

osoting of egg masses, tanglefooting of trees, spraying of trees, intensive forestry practice, and all such methods are simply out of the question. Can anything else be done to control, or better still, to prevent such damage? An answer can perhaps be found by considering the nature of an insect outbreak.

In the case of any particular insect, the struggle for existence is so intense that an outbreak is usually impossible. New Brunswick, for instance, probably supports at least ten thousand different kinds of insect but the competition for a livelihood is so keen that most of them are uncommon or rare. An outbreak then results from a set of peculiar conditions favoring a particular species.

A great many different factors tend to keep insects in a condition of numerical stability or control, or, in other words, to prevent outbreaks. The more important of these factors I will rapidly review.

In the first place the vagaries of climate are powerful factors in control. Hailstorms in July will sometimes free acres of forest lands from a destructive caterpillar. Ever so light a frost in June will often kill millions of tender larvae. In fact 'unusual' weather at any time is liable to produce direful results in the insect world.

#### *Value of Birds*

The useful work of insectivorous birds can scarcely be over estimated, particularly in reducing the numbers of succulent larvae feeding in the north woods. The wood warblers are pre-eminently useful in this respect as any one can testify who has camped in June and July beside one of the countless brooks in the north woods region. From dawn until the day grows hot groups of these shy little birds may be seen busily searching out a meal of insects from the leaves, from the twigs, or from the bark according to their respective preference.

Then again epidemic diseases play an important part in reducing the numbers of insects. With the insects

unduly abundant and the weather conditions favorable for incubating the fungus or bacteria organisms, causing these epidemics such a death rate may result that statistics for the great plague of London or for any human epidemic recounted in history pale into significance. At times, indeed, injurious insects are locally exterminated in this way.

#### *Predatory Insects*

Other powerful aids in reducing the numerical strength of certain kinds of injurious insects are the predatory mites and insects. In the case of the oyster shell or mussel scale, for instance, the most important single factor in control in Eastern Canada and many other places is a tiny eight legged mite. This little organism ekes out an existence by feeding on healthy eggs of the scale. In this way the scale is often reduced from a condition of great numerical abundance to one of extreme scarcity. As to predatory insects the importance of their work can be likened in a general way to that of insectivorous birds. In a favorable year such insects were estimated to destroy three quarters of the entire forest tent caterpillar crop of New Brunswick and better tribute could scarce be paid.

No account of the factors tending to reduce or prevent insect outbreaks would be complete without referring to the work of insect parasites. Among all the insects of the earth there are two groups that stand out from the rest on account of a method of existence involving parasitism on other insects. I refer to the parasitic two-winged flies (Diptera) and to the parasitic four-winged flies (Hymenoptera). In Canada there are several thousand species of such parasites and they are among the most useful members of our wild life. Some of them attack eggs, others small larvae, others older larvae, and some again attack only pupae; so that an insect like the forest tent caterpillar is liable to attack by parasites in any of its first three stages. Any of my readers who have tried to rear adult insects