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Pales Weevil

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The pales weevil, *Hylobius pales* (Herbst),[4] is the most serious insect pest of pine seedlings in the Eastern United States. Great numbers of adult weevils are attracted to freshly cutover pine lands where they breed in stumps and old root systems. Seedlings planted in freshly cut areas are injured or killed

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by adult weevils that feed on the stem bark. It is not uncommon to have 30 to 60 percent weevil-caused mortality among first-year seedlings in the South, and mortality of 90 percent or more has been recorded. In the North, pales weevil is also destructive to pine and other conifers grown for Christmas trees.

The range of pales weevil extends over the Eastern United States east of the Great Plains and into Canada from Manitoba to Nova Scotia (fig. 1). Over much of its range, pales weevil occurs in association with another insect of the same family, the pitch-eating weevil, *Pachylobius picivorus* (Germar). The pitch-eating weevil is a large black weevil that causes similar damage to seedlings. The ratio of pales to pitch-eating weevil ranges from 11 to 1 in the southern Appalachians to 2–3 to 1 on Piedmont and Atlantic Coastal Plain sites. However, along the Gulf Coast from Alabama to east Texas, the pitch-eating weevil is more common, with ratios of about 1 to 6–10 reported.

Hosts

In eastern North America, pales weevil has been recorded feeding on most native and several exotic con-

Figure 1.—*Range of pales weevil.*

iferous species. The most common species include pine, spruce, fir, Douglas-fir, hemlock, juniper, larch, and cedar. In fact, it is doubtful that any conifers are free of attack. Rare instances of pales weevil feeding on hardwoods have also been recorded.

Evidence of Infestation

Adult weevils usually feed on the aboveground bark tissue of the stems of seedlings. Feeding below the root collar also occurs, especially on planted seedlings that have loosely packed roots. Bark is eaten down to the wood (fig. 2). When feeding is light, small (3 mm, 1/8 in), isolated patches of bark are removed. Whitish, crystallized resin forms over the wounds, giving the seedling a sugary appearance. When feeding is heavy, large patches of bark are removed. This may girdle and kill the seedling. If girdling occurs quickly, no resin forms in the wound, and the stem wood appears dry and bare. When weevils are numerous, the seedling will be completely stripped, leaving a bare, curled stem surrounded at the base by a pile of detached needles. Feeding of the pitch-eating weevil is similar to that of pales weevil.

On saplings and larger trees, feeding is restricted to the bark on twigs near the ends of branches. The twigs may be girdled and when the needles die the branches have red tips, or flags. This type of injury is common on trees growing in or around harvested areas and on seedlings and saplings under bark beetle-killed trees. Sometimes feeding on branch tips is so heavy that all buds are killed, resulting in the death of the tree. The same type of feeding injury may occur in Christmas tree plantations. If the feeding is heavy enough to

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Figure 2.—*Pales weevil feeding damage: left, girdled loblolly pine seedling; right, twig of Scotch pine Christmas tree (courtesy W. H. Kearby, retired Professor of Entomology, University of Missouri).*

kill twigs and small branches, it can result in a noticeable defect which will lower the grade and thus the value of the trees. By the time Christmas trees are harvested, most of the dead needles haven fallen off girdled twigs, leaving bare, dead tips at the ends of branches. Twig mortality up to 40 percent in 5- to 10-year-old pine Christmas trees has been reported in southern Ontario. Pales weevil can be a persistent problem in Christmas tree plantations where annual cropping of trees continually provides breeding places for weevils; in other plantations, the attraction, and the resultant problem, ceases within 1 or 2 years when the old stumps and root systems have deteriorated.

