

Research Article

Evaluation of Chrysanthemum (*Chrysanthemum morifolium* Ramat.) varieties for flowering traits Under Ecological Conditions of Sub-Humid Zone of Rajasthan

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Abstract

Chrysanthemum (*Chrysanthemum morifolium* Ramat.) occupies one of the most important traditional flowers in the world and place of pride. Though it is a commercially cultivated crop in our country, the location specific cultivars are not available considering the importance of this cut flower experiment was conducted to evaluate the performance and adaptability of different Chrysanthemum varieties under ecological conditions of sub-humid zone of Rajasthan. Significant differences were recorded in maximum characters studied. 'White Star' was found to be superior with respect to maximum fresh flower weight (18.14 g), largest flower diameter (11.92 cm), highest stalk diameter (0.38 cm) and longest stalk length (28.52 cm). Thai Chen Queen recorded highest vase life (18.00 days), *in-situ* life (21.67 days) and ray florets per flower (286.67). Highest number of flowers per plant (47.67) was recorded in Pusa Chitraksha.

Keywords: Chrysanthemum, varieties, quantitative traits

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Introduction

Chrysanthemum (*Chrysanthemum morifolium* Ramat.) is occupied an important position among flower crops in the world. The genus belonging to the family Asteraceae includes over 200 species of annuals, perennials, and sub shrubs. The basic chromosome number is $n=9$ and wide range of ploidy level is found in different cultivars of the species. The chrysanthemum has earned tremendous popularity as an ornamental flower for the garden, as cut flower for interior decoration and for the green house cultivation.

Chrysanthemum derived from two Greek words (Chryos-golden, Anthos-flower) which means golden flower. It is also known as "Queen of East", "Autumn Queen", in English language and "Guldaudi" in Hindi language. It is National flower of Japan and originated in China. The development of day neutral cultivars revolutionised the year around availability. In International cut flower trade, it ranks next to rose [1]. Various types of red, yellow, white, pink and violet coloured chrysanthemum are grown in abundance for different purposes. The increase in economic importance of ornamentals in many countries, the international demand for chrysanthemum flowers has rapidly increased and become the most important commercial cut flower for presentation and interior decoration. Chrysanthemum is very rich in varietal wealth and every year there is an addition of new varieties. The performance of any crop or variety largely depends on interaction between genotype and environment. As a result, varieties, which perform well in one region, may not perform same in other regions of varying climatic conditions. Hence it is necessary to evaluate the new genotypes for their quality traits under varying climatic conditions. In view of the above, an experiment was carried out to evaluate the performance of different varieties.

Materials and Methods

The present investigation was carried out during July, 2016 to February, 2017 at the Instructional Farm, Department of Floriculture and Landscaping, College of Horticulture and Forestry, Jhalrapatan city, Jhalawar (Agriculture University, Kota) in order to study the most suitable varieties of standard chrysanthemum for flowering characters. The experimental site was geographically located at $23^{\circ}4'$ to $24^{\circ}52'$ N-Latitude and $75^{\circ}29'$ to $76^{\circ}56'$ E-Longitude in the South-Eastern Rajasthan. Agro-climatically, the district falls in Zone -V known as Humid South- Eastern Plain of Rajasthan.

The experiment was carried out to evaluate the performance of fifteen varieties *viz.*, 'BC-1-123', 'Shova', 'Accession No-24', 'Pink Cloud', 'Lalima', 'Jaya', 'Bravo', 'Ravikiran', 'Jafri', 'Shyamal', 'White Star', 'Thai Chen Queen', 'Pusa Kesari', 'Pusa Arunodaya', 'Pusa Chitraksha' in RBD design with three replications. The rooted cuttings were dipped with Bavistin @ 0.2% before planting then planted at a spacing of 40 cm X 40 cm. Recommended package of practices was employed to obtain satisfactory plant growth. Adequate measures were taken to prevent lodging by staking the plants and disbudding and dishooting also carried out.

Data on number of cut flowers per plant, flower diameter (cm), fresh flower weight (g), stalk length (cm), stalk diameter (cm), vase life (days), *in-situ* life (days), flower colour and type of the flower. The data was analyzed at 5% level of significance statistically. The vase life and *in-situ* life of flowers were measured up to the colour fading of the flowers.

