

Biological Control of Musk Thistle

Musk thistle, *Carduus nutans*, was introduced into the eastern United States in the 1800s. It is widely distributed in Alabama and is a serious weed in pastures, roadsides, and waste areas (idle ground). Herbicides have been used to control this and other thistles for many years. Frequent mowing can also help reduce thistle populations, and hand removal is effective for removing small, localized infestations. There is now a fourth option for controlling musk thistle: biological control using beneficial insects that feed almost exclusively on musk thistle.

Background

Musk thistle, *Carduus nutans* (Figure 1) has large, dark pink flower heads that bend the stalk, causing the heads to nod. The plant is also called nodding thistle. Its leaves are flattened with a white midrib. Musk thistle is usually a biennial. In the first year, the stem does not elongate. The leaves spread out around the central growing point in a flat rosette. In the second year, a larger rosette of leaves forms (Figure 2), the thistle stem elongates, and flower heads are produced.

Musk thistles can be distinguished from other thistles in Alabama pastures by the light green midrib in the leaves and by the flat-pointed bracts in the flower head. Musk thistles may grow to 8 feet in height. Yellow thistle (Figure 3) may have yellow or dark red flowers, but the leaves lack the light green midrib and the flower bracts are feathery. Milk thistle (Figure 4), a recent introduction in a few locations in Alabama, is also tall growing with purple flowers, but it has variegated leaves and long, spiny bracts. See ANR-616, *Weeds of Southern Turfgrass*, for more information on weedy thistles in Alabama.

In Europe and western Asia, where thistles originated, insects have been discovered that selectively feed on particular kinds of thistle. These insects, once evaluated, have become useful biological control agents, because they can be released into a new environment with little chance of harming other plants. Musk thistle is attacked by



Figure 1. Musk thistle



Figure 2. Musk thistle rosette



Figure 3. Yellow thistle



Figure 4. Milk thistle

at least ten different insects. Two of these species, the thistle head weevil, *Rhinocyllus conicus* (Figure 5) and the rosette weevil, *Trichosirocalus horridus* (Figure 6), show promise for use in Alabama.

Each insect attacks a different part of the plant. The thistle head weevil develops inside the flower head that blooms in spring, preventing seed production. The rosette weevil attacks the young musk thistle plants, and kills the plant outright or prevents normal plant growth. Excellent, long-term control of musk thistle has been observed in areas of the United States where the rosette weevil and the thistle head weevil are both present.



Figure 5. Thistle head weevil



Figure 6. Rosette weevil



Figure 7. Thistle head weevil adults (dark brown) lay eggs (light brown bumps)



Figure 8. Thistle head weevil grubs

The Thistle Head Weevil

In Alabama, the thistle head weevil is very host specific. Musk thistle is the primary host for the strain of thistle head weevil that was released. Therefore, pastures which are also infested with yellow thistle or other biennial or perennial thistle are not good candidates for release sites because they would still need to be sprayed for thistle control.

Adults have a broad snout, and are about $\frac{1}{4}$ to $\frac{3}{8}$ inches long. They are dark brown with a mottled appearance. The adults overwinter, and in spring (mid to late April in Alabama), the females begin to lay eggs on the bracts of developing flowers (Figure 7). The eggs are covered with chewed up plant material so that they have a rough, light brown, scalelike appearance. An adult usually lays about 150 eggs. After 6 to 9 days, the eggs hatch, and the young weevils tunnel into the base of the flower head. As many as 40 immature weevils (white-colored, legless grubs) can be found in a single head. The young weevils feed for about 4 to 6 weeks and go through four growth stages. By the time they are fully grown, the grubs have created woody, blackened cells inside the flower heads (Figure 8). There, they transform themselves into adults. The transformation stage, the pupa, lasts about 7 to 10 days. The new adults emerge, feed briefly, and pass the summer and winter in a period of inactivity, under the thistle rosettes, in litter, or in adjacent forest areas.

Infested flower heads produce few seeds (Figure 9). The more insects present inside the head, the fewer seeds produced. Fifteen weevil grubs per head will prevent all seeds from forming in that head. Seasonal activity of the head weevil is



Figure 9. Infested musk thistle flower heads

closely synchronized with the terminal heads in spring. Lateral flower heads, produced over the course of the summer, may escape attack by this insect.

The Rosette Weevil

The rosette weevil, also called the crown weevil, occurs on musk thistle, bull thistle, and plumeless thistle. The weevils are not able to complete their life cycle in other thistles found in Alabama.

Adults are dark brown, with a long, thin snout, and are about 1/4 inch long. They are about two-thirds the size of thistle head weevils and have a rough texture. Adults emerge from summer resting places in the fall. They lay eggs in the midrib of thistle leaves, and complete egg-laying in the spring. Adults, eggs, and larvae can all overwinter. An adult usually lays about 800 eggs.

