ANTS

IN YOUR PLANTS

IAN ROBERTSON PHOTO

By Kathleen Tuck and Brady Moore

They say that size matters, but don't tell that to an ant. Particularly an Owyhee harvester ant, which despite its diminutive size may threaten the survival of an entire plant species.

Or not.

Defining the role of harvester ants as contributors to the decline of a rare flowering plant called slickspot peppergrass (*Lepidium papilliferum*) is the aim of research by Dr. Ian Robertson, professor of biological sciences at Boise State.

The native desert plant, a member of the mustard family, is found only in limited parts of Southwest Idaho's sagebrush-steppe habitat. Its dwindling numbers have put it at the heart of heated debate among land users, conservation groups, and state and federal agencies. For years now the plant has found itself on and off the threatened species list.

At risk from a variety of sources such as human development, cheatgrass encroachment, wildfires, agriculture, off-road vehicles and grazing, to name just a few. Some researchers say the slickspot peppergrass plant soon could become just a memory.

The plant is named for its reliance on slick spots or shallow depressions of soil characterized by high levels of clay and salt. The unique composition of these slick spots allows the soil to retain moisture longer than in surrounding areas, but few plants other than peppergrass can grow in it because of the high salt content.

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"Because of the precarious situation slickspot peppergrass finds itself in with respect to survival, there is a lot of interest in learning more about the plant," Robertson said. "Over the years we've looked at its pollination biology, population structure and population genetics. Now we've transitioned to questions about seed predation."

Harvester ants are so called because of their diet. These voracious desert scavengers collect and eat seeds in droves, including those of Sandberg bluegrass, tumble mustard, and slickspot peppergrass. In some cases, up to 90 percent of the seeds produced by slickspot peppergrass are consumed by ants, leaving little behind for future generations.

"We're looking at whether and how this rare plant species is able to persist given such high levels of seed predation by ants," Robertson said.

Shedding light on the question could help inform land managers on how to better maintain or promote peppergrass populations. Robertson says the tedious and time-consuming work is still ongoing as the data is collected and analyzed.

The laborious process involves sifting through the soil samples to locate and count peppergrass seeds, which are about a millimeter in size; it can take hours to sift through a single sample.

Slickspot peppergrass numbers vary widely from year to year, likely in response to precipitation. Plants that survive to reproduce can drop thousands of seeds to the ground. Because individual seeds may persist in the soil for up to 10 years before germinating, the drop creates a "seed bank" that may help to ensure continuation of the species even after one or more years of unfavorable conditions.

What Robertson hopes to learn is whether there are circumstances that help seeds escape the jaws – or more correctly, mandibles – of hungry ants. For example, perhaps during favorable years for peppergrass the ants can't keep up with the abundant supply of seeds, thus leaving enough seed behind to replenish the seed bank and ensure continuation of the species. In lean years, when seed supply is low, the ants may consume all or most of them.

To address this question, one of Robertson's graduate students, Michelle Jeffries, is working to quantify how many seeds remain on the ground after ants take all they can consume. To accomplish this she uses cages to protect some plants from ants while leaving other plants unprotected. At the end of the summer she scoops up soil samples from beneath the plants and returns them to the lab for examination.

The data will help researchers understand whether there are certain conditions that promote replenishment of the seed bank despite the presence of ants. This knowledge could lead to new approaches to mitigate seed losses to ants, such as altering the surrounding vegetation to make peppergrass seeds a less attractive option to ants, or creating conditions on the ground that hinder the ability of ants to locate and collect seeds.

"Sagebrush-steppe habitat is changing. Historically the landscape was primarily sagebrush and harvester ants likely weren't as populous," Robertson said, noting that harvester ants don't typically nest in areas dense with sagebrush. "The current abundance of harvester ants near peppergrass presents a challenge to this plant's survival."

While Robertson thinks the plants will survive this latest assault from ants, their populations appear to be declining. Robertson points out that in addition to being a unique and intrinsically valuable part of the region's natural heritage, slickspot peppergrass could serve as a barometer for the overall health of the sagebrush-steppe ecosystem. In other words, "Efforts to promote the survival of slickspot peppergrass may help to maintain and improve the ecosystem as a whole."

Before coming to Boise State in 2000, Robertson served as a postdoctoral fellow at the University of Alberta in Edmonton. He received his Ph.D. from Simon Fraser University in British Columbia. Robertson says his projects typically involve the development of a theoretical framework that helps derive a testable hypotheses that then becomes subject to investigation in the field or lab. Robertson also has studied the predator-prey relationships between crab spiders and insects, host choice decisions in bark beetles, and the function and duration of parental care in subsocial insects. **B**


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MICHELLE JEFFRIES PHOTO

Biologist Ian Roberts works with graduate student Michelle Jeffries to determine the effect of seed predation on the slickspot peppergrass plant. Below: A pile of 23,228 seeds waits to be counted; the vial holds 5,000.

STUDENT PROFILE

MICHELLE JEFFRIES


ALLISON CORONA PHOTO

HOMETOWN: **Boise, Idaho**

DEGREE PROGRAM: **Master of Science in Biology**

ADVISOR: **Dr. Ian Robertson**

RESEARCH: **"Seed predation by harvester ants and herbivory by rodents: The plight of slickspot peppergrass, a rare endemic mustard in Idaho"**

Over the past two summers Michelle Jeffries has worked with Dr. Ian Robertson to investigate the level of slickspot peppergrass seed removal by Owyhee harvester ants. Jeffries said sifting through the seeds has proven to be a very challenging process, adding that some samples can take as long as 48 hours of work to examine.

"It has taken up the bulk of my time recently," she said. "I'm currently working on finishing data entry, processing photos, starting to look into analysis and finishing the last few soil samples of 58 total."

Jeffries said she has always known that her passion lies in biology. "I was raised spending most of my free time outside. I definitely feel at home in the outdoors."


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