Journal of the Lepidopterists' Society
35(3), 1981, 240–242

GENERAL NOTES

LEAF SELECTION FOR OVIPOSITION SITES BY A TROPICAL SKIPPER BUTTERFLY

This communication reports preferential oviposition by a skipper butterfly. *Phocides lilea sanguinea* (Scudder) (Hesperiidae) is a Neotropical skipper which occurs as far north as Brownsville, Cameron County, Texas (Neck, 1978, J. Lepid. Soc., 32: 107–110). All observations of *sanguinea* involve this skipper on strawberry guava, *Psidium cattleianum* Sabine (Myrtaceae) (see Bailey, 1949: 729, Manual of Cultivated Plants, Macmillan, New York), a native of Brazil grown in parts of the United States and Mexico (Standley, 1920–1926: II, 1036; Contrib. U.S. Nat. Mus., 23: 1721 pp.).

While a tremendous amount of data exists in the literature concerning reports of larval foodplants of numerous species of butterflies and skippers, only a small fraction of references refer to the specific plant parts attacked, especially with reference to old vs. new leaves. Little, if any, numerical data concerning intra-plant oviposition discrimination by skippers are available in published form. Practically every temperate zone lepidopterist "knows" that fresh plant growth is preferred by many larval forms. A number of workers (Owen, 1972, Oikos, 23: 200–205; Young, 1972, Psyche, 79: 165–178) have reported that a particular species feeds or oviposits preferentially or exclusively on new growth leaves. One butterfly has even been reported to prefer "young trees" (Muyshondt & Muyshondt, 1976, J. N.Y. Ent. Soc., 84: 23–33). Larvae of the mangrove skipper, *Phocides pygmalion okeechobee* Worthington, were found on "small specimens of red mangrove, *Rhizophora mangle*, which were in heavy shade cast by higher growth" (Strohecker, 1938, Ohio J. Sci., 38: 294–295). However, young leaves are not always the preferred ovipositional substrate. Some tropical heliconians are reported to preferentially oviposit on older leaves (Alexander, 1961, Zoologica, 46: 1–24; Benson et al., 1976, Evolution, 29: 659–680).

On two occasions egg counts of *sanguinea* were made on a single *Psidium* in a residential yard in Brownsville.

On 23 December 1970 a count was made of all leaves on this shrub. Two types of leaves could be differentiated visually at that time. Young leaves exhibited a general yellowish-green coloration with larger veins colored a darker green. Old leaves were a darker green in which veins and matrix were unicolorous.

On 30 November 1975 a second count of *sanguinea* eggs was made. As the selection of terminal leaves for oviposition had already been established, only eggs on these terminal leaves were counted. (A quick perusal of the plant revealed no eggs on non-terminal leaves.) Terminal leaves at this time consisted of three types of leaves. In addition to young and old leaves as previously described, the shrub also contained new leaves. New leaves were generally a rich bronze-green in color; many had not reached full size.

Table 1 contrasts the number of young and old leaves which contained eggs. The results indicate a decided tendency for eggs to be oviposited on young leaves. These data indicate that 92.0% of the eggs were laid on young leaves even though only 51.3% of the leaves on the shrub were classified as young. Further examination of the distribution of *sanguinea* eggs reveals an additional ovipositional discrimination. Leaves of *Psidium* occur in opposite pairs. Eggs found on immature leaves can be further divided into eggs on one leaf of a terminal pair (rarely a single terminal leaf) and eggs on non-terminal leaves. Examination of the data (Table 2) reveals a decided preference for terminal leaves. Although 87.0% of the young leaves with eggs were terminal leaves, only 36.1% of all young leaves are terminal leaves. Only 3.2% of all the leaves of this shrub contained a *sanguinea* egg while 12.8% of the terminal leaves contained eggs.

Few eggs were present on 30 November 1975, but four of the five eggs were on new leaves. No eggs were found on old leaves. At this same time seventeen early-instar larval retreats (see Neck, op. cit.) were located (most were associated with egg shell remnants); all were on new leaves. If one adds these larvae to the egg count, the difference is very significant (Table 3). Therefore, not only do adult females almost

TABLE 1. Eggs of *Phocides lilea sanguinea* on young and old leaves of *Psidium cattleianum* on 23 December 1970.

