FOREST INSECTS IN NOVA SCOTIA

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THE investigation of forest insects in the Maritimes and the Gaspé peninsula is carried out from the Dominion Entomological Laboratory at Fredericton, N.B. During the past season, Nova Scotia has provided us with the majority of our active infestations east of the St. Lawrence, and for this reason it has been chosen for discussion. While the species to be mentioned are also of importance to New Brunswick in that they exist in both provinces, New Brunswick has been comparatively free from important outbreaks this year. In two cases, however, the southerly portions have already been invaded and the problems of Nova Scotia tend to become those of New Brunswick.

The following insects were all observed to be active during the past summer and can be considered of importance to the forester, although their potentialities for damage vary and in some cases are not yet completely known. Some are comparatively new as forest pests, and hence of peculiar interest.

They are arranged for convenience in three groups, according to the type of feeding, as leaf feeders, bark borers, and bark sucking insects.

THE BLACK-HEADED BUDWORM

The defoliator of chief interest is the black-headed budworm (*Peronea variaria* Fern), a relative of the notorious spruce budworm (*Cacoecia fumiferana* Clem.). This insect has not been known in outbreak form until quite recently, although it is widely distributed. It appeared about two years ago in large numbers in British Columbia and Washington, chiefly on hemlock. I found it epidemic on spruce and fir in Wyoming in 1929.

In the same year it was reported for the first time in the East by officers of the Mersey Paper Company on Cape Breton island. There it had destroyed the greater part of the new growth of balsam fir and white spruce over some 200 square miles in the southern part of the island. In 1930, the numbers increased and feeding was noticeable over some 500 square miles. Somewhat less than 200 of this, however, can be considered as seriously attacked.

This year on the latter area, with a population of around 50,000 eggs per mature tree, all the new foliage was again eaten, together with a certain amount of the old. Overtopped balsam trees and reproduction were prac-

tically stripped. White spruce lost only its new foliage. Red and black spruce were but slightly fed on.

This fall a somewhat reduced, but nevertheless strong, flight of moths took place, and it appeared as though the stand was in danger of being destroyed. Fortunately, however, the number of eggs laid per female was unexpectedly small; and although we cannot as yet explain this, it will cause a very considerable reduction in the outbreak next year.

We cannot predict the final result with certainty, but there is good reason to expect that there will be no wholesale destruction from this particular outbreak, such as has generally followed spruce budworm outbreaks. The only mortality caused so far, has been among the overtopped trees and reproduction, and this is not a very serious loss. However, the trees have been weakened and would not stand another heavy attack. There will be a considerable reduction in increment in the next year or two.

The habits of this species are very similar to those of the spruce budworm. It feeds on the growing shoots within a loose web, commencing about a week after the buds burst. Pupation takes place among the needles about the end of July, by which time the trees look brown, just as with a spruce budworm attack. This brown appearance becomes less noticeable as the dead needles are removed by the weather. The black-headed budworm differs from the spruce budworm in that the eggs, which are laid during September, do not hatch until the following spring. For this reason, it is not quite so destructive to unopened buds, as they have mostly started to grow before feeding commences.

The caterpillar is smaller, being about $\frac{1}{2}$ inch long when full grown, and bright green in colour with a black head. The latter turns brown in the final stage, so that the name "black-headed budworm" is likely to be confusing.

The present outbreak indicates that epidemics will only occur where there are considerable areas of fir and that this species is an enemy of fir rather than spruce. It has, however, rather versatile food habits and may be capable of developing a race which will prefer other trees.

THE TUSSOCK MOTH

An interesting and important illustration of versatility in feeding habits was afforded this year by observations of the white-marked tussock moth (*Hemerocampa leucostigma* A and S) feeding in considerable numbers on balsam fir, and, to a lesser extent, on spruce and hemlock. This species has hitherto been considered an enemy only of hardwoods, and chiefly a shade tree pest. It has shown itself this summer to be also a forest insect capable of killing balsam fir.

Three small outbreaks were found; one near Cape North, one near Sherbrooke, and one not far from Truro. The outbreaks were not serious, and

in all cases observed have been brought to an end by parasites. Near Truro, however, over a small area of one or two acres, the balsam had been stripped and some of the trees will die.

The Douglas fir tussock moth (*Hemerocampa pseudotsugata* McD.), a close relative of similar habits, has during the past four years killed a great deal of fir in British Columbia and the Western States.

