C. CALLIPPE BEHAVIOR

1. Nectar Plants

Callippe are quite flexible in their nectaring requirements, being able to change from one suitable flower to another according to availability. A wide variety of plants were used for nectaring including both natives and exotics; however, composites and other species with compound flower heads were by far the most popular nectar sources.

The TRA observations summarized in Tables IV - 4, IV - 5, and other unrecorded observations of nectaring, support the picture of the primary Callippe nectaring plants described in IV.B above. The primary plants are Carduus spp., Cirsium sp., Silybum sp. (Thistles), and Monardella villosa (Coyote Mint). Secondary nectaring plants include Chrysopsis villosa (Golden Aster) and Eriogonum latifolium (Buckwheat). These plants are important because they are widely distributed over the grassland and are also good sources of nectar. Although these plants were flowering during most of the adult flight season, various other plant species were used to a lesser degree throughout the season, particularly near the end of the season when the primary and secondary sources were beginning to senesce. The California Poppy, Phacelia, Dudleya, and Sidalcea were observed as possible nectar plants once or twice during the study. It was a surprise to see these plants being used since they are thought to be poor nectar sources (Arnold, 1981 pers. comm.), but the proboscis was clearly observed at close range repeatedly probing the flowers. However, according to Arnold, the probing could also indicate that the butterflies were not able to reach the nectar.

Nectaring time varies throughout the day and is affected by weather conditions. Under average conditions nectaring takes place all day; on hot days, it is reduced towards the hottest part of the afternoon while the insects rest in the shade. During severely windy or cold weather nectaring, as well as most other activities, is greatly reduced throughout the day. The butterflies nectar in conjunction with a variety of activities such as hill-topping, traveling, and sunning. However, they do not seem to nectar while egg laying.

2. Barriers

The behavior crew made systematic observations of Callippe interactions with various potential barriers. In addition, mark-release-recapture field records were also examined for evidence of barrier crossings. Circumstances for quantitative testing of barrier response could not be established on San Bruno Mountain. Field observations were extensive enough to yield a reasonable picture of Callippe responses to barrier situations (see Table IV - 6). The observations do not lead to a quantitative statistical assessment of the effect of barriers since successful barrier crossings were more likely to be noted by the field crew than instances in which barriers inhibited crossings.

In contrast to the Mission Blue, the stronger, larger Callippe is fast and direct in flight. The Mission Blue fly erratically through scattered brush and often land on nearby vegetation, while Callippe fly one to three meters above the ground or above brush. Callippe's strong flight takes it over dense brush, scattered trees, burned areas, and major paved roads. It is apparently restricted from crossing dense stands of trees, and it was never

seen penetrating the Industrial Park or nearby urban areas. Callippe were found in some residential yards adjacent to the grassland near the southern edge of Brisbane.

3. Hilltopping Analysis

Unlike the Mission Blue, the species Speyeria callippe has been consistently described in the butterfly literature as a hilltopping species. (Please see Section IIIC, Hilltopping Analysis of the Mission Blue, for a definition and description of hilltopping behavior.) In Shields (1967) three subspecies of Speyeria callippe are described as "known" hilltopping species, and in Scott (1968) Speyeria callippe was also categorized as a hilltopper. Finally, Arnold (1981) observed that in Speyeria callippe callippe males were often found congregating on hilltops where they patrolled the habitat in search of females. To determine whether our field experience with Callippe agreed with earlier sources, Callippe MRR data were subjected to the same statistical analysis as Mission Blue data. Please refer to Section III.C for the methodology used in the analysis.

The results of the analysis shown in Table IV - 7 confirm that Callippe is a hilltopping species. About 62%* of all males caught in the hilltopping study area were found on hilltops, while only 48% of the females were. In addition, of the males found there, 54% were recaptures, and both new and recaptured animals displayed all states of wing condition from fresh to battered. These three items suggest that males do congregate on hilltops, and tend to remain or return to them throughout their lifespan, as is characteristic of hilltopping species. Females, on the other hand, were captured with roughly equal frequency on or off hilltops. It was expected that fresh females would be found more often on hilltops seeking mates or recently mated. The data are suggestive -- namely 66% of the females found on hilltops were fresh, while only 57% were found in a fresh condition off hilltops. The G-test, however, is non-significant (female condition is independent of hilltop location (Table IV - 7)).

The strong flight and high mobility of Callippe are also consistent with hilltopping. These characteristics allow the animals to orient to hilltops within a much larger habitat area.

4. Territoriality

Typical "territorial" or "area occupation" behavior observed consisted of the aggressive chasing of both the same and other species, and spiralling which is an upward flight of two or more insects spiralling around each other in a brief display. Such behavior is part of the aggressive patrolling of hilltops which increases the probability that dominant males will mate (Shields, 1967). The chasing behavior was commonly initiated either from a high perch or from flight. Males of hilltopping species are known to exhibit this type of territorial behavior. However since it is difficult to sex insects in flight we could not definitely establish that the behavior was limited to males.

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* This percentage was calculated by dividing the number of hilltopping males by the number of males captured in the area. In this case 183 added to 111 equals 294 and 183 divided by 294 equals .62. When .62 is multiplied by 100 we obtain the 62 percent.

TABLE IV - 6
SUMMARY OF CALLIPPE RESPONSES TO VARIOUS BARRIER SITUATIONS*
(Listed in order of Severity)

Barrier	Effect
1. Heavily built up areas such as nearby cities and industrial parks	Nearly total barrier; no observed penetration in the Industrial Park or in nearby cities.
2. Dense plantings of tall trees such as along Eucalyptus Road	Severe barrier; occasional penetration; observed preference for relatively clear corridors (20'wide)
3. Major paved roads, four lanes or more (Guadalupe Canyon Pkwy.)	Partial barrier; observed some crossings with some turning back. Transfer data show several crossings.
4. Burned areas	Partial barrier; observed some travelling across, others refused to enter.
5. Adjacent residential lots	Partial barrier; observed some in yards adjacent to mountain; did not penetrate far down into the neighborhood.
6. Scattered trees such as buckeyes in creek	Minimal barrier; observed skirting edges of creek, and flying between and over trees in creek
7. Dense Brush	Minimal barrier; rarely turned back or funnelled into natural corridors; often flew over, around, or through
8. Cyclone fence (7' high)	No barrier; observed flying over and through fence
9. Smaller paved and dirt roads like Randolph Ave. and fire roads	No barrier; frequently crossed and travelled along
10. Scattered Brush	No barrier.

* - See Figure IV - 20 for illustrations of each barrier type.