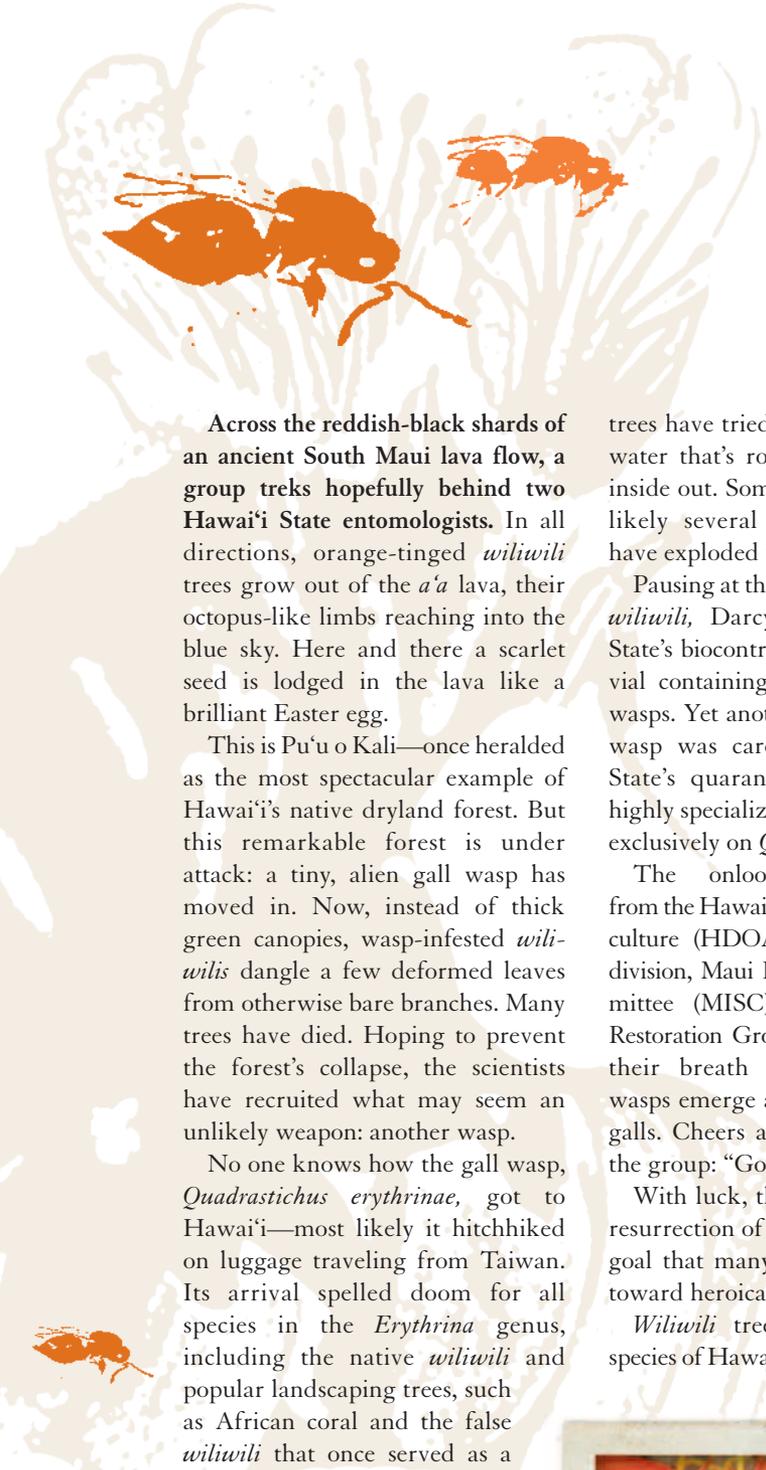


Story by
Shannon Wianecki



Saving the **Wiliwili**

A tiny wasp from Tanzania may be the last, best hope for one of Hawai'i's most important native trees.



