TABLE 1

Effect of 3-month outside chip storage on refiner-groundwood pulp brightness

Sample	Pile Position	Maximum Temperature in Pile (°F.)	Elrepho Brightness Fresh Chips	After 3-month Storage
Pine				
3-Cp-2-R	2	123.0	59.0	41.3
3-Cp-3-R	3	90.0	59.0	47.0
3-Cp-6-R	6	145.0	59.0	42.7
Spruce				
3-Cp-2-R	2	123.5	62.8	55.5
3-Cp-6-R	6	144.5	62.8	48.0

pole pine are caused by the great incidence of staining amongst the chips. Typical of these are the ochre-orange and red stains in the heartwood-sapwood (predominantly heartwood) and the fungal hyphae giving rise to blue stain in the sapwood. Identification of these microorganisms is currently proceeding.

The loss in pulp brightness due to storage of white spruce chips appears to be severe only in the hottest part of the pile.

In view of the extreme brightness loss of refiner-groundwood pulp prepared from lodgepole pine chips stored for 3 months in an outside chip pile, there can be but little question that any mill contemplating the manufacture of mechanical pulp from lodgepole pine by the stone or refiner-groundwood processes should carry out an intensive research program to determine the feasibility of using this species. In any event, it is recommended that if lodgepole pine is processed for mechanical-pulp manufacture then the roundwood or chips used should originate from freshly-felled trees, with a minimum number of days between stump and refiner — J. V. Hatton, Forest Products Laboratory, Vancouver, B.C.

Effect of Drying Techniques on Softwood Permeability. — The permeability of softwoods is the most important factor in controlling their impregnation by substances in preservative and fire-retardant treatments, or in the production of wood-polymer combinations. It is well-known that drying sapwood from certain organic solvents results in considerably higher permeability. It has been shown that green sapwood is permeable but that in air-drying this permeability is reduced to a fraction of its original value by the aspiration of the tori of the bordered pits caused by surface tension effects of the receding air-water interface. In this phenomenon, the torus acts like a valve and is pulled to one side, closing the pit aperture. The much lower surface tension of organic liquids is generally insufficient to aspirate the torus, so that the valve is not closed in solvent drying. Consequently, the permeability of wood so dried is similar to that of green wood.

An investigation at the Vancouver Laboratory into the effect of drying techniques on wood permeability has shown that freeze-drying in a similar manner results in high permeability of the wood. It is hypothesized that in freeze-drying the tori are encased in ice, which then sublimes without the formation of an air-liquid interface. Thus the forces responsible for aspiration of the tori are not activated. This investigation is being actively pursued — G. Bramhall, Forest Products Laboratory, Vancouver, B.C.

The Occurrence of 3-Hydroxyflavanones in Aspen Branch Stubs. — Dead branches and ingrown branch knots are of special interest in aspen [*Populus tremuloides* Michx.] because of their prolonged durability and their association with stains and heartrots. Extraction of dead branches, wounds and associated stained sapwood has revealed the presence of several biologically interesting compounds (Oberg *et al.* Tappi 39: 470-471, 1956; Wall and Kuntz, Can. J. Bot. 42:969-977, 1964) none of which are known to have been identified.

Lower branches which had been dead 5 to 15 years were collected from several 30- to 50-year-old stands in Manitoba. The basal 3-inch portions were subdivided into bark, the outer two or three annual rings of wood and the inner, discolored wood. The tissues were ground in a laboratory mill and extracted with small quantities of water in a Carver hydraulic press. Precipitation with acetone for 2 to 3 hours at 0 C and filtration yielded an amber-yellow filtrate which gave a red color when treated with magnesium and HCl, indicating the presence of flavonoids. This reaction was most pronounced in extracts from the outer wood tissue. The zinc-HCl test (Pew, J. Am. Chem. Soc. 70:3031-3034. 1948) also gave a red color, suggesting that at least one of the flavonoids was a 3-hydroxyflavanone.

Exhaustive extraction of outer wood tissue with methanol in a soxhlet apparatus and silica-gel thin-layer chromatography in chloroform-methanol (7:1) revealed at least seven spots by their fluorescence under long-wave ultraviolet light: R_f 0.93 (light blue); 0.84 (light blue); 0.74 (light yellow); 0.64 (deep yellow); 0.39 (light yellow); 0.20 (light yellow), and 0.09 (light yellow). All compounds except R_f 0.93 and R_f 0.84 reacted with diazotized sulfanilic acid to give yellow colors diagnostic for phenols. Compounds of R_f 0.64 and R_f 0.09 gave the red-purple zinc-HCl reaction specific for 3-hydroxyflavanones, using the technique recently developed by Barton (J. Chromatog. 34:562. 1968). By using chloroform-methanol (7:3) similar separations were achieved with higher R_f values, e.g., the two 3-hydroxyflavanones had R_f 0.71 and R_f 0.30, respectively. Using the latter solvent in preparative thick-layer chromatography, these two substances were isolated and one of them (R_f 0.71) crystallized, melting at 237.2 C (Mettler F. P. 1). Mass spectrometry showed a molecular weight of 288. Nuclear-magnetic-resonance spectroscopy further revealed the presence of six aromatic protons of which four formed an A_2B_2 pattern, and three phenolic hydroxyl groups, one of which was hindered.

