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Animal and Plant Health Inspection Service

Field release of the leaf-feeding moth, *Hypena opulenta* (Christoph) (Lepidoptera: Noctuidae), for classical biological control of swallow-worts, *Vincetoxicum nigrum* (L.) Moench and *V. rossicum* (Kleopow) Barbarich (Gentianales: Apocynaceae), in the contiguous United States.

Final Environmental Assessment, August 2017

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I. Purpose and Need for the Proposed Action

The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Plant Protection and Quarantine (PPQ), Pest Permitting Branch (PPB) is proposing to issue permits for release of a leaf-feeding moth, *Hypena opulenta* (Lepidoptera: Noctuidae). The agent would be used by the applicant for the biological control of swallow-worts, *Vincetoxicum nigrum* and *V. rossicum* (Gentianales: Apocyanceae), in the contiguous United States.

This environmental assessment[1] (EA) has been prepared, consistent with USDA, APHIS' National Environmental Policy Act of 1969 (NEPA) implementing procedures (Title 7 of the Code of Federal Regulations (CFR), part 372). It examines the potential effects on the quality of the human environment that may be associated with the release of *H. opulenta* to control infestations of swallow-worts within the contiguous United States. This EA considers the potential effects of the proposed action and its alternatives, including no action. Notice of this EA was made available in the Federal Register on July 13, 2017 for a 30-day public comment period. A total of 28 comments were received on the EA by the close of the comment period. Only one commenter was against the release of the agents, but did not raise any substantive issues. All other comments were in support of the release of *H. opulenta*, although a few questions were raised that are addressed in Appendix 4 of this EA.

APHIS has the authority to regulate biological control organisms under the Plant Protection Act of 2000 (Title IV of Pub. L. 106–224). Applicants who wish to study and release biological control organisms into the United States must receive PPQ Form 526 permits for such activities. The PPB received a permit application requesting environmental release of a leaf-feeding moth, *H. opulenta*, from Europe, and the PPB is proposing to issue permits for this action. Before permits are issued, the PPB must analyze the potential impacts of the release of this agent into the continental United States.

The applicant's purpose for releasing *H. opulenta* is to reduce the severity of infestations of invasive swallow-worts in the contiguous United States. Two swallow-wort species, *V. nigrum* and *V. rossicum*, are now widely distributed along the Atlantic coast of the United States and in Ontario and Quebec in Canada. The earliest record of *V. nigrum* in the United States is

[1] Regulations implementing the National Environmental Policy Act of 1969 (42 United States Code 4321 et seq.) provide that an environmental assessment "shall include brief discussions of the need for the proposal, of alternatives as required by section 102(2)(E), of the environmental impacts of the proposed action and alternatives, and a listing of agencies and persons consulted." 40 CFR § 1508.9.

from Massachusetts in 1854, and *V. rossicum* was first documented in New York in 1897 (Sheeley and Raynal, 1996). Swallow-worts are long-lived vines that overwinter as seeds or rootstalks. They outcompete native plants for resources and often form dense monocultures in a variety of habitats (Cappuccino, 2004). Swallow-worts pose a major threat to native species diversity and ecosystem functioning along with disruption of farmlands and pastures (DiTommaso et al., 2005).

Existing management options for management of swallow-worts are expensive, temporary, ineffective, and can have nontarget impacts. For these reasons, the applicant has a need to release *H. opulenta*, a host-specific, biological control organism for the control of swallow-worts, into the environment.

II. Alternatives

This section will explain the two alternatives available to the PPB—no action and issuance of permits for environmental release of *H. opulenta*. Although the PPB's alternatives are limited to a decision on whether to issue permits for release of *H. opulenta*, other methods available for control of swallow-worts are also described. These control methods are not decisions to be made by the PPB, and their use is likely to continue whether or not permits are issued for environmental release of *H. opulenta*, depending on the efficacy of *H. opulenta* to control swallow-worts. These are methods presently being used to control swallow-worts by public and private concerns.

A third alternative was considered, but will not be analyzed further. Under this third alternative, the PPB would have issued permits for the field release of *H. opulenta*; however, the permits would contain special provisions or requirements concerning release procedures or mitigating measures. No issues have been raised that would indicate special provisions or requirements are necessary.

A. No Action

Under the no action alternative, the PPB would not issue permits for the field release of *H. opulenta* for the control of swallow-worts. The release of this biological control agent would not take place. The following methods are presently being used to control swallow-worts; these methods will continue under the "No Action" alternative and will likely continue even if permits are issued for release of *H. opulenta*, depending on the efficacy of the organism to control swallow-worts.

1. Chemical Control

Herbicides, such as glyphosate or triclopyr, can provide long-term control of swallow-worts if applications are repeated.

2. Mechanical Control

Mechanical control of swallow-worts is limited to the manual removal of plants or seedpods, and mowing. The only method to ensure long-term control of swallow-wort requires excavation of the entire plant because root crown fragments left behind can root in the soil and produce additional shoots (DiTommaso et al., 2005). Hand picking seedpods from plants can limit spread, especially in areas where digging and herbicides are not an option. Repeated mowing can reduce the height of swallow-worts, but not overall ground coverage by the plants.

B. Issue Permits for Environmental Release of *H. opulenta*

Under this alternative, the PPB would issue permits for the field release of the leaf-feeding moth, *H. opulenta*, for the control of swallow-worts. These permits would contain no special provisions or requirements concerning release procedures or mitigating measures.

Biological Control Agent Information

1. Taxonomy

Common name: None
Scientific name: *Hypena opulenta* (Christoph)
Synonyms: None

Order: Lepidoptera
Family: Noctuidae
Subfamily: Hypeninae
Tribe: Hypenini
Genus: *Hypena*
Species: *H. opulenta* (Christoph)

2. Description of *H. opulenta*

Adults of *H. opulenta* are moths with dull, light brown forewings with a dark brown band in the middle and pale orange hindwings. The body length is about 1 centimeter (cm) and the wingspan is approximately 3 cm. The immature larval stage is white when it first hatches from the egg, and as it develops, the larva becomes green with black spots and the head turns yellow. Pupae are reddish to dark brown and about 1.2 cm long (Weed and Casagrande, 2010).

3. Geographical Range of *H. opulenta*

a. Native Range

Hypena opulenta is native to Eastern Europe where it is reported in Ukraine, Iran, Turkey, and Turkmenistan (Weed and Casagrande, 2010).

b. Expected Attainable Range of *H. opulenta* in North America

H. opulenta is expected to spread throughout the distribution of swallow-worts in North America (Casagrande et al., 2011). The applicant's culture of *H. opulenta* originated from Ukraine where there is generally a temperate continental climate with Mediterranean climates along the coast in the south. Most of Ukraine, including the applicant's collection sites, is in Plant Hardiness Zone 5 (-20 to -10ºF, -28.9 to – 23.4ºC). Much of the current distribution of swallow-wort in the northeastern and midwestern United States is also in USDA Plant Hardiness Zone 5; thus, winter temperatures should not restrict the establishment and spread of *H. opulenta* in North America.

3. Life History of *H. opulenta*

Hypena opulenta is a species that produces more than two generations per year. It develops through five larval instars (worm-like immature stages) and overwinters as a pupa in the soil and leaf litter (Weed and Casagrande, 2010). Typically, females begin laying eggs on the undersides of swallow-wort leaves or stems of leaves two to five days after emergence. The average lifespan of adult moths is 17 days and each female can lay up to 600 eggs with an average of 400 (Weed and Casagrande, 2010). Larvae feed individually on the underside of the leaf, typically through the third instar and then feed on the young, expanding swallow-wort leaves (Weed and Casagrande, 2010). It takes between four to six weeks for larvae to complete a life cycle. A portion of each generation undergoes pupal diapause, a resting period during which growth and development are suspended (Weed and Casagrande, 2010). More pupae enter diapause when larvae are reared under fall conditions. This indicates that whether a pupa enters diapause is affected by variation in plant quality and daylength (Weed and Casagrande, 2010). The multiple, overlapping generations of *H. opulenta* are expected to continuously defoliate and stress swallow-worts throughout the growing season (Casagrande et al., 2011). One study demonstrated that only two larvae per plant are needed to reduce shoot biomass and plant reproduction (Weed and Casagrande, 2010).

III. Affected Environment

A. Taxonomy of North American Swallow-worts

There have been discrepancies in the generic placement of swallow-worts in European and North American literature that has lead to considerable confusion regarding the place of origin of these species (Tewksbury et al., 2002; DiTommaso et al., 2005; USDA, NRCS, 2014). Some taxonomists use the generic names *Cynanchum* and *Vincetoxicum* interchangeably; however, the two invasive weeds targeted for biological control in North America belong to the genus *Vincetoxicum*, which is distinct from the genus *Cynanchum.* Designation of invasive swallow-wort species in North America to the genus *Vincetoxicum* is supported by molecular, morphological, and chemical evidence (Liede, 1996). For example, *Cynanchum* spp. have distinct floral traits that are lacking in *Vincetoxicum* and produce latex whereas *Vincetoxicum* does not (Liede, 1996). Molecular evidence suggests that *Vincetoxicum* is actually a sister genus to the Old World genus *Tylophora* and is placed in a different subtribe (Tylophorinae) than *Cynanchum* (Cynanchinae) (Liede, 1996). Moreover, recent name changes have moved North American species formerly placed in *Cynanchum* spp. to other genera (Liede and Täuber, 2002), but these changes are still not acknowledged in popular databases (USDA, NRCS, 2014). *Vincetoxicum hirundinaria* is the only other member of the Tylophorinae reported from North America. While this species has been reported in Michigan, New York, and Ontario, Canada (USDA, NRCS, 2014) these records are probably a result of past confusion with identification of *V. rossicum* and there is no evidence this species has naturalized (Gleason and Cronquist, 1991). "Naturalized" means" that a non-native plant is capable of surviving and reproducing without human intervention for an indefinite period. Thus, *V. hirundinaria* is not considered a primary target of *H. opulenta* but it was included as an additional control in host specificity testing discussed later in this document. The appropriate taxonomic placement of the two swallow-worts targeted for biological control is as follows:

Common name: Black swallow-wort
Scientific name: *Vincetoxicum nigrum* (L.) Moench
Synonyms: *Cynanchum louiseae* Kartesz & Gandhi, *Cynanchum nigrum* (L.) Pers.

