

survival of the remaining trees constituted an equally, if not more, important factor. In many extensive areas in Gaspé and elsewhere the probability of recovery was gradually decreasing year by year and in the older centres of infestation it was virtually nil. Then a remarkable thing happened. In 1936, entomologists studying the spruce sawfly infestation began to discover indications of the presence of a mysterious disease which caused a high percentage of mortality among the larvæ in a number of localities. This disease appeared to be caused by a virus and spread with phenomenal rapidity over practically the entire range of the distribution of the sawfly. In heavy infestations the mortality of larvæ reached as high as 99.7 p.c. By 1942, the spruce sawfly problem had, for the time being, been relegated to secondary rank in economic importance.

**The Jack Pine Budworm.**—While the European spruce sawfly was gradually making inroads into the forests of Eastern Canada, the jack pine budworm, a native species, began to appear in outbreak form in northwestern Ontario and Manitoba. Although there can be no parity between the two infestations from the standpoint of the national economy as a whole, the jack pine budworm presents a problem of the first rank for the lumber and paper industries in the affected territory.

The jack pine budworm is either a new species or a biological race or strain of the notorious spruce budworm from which it differs in habits rather than in form. It exhibits such a marked preference for pine instead of spruce or balsam that, from an economic standpoint, it must be considered as constituting a distinct problem. The principal injury caused by the budworm consists in the defoliation of the host-tree. Usually the tops of the crowns suffer more severely than the lower parts, resulting in the formation of stag-heads which are a striking characteristic of infested stands. Repeated heavy defoliation or complete defoliation before the formation of the next year's buds is fatal. Although large trees are likely to succumb first, young trees growing under them are frequently killed by larvæ which drop from the older trees. Thus far, comparatively few trees have been killed outright, but the production of stag-heads is very general in heavily-infested stands and is likely to favour the entrance of rots and secondary insects which may ultimately either kill the tree or render it unfit for utilization except as firewood.

### **The Approach to the Problems Involved**

The widespread belief that such insects as the spruce budworm, the spruce bark-beetle, the European spruce sawfly, etc., are inherently noxious and that the sole reason for their existence is to cause calamities, should be deprecated "in season, and out of season". In the natural order of things, insects are part and parcel of that great economy commonly referred to as the "balance of nature". The forest is a vast biological unit composed of plants and animals; it is perpetually subject to changes through the succession of species and individual organisms competing with each other for a place in the sun, and its composition at any one point of time is the resultant of the complicated interaction of all its vegetational and animal components, itself again dominated by climatic and edaphic conditions. In this intricate scheme of relationships insects play a dual regulatory role. Some, namely the herbivorous species, act upon the vegetation while others, endowed with carnivorous instincts, control the excessive multiplication of the first. Vegetarian insects may be roughly divided into two great classes: those that feed upon healthy, living trees and are therefore designated as primary; and those that attack only sickly, dead, or dying trees and, as such, are usually considered as secondary.