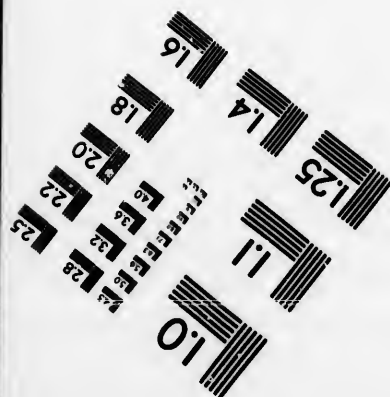
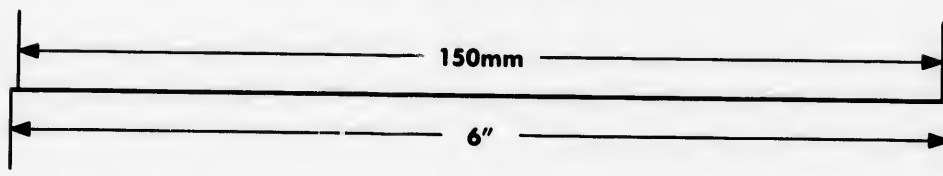
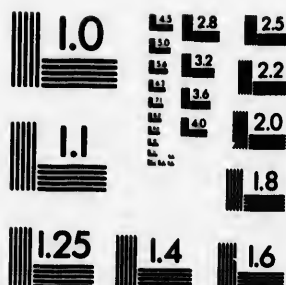
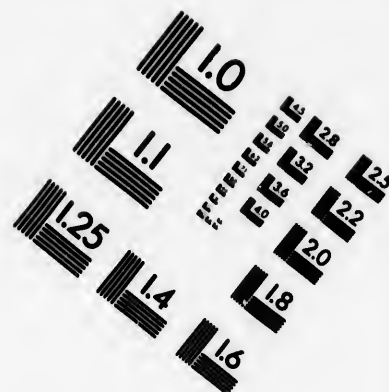
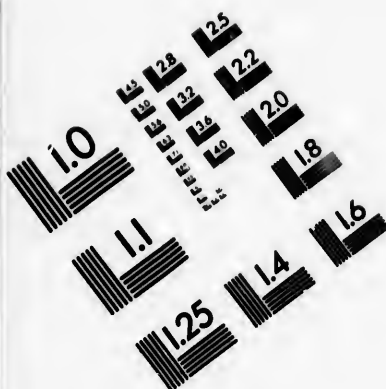


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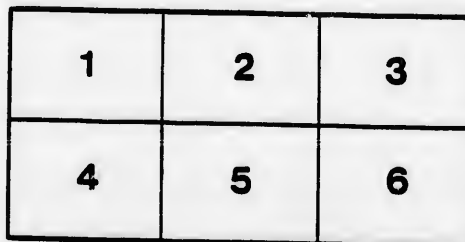
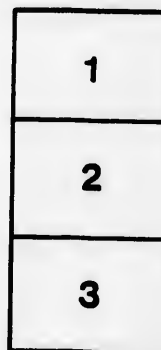
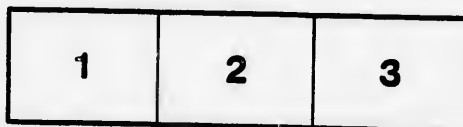
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BULLETIN LXXXI.

BEES IN RELATION TO FRUIT.

By J. H. Panton, M.A., Prof. of Biology, Ontario Agricultural College.

An Act passed by the Ontario Legislature last session, referring to the prevention of spraying fruit trees while in bloom, has led to considerable discussion among fruit-growers and bee keepers. The former feel that they should be permitted to spray whenever they desire, claiming that bees are not killed from visiting sprayed trees in search of nectar and that this cry of alarm raised by bee-keepers is unfounded. Further, many are under the impression that bees injure ripe fruit, and that it is questionable whether bees are as useful in the fertilisation of flowers as is claimed for them by their admirers.

The bee-keepers, on the other hand, maintain that bees are important in the fertilisation of flowers and thus become necessary to fruit production; that they do not injure fruit and that they are killed where trees are sprayed while in bloom. They go so far as to say that honey is affected where bees have been poisoned by Paris green.

