WINTER OBSERVATIONS ON LARVAL POPULATIONS OF *Culex tarsalis* COQUILLETT IN KERN COUNTY, CALIFORNIA [1]

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Culex tarsalis Coquillett is an abundant mosquito species throughout the vast irrigated agricultural areas of the Central Valley of California and the surrounding foothills. The aquatic stages of *C. tarsalis* have been well studied in the spring, summer, and fall, the period when intensive mosquito control programs are in force. However, there are few records of the occurrence of larvae or pupae during the winter. Brookman (1950) examined selected aquatic habitats in Kern County, California during the winter months and found some larvae and pupae of *C. tarsalis*. The observations reported here were made during the winter of 1959–1960 in Kern County and supplement Brookman's unpublished findings.

Beginning in November 1959, various aquatic situations in rural and urban localities in Kern County were inspected for mosquito larvae. Larvae of *C. tarsalis* were absent or very rare at most situations even by early November, but sizable populations were found to persist in two types of habitats. First, there was a series of shallow "duck club" ponds impounded on the valley floor in the autumn to attract ducks. A series of 10 of these, ranging in size from 10 to 110 acres and lying within 10 miles northward from the city of Buttonwillow were repeatedly inspected. Secondly, there was a series of marginal pools along Poso Creek in the Sierra Nevada foothills about 10 miles north of Bakersfield. Brookman's (1950) winter observations also were made along the same section of Poso Creek.

Considerable numbers of larvae and pupae of *C. tarsalis* were found in the duck club ponds in November and December. By January, partial drainage of the ponds left only residual pools with few or no larvae. By the 27th of January the most favorable sampling sites of seven of the 10 ponds were dry and emphasis was shifted to observations along Poso Creek.

The number and stages of development of specimens found at all localities are summarized in Table 1. No attempt was made to measure the density of larvae in such terms as "larvae per dip" or "larvae per acre," as during the cold months an exhaustive inspection was necessary to find any larvae.

TABLE 1.—Summary of collections of immature stages of *Culex tarsalis*, Kern County, California, November 1959 through March 1960.

Month	No. of inspections of aquatic habitats	Number specimens collected				
		1st instar	2nd instar	3rd instar	4th instar	Pupae
November	75	0	9	38	20	143
December	74	*1**	*16*	70	259	21
January	59	0	0	*13*	72	*58*
February	34	3	4	0	0	0
March	342	19	87	110	61	0
Total	584	23	116	231	412	222

* Italicised numbers indicate probable last detection of autumn brood and beginning of break period before the first detection of spring brood.

Records at the U. S. Weather Station in Buttonwillow for the period of this study show that temperature of 32° F. or lower were recorded on 5 days in November, 21 in December, 14 in January, 3 in February, and none in March. The lowest temperature for the period was 18° F., recorded on January 2 and 5. Larvae of *C. tarsalis* were found under a thin layer of ice at two localities on December 7.

In November and December, older larvae and pupae were more abundant than young larvae, and by January only third and fourth instar larvae and pupae were found (Table 1). In late January only one specimen, a third instar larva, could be found at the duck clubs. Older larvae and pupae could not be found at any location in February, but the finding of a small number of first and second instar larvae indicated that a new generation was developing. All larval instars but no pupae were found in March.

The persistence of third and fourth instar

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larvae and pupae along Poso Creek into January, after they could no longer be found on the valley floor, may indicate that milder temperatures in the foothill belt favored their survival.

Field observations at Poso Creek were extended to determine whether this persisting population of older larvae and pupae was culminating in successful emergence of adults. Three metal cylinders (12 inches in diameter) were set perpendicularly in the creek in about a foot of water and adapted to serve as emergence cages. Pupae were collected and placed in the cylinders and inspected each day from January 12 to 23 for adult emergence. The entire procedure was repeated from January 25 to February 5. A total of 74 adult *C. tarsalis* (37 males, 37 females) emerged during the two periods. Adults of other species that emerged were: *Culiseta inornata* (Williston) (155 males, 82 females), *Culex erythrothorax* Dyar (2 males, 1 female), and *Anopheles franciscanus* McCracken (1 female).

Bellamy and Reeves (1963) believed that overwintering of *C. tarsalis* in Kern County depended upon an autumn generation of adults and that the mated females persisted through early winter, took blood in January and February, and subsequently deposited eggs in the early spring. The present observations are consistent with these interpretations; however, they also indicate that occasionally an overlapping of autumn and spring brood populations of the aquatic stages may occur under favorable conditions.

Literature Cited

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OBSERVATIONS ON THE LIFE CYCLE OF *Culex quinquefasciatus*

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With many species of mosquitoes showing resistance to insecticides, there is a growing emphasis on screening of insecticides using both adult and immature mosquitoes. To give information of this type, the life cycle of the Isla Verde strain of *Culex quinquefasciatus* was studied. Larvae were collected from a cistern near the International Airport, Isla Verde, Puerto Rico, and brought to the School of Medicine, University of Puerto Rico, San Juan, Puerto Rico for rearing. The adults were allowed to feed three nights a week on month-old chicks which were restrained and placed in the cage with the mosquitoes. Sugar water was available to the mosquitoes at all times. Glass finger bowls filled with distilled water were put into the cage as oviposition sites. The egg rafts were placed in individual containers and the numbers of eggs per raft were counted. The larvae were fed on guinea pig food. After the first three days of growth, the food and water were changed daily until pupation ceased. The pupae were placed in pint fruit jars with screen covers, where the adults were allowed to emerge. The rearing area was in a well ventilated room, in which the temperature and humidity fluctuated with the outdoor environment.

Over a period of a month, 50 egg rafts were selected at random from the finger bowls. Larvae appeared during the first day after collection, pupae appeared from the 6th to 20th day, and adults appeared from the 7th to the 20th day. The average time needed to reach the adult stage was 10 days. Ten percent of the egg rafts did not produce larvae. The egg rafts contained from 55 to 236 eggs with an average of 129. Forty-seven percent of the mosquitoes reached the adult stage from the egg, 66.2 percent reached adulthood from the 4th stage larvae and 88.9 percent of the pupae became adults.

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LABORATORY NOTES ON SNIPE FLY LARVAE (RHAGIONIDAE: *Symphoromyia*)

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FEEDING. To determine the nature of the feeding habits of *Symphoromyia* larvae some medium-sized to almost mature larvae of species A and/or B, and species C of Sommerman (1962) were kept in soil in small shell vials, each accompanied by another soil-inhabiting larva. All of the *Symphoromyia* larvae that fed pierced the integument of the prey with their mouth parts. They pushed their heads in far enough to leave a gaping hole in the integument, and then apparently predigested the soft internal tissues. Examination of the remains of the prey indicated that generally one feeding hole sufficed for draining the prey, but if the carcass were sharply bent there were two feeding holes, one on either side of the bend; otherwise the tissues beyond the bend were still intact.

Larvae of *Symphoromyia,* species C, ate other dipterous larvae, (some of which were themselves predacious) and new pupae, coleopterous larvae, larvae of *Symphoromyia* sp. A–B, and smaller larvae of sp. C. Hence species C is cannibalistic.