

IOWA STATE UNIVERSITY  
Ames, Iowa  
Department of Genetics

1. Alleles at the vp-9 locus.

Viviparous-nine is a white-albino mutant (white endosperm-albino seedling) that has been placed on chromosome 7 eleven units to the left of gl-1. This mutant is very strongly viviparous, with only an occasionally dormant seed observed. As was indicated last year, positive allele tests based on single segregating F<sub>1</sub> ears were obtained in crosses between pas<sub>4889</sub> (a white endosperm, pale green seedling mutant) and w<sub>8657</sub> (a yellow endosperm, albino seedling mutant) and between pas<sub>4889</sub> and vp<sub>9</sub>. This year, numerous crosses involving these three mutants confirmed the allelism of pas<sub>4889</sub> and vp-9 but failed to confirm that of the pas<sub>4889</sub> and w<sub>8657</sub>, nor did w<sub>8657</sub> prove to be allelic to vp<sub>9</sub>.

Last spring, several of the white-albino mutants grown under dim light were analyzed for the accumulation of beta-carotene, zeta-carotene, phytofluene and phytoene. In these tests, it was found that vp<sub>9</sub> and its pas<sub>4889</sub> allele accumulate zeta-carotene and phytoene. A mutant contributed by Dr. Brawn (w<sub>Brawn #2</sub>), which we had not been able to place and for which no alleles had been found, accumulated the same two carotenoid precursors as vp<sub>9</sub> and in the same relative amounts. Extensive allele tests between these two mutants this past summer have established that they are alleles.

Donald S. Robertson  
I. C. Anderson

2. The relationship between the accumulation of carotenoid precursors and vivipary in the white-albino mutants.

The white-albino mutants can be divided into at least two groups: 1) those that have a tendency to germinate prematurely, and 2) those that very rarely if ever germinate prematurely. It has been shown by using A-B translocations (Robertson, Proc. Nat. Acad. Sci. 38: 580-583, 1952) that this tendency to germinate prematurely is independent of the genotype of the endosperm and depends on the genotype of the embryo. Thus, vivipary must be the result of changes in the embryo.

As has been indicated above, several of the white-albino mutants including both viviparous and non-viviparous types have been analyzed for the accumulation of the carotenoid precursors, zeta-carotene, phytofluene, and phytoene. The non-viviparous mutants, lw<sub>1</sub>, lw<sub>2</sub>, w<sub>7748</sub>, and cl<sub>1</sub> have very little or none of these compounds. However,

the three viviparous mutants tested accumulated one or more of these. White-3 accumulates all three, vp<sub>0</sub> accumulates zeta-carotene and phytoene while vp<sub>5</sub> accumulates only phytoene. Normal plants do not accumulate these precursors. Presumably, they are completely utilized in the production of beta-carotene and related compounds. These results suggest that the accumulation of phytoene or some other related precursor may somehow be related to vivipary. The evidence for this is not conclusive as yet but there are three other observations that give circumstantial support to such an explanation for vivipary.

1) Pastel<sup>8686</sup>, the pale green allele of the viviparous mutant w-3, and pastel<sup>4889</sup>, the pale green allele of vp<sub>0</sub>, have never been observed to be viviparous, nor have the pale green F<sub>1</sub>'s between these pastels and their respective viviparous alleles. Both of these pastels accumulate phytoene, and other precursors in the same manner as their viviparous alleles. However, since the pastels do produce some beta-carotene, it is reasonable to expect that these precursors might not accumulate to the level responsible for vivipary in their albino alleles.

2) Although viviparous-2 has not been analyzed for all three precursors, it has been shown to accumulate phytoene. The green mosaic allele of this mutant regularly undergoes mutation back to the normal allele resulting in albino seedlings with streaks of green tissue. Various levels of mutability have been found ranging all the way from only one or two small green spots per leaf to levels where seedlings may have so many spots that approximately a quarter of the total leaf area consists of normal tissue. It has been noticed as a consistent thing for many years that the low mutable stocks have a much higher frequency of viviparous seeds than the high mutable stocks. Because of the presence of more green tissue, the high mutable stocks would be expected to utilize more of the carotene precursors and thus these intermediate compounds would not accumulate to the level responsible for vivipary in the low mutable or stable white lines.

3) An albino mutant that accumulates phytoene also is known in the sunflower. In the summer of 1959, some sunflowers heterozygous for the albino mutant were grown. Normally, in the sunflower there is a short period of after ripening, necessary for the mature seed before they will germinate. However, the heads of some of the plants grown in 1959, which were observed to have come in contact with the damp ground before they were harvested, were found to contain some germinating seeds. In all cases, the germinating seeds produced albino plants. None of the seeds giving normal green plants were observed to have germinated. Thus, it appears that the normal dormancy mechanism in this albino mutant of the sunflower is defective, as it is in the albino viviparous mutants of corn, and that the accumulation of carotene precursors seem to be involved in both instances.

Donald S. Robertson  
I. C. Anderson