Performance of Different Standard Carnation (*Dianthus caryophyllus* L.) Cultivars in the Plains of West Bengal, India

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Abstract

The suitability to ten standard carnation cultivars (Dark Red, Yellow with Red, Bright Red, Pink, C. Rimo, Decio, Orange Isac, Lilac Tarres, Tashman Pink and Orange Triumph) in the plains of West Bengal was studied in this experiment. Results revealed that the longest plant producing cultivar was Dark Red (78.36 cm) and the shortest plant producing cultivar was Decio (51.96 cm). Highest leaf producing cultivar was Bright Red (28.96 leaves shoot^{-1}). Cv. Pink produced lowest number of leaves shoot^{-1} (20.59). Cv. Yellow with Red was identified the longest leaf producer (12.31 cm) and cv. Orange Triumph was identified the shortest (9.18 cm). Widest leaves (0.79 cm) produced by Orange Isac and narrowest leaves were the character of cv. Pink. (0.50 cm). Decio produced the highest number of side-shoots (2.61) and Pink and Orange Isac produced the lowest number of side-shoots (1.08) plant^{-1}. Earliest Flower Bud Initiation (FBI) was recorded with Lilac Tarres (69.66 days) and Orange Isac reached the FBI stage last of all (104.68 days). Bright Red recorded the lowest time period for flower bud development (18.94 days) and Orange Isac recorded the highest time period (24.98 days). In-situ longevity of flowers was found highest with Bright Red (11.78 days) and lowest with Orange Triumph (9.17 days). Bud length and bud diameter though non-significant was found highest with Tashman Pink (3.81 cm) and Lilac Tarres (1.88 cm) respectively. Longest stalks recorded with Dark Red (71.62 cm) and shortest with C. Rimo (49.70 cm). Bright Red was found to produce flowers of highest diameter (7.21 cm) and Tashman Pink was found the lowest flower diameter producing variety (5.85 cm). Variety Dark Red produced highest number of flowers plant^{-1} (4.54) and Bright Red produced lowest number of flowers plant^{-1} (2.65). The post-harvest longevity of cut flowers was found maximum with Dark Red (6.27 days) and minimum with Orange Triumph (4.97 days).

1. Introduction

Carnation (*Dianthus caryophyllus* L.) is one of the important export-oriented cut flowers having commercial value worldwide. It belongs to the family Caryophyllaceae and originated from Mediterranean region. It holds fourth position in the list of worlds' top ten cut flower. Besides its use as cut-flower it can be used in pots, borders, beds and in rockeries also. Miniature varieties are also used for edging purpose. The essential oil obtained from the flowers is rich in eugenol, which is used in the preparation of sophisticated perfumes. In 1995, carnation had a 15.2% share in the world import market and Netherlands was the ace supplier of carnation (739 million stems) to the European Union followed by Columbia (591 million stems), Spain (308 million stems), Kenya (303 million stems) and Turkey was taken the sixth position with 107 million stems (Bhattacharyya, 1997). In India, potentiality for growing good quality of carnation remains in cool climatic areas like Kashmir, Kullu Valley, Kalimpong and Bangalore etc. The area around Delhi, U.P. and Punjab, Nasik, Srinagar, Solan, Coimbatore including Nilgiri are the promising carnation growing zones in India. Carnation cultivation is also increasing in the area around Bangalore and Pune (Mysore et al., 2005). Delhi had the highest acreage (513 ha) and production (2515 MT) on carnation followed by Haryana (10 ha) but at the

same time Punjab had the highest productivity (40 MT ha^{-1}) followed by Maharashtra (18.75 MT ha^{-1}) in India in 1994-95 (Bhattacharyya, 1997). The area under standard carnation around Bangalore was found more than 3 times within one year [(2001-02) to (2002-03)] from 6 ha to 19 ha with a production of 338 lakh stems (Anonymous, 2003). Only in USA the total production of standard carnations reached 20.58 million stems in 2002 with a market value of $3.24 million (USDA report, 2003).

To develop the flower-based industries of any area it is essential to evaluate the performances of various cultivars of a crop in that particular area. Hence collection, evaluation and conservation of germplasms of the crop are of prime importance. Standard Carnation is not a traditional crop in the plains of West Bengal; so protected cultivation is a must. But it has tremendous business potential, because there is one of the major flower markets of the country, i.e., Calcutta. Carnation is largely sold there as potted plant and cut flower. If the best suited cultivar for this region be identified, the local flower growing peasantry will be benefited. With an eye to this an experiment on evaluation of standard carnation cultivars grown from cuttings to be used as cut-flowers was carried out in the plains of West Bengal under medium cost polyhouse.

