

Interagency Collaboration on Biological Control Programs

Dr. Eric Rohrig

Chief, Bureau of Methods Development and Biological
Control



**Florida Department of Agriculture and Consumer Services
Division of Plant Industry**

Florida: A Hotbed of Invasive Species

- State of Florida ranks #2 in the US for invasive pest and disease introduction risk, California is #1 (USDA-APHIS).
- Miami Dade County, Florida ranks #1 in the US (USDA-APHIS).
- Florida averages **more than 2** new non-native insects, plants or pathogens detected **per month** (FDACS-DPI).



Invasive Plants in Florida

- Approximately **1,400 non-native plant species** established in **Florida alone**.
- **76 species** are **Category I invasives**: “alter plant communities displacing native species, changing community structures or ecological functions” (FLEPPC)
- **Cost estimated at > \$40 million/year to control on public land** (local, city, county, state, national, private parks, preserves, forests, wildlife management areas)



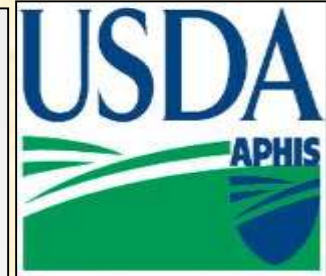
Florida Biological Control History

- Classical biological control against **invasive plants and insects** in Florida date to early 1890's.
- **1900-1925**
 - 11 species imported in Florida.
 - 7 species are known to have been released
 - 2 species are considered established
 - 1 additional species recorded as established was already widespread in Florida
- **1926-1950**
 - 28 species imported in Florida
 - 24 species known to have been released
 - 4 species are considered established
 - 4 species establishment is unknown, additional 5 species believed to have already been here (including 1 native).
- **1951-2014**
 - Over 300 species imported in Florida (many starting in the 1980's)
 - Over 130 species released
 - ~60 species considered established

Interagency Cooperation on Biological Control Programs

Collaboration plays a key role for the overall success of many programs:

1. Funding – no program without funds!
2. Background research
3. Foreign exploration (international collaborators)
4. Host range testing - data collection/analyzation (quarantine)
5. Report compilation for release petitions
6. Agent release/distribution (often statewide)
7. Mass rearing of agents
8. Public outreach (awareness and support) through various media
10. Agent monitoring (establishment, spread, and impact)
11. Data collection/analyzation
12. Publication of results
13. Feedback from stakeholders (successful control, cost savings)



Too much work for any one person or agency!!



Interagency/University Cooperation/Coordination

- Interagency coordination can improve the quality, quantity, and timeline of research, public outreach, insect production and release, and overall program impact over that which can be achieved by a single agency.
- Agency/university focus can vary: regulatory, research, outreach, land or resource management, etc.
 - allows each individual agency/university to focus on their specific objectives while the collective group works together to achieve a common goal = ultimately, the control of invasive species.
- Shared resources (\$, personnel/labor, data, IT, connections) to supplement each agencies limitations to strengthen the overall project.



Examples of Collaborative Biological Control Programs in Florida

- Many recent projects involve some level of coordination.
- Trend toward increase in coordination as funds and work force size of many agencies/universities decrease.
- A few examples of **recent** collaborative efforts:
 - * *Dioscorea bulbifera* (air potato vine)*
 - *Solanum viarum* (tropical soda apple)
 - *Melaleuca quinquenervia* (paperbark tree)

Air Potato Vine, *Dioscorea bulbifera*

- Native to Asia and Africa. Established in southern US and Hawaii.
- Smothers native vegetation, displaces wildlife, decreases biodiversity.
- Spread via aerial tubers. Approximately 1 bulbil produced per alternate leaf axil (2 leaves = 1 bulbil).
- Huge labor and herbicide costs yearly throughout Florida –underground tubers must be removed to prevent yearly re-growth.



Air Potato Biological Control Collaborators

Funding: USDA-APHIS, USDA-ARS, FDACS-DPI, UF-IFAS, Comprehensive Everglades Restoration Project (CERP), Miami Dade County DERM, Army Corps of Engineers (ACE), South Florida Water Management District (SFWMD), Florida Fish and Wildlife (FWC).

