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Correlation studies in carnation germplasm

RUPALI SHARMA and RANJAN SRIVASTAVA*

Department of Horticulture
CCS Haryana Agricultural University, Hisar 125004 Haryana
***Department of Horticulture**
GB Pant University of Agriculture and Technology, Pantnagar 263145 Uttarakhand
Email for correspondence: rupali_flori@rediffmail.com

ABSTRACT

The present investigations were undertaken during 2006-07 and 2007-08 at Model Floriculture Centre, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand on carnation genotypes. Sixteen carnation genotypes were planted in completely randomized block design under low cost polyhouse. The correlation studies revealed that number of flowers per square meter had highly significant and positive correlation with flower diameter (cm), flower duration and leaf pair/stem while flower yield/m^2 had negative and significant correlation with per cent incidence of disease and incidence of insect pests damage at both genotypic as well as phenotypic levels.

Keywords: Carnation genotypes; correlation; characteristics; indicator; phenotypic; genotypic

INTRODUCTION

Affection, elegance, politeness, a mirror of self and sometimes even a token of jealousy flowers represent several moods. Whether in India or in European countries they have their own space in hearts and of course in the market. *Dianthus caryophyllus* L a member of family Caryophyllaceae is native to the Mediterranean area. Carnations flower year round and have a wider colour range, large flowers and stronger stems than their wild ancestors. Carnations are cultivated as either standard carnations or sprays. There is great scope of growing carnations for the production of quality cut flowers in India. In certain parts of France and Holland light coloured carnation flowers are also used for the extraction of perfume. In Tarai region which is characterized by enough soil moisture severe winter and mild summer has emerged as one of the important zones for growing carnation. In last few years some area has come under the cultivation of this flower in this region. But suitability of varieties as per the seasonal requirement of the area is not known. It is imperative therefore to investigate the potentiality of various carnation varieties based on morphological characteristics and to analyse the genetic relationships among them. The selection practiced for one character may simultaneously bring change in the other related characters. The information may be useful in the prediction of correlated response to directional selection in the construction of selection indices and the detection of some characters having no value in themselves but being indicators of the more important ones under consideration (Johnson et al 1955).

MATERIAL and METHODS

The present investigations were conducted at Model Floriculture Centre, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar during 2006-07 and 2007-08. The climate of the region is broadly humid sub-tropical in nature. The soils at Pantnagar come under order mollisols. The soil of experimental plot was sandy loam with adequate drainage and optimum water holding capacity. The experimental material for the present investigations comprised of 16 carnation varieties which formed the part of germplasm collection. The observations were recorded on 3 plants of each cultivar under each replication and the mean value for different characters was subjected to statistical analysis. The correlations between all characters under study at genotypic and phenotypic levels were estimated according to the method given by Searle (1961).

RESULTS and DISCUSSION

Gene-pool studies are important in any crop because wide range of variability always provides more possibility of selecting desired types (Vavilov 1926). But little work so far has been done on variability and correlation studies on quantitative traits in carnation. Studies on correlations help in construction of selection indices and to detect some simple characteristics which may be useful as indicator of more complex ones (Johnson et al 1955). Correlation coefficient at phenotypic and genotypic level were worked out for vegetative and flowering characters. A perusal of data in Table 1 and 2 reveal that genotypic correlation (rg) was higher in magnitude than the phenotypic correlation (rp) in most of the cases indicating that there were inherent associations among various characters.

Days taken to bud appearance

A perusal of the data presented in Table 1 reveal that the days taken to bud appearance showed positive and significantly higher genotypic correlation with days taken to bud opening (0.9599) and significantly negative correlation with stem length (-0.5172) while with plant height at full flowering stage (-0.2826), leaf pair/stem (-0.3090) and incidence of insect pest damage (-0.1295) were non-significantly negatively correlated. Days taken to bud appearance showed significantly higher and phenotypically positive correlation with days taken to bud opening (0.8822) and non-significantly negative phenotypic correlation with plant height at full flowering stage (-0.2521), stem length (-0.4569), leaf pair/stem (-0.2692) and incidence of insect pest damage (-0.1125) respectively in first year.