Across the reddish-black shards of an ancient South Maui lava flow, a group treks hopefully behind two Hawai'i State entomologists. In all directions, orange-tinged *wiliwili* trees grow out of the *a'a* lava, their octopus-like limbs reaching into the blue sky. Here and there a scarlet seed is lodged in the lava like a brilliant Easter egg.

This is Pu'u o Kali—once heralded as the most spectacular example of Hawai'i's native dryland forest. But this remarkable forest is under attack: a tiny, alien gall wasp has moved in. Now, instead of thick green canopies, wasp-infested *wiliwili*s dangle a few deformed leaves from otherwise bare branches. Many trees have died. Hoping to prevent the forest's collapse, the scientists have recruited what may seem an unlikely weapon: another wasp.



No one knows how the gall wasp, *Quadrastichus erythrinae*, got to Hawai'i—most likely it hitchhiked on luggage traveling from Taiwan. Its arrival spelled doom for all species in the *Erythrina* genus, including the native *wiliwili* and popular landscaping trees, such as African coral and the false *wiliwili* that once served as a windbreak along island high-ways and farms.

Without a natural predator in the Islands, the gall wasp spread quickly from tree to tree, leaving behind a trail of devastation. It lays its eggs in leaf tissue, causing leaves to shrivel into gnarled galls around its developing larvae.

At Pu'u o Kali, the older trees weep—literally. Without functional leaves, they can't transpire. White streaks down their trunks show where the

trees have tried to expel the trapped water that's rotting them from the inside out. Some of the largest trees, likely several hundred years old, have exploded under the pressure.

Pausing at the base of a gall-wasted *wiliwili*, Darcy Oishi, one of the State's biocontrol experts, holds up a vial containing *Eurytoma erythrinae* wasps. Yet another alien species, this wasp was carefully reared in the State's quarantine facilities. It's a highly specialized predator that feeds exclusively on *Quadrastichus* larvae.

The onlookers—representatives from the Hawai'i Department of Agriculture (HDOA), the State forestry division, Maui Invasive Species Committee (MISC), and the Auwahi Restoration Group—collectively hold their breath as thirty *Eurytoma* wasps emerge and begin landing on galls. Cheers and hoots erupt from the group: "Go get 'em!"

With luck, this release signals the resurrection of the *wiliwili* forest—a goal that many have been working toward heroically.

Wiliwili trees are the keystone species of Hawai'i's dryland forest, the

pillars that provide the ecosystem's framework. "*Wiliwili* is crucial on the lava flow," says research biologist Art Medeiros, who manages conservation efforts at Pu'u o Kali and Auwahi forest reserves. "It flushes the flow with nitrogen once a year, preparing the soil for other native plants, such as 'ilima, 'awikiwiki, and hibiscus."

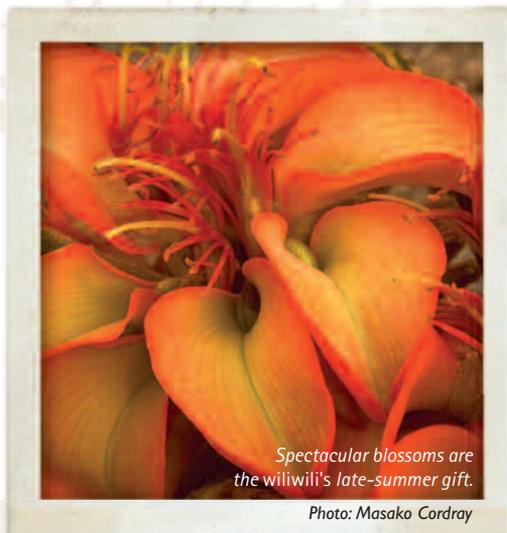
Medeiros adds, "Of all the forests I've been to, a deep, thick *wiliwili* forest is one of the most beautiful. When the leaves are flush, or when they fall and the porcelainlike barks are glowing . . . there is no more flashy ecosystem in the Hawaiian Islands."

