late as October 19. No relationship was evident between the peak bot population for any given year and the climatic conditions. The seasonal occurrence of cuterebrid bots is given in Table II. The peak bot population appears to coincide with that of its host.

TABLE II

SEASONAL OCCURRENCE OF CUTEREBRIDS IN THE WHITESHELL FOREST RESERVE IN JUNE, JULY, AUGUST, SEPTEMBER, AND OCTOBER

Host	1952	1953	1954	1955	1956	1957
	J A S O	J J A S O	J J A S	J J A S O	J J A S O	J J A S O
P. maniculatus....	1 3 1 0	0 1 6 0 0	1 3 0 0	1 0 3 0 0	0 1 8 2 1	1 0 5 0 1
M. pennsylvanicus.	9 3 0 0	1 3 1 1 0	0 0 4 1	0 0 1 0 4	0 0 2 0 0	0 0 0 0 0
C. gapperi.......	1 4 0 0	0 4 6 2 0	0 0 0 0	0 0 1 5 1	0 0 0 0 0	0 0 0 0 0

No evidence of mortality due to parasitism by bots was recorded. Thirty-nine animals were recaptured after attack by third-instar bots and in no case was there any evidence of serious ill effects. There was however the suggestion of a loss in vitality of three of these shortly following the emergence of the bot larva and it is conceivable that these animals could be more readily attacked by predators than an animal that had not been infested.

Data are limited regarding the effect of bot parasitism on the survival of host progeny. On July 18, 1954, a female *M. pennsylvanicus* with a bot on the shoulder region gave birth to four young in a live trap. The young appeared normal in all respects, and when the female was released she moved the young to a burrow. On August 11, 1954, a pregnant *C. gapperi* with a bot on the inguinal region was captured and retained in the laboratory until parturition on August 14. The seven young appeared normal, but were destroyed by the mother within two days. This habit is not uncommon in captive *C. gapperi*.

Sillman (Ann. Rept. Ent. Soc. Ont. 86: 89-97: 1955; *Ibid*. 87: 28-40: 1956) has reported aspects of the ecology of cuterebrids in southern Ontario. Although this author was concerned chiefly with *C. angustifrons* Dal., some comparisons with these observations are of interest. Sillman reports third-instar larvae in the field from July 28 to September 15 whereas in the Whiteshell Forest Reserve this period has been extended over a month in either direction. Sillman considers that cuterebrids do not seriously affect mortality of the host except indirectly in new-born animals. The writer is of similar opinon except that there is evidence that even new-born animals are not seriously in hazard because of maternal infection. Sillman reports that *C. angustifrons* attacks *P. maniculatus* almost exclusively whereas *C. grisea* is probably less host specific. Neither *C. angustifrons* nor *C. grisea* has been recorded on shrews or jumping mice in Manitoba and Ontario. It is further suggested by Sillman that the pupal period of *C. angustifrons* is determined by soil temperatures. The pupal period of *C. grisea* is probably governed likewise, for the developmental period following cold treatment was similar to that reported by Sillman.—C. H. Buckner.

Correction.—In the article by O. Vaartaja entitled *"Treating Seedbeds with the New Sterilizer Mylone"*, in Vol. 14, No. 2, page 3, the second last sentence of the third paragraph should read: "The 500-lb. rate of Mylone, however, caused a slight decrease in the numbers and a slight increase in the sizes of the seedlings."

BRITISH COLUMBIA

The Current Status of Pole Blight in British Columbia.—In British Columbia, the pole blight disease of western white pine (*Pinus monticola* Dougl. has been under continuous observation and investigation since it was first discovered in 1949. Early surveys and plot records indicated an alarmingly rapid intensification of the disease and heavy losses from mortality were anticipated. While these early fears were justified by the rapid progress of the disease on permanent sample plots up to 1953, more recently there has been a marked decrease in disease intensification. An improvement in stand condition has, in fact, been recorded on both disease progress and thinning plots and a similar trend has been observed in other pine stands. This trend now appears to have been sufficiently sustained to warrant a reappraisal of the potentialities of pole blight.

Progress of pole blight on the permanent sample plots was evaluated by rating each tree according to the degree of manifestation of its disease symptoms. These symptoms included reduced radial and leader growth, followed by yellowing, thinning, and stunting of the foliage. Long, narrow lesions accompanied by resinosis were also commonly found on affected trees. On the basis of symptom expression, plot trees were rated as healthy, early, intermediate, severe, or dead.

