Indian Res. J. Genet. & Biotech 7(2) : 179 – 186 (2015)

Studies on genotypic evaluation and correlation studies in china aster [*Callistephus chinensis* (L.) Nees.]

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(Received: March 2015; Revised: March 2015; Accepted: April 2015)

Abstract

The study on genetic variability and correlation among the different characters influencing the flower yield, seed yield and seed quality of different genotypes of china aster was carried out during kharif season of 2011-12 at the Kittur Rani Channamma College of Horticulture, Arabhavi. The first experiment comprised of ten china aster genotypes. Among the ten genotypes, Phule Ganesh White and Phule Ganesh Purple recorded maximum flower and seed yield per plant. Phule Ganesh Purple recorded higher germination percentage whereas Phule Ganesh Pink recorded maximum root and shoot length and seedling vigour index. Flower yield per hectare was positively and significantly correlated with plant height, plant spread number of secondary branches and leaf area at genotypic level. Germination and seedling vigour index (SVI) studies showed positive significant correlation with plant height, plant spread, leaf area, 50 per cent flowering, number of flower per plant, flower yield per plant, dry matter production and seed yield.

Key words- China aster, Correlation, Path, Variability

Introduction

China aster (*Callistephus chinensis* Nees.) is a half hardy annual and commercial flower crop belonging to the family Asteraceae. It is an important annual crop of our country and grown throughout the world. The genus *Callistephus* is derived from two Greek words *Kalistos* meaning 'most beautiful' and *Stephus*, 'a crown' referring to the flower head. The present day asters have been developed from a single form of wild species, *Callistephus chinensis*. The evolution of china aster was a history of remarkable variations. The original plant had single flowers with two or four rows of blue, violet or white ray florets. The stature was medium tall, 18 to 24 inches in height. The first change in the flower type had been the prolongation or development of central florets and the production of quilled flowers. In Karnataka it was cultivated on an area of 2199 ha, with a production of 20846 mt and productivity of 9.45 t / ha, respectively during 2013 (Anon., 2013). In importance it ranks next to chrysanthemum and marigold among the traditional flowers. Though the flower yield and quality are primarily varietal characters, they are also greatly influenced by climatic factors. The climatic factors like photoperiod, temperature, relative humidity and also soil moisture influence both vegetative and reproductive phases of the plant, ultimately leading to variation in the performance of genotypes. Growth and yield of any flower crop is influenced by various factors like variety, season, environment etc. Among these factors, varieties, themselves contribute much to the evolution of any flower crop. However, the performance of genotypes of any crop differs from one region to another region under given set of agro-climatic conditions. Hence, selection of variety is an important criteria for successful cultivation of flowers. The objective of crop improvement is to select an high yielding genotype with better crop growth and high flower quality. The main objective of study is to study the genetic variability and correlation among the different characters influencing the flower and seed yield of china aster

Material and Methods

The field and laboratory experiments were conducted to study the genetic variability and correlat0ion of the different morphological characters influencing the flower yield, seed yield and seed quality of different genotypes of china aster [*Callistephus chinensis* (L.) Nees.]. The experimental material comprised of ten china aster varieties Phule Ganesh White , P. G. Purple, P.G. Violet, Violet Cushion, Poornima, Kamini,

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Published by the Indian Society of Genetics, Biotechnology Research and Development
Biotech Bhawan 5 E Nikhil Estate, DPS Road, Shastripuram, Agra 282007
Online management by www.isgbrd.co.in

Namdhari Pink, Namdhari White, Budiguppa Local and Local Pink were evaluated in Randomized Block Design with three replications during *kharif* 2011-12 at K. R. C. College of Horticulture, Arabhavi. The entire experimental land was divided into plots of measuring 2.7 m x 4.0 m of totally 30 plots. Each entry was sown in one row with spacing of 45 cm and 30 cm, respectively, and all the recommended cultural practices were followed. 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 18 quantitative characters *viz.,* Plant height, Plant spread (EW&NS), No. of branches (primary), No. of branches (secondary), Leaf area of plant (cm^2), Days for commencement of flowering, Days for 50 per cent flowering, Number of flowers per plant, Flower yield per plant (g), Diameter of flower (cm), Dry matter production (g), Weight of hundred flowers (g), Flower yield (t/ha), Seed yield per plant (g), Seed yield per ha (kg), 1000 seed weight (g), Germination (%), Seedling vigour index were recorded. Mean values were subjected to analysis of variance, genotypic and phenotypic correlation coefficient was computed by using the formula of Dewey and Lu (1959).

