The acervuli of *K. thujae* were found on dead leaves and branches of yellow cedar but other fungi were also found. *Pestalotia funerea* Desm., a fungus of doubtful pathogenicity, was quite common. An unidentified *Cucurbitaria* sp. was occasionally mixed with *K. thujae*. Two branches were apparently killed by *Cytospora abietis* Sacc., a facultative parasite, indicating perhaps a weaking of the host by climatic conditions.

It is not known if *Kabatina thujae* is introduced, or native, to Canada. The simultaneous occurrence of outbreaks in Canada and Europe makes this a difficult question because definite precedence cannot be established. In the Fraser valley, simultaneous outbreaks occurred at several widely separated points, suggesting that some form of predisposition triggered the outbreak of the already present disease. A survey of this area indicates that none of the native, naturally growing Cupressaceae are infected by *Kabatina*.

We thank Dr. J. A. von Arx, Centraalbureau voor Schimmelcultures, Baarn, for confirming identification of the fungus.—
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Infection of Amabilis Fir by Larch Dwarf Mistletoe.—In nature, larch dwarf mistletoe [*Arceuthobium laricis* (Piper) St. John] occasionally attacks alpine fir [*Abies lasiocarpa* (Hook.) Nutt.] and grand fir [*A. grandis* (Dougl.) Lindl.] and, as our host-specificity studies show, it can also infect amabilis fir [*A. amabilis* (Dougl.) Forbes].

Larch dwarf mistletoe seeds were collected each year in September from southeastern British Columbia and stored in petri dishes at 5 C until used in inoculations in late October. Over a period of 4 years, 144 seeds were planted on eight amabilis fir growing in a plantation at Victoria, B.C. Seeds were wetted briefly and placed singly at the bases of needles and buds on 1- and 2-year-old branches.

A single, successful infection was first observed early in the third year after inoculation as a branch swelling with 14 small dwarf mistletoe aerial shoots. Several of these shoots produced female flowers in the fourth year, but all shoots were dead by the fifth, thus preventing development of fruit. The maximum height attained by the aerial shoots was 15 mm. The infection, still alive at the end of the fifth year after inoculation, had not produced any new aerial shoots. By this time, the swelling was 70 mm long and 19 mm wide.

Because the ranges of amabilis fir and western larch [*Larix occidentalis* Nutt.] do not coincide in British Columbia, this host-parasite combinttion will not occur naturally here. However, despite the low rate of infection indicated in the trials, the combination might be found in nature in the United States, since there is considerable overlap of the ranges of amabilis fir and western larch, particularly in Washington (Collingwood and Brush, Knowing your trees, Amer. Forest Ass., 1964). In the Mt. Adams area of south-central Washington and in north-central Oregon, the two species are reported as constituents of the same *Abies amabilis* zone (Franklin and Dyrness, U.S.D.A., Forest Serv., Res. Pap. PNW 80, 1969). Furthermore, larch dwarf mistletoe has been reported from these same general areas (Gill, Trans. Conn. Acad. Arts and Sci., 32: 111-245, 1935.)—
R. B. Smith and E. F. Wass, Pacific Forest Research Centre, Victoria, B.C.

Relative Susceptibility of Coastal and Interior Western Hemlock to Hemlock Dwarf Mistletoe *(Arceuthobium tsugense).*—Hemlock dwarf mistletoe [*Arceuthobium tsugense* (Rosend.) G. N. Jones] is restricted to coastal western North American forests. In British Columbia, it has been recorded up to 120 miles inland along main east-west valleys. Its principal host, western hemlock [*Tsuga heterophylla* (Raf.) Sarg.], has a much wider distribution and is found commonly in southeastern British Columbia in the Interior Western Hemlock Zone (Krajina, Ecol. West. Nor. Amer. 2(1):1-147, 1969), eastern Washington, northern Idaho and northwestern Montana. The reasons for the lack of hemlock dwarf mistletoe in interior areas has never been fully explored, though it has been demonstrated that western hemlock from southeastern British Columbia is not immune (Smith, Can. Dep. For., Bi.-Mon. Prog. Rpt. 21(6):3-4, 1965). As these early tests were not designed to discover whether differences in degree of susceptibility existed between interior and costal provenances of western hemlock (hereafter referred to as "interior hemlock" and "coastal hemlock", respectively), a new experiment was initiated.

