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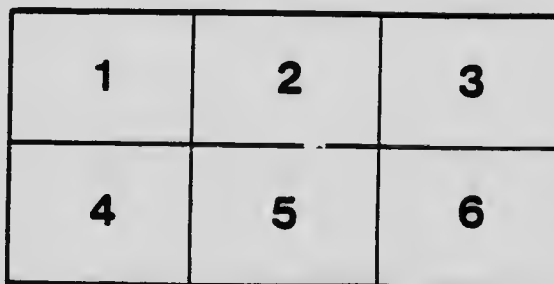
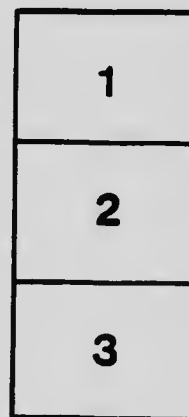
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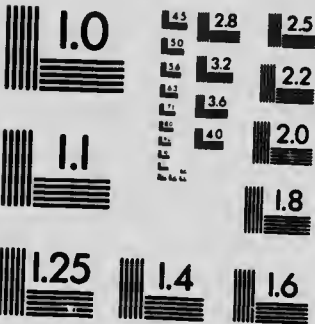
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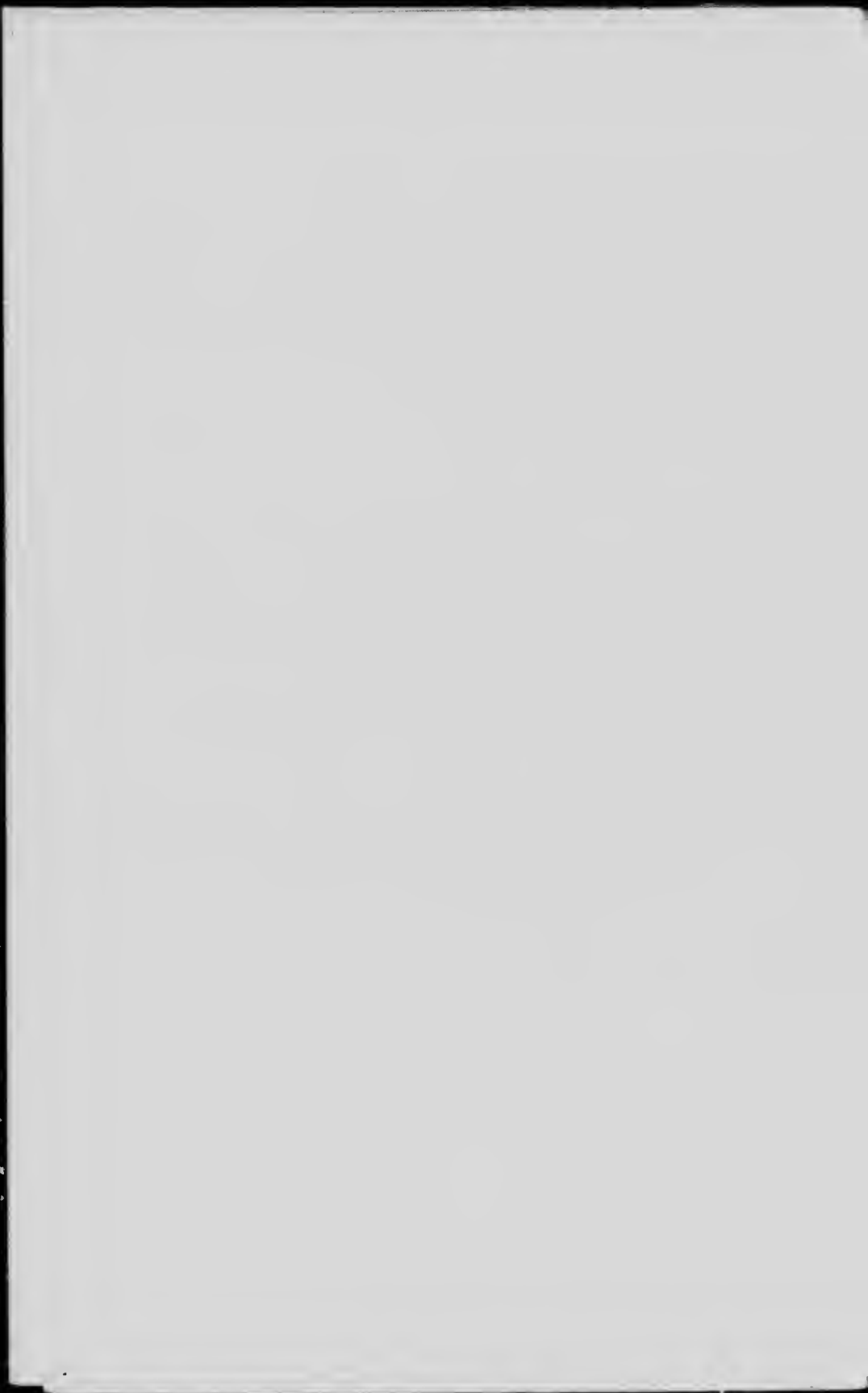
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PROVINCE OF BRITISH COLUMBIA.

