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

Veronica Manrique, Charity Schaffer, Felicia Amenyo and Rodrigo Diaz

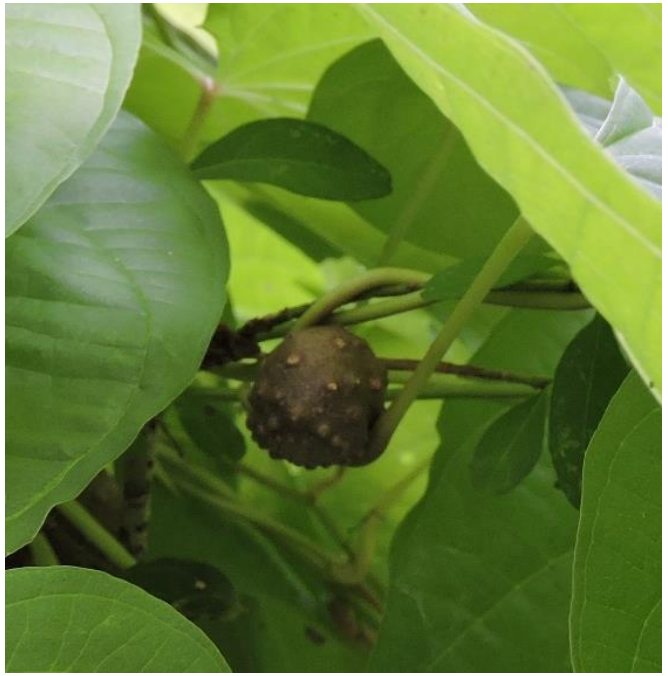
Department of Urban Forestry and Natural Resources,

Southern University A&M College

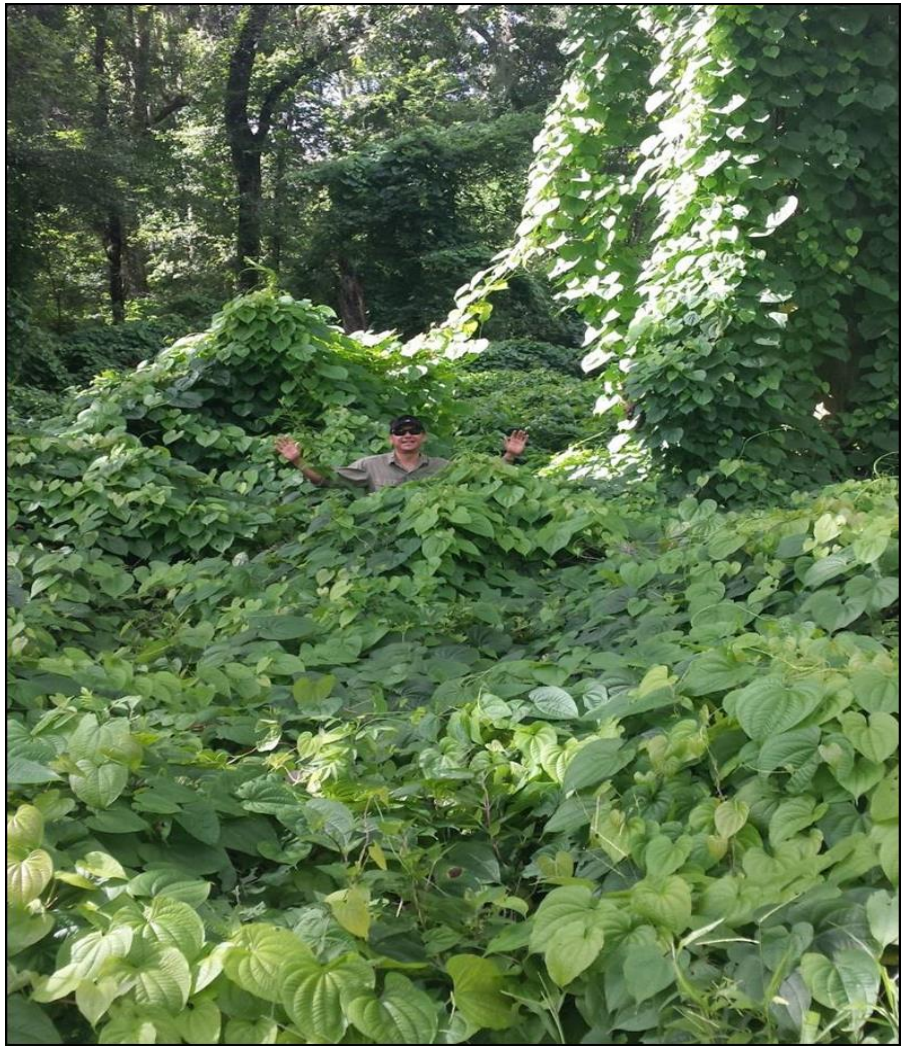
Invasive species - Air potato vine

- *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

Larval damage

Adult damage

Objectives

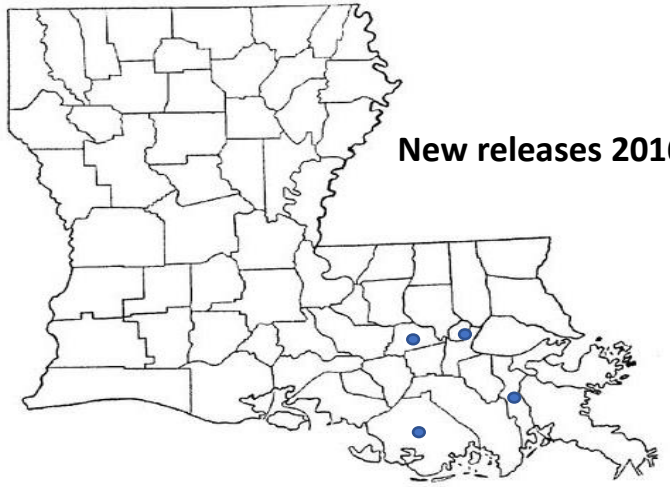
1. Increase release efforts and monitor the impact of *L. cheni*
2. Determine the overwintering survival of *L. cheni* pertaining to establishment
3. Develop educational materials to the public and other stakeholders in Louisiana