2. Materials and Methods

Healthy, disease-free plants of ten different popular standard carnation cultivars raised from cuttings were collected from the Indo-American Hybrid Seeds, Kolkata, West Bengal, India and grown to evaluate their performance in the plains of West Bengal. The names of the cultivars along with notations used are Dark Red, Decio, Yellow with Red, Orange Isac, Bright Red, Lilac Tarres, Pink, Tashman Pink, C. Rimo, Orange Triumph. The layout of the experiment was fixed following Randomized Block Design having ten varieties replicated thrice. Experiment on evaluation of standard varieties of carnation was conducted in a medium cost polyhouse at the Jaguli Horticulture Farm of Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal, India for consecutive two years and pooled analysis of the results of both the individual years were considered for evaluation. The protected structure was made of 4-angled aluminum bars and UV stabilized polyethylene sheet was used as cladding material. Irrigation was given with the help of rotary sprinkler nozzles. The humidity was controlled by placing wet gunny bags on the floor. Light intensity was controlled by using polyethylene roofing and 50% Agroshade Net. Temperature was somewhat controlled by the exhaust fans. The dimension of each plot was (0.9×0.9 m^2) and the plants were spaced at 0.3×0.3 m^2, thus accommodating 9 plants $plot^{-1}$. Each plot is separated by a path of 30 cm from other. The rate of fertilizer applied was 10 g N_2, 10 g P_2O_5 and 10 g K_2O m^{-2}. At the time of bed preparation well rotten and screened FYM was applied @ 2 kg $plot^{-1}$. 50% of the nitrogen and total P_2O_5 and K_2O were applied as basal and the rest of the nitrogen was applied in 2 splits of equal part (25% of the total) at an interval of 5 weeks. Nitrogen was provided in the form of urea. P_2O_5 was applied in the form of single super phosphate and K_2O in the form of muriate of potash. Staking was done as per standard technique and the intercultural operation was done as and when required. The biometric observation related to various plants, flower and qualitative characters were taken at different stages of crop growth and flowering and analyzed through MSTAT software following CRBD.

3. Results and Discussion

3.1. Plant height (cm)

Standard carnation varieties differed significantly among them in respect of plant height. Results represented Dark Red as the tallest variety (78.36 cm) statistically at par with Yellow with Red (76.56 cm) and Bright Red (76.25 cm). Next tall varieties were Lilac Tarres (70.32 cm), Orange Triumph (66.57 cm), C. Rimo (65.84 cm), Orange Isac (65.58 cm) and Pink (64.61 cm) respectively. Variety Tashman Pink was proved less effective (Table 1) regarding plant height (59.47 cm). The shortest plants (51.96 cm) were obtained from the variety Decio.

3.2. Leaf number $shoot^{-1}$

The carnation varieties showed significant variation regarding the leaf production (Table 1). The pooled effect resulted Bright Red (V_3) as the highest leaf producing variety (28.96), which was statistically at par with the variety Yellow with Red (27.10). The rest varieties produced statistically at par moderate number of leaves $shoot^{-1}$ except Lilac Tarres and Pink. Plants of the variety Pink produced the lowest number of leaves (20.59), which was statistically at par performer with Lilac Tarres produced 21.46 leaves $shoot^{-1}$.

3.3. Leaf length (cm)

The longest leaves (12.31 cm) were obtained from the plants of the variety Yellow with Red that was statistically at par with the leaves produced by the varieties Dark Red (12.24 cm) and Bright Red (11.64 cm) respectively (Table 1). The rest plant varieties showed statistically at par shorter leaves including Orange Triumph produced the shortest leaves (9.18 cm).

3.4. Leaf width (cm)

The pooled effect represented Orange Isac as the widest leaf producing (0.79 cm) standard carnation cultivar followed by Bright Red (0.69 cm). Moderate leaf widths (Table 1) were obtained from the plants of rest varieties except Pink (0.50 cm) that produced the lowest leaf width and statistically at par with the width of leaves of Orange Triumph (0.51 cm).