Class: Magnoliopsida
  Subclass: Asteridae
    Order: Gentianales
      Family: Apocynaceae
        Subfamily: Asclepiadoideae
          Tribe: Asclepiadeae
            Subtribe: Tylophorinae
              Genus: *Vincetoxicum*
                Species: *nigrum* (L.) Moench

Common name: Pale swallow-wort, dog-strangling vine
Scientific name: *Vincetoxicum rossicum* (Kleopow) Barbarich
Synonyms: *Cynanchum rossicum* (Kleopow) Borhidi

Class: Magnoliopsida
  Subclass: Asteridae
    Order: Gentianales
      Family: Apocynaceae
        Subfamily: Asclepiadoideae
          Tribe: Asclepiadeae

Subtribe: Tylophorinae
Genus: *Vincetoxicum*
Species: *rossicum* (Kleopow) Barbarich

B. Areas Affected by Swallow-worts

1. Native and Introduced Range of Swallow-worts

Vincetoxicum nigrum is native to Mediterranean regions of France, Italy, Portugal, and Spain (Tutin et al., 2006). *Vincetoxicum rossicum* is naturally distributed in Ukraine and southeastern Russia (Markgraf, 1972). In Ukraine it is found in the Ternopil, Kharkiv, Dniprppetrovsk, and Lugansk regions. It is found on the slopes of ravines among the shrubby vegetation, occurring in the Trans-Volga, Vloga-Don, Lower Volga, and Black Sea regions. It is now naturalized in Norway (Lauvanger and Borgen, 1998).

In North America, see Figures 1 and 2 for the distribution of the swallow-worts *V. nigrum* and *V. rossicum* in North America.

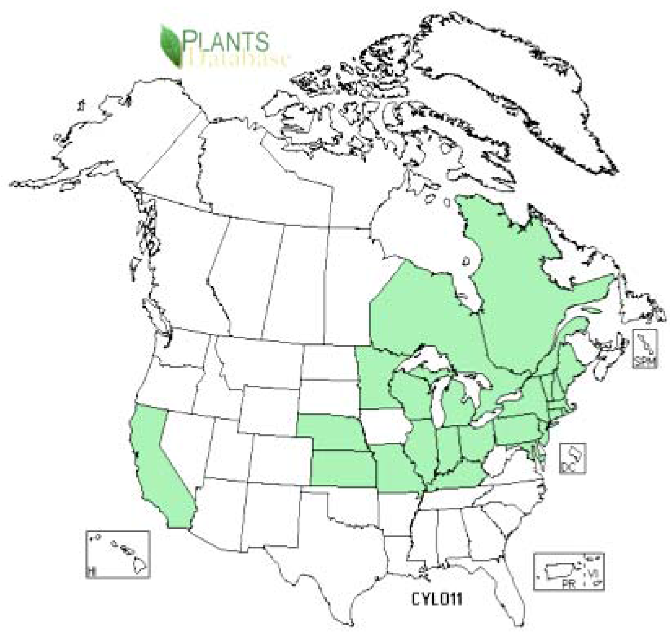

Figure 1: *Vincetoxicum nigrum* distribution in North America. USDA, NRCS Plants database, 2014.

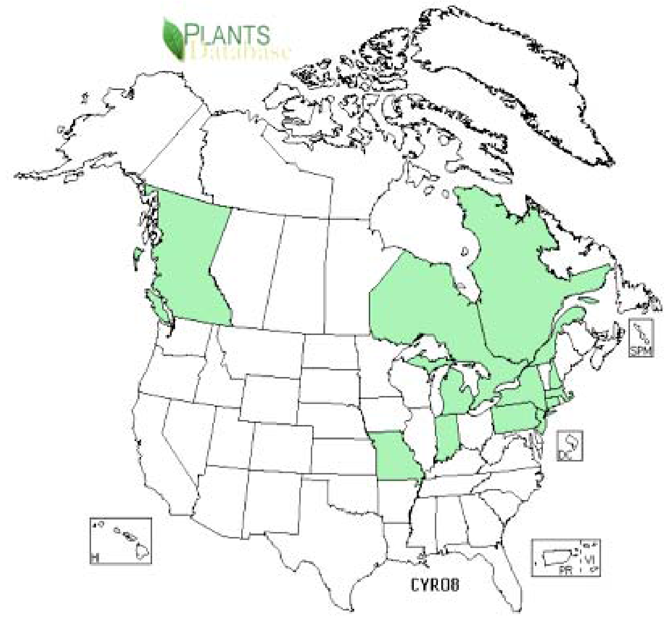

Figure 2: *Vincetoxicum rossicum* distribution in North America. USDA, NRCS Plants database, 2014.

2. Habitats Where Swallow-worts are Found in North America

In its native range of Ukraine, *V. rossicum* is usually distributed in small, scattered populations growing in forested sites, often close to rivers (Weed, 2010). *Vincetoxicum nigrum* is generally found in dry, stony slopes within its native range in France (Weed, 2010). However, with a long history of establishment and a lack of herbivore pressure (Milbrath, 2010) both species display a much greater tolerance to a wide array of habitats and climates within their North American range.

In North America, both species invade a wide variety of primarily upland habitats including, but not restricted to, pastures, old fields, hillsides, shores, flood plains, roadsides, and forest margins, where they have been associated with alkaline, calcareous, and acidic soils (DiTommaso et al., 2005). Both swallow-wort species can endure a broad range of moisture regimes and can flourish in either full sun or partially shaded areas; however, *V. rossicum* also establishes within forest understories.

C. Plants Related to Swallow-worts and Their Distribution

Plants related taxonomically to swallow-worts would be the most likely to be attacked by the proposed biological control organism *H. opulenta.* Plants related to the target swallow-worts in North America (*V. rossicum* and *V. nigrum*) are discussed below.

There are no *Vincetoxicum* species that are native to North America. The genus *Vincetoxicum* consists of around 70 species that are strictly Eurasian (Liede, 1997). Other than the target species, *Vincetoxicum hirundinaria* is the only other species that is reported to exist in North America. *Vincetoxicum hirundinaria* was first recorded in North America in Gray's Manual (Robinson and Fernald, 1908) as *Cynanchum vincetoxicum*. The USDA Plants Database shows this species (listed as *Cynanchum vincetoxicum*) as existing in New York, Michigan, and Ontario, Canada but unlike *V. nigrum* and *V. rossicum*, it has not become naturalized (Gleason and Cronquist, 1991). In fact, it may have very limited existence outside of botanical gardens. At least five of the six herbarium records that Sheeley and Raynal (1996) were able to locate were from or very near gardens and the most recent specimen was collected in 1956. If this plant currently exists in North America, it is rare and not naturalized. There is no evidence that *V. hirundinaria* is of any economic importance as an ornamental plant in North America. The closest relatives of *Vincetoxicum* spp. in North America belong to other subtribes within the tribe Asclepiadeae.

Vincetoxicum nigrum, *V. rossicum*, and *V. hirundinaria* are the only species in the subtribe Tylophorinae (tribe Asclepiadeae) present in North America. Further, there are only four genera in the tribe Asclepiadeae present in North America that presently overlap in distribution with swallow-wort populations. These include three *Funastrum* species, forty *Asclepias* species, six *Matelea* species and one *Cynanchum* species (Milbrath and Biazzo, 2007). Representatives of all of these genera have been included in host-specificity testing. Plant species that were used in testing the specificity of *H. opulenta* to swallow-worts are listed in appendix 1.

IV. Environmental Consequences

A. No Action

1. Impact of Swallow-worts

a. Native Plants and Animals

In North America, swallow-wort species affect ecosystems by reducing local biodiversity of native plants, vertebrates, and arthropods (DiTommaso et al., 2005). Studies in, Ontario have shown significantly lower arthropod diversity and abundance in old-fields where swallow-wort is the predominate vegetation, when compared with nearby old-field sites where native plant species thrive (Ernst and Cappuccino, 2005). There are several indirect and secondary effects of swallow-wort on native species as well. Investigations of grassland bird populations in New York and Ontario have shown reduced breeding and nesting behavior in areas where swallow-wort has formed mono-specific stands (DiTommaso et al., 2005, Miller and Kricfalusy 2008). There is also evidence of swallow-wort adversely impacting monarch butterfly populations because these butterflies often lay their eggs on swallow-worts instead of their normal host, native milkweed species (DiTommaso and Losey, 2003). Monarch larvae cannot survive on swallow-wort so these plants effectively act as a population sink for monarchs (Casagrande and Dacey, 2001; 2007). Swallow-wort may pose an even greater threat through competitive displacement of milkweeds as well as other important host plants of native species (DiTommaso et al., 2005).

b. Economic Impact

Swallow-worts negatively affect farming practices, livestock, and ornamental landscapes. Open pastures create ideal conditions for swallow-wort establishment and growth because grazing reduces competition from other plants. Swallow-wort contains the haemolytic glycoside vincetoxin, which is toxic to humans and most other mammals (DiTommaso et al., 2005). Cattle have demonstrated minimal consumption of swallow-wort; horses, goats, and sheep will graze around it, leaving those pastures open for successful colonization by swallow-wort (DiTommaso et al., 2005). Farmers, conservationists and gardeners often devote costly and extensive efforts towards manual removal and mowing of swallow-wort but underground rhizomes continuously send up new buds which create additional shoots (Lawlor and Raynal, 2002; Douglass et al., 2009). To eliminate populations, the entire rhizome must be removed, requiring substantial labor.

