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Genetic variability studies in F_2 segregating population of cross Miraj Local × Arka Kamini in China aster [*Callistephus chinensis* (L.) Nees.] for flower yield and quality

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Abstract
The present study was conducted to evaluate genetic variability in F_2 population of cross Miraj Local × Arka Kamini in China aster at the Kittur Rani Channamma college of horticulture, Arabhavi during 2021-22. High (>20 %) phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) was recorded for number of branches per plant and seed yield per plant. High heritability (>60 %) coupled with high genetic advance as per cent over mean (>20 %) were recorded for number of branches, number of leaves per plant, number of flowers per plant, flower yield per plant and seed yield per plant, indicated that the high heritability is due to additive gene effects which can be utilized for further crop improvement programme.

Keywords: China aster, miraj local, arka kamini, variability, heritability

Introduction
Callistephus chinensis (L.) Nees, often known as China aster, is a prominent winter annual flower and decorative plant endemic to China, falling to the Asteraceae family (Navalinskien *et al*. 2005) [11]. China aster is a self-pollinated crop but the natural crossing is approximately 10 per cent as reported by Fleming (1937) [3]. China aster is one of the most popular annuals, along with chrysanthemum and marigold. It is typically adaptable to a variety of agro-climatic situations, blooms practically all year and is grown all over the world. It is effectively grown in open situations for year-round production in *Kharif*, *Rabi* and summer, ensuring a steady supply of flowers for the market. It may be cultivated in a greenhouse. The growing popularity of China aster in India's main cities has led to commercial cultivation.

Creating and using diversity through effective breeding procedures is a top priority for genetic development of any crop. The effectiveness of any crop improvement is determined on the genetic diversity present in the available genotypes, which might be attributable to cultivar genetics or environmental variation. In general, the amount of uniqueness produced in early segregating populations is considerably higher than in subsequent generations. As a result, segregating F_2 population allows for the picking of suitable sergeants. As a self-pollinated crop, a high producing variant of China aster with unique colored blooms are required as a character for desirable breeding programme.

Materials and Methods
The present experiment was carried out in the Department of Floriculture and Landscape Architecture, Kittur Rani Channamma college of horticulture, Arabhavi during 2021-22. The Experiment consists of 198 F_2 populations of cross Miraj Local × Arka kamini and their parents *viz*., Miraj Local and Arka Kamini. Experiment was laid out in replicated randomized block design. Forty-five days old rooted cuttings were transplanted in 30 × 30 cm spacing and all the recommended agronomic package of practices were followed. Observations were recorded in all the F_2 populations for different growth, flowering, yield and quality parameters. The parameters of variability like mean, range, phenotypic and genotypic coefficient of variation (As per the Burton and De-Vane, 1953), broad sense heritability and genetic advance were calculated according to Johnson *et al*., (1955) [8].

Results and Discussion

The estimates of phenotypic coefficient of variation values were relatively higher than those of genotypic coefficient of variation for all the traits (Table 1) which indicated greater genotype × environment interactions. The estimates of PCV (phenotypic coefficient of variation) and GCV (genotypic coefficient of variation) were high (>20 %) for number of branches (37.70 % and 20.53 %) and seed yield per plant (43.48 % and 36.47 %). High PCV and moderate GCV (42.25 % and 15.52 %) noticed in the character number of flowers per plant indicating wider variation in the population and less environmental influence on the expression of this trait. This is in accordance with earlier observation by Hosalli *et al*. (2019) [7], Varun (2018) [16] in China aster, Hebbal *et al*. (2018) [5] in chrysanthemum and Patel *et al*. (2019) [12] in marigold.

Moderate PCV and GCV were recorded for stem girth (14.27 % and 12.65 %), flower diameter (16.86 % and 12.08 %), test weight (16.27 % and 14.36 %) and flower duration (13.72 % and 12.48 %) indicating environmental influence on the expression of the traits with little or high difference in PCV and GCV. This is in accordance with the findings of Rajiv *et al*. (2014) [14] and Harishkumar *et al*. (2017) [4] in China aster.

Low PCV and GCV were recorded for days to first flowering (6.63 %, 6.62 %), days to 50 % flowering (4.51 %, 4.56 %) and vase life (6.94 %, 4.92 %). These results are in conformity with the finding of Hosalli *et al*. (2019) [7], Varun (2018) [16] and Harishkumar *et al*. (2017) [4] in China aster.

