Ozone masks plant's volatiles, plant eating insects confused

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(Phys.org) —Increases in ground-level ozone, especially in rural areas, may interfere not only with predator insects finding host plants, but also with pollinators finding flowers, according to researchers from Penn State and the University of Virginia.

"Ozone pollution has great potential to perniciously alter key interactions between plants and animals," the researchers said in a recent issue of *Environmental Research Letters*.

The animal tested in this case was the striped cucumber beetle, a predator of cucurbits—cucumber, squash, pumpkin and melons. These insects dine on the plants from the moment they emerge from the ground and when fruit forms, they eat that as well.

"Insects detect odor with olfactory receptors located on their antennae," said Jose D. Fuentes, professor of meteorology, Penn State. "These receptors sense plant-emitted volatile organic compounds in very small amounts—as low as six molecules hitting an antenna."

However, ozone, which is a very reactive substance, degrades the volatile organic compounds when they mix to the point where they no longer stimulate the olfactory system.

Fuentes, working with John Zenker, Penn State undergraduate in meteorology, and T'ai H. Roulston, research associate professor and curator, Blandy Experimental Farm, University of Virginia, tested the

beetles in an enclosed Y-tube apparatus so that the insect could choose which branch to take. Researchers collected the insects from pumpkin and squash plants. They tested the insects using buffalo gourd plants, a naturally growing wild gourd that likes semiarid areas.

Separate air streams flowed into the two branches of the Y-tube. Choices of air in each tube were ambient filtered air, ambient filtered air plus up to 120 parts per million ozone, ambient filtered air plus volatile organic compounds, or airplus up to 120 parts per billion ozone and volatile organic compounds from the plant. To obtain this mix, or only ozone or volatile organic compounds, that branch flowed either to a plant chamber or ozone generator or both.

The researchers tested the insects with all ambient air, with ambient air and ozone, with ambient air and volatile organic compounds, and with ambient air and a mix of ozone and volatile organic compounds. When presented with an ambient air or volatile organic compound airstream, the beetles chose the volatile organiccompound tube 80 percent of the time.

"However, as the ozone levels increased, they chose the path to the flower less frequently," said Fuentes. "By the time the mix contained 80 parts per billion ozone, the beetles showed no preference for either tube."

The researchers also tested the beetles with volatile organic compounds and a mix of volatile organic compounds and ozone. At low ozone levels, the insects showed no preference, but as ozone levels increased, the insects increasingly preferred the ozone-free path. At 80 parts per billion, the beetles chose the volatile organic compounds without ozone significantly more often than the ozonized mixture.

While one might think that higher ozone levels in the lower atmosphere

would improve crops because predator insects would be unable to find their hosts, the additional ozone would also interfere with mutualistic insect plant responses such as pollination.

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