During examinations in 1953, it was noted that all plots, with the exception of the thinning plots at Arrow Park (Plot 456 B), showed a decrease in the rate of disease intensification when compared with previous years. Plot 456B did not show this reduction until 1954, at which time there was a slight over-all improvement in stand rating compared to 1953. By 1955, all plots showed a reduction in disease level, as evidenced by a decrease in the annual disease severity index (Fig. 1). This index, which is the weighted plot average of tree indices, as calculated by assigning each tree a value from 0 to 4 according to its classification as healthy, early, intermediate, severe, or dead. Prior to 1953, no improvement in individual trees was recorded and for many the rate of decline was rapid. Since then, although some trees have continued to decline, a larger proportion of the stand has shown a reduction in disease symptoms, resulting in a net improvement. On the Silverton thinning plot, for example, the number of healthy trees had dropped from 153 in 1950 to 19 in 1954, but by 1957 there had been an increase to 59 healthy trees (Table I). Similarly, the number of trees in the severe class on the same plot had dropped from 25 in 1954 to 16 in 1957 and during this period only one tree had died. It has also been noted in recent years that many affected trees, while showing no improvement, have declined no further. During the early years of pole blight observation, affected trees usually declined rapidly and frequently died shortly after reaching the severe stage. Similar trends in the redistribution of trees among severity classes occurred on all plots (Table I).

While the disease severity indices for all plots were lower in 1957 than in the peak years not all have shown a continuous reduction (Fig. 1). On Plots 456A and B (Arrow Park) there was a remarkable increase in the incidence of *Armillaria mellea* (Vahl ex Fr.) Quél. lesions at the root collar, the increase coinciding with a rise in the disease severity index of these plots. In 1957, 22 per cent of the live trees on Plot 456B had basal infections, twice the proportion recorded the previous year. The progress plots (456B) had an incidence of 17 per cent, which likewise was nearly double the previous year's incidence. The Silverton Plots (454A and B), on the other hand, where the index continued to drop, had a much lower incidence of 12 and 6 per cent respectively. While damage by *A. mellea* cannot be dissociated from the pole blight picture, the increase in index on Plots 456 A and B may be related to increased *Armillaria* activity, rather than to a reversal of the trend toward improvement.

One of the prominent features suggesting recovery of affected trees was an improvement in needle length, density, and colour. This improvement, first noted in a few trees in 1954, and which subsequently became fairly common, was apparent as a tufting of needles of nearly normal length and colour at the ends of branches which otherwise bore rather sparse, yellowed foliage. Such increases in foliage density at the ends of branches were distinct from the bunching of short, discoloured foliage, caused by a restriction of internodal growth characteristic of pole blight trees. This "recovery" foliage was observed even at the ends of almost bare branches. In other cases the leaders of trees in an advanced stage of decline had died back as much as 12 feet, but the foliage of the lower crown has since shown considerable improvement in colour and density. Initially such trees were confused with blister rust damage, but close examination failed to reveal trunk cankers. It was concluded, therefore, that they were pole blighted trees which had shown a remarkable degree of recovery. While the majority of "recovery" trees have maintained their improvement in vigour, some have suffered relapse, which is hardly unexpected when the complexity of the disorder is taken into account.

Further evidence indicative of the improved vigour of some trees is the healing of the elongate trunk lesions commonly associated with pole blight and the healing of basal lesions caused by *Armillaria mellea* infection. Healing of pole blight lesions was first observed on the plots in 1954, when two healing lesions were recorded. By 1957, a total of 56 were noted on the four plots. Healing lesions have also been observed in other stands. Such healing lesions were first noted as longitudinal cracks in the bark. On removal of the bark, callus formation was revealed along the margin of the lesion. Dissection in 1957 of some thirty of these lesions showed that healing in the majority of cases had begun during the period 1953 to 1957. In some cases, however, healing began as much as six years prior to dissection. Healing of basal lesions, caused by *Armillaria* infection also, took place during the same period, although a number of older healed lesions dating somewhat further back were recorded. Healing basal lesions were more common on the Arrow Park than the Silverton Plots, as was the incidence of *Armillaria*.

