southeastern region between Perce and the Grand Pabos River. In most of the remaining unsprayed territory, wherever mature stands of balsam fir occur, total defoliation was severe. In stands sprayed in 1954 and 1955, classification of total defoliation becomes very complex since most of these exhibit varying degrees of discontinuous defoliation, i.e. years of severe defoliation followed by years of light or moderate defoliation. Therefore, total defoliation in sprayed territories cannot readily be compared with that in unsprayed territories and for this reason will not be discussed here.

The total area where the mortality due to budworm defoliation occured covered approximatively 200 square miles. Mortality was generally restricted to higher elevations indicating that the epidemic probably started in stands growing on mountain tops and high plateaux. The greatest incidence of mortality prevailed in a band of territory about 6 miles wide and 60 miles long stretching from the headwaters of the Assemetquagan River to the Bonaventure River, and in the region lying between the Patapedia and Matapedia rivers. Tree mortality also occured, but more sparingly, near Matane Lake, northwest of Metis Lake, and in the Rimouski River watershed.

A total of 612 locations were sampled for spruce budworm eggs in 1956, 63 per cent by company personnel and 37 per cent by government crews. The pole pruner method was used at 405 locations and the axe method in the remainder. The proportion of the locations sampled in each of the unsprayed and sprayed areas is as follows: unsprayed 65 per cent; sprayed 1954, 6 per cent; sprayed 1955, 19 per cent; sprayed 1956, 10 per cent. A total of 1,345 trees were sampled with an average of 2.2 trees per location.

The average number of egg-masses per 100 square feet of foliage was 259; numbers varied from 0 to a maximum of 2,457. Negative samples were obtained in only 9 per cent, but in 23 per cent of the locations the population exceeded 500 egg-masses, i.e. 2.5 times the number necessary to cause severe defoliation.

Conditions as observed in 1955 and 1956 are compared in the following synopsis:

Year	Percentage of Egg-mass populations by categories		
	Light	Moderate	Severe
1955	46	9	45
1956	28	11	61

The above figures indicate that there was an increase in the number of egg-masses deposited in 1956. It must be mentioned however that some mortality is expected, particularly at higher elevations, owing to the late deposition of eggs.

The egg pouplation was generally high in unsprayed areas, the watersheds situated between the Bonaventure burn and the York River being the most heavily infested. The northeastern section of the Peninsula was the only one classified as lightly infested; high populations were found, however, in localized areas such as Marsoui, Rivière à Claude and the Dartmouth watershed.

In sprayed areas egg density varied depending upon the number of years since spraying occured. In areas sprayed in 1954 an increase was recorded and the population was generally heavy. In the areas sprayed in 1955, the sampled locations were about equally divided between the light and severe categories. The areas sprayed in 1956 were generally well protected, although some reinfestation apparently occurred in a few cases.

Spraying operations will again take place in the Lower St. Lawrence and Gaspe in 1957. On the basis of results obtained through the defoliation and egg surveys it is planned to spray approximatively 1,200,000 acres. All but one-tenth of this territory will be treated for the first time. Operations will encompass a territory extending from Rimouski to the extreme eastern tip of the Peninsula—J. R. Blais and R. Martineau.

ONTARIO

The Effect of a Microsporidian Disease on the Rate of Development of the Spruce Budworm.—While studying the effects of a microsporidian disease of the spruce budworm caused by *Perezia fumiferanae* Thom., it was noticed that the *Perezia*-infected larvae seemed to develop much more slowly than non-infected larvae. To check this observation, second-instar larvae from the Uxbridge Forest, Ont., were forced out of hibernation in the laboratory and reared individually until pupation. The pupae were then examined for the presence of the disease. This particular population was chosen because approximately 30 per cent of the larvae were known to be infected. Records were kept of the number of days from emergence to pupation and of the sex of the larvae. The results are shown in Table I.

TABLE I

Length of Larval Period (Days)

—	Female		Male	
	Non-infected	Infected	Non-infected	Infected
No. insects	20	11	14	9
Total days	608	428	369	296
Mean days	30.4	38.9	26.3	32.9

The differences between the means of the infected and non-infected insects in this and all succeeding tables were compared by the "t" test; in Table I the differences were found to be significant at the 1 per cent level. It is apparent that the diseased larvae do develop at a slower rate than the non-infected larvae. The increased period required for the development of diseased larvae evoked questions concerning the pupal and adult periods. To answer these questions, late-instar larvae were removed from the Uxbridge forest and reared individually until death; the number of days required to pass the pupal and adult stages was recorded for male and female insects, infected and non-infected. The effect of the disease on the development of the pupae is shown in Table II.