Life Stages and Habits

Adult pales weevil are large (7–12 mm, 0.3–0.5 in long) and dark reddish brown with tufts of yellow-white hairs on the wing covers and thorax (fig. 3). They are attracted to logging areas where they feed on the inner bark of freshly cut tops and stumps of conifers (until these dry out), on the twigs of residual trees and saplings, and on the stems of seedlings. Weevils may be found mating and feeding above ground at night, but during the day they are usually in the litter, under logs, around stumps, or at the bases of trees and seedlings. The females burrow underground where they lay their eggs on the subterranean parts of stumps and roots, in buried slash, or on the undersides of logs in contact with the soil. The females chew small niches in the bark and deposit one to three eggs per niche. The egg is pearly white, about 1.25 mm (0.05 in) in length (fig. 3). The young larva, a legless white grub with a light-brown head capsule (fig. 3), bores between the phloem and wood, making an irregular tunnel that scores the wood more deeply than the inner bark. The tunnel may be over 1 m (3 ft) long on roots of stumps. The larva passes through five or six larval stages, reaching a length of 12 mm (0.5 in). The gallery terminates in an oval pupation chamber about 15 mm (0.6 in) long and 6 mm (0.25 in) in diameter. The pupation chamber, which is plugged with borings, may be in the bark, in the outer surface of the sapwood, or completely within the sapwood. Pupation takes place in this chamber and emerging adults penetrate the bark and ascend to the soil surface. Adults are long lived, overwintering at least once in most of the United States. They have been reported overwintering twice and ovipositing in 2 successive years in southern Ontario.

In the Piedmont and Coastal Plain regions of the South, seasonal occurrence of the various life stages in any particular area depends on when eggs are laid. This, in turn, depends on when logging (or death of trees due to causes like bark beetle attack or fire) took place (fig. 4). Adult weevils are found year round and they are active throughout most of the year. So, with the probable exception of areas harvested during the colder months of November, December, January, and February, adult weevils begin to migrate to an area with the onset of cutting, and oviposition begins within a few weeks. Weevils probably migrate to winter cuts in the spring.

The life cycle on the Coastal Plain in North Carolina lasts from 3 to 12 months, depending on when the stand is cut. In stands cut before June, the entire brood reaches the adult stage and

emerges from late summer to mid-fall of the same year (fig. 4). In stands cut in June, part of the brood emerges in the fall and part overwinters as fifth- to sixth-stage larvae and emerges as adults in May and June of the following year. In stands cut from July to October, the whole brood overwinters as early- to late-stage larvae and emerges from May to August of the following year. In the southern Appalachians, weevils do not emerge during the same year that eggs are laid, but overwinter in the larval stage and emerge in late spring and early summer of the following year.

In the Northeastern and North Central United States and southeastern Canada, the period of activity is shorter than that found in the South, probably because of lower spring and fall temperatures. Adults become active between late April and late May. Oviposition lasts from May through July. Larvae from early eggs develop into pupae and adults from August through mid-October. Individuals from later eggs pass the winter as late-stage larvae and emerge from mid-June through July of the following year. Thus, the split emergence period found in the North is similar to that found in June cutting areas in the South (fig. 4).

In the South there is at least one generation per year, but part of the population may go through two generations if adults emerging in late summer and fall oviposit before winter. In the southern Appalachians and Northern States there is only one generation per year.

The biology of pales weevil in the North is somewhat similar to that in the South. However, the length of time the weevils remain in a cut area is different and calls for different control strategies in the two regions. In the South, control is unnecessary in winter-spring cuts because all weevils leave before the

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Figure 3.—*Life stages of pales weevil: top left, adult; top right egg; bottom left, last-stage larva in pupal chamber; and bottom right, pupa.*

