Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(5): 593-598
Received: 25-07-2019
Accepted: 27-08-2019

Anita Hosalli
Department of Floriculture and Landscape Architecture, University of Horticultural Sciences, Bagalkot, KRCCH Arabhavi, Karnataka, India

Mukund Shiragur
Department of Floriculture and Landscape Architecture, University of Horticultural Sciences, Bagalkot, KRCCH Arabhavi, Karnataka, India

BC Patil
Department of Floriculture and Landscape Architecture, University of Horticultural Sciences, Bagalkot, KRCCH Arabhavi, Karnataka, India

Dileepkumar Masuthi
Assistant Professor, Department of Seed Science and Technology, KRCCH, Arabhavi, Karnataka, India

Tatager MH
Associate Professor and Head, Department of HET, KRCCH, Arabhavi, Karnataka, India

Correspondence
Anita Hosalli
Department of Floriculture and Landscape Architecture, University of Horticultural Sciences, Bagalkot, Karnataka, India

Assessment of genotypic and phenotypic correlation for flower yield in F_4 population of China aster [*Callistephus chinensis* L. (Nees.)]

Anita Hosalli, Mukund Shiragur, BC Patil, Dileepkumar Masuthi and Tatager MH

Abstract
This study was mainly conducted to assess the correlation in China aster [C*allistephus chinensis* L. (Nees.)] flower crop was conducted during the year 2018-2019 at Department of Floriculture and Landscape Architecture, Kittur Rani Channamma College of Horticulture, Arabhavi. Treatment details having forty lines from F_4 population of two crosses *viz*., AAC-1 × Arka Poornima and Arka Kamini × P G Purple were assessed for 13 quantitative and qualitative traits for different parameters with yield components and their direct and indirect correlation on flower yield. Genotypic correlation for flower yield is positively associated with number of branches, plant height, number of flowers per plant, leaf area and plant spread and negatively with the flower diameter indicating the possibility of simultaneous selection for these traits to improve the yield.

Keywords: Genetic combining ability, specific combining ability, China aster, variance, growth, yield and quality

Introduction
China aster [C*allistephus chinensis* L. (Nees.)] is a semi hardy annual and commercial flower crop belonging to the family Asteraceae. China aster is a self-pollinated crop, but the natural outcrossing is approximately 10 per cent as reported by Fleming (1937) [2] and Strube (1965) described floral biology of China aster. The present day China aster had been developed from single wild species. According to Emsweller *et al*. (1937) [1], the original plant had single flower with two to four rows of blue, violet or white ray florets. The first change in the flower type was the prolongation or development of central florets and the production of quilled flowers.

Correlation coefficient analysis measures the mutual relationship between various plant characters and determines the component characters on which selection can be based for genetic improvement in yield. Yield being a complex character, is collectively influenced by various characters which are polygenically inherited and highly subjected to environment variations. Hence, for an effective and efficient selection of genotypes for yield, the knowledge of direction and magnitude of association between yield and its components and among the components themselves is very much essential. The phenotypic correlations indicate the extent of the observed relationship between two characters. This does not give true genetic picture of the relationship because it includes both heritable and non-heritable association.

Genotypic correlations provide an estimate of inherent association between genes controlling any two characters. Improving genetic correlation was mainly due to pleiotrophy and linkage (Jain, 1982) [5]. To split the observed correlations in to direct and indirect effect, the concept of path coefficient analysis was originally developed by Wright (1921) [17], which splits the correlation coefficient into the measures of direct and indirect effect so that relative influence of each component character on yield could be assessed that in turn helps to select the lines for further crop improvement.

Materials and methods
The study was conducted during the year 2018-2019 at Department of Floriculture and Landscape Architecture, Kittur Rani Channamma Collage of Horticulture, Arabhavi. The F4 population of cross AAC-1 × Arka Poornima and Arka Kamini × P G Purple were selected based on the superior yield and yield contributing characters. One month old seedling were transplanted into the main field with spacing of 30×30cm. Five competitive plants were tagged at random in each treatment in each replication for recording detailed observation and the data

were recorded for all the 13 quantitative and qualitative characters *viz.,* plant height, number of branches, stem girth, plant spread in north- south and east west direction, leaf area (cm^2), days taken for flower bud initiation, days to first flowering, days for 50 per cent flowering, duration of flowering (days), number of flowers per plant, individual flower weight (g), diameter of flower (cm) and flower yield per plant (g/plant) were recorded. Mean values were subjected to analysis of variance, genotypic and phenotypic path analysis was carried out separately to know the direct and indirect effects of the important components, which are the standardized partial regression.