Leaf type	Leaves with no eggs	Leaves with eggs	Total
Young	376	23	399
Old	376	2	378
Total	752	25	777

$\chi^2_{(1)} = 32.9$; $P \ll .001$.

exclusively oviposit on terminal leaves, but new leaves are preferentially chosen over older leaves.

Additionally, the data collected on 23 December 1970 can be examined to determine whether there is any tendency for females to oviposit on leaves which do not already contain eggs. Of the twenty-five leaves which contained eggs only two contained two eggs; no leaf contained more than two eggs. The observed two-egg-leaf frequency is 0.0026 (2 double-egg leaves of 777 total leaves), while the expected value, assuming leaf selection random with respect to presence/absence of egg, is 0.0012 (27 eggs on 777 leaves squared); this difference is not significant (d = 1.17; P = .24). These data do not indicate a significant tendency for ovipositing females to avoid laying an egg on a leaf which already contains an egg.

Preference for terminal leaves by *sanguinea* for oviposition sites could result from several factors. Larvae may be able to assimilate material from young, and/or new leaves more efficiently because of reduced levels of toxic phytochemicals as is known for other lepidopterans. Larvae of the winter moth (Geometridae: *Opherophtera brumata* (L.)) are known to gain more weight on new growth than old growth of oaks (Feeny, 1970, Ecology, 51: 565–581). Mature leaves are unacceptable, because high levels of tannic acids are produced following attainment of full leaf size. The general assumption is that immature leaves are more palatable due to low levels of deterrent and/or poisonous phytochemicals. This lower level allows more rapid development, decreasing the larval period with attendant exposure to parasites and predators. Larvae reared on immature leaves tend to be of greater weight which would seem to allow greater fecundity.

An argument might also be made that the rigid ovipositional behavior sequence of *sanguinea* as described previously leads to selection of terminal leaves simply because they are more accessible to quick ovipositional dips onto the foodplant. However, the behavioral choice of these leaves would be the result of natural selection because of increased survival of eggs placed on these leaves. The behavioral sequence is the result of a need to oviposit on new leaves; the choice of new leaves is not the result of a pre-determined ovipositional sequence. Newman & Clark (1926, Austral. For. J., 9: 95–99) reported that the jarrah leaf miner moth (Incuvariidae: *Perthida glyphoga* Common) preferentially oviposits in leaves near the ground, because adults laid eggs

TABLE 2. Distributions of eggs of *Phocides lilea sanguinea* on young leaves of *Psidium cattleianum* on 23 December 1970.

Leaf type	Leaves with no eggs	Leaves with eggs	Total
Terminal	136	20	156
Non-terminal	240	3	243
Total	376	23	399

$\chi^2_{(1)} = 21.3$; $P \ll .001$.

TABLE 3. Distribution of eggs and larvae of *Phocides lilea sanguinea* on terminal leaf pairs of *Psidium cattleianum* on 30 November 1975.

Leaf type	Without eggs or larvae	With eggs or larvae	Total
Young	65	1	66
New	23	21	44
Total	88	22	110

$\chi^2_{(1)} = 32.4$; $P \ll .001$.

on the first suitable leaves discovered and tended to remain in the lower part of the foliage. Subsequently, Wallace (1970, Austral. J. Zool., 18: 91–105) reported numerical data revealing a preference of *P. glyphoga* for younger, more succulent leaves.

Although comparative laboratory and/or field feeding experiments would be required for verification, I believe that placement of eggs on new leaves under growing conditions is an adaptively advantageous site, because such leaves represent a superior nutritive resource. The most efficient method to achieve the above location is to lay eggs on a terminal leaf. Depending upon seasonality of growth of the foodplant, the egg may actually be laid on a new leaf. Jennings (1975, Ann. Ent. Soc. Amer., 68: 1008–1010) reported that females of the southwestern pine tim moth (Tortricidae: *Rhyacionia neomexicana* (Dyar)), preferentially oviposit on leaves of upper crowns of small pine trees. Larvae are then able to locate the nearby growing meristems which provide superior food.

RAYMOND W. NECK, *Texas Parks and Wildlife Department, 4200 Smith School Road, Austin, Texas 78744.*