GENETIC VARIABILITY FOR QUANTITATIVE TRAITS IN CHINA ASTER [*Callistephus chinensis* (L.) NEES]

Rajiv Kumar, Gayatri Khangjarakpam, T. Manjunatha Rao and M.V. Dhananjaya

Division of Ornamental Crops

ICAR-Indian Institute of Horticultural Research

Hessaraghatta Lake Post, Bangalore 560 089

INTRODUCTION

- China aster [*Callistephus chinensis* (L.) Nees]
- Family Asteraceae
- Annual flowering plant
- Single species i.e. *C. chinensis* (2n=18) (Huziwara, 1954).
- Flowers are solitary, singles, semi-doubles, doubles
- Prominent flower colours: blue, pink and white
- Traditionally grown for loose flowers, cut flower, landscape, floral decorations, making garlands
- States: Karnataka, Andhra Pradesh, Tamil Nadu, West Bengal and Maharashtra

Single

Semi-double

Double

IMPORTANCE OF THE CROP

Loose flower

Cut flower

Pot plant

Landscape

Borders

Commercial

OBJECTIVES

- To estimate the genetic variability, heritability and genetic advance in twenty genotypes of China aster.
- To workout the relationships among different characteristics through correlation co-efficient and to assess direct and indirect effects of characters on flower yield through path analysis.

METHODOLOGY

- **Location:** Indian Institute of Horticultural Research, Bangalore, during 2012-13 (13° 58' N Latitude, 78° E Longitude and elevation of 890 m asl.)
- **Experimental Design:** Randomized Complete Block Design with three replications.
- **Statistical package used** 'Biostat IIHR, version 1.0' .

The experimental material:
Twenty genotypes

1.	Kamini	11.	Matsumoto Scarlet
2.	Poornima	12.	Matsumoto Pink
3.	Shashank	13.	Matsumoto White
4.	Violet Cushion	14.	Matsumoto Yellow
5.	Phule Ganesh Pink	15.	Local White
6.	Phule Ganesh White	16.	IIHR-H13A
7.	Phule Ganesh Purple	17.	IIHR-C 1
8.	Matsumoto Apricot	18.	IIHR-H 3
9.	Matsumoto Red	19.	IIHR-I 1
10.	Matsumoto Rose	20.	IIHR-G 13

OBSERVATIONS RECORDED

1. Plant height (cm)
2. Number of branches/plant
3. Number of leaves/plant
4. Plant spread (cm)
5. Days to first flower opening
6. Days to 50% flowering
7. Flower diameter (cm)
8. Number of flowers/plant
9. Weight of flowers/plant (g)
10. Number of ray florets/flower head
11. Number of disc florets/flower head
12. Flower stalk length (cm)
13. Flowering duration (days)
14. Vase life (days)
15. Shelf life (days)

IIHR RELEASED CHINA ASTER VARIETIES

KAMINI

POORNIMA

SHASHANK

VIOLET CUSHION

ARAK AADYA

ARKA ARCHANA

EXPERIMENTAL PLOT

RESULTS

TRAITS OF ECONOMIC INTEREST IN CHINA ASTER

- Plant height
- Plant spread
- No. of branches/plant
- No. of flowers/plant
- Weight of flowers/plant
- Flower diameter
- Vase life/shelf life

Table 1. Mean, range and coefficient of variation for different traits in China aster

Characters	Mean±SEm	Range		Coefficient of Variation (%)
		Minimum	Maximum	
Plant height (cm)	44.96 ±1.24	29.06	60.77	4.78
Number of branches/plant	13.92 ±0.23	11.13	22.86	2.91
Number of leaves/plant	186.28 ±4.70	128.86	258.33	4.37
Plant spread (cm)	27.67 ±0.42	23.9	33.45	1.89
Days to first flower opening	69.42 ±0.88	55.60	87.66	2.20
Days to 50% flowering	78.04 ±1.12	62.11	97.00	2.48
Flower diameter (cm)	5.24 ±0.05	3.75	8.19	1.70
Number of ray florets/flower head	111.00 ±3.40	40.33	149.06	5.31
Number of disc florets/flower head	184.35 ±4.79	123.13	255.06	4.50
Flower stalk length (cm)	27.03 ±0.67	16.00	58.05	4.35
Flowering duration (days)	28.04 ±1.48	23.44	32.11	9.17
Vase life (days)	7.15 ±0.25	5.83	8.66	6.13

GENETIC VARIABILITY

- PCV values were higher than the GCV for all the traits, which indicated greater genotype and environment interaction.

- High GCV and PCV were recorded for weight of flowers/plant, number of flowers/plant, flower stalk length, number of leaves/plant, flower diameter, number of ray florets/flower head, number of branches/plant, plant height and number of disc florets/flower head.

- High GCV coupled with narrow difference between the GCV and PCV was recorded for plant height, number of branches, leaves/plant, flower diameter, number of ray florets/flower head, number of disc florets/flower head, flower stalk length and weight of flowers/plant

- Hence, these traits could be utilized for improvement through selection .

