

NOTES ON THE LIFE HISTORY OF *EUPHYDRYAS EDITHA BAYENSIS*

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If the distribution of *Euphydryas editha* Bdv. is superimposed on a map of California, it will be seen that the subspecies are local and colonial. In the San Francisco Bay region, *Euphydryas editha bayensis* Stern. occurs in large colonies of many individuals, surrounded by a more or less solid "matrix" of *Euphydryas chalcedona* Dldy. & Hew. *E. editha* appears in the adult stage in March and April, and as a rule has finished its flight season before many *E. chalcedona* have appeared on the wing. Thus while both species may cohabit a given area, the distribution of *E. chalcedona* is much more general, and the adults of the two species are not synchronous.

The life history of our local subspecies of *E. editha* is very little known, and so a series of observations and experiments was begun in March, 1957, to attempt to add to our knowledge of the life history of this insect.

All the colonies of *E. editha bayensis* known to me have one thing in common; they occur on serpentine soils. A very large colony of this butterfly exists on the serpentine outcrops of the Silver Creek Hills, about ten miles southeast of San Jose, where the first hills break out of the Santa Clara Valley. In passing it is worth mentioning that since *E. editha* flies so early in the year, one might suspect as has been done, that it overwinters as a pupa, but this surmise is erroneous, as will be seen.

March 11, 1957, was cool, breezy and overcast, after a slight rain the previous day. At first, search of the area in Silver Creek Hills gave no results, but later in the morning the sun broke through and soon several larvæ of the *Euphydryas* type were found sunning themselves on open spots on the ground or on rocks. One individual was found feeding on the tiny native plantain, *Plantago erecta* Morris. That morning thirteen larvæ were collected and taken home, where they were housed in two containers with transplanted plants of *Plantago erecta*. It seemed fantastic the ease with which these larvæ and the food plant had been located, when I remembered the many times I had searched for them before without success.

On March 12, food was replenished and experiments were run to see if the larvæ would eat any other plants. Individual larvæ were placed in glass vials with *Plantago erecta*, *Plantago lanceolata* L. (Ribwort), *Erodium cicutarium* (L.) L' Her. (Filaree or Alfilaria), *Orthocarpus* spp. (Owl's Clover), *Montia perfoliata* (Donn) Howell (Miner's Lettuce), and three species of small composites, which without flowers I could not identify. Of these several plants, only the two species of Plantain were eaten. It was something of a surprise to see how readily the larvæ ate the Ribwort Plantain, since this generally distributed introduced weed grows in many places where *E. editha* does not occur. However, I was most happy to find a substitute food plant. *Plantago erecta* (which has no common name) is a small annual about three inches high and hard to keep fresh. Ribwort is a hardy plant, and plants with

roots placed in cans not only keep fresh but continue to grow if exposed to sun. So the food problem for the larvæ was happily solved.

The larvæ passed through two instars and then began to pupate one by one, beginning on March 20. On April 6, two adults, a male and a female, emerged. This pair could not be induced to mate, either in a cage or by attempted hand pairing. The remainder of the reared specimens were preserved as they emerged.

On April 7, six gravid field-caught females were placed in an outdoor cage, with honey, water and a potted plant of *Plantago lanceolata*. On April 10, five masses of eggs were found. The eggs are laid in masses of thirty to fifty eggs, placed near the bases of the stems. The eggs are subspherical, slightly higher than wide, with fifteen to twenty very faint vertical ridges. There is some slight cross-ridging that shows up under twenty power magnification. Some of the eggs are so slightly sculptured as to appear nearly smooth. The color is pale yellowish green when freshly laid, fading to dull yellow and becoming dark before hatching, at which time the dark larvæ show through the translucent chorion. The eggs are sticky when laid and adhere to the plant and to each other. This adhesive material dries in a few days and then the eggs are lightly cemented together.

It is interesting to speculate as to how the eggs are laid in the field, an act so far not observed in spite of many hours spent in observation of the females. *Plantago erecta* is dry and gone by the time most of the females are on the wing, and it is conjectured that oviposition must occur elsewhere than on the vernal food plant, which is in the seed stage at the time of egg-laying. It is hoped that this point may be cleared up another year.

The eggs began hatching on April 30, and most of the larvæ eclosed the same day. The remaining egg shell is very thin, pearly and translucent. Some of the larvæ ate a small part of the shell, but most of it was left uneaten. Some of the first stage larvæ were preserved, others were placed in vials with Ribwort, the substitute food plant, on May 1.

On May 7, the larvæ molted and entered the second instar. These small larvæ spin a communal web or nest, from which they go out into the leaves to feed. Feeding is mostly in the morning hours, and the larvæ sun themselves in the middle of the day, returning to the web at night.

On May 21, the remaining six larvæ were in the third instar, and were approximately the size that the overwintering larvæ had been when found in March. The larvæ molted in the silken web or nest and the exuviae were left there. The larvæ now spent most of the time sitting on the foliage or resting near the base of the food plant, and after the second molt used the communal web very little.

The larvæ had been kept on an open potted plant in a window, for good observation and to supply plenty of sun to the plant. On the mornings of the 25 and 26 of May, the larvæ disappeared from the plant, before I was aware of what was happening. They evidently sought crevices in the room in which to diapause until the following spring, but none was actually seen to leave the plant.

These incomplete observations leave unanswered at least three important questions: (1) Where and how are the eggs laid in the field? (2) What plant serves as food to the spring-developing first three instars of the larvæ? (3) Precisely where do the larvæ hide during the diapause?

In spite of the lack of complete knowledge concerning the life history of this species, several valuable though tentative conclusions may be drawn to guide future work. These may be enumerated as follows:

1. The food plants of *Euphydryas editha bayensis*, after the larvæ break the diapause, are members of the genus *Plantago*. The native food plant is primarily *Plantago erecta*, a small annual species.
2. The larvæ pass the dry season and the colder part of the winter in diapause and come out to feed after the vegetation begins to grow in late winter and early spring. This is an adaptation to the Mediterranean type of climate characteristic of Central California.
3. The larvæ diapause in the third instar and pass two more instars after coming out of diapause. This is similar to the habits of *E. chalcidona*, but the larvæ of *editha* come out of diapause earlier in the year.
4. Pupation is of about three weeks duration, with adults emerging in March and April.
5. The eggs are laid in masses in the laboratory. Field oviposition is still to be recorded.
6. During the early instars the young larvæ live in a communal web, as observed in the laboratory. Just prior to entering the diapause the larvæ leave the web, become more solitary and scatter.
7. This type of life history is adapted to a climate where there is a wet winter and fall. It is correlated with the growth of the food plants, which is essentially restricted to the wet season.

A few notes on the adults may be added. The males flutter over the fields searching for the females, in a manner similar to the males of *Speyeria*. On several occasions, males were seen to locate newly emerged females and to mate with them. The females gave every evidence of not having flown previous to mating. It is suggested that mating in this subspecies normally occurs before the females have flown much or at all. The females are at all times highly sedentary. The mated females did not seem to attract other males, although they were watched for long periods of time and many males flew by them. After mating, females visit flowers for some time before leaving the general vicinity of the mating. Flower feeding by the females is the normal activity of this sex in the early hours of the day.

Later in the day, usually after 10:00 A.M. P.S.T., females may be found courting over the fields and pausing occasionally as though to oviposit. Although several females were observed apparently intent on oviposition, in no case was oviposition actually observed in the field.

The author realizes the incompleteness of these notes, but feels that presentation of them at this time may stimulate observations by others, and the remaining problems may wait for some time before being solved.

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