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INCIDENCE OF THE FUNGAL PARASITE, *COLLETOTRICHUM GLOEOSPORIOIDES*, AND ITS POSSIBLE EFFECTS ON INTENSIFICATION OF DWARF MISTLETOE (*ARCEUTHOBIUM AMERICANUM*)

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INTRODUCTION

The fungus *Colletotrichum gloeosporioides* Penz. *sensu* Von Arx causes a blight disease of dwarf mistletoe aerial shoots (4). Surveys in Alberta (1), California (4) and Washington (6 & 7) revealed that large numbers of dwarf mistletoe infections may become infected by the fungus. These results suggested that the fungus had some promise as a biological control of dwarf mistletoes. An intensive survey was undertaken in Alberta during 1967 to determine the incidence of the fungus on dwarf mistletoe in two immature stands of lodgepole pine, and provide information on its effect upon the intensification of the host. Results from this survey are reported here. Two earlier reports (2, 3) dealt with the biology and epidemiology of the dwarf mistletoe in Alberta.

METHODS

The two immature stands of lodgepole pine, approximately 600 ft. apart, were located 36 miles west of Calgary, Alberta in the Upper Foothills Section of the Boreal Forest Region (5). Both stands were on

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a hillside of 20^{o} slope exposed to the south. The stands were sampled in late summer, just before dwarf mistletoe seed dispersal had commenced. In one stand (No. 131) an area of approximately 44,000 sq. ft. was sampled and twenty-six infected residual trees, 35 to 50 ft. in height, were located. Immature trees in the stand were selected using a square grid of sample points at intervals of 10 ft. All immature trees within a 5 ft. radius of each randomly selected point were thoroughly examined for dwarf mistletoe infections. In the other stand (No. 132) one infected residual tree (about 35 ft. height) was found, and all immature trees within a radius of 80 ft. from the residual tree were examined for dwarf mistletoe infections. All living infections found were labelled and taken to the laboratory.

Incidence of C. gloeosporioides was rated on the occurrence of lesions caused by the fungus on dwarf mistletoe aerial shoots 1/4 inch or more in length. Berries with lesions or on shoots distal to lesions were also rated as infected. It was assumed that these berries would be unable to discharge seed. Numbers of healthy and infected shoots and berries on each mistletoe were recorded. Ages of dwarf mistletoe infections were estimated by transversely sectioning host branches or stems and determining the age of the oldest infected ring. Intensification was estimated using as a criterion the number of mistletoe infections in the different age groups.

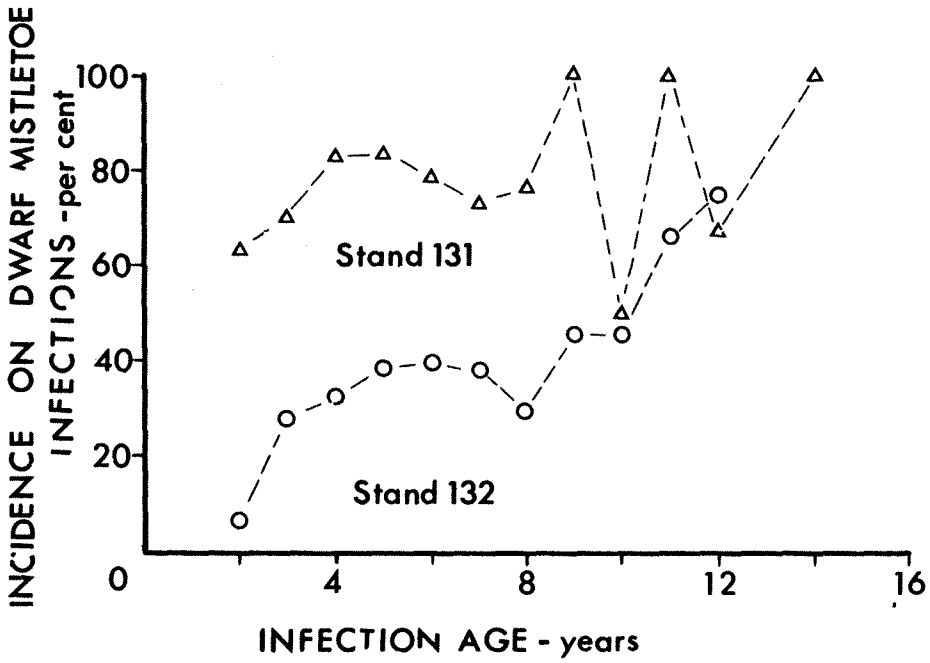

Fig. 1. Incidence of Colletotrichum gloeosporioides on dwarf mistletoe infections.