In second year days taken to bud appearance had significantly higher and positive genotypic correlation with days taken to bud opening (0.9950) and genotypically non-significant and negative correlation with flower diameter (-0.1917), flower duration (-0.4635) and leaf pair/stem (-0.2211) whereas significantly higher and positive phenotypic correlation with days taken to bud opening (0.9635) and non-significantly negative phenotypic correlation with flower diameter (-0.1458) and leaf pair/stem (-0.1699) (Table 2).

Days taken to bud opening

Days taken to bud opening showed highly significant and negative correlation with stem length (-0.6966) while non-significant positive correlation with flower duration (0.1665), incidence of disease (0.4370), incidence of insect pest damage (0.0439) and flower yield/m^2 (0.0346) and non-significant, negative correlation with flower diameter (-0.1360), plant height at full flowering stage (-0.3704) and leaf pair/stem (-0.3942) at genotypic level.

A significant and negative correlation was shown with stem length (-0.5521). Non-significant positive correlation characters were flower duration (0.1673), incidence of disease (0.2937), incidence of insect pest damage (0.0271) and flower yield/m^2 (0.1240) at phenotypic level. During second year days taken to bud opening showed non-significantly positive correlation with plant height at full flowering stage (0.0356), stem length (0.0377), incidence of insect pest damage (0.0959) and flower yield/m^2 (0.0694) and non-significant negative correlation with flower diameter (-0.1466), flower duration (-0.4393), leaf pair/stem (-0.1383) and incidence of disease (-0.0180) at genotypic level.

Phenotypically days taken to bud opening had non-significant positive correlation with plant height at full flowering stage (0.0426), stem length (0.0461), incidence of insect pest damage (0.0867) and flower yield/m^2 (0.0513).

Flower diameter

It is evident from the data presented in Table 1 that in first year flower diameter had significantly higher and positive correlation with flower duration (0.7918) and flower yield/m^2 (0.9011). Significant and positive correlation was recorded with leaf pair/stem (0.5713) whereas highly significant and negative correlation was depicted with incidence of disease (-0.7769) at genotypic level. At phenotypic level it had highly significant and positive correlation with flower duration (0.6745) and significant at positive correlation with leaf pair/stem (0.5026) and flower yield/m^2 (0.6208) while significant higher and negative correlation with incidence of disease (-0.6461). During second year flower diameter showed significant higher and positive correlation with flower duration (0.9091), plant height at full flowering stage (0.6915), stem length (0.6535), leaf pair/stem (0.7781) and flower yield/m^2 (0.7188) while had significantly higher and negative correlation with incidence of disease (-0.7250) genotypically and at phenotypic level flower diameter showed highly significant and positive correlation with flower duration (0.7756) and leaf pair/stem (0.6612) while significantly and positively correlation with plant height at full flowering stage (0.6083), stem length (0.5550) and flower yield/m^2 (0.6224). Highly significant and negative correlation was depicted with incidence of disease (-0.6586), negative and non-significant correlation with days taken to bud appearance (-0.1917), days taken to bud opening (-0.1466) and incidence of insect pest damage (-0.4157) (Table 2).

Flower duration

A perusal of data presented in Table 1 envisages that flower duration has shown highly significant and positive correlation with flower yield/m^2 at both genotypically and phenotypcal levels (rg= 0.8099, rp= 0.6374) while significant and negative correlation with incidence of disease (rg= -0.6056, rp = -0.5508). Non-significant and negative correlation was shown with plant height at full flowering stage (rg= 0.0398, rp= -0.0649), stem length (rg= -0.1264, rp = -0.119) and incidence of insect pest damage (rg = -0.2645, rp = 0-.2530). In second year genotypcially highly significant and positive correlation was found with plant height at full flowering stage (0.6934), stem length (0.6575) and leaf pair/stem (0.6234) while significantly positive correlation was recorded with flower yield/m^2 (0.5746) and non-significant and negative correlation with incidence of disease (-0.4901) and incidence of insect pest damage (-0.2788) (Table 2).