Since these data describe the well-known flavanone aromadendrin (dihydrokaempferol), this unknown's identity was confirmed by t.l.c. and by quantitative infrared spectral comparison with an authentic sample of aromadendrin. Additional confirmation was provided by preparing the known yellow derivative, kaempferol by dehydrogenation with aqueous sodium bisulfite (Hergert and Goldschmid, J. Org. Chem. 23:700-704, 1958).

The other 3-hydroxyflavanone (R_f 0.30 in chloroform-methanol, 7:3) is believed to be a glycoside of aromadendrin, since it was hydrolyzed in 2% aqueous oxalic acid to give aromadendrin. Current studies are under way to determine the type and position of the sugar moiety. Since a p-anisidine positive substance resembling glucose was detected in water extracts using silica gel t.l.c. and n-butanol-acetone-water (80:100:20) it is possible that hydrolysis of this or some other glycoside occurs during water extraction. Water extracts are acidic (pH 4 to 5) and may thus provide conditions favorable for such hydrolysis.

The discovery of these 3-hydroxyflavanones in aspen wood is important in view of their known inhibition on sulfite pulping, as well as their participation in color formation. The facile conversion of dihydrokaempferol to the intensely yellow-colored kaempferol could explain the presence of yellow stains in aspen wood. Factors causing their formation and their effects on decay fungi are of interest in future studies. — G. M. Barton, Forest Products Laboratory, Vancouver, B.C., and R. E. Wall, Forest Research Laboratory, Winnipeg, Man.

PATHOLOGY

Seasonal Variation in Infection of Douglas-Fir Logs and Stumps by Fomes annosus. — *Fomes annosus* (Fr.) Karst. is one of the most destructive root rots in immature forests in the temperate zone. The fungus becomes established in healthy stands primarily through spore infection of freshly exposed stumps but also through infection of logs left lying in the woods. The disease passes to living trees when their roots contact the fungus in these infected stump roots or logs.

To determine the frequency of log and stump infection by *F. annosus* and its subsequent threat to residual or second-growth stands, a number of Douglas-fir [*Pseudotsuga menziesii* (Mirb.) Franco], with an average diameter of 12 inches, was felled and cut into 24 to 32 ft logs each month from August 1961 to July 1962 and in November 1962 in the Lake Cowichan area of Vancouver Island. Half the logs were sampled 2 years after felling and the remainder 4 years after felling. Samples were taken from each end of the logs and at 8-foot intervals along their length. The stumps of these trees were sampled periodically 2 to 4 years after exposure.

F. annosus was isolated from logs from all periods of felling except from those of trees felled in both November 1961 and 1962 (Fig. 1). *F. annosus* was also isolated from stumps exposed during all periods of felling except from those stumps exposed during November 1961; incidence of infection in stumps was:

Year	1961					1962							
Month	A	S	O	N	D	J	F	M	A	M	J	J	N
Percent	50	35	20	0	7	14	25	7	36	45	19	28	36