High heritability coupled with high genetic advance as per cent of mean was recorded for number of leaves per plant (69.94 % and 81.07 %), number of flowers per plant (66.05 % and 57.48 %), flower yield per plant (72.50 % and 75.48%) and seed yield per plant (58.08 % and 52.03 %) indicating usefulness of these traits in selection of desirable sergeants due to its genetic control by additive gene action (Table 1). These findings are in agreement with Ramya *et al*. (2019) [15], Khangjarakpam *et al*. (2015) [10] in China aster, Henny *et al*. (2021) [6] in chrysanthemum and Patel *et al*. (2019) [12] in marigold.

Moderate to low heritability with moderate to low genetic advance as per cent mean was observed for plant height (5.49 % and 2.07 %), number of branches (46.51 %, 36.12 %), stem girth (2.32 % and 0.68 %), leaf area (5.48 % and 3.51 %), flower diameter (7.32 % and 2.54 %), individual flower weight (0.60 % and 0.32 %), seed test weight (3.87% and 1.30 %), days to first flowering (30.58 % and 4.18 %), days to 50 % flowering (16.05 % and 1.49 %), flower duration (43.08 %, 12.17 %) and vase life (1.89 %, 0.27 %) indicating non-additive gene action (Table 1). These results are in agreement with the result of Harishkumar *et al*. (2017) [4] in China aster, Prakash *et al*. (2017) [13] in chrysanthemum, Anil *et al*. (2015) [1] in balsam and Jyothi and Kulkarni (2017) [9] in dahlia. These results are in agreement with the result of Harishkumar *et al*. (2017) [4] in China aster, Prakash *et al*. (2017) [13] in chrysanthemum, Anil *et al*. (2015) [1] in balsam and Jyothi and Kulkarni (2017) [9] in dahlia.

High 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 conclusion present study revealed that there was a wide range of variability existed in cross Miraj Local × Arka Kamini for different growth, flowering, quality and yield parameters. Plants which exhibited different characters with high heritability coupled with high genetic advance would be effective for selection and utilized for breeding of high yielding China aster cultivars.

Table 1: Estimation of mean, range, components of variance, heritability and genetic advance of F_2 population "Miraj Local X Arka Kamini" for fifteen parameters

Character	Mean	Range	PCV (%)	GCV (%)	h^2 (%)	GA	GAM
Plant height	47.79	18.00 - 62.00	18.27	3.39	5.49	0.99	2.07
Number of branches	11.03	3.00 - 26.00	37.70	20.53	46.51	3.98	36.12
Stem girth	1.45	1.03 - 2.15	14.27	12.65	2.32	0.01	0.68
Leaf area	2053.70	975.20 - 3925.43	31.14	0.52	5.48	72.17	3.51
Number of leaves/plant	109.95	27.00 - 312.00	56.27	7.98	69.94	89.14	81.07
Flower diameter	5.02	2.43 - 6.81	16.86	12.08	7.32	0.13	2.54
Flower weight	2.55	1.35 - 5.43	25.51	4.86	0.60	0.01	0.32
Number of flowers/plant	27.40	6.00 - 64.00	42.25	15.52	66.05	15.75	57.48
Flower yield	75.43	13.15 - 210.40	50.54	9.80	72.50	56.94	75.48
Seed yield	4.37	1.32 - 11.12	43.48	36.47	58.08	2.27	52.03
Test weight	1.88	1.20 - 2.26	16.27	14.36	3.87	0.02	1.30
Days to first flowering	69.78	60.00 - 79.00	6.63	6.62	30.58	2.91	4.18
Days to 50 % flowering	80.57	72.00 - 90.00	4.51	4.46	16.05	1.20	1.49
Flower duration	27.68	22.00 - 38.00	13.72	12.48	43.08	3.37	12.17
Vase life	7.83	7.00 - 8.90	6.95	4.92	1.89	0.02	0.27

PCV- Phenotypic Co-efficient of Variation GCV- Genotypic Co-efficient of Variation h^2 - Heritability in broad sense GA-Genetic Advance GAM- Genetic advance as per cent of mean

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