POLYMORPHISM IN *PAPILIO GLAUCUS* L. (PAPILIONIDAE): MAINTENANCE OF THE FEMALE ANCESTRAL FORM

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The *Papilio glaucus* L. female is dimorphic. One form is dark and resembles *P.* (*Battus*) *philenor* L.; the other resembles the yellow male. The inheritance of female color is controlled by a Y-linked gene (Clarke & Sheppard, 1962). Yellow mothers produce yellow daughters and dark mothers produce dark daughters. Consequently the two morphs are in direct competition with each other; and, heterozygote advantage cannot be the mechanism which maintains the dimorphism.

The dark form of *P. glaucus* is thought to belong to the mimetic assemblage which surrounds *P. philenor.* Other members are *P. troilus* L., *P. polyxenes* (Fabricius), *Limenitis arthemis astyanax* (Fabricius), and the females of *Speyeria diana* (Cramer). The main evidence that the dark form of *glaucus* mimics *P. philenor* is the correspondence between the occurrence and abundance of the two. In general (Brower & Brower, 1962) the proportion of mimics is highest in the middle Atlantic States where *philenor* is common. This proportion decreases in a southerly and northerly direction as *philenor* decreases.

One hypothesis for explaining the maintenance of the dimorphic female population in *P. glaucus* is that the males show a mating preference for the yellow females. Burns (1966) has tested this hypothesis by counting the number of spermatophores present in the bursa copulatrix of the two morphs. He obtained data from two samples of females collected during the summer of 1965; one in the vicinity of Mountain Lake Biological Station, Giles County, Virginia, and the other in Baltimore County, Maryland. In each sample the mean number of spermatophores per female was higher in the yellow morph than in the dark morph (Mt. Lake, yellow morph-2.08 spermatophores, dark morph-1.69 spermatophores; Baltimore County, yellow morph-1.88 spermatophores, dark morphs-1.54 spermatophores).

The present study was suggested by the relatively small difference between the mean number of spermatophores per female (Mt. Lake sample, 0.39; Baltimore sample, 0.34) found by Burns. It seemed that further information about the insemination frequency in *P. glaucus* would be of interest.

Two hundred *P. glaucus* females were collected during August and

TABLE 1. Observed frequency distribution, expected frequency distribution (numbers in parentheses), and mean number of spermatophores in wild-caught females of *Papilio glaucus*.

Morph	Specimens (No.)	Number of Spermatophores				Mean Number of Spermatophores/ Female
		0	1	2	3	
Mimic	128	2 (2.56)	65 (65.92)	51 (51.84)	10 (7.68)	1.54
Yellow	72	2 (1.44)	38 (37.08)	30 (29.16)	2 (4.32)	1.44
Total	200	4	103	81	12	1.51

September of 1966, 1967 and 1968 from two valleys in Albemarle County, Virginia; one in the Blue Ridge Mountains (elevation 800′), the other approximately 24 miles east of the Blue Ridge (elevation 590′). The butterflies were found in abandoned fields in which thistle was growing. Streams and larval foodplant (*Liriodendron* and *Prunus*) were located nearby.

The females were either dissected immediately after they were caught or were frozen alive in a moist chamber and dissected later.

A comparison of the mean number of spermatophores per female (Table 1) shows that the yellow females ($\bar{x} = 1.44$) were inseminated less frequently than the mimic females ($\bar{x} = 1.54$). However, this difference is not significant ($\chi_{(2)}^2 = 2.07$; $.50 > P > .30$; categories 0 and 1 spermatophores combined). Statistical analysis also shows that there was no heterogeneity with respect to locality ($\chi_{(1)}^2 = .34$; $.80 > P > .70$).

The results, then, show that there is no difference in the frequency of insemination between the mimetic and yellow females in the population studied. These results conflict with those of Burns (1966) and with some but not all of the data collected by Levine (1970) from females found in the vicinity of Mountain Lake, Virginia.

The reason for the discrepancy between the two sets of data is not clear. It may be related to the altitude at which the butterflies are found, the relative frequency of the model in relation to the frequency of *P. glaucus*, or the relative frequencies of the two female morphs. The ratio of dark to yellow morphs is 6:1 in the Mountain Lake area and 2:1 in Albemarle County, while the yellow butterflies are preferentially inseminated at Mountain Lake and are inseminated equally as frequently as the mimics in Albemarle County. Thus, it is also possible that, as in the case of *Drosophila pseudoobscura* (Ehrman, 1967; Spiess, 1968), female mating advantage occurs in *P. glaucus*. That is, that where the morph is rare

it is inseminated more frequently. This hypothesis can be tested by obtaining data on the relative frequency of insemination of mimic females in populations where the proportion of the mimics is small.

While the mechanism which maintains the dimorphism in *P. glaucus* is not yet clearly understood, the evidence collected to date shows that regional differences exist in the frequency with which the two female morphs are inseminated.

ACKNOWLEDGMENT

This research was done while working in the laboratory of Dr. J. J. Murray, Jr., in the Department of Biology, University of Virginia, Charlottesville, Virginia. My thanks to Dr. Murray for his encouragement and for the use of his laboratory facilities.

LITERATURE CITED

BROWER, L. P. AND J. VZ. BROWER. 1962. The relative abundance of model and mimic butterflies in natural populations of the *Battus philenor* mimicry complex. Ecology 43: 154–158.

BURNS, J. M. 1966. Preferential mating versus mimicry: disruptive selection and sex-limited dimorphism in *Papilio glaucus*. Science 153: 551–553.

CLARKE, C. A. AND P. M. SHEPPARD. 1962. The genetics of the mimetic butterfly *Papilio glaucus*. Ecology 43: 159–161.

EHRMAN, L. 1967. Further studies on genotype frequency and mating success in *Drosophila*. Amer. Natur. 101: 415–424.

LEVIN, M. P. 1970. The biology of *Papilio glaucus* L. as it relates to polymorphism and mimicry. Doctoral dissertation, Virginia Polytechnic Institute, Blacksburg, Virginia.

SPIESS, E. B. 1968. Low frequency advantage in mating of *Drosophila pseudoobscura* karyotypes. Amer. Natur. 102: 363–379.

PSEUDOPHILOTES BEURET, 1958

In a recent article of mine about *Glaucopsychie piasus* I called attention to the fact that *Philotes sonorensis*, the type species of Scudder's genus, is generically different from the rest of the genus found in North America. This requires a different name for *enoptes* and its allies. Such a name has been proposed. It is *Pseudophilotes* Beuret, 1958, with European *baton* as its type species. *Baton* is cogeneric with *enoptes*, et al.

The probable reasons for this generic name being overlooked by American taxonomists are two: the *Zoological Record* citation made no mention of nearctic members in *Pseudophilotes*; the paper in which the name was proposed is in a journal rarely seen in North America. The full citation for the description of *Pseudophilotes* is: Beuret, H., 1958, "Zur systematischen Stellung einiger wenig bekannter Glaucopsychidi (Lep., Lycaenidae)" *Mitt. ent. Ges. Basel* (*N.F.*) 8: 61–79, 1 pl., 12 figs.; 8: 81–100, 13 pls. The original description begins on page 100.

I wish to thank Dr. Lionel G. Higgins for calling this publication to my attention.

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