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Biology and Management of Pine Needle Scale

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MICHIGAN STATE UNIVERSITY EXTENSION

Pine needle scale (*Chionaspis pinifoliae* and *C. heterophyllae*) is an important pest of Scotch pine grown for Christmas trees or ornamentals (Fig. 1). This bulletin is designed to help you identify and effectively manage pine needle scale in your fields.

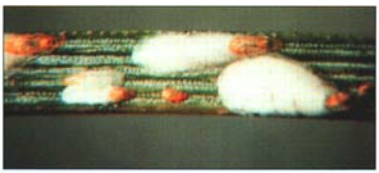

Figure 1. Pine needle scale on a Scotch pine needle.

Hosts

Pine needle scale, also known as "white scale", most often builds to high levels on Scotch pine trees. Other species of pine can also be infested. Pine needle scale is occasionally found on spruce, Douglas-fir and eastern red cedar trees.

Biology

Pine needle scale has two generations per year in Michigan. Eggs overwinter beneath the white "armor" – the hard, waxy covering left by their mother.

Spring generation

The spring generation eggs begin to hatch in May, about the time that lilacs are in full bloom. Nearly all eggs of the spring generation hatch during a 5- to 7-day period. The pinkish red immature scales, called crawlers, move about on the needles for a few days after hatching (Fig. 2). Once the crawlers settle on a needle, they insert their mouthparts. Pine needle scales have sucking mouthparts and feed on sap and liquid material in the cells of the needle.

Soon after the crawlers settle, they begin to turn yellow. After feeding for about a week, the crawlers molt to the second stage, called the hyaline stage (Figs. 2 and 3). At this point, the immature scales are exposed on the surface of the needles and have not started to produce the white, waxy armor.

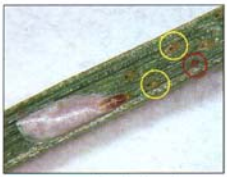

Figure 2. Adult female scale, a pinkish crawler (red circle) and yellowish scales in the hyaline stage (yellow circles).

As the scales continue to feed and develop, they begin to excrete the white, waxy material that forms the armor. After 6 to 8 weeks of feeding, the scales mature. Male adults have wings and fly to females to mate. Females lay eggs under the white covering, then die.

Figure 3. Close-up view of immature scales in the hyaline stage.

Summer generation

Eggs of the summer generation begin to hatch about 4 weeks later, often in early to mid-July. In most years, the summer

generation eggs continue to hatch over a relatively long time period of 2 to 4 weeks. This extended period of hatching probably occurs because the spring generation scales develop at different rates during May and June. Some scales develop relatively quickly because they are exposed to more sun and warmer temperatures than scales that feed in shaded locations on the tree.

The newly hatched crawlers move onto the expanding shoots and feed primarily on the current-year needles. These scales mature and lay eggs late in the summer, then die. Their eggs overwinter under the white armor until the following spring.

In Indiana, some pine needle scales reportedly complete part of a third generation in early autumn if temperatures stay warm. Few of these immature scales are likely to survive cold winter weather, however.

Damage

Heavy infestations of pine needle scale detract from the appearance and reduce the value of trees. When populations are high, trees appear to be flocked with white specks (Fig. 4). High scale densities may reduce the growth rate of the tree and can cause needles, shoots or entire branches to die.

Figure 4. Heavily infested Scotch pine foliage.

Natural Enemies

Natural enemies, including insect predators and parasitoid wasps, can have a major impact on populations of pine needle scale. Two species of ladybird beetles, in particular, are common and important predators of this scale. Most people are familiar with adult ladybird beetles, but the larvae look quite different. The usually resemble mobile pincushions or spiny alligators (Fig. 5).

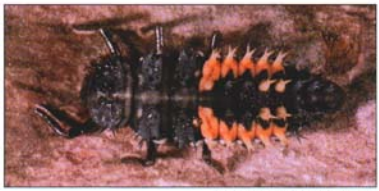

Photo by Gerald J. Lenhard, www.forestryimages.org

Figure 5. Ladybird beetle larvae are voracious predators.

The adult twice-stabbed ladybird beetle (*Chilocorus stigma* Say) is black with two red spots (Fig. 6). This species has at least two generations per year that roughly coincide with the hatching of pine needle scale eggs in the spring and summer.

Figure 6. Adult *Chilocorus stigma*, a ladybird beetle that is an important predator of pine needle scale.

The other ladybird beetle (*Microweisia misella*) is tiny and completely black (Fig. 7). Larvae of these beetles are especially difficult to observe in the field because they are so small and they often hide underneath the white scale armor (Fig. 8). Though these beetles are more difficult to see, they can be highly effective in reducing the pine needle scale population.

Figure 7. Adult *Microweisia misella*, a tiny, black ladybird beetle that feeds on pine needle scale

Figure 8. Larvae of M. *misella* feed on pine needle scales and their eggs.

The potential effect of these two predators on pine needle scale populations was examined in a recent MSU study. Two fields of young trees that were heavily infested with pine needle scale were left unsprayed for one season. By late August, *C. stigma* and *M. misella* had killed at least 70 percent of the summer generation of scales in both fields.

Highly specialized parasitoid wasps also kill many scales. Each tiny wasp lays one egg into a scale insect. After a wasp egg hatches, the larva feeds on the scale, eventually killing it. When the wasp completes its development, it emerges, leaving a round hole in the white armor (Fig. 9). The tiny wasps themselves are rarely seen in the field but can be important in controlling scale populations. In the MSU study, levels of scale mortality resulting from parasitism ranged from 25 to 52 percent.