Results and Discussion

The correlation coefficients only indicate the relationship between independent variable and the dependent variable without specifying cause and effect of relationship. Using Path coefficient analysis, it is possible to resolve the correlations, which will provide an indirect contribution of different quantitative traits. The analysis was done for flower yield per plant, which is dependent variable. Genotypic and phenotypic paths for the dependent variable were computed.

Correlation studies for F_4 population of AAC-1 × Arka Poornima

Genotypic correlation analysis for flower yield per plant

At genotypic level (Table.1) plant height was significantly (at p= 0.01) and positively correlated with flower yield per plant (0.644) followed by individual flower weight (0.564) and number of flowers per plant (0.402). Plant height was significantly (at p= 0.05) and positively associated with stem girth (0.340) and it was significantly (at p= 0.01) and negatively associated with duration of flowering (-0.414). Number of branches had significantly (at p= 0.01) and positively correlated with plant spread in east-west (0.934) followed by plant spread in north-south (0.539), leaf area (0.516), stem girth (0.434) and number of flowers per plant (0.430) and negatively associated with the days to flower bud initiation (-0.448) and days to fifty percent flowering (-0.436). It was significantly (at p=0.05) and positively associated with flower yield per plant (0.346) while, other parameters showed non-significant correlation with number of branches. Stem girth was significantly (at p= 0.01) and positively correlated with days to first flowering (0.936) followed by days to flower bud initiation (0.864), number of flowers per plant (0.657), days to 50% flowering (0.642) and leaf area (0.514). It was significantly (at p=0.01) and negatively associated with duration of flowering (-0.403). Plant spread in north-south direction had significant and positive correlation with plant spread in east-west (0.829) and it was significantly (at p=0.05) and negatively correlated with duration of flowering (-0.319) However, it had non-significant correlation with other parameters. Plant spread in east-west direction had significant (at p=0.01) and positive correlation with number of flowers per plant (0.546) followed by leaf area (0.447) and it was significantly (at p=0.05) and negatively correlated with days to 50% flowering (-0.314) but had non-significant correlation with other parameters. Leaf area was significantly (at p= 0.01) and positively correlated with flower yield per plant (0.629) and number of flowers per plant (0.608) and also significantly (at p=0.05) and positively associated with individual flower weight (0.326). However, it showed non-significant with correlation other parameters. Days taken to flowers bud initiation had highly significant (at p=0.01) and positive correlation with days taken for first flowering (0.856) followed by days taken for fifty per cent flowering (0.853) and it had negative and significant correlation with flower diameter (-0.546). However, it showed non- significant association with other parameters. Days taken for first flowering had high significant (at p=0.01) and positive correlation with days taken for fifty per cent flowering (0.849). However, it showed non-significant correlation with other parameters. Days taken for fifty per cent flowering had highly significant (at p=0.01) positive correlation with flower yield per plant (0.414) and had high significant (at p=0.05) positive correlation with duration of flowering (0.393) followed by number of flowers per plant (0.350), but it had non-significant correlation with other traits. Duration of flowering was significantly (at p= 0.01) and positively correlated with flower diameter (0.441), but it had non-significant association with other parameters. Number of flowers per plant was significantly (at p= 0.01) and positively correlated with flower yield per plant (0.695), but it had shown non-significant association with other parameters. Individual flower weight was significantly (at p= 0.01) and positively correlated with flower yield per plant (0.767) and it was having significant (at p= 0.05) and negative correlation with flower diameter (-0.376). However, it was not having significant correlation with other parameters. Flower diameter was positively and significantly (at p= 0.05) associated with flower yield per plant (0.356). However, it was not having significant correlation with other parameter. These results are in conformity with the earlier observations done by Mahesh *et al.* (2015) [8], Usha *et al.* (2014) [16] and Shivakumar *et al.* (2014) [13] in marigold for flower yield per plant and Rai *et al.* (2017) [11] in China aster for number of flowers per plant.