Results and discussion

The China aster genotypes showed variations for growth and yield parameters. Genotypes Phule Ganesh White, Phule Ganesh Purple and Phule Ganesh Violet showed good performance for growth attributes with the mean value for *viz.,* plant height (72.35, 65.06 and 62.66 cm respectively), number of primary branches per plant (20.20, 21.50 and 28.00 respectively), Secondary branches per plant (28.80, 27.90 and 31.60 respetively), leaf area per plant (37.56, 41.64 and 41.83 cm^2 respectively), leaf area index (0.0529, 0.0295 and 0.0345 respectively) and total dry matter production (51.09, 47.99 and 49.30 g respectively) (**Table**. **1**). . Similar variation in plant height due to genotypes was also observed in china aster by Poornima *et al.* (2006) and Munikrishnappa (2011), Zosiamliana *et al.* (2012).

The genotypes Namdhari White (43.70 days) and Phule Ganesh Purple (47.60) have taken least number of days for commencement of flowering, days taken for 50 per cent. However, the genotypes Phule Ganesh White and Phule Ganesh Purple records maximum flower yield per plant (485.29 and 307.19 g respectively), 100 flower weight (934.78 and 619.00 g), number of flower per plant (64.30 and 47.82) and flower yield per hectare (32.35 and 20.48 t/ha). The genotypes Violet Cushion and Phule Ganesh Violet also produced more number of flowers but their yield was comparatively lesser compared to other Phule Ganesh series. Variations in flower characters were expected due to china aster genotypes as evidenced by Munikrishnappa (2011) and Zosiamliana *et al.* (2012). Similarly, variations in flowering characters in other flower crops have been reported by in marigold (Vijayalaxmi, 1998).

Although higher number of flowers per plant were recorded in Phule Ganesh White, the other flower parameters *viz.,* flower yield per plant, 100 flower weight, flower yield in tones per hectare, number of cut flowers per plant and number of cut flowers per hectare were recorded maximum in genotype Phule Ganesh White followed by other Phule Ganesh Series and also in Namdhari White and Namdhari Pink and it was less in genotypes Budiguppa Local and Local Pink (Table 1). The variation among the genotypes with respect to flower yield characters was mainly because of increased flower size with prominent central disc florets and also due to the presence of fairly more number of developed ray florets. Further, being a genetical factor, variations were accepted among the genotypes of china aster. The maximum number of flowers was produced by genotypes Phule Ganesh White and Namdhari White. This was due to production of more number of branches with good number of developed flower buds on the branches, while, the minimum number of flowers were observed in genotype Budiguppa Local because this genotype recorded comparatively less number of secondary branches per plant. The similar results observed in china aster by Munikrishnappa (2011) and Zosiamliana *et al.* (2012).

The flower yield per plant (485.29 and 307.19 g resectively) and per hectare (32.35 and 20.48 t/ha respectively) was maximum in genotypes Phule Ganesh White and Phule Ganesh Purple. The increased flower yield was because of increased flower size, flower weight and more number of flowers per plant as in case genotypes Phule Ganesh White and Phule Ganesh Purple. Further, these genotypes had fairly high dry matter accumulation, which might have contributed for the increased flower yield. The flower yield was less in genotype Budiguppa Local. This was because of the fact that it had lesser number of leaves, which resulted in less dry matter accumulation. Variation in flower yield was also observed previously in china aster (Negi and Raghava, 1985), Munikrishnappa (2011), and Zosiamliana *et al.* (2012)

With respect to seed yield per plant, seed yield per hectare and 1000 seed weight, genotype Phule Ganesh White (10.76 kg, 717.13kg and 3.55 g, respectively) recorded maximum followed by genotype Phule Ganesh Purple (5.77 kg, 384.46 kg and 2.49 g respectively). The genotype Budiguppa Local recorded minimum seed yield per plant (3.66 kg), per hectare (243.66 g) and 1000 seed weight (1.91 g). The

variation might be due to the genotype ability to set seeds as it as being a genetically controlled factor. The results on yield of seeds were in agreement with the findings of Ravikumar (2002) and Munikrishnappa (2011) in china aster genotypes (Table 2).