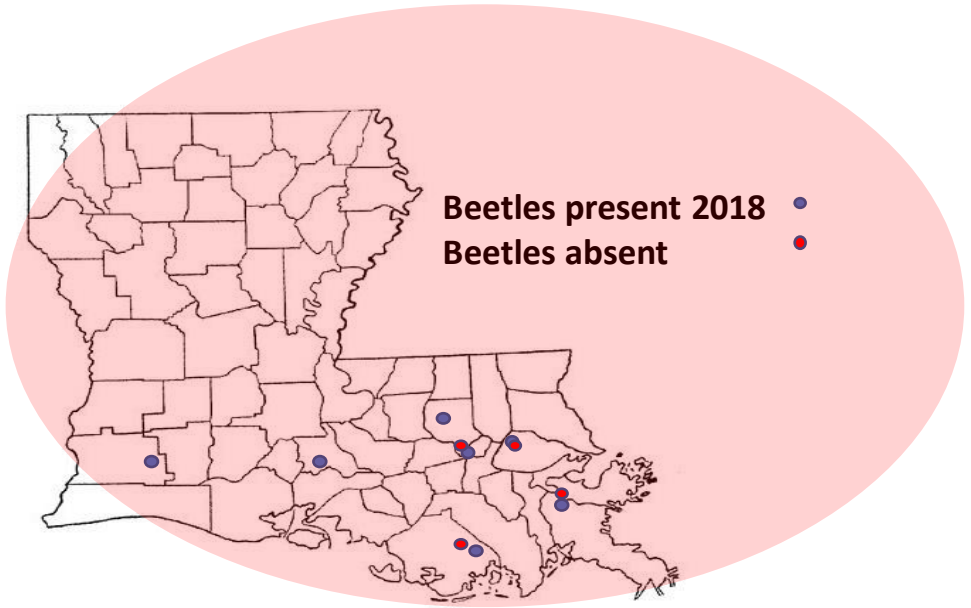
Beetle colony established in 2019

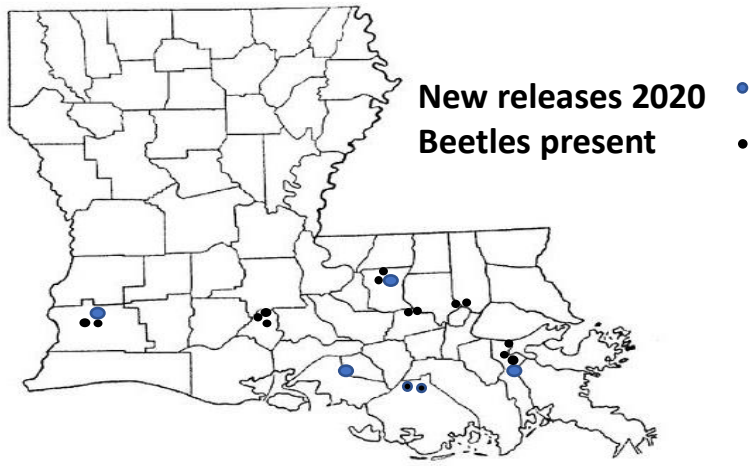
Growing air potato in greenhouse

Rearing air potato beetles in lab and outdoor cages

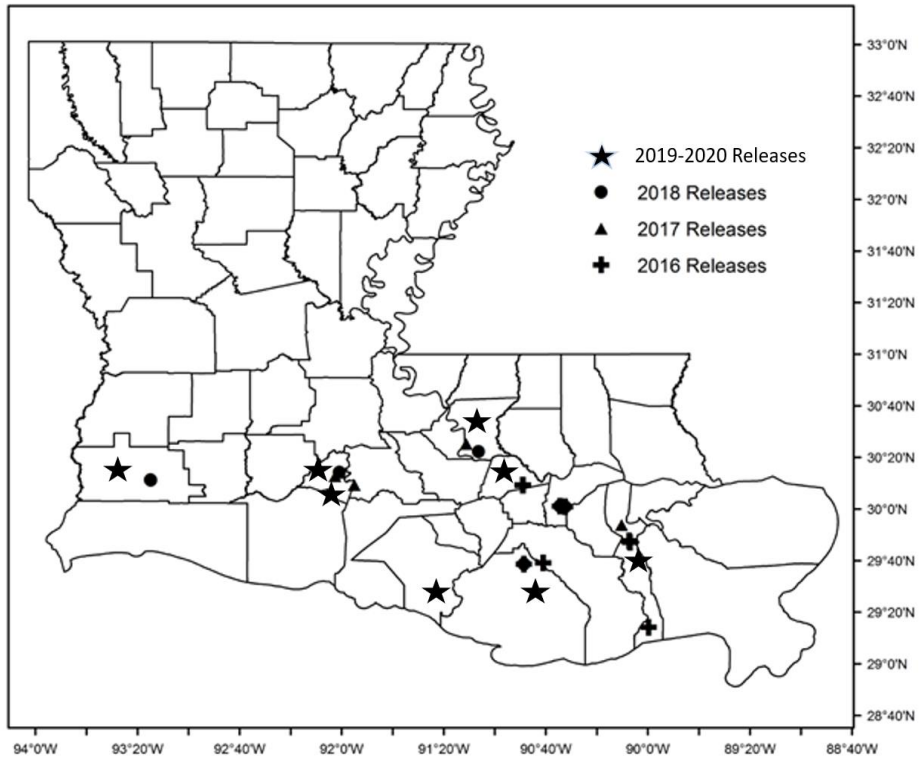
Field releases & establishment in LA





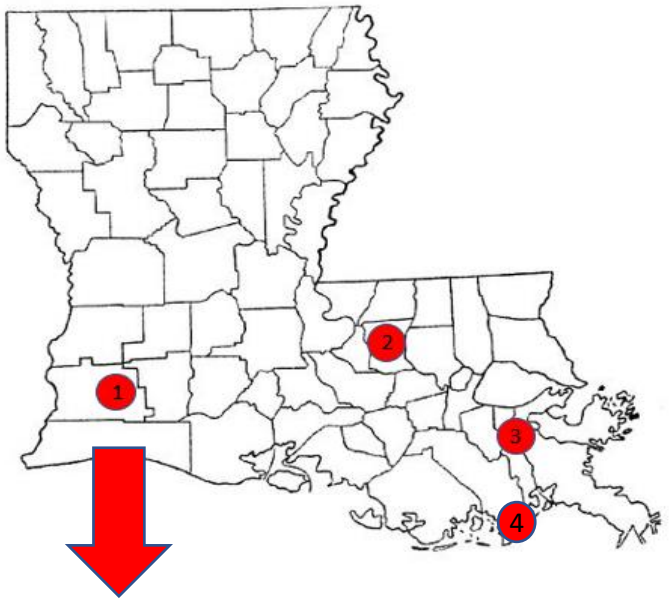


Field releases & establishment in LA



- 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

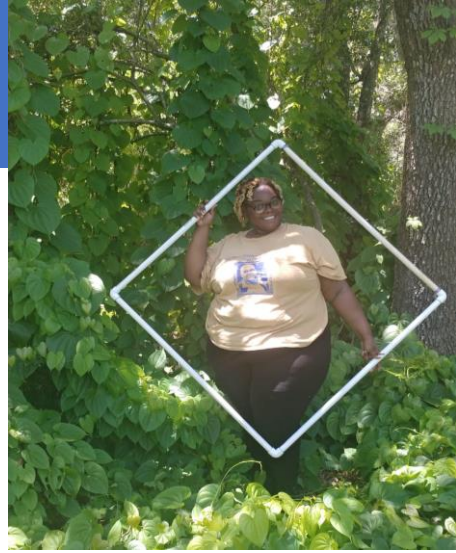
- 103-acre cypress swamp, beech-magnolia, hardwood forests
- Releases started Aug 2018