Despite nearly nine years of investigation in British Columbia and observations and research which date back to

1938 in the United States, the cause of pole blight is still not clear. Precipitation and temperature records indicate that during the years 1940 to 1951 many summers have had below normal rainfall and above average temperatures. Since then, summers have been somewhat moister and cooler. The current reduction in the rate of disease intensification and the apparent improvement in vigour of some trees suggest that climatic cycles may have provided an underlying cause or predisposition for decline. While the present trend toward recovery or at least slower intensification may not be indefinitely maintained, it would seem probable that losses in the immediate future are unlikely to be as great as early observations had indicated. There would, therefore, seem to be some justification for reserving trees showing little or no evidence of damage. On the other hand, cutting of pine in moderate to severe stages of decline would appear expedient, for although early mortality of these trees is not anticipated, many may eventually succumb to such agencies as root rots and bark beetles. In any event trees in such a low state of vigour are not likely to put on much increment, for excavations have shown their root systems to have suffered considerable deterioration and rapid recovery cannot be anticipated. However, the remaining thrifty trees even in those stands having a high proportion of severe pole blighted trees would appear, under present conditions, to have as good a chance of continued growth as thrifty trees in less heavily damaged stands.

Reconnaissance surveys in British Columbia have shown that pole blight damage ranges from nil to very heavy mortality of white pine. Surveys in the United States have indicated some correlation between pole blight incidence and soil moisture storage capacity. However, present knowledge of the environmental factors differentiating sites with varying degrees of damage is not sufficient to predict adequately the susceptibility of any given site. It will be necessary to continue investigation of environmental and site relationships in order to assign satisfactory hazard ratings to different stands, if white pine is to be managed with due regard to the potentialities of pole blight in the future.—A. C. Molnar and R. G. McMinn.

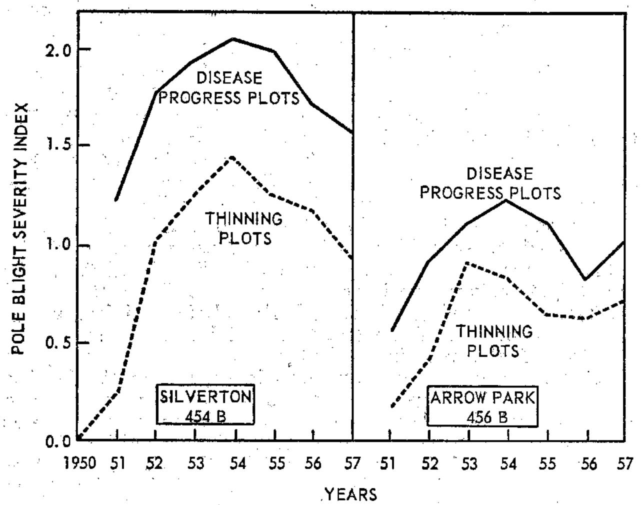

Fig. 1. The development of pole blight on permanent sample plots in British Columbia.

TABLE I. Pole Blight Development on Disease Progress and Thinning Plots as Shown by Annual Distribution of Trees in Disease Severity Classes

Disease severity class	Number of trees in severity class by year							
	1950	1951	1952	1953	1954	1955	1956	1957
	Silverton disease progress plot (454 A							
Healthy	......	58	33	20	18	17	25	27
Early	......	45	26	36	29	36	32	35
Intermediate	......	31	48	35	30	22	28	32
Severe	......	24	45	53	60	54	42	29
Annual dead	......	6	6	8	7	8	2	4
Accumulated dead	......	6	12	20	27	35	37	41
	Arrow Park disease progress plot (456 A)							
Healthy	......	182	135	99	90	85	122	83
Early	......	53	58	82	74	103	92	113
Intermediate	......	38	65	68	65	49	33	42
Severe	......	11	24	28	43	30	15	20
Annual dead	......	......	2	5	5	5	5	4
Accumulated dead	......	......	2	7	12	17	22	26
	Silverton thinning plot (454 B)							
Healthy	153	123	44	34	19	31	40	59
Early	3	29	73	67	72	73	72	60
Intermediate	......	4	38	34	40	32	20	20
Severe	......	......	11	21	25	20	23	16
Annual dead	......	......	......	......	......	......	1	0
Accumulated dead	......	......	......	......	......	......	1	1
	Arrow Park thinning plot (456 B)							
Healthy	......	216	163	95	104	125	131	119
Early	......	21	60	93	95	82	75	76
Intermediate	......	8	22	42	30	25	25	30
Severe	......	......	......	14	11	7	5	9
Annual dead	......	......	......	1	4	1	3	2
Accumulated dead	......	......	......	1	5	6	9	11

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