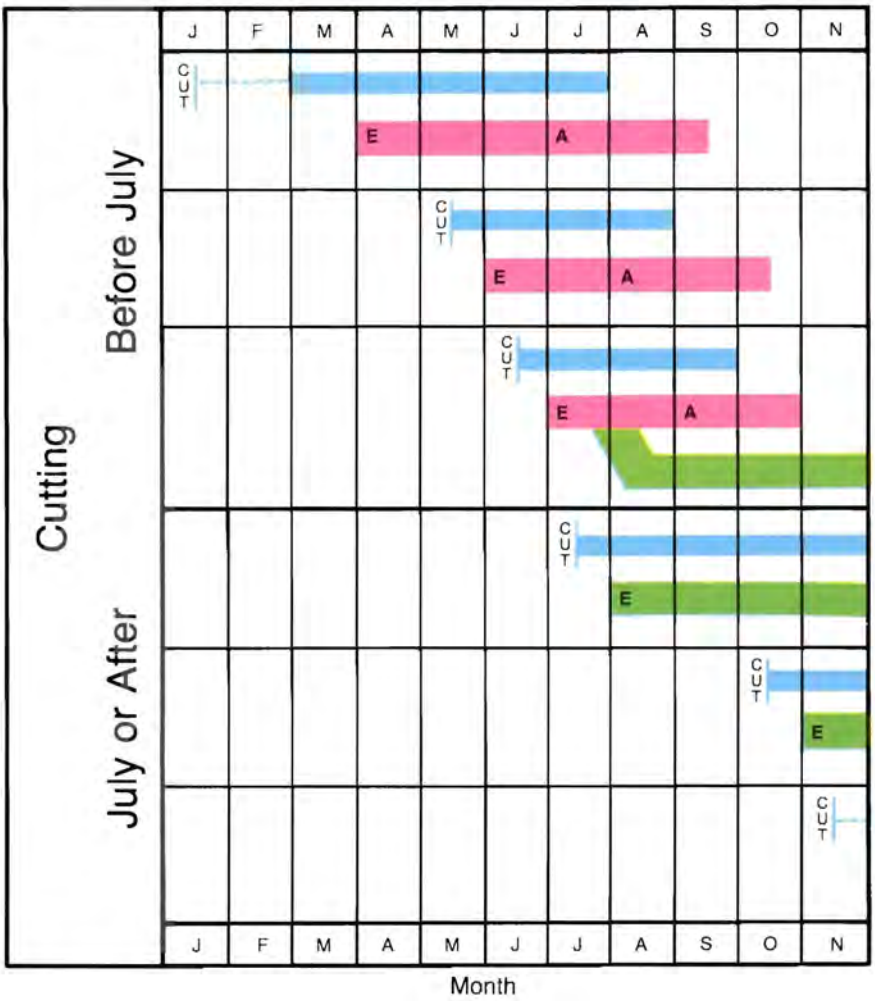
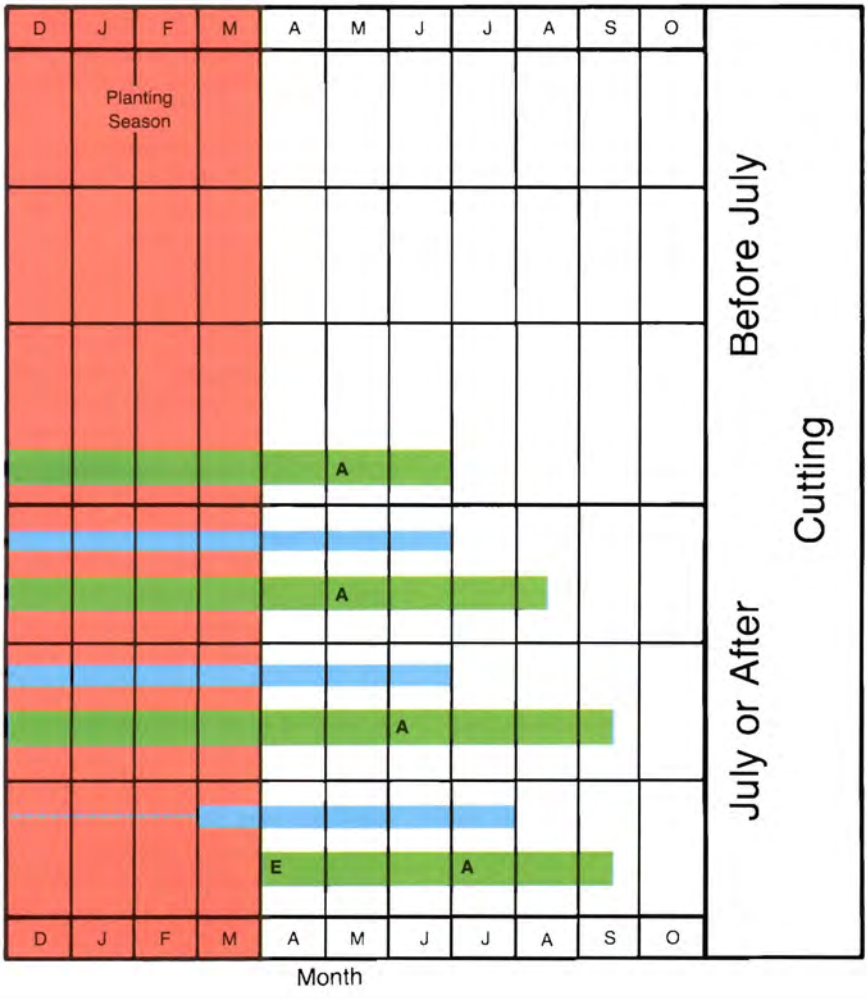