3. Barataria Preserve, JELA, Marrero

- 26,000 acres bayous, swamps, marshes, and forests
- Releases started July 2016

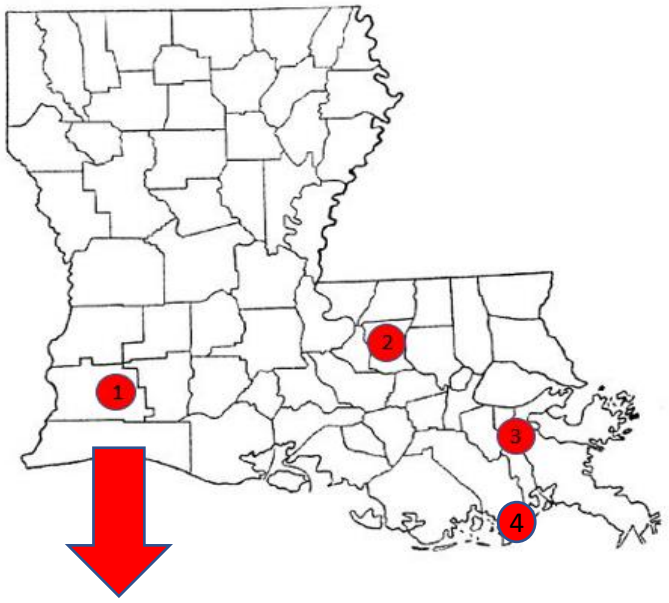
4. Grand Isle, Nature Conservancy property

- 21-acre Restored forest
- Releases started July 2016



PhD student,
Charity Schaffer

Tuten Park, Lake Charles LA



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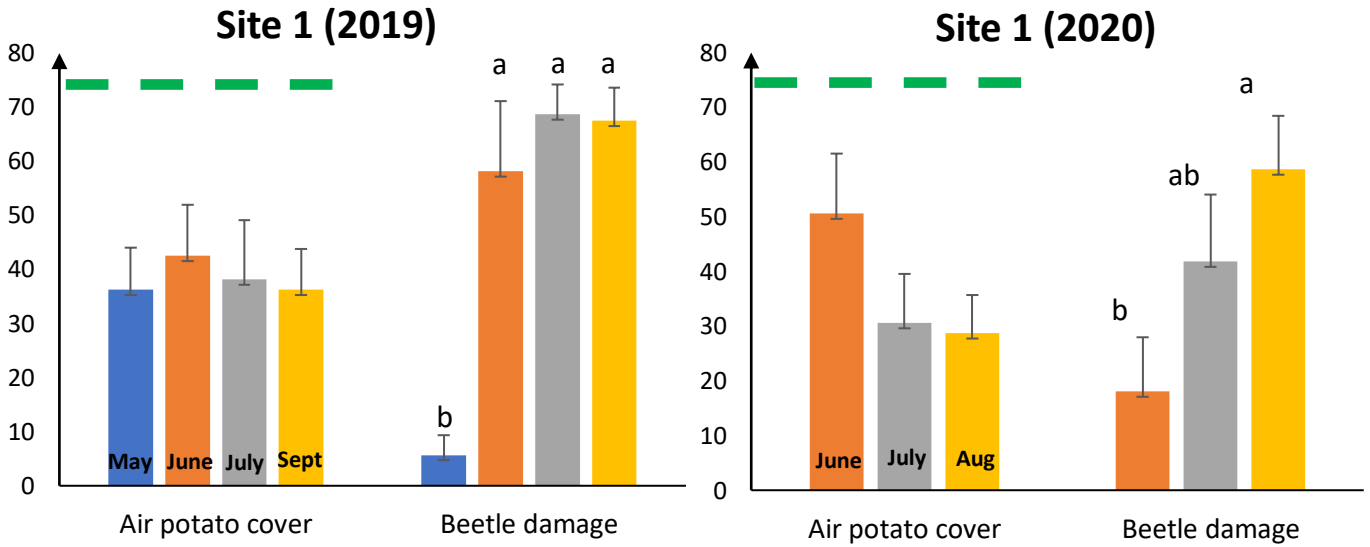
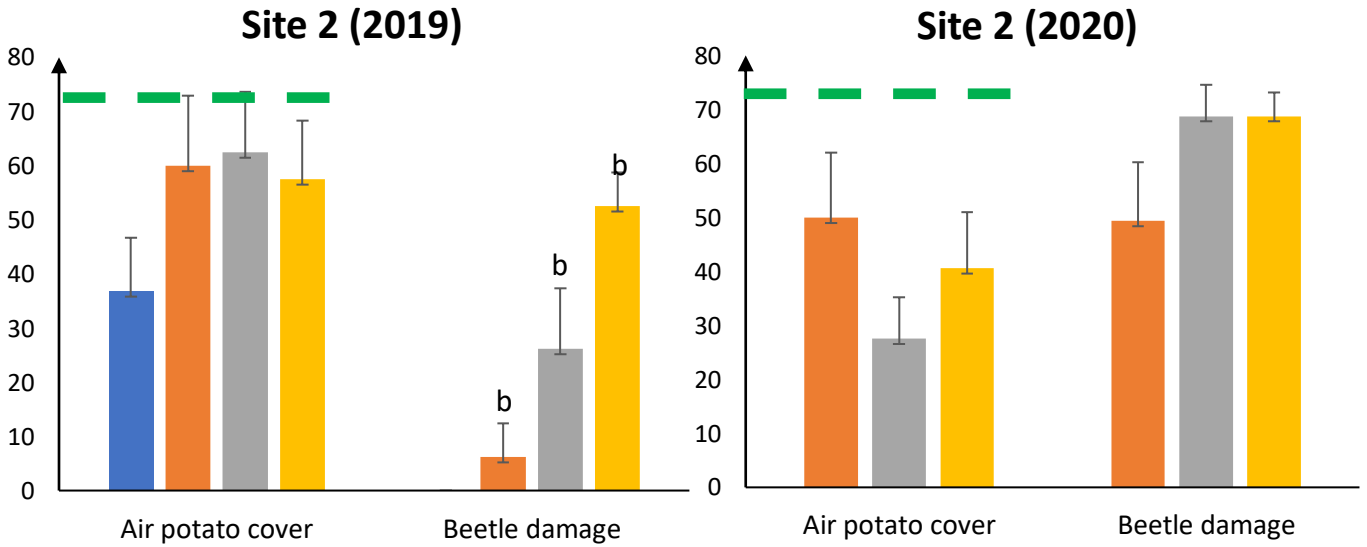


