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Common insect pests and diseases of shore pine on the Oregon coast

(*Pinus contorta* Douglas ex. Louden var. *contorta*)

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Shore pine (figure 1) is a subspecies of lodgepole pine that inhabits the coastal strip in Oregon. Insect pests, diseases, and nonbiological (abiotic) factors may have an impact on growth, visual appearance, and productivity of trees. However, shore pine is quite a vigorous tree and tolerates conditions most other trees could not. Perhaps the most commonly observed problems of shore pine are salt damage and shade (lack of full sun), both factors that may be confused with insect or disease damage. Biotic problems such as the pitch masses of the sequoia pitch moth, the roundish swellings (caused by western gall rust), reddish needles and poor needle retention (caused by foliage diseases) and the smaller pitch masses at the base of the tree (caused by red turpentine beetle) are commonly observed but rarely kill the tree. In this publication, we review the general nature of shore pine in Oregon and the common nonbiological, insect pest, and disease problems that impact tree health.

Figure 1. Shore pine on Battle Rock in Port Orford, Oregon.

Shore Pine in Oregon

Lodgepole pine has the widest range of environmental tolerance of any North American conifer. Because of this, the species is widely distributed throughout western North America. Lodgepole pine is a two-needled pine that is characterized as a hard pine or a yellow pine. Lodgepole pines can be found growing in the Rocky Mountains, Sierra Nevada, and the mountains and coasts of Oregon. Their range extends from Alaska to Mexico. It is the only conifer that is native to both Alaska and Mexico. Lodgepole pines vary in growth rate and form, depending on location. Lodgepole pine has four geographic varieties: *P. contorta* var. *contorta*, the coastal form known as shore pine, beach pine, or coast pine; *P. contorta* var. *bolanderi,* a Mendocino County White Plains form in California called Bolander pine; *P. contorta* var. *murrayana* in the Sierra Nevada, called Sierra lodgepole pine or tamarack pine; and *P. contorta* var. *latifolia*, the inland form often referred to as Rocky Mountain lodgepole pine or black pine. Although the coastal form grows mainly between sea level and 2,000 ft (610 m), the inland form is found from 1,600 to 12,000 ft (490 to 3,660 m).

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In much of its range lodgepole pine is an important commercial timber species. Lodgepole gets its name from the fact that Native Americans used its straight slender boles as poles for their teepees. It is an aggressive and hardy tree capable of restocking cutover land in a short time. These trees often reach heights of 80 ft and diameters of 30 in. They are characterized by long clear boles and short, narrow open crowns. Bark beetles and dwarf mistletoe are major damage agents of lodgepole pine outside the coastal areas, while the thin bark of lodgepole pine makes it easily killed by wildfire. Along the coast, bark beetles, dwarf mistletoe, and fire are not very important.

Shore pine

Lodgepole pines growing along the coast of the Pacific Northwest are called shore pine and sometimes beach pine or coast pine. Shore pine (*Pinus contorta* Douglas ex. Louden var. *contorta*) is a small tree that rarely exceeds 60 ft in height. Shore pine can vary from a shrub form on exposed coastal bluffs (figure 2), a dwarf tree planted on sand dune areas (figure 3), or tall trees growing in protected sites (figure 4). It is characterized by a short, often "contorted" bole with a dense irregular crown of twisted branches. In maturity, the crown becomes conical. The Latin word *contorta* means contorted or twisted and refers to the irregular crown of the typical, scrubby shore pine. They have little to no commercial timber value; however, the trees are greatly prized for their aesthetic characteristics and are important ornamental yard trees. They are important trees for wildlife, because the pine nuts are a favorite food of squirrels and songbirds.

Shore pines are often found on histosols (peat bogs or muskegs) in southeastern Alaska, British Columbia, and western Washington, and on dry, sandy, or gravelly sites in western Oregon and farther south along the coast on inceptisols, alfisols, and ultisols. Shore pine can be found growing with Douglas fir, Sitka spruce, western hemlock, western red cedar, redwood, and Port Orford cedar. On protected sites, shore pine will be replaced by these species, whereas on dune and bluff sites, it is the only tree that can grow there.

Shore pine needles occur two to a bundle and are typically 1 to 3 in long (2.5 to 7.5 cm), stout and somewhat flattened, and often appear twisted along their length. Shore pines start producing cones when

Figure 2. Shore pine at the coastal edge, near Gold Beach, Oregon.

Figure 3. Shore pine planted in sand dunes, near Dune City, Oregon.

