Study shows genetically engineered corn could affect aquatic ecosystems

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A study by an Indiana University environmental science professor and several colleagues suggests a widely planted variety of genetically engineered corn has the potential to harm aquatic ecosystems. The study is being published online this week by the journal *Proceedings of the National Academies of Sciences*.

Researchers, including Todd V. Royer, an assistant professor in the IU School of Public and Environmental Affairs, established that pollen and other plant parts containing toxins from genetically engineered Bt corn are washing into streams near cornfields.

They also conducted laboratory trials that found consumption of Bt corn byproducts produced increased mortality and reduced growth in caddisflies, aquatic insects that are related to the pests targeted by the toxin in Bt corn.

Caddisflies, Royer said, "are a food resource for higher organisms like fish and amphibians. And, if our goal is to have healthy, functioning ecosystems, we need to protect all the parts. Water resources are something we depend on greatly."

Other principal investigators for the study, titled "Toxins in transgenic crop byproducts may affect headwater stream ecosystems," were Emma Rosi-Marshall of Loyola University Chicago, Jennifer Tank of the University of Notre Dame and Matt Whiles of Southern Illinois University. It was funded by the National Science Foundation.

Bt corn is engineered to include a gene from the micro-organism Bacillus thuringiensis, which produces a toxin that protects the crop from pests, in particular the European corn borer. It was licensed for use in 1996 and quickly gained popularity. In 2006, around 35 percent of corn acreage planted in the U.S. was genetically modified, the study says, citing U.S. Department of Agriculture data.

Before licensing Bt corn, the U.S. Environmental Protection Agency conducted trials to test its impact on water biota. But it used Daphnia, a crustacean commonly used for toxicity tests, and not insects that are more closely related to the target pests, Royer said.

Royer emphasized that, if there are unintended consequences of planting genetically engineered crops, farmers shouldn't be held responsible. In a competitive agricultural economy, producers have to use the best technologies they can get.

"Every new technology comes with some benefits and some risks," he said. "I think probably the risks associated with widespread planting of Bt corn were not fully assessed."

There was a public flap over the growing use of Bt corn in 1999, when a report indicated it might harm monarch butterflies. But studies coordinated by the government's Agriculture Research Service and published in PNAS concluded there was not a significant threat to monarchs. Around that time, Royer said, he and his colleagues wondered whether the toxin from Bt corn was getting into streams near cornfields; and, if so, whether it could have an impact on aquatic insects.

Their research, conducted in 2005 and 2006 in an intensely farmed region of northern Indiana, measured inputs of Bt corn pollen and corn byproducts (e.g., leaves and cobs) in 12 headwater streams, using litter traps to collect the materials. They also found corn pollen in the guts of

certain caddisflies, showing they were feeding on corn pollen.

In laboratory trials, the researchers found caddisflies that were fed leaves from Bt corn had growth rates that were less than half those of caddisflies fed non-Bt corn litter. They also found that a different type of caddisfly had significantly increased mortality rates when exposed to Bt corn pollen at concentrations between two and three times the maximum found in the test sites.

Royer said there was considerable variation in the amount of corn pollen and byproducts found at study locations. And there is likely also to be significant geographical variation; farmers in Iowa and Illinois, for example, are planting more Bt corn than those in Indiana. The level of Bt corn pollen associated with increased mortality in caddisflies, he said, "could potentially represent conditions in streams of the western Corn Belt."

Source: Indiana University