DECLINE OF CONTAINERIZED WESTERN WHITE PINE SEEDLINGS AT THE USDA FOREST SERVICE NURSERY, COEUR D'ALENE, IDAHO

by

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ABSTRACT

Recently transplanted containerized western white pine seedlings in various stages of decline were analyzed for presence of Fusarium and other potentially pathogenic fungi on their roots. Fusarium oxysporum was isolated from two of the seedlings but was not consistently associated with decline symptoms. No other potentially pathogenic fungi were isolated. Other unknown causes of seedling decline were probably involved.

INTRODUCTION

Western white pine (Pinus monticola Dougl.) seedlings are an important crop at the USDA Forest Service Nursery, Coeur d'Alene, Idaho. Seedlings are grown for outplanting as well as seed orchard and tree improvement purposes. Several seedlings originally grown for tree improvement stock in super Leach® cells were transplanted into large 9.5 liter (2.5 gal) containers into which standard peat-vermiculite soil mix was added. However, a few months after transplanting, many of the seedlings began to decline in vigor. Needle tip dieback, shortened needles, and reduced growth occurred and several of the seedlings eventually died.

Growers were concerned about possible causes of seedling decline and mortality. They were particularly concerned if pathogenic organisms were involved. Therefore, investigations were conducted to determine if pathogens were associated with the problem.

MATERIALS AND METHODS

Five seedlings in various stages of decline were selected for laboratory analysis of their root systems. General health of their foliage and root systems were noted (table 1). Isolations were made from roots onto a selective medium for Fusarium (Komada 1975). This medium was used because Fusarium had been previously implicated as causing similar decline and wilt symptoms on containerized western white pine seedlings (James 1985a). Root systems were separated into "old roots" (those that were mostly necrotic and located within the original container plug) and "new roots" (those which had grown from the original plug). Fifteen pieces of root from each category were placed on the selective medium after root systems had been washed thoroughly to remove loose soil and surface sterilized in 0.21 percent aqueous sodium hypochlorite (4 percent bleach) for 4 minutes. Two samples of the soil mix adjacent to roots were also collected from each pot and placed directly on the selective medium to determine if pathogens were present.

RESULTS AND DISCUSSION

Roots from two of the seedlings were colonized with Fusarium (table 2). None of the soil mix samples contained populations of Fusarium. Two isolates of F. oxysporum Schlect. were consistently isolated from the roots of seedlings #1 and #4. Detailed descriptions of these isolates are included in the Appendix. No other potentially pathogenic fungi were isolated from roots.

Occurrence of Fusarium on the roots of containerized western white pine seedlings was not unusual. These pathogens may be responsible for reduced outplanting survival (James 1985a) and mortality in nursery transplant beds (James 1985b).

Table 1.--Disease symptoms of containerized western white pine seedlings from the USDA Forest Service Nursery, Coeur d'Alene, Idaho.

Seedling number	Foliage symptoms	Root symptoms
1	Needles chlorotic, drooping, heavily twisted; some needle tip necrosis; new growth very reduced.	Roots from original plug mostly necrotic, black, with epidermis easily sloughed off. Egressed roots mostly healthy with white tips and mycorrhizae.
2	Needles chlorotic, shortened, with tip necrosis; new growth reduced.	Many roots from original plug necrotic and black. Egressed roots mostly healthy with white tips and mycorrhizae.
3	Needles chlorotic, shortened, with extensive tip necrosis; new growth reduced.	Most roots from original plug necrotic and black. Egressed roots mostly healthy with white tips and mycorrhizae.
4	Needles mostly green with slight tip necrosis; new growth reduced.	Roots from original plug mostly necrotic and black. Egressed roots mostly healthy with white tips and mycorrhizae.
5	Needles chlorotic, twisted, with extensive tip necrosis; stem tip necrotic (no new growth)	Roots from original plug necrotic and black. Very few egressed roots--they were mostly necrotic. No new mycorrhizae.

Table 2.--Occurrence of Fusarium spp. on roots of containerized western white pine seedlings from the USDA Forest Service Nursery, Coeur d'Alene, Idaho[1].

Seedling number	Plug roots (old)	Egressed roots (new)	Soil mix A	Soil mix B
1	33.3	13.3	0	0
2	0	0	0	0
3	0	0	0	0
4	13.3	13.3	0	0
5	0	0	0	0
All seedlings	9.2	5.3	0	0

[1]Figures in table indicate percent of root pieces colonized with Fusarium spp. Fifteen pieces of "old" and "new" roots were randomly selected and cultured on a selective medium for Fusarium (Komada 1975).

Although the old roots from the original plug were mostly necrotic, pathogens were often not associated with this necrosis. This may indicate that once older roots are replaced by new egressed roots, they become nonfunctional and begin to deteriorate.

Because of the low incidence of Fusarium on seedling roots, it is apparent that some other causes of decline were likely involved. Further investigations will be required to elucidate these possible causes. Apparently, decline and mortality of these pine seedlings cannot be completely attributed to pathogenic fungi.

LITERATURE CITED

James, R. L. 1985a. Containerized western white pine seedling mortality at the Bonners Ferry Ranger District, Idaho Panhandle National Forests. USDA Forest Service, Northern Region, Rept. 85-18. 7 p.

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

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

APPENDIX

Descriptions of isolates 85-57A and 85-57B of *Fusarium oxysporum* Schlect. isolated from roots of declining containerized western white pine seedlings at the USDA Forest Service Nursery, Coeur d'Alene, Idaho.

Isolate 85-57A

A. Growth habit on potato dextrose agar (PDA) - colonize with floccose white to slightly ochre aerial mycelium; with slight orange tint and very slight violet pigmentation underneath.

B. Microconidia sparse and formed on short, mostly unbranched microphialides.

C. Chlamydospores abundant and formed in chains.

D. Sporodochia common on carnation leaf agar, orange, moist, and producing abundant macroconidia.

E. Macroconidia slightly flacate, 3- to 5-celled, with apical and distinct pedicellate basal cells. Macroconidia only produced within sporodochia on CLA.

Isolate 85-57

A. Similar to isolate 85-57A except a deep violet pigment was produced and sporodochia were less common on CLA.