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SCIENCE

Old Trees May Soon Meet Their Match

By JIM ROBBINS SEPT. 27, 2010

GREAT BASIN NATIONAL PARK, Nev. — For millenniums, the twisted, wind-scoured bristlecone pines that grow at the roof of western North America have survived everything nature could throw at them, from bitter cold to lightning to increased solar radiation.

Living in extreme conditions about two miles above sea level, they have become the oldest trees on the planet. The oldest living bristlecone, named Methuselah, has lived more than 4,800 years.

Now, however, scientists say these ancient trees may soon meet their match in the form of a one-two punch, from white pine blister rust, an Asian fungus that came to the United States from Asia, via Europe, a century ago, and the native pine bark beetle, which is in the midst of a virulent outbreak bolstered by warming in the high-elevation West.

Blister rust is a new challenge to the pines. It spread to Europe from Asia in the 19th century and then was shipped unknowingly to the East and West Coasts of North America around the turn of the last century on nursery trees. Only now is it reaching the high-elevation bristlecone. Anna Schoettle, a Forest Service ecologist in Fort Collins, Colo., said, “Neither the bristlecones nor their ancestors have been faced with a disease like this, and they have not evolved tolerances.”

“So really we’re in uncharted territory,” she said.

Dr. Schoettle is leading research efforts on the threat to bristlecones and other

species of five-needle pines, and strategies for sustaining them.

Blister rust is a slow-moving, slow-acting disease that appears as an orange patch on a tree. It could take many years or even decades for mature trees to succumb to the fungus. But there is little that can be done to stop its progress as it moves from one mountain range to another, as airborne spores. The spores land on gooseberries and currants, then move to attack any nearby five-needle pines, including limber and whitebark.

The rust enters a tree through the needles and moves into the twigs and branches and eventually arrives at the trunk, which it girdles and kills. Infected branches can be pruned, but that is not always effective. Scientists suspect warmer temperatures have helped the rust spread, but they do not have any evidence to show that this is the case. Pine bark beetles, on the other hand, are a fast killer.

And the pest and the disease working together are especially deadly. “Blister rust kills young trees rapidly,” Dr. Schoettle said. “The mountain pine beetle only kills the larger trees, but those are the trees that produce the seeds. So when you have a combination of blister rust and the beetle, that severely constrains recovery of the population.”

The long-term strategy that biologists are banking on to save the bristlecones from dying out completely is finding the few trees that are resistant to the fungus and growing their seeds into rust-resistant seedlings.

That is why Gretchen Baker, an ecologist here at Great Basin National Park, is collecting pine cones. The seeds will be sent to Dr. Schoettle’s lab, grown for a year or two and inoculated with blister rust. If they do not contract the fungus, other seeds from the same tree will be used to grow seedlings. The new resistant trees will be planted in bristlecone habitat. It is the same program being used for whitebark pines.

“For trees we collect cones from, we will be putting a pheromone patch on, so we can keep mountain pine beetles from attacking it,” Ms. Baker said. “Then if the tree has resistance we can collect additional pine cones.”

Still, everyone involved acknowledges that seedlings are a far cry from the wonder of a tree that was already ancient at the time of Jesus. “Bristlecones are one of the big draws here,” Ms. Baker said. “It would be a shame to see them go.”

The Wheeler Peak bristlecone pine grove here is one of the places Ms. Baker will gather cones. Like most bristlecones, those in this grove sit amid some of the world’s harshest conditions at timberline, adjacent to a field of giant boulders and a glacier. It is a forest of unusual, gnomish shapes, the trees spaced far apart, awash in brilliant desert light. The trees look almost dead, but that is a strategy to conserve energy. Only a small part of the tree keeps growing.

The oldest tree here is more than 3,000 years old. This grove was once home to the oldest known bristlecone, Prometheus, but in 1964, a graduate student named Donald Rusk Currey was studying tree ring data and got his drill bit stuck in the tree. He cut it down to fetch his tool. Later, when he counted the rings, he found the tree was at least 4,900 years old.

There are three species of bristlecones — the Great Basin, Foxtail and Rocky Mountain. All have prickly, immature cones, which prompted their common name. The Great Basin bristlecone forests grow on mountain summits in Nevada, California and Utah, and are the oldest.

Only the Rocky Mountain population has shown blister rust infection, though experts say it is only a matter of time before it reaches all groves. Pine beetles have killed at least one grove of as many as a hundred bristlecones in Colorado, ranging from 600 to 1,100 years old. They are present in Great Basin as well.

The fate of the whitebark pine is a grim hint of what may happen to the bristlecones. Blister rust and pine beetles have savaged stands of the pine, and in some places the mortality is 100 percent. In Glacier National Park, for example, virtually all of the whitebark pines are gone. Many other regions are under fierce attack.

“Blister rust is extremely virulent,” said Diana Tomback, a professor of integrative biology at the University of Colorado, Denver, who is studying the decline of the whitebark and helping to grow resistant strains. “We expect a lot more

mortality in the years to come.”

Environmentalists have petitioned the Fish and Wildlife Service to list the whitebark as an endangered species.

The bristlecones face even more fundamental changes. Warmer temperatures are significantly altering ecosystems, according to Matthew Salzer, a researcher at the Laboratory of Tree-Ring Research at the University of Arizona who studies bristlecone tree rings. Over the last 50 years, bristlecone rings have increased in size, growing 30 percent faster than in any other 50-year period for 3,700 years. “They’ve really taken off,” Dr. Salzer said. “The growth rate is really high, and it’s related to the warming occurring at higher elevations.”

“I think they risk burning themselves out,” he said. “One of the reasons these trees have such longevity is they have a conservative approach. If they are no longer under such harsh conditions it’s possible their life spans will decrease.”

Some ecologists think that as warming continues, species that live at the top of mountains may no longer have a niche and simply disappear, something that has been called the “rapture hypothesis.”

How the bristlecones live so long is an unanswered question. They are one of a handful of organisms known as negligibly senescent — they defy aging. That may seem especially miraculous in such harsh conditions, but those conditions may be central to their success. They live much longer here than they do at lower elevations, where conditions are more hospitable.

“The key to the bristlecone is that they grow in a rigorous environment,” said Ronald Lanner, a retired forest biologist who studied bristlecones and has written a book about them, “and that environment is also rigorous to their pests.”

“So warmer temperatures,” Dr. Lanner said, “especially in the presence of drought, would work against the tree.”

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