Figure 4. Tall stature trees in Honeyman State Park, Oregon.

they are between 5 and 10 years old. Shore pines are monoecious; that is, they have both male and female flowers on the same tree. Male flowers are yellow, cylindrical and clustered at branch tips, while female flowers are reddish purple at branch tips and appear in the upper crown. Female flowers become prickly cones that are 1 to 2 in long (2.5 to 5 cm) and egg-shaped. These cones are attached to the branches in pairs without stalks and measure 0.8 to 2.4 in long (2 to 6 cm). They are brownish orange when ripe and tend to point backward toward the main trunk. Some cones will open and release seed soon after maturing, while others can remain unopened for several years. The winged seeds are about 0.2 in long (5 mm).

Because lodgepole pine occupies such a variety of sites, when planting shore pine trees it is important that the seed or seedling source matches the site where the pines are being planted. A study of shore pines on Vancouver Island found that seed should not be transferred more than 500 ft in elevation. It could be moved 1.5° north or south but only a short distance east and west. The researchers concluded that seed used at their research site should come only from sites within the narrow rain shadow of Vancouver Island (Ying and Liang 1994). Sorensen (1992) and Stoneman (1984) both concluded that Sierra lodgepole pine in Oregon could be moved over large geographical areas, but should be restricted to narrow elevation differences. If a lodgepole seedling from the Blue Mountains in eastern Oregon is moved and planted on the Oregon coast, its chances of survival are minimal. Even our native shore pines can be damaged and sometimes killed when large storms move large amounts of salt spray inland. An imported lodgepole seedling does not stand a chance in our coastal environment.

Landscape vs. natural settings

Shore pine in the landscape is an important ornamental tree for homeowners (figure 5). As a yard tree, shore pine can attain heights of 40 ft or more. Even as a yard tree, its form is very often not straight, or it is purposely formed into contorted shapes. Some yard trees are pruned and may not have limbs for much of the length up the trunk. In contrast, natural shore pine can occur in dense stands along the coast. Canopy closure may happen when the trees are very short, often less than 20 ft tall. The lower branches extend to the ground and die from shade after canopy closure. The result is a thick dense stand with dead limbs extending from the ground level to the upper canopy, where live limbs still support needles capable of gathering sunlight for photosynthesis. Under this closure, very little other vegetation can survive. Many older shore pine stands, however, have even-sized trees that are widely spaced, each tree with a distinctive rounded crown and contorted branches. The understory may be thick with evergreen shrubs (salal, evergreen huckleberry, and rhododendron; figure 6). Most insects and diseases go unnoticed in natural stands, whereas the slightest impact on a specimen tree or on a yard tree may cause worry.

Figure 5. Shore pine in a yard, Port Orford, Oregon.

Figure 6. Shore pine and understory of salal, evergreen huckleberry, and rhododendron, Honeyman State Park, Oregon.

Common problems of shore pine

In the following section, we discuss major nonbiological problems of shore pine, followed by insects, and then diseases. Nonbiological problems such as shading or salt spray may appear as insect or disease damage, or one may find a biotic agent on a tree because it is stressed by abiotic factors.

Major Nonbiological Problems of Shore Pine (see table 1)

Table 1. Nonbiological problems that can impact shore pine and be confused with insects and disease.

Cause	Symptoms and description
Salt damage	Reddish foliage, often on one side of the tree. The canopy can have a burned look. Trees often recover. Associated with winter storms that blow salty water onto land.
Shade	Poor growth, spindly branches, crown uneven and lacking fullness. May have foliage diseases. Shore pine is a sun-loving plant and does poorly in shade.
Overwatering in lawns	Sudden death. Crown becomes red and foliage dies. Roots develop poorly. Watering shore pine in lawn settings is hard on the tree, as they are adapted to the dry Oregon summer/fall. Watering can increase root diseases such as *Phytophthora* spp. and *Armillaria*. Death is associated with poor root development.
Planting potted trees	After planting, the tree fails to develop and eventually dies, or one part of the crown dies. Potted trees may have constricted roots from being in the pot too long. When planting this type of tree, be sure to break up the bound roots and see that the root ball is not shaped like the pot.
Trenching/ construction damage	Tree declines and may die. Trenching can damage major roots, thus weakening tree vigor and possibly allowing entrance courts for root and butt rots. All roots serve the crown of the tree, and the size of the below-ground water and nutrient-uptake apparatus (roots) is related to the size of the crown. When roots are severed, the remaining roots may be unable to service the entire crown as before.
Improper pruning	Pitch moths common on pruning wounds. Persistant wound occurs. Pruning should occur from October to February. Avoid damaging branch collar.
Off-site planting	Tree declines and dies. Foliage disease causes foliage loss, tree just seems weak and never vigorous. Ask about the genetics of the tree before purchasing. (What is the seed source of this tree?)

