CONSPECIFIC HOST DISCRIMINATION BY OVIPOSITING
EUPHYDRYAS EDITHA BUTTERFLIES: ITS NATURE
AND ITS CONSEQUENCES FOR OFFSPRING
SURVIVORSHIP

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INTRODUCTION

Despite considerable recent interest in the diversity and evolution of patterns of host plant choice by phytophagous insects, little is known concerning the extent to which insects discriminate among conspecific plants in natural populations. Few field studies quantitatively demonstrate the existence of such discrimination in the field and fewer still (though see RAUSHER and PAPAJ, 1983) examine the behavioural mechanisms involved in such discrimination or the adaptive significance of this behaviour. The evidence to date, however, indicates that insects may discriminate among conspecific plants that exhibit variation in density and dispersion (CROMARTIE, 1975; RAUSHER et al., 1981), size (RAUSHER et al., 1981), age (IVES, 1978), chemical composition (MITCHELL, 1977), stress (LEWIS, 1979), vegetational background (RAUSHER, 1981b), microclimate (WILLIAMS, 1981) and the real or apparent presence of the offspring of other insects (ROTHSCHILD and SCHONHOVEN, 1977; RAUSHER, 1979; WILLIAMS and GILBERT 1981).

Discrimination among conspecific hosts has presumably usually evolved in response to variation in the quality of plants as hosts and it should therefore tend to be correlated with the suitability of plants for the growth, survivorship and future fecundity of the insect offspring placed upon them. This paper describes the discrimination that ovipositing Euphydryas editha (Boiss.) butterflies show among patches of one of their major host plants, Collinsia torreyi, in a polyphagous population in California. My evidence for the presence of this discrimination is based on comparisons of the characteristics of two classes of plants alighted on by searching butterflies. If females show post-alighting discrimination among plants, the characteristics of hosts that they alight on and accept (i.e. oviposit on) should differ in some way from the characteristics of the plants that they alight on but reject. A failure to find such a difference with respect to an arbitrary set of measured characteristics does not rule out the possibility of discrimination since the insects may discriminate among hosts on the basis of features different from, and un-
correlated with, the characteristics chosen for measurement. As discussed by RAUSHER and PAPAJ (1983), the presence of a significant difference between accepted and rejected plants with respect to measured characteristics indicates that the insects are discriminating among plants, but it should be remembered that they may be using different (though correlated) characters as the basis for such discrimination.

The consequences of the observed discrimination for the butterflies' offspring were also studied. If conspecific host discrimination is adaptive, insect progeny should be more successful on plants that are accepted by searching females than on plants that are rejected. In this study, I measured the survivorship of egg masses and larvae that I placed on collinsias having the characteristics of plants either accepted or rejected by searching E. editha females. I was able to do this with the aid of a statistical technique (see below) that enabled me to determine whether collinsias within an arbitrarily positioned quadrat had the characteristics of plants that were accepted or rejected by ovipositing butterflies.

**STUDY SITE AND METHODS**

This study was performed in June and July of 1980, 1981 and 1982 at the General's Highway (GH) population of RAUSHER et al. (1981). This population is located at an altitude of 2360 m in the western Sierra Nevada mountains and it is unusual among Californian E. editha populations in that the butterflies are polyphagous, feeding on four different host species, all in the Scrophulariaceae. Two hosts, Pedicularis semibarbata and Collinsia torreyi are common and receive most of the eggs laid by the butterflies (SINGER, 1983). All observations and experiments were performed in the 'Collinsia area' of MACKAY (1982). This site, approximately 50 x 100 m in extent, is located on a gently sloping hillside that was logged and burnt in 1967 and which, at the time of the study, supported a dense cover of low vegetation, dominated by Lupinus fulcratus, C. torreyi, Epilobium lactiflorum and Linanthus ciliatus. In this study site, the only host plant present was C. torreyi. Interestingly, although Collinsia occurs throughout the GH population it is only used as a host plant on the hillside containing the 'Collinsia area'. This plant is an annual and individuals grow to an average height of approximately 7-8 cm. It commonly occurs in dense clumps or patches containing many overlapping and contiguous individuals. Flowering usually occurs in late June and the blue and white petals of the flowers make the plants quite conspicuous at this time.

Data collection and analysis

E. editha butterflies at GH fly between late May or early June and late July. Ovipositing females lay their eggs in clusters that usually contain between 20 and 150 eggs and a butterfly would normally only lay one or two egg masses on each day. The oviposition search behaviour of E. editha butterflies at GH is very distinctive—the insects