The germination percentage of genotype Phule Ganesh Purple (99.03 %) was maximum and it was followed by Phule Ganesh White (98.32 %), whereas for seedling vigour index were higher in the genotype Phule Ganesh Pink (452) it was followed by genotypes Violet Cushion (438) and Phule Ganesh Purple (427) (**Table. 2**). The variation might be due to the genotypic ability for germination percentage, root length, shoot length, seedling length and seedling vigour index as these were controlled by a genetically controlled factor. The results on germination percentage, root length, shoot length, seedling length and seedling vigour index were in agreement with the findings of Ravikumar (2002), Shantappa Tirakannanavar *et al.* (2004) and Munikrishnappa (2011) in different china aster genotypes.

Correlation study revealed that, among the growth parameters, seed yield per plant of china aster is positively significantly correlated with plant height (0.674), plant spread (0.884), number of primary branches (0.607), days for commencement for flowering (0.852), days for 50% flowering (0.552), number of flowers per plant (0.844), flower yield per plant (0.833), dry matter (0.673), flower yield per hectare (0.833) and germination percentage (0.575). Number of secondary braches (0.283), leaf area (0.235) and flower diameter (0.136) are positively correlated but statistically non significant (**Table 2 & 3**). The result points that, for seed yield, one has to select genotypes with superior growth parameters. The study shows that delay in commencement of flowering produces higher seed yield per plant. Plant spread (0.844) and number of flower per plant (0.844) had highest positive significant correlation with seed yield. The result was in conformity with Vijayalaxmi (1998), Kumar *et al.* (2003) and Ravikumar and Patil (2003).

For increase of flower yield, selection may be based on plant height, plant spread, leaf area and number of flowers per plant. The characters having significant correlation with flower yield may be given weightage during selection for yield. Among the vegetative parameters, flower yield per hectare was positively significantly correlated with plant height, plant spread, number of secondary branches and leaf area. This result put light on photosynthetic efficiency and reproductive development of the crop. This result is in confirmation with Baweja (2000). Days for 50 per cent flowering and number of flower per plant were positively significantly correlated with flower yield per plant. Flower yield, in turn, contributed positively to seed yield per plant (0.936). Similar results are reported by Singh and Singh (2005).

Earliness (days for commencement of flowering and 50% flowering) did not show any significant relation with neither flower yield nor seed yield per plant. Flower and seed yield is found to be better in delayed flowering. Germination showed positive significant correlation with plant height, plant spread, leaf area, 50 per cent flowering, number of flower per plant, flower yield per plant, dry matter production and seed yield. Correlation for seed vigour index (SVI) also showed the similar trend. This shows the importance of vegetative parameters for quality seed production. The result is in substantiation with Mathad *et al.* (2005) (Table 2 & 3).

Conclusion

From the present investigation it concluded that Among the ten genotypes, Phule Ganesh White and Phule Ganesh Purple recorded maximum flower and seed yield per plant. Phule Ganesh Purple recorded higher germination percentage whereas Phule Ganesh Pink recorded maximum root and shoot length and seedling vigour index. Flower yield per hectare was positively and significantly correlated with plant height, plant spread, number of secondary branches and leaf area at genotypic level. Germination and seedling vigour index (SVI) studies showed positive significant correlation with plant height, plant spread, leaf area, 50 per cent flowering, number of flower per plant, flower yield per plant, dry matter production and seed yield.