In addition to disrupting agricultural crops such as no-till corn, swallow-worts have been reported as a major pest in Christmas tree farms in central New York (DiTommaso et al., 2005). The twining vines of swallow-worts have been documented pulling down small trees and smothering vegetation planted at restoration sites (Christensen, 1998) and pine plantations in Ontario (DiTommaso et al., 2005).

2. Impact from Use of Other Control Methods

The continued use of chemical herbicides, and mechanical and biological controls at current levels would be a result if the “no action” alternative is chosen. These environmental consequences may occur even with the implementation of the biological control alternative, depending on the efficacy of *H. opulenta* to reduce swallow-wort populations in the contiguous United States. All current swallow-wort control measures are generally only effective in the short-term, require substantial resources or labor and could have collateral impacts on native species in the surrounding habitats (Lawlor, 2000).

a. Chemical Control

The effects of two non-selective herbicides, triclopyr and glyphosate, were evaluated on populations of *V. rossicum* in Ontario (Christensen, 1998). At least two applications of glyphosate in mid-June and early August were required in order to reduce swallow-wort cover by 90 percent the following year. Further, after treatment with herbicides, the sites were open for successful colonization by another invasive plant, *Melilotus alba* (sweet white clover) which replaced *V. rossicum* as the dominant vegetation (Christensen, 1998). In New York, one treatment of triclopyr (1.9 kg ai/ha) reduced *V. rossicum* cover and stem density by 56 percent and 84 percent after 2 years (Averill et al., 2008). However, despite encouraging results from one application the authors cautioned that long-term control could only be sustained by repeated applications and active restoration.

In addition, herbicides are often used against large infestations of swallow-wort, but it is often intertwined with other plants, making application of herbicides a risk to non-target plants or crops in the surrounding area (Lawlor and Raynal, 2002; DiTommaso et al., 2005).

b. Mechanical Control

The only method to ensure long-term control of swallow-worts requires excavation of the entire plant because root crown fragments left behind can root in the soil and produce additional shoots (DiTommaso et al., 2005). Swallow-wort is often established in natural areas with native plant communities or near economically important crops where digging can have negative effects during manual removal (Lawlor and Raynal, 2002). Hand picking is only effective in reducing seed pressure if it is repeated throughout the growing season (Lawlor, 2000).

Tests conducted in Ontario revealed that repeated mowing reduced the average stem height of *V. rossicum* but did not decrease overall cover (Christensen, 1998). In a follow-up study, McKague and Cappuccino (2005) determined that mowing has no effect on plant biomass and is only slightly effective at reducing seed production if the treatment is timed following initial fruit production. In New York, Averill et al. (2008) demonstrated that clipping *V. rossicum* had no effect on stem cover, density, or seedpod production, regardless of how frequent the treatment was applied. Usually when the primary aerial stem is damaged on swallow-wort plants, the root crowns readily send up multiple auxiliary shoots which can increase infestations (DiTommaso et al., 2005; McKague and Cappuccino, 2005).

B. Issue Permits for Environmental Release of *H. opulenta*

1. Impact of *H. opulenta* on Nontarget Plants

Host specificity of *H. opulenta* to swallow-worts has been demonstrated through scientific literature, field observations, and host specificity testing. If an insect species only attacks one or a few closely related plant species, the insect is considered to be very host-specific. Host specificity is an essential trait for a biological control organism proposed for environmental release.

a. Scientific Literature

There are 29 reported species in the genus *Hypena* in North America north of Mexico; at least two of which are considered pests (Arnett, 2000). The complete host range of most species is unknown, but in general these species either feed on just a single host plant species or a limited number of plant species (McCabe and Vargas, 1998). McCabe and Vargas (1998) list the tree genera *Acer*, *Alnus*, *Cornus*, *Corylus*, *Juglans*, *Quercus*, *Tilia*, and *Ulmus* as hosts for some *Hypena* species. Other species attack a variety of plants. The green cloverworm moth, *Hypena scabra*, feeds on the leaves of strawberries (*Fragaria*), raspberries (*Rubus*), ragweed (*Ambrosia*), and many plants of economic importance in the legume family (Pedigo et al., 1973; Roberts and Douce, 1999). *Hypena humuli*, commonly known as the hop vine moth or hop looper, feeds on the leaves of most hop varieties (*Humulus lupulus*) (Grasswitz and James, 2008) and has been known to develop on stinging nettles (*Urtica* spp.) (Grimble et al., 1992). Other species (*H. manalis*, *H. lividalis*, and *H. obsitalis*) are reported to attack a variety of nettles (Urticaceae) (McCabe and Vargas, 1998; Kravchenko et al., 2006). *Hypena laceratalis* was introduced in Australia from Kenya to control the invasive plant *Lantana camara* (Verbenaceae), where it causes localized defoliation (Broughton, 2000). The only reported members of the Apocynaceae (milkweeds) attacked by *Hypena* belong to the subtribe Tylophorinae (Sridhar and Rani, 2003; Kravchenko et al., 2006), which is comprised exclusively of the genera *Vincetoxicum* (target swallow-worts) and *Tylophora* (Liede, 1996). No North American Apocynaceae species are confirmed hosts plants of any *Hypena* species (Casagrande et al., 2011).

Prior to 2006 field surveys conducted by the applicant, the host for *Hypena opulenta* was not documented (Weed and Casagrande, 2010). Thus, there are no records of other hosts for this insect in the scientific literature.

b. Field Observations

In field observations, *Hypena opulenta* was found feeding on the leaves of

V. rossicum near Donetsk, Ukraine during surveys in 2006 (Weed, 2010).

c. Host Specificity Testing

Host specificity tests are tests to determine how many plant species *H. opulenta* attacks/eats, and whether nontarget species may be at risk. See appendix 2 for information regarding host specificity testing methods. In host specificity testing, *H. opulenta* only fed and developed on swallow-worts (*V. hirundinaria*, *V. rossicum* and *V. nigrum*). No other plant species were attacked by *H. opulenta*, including plant species closely related to swallow-worts.

(1) Site of Quarantine Studies

Most larval feeding and impact testing of *H. opulenta* was done at the common garden and laboratory at the CABI Europe-Switzerland Centre (CABI EU- CH) in Delèmont, Switzerland. Host-range testing on *H. opulenta* took place in the insect quarantine facility at the University of Rhode Island in Kingston.

(2) Test Plant List

The list of plant species used for host specificity testing of *H. opulenta* is shown in appendix 1. The strategy used for selecting plants for testing is based on the phylogenetic approach, where closely related species are theorized to be at greater risk of attack than are distantly related species (Wapshere, 1974).

Plants for testing the host range of *H. opulenta* were selected from seven possible categories. Test categories consisted of the following:

CATEGORY 1: Genetic types of the target weed (*Vincetoxicum nigrum* and *V. rossicum*).

Studies of the genetics of *Vincetoxicum* spp. are ongoing (Guermache et al., 2010; Bon et al., 2011). For testing of the the target weeds, *Vincetoxicum nigrum* plants were collected from local populations in Rhode Island and Massachusetts. *Vincetoxicum rossicum* plants were field collected from sites in New York, Connecticut and Massachusetts and several plants were also used from areas in Europe.

CATEGORY 2: North American species in the same or closely-related genus as swallow-worts.

The only other species in the same genus and sub-tribe present in North America is *Vincetoxicum hirundinaria* but it is not native or even naturalized in North America.

CATEGORY 3: Species in other genera in the same family as the target weed (Apocynaceae), divided by Subfamily and tribes, including environmentally and economically important species.

Within the plant family Apocynaceae, 56 species were tested including native and non-native species. There were no North American species in the same sub-tribe as the target species. For plants in other sub-tribes but the same subfamily as the target swallow-worts, testing for species in the sub-tribe Asclepiadinae (15 species) were emphasized because this was the closest taxonomic group to the target plants and some of them were threatened or endangered species or species at risk, including *Asclepias meadii*. *Asclepias welshii* was not tested because obtaining live plants of this species is forbidden and to get seeds, for which there was no guarantee of germination, required extensive permitting and time. This species is only found in a few remote, desert environments in Arizona and Utah where there is no potential for *Vincetoxicum* species to spread. In addition, four species in the genus *Cynanchum* were tested. Ten species within the remaining sub-tribes: Gonolobinae, Metastelmatinae, and Oxypetaline in the same subfamily as the target weeds.

Considering plant species in the same subfamily but different tribes, four plant species in two the tribes Ceropegieae and Marsdenieae were tested. For plants in other subfamilies within the Apocynaceae, 15 species in the subfamilies Periplocoideae, Apocynoideae, and the tribe Apocyneae. Six species within the subfamily Rauvolfioideae were also tested, including the subfamily tribe Vinceae.

CATEGORY 4: Threatened and endangered species in the Asteraceae family, divided by subgenus, genus, subfamily, and tribe.

There were eight federally listed plant species somewhat related to *Vincetoxicum*, four of which are in Hawaii and thus not at risk. There were also 33 other species of concern for differing states. There are no threatened or endangered species in either the United States or Canada in the same genus or sub-tribe as the target plants.

