

Varietal evaluation of Carnation (*Dianthus caryophyllus*) in naturally ventilated polyhouse under Prayagraj agro-climatic condition

ABSTRACT

Carnation, scientifically known as *Dianthus caryophyllus*, is a popular and attractive flowering plant that belongs to the Caryophyllaceae family. Native to the Mediterranean region, carnations are now cultivated all over the world for their beauty and fragrance. Therefore, present investigation was carried out at the Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, Uttar Pradesh during the Winter-2022-23 with a view to determine the performance of different varieties of carnation for its growth and flowering under ventilated polyhouse. Under this experiment, overall, 6 varieties were used comprising of variety Cerventes, Master, Magno, Baltico, Realism and Kiro. It was concluded that variety Baltico (white) reported significantly better performance compared to other varieties, in terms of Growth parameters like plant height was seen in cervantes (25.19 cm), number of leaves were maximum in master (20.94), number of internodes was highest in realism (18.49), number of branches were seen to be maximum in baltico (4.47), Kiro was found to be less suited variety for Prayagraj agro climatic condition due to metabolic activity. Flowering parameters like days to first flower bud break (65.33 days), days taken for first flower bud opening (66.00 days) was seen in Master, Flower Stalk length was seen highest in Realism (40.80 cm), number of flowers per plant was seen in cervantes (5.17), number of days taken for flower senescence on plant was seen highest in kiro (15.40 days), the vase life in carnation was seen to be the highest in master (0.40 days).

Keywords: *Carnation, Varieties, stalk length, senescence.*

INTRODUCTION

“The Carnation (*Dianthus caryophyllus* L.) Member of the Caryophyllaceae family is one of the most widely grown cut flowers, among the top 10 cut flowers in the world. It is assumed to be a Mediterranean native with the diploid chromosome number $2n = 30$ and is grown in many parts of the world. It is a perennial that is only half hardy, with spreading stems, timid joints, and linear, glaucous leaves grouped in opposite or decussate pairs. Each stalk yields terminal blooms that are often unisexual or bisexual. The hybrids have a remarkable long flowering cycle in moderate climates, resulting in continuous flowers. Because of their long-lasting keeping qualities, wide variety of colours, attractive forms, ability to withstand long distance transportation, and exceptional capacity to rehydrate after continuous shipment, Carnations are a common flower crop with a high commercial value as a cut flower” (Bhatia *et al.*, 2007). “Carnations can be used in the garden for bedding, edging, borders, pots, and rock gardens in addition to producing cut flowers” (Dole and Wilkins, 2005). Because of their excellent keeping qualities, wide variety of forms and colours, and capacity to withstand long distance transit, carnations are preferred by many exporting nations over roses and chrysanthemums. Over half of the world's cut flower commerce is made up of cut carnations, roses, and chrysanthemums. “Flowers are most appealing form of human expression as they devote beauty, purity, honesty, and divinity. Flowers were referred extensively in ancient Sanskrit classics like Rig-Veda, Ramayana, Mahabharata, etc. where, beauty and divinity are described. Further, there is need to evaluate suitable varieties and production technologies as suited to our conditions. Hence, the present investigation was carried out under protected condition to know the performance

of different varieties of carnation. In carnation, there are lots of varieties having variable characters and variable qualities. Quality of flower has great value in case of marketing of cut flowers, so varietal performances have gotten value for deciding the planting of single variety. The mid hill of Uttarakhand provides an ideal condition for growing variety of flowers and quality carnation cut flowers can be grown under naturally ventilated green houses. Carnation being the most suitable for hilly areas even under open condition” (Bhatia *et al.*, 2007). “Selection of varieties, Pinching has direct relationship with number of flowers and regulation of flowering for successful marketing. Pinching delay the flowering time and increase number of branches per plant which directly increase yield. Pinching reduces flower size which is helpful in reducing the calyx splitting due to reduce number of petals in flower. The performance of carnation varieties varies with region, season, genotype, and growing environment. In India, there is a wide difference in temperature, light intensity, and humidity, which not only affect the yield and quality of flowers but also limit their availability for a particular period of a year. Hence, it is necessary to evaluate carnation varieties under different geographical areas or regions of the country. Carnation is popular as a cut flower on account of its exquisite shape, a wide range of colours, good vase life, lightweight which makes it ideal for distant markets, and the ability to withstand long-distance transportation. It has high ornamental value and easy technology to produce cut flowers” (Dole and Wilkins, 2005). It is being cultivated in many cities of India under protected structures considering its growing demand and high value of cut flowers. Many experiments were conducted and are still in progress for improving the growth and yield of carnation. Balanced ventilation and Temperature are one of the important factors that influence the productivity, growth, yield, and quality of flowers in carnation. This experiment is designed to evaluate the most promising flower variety incarnation and to obtain a higher yield under Polyhouse conditions.