DEPARTMENT OF AGRICULTURE (HORTICULTURAL BRANCH).

INSECTS INJURIOUS TO ORCHARDS.

BY W. H. BRITAIN, B.S.A., PATHOLOGIST AND ENTOMOLOGIST.

IT has been estimated that the annual loss to farm crops in Canada from the ravages of insect pests is somewhere in the neighbourhood of \$45,000,000. It is therefore obvious that every practical orchardist should be acquainted with the most improved methods of combating his insect foes. In order to intelligently apply such remedies, however, it is necessary for him to know a little about the insects themselves, and something of their structure and life-history.

A little observation will show whether an insect is injurious, neutral, or whether actually beneficial. Many of this latter class, including lady-bird beetles, which prey upon plant-lice, are among the best friends the farmer has.

A knowledge of the structure of insects is essential, for upon this depends, to a very large extent, the methods adopted for their control. For this purpose, insects are divided into two main classes: (1) Sucking-insects, and (2) biting-insects.

To the sucking-insects belong the aphides, leaf-hoppers, mealy-bugs, etc., whose mouth-parts are modified into a long sucking-tube, which pierces beneath the skin of the food-plant and sucks up the juices within. Stomach-poisons would, of course, be of no avail against insects of this class, and consequently some material must be applied that will kill them by contact. All insects breathe through tiny openings in the sides of their bodies. It is the object of the contact sprays to plug up these openings, enclose them in a film, or else to destroy the insects by means of the caustic action upon their bodies.

Biting-insects include all those forms that chew and swallow their food. The various leaf-eating caterpillars belong to this class. As these insects actually take portions of the food-plant into their systems, they can be controlled by the use of stomach-poisons, like lead-arsenate. Soft-bodied biting-insects may sometimes be destroyed by the use of contact sprays.

A knowledge of the life-history of any insect pest is necessary in order to tell at what period in its life it can be most readily, or cheaply, controlled. Insects, in the course of their development, pass through the following stages:—

(1.) The first is the egg stage, during which the insect is usually invulnerable to attack, but during which some kinds may be successfully treated.

(2.) The egg hatches into what is known as a larva. If the adult insect is a fly, the larva is called a maggot; if a moth or butterfly, a caterpillar;

if a beetle, a grub; and others have no special names. The larval stage is the growing and feeding period of the insect's life, when the most injury is done, and is usually the time when they can be most conveniently destroyed.

(3.) The third stage is the pupal or resting period, during which the insect remains quiescent and takes no food. In this stage the larval organs are broken down and built up again into the organs of the adult.

(4.) The fourth stage is the adult, or perfect form. The adult insect is usually winged, and during this period there is no further growth, only sufficient food being taken to maintain the vital activities of the insect.

Some insects have no pupal stage, and the second period in their life is called a nymph instead of a larva. Examples of this class of insects are grasshoppers, scale-insects, and aphides. Examples of those having all four stages are the tent-caterpillar, fall webworm, pear-tree slug, etc.