After 10 to 12 days, the eggs hatch, and the young weevils tunnel from the midrib toward the center growing point. It takes about a week for the larvae to make their way into the rosette. There, they continue to feed. Feeding by the rosette weevils kills the crown tissue (Figure 10). The immature weevils are white-colored, legless grubs that can be found by carefully lifting out the dead crown tissue. The young weevils feed for about 6 to 8 weeks. The transformation stage, the pupa, lasts about 12 to 20 days. The new adults emerge in May and June, feed briefly, and pass the summer in a period of inactivity.

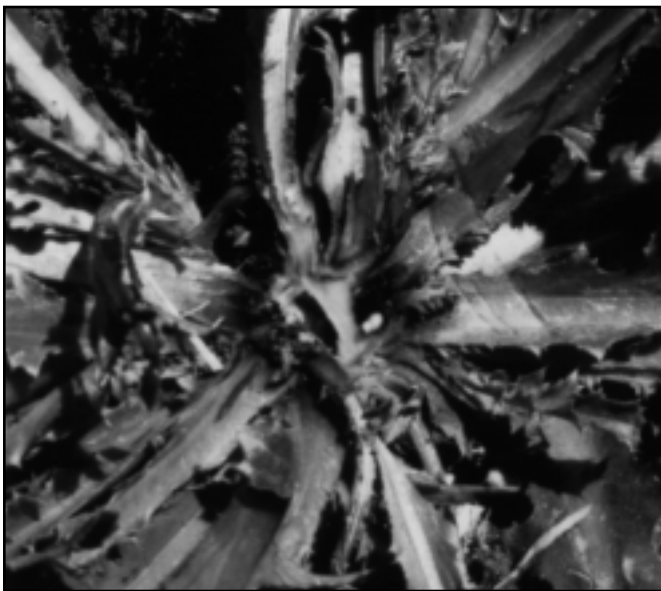


Figure 10. Rosette weevil damage

Weevil Impact

In 1992, a program was begun to establish beneficial insects for control of musk thistle in Alabama pastures. The thistle head weevil has been established in Franklin, Colbert, Limestone, Marshall, Tallapoosa, Calhoun, Lauderdale, Talladega, and Chambers Counties. A field in Chambers County that had a dense stand of musk thistle (Figure 11) was chosen for the first release of weevils in 1992. Four years later, there were fewer thistles in the field (Figure 12).



Figure 11. Field with a dense stand of musk thistle.



Figure 12. Same field 4 years later with fewer thistles

The rosette weevil has been released in six counties from 1992 to 1997, but has not yet become established. Prospects for establishment are good, because the rosette weevil is now in Georgia and Tennessee.

Control of musk thistle does not happen overnight. However, if the head weevil becomes established, dramatic reductions in thistle density can be seen in 2 to 3 years. It takes longer, often 7 to 10 years, for the rosette weevil to cause musk thistle populations to decline. Because the two insects attack different plant parts, they complement each other and provide for a greater stability of control than would be observed from each insect alone.

Occasionally, the biological control of thistles can be upset and thistles re-infest the area. This can be due to the dumping of soil infested with thistle seed, exposure of soil through overgrazing or cultivation, sharp temperature fluctuations in the winter, or cool springs that allow thistle growth but that are too cool for the development of the weevil.

Where Can Thistle Weevils Be Obtained?

In Alabama, our approach has been to establish the weevils in nursery sites. Then, as these weevil populations build up, they are redistributed from the nursery pastures to other fields. Weevils will also spread on their own, at least a mile per year. Eventually, we hope that both the thistle head weevil and the rosette weevil will be found throughout the northern half of Alabama as a result of redistribution efforts and natural spread.

Please check with your county Extension agent if you are interested in releasing the weevils on your farm. He or she will have the latest information on where the weevils have been released and where there are enough of them to be collected for redistribution.

Successfully Establishing The Thistle Head Weevil

Collect thistle head weevils in early spring by shaking them off flowerheads into a dishpan. Dump the weevils out of the dishpan into a small closed container and keep them shaded and cool until release. It is important to collect the weevils while the females are still laying eggs. The best time to collect is usually while the thistle flower stems are still elongating.

The area where weevils are released should have good soil moisture. Several hundred musk thistles should be present at any release site. In a large infested area, use 2,4-D or Grazon to control most of the thistles when they are in the rosette stage, leaving an untreated area of about 1 to 2 acres for release of the weevil.

One hundred weevils is probably the minimum that should be released in a localized area. To release the weevils, sprinkle five to ten weevils per plant on plants scattered throughout the infested area. Release the weevils within 1 day of collection.

The area where weevils are released should not be mowed or sprayed until the head weevil is well established. After that time, thistles can be mowed in the fall when the weevils are not developing inside the head.

Acknowledgments

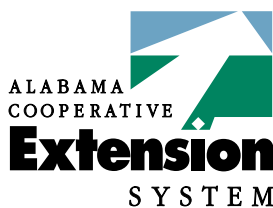
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Figures 5, 6, and 12—Photos courtesy of Richard McDonald, Sugar Grove, NC.
Figure 10—Photo courtesy of David Buntin, University of Georgia.

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For more information, call your county Extension office. Look in your telephone directory under your county's name to find the number.

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