CHOTEAU ACANTHA

MSU tree study

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In his nearly two years at Montana State University, there have only been about two weeks that Franklin Alongi has not been involved in undergraduate research, and those were his first two weeks on campus.

Alongi, a Kentucky native and a student in the Department of Plant Science and Plant Pathology in MSU's College of Agriculture, connected with professor Matt Lavin early in the fall semester of 2018 working with a genetic tool to help identify whitebark pine trees. The tree species, common in Montana and the Northern Rocky Mountains, is particularly difficult to distinguish from limber pine until it becomes mature, which can take upwards of 50 to 60 years. Since the two often coexist in mixed forest stands, genetics are often the only way to confidently tell the two apart, Alongi said.

"I started my first semester working on that genetic tool, and I was presented with an opportunity from the honors college to apply for a grant for my own project," said Alongi, who is also an MSU presidential scholar. "I'd been here for two months at the time, but I got to thinking about how I could expand what we'd been working on to a more widespread usage."

Understanding the genetics of Montana's pine trees is critical to addressing blister rust, the leading cause of whitebark pine decline, Alongi said. The project he designed seeks to understand the differences between whitebark and limber pine and the rate of blister rust infection in the trees across the Greater Yellowstone Ecosystem.

Blister rust spreads very slowly and requires two host plants, Alongi said. One of those hosts comes from the Ribes genus, which includes plants such as gooseberries and currants. Rust spores spread from those species and attach to secondary hosts, such as whitebark pines. After entering a tree through openings in the needles, the rust infects the branches and trunk, which weakens the tree's viability and ultimately and kills it.

Once the rust has reached the trunk, it creates spore pockets in the bark and spores disperse freely from the tree back to the Ribes host, from which the rust continues to spread. In defense, the tree produces sap, which attracts rodents and other animals because of its sweet taste. Because of that, Alongi said, rodent bite marks on the bark of trees is frequently an indicator that a tree is infected with blister rust.

"Whitebark pine is considered a keystone species, which means it has a disproportionate effect on its ecosystem," he said. "It's a major food source for species such as the Clark's nutcracker, as well as having interactions with animals like grizzly bears, who feed on nut storage. It's notorious for very, very slow growth that creates a lot of neat structures. It's a very unique species."

Whitebark pine is already listed as an endangered species in Canada, Alongi said, though it is uncertain whether trees in Canada or the U.S. first displayed infection. During his research, he has collected 351 samples from six stands across Montana and Wyoming. The genetic data from those samples paired with the climate information of their respective locations could provide more detailed information into where blister rust is currently found and where it may spread, in addition to identifying potentially resistant trees.

“We took DNA from the two species and determined areas of variation between them, then found special enzymes that will cut those regions of variation so that you can tell, based on analyzing one needle, what species of tree that is, instead of having to genetically sequence the tree’s DNA,” Alongi said.

Currently, the method of identifying resistant trees is both expensive and time consuming, Alongi said. The process involves simply searching for trees that appear healthy in a sea of unhealthy ones, then collecting cones, growing saplings from those cones in a laboratory, then subjecting those saplings to rust and watching to see if they become infected.

“On the samples that I took, in addition to location I noted any indicators of rust that the sample had, which is the traditional method of determining infection,” Alongi said. “I could then test those needles for rust, and what I found was that even trees that had no symptoms had rust somewhere inside or on them.”

What remains to be uncovered, Alongi said, is whether those trees are actually rust-resistant or simply hadn’t yet completed the years-long process of manifesting symptoms of infection.

Alongi has worked tirelessly on his research, said Lavin, and is poised for further impact in the field through the rest of his undergraduate career, let alone in what will come after.

“Franklin has dedicated himself to this project, both in the lab and the field, in a manner that makes him appear like a top-notch graduate student when in reality he is in his second year as an undergraduate student,” Lavin said.

There is more to be learned when it comes to whitebark pines and rust infection, and Alongi already has ideas for where his research will go next. His work and partnership with Lavin earned the two recognition in MSU’s 38th annual awards for excellence earlier in the spring semester.

“I think ultimately if there is a way to be able to tell where the rust is in the tree, that would be a crucial element,” he said. “A lot of these questions could potentially be answered by these genetic methods. It’s definitely a curiosity or obsession of mine at this point.”

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