UNUSUAL PHOTOPERIODIC REACTION OF PISUM RECOMBINANT B 112 F

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Recombinant R 142F of our collection arose after having crossed the weak mutant 142B, homozygous for gene dgl, with the high-yielding fasciated mutant 489C. Gene dgl causes a degeneration of stipules and leaflets, but expression is delayed so the apical leaves of the plants are normally green whereas the basal ones are brown and unable to photosynthesize. Because of this defect, the seed production of mutant 142B is very low (Fig. 1) and many plants produce no seeds at all.

The plants of recombinant R 142F are non-fasciated; thus, they do not contain one of the three or four genes for stem fasciation present in the parental mutant 489C. They show the following characters:

Degenerating leaves (gene dgl from 142B)
Very long internodes (long III from 489C)
Slightly reduced chlorophyll content (from 489C)
Lateness (from 489C)
Not flowering under short-day conditions (gene fis from 489C)

Under long-day field conditions in West Germany, the plants of R 142F begin flowering 15-16 days later than those of the mother variety. Mutant 489C likewise begins flowering about 10-12 days later than the mother variety (data of 1981, 1982). However, our results indicate that the genes present in 489C and R 142F are not identical. Mutant 142B does differ from the mother variety with regard to its flowering behavior.

The seed production of R 142F was extraordinarily variable in the 9 generations tested so far (Fig. 1) indicating a strong influence of environmental factors. This becomes particularly clear from the values of Fg/1978 when the material was grown in two different locations. In locality I, the yield was similar to the control value (DGV) whereas it was 60% higher at the second locality. The recombinant has, in general, a considerably higher yield than mutant 142B in spite of the presence of gene dgl for leaf degeneration. Its productivity is mainly due to the vigor of the plants which offsets the expression of dgl. Thus, the negative selection value of gene dgl could be strongly improved by combining it with specific other mutant genes of the genome.

Under short-day phytotron conditions (12 hr light, 12 hr darkness; night temperature 15, day temperature 25 C), plants of 489C and R 142F did not flower whereas 142B and the mother variety showed normal flowering behavior. Sixty-one days after sowing (the control plants already had well developed pods), the phytotron conditions were changed to long-day (18 hrs light, 6 hrs darkness). Three weeks later, mutant 489C had flower buds, but R 142F did not show any flower bud formation. Even after more than 5 weeks in long-days, the R 142F plants showed no sign of flower initiation and tiny foliage leaves were present exclusively at their apical growing points.

In a second trial, the genotypes were grown under permanent light whereas the other phytotron conditions remained unchanged. Mutant 4890 began flowering 15 days, and recombinant R 142F 30 days, later than the mother variety. The very tall plants of R 142F formed their first flowers at the 37th node, an unusually high number under these conditions. In the field, the first flowers were produced at the 22nd node, the total number of internodes at the end of ontogenesis being 28.

The non-flowering of mutant 489C in short-day is due to the action of gene fis controlling the photoperiodic behavior. Recombinant R 142F obviously has the same gene. It is, however, negatively influenced by another mutant gene causing a very large delay in the initiation of flowering under photoperiodic conditions which allow flowering of the two genotypes. Furthermore, the comparison of the data of field and phytotron plants shows that the flowering behavior of R 142F is influenced not only by the photoperiod but in addition by another environmental factor, probably temperature.

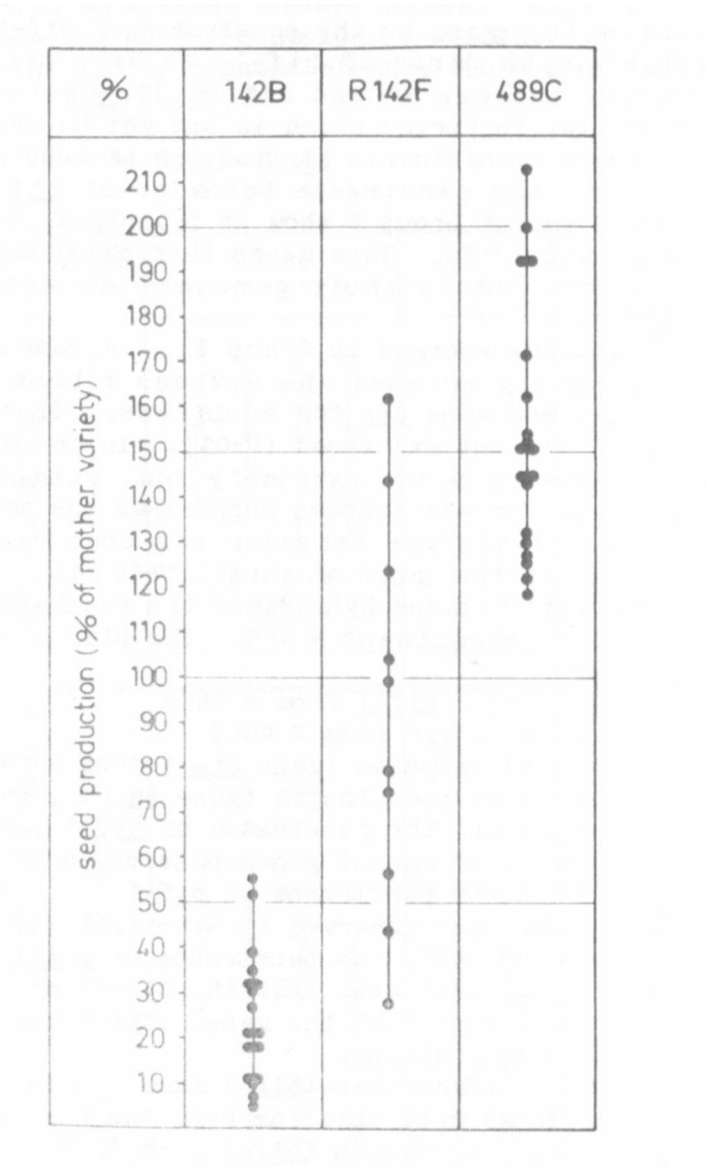

Fig. 1. Seed production of mutants 142B, 489C and recombinant R 142F in relation to DGV under German long-day field conditions. Each dot represents the mean value for the trait "number of seeds per plant" for one generation.