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Biological Control of Saltcedar

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Saltcedar is an invasive shrub or small tree that causes serious economic and environmental problems in Texas. Though it can be controlled with herbicides and by mechanical means, these methods are expensive, and desirable plants are sometimes harmed.

Biological control is the use of living organisms to suppress saltcedar. Four species of leaf beetles that feed only on species of saltcedars have been imported and released in the US for the biological control of saltcedars. Though this control method is slow, it is inexpensive, largely self-sustaining and targets only saltcedar species, leaving other plants unharmed.

More than 350 species of insects feed on saltcedar in central Asia and southern Europe. However, when this tree was brought to the United States in the 1830s, almost all of these natural enemies were left behind. As a result, saltcedars in the United States have been able to grow unchecked. Using biological control to suppress saltcedar involves restoring a natural balance by introducing insects that feed only on these plants.

Of the four species of leaf beetles approved for release in the United States, two are adapted to Texas conditions:

- The **Mediterranean tamarisk beetle,** *Diorhabda elongata,* was first released in 2004 in Texas. It was originally collected from the island of Crete. It is best adapted to west central Texas. (Fig. 1).

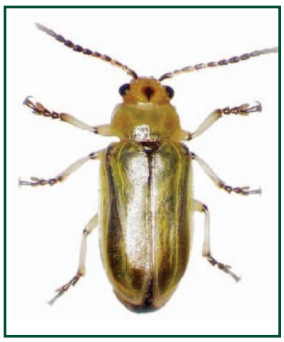

Figure 1. Mediterranean tamarisk beetle *Diorhabda elongata.*

Figure 2. Subtropical tamarisk beetle *D. sublineata.*

- The **subtropical tamarisk beetle,** *Diorhabda sublineata,* was collected in Tunisia and first released in Texas in 2009. It is best adapted to the Trans-Pecos and Rio Grande regions of Texas. (Fig. 2).

Saltcedar: A threat to streams, rivers and reservoirs

Saltcedar, or tamarisk is the common name for several species in the genus *Tamarix.* These plants were imported for use as ornamentals and windbreaks and to stabilize stream banks. Three species, however, escaped from cultivation and now grow along all of Texas' western rivers.

Invasive saltcedars have little economic value in the United States and are of little value to native wildlife; they are classified as a noxious and invasive plant by the State of Texas.

- They consume scarce groundwater water resources.

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- They slow stream flow, increasing the risk of flooding.
- They shade out native plants and forage grasses leaving less food for wildlife and livestock.

One *Tamarix* species, called athel, is not commonly invasive and is planted for shade and as a windbreak along the Rio Grande River in southwest Texas and northern Mexico.

Figure 3. Saltcedar trees defoliated by saltcedar leaf beetles.

How beetles control saltcedar

Adult saltcedar leaf beetles and larvae eat saltcedar leaves and tender bark, but the larvae do most of the damage. They eat the entire leaf or chew away only the surface tissue or tender bark, causing the rest of the foliage to die, turn tan and fall from the tree (Fig. 3).

Once the leaves have been destroyed, the tree must use energy reserves in the roots to survive and regrow leaves. When the new leaves appear, the leaf beetles return, consume them, and force the tree to again regrow leaves which further depletes its energy reserves.

Over several years, this cycle kills branches, thins canopies and slowly starves the saltcedar to death (Fig. 4). As trees are defoliated beginning in the spring, beetles move to nearby green trees and sometimes fly to trees miles away. By fall, brown and defoliated trees can extend for miles along saltcedar-infested rivers (Fig. 5). After 5 years of defoliation by leaf beetles, the saltcedar canopy at a study site in Big Spring, TX decreased by 85 to 95 percent, and about 20 percent of the trees were dead.

Biological control does not kill saltcedar trees quickly, but its benefits begin almost immediately.

