Indian J. Genet., **65**(2): 135-136 (2005)

Short Communication

Induced seed coat colour mutations and their inheritance in grasspea (*Lathyrus sativus* L.)

Dibyendu Talukder and Amal K. Biswas

Department of Botany, University of Kalyani, Kalyani, Nadia 741 235

(Received: January 2004; Revised: May 2005; Accepted: May 2005)

Testa colour and mosaic pattern are two important genetic markers in the study of seed coat inheritance. Apart from natural variations, in different leguminous crops stable variations in seed coat colour have been brought about by induction of mutation [1-3]. Induced mutations for different morphological characters have been reported in grasspea (*Lathyrus sativus* L.) [4-7]. The present authors have isolated three distinct seed coat colour mutants showing mosaic *vs.* non-mosaic distribution in M_2 generation of grasspea using gamma-ray irradiation. In this communication the mode of inheritance and distribution pattern of seed coat colour in the mutant have been described.

Dry and healthy seeds of grasspea var. Bio R-231 were irradiated with 200, 250, 300, 350 and 400 Gy of gamma rays. Treated seeds were space planted in M_1 generation raised during *rabi* season of 1996-1997. The M_1 seeds were harvested separately and sown to obtain M_2 generation. The observations on seed coat colour showing mosaic nature were recorded on M_2 seeds. In the M_2 progeny, 3 plants were detected as black seed coat colour with mosaic distribution following 300 Gy irradiation, while one plant each was identified as yellow non-mosaic and white mosaic nature in 250 Gy and 350 Gy irradiated progenies respectively. The parental variety had brown seed coat with no mosaic distribution. All the three types of mutants along with the parents were grown for raising M_3, M_4 and M_5 generations (*rabi* seasons of 1998-99, 1999-2000, 2000-2001) under uniform agro-climatic condition and found to be stable for the respective characters. The three seed coat mutants namely black mosaic, yellow non-mosaic, white mosaic and normal parent brown non- mosaic were intercrossed in all possible combinations during *rabi* 2001-2002. Inheritance of seed coat colour and mosaic-non-mosaic distribution pattern were studied separately (Table 1) and also together considering both the traits (Table 2). For joint segregation, the non-mosaic parents — brown seeded normal and yellow seeded mutant were crossed with mosaic parents-black and white seeded mutants. The F_1 obtained from each cross was back crossed with recessive parent and segregation data for respective characters were analysed with the help of chi-square test.

Genetics of seed coat colour. Crosses were made between normal parental variety having brown coloured seed coat and black seed coat, yellow seed coat and white seed coat mutants separately. In the selfed F_2 progeny, brown *vs* black brown *vs* yellow and brown *vs* white seed coat colour segregated into 3:1 phenotypic ratios (Table 1). This indicates that brown colour of seed coat is completely dominant over other seed coat colour. Seed coat colour in the F_1 plants raised through crosses between black × yellow, black × white and yellow × white seed coat coloured parents were black, black and yellow respectively. In the selfed F_2 progenies the segregation was 3:1 in all cases. Black seed coat colour thus appeared to be completely dominant over

Table 1. Monohybrid segregation of seed coat colour and mosaicism in F_2 generations (proposed gene symbols used)

Cross	F_1 phenotype	Segregation in F_2 progeny		Total	Ratio	χ^2
$C^{Br}C^{Br} \times C^{Bl}C^{Bl}$ (Brown × Black)	Brown	59 Brown	20 Black	79	3:1	0.04
$C^{Br}C^{Br} \times C^{y}C^{y}$ (Brown × Yellow)	Brown	68 Brown	21 Yellow	89	3:1	0.08
$C^{Br}C^{Br} \times CC$ (Brown × White)	Brown	70 Brown	24 White	94	3:1	0.01
$C^{Bl}C^{Bl} \times C^{y}C^{y}$ (Black × Yellow)	Black	31 Black	11 Yellow	42	3:1	0.03
$C^{y}C^{y} \times CC$ (Yellow × White)	Yellow	25 Yellow	9 White	34	3:1	0.03
For mosaic character $mS^{+}mS^{+} \times mSmS$ (Non-mosaic × Mosaic)	Non-mosaic	153 Non-mosaic	48 Mosaic	201	3:1	0.13

Table 2. Dihybrid segregation of seed coat colour and mosaic pattern in F_2 and back cross progenies of grasspea