PREVENTION AND TREATMENT OF INSECT PESTS.

This, from the farmer's or fruit-grower's standpoint, is the most important side of the subject. There are several general headings under which such methods may be discussed. The following are a few of the most important:—

(1.) *Clean Culture.*—This consists in gathering all crop residues—prunings, etc.—and destroying by fire or the use of lime; by removing and burning all dead wood and by scraping off the loose bark from the trees.

(2.) *Maintaining the Vitality of the Plants.*—As is the case with diseases, plants weakened from any cause are less able to withstand the attacks of insect pests than those in a vigorous, thrifty condition. Great growth does not necessarily denote health or vigour, and a tree that has made a good normal growth is often in better condition than one that has made a large sappy one. The grower should therefore endeavour to so cultivate his trees that they will make a stocky, normal growth characteristic of the particular variety. Do not invite winter injury by late cultivation, late irrigation, or excessive pruning. By observing these precautions the grower will render more simple the problem of keeping his trees free from insect and fungous pests. Much has been written concerning the insecticidal value of fertilizers, but it is probable that their chief value lies in the increased vigour they give the plants.

(3.) *Hand-picking.*—This method is of value in the control of large, leaf-eating caterpillars that come in comparatively small numbers, but may be capable of devouring considerable foliage.

(4.) *Trapping.*—This has been successfully employed in the control of such insects as climbing cutworms and the wingless females of canker-worms. The trees are banded with some sticky substance like tree tanglefoot, and in this the insects are caught.

(5.) *Fall Ploughing.*—Certain pests can be destroyed in this way, though not many orchard insects. Wireworms, the larvae of click-beetles, may be reached by this practice. A late fall ploughing, followed by cultivation, breaks up the hibernating cases of the grubs, so that they perish. Other insects that winter in the soil may, in a like manner, be exposed to the action of the frost and to the attention of various insectivorous birds.

(6.) *Crop Rotation.*—This method is extremely valuable in the control of insects of general farm crops, and to a certain extent of vegetables and small fruits as well. It does not, of course, apply to orchard crops.

(7.) Lastly, we have *Spraying*. This, to be effective, should be timely, and must be well done. As too often practised, it is little better than a waste of time and money.

Corresponding to the two kinds of insects already mentioned, we have two general types of sprays. These are: (1.) Contact insecticides. (2.) Stomach-poisons.

Contact insecticides are for the control of sucking-insects, like aphides, scale-insects, and leaf-hoppers. These sprays can never be used as preventives. To be of service, every insect must be touched, and care taken to spray when the insects can be most easily reached by the mixture. For example, do not wait to spray for the green aphid until the leaves have all curled, forming a protection around them, or for the leaf-hoppers until they become winged and leave the tree at the first touch of the spray.

Stomach-poisons for biting-insects are, for the most part, arsenical preparations, of which lead-arsenate is probably the most valuable. Paris green is another in common use. Stomach-poisons may sometimes be used as preventives. In the Dry Belt, a spray of lead-arsenate, as soon as the trees are in full leaf, will remain on the leaves most of the season, and is very useful for destroying many leaf-eating insects.

SOME PRINCIPAL ORCHARD INSECTS.

(1.) BITING-INSECTS.

The Bud-moth.—This is a small, cylindrical, cinnamon-brown coloured caterpillar, with legs, head, and segment back of the head black and shiny. When full grown it is nearly $\frac{1}{2}$ inch long.

The greatest injury is done in spring, to the opening buds and tender foliage, the caterpillar protecting itself by crumpling up a leaf and hiding it with silk, or by tying two leaves together. They become full grown in about seven weeks, and form pupæ within their nests. Upon emerging, the adult moth deposits her eggs upon the under-side of the leaves. These hatch in about ten days, and the young caterpillars feed upon the under-surface of the leaf, skeletonizing it, and forming their silken tubes, within which they remain protected and concealed. The winter is passed within silken cases on the twigs.

