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Musk Thistle

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Origin and Distribution

Musk thistle (*Carduus nutans* L.) is an aggressive weed that infests pasture and rangeland. It is native to Europe but was introduced accidentally into the eastern United States during the mid to late 1800s. Because of its prolific seed production and lack of natural enemies, it spread rapidly throughout much of North America. It is a weed of considerable economic importance in forage-producing areas and has been declared a noxious weed in many states.

Characteristics

Musk thistle plants grow from two to more than six feet in height (Figure 1). Flower color varies from purple to a deep reddish-pink. Each flower head is located at the tip of a long stem or branch. The large flowers commonly grow to two inches in diameter, causing the stems to bend or nod over as the flower matures. Musk thistle is also called nodding thistle.

Leaves, stems and branches of musk thistle plants are covered with sharp spines. The long leaves are deeply and irregularly indented. They have a smooth, waxy surface with a light-colored grayish-green margin and a lighter green mid-rib area (Figure 2).

Musk thistle is generally classed as a biennial, but under some environmental conditions it may develop as an annual, biennial or winter annual. Musk thistle reproduces and spreads only by seed. A musk thistle plant produces an average of 3,500 seeds, but large plants can produce up to 10,000. Seeds are usually disseminated by wind but can also be spread in contaminated hay or on farm equipment. Although some seed may be carried by wind currents for several miles, most fall within 100 yards of the site of production.

Figure 1. Flowering musk thistle plants.

Figure 2. Musk thistle rosette.

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Seeds generally germinate in the fall or spring but may germinate any time moisture is sufficient. Most seeds germinate the first year, but some dormant musk thistle seeds can remain viable in the soil for as long as five to seven years.

After seed germination, the plant develops a fleshy taproot with a rosette of leaves. The plant overwinters as a rosette. Seed stalks are formed in spring as the plant starts to bolt, followed by flowering which normally begins in early to mid-May (Figure 2A). Occasionally some plants can be found blooming through August. The plant dies after all its seeds mature.

Figure 2A. Bolted musk thistle beginning to flower.

Areas of Infestation

Musk thistle is commonly found along roadsides, railroad rights-of-way, fence borders, unimproved areas and in pastures and hay meadows. Newly established thistle rosettes are inconspicuous and may escape notice until they bolt and bloom. Diligent scouting should be done during fall and spring to locate infestations. Musk thistle can be a problem in fall-planted grains and forages but is not a serious weed problem in crops requiring spring seedbed preparation. Spring tillage eliminates established thistle rosettes before they produce seed.

The economic impact of musk thistle is greatest in pastures and rangeland. Moderate infestations of musk thistle have been reported to reduce pasture yields an average of 23 percent. Livestock won't graze around musk thistle plants or in heavily infested areas.

Integrated Control Tactics for Management

Chemical Control

Herbicides should be applied when the musk thistles are in the rosette stage during fall or early spring. Applications made after the plants begin to flower are too late to provide adequate control. Plants treated with herbicide after the onset of flowering may still produce viable seed.

Detailed information on recommended herbicides for thistle control is listed in the publications MP44, *Recommended Chemicals for Weed and Brush Control,* and MP522, *Pasture Weed Control in Arkansas,* which are available through the Cooperative Extension Service website at www.uaex.uada.edu.

Mechanical Control

Mowing can reduce the amount of seed produced, but often enough stem remains intact with the crown to produce flowers and seed. Mowing within two days after the terminal flower head blooms effectively inhibits seed production and reduces some branching of the remaining plant stems. Since thistles in a field do not all mature uniformly, mowing will usually need to be repeated to prevent seed production. Mowing on poor soil may actually reduce the competitive effect of other plants, thus favoring musk thistle seedling survival.

Digging and hand pulling are very effective for controlling light or scattered infestations of thistles. Plants must be cut off under the rosette or crown for effective control. If leaves or the crown bud are left attached to the root, the plant can still regrow and produce seed. Some landowners pile and burn any blooming plants they have pulled or dug in an attempt to destroy potentially viable seed.

Cultural Control

Good forage management practices are important in preventing serious musk thistle infestations. Overgrazing and improper soil fertility management reduce the vigor and competitiveness of the forage, allowing musk thistle seedlings to become established. A pasture program that makes use of soil testing and improved grazing management can greatly reduce the potential for thistles to become established.

Cutting hay before the thistles produce seed prevents on-farm and off-farm movement of seed in the hay. Refusing to buy hay that contains musk thistle seed can help prevent musk thistles from becoming established on your farm.

