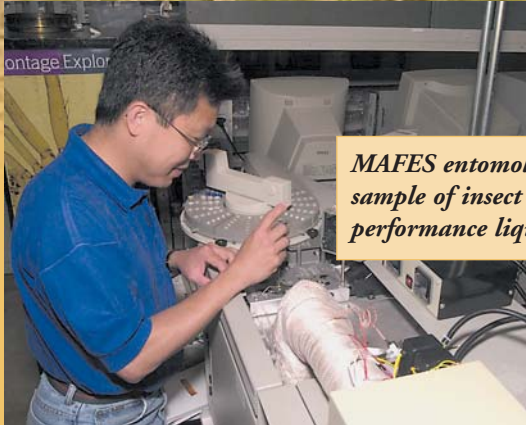


Pheromone Regulation Provides Key to corn earworm control

Control



MAFES entomologist Peter Ma injects a sample of insect blood into a micro-high performance liquid chromatograph.

Jim Lytle

By Charmain Tan Courcelle

Pheromones — those chemicals that stimulate courtship, mating and other social behavior in animals and insects — may one day be manipulated to manage the corn earworm. MAFES entomologist Peter Ma is discovering how the corn earworm pheromone production pathway is wired and searching for ways to short-circuit the process in the insect.

Controlling agricultural pests through their pheromones is not a new strategy. In the past, saturating amounts of pheromones have been discharged in orchards and fields to jam the come-hither signal sent by female moths. The released cloud of synthetic pheromone effectively damps any individual scent trail left by a female, preventing the male moth from finding a mate — a process known as mating disruption.

However, while pheromone release presents an attractive ecological approach to insect control, effective and practical methods of distributing this family of chemicals are still being developed. These efforts are made even more complex because the success of the pheromone-release technique depends on the physical characteristics — slope, shape, size, wind conditions and canopy — of the orchard or field to be treated. Ma's solution is to prevent any of the sex attractant from being made in the insect at all.

"If we can disrupt the synthesis of pheromone, we can in theory interfere with mating and egg laying," Ma said.

The corn earworm is an agricultural pest that costs farmers in the South an estimated \$2 billion annually in crop losses and chemical control expenses. Although corn is the earworm's preferred host, cotton, tomatoes, soybeans and other plants can also serve as food sources for this pest.

Several generations of corn earworm develop every year in Mississippi and the rest of the South. Corn earworm populations increase with each successive generation and as the season progresses. Ma's approach could help reduce the pest's numbers while providing the same environment-friendly advantage seen with pheromone release.

Ma is studying an insect neuropeptide that affects the synthesis of sex pheromones in the corn earworm. Pheromone biosynthesis activating neuropeptide (PBAN) is a short peptide sequence (33 amino acids) that is processed from a larger precursor protein together with four other related peptides. Ma's first task is to determine whether PBAN functions alone or in some combination with its sister peptides to regulate sex pheromone production.

"We want to know what the peptide profile is when sex pheromone is at its peak in the earworm's blood — is only PBAN present? Or are there other peptides in the blood as well?" Ma said. "This should help us understand how the switch for pheromone production works."

Because the amount of circulating PBAN and PBAN-related neuropeptides is diluted in the insect's blood, Ma has adapted an existing chemical separation technique — micro-high performance liquid chromatography (micro-HPLC) — to increase the sensitivity of peptide detection and isolation in his samples.

The identity of each HPLC-purified peptide is then confirmed using matrix-assisted laser desorption/ionization mass spectrometry, which gives an accurate measurement of molecular masses in biological tissues and individual cells, Ma said.

Using these techniques, Ma has determined which cells in the corn earworm produce PBAN and its sister neuropeptides. He has also found that while sex pheromone is used by female moths to attract males, PBAN, which controls sex pheromone production, is made in both females and males. And the neuropeptide is made in corn earworm larvae, which don't have pheromone glands.

"This suggests PBAN may have other functions besides sex pheromone regulation, which are dependent on the growth stage of the insect," Ma said.

If this is true, scientists may have yet another way of stopping the corn earworm by interfering with its development from caterpillar to adult moth.

Previous work that Ma was involved in showed corn earworms infected with baculovirus — an insect pathogen — carrying the PBAN precursor protein survived for a shorter amount of time (a reduction of 19 to 26 percent depending on insect growth stage) than those infected with a control baculovirus. Ma said he hopes an improvement in the killing efficiency of baculovirus can be made based on his new studies of the PBAN peptide family.

