OCCURRENCE OF FUNGI ON WESTERN WHITE PINE SEED
IDAHO DEPARTMENT OF LANDS

R. L. James
Plant Pathologist

USDA Forest Service
Northern Region
1201 Ironwood Drive
Coeur d'Alene, ID 83814

Nursery Disease Notes #84

January 1989

Western white pine (Pinus monticola Dougl.) seed from the 1988 Moscow Arboretum collection (designated lot WP 88), which had been processed and distributed to the Idaho Department of Lands (IDL), contained an unusually large amount of extraneous debris. This debris was made up mostly of pieces of cone scales, seed wings, and pitch globules. Because this seed was of such high value, IDL personnel were concerned that presence of so much debris may result in greater than normal seed contamination by potentially pathogenic fungi. Therefore, a representative sample of seed and debris were analyzed in the laboratory for fungal colonization.

Pre-stratification samples of seed were collected from bulk seed. Such collections contained seed mixed with pieces of debris. Seed selected from samples were aseptically placed on a selective agar medium for Fusarium spp. (Komada 1975). Fifteen seeds were placed on each agar plate (one replicate). A total of 7 replicates (105 seeds) were assayed. Likewise, 15 pieces of debris were aseptically placed on each agar plate (also a total of 7 replicates). Plates were incubated at about 22°C for 7-10 days under diurnal cycles of cool fluorescent light. After incubation, plates were examined and colonization of seed and pieces of debris by fungi were tallied. Selected isolates of Fusarium were transferred to potato dextrose and carnation leaf agar for identification using the taxonomic scheme of Nelson et al. (1983).

Assay results are summarized in table 1. Fusarium spp. were isolated from about 5% of the seed, but less than 2% of the pieces of debris sampled. This level of contamination would be considered within the "normal" range for conifer seed (James 1986, 1987c; James and Genz 1982). Species of Fusarium isolated included F. oxysporum Schlecht., F. subglutinans (Wollenw. & Reinking) Nelson, Toussoun & Marasas, and F. culmorum (W. G. Smith)Sacc. These latter two species have not previously been isolated from conifer seed in northern Rocky Mountain nurseries (although they may have previously been identified as a different species). Therefore, descriptions of their characteristics are

Table 1. Occurrence of fungi on western white pine seedcoats and debris - Idaho Department of Lands[1].

Replication[2] Seedcoats	Fungi[4] FUS	TRI	PEN	PHO	BOT	ALT	MUC
1	0	4	15	0	0	0	0
2	0	2	15	0	1	0	0
3	3	2	15	0	0	1	0
4	1	2	15	0	0	0	0
5	0	1	15	0	0	0	0
6	0	2	15	0	0	0	0
7	2	1	15	1	0	1	0
Totals	6	14	105	1	1	1	0
Percent	5.7	13.3	100.0	0.9	0.9	0.9	0
Debris[3]							
1	0	1	15	10	0	0	1
2	0	1	15	3	0	0	1
3	1	3	15	4	0	0	1
4	1	1	15	6	0	0	1
5	0	1	15	5	0	0	3
6	0	0	15	5	0	0	2
7	0	2	15	2	0	0	5
Totals	2	9	105	35	0	0	14
Percent	1.9	8.6	100.0	33.3	0	0	13.3

[1] Figures in table are number of seed or pieces of debris colonized with appropriate fungus (15 samples per replication).

[2] Fifteen seed sampled per replication.

[3] Debris made up of pieces of cone scales, seed wings, and pitch globules which were mixed with seed.

[4] FUS = Fusarium spp. BOT = Botrytis cinerea
TRI = Trichoderma spp. ALT = Alternaria sp.
PEN = Penicillium spp. MUC = Mucor sp.
PHO = Phoma spp.

included in the Appendix of this report.

Penicillium spp. were the most commonly encountered fungi on white pine seed and debris (table 1). All sampled seed and pieces of debris were colonized with these fungi. Although they are commonly assayed on conifer seed (James and Genz 1982; James et al. 1987), Penicillium spp. are generally considered saprophytes. Other fungal genera assayed on white pine seed included Trichoderma, Phoma, Botrytis, Alternaria, and Mucor. Most of these fungi are commonly found on conifer seed (James 1984b; James and Genz 1982) and are usually not pathogenic. Possible exceptions include B. cinerea Pers. ex Fr.,

which has been identified on conifer seed with increasing frequency in recent evaluations (James 1989a; James, Gilligan and Reedy 1988) and can cause serious disease problems in greenhouses (James 1984a), and Phoma spp. which are also capable of causing conifer seedling diseases (James and Hamm 1985).

Past assays of fungal colonization of western white pine seed (James 1987a, 1987b) have generally resulted in relatively low levels of Fusarium. Likewise, little damping-off or root disease caused by Fusarium usually occurs on containerized white pine seedlings as a result of seed infection. However, older white pine seedlings may have extensive root colonization by Fusarium (James 1985a), probably resulting from inoculum residing within styroblock or pine cell containers (James 1988; James and Gilligan 1988). There are also other root fungi, such as Cylindrocarpon, Mortierella, and Pythium, which are associated with disease problems of western white pine seedlings (James 1985b, 1987d, 1989b).

Results of this investigation indicate that western white pine seed for the IDL from the 1988 Moscow Arboretum crop was not excessively contaminated with pathogenic fungi despite extensive occurrence of debris within processed seed. It would be expected that seedlings grown from this seed should not become diseased at higher than normal levels as a result of seed-borne inoculum.

LITERATURE CITED

James, R. L. 1984a. Biology and management of Botrytis blight. In: Murphy, P. M. (compiler). Proceedings: Intermountain Nurseryman's Association 1983 Conference. USDA Forest Service, Intermountain Forest and Range Exp. Sta., Gen. Tech. Rept. INT-168. pp. 39-43.

