Story by Kathy Wythe

# Natural Predator

*Foreign beetle shows promise for controlling saltcedar*

In the northern part of the Texas Panhandle and along the West Texas banks of the Colorado and Pecos rivers, Texas scientists are successfully introducing a foreign beetle to help control an invasive and exotic water-thirsty plant.

Saltcedar, or *Tamarix*, was introduced to the western United States in the 1800s from central Asia as an ornamental tree and planted along riverbanks for erosion control. Without a natural predator, the tree soon out-competed native plants and has now infested an estimated 500,000 acres of Texas streams and riverbanks.

Saltcedar is a big water user, withdrawing 3 to 4 feet of water per year depending on plant density, tree age and depth-to-water table. It also increases soil salinity and wildfire risk and crowds out native vegetation used by wildlife.

The Texas Riparian Invasive Plants Task Force has identified saltcedar among the "worst of the worst" invasive species in Texas.

Dr. Allan McGinty, professor and Extension range specialist at The Texas A&M University System Agricultural Research and Extension Center at San Angelo, initially organized the Upper Colorado River Saltcedar Control Task Force in February 2001 to manage the use of chemical herbicides and more recently the use of biological control.

Although researchers are using aerial sprays with herbicides as well as controlled burning to reduce saltcedar, its natural enemy, the saltcedar leaf beetle, or *Diorhabda elongata*, offers a low-cost, sustainable alternative. If established over time, a sufficient population of saltcedar beetles has the potential to shrink the saltcedar population, producing significant water savings, researchers said.

Dr. Jack DeLoach, an entomologist with the U.S. Department of Agriculture's Agricultural Research Service in Temple, has researched biological control of saltcedar for 20 years and has determined the saltcedar beetle feeds only on saltcedar and will not harm native plants or trees when introduced in the western United States.

The Saltcedar Biological Control Consortium, a group of federal and state agencies, private interests and universities, was formed by DeLoach in November 1998 to coordinate and promote the biological control program in the United States. He organized the Texas, New Mexico, Mexico Section of the consortium in March 2005 to coordinate research efforts in these areas. The Agricultural Research Service is the lead agency responsible for identifying and testing insects approved for biological control of saltcedar.

Consortium scientists are conducting laboratory and field research, which includes beetle taxonomy and behavior, host range, reproduction and overwintering success, climate-matching, release methods, saltcedar growth modeling and beetle dispersal. They are also measuring the impact of beetle feeding on plant survival and conducting remote sensing and vegetation and bird surveys.

The saltcedar beetle feeds on the invasive, water-thirsty saltcedar tree in the western United States. Researchers in Texas have identified a biotype from Greece that survives in west and northern Texas. Photos courtesy of USDA-Agricultural Research Service.

DeLoach, Dr. Jack Moran, ARS entomologist, and Dr. Allen Knutson, professor and Extension entomologist at the Texas Agricultural Research and Extension Center at Dallas, have successfully established field nursery sites for rearing saltcedar beetles from Greece in the Upper Colorado River watershed, near Big Spring, which has more than 22,000 acres of saltcedar.

After saltcedar beetles from China and Kazakhstan failed to survive in Texas, the research group imported a specific ecotype from Crete, Greece, which has overwintered successfully for three years. "It was a challenge to find a strain adapted to Texas," Knutson said.

In 2004, the Crete beetle population was established in the field at Big Spring in cooperation with Okla Thornton, wildlife biologist for the Colorado River Municipal Water District. The beetles defoliated three trees.

"In 2005, this population increased dramatically and defoliated about 200 trees and dispersed across about two acres," Knutson said, whose research is funded in part by a Texas Water Resources Institute's Soil and Water Research Grant. A total of 5,200 beetles were released at 18 new sites in 2005.

Dr. Joaquin Sanabria, assistant research scientist at Blackland Research and Extension Center in Temple, is modeling the dispersal of the saltcedar beetle and the defoliation it causes at Big Spring as part of a Texas State Soil and Water Conservation Board (TSSWCB) project.

"At this time we are using two types of models on the Big Spring data, diffusion (physically based) and statistical models," Sanabria said. The models will help determine how far and how fast the beetle moves and what factors affect the dispersal and the severity of the salt cedar defoliation by the beetle, he said.

Through the Big Spring project, Knutson and DeLoach said they have developed several recommen-

dations for releasing and establishing beetles at new locations. The best way to establish nursery sites, Knutson said, is to cut the saltcedar down to 2 to 3 feet above the ground during the winter, so beetles can feed on fresh new shoots the following spring. In addition, beetles should be released at new sites as early in the spring as possible.

DeLoach said through the scientific studies they hope they can get a higher percentage of beetles established at future sites.

Jeremy Hudgeons, Knutson's graduate student in Texas A&M's Department of Entomology, has discovered that repeated defoliation by the beetles may cause the tree to use up its stored energy to grow new leaves, causing a "slow starvation" of the tree and eventually death.

Knutson said the project is now moving from the research stage to the implementation stage.

During the spring and summer of 2006, the team will work with Extension agents to distribute the beetles to selected sites in six counties along the Upper Colorado River. "The goal is to establish a nursery site in each county that would serve as a source of beetles for distribution to ranchers and land owners within that county," he said. "Currently, beetles are in very short supply so we need to increase their numbers for re-distribution to new sites."

"If the beetles overwinter well, they could disperse naturally and defoliate over 100 to 200 acres at Big Spring this summer," DeLoach predicted.

