Variability of Diapause in *Melissopus latiferreanus*

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Variation in the diapause has been recorded for several species of insects. For example, mature larvae of the pink bollworm, *Pectinophora gossypiella* (Saund.), were found by Gough (1916) to pass through variable periods of hibernation or suspended activity, some as long as 2 years. Ross (1914) and O'Kane (1914) observed that some individuals of the apple maggot, *Rhagoletis pomonella* (Walsh), remained in the ground through two winters, emerging the second summer after the maggots entered the ground. Lathrop & Nickels (1932) found that a few individuals of the same species on blueberry even pass through a 4-year cycle, emerging as flies approximately 4 years after entering the ground as maggots. More recently Yothers & Carlson (1941) have reported that considerable numbers of fully grown larvae of the codling moth, *Carpocapsa pomonella* (L.), may remain in a dormant condition through an entire season and transform to moths nearly 2 years after spinning their cocoons.

In the course of work with the filbert worm, *Melissopus latiferreanus* (Wlsm.)[1], in the Northwest a similar condition was observed and is here placed on record. This insect, which is indigenous to the United States and Mexico, was described in 1879 by Lord Walsingham from specimens reared from Catalina cherry, a wild shrub growing on Catalina Island, Calif. In the Pacific Coast States it has been reared from more than a dozen hosts, but most commonly from acorns, wild hazelnuts, galls formed on oak stems and twigs by *Andricus californicus* (Gillette), galls on oak leaves caused by *Cynips maculipennis* (Bassett), and the filbert nut. Although formerly the insect was known as the "Catalina cherry moth," its present accepted common name is the "filbert worm," because of the economic importance it has recently assumed as a pest of filbert.

Specialists in the taxonomy of the group which includes *Melissopus* find the moth to be extremely variable in color, size, and structure; and have separated *latiferreanus* into seven varieties, A to G. Varieties A, B, and C have been found west of the Rocky Mountains, and D, E, F, and G east of the Rocky Mountains, to the Atlantic coast. During the past 4 years collections of the above-mentioned common hosts in Washington, Oregon, and California have shown that *M. latiferreanus* variety A infests hazelnuts and the two galls, while variety C was reared from Catalina cherries, acorns, and filberts. No specimens of other varieties have been reared by the writer in this area.

When the intensive study of the filbert worm was started, a visit was made by the writer to Catalina Island to get material for study from the host from which the insect was first described. Arrangements were made with Albert A. Conrad, horticulturist to the company owning the island, for further collection of material and shipment to the Eugene, Oregon, laboratory throughout the summer. Four shipments of Catalina cherries, all collected from trees near the Avalon Golf course were received in 1938 as a result of that arrangement. At the laboratory each lot was transferred to one or more 6 by 9 inch battery jars for rearing. In the bottom of each jar, was placed about an inch of sterilized soil. A wire screen basket containing the cherries was placed over the soil in the bottom of each jar. These baskets were approximately 5 inches in diameter and 6 inches high and were provided with legs long enough to allow a little air space between the top of the soil and the cherries in the baskets so as to reduce the formation of mold. The jars had grooved wooden covers, each with a large screened ventilation hole in the middle. The following spring the baskets of cherries were transferred from the original battery jars to new clean jars, and the adults were allowed to emerge from larvae that may have hibernated within the mass of pulp and pit. Since the soil in the jars was known to harbor some hibernating larvae, that too was left undisturbed for the normal emergence of adults.

The first lot of material received from

[1] Order Lepidoptera, family Olethreutidae, subfamily Laspeyresiinae.

Catalina Island was collected on August 9 and consisted of 325 premature drops of the cherry. The second shipment, which was collected on August 20, contained two lots, one of 95 prematurely dropped cherries picked from the ground and one of 118 green cherries picked from trees. The third shipment, collected on September 1, was composed of 3 lots, namely, 160 cherries which had dropped prematurely just prior to collection, 60 pits also picked from the ground but which apparently had dropped some considerable time before being picked, since they were practically devoid of any pulp, and 84 cherries picked from trees. The last shipment received from Catalina Island consisted of two lots collected on September 6, 1938, and included 150 drops picked from the ground and 140 green cherries picked from trees.

The records of emergence of moths from the Catalina cherry material are shown in table 1.