Foreign exploration/ Insect collection: USDA-ARS-IPRL, Australian Biological Control Laboratory (ABCL), Nepal Agricultural Research Council (NARC) and Chinese Academy of Sciences (CAS) for search, shipment of natural enemies of air potato vines and other indirect supports.

Parasitoid host range testing (quarantine) and petition to release: USDA-ARS-IPRL

Extension activities/outreach: USDA-ARS, UF-IFAS, FDACS-DPI

Insect mass rearing: USDA-ARS-IPRL, FDACS-DPI, UF-IFAS

Insect releases: USDA-ARS, FDACS-DPI, UF-IFAS, Georgia Forestry Commission, LSU, Nature Conservancy, DEP, Boy Scouts of America, FDOT, local, city, state, and county personnel from numerous agencies, many elementary, middle, high school and colleges throughout Florida, and well over 1,500 “private” Florida citizens.

Data collection and publication: UF-IFAS; USDA-ARS; FDACS-DPI; FAMU

Air Potato Biocontrol Agent: *Lilioceris cheni* (Coleoptera: Chrysomelidae)

- Discovered in Nepal and China.
- Released in Florida from 2011 – present.
- Over 500,000 beetles released in nearly 50 Florida counties (+GA and LA), majority during past 5 summers.
- Drastic reduction in vine biomass and bulbil production in many areas of Florida.
- Numerous current and completed multi-agency research projects.
- Numerous multi-agency publications.



June 2012



August 2013



August 2014

Air Potato Working Group

Started a bi-annual working group to maximize our efforts and impact:

- Technology transfer of rearing techniques
- Insect sharing
- Funding opportunities
- Planning and updates of research projects and priorities
- Release coordination
- Extension and outreach activities
- Publication ideas and responsibilities
- Host range testing of bulbil feeding beetle (*Lilioceris egena*)



