

Order	Family	
Hymenoptera	Eurytomidae	<i>Eurytoma pissodis</i> Gir.
	Ichneumonidae	<i>Dolichomitus terebrans nubilipennis</i> (Vier.) <i>Ezeristes comstockii</i> (Cr.)
	Chalcididae	<i>Rhopalicus pulchripennis</i> (Cwtd.) <i>Amblymerus</i> sp.
	Braconidae	<i>Helcostizus ruficinctus</i> Cush. (first record for C.N.C.) <i>Eubadizon strigitergum</i> Cush. <i>Eubadizon</i> sp. A (first record for C.N.C.) <i>Eubadizon</i> sp. B. (first record for C.N.C.) <i>Bracon pini</i> (Mues.)
Diptera	Lonchaeidae	<i>Lonchaea</i> sp. nr. <i>corticis</i> Tayl.

Complete information is not yet available but differences were apparent in the geographic distribution of six species making up the parasite complex. Only one species, *Eurytoma pissodis*, was common to all collection areas.

All parasites have been found to be univoltine, overwintering as larvae or prepupae in weevil pupal chambers. The incidence of parasitism during the excavation of pupal chambers by weevil larvae in late July was 29 per cent; this percentage was based on an examination of 358 pupal chambers.

Parasite and predator rearings from weevil infestations in northern Alberta and the Northwest Territories are currently being conducted. The results of these rearings and observations on parasite life histories will be reported at a later date.—R. E. Stevenson.

BRITISH COLUMBIA

Decline and Mortality of Douglas Fir in the Interior Wet Belt.—Decline and mortality of Douglas fir (*Pseudotsuga menziesii* (Mirb.) Franco) prior to the established rotation age of 160 years has been evident for several years in parts of the Nelson and Kamloops forest districts. The diameter and height increment of affected trees is reduced markedly and reduction in foliage density is common. Symptoms occur in trees as young as 60 years old. The percentage of dead trees and those with decline symptoms varies considerably, although as much as 50 per cent of the Douglas fir in some stands are affected. Initial results of a survey in several areas of the Interior Wet Belt suggest that no single factor is responsible for all the decline and mortality encountered.

Although root rot caused by *Poria weirii* Murr. resulted in considerable mortality in areas of the Interior Wet Belt transitional to the Interior Douglas Fir Zone (Krajina, V. Univ. Brit. Col., Bot. Series No. 1, 1959), this disease seems to account for little of the mortality encountered in the Interior Hemlock Zone. The characteristic laminated rot present in the stumps of fallen trees provides ready identification of the disease in established infection centers. It is considered likely that advanced decay would be evident at the root collar of some of the trees that had been dead for several years if *Poria* root rot had caused an appreciable percentage of the mortality present in the Interior Hemlock Zone.

Unlike *Poria weirii*, *Armillaria mellea* (Vahl ex Fr.) Kummer was frequently found in the Interior Hemlock Zone at the root collar of both dead trees and living trees with decline symptoms. However, there is doubt that *Armillaria* root rot plays a significant role in the decline of trees without host pre-disposition. The presence of callused *Armillaria* lesions at the root collar of some trees indicates that invasion by this fungus has been checked. The occurrence of adventitious branching on many trees with callused lesions likewise suggests a sequence of host weakening and subsequent recovery of vigour.

Polyporus schweinitzii Fr. was associated with root and butt rot in some windthrown trees. Fruiting bodies were also found near the butt of living thin-crowned, and standing dead Douglas fir. However, evidence of *P. schweinitzii* infection was so infrequent that this fungus was thought not to contribute significantly to the decline encountered.

Douglas fir needle blight caused by *Rhabdochline pseudotsugae* Syd. was recognized for the first time during this survey as the cause of severe defoliation of pole-sized Douglas fir in the Interior Wet Belt. In many trees, defoliation had occurred for at least six years, leaving little but the current year's foliage and giving twigs a characteristic "fish-tail" appearance. While repeated severe defoliation could weaken trees sufficiently to cause death, the occurrence of *R. pseudotsugae* was too inconsistent to warrant assigning this fungus a primary role in decline.