Phenotypic correlations studies for flower yield per plant

At phenotypic level (Table 2) plant height was significantly (at p= 0.01) and positively correlated with flower yield per plant (0.541), individual flower weight (0.504) and it was significantly (at p=0.05) and positively associated with number of flowers per plant (0.342). However, it was having non-significant results with other parameters. Number of branches had significantly (at p= 0.01) and positively correlated with plant spread in east-west (0.484) followed by leaf area (0.458). While other parameters showed non-significant correlation with number of branches. Stem girth was significantly (at p= 0.01) and positively correlated with days to first flowering (0.543) followed by days to flower bud initiation (0.460). It was significantly (at p=0.05) and positively associated with number of flowers per plant (0.392) followed by leaf area (0.312). While other parameters showed non- significant correlation with stem girth. Plant spread in north-south direction had shown significant (at p= 0.01) and positive correlation with plant spread in east-west (0.535). However, significant (at p= 0.01) and negative correlation with days to flower bud initiation (-0.646). But it showed non-significant results with all other parameters. Plant spread in east-west had shown significant (at p= 0.05) and positive correlation with number of flowers per plant (0.388) followed by leaf area (0.336). However, it showed non-significant correlation with all other parameters. Leaf area was significantly (at p= 0.01) and positively correlated with flower yield per plant (0.540) followed by number of flowers per plant (0.533). However, other parameters showed non-significant correlation with leaf area. Days taken for flower bud initiation had shown significant (at p= 0.01) and positive correlation with days taken for fifty flowering (0.683) followed by days taken for first flowering (0.678). However, it showed non-significant correlation with all other parameters. Days to first flowering was significantly (at p= 0.01) and positively correlated with days to fifty per cent flowering (0.590) and it was having non-significant association with other parameters. Days to 50 per cent flowering was shows non-significant association with all parameter studied. Duration of flowering was not having significant correlation with other parameters. Number of flowers was significantly (at p= 0.01) and positively correlated with flower yield per plant (0.715). However, it was having non-significant association with other parameters. Individual flower weight was significantly (at p= 0.01) and positively correlated with flower yield per plant (0.779) and it was having non-significant association with other parameters. Flowers diameter was not having significant correlation with other parameters. Misra *et al.* (2013) [9] in chrysanthemum for number of secondary branches and number of leaves per plant, Patil *et al.* (2011) [10] and Shivakumar *et al.* (2014) [13] in marigold for plant height, plant spread, days to fifty percent flowering and number of flowers per plant and Kumari *et al.* (2017) [7] in China aster for number of flowers per plant and shelf life.

