Use of Two Oviposition Plants in Populations of Euphydryas phaeton Drury (Nymphalidae)

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Source: The Journal of the Lepidopterists' Society, 67(4) : 299-300

Published By: The Lepidopterists' Society

URL: https://doi.org/10.18473/lepi.v67i4.a7

Journal of the Lepidopterists' Society
67(4), 2013, xx–xx

USE OF TWO OVIPOSITION PLANTS IN POPULATIONS OF *EUPHYDRYAS PHAETON* DRURY (NYMPHALIDAE)

Additional key words: Baltimore Checkerspot, iridoid glycosides, Vermont

The Baltimore Checkerspot, *Euphydryas phaeton* Drury (Nymphalidae: Melitaeini), is a univoltine species that ranges from Georgia in the south, north to Maine and southern Canada and west to Kansas (Scudder 1889; Masters 1968; Harris 1972). Its native host plant is White Turtlehead, *Chelone glabra* L. (Plantaginaceae), a denizen of marshy, wetland habitats. In the Ozarks, another subspecies, *E. phaeton ozarkae* Masters, was described as somewhat different in appearance and using the oviposition plant *Aureolaria flava* (L.) Farw. (Orobanchaceae) (Masters 1968). Just over 30 years ago, a third oviposition plant was described for *E. phaeton*, the introduced weed, Ribwort or Narrow-leaved Plantain, *Plantago lanceolata* L. (Plantaginaceae) (Stamp 1979). *Plantago lanceolata* was introduced into North America about 200 years ago (Cavers et al. 1980) and has been incorporated into the diets of many native North American herbivores (Robinson et al. 2002). These three different species of oviposition plants are united by the presence of a particular group of plant chemical compounds, the iridoid glycosides (Bowers et al. 1992; Belofsky et al. 1989). Indeed all host plants of *E. phaeton* contain iridoid glycosides (Bowers 1980; Bowers et al. 1992).

Euphydryas phaeton has been declining in numbers in many areas such as Maryland and Rhode Island (Durkin 2009); however, in Vermont, there are many healthy colonies. Specifically, the recent Vermont Butterfly Atlas Project has documented *E. phaeton* populations at nearly 200 sites (McFarland and Zahendra 2010). Furthermore, the use of *Plantago lanceolata* has allowed some populations to get extremely large; for example, a recent survey of adults from a population on June 19, 2010, in Bristol, Rhode Island, in a field of approximately seven acres, revealed a population estimate of over 3,200 individuals of *E. phaeton* (4th of July butterfly count Rhode Island, 2010). A careful search of this site and surrounding areas revealed no evidence of *C. glabra*. More recently, during the 2012 butterfly count in Rhode Island, another large population (over 1000 individuals counted) was located on private land near Little Compton (2012 4th of July butterfly count Rhode Island, 2012).

Typically, only a single plant species is used as an oviposition plant by a single population of Baltimore Checkerspots, although post-diapause larvae may feed on a variety of plant species, including *Penstemon* (Plantaginaceae), Ash (*Fraxinus*, Oleaceae), *Viburnum* (Adoxaceae), false foxglove (*Aureolaria*) and honeysuckle (*Lonicera*, Caprifoliaceae). For example, in New York (Stamp 1979) and Rhode Island (Bowers and Schmitt 2013), populations of *E. phaeton* use solely *P. lanceolata* for both oviposition and larval feeding. Other populations using exclusively *P. lanceolata* also likely occur. Most populations, however, still use *C. glabra* as the sole oviposition plant.

Here we report the occurrence of two populations in Vermont that use both *C. glabra* and *P. lanceolata* as oviposition plants at the same sites (Figures 1 and 2). At both sites, ovipositing *E. phaeton* females were observed using both plant species on the same day (although we did not follow individual females) in 2011 and 2012 (Figure 1 and 2). The two sites were 1) Clark, Washington County (Figure 1); 2) Connor, Washington County (Figure 2). There are likely to be other *E. phaeton* populations that use both species for oviposition as well because many Vermont wetlands where *C. glabra* occurs are located in or near agricultural landscapes, where *P. lanceolata* is a very common weed of old fields, hay fields and roadsides. Recent studies of *E. phaeton* in Massachusetts indicate that populations using both host plant species as oviposition sites may be relatively common (G. Breed, E. Crone, personal communication; http://www.butterfliesofmassachusetts.net/baltimore-checkerspot.htm).

