

# Controlling Musk Thistle With an Introduced Weevil

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## Origin and Distribution

The musk thistle, *Carduus thoermeri*\* Weinmann, is a species native to Europe. Accidentally introduced in the United States in the late 1800s, the musk thistle has multiplied rapidly throughout the north central region, including the Plains states. The first report of an infestation in Missouri came from Palmyra (Marion County) in 1941. Musk thistle was not recognized as a serious weed problem until about 1960 when it became abundant in pastures, primarily in the northwest and south central part of the state. Its proliferation then, and now (Figure 1), is the result of airborne seed dissemination and by the movement of hay contaminated with thistle seeds to uninfested areas.

## Characteristics

Like most of its close relatives, musk thistle is overgrown with exceedingly sharp spines. They grow along the leaf margins, and extend down the branches and stems (Figure 2). The leaves are deeply and irregularly indented, have a smooth waxy surface or may be somewhat hairy and are a grayish-green along the outer edge with a lighter green midrib area. Plant height varies from 2 to 6 or more feet.

The flowers, which are a deep, reddish-pink, large and solitary, are delicately beautiful. Each flower is located at the tip of a long stem or branch which bends or nods and twists as the flower increases in size and matures. Blooming starts in early summer, but buds continue to develop and bloom until mid or late August.

The seed of musk thistle is airborne and consequently can be carried by wind for many miles from the site where it originated. Obviously, weed species spread by airborne seeds are difficult to control. Musk thistles produce an

\*Previously published as *Carduus nutans* L.

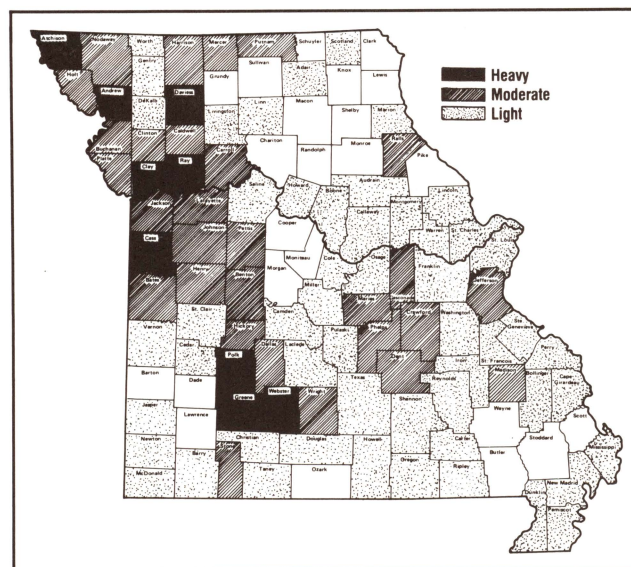


Figure 1. The distribution of musk thistle in 1981 in Missouri.

average of 10,000 seeds per plant but under favorable conditions can produce considerably more.

Musk thistle is generally classed as a biennial. This means that two growing seasons are required for a plant to mature. The plant dies after seed has matured. After seed germination, a rosette (Figure 3) develops and increases in size throughout the growing season. As low temperatures kill the rosette leaves, a fleshy tap root develops which overwinters. The following spring new leaves originate from crown buds and a shoot develops which branches and grows rapidly upward. Flower buds appear, and the plant starts to bloom from May in southern Missouri to early June in northern areas.



**Figure 2. Musk thistle was accidentally introduced in the United States in the late 1800s.**



**Figure 3. After seed germination, a rosette develops.**

Musk thistle is not a serious weed problem in crops requiring a spring seedbed preparation. Tillage will easily eradicate any rosettes established during the preceding summer or fall. However, musk thistle can be a problem in fall-planted grains, alfalfa or clover if conditions are favorable for seedling establishments and winter survival. The weed is found most commonly along roadsides, railroad rights-of-way, fence borders, wastelands and in pastures. Check inaccessible locations along fence rows, ditch banks and in waste areas periodically for musk thistles. Newly established thistles in the rosette stage are inconspicuous and may not be observed until they bloom the following year.

The economic impact of musk thistles is greatest in pastures and rangelands where the weed competes with



**Figure 4. The economic impact of musk thistles is greatest in pastures and rangelands.**

desirable forage plants for moisture, nutrients, light and space. Livestock probably will not graze infested areas (Figure 4) but will occasionally feed on the flower heads.