BIRCH DEFOLIATORS

Two leaf feeders on birch are worth mention as they both attracted a lot of attention and brought in a number of reports. One is the birch leaf skeletonizer (*Bucculatrix canadensisella* Cham.), which was epidemic throughout practically the whole of the Maritimes and caused birch stands to turn brown in the latter part of August.

This is a small moth, the caterpillars of which first mine in the leaves and later come out and eat the tissue between the veins. The destruction of the foliage, however, comes toward the latter part of the season and the effect on the trees is not serious unless it is continued for a number of years. It is very unlikely to cause important mortality.

There are a number of insects which mine in birch leaves but this one can be distinguished by the small, flat, white cocoons which it spins on the leaves.

The other defoliator of birch met with was a comparatively large looper, caterpillar of a Geometrid moth, which stripped the birch and partially stripped the other hardwoods throughout the famous Margaree valley and on the slopes of Smoky Mountain in Cape Breton. We were unable to determine the species, for when the outbreak was investigated it was found that it had been practically wiped out in the last larval stage. The trunks and limbs were literally covered with the remains of the caterpillars, all facing downwards. It was an extraordinary illustration of natural control, the exact causes of which are not known, but appear to be disease assisted by wet weather.

A few pupae were found in the duff and are believed to be survivors of the species responsible. They will probably emerge in the spring.

The defoliation in this case took place in June. The trees, however, were able to put out a very satisfactory second crop of leaves in July and no permanent damage need be expected as the outbreak will probably not reappear next year. Deciduous trees can withstand defoliation much better than evergreens.

THE SATIN MOTH (*Stilpnotia Salicis* L)

Another defoliator worthy of mention here is the satin moth, an imported pest of poplars and willows which was reported in Eastern Canada for the first time this year. The shade trees in Moncton, N.B., were heavily attacked and smaller infestations have been found in Yarmouth and Annapolis

counties in Nova Scotia. It has been established in the N.E. States and in B. C. for some years.

This European insect shows some preference for imported species of poplar and willow, and is a pest of towns rather than forests. On the other hand, it may adapt itself to native species and in any case it must be considered a serious menace where experimental poplar plantations are being made by pulp companies.

EASTERN SPRUCE BARKBEETLE

Two insects which bore beneath the bark were investigated in Nova Scotia this year. The first is the eastern spruce barkbeetle (*Dendroctonus piceaperda* Hopk), belonging to the genus of tree-killing barkbeetles which is so destructive, particularly in the West. It breeds normally in decadent red and white spruce but periodically breaks out in vigorous stands, attacking by preference the larger trees.

Infestations occur in groups of trees, from which they spread into the neighbouring spruce, sometimes taking every tree over six inches D.B.H. They often last for several years and destroy large patches of forest. Over-mature spruce is particularly susceptible.

Groups of recently attacked trees were found at several points in Richmond county. Near Grand River, a very fine stand of mature spruce had been attacked for several years. Some ten acres had been more than half killed and these outbreaks showed no signs of declining. South of Sydney, there is a considerable area of dead trees killed some years ago, and on the Boisdale peninsula an outbreak, apparently subsiding this year, has destroyed the greater part of the spruce over several hundred acres.

Conditions of ownership in Cape Breton and the fact that much of the spruce is pasture type make control measures difficult to apply. However, all mature spruce stands of value need to be watched for attacks by this beetle.

HEMLOCK BORER

A different type of beetle infestation, by a flat-headed borer (*Melanophila fulvoguttata* Harr) occurs in hemlock at Lake Rossignol. The flat-headed borers are not generally capable of attacking healthy timber but members of the genus *Melanophila* occasionally do so. They are on the border line between primary and secondary pests, breeding normally in dying trees, but, when conditions permit them to become numerous, entering green timber and doing considerable damage for a year or so.

In the winter of 1928-29 a considerable number of hemlock logs were cut in connection with the Mersey Power Development. In 1929, these were all heavily infested with the borer. In the following spring, the level of the lake was raised and a great deal of hemlock was flooded. All of these flooded trees were in turn attacked last year and thus a heavy population has been

built up in an area where there are some of the finest hemlock stands in the East.

No unflooded trees have as yet been entered, however, and we have no first-hand experience with this particular species. According to reports from the United States, it has killed a good deal of hemlock. Conditions are undoubtedly favourable at Rossignol and it remains to be seen whether the green timber will be attacked when the supply of drowned trees is reduced.

BEECH COCCUS

The two remaining species, the beech coccus (*Cryptococcus fagi* Barensp.) and the fir bark-louse (*Dreyfusia piceae* Ratz.) are of the sucking type, both very small bark-infesting forms and both apparently of European origin. They are also both covered with white wax-like wool and spend most of their life stationary on the bark, extracting their food through hair-like tubes several times longer than their bodies. No males have been found in either species.