Tuten Park, Lake Charles

- 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



Tuten Park, Lake Charles LA

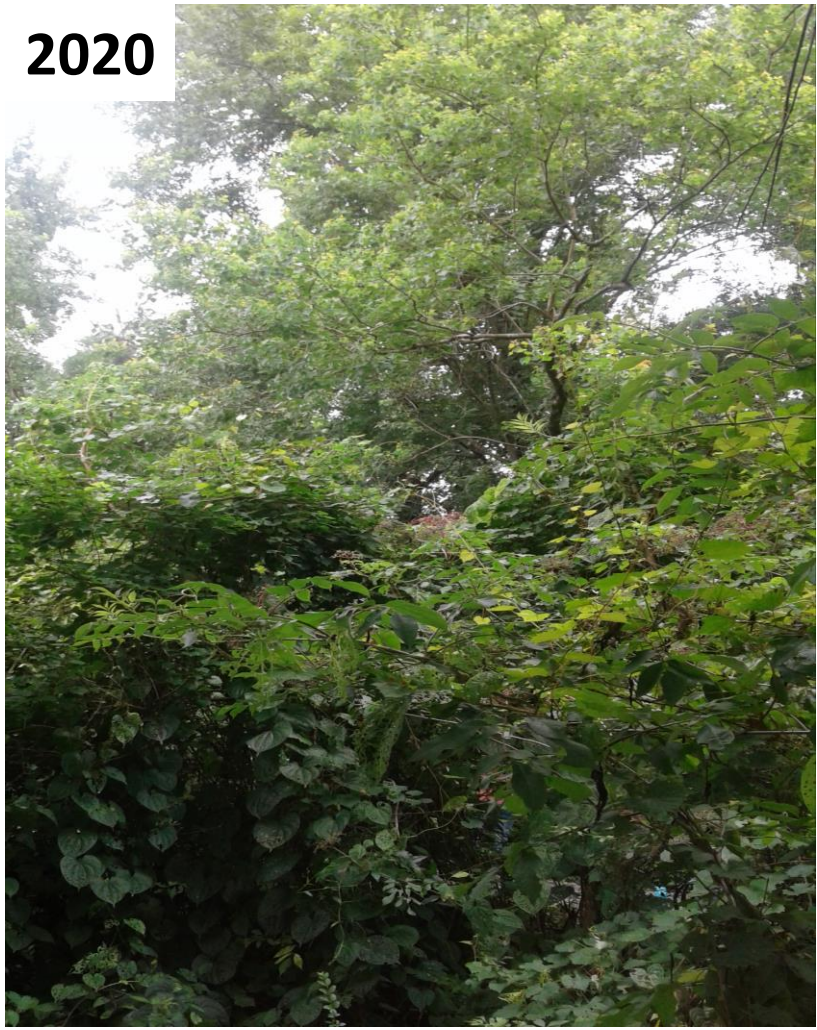
Site 1

2019 / 2020

Site 2

2019

2020



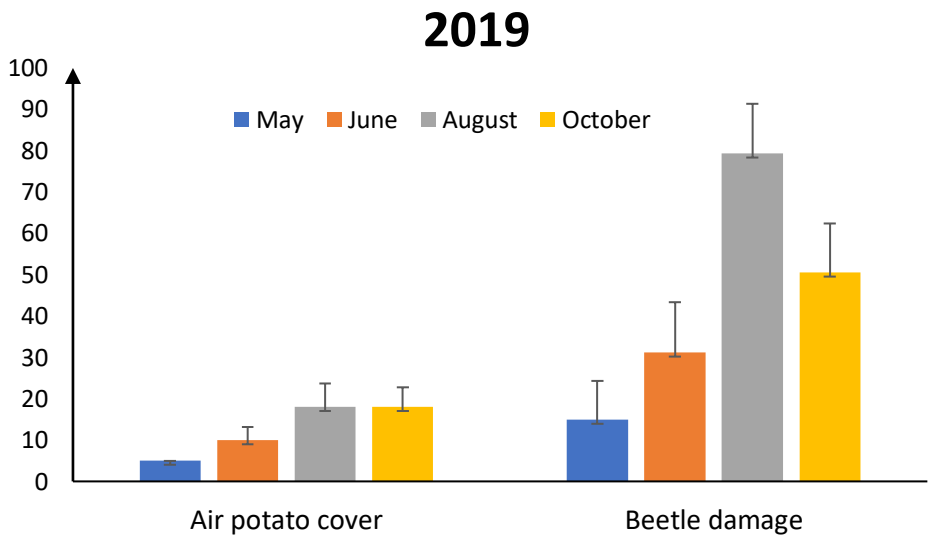
Tuten Park, Lake Charles LA – Closed due to hurricanes 2020

