Lesson Plan Overview

Recommended Grade Level:	**8**
Discipline:	**Life Science/Biology**
Topic:	**Insect Behavior**
Lab Activity Title:	**Rose Color Preference in Japanese Beetles**
Submitted By:	**Karen McCabe**

Overview: Japanese beetles are the "thorn in the side" of rose gardeners everywhere. As a child, part of my allowance was earned by picking the beetles off of my mother's rose bushes. I observed that some rose bushes seemed to have higher populations of beetles than others and thus sustained more damage. I often wondered why the beetles seemed to prefer one bush over another. This experiment will help to determine if color is the variable that caused the differences I observed.

Lesson Objectives:

- Students will conduct a scientific investigation.
- Students will observe insect behavior.
- Students will determine rose color preference for Japanese beetles, ***Popillia japonica***.

National Science Standards:

SCIENCE AS INQUIRY: ALL STUDENTS SHOULD DEVELOP ABILITIES NECESSARY TO DO SCIENTIFIC INQUIRY

- Identify questions that can be answered through scientific investigations
- Design and conduct a scientific investigation
- Use appropriate tools and techniques to gather, analyze, and interpret data
- Develop descriptions, explanations, predictions, and models using evidence
- Think critically and logically to make the relationships between evidence and explanations
- Recognize and analyze alternative explanations and predictions
- Communicate scientific procedures and explanations
- Use mathematics in all aspects of scientific inquiry

LIFE SCIENCE: REGULATION AND BEHAVIOR

- All organisms must be able to obtain and use resources, grow, reproduce, and maintain stable internal conditions while living in a constantly changing external environment.
- Regulation of an organism's internal environment involves sensing the internal environment and changing physiological activities to keep conditions within the range required to survive.
- Behavior is one kind of response an organism can make to an internal or environmental stimulus. A behavioral response requires coordination and communication at many

levels, including cells, organ systems, and whole organisms. Behavioral response is a set of actions determined in part by heredity and in part from experience.
- An organism's behavior evolves through adaptation to its environment. How a species moves, obtains food, reproduces, and responds to danger are based in the species' evolutionary history.

Materials:
- 6 Japanese beetles, ***Popillia japonica***
- 6 plastic shoe box size containers with lids
- 6 four inch cuttings (including at least one open bloom) from the same yellow rose bush
- 6 four inch cuttings (including at least one open bloom) from the same red rose bush
- Stopwatch

Time needed: One 90 minute block

Preparation for Activity:

BACKGROUND INFORMATION:

Japanese beetle Information:

Size: 15 mm long, 10 mm wide

Color: iridescent copper and green

Legs: 3 Pair

Shape: Oval

Wings: yes

Antenna: Yes, clubbed

Common Name: Japanese beetle

Kingdom: Animalia

Phylum: Arthropoda

Class: Insecta

Order: Coleoptera

Family: Scarabaeidae

Genus Species: ***Popillia japonica***

Diet: Japanese beetles are known to eat at least 300 different plant species

Habitat: Japanese beetles spend most of their lives in the soil as grubs. When they emerge in early summer they spend their time on the green leafy foliage that is their main food source. Habitats include gardens, woods and open meadows.

Japanese beetles are an invasive species introduced to North America in the early 19th century. They spread from New Jersey, where they were introduced via iris bulbs imported from Asia, throughout most of North America. The beetles cause widespread flower and foliage damage. The larval stage is also the most important consumer of turf grass in North America. Crop damage estimates range from the millions to tens of millions of dollars in every state infested with the beetles.

Despite the vast range of this insect pest, I could not find any suppliers on the internet. There is an abundance of information about how to get rid of them, but no information on acquiring them. This lab would have to be completed during the spring and summer when **beetle collection could be facilitated by the teacher**.

Japanese beetle Lifecycle:

K-W-L:

1. What did students already know (K) about the topic?
   Students were familiar with the scientific method. Students have a basic understanding of insect behavior and anatomy.

2. What did students want to know about the topic?
   Students wanted (W) to know whether Japanese beetles preferred one color of rose over another.

