The Great Lakes Entomologist

Volume 23
Number 3 - Fall 1990 *Number 3 - Fall 1990*

Article 1

October 1990

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TWO NEW ABERRANT FORMS OF TIGER SWALLOWTAIL BUTTERFLY FROM THE GREAT LAKES HYBRID/TRANSITION ZONE (LEPIDOPTERA: PAPILIONIDAE)

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ABSTRACT

Two aberrant forms of the tiger swallowtail butterfly. *Papilio glaucus*, are described. Both of these aberration types (one in a male, the other in females) are believed to be previously unreported and both are from the Great Lakes hybrid zone and plant transition zone (41°–44°N latitude). It is, therefore, possible that genetic introgression from the northern tiger swallowtail *P. glaucus canadensis* may have been involved in some way with these abnormalities.

While the specific causes of aberrant forms of tiger swallowtail butterflies remain basically unknown, it has been noted that the frequency of unusual forms may be greater within, or near, the plant and insect transition zone (Curtis 1957, Remington 1968) that occurs throughout the Great Lakes region (Scriber et al. 1987). For example the distinctive *Papilio glaucus* "fletcheri" variety (Fletcher 1889), as far as reported thus far, occurs only in males and typically north of, or very close to the transition/hybrid zone of the *P. g. glaucus L.* and *P. g. canadensis R. & J.* subspecies (Scriber and Lintereur 1983; and T.J. Allen, D. Mutusik, H. Romack and J.D. Zelias, pers. comm.). A different "dark cell" aberration has a genetic basis and was reported only from females which also originated within the subspecies transition zone in Schuykill County, Pennsylvania (Scriber and Evans 1988a). A large series of 42 sexual mosaics and bilateral gynandromorphs of *Papilio glaucus* (most of which are from the hybrid zone) is illustrated and described by Scriber and Evans (1988b), and it is concluded that intersubspecific pairings may be conducive to the infrequent occurrence of bilateral gynandromorphs.

Another low frequency phenomenon that may occasionally be related to hybrid interactions between subspecies of *Papilio glaucus* is the occurrence of "melanic intermediates" in which the dark morphotype female has incomplete expression (see figures and descriptions in Clark 1932, Clark and Clark 1951, Scriber et al. 1987). In these "intermediate" females the underlying black tiger striping pattern may be clearly visible with mostly yellow background, appearing lightly "dusted," or they may be essentially non-distinguishable due to a much heavier suffusion of dark scales, resulting in an "intermediate" color series or continuum. While partial dark suppression from *P. g. canadensis* genes may be involved (Scriber et al. 1987, Scriber et al. in prep.), these "dark intermediates" are known from nearly every state east of the Mississippi River, and it has been shown that the phenomenon can be environ-

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mentally induced in *P. g. glaucus* by high temperatures (Ritland 1986, R.C. Lederhouse and J.M. Scriber unpublished).

A slightly aberrant "sooty" region basally in both the dorsal and ventral sides of the forewings and hindwings was noted in female *P. g. glaucus* by Clark (1932) and Clark and Clark (1951). A similar darkened inner wing pattern was subsequently noted in a male *P. g. glaucus* and certain of his unique offspring (possibly involving a chromosome abnormality) that included dark segregating females where they were not expected to be possible, including offspring of a *P. g. canadensis* female (Scriber and Evans 1986).

Here, two new and different types of aberrations are described, which have not been previously reported as far as is known. One of these aberrations was found in a male from the potential hybrid zone of *P. g. glaucus* and *P. g. canadensis*, and the other aberrant form is represented by two females of two different family lines from the same hybrid zone population in Green Lake County, Wisconsin.

RESULTS

In the last 8 years our lab has reared more than 40,000 tiger swallowtail butterfly larvae. We have reared approximately 20,000 to the adult stage. In addition, we have collected from widespread geographic areas across the eastern half of the country. Two types of aberrations are described below that we have not seen in any of the other individuals we have reared or collected in the field.

