Aquatic insect 'family trees' provide clues about sensitivity to pollution

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A North Carolina State University study published online this week in *Proceedings of the National Academy of Sciences* shows that examining an insect's "family tree" might help predict a "cousin" insect's level of tolerance to pollutants, and therefore could be a reliable way to understand why certain insect species thrive or suffer under specific ecological conditions.

Evaluations of the health and well-being of rivers and streams are frequently tied to the presence – or absence – of resident aquatic insects. But these population evaluations are not designed to explain why certain species may be disappearing from specific places, says Dr. David Buchwalter, an NC State assistant professor of environmental and molecular toxicology and the lead author of the paper.

"Our results are exciting because they open up the possibility of predicting species' tolerance to environmental problems based on their evolutionary histories," Buchwalter says. This predictive power would give scientists a leg up on understanding insect responses to environmental stressors in the more than 6,500 aquatic insect species in North America.

In the study, Buchwalter and colleagues from the University of California, Riverside, and the U.S. Geological Survey examined how 21 species of insects field-collected from streams in North Carolina, California, Colorado and Oregon tolerated cadmium, a trace metal cancerous to humans that is used in batteries and found near hard-rock

mining and industrial sites.

By exposing the insects to a gamma emitting isotope of cadmium – a technique that allowed the scientists to gauge metallic concentrations in live insects over time – the researchers measured cadmium intake rates; cadmium elimination rates; whether insects "detoxified" metals using proteins; and whether related insects showed similar resistance or tolerance to cadmium.

The study showed a great deal of variation in how these insects internally process cadmium, including a 65-fold difference in uptake and a 25-fold difference in the rate at which different species eliminated it from their tissues.

For the most part, though, insects in the same family were similar when it came to pollution sensitivity.

The study also showed that species could face a trade-off between being able to protect cells from cadmium and being able to eliminate it from their tissues. "This paper helps explain why, in the same water, different species can carry around very different concentrations of metals," Buchwalter says. "And some species can carry those metal loads better than others."

Source: North Carolina State University