Results and Discussion

Flowering traits

Number of flowers per plant

The data on the number of flowers per plant presented in **Table 1** and exhibited significant differences among the varieties and highest number of flowers per plant (53.63) was recorded in Pusa Chitraksha' followed by Shyamal' (47.67), while minimum number of flowers per plant (16.87) was recorded in Pink Cloud.

Table 1 performance of different varieties with respect to plant height (cm), number of flowers per plant, fresh flower weight (g), number of ray florets.

S. No	Varieties	No. of flowers per plant	Fresh flower weight (g)	Flower diameter (cm)	No. of ray florets	Stalk length (cm)
1	BC-1-123	35.23	2.82	6.35	138.47	12.57
2	Shova	25.80	3.70	8.65	64.83	22.18
3	Accession No-24	17.53	3.64	7.82	137.00	11.28
4	Pink Cloud	16.87	3.54	6.76	178.13	11.03
5	Lalima	18.47	1.88	5.34	99.13	9.89
6	Bravo	39.28	5.16	7.21	251.63	19.50
7	Jaya	43.50	2.77	5.69	185.07	13.41
8	Ravikiran	34.80	9.94	10.47	190.30	28.30
9	Jafri	43.40	8.40	5.29	250.70	25.17
10	Shyamal	47.67	3.65	6.54	126.30	16.45
11	Pusa Chitraksha	53.63	4.06	6.87	36.00	19.18
12	White Star	23.87	18.14	11.92	250.83	28.52
13	PusaKesari	30.60	10.21	8.95	285.57	22.67
14	Thai Chen Queen	32.43	10.36	9.16	286.67	22.62
15	PusaArunodaya	33.33	5.68	7.61	98.50	17.14
	Mean	33.09	6.28	7.64	171.94	18.66
	SEm±	1.32	0.24	0.27	4.49	0.65
	CD 5%	3.84	0.71	0.79	13.01	1.89

Number of flowers per plant is related to recurrent blooming habit due to their genetic makeup [2] in rose. Variation in the number of flowers due to germplasm was also reported by [3] and [4] in chrysanthemum. The numbers of flowers per plant among the varieties is varied might be due to their genetic make-up that could have also been influenced by the environmental conditions especially temperature and photoperiod prevailed during the experimental trial period [5] in chrysanthemum.

Fresh flower weight (g)

The maximum fresh weight of flower (18.14 g) was recorded in White Star while minimum (1.88 g) was recorded in Lalima. The variation in flower weight is mainly dependent upon the size of the flower head in the varieties and it may be attributed to the inherent characters of the individual cultivars and environmental factors [6] in chrysanthemum. The increase in fresh flower weight occurs when the rate of water absorption is greater than the transpiration rate [7]. Water loss is due to decline in uptake of water coupled with transpiration which leads to water

deficit, and ultimately reduces turgidity in cut flower has been reported by [8]. The variation in fresh flower weight was also reported by [4] in chrysanthemum.

Flower diameter (cm)

The flower diameter was significantly differed among the different varieties. Maximum flower diameter (11.92 cm) was reported in White Star which was at *par* to Ravikiran(10.47 cm) whereas minimum(5.29) was reported in 'Jafri' being at *par* (5.34 cm) to Lalima.

This variation may be due to differences in the genetic makeup of cultivars and due to the genotypic differences in phenotypic expression of flower diameter [9]. It may also be influenced in some extent by the total number of flowers per plant. The flower diameter might be due to inherent character of individual cultivars. Similar variations have been reported previously by [4] and [10] in chrysanthemum.

Number of ray florets

The close view of the data depicted that the number of ray florets varied significantly among the varieties. The maximum numbers of ray florets (286.67) were recorded in Thai Chen Queen' which was at *par* (285.57) to Pusa Kesari while minimum (36.00) was recorded in Pusa Chitraksha. The number of ray florets is varied might be due to their genetic makeup [7] and also the varieties grown in the trial were differ in the type of flower, and florets arrangement. Similar results were also found by [4] and [6] in chrysanthemum. Variation in number of ray florets might also be due to differ in their morphological variations among the floral characters [11] in chrysanthemum.