Hemlock mistletoe seeds were obtained in early March 1968, by collecting seeds, already dispersed and germinating, from hemlock trees in a severely infected young stand near Cowichan Lake, Vancouver Island. Small twigs with seeds adhering to the needles and bark were clipped off, soaked in water, and the seeds gently removed with forceps. Since the seeds were no longer naturally sticky, inoculations were conducted by smearing a small amount of lanolin paste on twigs near needles. Seeds were placed singly on the paste with the radicles pointed toward the needle bases. In this manner, 12 seeds were planted on each of 15 interior hemlock and 15 coastal hemlock trees growing in pots in a greenhouse compartment. Temperatures within the compartment were kept as near as possible to the outside ambient temperatures. To reduce water loss from the seeds, the trees were given a water-mist treatment once a day during the first spring and summer. In nature, this moisture is provided by rain and dew. After 2 years, the potted trees were placed in an unheated shade-house.

Forty-three infections were produced on coastal hemlock and 40 on interior hemlock. One of the coastal hemlock trees died before infection could take place; thus, the inoculum was reduced from 180 to 168 seeds. By using this modified number of seeds for coastal hemlock, the rates of infection were 25.6% on coastal and 22.2% on interior hemlock. The only marked difference in host response was a more rapid development of symptoms and signs on interior hemlock than on coastal hemlock. During the first year after inoculation, swellings on interior hemlock were observed in 13 infections, during the second year, in the remaining 27. In contrast, only two swellings appeared on coastal hemlock during the first year, 35 during the second and six in the third year. Similarly, aerial shoots were slower to emerge from infections on coastal than on interior hemlock; 39 infections on interior hemlock and 17 on coastal hemlock bore aerial shoots in the second year. On all infections, shoots emerged by the end of the third year after inoculation.

The relatively advanced development on interior hemlock was short-lived. By the end of the fourth year, swellings on both provenances averaged 11.0 cm in length, and the average number and maximum height of aerial shoots differed only slightly. However, the earlier initial emergence of shoots on interior hemlock may have been the cause of the larger first fruit crop (500 per fruit-bearing infection) than that produced on the coastal hemlock (178 per fruit-bearing infection). Knowing that in other respects infections on coastal hemlock eventually equalled those on interior hemlock, it is assumed that fruit production would also become comparable in subsequent years.

There are thus no apparent differences in the susceptibility of interior and coastal hemlock to hemlock dwarf mistletoe that can explain the absence of hemlock mistletoe in interior areas. The earlier response to infection of interior hemlock would have, if anything, a favorable effect on the establishment and growth of hemlock mistletoe. Any explanation for the lack of dwarf mistletoe on hemlock in the Interior Western Hemlock Zone must lie, therefore, in present biological, geographic or climatic barriers, in historical events, or in some combination of these

factors. Hemlock mistletoe may never have colonized the interior because of adverse climate, or it may have existed but was eliminated during a change in climate. Since the parasite spreads much more slowly than its host, recolonization might be simply a matter of time, or recolonization might be checked by barriers such as belts of immune tree species, barren land or adverse climate. Some of the preceding explanations may be eliminated as results from current inoculation trials in the field become available.—R. B. Smith, Pacific Forest Research Centre, Victoria, B.C.

Is Decay Volume Strongly Related to Number of Knots and Log Volume in Poplar?—Seams, holes, conks, broken branches, unsound and rotten knots have all been used as indicators of decay presence in standing trees (Lavallée and Lortie, Forest. Chron. 44(4):5-10, 1968; Stayton *et. al.*, Forest. Prod. J. 20:55-58, 1970), however, estimating the amount of decay has posed problems mainly because qualitative classifications based on these indicators cannot always be described in quantitative terms. In addition, assessing the relationship between any one indicator and the decay volume presents problems. Sampling is affected because it is difficult to find and select trees having only one type of indicator. Most sample trees will have two or more indicator types and separating the effects of each is often not possible.