Biological Control

Biological control, the practice of using natural enemies, can reduce musk thistle populations and reduce the spread of musk thistles. Two species of weevils that attack musk thistle have become established in Arkansas. These weevils are the flower head weevil (*Rhinocyllus conicus* Froelich) and the rosette weevil (*Trichosirocalus horridus* Panzar). These natural enemies, native to Europe, were studied extensively to ensure they would not damage

economic plants. The flower head weevil will attack some species of native thistles.

Establishment of these weevils in Arkansas has been through both natural dispersal and releases of weevils collected from established populations in Missouri. Established populations of both weevil species have been found in 18 counties in central and north Arkansas.

The musk thistle weevils offer the benefit of reducing musk thistle populations in areas where no control measures are being made and can contribute significantly to long-term control efforts in areas where musk thistle populations are high. Control of thistles by the weevils is a slow but effective process. Missouri research has shown that the weevils can reduce the number of thistles by 50 to 95 percent over a six- to ten-year period.

Flower Head Weevil

Musk thistle flower head weevils overwinter as adults. The adults are slender and brown with scattered golden spots on the wing covers (Figure 3). They are about ¼ inch long and have a short, broad snout. In early spring, the adults emerge from overwintering sites and seek out musk thistle rosettes. Adults feed on leaves of the plants but do little damage. Females then mate and begin laying eggs when the plants start to bolt and bloom. Eggs are deposited on the bracts of the flowers. Each egg is covered with a secretion of chewed plant material, giving the eggs an easily noticeable brown, scale-like appearance (Figure 4). Each female lays an average of 100 eggs during its lifetime.

The eggs hatch in six to eight days. The larvae tunnel into the thistle flower where they feed on the developing seeds (Figure 5). Some flower heads turn brown prematurely due to the damage caused by the larvae feeding in the flower or in the stem just below the flower (Figure 6).

Larvae feed for about 25 to 30 days then begin pupation. Pupation lasts another 8 to 14 days. The pupa rests in an excavated cell in the flower, where it transforms into an adult. The adults emerge in July and seek overwintering sites under new musk thistle rosettes, ground litter or wooded areas, where they will remain dormant until the following spring. Flower head weevils usually produce only one generation per year.

Figure 3. Adult musk thistle flower head weevil.

Figure 4. Flower head weevil eggs covered with plant material.

Figure 5. Musk thistle flower infested with weevil larvae.

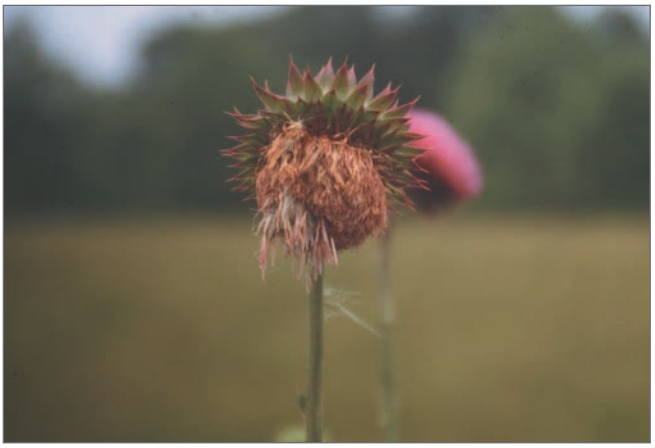


Figure 6. Flowers infested with weevil larvae turn prematurely brown.

Figure 7. Adult musk thistle rosette weevil.

Figure 8. Musk thistle rosette infested with rosette weevil larvae.

Rosette Weevil

Rosette weevils are slightly smaller than the flower head weevil with a shorter and more rounded body (Figure 7). This weevil is about ⅛ inch long and has a narrow snout. It also undergoes one generation per year. Adult weevils emerge from summer dormancy in early October. They feed on the underside of rosette leaves by puncturing leaf tissue. Females lay eggs during the fall and on warm days during the winter. These same adults overwinter and resume egg laying the following spring, up until about May 1. The eggs are usually laid in the mid-rib on the underside of rosette leaves or placed directly in the rosette crown (Figure 8). In late spring some egg laying occurs in secondary buds.

Emerging larvae burrow their way into the crown of the plant where they feed, causing damage to the growing point of the plant. Larvae complete their development then leave the rosette and pupate in the soil.

