GENERAL NOTES

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CALLOPHRYS ERYPHON (LYCAENIDAE) COLONIZES URBAN AND SUBURBAN SAN FRANCISCO BAY AREA, CALIFORNIA, USING PLANTED MONTEREY PINE

Additional key words: *Incisalia*, biogeography, dispersal.

The western banded elfin, *Callophrys* (*Incisalia*) *eryphon* (Boisduval), is widespread in western North America, mainly in Transition Life Zone and montane regions, where its larvae feed on various conifers, primarily Pinaceae (Hardy 1959, McGugan 1958, Newcomer 1973). In California, this butterfly occurs from the Cascade Range southward along both sides of the Sierra Nevada and in the North Coast Ranges, mostly at elevations of 1000–2500 m, to the San Bernardino and San Jacinto Mountains of southern California above 2000 m (Essig Museum specimens). Along the north coast, natural populations of *C. eryphon* range nearly to sea level, near Plantation, Sonoma Co. and Inverness, Marin Co., in association with Bishop pine, *Pinus muricata*. The elfin may have been native on the Peninsula south of San Francisco because there are three specimens in the Museum of Comparative Zoology, Harvard University, labelled "San Mateo, Cal. A. Agassiz," probably dating from the 19th century. However, there are no modern records from the Peninsula or Santa Cruz Mountains area (Steiner 1990). In Monterey County, a population occurs at the S. F. B. Morse Botanical Reserve on the Monterey Peninsula in association with an isolated colony of native Bishop pine (J. Lane pers. comm., LACM specimens), but *C. eryphon* is not known from Monterey pine (*Pinus radiata*) there or at the other native stands, nor from other native pines of central coastal California.

There are old records (1929 to 1950) from San Francisco (Steiner 1990); included are specimens collected at The Presidio, where Monterey pine has been grown for more than a century. However, H. Reinhard (unpubl. data), J. E. Hafernik (in litt.), and I have failed to find *C. eryphon* there in recent years. According to H. H. Behr, conifers grew on Lone Mountain at the western edge of the city in the late 1800's (Howell et al. 1958). These likely were *Pinus muricata* or *P. radiata*, Howell et al. reasoned, so it is possible that a colony of *C. eryphon* existed there, and its descendants adopted plantings of Monterey pine at The Presidio. However, because there are no specimens taken by H. E. Cottle, F. X. Williams, or other early 20th century collectors in San Francisco (Steiner 1990), it seems likely that the later records represent an adventive colony originating from native conifers of Marin County 15–30 km to the northwest, the direction of prevailing winds.

In recent years the western banded elfin has expanded its range in the San Francisco Bay region. It evidently occurred naturally inland in Marin County in association with Bishop Pine or Douglas-fir (*Pseudotsuga menziesii*), because the butterfly was collected at Mill Valley on the east side of Mt. Tamalpais in 1908. In recent decades, *C. eryphon* has been discovered successively southeastward from Mt. Tamalpais, in suburban areas distant from native conifers: on the eastern bay shore of Marin County at Strawberry Point in the grounds of a seminary in 1973 and in an urban yard in Belvedere in 1980; and across the bay, at Pt. Molate, Contra Costa Co. in 1989, in association with young Monterey pine in a park that was developed in the 1960's. In 1994 and 1995 *C. eryphon* appeared at several sites on both sides of the Berkeley Hills (Fig. 1). There is no record of this butterfly in the East Bay area (Contra Costa and Alameda counties) prior to 1989 (Opler & Langston 1968, Steiner 1990).

During 1994, single females were observed in urban gardens in Kensington and Berkeley, and east of the Berkeley Hills at San Pablo Reservoir males perched on understory shrubs in a mature Monterey Pine woods planted more than 50 years ago. Additional individuals were encountered on four dates in 1995: near Pt. Richmond, on the University of California (UC) campus, in Strawberry Canyon at the UC Botanic Garden, and at 425 m elevation in the Berkeley Hills near the southern end of Grizzly Peak Blvd. At each of these East Bay sites, adults were active in the vicinity of *Pinus radiata*.

Any of these populations could have much older origins than the records document.

FIG. 1. Central California, showing positions of counties mentioned in the text. Inset (below) depicts spatial and temporal distribution of *Callophrys eryphon* in Marin, San Francisco, Contra Costa, and Alameda counties adjacent to San Francisco Bay. Presumed native colonies in Marin County (filled symbols) are associated with native conifers; dated localities (half-filled symbols) refer to adventive colonies associated with Monterey pine plantings; no *C. eryphon* were seen at several peripheral East Bay sites in March–April 1995 (open symbols).

Nevertheless, because there is a long history of extensive Monterey pine planting in the cities around San Francisco Bay, in gardens, parks, at reservoirs, etc., the lack of older records suggests that the recent collections of *C. eryphon* reflect recent range extension. In 1994–95, the butterfly was encountered in the Berkeley area by four observers independently, one a novice collector in an introductory entomology course, each unaware of any prior occurrence of *C. eryphon* in the area. The evidence indicates the elfin has become established in Contra Costa and Alameda counties in quite recent years.

If this is true, why did the butterfly fail to colonize *Pinus radiata*, other than in San Francisco, at a much earlier date? Although *Callophrys eryphon*, *Pinus radiata*, and *P. ponderosa* are native species in central California, none occurred naturally in the East Bay area. Thus, this adaptation to non-native situations may be comparable to that of many in-

troduced insects, which undergo a sequence of introduction-establishment, then a long period of naturalization, followed by rapid range extension. Such delayed ecogeographical expansions are believed to involve increased genetic fitness to environmental conditions to which the founder populations were not adapted (e.g., Powell 1983, 1992). Presuming the eastward colonization of *C. eryphon* is recent, it seems reasonable to suppose that this handsome butterfly is becoming a widespread urban resident of the East Bay.

