Research uncovers reason for growing pest damage in genetically protected corn crops

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A UMD-led study provides new evidence of a decline in the effectiveness of genetically engineered traits widely used to protect corn crops from insects. This loss of effectiveness could damage U.S. corn production and spur increased use of potentially harmful insecticides.

Based on two decades of field experiments by University of Maryland researchers, the study concludes that damage to corn crops from a major insect pest called corn earworm is increasingly. Authored by two scientists from the University of Maryland's College of Agriculture and Natural Resources and one from Benzon Research, an independent contract research facility, the study documents the growing resistance of the earworm to protective "Bt" genetic modifications widely used in corn and cotton crops.

Lead author Galen Dively, Professor Emeritus in UMD's College of Agriculture and Natural Resources predicts that corn earworm resistance to the Bt technology is likely to increase, and spread. His team's results have broad implications for profitable corn production, biotechnology regulatory policies and sustainability of the use of Bt crop protection biotechnology.

Corn crops engineered with genes from the bacterium Bacillus thuringiensis (Bt) express specific proteins called Cry proteins (endotoxins) that, when ingested, kill crop pests like the earworm. Because the Bt protein is very selective, generally not harming non-target insects such as bees, wasps and beetles, its use less harmful than broad

spectrum insecticides. Bt modified crops are widely used and long have been effective in combating damage from agricultural insect pests. In 2015, 81 percent of all corn planted was genetically engineered with Bt. Recently however, certain states, most notably North Carolina and Georgia, have experienced increased corn ear damage, setting the stage for risk of damage to corn production across a large portion of the country.

Development of pest resistance to Bt has previously has been reported in five insect species, but all have been in response to crops that expressing a single Cry protein. This new paper is the first report of corn earworm resistance to multiple, or pyramided Cry proteins in genetically modified corn. The report also illuminates a need for more widespread resistance monitoring for all registered Cry proteins, including the Midwestern corn belt. Previously, resistance testing on corn earworm and other caterpillars has only taken place in southern production regions where Bt corn and cotton are prevalent.

"My team is pleased to bring this information to the forefront of the farming and biotechnology industries, but recognize there is still much work to do in understanding the evolution of how corn earworm developed resistance to Cry proteins," says Dively. "Unfortunately, with the realization of this resistance, many sweet corn farmers in Maryland have stopped growing Bt corn and by extension are applying more insecticide to combat pest infestation. Increased insecticide use is a time-consuming and hazardous long term approach, which provides strong motivation to find a comparable solution to Bt biotechnology."

More information: Galen P. Dively et al. Field-Evolved Resistance in Corn Earworm to Cry Proteins Expressed by Transgenic Sweet Corn, *PLOS ONE* (2016). DOI: 10.1371/journal.pone.0169115

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