To control this pest, spray with lead-arsenate, 2 lb. to 40 gallons, just as buds are opening, and again after the blossom-petals fall. Use a Bordeaux nozzle and a high pressure.

The Codling-moth.—This pest has not as yet become firmly established in British Columbia, but as outbreaks have occurred from time to time, it is well for fruit-growers to know something of the insect and of its control.

The small, pearly-white eggs of this insect are laid mostly on the leaves near the fruit. Upon hatching, most of the larvæ enter by the blossom end of the apple. The larvæ usually bore directly toward the core, around which they feed, and upon reaching full size emerge through a hole in the side of the apple. The newly hatched larva is about $\frac{1}{16}$ inch long, with a shiny black head and whitish body, having numerous dark-coloured tubercles scattered over it. When full grown, it is about $\frac{3}{4}$ inch long, of a light flesh colour, or occasionally whitish, with head glossy brown. The tubercles are more indistinct than in the young caterpillar.

The number of broods of this insect varies with climate and season. There may be as many as two complete broods, and a partial third brood in the interior of British Columbia. The work of the second brood is similar to that of the first, but a much larger percentage enters through the side of the apple.

The control consists in a spray of lead-arsenate, 2 lb. to 40 gallons of water, within a week after the blossom-petals have fallen. Sufficient pressure must be employed to drive the mixture into the lower calyx-cup. This spray may be used in conjunction with lime-sulphur or other fungicide. Sometimes a second spray may be necessary ten days after the first.

The Lesser Apple-worm.—This pest has often been mistaken for the codling-moth, from the similarity of its habits and appearance. The larva of the lesser apple-worm differs from that of the codling-moth in being somewhat more tapering towards each end, and of a rather deeper flesh colour. It does not, as a rule, penetrate as deeply into the fruit as the codling-worm, the burrows being usually quite shallow, frequently causing ugly blotches to appear upon the surface of the fruit. The same methods of control employed for the codling moth are also used for this insect.

Teat-caterpillar and Fall Webworm.—These may be controlled by cutting off and destroying their webs, or simply burning on the tree with a torch. These and all other leaf-eating caterpillars may be easily destroyed by a spray of lead-arsenate, 2 lb. to 40 gallons, when they first appear.

Pear and Cherry Slug.—The adult of this insect, a small, four-winged fly, deposits her eggs in crescentic slits beneath the skin of the leaf. The larva is dark-coloured and shiny, with front part of the body much swelled, almost concealing the head, giving the insect the appearance of a minute tadpole. The young slugs feed upon the upper surface of the leaf, skeletonizing it, nothing remaining except the veins and lower epidermis. The leaves will then have a brown, scorched appearance, many dying and dropping off altogether, so that the tree, in some cases, is forced to put out a new set of leaves. There are two broods, one appearing in June or early July, and another in August.

Though this is one of the easiest pests to control, the damage it will do, if unchecked, is considerable. A spray of lead-arsenate, 1 lb. to 40 gallons of water, is very effective. Contact insecticides, like whale-oil soap, or Black Leaf, may also be used. Simply dusting the foliage with hellebore, shaked lime, or even road-dust, will destroy the slugs.

Peach-tree Borers.—There are three of these and their life-histories differ; the control methods recommended are much the same. The presence of the borers is revealed by exudations of gum about the base of the tree and by the dust-like castings of the insects. Careful cutting-out of the borers in the spring with a sharp knife and a piece of short stout wire should be practised. Do not cut away any more of the bark than is necessary to get at the borers. Mounding the trees up with earth in June and forcing the borers to enter higher up the stem, where they can be more readily reached, is useful in controlling these pests. Lime-sulphur, with considerable extra lime added, sprayed around the base of the tree acts as a deterrent. The use of various other repellent washes and of paper wrappers has been tried with more or less success.

Flat-headed Apple-tree Borer.—This insect makes flat, shallow tunnels in the trunk and lower branches of the tree, sometimes girdling it. Its presence is revealed by its sawdust-like castings, by small depressions or discolorations of the bark, and sometimes by the exudation of sap. The full-sized grub is of a pale-yellow colour, legless, and with the head end of the body greatly enlarged and flattened.