Figure 9. A round hole in the white scale armor is evidence of parasitism.

If you look closely at infested shoots, you can often determine if predators or parasitoids have attacked the scales in your field. Ladybird beetles will tear apart the hard, white covering to eat the soft body of the scale or the eggs. When scales have been killed by ladybird beetles or other insect predators, the white armor will have jagged holes and tears (Fig. 10). A neat, round hole in the scale armor indicates that the scale was killed by a parasitoid wasp (Fig. 9).

Management

Effective management of pine needle scale involves careful scouting to monitor egg hatch and natural enemy activity. When insecticides are needed, sprays must be applied when pine needle scale is most vulnerable. Adequate spray coverage is also important for effective control.

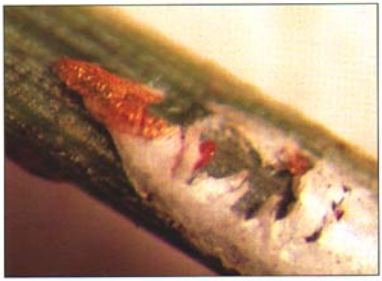

Figure 10. Jagged tears in the white scale armor indicate that the scale was killed by predators.

Scouting

Good scouting will help you assess the size of the pine needle scale population in your field and determine whether control is necessary. Pine needle scale tends to occur in patches within fields, and infested trees may not be visible from lanes or the edge of the field. Walk diagonal transects that zigzag through each block of trees. Be sure to inspect trees on all four aspects and look at foliage on the upper, mid- and lower canopy. Pine needle scale infestations often begin on the lower branches of a tree. If you see trees with pine needle scale, note the number of affected trees and the extent of the scale population.

If pine needle scale populations are at low or even moderate levels and the trees are at least a year from harvest, spraying may not be necessary. Look closely at some of the scales on infested trees. If you see the jagged tears left by predators or round holes left by parasitoid wasps, there is a good chance that the natural enemies will keep the scale population at low, non-damaging levels. Controlling pine needle scale becomes more important when trees are near harvest and even a light infestation of scales can reduce tree value.

Timing and degree-days

Proper timing is an important aspect of effective scouting and management activities. Using degree-days to time your scouting and control activities is more reliable and more accurate than basing your activities on the calendar. Degree-day accumulation is a way of keeping track of how quickly temperatures warm up in the spring and summer.

The best way to estimate when pine needle scale eggs will hatch is to monitor the accumulation of degree-days in spring and summer. For example, when spring weather is cool, degree-days accumulate at a relatively slow rate and pine needle scale eggs may not hatch until late May or early June. In contrast, if spring weather is sunny and warm, degree-days accumulate more rapidly and pine needle scale eggs may be hatching by early to mid-May.

Pine needle scale, like all insects, is cold-blooded and does not develop at low temperatures. Generally, insect development progresses only if temperatures are at least 50 degrees F. Therefore, degree-day accumulations are usually based on a threshold temperature of 50 degrees F. Accumulated degree-days are calculated weekly by Michigan State University (MSU) and are available from the MSU Extension Web site or your county MSU Extension office.

Applying insecticides at the proper time is a key element in controlling pine needle scale. Pine needle scale is most vulnerable to insecticides during the crawler stage. Although crawlers are tiny, they are readily visible on the needles (see Fig. 2), especially if you use a hand lens or magnifying glass. The ideal time to apply an insecticide spray is after nearly all the pine needle scale eggs have hatched and most crawlers have reached the hyaline stage (see Fig. 3). At this point, the young crawlers are exposed on the needles and have not yet started to produce the hard, white armor.

Spring generation eggs hatch in May or early June at roughly 300 degree-days base 50 degrees F (DD_{50}). Usually eggs hatch within about a week, and most crawlers should be in the hyaline stage by 400 to 500 DD_{50}. Recent research at MSU indicates that the summer generation eggs can begin hatching at roughly 1,280 DD_{50} (usually early to mid-July). Hatching may continue over 2 to 3 weeks. The ideal window for applying insecticides to control the summer generation eggs generally occurs at around 1,500 DD_{50}.

Spraying after nearly all eggs have hatched and most crawlers are in the hyaline stage should achieve good control. Applying an insecticide after scales have produced the hard, white armor will not be effective because scales and even scale eggs are well protected by the white armor. Spraying then will, however, suppress predators such as ladybird beetles.

Insecticides and horticultural oil

Several conventional insecticides are registered for controlling pine needle scale on Christmas trees. Contact insecticide products will be highly effective if they are applied at the correct time and if the spray adequately covers the tree. Systemic insecticides will not be any more effective than contact insecticides because of the way pine needle scale feeds.

Horticultural oils are often used on landscape trees to control scale insects, aphids and other small pests, but they have not been widely used in Christmas tree production. Oils act by suffocating the insects, so good coverage and good timing are especially important. Recent studies at MSU have shown that oils can be just as effective as conventional insecticides when applied at the right time in the scale life cycle.

Using horticultural oils for managing insect pests in Christmas tree fields has some advantages. Spray oils are non-toxic to humans and may be used on organically grown crops. Also, oils are not likely to harm populations of predatory insects such as ladybird beetles and parasitoid wasps. In contrast, conventional insecticides can dramatically reduce the abundance of beneficial insects.

Summary

Integrated management strategies — including scouting, conservation of natural enemies and proper application of horticultural oil or insecticides when necessary — will provide effective and economical control of pine needle scale.

Acknowledgements

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