Aphid "alarm" defined to aid in pest control

Cornell University scientists have defined the chemicals used by aphids to signal danger in their insect communities.

Moreover, the entomologists say it may be possible to use this knowledge to manipulate these chemical alarms and protect valued crops against insect damage.

William S. Bowers, professor of entomology at the N.Y. State Agricultural Experiment Station, Geneva, a unit of Cornell University, and Chikao Nishino, a post-doctoral associate, explain their findings in the May 6 issue of the journal "Science."

Their coauthors are Michael E. Montgomery, a post-doctoral associate, and Prof. Lowell R. Nault, of the Ohio Agricultural Research and Development Center, and Mervin W. Nielson (Ph.D.) of the U.S. Department of Agriculture.

Bowers explained that, in nature, when an aphid is attacked it secretes, in a dying gasp, a chemical warning to its cohorts. The response of fellow aphids, which are tiny herbivorous insects commonly called plant lice and known for their ability to cause feeding damage and transmit plant diseases, is to walk, fall or leap away from the plant and the oncoming enemy.

Five years ago, Bowers and his colleagues isolated and identified an alarm chemical, called trans-beta-farnesene, used by two subfamilies of aphids. Recently, he has discovered a new alarm chemical called germacrene A, used by different species of aphids, which is a serious pest of forage crops.

Isolation of these chemicals from insects is noteworthy because they are extremely unstable. For example, when an aphid secretes germacrene A, the chemical alarm degrades within 15 seconds. This instability ensures that the alarm chemical breaks down soon after the predator moves on, thus enabling the aphids to return to the feeding site.

But now Cornell scientists have manipulated the alarm system and have synthesized a stable chemical capable of deterring the insects from returning to their feeding site for an extended period.

"We have approached this problem through the successful synthesis of several simple analogs of trans-beta-farnesene, which are not quite exact copies of the real chemical alarm," said Bowers. "These analogs retain the warning quality of the natural chemical alarms but are considerably more stable than the natural chemicals. It may also be possible to develop analogs of the second chemical alarm, germacrene A," he added.

Bowers said that his chemical analogs, which have already been tested under laboratory conditions, will be given field tests this summer.

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