

## Injurious Insects with Some Methods of Combatting Them.



THE study of insects in relation to agriculture has of late years commanded much attention, and is usually referred to as Economic Entomology. This is largely owing to the fact that for the last quarter of a century injurious insects have at times become almost uncontrollable, and Science was asked to remedy the difficulty if possible, with the result that insect ravages of an alarming extent are becoming more and more a thing of the past.

According to recent enumerations nearly 100 species have been found preying upon grain and forage crops; upwards of 40 upon vegetables; 50 upon the grape; and 75 upon the apple. The pine has 125 species as enemies; the oak, 300; the elm, 80; the hickory, 170; the maple, 75; the beech, 15; and the willow 400 insect foes.

The average loss to the Dominion of Canada from insects during 1884 is calculated to have been \$35,000,000, and for 1891, \$25,000,000. These figures no doubt give an under-estimate, and we must conclude that a study of a subject that will enable us to lessen this loss is of great importance.

In order to cope successfully with the numerous insects which attack agricultural and horticultural products a knowledge of their life history, habits and mode of existing is almost indispensable. Such a knowledge enables the person concerned to use the best remedies, at the most favourable time, and thus achieve the best possible results.

Nearly all insects undergo a well-defined metamorphosis: i. e., they go through several changes in passing from the egg to the adult stage. For instance, the egg of the "currant worm," *Nematus ribesii*, hatches into a worm or larva, which feeds upon the leaves of the currant. In due time it develops, and after a few weeks falls to the ground, where it spins a tough brown case or cocoon for itself in the leaves or rubbish at the foot of the bush. This is what is known as the pupa or resting stage. When the insect undergoes another change, and in a few weeks bursts its cage and emerges as the full-grown imago of the currant fly, which in turn sets to work and lays another brood of eggs for future propagation of the race.

In nearly every instance insects are the most injurious in the larval state. During that period they are voracious feeders and attain their maximum weight, and if successfully exterminated it prevents the occurrence of succeeding broods.

All injurious insects can be classified according to their manner of eating, viz., those having biting mouths, such as the "potato beetle," *Doryphora decemlineata*, and those having sucking mouths such as the "plant aphid," *Aphis mali*, or the notorious "horn fly," *Hannetia bicolorata*. It will thus be readily seen that insects of the first class will require, as a rule, to take some poison which will act internally; while those of the second class will require some remedy which will kill by external application. For instance, the larva of the currant worm would be killed by an application of Paris Green to the bars attacked, while the plant aphid requires an external application of kerosene emulsion, which kills it by burning its soft body.

In dealing with injurious insects a great variety of remedies are

employed in their extermination, of which the following is a list of the more important ones:

1. NATURAL ENEMIES.—Nature is one endless chain of destruction and happily so. If such were not the case certain species of insects would soon become uncontrollable. No sooner does one particular insect become alarmingly numerous than a natural enemy in the form of some parasitic insect, or fungi, immediately comes on the scene to keep it in check. A good example of this is seen in the case of the "army worm," *Leucania unipuncta*. The Tachina fly lays its eggs on the back of the neck of this voracious larva, these hatch, and the Tachina larvae in turn feed upon the body of the army worm. A great many animals are insectivorous. Many kinds of birds are faithful friends in helping to keep down insects, when the latter become too numerous. Insectivorous birds should, therefore, be safely guarded by the agriculturist and fruit grower. Carnivorous plants, such as the famous "fly trap," serve to some small extent as an insect check.

2. INSECTICIDES.—There are very effective remedies in the hands of the skilful farmer or fruit grower. The most important ones are the following: Paris Green (arsenic of copper, containing 50 to 60 per cent. of arsenic). This is applied dry or in solution. In the dry form it should be mixed with 50 to 100 parts of plaster, wood ashes, or air-slaked lime, and dusted upon the plants. The form in solution is usually 1 lb. of Paris green to 200 gals. of water; but if the foliage is tender 250 to 300 gals. of water may be used. One pound of lime to every 100 gals. will prevent injury to the foliage. Kerosene emulsion consists of half-pound of hard soap in one gallon of water. Boil till dissolved, and then add two gallons of coal oil, and mix thoroughly for about five minutes. When properly mixed it will adhere to glass without oiliness. Dilute the mixture with nine parts of water. If the foliage is very tender the emulsion must be more dilute, 15-20 parts of water.

In nearly all cases Paris green is an effectual remedy against insects that feed by chewing. Kerosene emulsion is also a most successful general remedy when applied upon insects that feed by sucking the juices of plants, such as plant lice. We then have two insecticides which cover almost every case, and are no longer required to learn a different remedy for each pest, as was necessary not many years ago.

3. BARRIERS. In cases where the destructive larvae travel from one place to another some means is required to stop their march and confine their attack as far as possible to one particular spot. In the case of the army worm a whole field may be attacked, and it is an impossibility to attempt their destruction by spraying the crop. If kept in this certain spot until they pass into the pupa state there is very little fear for the surrounding crops. The edge of the field likely to be attacked may be sprayed with Paris green, and as the worms advance to feed upon it they are killed in large numbers. In bulletin No. 104, New Series, of the N. Y. Experiment Station, Geneva, the following is recommended as a method for checking the army worm. Plow deep furrows around the infested field, or around an infected section of a field; also where possible in front of advancing insects. Make the sides of the furrow as near perpendicular as possible, and where the soil will permit, slant them back, especially the sides op