

Breeding Cages Are Solving Codling Moth Problem

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Because of the exceptional damage to Missouri apples by the codling moth during the past two years, the department of entomology of this Station decided last spring to establish breeding cages in the different orchard centers of the State in order to see if the growers' failure to protect their fruit from worms might not be largely or in part due to irregularities in the emergence of the pest.

Breeding cage stations were established at Marionville, Cape Girardeau, Columbia, Independence, St. Joseph, and Louisiana. These were selected as strategic points and growers interested in the breeding experiment have cooperated in maintaining the stations. The different growers have reported emergence records to the writer and these records from the different stations have been summarized and through the cooperation of the State Horticultural Society, the emergence records have been sent to the growers of the State.

This has enabled the writer to advise the growers regarding the time each spray application should be made for the first brood of worms. By June 20 most of the first brood of moths had emerged and the breeding cages were used to breed moths of the second or summer brood.

In the past, most growers and most of the experiment stations have been following a regular schedule, making the spray applications according to the blooming date or the development of the fruit. As long as the moths emerged according to schedule the plan was all right. However, it has been very evident that something unusual has been developing in the case of the codling moth which has caused the increase of wormy fruit. To be sure some growers, applying as many as seven sprays and as much as twenty

gallons of spray to the tree each application, have not lost seriously from worms. On the other hand successful growers in the past two years with their usual efforts at controlling the pest have failed to keep their fruit clean.

So striking has been this failure to keep fruit clean that some growers have concluded that the poisons are not as strong as formerly. Some think arsenicals will not work effectively and some insecticide firms are rushing to the front with oil emulsions and other materials as substitutes for arsenate of lead for the apple worm. These things are to be expected, but to one who has spent years in constant contact with this and other pests and in touch with the practical work of control there is always an explanation for these unusual insect upheavals if he will simply look for it.

The writer, feeling sure that the codling moth was no exception to the rule, set about establishing the breeding cage stations to determine what part the irregularities in the development of the pest might play in the present epidemic. It now seems evident from the breeding records for the first brood of moths and worms that this is the difficulty. The breeding cage records show clearly why the spray schedule as commonly applied cannot control the pest under its present scheme of development. We control the pest by poisoning the worms with arsenate of lead when they attempt to enter the fruit and we must know when they are entering and when the fruit must be properly covered with the poison, if we are to get results.

Much of the discussion regarding the arsenicals being weak and concerning the young worm failing to swallow the bits of peeling which contain the poison, when it makes its entrance into the fruit, is entirely beside the real question. In the past the same arsenical sprays have controlled the pest. Also the young worms have not just recently learned to spit out the first tiny bits of peel which they cut off with their sharp jaws. They have undoubtedly followed the same practice for years past. They do not discard the first bits to escape poison for they continue to do so until they have become completely buried in the flesh of the fruit. They do not seem to actually swallow food for the first few hours, but seem intent on getting hidden in the flesh of the fruit. But though they discard these first bits they cannot avoid getting some of the fine poison granules into their mouths, if the fruit is well covered. They are evidently killed by arsenical poisoning but the fruit must

be well covered if a large percentage of the worms are to be killed.

Also the old belief that the small worms cannot cut through the smooth surface of the peel is erroneous. They do it readily after laying down a mat of silk threads to which they hold with their feet. The real explanation of the failure to keep the fruit clean is to be found in the fact that the growers have not been succeeding in keeping the fruits sufficiently well covered with the poison sprays throughout the period during which worms have been continuing to enter the fruit. In the future, the proper use of the breeding records will enable the growers to know definitely when and for how long a time they must keep the fruit thoroughly covered.

The codling moth is evidently off its normal cycle, as all insect pests are likely to become from time to time, and in the future each grower should know definitely when the moths are on wing and when their worms are entering the fruit. Each grower should maintain a small screen cage or tight box as a breeding cage somewhere in the orchard which will enable him to see when the moths are emerging.

PEST EMERGED LATE AND EMERGENCE LONG DRAWN OUT

To show just how utterly helpless the average grower in Missouri would have been this year without breeding cage data we need only consider the records from the Columbia breeding station. Most of the apple blossoms were off by April 25 and the calyx spray was completed in most orchards before the last of the month. Under normal conditions the grower would have expected moths on the wing by the first days of May and the cover spray for young worms would have been completed before May 10. Where a second cover spray was applied it would have been completed by May 20 and that is all the sprays that have usually been given in the past for the first-brood worms.

Here is what really happened. The first moth emerged at Columbia May 21, the peak of moth emergence was reached June 4, and the first entrance of worms of importance was June 12. It is evident that had the breeding cage records not been available, growers would have completed their spraying for first-brood worms before the first moth emerged and three weeks before the heaviest swarms of worms began to enter the fruit.

PRESENT APPLE CROP NOT YET SAFE FROM WORMS

While the first-brood moths had on June 20 about all emerged, laid their eggs and died, some were still emerging and later the offspring of the first brood will emerge as the second brood of moths. This will occur in July and August. With the first brood drawn out over a long period the second brood will also continue to emerge for a long time which will make it necessary to protect the fruit continuously for a long time in mid-summer. The work of keeping the apples covered with poison in July and August to prevent second brood apple worm injury is still to be done and where the control of the first brood has not been thorough the second brood is sure to be serious.

The following emergence records for the summer or July brood at Columbia taken from breeding cage records have been obtained. The first moths emerged July 4 and the peak was reached about July 11. However, emergence of the summer brood will be long drawn out through July and it may be necessary to apply two July sprays; one at the time of the peak emergence, the other about ten to fourteen days later in order to prevent all second-brood worms from entering the fruit. The first July spray is of great importance and should by all means be applied.

From these emergence records the growers will be able to determine when to spray and for what length of time to keep the fruit covered in order to prevent the worms from entering. Certainly these records show that the apple crop is not yet safe from worms.

ORCHARD SANITATION ESSENTIAL

In the Ozark region where the crop is an almost complete failure this year many growers are not following the regular schedule of sprays. The light crop will naturally result in some reduction of moths next year but the grower must keep in mind that the pest will be there in great numbers despite the present short crop. General orchard sanitation, always essential, is even more important where sprays are not regularly applied. Ozark growers must be prepared to fight the pest next year just the same as if their orchards had borne a full crop this year.