Mown grass smell sends SOS for help in resisting insect attacks, researchers say

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The smell of cut grass in recent years has been identified as the plant's way of signalling distress, but new research says the aroma also summons beneficial insects to the rescue, according to Dr. Michael Kolomiets, Texas A&M AgriLife Research plant pathologist in College Station. Credit: Texas A&M AgriLife Research photo by Kathleen Phillips

The smell of cut grass in recent years has been identified as the plant's way of signalling distress, but new research says the aroma also summons beneficial insects to the rescue.

"When there is need for protection, the plant signals the environment via the emission of volatile organic compounds, which are recognized as a feeding queue for parasitic wasps to come to the plant that is being eaten and lay eggs in the pest insect," said Dr. Michael Kolomiets, Texas A&M AgriLife Research plant pathologist in College Station.

The research stems from a look at the function of a large family of lipid-derived molecular signals that regulate differential processes in humans, animals and plants, according to Kolomiets, whose research was published in *The Plant Journal*.

In an effort to better understand these signals, the U.S. Department of Agriculture is granting Kolomiets $490,000 in 2015 to study how the signals may also impact drought tolerance.

The molecular signals are less understood in plants than in animals and humans, he noted.

"People take certain drugs such as aspirin to suppress the activity of these signals, because overproduction of these molecules may lead to headaches and pain and all sorts of disorders," Kolomiets said. "It's the same group of metabolites that are produced by the plants, but we know so little about them."

Yet a plant does "communicate" when attacked – whether by blade of a mower or jaws of a predatory insect – by producing defensive proteins and secondary metabolites either to repel the pest or make itself less appetizing, he said. What happens next is what scientists have been trying to figure out.

The best characterized molecule of the fatty acid-derived signals is called jasmonic acid, because it was first isolated as a volatile produced by jasmine, Kolomiets said. Jasmonic acid, one of perhaps 600 oxylipin

molecules identified in plants, is known to have diverse functions. Another volatile group derived from fatty acid is known as the green leaf volatiles.

To test how it functions in plant during insect attacks, Kolomiets and his team used a mutant corn plant that could not produce the green leaf volatiles, mown-grass smell when cut or torn.

And that's when they observed that the parasitic wasps didn't pay attention to plants without the green leaf volatile.

"There are actually two roles for this molecule," he said. "First, it activates the jasmonate hormone, which involves activation of defenses against insects on the plant. Then this molecule, since it is a volatile, attracts parasitic wasps. They come to the plant that is being chewed up by insect herbivores and lay eggs in the caterpillar's body.

"We have proven that when you delete these volatiles, parasitic wasps are no longer attracted to that plant,even when an insect chews on the leaf. So this volatile is required to attract parasitoids. We have provided genetic evidence that green leafy volatiles have this dual function—in the plant they activate production of insecticidal compounds, but also they have indirect defense capability because they send an SOS-type signal that results in attraction of parasitic wasps."

Kolomiets tested the phenomena both in the lab and in the field.

"We did not have to do any artificial infestation, because we had plenty of insects," he said. "We have discovered that even under the field conditions when there's enough insect pressure, then the plants are more susceptible to insect damage when they lack the green leaf volatiles."

Kolomiets hopes to continue the research by testing the impact of the

presence of jasmonates and green leaf volatiles in other grassy crops such as sorghum.

"This is just a tip of the iceberg. We have found that this gene is required for many, many different physiological processes, such as drought tolerance," he said."We observed that mutant plants are drought susceptible as well as susceptible to insect feeding. We are trying to identify the exact function of green leafy volatiles in drought tolerance and how it works."

Such findings may help plant breeders know how to develop new varieties that are more resistant to insects and drought, he noted.

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