Table 2. Estimates of genotypic and phenotypic coefficient of variation, heritability and genetic advance for different traits in China aster

Characters	GCV (%)	PCV (%)	Heritability (%)	Genetic Advance	Genetic Advance as per cent mean
Plant height (cm)	23.19	23.68	95.92	20.61	45.84
Number of branches/plant	23.32	23.51	98.46	6.59	47.34
Number of leaves/plant	27.37	27.71	97.51	102.42	54.98
Plant spread (cm)	9.19	9.38	95.92	5.03	18.17
Days to first flower opening	14.63	14.79	97.79	20.47	29.48
Days to 50% flowering	14.77	14.98	97.24	23.10	29.60
Flower diameter (cm)	25.10	25.15	99.54	2.70	51.52
Number of ray florets/flower head	24.96	25.52	95.66	54.61	49.19
Number of disc florets/flower head	20.45	20.94	95.37	74.07	40.17
Flower stalk length (cm)	43.25	43.47	99.00	23.85	88.23
Flowering duration (days)	5.76	10.84	28.30	0.94	3.35
Vase life (days)	10.98	12.58	76.24	1.24	17.34
Shelf life (days)	11.59	14.05	67.99	0.58	16.15
Number of flowers/plant	43.50	44.92	93.76	41.80	84.03
Weight of flowers/plant (g)	45.55	45.97	98.21	98.33	92.17

HERITABILITY AND GENETIC ADVANCE

- The high heritability was recorded for all the characters except for flowering duration.

- Heritability ranged from 28.30 per cent (flowering duration) to 99.54 per cent (flower diameter).

- High heritability coupled with high genetic advance as per cent mean was recorded for flower diameter, flower stalk length, number of branches/plant, weight of flower/plant, days to first flower opening, days to 50 per cent flowering, plant height, number of leaves/plant, number of ray florets/head, number of disc florets/head, number of flowers/plant, indicating the possible role of additive gene action.

- Thus, these characters can be improved through pureline selection, mass selection, progeny selection, hybridization and selection with pedigree.

Table 3. Estimates of phenotypic (r_p) and genotypic (rg) correlation among different characters in China aster

Character		Plant height (cm)	No. of branches/ plant	No. of leaves/ plant	Days to first flower opening	Days to 50% flowering	Flower diameter (cm)	No. of ray florets/ flower head	No. of disc florets/ flower head	Flower stalk length (cm)	Flowering duration (days)	No. of flowers/ plant	Weight of flowers/ plant (g)
Plant height (cm)	r_p	1.000	0.411	0.698**	0.534*	0.559*	0.500*	0.238	0.418	0.657**	0.120	0.744**	0.679**
	r_g	1.000	0.435	0.723**	0.557*	0.579**	0.513*	0.255	0.434	0.673**	0.223	0.787**	0.698**
No. of branches/plant	r_p		1.000	0.407	0.316	0.427	0.373	0.005	0.291	0.199	0.077	0.668**	0.634**
	r_g		1.000	0.412	0.322	0.442	0.376	0.005	0.299	0.200	0.134	0.694**	0.645**
No. of leaves/plant	r_p			1.000	0.358	0.487*	0.474*	0.273	0.312	0.754**	0.316	0.786**	0.742**
	r_g			1.000	0.364	0.499*	0.482**	0.283	0.325	0.766**	0.625**	0.818**	0.753**
Days to first flower opening	r_p				1.000	0.960**	0.839**	0.351	0.131	0.331	-0.037	0.389	0.501*
	r_g				1.000	0.977**	0.855**	0.371	0.133	0.333	-0.032	0.405	0.515*
Days to 50% flowering	r_p					1.000	0.848**	0.309	0.211	0.407	0.032	0.517**	0.612**
	r_g					1.000	0.866**	0.317	0.224	0.419	0.072	0.533*	0.630**
Flower diameter (cm)	r_p						1.000	0.540*	0.158	0.523*	0.074	0.418	0.539*
	r_g						1.000	0.550*	0.162	0.526*	0.132	0.437	0.540**
No. of ray florets/flower head	r_p							1.000	-0.280	0.496*	0.105	0.190	0.237
	r_g							1.000	-0.290	0.509*	0.179	0.202	0.241
No. of disc florets/flower head	r_p								1.000	0.112	0.255	0.374	0.376
	r_g								1.000	0.107	0.552*	0.391	0.384
Flower stalk length (cm)	r_p									1.000	0.184	0.689**	0.712**
	r_g									1.000	0.308	0.721**	0.719**
Flowering duration (days)	r_p										1.000	0.250	0.220
	r_g										1.000	0.511*	0.392
No. of flowers/ plant	r_p											1.000	0.889**
	r_g											1.000	0.933**
Weight of flowers/plant (g)	r_p												1.000
	r_g												1.000

CORRELATION ANALYSIS

- **The number of branches/plant was highly significant and positively correlated with number and weight of flowers/plant.**

