

scientists could have in their results. If the traps set in different areas of the plantation showed different results, then the scientists might suspect that something more than the chemicals was affecting the behavior of the beetles. If the results were similar across all experiments, then the scientists could assume that the beetles' behavior was the result of the different chemicals in the traps.

Findings

- **Look at table 1. Would you say the Scots pine volatiles attracted pine shoot beetles to the traps? Why or why not?** Yes. The average number of beetles caught was much higher than in the control, which contained no attractant.
- **If you were one of the scientists, what would you tell people who manage holiday tree plantations about the use of chemicals to discourage pine shoot beetle damage?** I would tell them they can discourage the pine shoot beetle by using broadleaf volatiles or a combination of broadleaf volatiles and verbenones.

Discussion

- **Why do you think the broadleaf volatiles discourage the pine shoot beetle from attack?** Because the broadleaf volatiles smell like a broadleaf tree to the beetle. Broadleaf trees are not the preferred habitat of the beetle. The beetle is fooled into thinking the tree is a broadleaf, not a pine.
- **Do you think these findings are important to people who grow holiday pine trees for sale during the winter holiday season? Why or why not?** Yes. If the pine shoot beetle damages or kills too many holiday trees, the trees will not be available for sale. If the people who grow these trees cannot sell them, they will lose money.

Tag, You're It!

Introduction

- **State in your own words the question the scientist wanted to answer through this research.** About how far do Asian long-horned beetles fly in a day's time?
- **If the Asian long-horned beetle were found again in the United States, how would forest managers use the scientist's information to help them destroy the insects?** They could determine approximately how far and how fast the insects would disperse. This information would help them determine how large an area they would need from which to remove and burn the trees.
- **If a different insect pest were found in the United States, should forest managers use this information about the Asian long-horned beetle to tell them how far the insect might fly? Explain.** If the insect pest were similar to the Asian long-horned beetle, the information learned in this study could be used as a guide, if no other information were available. Different insect species behave differently, however, and it could be disastrous to use information learned about one insect and apply it to the behavior of another.

Method

- **Do you think the scientist should have done this study in the United States? Why or why not?** No. The Asian long-horned beetle is an insect pest in the United States. It might be disastrous to do this study in the United States. Beetles would likely escape from the study area and destroy trees.
- **What would have happened if the scientist had forgotten to paint a number on each beetle?** The scientist would have no idea how far each beetle had dispersed, because he would have no way of knowing which beetle was which.

Findings

- **Why do you think the beetles moved only either east or west and did not move north or south? (Hint: Reread the second paragraph in the “Method” section.)** The study site was a row of willow trees growing along a highway with agricultural land on either side. Therefore, the beetles were most likely to fly from tree to tree, which were lined up east to west.
- **Do you think this study completely answers the question of how far Asian long-horned beetles travel? Why or why not?** The study does not completely answer the question because its findings were different from other findings. It gives a clue about the relationship between distance traveled and air temperature. It also provides a clue as to the relationship between the sexual maturity of females and whether and how far they will travel.

Discussion

- **In what way could a few female beetles traveling 30 meters pose a threat to American trees?** If the females laid eggs, those eggs could hatch and the population of Asian long-horned beetles would increase. To control the beetle population, forest managers might have to cut down hundreds or thousands of trees.
- **From the results of this study, what might you conclude about the dispersal of Asian long-horned beetles?** You might conclude that higher air temperatures slow the dispersal of beetles. You might also conclude that after a beetle begins to move, he will most likely continue to move in the same direction. You might also conclude that female beetles that are ready to lay eggs will be less likely to travel than female beetles that are not yet ready to lay eggs.

Hurry Up and Wait

Introduction

- **What human actions caused the problem we now have with Oriental bitterweet? What actions might be taken today to help solve the problem?** On the surface, the answer would be that we imported Oriental bitterweet as an ornamental plant, and this action certainly started the problem. You can challenge your students, however, to consider other actions that have expanded the current problem. Other actions include gardeners being careless with the plant and allowing it to escape from gardens. They also include using the plants for indoor arrangements, then discarding the plants outdoors along with their seeds. Actions that might help solve the problem include educating people about the danger posed by Oriental bitterweet and helping people identify the plant. People could also learn how to remove or destroy the plant when they find it.
- **If you were the scientist, how would you set up an experiment to compare the amount of seed germination and growth under different amounts of shade and sunlight?** You could take the seeds and plant them in containers. Then you could place them under different amounts of sunlight and shade and compare their germination and growth. You can ask your students to be as specific as possible as they think about how they would do this experiment.

Method

- **What is the reason the scientists used shade cloth to cover the four groups of containers and a quantum sensor to measure the amount of sunlight reaching them?** By using shade cloth, the scientists could control the amount of sunlight reaching the containers. By using the quantum sensor,