- Trees that have been defoliated (leaves are killed or consumed) by beetles use less water.
- Sunlight can again reach the soil beneath defoliated trees and encourage grasses and other plants to grow.
- Defoliated trees do not produce flowers and seeds. Each year small- to medium-sized trees produce about 600,000 seeds; large, healthy

Figure 4. Saltcedar tree with branch dieback in the spring following beetle attack the previous year.

Figure 5. Saltcedar trees defoliated by leaf beetles along the Pecos River. October, 2010.

trees produce up to 100 million seeds, which are spread by wind and water. By reducing seed production, beetles decrease the rate at which saltcedar spreads to new sites.

Like other control methods, biological control will never eradicate saltcedar, and its effectiveness will vary according to site characteristics and weather.

Risk to crops and other plants

Research studies by the United States Department of Agriculture (USDA) –Agricultural Research Service (ARS) demonstrate that saltcedar leaf beetles are very unlikely to injure any plant other than *Tamarix* species, which includes saltcedars and athel. Like the boll weevil, salcedar leaf beetles feed only on one type of plant. Studies by ARS demonstrate that saltcedar leaf beetles can survive only on *Tamarix* species; without saltcedar or athel, these beetles and their larvae die of starvation. Saltcedar leaf beetles have been in Big Spring, Texas, since 2004 and have been released at many additional sites. Since their release, there have been no reports of them feeding on any plant other than saltcedars and athel.

All biological control programs are regulated under the National Environmental Policy Act and the U. S. Department of Agriculture-Animal and Plant Health Inspection Service (USDA–APHIS). Exotic insects can be imported and released in the United States only if they have been approved by APHIS and the participating states.

Leaf beetle and Athel trees

One drawback of releasing the saltcedar leaf beetle is that it will attack athel trees, a different species of saltcedar. Athel, *Tamarix aphylla,* grows only along the Rio Grande River in south Texas and in northern Mexico. It is planted for shade and as a windbreak.

Athel is not a target of biological control, and though beetles prefer to feed on other species of saltcedar, they will feed on athel when beetle numbers are high. When large populations of leaf beetles develop on saltcedar, they may "spill over" and defoliate athel trees. Although athel trees will regrow leaves, repeated defoliation may cause branch dieback on large trees and may kill small trees.

For information on protecting athel trees from leaf beetle feeding, see Texas AgriLife Extension Service publication E-290 *Controlling Saltcedar Leaf Beetle on Athel,* available at *https://agrilifebookstore.org.*

Saltcedar leaf beetle: identification and life cycle

Landowners who are implementing a biological control program must know how to identify and monitor saltcedar leaf beetle populations on their property.

Saltcedar leaf beetles are about ¼ inch long and light yellow to brownish green (Fig. 6). Two dark stripes run the length of each wing cover. These stripes are very faint in the Mediterranean tamarisk beetle and are darker in the subtropical tamarisk beetle.

Figure 6. Adult.

The eggs are oval, cream to yellow, and laid in clusters (Fig. 7). Each cluster contains up to 20 eggs that are glued to the foliage. The female deposits an average of 280 eggs during a 16- to 20-day period.

Figure 7. Egg mass.

Larvae hatch from eggs in about 5 days. Small larvae are black; larger larvae have a light yellow stripe along each side of the body (Fig. 8). These larvae feed on the leaves and tender bark for about 12 to 14 days. Larvae grow to about ⅓ inch long, then crawl or drop to the ground where they enter the pupal stage.

Figure 8. Larva.

Pupae are yellow and about ¼ inch long (Fig. 9). Some are

Figure 9. Pupae.

surrounded by bits of dried leaves glued together for shelter. The pupa is especially vulnerable to drowning during heavy rains and is fed upon by ants and other predators. After 5 to 6 days, the pupa transforms into an adult beetle.

The saltcedar beetle life cycle from egg to adult takes about 33 days during the summer and longer during spring and fall. Three to four generations are completed annually in central Texas and about 5 generations are completed along the Rio Grande. Beginning in September, female beetles stop depositing eggs and start building up fat reserves. Beetles overwinter under leaf litter on the soil and in bunch grass. Adults emerge in the spring (February-March) when saltcedar leaves begin to appear.