UF Collaborative Air Potato Biocontrol Website

<http://bcrcl.ifas.ufl.edu/airpotatofiles/airpotatoforms.shtml>

****Gold Award Winner (2016), Association of Natural Resource Extension Professionals**

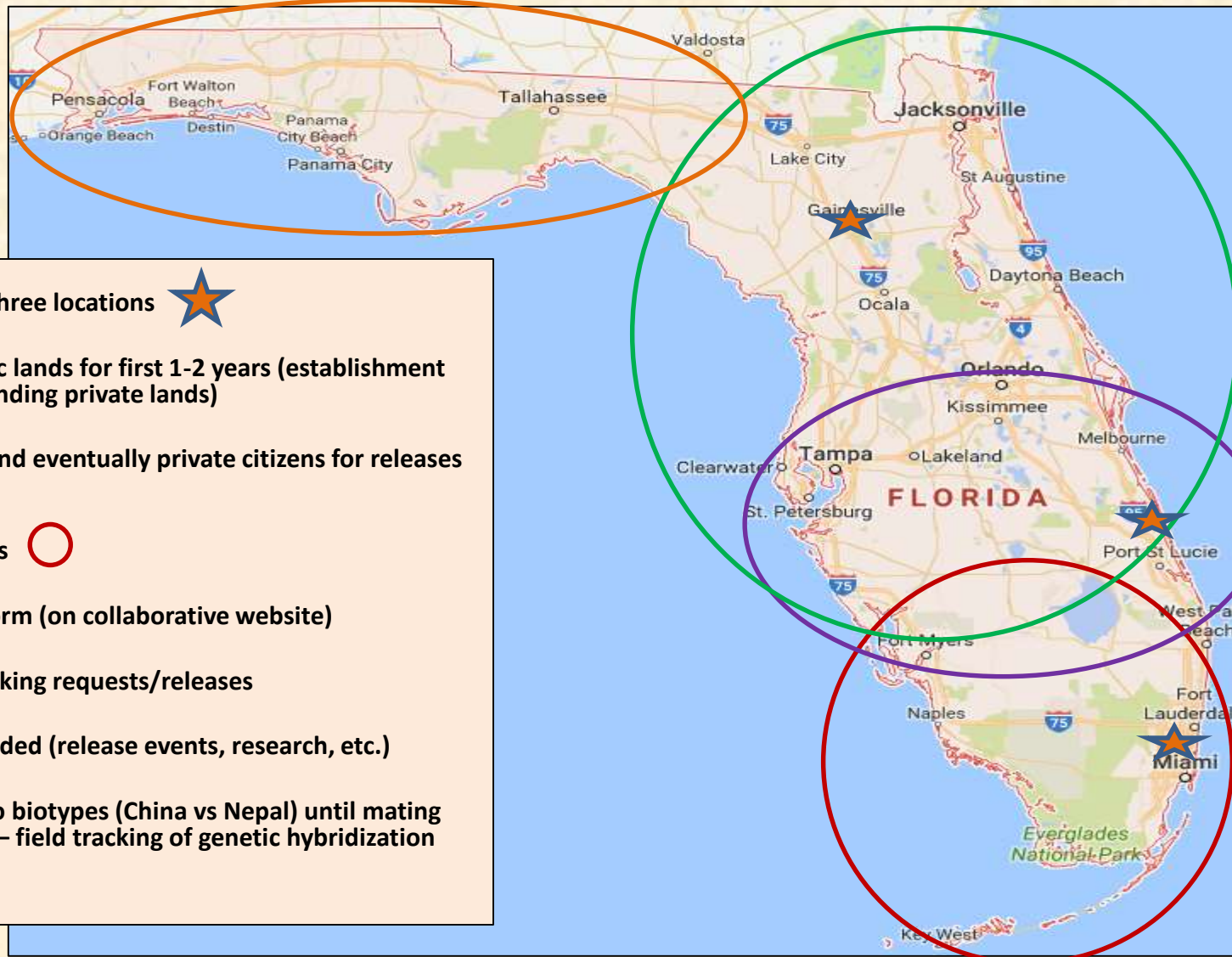
Contents:


- Program information
- FAQ's
- How to request beetles
- Air potato online IPM course
- News article
- Publications
- Posters/sketches –outreach materials

The screenshot shows the homepage of the Air Potato Biological Control website. The header features the title "Air Potato Biological Control" and the tagline "Solutions for Your Life". Below the header is a navigation menu with links for "Home", "About this Program", "Publications", "FAQ", and "Contact Us", along with a search bar. The main content area is divided into several sections: a video player for "Air Potato Biological Control", a "Request Air Potato Leaf Beetles" section with a form, an "Online Course: Air Potato IPM" section, an "Identifying Air Potato" section, a "Meet the Air Potato Leaf Beetle" section, and an "Air Potato Biological Control in the News" section. On the right side, there is a "Resources" section with a poster titled "Air Potato Poster" and a "Publications" section. The left sidebar contains logos for USDA, IFAS, UF IFAS, St. Lucie County, and the Florida Fish and Wildlife Conservation Commission.



Coordinated Insect Production and Release



- Insect mass rearing at three locations 
- Focus releases on public lands for first 1-2 years (establishment and dispersal to surrounding private lands)
- Utilize land managers and eventually private citizens for releases and feedback
- Division of release areas 
- Single beetle request form (on collaborative website)
- Single database for tracking requests/releases
- Share insects when needed (release events, research, etc.)
- Release only one of two biotypes (China vs Nepal) until mating studies were complete – field tracking of genetic hybridization post release

Coordinated Research

- **Air potato biocontrol extension needs assessment**

- determined the characteristics, needs and priorities of the target audience
- analyzed perceived knowledge of air potato and the role of IPM and biological control in the plant's management
- analyzed end users' preferred methods of obtaining information on air potato IPM strategies
- determined types and numbers of educational resources currently being used by end users to manage air potato

- **Beetle impact on vine infestations and native plant ecosystems**

- established long term field research sites to monitor impact over time (vine and bulbil decrease, increase in native vegetation, diversity)

- **Release and distribution of air potato biocontrol agent in Florida (2012-2015)**

