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TWO MOSAIC GYNANDROMORPHS OF *AUTOMERIS IO* (SATURNIIDAE)

THOMAS R. MANLEY¹

Bloomsburg State College, Bloomsburg, Pennsylvania

The recognition of a gynandromorph in nature is an exceedingly rare event. Hessel (1964) described a bilateral gynandromorph of *Automeris io* Fabricius taken at Washington, Connecticut. He refers to the capture of bilateral gynandromorphs of *Eacles imperialis* Drury taken at Pottersville, N. J. (1962) and *Callosamia promethea* taken at Crown Point, Indiana (1962) as momentous events in light of the extensively collected Saturniidae. The appearance of two gynandromorphs in a single season is unusual, and the data provided by these specimens is extremely valuable in understanding gene action.

In most Lepidoptera the female is heterogametic. Doncaster (1914), Remington (1954), and others have shown the female to have either a pair of non-homologous sex chromosomes (ZW type) or that one chromosome will be lacking (ZO type). The male possesses a homologous pair (ZZ type).

In *A. io*, the northern populations are polymorphic; the basic color of

¹ Research Affiliate in Entomology, Peabody Museum, Yale University, New Haven, Connecticut.

the male is yellow, while the female is a soft, rosy brown. Thus, cells of the male with ZZ chromosomes are expressed as yellow, while those of the female with a ZO chromosome complement are rosy brown.

The gynandromorphs described by Hessel (1964) were bilateral, one side of the body male, the other female. This bilateral condition may have been caused by a loss of a Z chromosome in the first cell division of the fertilized egg, or by the development of a binucleate ovum. Such gynandromorphs develop disproportionately in size because the female cells are larger. Consequently the female side is slightly larger than its male counterpart. Secondary sex characteristics such as form of antenna and the abdominal claspers, are quite obvious.

The gynandromorphs described in this paper are not bilateral, but mosaic. They are the first to appear in over 10,000 pupae observed by this author. Probably the loss or addition of the Z chromosome occurred at a later state in cleavage causing a disproportionate distribution of cells with a ZO chromosome expression in gynandromorph no. 19-69. Gynandromorph no. 18-69 suggests another possibility that a ZO cell in its division failed to form a cell membrane separating into two ZO cells, leaving a ZZ cell which produced male characteristics.

Gynandromorph 19-69 is predominantly male (Figure 1). The head and antenna are male, the prothorax and mesothorax are composed of male and female cells, the metathorax is female. The abdomen is male with a light dispersion of female cells. The upper surface of the right forewing which is slightly longer than the left, is predominately female with patches of male cells. The right hind wing is male with a band of female cells along the anal margin. The eyespot on the right wing is 11 mm by 7 mm while the left wing eyespot is 9 mm by 7 mm. The difference in size of the eyespots is caused by the band of female cells on the right wing whereas the left eyespot is composed entirely of male cells. The forewing undersides are unique in that identical patterns exist on both wings. A thin band of female cells is found along the costal margin, with a wide band of male cells extending from the subcosta radial₁ area to the medial₂ vein. The remainder of the wing is female except a small patch of male cells on the outer margin of the anal 2 area.

The right hind wing underside is male except for a narrow band of female cells from the center of the anal 2 area to the inner margin. The left hind wing underside is female except for male cells extending from the base along the distance from the base toward the apex.

In specimen 19-69 male cells are in greater proportion than female cells suggesting that initially the zygote was ZZ but loss of a Z chromosome in one cell occurred early in the cell cleavage phase causing the female ZO expression in all future cells developing from it.

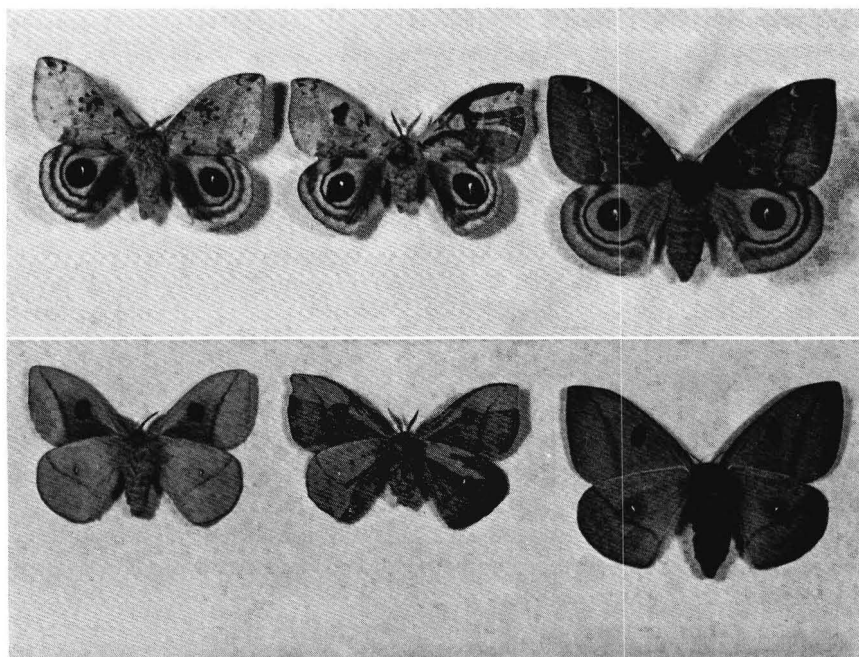


Fig. 1. *Automeris io* Fabr. Left, normal male; center, gynandromorph 19-69; right, normal female.

