

## Module 3 ~ Why Manage Invasive Plants? (UE) Effects of *Lilioceris cheni* on Air Potato Growth



Adapted from a UF Brain Bowl Laboratory Exercise  
Courtesy of Bill Overholt -- UF/IFAS Indian River Research & Education  
Brought to you by the Invasive Plant Education Initiative / Center for Aquatic and Invasive Plants  
<http://plants.ifas.ufl.edu/education>

**Title:** Effects of *Lilioceris cheni* on Air Potato Growth

**Essential Questions:** What is an invasive species? What is biological control, or “biocontrol”? Can the air potato leaf beetle (*Lilioceris cheni*) be used as an effective biocontrol for the invasive air potato vine in Florida?

**Science Subject:** biology, environmental science, life science

**Grade Level:** Upper elementary (4<sup>th</sup> and 5<sup>th</sup>)

**Science Concepts:** See list of suggested state standards at the end of this document

**Overall Time Estimate:** 50 minutes in class; teacher will need to grow plants 2 weeks in advance and prep experiment 1 week in advance of lab.

**Vocabulary:** biological control, quarantine, bulbils, defoliation, nodes, invasive species

**Lesson Summary:** Students work together to compare the growth of the invasive air potato vine when exposed to a biological control agent to the growth of an uninfested control plant. Students are introduced to the concept of biological control and to the ecological impacts of the invasive air potato vine in Florida.

**Student Learning Objectives:** Students will learn what a biological control agent is. They will also learn about Florida ecology and some of the impacts of invasive species.

### Materials:

- ❖ Air potato plants – enough for each pair of students to have 2 plants (experiment and control). To grow air potato plants, collect bulbils from October to March. Plant in the spring.
  - Air potato is a noxious weed, and you need a permit to collect bulbils for educational use. See the “resources” section on our site for a link to the application form, as well as an example of a form filled out for this lab.
- ❖ Air potato leaf beetles – enough to put 4 on each experimental plant. To obtain the air potato leaf beetle contact Eric Rohrig with the Florida Department of Agriculture and Consumer Services via the beetle request form (details on page 5 of this teacher guide).
- ❖ 2 liter soda bottles – one per air potato plant
- ❖ Mesh Screen – to place over holes in soda bottles to prevent beetles escaping
- ❖ Wooden dowels or sticks – one per air potato plant
- ❖ Student Data Sheets



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### Advance Preparation:

- ❖ Fill out FDACS form to collect air potato for educational use.
- ❖ Collect air potato bulbils (October-March) and plant in individual pots. Warm conditions speed up sprouting.
- ❖ 1 week before lab is planned, measure the length of each air potato plant and count the number of leaves and nodes. Record this information for each plant on the Student Data Sheet; the students will need it to complete the lab activity.
- ❖ Cut holes in the side of two liter bottles and cover with the mesh screen.
- ❖ Place 4 air potato leaf beetles on half of the plants. The other half will be the control plants. Place two liter bottles with screen over all plants.

### Procedure:

- 1) Teacher leads class in discussion. See next page for suggested talking points.
- 2) Pair the students into teams. Each team receives 2 potted air potato plants, one experiment and one control.
- 3) Teams will count the number of leaves and nodes on each plant and measure the heights of the plants.
- 4) As the students count and measure, the teacher will pass out the initial length, leaves, and node measurements to each team.
- 5) Instruct students to assess overall plant conditions by using a scale of 0-5, with 0 = no damage and 5 = severe defoliation.
- 6) Teacher projects the Student Data Sheet with initial data using ELMO, overhead, etc. Each team reports to the class the number of leaves, nodes, and assessment of damage.
- 7) Data from class will be pooled to calculate mean growth of infested and control plants based on three parameters:
  - i. increase in number of leaves during 1 week
  - ii. increase in number of stem nodes during 1 week
  - iii. increase in plant height during 1 week
  - iv. average damage score
- 8) Students illustrate data using graphs and then discuss the impact the beetles had on plant performance.



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**Discussion to be had PRIOR to handing out plants:**

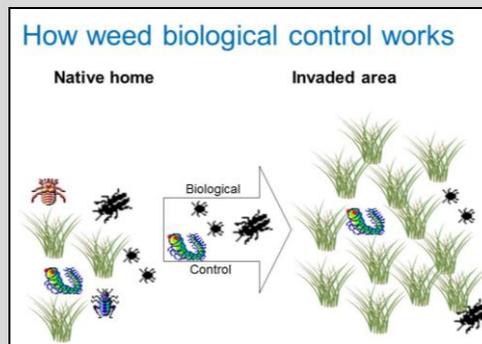
Adapted from the “Biocontrol in the Schools Project” of the Brandywine Valley Association

**Introduction:** Today we are going to learn about the invasive air potato vine, a plant that is causing a lot of problems in Florida. We will learn one way scientists have discovered to control the plant using a beetle from China. This type of control is called “biological control” or “biocontrol.”

