



ScienceWatch – “Eggcited” Plants Call 911

Plants produce an array of chemical compounds that help protect them from attack by leaf-eating insects. For example, when oak tree (*Quercus spp.*) leaves are eaten by gypsy moths (*Lymantria dispar*) the concentration of leaf tannin rises. The bitter tannin not only makes the leaves less palatable, but also interferes with caterpillar growth and egg-laying by making leaf proteins less available. In other instances compounds released by herbivore-damaged plants cause the induction of chemical defenses in neighboring plants. These warning signals take the form of volatile substances like jasmonic acid, which belongs to a group of chemicals called jasmonates. Jasmonates are hormones that regulate plant growth and development. For example, they trigger the production of ethylene in plants, which promotes fruit ripening. They are also made by plants in response to wound damage in order to elicit the production of defensive chemicals.

Recent research shows that beleaguered plants can also send out “SOS” signals, which tell specific parasites or predators of the herbivore that their dinner is ready. For example, tobacco plants (*Nicotiana attenuata*) manufacture methyl jasmonate (MeJ) in response to the saliva secreted by the tobacco hornworm (*Manduca sexta*) onto wounded tobacco leaves as it grazes. MeJ induces the plant to make volatile terpenes that attract the big-eyed bug (*Geocoris pallens*), a natural hornworm predator, which consumes both eggs and caterpillars. (See *ScienceWatch* for May 2001, *Stand and Fight*). Besides the combination of grazing damage and herbivore saliva, which together trigger an SOS signal, other SOS stimuli have been discovered. For instance, herbivore eggs deposited on wounded leaf areas elicit the production of plant volatiles that attract egg parasitoid wasps, which in turn attack the eggs.

Now a study by Stefano Colazza, an entomologist at the University of Palermo in Italy, and his colleagues, which appears in the January 1, 2004 issue of the *Journal of Experimental Biology*, shows that egg-laying can elicit a call for help even from plant parts that have not been damaged. Colazza and his team examined the tripartite interaction of: 1) broad bean and French bean plants (*Vicia faba* and *Phaseolus vulgaris*), 2) the leaf-eating pest, the green stinkbug (*Nezara viridula*), and 3) the parasitic wasp (*Trissolcus basalus*) that lays its eggs in the eggs of the bug.



A hollow, glass Y-tube (olfactometer) was used to assay wasps’ responses to volatile plant chemicals. The two arms of the tube were subjected to streams of air that differed by being passed through a jar containing different odor sources. For each 10-minute assay a female wasp was placed at the entrance to the stem of the olfactometer and assayed for the time spent in each arm. In this way the team could determine which treatments and combinations attracted the wasps as compared to undamaged leaves that

served as a control. Bean leaves damaged by feeding stinkbugs were no more attractive to the wasps than undamaged leaves. Furthermore, stinkbug eggs laid on nylon mesh did not attract the wasps when the eggs were presented alone or in combination with feeding-damaged leaves from plants that had never carried bug eggs. However, feeding-damaged leaves containing an egg mass did attract wasps and even intact leaves that had never been in contact with stinkbugs proved to be more attractive if they were taken from a damaged plant containing egg masses elsewhere.

Stinkbug eggs



These results show that stinkbug eggs must be present on bean plant leaves to induce an SOS signal (nature of signal is currently unknown, but terpenes are a good bet) that attracts a specific egg parasitoid wasp. Moreover, the presence of eggs triggers a systemic reaction throughout the affected plant. The egg requirement means that the SOS signal reliably predicts the presence of host to the wasp. A similar phenomenon occurs in elm and pine trees, but it may be more important for annuals like the bean plants that need to call for help before a lot of pest damage occurs in order to go to seed. So the next time you get upset seeing vegetation being chewed up by insects, remember that the plants are using an array of weapons to fight back.

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