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

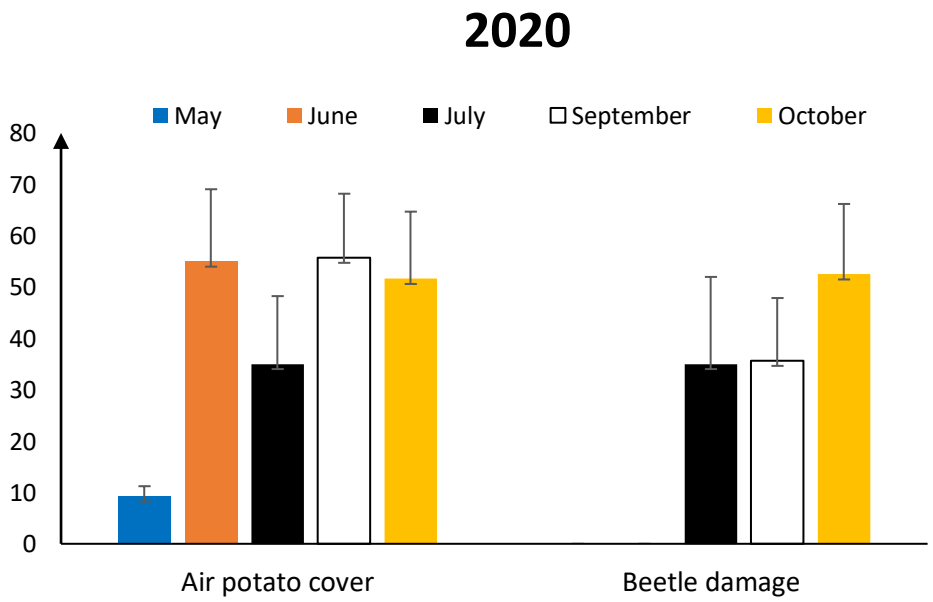
More beetles were released (300)

Bluebonnet Swamp Nature Center, Baton Rouge LA

- 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

Grand Isle, Nature Conservancy Property LA

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)

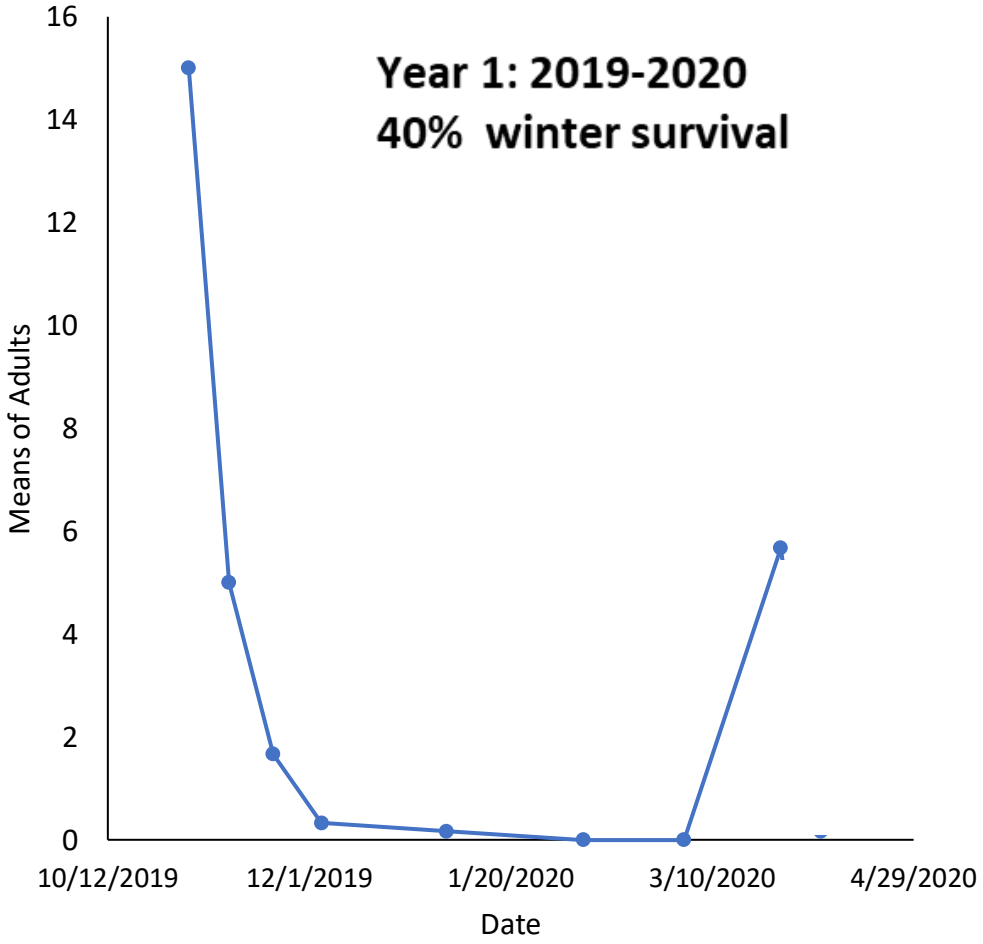
Extreme temperatures – Overwintering survival