- **What do plants need to survive?** (Sunlight, water, nutrients & space.) If students struggle with “nutrients” ask: how many of you take a multivitamin in the morning? This helps you to get the vitamins and minerals you need but might not get from your food every day. Where do plants get nutrients from? (Soil). How do they get to these nutrients? (With their roots).

To help explain “space” ask: would you want all your classmates to live in your room with you? Why not? (There isn’t enough room and you like your own space.) Plants need their own space too. If plants are too crowded together they have to compete for sunlight, water, nutrients and space. Air potato is an aggressive plant that outcompetes many other plants and grows up and over them in order to get more sunlight.

- **Where is air potato from? Why does it grow out of control?** Air potato is a vine native to Asia and Africa and was introduced to Florida in 1905. In its native range (home) there are insects and diseases that help control air potato’s growth. When air potato traveled to Florida, those diseases and insects did not come with it, and the plant was able to thrive with no natural enemies. (See diagram below)



- **How do we know the air potato leaf beetle won’t damage native plants?** Scientists spent years testing the beetle in a quarantine facility, where there was no chance it could escape, to make sure that it would not damage native plants. Ask students: Do you have a vegetable you do not like? (Yes.) Do your parents ever try to force you to eat that vegetable? (Yes.) Scientists did something similar with the beetle. In some experiments the beetle was only given one plant species for food – the beetle had to eat that plant or die. In other experiments the beetle was given a choice between different plants and air potato. The results of all of these experiments indicated that the beetle was host-specific to air potato.



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**Resources/References:**

EDIS Publication: *How Scientists Obtain Approval to Release Organisms for Classical Biological Control of Invasive Weeds* at <http://edis.ifas.ufl.edu/IN607>

Website: *Air Potato Biological Control - Solutions for Your Life*

- <http://bcrcl.ifas.ufl.edu/airpotatobiologicalcontrol.shtml>

Website: *Featured Creatures: Lilioceris cheni (air potato leaf beetle)*

- [http://entnemdept.ufl.edu/creatures/BENEFICIAL/BEETLES/air\\_potato\\_leaf\\_beetle.htm](http://entnemdept.ufl.edu/creatures/BENEFICIAL/BEETLES/air_potato_leaf_beetle.htm)

**The forms detailed below can be downloaded at:**

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

**Air Potato Beetle Release Forms for Florida:** The US Department of Agriculture, the Florida Department of Agriculture and the University of Florida are working together to rear and release air potato beetles in Florida. USDA and FDACS are concentrating releases on public lands, while UF is rearing beetles for release on private lands. The rearing facilities are located in Fort Lauderdale (USDA), Gainesville (FDACS) and Fort Pierce, (FDACS and UF). Releases are made between May and October when air potato plants are actively growing.

**Area 1:** Air potato leaf beetle release decisions will be based on program priorities and conducted on a first come, first served basis while supplies last until the end of November and will resume in April or May 2015. Fill out the form for **Broward, Charlotte, Collier, Dade, Glades, Hendry, Lee, Monroe and Palm Beach Counties** and email to [Min.Rayamajhi@ARS.USDA.GOV](mailto:Min.Rayamajhi@ARS.USDA.GOV)

**Area 2:** Air potato leaf beetle release decisions will be based on program priorities and conducted on a first come, first served basis while supplies last until the end of October and will resume in April or May 2015. Fill out the form below for **Other Remaining Counties** in Florida and email to [Eric.rohrig@freshfromflorida.com](mailto:Eric.rohrig@freshfromflorida.com)



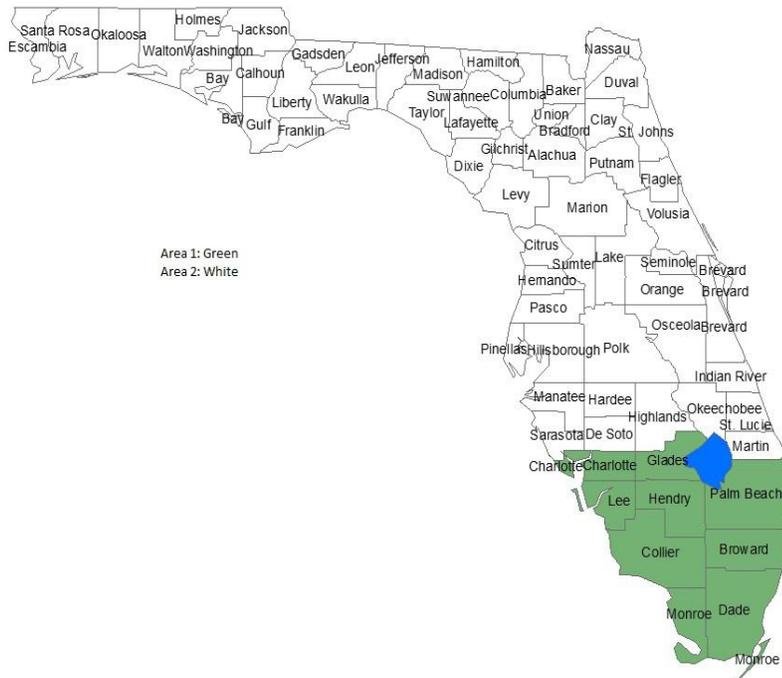
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The following is a list of suggested standards that pertain to this activity. This list is provided as a reference to incorporate and expand upon as needed.