All the moths that emerged were of variety C. Some of the individuals from the first two collections emerged in time to produce another generation the same season; about two-thirds of the insects collected emerged the following season; 7, or 13 per cent, of the larvae hibernated through two winters before issuing as adults; and 3, or 5 per cent, remained in the soil through three winters. The summer-generation larva forms a thin, frail cocoon, only sufficiently strong to permit the easy egress of the moth from the pupal shell. However, the cocoons of the over-wintering forms are spun finely and closely, are firm, tough, and strong, with particles of soil and gravel adhering all around their exterior. They are impervious to water, and their texture would seemingly protect the enclosed larvae from desiccation in severe or prolonged droughts.

A few specimens of variety C that had hibernated through two winters have been

Table 1.—Emergence of moths of Melissopus latiferreanus var. C from Catalina cherry material collected in the summer of 1938.

Date Collection	Nature of Material	Number of Fruits	Dates of Emergence				Total Emerged
			1938	1939	1940	1941	
Aug. 9	Premature drops	325	Sept. 15[1], 20[1]; Oct. 8, 10, 12	July 26			8
Aug. 20	Premature drops	95	Sept. 26	June 29; July 11, 12, 30; Aug. 25	July 16, 29, Aug. 6		9
	Green-picked cherries	118		July 30; Aug. 1, 7, 18		Aug. 22, 25	6
Sept. 1	Premature drops	160		July 11, 12, 16, 23, 25, 28; Aug. 1, 3, 7, 9,[1] 10, 11,[1] 17,[1] 23			17
	Cherry pits from ground	60			Aug. 28		1
	Ripe-picked cherries	84				Aug. 1	1
Sept. 6	Drop cherries	150		July 8, 10, 26, 27; Aug. 7			5
	Green-picked cherries	140		July 8, 27; Aug. 3,[1] 4	July 4, 19; Aug. 6		8
Total		1,132	8	37	7	3	55

[1] Two moths emerged.

reared from infested acorns and filberts collected in the Willamette Valley in northwestern Oregon.

The discovery of larvae which hibernate through two, and even three, winters leads one to the conclusion that it must be a provision of nature to perpetuate the species. The normal hosts of *Melissopus latiferreanus* variety C are acorns and Catalina cherry. It is a well-established fact that these plants, like many uncultivated plants growing in the wild, bear fruit profusely certain years and then are entirely unproductive or yield meager crops for periods of a year or more—usually several years. Assuming that during such periods of scarcity of host plants of *latiferreanus* variety C there occurs an over-abundance of its several natural control agencies, the species would be threatened with complete extermination. It seems, however, that nature has provided against such a catastrophe for this species.—1-6-42.

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The Seasonal Distribution of Myiasis-Producing Diptera[1]

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In an attempt to obtain quantitative data on the seasonal distribution of myiasis-producing Diptera at Davis in the southern part of the Sacramento Valley of California and with the hope of being able to anticipate the damage one might normally expect from these parasites, trapping was conducted continuously from November 26, 1935 until December 17, 1936.

TECHNIQUE.—Thirteen cone-type fly traps were set out, but two of these were soon discontinued. The remaining 11 traps were located in slightly different ecologic situations as shown in table 1. These traps were 24 inches tall and 12 inches in diameter with a cone 14 inches high. Each trap was baited with 0.5 pound of lamb liver, 7.5 grams of sodium sulphide, and enough water barely to cover the meat. The traps were examined daily and the baits were kept moist and were replenished as necessary. The catches were collected at intervals determined by the number of flies present. These intervals usually did not exceed 3 or 4 days and were never greater than 1 week. The traps were not permitted to become more than half full. At the times of collections from the traps a piece of rubber hose 3 feet long was attached to the exhaust pipe of an automobile; each trap was placed in a heavy canvas duffle bag; the hose was inserted into the bag which was tied tightly about the hose; and the motor of the car was speeded up with a retarded spark for about 2 minutes. This killed the flies without disturbing the taxonomic structures. Then the flies were poured through a metal funnel into large paper sacks.

After collection the flies were permitted to dry thoroughly before random sampling and identifying. A random sample of 500 specimens was taken from each catch. The myiasis-producers were identified and counted in each sample and the number of flies of each genus or species in the total catch was estimated by means of the following formula:

$$\frac{\text{Number of genus or species in total catch}}{\text{Number of genus or species in sample}} = \frac{\text{Weight of total catch.}}{\text{Weight of sample}}$$

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