Knutson said another objective is to integrate biological control with the herbicide spray programs for saltcedar control on the Pecos and Colorado rivers. Through the Pecos River Ecosystem Project, approximately 75 percent of saltcedar on the river in Texas has been treated with herbicides, according to Charles Hart, professor and Extension range

Researchers hope these saltcedar trees, defoliated by a saltcedar beetle, after repeated defoliation, will die. Saltcedar trees, introduced in the United States in the 1800s, take water away from native plants, deposit salt in the soil and increases the risk of wildfires.

specialist in Fort Stockton.

Knutson and DeLoach are working with Dr. Mark Muegge, associate professor and Extension entomologist at the Texas A&M Extension Center in Fort Stockton, to establish beetles along the Pecos River. "We have two sites on the Pecos River where we will evaluate the use of beetles for controlling re-growth from trees not entirely killed by herbicide and for suppressing saltcedar in areas where herbicide could not be used," Knutson said. "There is concern that these pockets of surviving trees will serve as sources of seeds that will be carried downriver and re-infest areas where saltcedar has been killed by herbicide."

Farther north at Lake Meredith on the Canadian River, researchers have successfully established saltcedar beetles imported from Posidi in northern Greece, Dr. Jerry Michels with The Texas A&M University System Agricultural Research and Extension Center at Amarillo, said.

Michels, professor of entomology, and Vanessa Carney, research associate, are working with the U. S. Department of Interior's Bureau of Reclamation, National Parks Service and the Canadian River Municipal Water Authority to establish the saltcedar beetle at Lake Meredith, which has approximately 6,000 acres of saltcedar.

In the spring of 2004, these researchers introduced about 2,000 beetle eggs into contained tents. The eggs produced about 150 adults in the spring. This initial population grew to over 1,500 by August 2004. They opened the tents in the fall to allow for natural establishment of the population.

"By the end of August 2005, we had probably thousands of beetles successfully established at significant distances from the initial release site," Michels said, including some at one kilometer from the original release site. The beetles seem to be following the saltcedar infestations to the northeast, along the course of the Canadian River, rather than concentrating in specific areas, he said.

Michels and his team are currently monitoring the beetles as they break dormancy and begin to feed again on saltcedar. "We are hoping that this summer will be a really good year and then we will move them around to different areas," Michels said, whose project was partially funded by a TWRI grant in 2004 and 2005.

"If the beetles increase at Lake Meredith as they have in other areas of the United States, we can expect significant defoliation to begin in one to three years," Michels said, adding that these estimates are based on good climate conditions for the beetles.

The Lake Meredith team is also monitoring 40 sentinel saltcedar trees, looking at their growth, seed production, soil type, percent ground cover, vegetative abundance and types of woody plants around these saltcedar. The scientists will use this data as a baseline in a comparative study to assess both the saltcedar's impact and extent in the area, along with the efficacy of the biocontrol agents in the future.

Michels said that saltcedar changes the soil structure, adding more salinity. When saltcedar is controlled, "we hope we get more favorable vegetation," he said.

DeLoach said he and Tyrus Fain of the Rio Grande Institute in Marathon and Patrick Moran of ARS in Weslaco are hoping to work with Mexico to control saltcedar along the Rio Grande, which has the highest concentration of saltcedar in Texas. DeLoach and Moran are currently doing open-field research at a release site near Kingsville on a related tree, athel (also an exotic *Tamarix*), grown in Mexico as an ornamental tree and a windbreak, to determine the amount of damage the saltcedar beetle may have on it.

The predicted water savings from controlling saltcedar could be enormous. Texas A&M University studies have shown that along the upper portion of the Pecos River, where there are an estimated 14,000 acres of saltcedar, an acre of dense saltcedar consumes an estimated 1 million gallons or about 3 to 4 feet of water per acre each year. With more than 22,000 acres of saltcedar in the Colorado River basin, the Colorado River Municipal Water District estimates that saltcedar consumes enough water in the district to meet the annual needs of the city of Odessa.

Complete eradication of the saltcedar is not the goal; reaching a balance is.

"We want the beetle and the plants to stay at low numbers," DeLoach said. Once populations of the beetles are established, they are self-sustaining and no additional releases, and hopefully no additional controls, will be necessary.

Getting the saltcedar back into the right balance is going to take time.

"We estimate that four to five years of repeated defoliation by beetles will be necessary to kill small saltcedar trees," Knutson said, "but, in the meantime, the saltcedar is not using as much water because it doesn't have the full canopy of leaves and other plants begin to grow in its place."

DeLoach agreed, saying that even without the death of the tree, the saltcedar uses only 5 percent to 10 percent of the water it previously used before beetle defoliation.

DeLoach predicted that saltcedar could be under control in Texas in five years "if everything goes well," referring to a site in Nevada where 50,000 to 60,000 acres are successfully in control five years after the first release. "All of this (defoliation after initial introduction) is at no cost and no damage to non-targeted plants," he said. "We think long-term, it's the way to go."

"No single person can do this research and implement biological control given the size of the saltcedar problem in Texas," Knutson said. "Fortunately we have a lot of people from many different agencies and organizations working together to accomplish this goal."

For more information on the TWRI-sponsored research, visit http://twri.tamu.edu/soil_water_grants/2005. A *Saltcedar Control* brochure is available at http://tcebookstore.org/tmppdfs/9714005-L5444.pdf.

An overview of the entire program is available as *Saltcedar Biological Control Consortium: Texas, New Mexico, Mexico Section, First (Organizational) Meeting: Minutes, Reviews of Research, Resource Guide* at http://bc4weeds.tamu.edu/weeds/rangeland/saltcedar.html#literature.

Saltcedar trees have been defoliated by its natural predator, saltcedar beetle from Crete, Greece, in fields near Big Spring.