Over time, rosette weevils have the potential to provide greater thistle control than the flower head weevil since the feeding damage by the larvae can kill a rosette outright or weaken the plant so it produces fewer flower heads and, thus, less seed. However, the damage caused by the rosette weevil is complementary to that caused by the flower head weevil in controlling musk thistles because the weevils are not in competition with each other.

Integrated Control

Prevention of a musk thistle infestation is easier than eradicating a population that has become well established. New infestations of musk thistle or invading scattered plants on a farm should be eradicated before seed production occurs. A combination of methods previously described provides more effective control than reliance on any single method.

The life cycle of the musk thistle weevils in relation to the seasonal development of musk thistle is shown in Figure 9. The chart shows an integrated control program using proper timing of mechanical and chemical control practices that encourages weevil populations for effective thistle control.

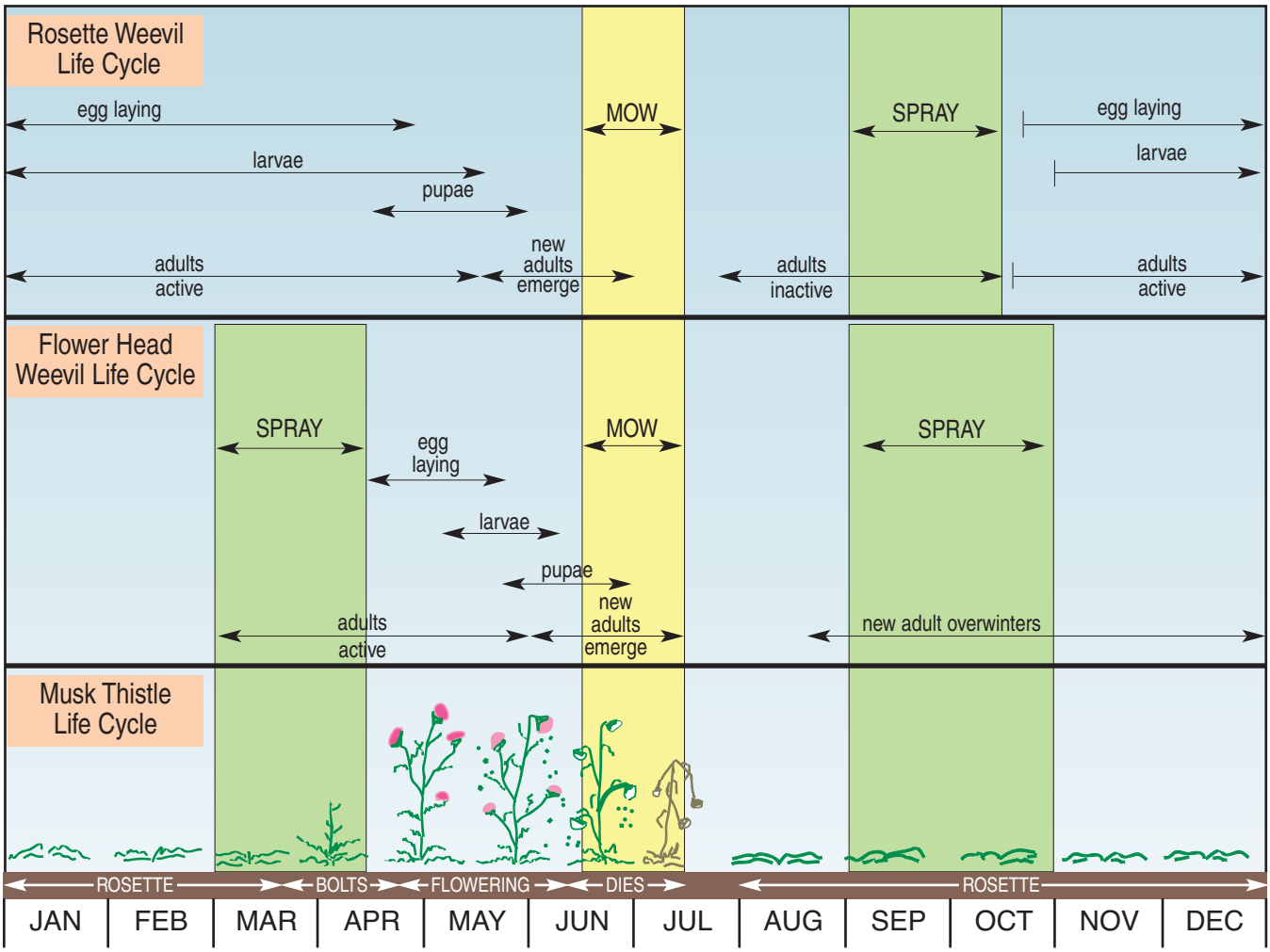
Figure 9 shows that if only the flower head weevil is established, rosettes can be sprayed with herbicide between mid-March and late April, thistles can be mowed in mid-July after the weevil completes its life cycle, and new rosettes can be sprayed from September to mid-October. If both the flower head weevil and the rosette weevil are present, herbicide applications should be limited to the fall. Spraying thistle rosettes in the spring will not only kill the thistles but will also kill the rosette weevil larvae feeding in the crowns of the thistle plants. This integrated approach allows maximum benefit from the weevils, yet allows other methods to be used for more effective thistle control.