Douglas fir bark beetles (*Dendroctonus pseudotsugae* Hopk.) cause some mortality each year in the Interior Wet Belt, but outbreaks are less severe than in the Interior Dry Belt (Annual Reports, Forest Insect and Disease Survey, Can. Dept. Forestry). Although assessment is difficult in Douglas fir which has been dead for some years, few of the dead trees in the stands examined showed evidence of severe bark beetle

attack. Douglas fir bark beetles, therefore, probably account for a relatively small proportion of the mortality present in the Interior Hemlock Zone.

On shallow-and coarse-textured soils, the death of some trees may be directly attributable to drought. On other sites, drought is more likely to act as a predisposing factor promoting invasion by organisms which could eventually result in decline and death. Water deficit may be a factor in the decline which sometimes follows partial cutting. When dominants and co-dominants have been cut on a diameter limit basis, residual trees which were formerly in the protected lower canopy are likely to be exposed to greatly increased transpiration stress. Such stress may render residual trees susceptible to attack by relatively weak pathogens.

Douglas fir, like western white pine (*Pinus monticola* Dougl.), is a pioneer species which rarely occurs with a frequency of more than a few trees per acre in overmature stands in the Interior Hemlock Zone. The prevalence of these species in adjacent immature stands suggests, however, that they were more numerous when such overmature stands were young. A reduction in the frequency of white pine and Douglas fir following the pole stage is therefore to be expected. Pole blight, evident on certain sites during the past few decades, may be an unusually sudden decline in the vigour of pole-sized white pine brought about because the summers between 1930 and 1946 were abnormally hot and dry. The occurrence of decline and mortality of Douglas fir, most of which likewise cannot be ascribed to a specific organism, may have been similarly initiated. It should not be concluded, however, that decline in Douglas fir will necessarily result in losses as great as those attributable to pole blight. A comprehensive study of the silvics of Douglas fir in the Interior Wet Belt, including the role of insects and pathogens, would be necessary for a proper understanding of the origin of decline and for the determination of appropriate rotation ages for specific sites.—A. C. Molnar, R. G. McMinn, and A. T. Foster.

A Note on the Use of Tetrazolium Chloride for Sapwood Staining.—Tetrazolium chloride (2,3,5, triphenyl tetrazolium chloride—TTC) has recently been used in this laboratory for indicating viability or metabolic condition of sapwood cells in Douglas-fir logs. Although a number of tests of tetrazolium staining have been made with plant material, only a few have involved sapwood (e.g., Kayll, A. J. Canada Dept. Forestry Pub. 1006, 1963.). Because of this, a brief description of our experience with this stain may be useful to others.

It was found, using small blocks of sapwood, that the time required for staining is considerably longer than one is led to expect from published information. One often finds a recommended staining time of four hours, or even less. We noted little or no indication of staining in this interval. Usually colour is faint even at 24 hours and reaches full intensity only after 48 to 72 hours or more at room temperature (68°F.) The long time needed for colour to appear may be due to slow penetration of the tetrazolium into the sapwood cells where the reaction takes place.

After staining, radial surfaces of freshly cut sapwood show conspicuous red streaks, due to colouring of the ray parenchyma cells. Cells associated with resin ducts are also coloured. After logs are cut, a gradual loss of ability of sapwood to stain with tetrazolium occurs. Samples tested some months after felling are negative in reaction or show only occasional light pink streaks associated with the ray parenchyma. A subjective scale of staining intensity has proved useful in comparing different samples.

When thin radial sections, cut from fresh material with a sliding microtome, were first tested the results were unexpected, as no staining occurred. On the basis of many subsequent tests it was found that with sections less than a certain thickness there was little or no staining, although blocks from which the sections were cut showed a strong reaction. But as section thickness was increased, the staining reaction became stronger until finally it was comparable with that in the blocks. Mechanical damage such as scratches, bruises, or cuts results in localized loss of staining reaction in sapwood blocks. We assume, therefore, that pressure of the knife or bending of the thin sections as they are cut, stress or damage the living cells, resulting in loss of their staining ability.

A series of tests were made with sections of different thickness cut from sapwood of Douglas fir, western red cedar, and western hemlock (logs of the former, sapling material of the latter two). Results are summarized in the accompanying table and illustrate the relation between section thickness and staining reaction. Each rating represents a combined subjective value from two to four replications. The data also show that this phenomenon differs in various tree species. This may be due to differences in sapwood physical properties and, therefore, in the stresses to which the living cells are subjected as thin sections are cut.