MATERIAL AND METHODS

The present investigation was done to understand the performance of different varieties for plant and floral growth and yield of Carnation. The investigation was carried out at Polyhouse at Horticultural Research Farm (HRF), Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj during *Winter Season 2022*. Observations were recorded at different growth parameters like plant height, number of leaves, number of internodes per stalk, flowering parameters like number of days to flower bud initiation, days to flower bud opening, days to first flowering, number of flowers per plant, stalk length, vase life. The data were statistically analysed by the method suggested by Fisher and Yates, 1963. The different varieties are V₁ (Cervantes); V₂ (Master); V₃ (Magno); V₄ (Baltico); V₅ (Realsim); V₆ (Kiro).

RESULTS AND DISCUSSION

A) Vegetative Parameters

Plant height and Number of leaves

Plant height statistically varies among different varieties of carnation. Maximum plant height after 90 days was recorded in variety Cervantes (31.00 cm), followed by variety Master (29.70 cm) and the shortest is found in the variety Kiro (26.63 cm). The variation in plant height among the carnation varieties may be due to genetic variability. Another possible reason for variation in plant height may be because of environmental conditions prevailing during field trial. Similar findings on differences in plant height were recorded by Kumar and Singh (2003), Shahakar *et al.* (2004), Maitra and Roy Chowdhury (2013) in carnation.

Number of leaves statistically varies among different varieties of carnation. Maximum number of leaves after 90 days was recorded in variety Master (28.37), followed by variety Magno (23.) which was at par with the variety Realism (23.03) and the lowest is found in the variety kiro (19.43). The differences in number of leaves per plant may be due to variation in the rate of vegetative growth among the carnation varieties that could be attributed due to genetic makeup and could have been further influenced by the environment. Similar findings were recorded by Patil *et al.* (2001), Kumar and Singh (2003), Sarkar and Sharma (2016) in carnation.

Number of branches per plant and Number of internodes

Number of branches per plant statistically varies among different varieties of carnation. Maximum number of branches was recorded in variety Baltico (4.47), followed by variety Realism (3.53) which was at par with the variety Cervantes (3.50) and the lowest is found in the variety Kiro (3.47).

Number of internodes statistically varies among different varieties of carnation. Maximum number of internodes after 90 days was recorded in variety Realism (14.37), followed by variety Baltico (12.23) which was at par with the variety Cervantes (8.83) and the lowest is found in the variety Magno (6.47). Variation in number of internodes per stem may be attributed due to the difference in genetic constitution and could also be because of environmental conditions prevailing during the field trial. Similar findings on differences in number of internodes per stem were recorded by Patil *et al.* (2001), Gharge *et al.* (2011); Sharma *et al.*, (2022); Taghizadeh and Khadivi (2023) in carnation.

B) Floral parameter

Days to flower bud initiation, Days to flower bud opening and Number of days for flowering from planting

Significant variation was observed among each variety for the days taken to bud initiation. Minimum days to flower bud initiation was recorded in variety Mater (65.33) and followed by the variety Cervantes (67.13) whereas the maximum days to bud initiation was recorded in variety kiro (89.33). Variation in days taken to flower bud initiation could have possibly been due to variation in genetic constitution and could have been further influenced by the environment. Similar findings in carnation were recorded by Sahakar and Sable (2003), Reddy *et al.* (2004), Pratibha *et al.* (2013), Jose *et al.* (2017); Sharma *et al.*, (2022); Taghizadeh and Khadivi (2023).

Minimum days to flower bud opening was recorded in variety Master (66.00) and followed by the variety Cervantes (90.77) whereas the maximum was in the variety Kiro (111.00). Differences in the days taken to bud opening in carnation varieties may be due to genetic makeup of the varieties or due to the influence of growing environment. Similar findings in carnation were recorded by Reddy *et al.* (2004), Jose *et al.* (2017) Sharma *et al.*, (2022); Taghizadeh and Khadivi (2023).

Minimum days to first flowering Variety Master (101.20) was recorded in variety Master (66.00) and followed by the variety Cervantes (101.73) whereas the maximum was in the variety Kiro (121.33). Some studies revealed that earlier flowering cultivars advanced most and were more variable than later flowering flowers. We furthermore discovered a strong relationship between flowering and climate variables, with temperature

appearing to be the main driver. Whilst the first flowering date averaged over all cultivars did show a significant variation, this was significant for only one of the individual cultivars.

Number of flowers per plant, flower stalk length, number of days taken for flower senescence on plant, vase life

Maximum Number of cut flower stalks per plant was recorded in variety Baltico (6.63) and followed by the variety Cervantes (5.17) whereas the minimum Number of cut flower stalks per plant was recorded in the variety kiro (2.23). The increased flower yield might be attributed to a greater number of auxiliary branches and leaves resulted in production and accumulation of maximum photosynthetic material which ultimately resulted in production of a greater number of flowers. Similar variations in carnation with respect to flower yield were also observed by Krishna *et al.* (1999); Shahakar (2003); Dwivedi and Kareem (2004); Reddy *et al.* (2004); Shahakar *et al.* (2004) and Kazaz *et al.* (2011) in carnation.