The first aberration, which is described in this paper, appeared in a male. In males, the blue scales in the submarginal area are usually reduced on the hindwings; however, this blue extends across most of the hindwings of females and often into the forewing. This aberrant male was reared from stock sent by William Houtz (Schuykill County, PA) and has the blue scaling essentially as in normal females (Fig. 1).

The second aberration occurred in two females reared from the same population in Green Lake County, Wisconsin. These females have an atypical melanism and atypical wing pattern (Figs. 2 and 3) compared to normal *P. g. glaucus* or *P. g. canadensis* (Fig. 2). The black band on the hindwing virtually fills the entire anal cell, and there is essentially no blue scaling on the dorsal or ventral wing surfaces as in most *P. g. glaucus* and *P. g. canadensis* females. These two females were reared from separate mothers, however, each originated from normal appearing yellow morph field-captured mothers from Green Lake County (see Table 1).

DISCUSSION

The control of blue scaling of the hindwings of *Papilio glaucus* subspecies has not been genetically determined yet (see West and Clarke 1988). There is also considerable variation in the blue scaling patterns observed among our voucher collection females (e.g. with blue scaling suffused across the entire dorsal surface of the hindwings) and males (with no blue scales). However, these two female individuals from Green Lake County Wisconsin represent an extreme case of reduced blue hindwing scaling and extra melanism. The aberrant male with unusually excessive blue scaling also represents an extreme case. It otherwise has basically similar patterns to other normal *P. g. glaucus* males. We know of no other previous record or existing specimens of these types.

We are unable to determine if introgression from hybrid interaction of *P. g. glaucus* and *P. g. canadensis* was involved in either of these aberrants (Figs. 2 and 3); however, both are from the near vicinity of the known subspecies hybrid zone across the Great Lakes region southward into the Appalachians (Luebke et al. 1988, Scriber and Hainze 1987). Other individuals caught in the exact location as the two females from Green Lake Co., Wisconsin do produce mixed color broods of daugh-

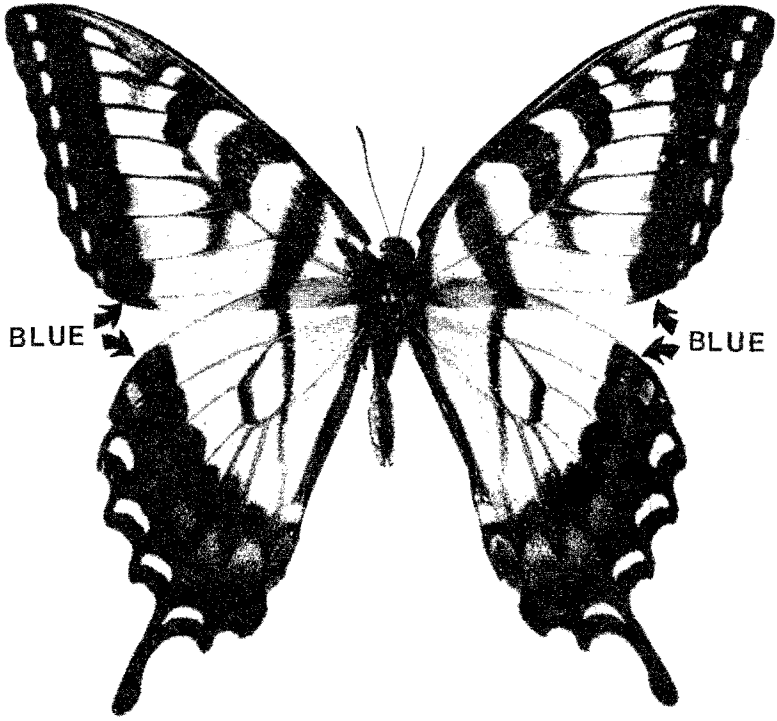
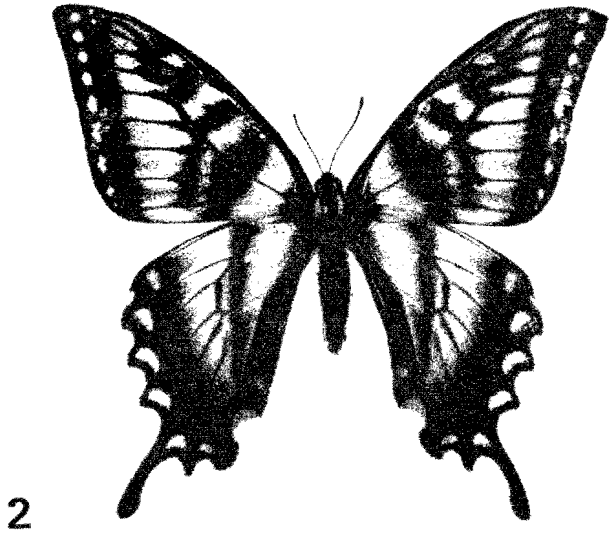