Stalk diameter (cm)

The data given in the **Table 2** presents that maximum stalk diameter (0.38 cm) was recorded in White Star followed by Thai Chen Queen'(0.30 cm) whereas minimum (0.10 cm) was reported in the 'BC-1-123' with a mean of 0.18 cm. The stalk diameter variation among different cultivars may be due to their genetic characters [8]. Production of strong and sturdy stalk or thin and weak stalk might be dependent upon the genotype that could have been further persuaded by the environmental condition [7] in chrysanthemum.

Stalk length (cm)

The variation was reported in stalk length among the varieties which differ significantly with a range of Lalima (9.89 cm) to White Star (28.52 cm). The variation in stalk length among the various varieties might be due to genotypic differences in phenotypic expression of stalk length [12] in chrysanthemum. Stalk length variation may be due to their genetic characters [8]. Another probable reason for the stalk length among the varieties might be due to environmental conditions prevailed during growth stage of stalk [7]. It was also reported that the cultivars with higher plant height produced the longer flower stalk as compared to cultivars with smaller plant height [3] in chrysanthemum.

Vase life in distilled water (days)

Vase life of cut flowers varied significantly among the varieties. The maximum vase life (18.00 days) was reported in Thai Chen Queen which was at *par* (17.00 days) to Pusa Kesari, while minimum number of days of vase life was reported in Lalima (10.00 days). The variation is might be due to the inherited trait of better storage of photosynthates as it produces more number of leaves in its growth period [11]. Generally being ethylene non sensitive flower the difference in days taken to flower senescence may be due to the varietal characteristics of different chrysanthemum cultivars [7]. Thus it is concluded that variation in vase life of flower of different varieties may be due to leading differential accumulation of carbohydrates due to varied leaf production and disparity in sensitivity to ethylene. The longest vase life was mainly due to reduced rate of evaporation and transpiration, prevailing low temperature [4] in chrysanthemum. Such variation in vase life has also been reported by [13] in Gaillardia.

In-situ life (days)

The performances of the *in-situ* life of the different varieties were significantly differed. The maximum *in-situ* life of flower (21.67 days) was recorded in Thai Chen Queen while the minimum (14.33 days) was recorded in Lalima.

The varieties had a variation in the *in-situ* life due to the inherited trait of better storage of photosynthates which depends upon the presence of the number of leaves in its growth period [11]. Differential sensitivity of the varieties to ethylene could also be a probable reason of variation in vase life [7] in chrysanthemum. It also depends upon the storage food material present in the plant and due to reduced rate of evaporation, transpiration and prevailing to low temperature [4] in chrysanthemum. Similar variations are also reported by [14] and [3] in chrysanthemum.

Table 2 Performance of different varieties with respect to stalk length (cm), stalk diameter (cm), vase life in distilled water (days), *in situ* life (days), flower type and flower colour

S. No	Varieties	Stalk diameter (cm)	Vase life in distilled water (days)	<i>In situ</i> life (days)	Flower type	Flower colour (RHS colour chart)
1	BC-1-123	0.10	11.00	15.67	Decorative	11 B (Light yellow)
2	Shova	0.14	16.67	20.67	Semi-double	NN 155B (White)
3	Accession No-24	0.11	13.00	19.00	Korean	16 D (Pale orange yellow)
4	Pink Cloud	0.14	13.67	18.33	Decorative	50B (Deep pink)
5	Lalima	0.11	10.00	14.33	Decorative	NN 74B (Strong reddish purple)
6	Bravo	0.16	14.00	20.33	Decorative	47A (Moderate red)
7	Jaya	0.11	13.70	18.67	Decorative	185A (Deep reddish purple)
8	Ravikiran	0.16	16.00	20.33	Decorative	N 34D (Moderate reddish orange)
9	Jafri	0.15	13.67	17.00	Korean	N 34B (Strong reddish orange)
10	Shyamal	0.13	16.33	20.00	Korean	N 155B (Pinkish white)
11	Pusa Chitraksha	0.16	15.67	19.67	Single flower	59A (Dark red)
12	White Star	0.38	14.10	18.00	Incurved	NN 155D (White)
13	PusaKesari	0.29	17.00	21.00	Semi-double with incurving ray florets	171A (Moderate reddish orange)
14	Thai Chen Queen	0.30	18.00	21.67	Semi-double with incurving ray florets	164B (Moderate orange yellow)
15	PusaArunodaya	0.26	16.67	20.67	Semi-double with incurving ray florets	65D (Pale purplish pink)
	Mean	0.184	14.63	19.02		
	CD 5%	0.022	2.23	1.88		

Conclusion

From the present investigation, it is concluded that White Star, Thai Chen Queen, PusaKesari, Ravikiran was recorded the highest mean for most of the characters, Hence these were suitable for the sub-humid zone of Rajasthan conditions.