Saltcedar Biological Control Implementation Program

Because saltcedar infests such a vast area in Texas, AgriLife Extension conducts the Saltcedar Biological Control Implementation Program to collect and release beetles at new sites and thus accelerate their regional impact. This program also educates and provides technical assistance to landowners and land and water resource managers regarding saltcedar biological control. By 2010, the agency had established leaf beetle populations in the western watersheds of the Red, Brazos and Colorado Rivers and along the Pecos and Rio Grande Rivers. Partners in this effort include the USDA–ARS, Natural Resource Conservation Service, Colorado River Municipal Water District, and the Texas Water Resources Institute.

Establishing new beetle populations is difficult. Release sites must be selected carefully and ants must be controlled temporarily to prevent them from preying on beetle pupae. As many as 20,000 or more beetles must be collected and released several times during the summer to establish a new population.

Where are saltcedar leaf beetles in Texas?

Mediterranean tamarisk beetles were released on Beals Creek near Big Spring in 2004; since then, they have rapidly established and their numbers have increased annually. In 2009, beetles from this site defoliated saltcedar trees along 35 miles of Beals Creek.

Beetles from the Big Spring site were collected and released in adjacent counties; others spread naturally by flying to new sites. As a result, this species is now widely distributed across Howard, Martin, Mitchell, Glasscock, and Borden Counties.

The Mediterranean tamarisk beetle was also released on the Pecos River in 2006. In 2010, beetles defoliated the saltcedar along about 11 miles of the Pecos River in Reeves and Pecos Counties. By 2010, the Mediterranean tamarisk beetle had been released at 23 sites in 16 counties within the basins

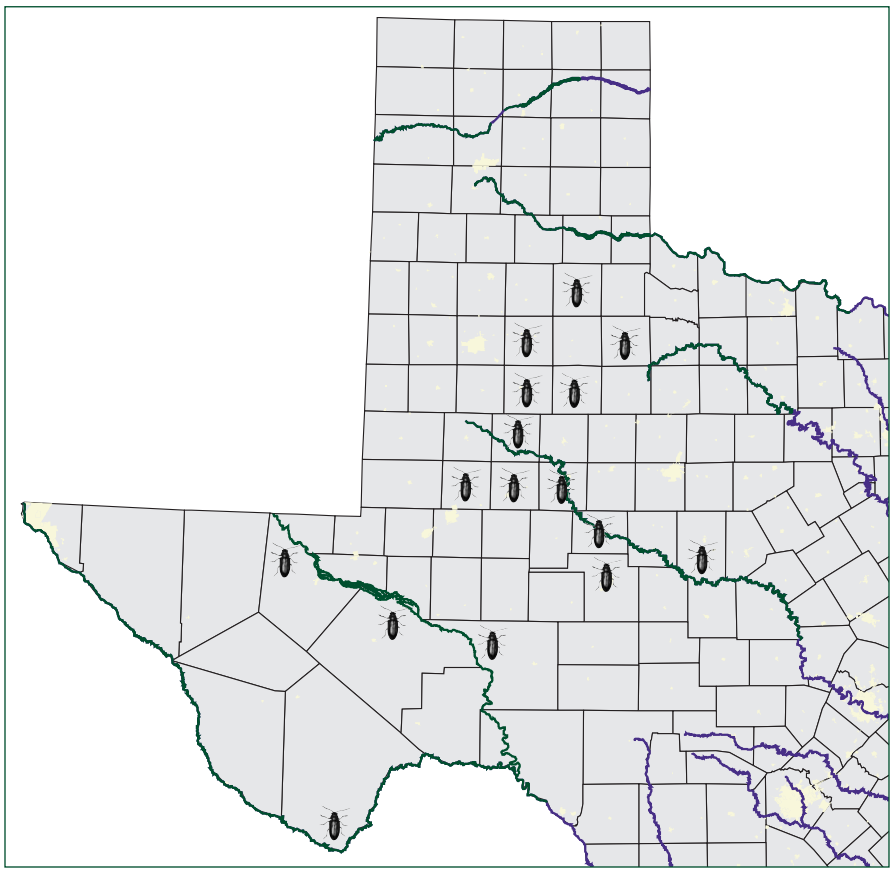

Figure 10. Map showing counties where saltcedar beetle populations have been released in Texas.