Each year in late summer, *wiliwili* trees erupt in showers of crab-claw blossoms: iridescent green, ivory, coral, and red. After the flowers fade, curled seedpods emerge, bearing striking red seeds. Both the flowers and seeds are coveted by lei makers. Early Hawaiians used the *wiliwili*'s buoyant wood for surfboards, net floats, and canoe outriggers.

Until the gall-wasp invasion, conservationists viewed the *wiliwili* as one of the few native plants still thriving in modern Hawai'i.

The wasp was first detected on O'ahu in April of 2005. Nonnative *Erythrina* species fell prey first; galls showed up on trees around Honolulu. In July, Maui's resident entomologist Mach Fukada spotted galls on coral trees at Queen Ka'ahumanu Shopping Center. Within a week, the Big Island and Kaua'i reported that *Quadrastichus* had also reached their shores.

Stunned biologists immediately launched into action. Maui's invasive-species experts met with then-mayor Alan Arakawa to



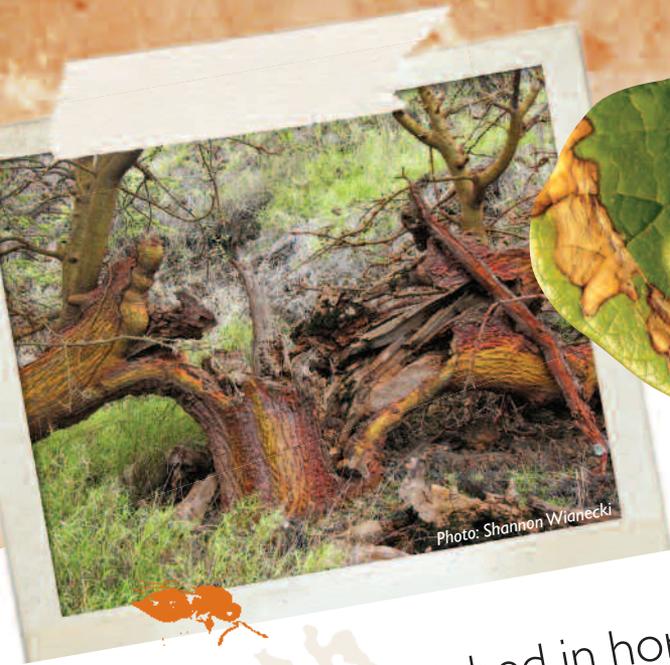


Photo: Shannon Wiarecki



Quadrastichus erythrinae photos: Michelle N. Tremblay

Infected leaf photo: Forest & Kim Starr



Photo: Lissa Fox

Arborists watched in horror as the wasp marched from residential neighborhoods into the native forest.

devise a strategy. The County agreed to release emergency funds and MISC led cooperative efforts to prune and mulch infected trees.

Not much was known about the gall wasp when it arrived in Hawai'i. The species was new to science; it had only been described in Singapore a few months prior. Crafting an effective control plan for an unfamiliar pest proved difficult.

"The gall wasp was moving too quickly," says Medeiros. "Nobody knew this then, but it turned into a worldwide invasion."

Initially, biologists thought that removing infected limbs might save the trees and prevent the wasp from spreading into pristine areas. That wasn't the case. The gall wasps attacked the new growth on trimmed trees even more vigorously. Pesticide treatments were tried, but they were expensive and unfeasible for wilderness populations. Trees were dying faster than anyone had imagined, and arborists watched in horror as the wasp marched from

residential neighborhoods into the native forest.

By October 2006, the last *wiliwili* stand in remote Nu'u had been thoroughly infected. Newspaper headlines read, "Efforts to control erythrina gall wasps fail" and "Alien wasp may doom the wiliwili."