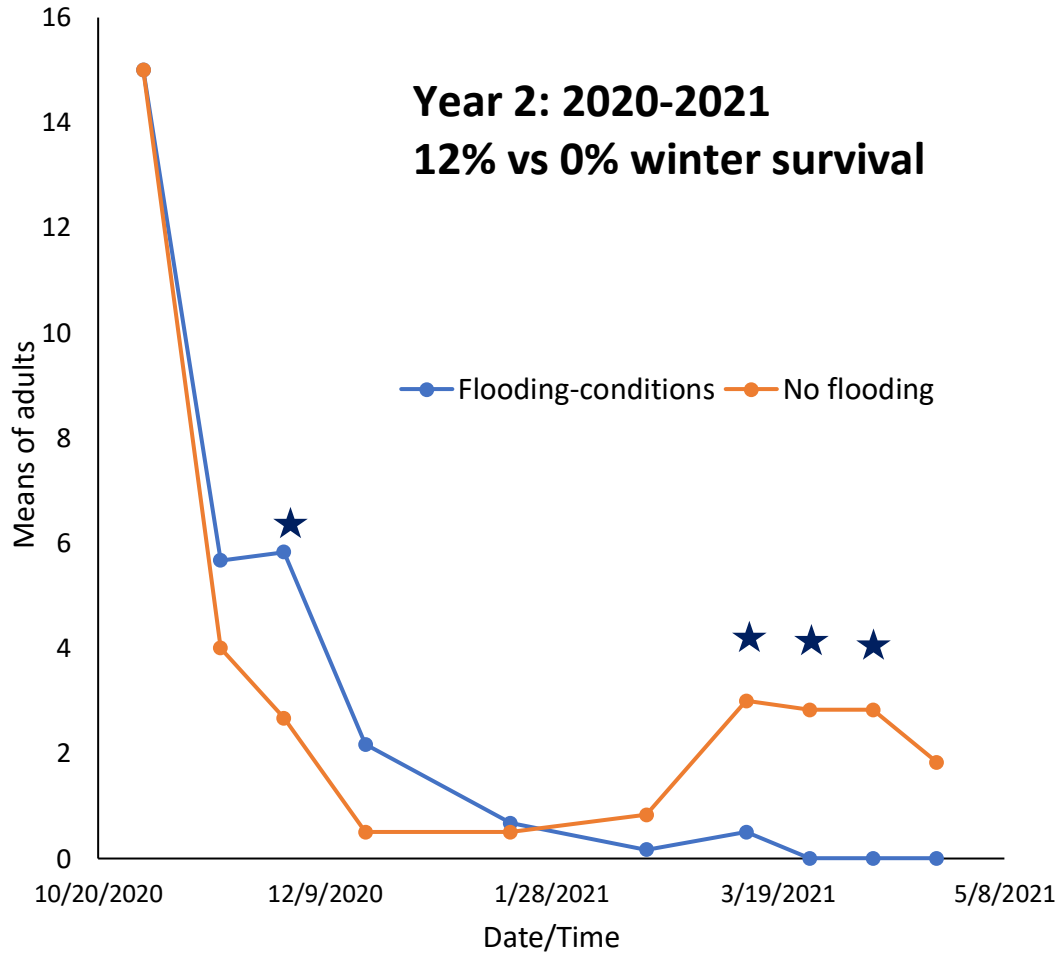
Field cages in Baton Rouge

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

PhD student, Felicia Amenyo

Higher overwintering survival in 2019-2020





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

Students presented research in Conferences

- **Felicia Amenyo**. Poster presentation at Southeastern Branch of the Entomological Society of America (virtual). March 29-31, 2021.
- **Felicia Amenyo**. Oral Presentation at Annual Meeting of the Entomological Society of America (virtual). November 11-25, 2020.
- **Charity Schaffer**. Oral Presentation at Annual Meeting of the Entomological Society of America (virtual). November 11-25, 2020.
- **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)**

Materials available for the public

BUG BIZ

Pest Management and Insect Identification Series

LSU AgCenter Research · Extension · Teaching

Air Potato Leaf Beetle

Scientific name: *Lilioceris cheni* Gressitt and Kimoto (Coleoptera: Chrysomelidae)

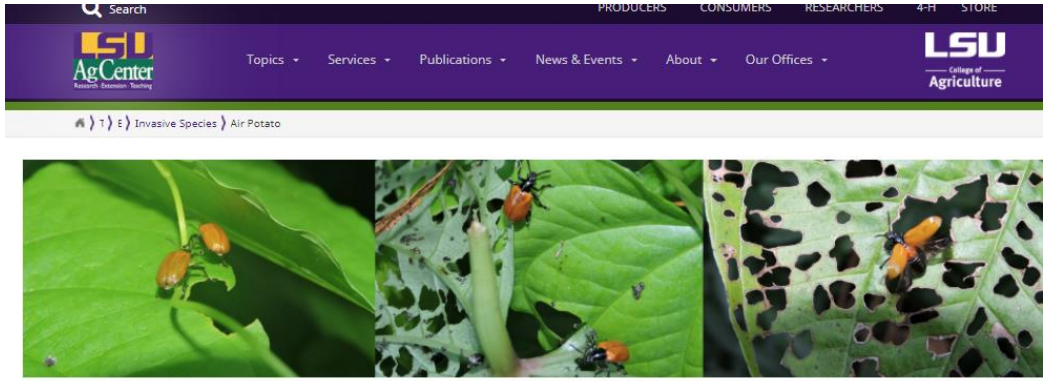
Introduction

Air potato, *Dioscorea bulbifera* L. (Dioscoreales: Dioscoreaceae), is a fast-growing perennial vine native to Asia and Africa. It has been introduced into the southeastern United States on multiple occasions and has become established in Hawaii, Florida, Georgia, Alabama, Mississippi, Louisiana and Texas. Currently air potato is registered as a noxious weed in Florida and Alabama (USDA 2015). In Louisiana, populations of *D. bulbifera* have been recorded in 13 parishes (Figure 1). The air potato vine quickly grows to cover large areas and outcompetes native vegetation. It proliferates freely from vegetative bulbils formed in the leaf axils and is difficult to remove, requiring repeated mechanical and herbicidal treatments.

Figure 1. Distribution of air potato (Dioscorea bulbifera) in the United States. Source: EDDMapS.org

A successful biological control program against *D. bulbifera* was initiated in Florida in 2011 using the air potato leaf beetle, *Lilioceris cheni* (Rayamajhi et al., 2014). Extensive laboratory and open field studies showed *L. cheni* to be extremely host-specific, feeding and developing only on *D. bulbifera* and not on related species of *Dioscorea* found in Florida including *D. floridana*, *D. villosa*, and *D. sansibarensis* (Lake et al., 2015). Rearing and release of L. cheni on public and private lands is currently conducted by the United States Department of Agriculture (USDA), the Florida Department of Agriculture and Consumer Services (FDACS) and the University of Florida. Establishment of the beetle has been confirmed across Florida. Based on its success in Florida, there is reason to believe that *L. cheni* will be an effective biocontrol agent against *D. bulbifera* in Louisiana.

Factsheet about the beetle



Website about Air potato and BC program

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 bulbils that fall to the ground to produce new plants (Fig. 1). **Active growth** occurs from May to November, and plants senesce and dieback during the winter.

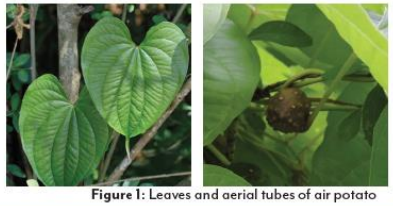
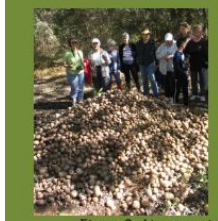


Figure 1: Leaves and aerial tubes of air potato

WHY IS AIR POTATO INVASIVE?

Air potato is native to Asia and Africa, and was introduced into the US in the 1770s. This vine grows fast covering large areas, smothering native species, reducing biodiversity and altering local communities (Fig. 2). Air potato is a threatening urban and natural ecosystems in Louisiana and Southeastern US.



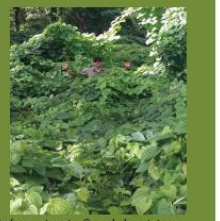


Figure 2: Air potato infestation in South Louisiana

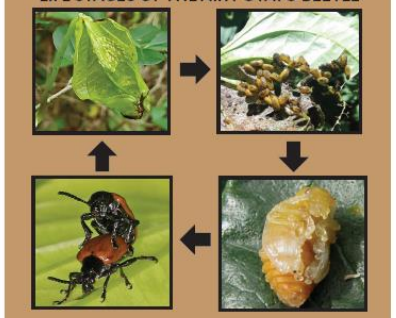
HOW CAN WE MANAGE AIR POTATO?

