

## Tropical Soda Apple Learning Materials

### Overview

The invasion of tropical soda apple into the southeastern U.S. is a major problem for ranchers and has resulted in negative environmental and economic impacts. Scientists from the University of Florida/Institute of Food and Agricultural Sciences and the United States Department of Agriculture have found a way to battle tropical soda apple effectively: biological control made possible by a leaf-feeding beetle, *Gratiana boliviana*.



### Materials

Videos available at:

<http://pesticide.ifas.ufl.edu/TropicalSodaApple>

<http://www.youtube.com/user/UFGENETICS>

1. **Video:** Identifying Tropical Soda Apple (3:30 mins)
2. **Video:** Tropical Soda Apple: A Rancher's Perspective (4:16 mins)
3. **Video:** What to Expect When Using Tropical Soda Apple Control Agents (3:37 mins)
4. **Video:** Identifying *Gratiana boliviana* (4:04 mins)
5. **Video:** Releasing *Gratiana boliviana*: A Tropical Soda Apple Control Agent (3:49 mins)
6. **Video:** Tropical Soda Apple Biological Control with *Gratiana Boliviana* - Time Lapse (5:33 mins)
7. **News story:** Invasive Plant Species Controlled with Beetles
8. **Worksheet:** Dare to Compare (And Contrast)
9. **Worksheet:** The Match Game

### Related Resources

- Visit <http://edis.ifas.ufl.edu> and search "tropical soda apple"
- Visit <http://pesticide.ifas.ufl.edu/>

### Interest approach

#### *Concept map*

Have students create a concept map around the phrase "tropical soda apple."

To create a concept map:

1. Place main idea at top or in center of page
2. Write information known about the topic from general to specific
3. Use linking words to connect ideas
4. Modify your map as you learn

When students have completed their maps, have students create a classroom concept map on the overhead or board. Remind students to modify their concept maps as they watch the videos, read the news story, and complete the lesson.

## Discussion Questions

### **Overall**

1. What are the potential damaging effects associated with tropical soda apple?

*Answer:* The invasion of tropical soda apple (TSA) into the southeastern United States has resulted in negative environmental and economic impacts, TSA tends to be a major problem for ranchers because not only does it out-complete grazing grass, but also, the cows won't eat it.

### **Video: Identifying Tropical Soda Apple**

1. How does tropical soda apple spread?

*Answer:* Tropical soda apple is spread by cattle, wild animals, hay or turf.

2. How do you identify tropical soda apple?

*Answer:* There are prickles on the top and underside of the leaves. It's a perennial plant. It has white flowers. It has fruits about an inch in diameter that look like watermelons when young and then turn bright yellow.

### **Video: Identifying *Gratiana boliviana***

1. How is the *Gratiana boliviana* feeding pattern different from the Colorado potato beetle feeding pattern?

*Answer:* *Gratiana boliviana*'s feeding pattern leaves a shotgun hole appearance. They make very small holes, whereas the Colorado potato beetle tends to eat the leaf from the outside, and if they do eat it from the inside, the holes are much bigger.

2. What are the four life stages of *Gratiana boliviana* and how many generations can they produce in one year?

*Answer:* The four stages are: eggs, larvae, pupae and adults. They can produce up to 7 or 8 generations in a year.

### **Video: Tropical Soda Apple: A Rancher's Perspective**

1. How did St. Lucie County rancher Buzz Eaves finally get rid of tropical soda apple on his land?

*Answer:* He obtained *Gratiana boliviana* to control tropical soda apple.

2. Why is tropical soda apple bad for cattle?

*Answer:* The cattle will not eat tropical soda apple.

### **Video: What to Expect When Using Tropical Soda Apple Control Agents**

1. How do the beetles (*Gratiana boliviana*) control tropical soda apple?

*Answer:* The beetle, *Gratiana boliviana*, will eat holes in the leaves, skeletonize the plant, and kill it.

2. What are the challenges to using control tactics other than *Gratiana boliviana*?

*Answer:* Pulling and mowing the plant is tedious, painful (because of the prickles), and if you do not get the root out, tropical soda apple will regenerate. Herbicides are costly and only control tropical soda apple for small amounts of time.

3. What is the best control tactic for long-term control?

*Answer:* The *Gratiana boliviana*.

4. What is the integrated approach to controlling tropical soda apple?

*Answer:* Use mowing and herbicides in an open-field area. Release *Gratiana boliviana* in wooded/hammocked areas.

