POPULATION BIOLOGY AND ADULT BEHAVIOR OF *LYCAENA XANTHOIDES* (LYCAENIDAE)

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A mark-release study of *Lycaena xanthoides* Boisduval was carried out in a small field in Berkeley, Alameda County, California from 6–17 July 1969. In addition, adult behavior was studied at nearby Point Richmond, Contra Costa County. This account serves as a comparison to that for *Lycaena arota* Boisduval. (Scott, 1973b). The methods used are those of Scott (1973b).

Mating. Lycaena xanthoides is a perching species as is *Lycaena arota* (Scott, 1973b). Males perch on vegetation about a meter above the ground, and dart out at passing insects in search of potential mates. Perching takes place near the larval hosts, *Rumex* spp. (Polygonaceae), along watercourses and in flat fields. Aerial encounters are common between conspecific males as well as between male *Lycaena* and males of other butterflies. In the morning males perch on non-flowering vegetation, but in the afternoon both sexes congregate at flowers, where males perch and court females.

A male will fly after a passing female. The male often hovers over the female, beating his wings with wide amplitude about seven times per second, then lands behind the female and bends his abdomen laterally to copulate. The male rarely flutters while sitting behind the female. Two successful copulations were observed in which the females remained quiescent after landing. Females were unreceptive in most attempted courtships. Unreceptive females when pursued by a male, alight and flap their wings with wide amplitude about five or more times per second until the male departs. This flapping by the females seems to be a "rejection dance" as in *L. arota.* Unreceptive females also raise their abdomens slightly so that males cannot join. Courtships were observed at 0916, 0930, 0931, 0938, 1113, 1122, 1155, 1332, 1444, 1502, 1540, 1610, and 1620. Copulating pairs were found at 0938 and 1122. Six of 26 dissected females had not mated, 18 had mated once, and two had mated twice. Most of these individuals were fresh, so that the number of matings might be expected to increase with age. The spermatophores

TABLE 1. Population parameter estimates of *L. xanthoides* at Berkeley study site.

	Day	Apha[1]	M[2]	N[3] + 1.96 SE[4]	Phi[5] + 1.96 SE	B[6] + 1.96 SE
Males	July 6	0.	0.	0. + 0.	.860 + .241	0. + 0.
	9	.7917	37.86	47.8 + 14.7	.933 + .548	−4.6 + 7.1
	11	1.0000	40.00	40.0 + 22.2	.912 + .787	2.6 + 4.5
	13	.9333	36.50	39.1 + 27.2	.327 + .294	− .5 + 1.8
	15	1.0000	12.25	12.2 + 7.8	0. + 0.	0. + 0.
	17	.8750	0.	0. + 0.	0. + 0.	0. + 0.
Females	July 6	0.	0.	0. + 0.	.721 + .215	0. + 0.
	9	.6316	31.00	49.1 + 18.5	.939 + .319	− .5 + 14.4
	11	.7826	35.69	45.6 + 15.6	.852 + .467	3.5 + 12.0
	13	.8182	34.67	42.4 + 23.8	.895 + .631	5.0 + 13.1
	15	.7647	32.83	42.9 + 25.9	0. + 0.	0. + 0.
	17	.7222	0.	0. + 0.	0. + 0.	0. + 0.
Both Sexes Combined	July 6	0.	0.	0. + 0.	.798 + .164	0. + 0.
	9	.7209	69.39	96.3 + 22.9	.907 + .275	− .3 + 16.0
	11	.8485	73.83	87.0 + 25.8	.951 + .456	2.0 + 13.7
	13	.8846	75.00	84.8 + 37.5	.564 + .324	5.0 + 9.5
	15	.8333	44.00	52.8 + 23.4	0. + 0.	0. + 0.
	17	.5556	0.	0. + 0.	0. + 0.	0. + 0.

[1] Proportion of marked animals.
[2] Total marked population.
[3] Total population.
[4] Standard error.
[5] Probability of survival.
[6] Number of new animals joining the population.

of both *L. xanthoides* and *L. arota* disappear rapidly compared to those of other butterflies (Scott, 1973a), making counts more difficult.

Population parameters. In order to study movements and population parameters, a mark-release-recapture effort was carried out. Fifty-one males and 66 females were individually marked and released; of these, 32 males (63%) and 38 females (58%) were recaptured at least once. Because the study was done in a 30 × 40 m field, dispersal could not be followed. Within the study site, which was separated into six areas based on physical markers, many individuals changed position between recaptures, and of the individuals recaptured more than once, many crossed the area several times. Because the estimated lifespan of males was nine days and 14 days for females, it is assumed that very little emigration occurred. The surrounding area consisted of asphalt, lawns, and buildings, so that emigration would not have led to any favorable area nearby. The species may have colonized the lot by moving short distances along the creek which runs through the site. At the Point Richmond site adults were almost completely limited to flat areas at the base of a hill, although one male was found on a hilltop about 300 meters distant from the

nearest colony, and several others were found on other parts of the hill at least 100 meters distant from the closest larval host.

The number of males was about 40 at the beginning of the study, but declined at the end. The number of females remained at about 33 throughout the study. During the study period the number of new animals was very small for both sexes; adults probably began to emerge in late May or early June, and the mark-recapture effort was conducted near the end of the flight period. Population parameters for both sexes (Table 1) were estimated using the stochastic model of Jolly (1966).

The average survival rate and lifespan for males was .893 (8.9 days) using method 1, and .890 (8.6 days) using method 2. For females the rate was .932 (14.2 days) using method 1, and .933 (14.4 days) using method 2. For both sexes combined, the rate was .900 (9.5 days) using method 1, and .901 (9.6 days) using method 2. Five males and two females survived for at least the entire 11-day period. Many individuals went from fresh to battered wing-condition during the study period. The lifespan of *L. xanthoides* was much greater than the lifespan of *L. arota*; extensive predation and very hot weather at the *L. arota* study site may have reduced survival (Scott, 1973b).

Feeding. Both sexes visited flowers during warm sunny hours, especially early afternoon. Yellow flowers were visited most frequently because of their availability; elsewhere (Colorado) both sexes feed most often on blue-red *Asclepias* sp. (Asclepiadaceae). Plants whose flowers were visited at Berkeley were yellow *Grindelia* (Compositae), 130 visits; blue-white *Dipsacus* (Dipsacaceae), 15 visits; yellow *Brassica nigra* (Cruciferae), 1 visit; and yellow *Foeniculum vulgare* (Umbelliferae), 1 visit. At Point Richmond adults visited *Grindelia* and red-blue *Centranthus ruber* (Valerianaceae).

Oviposition. Oviposition was not observed. First instar larvae were found upon young leaves of *Rumex hymenosepalus* during February. Older larvae were found on the underside of slightly older leaves.

Thermoregulation. Both sexes bask by spreading their wings 20–60° from vertical, and facing away from the sun. Basking occurs at cool temperatures, primarily during morning and late afternoon.

SUMMARY

Males of *Lycaena xanthoides* perch on vegetation in open flat areas from approximately 0700 to 1600 and fly out at other insects in order to locate receptive females. Pre-mating behavior involves the male fluttering near the quiescent female. Unreceptive females flutter their wings until the male departs. The average lifespan is nine days for males and

14 days for females. Both sexes feed upon nectar from flowers of many colors.

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