3. What did students learn (L) about the topic?
   Students learned that the beetles seemed to prefer the lighter colored roses. Students also learned that this may be due to differences in odor rather than being based solely on color.

Hypothesis:

If given a choice between yellow roses and red roses, Japanese beetles will choose the yellow roses.

Procedure:

1. Place one of each rose cutting in each of the 6 containers (6 yellow, 6 red).
2. Cuttings should be placed in container so the blooms are facing opposite ends like the diagram below.

Red Yellow

3. Place one Japanese beetle in each of 6 containers.
4. Place the lids on each of the 6 containers to prevent the beetles from escaping.
5. Collect and record data for beetle location at given time intervals for each of the **SIX REPLICATIONS**.

Questions for Further Study

- Do Japanese beetles behave differently when they are in groups or alone?
- Do Japanese beetle flower preferences relate to odor more than color?
- Do male and female Japanese Beetles prefer the same flowers?

SOURCES

http://en.wikipedia.org/wiki/Japanese_beetle

http://www.ca.uky.edu/entomology/entfacts/ef451.asp

http://www.ca.uky.edu/entomology/entfacts/entfactpdf/ef409.pdf

http://www.cirrusimage.com/beetles_japanese.htm

http://www.oregon.gov/ODA/PLANT/docs/pdf/ippm_jb_pra_or08.pdf?ga=t

http://www.exemplars.com/resources/rubrics/science.php

Recommended Ward's Science Materials

Ward's Bessbug Habitat	Item No. 876286
Biology, The Abundant Beetles Video	Item No. 470000-016
Insectivorous Terrarium Set	Item No. 869120
Ward's Insect Collecting Tip	Item No. 146110

Student Activity & Worksheets

Name:_____

Date:_____

Rose Color Preference in Japanese Beetles

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- Students will determine rose color preference for Japanese Beetles, ***Popillia japonica***.

Hypothesis:

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Experimental Design:

Materials:

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- 6 four inch cuttings (including at least one open bloom) from the same red rose bush
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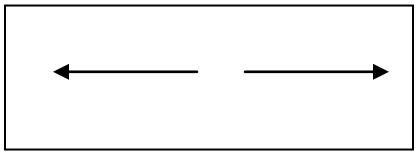

Red Yellow

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5. Collect and record data for beetle location at given time intervals for each of the **SIX REPLICATIONS**.

Data:

Container #	5 min	10 min	15 min	20 min	25 min
1	Red Yellow Neither	Red Yellow Neither	Red Yellow Neither	Red Yellow Neither	Red Yellow Neither
2	Red Yellow Neither	Red Yellow Neither	Red Yellow Neither	Red Yellow Neither	Red Yellow Neither

3	Red Yellow Neither	Red Yellow Neither	Red Yellow Neither	Red Yellow Neither	Red Yellow Neither
4	Red Yellow Neither	Red Yellow Neither	Red Yellow Neither	Red Yellow Neither	Red Yellow Neither
5	Red Yellow Neither	Red Yellow Neither	Red Yellow Neither	Red Yellow Neither	Red Yellow Neither
6	Red Yellow Neither	Red Yellow Neither	Red Yellow Neither	Red Yellow Neither	Red Yellow Neither

Results:

Create a triple bar graph to display your data. You may use any available software or hand draw your graph and attach to this handout. Discuss the trend in your data below.

_____
_____
_____
_____
_____
_____

Conclusion:

Write your conclusion on the lines below. Remember to include all parts required of a conclusion (restate hypothesis, was it proven or disproven? Why? Discuss data specifically, did

anything happen during experiment that affected data? Would you do anything differently if you had to do it again?)

_____
_____
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_____
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_____
_____
_____

Questions for Further Study

- Do Japanese beetles behave differently when they are in groups or alone?
- Do Japanese beetle flower preferences relate to odor more than color?
- Do male and female Japanese Beetles prefer the same flowers?

Which of the questions for further study listed above would you prefer to explore? Give a brief description of how we could further investigate the question you chose.

_____
_____
_____
_____
_____

See scoring rubric below for a detailed description of how you will be graded.