Gynandromorph 18-69 (Figure 2) represents one of the rarest expressions of the characters of *A. io*, the broken-eye blotch. This feature was discovered in 1965 among a group of pupae emerging that summer. It has since been bred to a population where its occurrence can be predicted. The genetics of the broken-eye blotch will be published later this year. Its size and coloration suggest it is more female than male. Comparing its size with normal specimens representing each sex shows this gynandromorph to be considerably larger than most males. This leads to an interesting speculation. Possibly the fertilized ova was female ZO which in early cleavage had a cell divide but fail to form a cell membrane dividing it into two equal cells. This may have resulted in a cell with a ZZ chromosome complement which produced only male cells.

The head of this moth is female, as evidenced by the rosy brown color and antenna. A few isolated patches of male cells are present, notably in the frons area. The thorax is predominantly female with an occasional cluster of male cells, the principal one found on the metathorax at the point of attachment of the right hind wing.

The terga of the abdomen is male with a few small patches of female

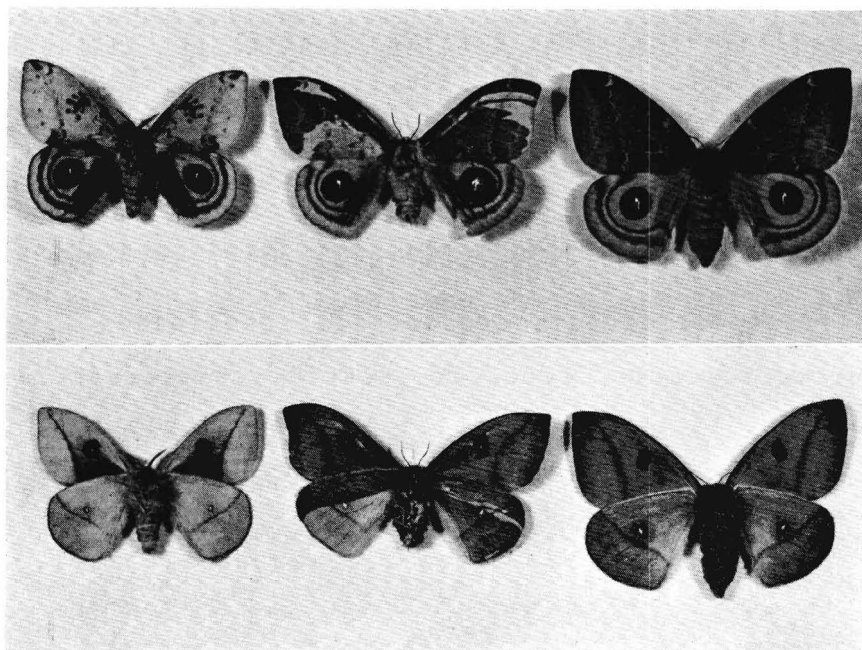


Fig. 2. *Automeris io* Fabr. Left, normal male; center, gynandromorph 18-69 with broken-eye blotch; right, normal female.

cells. The sterna is a mixture of male and female cells giving a mottled effect. The terminal, abdominal segment is male on the right side with a caudal tuft of hair covering the clasper. The left side is female. The legs are covered with a mixture of male and female colored hair-like scales.

The color patterns of the forewing uppersides are almost direct opposites. The areas on the left side which are male are female on the right side, and those that are female on the left side are male on the right. The indentation along the margin of the right forewing is due to the smaller size of the male cells in that area.

The right hind wing on the upperside is male; the left hind wing is female. The unique nature of this gynandromorph is enhanced by the multiple expression of the broken-eye blotch. Several complimentary genes control the expression of the blotch, and these act quantitatively. The male right forewing reveals the blotch as a single factor expression, whereas the female left wing shows the blotch in its full expression. The right wing measures 27 mm, the left wing measures 30 mm.

The forewing underside is female. The right hind wing underside is

female from the costal margin to the medial₂ vein; the remainder of the wing is male. The left hind wing underside is predominantly female with a few narrow lines of male cells, the principal one being a band in the anal area along the inner margin.

As additional information on the genetics of *A. io* is unraveled we may be able to interpret more fully the behavior of cells from zygote to the mature insect. Controlled breeding is revealing many more unique patterns of this beautiful moth.

Acknowledgments

The author is indebted to Mr. Larry J. Kopp, Klingerstown, Pa., who reared the larvae; to Dr. James Cole, Bloomsburg State College, who edited the manuscript, and to Dr. Bradford Sterling, Bloomsburg State College, for the photography.

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NEUTRON IRRADIATION IN *ANTHERAEA EUCALYPTI* SCOTT (SATURNIIDAE)

PHILLIP M. LIGHTY

Eaker Research Center, Stanford, California

Considerable attention has been directed at the entomogenetic effects of irradiation with 14.1 MeV neutrons. Measurements of neutron induced anomalies within chromosomes furnishes a biological dosimeter. Moulton and Meyer (1970) have found in *in vivo Drosophila melanogaster* that the frequency of structural abnormalities increases with the radiation exposure level. They demonstrated that the production of dicentrics and rings corresponds closely to a curvilinear dose response curve. Supportive evidence for this has been provided by McFee *et al.* (1970) in *in vivo* swine leukocytes and Gooch *et al.* (1964) in human somatic cells.

The present study offers the results obtained from irradiation of *in vitro Antheraea eucalypti* Scott tissue cells with 14.1 MeV neutrons.