

Original Research Article

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Studies on Genetic Variability, Heritability and Genetic Advance in F₄ Population of China Aster [*Callistephus chinensis* L. (Nees.)]

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ABSTRACT

Keywords

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China aster (*Callistephus 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 and described floral biology of China aster. The study results revealed that high heritability along with high genetic advance existed in cross viz., AAC-1 × Arka Poornima and Arka Kamini × P G Purple for number of flowers per plant, individual flower weight and flower yield per plant. Thus, these characters could be improved through simple selection procedure due to the presence of additive type of gene action.

Introduction

The present day China aster had been developed from single wild species. According to Emsweller *et al.*, (1937), 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. Creation and utilization of variability using proper breeding procedure is a pre-requisite for the genetic improvement of any crop. Generally, amount of variability generated is more in the early segregating generations as

compared to later generations. The knowledge of high estimate of heritability and genetic advance as per cent mean assist the breeders to decide and select superior plants, so that the plants can perform superior for the traits of interest in subsequent generation. Being a self pollinated crop, there is need of high yielding variety of China aster with specific colored flowers to overcome farmer's predicament. Hence keeping all these in view, the present study was undertaken to assess and estimate the magnitude of variation among the F₄ population with respect to various traits which can be further utilized in crop improvement programme.

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 two crosses viz., AAC-1 × Arka Poornima and Arka Kamini × P G Purple were selected based on the superior yield and yield contributing characters. The parent AAC-1 is locally cultivated genotype with yield of 50 flowers per plant and flower diameter of 6 cm; Arka Poornima has flower yield per plant of 25 flowers and flower diameter of 5 cm; Arka Kamini yields about 50 flowers with flower diameter of 6 cm, and P G Purple released by MPKV, Rahuri has yield of 42 flowers per plant. One month old seedling were transplanted into the main field with spacing of 30×30cm. Observations were recorded for the best 5 plants in each line for plant height (cm), number of branches per plant, flower stalk length (cm), flower diameter (cm), days taken for flower bud initiation, days to 50 percent flowering, duration of flowering (days), number of flowers per plant, individual flower weight (g) and flower yield (g/plant). The genotypic and phenotypic coefficient of variation was estimated according to the methods of Burton and De-Vane (1953). Heritability in broad sense was calculated as per method given by Johnson *et al.*, (1955) and Robinson *et al.*, (1949). The expected genetic advance as per cent of mean was worked out as suggested by Johnson *et al.*, (1955).

Results and Discussion

Among the two crosses, AAC-1 × Arka Poornima cross was found to be significantly superior for plant height, number of branches, leaf area, flower diameter, stem girth, plant spread in north -south and east-west direction, shelf life (days), days taken for flower bud

initiation, number of flowers per plant, individual flower weight and flower yield per plant (Table 1). The cross Arka Kamini × P G Purple recorded highest in flower stalk length. Both crosses differed significantly for all traits except for days to flower bud initiation, duration of flowering, flower diameter and individual flower weight.

The estimates of phenotypic coefficient of variation (PCV) values were relatively higher than those of genotypic coefficient of variation (GCV) for all the traits (Table 1) which indicated greater genotype x environment interactions. The result is in accordance with the report of Singh and Mishra (2006) High phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) was found for number of flowers per plant, individual flower weight, flower yield(g) per plant and for growth characters like number of branches per plant and leaf area.(Karuppaiah and Kumar, 2011 in marigold; Vikas *et al.*, 2011 in dahlia and Rajiv *et al.*, 2014 in China aster). There was less difference between PCV and GCV indicating less influence of environment on this trait (Suma and Patil, 2016 in daisy). Moderate PCV and GCV were obtained for flower stalk length, plant height and stem girth in both the crosses, AAC-1 × Arka Poornima and Arka Kamini × P G Purple.

It indicated that selection would be difficult for these characters, as the genotypic effect would be modified by the environmental effect. These results are in agreement with the results of Jankiram and Rao (1991) in marigold, Mishra *et al.*, (2013) in chrysanthemum and Rachappa (2014) in China aster.

The crosses AAC-1 × Arka Poornima and Arka Kamini × P G Purple showed almost high heritability for all the traits shelf life in AAC- 1 × Arka Poornima.

Table.1 Estimates of mean, range, components of variance, heritability and genetic advance for growth, quality and yield parameters in F₄ populations of two crosses in China aster