Salt damage

Salt damage to shore pine is a common phenomenon along the Oregon coast in certain years. Violent storms and high winds along the coast pick up salt spray (usually in winter) and can blow this material inland a considerable distance. Salt interferes with normal biological function of the needle and will kill part or all of a shore pine needle. The needle reddens and dies, or portions of the needle die, depending on how much salt is deposited. This can give the tree crowns a singed or scorched look, which may appear only on the windward side of the crown (figure 7). There is a clear landscape effect, with trees in exposed windward hillsides overlooking the ocean often getting the full brunt of the salt spray, with the occasional more inland hilltop getting hit also.

Figure 7. Shore pine with salt damage.
(Photo by Alan Kanaskie, Oregon Department of Forestry, used by permission.)

Shade

Shore pine is a sun-loving tree that can tolerate Oregon's coastal rainfall and drizzle patterns. It requires full sun for best health and vigor. Crowding and shading will impair tree vigor and result in spindly and poorly growing trees with poor foliage retention (figure 8). Some trees growing in deeper shade may look thin-crowned, have foliage disease or insect scales on old needles, and have thin spindly branches with small tufts of foliage at the ends. If trees are left in this condition for a long time, they may not respond well if they are suddenly exposed when competing vegetation is removed.

Figure 8. Shore pine growing in shady spot, with poor foliage retention. Note also that the tree is in a canopy gap where humid air pools and foliage diseases and gall rust might be enhanced.

Overwatering

A shore pine growing on a lawn is best left unwatered, even in our sandy soils, except in the initial planting. Shore pine is adapted to the summer and fall drought that occurs most years along Oregon's coast. Tree roots develop poorly if the tree is overwatered. Root diseases such as the exotic water mold *Phytophthora cinnamomi* and other *Phytophthora* species can cause disease in the well-watered landscape, whereas they are rarely a concern in the natural stands. Armillaria root disease can also impact trees not used to well-watered roots. Therefore, a tree growing in a watered lawn that dies for no apparent reason may have been killed by the invisible action of below-ground agents that are difficult to detect after the tree has died.

Potted trees

Trees grown in pots can have very constricted and bound roots, especially if the tree has been in the pot too long. If you buy a tree that is in a pot and you pop it out of the pot and plug it into a hole in the ground, the tree may not thrive. Perhaps it will remain there for a few months or even a few years, and then die (figure 9). Another possibility is that the tree will grow roots out of the bind and recover to grow into a nice shade tree. Often times a portion of the crown may die because of poor root development, but the whole tree does not.

Inspect the root ball of a tree *before* buying it to determine if it has severe root binding. If you purchase a tree, you should know if it has been potted for too long. When planting a potted tree, break up the root ball and don't allow it to retain the shape of the pot so that the tree can grow roots out into the surrounding soil.

Figure 9. A purchased shore pine that died recently after planting, near Newport, Oregon.

Trenching/construction damage

The architecture of a given tree is a balance between the crown and the roots. The size of the crown is related to the size of the root system. Each individual leaf has a direct connection to certain roots due to small capillary water streams. Although trees have some ability to compensate when a major portion of the root system is severed, the crown cannot be sustained, and a portion of the leaves and branches are shed (die). Butt wounding and root damage, especially severed roots from trenching, can cause a tree to die or to lose some portion of the crown to what appears as drought damage. Wounding also allows access to root diseases and wood rots and encourages bark beetles such as the red turpentine beetle, which further weakens the

tree. Therefore, trenching and construction damage are major concerns to existing trees in the landscape and housing areas. Expect damaged trees to have a wide range of health problems.

Windthrow

Windthrow of shore pine can occur during violent windstorms, which often strike the coast of Oregon. A recent example is the November 2007 storm along the north coast. Although this is not often confused with insect damage, heavily broken trees are often attacked by red turpentine beetle. These beetles cause pitch masses (1/2–1 inches across (1 – 3 cm)) to form at the base of the tree, where the beetles enter the inner bark, lay eggs, and feed on cambium. How this influences overall tree vigor is not well quantified, as it is thought that a healthy tree can tolerate red turpentine beetle and that these beetles rarely kill a tree. However, for crown-damaged trees, an additional assault on individual tree resources may further reduce their vigor and the tree may die.