Table 1: Comparison of growth parameters of different standard carnation cultivars

Cultivar	Plant height (cm)	Leaf number shoot^{-1}	Leaf length (cm)	Leaf width (cm)	No. of side shoots plant^{-1}	Days required for FBI	Days required for FBD
Dark Red	78.36	25.27	12.24	0.56	1.49	80.17	22.18
Yellow With Red	76.56	27.10	12.31	0.61	1.54	82.06	21.75
Bright Red	76.25	28.96	11.64	0.69	1.12	85.90	18.94
Pink	64.61	20.59	10.00	0.50	1.08	93.51	20.13
C. Rimo	65.84	22.11	10.68	0.61	1.86	90.58	18.51
Decio	51.96	24.38	9.58	0.52	2.61	76.57	22.34
Orange Isac	65.58	23.78	10.77	0.79	1.08	104.68	24.98
Lilac Tarres	70.32	21.46	10.96	0.59	1.76	69.66	24.19
Tashman Pink	59.47	22.37	11.40	0.60	1.59	78.35	21.18
Orange Triumph	66.57	23.12	9.18	0.51	2.33	96.49	19.96
SEm±	1.68	1.18	0.30	0.03	0.18	2.19	0.78
CD (p=0.05)	4.81	3.39	0.86	0.08	0.52	6.29	2.24

3.5. Number of side-shoots plant^{-1}

Significant differences were observed between the carnation varieties regarding the number of side-shoots plant^{-1} in the pooled effect (Table 1). Results revealed Decio as the highest number of side-shoot producing variety (2.61), which was statistically at par with Orange Triumph (2.33). The next improved performers were C. Rimo (1.86 side-shoots plant^{-1}), Lilac Tarres (1.76), Tashman Pink (1.59), Yellow with Red (1.54) and Dark Red (1.49 side-shoots plant^{-1}) respectively. The rest varieties were found equally less effective including Pink and Orange Isac produced the lowest number of side-shoots plant^{-1} (1.08).

3.6. Days required for flower bud initiation

The different carnation varieties showed statistically significant variation on the days required for flower bud initiation. The pooled effect resulted that the plants of Lilac Tarres reached the FBI stage earliest (69.66 days after planting) followed by the plants of Decio (76.57 days), which was statistically at par with the plants of Tashman Pink (78.35 days), Dark Red (80.17 days) and Yellow with Red (82.06 days). The next earlier time period (Table 1) was achieved from the plants of Bright Red (85.90 days). Moderately late time period was achieved from the plants of C. Rimo (90.58 days), Pink (93.51 days) and Orange Triumph (96.49 days) respectively. The most delayed FBI was obtained from the plants of Orange Isac (104.68 days).

3.7. Days required for flower bud development

The different standard varieties of carnation showed significant variations on days required to flower bud development (Table 1). The pooled effect represented the variety C. Rimo reached the blooming stage earliest (18.51 days after FBI) and the most delayed time period required for FBD was found to the flowers of the variety Orange Isac (24.98 days) that was statistically at par with the variety Lilac Tarres (24.19 days).

3.8. Field-life of the flower (days)

The field-life of the flowers differed significantly according to the different varieties of carnation (Table 2). The highest days of field-life (11.78 days) of the flowers were obtained from the plants of Bright Red which was statistically at par with the cultivars of Pink (11.65 days) and Yellow with Red (11.38 days). The lowest days of field-life were noticed with the flowers of the variety Orange Triumph (9.17 days) which was statistically at par with the flowers of C. Rimo (9.58 days).

3.9. Bud length (cm)

The performance of different varieties on the bud length of carnation was found statistically non-significant (Table 2). The pooled effect resulted Tashman Pink as the longest bud producer (3.81 cm) and C. Rimo as the shortest bud producer (3.64 cm).

3.10. Bud diameter (cm)

Results though found statistically non-significant represented Lilac Tarres and Yellow with Red as the highest (1.88 cm) and the lowest (1.72 cm) flower bud diameter producers respectively (Table 2).

3.11. Number of flowers plant^{-1}

The carnation varieties were found to produce significant differences regarding the flower production (Table 2). Results established Dark Red as the highly floriferous variety produced 4.54 flowers plant^{-1} followed by Decio and Orange Triumph (3.55 flowers plant^{-1}), Orange Isac (3.42) and Yellow with Red (3.33). The rest of the varieties proved less floriferous. The lowest number of flowers plant^{-1} (2.65) was obtained from