Thirty-one of the species of concern listed by Milbrath and Biazzo (2007) were in the same tribe as the target species, located in 3 genera: *Asclepias* (20 species), *Cynanchum* (1 species) and *Matelea* (10 species).

The remaining six species of concern listed by Milbrath and Biazzo (2007) were more distant from the target species and located in 2 different sub-families: the Apocynoideae and Rauvolfioideae of the Apocynaceae. Seven species were tested in Apocynoideae including two species of concern: *Apocynum cannabinum* and *Trachelospermum difforme*. Seeds of the federally listed species *Cycladenia humilis* Benth. var. *humilis* did not germinate and thus, the plant could not be tested. However, *Cycladenia* is a monophyletic genus that is restricted to desert regions of California, Utah, Nevada and Arizona where *Vincetoxicum* species are not found.

For the Rauvolfioideae, six species were tested, including the species of concern *Amsonia tabermaemontana* Walt. var. *gattingeri*. The applicant was unable to find a source for the federally listed plant *Amsonia kearneyana*. However, species in the same tribe as *A. kearneyana* (Vinceae) were tested as surrogates.

CATEGORIES 5 and 6: North American or introduced species in other families (Group 5) or orders (Group 6) that have some phylogenetic, morphological, or biochemical relationship to swallow-worts, including economically and environmentally important plants

Fifteen species from four families (Gentianaceae, Loganiaceae, Gelsemiaceae and Rubiaceae) were tested (Group 5). For species in other orders (group 6), two species *Buddleja davidii* (introduced ornamental from the northeastern United States and present in British Columbia) and the native plant *Polypremum procumbens* were tested.

CATEGORY 7: Any plant on which the biological control agent or its close relatives (within the same genus) have been previously recorded to feed and/or reproduce.

Six species of the family Urticaceae: *Boehmeria cylindrica, Laportea canadensis, Parietaria floridana, Pilea microphylla, Pipturus albidus,* and *Urtica dioica* were tested based on previous host records for other species in the genus *Hypena*. Two varieties of hops, *Humulus lupulus*, were also tested in this category because of the known host range of the noctuid, *Hypena humuli*. Seven additional species, *Artemisia absinthium*, *A. caudata*, *A. ludoviciana*, *A. stelleriana*, *A. vulgaris, Tanacetum vulgare,* and *Calystegia sepium* were also tested.

(3) Discussion of Host Specificity Testing

Hypena opulenta displayed extremely minimal feeding and never completed development on any species outside of the genus *Vincetoxicum* during testing. See appendix 1 for host specificity testing results.

2. Impact of *H. opulenta* on swallow-worts

Based on testing in quarantine, most impact from *H. opulenta* is expected to occur on *V. rossicum* rather than *V. nigrum.* All larval densities significantly reduced aboveground biomass and increased the production of axillary branching of *V. rossicum*. Despite the increase in branching, the plants were unable to fully compensate for the loss of aboveground biomass caused by feeding by *H. opulenta*. However, larval feeding did not affect any measure of *V. nigrum* growth. While larval feeding did not affect stem growth of either species, it did significantly reduce flowering, seedpod mass, seedpod production, and the number of seeds of *V. rossicum*, but not *V. nigrum*. Based upon the results of a diapause induction experiment, H. opulenta will produce multiple, overlapping generations (Weed and Casagrande, 2010). These generations may continually limit the smothering growth of *V. rossicum* in forested sites and ultimately enable native species to regenerate. Continual defoliation of *V. rossicum* is likely to lead to reductions in root mass (Weed and Casagrande, 2010).

The impact of *H. opulenta* is likely to be dependent on local light conditions (Milbrath, 2008), level of herbivory, and plant community composition. For example, the impact of artificial defoliation on growth and reproduction of *V. rossicum* and *V. nigrum* was significantly higher when plants were grown under shade compared to high light conditions (Milbrath, 2008). Defoliation could also decrease the competitive ability of swallow-worts in North America (Douglass et al., 2009; Weed et al., 2011a). Cappuccino et al. (2002) demonstrated that *V. rossicum* growth is negatively affected by direct competition with other plants. It is possible that herbivory together with competition from mixed plant communities will further decrease the competitive ability of swallow-worts.

3. Uncertainties Regarding the Environmental Release of *H. opulenta*

Once a biological control agent such as *H. opulenta* is released into the environment and becomes established, there is a slight possibility that it could move from the target plants (swallow-worts) to attack nontarget plants. Host shifts by introduced weed biological control agents to unrelated plants are rare (Pemberton, 2000). Native species that are closely related to the target species are the most likely to be attacked (Louda et al., 2003). If other plant species were to be attacked by *H. opulenta*, the resulting effects could be environmental impacts that may not be easily reversed. Biological control agents such as *H. opulenta* generally spread without intervention by man. In principle, therefore, release of this biological control agent at even one site must be considered equivalent to release over the entire area in which potential hosts occur, and in which the climate is suitable for reproduction and survival.

In addition, this agent may not be successful in reducing swallow-wort populations in the contiguous United States. Worldwide, biological weed control programs have had an overall success rate of 33 percent; success rates have been considerably higher for programs in individual countries (Culliney, 2005). Actual impacts on swallow-worts by *H. opulenta* will not be known until after release occurs and post-release monitoring has been conducted. However, it is expected that *H. opulenta* will reduce swallow-wort populations by reducing flowering, seedpod mass, seedpod production, and the number of seeds of *V. rossicum*, but not *V. nigrum*.

4. Human Health

Hypena opulenta is a plant-feeding insect and poses no risk to humans.

5. Animal Health

Hypena opulenta is a plant-feeding insect and poses no risk to animal species. Animals could potentially ingest *H. opulenta*, but there is no evidence that *H. opulenta* is toxic, and the agent may provide an additional food source to animals that might forage near swallow-worts. Reducing swallow-worts may have a positive effect on monarch butterfly populations by reducing the frequency that they lay eggs on swallow-wort instead of native milkweed populations. Monarch larvae cannot survive on swallow-wort.

6. Cumulative Impacts

"Cumulative impacts are defined as the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agencies or person undertakes such other actions" (40 CFR 1508.7).

Other private and public concerns work to control swallow-worts in invaded areas using available chemical and mechanical or manual control methods. *Vincetoxicum rossicum* can be a serious problem in perennial cropping systems such as pastures and Christmas tree plantations. As described previously, herbicides, such as glyphosate or triclopyr, can provide long-term control of swallow-worts if applications are repeated. Mechanical control of swallow-worts is limited to the manual removal of plants or seedpods, and mowing. The only method to ensure long-term control of swallow-wort requires excavation of the entire plant because root crown fragments left behind can root in the soil and produce additional shoots (DiTommaso et al., 2005). Hand picking seedpods from plants can limit spread, especially in areas where digging and herbicides are not an option. Repeated mowing can reduce the height of swallow-worts, but not overall ground coverage by the plants.

These control methods can have non-target effects, and improper disposal of plant fragments or seeds can result in further spread of swallow-worts. Release of *H. opulenta* is not expected to have any negative cumulative impacts in the contiguous United States because of its host specificity to swallow-worts. Effective biological control of swallow-worts will have beneficial effects for weed management programs, and may result in a long-term, non-damaging method to assist in the control of swallow-worts, particularly in natural or environmentally sensitive areas.

7. Endangered Species Act

Section 7 of the Endangered Species Act (ESA) and ESA's implementing regulations require Federal agencies to ensure that their actions are not likely to jeopardize the continued existence of federally listed threatened and endangered species or result in the destruction or adverse modification of critical habitat.

a. Critical Habitat

APHIS has determined that release of H. opulenta will have no effect on any designated critical habitat in the United States. Swallow-worts are not part of the primary constituent elements of any listed species. Swallow-worts are adversely affecting Jesup's milk-vetch, *Astragalus robbinsii* var. *jesupi* and American hart's tongue fern, *Asplenium scolopendrium* var. *americanum,* but neither of these species have designated critical habitat.

b. Animals

Release of *H. opulenta* will have no effect on any listed vertebrate animals including mammals, birds, reptiles, amphibians, or fishes. Some of these species could potentially ingest *H. opulenta*, but there is no evidence that *H. opulenta* is toxic, and the agent may provide an additional food source to listed vertebrates that might forage near swallow-worts.

Release of *H. opulenta* will have no effect on any listed invertebrate animals, including clams, snails, arachnids, crustaceans, or insects. Clams, snails, and crustaceans would not come into contact with *H. opulenta*. For arthropods (insects and arachnids), Young and Weed (2014) describe *H. opulenta* and provide a key to separate the larvae from the common native North American *Hypena* spp. None of these species use swallow-worts as hosts (Wagner et al. 2011). In a 3-year study of arthropods feeding on swallow-wort, Milbrath (2010) found only 10 species able to complete development on this host. These were all common generalist feeders and not one was abundant (or even common) on swallow-wort. There is no concern about competitive interactions between *H. opulenta* and native insects on swallow-wort. Endemic species have no impact on populations of swallow-worts and all have other hosts if displaced. Swallow-worts replace hosts of native herbivores (and their natural enemies), reducing populations of native species and negatively affecting food webs. Abundant *H. opulenta* populations could serve as food for many native predaceous invertebrates or hosts of native parasitoids, but with control of swallow-worts, *H. opulenta* populations would decline and be replaced by native species. In addition, *H. opulenta* is not known to be toxic to other arthropods that may ingest them.

c. Plants

Host specificity testing has demonstrated that *Hypena opulenta* is host-specific *to Vincetoxicum* species. As *V. nigrum* and *V. rossicum* are the only representatives of this genus in North America, no direct impact on any non-target plant species are expected. Thus, APHIS has determined that release of *H. opulenta* will have no effect on any listed plant species in the contiguous United States besides those discussed below.

