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Assessment of Survivability and Genetic Variability in Mutated Population of Hybrid cut *Chrysanthemum* cv. Lexy Red

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ABSTRACT

An experiment was conducted at experimental plot at college of Horticulture, Mudigere. Rooted terminal stem cuttings were irradiated with gamma rays (0, 10, 15, 20, 25 and 30 Gy) and the maximum survival percentage (100.00) was observed in control (0 Gy) and the minimum (0.00 %) was observed in 30 Gy and based on the survivability the LD_{50} was determined to be 25 Gy. High PCV and GCV was observed for plant height, number of leaves, leaf length, leaf width, leaf area, chlorophyll a and b and number of flowers per plant.

Key words : *Gamma, Heritability, GCV and PCV*

Introduction

Chrysanthemum (*Dendranthema grandiflora* Tzvelev.) is an herbaceous perennial flower crop commercially cultivated in many parts of the world. It is called as “autumn queen”, “queen of the east”, “guldaudi” and “mums”. Originated in the Northern Hemisphere, primarily in Europe and Asia. It is a member of the Asteraceae family, having chromosome number n=9 (Dowrick, 1952). There are wide varieties of chrysanthemums that were released through various conventional methods but these methods of plant breeding are cumbersome and time-consuming. Thus, to get faster results, plant breeders also have the option to go for mutation breeding. Gamma irradiation is a suitable method of mutation breeding for the creation of the desired variability in heritable cultivated plants. The present investigation was carried out to induce desirable changes in the morphological characters of well-es-

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tablished cultivars having significant consumer preference.

Materials and Methods

Terminal rooted cuttings (100 per treatment) of chrysanthemum *cv.* Lexy Red were irradiated with gamma rays to the doses of 0 Gy (control), 10, 15, 20, 25 and 30 Gy at the Indian Institute of Horticultural Sciences (IIHR), Bengaluru. They were immediately planted with an Augmented Block Design. Survival was recorded at the bud initiation stage and expressed in percentage. Vegetative parameters include plant height, number of leaves, leaf length, leaf width, leaf area, plant spread (E-W), plant spread (N-S) and flowering parameters, including days to bud initiation, days to flowering, days to colour visibility, total chlorophyll, number of flowers per plant, diameter of flower and vase life were recorded at the grand growth stage.

Observed data on each plant was considered for statistical analysis. Genetic variability parameters viz., genotypic variability (Vg), phenotypic variability (Vp), genotypic co-efficient of variability (GCV), phenotypic coefficient of variability (PCV), broad sense heritability (H), genetic advance as per cent of mean. The mean and range were estimated from all mutant populations and check.

Results and Discussion

Relative mutagenic efficiency

Per cent plant survival was calculated by counting the number of survived plants at the time of full bloom and dividing by total number of plants planted and multiplied by hundred in each treatment. Survival percentage was decreased with increasing dose of gamma rays. maximum survival percentage (100.00) was observed in control (0 Gy). Whereas, minimum (0.00 %) was observed in 30 Gy. Based on the survivability LD_{50} was found to be 25 Gy. The decrease in survival after mutagen exposure could be due to inactivation or a decrease in auxin content, which affected cell division and resulted in poor establishment or it could be due to an inherent chromosomal aberration caused by mutagens. These finding are in closer conformity with the findings of the earlier workers like Verma *et al.* (2016) and Singh and Bala (2015) and Chandrakala *et al*. (2022).

Genetic variability, heritability and GAM

Coefficients of variation are more useful indices for comparing characters with different measurement units. Even though the phenotypic coefficient of variation (PCV) was higher than the corresponding genotypic coefficient of variation (GCV) for all of the characters in this study, there was only a slight difference between them (Table 1). This revealed more excellent stability of the characters against environmental fluctuation. Thus, the selection based on phenotypic performance will be reliable. A major portion of PCV was contributed by GCV for most of the characters suggesting that the observed variation was mainly due to genetic factors. This similarity between PCV and GCV was reported earlier by Anitha *et al.* (2021) in chrysanthemum.

High PCV and GCV observed for plant height (42.37 and 41.98 %), number of leaves (42.45 and

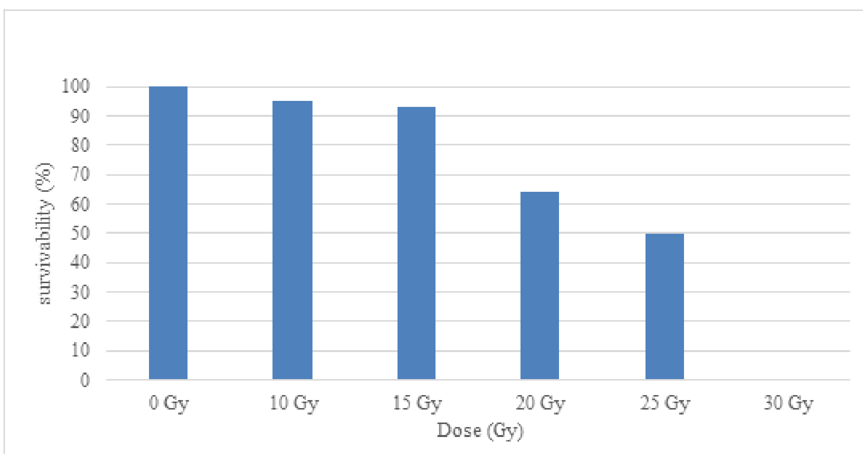

Fig. 1. Survivivability (%)

