FURTHER GENES INFLUENCING THE PENETRANCE OF GSNE bif-1 FOR STEM BIFURCATION

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The penetrance of gene bif-1 for dichotomous stem bifurcation, hornoz ygous] y present in mutant 1201A of our collection, depends on both errvironmentai factors and other mutant genes of the genome (1). During the past years, further genes were found to influence its penetrance positively or negatively; some of them are discussed in the present paper. The method used consists in comparing bifurcated recombinants with mutant 1201A with regard to the penetrance of bif-1.

Mutant 1201A, the donor of bif-1. shows a broad variation of penetrance ranging between 22 and 84% in 20 generations due to a specific environmental factor(s) which is not yet known to us.

The 10 different recombinants studied can be subdivided into three groups according to the penetrance behavior of bif-1 (Fig. 1, upper part). The 4 genotypes of Group I show in principle the same degree of penetrance as mutant 1201A. This means that those mutant genes, which additionally present in their genomes, do not influence the penetrance of bif-1.

A different picture emerges in Group II. Recombinant RM 836 was selected after having crossed the waxless mutant 445 with R 46C, homozygous for bif-1 and gene efr for earliness. In two generations, the action of bif-1 was not expressed (P=0%). In the other three generations tested the penetrance was extremely low, ranging between 2 and 4%. Thus, the gene for waxlessness suppresses the penetrance of bif-1 almost completely. A similar behavior was observed in recombinant RM 427 arisen in F2 of the cross of mutant 176A with recombinant R 862, which itself arose after having hybridized the fasciated mutant 123 with the early flowering recombinant R 46C. The plants of RM 427 have the folowing characters:

Stem bifurcation (gene bif-1 from R 46C)
Early flowering (gene efr from R 46C)
Narrow leaflets and stipules (gene dim-1 from mutant 176A)
Slightly reduced internode length (gene short I from mutant 123)

In this combination, the penetrance of bif-1 ranged between 0 and 15%. Thus, one of the other mutant genes present in RM 427 likewise has a suppressing effect on the penetrance of bif-1.

The opposite effect was observed in 4 recombinants of Group III. In R 177, RM 516, and RM 1010, the penetrance of bif-1 varied between 86 and 100% over 3 to 10 generations. All the plants of RR 507 were bifurcated, i.e. full penetrance of the gene. The 4 recombinants have the followinggenotypicconstitutions:

R 177: Stem bifurcation (bif-1 from 1201A)
Reduced seed size (sg. from the fasciated mutant 489C)

R 507: Stem bifurcation (bif-1 from 1201A)
Reduced seed size (sg from 489C)
Reduced internode length (short-I from 489C)

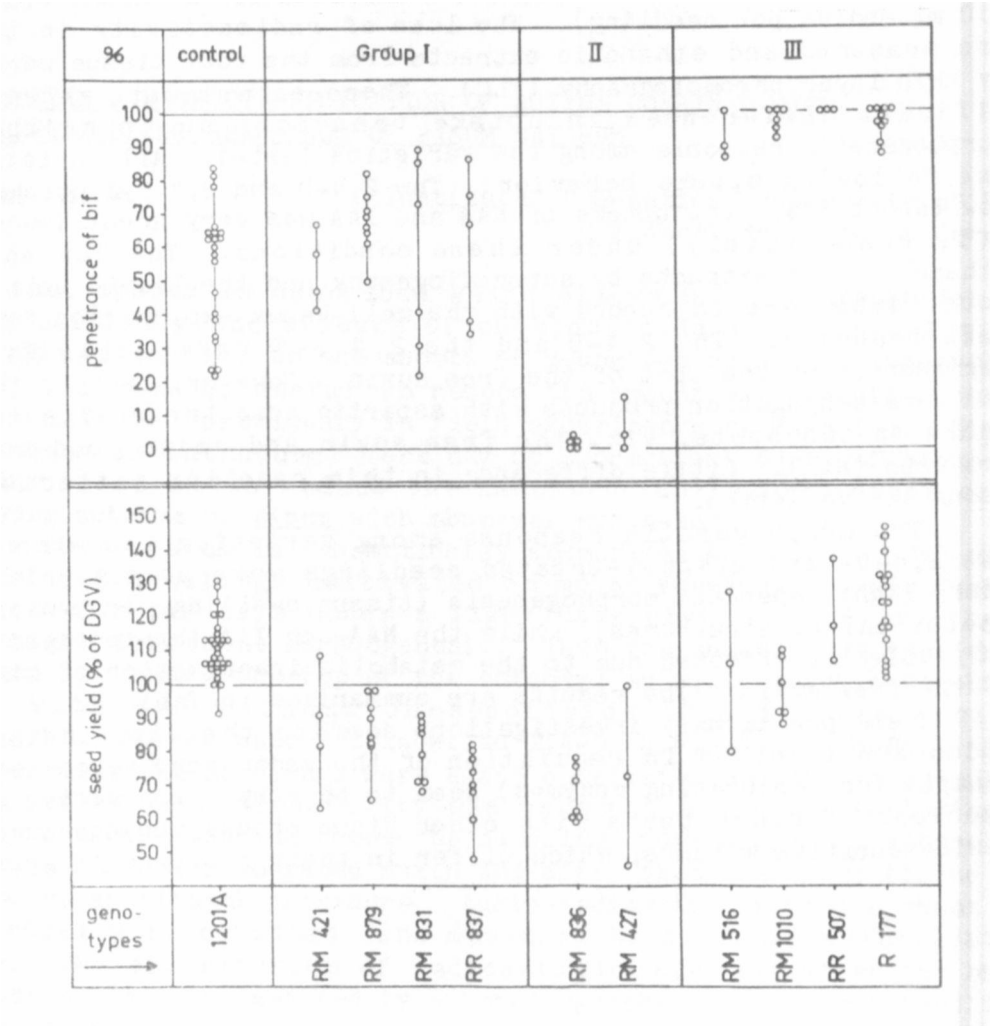
RM 516: Stem bifurcation (bif-1 from 1201A)
Reduced internode length (short I from the fasciated mutant 251A)
Later flowering (from 251A)

HM 1010: Stem bifurcation (bif-1 from 1201A)
Later flowering (from 489C)

These 4 recombinants do not have a specific gene in common which could be responsible for stabilizing the penetrance of bif-1. In R 177 and RR 507, this effect could be due to the presence of gene sg for small grains. This gene, however, is not present in the genomes of RM 516 and RM 1010. Both these genotypes begin flowering a few days later than the mother variety, but this is not a very reliable trait.

The seed production of the material tested i- given in the lower part of Fig. 1. A strong correlation between see< yield and penetrance of bif-1 could not be found, as is evident if wo compare the recombinants of Group I with mutant 1201A. The penetrance of bif-1 is about equal to, but the seed production of the 4 recombinants is considerably lower than, that of mutant 1201A. If, however, we compare the genotypes of Groups II and III with each other, a certain parallelism between penetrance behavior and seed production is evident. At least in some of these genotypes, the low or high penetrance could contribute to the low or the high yield, respectively.

1. Gottschalk, W. 1978. PNL 10:13.



Upper part: The penetrance of gene bif-1 in mutant 1201A (the donor of the gene) and in 10 recombinant lines homozygous for bif-1 and for other mutant genes.

Lower part: The seed production (number of seeds per plant) of the 11 genotypes studied as related to the corresponding values of the mother variety 'Dippes Gelbe Viktoria' (DGV; = 100%.

Each dot give the mean value for one generation.