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# Induced polygenic variability in coriander (*coriandrum sativum* L.) and scope of selection

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## ABSTRACT

*Coriander is one of the major seed spice grown for leaf and seed purpose. The present investigation was undertaken with a view to estimate the nature and extent of genetic variability induced by three doses of gamma irradiation, three doses of EMS and combination of gamma rays with EMS in Coriander variety Swathi. Separately harvested $M_1$ plants were used to raise $M_2$ generation. Observations on twelve quantitative traits were recorded on five randomly selected normal looking plants in each family of a treatment. Mean, range and coefficient of variation for these traits were estimated. Results of the experiment indicated (i) variation in behaviour of means, (ii) widening of ranges and (iii) increase in coefficient of variation (CV) for all characters in mutagenic treated populations as compared to their controls. The magnitude of coefficient of variation was different for different treatments and characters in the variety. Of the twelve characters studied, induced variability was higher for number of primary and secondary branches, leaf yield, number of leaves, number of umbels and yield per plant suggesting scope of improvement through selection in these characters.*

***Keywords***: *Coriander, coefficient of variation, gamma rays, EMS*

## INTRODUCTION

Coriander (*Coriandrum sativum* L.) generally called as "Dhania" is a rabi seed spice crop even though it is grown for leaf throughout the year. India exports about 10 to12 thousand tonnes of coriander seed valued at Rs.15 to 30 crores and 700 to 1300 tonnes of powder valued Rs.2.1 crores to 2.6 crores[1]. However, the productivity of this important annual seed spice crop in India is very low (350-650 Kg/ha). Lack of adequate genetic variability in economically important quantitative traits is considered to be one of the major impediments in yield improvement of this crop. Induction of mutation is considered to be quite promising. During last six decades, induced mutation has led to the development of more than 1500 cultivars in different crop plants[3, 6]. Keeping the above facts in view, the present investigation in coriander was undertaken to induce genetic variability through gamma irradiation, EMS and their combinations in economically important traits for yield improvement of the crop.

## MATERIAL AND METHODS

In the present investigation seeds of coriander variety (Swathi) was taken as experimental material and was subjected to three doses (5,10 and 15 Kr) of gamma irradiation , three doses of EMS (0.2%,0.3% and 0.4% EMS) and their combinations with 5Kr gamma rays(5kr +0.2% EMS, 5kr +0.3% EMS. 5kr +0.4% EMS). For this purpose 400 seeds for coriander variety Swathi were treated with gamma irradiation at PHT (Rajendranagar, Hyderabad).

The treated seeds and their untreated controls were sown at HRS, Lam, Guntur to raise the $M_1$ generation in randomized block design with three replications. Fifty randomly selected $M_1$ plants from each replication were harvested separately and harvested seeds were sown in plant to progeny method to raise $M_2$ generation in randomized block design with three replications. In each replication 50 families were raised per treatment. Observation on different quantitative characters viz., plant height (cm), number of primary and secondary branches / plant, number of leaves, leaf yield (gm/pl), days taken for 50 % flowering, days for maturity, umbels/plant, umbellets per umbel, seeds per umbel, (cm), 1000-seed weight (g) and single plant yield (g) were recorded on five randomly chosen normal looking plants per family. Observed data were processed to estimate mean, range and coefficient of variation following the standard procedure[8].

## RESULTS AND DISCUSSION

The mean, range and coefficient of variation for twelve quantitative characters in $M_2$ generation are presented in Table 1, 2 and 3. Mean values for different characters behaved differently in mutagen treated populations indicating variable response of characters to mutagenic treatments. The mean for the characters under study showed positive and negative trend in mutagen treated populations than control suggesting different nature of induced changes in the various characters. However, no clear trend for the mean was observed for various characters under study and it shifted in both positive and negative directions around the control mean. Similar behavior of means for different characters in mutagen treated populations have been reported earlier by different workers in coriander[2,47,10] , in fenugreek[11] in fennel[5]. Reduction of mean in mutagenic populations might be due to induction of more mutations in negative direction and increase in mean could be attributed to induction of more positive mutations in the polygenes governing the character.

Positive shift in mean was observed in plant height, number of leaves and leaf yield at lower doses and in other traits negative shift in mean was observed at higher doses for most of the characters. However, there was a sudden increase in mean of the plant height at higher doses indicating different nature of induced changes in mutated population. The range of character means were wider in irradiated populations than the range in the control population of all the traits under study indicating the variation created by mutagens in the coriander variety, Swathi.

