

Holly Insects

W. DOWNES

ENTOMOLOGICAL LABORATORY, VICTORIA, B.C.

The Holly Leaf Miner (*Phytomyza ilicis* Curtis)

The climate of the coastal region of southern British Columbia has proved to be very favourable to the growth of holly, both for ornamental and commercial purposes. Very fine trees are to be seen in the city of Victoria and there are also some commercial plantings of considerable size. Unfortunately, when young hollies were first imported, the leaf miner was imported with them and at the present time it is an unusual thing to find a holly bush in any part of southern Vancouver Island or the lower mainland which is not infested with this pest.

The disfigurement of the leaves, while objectionable enough in ornamental plantings, is a still more serious matter in hollies that are grown for commercial purposes, the proportion of affected leaves often being as high as seventy-five or eighty per cent. Study of the life history of the miner has been carried out at Victoria, B. C. and from time to time various methods of control have been tried, generally with little success, but during the last two seasons very promising results were obtained by means of nicotine-lime dust against the adults and it appears as if we were getting near a solution of the problem.

The Holly leaf miner belongs to the family Phytomyzidae the members of which are all leaf miners. The adults begin to appear about May 5th with the maximum emergence about the 12th and the emergence continues in small numbers until the end of the month. Within a few days the flies mate and at once begin to deposit eggs. The eggs are deposited in the midribs of the young leaves, a puncture being made in the midrib on the underside of the leaf. This occurs when the leaves are very small and scarcely out of the bud stage. At that time the tissue of the midrib is extremely soft and easily penetrated by the fly's ovipositor. The puncture is made generally slightly to one side of the midrib and then the egg is thrust into a position longitudinal with the axis and at right angles to the puncture. The egg is pure white, tapering slightly at the ends, somewhat larger at one end than the other and measures .383 mm. in length by .160 mm. in width. Leaves examined were found to contain from one to five eggs. It is seldom, however, that more than three larvae are found in a leaf and the usual number is only one or two.

The first sign of a mine is seen in August and appears as a small red spot in the body of the leaf. Or it may appear as a narrow red linear mine extending from the midrib. The first mines were noticed on August 8 and at that time it was reckoned that the mine was about ten days old, or rather, that it had taken the larva ten days to advance that distance from the midrib. It was found that the rate of advance was

about a millimeter a day but the progress of the larva was by no means uniform and might cease for a time and then continue. Most of the mines extended from the midrib directly across the leaf in the direction of the edge. There is a discoloured dark area about 2 mm. wide on each of the mine and when the larva is alive the terminal portion of the mine is white or lightish in colour. Should the larva die this becomes entirely obscured by red. The larva when full grown is cylindrical, short, whitish grub about 4 mm. long with black mouth hooks, the anal segments tapering slightly. It makes but little movement when disturbed other than retracing the mouth hooks and first two segments of the body. The course of the mine is by no means uniform. Some take a direct course to the outer edge of the leaf, others may be serpentine, a few take a nearly circular course, while in the case of those that merely make a red blotch the larva seems to remain in one spot, merely making a small discoloured area which gradually widens. Until after Christmas time the mines are not at all noticeable and are seldom more than one fourth of an inch across at the end of the year. But in January the larva continues to feed during mild weather and in February the mine assumes the appearance of a blotch often with linear ramifications.

Pupation commences in February and in most years is complete by the end of March. Previous to pupation the larva makes a small opening in the cuticle of the leaf. The puparium will always be found close to the opening, sometimes slightly projecting from the hole. Emergence is usually from the upper surface but some of the mines turn downwards during the latter stages and emergence is from the under side of the leaf. The proportion that did so was found to be about 30 per cent.

The puparium measures 2.61 mm. long by 1.18 mm. in width tapering uniformly to a blunt point at each end. It is pale yellowish brown in colour. Both dorsal and ventral sides are flattened. The number of puparia in a leaf varies from one to four.

The adult flies may always be seen frequenting the young shoots and partly expanded leaves and there they seem to feed on any exudate that is present as they were continually noticed to apply the labella to the leaf surface. When so engaged they are very tame and are easily taken with a small collecting tube. Their numbers decrease rapidly during the last week of May and beginning of June and by the third week in June they have usually disappeared.

