Implementation of biological control of air potato in Louisiana: Project outcomes and updates

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Invasive species - Air potato vine

- *Dioscorea bulbifera* L. (Family: Dioscoreaceae)
- Native to Asia and Africa
- Perennial vine characterized by rapid growth

Heart shaped leaves
Aerial tubers or bulbils
Biological control (BC) of Air potato

*Lilioceris cheni* (Chrysomelidae)

- Released in Florida since 2011
- Released in Louisiana since 2016
Objectives

1. Increase release efforts and monitor the impact of *L. cheni*

2. Determine the overwintering survival of *L. cheni* pertaining to establishment

3. Develop educational materials to the public and other stakeholders in Louisiana
Beetle colony established in 2019

Growing air potato in greenhouse

Rearing air potato beetles in lab and outdoor cages
Field releases & establishment in LA

New releases 2016

New releases 2017
Beetles present

New releases 2018
Beetles present
Beetles absent

New releases 2019
Beetles present

New releases 2020
Beetles present
Field releases & establishment in LA

- Despite the pandemic (2020), we continued with releases
- **5,700 total beetles** released since 2016
- Beetles are dispersing to new sites
- Moved 15-40 Km from original releases
Measuring impact of BC in Louisiana

1. Tuten Park, Lake Charles
   • 24-acre Woodland Park
   • Releases started Aug 2018

2. Bluebonnet Swamp Nature Center, Baton Rouge
   • 103-acre cypress swamp, beech-magnolia, hardwood forests
   • Releases started Aug 2018

3. Barataria Preserve, JELA, Marrero
   • 26,000 acres bayous, swamps, marshes, and forests
   • Releases started July 2016

4. Grand Isle, Nature Conservancy property
   • 21-acre Restored forest
   • Releases started July 2016
Tuten Park, Lake Charles LA

- 2019: Early beetle damage in May reduced vine cover in site 1
- 2020: We suspect beetles were active in May, resulting in higher control of air potato

PhD student, Charity Schaffer
Tuten Park, Lake Charles LA – Closed due to hurricanes 2020

- Visited the site in **July 2021** (still closed)
- Some air potato, no beetles found

More beetles were released (300)
• Beetles prefer to feed in sunny areas
• Reduction of air potato climbing on trees
• More air potato at ground level

Early beetle activity resulted in higher reduction of air potato

Late beetle activity
Barataria Preserve, Marrero LA

2019-2021

- Smaller patch of air potato (40-60%)
- Low beetles damage (20-30%)
- Other management tactics will be incorporated
Larger number of releases

- 2016: 300 beetles
- 2019: 750 beetles
- 2020-2021: 500 beetles
Grand Isle, Nature Conservancy Property LA

• Hurricane Ida (category 4) in Aug 2021
• Destroyed coast, grand isle closed
• What happened with the beetle?

Visited site **October 2021**:  
• High beetle damage (50-80%)  
• Low air potato cover (10-30%)
Releasing beetles in private properties – Lafayette, Covington

- Visited new sites in 2021
- Air potato beetle already found in the sites
- Beetle activity started late in the season
- Unusual cold Feb 2021
Reduction of air potato bulbils

Bulbil collection Feb 2019
(>450 collected)

Bulbil collection Feb 2020
(<100 collected)
Field cages in Baton Rouge

- Winter 2019-2020: 6 cages, 15 adults per cage
- Winter 2020-2021: Flooded vs. non-flooded (6 replications each)
Higher overwintering survival in 2019-2020

Year 1: 2019-2020
40% winter survival

Year 2: 2020-2021
12% vs 0% winter survival

In February 2021, hard freeze (Tmin -10°C) and heavy rainfall in Baton Rouge
Students presented research in Conferences

- **Felicia Amenyoo.** Poster presentation at Southeastern Branch of the Entomological Society of America (virtual). March 29-31, 2021.
- **Charity Schaffer.** Oral presentation at the Annual Meeting of the Entomological Society of America, St Louis MO, November 17-20, 2019.

