

Non infectious diseases

A- Non infectious diseases-

Diseases caused by extreme environmental conditions

High temperature

Seedlings in transplants are vulnerable to excessive heat due to their fragile cortical cells which could be killed in 30 minutes by exposure to temperatures between 57-59°C.

Resistant to heat vary between forest trees. For instance, eastern white pine and white spruce have high ability to recover from heat injury, whereas red pines are less recoverable.

Symptoms

Symptoms on the green stems of very young seedlings of conifers are looks like short, white, shrunken, watery-looking lesions. This is usually appears above the soil surface and on the south side of the stems or on the top side of curved or bent stems. This injury called white spot. Commonly the entire stem is constricted (rigid) by the lesion, resulting in lopping (slicing) over and death of the plant. Symptoms of heat injuries on seedlings are similar to that of damping off. However, lesions caused by heat can be distinguished by their light colour, definite boundaries, and limitation to the portion of the stem aboveground.



Forest and Shade Tree Diseases - Lecture 3 (2022-2023)

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Low temperature

Affects plant species not adapted to normal low temperatures to the region to which they have been introduced or exposure of species within their natural habitats to excessive low temperatures.



Frost

Injuries cause damages to the unripened tissues of hardwood and conifers above ground. Roots may be injured by the soil frost. Hardwoods generally are more susceptible than conifers to early frosts. In general, late frosts are more serious than early frosts.

Frost damage is caused by moisture condensing on the leaf and forming ice crystals by drawing water from the plant. This dehydrates the plant and is why frost damage looks like a burn. Because many trees and plants become casualties during freezes, every effort should be made to protect vulnerable plants to minimize winter damage.

Heaving (bursting) is caused by repeating freezing and thawing in the upper soil layers, accompanied by expansion and contraction, particularly vertically, owing to the formation of ice crystals and ice lenses. The root collar of the affected seedlings may be raised above the soil surface, or the plant may be completely thrown out of the ground. The roots are usually broken off at a depth of a few inches. Snow, brush, and ground cover reduce losses from heaving. In nurseries, the trouble can be prevented by mulching or by lowering the water table.



Purple foliage

During winter a bronze to purplish-coloured foliage sometimes develop on the coniferous seedlings. Seedlings in exposed beds are most likely to discolour. The cause is due the change of pigments in the foliage caused by low temperatures. This should not be confused with the purpling in pines caused by acute phosphorous deficiency.



Purple foliage on conifers

Water deficiency - drought

This normally happen in arid forest regions during certain seasons of the year. This even happen with artificial watering using hoses not providing sufficient water during a dry season. Droughts may cause killing whole plant or a part of it. The injured needles first become yellowish and then become pale-straw colour then gradually turn brown and finally become nearly red.

B-Non infectious diseases-diseases caused by non-environmental causes

Mineral deficiency

Symptoms related to nutrient ion appear on different forest trees. Here are some of them:

Disease	Host	Cause	Symptom
Purple top	Scottish pine, western white pine, pine seedlings	Phosphoric acid deficiency and lime in the soil	Violet colour of the foliage
Zonate chlorosis	Cedar	Nitrogen deficiency, Lack of potassium and magnesium	Reddish-brown to brown discolouration of the foliage and stunning
Needle tip burn	Sitka spruce seedlings	Copper deficiency	Tips of the upper needles shrivelling and becoming straw coloured

Toxic chemicals

These disease symptoms caused by excessive use of fertilizers and pesticides. This may result to kill seedlings by acting either directly on the foliage or indirectly through the soil.



Infectious diseases:

Disease caused by fungi

The damages are sensible in broadleaf trees in nurseries.

Leaf spots:

There are many living organisms causing leaf spots on forest broad-leaved seedlings. Most hardwood species are affected by one or more fungi or bacteria that cause leaf spots and blights. The impact of leaf diseases on seedlings can range from minor loss of leaf area to entire crop loss. Leaf disease incidence can increase dramatically within nurseries due to seedling densities and frequent irrigation in nurseries. Defoliation of young seedlings in nurseries can lead to serious damage and mortality if the seedlings are unable to produce new leaves.



