CHAPTER SEVEN

Seed Fungi

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Several different species of fungi are associated with conifer seed. Early studies linked declines in germination in conifer seedlots to high levels of seedborne mold fungi. However, such occurrences are sporadic and hard to predict. Cone handling and storage practices after harvest affect levels of seedborne fungi significantly.

Seedborne fungi also contribute to outbreaks of Fusarium and Siroccoccus diseases in container and bareroot conifer nurseries. These problems are covered elsewhere in this book.

Fungi and hosts

Seedborne fungi (Figure 7-1) are very common in conifers and other plant species. The literature contains numerous references to fungi isolated from cone integuments (bracts and scales), seed coats, and embryos. The seedborne fungi of Douglas-fir and ponderosa pine have been studied more thoroughly than those of other Pacific Northwest timber species. Some of the more common fungi are listed in Table 7-1 on page 24.

Fungus biology

The process through which fungi become established on Douglas-fir seed has been well documented. Less information is available for other tree species, but similar circumstances surrounding the buildup of inoculum on cones and its subsequent transfer to seed can be inferred. Fungal infection of seed

Seed fungi symptoms appear:
1+0
Late spring through early summer

Figure 7-1. Fungi growing from true fir seed in a germinator. The amount of fungal contamination can vary by tree species and method of collection, and between seedlots.
Loss potential

It is difficult to predict damage from seedborne fungi. The most common fungi are saprophytic or even beneficial because they compete with other potentially pathogenic species. Some, however, are consistently associated with reduced germination rates and vigor. In general, fungi that are present within seed are more damaging than those that merely contaminate the outer seed coat. *Trichothecium*, for example, can reduce germination of Douglas-fir seedlots by 20 percent. *Caloscypha* is still more damaging; this fungus penetrates and kills seeds before germination. It can spread during cool, moist storage and even after sowing. Damage from *Caloscypha* has been most severe in British Columbia and in Europe.

Management

Seed fungi are common in the environment and increase rapidly under warm, wet conditions. Preventing contamination is generally more successful than trying to cure diseased seedlots. Collecting clean cones, drying them, and extracting seed promptly are essential first steps. Storage of cones on the forest floor is important in the transmission of the seed fungus *Caloscypha*. Molds can develop in cone storage bags even with proper handling. Levels of seedborne fungi have been shown to be significantly higher following cone storage and extraction. This evidence might pinpoint the extraction phase as the primary stage when inoculum transfer occurs. Because cones appear to be a prime source of inoculum, the potential for cross-contamination between seedlots during cone processing is high.

Seed may be tested for the presence of fungal inoculum by plating seed on agar media. Testing should be selective enough to pinpoint the pathogen and to identify individual seedlots that need treatment. Fast-growing fungi and bacteria are readily isolated on non-selective media such as potato dextrose (PDA) or 2-percent malt extract (Figure 7-2). Selective or semi-selective media may be used to detect most seed fungi.

Detecting internal fungi requires sterilization of the seed surface with 1-percent bleach or 30-percent hydrogen peroxide, or a combination of the two. This will remove approximately 90 percent of the surface fungi. Better results can be achieved by increasing the soaking time, washing seed in a surfactant, and rinsing repeatedly in sterile distilled water.

Certain pathogens can be detected more quickly and accurately with monoclonal antibody tests in an enzyme-linked immunosorbent assay (ELISA). To date, ELISA tests are available for *Sirococcus* and *Caloscypha* on spruce seedlots.

Selected references


Figure 7-2. Douglas-fir seed in a petri plate. Notice that most seeds have white, cottony colonies of fungi growing from them.
Table 7-1. Common seedborne fungi in Pacific Northwest conifer species.

<table>
<thead>
<tr>
<th>FUNGUS</th>
<th>HOSTS</th>
<th>APPEARANCE IN CULTURE</th>
<th>DISEASE PROBLEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Alternaria</em></td>
<td>many conifers</td>
<td>gray-green to black; septate, club-shaped spores</td>
<td>radicle and cotyledon disease of white spruce</td>
</tr>
<tr>
<td><em>Caloscypha</em> (= <em>Geniculodendron</em>)</td>
<td>pine, spruce true fir, Douglas-fir</td>
<td>beige, whitish gray, orange to pale yellowish brown; smooth, colorless round spores</td>
<td>seed rot, reduced germination</td>
</tr>
<tr>
<td><em>Cladosporium</em></td>
<td>many conifers</td>
<td>dark velvety green; pickle-shaped conidia</td>
<td>reduced vigor of germination</td>
</tr>
<tr>
<td><em>Fusarium</em></td>
<td>many conifers</td>
<td>white, salmon to pinkish-red; macroconidia sickle-shaped with 3-4 septations</td>
<td>reduced germination disease in seedbeds</td>
</tr>
<tr>
<td><em>Penicillium</em></td>
<td>many conifers</td>
<td>green to bluish-green; small, round conidia</td>
<td>reduced vigor of germination</td>
</tr>
<tr>
<td><em>Trichoderma</em></td>
<td>many conifers</td>
<td>white turning to green, fast-growing; small, round conidia</td>
<td>none; this is usually a beneficial fungus</td>
</tr>
<tr>
<td><em>Trichotheccium</em></td>
<td>many conifers</td>
<td>pinkish, two-celled conidia</td>
<td>reduced germination</td>
</tr>
</tbody>
</table>