References

- [1] Bhattacharjee, S.K. and De, L.C. Floriculture industry in India. Advanced commercial floriculture Chrysanthemum, 2003, Volume. 1
- [2] Nadeem, M., Khan, M. A., Riaz, A. and Ahmad, R. Evaluation of growth and flowering potential of (*Rosa hybrida*) cultivars under Faisalabad climatic conditions. Pakistan. J. Agri. Sci., 2011, 48 (4): 283-288.
- [3] Uddin Jamal, A. F. M., Taufique, T., Ona, A. F., Shahrin, S. and Mehraj, H. Growth and flowering performance evaluation of thirty two chrysanthemum cultivars. J. Biosci. Agric. Res. 2015, 4 (1): 40-51.
- [4] Suvija, N. V., Suresh, J., Kumar, R. S. and Kannan, M., Evaluation of Chrysanthemum (*Chrysanthemum morifolium* Ramat) Genotypes for loose flower, Cut flower and pot Mums. International. J. Innov. Res. and Advanced Studies, 2016, 3 (4): 100-103.

- [5] Punetha, P., Rao, V. K. and Sharma, S. K. Evaluation of different chrysanthemum (*Chrysanthemum morifolium*) genotypes under mid hill condition of Gharwal Himalaya. *The Indian J. Agric. Sci.*, 2011, 81 (9).
- [6] Talukdar, M. C., Mahanta, S., Sharma, B. and Das, S. Extent of genetic variation for growth and floral characters in chrysanthemum cultivars under Assam condition. *J. Orna. Hortic.*, 2003, 6 (3): 201-211.
- [7] Baskaran, V., Jayanthi, R., Janakiram, T. and Abirami, K. Evaluation of post-harvest quality of some cultivars of chrysanthemum. *J. Hortic. Sci.*, 2010, 5 (1): 81-83.
- [8] Halevy, A. H. and Mayak, S. Senescence and post-harvest physiology of cut flowers, Part-II, *Hort. Rev.*, 1981, 3: 59-143.
- [9] Singh, D. D., Tyagi, S., Singh, Shashank, S. and Kumar, P. R. Studies on the performance and flower characterization of *Chrysanthemum (Dendranthemagrandidiflora L.)* genotypes under Uttar Pradesh conditions. *Adv. in Res.*, 2017, 9 (1): 1-7.
- [10] Singh, M. K. and Baboo, R. Response of nitrogen, potassium and pinching levels on growth and flowering in chrysanthemum. *J. Orna. Hortic.*, 2003, 6 (4): 390-393.
- [11] Dewan, N., Kumar, Sl., Sharma, S. and Chakraborty, S. Evaluation of *Chrysanthemum (Chrysanthemum morifolium Ramat.)* genotypes under West Garo hills district, Meghalaya. *Hort Flora Res Spectrum.*, 2016, 5 (3): 189-194.
- [12] Ona, A. F., Roni, M. Z. K., Ahmad., H. A., Jui, N. J. and Uddin Jamal, A. F. M. Study on growth and flower yield of snowball varieties. *Bangladesh Res. Pub. J.*, 2015, 11 (3): 182-186.
- [13] Agale, M. G. and Dawane, P. T. Evaluation of different genotypes of *Gaillardia (Gaillardia pulchella)* for growth and yield of flowers. *Indian Hortic. J.* 2016, 6 (1): 102-105.
- [14] Bala, M. Evaluation of chrysanthemum (*Chrysanthemum morifolium Ramat.)* genotypes for morphological traits. *J. Hortic. Sci.*, 2015, 10 (2): 242-244.

Publication History

Received 01st June 2017
Revised 20th June 2017
Accepted 24th June 2017
Online 30th June 2017

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