THE SEED PRODUCTION OF EARLY FLOWERING FASCIATED PISDM RECOMBINANTS

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Our high-yielding fasciated mutants have some negative characters which reduce their breeding value. They are too late and too tall; moreover, they are homozygous for gene .sg. for reduced seed size. Theoretically, the breeding value of these genotypes could be improved by eliminating some of these negative traits. This sems to be possible since the characters just mentioned are not part of pleiotropic patterns of the fasciata genes. Instead, they are controlled by independently acting genes. Another approach to improvement is to incorporate useful genes from other mutants.

An important consideration bearing on this objective is the fact that the fasciated mutants are homozygous for 14-18 mutant genes. Thus, highly heterozygous hybrids arise when they are crossed with non-fasciated genotypes. Complicated segregations occur in their progenies and a great number of different recombinant types can be selected. They have been propagated and are available in the form of pure lines at our institute.

Most of the genes present in our fasciated mutants are hypostatic and are therefore not discernible in the plants. This holds true also for some genes controlling traits of agronomic interest such as internode length, plant height, flowering, and ripening.

We have crossed these mutants with recombinant R 46C carrying gene efr for early flowering. A large number of fasciated recombinants with different genotypic constitution is available, all of them containing efr. as additional mutant gene. These early flowering, fasciated recombinants have been tested for seed productivity. They are compared to both parental groups (the fasciated mutants and the early flowering recombinant R 46C) as well as to the mother variety used for our irradiations in Fig. 1.

As the figure shows, R 46C did not yield as well as the mother variety, pooled mean for all the 23 generations tested being only *13%* of the control value. Thus, the genotype cannot be utilized agronomically in its present form. The fasciated mutants, on the other hand, were found to have an excellent seed production in most generations tested (lefthand part of the figure). In the righthand part, the yield of 44 different recombinant strains is given, homozygous for efr. for one or several genes of the polymeric fasciata group, and for different genes controlling internode length. They are subdivided into four groups according to their plant height.

The first sub-group contains recombinants with the genes "short III" and "short II" having plant heights ranging between 20 and 50 centimeters. In spite of the stem fasciation, their yield was very low, about similar to that of the non-fasciated R 46C. Thus, stem fasciation does not lead to an increase of the seed production in the presence of the genes for strongly reduced internode length. The recombinants of the second sub-group contain gene "short I" in addition to efr and fasciata genes which reduce the internode length only slightly. Their seed production was better than that of the first group but considerably