- statewide survey at 113 randomly selected air potato infestations in 67 counties to determine distribution and impact, dispersal, rate of spread

- **Growth and biomass production by air potato vines generated from bulbils**

- determine growth and bulbil production from various size bulbils of both brown and tan morphotypes

- **Air potato management plan for Florida**

- **Host range validation, molecular identification, and release and establishment of a air potato beetle**

- importation, host range testing, initial release and establishment of Chinese biotype

- **Organisms feeding and/or developing on air potato vine in Florida (other than biocontrol agent)**

- **Air potato beetle biotype hybridization studies**

- **Artificial diet production for mass rearing beetles without need for live vines as a food source**

- **Field host specificity (naïve vs. experienced treatments)**

- **Beetle overwintering ability**

- south vs central vs north Florida (Chinese and Nepalese biotype)
- body fat reserve comparison through overwintering period

- **Beetle establishment and dispersal**

- how many beetles are required to achieve establishment?

- **Beetle fecundity, longevity, cold tolerance (lab)**

- **Economic evaluation to determine economic benefits of the biocontrol program to Florida.**



Program Outreach and Education

Outreach conducted by numerous agencies for maximum impact :

- Beetle release events (parks, schools, garden clubs)
- Beetle giveaways – education events open to public (parks, environmental groups)
- Posters, flyers, temporary tattoos, stickers, t-shirts
- Media – television, newspaper, internet
- Air potato roundups
- Publications
- State fair
- UF-IFAS extension events
- Presentations
- General public releases



Air Potato Citizen Science Website



Become a Citizen Scientist.

Join the Air Potato Patrol and Become a Citizen Scientist Today.

The Air Potato Patrol is a **citizen science project** that involves scientists and researchers with the USDA, State of Florida and University of Florida and of course you – citizens concerned about the effects of invasive species on our economy and environment.


Our goal is to **educate and involve** as many members of the public as possible to help control **air potato vine in Florida**.

How we plan on doing that is to involve **YOU** in the process as our eyes on the ground and around the state.

Science is making great strides in better understanding air potato vine, how to **stop its spread** and **how to better control it**, but we need your help.

<http://airpotatobeetle.com>

- Educate and involve the general public about the program and effects of invasive species on Fl. Economy and environment
- Take online training and pass pretest to submit info.
- Public report vine growth, beetle activity and impact throughout the year.



What is Citizen Science?

Have you ever wanted to assist with a science research project or have a hand in solving an environmental issue in your own back yard? (A GREAT OPTION!)

Citizen science projects are a great way for everyone to get involved with the sciences and contribute to the discovery of the solutions to our world's biggest problems. We require no PhD.

Our volunteers will have the opportunity to get involved with ongoing research and have the chance to contribute to the battle against Air Potato Vine.

How Do You Become a Citizen Scientist?

FIRST THE HARD PART! You have some of training videos that you need to watch to learn about air potato vines, other similar plants, how to avoid being contaminated by seed etc, and our new field kit that we are giving away.


You will also have a brief pretest to take at the beginning with a pass/fail at the end.

When we need your money or donation or if you have any questions about what is happening with the air potato vine at your property we will contact you.

All you have to do is check your e-mail and when we reach a steady question, answer part and pretest/quiz, we'll respond.

We certainly would love to have if the plants have died (and from other sources), that'll be great to the point to if you observe any further findings on your plants.

LET'S GET STARTED >>



Paperbark Tree, *Melaleuca quinquenervia*

- Native to Australia
- First introduced to Florida in 1906.
- Took over hundreds of thousands of acres in the Everglades
- Prolific seeder



Melaleuca Biological Control Collaborators

Funding: USDA-ARS, SWFWMD, USACE, FWC, Miami Dade County DERM

Foreign exploration/ Insect collection: USDA-ARS: IPRL and CSIRO Australia

Parasitoid host range testing (quarantine): USDA-ARS-IPRL, UF-IFAS

Petition for agent release: USDA-ARS-IPRL

Extension activities/ outreach: USDA-ARS-IPRL, UF-IFAS

Mass rearing and release of agent: USDA-ARS-IPRL, UF-IFAS

Data collection and publication: USDA-ARS-IPRL, UF-IFAS, U of M



Melaleuca Agents: Four Species Imported From Australia

- *Oxyops vitiosa*: leaf weevil, released in 1997
- *Boreioglycaspis melaleucae*: psyllid, released in 2002
- *Fergusonina turneri*: bud gall-fly, released in 2005 (not established)
- *Lophodiplosis trifida*: stem-gall midge, released in 2008

Together, drastically reducing melaleuca in Florida!!!