LEVEL SCIENTIFIC TOOLS AND TECHNOLOGIES	SCIENTIFIC PROCEDURES AND REASONING	STRATEGIES	SCIENTIFIC COMMUNICATION/USING DATA	SCIENTIFIC CONCEPTS & RELATED CONTENT
Novice (13/20)	• Did not use appropriate scientific tools or technologies (e.g., rulers, pH paper, hand lens, computer, reference materials, etc.) to gather data (via measuring and observing).	• No evidence of a strategy or procedure, or used a strategy that did not bring about successful completion of task/investigation. • No evidence of scientific reasoning used. • There were so many errors in the process of investigation that the task could not be completed.	• No explanation, or the explanation could not be understood, or was unrelated to the task/investigation. • Did not use, or inappropriately used scientific representations and notation (e.g. symbols, diagrams, graphs, tables) • No conclusion stated, or no data recorded.	• No use, or mostly inappropriate use, of scientific terminology. • No mention or inappropriate references to relevant scientific concepts, principles, or theories (big ideas). • Some evidence of understanding observable characteristics and properties of objects, organisms, and/or materials used.
Apprentice(15/20)	• Attempted to use appropriate tools and technologies (e.g., rulers, pH paper, hand lens, computer, reference materials, etc.) to gather data (via measuring and observing) but some information was inaccurate or incomplete.	• Used a strategy that was somewhat useful, leading to partial completion of the task/investigation. • Some evidence of scientific reasoning used. • Attempted but could not completely carry out testing a question, recording all data and stating conclusions.	• An incomplete explanation or explanation not clearly presented (e.g., out of sequence, missing step). • Attempted to use appropriate scientific representations and notations, but were incomplete (e.g., no labels on chart). • Conclusions not supported or were only partly supported by data.	• Used some relevant scientific terminology. • Minimal reference to relevant scientific concepts, principles, or theories (big ideas). • Evidence of understanding observable characteristics and properties of objects, organisms, and/or materials used.
Practitioner(17/20)	• Effectively used some appropriate tools and technologies (e.g., rulers, pH paper, hand lens, computer, reference materials, etc.) to gather and analyze data, with only minor errors.	• Used a strategy that led to completion of the investigation/task. • Recorded all data. • Used effective scientific reasoning. • Framed or used testable questions, conducted experiment, and supported results with data.	• A clear explanation was presented. • Effectively used scientific representations and notations to organize and display information. • Appropriately used data to support conclusions.	• Appropriately used scientific terminology. • Provided evidence of understanding of relevant scientific concepts, principles or theories (big ideas). • Evidence of understanding observable characteristics and properties of objects, organisms, and/or materials used.
Expert(20/20)	• Accurately and proficiently used all appropriate tools and technologies (e.g., rulers, pH paper, hand lens, computer, reference materials, etc.) to gather and analyze data.	• Used a sophisticated strategy and revised strategy where appropriate to complete the task. • Employed refined and complex reasoning and demonstrated understanding of cause and effect. • Applied scientific method accurately: (framed testable questions, designed experiment, gathered and recorded data, analyzed data, and	• Provided clear, effective explanation detailing how the task was carried out. The reader does not need to infer how and why decisions were made. • Precisely and appropriately used multiple scientific representations and notations to organize and display information. • Interpretation of data supported conclusions, and raised new questions or was applied to new contexts. • Disagreements with data	• Precisely and appropriately used scientific terminology. • Provided evidence of in-depth, sophisticated understanding of relevant scientific concepts, principles or theories (big ideas). • Revised prior misconceptions when appropriate. • Observable characteristics and properties of objects, organisms, and/or materials used went beyond the task/investigation to make other connections or extend thinking.

	verified results).	resolved when appropriate.

**Note: This lab activity was submitted to Ward's Science by a third party educator for the sole purpose of sharing content and ideas with other educators. Ward's Science is not affiliated with the author of this lesson plan. All product recommendations made by Ward's Science are suggestions for completion or extension of the activity or topics addressed, but are not required to complete the activity.*