Pruning

Injured trees are more susceptible to insect attack. Injury can either be naturally occurring, such as by windstorms or ice breakage, or human-induced, such as by pruning or breaking of limbs or rupturing the bark on the trunk. Injured trees release volatile compounds that attract insects by showing that the tree's defenses are weakened. To minimize insect attacks, do not prune shore pine in the spring or summer. Pruning should be done between October and February. Particular attention should be paid to proper pruning; do not damage the branch collar, because this will attract pitch moths.

Off-site plantings

Trees that are not genetically suited to an area are called off-site. Off-site plantings are often more susceptible to insect attacks. So, if you plant a shore pine, make sure that the tree was grown from local seed sources; i.e., it is a shore pine and not a lodgepole pine from eastern Oregon or the Rocky Mountains.

Major Insect Problems of Shore Pine (see table 2)

There are few major insect problems of shore pine; the sequoia pitch moth is perhaps the most common. We discuss insects that could damage the tree, based on our local knowledge and their importance in other lodgepole systems. This discussion follows the listing in table 2 and begins with beetles.

Table 2. Potential insect pests of shore pine. Many of these insects are known pests of lodgepole pine and therefore could influence shore pine. Documentation of shore pine pests is lacking, perhaps due to the low number of pests along the coast. Symptoms are the visible response of the plant (red foliage, resin flow, reduced growth, and wilting). Signs are the physical presence of causal agents (beetle grub or fungal fruiting body).

A. Bark beetles, ambrosia beetles, and wood borers.

Species	Notes	Symptoms	Signs
Red turpentine beetle *Dendroctonus valens*	Rarely kills trees	Pitch mass at base of tree, up to ~5 ft. Can be small reddish pitch outs.	Adult beetles red-brown, 3/8 in long. Grubs feed gregariously.
Pine engraver beetles *Ips* species *Pseudips mexicanus* (Monterey pine engraver)	Can kill tops, branches, and whole trees. Usually invades recent dead tree.	Red boring dust. Pitch out. Red foliage.	Adult beetles 1/8–3/16 in long. White grubs at bark/wood interface.
Shore pine bark beetle *Pseudohylesinus pini*	Known from branches and upper bole of weakened and dying trees.	Red boring dust.	Adult beetles ~ 1/8 in long. White gurbs at bark/wood interface.
Dendroctonus ponderosae (Mt. Pine beetle)	The Mt. Pine beetle, which is killing billions of lodgepole pine trees in western North America, is **not present** on the coast, although there have been rare reports of outbreaks associated with imported fresh firewood.		
Ambrosia beetles Several species	Does not kill trees. Invades recent dead tree.	White boring dust outside bark. Pinholes in wood with associated stain.	Adult beetles 1/64–1/8 in long. White grubs in "cradles" in wood.
Wood borers Several species *Monochamus maculosus* (spotted pine sawyer)	Colonizes dead trees. Not a tree killer.	Boring throughout dead wood. Wandering galleries at bark and wood interface.	Adult beetles and larvae can be large, >1.5 in.

B. Defoliators.

Species	Notes	Symptoms	Signs
Silver spotted tiger moth *Lophocampa argentata*	Abundance varies year to year. Rarely harms trees, but can be unsightly.	Localized defoliation of older needles in winter and spring. Webbing and red foliage hang on tree.	Hairy black caterpillar, becoming very ornamented. Can cause reaction on skin. Colonial feeding and webbing tent, but not as organized as tent caterpillar.
Sawflies *Neodiprion* spp.	Locally common in some years.	Messy eating of foliage, red foliage among feeding areas. Spring feeding.	Larvae feed together, green, black heads. May have stripes. Have six prolegs.
Pine needle miners* *Coleotechnites* spp.	Of unknown importance, but could be present anywhere.	Orange tips of needles above feeding point. Lower portion of needle stays green.	Moth larvae mine the inside of needles. Hollow interiors.
Pine needle sheath miner* *Zelleria haimbachi*	Of unknown importance, but could be present anywhere.	Current-year foliage wilts and dies, or current- year needles stunted. Needles pull easily from sheath.	Moth larvae mine the base of the needles at the fascicle (needle group) sheath. Webbing may be present. Small hole at fascicle base.
Pine butterfly* *Neophasia menapia*	Possible foliage feeder.	Sparse crown and foliage concentrated at tips. General feeding on older foliage in spring and early summer.	Adult a white butterfly with black marking on wingtips. Caterpillar hairless, green head and body with two white stripes.
Defoliating weevils* Several species *Scythropus* species *Magadalis gentilis*	Poorly known, but may be generally common.	Needles punctured and partially consumed. May kill needles and cause early leaf drop.	Adult weevils are ¼ in long, have elongated snout.

* Known pests for lodgepole pine and are thought to be possible on shore pine, but are poorly known on the coast.

