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Short Communication

A viable chlorophyll mutant in black cumin (*Nigella sativa* L.)

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A research programme has been under taken to induce genetic variations and to screen useful mutations for efficient plant breeding in black cumin [1-2], a spice yielding member of the family Ranunculaceae and this communication is a report on a viable chlorophyll mutant in black cumin [*Nigella sativa* L.].

Of the seven different types of chlorophyll mutants (*albina, xantha, lutea, chloroxantha, albescence, chlorotica* and *viridis*) screened at M_2, *chloroxantha* was the only type which survived till maturity and yielded seeds. The name and specification of the colour of the mutant were laid with reference to "Dictionary of colour" by Maerz and Paul [3]. The *chloroxantha* type was spotted [Fig. 1] following treatments of dry and filled seeds of black cumin (cultivated var. *persian jewels*, moisture content - 7.5%) with 20KR gamma irradiation; 0.25% EMS, 12 hours; 5KR + 0.25% EMS, 12 hours (38 mutant plants were scored from 150 germinated seedlings at this dose) and 20KR + 0.25% H_2O_2, 6 hours. Estimated mutation frequency of *chloroxantha* over the treated population (7956 plants screened) was 0.54% and it was assessed as per 100 M_2 plants.

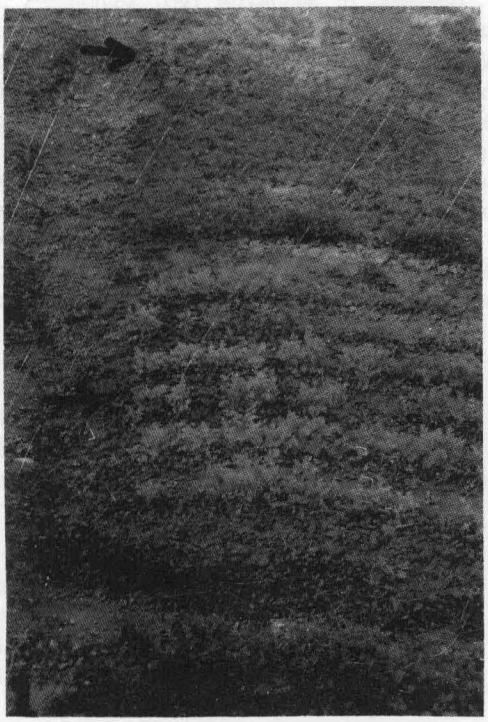

Fig. 1. Chloroxantha (→) and normal plants

The seedlings of *chloroxantha* were pale greenish yellow in colour (2012) and the mutant could be easily marked at the very seedling stage. Chlorophyll content in mg/gm of leaf in *chloroxantha* (chlorophyll *a* - 0.32, chlorophyll *b* - 0.25 and total - 0.57) following Arnon [4] was less than normal plants [chlorophyll *a* 0.51, chlorophyll *b* - 0.37 and total - 0.88]. The mutant plants showed delayed flowering (17 to 29 days from control plants) and maturity, which indicates that the mutant being deficient in chlorophyll content might have utilized their buffering capacity to maintain the photosynthetic efficiency by increasing the number of branches (consequently pinnae of the leaves increased in the mutant) and duration of the crop to complete their life cycle successfully.

Reciprocal crosses were made between normal and *chloroxantha* mutant plants and subsequently F_1 (all F_1s were of normal colour phenotypes) and F_2 plants were raised. The F_2 plants were used for estimating the segregating ratio for seedling colours by using the Chi-square test. The pattern of (mutant as stigma parent in crossing with normal plants), F_2 segretation - 25 normal and 15 chloroxantha plants, X^2 = 0.64 for 9 : 7 ratio, p value - 0.40 to 0.50; mutant as pollen parent in crossing with normal plants, F_2 segregation - 48 normal and 28 mutant plants, X^2 = 0.86 for 9 : 7 ratio, p value - 0.40 to 0.50) revealed that the inheritance of the *chloroxantha* mutant was recessive and was under the control of two gene loci.

Selfed progenies of *chloroxantha* and normal

Table 1. Range, mean and standard error analyzed for different quantitative characters in black cumin and in *chloroxantha* at M_4

Character	Control plants		*Chloroxantha* mutant plants	
	Range	Mean	Range	Mean
Plant height (cm.)	31.8-64.0	49.7±1.13	42.5-67.8	50.5 ± 1.54
No. of primary branches/plant	4.0-9.0	6.8±0.15	5.0-10.0	7.0** ± 0.28
Total capsule numbers/plant	12.0-65.0	24.4±6.50	22.0-77.0	38.4 ** ± 4.03
No. of seta/capsule	5.0-7.0	5.4±0.08	5.0-7.0	5.6 ± 0.15
Capsule length/fruit (cm.)	1.0-1.4	1.2±0.02	1.0-1.4	1.2 ± 0.03
Seed length (mm.)	2.0-2.9	2.6±0.05	2.0-2.8	2.4* ± 0.04
Seed breadth (mm.)	0.9-1.7	1.3±0.04	0.8-1.5	1.3 ± 0.05
Seed number/plant	325.0-2448.0	1535.76 ±153.47	405.0-2145.0	1592.75 ±183.64
Seed weight/plant (gm.)	1.0-6.2	2.7±0.16	1.0-6.8	2.7±0.25

* and ** = Significant at 5% and 1% level respectively.

plants were grown in randomized block design (plot size - 3m × 1.5 , 4 rows in each plot - each 250 cm long, spacing of 30 cm between rows and 10 cm. between plants) with 3 replications at M_4 and a number of quantitative characters were assessed in the plant types (5 randomly selected plants from each row and a total of 60 plants from each plant type was analyzed). Result indicate (student t-test was computed between the sample means) that *chloroxantha* possessed significantly higher number of primary branches and capsules per plant and had smaller seeds (length) than normals; although, the other traits assessed were more or less similar in the plant types (Table 1). Thus, *chloroxantha* is a productive mutant and better utilization of such mutant can be made through intercrossing with normal plants followed by selection.

The characteristic phenotypic colour of *chloroxantha*, which has been evident in the very cotyledonary leaf stage may be exploited as genetic marker in different breeding experiments of black cumin.

References

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