Control measures. Efforts to destroy the larvae within the leaves have proved ineffectual owing to the difficulty of reaching them through the tough tissue of the leaf with any of the ordinary insecticides which are commonly used against leaf-mining insects. Moreover the holly is very susceptible to spray injury and some of the stronger sprays which have been tried, including certain oil emulsions, simply resulted in the hollies casting all their leaves. Up to the present time the best results have been obtained by dusting with nicotine and lime to destroy the adult flies. Owing to the sluggish nature of the insects they lend themselves readily to control by dusting and they are very susceptible to a comparatively weak nicotine dust. In experiments conducted at Victoria, B. C. excellent results were obtained by using a 2 per cent. nicotine-lime dust applied with a rotary duster. The flies are very loth to leave

the holly buds on which they settle and not many appear to escape the dust. They commence to fall within thirty seconds. The average number of dead flies gathered up from beneath heavily infested trees ten feet high was about two thousand but it was not unusual to kill three thousand or more on some of the trees when dusting was carried out during the height of emergence. In view of such results it is not unreasonable to expect that three or more applications of dust would control the fly. Trees that were given two applications of dust in 1930 showed a very definite improvement in 1931 although it was evident that the dust should have been applied earlier, in fact as soon as the flies appeared on the trees. The cost of the dust is from $1\frac{1}{2}$ to $2\frac{1}{2}$ cents per tree and it can be very quickly applied. It is suggested that applications of 2 per cent. dust should be made at weekly intervals, commencing when the flies first appear upon the trees.

The Holly Bud Moth *Rhopobota naevana ilicifoliana*, Hb.

This is another insect which has been imported from abroad and is now present on practically all hollies grown in British Columbia. In some years the infestation is particularly heavy, every young shoot being infested. Fortunately, however, this bud worm does not cause as serious injury to the holly as the miner and does not spoil the holly for market purposes, since the injured shoots are in many cases either covered up or replaced by new growth. It does, however, cause sufficient injury, by checking the young growth and causing it to branch after the injured bud has died and dropped off, to necessitate regular control measures in commercial plantings.

The winter is spent in the egg stage and the young larvae appear in the holly buds as soon as the first young leaves begin to form which is usually towards the end of April or, in backward seasons, during the first week of May. The young larva is at first greenish white in colour with a black head and measures 1.22 mm. in length. At first they live between the terminal leaves of the young holly shoots without spinning any web, and in this stage are easily seen and can be reached by a spray. More than one larva may occupy a shoot at this time and as many as three have been found in one shoot. By the 3rd week in May the majority of larvae have begun to join the terminal leaves together and the tendency for two or more to occupy the same shoot has decreased. As growth progresses a compact case is formed by spinning the leaves together at the tip. The centres of the shoots are now beginning to unroll and in the cylinder thus formed the caterpillar may be found. From this stage onwards not more than one caterpillar will be found in a shoot but each one will have its occupant, and it is hardly possible to find a shoot that is not attacked. The larvae darken in colour with each instar until when full grown they are dull grey green with a jet black head and harmonize well with the colour of the holly leaves. At maturity they measure 10 mm. in length. When disturbed they wriggle out of their nests and drop to the ground. During the last instar the larvae spin together the principal terminal leaves and feed within this case eating back the shoot so that the mass of leaves spun together dies, and forms a black unsightly object on the bush which does not drop until it is pushed off by the subsequent new growth. The majority of

the larvae leave the nests when full grown and spin a loose cocoon between dead leaves or rubbish on the ground, very few pupae being found on the trees.

The pupa is pale brown in colour and averages 7 mm. in length. Pupation commences during the first week in July.

The perfect insect measures from 14 mm. to 15 mm. in expanse of wing, the females being usually the larger. Much variation in depth of colouring is shown although the general pattern of the wing remains fairly constant. The inner angle of the fore wings is usually occupied by a patch of dark brown; this is followed by a lighter area which may vary from dark slate grey to nearly white; next to this the wing is crossed by an irregular dark band, beyond this is a nearly circular light patch extending to the outer margin. Other forms may have the general colour of the fore wings, slate grey crossed by two or three irregular bands of mahogany brown. The wing is notched on the outer margin just below the apex. The hind wings are grey brown. Both wings have short fringes, the fore wings on the outer margin and the hind wings on the outer and lower margins. The thorax and abdomen are brown.

The eggs are laid singly on the under sides of mature holly leaves, very few being laid on the branches. The egg measures .66 mm. by .83 mm. It appears as a flattened translucent oval body orange red in colour surrounded by a narrow colourless transparent shining border of mucilaginous matter.

Control measures: Since the larvae invariably feed from within their nests, stomach poisons alone have been found ineffective and the best control has been obtained with contact sprays against the young larvae shortly after hatching. They can be readily killed by such sprays if the operation is carried out before they have begun to spin the terminal leaves together. Since the hatching period may extend for about two weeks a second spraying should be given at the end of a week's time. The best results have been obtained with the following combined spray: Water 3 gallons, nicotine sulphate 1 oz., whale oil soap 4 oz., lead arsenate 3 oz. The spray must be applied with force to the opening buds.

A commercial holly plantation in Victoria which formerly was much infested with bud moth but is now fairly free of the pest has been sprayed every year with the following: water 40 gallons, nicotine sulphate $\frac{3}{4}$ pint, whale oil soap 2 lbs., lead arsenate 1 lb.

Since the majority of the caterpillars pupate in the rubbish beneath the bushes, the dead leaves should be gathered up and burned early in July before the moths emerge.