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A NOTE ON THE PHENOLOGY OF *PLEBEIUS ACMON* (LYCAENIDAE)

Microgeographic differences in physiological responses to seasonality among conspecific populations are of potentially great evolutionary interest. In his review of host specificity in *Plebeius acmon* Westwood & Hewitson (Lycaenidae) and its relatives, Goodpasture (1974, J. Lepid. Soc. 28: 53–63) mentioned an apparent case of this sort. According to Goodpasture, *acmon* begins flying in March near Monticello Dam in the Vaca Mountains (central California Inner Coast Ranges), where it has a seasonal succession of hosts—but not until June at Putah Creek near Davis, on the floor of the Sacramento Valley 25 miles to the east. Goodpasture claims that *acmon* has only one host at Putah Creek, the summer leguminous annual *Lotus purshianus* Benth., and that its late appearance there (which he documents by reference to two years' field experience, years not specified, and the dates of museum specimens) is thus adaptive. Laboratory stocks from the two localities are stated not to differ in their responses to photoperiod in the induction of larval diapause. Without any experimental evidence, Goodpasture concludes that "seasonal flight data indicate that these populations differ markedly in response to conditions initiating *breaking* of diapause" (emphasis added). If real, this situation would deserve careful genetic study. However, it is not.

Monticello Dam controls the flow in Putah Creek. Below the dam the creek bed is virtually dry in mid- to late summer, when *Lotus purshianus* and *P. acmon* (and *Everes comyntas* Godart, which also feeds on this plant) are at their peak there. Winter flow is variable from year to year, depending on rainfall. In dry years there is little surplus water to be released downstream, and at Davis little disturbance of *acmon* breeding sites occurs. In wet years enormous volumes of water move through the bed of Putah Creek from levee to levee at high velocity, stripping the organic litter from some places and burying it in silt in others. Under such conditions successful overwintering of *acmon* larvae is very unlikely. This obvious influence on the apparent phenology of *P. acmon* is borne out for the 1972 through 1974 seasons.

Rainfall for the 1971/72 water year (July 1 through June 30) at Davis was 8.60 inches, *vs.* a 100-year mean of 16.80 inches. This was the lowest seasonal rainfall since 1938/39 and the third lowest of record. The bed of Putah Creek was nearly dry all winter. *P. acmon* was flying at Davis on 4 March 1972. Putah was not collected until 17 April, and on that date *acmon* was numerous. It was subsequently seen on every visit to Putah in spring, i.e. 19 and 25 April, and 1, 12, 23, and 28 May, the last two dates representing the beginning of the second generation.

The rainfall at Davis for 1972/73 was 27.65 inches, the heaviest since 1957/58 and the fourth heaviest of record. Putah Creek was in flood much of the winter, and the litter in *acmon* breeding areas—which had been left in place the preceding

year—was nearly all swept away. Although *acmon* was flying on the floor of the Sacramento Valley under non-floodplain conditions as early as 14 March 1973, it was not seen at Putah until 11 June. This pattern was repeated in 1974 after the wet 1973/74 winter (about 22 inches); Putah Creek was in flood much of the winter and through mid April, and although *acmon* was seen near Davis as early as 19 March it had not appeared at Putah a month later.

At all elevations in California the *acmon* produced by overwintered larvae are of the spring phenotype, "*cottlei*" Grinnell. When the first flight dates for *acmon* at Putah or elsewhere on the Valley floor are as late as mid-May, the first individuals taken are of the summer phenotype corresponding to the second generation emerging at other, nearby localities where a March–April flight had been observed. The control of this phenotypic switch has never been studied in a controlled laboratory experiment, but its seasonality argues against May or June butterflies on the Valley floor being produced by overwintered larvae.

At Davis *P. acmon* breeds extensively on *Polygonum aviculare* L. (Polygonaceae), a common vacant-lot weed which has a succession of generations throughout the year. The vacant lots in which plant and butterfly occur are plowed under one or more times each year, and I have been able to study the rate of recolonization by *acmon*. These studies, still in progress, demonstrate that this is a very vagile butterfly with extraordinary colonizing ability. It should not be surprising that its populations at Putah Creek are periodically wiped out by catastrophic flooding and replaced by colonizing butterflies from elsewhere. At least in the Sacramento Valley, it is very unlikely that *any* population of *P. acmon* can persist long enough to undergo much genetic adaptation to a local microclimate (or hostplant).

Goodpasture is correct in stating that *P. acmon* flies earlier near Monticello Dam than on the Valley floor; it begins emerging there in late February apparently every year, two–four weeks ahead of Davis. However, it is far from unique in this regard; so do *Lycaena helloides* Boisduval, *Strymon melinus* Hubner, *Atlides halesus* Cramer (all Lycaenidae), *Pieris rapae* L., *Colias eurytheme* Boisduval (Pieridae), *Precis coenia* Hubner and *Phyciodes mylitta* Edwards (Nymphalidae), all common multivoltine species which overwinter in the larva or pupa, as well as the hibernating nymphalids. Rather than postulating that all these vagile (potentially panmictic) species have convergently evolved phenological ecotypes in the Valley and adjacent canyons, it is more parsimonious to look for environmental differences which would call forth an earlier emergence in the canyons given identical genetic "instructions." Such differences are not hard to find. The canyons have higher minimum temperatures, fewer days and hours of fog and low cloudiness, and much less wind than the Valley floor in winter and early spring. The discrepancy between first flight dates of weedy butterflies in the Valley and the Vacas is mirrored, incidentally, in the flowering dates of weedy plants.

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