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Short Communication

Mutation in seed-coat colour in black cumin (*Nigella sativa* L.)

Subhendu Kumar Rang and Animesh K. Datta

Department of Botany, Breeding and Cytogenetics Lab, Kalyani 741 234

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In the M_2 generation of *Nigella sativa* L. (*Ranunculaceae*), five dark reddish brown (3/2), one yellowish brown (5/4) and one peach (512/1) colour seeded plants were spotted out of 7956 plants progenies following treatments of dry, filled and black seeds (moisture content –7.5%) of black cumin with 20 kR gamma irradiation, 10 kR gamma irradiation + 0.25 per cent EMS for 6 h and 0.25 per cent EMS for 12 h respectively. Fully mature seeds were used for colour identification. The colours of the seeds were confirmed from Horticultural Colour Chart (1968) and Munsell Soil Colour Chart (1975). The seeds having peach colour were associated with blackish tinge at the base and apical region and has been designated as *bicolour* mutant in the text. Mutation frequency of dark reddish brown colour, yellowish brown colour and bicolour seeds was 1.92, 0.055 and 0.54 per cent respectively.

Reciprocal crosses were made between black seeded normal plants and mutants and subsequently F_1 and F_2 plants were raised. The F_2 plants were used for estimating the segregation ratio for seed- coat colour by using the Chi-square test. The pattern of F_2 segregation revealed that dark reddish brown and yellowish brown seed colour were monogenic recessive to black seeds; while, the inheritance of bicolour trait of seeds was under the control of two pairs of recessive genes (Table 1). Further this was supported from the result of segregation which was obtained following back crossing of F_1's with the mutant plants (hybrid plants of black × dark reddish brown back crossed to dark reddish brown produced 62 *black* seeded plants and 54 dark reddish brown seeded plants - X^2 = 0.56 for 1:1, p value 0.30-0.50; hybrids of *black* × yellowish brown back crossed to yellowish brown yielded 38 black and 31 yellowish brown seeded plants - X^2 = 0.72 for 1:1, p value 0.30-0.50; and hybrids of black × bicolour back crossed to bicolour produced 66 black and 15 bicolour seeded plants - X^2 = 1.82 for 3:1, p value 0.10- 0.20). Results indicate that black colouration of seeds in black cumin is dominant over the other seed colours. Assigning the gene symbols B for black. b^{dr} for dark reddish brown and b^Y for yellowish brown colours of seeds and also if we assume that p is responsible for peach colour in seeds and the dominant from (P) of this gene has no effect on B or on any allelic forms of B (b^{dr}/b^Y) and that mutation involving both the dominant genes (B-P) results to bicolour seeds, then the following genotypes BBPP, b^{dr} b^{dr}, X PP, b^Yb^Y PP and bbpp can be proposed for black, dark reddish brown, yellowish brown and bicolour seeds respectively. However, inter-mutant crosses will throw more light on the genetic control of the expression of different seed-coat colours in back cumin.

The mutant plant types were also evaluated for number of quantitative characters in comparison with their black seeded control plants in M_4 generation. Selfed progenies of seed-coat colour mutant plant and

Table 1. Segregation for seed colours in black cumin

Seed colour parents		F_1	F2-segregation (number of plants)		X^2 value (expected ratio)	P range of X^2
Pollen	Stigma					
Black	Dark reddish brown	Black	Black (101)	Dark reddish brown (28)	0.74 (3:1)	0.30-0.50
Dark reddish brown	Black	Black	Black (187)	Dark reddish brown (72)	1.08 (3:1)	0.30-0.50
Black	Yellowish brown	Black	Black (108)	Yellowish brown (44)	1.25 (3:1)	0.20-0.30
Yellowish brown	Black	Black	Black (80)	Yellowish brown (21)	0.95 (3:1)	0.30-0.50
Black	Bicolour	Black	Black (86)	Bicolour (06)	0.01 (15:1)	$p \geq 0.90$
Bicolour	Black	Black	Black (61)	Bicolour (05)	0.19 (15:1)	0.50- 0.70

Table 2. Mean values for different quantitative characters in normal and in three seed-coat mutants of black cumin

Plant types with seed-coat colours	plant height	No. of primary bran-ches/ plant	No. of total bran-ches/ plant	No. of capsule/pla nt	No. of seta/ capsule	Capsule length/fruit (cm)	Seed length (mm)	Seed breadth (mm)	Seed yield/ plant (gm)	Harvest index (%)
Black (Normal)	50.1 ± 1.13	6.2 ± 0.15	23.8 ± 1.47	24.8 ± 1.47	5.4 ± 0.08	1.2 ± 0.02	2.6 ± 0.05	1.3 ± 0.04	2.7 ± 0.16	36.4
Dark reddish brown	52.9 ± 1.38	5.5 ± 0.19	22.3 ± 1.99	23.4 ± 1.99	5.7 ± 0.12	1.1 ± 0.02	2.4 ± 0.04	1.4 ± 0.03	2.0 ± 0.25	31.3
Yellowish brown	37.7 ± 1.9	6.0 ± 0.2	23.4 ± 2.18	24.4 ± 2.18	5.1 ± 0.10	1.1 ± 0.02	2.2 ± 0.04	1.3 ± 0.04	2.0 ± 0.19	31.0
Bicolour	39.7 ± 2.05	6.3 ± 0.67	22.7 ± 4.91	23.7 ± 4.91	5.1 ± 0.33	0.9 ± 0.0	2.2 ± 0.05	1.1 ± 0.04	0.9 ± 0.18	21.9
CD at 5% level	10.13	1.11	8.77	8.77	0.42	0.13	0.32	0.26	0.97	10.65

black seeded normal plants were grown in randomized block design with 3 replications. Each plot (3m × 1.5 m) consisted of 4 rows, 250 cm long with a spacing of 30 cm between rows and 10 cm between plants. Observation in 5 randomly selected plants from each row and a total of 60 plants from 3 replications were recorded for different quantitative traits in control and in the mutant plant types and have been presented in Table 2. Result indicate that dark reddish brown seed-coat mutant was as productive as normals; while the bicolour and the yellowish brown seed-coat mutants were short sized and small seeded plants. Proper utilization of such mutants for better yield can be made through intercrossing with normal plants followed by selection.

As India exports black cumin [1-2], induced genetic variation in seed-coat colour may be better utilized and exploited for market value and furthermore, the seed-coat mutants may also be used as genetic markers in different breeding experiments.

References

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