## Chemical Control

Chemical control can be effective if properly timed. Pictoram (Tordon) and 2,4-D are recommended control agents. Apply herbicides to the musk thistle rosettes either in the fall or spring. One problem with herbicides is that applications are often made after the plant bolts, too late for good control. Although treated plants may appear to be injured, with much wilting of leaves and twisting of stems, the plants will nevertheless flower and produce viable seed. Consequently, for optimum control, you must apply herbicides while musk thistles are in the rosette stage or pre-bud stage when plants are most vulnerable.

Infestations of musk thistle often occur in relatively inaccessible areas and may escape notice until after flowering. Farmers are usually quite busy in the spring and may postpone chemical application until they are caught up with field work. Since musk thistle seeds are long-lived in the soil, plants must be prevented from producing seed until new rosettes are no longer produced. The effective eradication of this weed pest from an infested pasture requires dedication and perseverance because of the longevity and viability of seeds (5-7 years) in the soil.

## Biological Control

Specific natural enemies can aid in regulating the spread of musk thistles. *Rhinocyllus conicus* Froelich, commonly referred to as the musk thistle weevil (Figure 5), is one such natural enemy that feeds on the seeds in the developing flower heads. A native to Europe, musk thistle weevils were studied extensively to insure that the weevil would not cause damage to any economic plants before its 1968 introduction in Canada. Releases have since been made in Virginia in 1969, Montana in 1969 and 1973, and later into most states with infestations of musk thistle.



**Figure 12. Incompletely filled flower heads indicate weevil infestation.**

said to have only one generation per year in Missouri. However, from observation in Webster County, a few of the new emergents may not be ready to overwinter and instead will mate and lay more eggs, thus producing to a partial second generation in late August.

## Summary

- ✔ Overwintering adults become active in late April and early May while musk thistles are in the rosette stage or just starting to bolt.
- ✔ Weevils should be collected in early May to mid May for distribution to new areas.
- ✔ Overwintering female weevils lay eggs on the bracts of the flower heads from mid May through June.



**Figure 13. This broken flower head reveals full-grown larvae.**

- ✔ The life cycle of the weevil, from egg to adult, ranges from 39-52 days.
- ✔ By the end of July in southern Missouri, most first generation adults have emerged to seek overwintering sites.
- ✔ In southern Missouri, musk thistle weevils may produce a partial second generation.

The full impact of the musk thistle weevil in regulating or suppressing populations of the thistle will not be forthcoming until the weevil is established throughout the state or at least until it reaches a saturation point within a county. In Missouri, it is estimated that this process will take 15 to 25 years. The cooperative distribution program is intended to speed up this time to achieve maximum return in the shortest period of time.

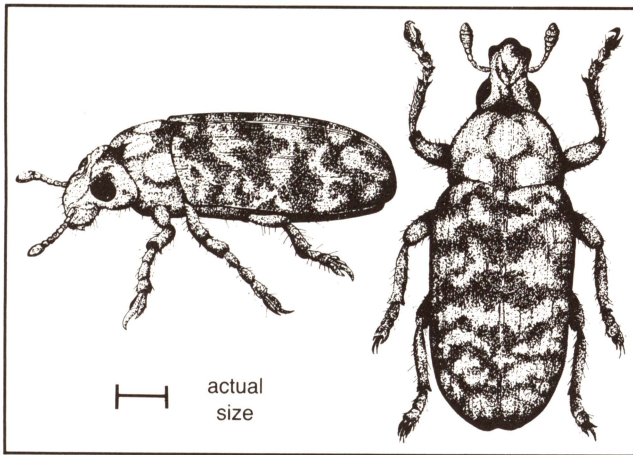


Figure 5. Adult musk thistle weevils.



Figure 7. By mid May, most musk thistles have budded or flowered.

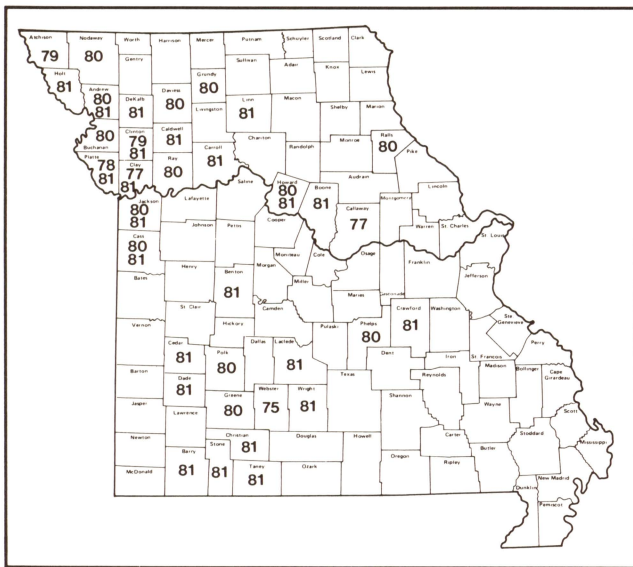


Figure 6. The locations of musk thistle weevil releases as of 1981. The number indicates year of release.