The orchard should be carefully watched and the borers cut out with a sharp knife and wire when first detected. Repellent washes have been used with some success in preventing the females from depositing their eggs in the trunk. A saturated solution of washing-soda, made into a thick paste with

soft soap, and enough crude carbolic acid added to give it a distinct odour, has proved very satisfactory. The trees may also be wrapped with stiff brown paper for the same purpose.

Peach Twig-borer.—This is the larva of a small moth which injures the tree by boring in the twigs, killing them, and later in the season attacks the fruit. In the fall the half-grown larvae make small excavations in the bark, usually at the crotches, where the new growth joins the old. They begin work very early in the season, and, upon reaching full size, spin their cocoons for the most part under the curls of the bark on the trunk.

The regular winter spraying of lime-sulphur is usually sufficient to keep down this pest. If a special spray is needed, it should be applied in the spring as the buds swell.

12.1 SUCKING-INSECTS.

Scale-insects.—The oyster-shell scale and the European scale are two scale-insects found affecting orchard trees in British Columbia. Their life-histories differ, but the method of treating these and other scale-insects is the same. The commercial lime-sulphur, testing 32½° Beaume, should be diluted with nine parts of water. This may not exterminate the scales the first season, but in the end it can be depended upon to rid the orchard of these pests. If applied late in the spring as the buds are swelling, it will kill many aphides and red-spider eggs. It is also a very valuable fungicide.

Aphides.—We have several species of these insects affecting the different orchard trees. On the apple, we have the green aphids, the rosy aphids, and the woolly aphids; on the pear, the green aphids; on the plum, the hop-louse and the mealy aphids; on the peach, the black and green aphides. The methods used in combating the various forms are similar.

The spring application of lime-sulphur will kill some eggs, and over wintering forms, but cannot usually be depended upon to keep the insects in control. The attacks of the aphids in the summer are controlled by the use of Black Leaf, Black Leaf 40, or other good contact insecticides. The dark-coloured species, or the woolly or mealy kinds, usually require a somewhat stronger spray than the others. As high a pressure as possible should also be given. With those that cause a curling of the leaves, spraying should be done before this has gone too far, else it will be next to impossible to touch the insects with the spray, even though a high pressure be employed.

For the root forms of the woolly apple-aphids and the black peach-aphids, the earth may be removed for a few inches over the affected roots, and the ground well soaked with Black Leaf solution, or other good contact insecticide. Refuse tobacco dust may also be used.

Apple-leaf Hopper.—The apple-leaf hopper is capable of doing appreciable damage when present in large numbers, as it often is in the Dry Belt. They live upon the lower side of the leaves, sucking the sap and causing them to become spotted with brown. If numerous enough, the leaves may fall as a result of the injury.

To control, spray with Black Leaf 40 or Black Leaf while the insects are still young and before they have acquired their wings, taking care that every insect is actually touched with the spray. After they have become winged, spraying is useless.

Pear-leaf Blister-mite.—The small reddish blister-like spots that appear on the leaves in the spring, which gradually change in colour until they are dark brown or black, are the marks of the pear-leaf blister-mite. When present in large numbers they may cause a premature drop of the leaves. They sometimes attack the young fruit.

The regular spring spraying of lime-sulphur will usually control the mites. If a special spray is necessary, it should be applied in the fall, after most of the leaves have fallen. Applied at this time, it will destroy the mites more readily, as most of them have not taken shelter under the bud-scales, where they are harder to reach.

Red Spiders.—These sometimes become a serious enough pest of orchard fruits to demand special treatment. The winter spray of lime-sulphur will destroy some of the eggs. Black Leaf solution or the summer strength of lime-sulphur will generally control the mites themselves. Tusting with powdered sulphur has given good results, and a wash of compound of sulphur, 1 lb. to 4 gallons of water, with 1 lb. of whale-oil or ordinary laundry soap added, has also given satisfaction.

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