K-12 IYS Activity

Soil Science Society of America

K-12 IYS Activity

Root-Nematode-Weevil Game (Rock-Paper-Scissors)

Summary

The soil is home to diverse organisms that communicate with each other. Roots, microbes, and fauna communicate with each other through chemical signals they release in the soil. Gaseous or dissolved chemicals are produced by one organism, diffuse through the soil water and soil air, and are received by other organisms. Some organisms have adapted to certain chemical signals so that when they receive them, they know if a host or prey is near and can move toward the source of the chemical signal. This game provides students with an example of the complex interactions among soil organisms. The game of root-nematode-weevil is played in the fashion of rock-paper-scissors.

Ages of Audience

– K-12

Learning Objectives

– To understand how soil organisms communicate with each other
– To know at least some reasons why they would want/need to communicate

Materials Needed

– Pictures or slides of a strawberry plant, a black vine weevil, and a soil nematode

Celebrating the 2015 International Year of Soils

soils.org/IYS

Ages of Audience

K-12

Recommended group size?

20-50

Where could you offer this?

Local school or library

Type of Lesson

1. Hands-on (participants touch the stuff)
2. Lecture (basic info, invited speaker)

Time Needed:

1. Scientist prep time + clean up time: 30 minutes for reviewing the organisms and their interactions
2. Participant/class time: 5 minute lecture time, 10-15 minutes play time, and 15 minute discussion time

Background

This game demonstrates the tritrophic (three-way) interaction among strawberry roots, pathogenic weevil larvae, and an entomopathegonic nematode (a nematode that eats insects). The weevil is called Otiorhynchus sulcatus, or black vine weevil, and the nematode is called Heterorhabditis megidis. The weevil larvae are pathogenic and feed on strawberry roots. As the weevils feed on the roots, the plant releases a gaseous (volatile) chemical into the soil. Scientists don't know what this chemical is yet, but it could be CO_2 or some other chemical released by the damaged roots. The chemical moves through the soil and is detected by the nematode, which then moves through the soil water toward the source of the chemical signal– roots where weevils are feeding. The larvae accidentally eat the nematodes, and once inside, the nematodes kill and digest the weevil.

Method

The game is played like the traditional rock-paper-scissors. In this game, the weevil attacks the plant roots (weevil wins), the plant attracts the nematode (plant wins), and the nematode kills the weevil (nematode wins). An open hand with fingers spread apart is the sign for the plant (with five roots); a wiggling index finger is the sign for the nematode; and the "hang loose" sign is the sign for the weevil (head and antennae).

Discussion questions

1. How can plants talk to other organisms if they don't have mouths or a voice?
2. What does volatile mean? How would a chemical signal move through soil? (Students can demonstrate molecules moving through a twisty pathway of "pores" that could widen and narrow.)
3. What do you think might happen to the two other organisms if one was missing or went extinct?

References

Boff, M.I., F.C. Zoon, and P.H. Smits. 2001. Orientation of Heterorhabditis megidis to insect hosts and plant roots in a Y-tube sand olfactometer. Entomologia Experimentalis et Applicata 98:329-337.