Table 1. Estimates of genetic components of variance, heritability and genetic advance as percent of mean (GAM) in mutant population of chrysanthemum cv. Lexy Red

Traits	Mean (checks)	Mean (mutants)	Range	PCV (%)	GCV (%)	h^2 (%)	GA	GAM (%)
Plant height (cm)	99.97	58.24 ± 1.67	23.00 - 108.00	42.37	41.98	98.18	47.45	85.69
Number of leaves	86.63	55.70 ± 1.55	20.00 - 105.00	42.45	41.74	96.69	45.35	84.55
Leaf length (cm)	6.58	5.27 ± 0.08	3.30 - 9.00	23.99	23.38	94.97	2.43	46.93
Leaf width (cm)	4.42	3.68 ± 0.06	1.80 - 6.00	25.13	23.13	84.66	1.59	43.83
Leaf area (cm^2)	2413.82	1210.87 ± 56.92	174.80 - 4536.00	72.74	66.00	82.34	1386.52	123.38
Plant spread (E-W) (cm)	16.73	10.62 ± 0.23	5.10 - 21.00	31.37	10.70	11.63	0.77	7.51
Plant spread (N-S) (cm)	12.75	9.80 ± 0.17	4.30 - 17.00	26.97	18.83	48.78	2.60	27.10
Days to bud initiation	58.93	67.94 ± 0.39	56.00 - 85.00	8.25	7.79	89.16	10.38	15.15
Days to colour visibility	86.93	96.57 ± 0.41	84.00 - 114.00	6.10	5.79	90.15	11.02	11.33
Days to flowering	96.92	101.00 ± 0.52	94.00 - 113.00	4.36	4.25	94.69	8.70	8.45
Number of flowers/plant	17.40	14.20 ± 0.23	7.00 - 21.00	24.33	22.58	86.15	6.04	43.18
Diameter of Flower(cm)	4.56	4.29 ± 0.01	3.70 - 5.10	5.50	4.52	67.43	0.33	7.65
Total chlorophyll (mg/g)	3.03	2.93 ± 0.09	1.22 - 5.01	31.76	15.03	22.39	0.48	14.65
Vase life (days)	18.42	16.00 ± 0.18	14.00 - 19.00	12.53	10.04	64.24	2.49	16.58

PCV-Phenotypic co-efficient of variation GCV-Genotypic co-efficient of variation h^2 - heritability GA-Genetic advance

41.74 %), leaf length (23.99 and 23.38), leaf width (25.13 and 23.13 %), leaf area (72.74 and 66.00 %) and number of flowers per plant (24.33 and 22.58 %) which indicates that selection will be rewarding. Similar results were obtained by Anitha *et al.* (2021), Henny *et al.* (2021) for the number of flowers per plant.

Moderate PCV and GCV were observed for vase life which means that the magnitude of genetic variation observed somewhat less for these characters and there is a greater scope for selection to improve upon these traits in mutant population. Similar results were obtained by Verma and shukla (2018) in chrysanthemum, Nataraj *et al*. (2021) in China aster for vase life and Arulmani *et al.* (2016) in gaillardia.

Low PCV and GCV was observed for days to bud initiation, flowering duration, days to colour visibility, diameter of flower and days to flowering, indicating that extent of genetic variation observed was low for these characters. Low PCV and GCV showed the narrow genetic base consequently selection for such traits may not give pleasing results. Harishkumar *et al.* (2017) in China aster.

The genotypic coefficient of variation does not provide enough information to estimate heritable variation, so heritability estimation is required. The knowledge of heritability, along with genetic advance aid in drawing valuable conclusions for effective selection based on phenotypic performance. In the present study high heritability coupled with high GAM was observed for plant height (98.18 and 85.69 %), number of leaves (96.69 and 84.55 %), leaf length (94.97 and 46.93 %), leaf width (84.66 and 43.83 %) and leaf area (82.34 and 123.38 %) and number of flowers per plant (86.15 and 43.18 %). The high value of heritability indicates that the trait phenotype strongly reflects the genotype and suggests the major role of the genotypic constitution in the expression of the character. Therefore, reliable selection could be made for these traits on the basis of phenotypic expression. Similar results were obtained by Prakash *et al.* (2017) in chrysanthemum for the number of flowers per plant, Henny *et al.* (2021) in chrysanthemum.

Conclusion

It can be concluded that LD_{50} is 25Gy. Genetic variability indicates that high values of PCV and GCV were registered for leaf area, number of leaves, plant height, leaf width, number of flowers per plant, leaf length, total chlorophyll. Thus, it can be summarized that analyzing the variability in mutant population and selection out of it for forwarding into further generations are the key steps in varietal development.

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Conflict of interest

The authors have declared that no conflict of interest exists.

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