Powdery mildews:

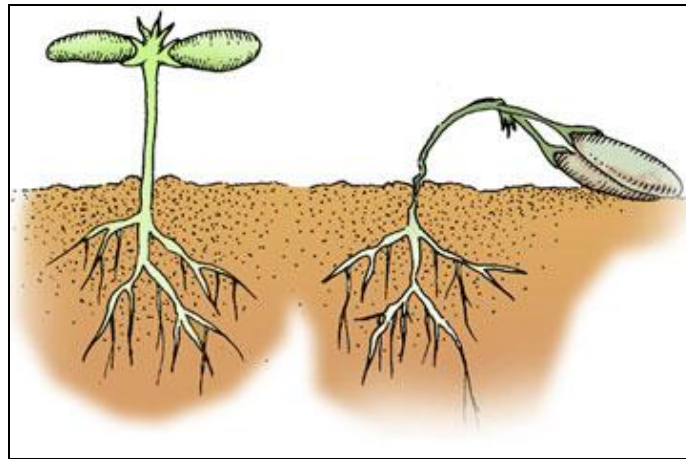
Powdery mildews are well recognised by having a white powdery feature on the infected surfaces of plant parts. The white colour is represented by the mycelium and conidia of the pathogen (the fungus). Different genera of fungi attack different forest seedlings having similar symptoms.

Damping off:

Damping off is a rapid decay of young succulent seedlings or other shoots. It is caused by a number of soil-inhabiting fungi that are facultative parasites and not specialized as to host.

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Damping off is an extremely destructive disease, and it causes large losses in coniferous nurseries. Losses due to damping off are both direct and indirect. There is the actual reduction in the quantity of stock. Then, to maintain production, a much larger area must be sown to seedbeds, with an added cost for seed and sowing and the expense of caring for the additional seedbeds until transplanting. Indirect losses, plants are temporarily disturbed. The poor quality of seedlings may be one of indirect damages.



Symptoms of damping off:

Early decay and death of seedlings whose stems are still soft and succulent

Three stages of damping off may be recognized:

1. **Seed decay:** decay of the seeds before transfer to seedlings (invisible, in the soil).
2. **Pre-emergence damping off:** the damping –off organism kill the seedlings before they emerge from the soil.
3. **Post-emergence damping off:** the seedlings are affected after they appear above the ground.

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Damping off fungi:

Damping offs are caused by a number of fungi that live as saprophytes in the upper layers of the soil, but under favourable conditions, may become virulently pathogenic. Major damping off fungi include:

Pythium spp, *Phytophthora* spp, *Rhizoctonia solani*, *Sclerotium bataticola*, *Botrytis cinerea*, *Fusarium* spp

Control:

- Avoid of wet soil and excessive water
- Build nurseries in well-drained sites
- Thick sowing should be avoided
- Grow coniferous in acid soils
- Soil disinfection, using heat or chemicals
- Use and encourage competing organisms in the soil, notably *Trichoderma* spp
- Sterilize of soil using different methods

Top killing

Caused from fungi that attack the tops of hardwood and coniferous after the plants have developed stems stiff enough to continue standing after death. The disease is more sever during moist seasons in dense stands in which the tops of the seedlings are in contact with each other.

Pathogen:

Rhizoctonia spp on 1-2 year old red spruce and *Diplodia pinea* on the 1st year old seedlings of Douglas fir.

Root rots

Damping off fungi may continue their activities by causing root rot in nursery seedlings even into the second or third season. The same factors that favour damping-off will also favour root rots.

