



Biological Control of Musk Thistle in Texas

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The musk thistle, a member of the *Carduus nutans* L. (Compositae) complex, is a noxious weed in pastures, rangelands, croplands, along state highways and even in urban areas in many parts of the U.S. It was introduced from Eurasia in about 1853, and is now found in more than 40 states. Chemical control, although effective, is not usually permanent because the thistle produces large numbers of seeds, the seeds have a long life, the plant com-



Musk thistle has become a common weed along roadsides and in overgrazed pastures.

petes well with other plants and it has no natural enemies in this country. Musk thistle has become a problem weed in several counties in the Texas Hill Country. It also occurs in several other parts of the state but has not been documented.

Musk thistles are annuals, winter annuals or biennials. In Texas, seeds produced in summer germinate to form young rosettes in the fall. The rosettes over-winter and resume development in spring. Stems elongate from March to April and the plant flowers in April and May. Determinate blooming continues through June, with seeds dropping in June and July.

Musk thistle can be controlled mechanically, chemically with herbicides, and biologically using natural enemies that feed on the plant. The advantages of a biological control program are:

- It is inexpensive;
- It poses no threat to non-target organisms;
- Once established, natural enemies move into adjoining infested areas;
- Little additional effort is required once a natural enemy is established, while other controls must be applied periodically; and
- It does not threaten water quality, even along streams.

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Musk thistle plants may grow to 5 feet tall; they produce numerous seeds.

A Weevil for Biological Control

The first insect released in North America for musk thistle control is *Rhinocyllus conicus* Froelich. A native of southern and central Europe, this weevil attacks the thistle's flower buds. This thistle head weevil was approved by the U.S. Department of Agriculture Animal and Plant Health Inspection Service (APHIS) for release in North America in 1968 after research indicated that it would not attack non-target plants.

Adult *R. conicus* are dark brown in color and 10 to 15 mm long. Each female lays about 100 to 200 eggs on the bracts of thistle heads. Eggs hatch in 6 to 9 days and newly hatched larvae feed through the bracts into the receptacle. Developing larvae feed on the receptacle and the young seeds, reducing or preventing the production of viable seeds. There are four larval growth stages which last about 4 to 6 weeks. Pupation occurs in a black oval cell inside the thistle head, and requires another 7 to 10 days. Adults emerge from seed heads in July and August in more northern locations and in June and July in Texas. They remain inactive during the summer and then hibernate through the winter. The following spring adults emerge from winter shelter to lay eggs on the developing buds. There is one adult generation per year.

Impact of Weevils

In 1987 the first weevils were released in Texas, near Kerrville. They became established and have dispersed at least 1.5 miles from the release site. Since then, weevils have been released at other Hill Country sites.

Research in other states shows a 50 to 05 percent reduction in numbers of thistles after weevils

have become established. The decline in thistle populations is gradual over several years, and some resurgence of the weed may take place. Resurgence of thistles can be caused by dumping soil containing seeds onto a site, exposing soil containing thistle seeds during tillage, overgrazing that creates bare patches of soil where thistle seeds can germinate, or temperature fluctuations during the winter which kill many over-wintering weevils. Cool spring temperatures also inhibit weevil activity. Resurgence of thistles is temporary, however, and established weevils eventually regain control.

R. conicus has been highly successful in controlling musk thistle after an establishment period of 5 to 6 years. In locations where the weevils can multiply rapidly, a dramatic decline in musk thistle may be possible in as little as 2 to 3 years. This successful biological control of musk thistle is partly due to the good synchronization of plant growth and insect activity.



Adult thistle head weevils feed on the plant and lay eggs in the thistle head.

Combined Control Procedures

Research shows that maintaining a good stand of an appropriate grass (to compete with thistles) increases the effectiveness of the thistle head weevil.

Also, the herbicide 2,4-D, commonly used for thistle control, does not directly harm the weevils and could be used in conjunction with biological control.

Although the use of biological agents alone can be highly successful, combining biological control with plant competition and herbicides may enhance the control program and reduce the weed population at a faster rate.

Biological Control Plan

Biological control of musk thistle can best be implemented by taking the following steps:

1. Select release sites. An appropriate site is any dense patch of thistles that will not be disturbed for 3 to 5 years after the release. Select a site where cattle will not be grazing because cattle interfere with thistle head weevil activity.

2. Obtain starter colonies of thistle head weevils. Spring emerging *R. conicus* can be collected at established sites in April before they complete egg laying. Use a beating sheet and an aspirator to collect adult weevils as they feed on thistles and lay eggs in the heads. Contact your county Extension agent or the Extension entomologists for information about local release and establishment efforts. Thistle head weevils are also available from a few commercial sources.

3. When weevils are received, keep them in a cool place (less than 80 degrees F) because high temperatures will kill them. Paper cartons with tight lids are appropriate for holding and transporting weevils. Release them as soon as possible.

4. Release a minimum of 300 to 500 weevils per site depending on the size of the thistle infestation. Starter colonies are best released when thistles have elongated and buds have formed. Release adult weevils among dense thistle patches away



Thistle head weevil larvae feed inside the thistle head and destroy the seed.

from traffic and in non-windy areas near trees or shelter. Release weevils in the evening, not during the hottest time of the day. For widespread thistle infestations, release weevils at a number of sites.

5. If herbicides are to be used, they should be sprayed on the thistle rosettes before weevils are released. Leave a small area unsprayed and release the weevils there.

6. Monitor weevil establishment. Make additional releases only if weevils fail to become established.

Along with biological control:

1. Establish a good stand of an adapted grass.
2. Avoid overgrazing or unnecessary plowing that would expose barren land.
3. Cut small infestations of thistles before they produce seed.

Photographs by J.W. Stewart and J.A. Jackman.

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