Table 1- Mean performance of 10 genotypes for growth and flower yield characters of china aster

Variety (V)	Days for commencement of flowering	Days for 50% flowering	Plant height (cm)	Plant spread (EW & NS) cm2	No. of branches (primary)	No. of branches (secondary)	Leaf area of plant (cm^2)	Dry matter production (g)	Flower yield per plant (g)	Flower yield (t/ha)
V_1: PG White	68.3	79.3	72.35	2181.32	20.2	28.8	37.56	51.09	485.29	32.35
V_2: PG Purple	47.6	74.2	65.06	2893.93	21.5	27.9	41.64	47.99	307.19	20.48
V_3: PG Pink	52.6	70.6	61.31	2523.37	22.5	21.8	27.03	47.09	215.23	14.35
V_4: PG Violet	54.2	75.2	62.66	2097.54	28	31.6	41.83	49.3	242.32	16.15
V_5: Violet cushion	54.7	74.3	61.17	1144.53	26.7	30.6	34.7	43.39	251.93	16.8
V_6: Kamini	54	72.3	57.19	1062.78	20.9	24.7	25.99	43.25	128.51	8.57
V_7: N.White	43.7	68.9	58.05	1874.86	19.8	23.5	25.93	44.01	225.9	15.06
V_8: N.Pink	53.3	67.5	60.12	1914.88	20.8	22.6	28.44	42.79	229.99	15.33
V_9: B. Local	53.7	66.7	56.38	1052.86	19.9	23.1	23.83	38.6	117.37	7.82
V_{10}: Local pink	56.3	64.9	55.37	1036.85	20.1	25.7	30.79	40.34	120.72	8.05
S.Em. ±	0.43	0.25	0.26	0.61	0.18	0.14	0.09	0.2	0.52	0.03
CD at 5 %	1.28	0.74	0.77	1.82	0.54	0.42	0.28	0.61	1.55	0.1
Grand Mean	53.84	71.39	60.966	1778.292	22.04	26.03	31.774	44.785	232.445	15.496
Range	43.3-68.3	64.9-79.3	55.37-72.35	1036.85-52893.93	19.8-28	21.8-31.6	23.83-41.83	38.6-51.09	117.37-485.29	7.82-32.35

Table 2- Mean performance of 10 genotypes for flower quality characters of china aster

Variety (V)	Diameter of flower (cm)	Weight of 100 flowers (g)	Number of flowers per plant	Seed yield per plant (kg)	Seed yield per ha (kg)	1000 seed weight (g)	Germination (%)	Seedling vigour index
V_1: PG White	5.04	934.78	64.3	10.76	717.13	3.55	98.32	410
V_2: PG Purple	4.42	619	47.8	5.77	384.46	2.49	99.03	427
V_3: PG Pink	4.91	578.52	54.5	4.74	315.93	3.13	95.34	452
V_4: PG Violet	5.08	449.07	50.7	5.47	364.33	2.17	89.48	353
V_5: Violet cushion	5.01	429.15	54.3	4.96	330.6	2.53	94.29	438
V_6: Kamini	4.5	344.38	44.9	3.77	251.13	2.28	89.93	364
V_7: N.White	3.64	424.29	55.2	4.6	306.73	2.25	89.28	365
V_8: N.Pink	3.4	419.49	53	4.7	313.26	2.29	89.65	361
V_9: B. Local	4.68	336.74	41.8	3.66	243.66	1.91	84.16	298
V_{10}: Local pink	4.75	328.3	42.5	4.53	301.66	2.17	87.02	322
S.Em. ±	0.07	0.61	0.37	0.05	3.56	0.01	0.52	3.1
CD at 5 %	0.2	1.81	1.1	0.16	10.59	0.03	1.55	9.22
Grand Mean	4.543	486.372	50.9	5.296	352.889	2.477	91.65	379
Range	3.4-5.08	328.3-934.78	41.8-64.3	3.66-10.76	243.66-717.13	1.91-3.55	84.16-99.03	298-452

Table 3: Genotypic correlation coefficients among growth, yield and quality parameters in china aster