Figure 1. Dorsal view of an aberrant male *P. glaucus* reared from a mother (#16) collected by W. Houtz from Schuykill County, Pennsylvania.

ters (both dark mimetic and yellow) and are often computer-scored as hybrids using multivariate discriminant analyses of male wing characteristics (Luebke et al. 1988), suggesting that subspecies introgression does occur in this area (Scriber 1990, and Scriber et al. 1990).

ACKNOWLEDGMENTS

This research was supported by the Michigan State University College of Natural Sciences and the Agricultural Experiment Station (Project 8051) and in part by the National Science Foundation (BSR 8306060, BSR 8718448), USDA grants #87-CRCR-1-2851, and the Graduate School and College of Agricultural and Life Sciences (Hatch 5134) of the University of Wisconsin. Special thanks are extended to the following people for their assistance in field collections for this study: Mark Evans, William Houtz, Sean Sippl, Jeff Thorne, and William Warfield.



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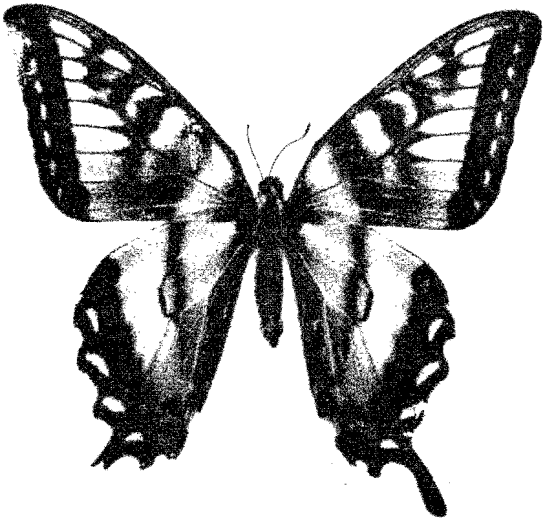

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Figure 2. Dorsal view of an aberrant yellow female *P. glaucus* reared from the female parent (#1310) collected in Green Lakes County Wisconsin by J. Thorne, S. Sippl, and M. Evans.

Figure 3. Dorsal view of another aberrant yellow female *P. glaucus* reared from the female parent (#1372) collected in Green Lake County, Wisconsin by W. Warfield.

Table 1. — Siblings of the aberrant *Papilio glaucus* females.

PARENT	OFFSPRING				
(Brood #)	males	yellow females	dark females	dead pupae	aberrant colored females
1310[a] wild female (Green Lakes Co., WI)	5	13	0	1	1 (Fig. 2)
1372[b] wild female (Green Lakes Co., WI)	31	26	0	2	1 (Fig. 3)

[a]The mother (1310) produced 41 eggs, of which 10 were infertile and 31 became neonate larvae that were reared on black cherry, *Prunus serotina*. Twenty survived to pupation.
[b]The mother (1372) produced 137 eggs, 99 of which resulted in viable larvae (60 survived to pupation). They were on black cherry, *P. serotina*, balsam poplar, *Populus balsamifera*, and paper birch, *Betula papyrifera* and first instar survival was 45/57, 12/12, and 13/19 respectively. All larvae (n = 5) died on tuliptree, *Liriodendron tulipifera* and (n = 6) on *Ceanothis* spp.

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