Table 1. Frequencies of Homozygotes and Heterozygotes for Two *X*-Chromosome Inversions in Two Brazilian Populations of *D. willistoni* and Two of *D. paulistorum*

Origin of sample and chromosome studied	Homozygotes	Heterozygotes	Total	χ^2
D. willistoni				
Monjolinho	*DD* + *dd*	*Dd*		
XR	11	72	83	44·8
Salvador	*DD* + *dd*	*Dd*		
XL	46	77	123	7·8
D. paulistorum				
Cantareira	*CC* + *cc*	*Cc*		
XL	7	22	29	7·7
Sooretama	*CC* + *cc*	*Cc*		
XL	11	45	56	20·6

and in two *D. paulistorum* samples, those from Cantareira (unpublished) in the State of São Paulo and from Sooretama (unpublished) in the State of Espirito Santo, *X*-chromosome inversion heterozygotes were found with a frequency significantly higher than 50 per cent (see Table 1, where the deviations are calculated taking 50 per cent as the expected frequency of the heterozygotes).

As is well known, in panmictic populations, such as *D. willistoni* and *D. paulistorum* populations, inversion heterozygotes may have frequencies higher than 50 per cent only if the heterozygotes have adaptive values higher than that of both homozygotes.

The data presented in Table 1 show clearly that the *X*-chromosome inversions studied are heterotic. The heterotic value of the *X*-chromosome inversions can be manifested only in the females, the males being haploid for the *X*-chromosome. Genes with sex-limited effects must therefore be responsible for the heterotic value of the heterozygous *X*-chromosome inversions, as has been shown also by Wallace for the 'sex-ratio' gene arrangement in *D. pseudoobscura*[4].

The cytological data here presented show, from an aspect different from that studied by Kerr and Kerr[1], the importance of gene combinations with sex-limited effects in the genetics of natural populations of *Drosophila*.

These data give also further evidence of the adaptive value of chromosomal inversions in *D. willistoni* and in *D. paulistorum*.

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[1] Kerr, W. E., and Kerr, L. S., *Amer. Nat.*, **86**, 405 (1952).
[2] Dobzhansky, Th., Burla, H., and da Cunha, A. B., *Amer. Nat.*, **84**, 229 (1950).
[3] da Cunha, A. B., Burla, H., and Dobzhansky, Th., *Evolution*, **4**, 212 (1950).
[4] Wallace, B., *Evolution*, **2**, 189 (1948).

Reconstitution of Virus X-Saturated Potato Varieties with Malachite Green

Potato virus *X* is well known as a source of loss to the potato industry, and schemes exist to protect newer varieties from contamination. In most countries there remain in use – often in favour – varieties that are saturated with virus *X*. In Australia the varieties Brownell, Carman and Delaware are in this class. To free such a variety from virus *X* by chemotherapy would be a significant economic advance. It would also be of importance to the general problem of plant virus control by demonstrating that, even with a stable, mosaic-type virus like potato *X*, there is a sufficient difference between the biosynthetic processes of the virus and of the host to make selective chemical therapy a real possibility.

An attack on this problem was made using the potato variety Early Carman. Limasset and Cornuet[1] showed that the content of tobacco mosaic virus steadily decreases as the stem apex is approached, so that the cap of meristem above the leaf rudiments contains very little virus. Takahashi[2] showed that the diaminotriphenylmethane dye, malachite green, strongly inhibited the biosynthesis of tobacco mosaic virus, apparently by enzyme blockage. Assuming that these findings applied equally to virus *X*, the problem was to expose the extreme growing tips of potato stems to the action of malachite green in such a way that maximum inhibition of virus multiplication occurred, but at the same time growth of the stem tip continued, so that the apex might grow away from the virus. It was decided to work aseptically in complete culture solution, and the stock nutrient of Phillip White[3] was chosen. A bacteriologically sterile clone of Early Carman potato was developed by removing a stem apex to agar culture medium and propagating the resultant plantlet vegetatively either on agar in tubes or on filter paper slopes in liquid nutrient. When sufficient material had been developed, stem tips approximately 1 cm. long were added to flasks containing 50 ml. of liquid nutrient plus malachite green at concentrations of 1–4 parts per million, and allowed to float in the nutrient for three weeks. Some growth occurred. The tips of these stems, approximately ½ cm. in length, were then transferred to new liquid nutrient without malachite green to recover and grow for testing by inoculation to *Datura stramonium* or *Gomphrena globosa*. Of the sixteen plants that survived, one plant, from the series containing malachite green at 3×10^{-6}, proved to be free from virus *X*. Others gave a positive test for virus *X* only after some time had elapsed, indicating that the virus *X* content had been reduced by treatment to a very low level. All plants of the untreated control series retained a high content of virus *X*. The malachite green seems to have exerted a true chemotherapeutic effect.

The only instance of successful chemotherapy of a plant virus so far reported is that of peach *X*-disease by Stoddard[4]. This virus showed every evidence of instability. From the number of chemicals that successfully inactivated it *in vivo*—a list including calcium chloride and zinc sulphate—and from the fact that spontaneous recovery occurred among the control plants, one would doubt whether any true chemotherapy was involved. The freeing of potato tissue from virus *X* by malachite green is, to my knowledge, the first instance of successful chemotherapy of a stable mosaic-type virus.

A full account of this work will be published elsewhere.

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[1] Limasset, P., and Cornuet, P., *C.R. Acad. Sci., Paris*, **228**, 1971 (1949).
[2] Takahashi, W. N., *Science*, **107**, 226 (1948).
[3] White, P. R., "A Handbook of Plant Tissue Culture" (Jacques Cattell Press, Lancaster, Penn., 1943).
[4] Stoddard, Ernest M., *Conn. Agric. Exp. Stat. Bull.*, 506 (1947).