Nash, W.G. The George Washington University, Washington, D.C. Deep orange and carnation: Another lethal gene combination in D.m.

The dor car lethal gene combination resembles both dor ry (Lucchesi, DIS 39: 127) and ey eyg (Hunt, Gen. Res. Camb. 15: 29-34) in that the genes involved are all recessive whose combined action results in death of the pupa. Unlike the latter two lethal combinations it is rare for dor car zygotes to develop beyond the early stages of the pupal period.

With the exception of having colorless malphigian tubules dor car larvae appear to develop in a completely normal manner. Shortly after pupating, however, normal development stops abruptly and is signaled by the formation of a large air bubble in the center of the pupa. Since larval development appears normal it seems likely that the lethal biochemical lesion is affecting some or all of the adult imaginal disks.

This hypothesis is tested using a special stock which produces gynandromorphs with a high frequency. Certain female zygotes in this stock have an unstable ring X chromosome (X^{c2} $In(1)w^{vC}$, w^{vC}, f) which may be lost at the first meiotic division in the egg or at any later nuclear division. The genes on the remaining X chromosome are thus unmasked in a hemizygous condition. For example, dor car/X^{c2} $In(1)w^{vC}$, w^{vC} f female zygotes will express the dor car phenotype in any tissues which are derived from a cell line having lost the unstable ring X chromosome.

The mating scheme used to produce the type of female zygote in the above example follows.

Balanced lethal stock

FM-6, y^{31d} dm B/y dor car x FM-6, y^{31d} dm B

FM-6, y^{31d} dm B/y dor car x X^{c2} $In(1)w^{vC}$ w^{vC} f/Y

Type A ♀ y dor car/X^{c2} $In(1)w^{vC}$

Type B ♀ FM-6, y^{31d} dm B/X^{c2} $In(1)w^{vC}$ w^{vC} f

The yellow alleles in type A and B females makes it possible to recognize any male cuticular tissues in the resulting gynandromorphs. In type A zygotes dor car male tissue should result only from imaginal disks in which this gene combination is viable. Type B zygotes act as controls in the sense that any gynandromorphic patterns possible should be unrestricted in their appearance among these zygotes. The results of this experiment are shown in Table 1.

Table 1. A comparison of gynandromorphic tissue patterns between type A and type B female zygotes.

	Total No. of flies	Total No. of gynandromorphs	Hemizygous tissue found in gynandromorphs		
			Head	Thorax	Abdomen
Type A zygotes	624	24	14	6	9
Type B zygotes	640	69	36	42	38

Of the 69 gynandromorphs which appear among the type B adult progeny, the hemizygous FM-6 chromosomal markers express themselves randomly in the head, thorax and abdominal tissues. Only 24 gynandromorphs appeared among the type A adult progeny. This might result from a random killing tendency among all kinds of type A gynandromorphs or from the specific elimination of certain kinds of gynandromorphic patterns. The latter explanation appears to be correct in that complete bilateral gynandromorphs are common in type B adults but absent amoung type A adults. It is also interesting that in the six cases where the whole head of type A adults is dor car no part of the thorax or abdomen is dor car. If only half of the head is dor car then parts of the thorax are sometimes also dor car. The kinds of gynandromorphic patterns among type A adults suggest that the dor car gene combination is lethal due to an abnormal interaction between the different regions of the fly and not due to the lack of development of any single region.