THE BEHAVIOR OF GENE efr FOR EARLINESS IN NEW RECOMBINANTS UNDER SHORT-DAY PHYTOTRON CONDITIONS

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The reaction of gene efr under controlled short-day conditions in some recombinant types was discussed previously (1). In the meantime, new recombinants, homozygous for efr but different for other mutant genes, have been selected and developed into pure lines. Thirty-eight of them were grown together with their mother variety and recombinant R 46C (the donor of gene efr) in our phytotron under short-day conditions as follows: 11 hrs full light (30,000 lux); 12 hrs darkness; 1 hr dim light (1/2 hour before and 1/2 hr after full light); humidity, 60%; temperature, 25 C in light, 15 C in dark. Eight normally developed plants per genotype were grown in Mischerlich pots and the number of days to flowering was recorded. Some other traits, such as position of the first flower at the stem, plant height, number and length of internodes, seed production, and fresh and dry weight, were also determined. Their flowering behavior is graphically presented in Fig. 1. In spite of the homozygosity of the material studied and the equal environmental conditions, there was considerable variation in number of days to flower.

The mean value for R 46C was 39.3 days, individual values ranging between 35 and 48 days. The corresponding mean of the mother variety 'Dippes Gelbe Viktoria' was 53-1 days with a range of 47 to 62 days. Thus, the plants of R 46C started flowering about 14 days earlier than fch'3 control plants under the conditions of this experiment.

Many recombinant types, homozygous for efr and specific other genes, showed about the same flowering behavior as R 46C so the other mutant genes involved apparently had little or no influence on the action of gene efr. A few recombinants flowered earlier:

— R 451 (efr, very long, acacia, afila): 5 days earlier
— R 546 (efr, very long): 4 days earlier
— R 467 (efr, longer than R 546, less chlorophyll): 3 days earlier

Host recombinants tested, however, flowered considerably later than those of R 46C. Details can be seen in Fig. 1. Some of the genotypes began flowering about the same time as the non-early mother variety or even later. They are early due to homozygosity for gene ,efr. but this gene is not able to manifest its normal action, presumably because of its interaction with other mutant genes. Moreoever, Fig. 1 shows another well-known feature: the later the plants flower, the greater the variation in days to flower. The mean value for R 570, for example, was 54.9 days, i.e. about 15 days later than R 46C. Of the 8 plants studied, however, two flowered simultaneously with R 46C whereas the others were much later. The causes for this behavior are not yet known, but they are obviously connected with the tendency to form tiny floral buds at low nodes which do not develop into normal flowers.

The most interesting recombinant of the group is R 713. derived from the cross of the fasciated mutant 107D x R 46C. The plants are homozygous for the following genes: efr for earliness (from R 46C);

"short I" (a hypostatic gene from 107D); a gene for stem fasciation (from 107D); a gene for dichotomous stem bifurcation (not yet sure whether it is bif-1 from R 46C or a similar gene from 107D).

In these plants floral induction occurred about the same as in R 46C. Tiny floral buds were formed, but they remained undeveloped. This holds true for all the buds produced by all the plants of this genotype. They are genetically early, but they were not able to produce fully developed flowers. This behavior, however, occurred only under the short-day conditions; under the long-day field conditions of West Germany R 713 flowers richly. After having changed the photoperiod in the phytotron from short- to long-day, normal flowers appeared a few days later.

It is difficult to interpret these findings. Undoubtedly, the photoperiod is one of the deciding environmental factors. This is an interesting example for the cooperation of an environmental factor, the photoperiod, with a specific mutant gene which commonly suppresses the action of a gene for flower formation.

Recombinant R 173 is already the fourth genotype of our collection which shows this reaction. These 4 recombinants are genetically different from each other. It is, however, not yet clear which of the mutant genes present in their genomes is responsible for the suppression of efr.

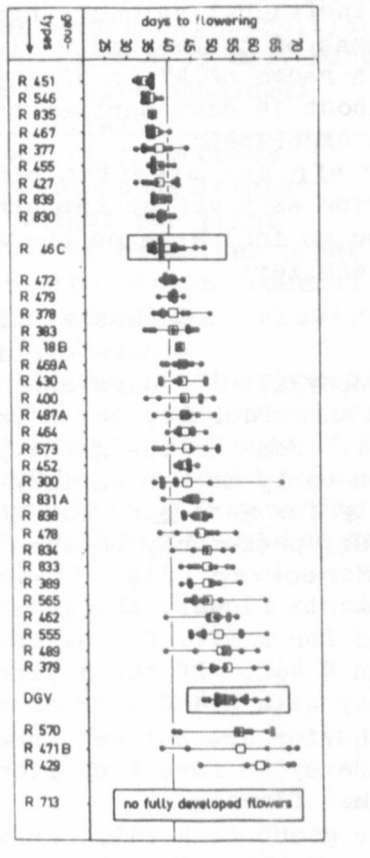

Fig. 1. The flowering behavior of 38 different Pisum recombinants homozygous for gene efr for earliness, under short-day phytotron conditions. Each dot represents the value for a single plant; squares are the mean values for each genotype tested. The recombinants are compared to R 46C, the donor of gene efr. and to the late flowering mother variety 'Dippes Gelbe Viktoria' (DGV).

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x Editor's Note: The flower abor-
x tion phenomenon described here
x has been observed previously and
x has been discussed in publica-
x tions of I. C. Murfet and others,
x See particularly: Murfet, I. C.
x 1977. Ill Physiology of the Garden
x Pea. J. F. Suttcliffe and J. S.
x Pate, eds. Academic Press,
x London.
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