Manual removal of vines and bulbils 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

Liliocerís cheni (Coleoptera: Chrysomelidae) 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

LIFE STAGES OF THE AIR POTATO BEETLE



Beetle females (1/3 inch long) lay egg masses on underside of the leaves, and make cup-like leaf shape. Larvae hatch in 4-5 days and start feeding in groups on new leaves. Older larvae will stop feeding and pupate in the soil. Two weeks after pupation, new adults emerge and the cycle starts again.

HOW CAN I GET BEETLES?

If you have air potato on your property, you can obtain beetles at no charge. Contact Dr. Veronica Manrique or Charity Schaffer (Southern University):

veronica_manrique@subr.edu
charity_schaffer_00@subr.edu
phone: 225-771-6224

Release of air potato beetles

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 few weeks later. Beetles will stop feeding and remain dormant (diapause state) during the winter. Adults will be active again by next May or June. As beetle populations increase, adults will start dispersing to close-by sites. Air potato vine will remain at the site, but at lower densities.

Figure 3: Adult and larval feeding damage

BEETLES IN ACTION

Before

After

Lumen Christi Retreat Center, Schriever, LA (2016)

SCIENTISTS AT WORK

FOR MORE INFORMATION

The LSU website provides further information on the biological control program of air potato in Louisiana:

www.lsuagcenter.com/airpotato

Dr. Veronica Manrique, Department of Urban Forestry, Southern University: veronica_manrique@subr.edu

Dr. Rodrigo Diaz, Department of Entomology, Louisiana State University: RDiaz@agcenter.lsu.edu

Pictures were taken by V. Manrique, R. Diaz, C. Schaffer, S. Spinner, L. Moshman, J. Hartgerink and FDACS, Division of Plant Industry

TrueBLUE EDUCATION. CONSERVATION. COMMUNITY.

BTNEP

BIOLOGICAL CONTROL of AIR POTATO IN LOUISIANA

LSU AgCenter Research · Extension · Teaching

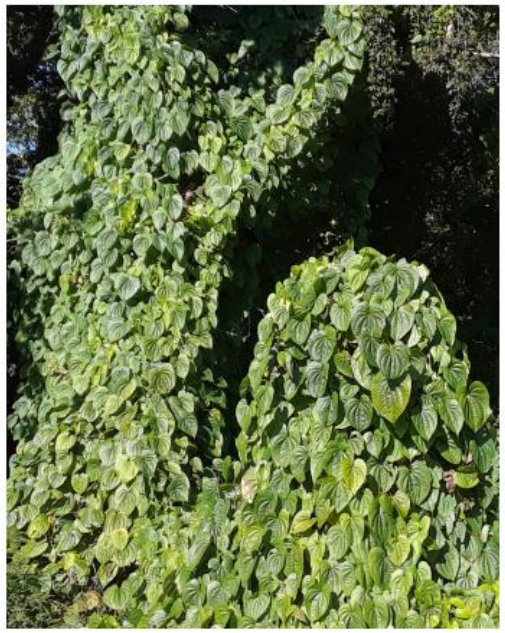
Southern University joined forces with Louisiana State University to combat invasive species in Louisiana

New materials developed: Manual

MANUAL FOR IMPLEMENTING

BIOLOGICAL CONTROL OF AIR POTATO

IN LOUISIANA



Felicia Amenyo[1], Veronica Manrique[1] and Rodrigo Diaz[2]

Southern University and A&M College[1]

Louisiana State University[2]

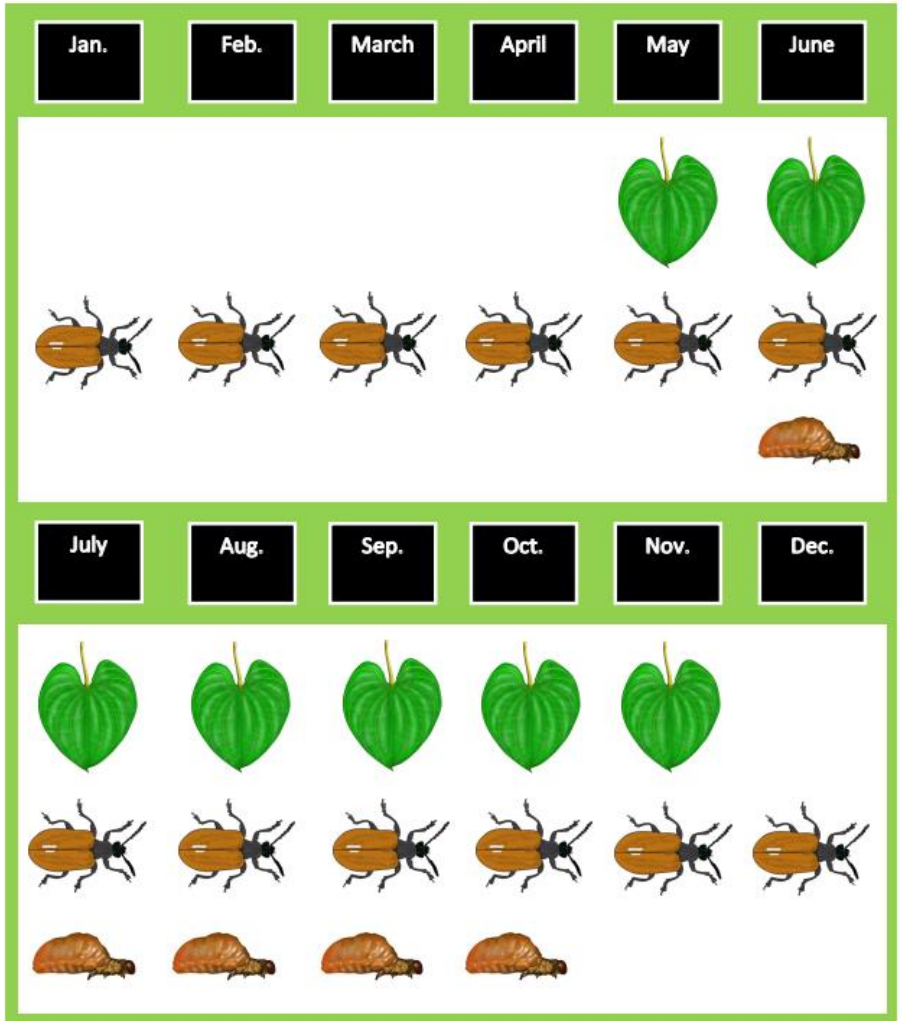


Figure 8. Phenology of air potato and beetles in Louisiana: Vine's active growth is from May to November and senesces during the winter months. Beetle adults and larvae are found feeding on vines from June to October or November. Adults enter diapause (dormancy state) and stop feeding during the winter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