There are two federally-listed species in the plant family Apocynaceae in the continental United States: *Amsonia kearneyana* (Kearney's bluestar) and *Cycladenia humilis* var. *jonesii* (Jones cycladenia). These are the listed plants in the United States that occur in the same family as swallow-worts and are the most closely related to those species. In an effort to be conservative in making a determination, APHIS closely evaluates impacts to listed plant species that are related to the target species. However, based on host specificity of *H. opulenta* reported in testing, and also that *Vincetoxicum* species do not overlap in distribution with these plants, APHIS has determined that environmental release of *H. opulenta* may affect, but is not likely to adversely affect the Kearney's bluestar and Jones cycladenia. In addition, release of *H. opulenta* may be beneficial to Jesup's milk-vetch*, Astragalus robbinsii* var. *jesupi* and American hart's tongue fern*, Asplenium scolopendrium* var. *americanum* in areas where swallow-worts are having adverse effects on these plants. APHIS requested concurrence with these determinations from the U.S. Fish and Wildlife Service and received a concurrence letter dated August 8, 2016.

V. Other Issues

Consistent with Executive Order (EO) 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations," APHIS considered the potential for disproportionately high and adverse human health or environmental effects on any minority populations and low-income populations. There are no adverse environmental or human health effects from the field release of *H. opulenta* and will not have disproportionate adverse effects to any minority or low-income populations.

Consistent with EO 13045, "Protection of Children from Environmental Health Risks and Safety Risks," APHIS considered the potential for disproportionately high and adverse environmental health and safety risks to children. No circumstances that would trigger the need for special environmental reviews are involved in implementing the preferred alternative. Therefore, it is expected that no disproportionate effects on children are anticipated as a consequence of the field release of *H. opulenta*.

EO 13175, "Consultation and Coordination with Indian Tribal Governments," was issued to ensure that there would be "meaningful consultation and collaboration with tribal officials in the development of Federal policies that have tribal implications…."

APHIS is consulting and collaborating with Indian tribal officials to ensure that they are well-informed and represented in policy and program decisions that may impact their agricultural interests in accordance with EO 13175.

VI. Agencies, Organizations, and Individuals Consulted

The Technical Advisory Group for the Biological Control Agents of Weeds (TAG) recommended the release of *H. opulenta* on August 30, 2013. TAG members that reviewed the release petition (Cassagrande et al. 2011) included USDA representatives from National Institute of Food and Agriculture; U.S. Department of Interior's U.S. Fish and Wildlife Service, Bureau of Indian Affairs, and Bureau of Land Management; Environmental Protection Agency; U.S. Army Corps of Engineers; and representatives from California Department of Food and Agriculture, SAGARPA-Mexico, Agriculture and Agri-Food Canada.

This EA was prepared by personnel at APHIS, University of Rhode Island, and CABI Europe-Switzerland Centre. The addresses of participating APHIS units, cooperators, and consultants follow.

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Appendix 1. Results of no-choice larval development testing for *Hypena opulenta* on the target weeds and test plants.

FAMILY **Subfamily** ***Tribe:*** **Subtribe**	**Test Plant Cat.** [A]	**Species**	**Orig.** [B]	**US Distribution** [C]	**Canada Dist.** [C]	**Reps**	**% survival** [D]
APOCYNACEAE **Asclepiadoideae** ***Asclepiadeae*** **Tylophorinae**	Target	*Vincetoxicum nigrum* (L.) Moench (black swallow-wort)	I	CT, NY (for testing), CA, IL, IN, KS, KY, MA, MD, ME, MI, MN, MO, NE, NH, NJ, OH, PA, RI, VT, WI	ON, (for testing), QC	190	80.0
	Target	*Vincetoxicum rossicum* (Kleopow) Barb (pale swallow-wort)	I	CT, NY (for testing), IN, MA, MI, MO, NH, NJ, PA	ON (for testing), QC	120	75.4
	2	*Vincetoxicum hirundinaria* (Medic.) (white swallow-wort)	I	European species not found in North America		40	78.9
	3a	Species in the same subtribe as target weeds: None in North America				N/A	N/A
APOCYNACEAE **Asclepiadoideae** ***Asclepiadeae*** **Asclepiadinae**	3b	*Asclepias asperula* (Dcne.) Woods. (spider milkweed)	N	AZ, CA, CO, ID, KS, NE, NV, NM, OK, TX, UT	None	10	0
	3b	*Asclepias curassavica* L. (bloodflower)	N	CA, FL, HI, LA, PR, TN, TX, VI	None	10	0
	3b	*Asclepias fascicularis* Dcne. (Mexican whorled milkweed)	N	CA, ID, NE, WA, OR, UT	None	10	0
	3b	*Asclepias fruticosa* L. (white swan milkweed)	I	CA	None	10	0
	3b	*Asclepias incarnata* L. (swamp milkweed)	N	AL, AK, AS, AR, CO, CT, DE, DC, FL, GA, HI, ID, IL, IN, IA, KS, KY, LA, ME, MD, MA, MI, MN, MO, MT, NE, NV, NH, NJ, NM, NY, NC, ND, OH, OK, PA, PR, RI, SC, SD, TN, TX, UT, VT, VI, VA, WV, WI, WY	MB, NB, ON, PE, QC	10	0

FAMILY Subfamily *Tribe:* Subtribe	Test Plant Cat. [A]	Species	Orig.[B]	US Distribution[C]	Canada Dist. [C]	Reps	% survival[D]
	3b,4	*Asclepias hirtella* (Pennell) Woodson (tall green milkweed)	N	AL, AR, GA, IA, IL, IN, KS, KY, LA, MI, MN, MO, MS, OH, OK, TN, WI, WV	ON	10	0
	3b,4	*Asclepias meadii* Torr. Ex Gray (Mead's milkweed)	N	IL, IN, IA, KS, MO, WI	None	10	0
	3b,4	*Asclepias purpurascens* L. (purple milkweed)	N	AR, CT, DC, DE, GA, IA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, NE, NH, NJ, NY, OH, OK, PA, RI, SD, TN, TX, VA, WI, WV	ON	10	0
	3b	*Asclepias rubra* L. (red milkweed)	N	AL, AR, DC, DE, FL, GA, LA, MD, MS, NC, NJ, NY, PA, SC, TX, VA	None	Not Tested	N/A
	3b,4	*Asclepias speciosa* Torr. (showy milkweed)	N	AZ, CA, CO, ID, IL, IA, KS, MI, MN, MT, NE, NV, NM, ND, OK, OR, SD, TX, UT, WA, WI, WY	AB, BC, MB, SK	10	0
	3b,4	*Asclepias sullivanti* Engelm. Ex Gray (prairie milkweed)	N	AR, IA, IL, IN, KS, MI, MN, MO, ND, NE, OH, OK, SD, WI	ON	10	0
	3b	*Asclepias syriaca* L. (common milkweed)	N	AL, AR, CN, DE, GA, IL, IN, IA, KS, KY, LA, ME, MD, MA, MI, MN, MS, MO, NE, NH, NJ, NY, NC, ND, OH, OK, OR, PA, RI, SC, SD, TN, TX, VT, VA, WV, WI	MB, NB, NS, ON, PE, QC, SK	10	0
	3b,4	*Asclepias tuberosa* L. (butterfly milkweed)	N	AZ, AR, AL, CA, CO, CN, FL, GA, IL, IN, IA, KS, KY, LA, MI, MN, MS, MO, NE, NC,NM, NY, OH, OK, PA, SC, SD, TN, TX, UT, WV, WI	None	10	0
	3b	*Asclepias verticillata* L. (linear-leaved milkweed)	N	AL, AR, AZ, CT, DC, DE, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, MI, MN, MO, MS, MT, NC, ND, NE, NJ, NM, NY, OH, OK, PA, RI, SC, SD, TN, TX, VA, VT, WI, WV, WY	MB, ON, SK	10	0

FAMILY **Subfamily** ***Tribe:*** **Subtribe**	**Test Plant Cat.** [A]	**Species**	**Orig.** [B]	**US Distribution** [C]	**Canada Dist.** [C]	**Reps**	**% survival** [D]
	3b,4	*Asclepias viridiflora* Raf. (green milkweed)	N	AL, AZ, AR, CO, CN, DE, FL, GA, IL, IN, IA, KS, KY, LA, MD, MI, MN, MS, MO, MT, NE, NJ, NM, NY, NC, ND, OH, OK, PA, SC, SD, TN, TX, VA, WV	AB, BC, MB, ON, SK	10	0
	3b	*Asclepias viridis* Walt. (green antelope horn)	N	AL, AR, FL, GA, IL, IN, KS, KY, LA, MO, MS, NE, OH, OK, SC, TN, TX, WV	None	10	0
	3b,4	*Asclepias welshii* N. & P. Holmgren (Welsh's milkweed)	N	AZ, UT	None	Not Tested	N/A
APOCYNACEAE **Asclepiadoideae** ***Asclepiadeae*** **Cynanchinae**	3b	*Cynanchum acutum* L. (stranglevine)	F	None	None	Not Tested	N/A
	3b	*Cynanchum ascyrifolium* Matsumura (Mosquito trap plant)	F	None	None	10	0
	3b,4	*Cynanchum laeve* (Michx.) Pers. honeyvine)	N	Al, AR, DE, FL, GA, ID, IL, IN, IA, KS, KY, LA, MD, MS, MO, NE, NY, NC, OH, OK, PA, SC, TN, TX, VA, WV	ON	10	0
	3b	*Cynanchum marnierianum* Rauh	F	None	None	10	0
	3b	*Cynanchum racemosum* (Jacq.) Jacq. (talayote)	N	TX	None	10	0
APOCYNACEAE **Asclepiadoideae** ***Asclepiadeae*** **Gonolobinae**	3b	*Matelea carolinensis* (Jacq.) Woods. (maroon Carolina milkvine)	N	AL, AR, DC, DE, GA, KY, LA, MD, MS, NC, SC, TN, TX, VA	None	10	0
	3b	*Matelea decipiens* (Alexander) Woods.	N	AR, GA, IL, IN, KS, KY, LA, MD, MO, NC, OK, SC, TN, TX, VA	None	10	0
	3b	*Matelea gonocarpos* (Walt.) Shinners (angularfruit milkvine)	N	AL, AR, FL, GA, IL, IN, MD, MS, MO, NC, OK, SC, TN, TX, VA	None	10	0