Correlation studies for F_4 population of Arka Kamini × P G Purple

Genotypic correlation analysis for flower yield per plant

At genotypic level (Table 3) plant height was significantly (at p= 0.01) and positively correlated with plant spread in east-west (0.457) followed by plant spread in north-south (0.421) and negatively associated with days to flower bud initiation (-0.344). However, it was not having significant correlation with other parameters. Number of branches had significantly (at p= 0.01) and positively correlated with number of flowers per plant (0.443) followed by days taken for fifty percent flowering (0.416). It was significantly (at p=0.05) and positively associated with plant spread in north-west (0.357). While other parameters showed non-significant correlation with number of branches. Stem girth was significantly (at p= 0.01) and positively correlated with days to flower bud initiation (0.506) followed by days taken for fifty percent flowering (0.468) and days to first flowering (0.464). While other parameters showed non-significant correlation with stem girth. Plant spread in north-south direction had significant (at p= 0.01) and positive correlation with plant in east-west (0.790) and also significantly (at p= 0.05) and negatively correlated with days to flower bud initiation (-0.388). However, it had non-significant association with other parameters. Plant spread in east-west direction had significant (at p= 0.01) and positive correlation with flower yield per plant (0.603) and negatively correlated with days to flower bud initiation (-0.521) and flower diameter (-0.434) also significantly (at p=0.05) positive correlation with number of flower per plant (0.347) followed by individual flower weight (0.326). However, days taken for fifty percent flowering showed negatively significant correlation (-0.349). But, it had non-significant correlation with other parameters. Leaf area was significantly (at p= 0.05) and positively correlated with number of flowers per plant (0.395) and significantly and negatively associated with days to first flowering (-0.368) and flower diameter (-0.316) and also significantly (at p= 0.01) and negatively associated with days to flower bud initiation (-0.636). However, it had non-significant association with other parameters. Days taken for flower bud initiation had shown significant (at p= 0.01) and positive correlation with days taken for first flowering (0.898), days taken for fifty per cent flowering (0.833) and also significantly (at p=0.05) and negatively associated with flower yield per plant (-0.419) followed by duration of flowering (-0.338). However, it showed non-significant correlation with all other parameters. Days to first flowering was significantly (at p= 0.01) and positively correlated with days to 50 per cent flowering (0.912) and it was having non-significant association with other parameters. Days to 50 per cent flowering was significantly (at p= 0.01) and positively correlated with flower diameter (0.469) followed by duration of flowering (0.446) and it was significantly (at p=0.05) and negatively associated with individual flower weight (-0.361). However, it was having non-significant association with other parameters. Duration of flowering was significantly (at p= 0.01) and negatively correlated with individual flower weight (-0.520) followed by number of flowers per plant (-0.402). However, it had non-significant association with other parameters. Number of flowers was significantly (at p= 0.01) and positively correlated with flower yield per plant (0.612). However, it was having non-significant association with other parameters. Individual flower weight was significantly (at p= 0.01) and positively correlated with flower yield per plant (0.628) and it was having non-significant association with other parameters. Flowers diameter showed non-significant correlation with all other parameters. These results are in conformity with Shivakumar *et al.* (2014) [13] in marigold, Gaidhani *et al.* (2016) [3] in tuberose for number of florets per spike and spike yield per plot and Sreenivasulu *et al.* (2007) [15] in China aster for number of flowers and number of branches per plant, Shanmugam *et al.* (1972) [12] and Misra *et al.* (2013) [9] in chrysanthemum for number of secondary branches and number of leaves per plant and Kumari *et al.* (2017) [7] in China aster for number of flowers per plant and shelf life.

Phenotypic correlations studies for flower yield per plant

At phenotypic level (Table 4) plant height was significantly (at p= 0.01) and positively correlated with plant spread in east-west (0.402) and it was significantly (at p=0.05) and positively associated with plant spread in north-south (0.375). However, it was not having significant results with other parameters. Number of branches had significantly (at p= 0.01) and positively correlated with plant spread in north-south (0.381) followed by days taken for fifty percent of flowering (0.360). While, other parameters showed non-significant correlation with number of branches. Stem girth was significantly (at p= 0.05) and positively correlated with days to flower bud initiation (0.405) followed by days taken for fifty percent flowering (0.346). While, other parameters showed non-significant correlation with stem girth. Plant spread in north-south direction had significant (at p= 0.01) and positive correlation with plant spread in east-west (0.700). However, it had non-significant results with other parameters. Plant spread in east-west direction had significant (at p= 0.01) and positive correlation with flower yield per plant (0.522) and it was significant (at p= 0.05) positively correlated with individual flower weight (-0.316) and negatively correlated with days to flower bud initiation (-0.391). But had non-significant results with other parameters. Leaf area was significantly (at p= 0.05) and positively correlated with number of flowers per plant (0.324) and it was significantly (at p= 0.01) and negatively correlated with days to flower bud initiation (-0.424). However, it showed non-significant correlation with all other parameters. Days taken for flower bud initiation had shown significantly (at p= 0.01) and positively correlated with days taken for first flowering (0.596) followed days taken for fifty per cent flowering (0.490) and also significantly (at p=0.05) and positively associated with duration of flowering (0.366) and negatively correlated with flower yield per plant (-0.356). However, it showed non-significant correlation with all other parameters. Days to first flowering was significantly (at p= 0.01) and positively correlated with days to 50 per cent flowering (0.513) and it was having non-significant association with other parameters. Days to 50 per cent flowering was significantly (at p= 0.05) and positively correlated with flower diameter (0.316). However, it was having non-significant association with other parameters. Duration of flowering had shown non-significant correlation with all other parameters. Number of flowers was significantly (at p= 0.01) and positively correlated with flower yield per plant (0.610). However, it was having non-significant association with other parameters. Individual flower weight was significantly (at p= 0.01) and positively correlated with flower yield per plant (0.624) and it was having non-significant association with other parameters. Flowers diameter was showed non-significant with all other parameters. This is in relation with the earlier reports of Kuruppaiah *et al.* (2004), Singh and Singh (2005), Kuruppaiah and Kumar (2010) in marigold, Kavitha and Anburani (2010) [6] Shivakumar *et al.* (2014) [13] in marigold, Harishkumar *et al.* (2018) [4] in F_2 segregating population of China aster for flower yield and individual flower weight.