Increase in range towards both positive and negative direction in the mutagen treated populations for different characters indicates induction of micro- mutations and release of polygenic variability in these characters. Widening of range towards positive side was observed in plant height and in other traits such response was not observed. However, at lower doses the shift was towards positive direction and at higher doses the range was more towards negative direction.

The coefficient of variation (CV) was invariably higher in mutagen treated populations than the CV in controls for all the twelve quantitative characters studied (Table 1 - 3). This could be due to induced genetic changes and release of polygenic variability in all the treated populations. The magnitude of CV was different in treated populations for different characters indicating the variable degree of induced changes in different doses of mutagens. Though no linear relation between dose of mutagen and CV was observed, invariably CV was higher in populations treated with high dose of mutagen. Similar response of behaviour of CV in mutagen treated populations had been reported in green gram[9]. Among different characters studied, CV was higher for plant height, primary branches, secondary branches, leaf yield, number of leaves, number of umbels, number of seeds per umbel and yield per plant indicating the extent of polygenic variability induced in these characters. In a mutation breeding programme, greater emphasis is given to treated populations showing high mean and high CV in the characters of interest as there is more chance of getting desirable mutant.

In the present investigation, high mean as well as high CV was observed for the character; plant height, primary branches, secondary branches, leaf yield, number of leaves, umbels, number of seeds per umbel and yield per plant This suggests that selection in these characters in subsequent generations would be rewarding.

**Table 1: Range, Mean and Coefficient of variation in vegetative characters of coriander variety: Swathi**

| Treatment | Plant height(cm) | | | | Number of primary Branches | | | | Number of secondary branches | | | | Leaf yield(g/pl) | | | | Number of leaves | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range | | Mean (cm) | CV (%) | Range | | Mean (cm) | CV (%) | Range | | Mean (cm) | CV (%) | Range | | Mean (cm) | CV (%) | Range | | Mean (cm) | CV (%) |
| | Min | Max | | | Min | Max | | | Min | Max | | | Min | Max | | | Min | Max | | |
| 5Kr | 37.17 | 77.7 | 51.5 | 22.1 | 3 | 7 | 4.0 | 19.2 | 7 | 26 | 11.7 | 25.6 | 1 | 9.2 | 5.4 | 21.0 | 1.3 | 10.2 | 6.7 | 21.3 |
| 10Kr | 35.33 | 74.5 | 52.4 | 21.9 | 1.5 | 6.5 | 3.7 | 24.9 | 5 | 19 | 10.8 | 24.2 | 1.4 | 10.5 | 5.2 | 27.1 | 1.7 | 13.6 | 6.5 | 29.8 |
| 15Kr | 41.17 | 79.7 | 55.3 | 18.9 | 1.5 | 6 | 3.7 | 23.6 | 5 | 21.5 | 9.98 | 24.9 | 1.2 | 9.1 | 4.3 | 26.6 | 1.6 | 10.9 | 5.3 | 26.3 |
| 0.2% EMS | 34.67 | 70.17 | 48.2 | 21.3 | 1.5 | 6.5 | 3.7 | 24.4 | 6 | 19.5 | 12.9 | 23.3 | 1.6 | 12.1 | 6.2 | 32.6 | 1.9 | 16.8 | 7.7 | 33.5 |
| 0.3% EMS | 33 | 82.2 | 51.1 | 21.5 | 2 | 7.5 | 3.6 | 24.7 | 7 | 26.5 | 13.1 | 26.4 | 2.5 | 13.1 | 6.1 | 29.6 | 3 | 18.4 | 7.6 | 32.5 |
| 0.4% EMS | 35.5 | 75 | 55.1 | 22.2 | 1.5 | 6 | 3.0 | 22.8 | 6 | 17.5 | 10.1 | 23.1 | 1.6 | 9.1 | 5.5 | 20.6 | 2.2 | 11.8 | 6.9 | 22.0 |
| 5Kr + 0.2% EMS | 37.33 | 77.3 | 54.7 | 21.6 | 2 | 7.5 | 4.5 | 24.3 | 6 | 22.5 | 12.9 | 24.2 | 3.25 | 14.1 | 7.7 | 33.6 | 3.8 | 19.7 | 9.7 | 37.8 |
| 5Kr + 0.3% EMS | 32.47 | 77.2 | 52.5 | 20.4 | 2 | 6.5 | 3.5 | 24.2 | 7 | 24.5 | 14.4 | 24.0 | 3 | 12.4 | 7.7 | 29.5 | 3.3 | 16.0 | 9.6 | 32.2 |
| 5Kr + 0.4% EMS | 37.57 | 81.5 | 55.9 | 22.0 | 1.5 | 7.5 | 3.6 | 28.0 | 6 | 21 | 12.7 | 23.2 | 0.8 | 13.6 | 6.8 | 33.77 | 1.1 | 18.9 | 8.5 | 36.8 |
| Control | 47.33 | 57 | 52.2 | 4.6 | 2.8 | 4.8 | 3.8 | 10.2 | 8.8 | 14 | 11.5 | 7.5 | 3.4 | 10.4 | 5.9 | 17.38 | 3.6 | 12.2 | 7.07 | 18.67 |
| CD | | 1.75 | | | | 0.07 | | | | 0.21 | | | 0.19 | | | | 0.07 | | | |