- First place at ESA Annual Meeting (2020)
- First place at SEB ESA Meeting (2021)
Factsheet about the beetle

Introduction
Air potato leaf beetle, Lilioceris cheni, has been introduced into the southeastern United States on multiple occasions and has become established in Louisiana, Florida, Georgia, Alabama, Mississippi, and Texas. Currently, it is a pest in Florida and Alabama (USDA 2015). In Louisiana, it is considered a pest in 13 parishes. The air potato vine quickly grows to cover large areas and outcompetes native vegetation. It proliferates freely from vegetative bulblets formed in the leaf axils and is difficult to remove requiring repeated mechanical and herbicidal treatments.

A successful biological control program against L. cheni is being conducted in Florida. The program uses a parasitoid, Acrobasis cheni, which is highly specific for L. cheni, to control the beetle population. This program is being conducted by the United States Department of Agriculture (USDA). The Florida Department of Agriculture and Consumer Services (FDACS) and the University of Florida.

Air potato leaf beetle is an invasive species in parts of the southeastern U.S. It is a pest in Florida and Alabama, where it feeds on the leaves of the air potato plant. The beetle is a significant pest in these areas, where it can cause severe damage to the plants it feeds on.

Materials available for the public

Website about Air potato and BC program

Figure 1. Distribution of air potato (Dioscorea bulbifera) in the United States. Source: EDDMapS.org
**New materials developed: Brochure**

**HOW TO RECOGNIZE AIR POTATO?**
Air potato (Dioscorea bulbifera L.) is a perennial vine in the family Dioscoreaceae. It is recognized by heart-shaped leaves and aerial tubers or bulblets that fall to the ground to produce new plants (Fig. 1). Active growth occurs from May to November, and plants senesce and die-back during the winter.

**HOW CAN WE MANAGE AIR POTATO?**
Manual removal of vines and bulblets is recommended for small infestations. Chemical control should be used with caution. However, a more ecologically-friendly approach is available. Biological control is the use of specialist insects to manage invasive species. This approach is safe, sustainable, and cost-effective.

**BIOLOGICAL CONTROL USING L. CHENI**
Luben cheni (Calochromis cheni), also known as air potato beetle, was discovered in Nepal and China by USDA-ARS. After years of study, scientists proved that this beetle feeds exclusively on air potato. Beetle adults and larvae feed on the leaves, reducing plant damage.

**LIFE STAGES OF THE AIR POTATO BEETLE**

- **Early stage:** Eggs are laid on the underside of the leaves and the larva hatches within 4 to 5 days. Larvae then feed on the leaf underside, creating a window.
- **Late stage:** Larvae pupate in the soil and emerge as adult beetles in 10 to 12 days. Adult beetles mate and lay eggs within 2 to 3 days. New eggs hatch, and the cycle repeats.

**WHAT TO EXPECT AFTER RELEASE?**
The adult beetles will start feeding on leaves of air potato vines at the release site (Fig. 3). Larval feeding will be evident two weeks later. Beetles will stop feeding and pupate in 8 to 10 days during the winter. Adults will be active again by May or June. As beetle populations increase, adults will start pupating to close-by vines. Air potato vines will remain at the site, but at lower densities.

**BEETLES IN ACTION**

**BEFORE**

**AFTER**

**FOR MORE INFORMATION**
The LSU website provides further information on the biological control program of air potato in Louisiana: www.uncogencenter.com/airpotato

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Pictures were taken by V. Manrique, R. Diaz, C. Schaffer, S. Spinners, L. Mushman, J. Harrington and FDACS, Division of Plant Industry.
New materials developed: Manual

MANUAL FOR IMPLEMENTING BIOLOGICAL CONTROL OF AIR POTATO IN LOUISIANA

Figure 8. Phenology of air potato and beetles in Louisiana. Vine’s active growth is from May to November and senescence during the winter months. Beetle adults and larvae are found feeding on vines from June to October or November. Adults enter diapause (dormancy state) and stop feeding during the winter when the vine is absent. Digital illustrations from R. Díaz.
Program used for teaching and outreach

Research on air potato beetle in the laboratory

Research of beetle impact using outdoor cages
Program used for teaching and outreach

Mentorship program (2019):
High school student helping in the lab
Thank you!

Lilioceris cheni (Coleoptera: Chrysomelidae)
Watercolor from Rodrigo Diaz