Table 1: Estimates of Genotypic correlation coefficients in F_4 population of cross "AAC-1 × Arka Poornima"

Traits	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1	1.000	0.243	0.340*	0.211	0.132	0.231	0.243	0.184	0.112	-0.414**	0.402**	0.564**	-0.331*	0.644**
2		1.000	0.434**	0.539**	0.934**	0.516**	-0.448**	-0.214	-0.436**	0.241	0.430**	0.247	-0.080	0.346*
3			1.000	-0.071	0.132	0.514**	0.864**	0.936**	0.642**	-0.403**	0.657**	0.150	-0.150	0.518**
4				1.000	0.829**	0.226	0.007	-0.097	-0.095	-0.319*	0.251	-0.123	-0.107	0.033
5					1.000	0.447**	0.029	-0.218	-0.314*	-0.277	0.546**	-0.305	0.092	0.077
6						1.000	-0.071	0.022	-0.141	-0.207	0.608**	0.326*	-0.047	0.629**
7							1.000	0.856**	0.853**	-0.105	0.380*	0.084	-0.546**	0.308
8								1.000	0.849**	-0.130	0.210	0.035	-0.175	0.173
9									1.000	0.393*	0.350*	0.247	0.154	0.414**
10										1.000	-0.067	-0.147	0.441**	0.155
11											1.000	0.093	-0.175	0.695**
12												1.000	-0.376*	0.767**
13													1.000	0.356*
14														1.000

* Significant at P = 0.05 **Significant at P = 0.01 r value at 5% = 0.311 and 1% = 0.402

1. Plant height (cm)	5. Plant spread (cm) in [E-W]	9. Days for 50% flowering	13. Flower diameter (cm)
2. Number of branches	6. Leaf area (cm^2)	10. Duration of flowering (days)	14. Flower yield per plant (g)
3. Stem girth (cm)	7. Days to flower bud initiation	11. Number of flowers per plant	
4. Plant spread(cm) in [N-S]	8. Days to first flowering	12. Individual flower weight (g)	

Table 2: Estimates of phenotypic correlation coefficients in F_4 population of cross "AAC-1 × Arka Poornima"

Traits	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1	1.000	0.200	0.089	0.245	0.031	0.160	0.113	0.088	0.010	-0.276	0.342*	0.504**	0.085	0.541**
2		1.000	0.006	0.261	0.484**	0.458**	-0.158	-0.208	-0.188	0.100	0.303	0.113	0.145	0.221
3			1.000	-0.059	0.199	0.312*	0.460**	0.543**	0.160	-0.058	0.392*	0.092	-0.149	0.281
4				1.000	0.535**	0.180	-0.646**	-0.060	-0.176	-0.169	0.204	0.005	-0.080	0.078
5					1.000	0.336*	-0.019	0.011	-0.116	-0.053	0.388*	-0.249	-0.101	0.024
6						1.000	-0.118	-0.021	-0.141	-0.106	0.533**	0.302	0.094	0.540**
7							1.000	0.678**	0.683**	-0.104	0.250	-0.020	-0.276	0.142
8								1.000	0.590**	-0.107	0.215	0.115	-0.186	0.220
9									1.000	0.130	0.208	0.135	0.006	0.163
10										1.000	-0.075	-0.142	0.325	-0.157
11											1.000	0.148	-0.114	0.715**
12												1.000	-0.179	0.779**
13													1.000	-0.213
14														1.000

* Significant at P = 0.05 **Significant at P = 0.01 r value at 5% = 0.311 and 1% = 0.402