Table 1. Incidence of Colletotrichum gloeosporioides on dwarf mistletoe in two immature stands of lodgepole pine.

DWARF MISTLETOE	Number examined		INCIDENCE OF C. gloeosporioides (per cent)	
	Stand 131	Stand 132	Stand 131	Stand 132
Infections - staminate	128	390	75[1]	35[1]
- pistillate	174	288	75[1]	36[1]
- total	302	678	75	35
Shoots - staminate	2006	6378	54	7.9
- pistillate	3615	5875	40	6.4
- total	5621	12253	45	7.3
Berries	1377	1503	8.2[2]	6.9[2]

[1]Infections with one or more shoots infected by C. gloeosporioides

[2]Berries infected or on shoots distal to lesions of C. gloeosporioides

Although a large proportion of the mistletoe berries in each stand were not affected, earlier observations suggested that owing to their history of infection, berry production was low. In 10 young stands studied in 1965 and 1966, and free of the parasitic fungus, the mean proportion of mistletoe infections with berries was 63 per cent (range 38 to 90 per cent), but in stands 131 and 132, these proportions were only 17 and 16 per cent, respectively. The effect of the fungus on longevity of dwarf mistletoe infections is presently unknown, but Parmeter et al. (4) found that the fungus was able to invade the absorbing (endophytic) system of the mistletoe in the host tissues. Possibly this invasion by the fungus could eventually cause the death of the infection.

To determine the possible effects of the fungus on the intensification of dwarf mistletoe infections, it was necessary to assume that the fungus had been present in the stands for about 15 years prior to this survey. This assumption seemed reasonable in view of dates of previous collections of the fungus near the stands. Herbarium specimens at the Calgary laboratory indicated that the fungus had been present at the Kananaskis Forest Experiment Station, located 16 miles west of the two stands, for at least 15 years. The fungus had also been collected in 1961 from a stand located less than 2 miles from the stands.

Observations used to estimate the intensification of dwarf mistletoe are summarized in Fig. 2. Highly significant linear regressions (correlation coefficients of 0.92 and 0.87) were found between logarithms of numbers of infections and infection age in each stand. Regressions were calculated only for infections aged 30 to 10 years to minimize variations in numbers of infections caused by the dwarf mistletoe incubation period and mortality of infections. The regressions

indicated that the number of infections in each stand had increased at a logarithmic rate during the seven year period. Logarithmic intensification of dwarf mistletoe infections was also found previously in 10 young stands where the fungus was absent (3). The logarithmic rates in stand 131 and 132 were 0.214 and 0.159, respectively; in seven of the 10 stands previously sampled the average logarithmic rate was 0.242.

Covariances of the regressions from stands 131, 132, and of the average regression from the seven stands where the fungus was absent were analyzed. The analyses showed that the rates in stands 131 and 132 were not significantly different, and only the rate in stand 132 was significantly less, at a probability of 0.01, than the rate of the average regression for the seven stands.

The effect of the fungus on intensification of dwarf mistletoe appears to vary considerably between localities. The results of this preliminary study indicate that the fungus can significantly reduce the rate of intensification of dwarf mistletoe in some young stands. In the two stands investigated, however, the degree of natural control of dwarf mistletoe by the fungus seemed insufficient to prevent dwarf mistletoe infections from attaining a damaging level of occurrence within a short time. Under these conditions silvicultural control of dwarf mistletoe seems warranted. Further studies, however, may reveal locations where the fungus more effectively restricts dwarf mistletoe reproduction. Determination of factors affecting the incidence and virulence of the fungus is needed before the fungus can be used as a biological or natural control of dwarf mistletoe.

