Common fungicide wreaks havoc on freshwater ecosystems

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Chlorothalonil, one of the world's most common fungicides used pervasively on food crops and golf courses, was lethal to a wide variety of freshwater organisms in a new study, University of South Florida researchers said Wednesday.

Biologists Taegan McMahon and Jason Rohr, co-authors of the study published in the journal Ecology Letters, report that chlorothalonil killed amphibians, snails, zooplankton, algae, and aquatic plants below estimated environmental concentrations previously deemed safe by the U.S. Environmental Protection Agency. The loss of these herbivores and plants freed the algae from predation and competition, which eventually resulted in algal blooms that were similar to the effects of eutrophication.

"Some species were able to recover from the chemical assault, but the ecosystem was fundamentally changed after its exposure to chlorothalonil," Rohr said.

The four-week study was conducted in a series of 300-gallon tanks used to mimic pond conditions. It follows a 2011 laboratory study conducted by McMahon and Rohr that found that ecologically-relevant concentrations of chlorothalonil killed four species of amphibians.

"Although our new study is the only reported community- and ecosystem-level experiment on chlorothalonil, our results are consistent with several direct toxicity studies conducted in the laboratory and with observations

in the field," McMahon said.

Chlorothalonil kills molds and fungus by disrupting cellular respiration, an essential process for most multicellular organisms on the planet. Like the infamous DDT, chlorothalonil is a member of the organochlorine chemical family.

Fifty years after the book "Silent Spring" led to a ban on most forms of the pesticide DDT, chlorothalonil is one of a few organochlorine pesticides still registered for use in the U.S., Europe and Australia.

"In addition, to reducing biodiversity and altering ecosystem functions, chlorothalonil reduced the decomposition of waste, an important service that freshwater ecosystems provide to humans," McMahon added.

"Interest in the relationship between biodiversity and ecosystem functions stems at least partly from the concern that anthropogenically-driven declines in biodiversity will reduce or alter the benefits offered by ecosystems," Rohr said. "Surprisingly, however, this is one of the first studies to actually manipulate an anthropogenic factor and link it to changes in ecosystem functions mediated by declines in biodiversity."

"This is important because many species in ecosystems might contribute little to ecosystem functions or are functionally redundant with other species, and thus declines in biodiversity do not always affect the functions and services of ecosystems," Rohr said.

McMahon and Rohr encourage further research on effects of anthropogenic factors on ecosystem functions in systems with complex food webs and the re-evaluation of the safety of chlorothalonil.

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