1. Plant height (cm)	5. Plant spread (cm) in [E-W]	9. Days for 50% flowering	13. Flower diameter (cm)
2. Number of branches	6. Leaf area (cm^2)	10. Duration of flowering (days)	14. Flower yield per plant (g)
3. Stem girth (cm)	7. Days to flower bud initiation	11. Number of flowers per plant	
4. Plant spread(cm) in [N-S]	8. Days to first flowering	12. Individual flower weight (g)	

Table 3: Estimates of Genotypic correlation coefficients in F_4 population of cross "Arka Kamini × P G Purple"

Traits	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1	1.000	-0.270	-0.009	0.421**	0.457**	0.096	-0.344*	-0.128	-0.077	0.250	-0.278	0.280	-0.212	0.064
2		1.000	-0.101	0.357*	0.242	0.286	0.110	0.272	0.416**	0.054	0.443**	-0.248	0.271	0.200
3			1.000	0.039	0.033	-0.168	0.506**	0.464**	0.468**	-0.198	-0.035	-0.025	-0.159	0.026
4				1.000	0.790**	0.127	-0.388*	-0.097	0.066	0.310	0.151	0.106	0.035	0.298
5					1.000	0.143	-0.521**	-0.307	-0.349*	0.043	0.347*	0.326*	-0.439**	0.603**
6						1.000	-0.636**	-0.368*	-0.261	-0.127	0.395*	-0.064	-0.316*	0.259

7							1.000	0.898**	0.833**	-0.338*	-0.278	-0.180	-0.234	-0.419*
8								1.000	0.912**	0.106	-0.102	0.161	0.218	-0.290
9									1.000	0.446**	-0.064	-0.361*	0.469**	-0.261
10										1.000	0.008	-0.520**	-0.028	-0.402**
11											1.000	-0.204	-0.138	0.612**
12												1.000	-0.108	0.628**
13													1.000	-0.223
14														1.000

* Significant at P = 0.05 **Significant at P = 0.01 r value at 5% = 0.311 and 1% = 0.402

1. Plant height (cm) 2. Number of branches 3. Stem girth (cm) 4. Plant spread(cm) in [N-S]	5. Plant spread (cm) in [E-W] 6. Leaf area (cm^2) 7. Days to flower bud initiation 8. Days to first flowering	9. Days for 50% flowering 10. Duration of flowering (days) 11. Number of flowers per plant 12. Individual flower weight (g)	13. Flower diameter (cm) 14. Flower yield per plant (g)

Table 4: Estimates of Phenotypic correlation coefficients in F_4 population of cross "Arka Kamini × P G Purple"

Traits	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1	1.000	-0.195	0.044	0.375*	0.402**	-0.047	-0.304	-0.027	-0.159	0.195	-0.269	0.259	-0.207	0.056
2		1.000	0.091	0.381**	0.267	0.224	0.145	0.248	0.360**	0.024	0.283	-0.223	0.235	0.101
3			1.000	0.044	-0.030	-0.178	0.405*	0.236	0.346*	-0.124	-0.010	-0.016	-0.119	0.048
4				1.000	0.700**	0.112	-0.276	-0.101	0.029	0.237	0.103	0.105	0.037	0.264
5					1.000	0.168	-0.391*	0.162	-0.228	0.030	0.267	0.316*	-0.263	0.522**
6						1.000	-0.424**	0.162	-0.231	-0.168	0.324*	-0.054	-0.222	0.234
7							1.000	0.596**	0.490**	0.366*	-0.242	-0.177	0.261	-0.356*
8								1.000	0.513**	0.075	-0.063	-0.177	0.045	-0.265
9									1.000	0.208	0.032	-0.261	0.316*	-0.183
10										1.000	0.024	-0.429	0.072	-0.293
11											1.000	-0.176	-0.128	0.610**
12												1.000	-0.071	0.624**
13													1.000	-0.171
14														1.000

* Significant at P = 0.05 **Significant at P = 0.01 r value at 5% = 0.311 and 1% = 0.402

1. Plant height (cm) 2. Number of branches 3. Stem girth (cm) 4. Plant spread(cm) in [N-S]	5. Plant spread (cm) in [E-W] 6. Leaf area (cm^2) 7. Days to flower bud initiation 8. Days to first flowering	9. Days for 50% flowering 10. Duration of flowering (days) 11. Number of flowers per plant 12. Individual flower weight (g)	13. Flower diameter (cm) 14. Flower yield per plant (g)

Future line of work

- The present investigation revealed that the characters like number of flowers per plant, individual flower weight and flower diameter recorded significant positive correlation and high direct positive effect on flower yield. Hence, these characters should be given prime importance in future breeding programme.

