SYNTHETIC STERILITY IN DROSOPHILA WILLISTONI*

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Viability is the component of fitness which has been given much attention and study in natural populations of Drosophila. The influence of homozygosis and heterozygosis on the viability of the flies has been investigated in several species. One of the interesting findings is that some of the crossover products of two chromosomes, each permitting normal viability in homozygotes, may be semilethal or even lethal when homozygous. Such synthetic, or recombinational, lethals due to epistatic interactions of blocks of genes in the same chromosome, were found by Dobzhansky,1 Wallace et al.,2 Spassky et al.,3 Dobzhansky et al.,4 Spiess,5 and Krumbas6 in five different species of Drosophila. On the other hand, Hildreth7,8 obtained no synthetic lethals in the X and third chromosomes of Drosophila melanogaster, and Gantner9 found none in the second chromosome of the same species, thus apparently contradicting the result of Wallace et al.2 The discrepancy is in part explicable. Synthetic lethals acting independently of sex are hardly expected in the X chromosome, since one third of the X chromosomes are carried in the population in the males; probably only synthetic lethals that would kill homozygous females but not males could be found. Gantner studied the crossover products of “wild” chromosomes and a laboratory chromosome bearing several recessive mutant genes. It is known, however, that only some chromosomes, or pairs of chromosomes, produce synthetic lethals, and the laboratory chromosome used by Gantner was not one of those. The lack of synthetic lethals in the third chromosomes in Hildreth’s experiments is not easily explicable. Meanwhile, proof of the existence of synthetic lethals has been given by Dobzhansky and Spassky10 by “desynthesis” of such lethals in Drosophila pseudoobscura.

It is interesting to inquire whether components of fitness other than the viability are subject to epistatic gene interaction effects analogous to synthetic lethality. Homozygotes for wild chromosomes from Drosophila populations are often sterile in females, or in males, or in both sexes. Does synthetic sterility exist? Ten second chromosomes yielding subnormal to normal viability in homozygotes were selected from the population of D. willistoni from Angra dos Reis, state of Rio de Janeiro, Brazil.11 Two of these chromosomes, designated as A and B, produce, when homozygous, sterile females and fully fertile males. A third chromosome, C, produces fully fertile homozygous females as well as males.

Intercrossing strains carrying the chromosomes A and B, we obtained six recombination chromosomes, two of which, when made homozygous, caused females as well as males to be completely sterile; three made sterile females but fertile males; and one, fertile in both sexes. From an intercross involving the chromosomes A and C, six recombination chromosomes were obtained, one of which, when homozygous, produced fertile females but sterile males, three gave sterile females; and two, fully fertile individuals of both sexes. Sixty chromosomes which were crossover products between five different chromosomes giving no sterility when
homozygous were also tested. All gave fertile female as well as male homozygotes.

The observations concerning the chromosomes A and B were confirmed by making a new intercross of the respective strains. This time 15 recombination chromosomes were isolated and studied for male fertility. Two of them gave sterile males. A re-check of the chromosomes A and B themselves confirmed the production of female sterility but male fertility. It should be noted that in Drosophila the gene complexes responsible for male and for female sterility are as a rule independent.

The above observations make the existence of synthetic sterility very probable but not wholly certain. The difficulty is that the mutation rates for genetically conditioned sterility are completely unknown in Drosophila. It would be interesting to inquire how many of the sterility factors encountered in artificial selection experiments are due to point mutations and how many to synthetic sterility. Recently, Gibson and Thoday\textsuperscript{12} showed that in a laboratory polymorphic population of \textit{D. melanogaster}, produced by disruptive selection, recombinational lethals were constantly generated.

The experimental results described above strongly support the idea of an integrated gene pool, comprising many operationally distinct isoalleles per locus.

\* Dedicated to Professor Th. Dobzhansky on his 60th birthday.

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\textsuperscript{1} Wright, S., and Th. Dobzhansky, \textit{Genetics}, 31, 125–156 (1946).


\textsuperscript{6} Krimbas, C., unpublished data.

\textsuperscript{7} Hildreth, Ph. E., these \textit{Proceedings}, 41, 20–24 (1955).

\textsuperscript{8} Hildreth, Ph. E., \textit{Genetics}, 41, 729–742 (1956).


\textsuperscript{10} Dobzhansky, Th., and B. Spassky, unpublished data.


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\textbf{THE GENETIC STRUCTURE OF THE INCOMPATIBILITY FACTORS OF SCHIZOPHYLLUM COMMUNE: THE A-FACTOR*}

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A specific 2-subunit model was proposed in an earlier paper for the A incompatibility factor of \textit{Schizopyllum commune}, a species that typifies the bifactorial incompatibility system (tetrapolar sexuality) common in the hymenomycetous fungi.\textsuperscript{1} A preliminary study, reported at the same time, also indicated the same