Plant height at full flowering stage

Significantly higher and positive correlation was found with plant height at full flowering stage (0.6404) and significantly positive correlation with stem length (0.5977) and leaf pair/stem (0.5461) while non-significant and negative correlation was found with incidence of disease (-0.4419) and incidence of insect pest damage (-0.2447) at phenotypic level. A perusal of data presented in Table 1 envisages that in first year (2006-07) plant height at full flowering stage had highly significant and positive correlation with stem length (0.8426) and leaf pair/stem (0.7282) and non-significant and negative correlation was found with incidence of disease (-0.3729) and incidence of insect

Table 1. Character association (genotypic and phenotypic correlation) between different character pairs in different carnation genotypes during 2006-07

Character	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Days taken to bud (1) appearance	-	0.9599**	0.0323	0.1676	-0.2826	-0.5172*	-0.3090	0.3801	-0.1298	0.1921
Days taken to bud (2) opening	0.8882**	-	-0.1360	0.1665	-0.3704	-0.8966**	-0.3942	0.4370	0.0439	0.0341
Flower diameter (3)	0.0003	-0.0044	-	0.7918**	0.1421	0.2471	0.5713*	-0.7769**	-0.1263	0.9011**
Flower duration (4)	0.1258	0.1673	0.6745**	-	-0.0398	-0.1264	0.3697	-0.6056*	-0.2645	0.8099**
Plant height at full (5) flowering stage	-0.2521	-0.3011	0.1286**-	0.0649	-	0.8426**	0.7282**	-0.3729	-0.1660	0.2081
Stem length (6)	-0.4569	-0.5521*	0.2156	-0.1199	0.8269**	-	0.7611**	-0.4692	-0.0981	0.1925
Leaf pair/stem (7)	-0.2692	-0.2971	0.5026*	0.3205	0.7090**	0.7332**	-	-0.7580**	-0.2944	0.6529**
Incidence of (8) disease (%)	0.2978	0.2937	-0.6461**	-0.5508*	-0.3472	-0.4566	-0.6939**	-	0.0358	-0.7452**
Incidence of insect (9)	-0.1125	0.0271	-0.1202	-0.2530	-0.1540	-0.0965	-0.2787	0.404	-	-0.4791
Flower yield/m² (10)	0.1994	.1240	0.6208*	0.6374**	0.1507	0.1413	0.5015*	-0.5878*	-0.3862	-

*Significant at 5% level, **Significant 1% level pest damage (-0.1660) at genotypic level. Highly significant and positive correlation was found with stem length (0.8269) and leaf pair/stem (0.7090) and non-significant and negative correlation with incidence of disease (-0.347) and incidence of insect pest damage (-0.1540) at phenotypic level. At both genotypic and phenotypic levels plant height at full flowering stage was found highly significant and positively correlated with stem length (rg= 0.9986, rp= 0.9787), leaf pair/ stem (rg= 0.8171, rp= 0.7608) and flower yield/m^2 (rg= 0.7214, rp= 0.6466). Significant and negative correlation was found with incidence of disease (rg = -0.5834), rp = -0.5662) while non-significant and negative correlation with incidence of insect pest damage (rg = -0.3021, rp = -0.2967) during second year (Table 2).

Stem length

A perusal of data presented in Table 1 clearly shows that stem length was significantly higher and positively correlated with leaf pair/stem (rg= 0.7611, rp= 0.7332) at both genotypic and phenotypic levels whereas it was non-significantly and negatively correlated with incidence of disease (rg= -0.4692, rp= -0.4566) and incidence of insect pest damage (rg= -0.0981, rp= -0.0965) during first year. During second year stem length had highly significant and positive correlation with leaf pair/stem (rg= 0.7963, rp= 0.7418) and flower yield/m^2 (rg= 0.7264, rp= 0.6350) (Table 2). Genotypically and phenotypically stem length had significant and negative correlation with incidence of disease (rg = -0.5624, rp = -0.5498).

Leaf pair/stem

Leaf pair/stem was observed to be positive and highly significant with flower yield/ sqm (0.6529) and significantly higher and negatively correlated with incidence of disease (-0.7580). Non-significant and negative correlation was found with incidence of insect pest damage (-0.2944) at genotypic level. Phenotypically significant and positive correlation was found with flower yield/m^2 (0.5015). It had significantly higher and negative correlation with incidence of disease (-0.6939) and non-significant and negative correlation with incidence of insect pest damage (-0.2787) (Table 1). During second year as evident from data in Table 2 leaf pair/stem had significantly higher and positive correlation with flower yield/m^2 (rg= 0.7849, rp= 0.6938) at both genotypic and phenotypic levels. Highly significant and negative correlation was found with incidence of disease (rg = -0.7926, rp = -0.7422). Genotypically there exists significant and negatively correlation with incidence of insect pest damage (-0.5491) and phentoypically non-significant and negative correlation with incidence of insect pest damage (-0.4929).