Table 2: Comparison of flower quality of different standard carnation cultivars

Cultivar	Field-life of flowers (days)	Bud length (cm)	Bud diameter (cm)	No. of flowers plant^{-1}	Flower diameter (cm)	Stalk length (cm)	Vase-life of flowers (days)
Dark Red	10.67	3.70	1.81	4.54	6.31	71.62	6.27
Yellow With Red	11.38	3.66	1.72	3.33	6.37	62.53	6.15
Bright Red	11.78	3.68	1.78	2.65	7.21	70.75	6.10
Pink	11.65	3.70	1.75	2.82	6.23	59.16	6.22
C. Rimo	9.58	3.64	1.80	2.82	5.93	49.70	5.02
Decio	10.13	3.69	1.84	3.55	6.36	56.25	5.55
Orange Isac	10.17	3.78	1.81	3.42	6.15	63.80	6.08
Lilac Tarres	10.02	3.72	1.88	3.02	6.34	71.37	5.97
Tashman Pink	10.48	3.81	1.78	3.07	5.85	65.05	592
Orange Triumph	9.17	3.70	1.84	3.55	5.96	55.80	4.97
SEm±	0.21	0.05	0.03	0.08	0.15	3.16	0.07
CD (p=0.05)	0.61	N.S.	N.S.	0.23	0.44	9.07	0.21

Bright Red.

3.12. Diameter of flowers (cm)

Significant differences were observed between the results exhibited by different standard carnation varieties regarding the diameter of flowers. The pooled effect reflected Bright Red as the cultivar producing the flowers of highest average diameter (7.21 cm) among the ten different carnation cultivars followed by Yellow with Red (6.37 cm), Decio (6.36 cm), Lilac Tarres (6.34 cm), Dark Red (6.31 cm), Pink (6.23 cm) and Orange Isac (6.15 cm) respectively (Table 2). Cultivar Tashman Pink produced flowers with shortest diameter (5.85 cm).

3.13. Stalk length (cm)

Statistically significant differences were observed among the ten different standard carnation cultivars in respect of stalk length where plants of Dark Red produced the longest stalks (71.62 cm) that was statistically at par effective (Table 2) with the plants of the varieties Lilac Tarres (71.37 cm), Bright Red (70.75 cm), Tashman Pink (65.05 cm) and Orange Isac (63.80 cm). The rest of the varieties were found to produce stalks of statistically at par length like Yellow with Red (62.53 cm), Pink (59.16 cm), Decio (56.25 cm) and Orange Triumph (55.80 cm), except C. Rimo that produced the flowers having the lowest stalk length (49.70 cm).

3.14. Vase-life of the flowers (days)

The post-harvest longevity of cut carnation flowers of ten different cultivars showed statistically significant variation (Table 2). Flowers of the variety Dark Red showed the highest days of vase-life of carnation (6.27 days) that was statistically at par with Pink (6.22 days), Yellow with Red (6.15 days), Bright Red (6.10 days) and Orange Isac (6.08 days). The lowest days of vase-life were noticed with the flowers of the variety Orange Triumph (4.97 days) that was statistically at par with flowers of C. Rimo (5.02 days).

The various growth and developmental parameters of ten different varieties of standard carnation were studied in this experiment. Results revealed that standard cultivar Dark Red produced greater plant height (78.36 cm) but the variety Decio performed better in respect of side-shoot production (2.36 side-shoots plant^{-1}) under the protected structure in the plains of West Bengal with a minimum winter temperature of 9.90^0-19.90^0 C. The cultivar Decio also reached the flower bud initiation stage earliest (76.57 days after planting). Plants of cultivar Dark Red produced more number of flowers (4.54) plant^{-1}. The influence of winter temperature in the production of flowers plant^{-1} also noticed by Vidaliae (1982), reported in an experiment on varietal evaluation under glasshouse and polytunnel. The difference in flower production in naturally ventilated greenhouse grown carnation cultivars was also noticed by Sahakar and Sable (2003). Gill and Arora (1988) reported the development of weak and thrifty shoot of carnation in summer and vigorous shoots during winter. Dalal et al. (2009) and Mukund et al. (2004) reported differences in qualitative and quantitative characters in polyhouse grown carnation cultivars. Longevity of flowers is strictly governed by the genetic constitution of the plant and this quality differs from flower to flower and also from cultivar to cultivar of the same flower. In this experiment highest days of longevity of flowers in-situ was noticed with the cultivar Bright Red but the longest post-harvest life was obtained from the flowers of the cultivar Dark Red. Parallel information also

cited by Gelder and Uitermark (1985).

4. Conclusion

Standard carnation cultivars raised from cuttings when grown in medium cost polyhouse in the plains of West Bengal showed significant variation in respect of different qualitative and quantitative parameters related to growth, development and flowering. Cultivar Dark Red produced tallest plants, Decio produced highest number of side shoots plant^{-1} and Lilac Tarres showed earliness in flowering. All the cultivars are well suited to this region among them better performing one was Dark Red in respect of cut flower production and post-harvest longevity of cut flowers.

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