Pathogens of root rots:

Phytophthora cinnamomi causes dry type of root rot of hardwoods and conifers

Diplodia pinea cause root rot and death of 3-5 year old red pines

Control:

As in damping-off

Snow blight (Phacidium blight) of conifers

Symptoms

The pathogen attacks foliage under the snow. The damage is proportionate to the depth and persistence of the snow cover. Affected foliage assumes a soft and more or less glaucous-brown colour (from the Latin glaucus, meaning "bluish-grey or green", from the Greek glaukos) is used to describe the pale grey or bluish-green appearance). In closely planted nursery beds the disease occurs in subcircular patches of 60 cm or more in diameter. A white mycelium may be observed on the browned foliage.

Causal agent

Snow blight caused by *Phacidium infestans* (ascomycota) . In the summer ascospores discharged from apothecia appear on the underside of needles. In addition, tiny black microsclerotia, very resistant to drought, also produced abundantly on the surface of needles.

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Control

- Grow healthy plants in plantations
- Late autumn spray with fungicides in nursery beds
- Remove of infected seedlings as soon as sawn and burn them

Moulding and smothering

Moulds

Moulds resulted from injuries on the leaves, allowing penetration of weakly parasitic fungi during shipping or prolonged periods by mulch. From these diseases:

Gray mould blight

Gray mould occurs in seedlings and the lower branches of saplings up to about 150 cm high. Have an extremely large number of hosts. In fact, nearly all forest tree seedlings are susceptible to some degree; but redwood, giant sequoia, and Monterey and Italian cypress are especially susceptible. It is also found in Douglas fir. The most characteristic symptoms is the withering, curling, and dying of the current season's shoots. Under moist conditions, a dense aerial mycelium develops, forming a gray mould over the affected twigs and leaves.

Fungus

Botrytis cinerea (imperfect fungi)

sexual state: *Botryotinia fuckeliana*

Rosellinia Blight

Rosellinia minor has recently been identified on container-grown seedlings. The moist, mild falls and winters are ideal for *Rosellinia*.

Hosts and damage

The disease found on Douglas-fir. It also affects bare root Douglas-fir and Sitka spruce. Damage occurs in the centre of densely sown seedbeds, container-nursery benches, or individual containers where prolonged high humidity, free water on stems and needles, and dense foliage favour the disease. The fungus forms dense mats of whitish brown mycelium on the lowermost stems and needles of seedling shoots, sometimes binding them together.

Superficially, *Rosellinia* can resemble the gray mould, *Botrytis cinerea*, which thrives under similar conditions, and sometimes the two occur together. The two fungi differ in that *R. minor* forms sexual fruiting structures (perithecia). *Rosellinia* also has the tendency to grow upward and cover the shoot. Needles beneath the mycelium become chlorotic, die, and are cast, resulting in the seedlings being culled. Few seedlings die. Defoliation can reach 80% on heavily attacked seedlings. After needle death, the mycelium loses its mould-like appearance and becomes flattened against twigs and needles, exposing the small black, perithecia.

Life history

Infection may result from air-borne conidiospores, mycelium from contaminated soil, ascospores, or all three. Generally, perithecia produce ascospores after the decayed host material is subjected to winter temperatures. Conidiospores are produced during summer. Under favourable growing conditions this may vary, with ascospores produced and released to start new infection centres the same growing season, while mild winters may result in conidiospore production.

Management

Cultural practices are important in *R. minor* management as the fungus requires long periods of high humidity and free moisture. Humidity can be reduced by spacing containers to improve aeration, decreasing irrigation, and increasing ventilation. Growing media should have good drainage to avoid water accumulation. Sanitation is important, so diseased plant material should be removed from the nursery. In bareroot nurseries, bare fallowing during summer will expose the pathogen to the sun's heat and desiccation.

Smothering disease

Smothering infects both coniferous and deciduous seedlings in nurseries under natural conditions. Smothering is caused by the fruit body of the fungus growing up from the soil around the lower stem of the seedling, and sometimes only the tip of the seedling is left projecting. The disease usually occurs where seedlings are dense enough to shade the ground.

Fungus

Telephora terrestris (Basidiomycota)