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Inheritance of giant mutant plant type in fenugreek (*Trigonella foenum-graecum* L.)

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Abstract

The inheritance of giant mutant plant type was worked out by evaluating F_1, F_2 and F_3 generations in a cross (RMt-1 x Mutant) of fenugreek. On the basis of plant type in F_1 and the segregation ratios in F_2 and F_3, it was concluded that the normal plant type of RMt-1 was controlled by a single dominant gene and mutant plant type by its recessive allele.

Key words: fenugreek, inheritance, mutants, *Trigonella foenum-graecum.*

The availability of morphological markers in a crop species provides an added advantage in characterizing and maintaining genetic purity. Moreover, knowledge of inheritance of the marker trait is important so that it can be used in breeding programmes and for conducting genetical studies. Several morphological mutants for size, shape and pigmentation have been used as markers in different crop species. A giant mutant was isolated from one germplasm entry "Nagor Local Methi" (Prabha), maintained at Jobner center of AICRP on spices. Now this entry (Prabha) is known as RMt-1, a commercial variety of fenugreek. RMt-1 and the giant mutant both have indeterminate growth habit. However, the giant mutant has a peculiar plant type with broad leathery leaves, thick stem, large flowers, large seeds, large pods with thick pod wall in contrast to RMt-1, which has normal stem, leaves, flowers, pods and seeds (Figs.1 & 2). Thus, it was thought that the plant type of this giant mutant could be used as a potential marker in crop improvement programme. Earlier, cytological studies on meiotic behaviour in the RMt-1 and the giant mutant (Vinod & Sastry 1999) indicated that the giant mutant was not a polyploid of RMt-1 but a diploid. With this background information it was felt that the knowledge about the inheritance pattern of this giant mutant plant type will be very useful in fenugreek breeding as it can be used as a marker trait. Thus, the present investigation was undertaken to determine the inheritance of the giant mutant plant type in fenugreek.

In the rabi season of 1996-97 crossings were done between the variety RMt-1 and the giant mutant by taking RMt-1 as the female parent and the giant mutant as the male parent. In the rabi season of year 1997-98, F_1 was grown along with the parents. F_1 was closely observed for plant type and morphological characters. Observation on dominance behaviour of plant type in F_1 generation was recorded. The F_1 was harvested to procure seeds for F_2. In the rabi season of 1998-99 the

seeds were sown in two rows of 3 m length with row to row distance of 30 cm to raise F_2 generation. In the F_2 generation, plants were scored for mutant and normal plants and the pattern of segregation was recorded. Chi-square test was applied to test the goodness of fit for the assumed segregation ratio. All the F_2 plants were harvested individually to get seeds for F_3 family. The experiment was continued to F_3 generation to confirm the results obtained in the F_2 generation. For this, five normal F_2 plants out of 39 normal F_2 plants and 3 mutant plants out of 15 mutant plants were randomly selected for testing in F_3 generation. Thus, in rabi 1999-2000 five single plant progenies derived from 5 normal F_2 plants and 3 single plant progenies derived form 3 mutant F_2 plants were grown in 3 m long single row plots as F_3 families. In each F_3 family, the plants (291 plants) were scored for mutant and normal plants. The number of mutant and normal plants of the segregating F_3 families were totaled and Chi-square test was applied to test the goodness of fit for the assumed segregation ratio.

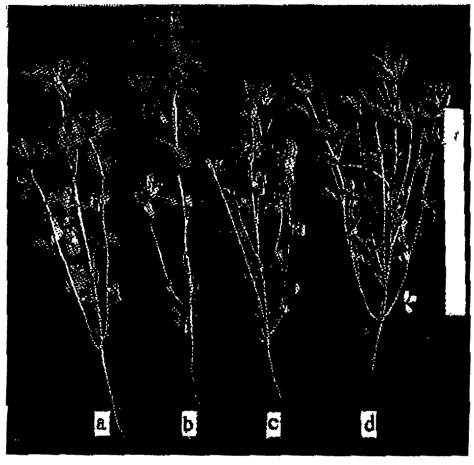

Fig. 1. Parental mutant (a) and F_3 generation mutant (b) along with normal RMt-1 plant of parent (d) and F_3 generation (c)

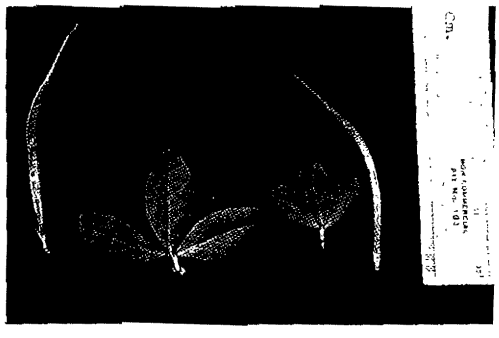

Fig. 2. Pod and leaf of mutant (left) and normal plant (right) used in the crossing

The F_1 plant was having normal plant type, just same as that of the female parent i.e. RMt-1. The normal plant type of F_1 plant indicated that the trait normal plant type was completely dominant over the mutant plant type. The F_2 population segregated in to 39 normal plants (with normal plant type) : 15 mutant plants (with mutant plant type), a good fit to 3 : 1 monohybrid ratio (X^2 = 0.0987; P = 0.8 - 0.7). This indicated that the normal plant type is controlled by a single dominant gene and the mutant plant type by its recessive allele.

All the F_3 families derived from 5 randomly selected normal F_2 plants segregated for the normal and mutant plant types. This indicated that all the 5 randomly selected progenitor F_2 plants of these F_3 families were heterozygous for the gene governing the plant type. Absence of true breeding F_2 plants in the 5 randomly selected normal F_2 plants was solely due to non inclusion, by chance, of any dominant homozygous F_2 plant in the random sample of 5 normal F_2 plants. All the F_3 families, derived form 3 mutant F_2 plants, only had mutant plants. Thus, all the F_2 mutant plants bred true. This confirms that the mutant plant type is governed by a single recessive allele. All the normal and mutant plants in the 5 segregating F_3 families were counted and Chi-square test was applied to test the fitness of the data for expected ratio of 3 normal plants : 1 mutant plant. The observed 3 normal plants : 1 mutant plant ratio in F_3 generation was fitting at a very high probability level (P = 0.8 – 0.7), which again confirms that the normal plant type is governed by a single dominant gene and mutant plant type by its recessive allele. The results of 3 mutant : 1 normal plant type disomic ratio in both F_2 and F_3 generations indicate that the mutant is a diploid, which confirms the finding of Vinod & Sastry (1999).

Reference

Vinod & Sastry E V D 1999 Meiotic studies in fenugreek. Crop Res. 17 : 266-267.