### **News story: Invasive Plant Species Cured with Beetles**

1. How did researchers discover *Gratiana boliviana* as a biological control agent?

*Answer:* They went back to the point of origin in South America and looked for natural enemies.

## Quiz Questions

### *Video: Identifying Tropical Soda Apple*

1. True or False? Tropical soda apple is a perennial plant?

*Answer:* True. Tropical soda apple can grow all year round in areas which do not freeze.

2. What are the characteristics of tropical soda apple?

*Answer:* There are prickles on the top and underside of the leaves. It's a perennial plant. It has white flowers. It has fruits about an inch in diameter that look like watermelons when young and then turn bright yellow.

3. What are the characteristics of red soda apple?

*Answer:* Red soda apple has shinier leaves than tropical soda apple. Also, red soda apple's fruit is bright red instead of yellow.

4. How is tropical soda apple spread?

*Answer:* By cattle, wild animals, hay or turf.

5. A tropical soda apple plant can produce how many seeds in a year?

A. 400 to 500      B. 4,000 to 5,000      C. 40,000 to 50,000

*Answer:* C

### *Video: Tropical Soda Apple: A Rancher's Perspective*

1. How did tropical soda apple get into St. Lucie County rancher Buzz Eaves' fields?

A. It just appeared      B. In a delivery of hay      C. Other cattle brought it

*Answer:* B

2. True or False? The tropical soda apple plant will regenerate if you do not remove the root from the ground.

*Answer:* True. The plant will regenerate if you do not remove the root.

### *Video: What to Expect When Using Tropical Soda Apple Control Agents*

1. About how long does it take *Gratiana boliviana* to control tropical soda apple?

A. Less than a year      B. A year      C. Three to four years

*Answer:* C

2. True or False? If tropical soda apple spreads, the population of the beetles will increase.

*Answer:* True. The beetles and tropical soda apple coexist. When tropical soda apple dies down, so will the beetle population. It's the same if tropical soda apple spreads more, the beetle population will continue to grow.

3. How many generations of beetles should a rancher expect during the year?

*Answer:* Seven or eight generations

### *News story: Invasive Plant Species Controlled with Beetles*

1. How do ranchers obtain the beetles for use?

*Answer:* They contact their local extension office at <http://www.solutionsforyourlife.com>.

2. How many beetles have been released across the state since 2003?

A. 340      B. 1,800      C. 180,000

*Answer:* C

## Activities

### *Time Lapse*

*Supplies:* Video: Tropical Soda Apple Biological Control with *Gratiana Boliviana* - Time Lapse.

*Directions:* Show the video to demonstrate how *Gratiana boliviana* feeds on tropical soda apple.

### *Around the World*

*Supplies:* Index cards or square pieces of scrap paper (at least 5 per student).

*Directions:* Distribute index cards or squares of scrap paper to students. Have students use a pencil to write at least five questions, one on each piece of paper, and write the answer on the back. You may also want to write some challenge questions. Collect the questions and shuffle them. Have one student stand beside another student. Hold up the first question card. The first student to correctly answer the question moves to the next student in class and the other student sits in that location. If both students answer the question incorrectly they both sit down and the next two students face off. Play continues around the room until all the questions have been answered or until time runs out.

### *Dare to Compare (And Contrast)*

*Supplies:* Worksheet, Video: Identifying Tropical Soda Apple (3:30 mins)

*Directions:* Have the students complete the worksheet in teams. They will fill out the Venn Diagram with red soda apple characteristics on the left, tropical soda characteristics on the right and common characteristics in the center. After 20 minutes, draw a diagram on the board and have them fill in the blanks and discuss.

*Answers:* Red soda apple has shiny leaves, red fruit and prickles. Tropical soda apple has thorns, blooms with white flowers and the fruit looks like a watermelon then turns bright yellow. They both are perennial plants, have fruit and have big green leaves.

### *The Match Game*

*Supplies:* Worksheet

*Directions:* Have the students complete the worksheet in teams. After 20 minutes, discuss the answers.

*Answers:* 1. Tropical soda apple with shotgun feeding pattern. 2. Flower that blooms from the TSA. 3. TSA fruit. 4. *Gratiana boliviana*.

## FCAT Writing Prompt

### *Video: Identifying Tropical Soda Apple*

Writing to Explain

- Write an essay to explain how a rancher can identify a tropical soda apple.