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

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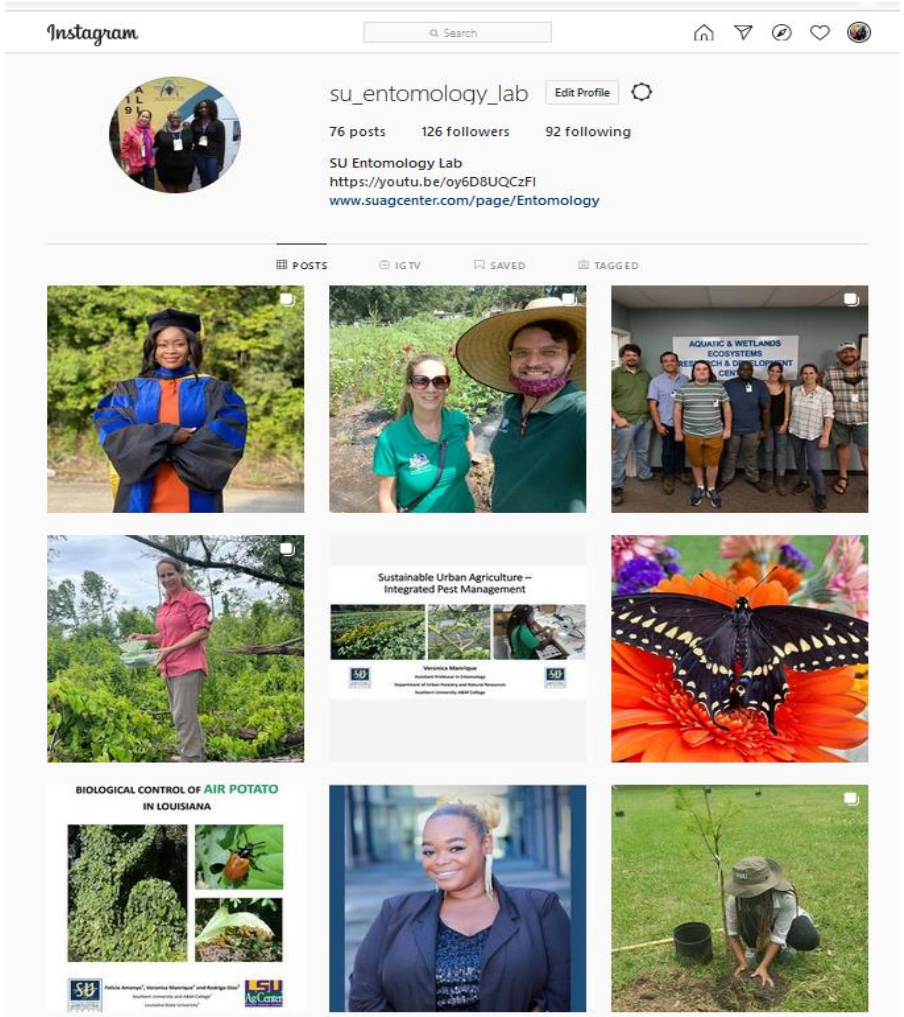

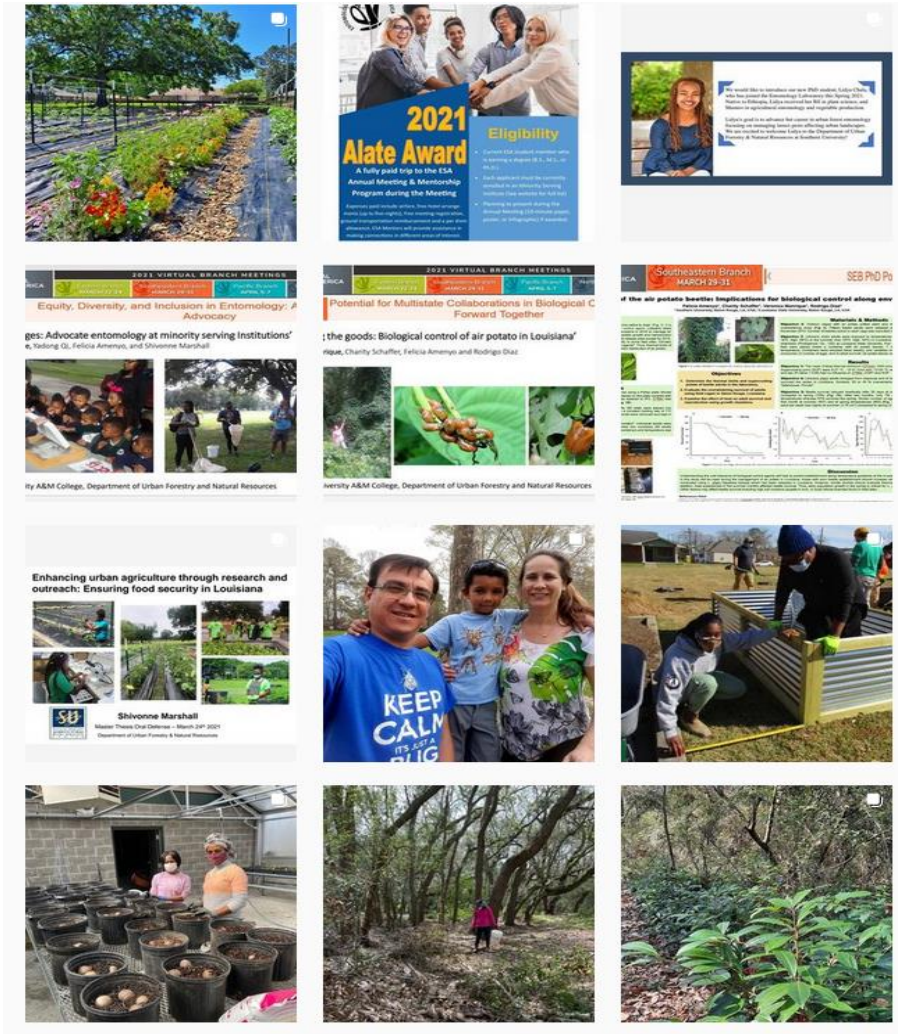

Thank you!

Lilioceris cheni (Coleoptera: Chrysomelidae)

Watercolor from Rodrigo Diaz

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NATIONAL ESTUARY PROGRAM

USDA United States Department of Agriculture
Animal and Plant Health Inspection Service