of the Red, Brazos, Colorado and Pecos Rivers (Fig. 10). These populations are expected to increase and spread naturally to new saltcedar infestations.

The subtropical tamarisk beetle was released on the Rio Grande River in 2009 and its population has grown and spread quickly. In 2010, this species defoliated saltcedar trees along 20 miles of river bank near Presidio and along 17 miles of the Rio Grande in Big Bend National Park.

Once established at a site, beetle populations are expected to be self-sustaining, and additional releases should not be necessary.

Other insects that feed on saltcedar

Other insects found on saltcedar or their damage may be confused with saltcedar beetles. These include scale insects, leafhoppers, twice-stabbed lady beetles, assassin bugs and ants.

Figure 11. Scale insects on saltcedar.

Scale insects appear as white, waxy specks on saltcedar leaves (Fig. 11). A tiny insect creates the wax scale and rests beneath it, sucking sap from the saltcedar leaf. As scale infestations grow, their feeding in late summer can cause saltcedar leaves to turn yellow and brown.

Figure 12. Leafhoppers.

The white scales on the foliage help differentiate scale damage from that of leaf beetles. Also, leaves damaged by leaf beetles are easily pulled and fall from the branches, whereas scale-damaged leaves are firmly attached.

The **leafhopper,** *Opsius stactogalus,* is ⅛ inch long, bright green and wedged shaped (Fig. 12). It feeds only on saltcedar and flies very quickly when disturbed. Leafhoppers suck sap from saltcedar stems and can cause the leaves to turn yellow-brown and fall from the tree. Leafhopper injury to leaves can appear similar to leaf beetle feeding.

Twice-stabbed lady beetles, *Chilocorus stigma,* are small, oval-shaped and shiny-black and get their name from their two red spots (Fig. 13).

Figure 13. Lady beetle larva feeding.

Twice-stabbed lady beetles are common on saltcedar, and both adults and larvae feed on scale insects. The larve are dark and spiny. Once the larvae have completed feeding, they fasten themselves to a branch and become a spiny pupa. When the beetle emerges, the spiny pupal skins remain attached to the tree. Lady beetle infestations are common during outbreaks of the scale insect.

Assassin bugs (Fig. 14) are about ½ inch long, slender, slow-moving and yellow-green to red and brown. They have long legs and antennae and the head is narrow. An assassin bug uses its stout beak to stab and feed on other insects, including leafhoppers and saltcedar beetles. It can inflict a painful bite and should not be handled.

Figure 14. Assassin bug eating saltcedar leaf beetle.

Ants. Many species of native ants and the red imported fire ant feed on saltcedar beetle larvae and pupae on the ground. A large black ant, Formica species, sometimes forages on saltcedar trees but feeds on leafhopper and treehopper secretions and probably does not attack saltcedar beetles.

Other resources

- *http://bc4weeds.tamu.edu/*

The following are available from *http://agrilife bookstore.org:*

- *Saltcedar Biology and Management,* L-5440
- *Controlling Saltcedar Leaf Beetle on Athel,* E-290
- *How to Put a Halt to Saltcedar,* L-5398

Photo credits

James Tracy, ARS (Figs. 1, 2, 7 and 8); Mark Muegge (Figs. 5, 6, 12 and 14); Allen Knutson (Figs. 3, 4, 9 and 11); Louis Tedders (Fig. 13)

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