

THE BREEDING IN CAPTIVITY OF THE HYBRID  
*PAPILIO RUTULUS* FEMALE  $\times$  *PAPILIO GLAUCUS* MALE

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Using the technique of hand-pairing (Clarke 1952) it has been found possible to hybridise many members of the *Papilio machaon* group of Swallow-tails, and the preliminary results of these crosses have already been reported (Clarke & Sheppard 1953 and in press). It occurred to us that the same technique might give useful information about other groups of Swallowtails, and during 1954 *P. glaucus* was bred in order to investigate the genetics of the dimorphism in the female. The results of this are not yet complete but during the work it was found possible, by hand-pairing, to hybridise *P. rutulus* ♀ with *P. glaucus* ♂ and this seems worth while reporting separately. It is not known whether hybrids between *P. glaucus* Linné and *P. rutulus* Lucas occur in nature but C. L. REMINGTON (personal communication, 1955) states:- "I have seen only two wild-caught specimens which closely resemble your hybrids, and both are from localities near the meeting-line between the ranges of the two species."

For our experiments *P. rutulus* pupæ were obtained from Washington State and those of *P. glaucus* from Chicago, Illinois. Both were kindly supplied through Mr. EUGENE DLUHY.

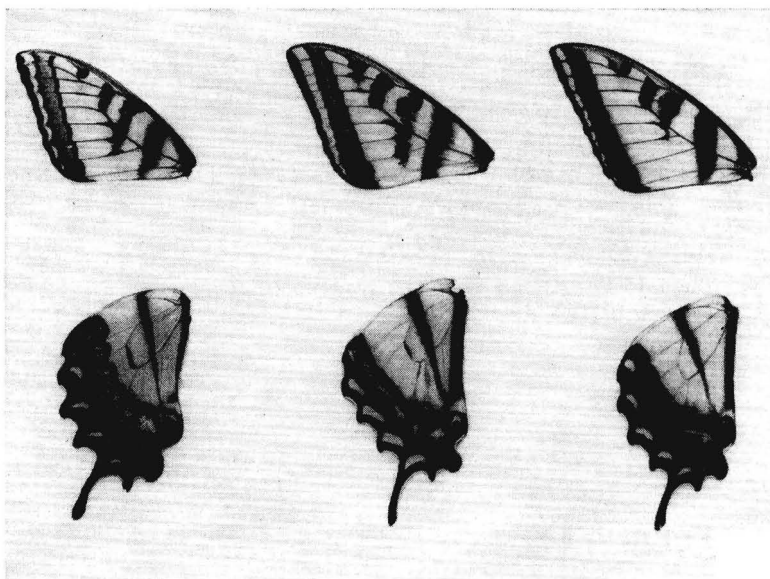
The male and female butterflies were mated (mating 249) on 13 June 1954, both parents having emerged a few days previously. The male had been bred by us from an earlier mating (mating 108, ♀ *glaucus* (yellow form) X ♂ *glaucus*).

The ♀ *P. rutulus* laid readily on *Liriodendron*, and 21 ova were deposited on 15 and 16 June. One of these failed to darken, but all the rest hatched. One larva died, and one was killed accidentally. The surviving hybrid caterpillars appeared to us to resemble those of *P. glaucus*, but it should be pointed out that we have never seen the early stages of *P. rutulus*. The larvæ fed readily on *Liriodendron* and, when supplies were low for a short period, they accepted *Syringa* (lilac). Pupation occurred at the end of July and the butterflies started to emerge on 11 August, three females emerging first. By 9 September all 18 butterflies had come out, 10 ♂ ♂ and 8 ♀ ♀; all of them had a yellow ground colour.

Edwards (1897) stated that the main difference between *P. glaucus* and *P. rutulus* lay in the character of the submarginal border on the underside of the forewings, — separate yellow lunules in *glaucus* and an unbroken yellow band in *rutulus*. Dr. REMINGTON (personal communication, 1955) states that this difference does not hold good for all localities and that it appears that the only character which is consistently clear-cut between the two species is the colour of the most anterior outer spot on the hindwing underside. This is orange in *P. glaucus* and yellow in *P. rutulus*. In addition, in some areas dimorphism in the female (yellow and black forms) is present in *glaucus* but never in *rutulus*.

In the hybrids the colour of the most anterior outer spot on the hindwing underside is yellow streaked with orange — that is intermediate between the two parent forms.

No dimorphism was present in the hybrid females, all being yellow, but it should be noted that their father had been bred from a yellow female and that his single sister was also yellow. Consequently, as the difference between the black and yellow forms of the female is almost certainly controlled by a pair of allelomorphs, it is not at all remarkable that only yellow females were produced.



Left, *P. glaucus*; center, *P. rutulus*; right, F<sub>1</sub> hybrid. Male forewings above, female hindwings below; undersides only. Large orange spot near outer angle of ♀ *glaucus* appears dark in photo.

In the particular *P. glaucus* and *P. rutulus* butterflies which were the parents of our hybrids the character of the sub-marginal border on the underside of the forewings showed very distinctly the differences noted by EDWARDS (see above). In the hybrids this band was intermediate (see photograph).

#### Fertility

Seven sib matings were obtained by hand-pairing the hybrids. Two females laid two and nine eggs respectively on *Liriodendron*, but all failed to show signs of development. The hybrid females were tested on *Liriodendron*, *Populus alba*, *Populus* sp., *Salix caprea*, and *Betula*.

Three backcross matings were obtained (see table).

BROOD NO.	MATING	EGGS LAID	SIGNS OF DEVELOPMENT IN EGGS	OFFSPRING		REMARKS
				♂	♀	
312	♀ 215 (yellow) × ♂ 249 (F <sub>1</sub> hybrid)	49	None	0	0	4 laid on <i>Populus alba</i> , remainder on <i>Liriodendron</i>
333	♀ 252 (black) × ♂ 249 (F <sub>1</sub> hybrid)	9	None	0	0	
334	♀ 249 (F <sub>1</sub> hybrid) × ♂ 237 (black mother)	13	One none, 12 hatched	5 3 still in pupa; one died as larva	3	all ♀ ♀ yellow

In the 8 backcross butterflies the colour of the most anterior outer spot on the hindwing underside was intermediate (hybrid-like) in 4 butterflies, yellow in 2, and orange in 2.

It is also of interest that the three females which have so far emerged are all yellow, but no deductions as to the genetics of the ground colour can be drawn from such a small number.

The fact that one backcross was fertile, as are many between species in the *P. machaon* group, allows the differences between the forms to be investigated genetically, and these are to be the subject of a further paper.

#### References

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