C. Aphid and scale insects.

Species	Notes	Symptoms	Signs
Western pine spittlebug *Aphrophora permutata*	Generally not a problem.	Off-color, stunted growth when heavily infested.	Spittle froth with nymph or adult in the froth.
Black pine leaf scale *Nuculaspis californica*	Known from lodgepole pine, but not documented from the coast.	Declining thin crown, discolored foliage.	Small black scale insect on leaves.
Pine needle scale *Chionaspis pinifoliae*	Known from lodgepole pine, but not documented from the coast.	Declining thin crown, discolored foliage.	Small white scale insect on leaves.

D. Terminal/branch and trunk.

Species	Notes	Symptoms	Signs
Sequoia pitch moth *Synthedon sequoiae*	Common, but rarely kills trees.	Large resin globs on trunk, esp. associated with pruned branches.	Moth caterpillar in cavity in inner bark, under resin.
Monterey pine weevil *Pissodes radiatae*		Dead top or branch. Can occur on leader, branch or root collar.	Feeding under bark.
Lodgepole terminal weevil *Pissodes terminalis*	Known from lodgepole pine, but not documented from the coast.	Current year leader dead. Can cause deformation.	Grubs mine beneath bark and then into pith.
Western pine shoot borer *Eucosma sonomana*	Known from lodgepole pine, but not documented from the coast.	Stunted leader length, rarely is leader killed. Growth loss.	Larvae mine the pith.
Tip moths (*Rhyacionia* spp.), including the introduced European pine shoot moth (*R. buoliana)*	Known from lodgepole pine, but not documented from the coast.	Dead tips, not the leader only.	Larvae mine shoots and buds of young pines.

Bark beetles and wood borers

Although bark beetles, particularly the mountain pine beetle, *Dendroctonus ponderosae* (Coleoptera: Curculionidae: Scolytinae), are a major tree mortality agent of lodgepole pine, shore pine is rarely killed by bark beetles. Perhaps the trees do not become large enough on the coast, or the mountain pine beetle is not adapted to the coastal climate. The Oregon Department of Forestry has reared beetles from dead and dying shore pine over the years and has provided the list in table 3 for reference.

The most common bark beetle observed on shore pine is the red turpentine beetle. The red turpentine beetle, *Dendroctonus valens*, is the largest bark beetle in Oregon, 3/8 inches (10 mm) long, and the adult is reddish brown and shaped like a small tank. Unlike many other bark beetles, the red turpentine beetle lays its eggs together in one location, and the grubs feed in a single enlarging gallery. Outside the bark, the observer sees a large resin mass 2–3 in across, somewhat smaller, but resembling the sequoia pitch moth, and limited to the base of the tree. Red turpentine beetles are often observed on stressed trees and have recently been reported as common on wind-damaged trees on the north coast. Typically, the beetle does not kill a tree but may speed its decline. No research on control of this insect in shore pine has been done in our region. Control is not usually necessary.

Table 3. Beetles reared from dead/dying shore pine by Dave Overhulser (retired), Oregon Department of Forestry (Overhulser 2005). Identifications made/confirmed by Jim LaBonte and Rick Westcott, taxonomists with the Oregon Department of Agriculture. This list is not exhaustive but is a product of technical assistance requests by landowners and land managers over the years. Provided by Rob Flowers, Oregon Department of Forestry.

Beetles infesting living shore pine and possibly killing weakened trees	**Beetles not thought to infest living trees**
Pseudips mexicanus (Monterey pine engraver)	*Hylurgops reticulates, Hylurgops porosus* (bark beetles, sour sap beetles)
Pseudohylesinus pini (bark beetle)	*Cossonus piniphillus* (weevil)
Dendroctonus valens (red turpentine beetle)	*Monochamus maculosus* (spotted pine sawyer)
Pissodes radiatae (Monterey pine weevil)	

Slash from windthrow, logging, pruning, and firewood collecting is known to attract engraver (Ips) beetles to live Oregon pines although on the coast it is apparently not a problem. However, managing slash in pine forests and landscapes is thought to be good policy. This involves cleanup of any slash greater than 3 inches in diameter and either spreading and smashing in openings, tarping, or burning the material. Engraver beetles, which have 2 or 3 generations/year, emerge in the spring from overwintering sites as adults, and if large amounts of slash are available, the beetles can increase in population, emerging in July with the ability to mass-attack nearby pine or kill tops. However, in shore pine of Oregon, this is apparently rare. *Pseudips (Ips) mexicanus*, the Monterey pine engraver, has been recorded in Oregon shore pine (Overhulser 2005). Regardless of consequences, it does make sense to manage slash. Also, avoid piling green pine firewood and green slash against healthy pine trees, as the volatiles from the cuttings can attract bark beetles to live trees for several months. Another bark beetle, *Pseudohylesinus pini*, can be found on the branches and upper bole of weakened and dying shore pine, but is not known to kill trees.

