and shake or stir to dissolve completely. Thread a fresh wick through hole on jar lid and screw lid to jar. Make sure that the wick reaches the bottom of the jar, as the solution will evaporate over the week.

Cage Placement

Jars of honey water should be hung one of the eye hooks in a cage corner closest to the door.

Please replace the honey water container and wick once/week.

Containers can be brought home, cleaned, and reused. Wicks should be thrown away.

Video References

Meet Hypena!

https://cornell.box.com/s/qglaedvckxi43ym0vkbo858ykgt2gcif

A 6-minute video overview of the project and weekly insect monitoring.

Releasing and Monitoring Swallow-wort Biocontrol in New York State

https://cornell.box.com/s/khq0wyi2s3c9a85iw05zc1dyz7jstm49

A 10-minute video with information on swallow-wort and swallow-wort biocontrol, as well as information on setting up a site (site selection, erecting a cage, setting up monitoring plots).

Swallow-wort Project: Engaging land managers and agricultural communities to apply and evaluate biological control of swallow-wort in New York

Site Access and Management Collaboration Commitment

Project Summary: Black and pale swallow-worts are highly invasive plant species that negatively impact agricultural and natural lands. In 2017, a leaf-feeding moth was approved for release as a biocontrol agent in the US. A monitoring protocol and recording system are essential to track these releases and ultimately inform our understanding of the effectiveness of this agent in controlling swallow-wort.

Background: Black and pale swallow-worts (*Vincetoxicum* sp.) are highly invasive plant species that have been rapidly expanding throughout agricultural fields and natural areas across New York State resulting in negative ecological and economic impacts. Swallow-worts are overtaking rare plant communities in northern New York's unique alvar habitats, and evidence suggests they threaten species of federal concern, including the monarch butterfly, and the endangered hart's tongue fern. Encroachment on agricultural fields has negatively impacted hay farmers by reducing product value, due to suspected negative health effects in livestock when consumed. Swallow-worts thrive and develop monocultures in both open and forested habitats and are extremely difficult to control using mechanical and chemical methods. Despite these challenges, significant public and private funds are spent to control this species each year, often to no avail.

After years of research, testing and review, a leaf-feeding moth, *Hypena opulenta*, was approved in August 2017 for release in the United States. New York is eager to see this new control option deployed, however it is important to have a reporting system in place to document where and in what quantity these insects are being released. In previous years, this information would have been captured by New York State's biocontrol permitting system, however recent changes to the process have removed the need for this permit. Therefore we are left with no procedure in place to track and monitor impact of biological control agent releases.

In collaboration with a team of researchers (Drs. Dylan Parry at SUNY ESF, Andrea Dávalos at SUNY Cortland, Lindsey Milbrath at Cornell University, and Jackie Schnurr at Wells College) who are rearing, releasing, and assessing the efficacy of *H. opulenta*, we are working to **establish *Hypena opulenta* demonstration cages in swallow-wort infestations throughout the state for training purposes**. We hope to use these locations to first vet our protocols and then use established sites to train land managers who plan to release the agents on 1) identification of swallow-wort and *H. opulenta* at all life stages and 2) establishing and following the monitoring protocol.

Project Objective: Establish *Hypena opulenta* demonstration cages in swallow-wort infestations throughout the state for training purposes. Cages will serve for field testing and

demonstrations in the training described below and may also be used by researchers as appropriate.

Site Selection Criteria: Sites can be established around swallow-wort populations existing in forested or field edge locations. Sites must have large enough swallow-wort populations to place place ten 1x1m swallow-wort monitoring locations a minimum of 2 meters apart, as well as one 2x2x2 meter cage for releasing insects. Criteria for the different site types are as follows:

Forested Sites

- Swallow-wort density greater than 10 stems/square meter
- Plot locations >15 meters away from any forest edge
- No future management planned in area (within 2 acre radius)

Field Sites

- Field edge location - shaded for a good portion of the day, >10 meters away from roads or trails
- No mowing (or other disturbance) planned for the next 5 years
- Swallow-wort stem density between 40 – 200+ stems/square meter

Site Management: Assessment of the survival and effectiveness of *Hypena opulenta* as a swallow-wort biocontrol agent necessitates the need to establish guidelines for site management activities of existing swallow-wort infestations where field release cages are placed. Certain management activities could interfere with research objectives and outcomes, as well as successful establishment of *H. opulenta* populations. It is therefore critical to the project's success, that the following site management guidelines be implemented and followed for the duration of time the field release cages are present. A perimeter of 200 meters will be delineated around the release cage(s). For the next 3-5 years, in the area of this perimeter **we request that you please refrain from**:

1) Use of mechanical management activities (i.e., mowing, raking, digging, hand-pulling, cutting)
2) Use of chemical management practices (i.e., herbicides, pesticides, insecticides)
3) Use of prescribed/controlled burning as a management activity
4) Moving, disturbing, trampling or otherwise tampering with field release cages and permanent vegetation monitoring plots

Site Collaboration Commitment

I have read and acknowledge the content above regarding the management of _____ (*Site Name*) at _____ *(Site Coordinates*).

Site Manager (or Representative)

Name: _____

Signature:_____ Date: _____

Swallow-wort Outreach Group Contact (or Representative)

Name: _____

Signature:_____ Date: _____

MEET HYPENA OPULENTA

A Biological Control Agent

Hypena opulenta is a moth that feeds exclusively on the leaves of black and pale swallow-wort. After more than 10 years of research to verify safety to ecosystems, the moth was approved for field release by the USDA in 2017.

- *Hypena opulenta*, like swallow-wort, is native to Europe, where its larvae are herbivores of the swallow-wort species.
- The goal of biocontrol is to reacquaint invasive species with their native predators, to restore a more natural mechanism of long-term control. Ongoing research is assessing the effectiveness of *H. opulenta* in controlling swallow-wort.
- *Hypena opulenta* demonstration cages are established to serve as sites for field trainings for interested land managers and land owners.

If you have any questions, please contact:

Cornell University

NYISRI New York Invasive Species Research Institute

NEW YORK STATE OF OPPORTUNITY. Parks, Recreation and Historic Preservation

Cornell Cooperative Extension

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