tion. Similar information on the incidence of butt decay is lacking, although Redmond (Forest Sci. 4:15-21, 1957) reported that the presence of butt decay could not be exclusively related to rootlet mortality resulting from budworm defoliation. However, existing infections may spread more quickly because of the reduction in tree growth and vigor.

In 1967, 368 trees greater than 4.5 inches dbh. were felled in two stands which had not been sprayed with insecticide during the 1949-1959 outbreak of spruce budworm: 191 trees were from the Kedgwick watershed in northwestern New Brunswick and 177 were from the Charlo watershed in north central New Brunswick. Both stands were released by the 1912-1920 outbreak and are predominantly balsam fir. The Kedgwick and Charlo stands were subjected to 9 and 7 years respectively of moderate to severe defoliation.

The volume of butt decay was determined for each tree. If no decay was visible in the stump, all main roots were cut about 1 foot from the root collar and examined. Decay fungi were cultured on 2% malt agar slants. A disk, marked on the north side, was taken from each tree about 2 feet from ground level and the dates and number of suppression rings were determined.

Of the isolation attempts on the two study areas, 54% yielded basidiomycetes. Six basidiomycetes were commonly isolated from both areas with nearly the same relative frequency (Table 1). Of the 122 basidiomycete isolates, 38% were *Scytinostroma galactina* which did not appear to be associated with any particular suppression group. *Armillaria mellea*, previously isolated with low frequency from balsam fir, constituted 30% of the isolates and was associated with trees of the higher suppression classes; conforming with the established pattern of *A. mellea* progressing rapidly in weakened trees (Boyce, Forest Pathology, McGraw Hill, 1961). *Coniophora puteana* comprised 22% of the isolates and was isolated with about equal frequency from all suppression classes.

TABLE 1
Frequency of isolation of basidiomycetes from butt decay in the Kedgwick and Charlo stands

Fungus	Kedgwick	Charlo
	Number of times isolated	
Scytinostroma galactina (Fr.) Donk	25	22
Armillaria mellea (Vahl ex Fr.) Kummer	21	15
Coniophora puteana (Schum. ex Fr.) Karst	17	10
Odontia bicolor (Alb. & Schw. ex Fr.) Quel	1	2
Polyporus balsameus Peck	2	2
Xeromphalina campanella (Batsch ex Fr.) Kuehn. & Maire	4	1
Total	70	52
	122	

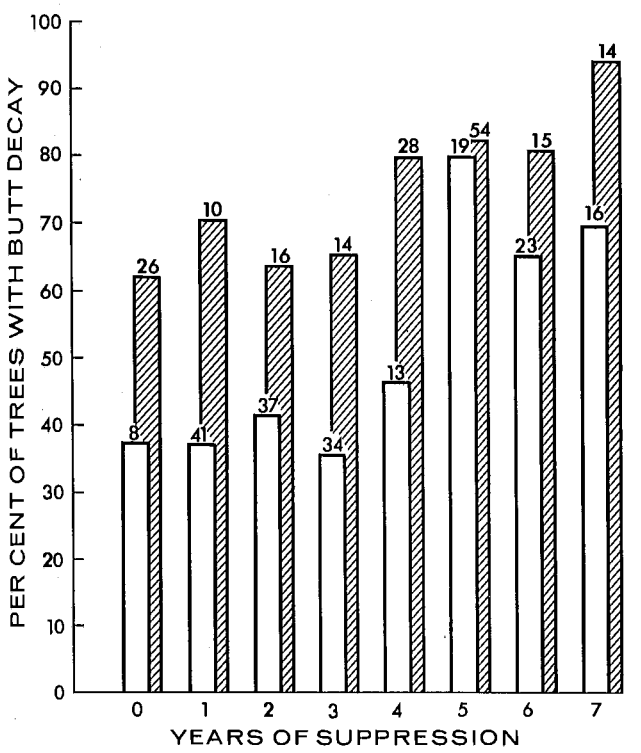

FIGURE 1. Percentage of trees containing butt decay in each suppression class. Numbers at top of bars indicate the total number of trees in each suppression class. Open — Kedgwick; hatched — Charlo.

Radial growth of balsam fir is reduced 1 to 3 years after the first severe defoliation (Mott, Nairn, and Cook, Forest Sci. 3:286-304, 1957). In the present study, all suppression rings initiated during the known period of the budworm infestation were assumed to be the result of defoliation. The few stems with more than seven suppression rings appeared to be suppressed by factors in addition to defoliation and were discarded.

The percentage of trees with butt decay in each suppression class is shown in Figure 1. Regression analysis of the data resulted in r^2 values of 0.67 and 0.79 for the Kedgwick and Charlo stands respectively, and the slopes of both regression lines were significant at the 5% level. Trees in the Charlo stand that suffered little or no suppression had an appreciably higher incidence of decay than trees of the same group in the Kedgwick stand. This suggests that factors in addition to budworm defoliation, such as site and stand history, are responsible for the overall higher incidence of decay in the Charlo stand.

The majority of the decay volumes were small and no relationship was apparent in either area between volume of decay and severity of suppression. Only 23% of the decayed trees from the Kedgwick stand had decay pockets more than 1 inch in diameter and only 27% of the decay pockets extended more than 6 inches above ground level. Decay volumes were somewhat higher in the Charlo stand where the values were 43 and 49%. As similarly defoliated trees age, however, they may contain higher volumes of butt decay which would tend to make them more susceptible to windthrow than trees that had not been defoliated. Consequently, this aspect of "budworm damage" should also be assessed so that a more precise prediction of the stands' future could be made.—T. E. Sterner, Forest Research Laboratory, Fredericton, N.B.