Wood borers are beetles, generally in two families that have different names given to the adults and grubs (larvae). Long-horned wood borers can be conspicuous large beetles with long anntenae as adults and are known as round-headed wood borers as larvae (Coleoptera: Cerambycidae). The metallic wood borers are often iridescent and attractive as adults and are known as flat-headed wood borers as grubs (larvae). In general, wood borer beetles are not a problem for live shore pine trees, however, they may degrade firewood or emerge from firewood in the home. These beetles are not a threat to homes. They are best managed by quick splitting and processing of firewood. In natural stands, they are important in the decomposition process of logs. The Oregon Department of Forestry has reared the spotted pine sawyer, *Monochamus maculosus*, from shore pine wood (Overhulser 2005).

Defoliators

Defoliation of shore pine by leaf-eating insects in Oregon is rare. A common leaf-eating insect seen occasionally on shore pine (reports from the Tillamook area) is a type of tent caterpillar, the silver spotted tiger moth (*Lophocampa argentata*). This insect is most common on Douglas fir. The caterpillars are social and aggregate for warmth and protection. The eggs are laid in the late summer and hatch in the fall. The gregarious caterpillars stick together, defoliate only local areas near the tent, and do not damage the buds. The female typically lays eggs on the south aspect of the tree, so the winter active caterpillars can take advantage of sunny days. In the spring the hairy caterpillars disperse and eventually pupate; the adults fly in July and August. Management is rarely required, but pruning out tents or just knocking the early instar caterpillars off the tree in winter may be sufficient. The insects do not feed on the terminal bud, so foliage is replaced the following year.

The silver spotted tiger moth seems to occur in cycles of 8–12 years. Peak occurrence may last 2 or more years, and then it is difficult to find for many years. There are really no other insect defoliators of shore pine of consequence on the Oregon coast (probably because of the weather). Others listed in table 2 are considered generally important to lodgepole pine and may be encountered here.

Sawflies may become locally common in some years, but in subsequent years they rarely cause significant damage. Sawflies have caterpillar-like larvae, but are related to bees, wasps and ants, not to moths and butterflies, as are most caterpillars. Pine sawfly (*Neodiprion* sp.) generally occurs in spring and early summer, disappearing by late summer. Damage tends to be limited to a few branch sprays and previous years' foliage, as the larvae are gone by the time new foliage is fully developed.

Aphid and scale insects

The western pine spittlebug may be common in some years. When abundant, they can cause stunting of growth and foliage loss on some branches. They are typically not a problem, but they can flare up. Aphids and spittlebugs have an incomplete metamorphosis, with the nymph resembling the adult; however, only adults have wings, and the nymph of the western spittle bug usually has a protective spittle mass around it. The insect has an interesting life cycle, spending much of its nymphal state in the nonpine, understory vegetation, then moving to overstory pines later in development.

Other aphid and scale insects can be expected on shore pine, perhaps associated with overfertilization, or shading where the tree is stressed. However, no major problems have been reported.

Trunk, branch, and terminal insects

Sequoia pitch moth larval feeding causes resin masses and streaming (figure 10), which may be the most common symptom of any agent observed on shore pine. There is a single larva in each pitch mass (figure 11), and they have a 2-year life cycle,

Figure 10. Sequoia pitch moth resin mass. Note the older resin with an exit hole, where the moth exited, and the newer resin, which may have a larva still feeding inside.

Figure 11. Sequoia pitch moth caterpillar exposed by cutting away the resin mass.

spending most this time feeding on the cambium of the tree under the pitch mass. Pitch masses dry out and persist long after the insect has pupated and left the tree; therefore, some trees can seem to be covered with attacks (figure 12). Fresh pitch, indicating the insect may be present, usually is very pliable and may include insect frass (eaten inner bark). Scraping away the pitch mass and removing the caterpillar is one management technique. The adult moths are clearwing moths. The female lays eggs at wounds and limb junctions. The moths are especially attracted to pruning wounds and stressed trees; therefore, a major recommendation for minimizing pitch moth attacks is to prune from November to February, when the adults are absent. Special attention should be made to properly prune the trees, as this will speed callusing of the wound. A few pitch moth attacks on a tree usually do not cause any real damage to the tree. This insect is not a major concern, although it is very common.