To solve these problems some investigators combine all indicators into counts (Ware, Proc. Soc. Amer. Forest. 211-217, 1964), whereas others choose only those which most affect the resulting product volume (Barger and Ffolliott, U.S. Dep. Agr., Forest. Serv., Res. Pap. RM-57, 1970). This note presents an analysis of poplar [*Populus tremuloides* Michx.] trees at two locations in Ontario and provides some indication of the relationships existing among decay volume, number of unsound knots and log volume.

Fifty-six trees were sampled at the Petawawa Forest Experiment Station, Chalk River, and fifteen trees were taken at the Larose Forest near Bourget, Ontario. On each tree, breast-height diameter, stump age and total height were measured. After felling, the merchantable bole was bucked into 16-foot logs to a 3-inch top diameter inside bark, the last merchantable log being equal to or shorter than 16 feet. Each log was diagrammed and all indicators on the log surface, easily recognizable by visual inspection, were identified and recorded by their type, frequency, size and location. Furthermore, each log was sectioned into 2-foot lengths to examine the discoloration and/or decay patterns on the cross-sectional areas, and to measure section and decay diameters.

From these data, 114 logs— 75 from Petawawa and 39 from Larose Forest— having unsound knots as the only type of decay indicator were selected for further analyses. The distribution of the number of logs within the tree was as follows:

Location	1st log	2nd log	3rd log	Total
Petawawa	18	28	29	75
Larose	15	12	12	39

In this study, an unsound knot was defined as: "A knot not solid across its face or else softer than the surrounding wood, due to decay or other defects" (Terminology of Forest Science, Technology, Practice and Products, Soc. Amer. Forest., 1971). The relationships of decay volume with number of unsound knots and log volume were investigated using the regression equation $Y = b_o + b_1X$. The dependent variables were decay volume in cubic feet, and decay volume as a percent of log volume, whereas the independent variables were log volume in cubic feet, the number of unsound knots, and the number of unsound knots per square foot of log-surface area.

Table 1 shows the results of the regression analyses. In every case the contribution of the unsound knots in explaining the variation in decay volume and decay volume percent was non-significant at the 5% significance level. For the Petawawa sample only, the cubic foot log volume was significant in explaining the variation in decay volume but not in decay volume percent.

On the basis of this small study it appears that the frequency and distribution of unsound knots shows no relationship with the decay volume present in the log. While log size was related to decay volume in the Petawawa sample, its importance as a variable for estimating purposes might depend upon geographic location. Additional data are required to substantiate these findings. — I.S. Alemdag and T.G. Honer, Forest Management Institute, Ottawa.

TABLE 1

Statistics for relationships of decay volume and decay volume percent with log size, number of knots, and number of knots per square foot of surface area

Dependent variable	Independent variable	First 16-ft log			All 16-ft logs of 1st-3rd positions		
		Total variation accounted for %	Significance of X variable	SE% of mean	Total variation accounted for %	Significance of X variable	SE% of mean
(a) Petawawa data							
Decay volume of a log in cu ft	Log volume—cu ft	39.18	S	148	19.77	S	131
	No. of knots on log	0.73	NS	189	0.09	NS	146
	No. of knots per sq ft	9.34	NS	181	3.73	NS	143
Decay volume of a log in %	Log volume—cu ft	5.05	NS	128	1.01	NS	119
	No. of knots on log	4.47	NS	129	0.13	NS	120
	No. of knots per sq ft	10.93	NS	124	0.00	NS	120
(b) Larose data							
Decay volume of a log in cu ft	Log volume—cu ft	0.11	NS	184	4.02	NS	171
	No. of knots on log	10.32	NS	174	0.21	NS	174
	No. of knots per sq ft	10.99	NS	173	0.02	NS	174
Decay volume of a log in %	Log volume—cu ft	1.30	NS	201	<0.01	NS	158
	No. of knots on log	7.88	NS	194	0.28	NS	158
	No. of knots per sq ft	8.08	NS	194	0.23	NS	158