FAMILY Subfamily *Tribe:* Subtribe	Test Plant Cat. [A]	Species	Orig.[B]	US Distribution[C]	Canada Dist. [C]	Reps	% survival[D]
	3b,4	*Matelea oblique* (Jacq.) Woods. (climbing milkvine)	N	AL, GA, IL, IN, KY, MD, MS, MO, NC, OH, PA, TN, VA, WV	None	10	0
	3b	*Gonolobus stephanotrichus* Griseb. (anglepod)	N	PR	None	20[E]	0
APOCYNACEAE **Asclepiadoideae** ***Asclepiadeae*** **Metastelmatinae**	3b	*Funastrum angustifolium* (Pers.) Liede & Meve (gulf coast swallow-wort)	N	AL, FL, GA, LA, MS, NC, SC, TX	None	10	0
	3b	*Funastrum cynanchoides* (Dcne.) Schlechter (fringed twinevine)	N	AZ, CA, NV, NM, TX, UT	None	10	0
	3b	*Metastelma barbigerum* Schelle (bearded swallow-wort)	N	TX	None	10	0
	3b	*Metastelma palmeri* S. Watson (MacCart's swallow-wort)	N	TX	None	Not Tested	N/A
APOCYNACEAE **Asclepiadoideae** ***Asclepiadeae*** **Oxypetalinae**	3b	*Araujia sericifera* Brot. (white bladderflower)	I	CA	None	10	0
APOCYNACEAE **Asclepiadoideae** ***Ceropegieae***	3c	*Ceropegia woodii* Schltr. (rosary vine)	I	Cultivated	cultivated	10	0
	3c	*Stapelia gigantea* N.E. Br. (zulu giant)	I	HI	None	10	0
APOCYNACEAE **Asclepiadoideae**	3c	*Hoya carnosa* (L. f.) R. Br. (porcelain-flower)	I	PR	None	10	0

FAMILY Subfamily *Tribe:* Subtribe	Test Plant Cat. [A]	Species	Orig.[B]	US Distribution[C]	Canada Dist. [C]	Reps	% survival[D]
Marsdenieae	3c	*M. floribunda* for *Marsdenia edulis* Wats	N		None	10	0
APOCYNACEAE **Periplocoideae**	3d	*Periploca graeca* L. (silkvine)	I	CN, KS, NJ, NY, OK, PA, RI, TN, TX	None	10	0
APOCYNACEAE **Apocynoideae** ***Wrightieae***	3d	*Nerium oleander* L. (oleander)	I	AL, CA, FL, GA, LA, MS, NC, PR, SC, TX, UT, VI	None	10	0
APOCYNACEAE **Apocynoideae** ***Malouetieae***	3d	*Pachypodium lamerei* Drake (Madagascar palm)	I	Cultivated	cultivated	10	0
APOCYNACEAE **Apocynoideae** ***Apocyneae***	3d,4	*Apocynum androsaemifolium* L. (spreading dogbane)	N	AL, AK, AZ, AR, CA, CO, CT, DE, DC, GA, ID, IL, IN, IA, ME, MD, MA, MI, MN, MO, MT, NE, NV, NH, NJ, NM, NY, NC, ND, OH, OK, PR, PA, RI, SD, TN, TX, UT, VT, VA, WA, WV, WI, WY	AB, BC, MB, NB, NL, NS, NT, ON, PE, QC, SK, YT	10	0
	3d,4	*Apocynum cannabinum* L. (Indian hemp)	N	AL, AK, AZ, AR, CA, CO, CT, DE, DC, FL, GA, ID, IL, IN, IA, KS, KY, LA, ME, MD, MA, MI, MN, MS, MO, MT, NE, NV, NH, NJ, NM, NY, NC, ND, OH, OK, PR, PA, RI, SC, SD, TN, TX, UT, VT, VA, WA, WV, WI, WY	AB, BC, MB, NT, NB, NL, NS, ON, QC, SK	10	0
	3d,4	*Trachelospermum difforme* (Walt.) Gray (climbing dogbane)*	N	AL, AR, DE, FL, GA, IN, IN, KY, LA, MD, MS, MO, NC, OK, SC, TN, TX, VA	None	10	0
	3d	*Trachelospermum jasminoides* (Lindl.) Lem. (confederate jasmine)	I	FL, LA	None	10	0
	3d	*Trachelospermum mandianum* (yellow confederate jasmine)	I	Ornamental	Ornamental	10	0

FAMILY **Subfamily** *Tribe:* Subtribe	Test Plant Cat. [A]	Species	Orig.[B]	US Distribution[C]	Canada Dist. [C]	Reps	% survival[D]
APOCYNACEAE **Apocynoideae** ***Echiteae***	3d,4	*Cycladenia humilis* Benth. var. *humilis* (Sacramento waxy dogbane)	N	CA	None	Not Tested	N/A
APOCYNACEAE **Rauvolfioideae** ***Vinceae***	3d	*Amsonia illustris* Woodson (Ozark bluestar)	N	AR, KS, MO, OK, TX	None	10	0
	3d, 4	*Amsonia tabernaemontana* Walter (eastern bluestar)	N	AL, AR, DE, FL, GA, IL, IN, KS, KY, LA, MD, MA, MS, MO, NJ, NY, NC, OK, OH, PA, SC, TN, TX, VA	None	10	0
	3d	*Vinca minor* L. (common periwinkle)	I	AL, AR, CT, DE, GA, IL, IN, IA, KS, KY, LA, ME, MD, MA, MI, MN, MS, MO, NE, NH, NJ, NY, NC, OH, PA, OH, RI, SC, TX, TN, UT, VT, VA, WA, WV, WI	BC, NB, NS, ON, QC	10	0
	3d	*Catharanthus roseus* (L.) G. Don.	I	CA, FL, GA, HI, LA, MS, NC, SC, TX, PR, VI	None	10	0
	3d,4	*Amsonia kearneyana* Woods. (Kearney's bluestar)	N	AZ	None	Not Tested	N/A
APOCYNACEAE **Rauvolfioideae** ***Plumerieae***	3d	*Allamanda cathartica* L. (golden trumpet)	I	FL, PR, VI	None	10	0
	3d	*Plumeria rubra* L. (frangipani)	I	PR, VI	None	10	0
APOCYNACEAE **Rauvolfioideae** ***Carisseae***	3d	*Carissa macrocarpa* (Eckl.) A.DC. (natal plum)	I	FL, PR	None	10	0
GENTIANACEAE	5	*Bartonia virginica* (L.) B.S.P. (yellow screwstem)	N	AL, CT, DC, DE, FL, GA, IL, IN, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, NH, NJ, NY, OH, PA, RI, SC, TN, TX, VA, VT, WI, WV	NB, NF, NS, ON, QC	10	0

FAMILY **Subfamily** ***Tribe:*** **Subtribe**	**Test Plant Cat.** [A]	**Species**	**Orig.** [B]	**US Distribution** [C]	**Canada Dist.** [C]	**Reps**	**% survival** [D]
	5	*Centaurium erythraea* Rafn. (European centaury)	I	CA, GA, HI, ID, IN, MD, MA, MI, NY, NC, OH, PA, RI, VT, VA, WA	BC, NS, ON, QC	10	0
	5	*Gentiana andrewsii* Griseb. (closed bottle gentian)	N	CO, CN, DE, IL, IN, IA, KY, MD, MA, MI, MN, MO, MH, NE, NJ, NY, ND, OH, PA, RI, SD, VT, VA, WV, WI	MB, ON, QC, SK	10	0
	5	*Gentianella quinquefolia* (L.) Small (agueweed)	N	AR, CN, GA, IL, IN, IA, KS, KY, ME, MI, MD, MA, MS, MO, NH, NJ, NY, NC, PA, OH, SC, TN, VA, VT, WI, WV	ON, QC	10	0
LOGANIACEAE	5	*Mitreola petiolata* (J.F. Gmel.) Torr. & Gray (lax hornpod)	N	AL, AR, FL, GA, LA, MS, MO, NC, OK, PR, SC, TN, TX, VA	None	Not Tested	N/A
	5	*Spigelia marilandica* (L.) L. (woodland pinkroot)	N	AL, AR, FL, GA, IL, IN, KY, LA, MD, MS, MO, NC, OK, SC, TN, TX, VA	None	10	0
GELSEMIACEAE	5	*Gelsemium sempervirens* (L.) St. Hil. (yellow jessamine)	N	Al, AR, FL, GA, LA, MS, NC, SC, TN, TX, VA	None	10	0
RUBIACEAE	5	*Cephalanthus occidentalis* L. (common buttonbush)	N	AL, AZ, AR, CA, CN, DE, FL, GA, IL, IN, IA, KS, KY, ME, MD, MA, MI, MN, MS, MO, NE, NH, NJ, NY, NC, OH, OK, PA, RI, SC, TN, TX, VT, VA, WV, WI	NB, NS, ON, PE, QC	10	0
	5	*Coffea arabica* L. (coffee)	I	HI, PR, VI	None	10	0
	5	*Galium boreale* L. (northern bedstraw)	N	AK, AZ, CA, CO, CN, DE, ID, IL, IN, IA, KY, ME, MD, MA, MI, MN, MO, MT, NE, NV, NH, NJ, NM, ND, OH, OR, PA, RI, SD, TN, TX, UT, VT, VA, WA, WV, WI, WY	AB, BC, MB, NT, NB, NS, ON, QC, SK, YT	10	0