**Table 2: Range, Mean and Coefficient of variation on days to 50% flowering, days to maturity and test weight of coriander variety: Swathi**

| | Days to flowering | | | | Days to maturity | | | | Thousand seed weight(gm) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of Treatment | Range | | Mean | CV | Range | | Mean | CV | Range | | Mean | CV |
| | Min | Max | | % | Min | Max | | % | Min | Max | (gm) | % |
| 5Kr | 47 | 57 | 54.6 | 6.39 | 91 | 99 | 96.2 | 2.41 | 10.64 | 22.5 | 16.38 | 21.2 |
| 10Kr | 45 | 57 | 53.6 | 8.96 | 91 | 105 | 96.5 | 2.58 | 10.35 | 22.52 | 16.65 | 21.41 |
| 15Kr | 45 | 57 | 53.7 | 7.07 | 88 | 102 | 92.3 | 1.54 | 10.37 | 22.64 | 16.07 | 21.33 |
| 0.2% EMS | 47 | 59 | 56.6 | 2.39 | 91 | 99 | 94.2 | 2.61 | 10.8 | 22.25 | 16.88 | 21.32 |
| 0.3% EMS | 48 | 59 | 52.3 | 6.66 | 91 | 99 | 97 | 1.45 | 11.22 | 22.11 | 16.16 | 21.5 |
| 0.4% EMS | 47 | 57 | 50.7 | 5.38 | 91 | 99 | 96.8 | 1.75 | 10.7 | 21.86 | 15.63 | 20.95 |
| 5Kr + 0.2% EMS | 45 | 58 | 55.6 | 4.07 | 91 | 99 | 95.2 | 1.93 | 10.59 | 22.31 | 16.52 | 21.34 |
| 5Kr + 0.3% EMS | 52 | 58 | 54.9 | 2.94 | 91 | 99 | 96.5 | 2.22 | 10.17 | 22.92 | 16.17 | 21.42 |
| 5Kr + 0.4% EMS | 44 | 57 | 52.5 | 7.8 | 91 | 107 | 95.1 | 2.77 | 10.36 | 22.1 | 15.54 | 21.37 |
| Control | 53 | 56 | 55 | 0.87 | 94 | 99.5 | 95.52 | 0.93 | 15.1 | 18.2 | 16.41 | 1.34 |
| CD | 0.19 | | | | 0.25 | | | | 0.07 | | | |