Tropical Soda Apple (TSA), *Solanum viarum*

- Native to South America (Brazil, Argentina, Paraguay, Uruguay)
- First found in Florida in 1988. Established throughout SE USA. >0.5 million Hectares in 11 states, displacing native grasses, major pasture pest.
- Seeds (40,000/plant) dispersal by cattle and wildlife feeding on fruits (50-100 fruits/plant)
- Florida ranchers were losing US \$6.5 to 16 million annually.
- **Heavy herbicide use in Comprehensive Everglades Restoration Plan (CERP) areas.**



Spiny bush (1-2 m high) known as ‘The Plant from Hell’

Tropical Soda Apple Biological Control Collaborators

Funding: USDA-APHIS, UF-IFAS, FDACS-DPI, SWFWMD

Foreign exploration/ Insect collection: UF-IFAS, USDA-ARS Hurlingham, Argentina, USDA-ARS – MS, FL, Universidade Paulista de Jaboticabal, Universidade Federal de Curitiba, Universidade de Santa Catarina, Blumenau, Universidade de Parana, Irati – Brazil, Museo de Entomologia - Paraguay.

Parasitoid host range testing (quarantine): UF-IFAS; USDA-ARS Lab Hurlingham, Argentina; USDA-ARS, MS; USDA-APHIS, FL; Universidade Paulista de Jaboticabal, Universidade Federal de Curitiba, Universidade de Santa Catarina, Blumenau, Universidade de Parana, Irati – Brazil.

Petition for agent release: UF-IFAS; USDA-ARS Lab Hurlingham, Argentina; USDA-ARS, MS

Extension activities/outreach: UF-IFAS, FDACS-DPI

Mass rearing and release of agent: UF-IFAS; FLDACS-DPI; USDA-ARS; USDA-APHIS

Data collection and publication: UF-IFAS; USDA-ARS; USDA-APHIS; FDACS-DPI; FAMU



TSA agent: *Gratiana boliviana* (Coleoptera: Chrysomelidae)

- Discovered in Paraguay
- Rereleased in Florida from 2003 to 2011
- Over 250,000 beetles released
- Drastically reduced TSA throughout Florida. Also, greatly reduced labor and herbicide use/costs.



Continued collaboration is essential for future funding and maximum effectiveness

Interagency coordination can improve the quality, quantity, and timeline of research, public outreach, insect production and release, and overall program impact over that which can be achieved by a single agency.

Some federal funding sources show move toward awarding collaborative projects funds more often and higher amounts than single agency proposals.

Dr. Gary R. Buckingham

(Dec. 7, 1942 – Jan. 2016, 2017)

BS Agriculture from Purdue University (1964)

Ph.D. Entomology from University of California, Berkeley (1975)

USDA-ARS Entomologist 1970-2004 (Rome, Italy and Gainesville, Florida)

Biocontrol of *Melaleuca quinquinervia* (melaleuca), *Lygodium microphyllum* (old world climbing fern), *Alternanthera philoxeroides* (alligator weed), *Myriophyllum spicatum* (Eurasian watermilfoil), *Hydrilla verticillate* (hydrilla), and *Eichhornia crassipes* (waterhyacinth).

Conducted foreign exploration for biocontrol agents in 20 countries. Visited an additional 19 countries to lecture or attend meetings.

Avid photographer



Lilioceris cheni (Coleoptera: Coccinelidae), biocontrol agent of air potato vine, *Dioscorea bulbifera*, in Florida

Questions??