Use of these two host plant species for oviposition by a single *E. phaeton* population may have important consequences for those populations. For example, in the two populations we studied, there is likely to be strong selection against oviposition on *P. lanceolata*: haying operations destroyed all egg masses we detected on *P. lanceolata*. The *P. lanceolata* plants we observed occurred almost exclusively in hayfields and these fields may be cut two or more times in a single summer, depending on grass growth. Early season (i.e., June) haying kills post-diapause late instar larvae and pupae, when *Plantago* is a common food plant; while later season haying could kill adults, egg masses, and prediapause larvae. Because the native host plant, *C. glabra*, often occurs near farm fields, use of this non-native, alternative oviposition host by checkerspots may

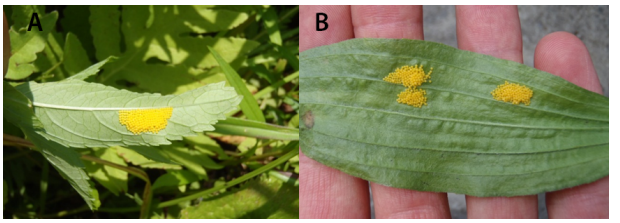

FIG. 1. Egg masses from the Clark site (East Montpelier County, Vermont). **A)** Egg mass on *C. glabra* from this site; **B)** egg mass on *P. lanceolata* from this site. Photographs taken on July 11, 2011.

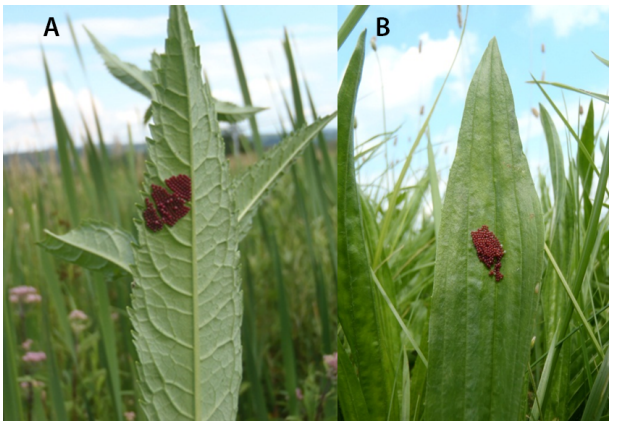

FIG. 2. Egg masses from the Connor site (East Montpelier County, Vermont). **A)** egg mass on *C. glabra* from this site; **B)** egg mass on *P. lanceolata* from this site. Photographs taken on July 18, 2011.

be relatively common. There may be other effects on *E. phaeton* populations as well. For example, specialist parasitoids such as *Cotesia euphydryidis* (Muesebeck) (Braconidae) and *Benjaminia euphydryadis* Vierick (Ichneumonidae) often search for hosts on larval webs of *E. phaeton* (Stamp 1982). These webs may be much less conspicuous when they occur on *P. lanceolata* because of the low stature of this species compared to *C. glabra*, making them more difficult for parasitoids to find. Thus larvae from egg masses on *P. lanceolata* may better escape parasitoids. Furthermore, larval feeding on these two different host plant species may also affect palatability of both larvae and adults. When reared on *P. lanceolata*, larvae and adults contain two iridoid glycosides, aucubin and catalpol, whereas those reared on *C. glabra* contain almost exclusively catalpol (Bowers et al. 1992). Feeding experiments with birds showed that the *C. glabra*-reared individuals are much less palatable than those reared on *P. lanceolata* (Bowers 1980); thus use of *P. lanceolata* may affect this important chemical defense in this species.

In conclusion, use of both the native *C. glabra* and the introduced *P. lanceolata* in individual populations of *E. phaeton* may have important consequences for these insects. As wetlands where *C. glabra* is found become less common and agriculture and disturbance become more common, use of *P. lanceolata* may increase in this butterfly, with multiple and potentially long-term effects on its populations.

Thanks to E. Crone and G. Breed for their observations on Massachusetts *E. phaeton* populations.

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Submitted for publication 5 February 2013; revised and accepted 3 May 2013.