In 1975 Ben Puttler, an entomologist with the USDA S/E ARS Biological Control of Insects Research Laboratory in Columbia, Missouri, released 490 musk thistle weevils near Marshfield in Webster County. Since then, the weevils have been found a distance of 11 miles from the 5-acre pasture where the original release was made. Extensive research has been conducted at the release site to determine the effects of the weevil on the musk thistle population. Preliminary indications show that the weevil can contribute to a reduction in numbers of thistles.

The importation and release of natural enemies offers an alternative way to reduce infestations of musk thistles. The advantages of this biological control program are:

- It is inexpensive.
- It poses no threat to non-target organisms.
- Once established, weevils will move into adjoining infested areas.
- It requires little additional effort once the weevil is

established, while chemical controls must be periodically applied.

## Collection and Distribution

Since 1980, an extension integrated pest management program called Musk Thistle Biological Control has coordinated the collection and distribution of musk thistle weevils to infested areas of Missouri. This has been a cooperative effort, involving personnel from USDA, Missouri Division of Plant Industries and the University of Missouri Extension Service. In 1981, 13,000 weevils were collected within a radius of 2 miles from the 1975 release site. These were recolonized at 26 locations (500 weevils per release) in 23 counties. The locations of weevil releases since 1975 are shown in Figure 6.

The long-term plan is to use new release sites as collection sites for musk thistle weevils four to five years after establishment. This should be enough time for numbers to increase substantially. When these new sites are opened for collection, it should be possible for individual farmers and ranchers to collect weevils for release on their own land. This will greatly ease the rapid establishment of musk thistle weevils throughout the state.

## Biology of the Musk Thistle Weevil

Because the introduction of musk thistle weevils in Missouri is a relatively new concept, there is little available information on the biology of the insect and its relationship to the host plant.

Musk thistle weevils overwinter as adults. In early spring, the adults can be found crawling or feeding on the leaves of the musk thistle rosettes. Mating takes place shortly thereafter, and by the time musk thistles begin to bolt,



**Figure 8. Weevils lay eggs on the bracts of developing flowers.**



**Figure 10. Larvae may tunnel into the stems.**



**Figure 11. Tunneling causes flower heads to turn brown.**



**Figure 9. This cross section of a flower shows larval tunnels.**

sending up flower heads, the females are ready to lay eggs. In Webster County, collections are generally made during the first week of May when the plants are still in the rosette stage or starting to bolt. These events will occur slightly later in northern parts of the state.

By mid May, most musk thistles have begun flowering (Figure 7). Weevils lay numerous eggs on the bracts of

the developing flowers and cover each egg with a secretion of chewed plant material. This secretion gives the eggs a dirty, scale-like appearance (Figure 8). Each female lays up to 200 eggs during its lifetime.

The eggs hatch in six to eight days, and the larvae tunnel into the bracts, then work their way into the receptacle where the growing larvae feed on the developing seeds (Figure 9). As many as 40 larvae have been found per terminal head. The number of larvae per head decreases as subsequent flowers develop. In some instances larvae will tunnel into the stem just below the flower head (Figure 10), preventing normal seed development. Some flower heads will turn brown prematurely (Figure 11). This may occur either because of a high number of larvae feeding in the receptacle or from larvae feeding in the stem just below the receptacle. Incompletely filled flower heads with a necrotic area (dead plant tissue) in the center (Figure 12) are another indication that musk thistle weevils are present.

Larvae take approximately 25-30 days to complete development (Figure 13). Feeding then ceases and a resting stage called pupation occurs for another 8-14 days. The white pupa is found in an excavated cell in the receptacle where it transforms into an adult.

The adults emerge in July and seek overwintering sites in ground litter or wooded areas where they will remain dormant until the following year. For this reason, the insect is