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1	**0.647****	0.162	0.502*	**0.682****	**0.549****	**0.862****	**0.774****	**0.973****	0.318	**0.874****	**0.973****	**0.925****	**0.823****	**0.594****
2		1	0.074	0.073	0.511*	-0.141	0.439*	0.486*	**0.610****	-0.072	**0.776****	**0.61****	0.431*	**0.711****	**0.591****
3			1	**0.708****	**0.561****	0.031	0.443*	0.121	0.082	0.506*	0.343	0.082	-0.033	0.157	0.317
4				1	**0.861****	0.335	**0.709****	0.231	0.466*	0.578**	0.505*	**0.466***	0.451*	0.362	0.229
5					1	0.244	**0.704****	0.291	**0.624****	0.419*	**0.716****	**0.624****	**0.558****	**0.595****	0.373
6						1	0.448*	0.374	0.489*	**0.558****	0.302	0.489*	**0.714****	0.221	0.041
7							1	**0.638****	**0.802****	0.486*	**0.852****	**0.802****	**0.736****	**0.751****	**0.602****
8								1	**0.851****	0.023	**0.702****	**0.851****	**0.757****	**0.642****	**0.617****
9									1	0.173	**0.818****	**0.847****	**0.936****	**0.795****	**0.57****
10										1	0.318	0.173	0.319	0.249	0.226
11											1	**0.818****	**0.738****	**0.787****	**0.628****
12												1	**0.936****	**0.795****	**0.572****
13													1	**0.655****	0.375
14														1	**0.902****
15															1

1**-** Plant height; 2- Plant spread (EW&NS), 3- No. of branches (primary), 4- No. of branches (secondary), 5- Leaf area of plant (cm^2), 6- Days for commencement of flowering, 7- Days for 50 per cent flowering, 8- Number of flowers per plant, 9- Flower yield per plant (g), 10- Diameter of flower (cm), 11-Dry matter production (g), 12- Flower yield (t/ha), 13- Seed yield per plant (g), 14- Germination (%), 15- Seedling vigour index,

Table 4: Phenotypic correlation coefficients among growth, yield and quality parameters in china aster

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1	**0.645****	0.165	0.498*	**0.679****	**0.544****	**0.854****	**0.763****	**0.969****	0.305	**0.864****	**0.969****	**0.923****	**0.807****	**0.579****
2		1	0.074	0.073	0.512*	-0.141	0.437*	0.484*	**0.612****	-0.071	**0.773****	**0.618****	0.431*	**0.699****	**0.588****
3			1	**0.702****	**0.559****	0.031	0.442*	0.118	0.081	0.494*	0.337	0.081	-0.033	0.158	0.316
4				1	**0.859****	0.334	**0.701****	0.229	0.465*	**0.558****	0.499*	0.465*	0.452*	0.357	0.228
5					1	0.241	**0.699****	0.292	**0.624****	0.412*	**0.714****	**0.624****	**0.558****	**0.583****	0.375
6						1	0.445*	0.373	0.485*	**0.536****	0.291	**0.485****	**0.705****	0.226	0.044
7							1	**0.633****	**0.798****	0.473*	**0.846****	**0.798****	**0.731****	**0.744****	**0.612****
8								1	**0.848****	0.023	**0.695****	**0.848****	**0.753****	**0.625****	**0.615****
9									1	0.172	**0.815****	0.462*	**0.935****	**0.781****	**0.567****
10										1	0.315	0.174	0.311	0.242	0.226
11											1	**0.815****	**0.736****	**0.762****	**0.619****
12												1	**0.935****	**0.781****	**0.567****
13													1	**0.641****	0.371
14														1	**0.892****
15															1

1**-** Plant height, 2- Plant spread (EW&NS), 3- No. of branches (primary), 4- No. of branches (secondary), 5- Leaf area of plant (cm^2), 6- Days for commencement of flowering, 7- Days for 50 per cent flowering, 8- Number of flowers per plant, 9- Flower yield per plant (g), 10- Diameter of flower (cm), 11-Dry matter production (g), 12- Flower yield (t/ha), 13- Seed yield per plant (g), 14- Germination (%), 15- Seedling vigour index.

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