TABLE II

Length of Pupal Period (Days)

—	Female		Male	
	Non-infected	Infected	Non-infected	Infected
No. insects	28	13	33	17
Total days	220	112	266	146
Mean days	7.9	8.6	8.1	8.6

In the case of the females the difference was found to be significant at the 1 per cent level, the difference between males was significant at the 5 per cent level. It is apparent that the non-infected pupae develop somewhat faster than infected pupae. Although under test conditions the difference is small, lower temperatures, which tend to increase the period of pupal development, might increase the effect of the disease.

The length of the adult period of infected and non-infected adults was determined from the same material used for the pupal measurements. The results are shown in Table III.

TABLE III

Length of Adult Life (Days)

—	Females		Males	
	Non-infected	Infected	Non-infected	Infected
No. insects	28	13	33	17
Total days	442	114	320	122
Mean days	15.8	8.8	9.8	7.2

The length of life of *Perezia*-infected adults is considerably shorter than that of non-infected adults, the differences being significant at the 1 per cent level.

From the above results it is quite apparent that budworm infected with *Perezia fumiferanae* develop at a slower rate during both the larval and pupal stages and have a shorter adult life than non-infected insects. Females are affected more than males.—H. M. Thomson.

BRITISH COLUMBIA

A Test of Three Disinfectants in Nursery Soil.—Three soil disinfectants were tested at the Duncan forest nursery in 1956 for control of damping-off and weeds. They were: chlorobromopropene (CBP), 4.4 oz. with emulsifier in 27 qts. of water per 100 sq. ft.; allyl alcohol (AA), 4.4 oz. in 27 qts. of water per 100 sq. ft., and dimethyl tetrahydrothiazine thione (Mylone) at 4.4 oz. in 20 qts. of water per 100 sq. ft. The experiment was limited to one rate for each material, and to plots each 11.1 sq. ft. replicated four times. Highest recommended rates were avoided because, if weather had been cool, concentrations remaining at sowing might have been phytotoxic. The weather, however, was normal. In the four days before treatment mean air temperature was 50°F. with .01 in. of rain. Chemicals were applied to the seed-bed May 4. In the thirteen days after treatment mean air temperature was 55.8°F. with .09 in. of rain. Stratified Douglas fir seed was then sowed May 17 and covered with one-half inch of sandy soil relatively free of seeds and pathogens. For the 53 days after sowing, mean temperature was 60.5°F. with 4.07 in. of rain. The test area was not irrigated. As in the rest of the nursery, the soil was sandy loam with porous subsoil. This area, which had been cover-cropped several years, showed a low incidence of damping-off and weed emergence. The bulk of the weed growth was formed of a few early-emerged weeds averaging 3½ per control plot and ¼ per treated plot. The freedom of Douglas fir on the AA and Mylone plots from smothering was obviously significant compared with the controls. Further, the average numbers of weeds of all sizes counted on the plots, control, CBP, AA, and Mylone were, respectively, 46.0, 34.3, 21.0*, and 21.8*. (*Significant. L.S.D. at .05 was 18.4). At the rates used CBP was erratic in effect, AA appeared to control spring emergence of erect knotweed, wild buckwheat, common chickweed, sand spurrey, and orchard grass, and Mylone appeared to control the weeds named except orchard grass. Other weeds, notably clover and fine grasses, were present but were small and of sporadic occurrence. Many of the weeds counted after 53 days were assumed to have seeded in after the chemicals dissipated and, although willow was obviously present, no attempt was made to identify weeds in the cotyledon stage.

Increases in stand of Douglas fir were associated with soil treatments but were non-significant. The increases with CBP, AA, and Mylone were 10.3, 3.3, and 3.3 per cent, respectively, 53 days after sowing. Douglas fir seedlings were a normal green in the treated plots, but in two of the four controls they were chlorotic, possibly from competing and shading weeds or from low availability of nitrogen which sometimes is associated with growth of microorganisms on green manure in the soil.

Under 1956 conditions and rate of application of the disinfectants the results suggest the following. Only the seed-bed and not a cover soil that is reasonably weed- and disease-free need be treated. Partial soil sterilization may sometimes increase the stand of Douglas fir seedlings possibly as an indirect result of increasing the vigour of the seedlings, as well as by decreasing pathogens in the soil. For AA and Mylone, the rate tested shows promise if only susceptible weeds are present or if resistant weeds are few.

Further tests of the soil-disinfectant method of weed control appear worth while since Douglas fir tends to be sensitive to post-emergence application of selective herbicides. In addition, the increases in stand from soil disinfection were comparable in magnitude, though not in statistical significance, with the 4.3 per cent increase in stand 56 days after sowing, obtained by treating Douglas fir of the same seed-lot with Thiram before sowing it in the same part of the nursery.—P. J. Salisbury.

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