The beech coccus was first reported in America at Halifax in 1911. It has now spread throughout the whole of Nova Scotia and is invading New Brunswick. Westmorland and Albert counties are badly infested and stray attacks have been found not thirty miles east of Fredericton. A great many of the trees are already dead and it seems likely that most of the beech in Nova Scotia will be destroyed.

The actual cause of death seems to be a fungus associated with the insect. A study of the associated fungi was commenced last year by Mr. Ehrlich, of Harvard University. The insect is apparently more destructive here than in Europe.

A predaceous ladybird beetle (*Chilocorus bivulnerus* Muls.) has appeared in considerable numbers, but so far only on the heavily infested areas after the damage has been done.

THE FIR BARK LOUSE

An infestation somewhat similar in appearance to that of the beech coccus, consisting of a white woolly growth on the bark, has been noticed during the past few years on balsam fir here and there throughout Nova Scotia. This is the fir bark louse, or fir chermes, (*Dreyfusia piceae* Ratz) apparently imported from Europe, possibly about the same time as the coccus. It was reported in New England in 1909, but has been collected also in California and appears to be quite widely distributed.

Last season, heavy infestations were found at several points in Nova Scotia and also in the extreme southern part of New Brunswick. The trunks often become covered with the wool of the insects and some of the trees are already dying. During the attack, for several years before death, these trees have produced abnormally large annual rings. Frequently, the balsam weevil (*Pissodes dubius* Rand) follows the chermes and hastens death.

This insect has not been studied in America and its habits and life history here are unknown. Observations during the past fall, however, have shown that it attacks both the stem, twigs, and buds and apparently is the cause of gall-like swellings and the death of buds and twigs, especially in the tops of the trees.

There is a condition on balsam, wide-spread in Nova Scotia, which has been known as "gout" or "dropsy." Affected trees have swollen twigs, dead tops, umbrella tops, rapid taper, and a dark brittle condition of the wood. Various degrees of this "dropsy" will be seen, but some evidence of it can be found in practically every considerable stand of balsam in the province. In some areas all of the trees are more or less affected. It is the most serious injury at present affecting the fir.

This condition has been looked upon as a fungus disease and is now being studied by pathologists. Recent observations on the fir bark-louse, however, suggest that it may be the primary cause of "gout" and experimental work is being planned for next season.

CONTROL

The question of control measures is always a difficult one in forest entomology and can only be mentioned briefly here. Such artificial methods as are possible are often costly and can only be undertaken when the probable damage can be estimated and the value of the protected timber is at least equal to the cost of control.

In the case of the defoliators, dusting from aeroplanes offers future possibilities, where these conditions apply and where small centres of infestation can be recognised in time. None of the present Nova Scotia outbreaks warrant dusting operations. The satin moth should be controlled by spraying, but it is important that the correct time be chosen. It was found at Moncton, N.B., that the trees were being sprayed after the feeding was over, which is obviously not the right time. The spray, however, remained on the trees long enough to kill the next brood in the fall.

In the case of the borers it is often possible to halt an incipient outbreak by cutting and burning, peeling, or submerging the infested trees before emergence of the insects. Where this can be done as a part of regular cutting operations, the cost is not high. It is necessary, however, that all the owners of infested timber co-operate to make a thorough clean-up.

The bark lice on beech and fir are already so widespread and so inconspicuous when in small numbers that general control seems out of the question. It is possible that if the beech coccus had been attacked when it was first noticed it might have been exterminated before it spread. When we know more about the fir bark-louse it may be possible to minimize the damage by silvicultural methods.

The discovery and introduction of effective parasites and predators may eventually reduce some of these pests to endemic proportions. The Imperial Institute of Entomology in England is working on some of the Canadian forest problems in so far as its resources permit, and it is hoped that some assistance from these natural factors of control may be obtained, especially in the case of imported species. Such work, however, demands a good deal of preliminary investigation and rapid effects are not to be expected.

The whole question of forest insect control will become simpler as management becomes more intensive. One of the first steps is towards a more general ability to recognise outbreaks in their early stages. The Forest Insect Division is now issuing a number of illustrated leaflets describing some of the more important species and it is hoped that they will be used by foresters, and also by rangers, to keep the Entomological Branch informed of insect activity. Reports will be investigated wherever it is possible and information given as to the possibilities of control or salvage.