### NEXT GENERATION SUNSHINE STATE STANDARDS:

#### 4<sup>th</sup> Grade:

SC.4.L.16.2: Explain that although characteristics of plants and animals are inherited, some characteristics can be affected by the environment.

SC.4.L.17.4: Recognize ways plants and animals, including humans, can impact the environment.

SC.4.N.1.1: Raise questions about the natural world, use appropriate reference materials that support understanding to obtain information (identifying the source), conduct both individual and team investigations through free exploration and systematic investigations, and generate appropriate explanations based on those explorations.

SC.4.N.1.3: Explain that science does not always follow a rigidly defined method ("the scientific method") but that science does involve the use of observations and empirical evidence.

SC.4.N.1.4: Attempt reasonable answers to scientific questions and cite evidence in support.

SC.4.N.1.5: Compare the methods and results of investigations done by other classmates.

SC.4.N.1.6: Keep records that describe observations made, carefully distinguishing actual observations from ideas and inferences about the observations.

SC.4.N.1.7: Recognize and explain that scientists base their explanations on evidence.



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**5<sup>th</sup> Grade:**

- SC.5.N.1.1: Define a problem, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types such as: systematic observations, experiments requiring the identification of variables, collecting and organizing data, interpreting data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.
- SC.5.N.1.2: Explain the difference between an experiment and other types of scientific investigation.
- SC.5.N.1.4: Identify a control group and explain its importance in an experiment.
- SC.5.N.1.5: Recognize and explain that authentic scientific investigation frequently does not parallel the steps of "the scientific method."
- SC.5.N.1.6: Recognize and explain the difference between personal opinion/interpretation and verified observation.
- SC.5.N.2.1: Recognize and explain that science is grounded in empirical observations that are testable, and explanation must always be linked with evidence.
- SC.5.N.2.2: Recognize and explain that when scientific investigations are carried out, the evidence produced by those investigations should be replicable by others.

**Common Core State Standards**

**4<sup>th</sup> Grade**

Common Core Code	FL Common Core Code	Common Core Standard
RI.4.4	LAFS.4.RI.2.4	Determine the meaning of general academic and domain-specific words or phrases in a text relevant to a grade 4 topic or subject area.
RI.4.6	LAFS.4.RI.2.6	Compare and contrast a firsthand and secondhand account of the same event or topic; describe the differences in focus and the information provided.
RI.4.7	LAFS.4.RI.3.7	Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.
RF.4.4	LAFS.4.RF.4.4	Read with sufficient accuracy and fluency to support comprehension.
RF.4.4a	LAFS.4.RF.4.4a	Read grade-level text with purpose and understanding.
RF.4.4c	LAFS.4.RF.4.4c	Use context to confirm or self-correct word recognition and understanding, rereading as necessary.
SL.4.1c	LAFS.4.SL.1.1c	Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and link to the remarks of others.
L.4.3a	LAFS.4.L.2.3a	Choose words and phrases to convey ideas precisely.
L.4.4a	LAFS.4.L.3.4a	Use context (e.g., definitions, examples, or restatements in text) as a clue to meaning of a word or phrase.



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**5<sup>th</sup> Grade**

RI.5.4	LAFS.5.RI.2.4	Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 5 topic or subject area.
RI.5.7	LAFS.5.RI.3.7	Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.
RF.5.4	LAFS.5.RF.4.4	Read with sufficient accuracy and fluency to support comprehension.
RF.5.4a	LAFS.5.RF.4.4a	Read grade-level text with purpose and understanding.
RF.5.4c	LAFS.5.RF.4.4c	Use context to confirm or self-correct word recognition and understanding, rereading as necessary.
W.5.3d	LAFS.5.W.1.3d	Use concrete words and phrases and sensory details to convey experiences and events precisely.
SL.5.1	LAFS.5.SL.1.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 5 topics and texts, building on others' ideas and expressing their own clearly.
SL.5.1c	LAFS.5.SL.1.1c	Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.
L.5.4a	LAFS.5.L.3.4a	Use context (e.g., cause/effect relationships and comparisons in text) as a clue to the meaning of a word or phrase.



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