INFLUENCES OF INSECTS AND DISEASES ON PLANTING STOCK QUALITY[1]

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INTRODUCTION

Growing large numbers of seedlings in nurseries often provides ideal conditions for damage by insects and pathogens. Conditions suitable for seedling production are also conducive for infection by many pathogens. For example, greenhouse environments which stimulate seedling growth may also be ideal for development of Botrytis blight. Seedlings grown in nurseries are usually not influenced by the wide range of organisms, including natural biological controls, that are present in natural forest environments. For example, populations of soil pathogens are often much higher in nonsterilized nursery soils than in natural forest soils. Therefore, insects and diseases can be important factors affecting nursery seedling quality.

Seedling quality is usually evaluated on the basis of several physiological parameters which can be measured (Jaramillo 1981). Some of these include water status (Cheung et al. 1975; Clery and Zaerr 1979) and electrical impedance (Glerum 1973; van der Driessche 1973), resistance (Ferguson et al. 1975), and conductivity (Aronsson and Eliasson 1970). Other measurements of seedling quality include level of carbohydrate reserves (Krueger and Trappe 1967), mineral-nutrient content (Krueger 1967), and field survivability (Askren and Hermann 1970; Hermann and Lavender 1979). Insect and disease damage can affect seedling quality by altering many of these factors. Unfortunately, there is very little information describing quantitative effects of insect and disease damage on seedling quality. Representative examples of insect and disease damage commonly encountered in northern Rocky Mountain nurseries will be discussed relative to their suspected impact on seedling quality.

CRANBERRY GIRDLER MOTH

The cranberry girdler moth (Chrysoteuchia topiaria Zeller) is a sod webworm that attacks bareroot 2-0 Douglas-fir and grand fir seedlings in nurseries. Feeding damage by larvae occurs just below the root collar and is similar to that caused by rodents or cutworms. Damage is usually not noticeable until seedlings are lifted because little mortality or foliage discoloration occurs. Feeding usually occurs in patches, causing groups of seedlings to be affected.

Recent investigations of this insect at the Coeur d'Alene Nursery has entailed moth population sampling using pheromone-baited sticky traps (McDonough and Kamm 1979) and inspection of seedlings for injury during lifting operations (Tunnock 1982). Occurrence of adult male moths in traps was common, but only 0.9 percent of the sampled 2-0 seedlings was damaged.

Seedlings with evidence of feeding injury are rountinely culled by nursery workers. Since seedlings are partially girdled as a result of feeding, their vigor and survivability after outplanting are probably adversely affected. However, quantitative effects on vigor or outplanting survival of damaged seedling have not been measured.

BOTRYTIS BLIGHT

Botrytis blight, caused by the fungus Botrytis cinerea (Fr.) Pers., is one of the most damaging diseases of seedlings in forest tree nurseries. The disease is especially severe on containerized conifers in greenhouses where conditions are ideal for infection by and buildup of the fungus (James et al. 1982; McCain 1978). Botrytis also causes seedling mortality and decay in storage (Smith et al. 1973).

Severely infected seedlings are usually killed by Botrytis blight. Others with extensive foliage infections are discarded during culling operations. However, some infected seedlings are likely shipped to the field for outplanting. If storage temperatures exceed 0° C., Botrytis can actively colonize seedlings, especially if seedlings are stored within impermeable plastic bags. Treating seedlings with fungicides prior to storage may reduce losses in transit (Smith et al. 1973).

Botrytis blight affects seedling quality by causing mortality, foliage necrosis, and cankers on branches or the main stem (McCain 1978; Sutherland and Van Eerden 1980). Cankers usually occur only on severely infected seedlings that would likely be culled prior to shipment. Extensive necrosis and premature loss of foliage will result in reduced photosynthetic capacity and overall loss of vigor. However, seedlings can probably tolerate light foliage infection with little adverse effect on quality.

Seedlings with slight Botrytis infection can probably be outplanted with as good a chance for survival as noninfected seedlings. Once seedlings are no longer crowded together and their foliage dries out, the pathogen cannot successfully colonize tissues. Therefore, the disease is of most importance while seedlings are within the nursery and during shipment. Once trees are outplanted, the disease is of little consequence.

FUSARIUM ROOT DISEASE

Fusarium root disease, caused primarily by F. oxysporum Schlect., is an important disease of both bareroot and containerized conifer seedlings in northern Rocky Mountain nurseries. Effects of the disease on planting stock quality include mortality (James 1983a), stunting (Landis 1976), chlorosis (Landis 1976), and tip dieback (James 1983b). Once Fusarium infects small feeder roots, it may become dormant (Bloomberg and Lock 1972) or actively colonize tissues causing disease.

Most stunted seedlings and those with very chlorotic foliage or extensive tip blight are culled during lifting operations. Because Fusarium may remain inactive within roots without symptoms being produced, lightly infected seedlings may be shipped for outplanting. However, Fusarium decreases rapidly on roots of seedlings planted in natural forest soils (Smith 1967). This is likely due to competition and antagonism by nonpathogenic forest soil fungi. Therefore, lightly infected seedlings can probably survive outplanting as successfully as noninfected seedlings.

MERIA NEEDLE CAST

Meria needle cast, caused by Meria laricis Vuill., is a common disease of western larch in forests of the northern Rocky Mountains (Dubreuil 1982). The disease also occurs on bareroot nursery seedlings (Cooly 1981; Hubert 1954). Meria causes needle discoloration and premature needle loss (Leaphart and Denton 1961). Mortality of severely infected seedlings may occur (Hubert 1954).

Seedlings with slight needle discoloration or loss of a few needles are probably not greatly affected by the pathogen. However, natural infection can occur after seedlings are outplanted (Durbreuil 1982), causing survival problems. Survival of severely infected seedlings was monitored by Cooley (1981); she found that 85 percent of the seedlings had survived after 3 months in a natural-forested area. Level of natural infection and long-term survival were not determined.

It is suspected that diseased seedlings usually survive if they are not reinfected after outplanting. A test of outplanting survival of seedlings with different levels of infection is planned for Montana.

WESTERN GALL RUST

Western gall rust, caused by Endocronartium harknessii (J. P. Moore) Y. Hirat., is a common disease of two- and three-needle pines in the western United States (Donaldson et al. 1976). The disease also occurs on bareroot nursery stock (Carlson 1969; Johnson 1979); primary hosts in the northern Rocky Mountains are lodgepole and ponderosa pines. Primary effects on planting stock include stunting, gall formation on the main stem, and needle chlorosis (Johnson 1979).

Diseased seedlings with noticeable galls are usually culled during lifting operations. However, some infected seedlings may be missed because it takes 6 months to 1 year for galls to become evident after infection (Donaldson et al. 1976). If infected seedlings are outplanted, they may be killed after galls form. Galled seedlings may also provide inoculum to infect nearby seedlings since an alternate host is not required for this pathogen.

Johnson (1979) sampled ponderosa pine seedlings transplanted from a bareroot nursery for western gall rust over a few years. He found very little disease incidence (0-0.5 percent) and concluded that the disease did not significantly impact planting stock. However, Donaldson et al. (1976) advocated rejection of an entire shipment if any galled seedlings were found. Galled seedlings should be discarded when examining pine planting stock and galled trees should be removed during intermediate cuttings.

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