FAMILY Subfamily *Tribe:* Subtribe	Test Plant Cat. [A]	Species	Orig.[B]	US Distribution[C]	Canada Dist. [C]	Reps	% survival[D]
	5	*Gardenia jasminoides* J. Ellis. (cape-jessamine)	I	PR	None	10	0
	5	*Hedyotis purpurascens*			None	10	0
	5	*Houstonia caerulea* L. (azure bluet)	N	AL, AR, CN, DE, GA, IL, IN, KY, LA, ME, MD, MA, MI, MS, MO, NH, NJ, NY, NC, OH, PA, RI, SC, TN, VT, VA, WV, WI	NB, NS, ON, QC	10	0
	5	*Houstonia longifolia* (longleaf bluets)		AL, AR, CT, DC, FL, GA, IL, IN, KS, KY, MA, MD, ME, MI, MN, MO, MS, NC, ND, NH, NJ, NY, OH, OK, PA, RI, SC, TN, VA, VT, WI, WV	AB, MB, ON, QC, SK	10	0
	5	*Mitchella repens* L. (partridgeberry)	N	AL, AR, CN, DE, FL, GA, IL, IN, IA, KY, LA, ME, MD, MA, MI, MN, MO, NH, NJ, NY, NC, OH, OK, PA, RI, SC, TN, TX, VT, VA, WV, WI	NB, NL, NS, ON, PE, QC	10	0
	5	*Rubia tinctoria* L. (madder)	I	CA, MA, NV, OR, PA, UT	None	10	0
SCROPHULARIACEAE	6 Ornam.	*Buddleja davidii* Franch. (butterfly-bush)	I	CA, CN, GA, HI, KY, MA, MD, MI, NC, NY, NJ, OH, PA, TN, SC, VA, WA, WV, PR	BC	10	0
	6	*Polypremum procumbens* L. (juniper leaf)	N	NY, NY, PA, DE, MD, TX, IL, MO, LA, FL, OK, TN, AL, GA, NC, SC, MS, AK, KY, IN	None	10	0
ASTERACEAE	7	*Artemisia absinthium* L. (wormwood)	I	CO, CT, IA, ID, IL, IN, KS, MA, MD, ME, MI, MN, MO, MT, NC, ND, NE, NH, NJ, NY, OH, OR, PA, RI, SC, SD, TN, UT, VT, WA, WI, WY	AB, BC, MB, NB, NF, NS, ON, PE, QC, SK	10	0
	7	*Artemisia caudata* (Michx.) H.M. Hall &	N	AL, AZ, CO, CT, FL, IA, IL, IN, KS, MA, ME, MI, MN, MO, MS, MT, ND, NE,	LB, MB, NB, NF, NS, NU, ON, QC,	10	0

FAMILY Subfamily *Tribe:* Subtribe	Test Plant Cat. [A]	Species	Orig.[B]	US Distribution[C]	Canada Dist. [C]	Reps	% survival[D]
		Clem. (wild wormwood)		NH, NJ, NM, NY, OH, OK, PA, RI, SC, SD, TX, VA, VT, WA, WI, WY	SK		
	7	*Artemisia ludoviciana* Nutt. (white sagebrush)	N	AR, AZ, CA, CO, CT, DE, GA, IA, ID, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VA, VT, WA, WI, WY	AB, BC, MB, NB, NT, ON, PE, QC, SK	10	0
	7	*Artemisia stelleriana* Besser (dusty miller)	I	AK, CT, DC, DE, FL, HI, LA, MA, MD, ME, MI, MN, NC, NH, NJ, NY, OH, PA, RI, VA, VT, WA, WI, WV	NB, NF, NS, ON, PE, QC	10	0
	7	*Artemisia vulgaris* L. (mug-wort)	I	AK, AL, CA, CT, DC, DE, FL, GA, HI, IA, ID, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MT, NC, NH, NJ, NY, OH, OR, PA, RI, SC, TN, VA, VT, WA, WI, WV	AB, BC, MB, NB, NF, NS, ON, PE, QC, SK	10	0
	7 Weed	*Tanacetum vulgare* L. (common tansy)	I	AK, AR, AZ, CA, CO, CT, DC, DE, HI, IA, ID, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SD, TN, UT, VA, VT, WA, WI, WV, WY	AB, BC, MB, NB, NF, NS, NT, ON, PE, QC, SK, YT	10	0
CANNABACEAE	7 Crop	*Humulus lupulus* var. "Newport" (hop plant)	**I**	Crop	Crop	10	0
	7 Crop	*Humulus lupulus* var. "Golden Nugget" (hop plant)	**I**	Crop	Crop	10	0
CONVOLVULACEAE	7	*Calystegia (Convolvulus) sepium* R. Br. (larger bindweed)	I	AK, AL, AR, AZ, CA, CO, CT, DC, DE, FL, GA, IA, ID, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VA, VT, WA, WI, WV, WY	AB, BC, MB, NB, NF, NS, ON, PE, QC, SK	10	0

FAMILY Subfamily *Tribe:* Subtribe	Test Plant Cat. A	Species	Orig.B	US Distribution C	Canada Dist. C	Reps	% survival D
URTICACEAE	7	*Urtica dioica* L. (stinging nettle)	I	AK, AL, AZ, CA, CO, CT, DC, DE, FL, GA, IA, ID, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VA, VT, WA, WI, WV, WY	AB, BC, LB, MB, NB, NF, NS, NT, ON, PE, QC, SK, YT	20	0[E]
	7	*Boehmeria cylindrica* (L.) Sw. (smallspike false nettle)	N	AL, AR, AZ, CA, CT, DC, DE, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, NE, NH, NJ, NM, NY, OH, OK, PA, RI, SC, SD, TN, TX, UT, VA, VT, WI, WV, PR	NB, ON, QC	10	0[F]
	7	*Laportea canadensis* L. (wood nettle)	N	AL, AR, CT, DC, DE, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, ND, NE, NH, NJ, NY, OH, OK, PA, RI, SC, SD, TN, VA, VT, WI, WV	MB, NB, NS, ON, PE, QC, SK	10	0
	7	*Parietaria floridana* Nutt. (Florida pellitory)	N	AL, DE, FL, GA, KY, LA, MD, MS, NC, NH, SC, TX	None	20	0
	7	*Pilea microphylla* (L.) Liebm. (artillery plant)	N	AL, AR, FL, GA, HI, LA, MI, MS, NC, SC, TN, TX, PR, VI	None	10	0
	7	*Pipturus albidus* (Mamaki)	N	HI	None	10	0

[A] Test Plant Categories: **1.** Genetic types of target weed; **2.** Species of the same (or closely related) genus; **3**. Species in the same family as the target weed (**3a**. Plants in same sub-tribe; **3b**. Plants of other sub-tribes; **3c**.Plants in same subfamily other tribes; and **3d.** Plants in other subfamilies); **4**. Threatened and endangered species in the same family; **5**. Species in other families in the same order having similar characteristics as target plant; **6** Species in other orders that have some physiological, morphological or biochemical similarities to the target weed including environmentally and economically important species; **7**. Any plant on which the biological control agent OR its close relatives have been found or recorded to feed and/or reproduce.
[B] Plant origin: introduced (I), native (N) to North America or (F) Foreign not in North America (Milbrath and Biazzo, 2007 or USDA Plants Database, 2011)
[C] Distribution from USDA Plants Database, 2011.
[D] Indicates the mean number of larvae that were successfully reared to pupation.
[E] One larva fed but died in the second instar
[F] One larva fed and survived to the final instar but died before pupation. Test was repeated and displayed no feeding.

Appendix 2. Host-specificity testing methods

Design and Methods of No-choice Larval Development Tests

At the end of each summer, pupae of *H. opulenta* are sexed and placed in plastic cups (473 millileter (ml)) containing sterilized vermiculite and covered with plastic lids. The pupae are then placed in a 10°C incubator until September when they are moved to a 4°C overwintering chamber. Annually beginning in May, pupae are taken out of the overwintering chamber and placed at room temperature. The quarantine laboratory is maintained about 25°C and cages were held under light fixtures set on a 16:8 (Light:Dark) hours photoperiod with additional natural light coming from windows within each room. The light fixtures contained four GE High Output Daylight (F48T12-D-HD) fluorescent bulbs that were hung from racks approximately 10 centimeters (cm) above oviposition cages containing adults and plants and about 50 cm above cups of larvae used in no-choice development tests.

As *H. opulenta* adults emerged, they were moved to screened cages containing potted plants of *Vincetoxicum nigrum*, *V. rossicum*, or *V. hirundinaria* as well as a source of honey-water for sustenance. Each cage contained several females and males depending on the number of adults available – generally about five females and five males per cage. For testing and rearing purposes it was beneficial to have more adults in each cage for increased oviposition in order to maintain colonies of each species. From 2008 through 2010, 40 x 40 x 40 cm screen cages containing plants in 2-liter pots were used. During the 2011 testing period, taller (40 x 40 x 76 cm) oviposition cages with four plastic sides and a screen top were used. A tray of moistened soil (Metro 510 mix) was added to the bottom of the cage and larger plants in 4-liter pots were used. The additional space, more plant biomass, and increased humidity levels may have been factors in observations of increased numbers of eggs laid compared to previous years.