In this somewhat confused state of affairs a bulletin bearing upon bees in relation to fruit should be of interest and practical benefit when the following Act (*passed April, 1892*) is about to be enforced:

1. No person in spraying or sprinkling fruit trees during the period within which such trees are in full bloom shall use or cause to be used any mixture containing Paris green or any other poisonous substance injurious to bees.

2. Any person contravening the provisions of this Act, shall on summary conviction thereof before a justice of the peace, be subject to a penalty of not less than \$1.00 or more than \$5.00 with or without costs of prosecution, and in case of a fine or a fine and costs being awarded, and of the same not being upon conviction forthwith paid, the justice may commit the offender to the common gaol, there to be imprisoned for any term not exceeding thirty days unless the fine and costs are sooner paid.

3. This Act shall not come into force until the first day of January, 1893.

BEES IN RELATION TO FERTILISATION. During the process of fertilisation the contents of the pollen grains become mingled with those of the ovules, after which the latter develop into seeds. This takes place somewhat as follows: The dust-like substance (pollen) on the ends of the stamens falls upon the top of the pistil. The outer coat of the pollen grain bursts and the inner pushes out in the form of a tube, which forces its way from the top of the pistil down through it until it reaches the ovary (the lower and enlarged part of the pistil) where the ovules are located. In the meantime a minute structure (germinal vesicle) has formed in the ovule. This point is

reached by the pollen tube, an interchange of elements takes place, the ovule is fertilised and at once changes begin which end in the complete development of a seed.

The question naturally arises, How do the pollen grains get to the pistil? This effected, fertilisation will in all likelihood take place.

Observation shows that this may be done in several ways.

1. *By the wind.* Where this is the usual way we find the plants are rich in pollen, have no nectar, grow crowded together, in some cases bloom before the leaves appear and are seldom attractive in appearance. The grasses, willows and some maples afford examples of plants largely dependent upon the wind for the transport of the pollen to the pistil.

2. *By artificial means.* Man can effect the same result by simply taking the pollen and placing it upon the pistil. This has enabled him to cross-breed and hybridise to such an extent that he has developed innumerable varieties of plants of great economic value, as is exemplified in our beautiful flowers and luscious fruits.

3. *By birds,* which to some extent aid in carrying pollen from plant to plant, especially such as the humming birds.

4. *By insects.* This probably is by far the most common method in nature, and may be viewed as the chief use of insects.

Plants fertilised by insects present an attractive appearance, are rich in perfume, and above all supply nectar to the insects which frequent them. It can be readily seen how insects moving about in a flower will become loaded with the dust-like pollen, and in passing to other flowers aid much in transferring the pollen from one plant to another, and thus bring about a cross-fertilisation, or in other words, cross-breeding, which seems as essential to the production of vigorous and fertile plants as it does in animal life.

Among insects which aid largely in this interesting process no class is more useful than bees. Where imperfect fertilisation has taken place fruit is incompletely developed in size and form, so that the quantity and quality are affected. Careful investigation has shown that the fruitfulness of many plants is largely influenced by bees and such insects as search for the nectar and pollen of flowers.

Although many flowers have both stamens and pistils in the same flower, still scientific observation has shown that even in these cross-fertilisation is favored by the structure of the flower. From observations made it is claimed that orchards with bee-hives in them have been more fruitful than those without hives. In some cases bees have been given access to greenhouses so that the flowers might be fertilised and thus develop more and better fruit under such conditions. Flowers have been covered so as to prevent insects reaching them, but light and air admitted. Side by side were others to which bees had access. An examination of the seed showed those of the

former to be weak in vitality, those of the latter strong. In many instances it has been observed where fruit trees were covered with bloom and poor results followed, that the weather at the time of bloom was cloudy, wet and cold and thus unfavorable to bees working among the flowers.

Scientific investigation indicates more and more as the question of fertilisation is considered, that bees are important factors in the production of fruit and thus become co-workers with fruit-growers.