Maximum flower stalk length was recorded in variety Realism (40.80cm) and followed by the variety Baltico (36.03cm) whereas the shortest flower stalk length was recorded in the variety Kiro (27.63cm). Differences in flower stalk length may be due to the variation in genetic characters of the varieties and could have been further influenced by the growing environment. Similar findings were recorded by Singh and Sangama (2003), Shahakar *et al.* (2004), Chauhan *et al.* (2014), Jose *et al.* (2017); Sharma *et al.*, (2022); Taghizadeh and Khadivi (2023).

Maximum flower stalk length was recorded in variety Realism (40.80cm) and followed by the variety Baltico (36.03cm) whereas the shortest flower stalk length was recorded in the variety Kiro (27.63cm). This show that varieties respond in a different manner to climatic condition due to difference in metabolic activity. During floral senescence, petals are actively degraded for nutrient remobilization, culminating in a period of programmed cell death (PCD) (Shibuya *et al.*, 2016). “Macromolecules, including proteins and starch are broken down and remobilized to sustain the energy demands of maintaining expensive floral organs for nectar production and, following fertilization, for the developing ovary and seeds” (Ashman & Schoen, 1994). “The sequence of events in floral senescence is very similar in flowers on the plant or in cut flowers, although a more rapid senescence off the plant has been noted e.g., in lilies” (Arrom and Munne-Bosch, 2012). “The phytohormone ethylene is a key regulator of floral senescence in many species, associated with pollination” (Iqbal *et al.*, 2017; Ma *et al.*, 2018). “Ethylene production in these species is regulated auto-catalytically with an initial ethylene burst triggering transcriptional activation of ethylene biosynthetic genes” (Ma *et al.*, 2018).

Maximum vase life was recorded in variety Master (10.40) and followed by the variety Magno (7.40) whereas the minimum vase life was recorded in the variety Kiro (3.60). The maximum extension of vase life which might be due to the overall modified effect on the vegetative and reproductive growth of the plant. Variation in vase life could be attributed due to the variation in ability to produce ethylene and sensitivity to it among the different carnation varieties. Similar findings on the differences in vase life were recorded by Krishnappa *et al.* (2000), Patil *et al.* (2001), Singh and Sangama (2003), Gharge *et al.* (2011), Sharma *et al.*, (2022); Taghizadeh and Khadivi (2023).

Conclusion

It was concluded that variety Baltico (white) reported significantly better performance compared to other varieties, in terms of Growth parameters like plant height was seen in cervantes (25.19 cm), number of leaves were maximum in master (20.94), number of internodes was highest in realism (18.49), number of branches were seen to be maximum in baltico (4.47), Kiro was found to be less suited variety for Prayagraj agro climatic condition due to metabolic activity. Flowering parameters like days to first flower bud break (65.33 days), days taken for first flower bud opening (66.00 days) was seen in Master, Flower Stalk length was seen highest in Realism (40.80 cm), number of flowers per plant was seen in cervantes (5.17), number of days taken for flower senescence on plant was seen highest in kiro (15.40 days), the vase life in carnation was seen to be the highest in master (0.40 days).

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Table 1 Performance of different varieties for vegetative and floral parameters studied for Carnation.

Treatment Notation	Treatment details	Plant height (cm) [90 DAP]	No of leaves [90 DAP]	No of branches per plant	No of internodes [90 DAP]	Days to flower bud initiation (DAP)	Days to flower bud opening (DAP)	Days to first flowering (DAP)	Number of flowers per plant	Flower Stalk length (cm)	Number of days taken for flower senescence on plant.	Vase life (days)
V₁	Cervantes	31.00	20.37	3.50	8.83	67.13	90.77	101.73	5.17	35.37	12.17	5.58
V₂	Master	29.70	28.37	3.47	6.60	65.33	66.00	101.20	4.07	34.60	11.03	10.40
V₃	Magno	29.37	23.9	3.50	6.47	76.17	94.87	190.10	4.63	35.83	11.67	7.47
V₄	Baltico	29.17	24.57	4.47	12.23	77.80	100.60	107.87	6.63	36.03	15.40	5.87
V₅	Realism	30.27	23.03	3.53	14.37	77.17	90.77	114.47	4.77	40.80	9.90	4.47
V₆	Kiro	26.63	19.43	3.47	8.40	89.33	111.00	121.33	2.23	27.63	5.90	3.60
'F' test		S	S	S	S	S	S	S	S	S	S	S
S.E. (d)		0.87	0.88	0.23	0.60	3.35	2.98	1.89	0.58	1.87	1.15	1.08
CD_{0.05}		1.94	1.96	0.51	1.34	7.47	6.63	4.22	1.30	4.16	2.56	2.41
CV		3.64	4.64	7.60	7.79	5.44	3.99	2.09	16.85	6.53	12.76	21.28