Eggs were removed from the host plants daily using a soft, fine-tip brush and then placed in 90 millimeter Petri dishes lined with filter paper. As eclosion occurred, individual larvae were placed in plastic cups (473 ml) lined with moistened filter paper. In every no-choice larval development test, a single excised leaf of a test plant species was added to each cup with a single larva and cups were sealed with a clear, plastic lid. Whenever possible, leaves were taken from the top three nodes of test plants species because neonates tend to feed on newly expanded leaves in the field (Weed, 2010). This was repeated using ten cups for each test plant species. The dates and number of larvae set up on each test plant species was recorded. The test plant cups were monitored daily and any feeding damage, frass production, larval survival, development and pupation was recorded. After all larvae in each test replicate died, the contents were discarded and the corresponding test plant was considered outside of the agent's physiological host range.

Throughout the testing periods, every three days, an additional ten cups were set with a single larva and an excised leaf of *Vincetoxicum* spp. to serve as controls which were handled and examined similar to other treatments. Fresh leaves and clean filter paper were replaced in all cups as needed.

The survival rates, development time, and pupation rates of controls were recorded for all testing. At various times throughout the testing period the pupal weights of controls were recorded as a reference point for the health of populations from year to year.

Sources of plants tested

Vincetoxicum nigrum plants were collected from local populations in Rhode Island and Massachusetts. *Vincetoxicum rossicum* plants were field collected from sites in New York, Connecticut, and Massachusetts and several plants were also sent from areas in Europe. In addition to the target weeds, plants of *V. hirundinaria* were obtained from Switzerland and Gottingen and Leipzig, Germany. All test plant species were either collected in the field locally or obtained through reliable sources from around North America, including from colleagues in other regions or commercial and native plant nurseries. Any species that were collected in the field were identified with support from local botanists.

Positive Control

As described under the heading Design and Methods of No-choice Larval Development Tests, controls were set up every three days with each batch of test plants. The *Vincetoxicum spp.* controls consistently averaged 75-82 percent survival (Table 1) and it was never necessary to discard a series of tests because of poor survival of controls.

Appendix 3. Release Strategy for *Hypena opulenta.*

Culture purity and correct identification

The current cultures of *H. opulenta* are pest free and have been reared in quarantine since 2008. If additional cultures of *H. opulenta* are needed, they will be obtained from original collection sites through CABI EU-CH. Voucher specimens of *H. opulenta* are kept at the University of Rhode Island (URI) Insect Quarantine Laboratory.

General release protocol to ensure the absence of natural enemies and cryptic or sibling species

The current *H. opulenta* colony at URI will be used for all insects to be used in the proposed releases. As indicated, the current cultures are pest free. If there are unforeseen problems with the *H. opulenta* colony and additional material is required it will be collected from the same locality in the Ukraine as the tested populations. Once in containment, the new material will be reared for at least one generation before any field releases to ensure that populations are pest free and no cryptic species are present.

Intended sites, timing, methods, and number of agents for initial release

United States: Release of *Hypena opulenta* is planned for early June on Naushon Island, Massachusetts into forested populations of *V. nigrum* and *V. rossicum.* Releases of *H. opulenta* into plots of both swallow-wort species in sunny sites in fields are also planned. About 500 adults will be released into each of these sites on the island. Release sites will be monitored as described below.

Canada: This insect is approved for release in Canada, and approximately 500 *H. opulenta* larvae were released at the Central Experimental Farm, Ottawa, Ontario, Canada, on September 20, 2013.

Appendix 4. Response to Comments.

1) One commenter in support of the release expressed a concern that if *H. opulenta* would interfere negatively with the ecosystem where it's placed, what are the controls for it?

Response: In the unlikely event that it became necessary to control *Hypena opulenta*, the researchers would use the natural product, *Bacillus thurengiensis* (Bt), to control it. However, as stated on page 15, if other plant species were to be attacked by *H. opulenta*, the resulting effects could be environmental impacts that may not be easily reversed. Biological control agents such as *H. opulenta* generally spread without intervention by man.

2) One commenter indicated that they have battled swallow-wort for over 10 years now on Galloo Island in Lake Ontario. All of their efforts and expenditures have been to no avail. The commenter stated that Galloo Island could be a perfect test site for the controlled release of this moth. It is approximately 5 miles from mainland and encompasses about 2,000 acres of uninhabited land. They fully support the continued efforts to develop a natural check to this invasive plant and would like to discuss offering Galloo Island for the controlled release and testing phase of *H. opulenta*. Another commenter also requested information on the procedure for becoming a test site.

Response: The researchers are collecting information about potential release sites and will contact those who suggest these sites, when appropriate, in preparation for a release. If you are interested please send Lisa Tewksbury an email (lisat@uri.edu) describing the site, with the name of a contact person, their email address, and telephone number. The researchers are coordinating with Dr. Lindsey Milbrath of the USDA, Agricultural Research Service at Cornell University. He is planning on releases on the mainland near Galloo Island and may also include the island.

3) Two commenters wondered what the results of the 2013 release of *H. opulenta* in Ottawa, Canada have shown.

Response: *Hypena opulenta* has been established near Ottawa, Canada since 2016 when there was evidence of localized feeding, dispersal, and a second annual generation. It is too soon to expect control of this weed.

4) A commenter noted that with the expectation that a release anywhere will result in the spread of *H. opulenta* freely throughout the North American range(s) of swallow-worts, has it been observed yet in the United States?

Hypena opulenta has not yet been observed in the United States.

5) One commenter in support of the release indicated that his only criticism is that there should be more than one natural enemy for this project. Are there any other biological controls in the pipeline for swallow-wort?

Response: The researchers have a second biological control agent which may have adequate host specificity and potential efficacy. They are awaiting results of *H. opulenta* before deciding on releasing a second agent. There are other potential biological control agents for swallow-worts which are currently being evaluated.

Decision and Finding of No Significant Impact
for
Field release of the leaf-feeding moth, *Hypena opulenta* (Christoph) (Lepidoptera: Noctuidae), for classical biological control of swallow-worts, *Vincetoxicum nigrum* (L.) Moench and *V. rossicum* (Kleopow) Barbarich (Gentianales: Apocynaceae), in the contiguous United States
August 2017

The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS) is proposing to issue permits for release of a leaf-feeding moth, *Hypena opulenta* (Lepidoptera: Noctuidae). The agent would be used by the applicant for the biological control of swallow-worts, *Vincetoxicum nigrum* and *V. rossicum* (Gentianales: Apocynaceae), in the contiguous United States. Before permits are issued for release of *H. opulenta*, APHIS must analyze the potential impacts of its release into the contiguous United States in accordance with USDA, APHIS National Environmental Policy Act implementing regulations (7 Code of Federal Regulations Part 372). APHIS has prepared an environmental assessment (EA) that analyzes the potential environmental consequences of this action. The EA is available from:

U.S. Department of Agriculture
Animal and Plant Health inspection Service
Plant Protection and Quarantine
Pests, Pathogens, and Biocontrol Permits
4700 River Road, Unit 133
Riverdale, MD 20737
http://www.aphis.usda.gov/plant_health/ea/index.shtml

The EA analyzed the following two alternatives in response to a request for a permit authorizing environmental release of *H. opulenta*: (1) no action, and (2) issue permits for the release of *Hypena opulenta* for biological control of swallow-worts. A third alternative, to issue permits with special provisions or requirements concerning release procedures or mitigating measures, was considered. However, this alternative was dismissed because no issues were raised that indicated that special provisions or requirements were necessary. The No Action alternative, as described in the EA, would likely result in the continued use at the current level of chemical and mechanical control methods for the management of swallow-worts. These control methods described are not alternatives for decisions to be made by APHIS, but are presently being used to control swallow-worts in the United States and may continue regardless of permit issuance for field release of *H. opulenta.* Notice of the EA was made available in the Federal Register on July 13, 2017 for a 30-day public comment period. A total of 28 comments were received on the EA by the close of the comment period. Only one commenter was against the release of the agents, but did not raise any substantive issues. All other comments were in support of the release of *H. opulenta*, although a few questions were raised that are addressed in Appendix 4 of the EA.

I have decided to authorize APHIS to issue permits for the environmental release of *Hypena opulenta*. The reasons for my decision are:

- *Hypena opulenta* is sufficiently host specific and pose little, if any, threat to the biological resources, including non-target insect species, of the contiguous United States.

- *Hypena opulenta* is not likely to adversely affect federally listed threatened and endangered species or their critical habitats in the contiguous United States.

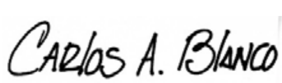
- *Hypena opulenta* poses no threat to the health of humans or animals.

- No negative cumulative impacts are expected from release of *H. opulenta.*

- There are no disproportionate adverse effects to minorities, low-income populations, or children in accordance with Executive Order 12898 “Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations” and Executive Order 13045, “Protection of Children from Environmental Health Risks and Safety Risks.”

- While there is not total assurance that the release of *Hypena opulenta* into the environment will be reversible, there is no evidence that this organism will cause any adverse environmental effects.

I have determined that there would be no significant impact to the human environment from the implementation of the action alternative and, therefore, no Environmental Impact Statement needs to be prepared.



Carlos A. Blanco, acting for Colin Stewart,
Assistant Director
Pests, Pathogens, and Biocontrol Permits
U.S. Department of Agriculture
Animal and Plant Health Inspection Service
Plant Protection and Quarantine

21Aug17
Date