

**MICHIGAN STATE COLLEGE
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**CODLING MOTH SITUATION IN
LOWER MICHIGAN**

BY R. H. PETTIT, PROFESSOR OF ENTOMOLOGY.

It is now apparent to many apple growers that, under adverse weather conditions, we may not hope to keep the codling moth in subjection by sprays alone in districts where the insects are plentiful. This is especially true in sections where the population of codling moths has built up to unusual proportions. This is all the more apparent when trying to grow apples free from excessive amounts of spray residue.

The tolerance of spray residue allowed by the Federal Government has been steadily reduced each year, until in 1932 the world's tolerance will be adopted as standard in the United States. In other words, to grow apples reasonably free from codling moth larvae, the usual spraying program would provide for a series of arsenical sprays applied at intervals throughout the growing season—in fact, almost up to picking-time. Such a program would, undoubtedly, result in the presence of residue exceeding the tolerance allowed on fruit grown for sale in the United States. The other alternative is to spray heavily early in the season and to stop spraying after one application has been applied for the second generation of moths, which time usually comes early in August. Such a restricted program is likely to result in the presence of many wormy apples and many "stung" apples. Having this in mind, the most recent spraying calendar issued by Michigan State College Experiment Station (1931) was so arranged that a choice was offered between the two spraying programs, one providing for restricted spraying with light doses during the latter part of the series, and the other providing for the application of heavy doses to be continued later in the season. In the latter case, it was expected that fruit when picked would be heavily coated with spray residue and that such residue would be removed by washing in chemicals before the fruit was packed. This choice was also made clear on page 43 of the Michigan Experiment Station circular bulletin No. 137, on "Pests of Apples and Pears in Michigan." This bulletin was published in May, 1931, by the Section of Entomology of the Experiment Station. Both this bulletin and the spray calendar are available on request, and every fruit grower is urged to familiarize himself with their contents. Wherever it is feasible to do so, growers are urged to plan to wash their fruit in the years to come, if not immediately; at any rate as early in the future as is expedient.

It is certain that in seasons like that of 1931, a long series of heavy applications of sprays is necessary in order to produce worm-free fruit; and, no matter what may be thought privately, the amount of residue tolerated by law is fixed, and in order to place apples on the market the requirements of the law must be met.

We are all familiar with the codling moth in its larval stage. The small pink "worm" that works around the core and does so much damage comes out from the apples in many cases before the fruit is picked and seeks shelter under loose bark flakes on the tree. Each one spins a small, white, silken cocoon, coming out later as a moth or "miller," which flies about on warm nights and lays its eggs, either on the foliage or on the fruit.

For many years the writer has been urging fruit growers to deprive the caterpillars of their winter homes by scraping the loose bark from the tree. When this is done, bands of prepared corrugated paper should be substituted for the bark flakes in order that the larvae may crawl into the cavities of the bands and die from the effect of chemicals with which the band is treated. This practice of banding and scraping is not, by any means, a new thing. Trees have been scraped and burlap bands have been placed about the trunks for at least 30 years. To be sure, if burlap is used, the bands must be removed and placed in boiling water before any of the moths emerge. The prepared corrugated paper bands are simpler and do not require any treatment other than removal at the proper time, when they are replaced by new bands. Details as to the making of such bands and instructions for using them will be supplied, either by your local County Agent or by the Michigan State College Department of Entomology on request. It is the belief of the writer that the total population of codling moths will be very appreciably cut down in any district where this practice is generally followed.

The crates and baskets in which apples are handled often contain many cocoons of codling moths in the cracks and crevices, between the slats, and wherever there is an opening into which a larva may crawl. Once each year, dip these crates, one by one, in a cauldron of boiling lye, using about two pounds of ordinary crystal lye, such as is sold in every grocery store, to each gallon of water. All larvae hidden away in the crevices will be killed in this way, and consequently the number of moths or "millers" that are left to lay eggs will be reduced. The disposal of cull apples, such as are not made into cider, should be given some consideration. Everyone knows that many of the apples that drop to the ground and many of those discarded at picking-time contain larvae of codling moths. If they are left to rot on the ground, the larvae will desert the apple and frequently succeed in gaining shelter in the vicinity. All "drops" and culls should be disposed of immediately—at least, insofar as is possible. The methods by which culls are destroyed—whether by feeding them out to livestock, by burying them deeply and covering with soil, or by some other method, will depend largely on the ingenuity of the grower and the conditions under which he is working.