James, R. L. 1984b. Fungi colonizing Douglas-fir seed at the Champion Timberlands Nursery, Plains, Montana. USDA Forest Service, Northern Region. Rept. 84-13. 3p.

James, R. L. 1985a. Decline of containerized western white pine seedlings at the USDA Forest Service Nursery, Coeur d'Alene, Idaho. USDA Forest Service, Northern Region. Nursery Dis. Notes #24. 4p.

James, R. L. 1985b. Root diseases of transplanted western white pine seedlings at the USDA Forest Service Nursery, Coeur d'Alene, Idaho. USDA Forest Service, Northern Region. Nursery Dis. Notes #21. 4p.

James, R. L. 1986. Occurrence of Fusarium on Douglas-fir seed and containerized seedlings at the Plum Creek Nursery, Pablo, Montana. USDA Forest Service, Northern Region. Rept. 86-4. 10p.

James, R. L. 1987a. Fungi on bleach-treated western white pine seed, Raintree Nursery, Libby, Montana. USDA Forest Service, Northern Region. Nursery Dis. Notes #48. 1p.

James, R. L. 1987b. Occurrence of fungi on western white pine seed - Plum Creek Nursery, Pablo, Montana. USDA Forest Service, Northern Region. Nursery Dis. Notes #45. 3p.

James, R. L. 1987c. Occurrence of Fusarium on conifer tree seed from northern Rocky Mountain nurseries. In: Landis, T. D. (tech. coord.). Proceedings: Combined Western Forest Nursery Council and Intermountain Nursery Association Meeting. USDA Forest Service, Rocky Mountain For. and Range Exp. Sta., Gen. Tech. Rept. RM-137. pp. 109-114.

James, R. L. 1987d. Root deterioration of containerized western white pine seedlings, Plum Creek Nursery, Pablo, Montana. USDA Forest Service, Northern Region. Nursery Dis. Notes #47. 5p.

James, R. L. 1988. Fungal colonization of styroblock containers - Plum Creek Nursery, Pablo, Montana. USDA Forest Service, Northern Region. Rept. 88-10. 9p.

James, R. L. 1989a. Fungal colonization of ponderosa pine and Douglas-fir seed - USDA Forest Service Nursery, Coeur d'Alene, Idaho. USDA Forest Service, Northern Region. Nursery Dis. Notes #83. 3p.

James, R. L. 1989b. Root disease of containerized western white pine seedlings - Plum Creek Nursery, Pablo, Montana. USDA Forest Service, Northern Region (In preparation).

James, R. L., R. K. Dumroese, D. L. Wenny, J. F. Myers and C. J. Gilligan. 1987. Epidemiology of Fusarium on containerized Douglas-fir seedlings. 1. Seed and seedling infection, symptom production, and disease progression. USDA Forest Service, Northern Region. Rept. 87-13. 22p.

James, R. L. and D. Genz. 1982. Evaluation of fungal populations on ponderosa pine seed. USDA Forest Service, Northern Region. Rept. 82-22. 21p.

James, R. L. and C. J. Gilligan. 1988. Occurrence of Fusarium on Leach pine cells from the USDA Forest Service Nursery, Coeur d'Alene, Idaho. USDA Forest Service, Northern Region. Rept. 88-8. 10p.

James, R. L., C. J. Gilligan and V. Reedy. 1988. Evaluation of root disease of containerized conifer seedlings at the Champion Timberlands Nursery, Plains, Montana. USDA Forest Service, Northern Region. Rept. 88-11. 21p.

James, R. L. and P. B. Hamm. 1985. Chlamydospore-producing species of Phoma from conifer seedlings in Pacific Northwest forest tree nurseries. Proc. Mont. Acad. Sci. 45:26-36.

Komada, H. 1975. Development of a selective medium for quantitative isolation of Fusarium oxysporum from natural soil. Rev. Plant Prot. Res. 8:114-125.

Nelson, P. E., T. A. Toussoun and W. F. O. Marasas. 1983. Fusarium species: and illustrated manual for identification. The Pennsylvania State University Press, University Park. 193p.

Fusarium subglutinans (Wollenw. & Reinking) Nelson, Toussoun & Marasas

Section: Liseola

Colony Morphology:
- on potato dextrose agare, F. subglutinans resembles F. oxysporum.
- the white aerial mycelium grows rapidly and is sometimes tinged with purple.
- sporodochia may be present or absent; when present, they may be tan or orange.
- sclerotia may also develop and are frequently dark blue.
- undersurface varies from colorless to dark purple.

Conidia:
- microconidia are abundant, oval, and usually single-celled, but may be 1-3 septate; they are produced only in false heads.
- macroconidia are abundant, only slightly sickle-shaped to almost straight with the dorsal and ventral surfaces almost parallel. The basal cell is foot shaped.

Conidiophores:
- unbranched and branched polyphialides and monophialides.

Chlamydospores:
absent.

Fusarium culmorum (W. G. Smith) Sacc.

Section: Discolor

Colony Morphology:
- on potato dextrose agar growth is very rapid with dense aerial mycelium, generally white but often yellow and tan.
- orange to red-brown sporodochia appear as the culture ages.
- undersurface is carmine red.

Conidia:
- microconidia are absent.
- macroconidia are stout, thick-walled, distinctly septate, and have curved ventral and dorsal surfaces (Produces the most distinct short, stout macroconidia of the section Discolor).

Conidiophores:
- unbranched and branched monophialides.

Chlamydospores:
- form abundantly and quickly and may occur singly, in chains, or in clumps.