Figure 12. Shore pine tree with many sequoia pitch moth attacks.

Major Disease Problems of Shore Pine (see table 4)

Table 4. Common diseases of shore pine. Symptoms are the visible response of the plant (red foliage, resin flow, reduced growth, and wilting). Signs are the physical presence of causal agents (beetle grub or fungal fruiting body).

A. Root rots, butt rots, and stem decays.

Species	Notes	Symptoms	Signs
Armillaria root disease *Armillaria* spp.	Common, but of unknown importance. Generally associated with already stressed trees.	Chlorotic tree, reduced leader growth, heavy resin flow at ground line.	Mycelial fan of fungus under bark. Honey mushrooms in fall. Stringy rot.
Schweinitzii root and butt rot, or cow pie fungus, velvet top fungus *Phaeolus schweinitzii*	Locally common root heartrot and butt rot of live trees.	Red-brown cubical root and butt rot of live trees.	Mushroom-like fruiting bodies with pores and a stalk. Velvet top when fresh.
Conk rot or pini or red ring rot, or white speck *Porodaedalia (Phellinus) pini*	Locally common heartrot of live trees.	Heartrot of live tree. Pocket rot. Often red crescent wood stain.	Conk at branch stobs, cinnamon interior. White mycelium in pockets.
Pitted saprot *Trichaptum abietinum*	Dead sapwood decay, but can colonize wounded trees.	Honeycombed decay with small pits.	Conks on dead wood, violet underside, thin, shelflike, upper surface zoned, may be fuzzy.
Red belt fungus or brown cubical rot *Fomitopsis pinicola*	Common dead wood decay.	Brown cubical rot of dead trees.	Conk usually has red band/belt on it. Common on dead logs.
Pouch fungus or gray-brown sap rot *Cryptoporus volvatus*	Associated with bark beetles and wood borers.	Gray-brown rot of sapwood.	White, rounded conk, with hollow interior where pores are hidden.

B. Foliage diseases.

Species	Notes	Symptoms	Signs
Red band needle blight, Dothistroma needle blight *Mycosphaerella pini*	Occassional flare-up associated with wet spring weather.	Reddish brown bands on both sides of foliage. Partially dead foliage at ends of the needles.	Small dark fruiting body in band.
Lophodermella/Lophodermium diseases *Lophodermella concolor* (lodgepole pine needle cast, may be most important) *Lophodermium pinastri*	Various species known to infect lodgepole pine. Not well documented on the coast. Shaded wet sites and wet spring weather.	Early needle loss, low foliage retention. Red fruiting foliage.	Small black bodies on dead leaves.

C. Cankers and stem rusts.

Species	Notes	Symptoms	Signs
Western gall rust *Endocronartium harknessii*	Locally important gall of shore pine. Can heavily infect trees in wave year.	Swollen woody gall. Hip canker on main stem, trees broken at gall. Branch flagging.	Orange spore mass in spring.
Diplodia tip blight *Diplodia pinea* *(Sphaeropsis sapinea)*	Known for lodgepole pine, but are not documented from the coast.	Dying needles and twigs, possible branch and top kill. Shrunken resinous tips, with black stained wood.	Small black fruiting bodies embedded in leaves, bark and cone scales.
Atropellis canker *Atropellis piniphila, A. pinicola.*	Known for lodgepole pine, but are not documented from the coast. Uncertain how common on coast.	Large spindle-shaped perennial canker. Wood stained black.	Small black cup-shaped fruiting body.

Root, butt, and stem rots

Root, butt, and stem rots of shore pine are minimal. Large root rot disease centers have never been reported. Although several root and butt rots can occur on shore pine, they are associated with large trees that have been wounded or are adjacent to houses and other structures or parking lots. Red brown root and butt rot (caused by *Phaeolus schwienitzii*) is a common butt rot that may occur on older trees and cause a heartrot of the tree butt and large roots. Little is known about the significance to shore pine in general. The fruiting body of *P. schwienitzii* is stalked and mushroom-like but with pores. When fresh in the fall, it is brightly colored, with bands of dark brown and yellow. These dry out and persist as brown cow pie–looking fungi (figure 13).

Armillaria root disease is common everywhere and could be associated with declining trees. Armillaria is typically associated with stress, such as from over-fertilization and overwatering.

Figure 13. The mushroom-like fruiting body of red brown root and butt rot (*Phaeolus schwienitzii*) attached to a cut shore pine stump. Note the decayed center of the stump. The fungus probably fruited in the fall. (This picture was taken in March at Honeyman State Park, Oregon.)