Preliminary Results of a Study to Control Poria Root Rot of Douglas Fir—Poria root rot of Douglas fir (*Pseudotsuga menziesii* (Mirb) Franco), caused by *Poria weirii* Murr., infects most commercially important conifers in British Columbia and the northwestern United States, and is responsible for large annual losses in immature Douglas fir. Initial tree infection arises through contact between living roots and infected stumps and large roots left from the preceding stand. It spreads among living trees via root contact and grafts. Viable mycelium of the fungus may persist for as long as 50 years in the infected residue.

In 1968, an experiment was established to test the feasibility of control of the root rot through mechanical removal (scarification) of the larger sources of inoculum in the soil, and the planting of mixed susceptible and resistant species. This report gives preliminary results of the effects of scarification.

A block, 9 chains square (8.1 acres), was marked in a stand infected with root rot near Salmon Arm, B.C. All trees in the area were tallied and mapped with respect to species, diameter, condition (alive or dead) and exact position. The study area, 8 chains square (6.4 acres), was staked out in the center of the block and divided equally into a treated and an untreated plot. A buffer strip, 0.5 chains wide (1.7 acres), surrounded the study area to prevent encroachment of the fungus from the adjacent stand and to provide sample areas for assessing the immediate effects of scarification. Trees in the untreated plot were felled conventionally and removed by tractor. As an aid to scarification, trees in the treated plot and in the buffer strip were pushed over and removed with attached roots. The ground was then scarified with a land-clearing blade to a depth of 18 inches.

Both plots were divided into 32 subplots, each 1 chain square. These were planted in random design, incorporating three replications each of pure and mixed species of susceptible

and resistant trees in each plot. Two subplots in each of the treated and untreated areas, left after completion of the design, were planted to pure stands of incidental species.

After 5 months, an assessment was made of the size and condition of residual roots in the treated and untreated areas. Pits were excavated in both areas to a depth of 2 feet, in one-foot levels. Roots were screened from the soil, recorded as to size and soil level, and examined for the presence of fungi. *Armillaria mellea* (Vahl ex Fr.) Kumm. and non-pathogenic fungi were noted, in addition to *Poria weirii.*

The data (Table 1) showed that while treatment resulted in a greater number of residual roots in the upper level of soil, the

TABLE I

Number and volume of infected residual roots per cubic foot of soil.

Root condition	Level of sample (ft)	Number of roots		Volume of roots (cm^3)	
		Untreated	Treated	Untreated	Treated
Infected with *P. weirii*	0—1	0.9	4.2	137.8	13.9
	1—2	1.4	0.7	19.8	1.4
		2.3	4.9	157.6	15.3
Infected with *A. mellea*	0—1	0.9	2.3	40.7	5.3
	1—2	1.3	0.4	5.5	0.6
		2.2	2.7	46.2	5.9
Infected with other fungi	0—1	0.9	5.9	51.9	48.8
	1—2	3.3	1.1	13.7	3.0
		4.2	7.0	65.6	51.8
Apparently healthy	0—1	3.3	15.8	30.8	56.2
	1—2	19.3	2.0	34.7	12.9
		22.6	17.8	65.5	69.1
Total of all roots	0—1	6.0	28.2	261.2	124.2
	1—2	25.3	4.2	73.7	17.9
		31.3	32.4	334.9	142.1

volume of inoculum had been reduced by approximately 70%. Over 95% of the roots in the upper level of treated soil were 1.0 cm or less in diameter, which accounts for the small volume of infected roots. The preponderance of small roots in the upper level undoubtedly resulted from breakage and physical shifting of level during the treatment. As expected, small numbers of large roots were found in the upper level of untreated soil.

Although small infected roots were not removed by the treatment, they are not likely to retain viable mycelium of the root rot for an extended period of time. The breaking of roots during treatment should enhance their susceptibility to secondary saprophytic wood-destroying organisms and thus shorten the period of viability. The data suggest that control through scarification is possible. The survival of *P. weirii* will be studied from periodic sampling of buried roots, and its ability to infect living roots will be ascertained through assessment of disease development in planted species.—L. C. Weir and A. L. S. Johnson, Forest Research Laboratory, Victoria, B.C.

Arceuthobium americanum in Ontario.—In 1955, Hord and Quirke (*In* Annu. Rep. Forest Insect and Dis. Surv., Forest Biol. Div., Can. Dep. Agr. p. 56-69, 1955) reported the occurrence of the dwarf mistletoe [*Arceuthobium americanum* Nutt. ex Engelm.] on jack pine [*Pinus banksiana* Lamb.] in northwestern Ontario. However, as reported by Sippel *et al.* (*In* Annu. Rep. Forest Insect and Dis. Surv., Can. Dep. Forest. Rural Develop., Forest, Br. p. 51-75, 1967), subsequent examination of the specimen upon which the record was based [SSMF Herbarium, Can. Dep. Fish. Forest., Sault Ste. Marie, Ont.) 4240, Fig. 1] revealed that the mistletoe associated with jack pine in that instance was *Arceuthobium pusillum* Pk. This was confirmed by Laut (Plant Dis. Reptr. 51:899-900, 1967); and to date the occurrence of *A. americanum* east of Manitoba is unknown.