

PENETRANCE AND SEED PRODUCTION IN PISUM

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Two polymeric genes of *Pisum*, *bif-1* and *bif-2*, are responsible for altering the monopodial shoot into a dichotomous shoot. The agronomic value of these genotypes is reduced by the unstable penetrance of the genes involved. In spite of this disadvantage, mutant 1201A, homozygous for *bif-1*, showed higher productivity than its mother variety in most of the 22 generations tested so far (Fig. 1, lefthand part). Mutant 157A, homozygous for *bif-2*, was found to be not as productive as 1201A considering the mean values of 12 generations. Recombinant R 837 is homozygous for gene *bif-1*, gene *efr* for earliness and a gene for waxlessness. The seed production of this genotype was relatively low.

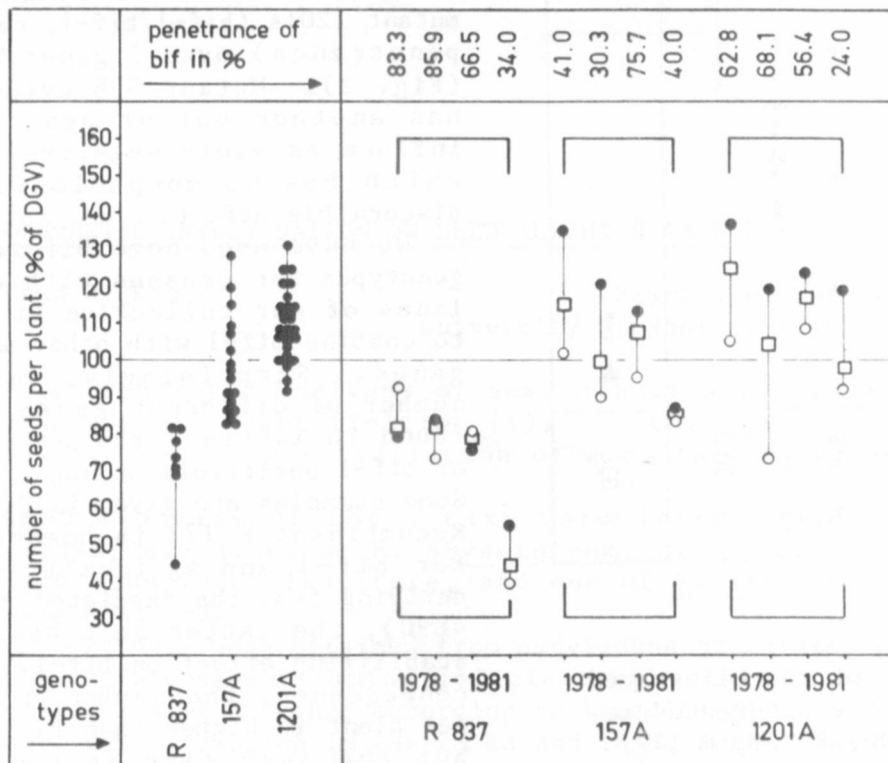


Fig. 1. Relationship between seed production of bifurcated *Pisum* genotypes and the penetrance of the *bif*-gene. Left: The yield of mutants 157A, 1201A and of recombinant R 837 in different generations. Each dot is the mean value for one generation. Right: The yield of the same genotypes in the last 4 generations in relation to the penetrance of the *bif*-genes. Solid circles: Bifurcated plants. Open circles: Entire strains with bifurcated and non-bifurcated plants.

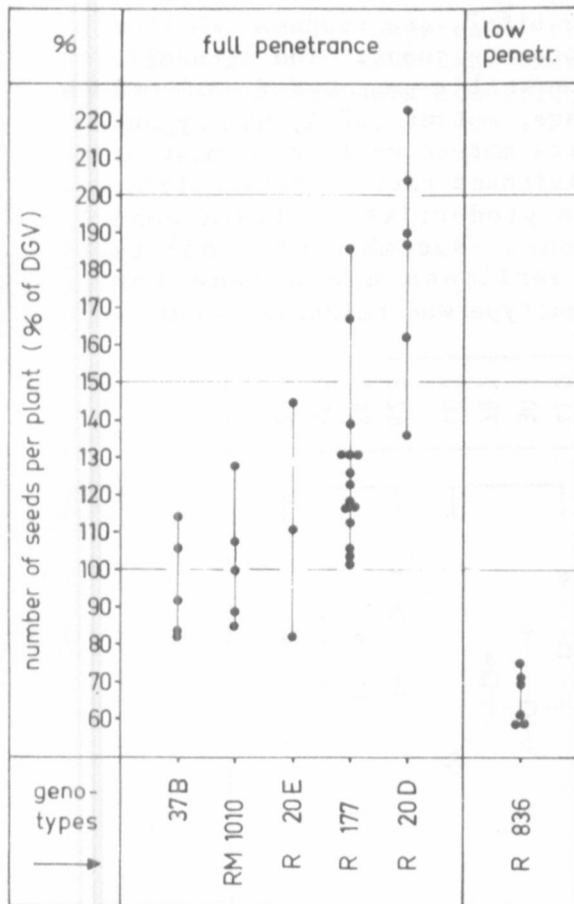


Fig. 2.

