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Fungi From Foliage of *Arctostaphylospatula, Castanopsis chrysophylla,* and *Ceanothus velutinus*

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Abstract

Twelve fungus species were isolated from three shrubs—*Arctostaphylos patula, Ceanothus velutinus,* and *Castanopsis chrysophylla*—in ponderosa pine stands in central Oregon. *Hormonema dematioides* was most frequently isolated and was recovered from all three shrubs. *Penicillium frequentans* was most frequently isolated from the single shrub, *Arctostaphylos patula,* at all but one location. Three potential plant pathogens, *Alternaria alternata, Drechslera* sp., and *Truncatella angustata,* should be further investigated as possible biological control agents.

Keywords: Woody plants, brush control, competition (plant), fungi, biological control.

Introduction

Greenleaf manzanita *(Arctostaphylos patula* Greene), golden chinkapin *(Castanopsis chrysophylla* (Dougl.) A. DC), and snowbrush ceanothus *(Ceanothus velutinus* Dougl.) are major shrub competitors in commercial seedling stands of young ponderosa pine *(Pinus ponderosa* Dougl. ex Laws.) in central Oregon (Zavitkovski and others 1969). These shrubs cover about 27 percent of the Deschutes National Forest and are pioneers in forest lands after fire. Snowbrush and chinkapin easily regenerate after fire via sprouts from buried rootstock; manzanita has hard seeds that can remain dormant in the soil for up to 300 years (Hayes 1959). Competition from snowbrush can reduce growth of western white pine *(P. monticola* Dougl. ex D. Don) and ponderosa pine seedlings by more than 50 percent. Snowbrush can also enhance animal populations; animal browsing is often a major cause of seedling mortality (Zavitkovski 1966).

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Snowbrush dominates thousands of acres of logged or burned forest lands in the Pacific Northwest, and its dominance is likely to increase with the present methods of logging and prescribed burning. The role of snowbrush in the regeneration of conifers has been studied primarily for its potential as a nurse crop and as a fixer of nitrogen. Shrub and brush control can also promote growth of young seedlings (Bentley and others 1971). Bulldozing is an effective method for initial shrub and brush control (Buck 1959); but within 2 years after bulldozing, a dense stand of competitive shrub and brush plants commonly reestablishes (Bentley and others 1970). Since 1962, control practices have included spraying with herbicides, such as 2,4-D (2,4-dichlorophenoxyacetic acid) and 2,4,5-T (2,4,5-trichlorophenoxyacetic acid), the first or second year after bulldozing. Spraying can be repeated as needed to maintain an open shrub or brush stand. Gratkowski (1959) has shown, however, that greenleaf manzanita and snowbrush are only moderately susceptible to 2,4-D and 2,4,5-T, whereas golden chinkapin is resistant. In addition, these herbicides must be carefully timed to prevent damage to pine seedlings (Gratkowski 1977).

This paper reports results of initial searches for previously unstudied endemic foliar fungi that might serve as biological control agents of these competing shrubs.

Materials and Methods

Leaves exhibiting necrotic spots or lesions were collected from shrubs on randomly selected, widely spaced areas on Lookout Mountain, Benham Butte, Bessie Butte, Black Butte, and China Hat in the Deschutes National Forest Deschutes County, Oregon. Necrotic (with lesions) and nonnecrotic leaves from *Arctostaphylos patula, Castanopsis chrysophylla,* and *Ceanothus velutinus* in forest areas containing a high density of these shrubs were severed, placed in individual plastic containers, labeled, and dated. All collections were made between June and August.

Necrotic and nonnecrotic portions of each leaf were aseptically cut into 5- to 10-mm squares; necrotized leaf-squares also included areas with green tissue. The squares were surface sterilized in a 5.75-percent solution of sodium hypochlorite for 30,60, 90, and 120 seconds; aseptically removed with sterile forceps; and rinsed in sterile distilled water. The tissue squares were blotted on sterile filter paper to remove excess water and transferred immediately to sterile 100- by 15-mm plastic petri dishes containing ca 20 mL potato dextrose agar (PDA) (Difco).[1]

Cultures were maintained at ambient temperature (25 °C) and lighting. The tissue squares on agar plates were examined daily for fungal growth. Mycelia growing from the plant tissues onto the agar medium was subcultured and subsequently maintained on PDA agar plates and slant tubes. Samples were prepared for microscopic observation by making wet slide mounts and slide cultures.