Sl. No.	Character	F ₄ population	Mean	Range	PCV (%)	GCV (%)	h ² (%)	GA	GAM
1.	Plant height (cm)	AAC-1 × Arka Poornima	50.51	40.00-62.00	13.22	11.48	75.43	10.38	20.55
		Arka Kamini × P G Purple	47.85	30.25-60.30	20.40	20.35	90.00	17.35	37.82
2.	Number of branches	AAC-1 × Arka Poornima	14.75	12.00-20.00	27.49	11.66	44.43	2.36	16.01
		Arka Kamini × P G Purple	8.07	6.00-10.50	28.05	25.53	74.06	2.22	27.53
4.	Leaf area (cm ²)	AAC-1 × Arka Poornima	2072.21	1233.49- 3235.76	31.30	27.93	79.66	1064.34	51.36
		Arka Kamini × P G Purple	1786.33	1069.54- 2592.17	25.60	23.57	72.22	762.34	42.67
5.	Stem girth (cm)	AAC-1 × Arka Poornima	1.47	1.28-1.68	9.07	5.83	41.33	0.11	7.72
		Arka Kamini × P G Purple	1.34	1.07-1.87	14.10	12.43	83.50	0.35	26.55
6.	Plant spread (N-S) (cm)	AAC-1 × Arka Poornima	35.46	25.76-45.32	18.91	16.47	75.91	10.48	29.57
		Arka Kamini × P G Purple	28.63	19.65-51.40	31.14	30.31	94.74	17.40	60.79
7.	Plant spread (E-W) (cm)	AAC-1 × Arka Poornima	32.02	23.95-50.96	21.82	17.82	66.70	9.60	29.98
		Arka Kamini × P G Purple	30.74	29.51-41.35	25.60	23.11	81.47	13.21	42.97
8.	Days taken for flower bud initiation	AAC-1 × Arka poornima	52.09	47.90 -56.70	6.62	5.11	59.68	4.24	8.14
		Arka Kamini × P G Purple	44.92	40.80 – 52.47	7.83	6.20	62.69	4.54	10.11
9.	Days taken for first flowering	AAC-1 × Arka poornima	61.42	57.10 – 66.50	5.84	4.95	71.97	5.32	8.66
		Arka Kamini × P G Purple	56.40	51.38 - 65.07	7.96	6.07	58.33	5.3	9.5
10.	Days taken for 50% flowering	AAC-1 × Arka poornima	75.10	70.50 – 80.50	4.48	3.37	56.64	3.93	5.23
		Arka Kamini × P G Purple	72.16	64.00 –82.00	5.20	4.52	75.68	5.91	8.11
11.	Duration of flowering (days)	AAC-1 × Arka poornima	35.26	31.50 - 40.65	7.84	5.43	47.94	2.73	7.74
		Arka Kamini × P G Purple	36.52	29.82-42.42	9.29	10.99	71.55	5.91	16.20

12.	Flower stalk length (cm)	AAC-1 × Arka poornima	21.17	14.75-27.50	18.41	12.00	82.50	3.41	26.11
		Arka Kamini × P G Purple	22.06	16.48 – 29.87	21.71	19.99	84.83	8.37	37.93
13.	Flower diameter (cm)	AAC-1 × Arka poornima	5.30	4.03- 6.08	12.07	7.75	41.22	0.54	10.24
		Arka Kamini × P G Purple	4.99	3.15-6.00	13.44	10.23	82.74	1.14	22.92
14.	Shelf life (days)	AAC-1 × Arka poornima	2.45	2.50-4.50	8.65	5.33	37.00	0.50	6.77
		Arka Kamini × P G Purple	2.27	2.00-400	9.62	7.26	56.87	0.86	11.27
15.	Number of flowers per plant	AAC-1 × Arka Poornima	40.62	23.00-59.00	30.09	29.31	94.87	19.83	58.81
		Arka Kamini × P G Purple	28.12	18.35- 42.20	24.06	22.56	87.87	12.25	43.57
16.	Individual flower weight (g)	AAC-1 × Arka Poornima	3.47	2.04- 5.85	30.31	29.73	96.20	1.54	60.06
		Arka Kamini × P G Purple	2.87	1.4 - 4.70	29.16	28.47	95.38	1.64	57.29
17.	Flower yield (g/plant)	AAC-1 × Arka Poornima	114.59	35.65- 225.60	40.10	39.18	95.46	84.85	78.86
		Arka Kamini × P G Purple	78.73	31.98- 120.48	32.83	31.57	92.47	49.25	62.55
18.	Flower yield (t/ha)	AAC-1 × Arka Poornima	3.46	2.11 – 5.23	23.05	20.45	78.71	1.29	37.38
		Arka Kamini × P G Purple	2.84	2.10 – 6.65	23.38	17.64	56.92	0.78	27.42
19.	Seed yield/plant (g)	AAC-1 × Arka Poornima	3.15	2.80 – 2.69	19.64	19.14	98.70	1.46	39.85
		Arka Kamini × P G Purple	2.73	2.15 – 4.10	20.71	19.82	91.55	1.06	39.06
20.	Seed test weight (g)	AAC-1 × Arka Poornima	2.15	1.80 – 2.69	9.68	7.83	65.43	0.28	13.05
		Arka Kamini × P G Purple	2.08	1.87 – 2.60	9.94	5.45	30.00	0.13	6.15

These findings suggest the scope for improvement of the character through direct selection. The results of the present study were supported by those of Vikas *et al.*, (2011) and Rachappa (2014) for flower stalk length, flower diameter, ray floret length and disc diameter in China aster. Karuppaiah and Kumar (2011) in marigold recorded high heritability for number of flowers per plant, individual flower weight and flower yield per plant. Anuja and Jahnavi (2012) reported similar results in marigold for plant height, number of branches and number of leaves. Heritability along with genetic advance increases the efficiency of selection in a breeding programme by assessing the influence of environmental factors and additive gene action. In both the crosses high heritability along with high genetic advance as per cent mean for number of flowers per plant, individual flower weight and flower yield per plant and vase life. These results are in line with the findings of Karuppaiah and Kumar (2011) in marigold and Rajiv *et al.*, (2014) in China aster for stalk length, flower diameter, disc diameter, number of flowers per plant, individual flower weight and flower yield per plant. The cross Arka Kamini × P G Purple recorded high heritability along with high genetic advance for plant height and stem girth. similar results are in accordance with the finding of Rachappa (2014). This revealed that the characters are governed by the additive type of action and these characters are useful for phenotypic selection.

The study results revealed that high heritability along with high genetic advance existed in cross *viz.*, AAC-1 × Arka Poornima and Arka Kamini × P G Purple for number of flowers per plant, individual flower weight and flower yield per plant. Thus, these characters could be improved through simple selection procedure due to the presence of additive type of gene action.

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