References

1. Emsweller SL, Brierley P, Lumsden DV, Mulferd FL. breeding of ornamental plants. U. S. D. A. Year book of Agriculture, U. S. Dept. of Agric., 1937, 926-929.
2. Fleming WM. U. S. D. A. Year book of Agriculture, U. S. Dept. of Agric., 1937, pp. 985.
3. Gaidhani A, Bagade S, Patil S, Ingole M, Ganorkar AA. Genetic and correlation studies in Tuberose for assessing the genetic variability. J Crop Weed. Sci. 2016; 12(1):52-55.
4. Harishkumar K, Mukund Shiragur, Balaji Kulkarni S, Patil BC, Sadyarani Nishani. Correlation and path co-efficient analysis in F_2 segregating population of AAC-1× Arka Poornima cross in China aster (*Callistephus chinensis* [L.] Nees.). Int. J Pure App. Biosci. 2018; 6(2):1216-1221.
5. Jain SP. Statistical techniques in quantitative genetics. Indian Agricultural Statistics Research Institute, New Delhi, 1982.
6. Kavitha R, Anburani A. Screening of genotypes through correlation and path co-efficient analysis in African marigold (*Tagetes erecta* L.). Asian J Hort. 2010; 5(2):458-460.
7. Kumari P, Kumar R, Rao TM, Dhananjaya MV, Bhargav V. Genetic variability, character association and path coefficient analysis in China aster [*Callistephus chinensis* (L.) Nees]. Hort. Flora Res. Spectrum. 2017; 6(4):278-282.
8. Mahesh C, Beniwal BS, Anop K. Character association and path coefficient analysis studies in marigold. Eco. Env. & Cons. 2015; 21(1):165-171.
9. Misra S, Mandal T, Vanlalruati, Das SK. Correlation and path coefficient analysis for yield contributing parameters in spray chrysanthemum. J Hort. Letters. 2013; 3(1):14-16.
10. Patil KV, Kulkarni BS, Reddy BS, Jagadeesha RC, Kerure P, Ingle A. Stability analysis in marigold (*Tagetes erecta* L.) for flower yield and quality parameters. Res. J Agri. Sci. 2011; 2(2):237-240.
11. Rai TS, Chaudhary SVS, Dhiman SR, Dogra RK, Gupta RK. Genetic variability, character association and path coefficient analysis in China aster (*Callistephus chinensis*). Indian J Agric. sci. 2017; 87(4):540-543.
12. Shanmugam A, Muthuswamy S, Srinivasan N. Interrelationship between yield and certain growth and floral attributes in two chrysanthemum varieties *(Chrysanthemum indicum* L.). South Ind. Hort. 1972; 36:30-31.
13. Shivakumar Srinivasa V, Sudeep HP, Shivayya KM, Ketana GB. Correlation studies in African marigold (*Tagetes erecta* L.) genotypes. Int. J Bio. Sci. 2014; 5(2):83-87.
14. Shivakumar Srinivasa V, Sudeep HP, Shivayya KM, Ketana GB. Correlation studies in African marigold

(*Tagetes erecta* L.) genotypes. Int. J Bio. Sci. 2014; 5(2):83-87.
15. Sreenivasulu GB, Kulkarni BS, Natraj SK, Reddy BS, Naik KM, Chandan K. Correlation studies for yield and yield contributing characters in China aster (*Callistephus chinensis*). Asian J Hort. 2007; 2(2):192-194.
16. Usha BT, Jawaharlal M, Kannan M, Manivannan N, Raveendran M. Correlation and path analysis in African marigold (*Tagetes erecta* L.). The bioscan, Int. quarterly J. Life Sci. 2014; 9(4):1673-1676.
17. Wright S. Correlation and causation. J Agric. Res. 1921; 20:557-585.