BEES IN RELATION TO THE DESTRUCTION OF FRUIT. Along this line of investigation exhaustive experiments have been carried on under the direction of the Department of Agriculture, U. S. Neither care nor expense was withheld by the apiculturist to whom the work was intrusted. Hives were kept within a building from which the bees could not escape. In this grapes, peaches, pears and plums, varying from green to dead ripe, were placed. The bees were deprived of food and left with the fruit exposed, so that they might feed upon it when hunger affected them. Many came to the fruit from time to time but never broke the skin, but where they found it broken they at once fed upon the exuding juice. They showed no tendency to use their jaws in cutting open a place. The test was continued for thirty days and other bees tried with similar results. In all cases food was taken only from fruit which had been previously broken. Consequently it appears that bees will not injure perfect fruit, a conclusion arrived at by many observers before these thorough experiments were undertaken. This is what might be expected when the structure of the bee's mouth is considered. It is quite different in the case of wasps which are supplied with jaws suitable to break into the skin, and in all likelihood they are the cause of the injured fruit upon which some observers have seen bees feeding. Much evidence has been collected upon the amount of injury done by bees to fruit, and it all seems to be in favor of exonerating the bee from the charge of injuring sound fruit.

PARIS GREEN IN RELATION TO BEES. In several places where spraying is carried on extensively it has been observed that since the introduction of that practice many bees have perished during the time trees are in bloom, and some observers have noticed that the brood also perished.

Before the days of spraying such mortality was unknown. Now although there has been no analysis of the bodies of the dead bees for the purpose of ascertaining the presence of arsenic, still the death of the bees is so intimately associated with spraying that there seems but little reason to believe otherwise than that the bees have been poisoned by Paris green used in spraying fruit trees. However this will likely soon be settled by an analysis of the bodies of bees supposed to have been poisoned, and I have no doubt arsenic will be de-

tected. I suggest the propriety of bee-keepers forwarding some specimens of poisoned bees to the chemist of the Agricultural College.

Prof. Cook of Michigan has proved by experiment that a solution of Paris green in the proportion of 1 pound to 200 gallons (a common mixture used in spraying trees) proved fatal to bees within 24 hours.

Regarding the effect upon honey there is considerable diversity of opinion. The writer is not aware of any experiments having as yet been undertaken to show that even the honey is affected, though there is in the minds of some very practical men such as the inspector, Mr. McEvoy, who is thoroughly convinced, a great fear that honey produced at the time of spraying is a dangerous article of food. The writer would suggest that some such suspicious honey be sent to the chemist already referred to so that there may be no longer any doubt regarding the subject.

Experiment in the laboratory and observation by practical men indicate that spraying trees in bloom with Paris green is followed by most disastrous results to bees in the neighborhood, and no doubt some degree of injury to the trees as far as fruit is concerned.

THE TIME TO SPRAY. To spray when trees are in bloom is a great mistake, because it is a waste of material, time and fruit. The plum curculio and codling moth are the chief enemies we seek to destroy with Paris green. The adult of the former lays its eggs in the plum just beneath the skin and is not likely to be present to any great extent till the fruit is set, consequently applying the poison while the trees are in bloom is commencing the attack too soon. If thought necessary to attack insects before the time of bloom spraying may be done, and afterwards, but certainly *never while the trees are in flower.*

In the case of the codling moth which deposits its eggs in the blossom end of the young apple, a mistake is also made by spraying before the fruit is set, which does not take place till the bloom is off.

The portion of the pistil upon which the pollen falls is exceedingly tender and sensitive, so much so, that the application of such substances as Paris green injure it to so great an extent that the process of fertilisation is affected and the development of fruit checked. With these facts before us as revealed by scientific investigation, it does seem strange that anyone would attempt to spray at a time not in accord with the teachings of science, and that anyone would feel it a hardship to conform to the requirements of a law calculated to protect the interests of two so important classes as the producers of fruit and honey. Spraying is only in its infancy, but as time rolls on and this practice becomes more general, the practicability of the law referred to will become more evident and the efforts of those seeking to enforce it thoroughly appreciated.

