

The results of the attacks of this insect, though a defoliating insect, are serious, though they are more complex than would appear at first sight. Packard stated that the destruction of the spruces along the Maine coast in the early 'eighties' was chiefly due to this insect. It is not unlikely, however that the budworm was followed by other insects. The primary injury is to the buds which are destroyed and thus the growth is checked—a serious matter on a slowly-growing tree. The repeated defoliation weakens the vitality of the tree with the result that it reaches a certain point at which it is susceptible to the attacks of bark-beetles, the chief of which is the Eastern Spruce Beetle (*Dendroctonus piceaperda* Hopk.). This beetle is more serious in its effects than any other enemy of the spruce, as it kills the tree which is then readily attacked by timber borers and fungi. As Hopkins has stated this species of bark beetles has caused the death of a very large percentage of the mature spruce over an area of thousands of miles in the spruce forests of New York and the New England States and southeastern Canada. It has been found killing the mature spruce in Quebec, New Brunswick and Nova Scotia. The greatest danger to my mind, therefore, of the present outbreak of the spruce budworm in Quebec is not so much the direct killing of the trees by repeated defoliation but the reducing of the vitality of the trees and rendering them more susceptible to the attacks of bark beetles especially the spruce beetle which is present in many of the affected localities, and one of my chief objects in making a tour of inspection of the most severely infested localities will be to discover whether the trees are being weakened in vitality, and this secondary attack of bark beetles is taking place. That the spruce budworm is able, however, to cause the death of the trees directly is demonstrated in British Columbia where it has killed a considerable quantity of the young Douglas firs of the second growth which is a most serious matter as affecting the natural regeneration and afforestation.

Spreading like fire by means of the moths it is impossible to check the spread of this pest by ordinary means. Two things only appear to be possible; to study, in the manner I describe later in my account of the larch sawfly, the progress of the work of the parasites with a view to ascertaining whether the natural means of control are proving effectual and, by careful inspection of the infested areas, to detect the beginning of the attacks of the bark-beetles upon the weakened trees. As soon as such attacks are observed the trees should be immediately dealt with, as is possible in the early stages of the outbreaks of these insects. By such timely action it may be possible to prevent the spread of the beetles and the weakened trees, instead of being killed by the latter, will have the opportunity to recover, should the outbreak of the budworm be transient or checked by natural causes. These bark beetles are the most destructive of all insects attacking conifers but, at the same time, if the necessary steps are taken, it is possible to prevent serious outbreaks. The chief essential is that the forest rangers shall have such entomological knowledge as will enable them to detect the first signs of the outbreak the chief of which is the turning yellow or red of the tops of the trees. The presence of the spruce budworm will make such detection more difficult. If the identity of the species of beetle is scientifically determined, it is usually possible to recommend the measures to be taken to check the further spread of the insect.

A study of the parasites of the spruce budworm, both in Quebec and British Columbia, is being made with a view to ascertaining the extent of their work. This insect is stated not to have many parasites. So far, we have discovered about seven species of parasites which attack it, and next year we hope to have sufficient material to enable us to estimate the degree of parasitisation.

THE LARCH SAWFLY.

This 'larch-worm,' as it is sometimes called, since the defoliation of the larch or tamarack is caused by the caterpillar, has been known in Europe since the early part of the nineteenth century where it was injurious to the European larch in cer-