### *Video: What to Expect When Using Tropical Soda Apple Control Agents*

Writing to Persuade

- Write an essay to persuade a rancher to use the beetles as a biological controller in his field rather than other methods, such as herbicides.

## Invasive Plant Species Controlled with Beetles

In 2001, Buzz Eaves, a St. Lucie County rancher, noticed some unwanted guests in his fields.

“No one had any idea what they were,” said Eaves. “We would look at it and say, ‘Oh, this is a nice little plant’ and then get pricked by the thorns and say, ‘Oh, OK, we better leave that alone.’”

The invasion of tropical soda apple (TSA) into the southeastern United States has resulted in negative environmental and economic impacts, TSA tends to be a major problem for ranchers because not only does it out-complete grazing grass, but also, the cows won’t eat it.

Eaves suspects the plant came in with a load of hay from Glades County. He tried everything from pulling the plant out to spending \$25,000 on herbicides, but nothing seemed to work. That was until University of Florida entomologist Bill Overholt said he had a solution: beetles.

“Bill and his crew came out and released these beetles,” Eaves said. “They [the beetles] started to work on the soda apple”

The beetle, *Gratiana boliviana*, will eat holes in the leaves, skeletonize the plant, and kill it.

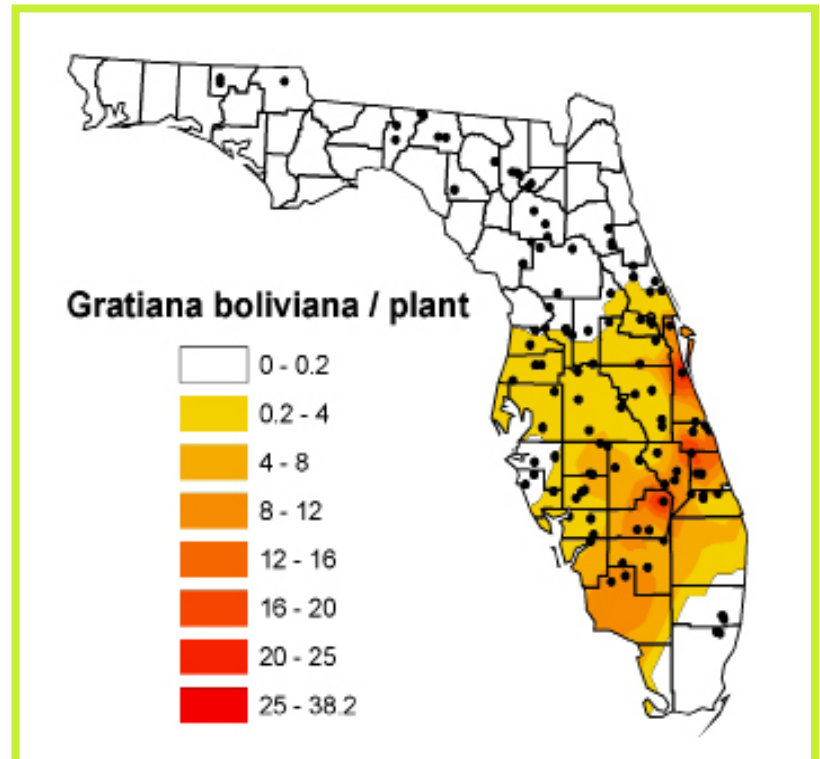
In 1994, researchers from UF’s Institute of Food and Agricultural Sciences and the United States Department of Agriculture found the beetle, tropical soda apple’s natural enemy, in Argentina and Paraguay. They tested the beetle against 118 different plants and found that it fed exclusively on tropical soda apple. In 2003, the researchers began releasing the biological control agent, and have distributed more than 180,000 beetles in more than 340 locations across the state.

“The reason the beetle we released is an effective biological control agent is that it only feeds on tropical soda apple. It will feed on nothing else,” Overholt said. “If there is no tropical soda apple, the beetles will die.

Overholt said to expect to see an impact in a year and give it three to four years before the problem is solved.

If you are interested in obtaining these beetles, contact your local county extension office. Contact information can be found at <http://www.solutionsforyourlife.com>.

