

Codling Moth Emergence Records for 1952 and 1953

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Under Oklahoma conditions, the codling moth, *Carposapsa pomonella* (Linn.) is one of the more important insect pests the apple grower must combat. In established orchards, it is not unusual to find 90 to 95 per cent of the fruit infested, if no control measures are applied. However control measures will not bring the desired results unless they are properly timed and intelligently applied. The data reported here were obtained to provide a basis for more accurately timing control measures.

After the codling moth larvae first emerge from the egg, they are vulnerable to insecticides only during the short period of time that they feed on the foliage and the exterior fruit surfaces, or crawl from the hatching site to where they enter the fruit. As soon as the larvae enter the apples, they are safe from practically any insecticide the grower might apply. It, therefore, becomes necessary for him to know when the majority of the codling moth larvae appear and are exposed and vulnerable.

These insects go through the winter in the larval stage and normally hibernate on the tree trunks under the loose bark scales, or in the crotches and forks of the larger branches of the tree. They move into these winter quarters beginning about the latter part of August and continue until after the fruit is harvested. In preparing for the winter period, the larvae spin a rather thick, closely-woven silken cocoon in which they are enclosed for the winter months. In the process of preparing for winter, they frequently eat out shallow cavities to effect, better accommodations and perhaps to give better protection.

OVERWINTERING GENERATIONS

To obtain information as to when and how rapidly the adults emerge in the spring large numbers of overwintering forms were placed in hibernation cages where their emergence could be observed and recorded. To collect the larvae for the cages, two procedures were employed. One method consisted of taking advantage of the larval habit of moving down or up the trunk in search of suitable hibernating sites. Removable sites were provided by first cutting large corrugated paper boxes into two-inch strips across the corrugations. These strips were fastened around the trunks of the trees so that any larvae moving up or down the tree trunk would have easy access to the open ends of the corrugations. Such strips seem to form ideal protection for the larvae and are readily accepted by them. The bands were left on the trees until after the apples were harvested allowing ample time for the larvae to leave the fruits and seek shelter on the tree trunks. The bands with the larvae were collected from the trees during the middle of November and placed in the hibernation cage. Another method of obtaining the larvae was that of gathering wormy apples from the trees, as well as off the ground, and placing these in the cage where they remained until the larvae left the apples and moved over into the hibernation material provided for them in the cage.

The cage containing all of the hibernating larvae had previously been placed in the partial shade of a large tree where it was left undisturbed. exposed to the weather the remainder of the winter. The conditions under which the larvae were kept are believed to have been similar to the conditions one would normally find in an apple orchard.

Observations made during previous years indicated that the first adult moths could be expected to emerge about the middle of April. Daily observations for the emergence of adult moths were, therefore, started April 7 and made daily at about one o'clock in the afternoon. The first moth emerged in the cage on April 17; and from that date on, adults emerged almost daily for a period of nine weeks, or until June 13 when the last moth was taken

from the cage. No adult moths were taken from the cage on April 26, May 10, 14, or June 12. On May 10 and 14 emergence was, in all probability, retarded as a result of the prevailing cold weather. The records show that the rate of emergence was slow at the beginning, but speeded up in numbers of moths emerging as the season progressed and the daily temperatures went up. The peak of emergence was reached rather rapidly, and then dropped as rapidly as it rose.

TABLE I

Daily Emergence Record of Overwintering Codling Moths for 1952 and 1953.

MONTH	1952	1953	MONTH	1952	1953	MONTH	1952	1953	MONTH	1952	1953			
April	16	0	May	4	0	May	22	24	June	9	27			
	17	0		5	1		23	2		26	10	38	2	
	18	0		6	3		24	14		40	11	47	0	
	19	0		7	2		25	16		45	12	40	0	
	20	0		8	4		26	18		54	13	53	2	
	21	0		9	4		27	12		47	14	13	0	
	22	0		10	5		28	12		37	15	26	0	
	23	0		11	3		29	16		33	16	18	0	
	24	0		12	3		30	10		49	17	14	0	
	25	0		13	9		31	22		47	18	7	0	
	26	0		14	11		0	June		1	8	34	19	7
	27	0		15	10		1			2	34	17	20	2
	28	0		16	14		2			3	26	15	21	4
	29	0		17	6		11			4	26	19	22	1
30	1	18	1	2	5	8	13		23	0				
May	1	0	19	2	9	6	7		5	24	2			
	2	0	20	9	5	7	16		8	25	1			
	3	1	21	12	9	8	27		3	26	0			

In 1953 the first overwintering adult emerged April 17, 13 days earlier than in 1952 (Table I) when the first adult did not emerge until April 30. The peak of emergence for 1953 was likewise earlier and came during the week of May 22nd to June 2 as compared to June 6 to 13 for 1952. The late 1952 peak emergence followed the pattern set by the emergence of the first moths although in 1952 the high rate of emergence extended over a longer period of time and there were two peaks instead of one, a smaller preceded by the larger. The period of time over which the overwintering adults appeared for both seasons was about nine weeks, the only difference in this respect being that it came earlier in 1953.

FIRST GENERATION

As soon as the first small apples appeared on the trees, observations were begun in the orchard by looking for the eggs and larval entrances into the young fruits. On finding the first larval entrance, the young wormy fruits were collected and placed in separate cages to determine when the first generation of adults would appear. With this procedure, it was found that the first generation adults began to show up on June 8, a time during which the overwintering forms were still emerging. This then brings about the overlapping of the overwintering forms with those of the first generation. Similar observations were made and recorded for 1952, so that in this respect the moths performed in a similar manner for the two seasons.

The time period over which the two generations were actually issuing, as here determined, was comparatively short; but, nevertheless, it was sufficient to add materially to the difficulty of controlling this pest, as from that point on, there were two generations of moths ovipositing instead of but one. This was multiplied as the season progressed. The overlapping

of generations that early in the spring made it difficult, if not impossible, to separate the different broods from that point on to the end of the season.

The records taken from the specimens collected with the small wormy apples collected in the spring indicated that the peak of emergence for the first generation was reached during the period June 24 to July 4. The time interval between the peaks of emergence for the overwintering forms and the first brood was only 29 days for 1953. The comparable interval of time for the 1952 season was but 25 days.

SUMMARY

Under Oklahoma conditions, the adults of the overwintering codling moth larvae can be expected to emerge during the month of April. The past two seasons' records indicate this may be as early as April 17 or as late as April 30. In 1952, the overwintering forms emerged later than in 1953, but while the emergence began later, it also continued later into the season by a corresponding length of time. The rate of emergence for 1953 was slow at the beginning, but as temperatures increased, the rate of emergence stepped up and reached a peak over a short interval of time and earlier in the season than during 1952. In 1953, all the overwintering moths had emerged by June 14, while during 1952 the last adult of the overwintering individuals did not emerge until June 26. The first adults of the first generation moths appeared on June 3 in 1953 compared with June 20 for 1952. The interval of time between the peaks of emergence for the overwintering forms and the first generation was 4 days shorter in 1952 than in 1953.