The gene encoding PBAN is found in other insects, such as cockroaches and flies, and arthropods like ticks and centipedes as well, Ma said. So, information on PBAN gene function in the corn earworm may also apply to other insect and arthropod pests.



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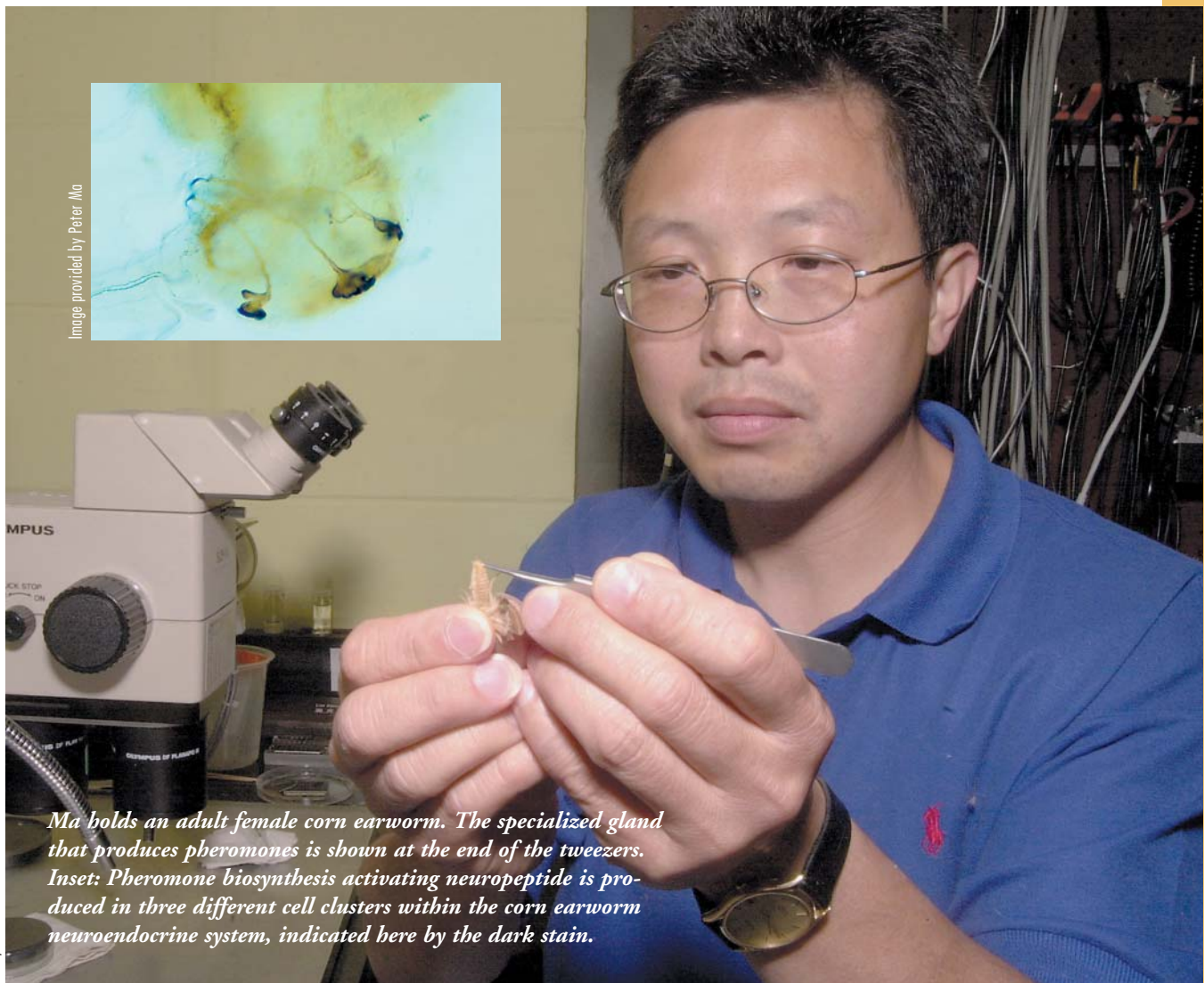


Image provided by Peter Ma

Ma holds an adult female corn earworm. The specialized gland that produces pheromones is shown at the end of the tweezers. Inset: Pheromone biosynthesis activating neuropeptide is produced in three different cell clusters within the corn earworm neuroendocrine system, indicated here by the dark stain.

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