In the Canadian Forest Insect Survey, host tree preferences of *C. eryphon* in Alberta and British Columbia, based on 187 larval collections, were 83% on several species of pines (70% on lodgepole pine), 3% on other Pinaceae, namely Douglas-fir and western hemlock (*Tsuga heterophylla*), and 14% on *Thuja plicata* (Cupressaceae) (McGugan 1958). In California, there are no records of larval *C. eryphon* collections from Pinaceae other than *Pinus* (Garth & Tilden 1986, Powell & De Benedictis 1995).

Collection data for San Francisco Bay region (sr = sight record; sw = slightly worn; w = worn): Napa Co.: 2 mi. N Angwin, IV-26-73, IV-17-77, assoc. *Pinus ponderosa* (R. L. Langston). Sonoma Co.: 3 mi. W Plantation, V-5-55 (Langston); 4 mi. W Plantation, V-25-57 (J. Powell); Plantation, 800 ft. elev. V-16-58 (O. E. Sette), V-29-60 [P. A. Opler]. Marin Co: Inverness, V-18-63 (C. A. Toschi), Inverness Ridge 800–1040', V-15-70, V-10-74, assoc. *Pinus muricata* (Powell), IV-25-76 (E. Schlinger, M. Helena), IV-22-78 (Powell), IV-26-96, in 1995 fire zone (Powell); Mt. Vision, IV-24-82 (Powell); 1 mi. SW Lagunitas, III-21-70 (Opler); Mill Valley, IV-4-1908 (F. X. Williams); Strawberry, Golden Gate Baptist Seminary, III-28/31-73 (♂♂ ♀♀) (V. & L. Donahue); Belvedere, IV-6-80 (sw ♂) (Powell). Contra Costa Co.: Pt. Molate Beach, IV-6-89 (sw ♂) (Powell); Pt. Richmond III-16-95 (sw ♀) (Powell); Kensington, IV-13-94 (sr) (Langston); San Pablo Reservoir, IV-18-94 (sw ♂♂) (Powell); Berkeley Hills, nr. jct. Grizzly Peak-Skyline Blvds., IV-14-95 (sw ♀) (Powell). Alameda Co.: Berkeley, nr. La Loma Park, IV-30-94 (w ♀) (D. Rubinoff); UC Botanic Garden, Strawberry Cyn., III-28-95 (sr), IV-10-95 (sw ♀), III-6-96 (sr) (Powell); UC Campus, IV-5-95 (w ♀) (K. Wong). San Francisco Co.: San Francisco, III-29-1929 (W. D. Field), III-15-1931 (R. G. Wind), V-5-35 (M. Doudoroff); Presidio, IV-16-49 (L. I. Hewes), IV-12-50 (E. S. Ross), Presidio nr. Baker Beach, IV-15-50 (J.W. Tilden).

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DIURNAL LEPIDOPTERA OF NATIVE AND RECONSTRUCTED PRAIRIES IN EASTERN MINNESOTA

Additional key words: surveys, species richness, vagility.

Prairie butterflies are subjects of increasing conservation concern. Their habitat has been greatly diminished, and their ability to survive on managed sites and to colonize new sites or recolonize old ones is in doubt (Opler 1991). In this paper I report on and compare the diurnal Lepidoptera communities of both native and reconstructed prairies in Minnesota.

I collected insects from the flowers of 58 forb species in four native prairie sites and four prairie reconstructions (former agricultural areas recently replanted to prairie) during the summers of 1990, 1991 and 1992. The sites are described in Table 1. Insects were collected between 0900 h and 1600 h on sunny or partly cloudy days when the temperature was between 20° and 35° C. Collections were made from late May to late September. I made one 15 min aerial net collection of insects on the flowers of each forb species with at least 100 flowers or inflorescences open, for a total of 507 collections from all forb species in all sites over the three summers. Thus, the number of collections made from a site was closely related to the number of forb species present in populations large enough to produce 100 or more flowers. Although only a small fraction of the Lepidoptera present on a site can be sampled by daylight collections, many of the species of conservation concern are diurnal.

The 507 collections yielded 3702 insects representing 305 species; 295 of these were identified at least to genus (Reed 1995). There were 118 Lepidoptera individuals representing 28 species: 24 butterflies and four diurnal moths (Table 2). Insect vouchers are deposited in the University of Minnesota Insect Museum, and plant vouchers are in the University of Minnesota Herbarium.

Collections in native sites produced greater species richness than in reconstructed sites: 73 individuals and 21 species in 218 15-min collections from native sites, compared to 45 individuals and 16 species in 289 collections from reconstructions. Five of the 28 species collected were described as prairie obligates by Orwig (1992): *Callophrys gryneus* (Hubner), *Hesperia l. leonardus* Harris, *H. l. pawnee* Dodge, *Polites origines* (Fabr.) and *Satyrium edwardsii* (Grote & Robinson) and an additional four species were described as remnant-restricted by Panzer et al. (1995): *Euphyes conspicua* (Edw.) *Harkenclenus titus* (Fabr.), *Speyeria aphrodite* (Fabr.) and *Thorybes pylades* (Scudder). Of these nine species, eight were collected from native sites only, none from reconstructions only, and one was collected from both native and reconstructed sites. Of the 19 species not considered site-restricted, four were collected from native sites only, seven from reconstructions only, and eight from both native and reconstructed sites (Table 3).

Management practices do not appear to account for the differences in species presence among sites. There are no obvious differences in management between native sites and reconstructions as a group: the large sites are burned in sections, while the small sites