"I was pretty hopeless then," says Medeiros. The conservation community's emphasis switched from saving trees to preserving seeds. O'ahu's Lyon Arboretum agreed to store seeds in anticipation of the worst-case scenario: extinction. The crisis brought scores of volunteers out of the woodwork; they helped pluck seeds from lava plains around Maui County, representing the *wiliwili's* diverse genetic pool.

Among the volunteers were some spirited third graders from Montessori School of Maui. The students reacted passionately to a slideshow Medeiros had shared with their class. They committed to shucking seeds—all 90,000 collected on Maui—for stor-

age at Lyon Arboretum. They wrote and performed a skit telling the *wiliwili's* tale.

"About halfway through, you get goosebumps," says Medeiros.

One student reportedly told his mother, "I feel sick today, but if I don't go to school, no one will protect the *wiliwilis*."

Thankfully, the students weren't the only ones going to any lengths for the *wiliwili*.

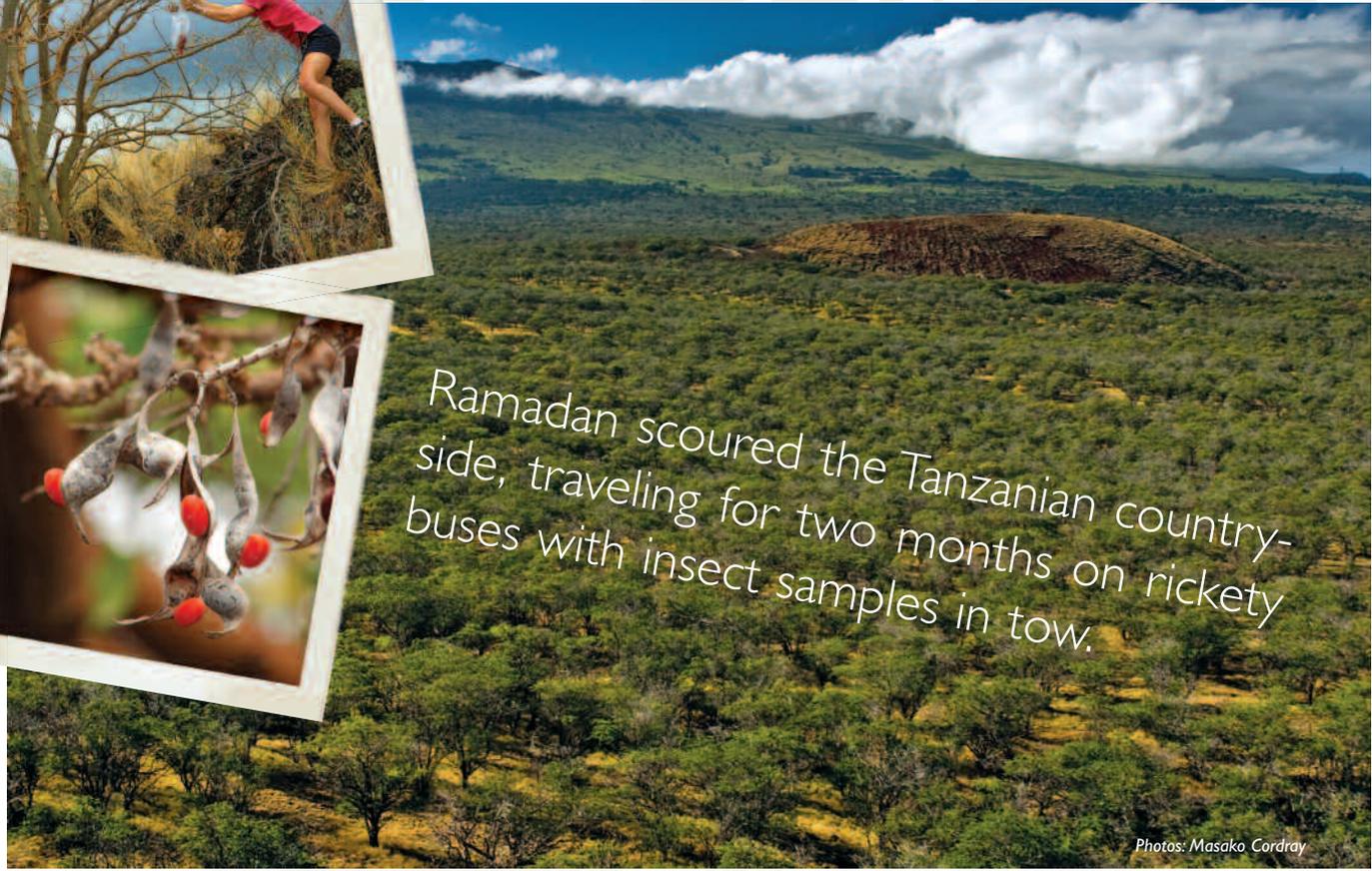
Just months after the gall wasp's arrival, in December 2005, HDOA exploratory entomologist Mohsen Ramadan traveled to Africa in search of a possible predator. His research revealed that Tanzania had the world's largest number of *Erythrina* species, and was most likely the source of both the *Erythrina* gall wasp and its natural enemy.