Field Collection of Musk Thistle Weevils

Collection and Release

Musk thistle weevils are not produced commercially but may be collected from established populations and released at new sites. Flower head weevils can be collected in early to mid-May. Rosette weevils are most readily found in late May to mid-June but are more difficult to collect than the flower head weevil. Studies show spring-released adult weevils are 80 times more effective in colonizing musk thistle than adult weevils collected and released in July. Because of this, attempts to establish populations of weevils by moving flowers or plants infested with weevil larvae are generally not effective.

Figure 9. Integrated control schedule matching chemical and mechanical control with the life cycles of musk thistle and musk thistle weevils.



A minimum of 500 flower head weevils or 200 rosette weevils should be released at a new site to help ensure establishment of either weevil species. Weevils can be sprinkled over the leaves and blooms of musk thistle plants, then plant-to-plant movement of the weevils provides adequate dispersal. Written records of the release and a photograph of the site will help document the establishment and effect of the weevils over time.

Collection Techniques

Simple equipment can be used for collecting weevils. Weevils can be collected in a canvas insect sweep net, plastic trash bag or large plastic bucket. A large pan or plastic dish pan will serve to deposit weevils in for sorting. Other items include leather gloves, a three-foot-long dowel or stick, small cardboard boxes or one-pint ice cream cartons for each 500 weevils collected, large ice chest and ice packs or ice.

Musk thistle weevils are most active on sunny, warm days. It is best to collect flower head weevils when plants have bolted one to two feet. Rosette weevils will be more numerous after the plants begin to bloom. Because of some overlap of emergence and egg laying of flower head and rosette weevils, both species are sometimes collected at the same time.

To collect the weevils, bend the bolting portion of a musk thistle plant into the canvas sweep net while wearing leather gloves. Rap on the plant several times with the dowel rod. This will cause the weevils to feign death and drop into the sweep net.

After netting 50 to 100 weevils, dump the sweep net contents into the plastic wash basin for sorting. Keep the basin in the shade to prevent its surface from heating up and causing the weevils to fly off.

Storage and Transport

Adult weevils can be stored and transported in lots of up to 500 in small cardboard cartons. A thistle bud or bloom should be included in the carton, and the lid should be sealed tightly to prevent escape. Plastic cartons should not be used because they allow moisture to build up, increasing mortality. Cardboard cartons of weevils can be stored for up to a week in an insulated chest if kept dry and cool (but not frozen) with ice or ice packs. Release weevils at the new site as soon as possible after collection to enable them to deposit most of their eggs at the release site rather than in the carton.

Suggestions for Successful Weevil Releases

Studies show establishment success of musk thistle weevils is improved by following these factors:

1. The area should not be mowed or sprayed. (Rights-of-way and unimproved fields work well.)

2. Areas with heavy infestations work best (at least 1,000 musk thistle plants).

3. All the weevils should be placed in the same area (five to ten per plant).

4. Release weevils away from livestock.

5. Five to seven years may be required before weevil populations are high enough to provide significant thistle control.

Summary

- Musk thistle plants reproduce only by seed. Mature plants die after seed is produced.

- Herbicides are most effective if applied during spring or fall to musk thistles in the rosette stage.

- Rosette weevil larvae feed in the thistle crown and weaken or kill the plant.

- Flower head weevil larvae feed in the flower and reduce the number of seed produced.

- Mowing is most effective when done within two days after the terminal flower blooms.

- Good pasture management practices reduce establishment of musk thistles.

- Integrated control, using a combination of biological, chemical, mechanical and cultural control methods, is the most effective program for reducing infestations of musk thistles.

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