Stem rots, such as conk rot or red ring rot (caused by *Porodaedalia pini*, formerly, Phellinus pini; figure 14), are known from lodgepole pine, but in general are not commonly reported. Conk rot is thought to be most common in older trees. A conk likely indicates extensive heartrot. Stem decay should be expected in severely wounded trees from sapwood rotters like pitted sap rot (caused by *Trichaptum abietinum*), and older trees could expect to show conk rot, but the literature on shore pine is very limited.

Perhaps the most common fungal conk observed on shore pine is on dead trees. The red belt fungus (*Fomitopsis pinicola*) is an important wood decay of dead trees. It has a distinctive, cream-colored conk, with pores on the undersurface and a solid, smooth upper surface often with a distinct red band. The red belt fungus is not known to occur on live trees, except perhaps for severely wounded older trees.

Foliage diseases

Foliage disease can be important on shore pine along the coast, especially following consecutive years of wet spring and summer weather and mild winters. In addition, most shaded trees are influenced by foliage diseases (figure 15). In May of 2008, the Oregon Department of Forestry noted striking discoloration of the 1-year-old foliage on shore pines along the central and southern Oregon coast (figure 16). They found the cause to be both Dothistroma (red band) needle blight (caused by *Mycosphaerella pini*) and lodgepole pine needle cast (caused by *Lophodermella concolor*). They believe that the leaves were thoroughly infected during the previous summer when conditions were moist.

These fungi reproduce and disperse with small spores during optimum moisture and temperature conditions. If these conditions persist for long periods, such as during unsually wet summers, then

Figure 14. Conks of *Porodaedalia pini* (formerly *Phellinus pini*) on older shore pine.

Figure 15. Shaded shore pine planted alongside a road, Honeyman State Park, Oregon.

Figure 16. Foliage disease in shore pine. Note the previous year needles are red and will die. This tree was infected by both Dothistroma needle blight (red band needle blight, *Mycospaerella pini*) and lodgepole pine needle cast (*Lophodermella concolor*).
(Photo by Alan Kanaskie, Oregon Department of Forestry, used by permission.)

the fungi can quickly build up on the needles of shore pine. The disease may become more apparent in the second year, following a good year of build up. Opening the canopy to allow air flow and drying of the foliage is the best management tool for foliage disease because moisture on the needles prevents drying of the spore and fungal hyphae, therefore allowing infection of the needle. If the needle and air are dry, infection is much less successful. Another known factor in foliage disease is the genetics of the tree. Off-site seed source is often associated with severe foliage disease in pines. For example, lodgepole pine from eastern Oregon would likely have severe foliage disease on the coast.

Cankers and stem rusts (galls)

Western gall rust (caused by the fungus *Endocronartium harknessii*), causes a distinctive roundish gall or swelling on branches (figure 17) and, occasionally, on the main stem. This is one of the most common diseases of shore pine, yet it can be very patchy in distribution because it is closely associated with the microenvironment. The environmental requirements for successful infection (moisture during spore dispersal and infection) are very specific, and the fungus may not be successful in initiating new infections during most years or generally in certain habitats. However, in some geographic settings the disease may be chronic, while in some years many new infections can occur in what is called a wave year. The primary management of western gall rust involves pruning infected branches or culling heavily infected trees.

Figure 17. Woody swelling (gall) caused by the western gall rust fungus, *Endocronartium harknessii*.

The fungus erupts from cracks in the gall to produce bright orange-yellow spores that are dispersed in air during spring (figure 18). The spores must land on newly expanding shoot tissue, because they can infect only very young tissues. Once in the stem, the fungus develops in place without spreading. An enlarged swelling, which can be very large and woody, develops. Unlike other rust fungi, this fungus does not require an alternate host, but spreads from pine tree to pine tree. If the main leader of the tree is infected, a gall will develop on the main stem of the tree. This often occurs when the tree is young, and the resulting large gall is

Figure 18. Gall with dispersing spores in spring. This specimen is on ponderosa pine, but looks very similar on shore pine.

called a hip canker. The tree usually breaks at the hip canker over time because the tree structure is weakened.

Dwarf mistletoes

Shore pine dwarf mistletoe (*Arceuthobium tsugense* subsp. *contortae*) is not known in Oregon. It occurs mainly in British Columbia and is in Washington State only in the San Juan Islands (for example, on top of Orcas Island is a great place to see it). Lodgepole pine dwarf mistletoe (*A. americanum*) is another dwarf mistletoe that does not occur on the Oregon coast. However, knobcone pine dwarf mistletoe (*A. siskiyouense*) does occur on an inland population of shore pine north of Cave Junction, Oregon.

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