- **The number of flowers/plant was highly significant and positively correlated with plant height, number of branches and leaves/plant, flower stalk length and weight of flowers/plant. The direct selection of this character results quality flowers with higher yield.**

- **The flower diameter showed highly significant and positive correlation with number of leaves/plant, days to first flower opening and days to fifty per cent flowering.**

Table 4. Phenotypic and genotypic direct (diagonal bold) and indirect effects among different quantitative traits in China aster

Character		Plant height (cm)	No. of branches/ plant	No. of leaves/ plant	Days to first flower opening	Days to 50% flowering	Flower diameter (cm)	No. of ray florets/ flower head	No. of disc florets/ flower head	Flower stalk length (cm)	Flowering duration (days)	No. of flowers / plant	Correlation with weight of flowers/ plant
Plant height (cm)	P	-0.239	0.101	0.017	0.233	-0.043	-0.100	-0.002	0.066	0.303	0.002	0.339	0.679**
	G	0.253	0.134	-0.398	-0.396	0.740	-0.146	-0.028	-0.071	0.407	0.092	0.111	0.698**
No. of branches plant	P	-0.098	0.248	0.010	0.137	-0.033	-0.074	0.000	0.046	0.092	0.001	0.304	0.634**
	G	0.110	0.308	-0.226	-0.228	0.564	-0.107	-6E-04	-0.049	0.121	0.055	0.097	0.645**
No. of leaves/plant	P	-0.167	0.100	0.025	0.156	-0.037	-0.095	-0.002	0.049	0.348	0.005	0.358	0.742**
	G	0.183	0.127	-0.550	-0.259	0.636	-0.137	-0.0316	-0.053	0.464	0.258	0.115	0.753**
Days to first flower opening	P	-0.128	0.078	0.009	0.436	-0.074	-0.168	-0.003	0.020	0.153	-0.0007	0.177	0.501*
	G	0.141	0.099	-0.200	-0.711	1.248	-0.243	-0.041	-0.022	0.201	-0.013	0.057	0.515*
Days to 50% flowering	P	-0.134	0.106	0.012	0.419	-0.077	-0.170	-0.002	0.033	0.188	0.0006	0.236	0.612**
	G	0.146	0.136	-0.274	-0.695	1.277	-0.246	-0.035	-0.037	0.253	0.029	0.075	0.630**
Flower diameter (cm)	P	-0.119	0.092	0.011	0.366	-0.065	-0.200	-0.004	0.025	0.241	0.001	0.190	0.539*
	G	0.130	0.116	-0.265	-0.608	1.106	-0.284	-0.061	-0.026	0.318	0.054	0.061	0.540**
No. of ray florets/flower head	P	-0.057	0.001	0.006	0.153	-0.023	-0.108	-0.008	-0.044	0.229	0.001	0.086	0.237
	G	0.064	0.001	-0.155	-0.264	0.405	-0.156	-0.111	0.047	0.308	0.073	0.028	0.241
No. of disc florets/flower head	P	-0.100	0.072	0.007	0.057	-0.016	-0.031	0.002	0.158	0.051	0.004	0.170	0.376
	G	0.109	0.092	-0.178	-0.095	0.286	-0.046	0.032	-0.165	0.064	0.228	0.055	0.384
Flower stalk length (cm)	P	-0.157	0.049	0.018	0.144	-0.031	-0.105	-0.004	0.017	0.462	0.003	0.314	0.712**
	G	0.170	0.061	-0.421	-0.237	0.535	-0.149	-0.056	-0.017	0.605	0.127	0.101	0.719**
Flowering duration (days)	P	-0.028	0.019	0.007	-0.016	-0.002	-0.014	-0.0009	0.040	0.084	0.017	0.113	0.220
	G	0.056	0.041	-0.344	0.022	0.092	-0.037	-0.020	-0.091	0.186	0.413	0.072	0.392
No. of flowers/plant	P	-0.178	0.165	0.019	0.170	-0.040	-0.083	-0.001	0.059	0.318	0.004	0.456	0.889**
	G	0.199	0.214	-0.450	-0.288	0.680	-0.124	-0.022	-0.064	0.436	0.211	0.141	0.933**

PATH CO-EFFICIENT ANALYSIS

- Plant height had positive direct effect on weight of flowers per plant, however, its correlation with weight of flowers per plant was positive and highly significant.

- This character indirectly contributed to weight of flower per plant via number of branches per plant, flower stalk length, flowering duration and number of flowers per plant.

- Number of branches per plant had positive direct effect and highly significant correlation with weight of flower per plant.

CONCLUSION

- **Observations recorded on 15 potential traits indicated highly significant genotypic differences for all the characters.**

- **Traits *viz.*, plant height, flower diameter, number of ray and disc florets/flower head, flower stalk length, number and weight of flowers/plant showed high GCV, heritability and genetic advance. These characters can be useful in breeding programme of China aster.**

- **Characters contributing in improvement in yield of flowers are number and weight of flowers/plant, plant height, number of branches/plant and flower stalk length.**

Thank You