Cross	F_1 Phenotype	Segregation in F_2				Total	Ratio	χ^2
		Brown nonmosaic	Brown mosaic	Black/white nonmosaic	Black/white mosaic			
$C^{Br}C^{Br}$ ms^+ms^+ (Brown non-mosaic) × $C^{Bl}C^{Bl}$msms (Black mosaic)	Brown non-mosaic	179	57	59	18	313	9:3:3:1	0.23
F_1 × $C^{Bl}C^{Bl}$msms	-	39	33	37	32	141	1:1:1:1	0.93
$C^{Br}C^{Br}ms^+ms^+$ (Brown non-mosaic) × CCmsms (White mosaic)	Brown non-mosaic	111 Yellow non-mosaic	35 Yellow mosaic	33 White non-mosaic	12 White mosaic	191	9:3:31	0.31
$C^yC^yms^+ms^+$ (Yellow non-mosaic) × CCmsms (White mosaic)	Yellow non-mosaic	40	13	14	5	72	9:3:3:1	0.08
F_1 × CCmsms (Recessive)	-	29 Yellow non-mosaic	26 Yellow mosaic	22 Black non-mosaic	25 Black mosaic	102	1:1:1:1	1.40
$C^yC^yms^+ms^+$ × $C^{Bl}C^{Bl}$msms (Black mosaic)	Yellow non-mosaic	124	39	40	14	217	9:3:3:1	0.15
F_1 × $C^{Bl}C^{Bl}$msms (Recessive)	-	51	48	46	49	194	1:1:1:1	0.21

yellow and white colour, and yellow colour over white colour. Obviously, white colour of seed coat was found to be recessive to all other types.

Genetics of seed mosaic: In the crosses between mosaic and non-mosaic seed coat mutants, the segregation in F_2 showed good fit to 3 non-mosaic : 1 mosaic (Table 1). The result reflected complete dominance of non-mosaic pattern of seed coat over mosaic pattern.

Segregation of seed coat colour and mosaic character: In the typical dihybrid crosses between brown non-mosaic × black mosaic and brown non-mosaic × white mosaic each of the two characters segregated independently in F_2 showing good fit to Mendelian dihybrid ratio 9 brown non-mosaic : 3 brown mosaic : 3 black non-mosaic : 1 black mosaic in the former cross and 9 brown non-mosaic : 3 brown mosaic : 3 white non-mosaic : 1 white mosaic in the latter cross respectively. The mode of segregation was similar (9:3:3:1) in the F_2 raised through the crosses involving yellow non-mosaic mutant with the plants having black mosaic and white mosaic seed coat (Table 2).

Segregation pattern of colour and mosaic nature of seed coat in grasspea indicates involvement of two pairs of genes in the process. Seed coat colour in the cultivar BioR-231, thus assumed to be controlled by a series of multiple alleles and the dominance relationship among the alleles has been shown by designating the genes with the symbols as C^{Br} (brown) > C^{Bl} (black) > C^y (yellow) > C (white). The other gene, controlling mosaic pattern has only one pair of alleles, proposed as ms^+/ms. Dominant allele ms^+ controls the non-mosaic character while recessive allele ms regulates mosaic pattern of seed coat. Recovery of different recombinants in the F_2 progenies clearly showed that there was no linkage between these two pairs of genes and they are most likely either distantly mapped (located) in one chromosome or present on different chromosomes.

References

1. **Sharma B. and Kharkwal M. C.** 1983. Mutation breeding of lentil, cowpea and chickpea. Mutation Breed. News lett., **21**: 5-6.
2. **Pandey R. N., Pawar S. E., Chintalwar G. J. and Bhatia C. R.** 1989. Seed coat and hypocotyl's pigments in green gram and black gram. Proc.Indian Acad. Sci. (Plant Sci.)., **99**: 301-306.
3. **Kharkwal M. C.** 2000 . Induced mutations in chickpea (*Cicer arietinum* L .) IV. Types of macromutations induced. Indian J. Genet., **60**: 305-320.
4. **Talukder D., Biswas S. C. and Biswas A. K.** 2001. An induced dwarf mutant of grass pea. Indian J. Genet., **61**: 383-384.
5. **Waghmare V. N. and Mehra R. B.** 2000. Induced mutations in grass pea (*Lathyrus sativus* L.) Lathyrus Lathyrism News letter., **1** : 21-23.
6. **Waghmare V. N., Waghmare D. N. and Mehra R. B.** 2001. An induced fasciated mutant in grass pea (*Lathyrus sativus* L.). Indian J. Genet., **61**: 155-157.
7. **Talukder D. and Biswas A. K.** 2002. Characterisation of an induced mutant and its inheritance in grass pea (*Lathyrus sativus* L.). Indian J. Genet., **62**: 355-356.