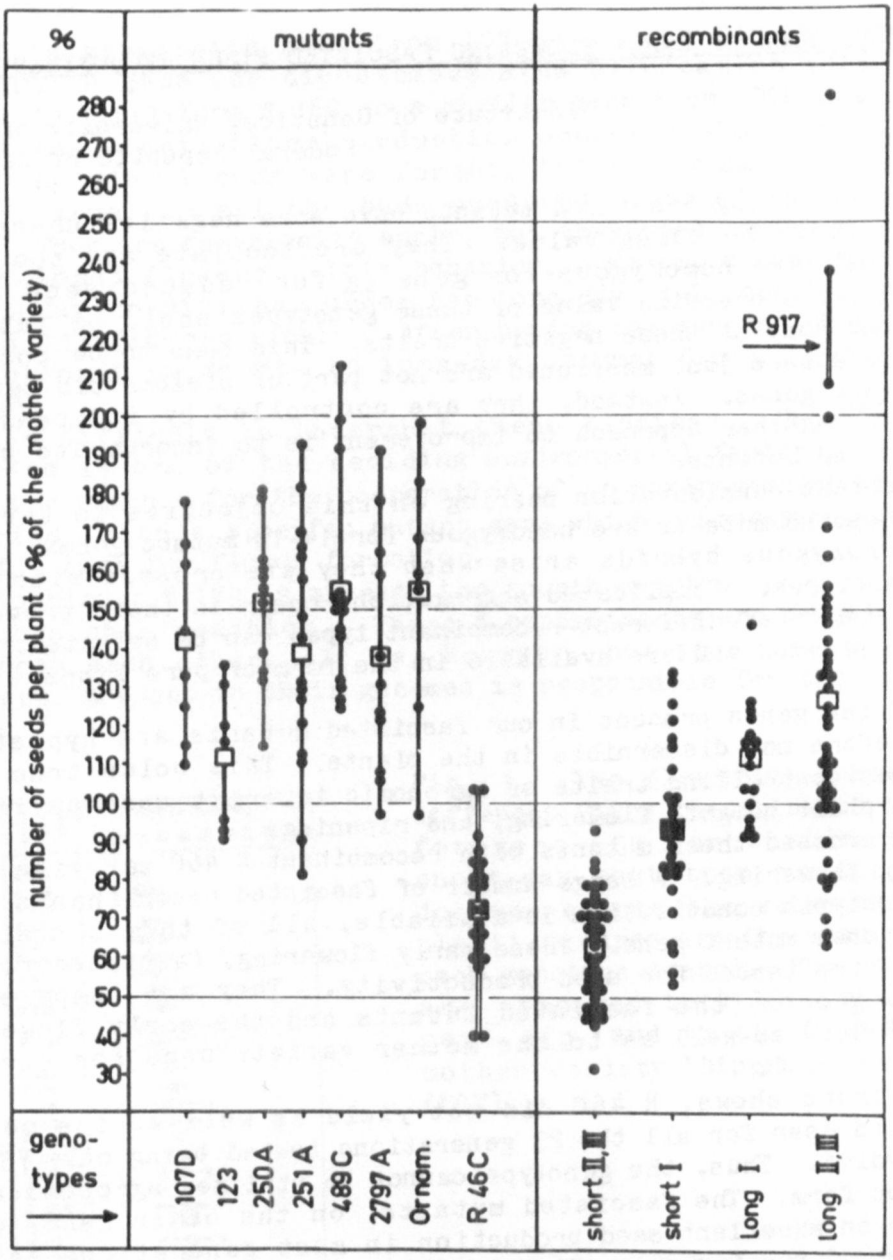

Fig. 1: Lefthand part: The seed production of 6 fasciated mutants: the fasciasted fodder pea variety 'Ornamenta' and genotype R 46C containing gene efr for earliness.

Righthand part: The seed production of 44 recombinant lines homozygous for efr, for fasciata genes, and for genes for different internode lengths. The material is subdivided into 4 groups according to plant height.

Each dot represents the mean value for the character "number of seeds per plant" for one generation as related to the control value of the mother variety. The squares represent the pooled means of the material tested.

worse than that of the fasciated mutants. The third sub-group had plant heights similar to the fasciated mutants. The additional presence of gene efr for earliness did not lead to an improvement in yield. Only some genotypes of the fourth sub-group yielded more than the fasciated mutants, but they are so tall that they are not suited for field cultivation.

The findings show that the combination of gene efr for earliness and distinct genes for reduced internode length with the fasciata genes has a negative influence on the seed production of the plants. It was not possible to maintain the high yield of the fasciated mutants when otherwise desirable genes were incorporated.

A PROPOSED ASSAY FOR DETECTION OF AUXIN-SENSITIVE MUTANTS OF PISUM USING INTACT SEEDLINGS

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Many of the morphological differences among mutants or recombinants may result from the action of genes that control plant growth regulators such as auxins. Experiments show that exogeneously applied auxins are able to induce several morphological changes in plant form and size. In such experiments different morphogenetic effects often are caused by different auxins applied under equimolar conditions, and for Pisum sativum these different effects could be correlated with differences in metabolic availability and translocation of the applied auxins (1). These studies led us to propose a simple test system to screen for mutants which affect auxin metabolism, using intact pea seedlings.

Experimental background: Our previous experiments showed that normal pea seedlings exhibit a characteristic morphogenetic effect when auxins 2,4-D, IAA, and NAA were applied via the root system (1). Seedlings treated with 2,4-D were strongly inhibited in root and shoot development, while IAA- and NAA-treated seedlings were not. This could be correlated with higher metabolic availability of the IAA and NAA molecules by different mechanisms: IAA is mainly decarboxylated or conjugated to aspartic acid; NAA is mainly conjugated; and 2,4-D is neither decarboxylated nor conjugated to any extent. In the case of IAA and NAA, these mechanisms prevent the morphogenetic alteration of the seedling by inactivating many of the free molecules. Hence, these auxins are not able to reach the vascular tissue in the root in high amounts and are not translocated into the shoot to cause morphogenetic aberrations there. On the other hand, 2,4-D does reach the vascular tissue and is actively translocated in lethal amounts into the shoot.