



Sherrri Barber/The Coloradoan

KILLER WEED: Jorge Vivanco, an assistant professor of horticultural biotechnology at Colorado State University holds up a beaker filled with knapweed root Tuesday. Vivanco found what scientists long have searched for: a chemical in knapweed that kills other plants.

CSU researcher discovers agent for herbicide

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Outside of the laboratory, Colorado State University researcher Jorge Vivanco never has seen spotted knapweed. Yet after a year of study, he has unlocked the mystery of this noxious weed that has baffled and intrigued scientists since the 1830s.

Vivanco's discovery could lead to the development of a natural herbicide that could work as well as 2,4-D - a toxic herbicide used in Vietnam by US troops to defoliate plants and believed to be a carcinogen - without the risks. Or it could lead to ways to genetically modify crops to make them more resistant, he said.

"It's a very clever plant," said Vivanco, 30. "It's been very interesting. I think (other scientists) may have been looking too hard."



KNAPWEED

Scientists had hypothesized the hearty weed released an agent that killed other plants in its midst clearing the way for knapweed to take over. But the agent remained a mystery.

A year ago, the journal *Science* wrote that the spot, the knapweed mystery seemed to be locked in the plants' roots.

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Scientists were having trouble isolating possible compounds from other compounds that occur naturally in the soil.

Vivanco said he took the *Science* report as a challenge and enlisted a team of researchers to help him.

He knew CSU labs had the capability of isolating the organisms and growing just the root of the plant in sterile beakers.

All plants release their own specific agents into soil, said Vivanco, a horticultural biotechnology assistant professor. This release is sort of the equivalent of mucous in humans, he said. It's just that some plants release friendly agents while spotted knapweed releases phytotoxins, unfriendly agents that kill everything in its way.

Vivanco isolated a compound known as catechin in spotted knapweed. The weed produces two types of catechin, mirror images of each other, known as negative and positive catechin. Negative catechin acts like a natural herbicide, while positive catechin has antibacterial properties and has been available for years as an antioxidant and anti-aging compound. Until now, negative catechin was considered a byproduct with no commercial value.

Weed researchers at CSU have been spraying the negative compound on plants in the CSU greenhouses and found it works well as a herbicide. Vivanco said. The compound is exactly the same as the compound he "milks" from beakers full of knapweed roots in his lab, he said.

The research team has found that spraying the compound on plants or adding it to the soil is as effective as 2,4-D against pig-weed, lambs quarters and other common weeds. It usually kills cells within the plants in an hour and kills the plants in about a week. The researchers are working with commercial companies to make a spotted catechin spray available to consumers within a year or two.

I think it's fantastic if this is true," said Mike Carroll,

Larimer County weed district manager. "We've known for a long time that several plants do this to give them the competitive edge."

A spotted catechin spray would add to the arsenal the county already uses, he said. Technology has improved to the point where the county uses very few man-made compounds. Carroll said.

Vivanco also hopes to isolate the gene that produces the negative catechin so it could be added to crops to give them the same protective qualities knapweed has. Farmers then could plant the crops and not need to add herbicides, he said.

Before that could work, researchers would need to identify the mechanism knapweed uses to keep the compound from killing itself, he said.

The compound could be a boon to organic farmers who have few ways to get rid of weeds, said Ruth Hufbauer, a CSU professor who studies ecology and the genetics of invasive plants.

The Environmental Protection Agency will fast-track the compound cause it already is prevalent in the soil, unlike man-made compounds that don't exist in nature. Vivanco said.

It's unknown if these man-made compounds kill beneficial insects, hurt grazing animals or cause cancer. This compound already is considered safe, because it always has been there, he said.

Grasses and grass-like plants such as wheat and corn seem to be immune to the negative agent, making it ideal for use on lawns or in wheat or corn fields. The compound also kills other species of knapweed, such as diffuse knapweed, which also is a noxious weed.

Despite the wealth of applications, knapweed won't be grown as a cash crop since it's still a noxious weed, Vivanco said. The roots could be produced in labs, although the process likely would be expensive, he said.