1/Use of trade nanies does not imply endorsement or approval of any product by the USDA Forest Service to the exclusion of others that may be suitable.

Results and Discussion

Twelve fungus species were isolated from necrotic tissue of greenleaf manzanita, snowbrush ceanothus, and golden chinkapin (tables 1 -3). The majority of fungal isolates were weak saprobes or parasites and varied greatly in their occurrence both on the three shrub species and by site. *Hormonema dematioides* was most frequently isolated from all three shrub species (frequency refers to the number of sites from which the isolates originated) (tables 1-3). *Penicillium frequentans* was most frequently isolated from a single shurb species (A *patula).* Three of the isolated species *(Alternaria alternata, Drechslera* sp., and *Truncatella angustata)* are important as potential plant pathogens. *Alternaria alternata* was isolated from *Arctostaphylos patula* on Bessie Butte and *C. velutinus* on China Hat; *Drechslera* sp. and *T. angustata* were isolated from *C. velutinus* on Bessie Butte and *Castanopsis chrysophylla* on Black Butte, respectively. None of these fungi were isolated from nonnecrotic shrub structures.

Table 1—Fungal species isolated from *Arctostaphylos patula* at 5 locations in Deschutes National Forest, Oregon

	Location				
Isolated fungal species	Black Butte	Benham Butte	Bessie Butte	China Hat	Lookout Mountain
Acremonium chrysogenum (Thirum. & Sukap) W. Gams					
Agyriella sp.					
Alternaria alternata (Fr.) Keissler			+		
Alternaria tenuissima (Kunze ex Pers.) Wilts.					
Aspergillus sp.	+				
Cladosporium cladosporioides (Fres.) de Vries					
Drechslera sp.					
Hormonema dematioides Lagerb. & Melin		+	+		
Penicillium frequentans Westling	+	+	+		+
Penicillium sp.					
Trichoderma viride Pers. ex Gray	+			+	
Truncatella angustata (Pers. ex Lk.) Hughes					
Total number of species by location	3	2	3	1	1
Total number of fungi/shrub		5			

Table 2—Fungal species isolated from *Ceanothus velutinus* at 5 locations in Deschutes National Forest, Oregon

Isolated fungal species	Location				
	Black Butte	Benham Butte	Bessie Butte	China Hat	Lookout Mountain
Acremonium chrysogenum					
Agyriella sp.					
Alternaria alternata	+				
Alternaria tenuissima					
Aspergillus sp.				+	
Cladosporium cladosporioides				+	
Drechslera sp.			+		
Hormonema dematioides	+			+	
Penicillium frequentans					
Penicillium sp.			+		+
Trichoderma viride					+
Truncatella angustata					
Total number of species by location	1	0	2	4	3
Total number of fungi/shrub		8			

Table 3—Fungal species isolated from *Castanopsis chrysophylla* at 5 locations in Deschutes National Forest, Oregon

Isolated fungal species	Location				
	Black Butte	Benham Butte	Bessie Butte	China Hat	Lookout Mountain
Acremonium chrysogenum					+
Agyriella sp.					+
Alternaria alternata					
Alternaria tenuissima	+				
Aspergillus sp.	+				
Cladosporium cladosporioides					
Drechslera sp.					
Hormonema dematioides					+
Penicillium frequentans					
Penicillium sp.	+				
Trichoderma viride					
Truncatella angustata	+				
Total number of species by location	4	0	0	0	3
Total number of fungi/shrub		7			

For the most part, no consistent distribution pattern of fungus species with particular shrub species or locations was observed (tables 1-3). One exception, however, was the occurrence of *P. frequentans* only with *A. patula* and isolated from all locations except China Hat. All fungi associated with *C. chrysophylla* were isolated from two locations, Black Butte and Lookout Mountain.

The results reported here suggest that finding a common pathogen that will effectively control all three shrub species is unlikely. Because *Alternaria alternata, Drechslera* sp., and *T. angustata* are the most probable pathogen forms, they should be further investigated for their ability to induce disease symptoms in healthy shrubs. Caution must also be taken in such a research program to assure that the biological control agents are not pathogenic to desired crop species.

English Equivalents

1 millimeter (mm) = 0.0394 inch
°C = (°F-32) 5/9
1 milliliter (mL) = 0.001056 quart

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