Scientists reveal global patterns of specialized feeding in insect herbivores

January 29 2015

Matt Forister, associate professor and ecologist from the University of Nevada, Reno, examines plants for caterpillars near the Yanayacu Biological Station in the Eastern Andes of Ecuador. A scientific paper about his work on global patterns of specialized feeding in insect herbivores was published in the *Proceedings of the National Academy of Sciences*. Credit: University of Nevada, Reno.

Insects are picky eaters, and not the voracious eat-everything-in-sight bingers that devour all the plants in your garden.

After decades of field work from dozens of sites around the world, and after two years of combing through and analyzing data, Matt Forister, associate professor and ecologist from the University of Nevada, Reno, and an international team have reported on global patterns in the diets of insect herbivores. Among other findings, they report that most insect herbivores, such as caterpillars, find and feast on just one kind of plant in any one location, rather than taking the buffet approach and eating everything in sight.

"This is important to know as we pursue conservation, ecosystem management and restoration," Forister said. "Our dietary specialization studies show us that a majority of insect herbivores, around the world, pick one plant in their local ecosystem and feed on just that one type of plant, not every plant that's available, as many people assume."

This is something that many scientists have known intuitively for a long time, but it has not before been quantified on this scale.

Forister and his colleagues and co-authors in the University's interdisciplinary Ecology, Evolution and Conservation Biology graduate program, and from universities around the world, have published an article in the renowned *Proceedings of the National Academy of Science*s, which publishes cutting-edge research, science news, and actions of the National Academy of Sciences. It documents diets from site-specific host records for more than 7,500 species of insect herbivores from several continents.

"This resolves a big debate in the scientific literature," Forister said. "Previous studies had disagreed on whether or not insect herbivores in the tropics have more narrow diets than their temperate relatives."

The researchers found that insects in tropical zones are indeed more specialized, and this was evident across hemispheres and across

unrelated groups of insect herbivores.

While the comparison with tropical insects is of general scientific interest, the study is also important for ecosystem management. Variation in insect diet has implications for numerous ecological and evolutionary processes, including effects of environmental disturbance, the stability of networks of interacting species and the top-down effects of predators being controlled by the level of herbivore diet specialization.

"We need to know what insects eat when doing ecosystem restoration, and we shouldn't assume that species with generalist feeding habits will necessarily fill the same ecological roles as more specialized species."

For example, as restoration is completed along the Truckee River in Reno and Sparks, restoring and encouraging native plants that support specific insect herbivores will help keep the ecosystem and food chain stable and functioning into the future.

His collaboration with the European scientists doubled the amount of data Forister and his group had to work with. A large amount of data came from extensive studies conducted here in the Great Basin.

"I'm indebted to my partners here at the University of Nevada, Reno for their hard work," he said. "Lee Dyer and Angela Smilanich, in particular, have spent years in the field gathering data - finding the caterpillars and finding what they eat and then confirming their habits through lab studies."

Dyer and Smilanich, noted biologists in the University's biology department, also teach in the Ecology, Evolution and Conservation Biology graduate program. Dyer, Smilanich and Forister advise three graduate students - Josh Jahner, Andrea Glassmire and Nick Pardikes -

who worked on the study with them. Forister noted the team has waded into creeks in Costa Rican forests, beat through the bushes of the Sierra Nevada mountains and scraped through the sagebrush of the Great Basin searching for the insects and their food.

Along with their host of international collaborators, Dyer leads a cadre of citizen scientists who volunteer through his Earthwatch program to help gather data. The Earthwatch program is part of an international environmental effort that enlists bankers, lawyers, high school students and others interested in science, who each spend a couple of weeks in the field searching for insects and plants.

"We do this in the summer, both in Ecuador and here on the east side of the Sierra and the Great Basin," Dyer said. "This generates real, usable data that gives us definitive answers to the variety of questions we seek to answer."

They wanted to answer questions about why some animals have narrow diets and others are more generalized and if different regions of the earth support more specialized interactions.

"If standing in nature, anywhere, the desert, the tropical forest, we should remember that we are surrounded by unique interactions. Sometimes I think people have a tendency to assume that the most interesting and highly-adapted relationships are far away, in a nature preserve in another country that they might visit on vacation some day. Nature is everywhere specialized, and it's something we need to understand more about," Forister said.

The study established consumer-host relationships at sites in North, Central and South America, Papua New Guinea, Japan and Europe. The tropics are extremely well-sampled with 71 site-years of sampling below 30 degrees latitude - just for moths and butterflies.

"We're confident in the global gradient that we have reported. Although we don't have data from Africa, yet, it would be shocking to see something different," Forister said.

"Breakthroughs in biology are increasingly reliant on very large data sets that depend on scientists who are skilled at working together," Jack Hayes chair of the biology department in the College of Science, said of the published work. "Forister, Dyer, and Smilanich built an impressive team that enabled them to tackle an important question with an unprecedentedly comprehensive data set. Not only does their paper reveal a key insight about some of the world's most important herbivores, it also shows how collaboration opens the door to answering questions beyond the reach of individual scientists."

That collaborative mindset is especially prevalent in the Ecology, Evolution and Conservation Biology graduate program to which they belong. The program encompasses several departments and institutions and is one of seven successful interdisciplinary graduate programs at the University.

Provided by University of Nevada, Reno

Citation: Scientists reveal global patterns of specialized feeding in insect herbivores (2015, January 29) retrieved 20 March 2024 from https://phys.org/news/2015-01-scientists-reveal-global-patterns-specialized.html