Incidence of disease

A perusal of data presented in Table 1 reveals that the incidence of disease

Table 2. Character association (genotypic and phenotypic correlation) between different character pairs in different carnation genotypes during 2007-08

Character	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Days taken to bud (1) appearance	-	0.9950**	-0.1917	-0.4635	0.0108	0.0180	-0.2211	0.0535	0.1845	0.0403
Days taken to bud (2) opening	0.9635**	-	-0.1466	-0.4393	0.0356	0.0377	-0.1383	-0.0180	0.0959	0.0694
Flower diameter (3)	-0.1458	-0.1420	-	0.9091**	0.6915**	0.6535**	0.7781**	-0.7250**	-0.4455	0.7188**
Flower duration (4)	0.3742	-0.3774	0.7756**	-	0.6934**	0.6515**	0.6234	-0.4901	-0.2788	0.5746*
Plant height at full (5) flowering stage	0.0235	0.0426	0.6083*	0.6404**	-	0.9986**	0.8171**	-0.5834*	-0.3021	0.7214**
Stem length (6)	0.0404	0.0461	0.5550*	0.5977*	0.9787**	-	0.7963**	-0.5624*	-0.3230	0.7264**
Leaf pair/stem (7)	-0.1699	-0.1236	0.6612**	0.5461	0.7608**	0.7418**	-	-0.7926**	-0.5491*	0.7849**
Incidence of (8) disease (%)	0.0090	-0.0370	-0.6586**	-0.4419	-0.5662*	-0.5498*	-0.7422**	-	0.7126**	-0.8627*
Incidence of insect (9)	0.1679	0.0867	-0.4151	0.2447	-0.2967	-0.3055	-0.4929	0.6718**	-	-0.6779**
Flower yield/m^2 (10)	0.0100	0.0513	0.6224*	0.4870	0.6466**	0.6350**	0.6938**	-0.7831**	-0.6315**	-

*Significant at 5% level, **Significant 1% level was significantly higher and negatively correlated with flower yield/m^2 (-0.7452) and positively non-significantly correlated with incidence of insect pest damage (0.0358) at genotypic level. Phenotypically incidence of disease was found significant and negatively correlated with flower yield/m^2 (-0.5878) and exhibited non significant positive correlation with incidence of insect pest damage (0.0404). In second year (Table 1) incidence of disease was highly significant and positively correlated with insect pest damage (rg= 0.7126, rp= 0.6718) at both genotypic and phenotypic levels. While genotypically it had significant and negative correlation with flower yield/m^2 (-0.8627). Phenotypically incidence of disease had highly significant and negative correlation with flower yield/m^2 (-0.7831).

Incidence of insect pest damage

In first year (Table 1) incidence of insect pest damage was found non-significant and negatively correlated with flower yield/m^2 (rg= -0.4791, rp= -0.3862) at both genotypic and phenotypic levels. During second year genotypically and phenotypically incidence of insect pest damage had highly significant and negative correlation with flower yield/m^2 (rg= -0.6779, rp= -0.6315). The present investigations revealed positive correlation with plant height, stem length and days to bud appearance which is in confirmation with the findings of Shyamal and Kumar (2002) who reported positive correlation of number of flowers per plant with days to flowering in dahlia. Misra and Saini (1990), De et al (1993) and Anuradha and Gowda (1994) reported positive correlation between plant height, spike length and number of florets per spike in gladiolus. Gowda (1989) reported that plant height, spike length and number of leaves in gladiolus had significant positive association with each other. Syamal and Kumar (2002) obtained positive correlation between flower diameter and number of leaves in dahlia. The present investigations also revealed positive correlation of flower size with number of leaves. John et al (1994) in zinnia, and Syamal and Kumar (2002) in dahlia obtained positive correlation between days to flowering and flowering duration. It is obvious from the discussion on correlation that for improvement of carnation both for market value and maintaining quality the characters like number of flower/m^2, plant height, stem length, leaf pair/stem, flower diameter and flower duration are of primary significance. The selection of cultivars on the basis of these characters can help to find good recombinant through a suitable breeding programme.

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