"Natural enemies reduce the numbers so you don't see the exten-

Left: Unable to process water without functional leaves, an ancient Pu'u o Kali tree has burst. Above: Seen in magnification, Quadrastichus pupae will become food for the new predatory wasp. Left unchecked, Erythrina galls cripple the tree's ability to transpire.



Ramadan scoured the Tanzanian countryside, traveling for two months on rickety buses with insect samples in tow.



Photos: Masako Cordray



Above: Erica von Allmen gathers seeds for safekeeping at Lyon Arboretum. Volunteers collected more than 90,000 seeds. Remnants of Hawai'i's most magnificent dryland forest can still be found amidst kiawe trees in South Maui. Below: Wiliwili will survive, thanks in part to Art Medeiros's restoration team. (That's Medeiros up in the tree.)

sive damage that we're seeing here," says Ramadan. "To find specific natural enemies, you really have to explore their native region."

Ramadan scoured the Tanzanian countryside, traveling for two months on rickety buses with insect samples in tow. "I was lucky enough to find some galls similar to those we had in Hawai'i," he says. "More than 90 percent of the galls showed parasitoids." He dispatched samples back to Hawai'i, where the parasitoids were identified as *Eurytoma erythinae*, a predatory wasp that lays its eggs beside those of *Quadristichus erythinae*. *Eurytoma's* larvae hatch first, and devour their neighbors.

HDOA performed comprehensive tests to insure that *Eurytoma* wouldn't become a new pest. "We are able to say that this insect is specific enough that it will not attack anything other than the *Erythrina* gall wasp," says Ramadan. *Eurytoma* was approved for release last December.

Plant Pest Control Manager Neil

Reimer calls biological control "the only way to save the *wiliwili* in remote and forested areas." Reimer helped shepherd the project through the cumbersome permitting process.

"Projects like this take about three years, sometimes ten," says Ramadan. "We did it really fast."

The new wasp won't have it as easy as the first wasp; many of the original host trees are gone. Still, Darcy Oishi thinks *Eurytoma* has a good chance. "It will disperse as well as the gall wasp, maybe better, because it's a little more robust, bigger."

Plus, HDOA is working on two additional parasitoids collected by Ramadan. "Testing is 80 percent complete on the third parasitoid," says Oishi. "Everything indicates it's a really good candidate."

Among the three predators, Ramadan is confident that "we'll be able to see what I saw in Africa: gall wasp present, but in very few numbers, and trees that are healthy and doing well."

Not a moment too soon. Back at Pu'u o Kali, Medeiros estimates that between 10 and 20 percent of the forest's 20,000 trees have died. Still, the native Hawaiian tree has managed to resist the gall wasp better than the other *Erythrina* species.

"The *wiliwili* is a tough tree," says Fukada. "It will figure out how to get through this."

Thankfully, it has some pretty tenacious folks watching its back. 🦋

