

A GENE FOR FLOWER DOUBLING IN PISUM

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The flowers of the X-ray induced recessive mutant 175 of our collection are doubled. Doubling is due both to an increase in the number of petals in the corolla and to the formation of petal-like organs in the staminate whorl. The later the flowers are formed the higher is their degree of doubling. Most of the stamens have petal-like appendices of varying size and shape. Sometimes these organs carry a rudimentary anther with predominantly sterile pollen grains. The ovary is mostly open; style and stigma are present but ovules are absent. Thus, the mutant is both male and female sterile.

The gene causes an additional anomaly: from many growing points, inflorescence-like organs develop instead of single flowers (Fig. 1). Differentiation begins normally in the basal region of these growing points, forming a normal calyx, a doubled corolla, and a corolla-like staminate whorl. The pistil, however, shows a stronger reduction as compared to the same organ in the single flowers of the mutant. It is completely open and has a petal-like shape; only a narrow centrally located sector consists of carpel tissue. In this way, the basic flower of such an "inflorescence" is formed. A second flower is produced from the same growing point sitting on a short stalk, but there is no calyx and no pistil in most of these apical flowers and the number of petals and petal-like stamens is reduced.

More rarely even three-flowered inflorescences are produced from such growing points. Their middle flower is strongly reduced, consisting mostly of a single petal only. Calyx, staminate, and pistillate cycles are lacking. Also the apical flower is reduced but not to such a high degree. There is no calyx and the staminate and pistillate cycles are mostly absent. The whole flower consists exclusively of petals the number of which is somewhat higher than in normal pea flowers. In a few cases, even five strongly reduced flowers were differentiated from a single growing point. The uppermost two or three flowers of these "inflorescences" were small, consisting only of a large number of scale like leaflets without any specific characteristics.

The differentiation of the growing points of this mutant is a very labile process resulting in flowers or even inflorescence-like organs which differ from each other in many details even within the same plant. This lability is interpreted as variable expressivity of the mutant gene. In all those cases in which inflorescences are produced, distinct regions of the growing points remain meristematic whereas other regions undergo some degree of differentiation. Later these meristematic zones produce somatic tissues in the form of small stalks. Finally, their apical regions differentiate into flowers. As a consequence of this "fractionated differentiation", not the usual single flowers but reduced inflorescences arise from the respective growing points.

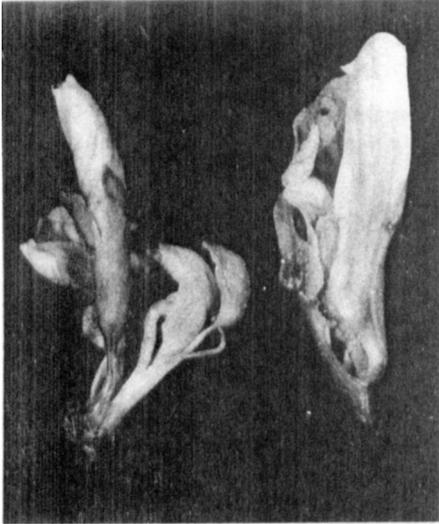


Fig. 1. Flowers of mutant 175

Left: Inflorescence with two flowers derived from a single growing point. The calyx of the lower flower was removed; the second flower, sitting on a short stalk, comes from the central region of that calyx.

Right: Inflorescence with three flowers derived from a single growing point. Most of the lower flower was removed. The middle flower consists only of a single petal opposite to the leaf-like carpel of the lowest flower. Between these two organs, the stalk is discernible carrying the apical flower inside the petal of the middle flower.

INFLUENCE OF TEMPERATURE ON THE FLOWERING BEHAVIOR OF FASCIATED AND BIFURCATED PISUM GENOTYPES

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and

The flowering behavior of four mutants with dichotomous stem bifurcation, four bifurcated recombinants, three fasciated mutants, and a fasciated recombinant was studied in the phytotron under the following temperature conditions:

- 12.5C constant (experiment 1)
- 12.5C night, 25.5C day (experiment 3)
- 23.5C constant (experiment 2)

The plants were grown under 18 hr light and 6 hr darkness in all three experiments. Number of days from sowing to the beginning of flowering was determined in ten plants per genotype. The mean values and the variability observed are given in Fig. 1 together with the values of the mother variety 'Dippes Gelbe Viktoria' (DGV).

The bifurcated mutants 239CH and L201A are homozygous for gene bif-1; mutant 157A is homozygous for bif-2 which is polymeric to bif-1. Both these genes show reduced penetrance. The mutant gene of 37B is allelic to bif-1 but it shows full penetrance. The bifurcated recombinants, considered in the lefthand part of the figure, contain bif-1 together with genes for waxlessness, different internode lengths and/or different seed sizes. As expected, all these genotypes flowered considerably later under constant low temperature than under high temperature. The differences between experiment 2 and 3, however, were very small. In experiment 3, the high temperature was only given over a period of 6 hr per day, i.e. between 10:00 a.m. and 4:00 p.m. From 6:00 to 10:00 a.m. the temperature gradually rose from 12.5 to 25.5C and from 4:00 to 9:00 p.m. it fell from 25.5 to 12.5C. This relatively short duration of the high temperature had a very positive effect on the flowering behavior of the bifurcated genotypes tested. Thus, the period of low temperature had relatively little effect on the rate of development, provided that the plants were exposed to high temperature during daytime. DGV plants behaved similarly. Plants of mutant 1201, however, showed a certain degree of earliness in experiment 2 which was not observed in experiment 3.