**Table 3: Range, Mean and Coefficient of variation in yield and yield attributes of coriander variety: Swathi**

| | umbels | | | | umbellets-umbel | | | | Seeds-umbel | | | | Yield(gm/Pl) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of Treatment | Range | | Mean | CV | Range | | Mean | CV | Range | | Mean | CV | Range | | Mean | CV |
| | Min | Max | | % | Min | Max | | % | Min | Max | | % | Min | Max | /pl) | (%) |
| 5Kr | 8.5 | 30 | 20.2 | 23.7 | 3.2 | 6.8 | 4.7 | 14.9 | 15.3 | 31.8 | 20.3 | 9.3 | 2.3 | 7.57 | 4.1 | 26.9 |
| 10Kr | 8 | 30 | 19.7 | 23.8 | 3.0 | 6.8 | 4.8 | 12.3 | 10.9 | 24.6 | 19.1 | 11.5 | 2.05 | 6.15 | 3.6 | 21.2 |
| 15Kr | 10.5 | 27 | 16.0 | 23.0 | 2.6 | 6.0 | 4.5 | 12.1 | 13.7 | 26 | 18.3 | 10.4 | 1.8 | 7.5 | 3.6 | 26.1 |
| 0.2% EMS | 8.5 | 29 | 17.4 | 22.6 | 3.0 | 6.8 | 4.4 | 17.0 | 15.4 | 27.8 | 21.6 | 8.5 | 2.3 | 8.05 | 4.3 | 23.3 |
| 0.3% EMS | 9 | 31.5 | 18.3 | 23.1 | 3.0 | 6.4 | 4.7 | 14.9 | 11.1 | 23.4 | 17.2 | 11.7 | 2.2 | 7.8 | 4.0 | 25.9 |
| 0.4% EMS | 7.5 | 24.5 | 15.4 | 23.3 | 2.4 | 7.4 | 4.3 | 16.2 | 12.4 | 23.4 | 17.2 | 10.6 | 1.9 | 6.8 | 3.3 | 27.8 |
| 5Kr + 0.2% EMS | 8 | 35 | 21.6 | 23.1 | 3.2 | 6.8 | 5.0 | 11.5 | 12.5 | 25.4 | 18.5 | 10.3 | 2.07 | 7.9 | 4.1 | 32.1 |
| 5Kr + 0.3% EMS | 8 | 31 | 19.3 | 24.1 | 3.4 | 7.0 | 4.9 | 12.3 | 12.7 | 24.4 | 19.1 | 10.3 | 2.41 | 7.8 | 4.5 | 22.2 |
| 5Kr + 0.4% EMS | 8 | 28 | 17.6 | 24.4 | 3.0 | 6.6 | 4.8 | 14.4 | 11.5 | 25.4 | 18.5 | 11.0 | 2.05 | 7.1 | 4.1 | 24.5 |
| Control | 14 | 22.5 | 18.1 | 7.0 | 3.4 | 5.7 | 4.9 | 6.3 | 13.6 | 23 | 18.2 | 6.8 | 2.75 | 5.05 | 4.0 | 6.1 |
| CD | 0.24 | | | | 0.03 | | | | 0.22 | | | | 0.06 | | | |

## REFERENCES


1. Anonymous 2008 Seasonal Report on Coriander Seeds. Karyy Comtrade limited.
2. Bhavanisingh, Dashora, S. L. Sharma, R. K. and Sastry, E.V.D., Gamma rays induced variation in coriander (*Coriandrum sativum*) L.). *Indian Cocoa Areca nut and Spices Journal.* **16(2)**: 60 – 62 (1992)
3. Gupta, P.K. In: Recent Advances on Mung Bean Research (Asthan A.N. and Kim, D.H. ed.) ISPRD and IIPR, Kanpur, p.121-123 (1996)
4. Mahla, H. R. Ramakrishna, K. and Sharma, R. K., An assessment of induced variability in $M_2$ progenies of coriander. *Annals of Arid Zone Research,* **38(1)**: 81-83 (1999)
5. Mahla, H.R. and Ramakrishna, K., An assessment of induced variation in fennel (*Foeniculum vulgare* Mill.). Annals of Agricultural Research. News Series, **23(1)**: 124 – 129 (2002)
6. Maluszynski, M.B. Sigurbjornsson, E. Amono, L. Stich and Karma, O., Mutation varieties data bank FAO/IEAE Data Base. Mutation Breeding News Letter, **38**:16-49 (1991)
7. Punia, S.S. and Ramkrishna, K., Induction and exploitation of polygenic variation in coriander (*Coriandrum sativum* L.) through mutagenesis. *National Journal Plant Improvement*, **4(2)**: 62 – 63 (2002)
8. Singh, R.K. and Chaudhury, B.D. (1977) Biometrical Methods in Quantitative Genetic Analysis, Kalyani Publication, New Delhi.
9. Singh, B. and Rao, T.G., Induced polygenic variability in greengram (*vigna radiata* (L.) wilczek) and scope of selection Legume Research, **31(2)**: 114 – 117 (2008)
10. Vedamuthu, P.G.B., Selvan, M., Shanmugavela, K.G. and Abdul Khader Md Genetic variability in certain mutant lines of coriander *(Coriandrum sativum*_L.).Papers presented in First national Seminar on seed Spices held at Jaipur from 24$^{th}$ octo. to 25$^{th}$-October (1989)
11. Yadav, S.M. 1992 Gamma rays induced variability in $M_1$, $M_2$ and $M_3$ generation of Fenugreek. M.Sc(Ag) Thesis submitted to Rajasthan Agricultural University Bikaner.