Figure 4.—*Adult migration and seasonal development of pales weevil in the North Carolina Coastal Plain in relation to time of cut. Cutting begins when indicated and lasts up to 2 weeks. Blue bars indicate when adults migrate to stands cut at different times of year and how long they are present. Brood development depends on the time eggs are laid, which in turn depends on time of cutting. Red bars represent brood from early eggs that reach the adult stage from late summer to mid-fall. Green bars are brood from later eggs that overwinter as larvae and emerge the second*



year. E *indicates when egg laying begins.* A *indicates when brood adults begin to emerge.*

In areas cut before July, the brood that emerges by fall and any surviving parent adults (blue bars) will migrate to fresh cuttings before the planting season (orange area) and, therefore, feeding damage on seedlings does not occur. In areas cut in July or after, migrating parent adults remain in the area through the following winter and spring, causing seedling damage.

next winter, and, thus, do not damage seedlings planted then. On the other hand, in summer-fall cuts, control will probably be necessary because the weevils originally attracted to the area overwinter there and feed on newly planted seedlings until June. In the North, weevils do not leave a cutting area for 1 to 2 years and feeding damage in a winter cutting could occur on planted seedlings the following spring and early summer, the next fall, and the second spring following cut. Therefore, surveillance and control in the North may be necessary in all cutting areas for 2 years after the cut.

Natural and Applied Controls

Only a few biological control agents that affect pales weevil have been reported, and very little is known about their effect in regulating field populations. Infection of all stages by white and green muscardine fungi, *Beauveria bassiana* (Balsamo) Vuillemin and *Metarhizium anisopliae* (Metsch.) Sorok., respectively, is not uncommon. Larvae and adults of the pales weevil are also frequently infected with a gregarine protozoan similar to, or identical with, the one described in the European *Hylobius abietis* L.[5] Infection of larvae and pupae by neoaplectanid nematodes has been reported. Several species of mites are associated with pales weevil adults and larvae, but little is known about the relationship.

Currently, there are two effective applied control measures for prevention of weevil-caused mortality of seedlings: delaying planting for 1 year in the South and 1 to 2 years in the North until weevils have left the area; and treating seedlings with an insecticide before or after planting.

While delaying planting is an easy way to prevent damage, it may have financial consequences. Depending on management objectives, it may be costly to let land lie idle for 1 year if planting the winter following harvesting is otherwise feasible. The loss due to delay is roughly equal to the discounted value of 1 year's growth minus the cost of chemical control. Although chemical control requires an immediate expenditure for the insecticide and labor, this cost is usually much less than the loss in growth and yield due to delayed planting. Also, unless the site is intensively prepared by using root raking, windrowing, and bedding, a year's delay may allow competing hardwoods to become established on the site.