Seed production of the bifurcated mutant 37B and the bifurcated recombinants R 20D, R 20E, R 177, RM 1010 with stabilized penetrance of gene *bif-1*. Right: Recombinant R 836 with extremely low penetrance of *bif-1*. Each dot represents the mean value for the trait "number of seeds per plant" for one generation as related to the control value of the mother variety DVG = 100%.

The penetrance of the two *bif*-genes varies from year to year depending on the climatic conditions. In the three genotypes mentioned, a certain correlation between penetrance and seed production was observed, the productivity of the strains decreasing with decreasing penetrance (Fig. 1, righthand part). This, however, did not hold true for mutant 37B containing a multiple allele of *bif-1*. This allele shows full penetrance, but the seed production of the mutant was lower than that of mutant 1201A (*bif-1/bif-1*, reduced penetrance) over 5 generations (Fig. 2). Mutant 37B evidently has another mutant gene which influences yield negatively but which has no morphologically discernible effect.

We have used some bifurcated genotypes for crosses with other lines of our collection in order to combine *bif-1* with other mutant genes. Surprisingly, quite a number of different genes were found to influence the penetrance of *bif-1* positively or negatively. Some examples are given in Fig. 2. Recombinant R 177 is homozygous for *bif-1* and *sg* (small seeds, deriving from the fasciated mutant 489C), the latter gene having a stabilizing effect on *bif-1*. As a consequence, the number of seeds per plant is higher than in 1201A, but the seed size is reduced. Therefore, R 177 was crossed with mutant 1000 (having larger seeds) giving rise to recombinant RM 1010 homozygous for *bif-1* and a gene for almost normal seed size. All the plants of this genotype were bifurcated. Thus, not only gene 8g of mutant 489C but also a gene of mutant 1000 had a stabilizing effect on the penetrance of *bif-1* which, however, did not result in the increased seed production expected.

Recombinant R 20D is homozygous for *bif-1*, *efr* and a gene for long internodes. The plants are tall and repeatedly bifurcated. They begin flowering very early due to the presence of *efr* but seed ripening is considerably delayed. The high yield of this genotype is mainly due to the completely stabilized penetrance of *bif-1* in this combination. Plants of recombinant R 20E likewise were early and repeatedly bifurcated, with full penetrance of *bif-1*, but their internodes were strongly shortened. This may be the main reason for their relatively low seed production.

The opposite effect was noted in recombinant R 836, homozygous for *bif-1* and a gene for waxlessness. In this combination, the penetrance of gene *bif-1* was very low, demonstrating thereby a negative influence of the gene for waxlessness on the penetrance of *bif-1*. Correspondingly, the seed yield of this genotype was lower than that of mutant 1201A and of the initial line. Some mutant genes, which suppress the action of *bif-1* completely or reduce its penetrance markedly, are under study.

SDS-ELECTROPHORETIC INVESTIGATION ON SEED ALBUMINS IN PISUM

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The electrophoretic analyses of seed albumins in *Pisum* are of interest in taxonomic identification (1). In this genus, however, scanty data are available on variation of albumin subunit molecular weights.

The seed albumins of three taxa were investigated by SDS-electrophoresis; six lines of *P. abyssinicum*, seven of *P. fulvum* obtained from John Innes Institute, and one of *P. sativum* (cultivar 'Proteo') were analyzed.

Albumin extracts were obtained from cotyledons of mature seeds (2) and submitted to SDS-polyacrilamide gel electrophoresis on slab gels with 15% running and 4% stacking, according to Laemmli (3).

Two major bands, ranging in the 28 Kd and 18 Kd zones, were always present (Fig. 1a and 1b). Slight differences were found among *P. abyssinicum* lines, mainly regarding bands falling in the 18 Kd zone. Larger differences were found among *P. fulvum* lines, particularly for the bands in the 15-20 Kd area; line JI 1010 (Fig. 1b) showed a specific pattern characterized by the presence of an additional band of molecular weight around 23 Kd. The *P. sativum* patterns were less different from the *P. abyssinicum* than from the *P. fulvum* profiles.

1. Przybylska, J., S. Blixt, J. Hurich, and Z. Zimniak-Przybylska. 1977. *Genetica Polonica* 18:27-38.
2. Grillo, S. and R. Rao. 1982. *Ann. Fac. Agraria, University of Naples Serie IV XVI*:1-5.
3. Laemmli, U. K. 1970. *Nature* 227:680-685.