

# 2014 Research Update

## Swallow-wort Biological Control Program

### USDA-ARS Ithaca, NY



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Pale and black swallow-wort (PSW and BSW; *Vincetoxicum rossicum* and *V. nigrum*, respectively) are European viney milkweeds introduced in the latter-1800s which have become invasive within the last 30 years. They infest a variety of natural and managed habitats.



#### Potential Biological Control Agents

- Few insects or mites in North America attack introduced SW (Milbrath 2010 Environmental Entomology 39: 68-78).
- Nine insect species and one pathogen have been collected from *Vincetoxicum* spp. in Europe, Siberia and the Russian Far East. Foreign surveys are continuing.
- Host-range testing has been conducted on the insect species *Abrostola asclepiadis* (defoliating noctuid moth), *Chrysochus asclepiadeus*, *C. chinensis*, *C. globicollis*, *C. goniostoma*, and *Liprus punctatostriatus* (beetles with root-feeding larvae). *Chrysochus* and *Liprus* appear to present a risk to some native milkweeds; *Abrostola* appears to be specific to *Vincetoxicum*. In addition, a pathogen discovered in New York is being tested (Gibson et al. 2012 Plant Disease 96: 456).

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#### Integrated Control Strategies

- Long-term mowing study underway to evaluate frequency and intensity of mowing in order to reduce SW vegetative vigor and reproductive output.
- Six-year field study in progress using repeated artificial defoliation or clipping on PSW and BSW growing in an open field (without plant competition). After four years, clipping 4x per season was the only type of damage that consistently reduced biomass and reproduction.
- Various herbicide-plus-cutting treatments were effective in controlling PSW in field and forest habitats although it may take 2 years of treatment to achieve satisfactory control (DiTommaso et al. 2013 Invasive Plant Science and Management 6: 381-390).

#### Weed Biology / Ecology

- Ongoing plant population studies of BSW (field populations) and PSW (field and forest populations) will identify key points in the SW life cycle to be targeted for disruption and thereby guide the selection of effective biological control agents. This is a new approach for weed biocontrol.

- The identities of North American PSW and BSW have been confirmed by Dr. Gaina Konechnaya and Dr. Nikolai Tselev (Institute of Botany RAS, St. Petersburg, Russia).
- Both species have much less genetic diversity in North America compared to Europe. Only one major genotype is present in North America for both species - the invasive genotype of PSW is from the Ukraine; BSW origin is currently unknown. Thanks to many U.S. and Canadian collectors for their assistance!
- (-) antofine, a known cytotoxic alkaloid, was identified as the phytotoxin present in all SW tissues, which greatly reduced seedling root growth in related native species and also had antifungal and antibacterial activity. Lab assays and field soil samples are being processed to confirm active release and determine relevant field concentrations of antofine (Gibson et al. 2011 *Journal of Chemical Ecology* 37: 871-879).
- PSW invests in an extensive root mass beginning at the seedling stage, whereas BSW typically invests more in shoot growth and reproduction at an earlier age (Milbrath 2008 *Botany* 86: 1279-1290).
- Both SW species have colonized soils with a wide pH range (4.7-8.0) (Magidow et al. 2013 *Invasive Plant Science and Management* 6:281–291).
- BSW is clearly a sun-adapted species, with higher photosynthesis rates under high light than PSW. Both species had similar photosynthesis rates in the intermediate light environment of a forest edge and low light levels typical of forest understories, although BSW is rarely found growing in forests.
- PSW seedlings can establish under a range of disturbance regimens, with survival rates up to 84%. In more disturbed plots, plants grew larger and some reproduced in their second season of growth (Averill et al. 2010 *Plant Ecology* 211: 65-77).



- Clonal expansion (annual increase in stem number) can be high in field-grown BSW and PSW, and both species have comparable annual survival rates (~100%) and seed production rates. Clonal expansion and seed production is much less for forest-grown PSW unless there is good light penetration to the forest floor; survival is still ~100% (Averill et al. 2011 *Invasive Plant Science and Management* 4: 198-206).
- As part of the ongoing long-term field monitoring for this project, five years of pre-release PSW density data and three years of plant community data have been collected. BSW is now also being monitored.

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