If delaying planting is economically unacceptable to the forest manager, seedlings may be treated with insecticide to prevent damage. Several registered insecticides are available to control pales weevil and pitch-eating weevil. Seedlings may be treated with a dip before planting, with a soil systemic during planting, or with a spray after planting. A detailed description of the insecticides and their use is beyond the scope of this publication, so the user should consult a State forest entomologist or county agricultural extension agent for the names of registered insecticides and details on their proper use.

Timing of insecticide application varies by region. In the Southern States,

[5]Hans G. Schabel, Associate Professor of Forestry, University of Wisconsin, Stevens Point, Wis., personal communication.

populations of weevils are usually high from year to year. Most injury occurs in the late winter and spring before June, and serious weevil damage may occur within a few days of planting even in midwinter. Therefore, unless close surveillance of the plantation is practical, insecticide should be applied at or before the time of planting.

In the Midwest and Northeast, surveillance of plantations on recently cut pine lands should begin in the spring and summer and continue through the fall and following spring, and insecticide applied if damage becomes serious. Sometimes damage in winter cuts does not become serious until the following late summer and fall, so surveillance of the plantation is highly recommended.

Because the decision to use control measures in the South must be made before planting, an assessment of weevil hazard before planting is necessary. Weevils are not a problem when plantations are established on areas formerly covered with nonconiferous vegetation (for example, old fields and hardwoods); in pine areas that will be regenerated by direct seeding; and in plantations on conifer sites where the trees were cut prior to July. In other words, weevils are not attracted to nonconiferous cutting areas; they usually leave an area before direct seeded regeneration is large enough to be fed upon, and they leave old cutting areas before the following winter planting season. In areas regenerated by the seed tree or shelterwood methods, seedlings may not be damaged the first year because of their size, but they may sustain damage after the final cuts are made when additional weevils are attracted to the area.

A rule of thumb, based on cutting and site preparation dates, that can be used by a forest manager to determine weevil hazard has been developed for the Coastal Plain and Piedmont regions of the South: Pine lands that are cut and site prepared before July can generally be planted the following winter without control measures. However, on pine lands harvested in July and later, or in older cuttings where residual pine is cut during late summer or fall site preparation, planting should either be delayed 1 year or seedlings should be treated with insecticide to prevent weevil-caused mortality.

This rule of thumb may not apply to pine sites in the southern Appalachians. There, seedlings planted on sites cut before the previous July would probably sustain damage and, thus, control is needed.

Heavy populations of weevils, with resultant high seedling mortality, have been experienced by some landowners when large clearcuts were made adjacent to large areas clearcut the year before, even when the seedlings were treated with insecticide. By reducing the size of clearcuts, spacing them throughout an area, and planting with insecticide-treated seedlings, an acceptable level of seedling survival can usually be achieved. This practice tends to spread the weevil population over a given area and prevents large populations from migrating en masse short distances into new cutting areas, where weevils might overwhelm even treated seedlings.

Six control strategies are effective in Christmas tree plantations: to delay planting 1 to 2 years if land was previously used for Christmas trees, to

treat seedlings with insecticide, to remove stumps in spring, to treat stumps in spring with insecticide, to spray trees with insecticide in late August to mid-September to control weevil feeding on branches, and to leave a whorl of live branches on the stump to keep the stump alive and unattractive to weevils.

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Pesticides used improperly can be injurious to human beings, animals, and plants. Follow the directions and heed all precautions on labels. Store pesticides in original containers under lock and key—out of the reach of children and animals—and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides where there is danger of drift when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment, if specified on the label.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

NOTE: Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the U.S Environmental Protection Agency, consult your local forest pathologist, county agriculture agent, or State extension specialist to be sure the intended use is still registered.

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