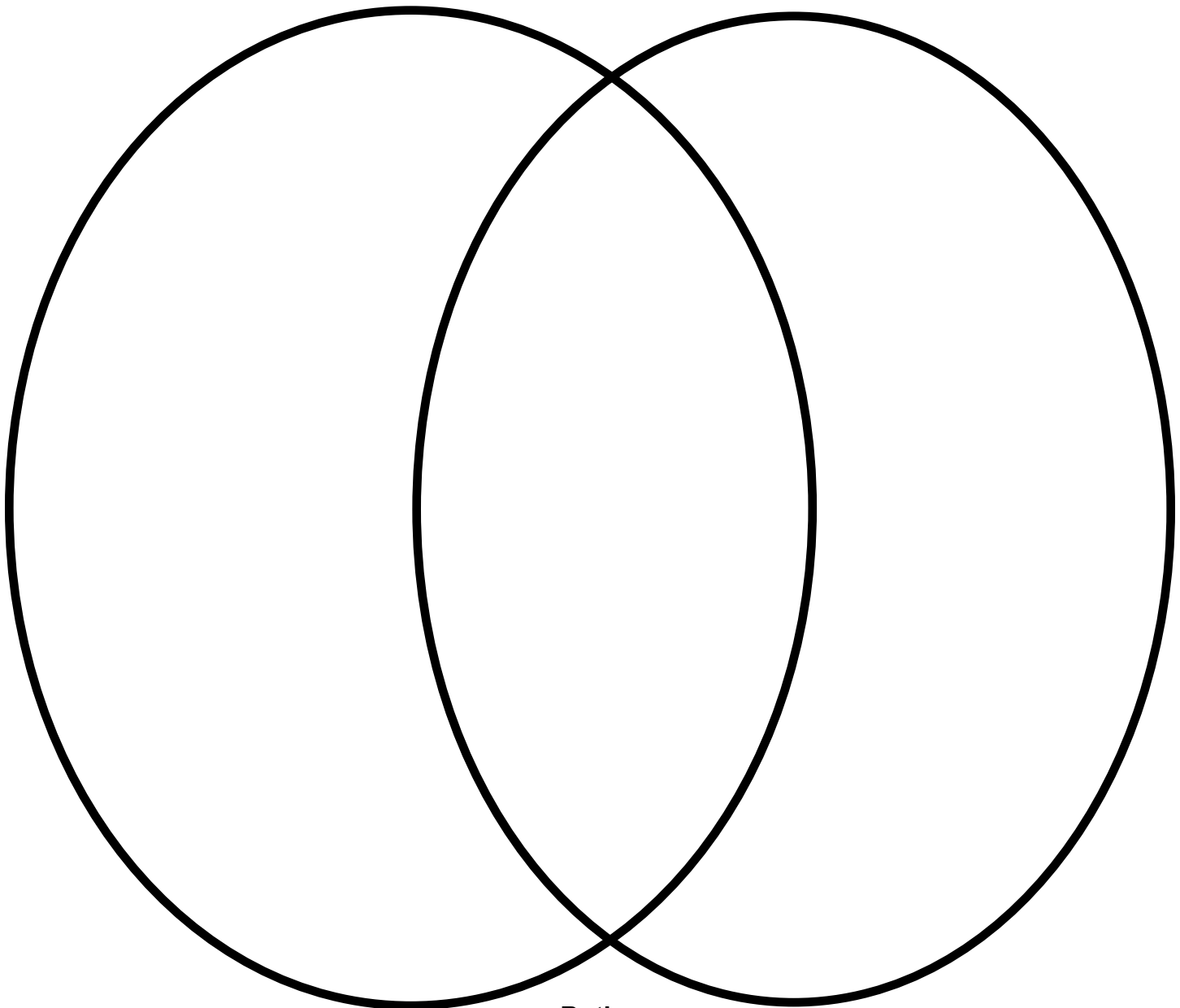
“We will show you how to identify tropical soda apple and use the biological control agent,” said Ken Gioeli, a UF/IFAS Extension agent. “We will help you come up with an integrated pest management plan to tackle your tropical soda apple problems.”



**The density of beetles per plant at different locations in Florida and areas where the beetle was absent.**

## Dare to Compare (and Contrast)

**Directions:** Compare and contrast the red soda apple plant and the tropical soda apple plant. Include physical descriptions, growing conditions, climate preferences, natural enemies and seed distribution. Use the Venn Diagram to organize your thoughts.



Red Soda Apple

Both

Tropical Soda Apple



## The Match Game

**Directions:** Match the following phrases with the pictures below: tropical soda apple fruits, *Gratiana boliviana*, tropical soda apple with shotgun feeding pattern, and flowers that bloom on tropical soda apple.



1



2



3



4