In conclusion, it may be said that the sudden attack which has recently occurred is by no means shrouded in mystery. Weather conditions are largely responsible, and, while it is likely that much damage could have been prevented had it been possible to forecast these weather conditions; still, in the absence of chemical washing, it would have been impossible to take advantage of such advance information, because any measure that might have been taken to check the injury would have necessitated the chemical washing of the fruit.

State Department Finds That Arsenicals Generally Meet Requirements

In regard to the quality of arsenate of lead used in 1931, Mr. W. C. Geagley,* states the following:

"In the enforcement of the insecticide and fungicide law by the Michigan Department of Agriculture, official samples, as well as samples submitted by interested individuals, of spray materials are examined for the purpose of determining whether or not materials are adulterated, below guarantees made for them, or packages of products are correctly labeled.

"It is significant to point out that the official samples of arsenicals and those submitted by individuals and analyzed in the Department laboratories have been found to meet the requirements of the insecticide law, both as to composition and labeling.

"By far the greater volume of arsenicals for spray purposes are manufactured outside of the State, and restricted to a comparatively few large manufacturers. In fact, our records show only one manufacturer in this State. Insecticides and fungicides shipped into this State must not only conform to the Michigan requirements, but also must meet the requirements of the Federal insecticide and fungicide law, thereby giving users a 'double check' on the materials offered for sale. From the regulatory campaigns carried on in examining materials that move in interstate commerce, it has been found that generally such materials are in accord with the claims made therefore on labels.

"The Department will gladly cooperate in investigating any specific instances where arsenicals are suspected of being marketed in violation of the law."

LATE CODLING MOTH INJURY BROUGHT ABOUT BY HOT WEATHER

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Codling moth development, abundance, and egg-laying are dependent upon temperature to such a degree that any fluctuations in temperature between 50 and 86° F. strongly influence the amount of injury inflicted by the larvae. It follows that in any district where the codling moth is a yearly problem high summer temperature will favor the pupation and simultaneous emergence of large numbers of moths. Larvae hidden away in crevices, in deep shade, and on the north sides of the trees, will emerge as moths. Since just so many hours at an average temperature between 50° and 86° F. will result in the codling moth larvae changing to moths, continued hot summer weather will cause many larvae to pupate and emerge as moths that, with cool weather, would go through the winter as larvae. Hot weather also extends the life of the individual. Lastly, the females deposit their eggs only after dark, when the temperature is 62° F. or above at nightfall. *Warm nights therefore result in the laying of more eggs.*

Examining the present codling moth situation in lower Michigan, with these facts in mind, the logical explanation for the late injury is apparent.

*Michigan Department of Agriculture, Division of Chemical Laboratories.

The very hot weather between the tenth and fifteenth of September caused the moths to lay a maximum number of eggs, and then caused the eggs to hatch.

Such a situation may easily come about again if conditions are favorable for it. Relief can be had by employing two methods of control. (1) continuous spraying until picking-time, followed by chemical washing of the fruit; and (2) supplementary measures (such as scraping, banding, etc.) to reduce the codling moth population. Full information on both may be had by application to the local county agent or to the Department of Entomology, Michigan State College.

This bulletin has been prepared in answer to an insistent demand for information as to why in certain parts of the State codling moth infestation has become so severe within the past two or three years in the face of methods of control that formerly were reasonably satisfactory. Experiments in the use of some of the newer spray materials, special combinations of old ones, special methods of application and the effectiveness of tree scraping, banding and other clean-up measures have been under way in this state during the past four years. Quantitative data on just how effective they are under extreme conditions have been obtained and will be published in bulletin form as soon as the final harvesting records of the current season can be obtained and the whole work summarized.