

Oriental Fruit Moth Control by Spraying

C. EDW. MARSHALL, Purdue Agricultural Exp. Station

The Oriental fruit moth entered Indiana in the late 20's, and spread rapidly into all the peach growing sections of the State. As early as 1930 infestations had begun to be so heavy that the growing of this crop became hazardous in many sections. Within the next few years it was suggested by the experiment station itself that varieties of peaches grown and ripening later than midseason Elberta be dispensed with to prevent crop losses, and to eliminate varieties which would permit the development of late broods of the moth permitting it to successfully overwinter. Following this, such late varieties as Fleener, White Heath, and Williams Favorite and so-called "pickling peaches" passed out of the picture. Between 1932 and 1936 it was not uncommon for such late varieties, where they had not been destroyed, to be 95 per cent infested by the Oriental fruit moth by ripening time.

Not only were the late varieties heavily infested, but in many instances midseason Elberta carried from 35 to 65 percent infestation in the fruit at harvest time. This led to the harvesting and sale of fruit that was hard ripe, and of rather poor quality in order that the fruit could be picked and sold before the full fourth brood of the Oriental fruit moth had a chance to attack.

In Indiana, three methods of control of the insect were attempted, each with a measure of success, but only one of them outstanding. These were by parasite introduction, mechanical control, and by spraying. Immediately after the pest became well established in Indiana, and as a result of research work done in New Jersey and other eastern states before the arrival of the insect in this state, it was possible to attempt control by the introduction of parasites and predators. This work was cooperative with the United States Department of Agriculture. Approximately half a dozen species of parasitic hymenopterus insects were introduced. Of the several species of hymenoptera colonized only one *Macracentrus ancyllivorus*, gave promise of being of economic importance. Scores of liberations were made, and these scattered over the entire state. Liberations made during the summer of one year were followed by the recovery collections and rearings the next year. In this way it was found that in the sandy and low lying or level sections this parasite became established very readily, and it soon brought the Oriental fruit moth attack on peaches down to 20 percent or less. This did not take place, however, in the knob or ridge orchard localities having heavy clay soils. Repeated attempts to recover the parasites, after colonization a year earlier, failed. This then is where the work of introducing parasites finally stood. The reason why *Macracentrus ancyllivorus* was unable to establish itself in orchards with heavy soils was never learned.

A few years after the parasite work began, an effort was made to control the Oriental fruit moth mechanically. The larvae of the first three broods of this species attack and feed on the succulent, rapidly growing twigs of the peaches. It requires fifteen to eighteen days, according to the temperature, for them to become full fed. It was surmised control could be obtained by clipping off the wilted or infested twigs. First an attempt was made to clip off all the infested twigs about twice during the larval life of fifteen to eighteen days. This was found to be insufficient so, in later studies, the clipping was done every five days. If such intervals are maintained in the clipping, it was found that on an average one larvae was destroyed to every two twigs clipped. The work was finally carried to the 90 odd acre Wood-Gamble orchard at Sullivan to learn whether or not it was practicable on a commercial scale. It was found to offer a great deal of promise in control though the high old trees in this orchard made the labor cost high, and the height of the trees made it difficult to see newly wilted twigs.

For this reason an orchard of Gage Elberta peaches was grown low (no tree more than nine feet high) in order that the infested twigs would be more accessible. To further reduce the cost of the work below that expended when ladders were used, stilts were substituted. By growing the trees low, and by using stilts instead of ladders the labor cost of the operation was reduced a third. Not only were the infested twigs removed, but with the numerous times the trees were inspected it was not difficult to remove practically all defective fruits.

As the program was finally perfected, the Oriental fruit moth could easily be held to less than 15 percent infestation if the clippings was continued through the third brood. In addition the curculio was brought to a standstill inasmuch as the defective peaches were removed whenever they were noticed during the clipping operation. Most important, brown rot, which follows with proportional severity the attacks of curculio and Oriental fruit moth, ceased to be a threat. All in all then the clipping operation proved to be a good and practical operation in peach plantings grown to facilitate the practice. Its adoption, however, was limited to sections where *Macracentrus ancylovorus* could not be successfully colonized.

During the intervening period between the introduction of the Oriental fruit moth in Indiana, and the advent of DDT every spray material or combination of dust and spray that seemed to offer promise in control was given a trial on plot tests. The nearest approach to success was through the use of a five percent oil-sulphur dust developed in Illinois. Though the claim for the material was that it would, if used four or five times beginning a month before harvest and at five day intervals, control up to 50 percent of the Oriental fruit moth larvae, this was not enough. In south central Indiana the attack too often reached 60 percent, and with 50 percent control the loss of peaches to the insect was still 30 percent which is too high.

After the advent of DDT, control seemed rather simple as the result of our having worked out the clipping program so completely. We knew that the larvae spend fifteen to eighteen days in the twigs, that in that time they go from one twig to another and in all each larvae attacks an average of five twigs. We also knew that it is the fourth brood that enters the Gage Elberta variety with which we were working. Since the succulent peach twigs grow very rapidly it is difficult to keep them covered with spray material. It was early decided that to prevent attack the trees would need to be sprayed often with the insecticide. Applications of eight ounces of actual DDT were put on every five days beginning just before the first hatch of the fourth brood of larvae. This done the program went well from the standpoint of control and application. The control of the insect was very satisfactory (2.5 percent wormy as compared to an infestation of 23.7 percent in the neighboring orchard).

Such a program when presented to growers and entomologists led to considerable discussion for it was believed that as a result of four or five applications of DDT so late in the season the residue of DDT would be above the tolerance set by the Food and Drug Administration. No analysis of DDT in the harvested fruit had been made between the last application and harvest so there could be no certainty as to this point. However, in order to reduce the possibility of such being the case, the 1948 plot spray treatments were worked out keeping this in mind.

Instead of directing the DDT spray program against the fourth brood of larvae of the Oriental fruit moth it was applied to control of the third brood. This left almost a month between the last DDT spray and harvest. Such a program worked more successfully than any used earlier, and the harvest infestation was .025 percent Oriental fruit moth this year. In the first place it controls the Oriental fruit moth after late July thereby giving the twigs on the trees a chance to get considerably more growth before fall without being attacked by the Oriental fruit moth as was usually the case. This past season especially was growth needed for the second brood had attacked practically every succulent twig. In addition, from observations made to date, two and possibly only one, DDT spray in addition to those for Oriental fruit moth control may be necessary for the control of the peach borer, *Sanninoidea exitiosa* (Say). The program aids indirectly in brown rot control, and it is very effective against the second generation attack of the plum curculio. If no DDT has been applied earlier in the season it is probable that a serious spider mite problem will not develop for in the two years of the study there has been no serious mite population built up. The program fits well with the use of benzene hexachloride for the control of curculio, and with the use of chlordane for the control of insects causing cat-facing or for curculio.

One disadvantage which will be voiced against this kind of control is that it is a spray instead of a dust program. However, it may be that

further study will lead to a satisfactory dust program. Meanwhile, and for the first time since the introduction of the Oriental fruit moth into Indiana, the latest ripening varieties of peaches that can be grown in this state may be planted with certainty that this pest, for a time uncontrollable, can be held in almost complete check. Now again we are growing "pickling peaches" such as Salberta, Fleener, White Heath, and Autumn, the latter a new variety developed in New York and one ripening just before freezing weather.