

## INHERITANCE AND FREQUENCY OF $y$ GENE IN THE WHITE MARKED TUSSOCK MOTH

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Larvae of the white marked tussock moth, *Hemerocompa leucostigma*, were observed to have either yellow or white tussocks, dorsal paired tufts of hair. The inheritance of the color was studied to determine dominance and to calculate the frequency of the genes in the population.

The tussock moth is an excellent organism to study gene drift, mutation pressure, selection, and the effect of size of breeding population upon change of genetic constitution of the population. The female moth is flightless and grub-like in appearance, and the male is a weak flier. Upon emergence the female does not move from the remains of the pupa, and after fertilization lays her eggs around the shell of the pupa. Thus the dispersal of the moth is restricted.

During the summer of 1948 larvae were collected in Armour Square Park, Chicago, and isolated in half-pint milk bottles. The larvae were fed maple leaves and a few drops of water daily and kept in a room with a constant temperature of 20°C. The pupae from which the males emerged were smaller and usually lighter in color. There were no visible differences between pupae of females that were produced by larvae that had yellow or white tussocks.

Results of the matings are reported in table 1. It is evident that white tussock color is dominant over yellow, for in experiment D, the yellow female mated to a white male produced all white offspring in the first generation. Upon inbreeding the typical three-to-one Mendelian ratio is obtained with yellow tussock color ( $y$ ) as the recessive factor. The results from the matings made in experiment A indicate that sex-linked inheritance is ruled out for this set of alleles of tussock color. If the  $y$  gene were sex-linked then a yellow male when mated to a white female should produce all yellow females in the first generation (in moths females are the heterogametic sex); however, this is not the case. The  $y$  gene is an autosomal recessive one.

Table 2 is a summary of the counts of tussock color made during three summers. In the Chicago area there are normally two generations; the caterpillars are to be seen most frequently during the middle of July and at the end of August. The instar before pupation was one counted. One can see that white tussock moths number about 70 percent, which fact is reflected in that the full common name is the "white-marked" tussock moth. By means of the Hardy-Weinberg formula

TABLE 1.—RESULTS OF MATINGS OF *H. LEUCOSTIGMA*

A. White ♂ × yellow ♂	F <sub>1</sub> 41 ♂ white 44 ♂ white 0 yellow	F <sub>2</sub> 96 ♂ white 91 ♂ white 32 ♂ yellow 31 ♂ yellow
B. Yellow ♂ × yellow ♂	F <sub>1</sub> 94 ♂ yellow 97 ♂ yellow 0 white	F <sub>2</sub> 101 ♂ yellow 107 ♂ yellow 0 white
C. White ♂ × white ♂	F <sub>1</sub> 107 ♂ white 101 ♂ white 0 yellow	F <sub>2</sub> 151 ♂ white 163 ♂ white 0 yellow
D. Yellow ♂ × white ♂	F <sub>1</sub> 84 ♂ white 81 ♂ white 0 yellow	F <sub>2</sub> 89 ♂ white 95 ♂ white 32 ♂ yellow 30 ♂ yellow
E. White × yellow	F <sub>1</sub> 74 ♂ white 73 ♂ white 76 ♂ yellow 72 ♂ yellow	

(1, 2)  $q^2TT : 2q(1-q)Tt : 1-q^2tt$ , in which  $tt$  = homozygous recessive yellow tussock color, the percentage of population that is heterozygous for  $y$  and homozygous for  $Y$  can be calculated. The results of these calculations are presented in table 2. The frequency of gene  $y$  ( $t$ ) is approximately 55 percent, but since it is recessive it is apparent in only 30 percent of the population.

The  $y$  gene did not increase or decrease significantly during 1948, 1949 and 1950. The population with reference to gene  $y$  is stable. There

appears to be no selection for or against this gene or the chromosome in which it is located. This does not mean that there is no selection occurring in this organism; it means that there is no advantage or disadvantage to the organism when it contains  $YY$  or  $yy$  genes.

## REFERENCES

- HARDY, G. H., 1908, Mendelian proportions in a mixed population: Science 28.  
 WEINBERG, W., 1908, Über den Nachweis der Vererbung beim Menschen. Verein Vaterland. Naturk: Wurttemberg Jahresh 64:368-382.

TABLE 2.—FREQUENCY OF TUSOCK COLOR IN LARVAE IN ARMOUR SQUARE PARK, CHICAGO.

Year	White	Yellow	$q^2 TT : 2q(1-q) Tt : 1-q^2 tt$			$t$
			$YY$	$Yy$	$yy$	
1948.....	721	316	20.27%	49.26%	30.47%	.552
1949.....	1352	577	20.52	49.57	29.91	.547
1950.....	963	416	20.34	49.50	30.16	.549