A NEW MUTANT WITH DICHOTOMOUS STEM BIFURCATION

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Three X-ray induced mutants of our Pisum collection (Nos. 157A, 239CH, 1201A) show a dichotomous stem bifurcation resulting in the formation of two corresponding stems in the upper part of the shoot. Former investigations have shown that the two polymeric genes bif-1 and bif-2 are responsible for this deviation from the normal shoot structure. Mutants 239CH and 1201A were found to be genetically identical in this respect, containing gene bif-1. whereas mutant 157A is homozygous for bif-2. The common peculiarity of the three mutants is that each shows unstable penetrance of the bif genes, ranging between 20 and more than 80% over 13-22 generations of observation.

A few years ago, a fourth mutant with dichotomous stem bifurcation was selected, the mutant having arisen after X-ray treatment (No. 37B). The plants are phenotypically identical with those of the other three mutants, but the penetrance of the bif gene in 37B is stable. Mutants 1201A and 37B were crossed with each other in order to clarify the genetic constitution of 37B. Some of the few F_1 plants available were bifurcated, others were not. In F2, 141 plants were available, 42 of them (29.8%) showing stem bifurcation. These findings demonstrate that the same locus is involved in the two mutants. Yet, as they showed regularly clear differences in their penetrance behavior in each generation studied so far, the mutant genes seem not to be identical. It is suggested that they represent two alleles of the Blf-1 locus which are provisionally designated as bif-1^{1201} and bif-137. Moreover, certain conclusions on the dominance relations can be drawn from the F1 and F2 findings. As only some of the F1 and F2 plants were bifurcated, the allele blf-1 cannot be dominant over bif-1^{1201}. Therefore, we postulate the following order of dominance of the multiple series:

Bif-1	Bif-1^{1201A}	bif-1^{37}
normal stem	bifurcation, reduced penetrance	bifurcation, full penetrance

In mutants 157A, 239CH, and 1201A, a clear correlation exists between the degree of penetrance of the bif genes and the yield of the plants: the higher the penetrance, the higher the seed production. It should thus be expected that mutant 37B would show a better yield than the other three mutants of the group because of the full penetrance of its bif gene. This is, however, not the case (yielding comparisons of only five generations are available so far for mutant 37B). Fig. 1 shows that at the mean values for the trait "number of seeds per plant" of mutants 157, 239CH, and 37B were approximately equal and similar to the control values of the mother variety. Only mutant 1201A was somewhat better if we consider its performance over 22 generations.

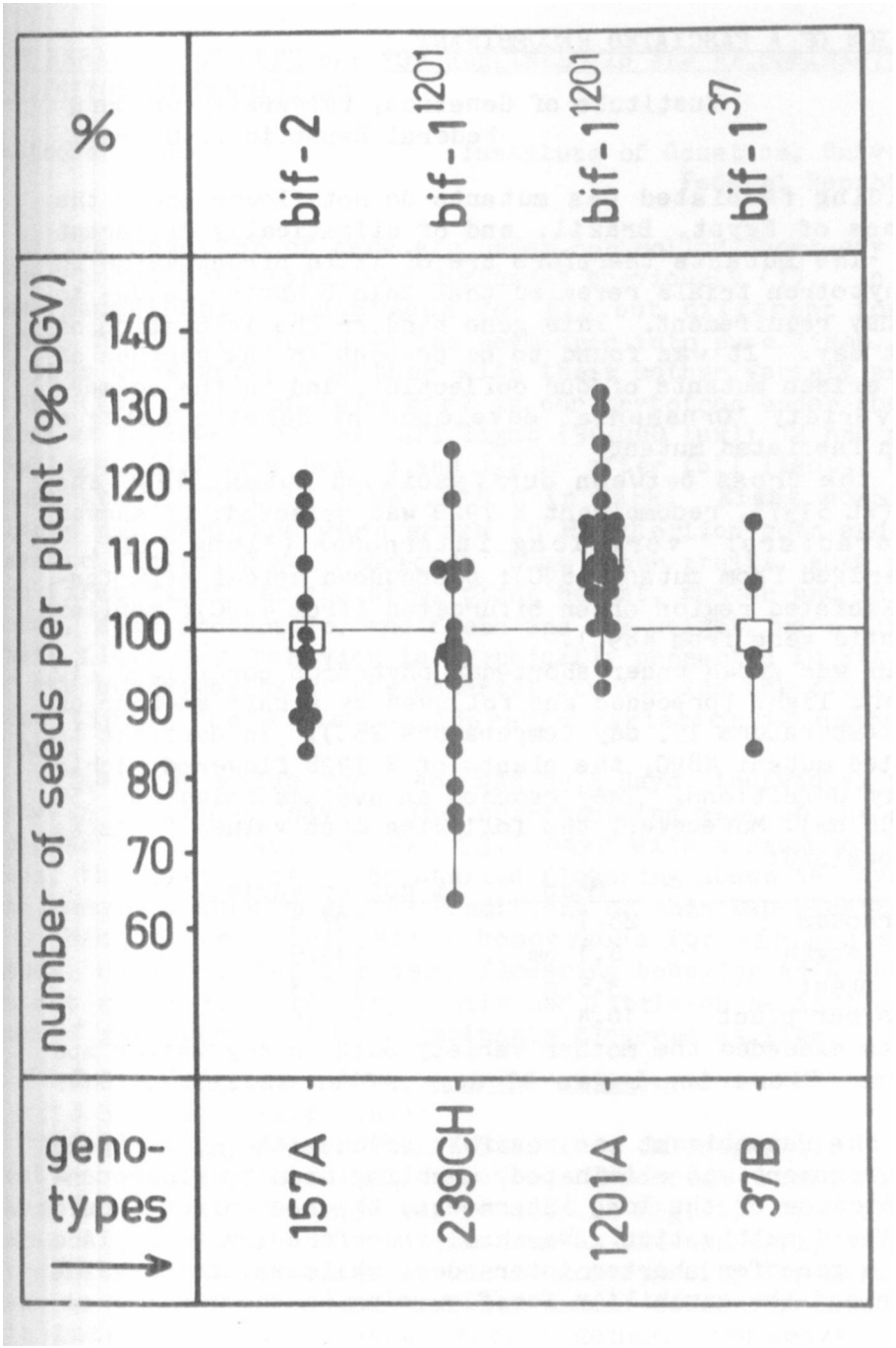

Fig. 1: The seed production of the bifurcated mutants 37B, 157A, 239CH, and 1201A in a varying number of generations. Each dot represents the mean value for one generation as related to the corresponding mean of the mother variety. The squares are the combined means for all the generations tested.

Thus, the stabilized penetrance of the bif-gene did not result in the expected improvement in yield.

The differences in the yield between mutants 1201A and 239CH are not yet explicable. Mutant 1201A contains only a single mutant gene (bif-1^{1201}). Mutant 239CH, however, is homozygous for two genes, one of them being bif-1^{1201}. The second one has a slight influence on the flower structure without reducing its function or fertility directly. Tne somewhat lower yield of 239CH may be related to the presence of the two genes together.