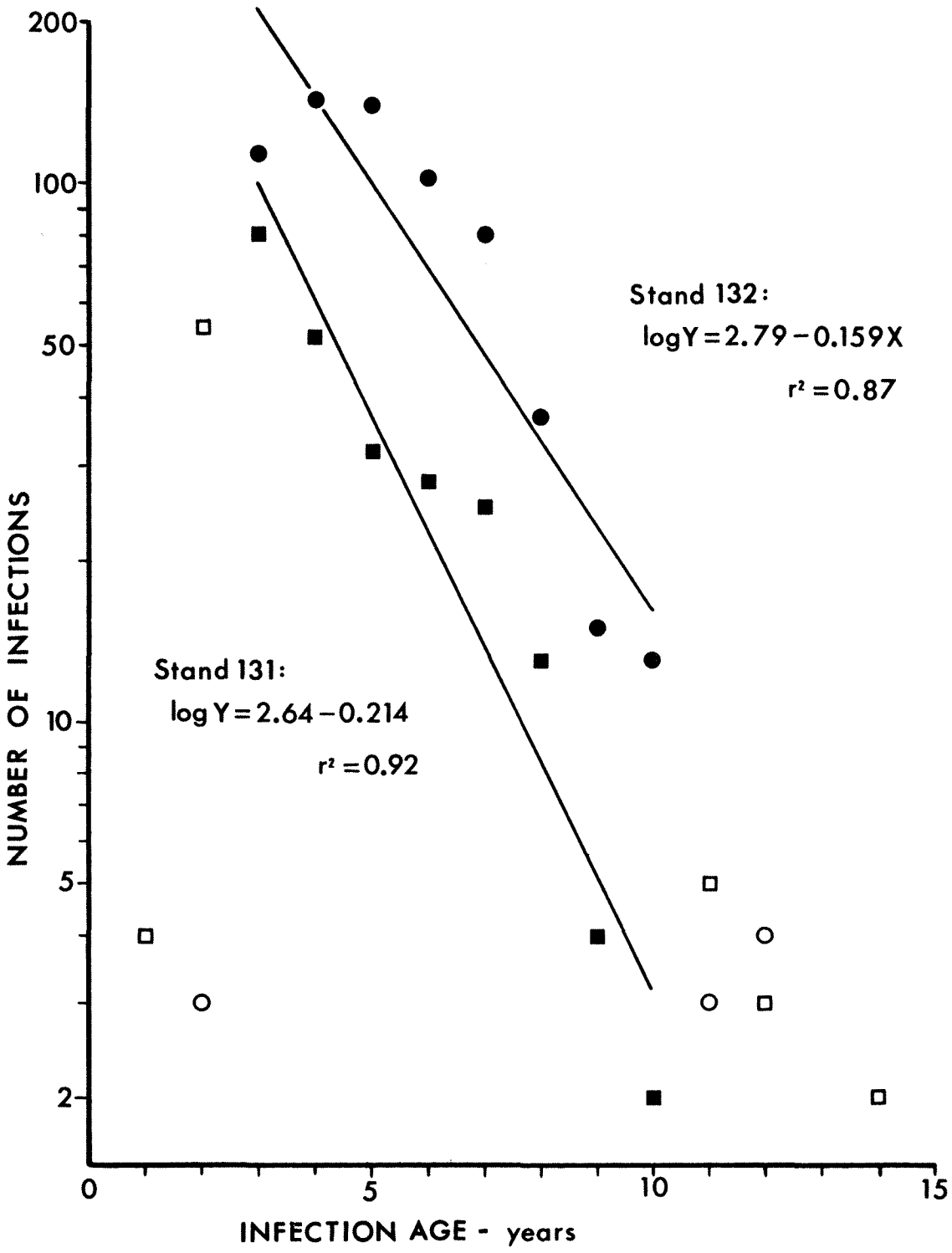

Fig. 2. Age distribution and intensification of dwarf mistletoe in two young stands infected by Colletotrichum gloeosporioides.

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