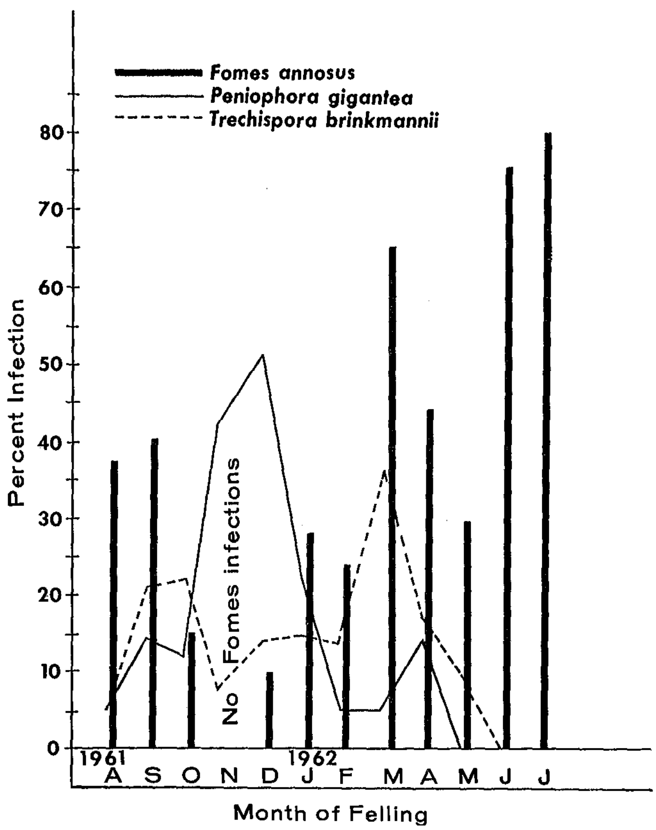

FIGURE 1. Monthly incidence of Douglas-fir log infections by three fungi.

Log and stump infection was highest from March through September, with an average of 53% of the logs and 29% of the stumps becoming infected. Log infection reached a maximum of 80% in July, and stump infection of 50% in August. The incidence of log infection was similar for both the second- and fourth-year sampling periods.

Approximately half the infected logs showed infection in the mid-portion, which could not be attributed to penetration through the ends; the fungus possibly gained entrance to the woody tissues through insect galleries or bark injuries.

Sporophores of *F. annosus*, which developed on several logs as early as 2 years after felling, could be important in increasing the air-spore population where debris accumulation is extensive.

The seasonal variation in stump and log infection generally showed a negative correlation with the variation in spore deposition shown by Reynolds and Wallis (Bi-Mon. Res. Notes, Vol. 22(4):6-7, 1966).

The incidence of *Peniophora gigantea* (Fr.) Massee and *Trechispora brinkmanii* (Bres.) Rogers & Jacks showed a strong negative correlation with that of *F. annosus* (Fig. 1). — G. Reynolds and H. M. Craig, Forest Research Laboratory, Victoria, B.C.

SILVICULTURE

Effect of Seed Wings on Germination and Establishment of Jack Pine Seed. — Regeneration of jack pine [*Pinus banksiana* Lamb.] from natural seedfall or seedfall from scattered slash may prove to be silviculturally practical in southeastern Manitoba (Cayford, Forest. Br. Dep. Forest. Rural Develop. Pub. No. 1165, 1966). Observations have suggested that the attached wing on natural seed may physically prevent the seed from establishing good contact with the seedbed. Therefore a test was carried out to obtain information on the effect of wings on the germination and establishment of jack pine seed.

Seed was obtained from the Pineland nursery operated by the Provincial Government at Hadashville, Man. Seed was extracted by standard methods and samples for testing were randomly selected from the same lot before and after de-winging. A cutting test showed the winged seed to be 85% sound and the de-winged seed 98.5% sound.

Although jack pine usually germinates well with no pretreatment, both stratified and unstratified seed was used. Seed was stratified according to recommendations of the United States Forest Service (U.S. Dep. Agri. Misc. Pub. No. 654). To simulate spot seeding, half the seeds were tamped down to make firm contact with the soil. The remaining seeds were dropped on the soil and care was taken to avoid covering or tamping them down.

Seeds were surface-sown in small waxed paper tubs, about 4½ inches in diameter and 3 inches deep, which were filled to within ½ inch of the top with medium textured sand. A 2 x 2 x 2 factorial design was used with 20 replications. A replication contained eight tubs, each sown with 50 seeds, representing the eight treatment combinations.

The test was carried out in a greenhouse using a photoperiod of 15 hours under fluorescent lamps. Maximum and minimum air temperature averaged 89 and 64 F with extremes of 100 and 56 F, respectively. Soil surfaces were kept moist by surface watering.

Germinated and established seedlings were tallied daily for 6 weeks. A seed was classified as 'germinated' when the radicle became exposed and 'established' when the seed coat separated from the cotyledons. Because of the differences in seed soundness between winged and de-winged seed, germination results were adjusted to a comparable basis by dividing results by the decimal percentage of seed soundness.

Test results are shown in Table 1.

Analysis of variance indicated that de-winging and tamping significantly increased germination and establishment at the 1% level. Stratification did not significantly affect germination and no treatment interactions were significant.

The results show that, under the ideal conditions of this experiment, wings significantly reduce germination and establishment of jack pine seed. Reasons for the reduction, other than poor contact with the seedbed (when seeds were tamped the adverse effect of the wing was nullified), are not known and further research into exact mechanical and physiological influences of the seed wing are needed.

Although germination of the winged seed was adequate under the conditions of this experiment, the adverse effect of