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EVALUATION OF DIFFERENT CHINA ASTER (*CALLISTEPHUS CHINENSIS* NESS.) GENOTYPES UNDER BANGALORE CONDITION

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ABSTRACT

The aim of the study is to find out suitability of 20 genotypes of China aster for cultivation on Bangalore region of Karnataka. The experiment was laid out in Randomised Complete Block Design with three replications at experimental farm of IIHR, Bangalore. Significant variations were observed among the genotypes with respect to vegetative, floral and post-harvest characters. Maximum plant height was recorded in 'IIHR H3' (60.77 cm). Maximum number of leaves/plant was produced by 'IIHR I 1' (258.33). 'P.G White' produced maximum number of branches/plant (32.33 cm), plant spread (32.33 cm) and flower diameter (8.19 cm). 'IIHR G13' recorded maximum stalk length (42.48 cm) and number of ray florets/ plant (153.33). 'Matsumato White' recorded minimum days to first flower opening (55.66 d) and days to 50 % flowering (62.11 d). Maximum flowering duration was observed in 'Violet Cushion' (32.11d). 'Local White' recorded maximum number of flowers/plant (81.89). 'PG Purple' recorded maximum number of disc florets/plant (255.06). 'IIHR H13A' recorded maximum weight of flowers/ plant (178.16 g) and shelf life (4.66 d). 'PG Pink' recorded maximum vase life in (8.66 d). It was concluded that genotypes 'IIHR-H3', 'Local White', 'P.G. White', 'Violet Cushion' and 'IIHR-13A' were found best for cultivation in Bangalore condition.

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INTRODUCTION

China aster (*Callistephus chinensis*) is one of the popular annual flowering plant grown throughout the world. Its flower has typical inflorescence called head or capitulum which consists of central disc and outer ray florets. Flowers are borne solitary in blue, pink or white colours. In India, it is grown traditionally for its loose flower, cut flower, arranging in vase, floral decorations, making garlands and *venis* (Rao *et al.,* 2012). It is extensively grown in Karnataka, Tamil Nadu, West Bengal and Maharashtra by marginal and small farmers. In Karnataka it was cultivated on an area of 2199 ha, with a production of 20,846 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.

The flower yield and quality depends primarily on genotype of the plants, however, it is also greatly influenced by climatic factors like photoperiod, temperature, relative humidity, soil moisture, etc. (Hammad, 2009). In order to recommend a variety for commercial cultivation it is essential to evaluate the performances of various cultivars of a crop in that particular area (Kumari *et al.,* 2010; Singh *et al.,* 2013; Maitra *et al.,* 2013 and Uddin *et al.,* 2013). Some few works on evaluation of China aster varieties for cultivation in South India has already been carried out by Zosiamliana *et al.* (2013) in Andhra Pradesh, Poornima *et al.,* (2015) in hill zone of Karnataka and Munikrishnappa *et al.* (2013) in northern Karnataka. However, no research work has been done on evaluation of suitable variety of China aster for cultivation in Bangalore region. Therefore, a study was undertaken to evaluate suitable genotypes of China aster for successful cultivation as loose and cut flowers in Bangalore region.

MATERIALS AND METHODS

The study was carried out at experimental field of Division of Ornamental Crops, Indian Institute of Horticultural Research, Bangalore during the period September 2012 to March 2013 laid out in Randomized Complete Block Design with three replications. The experimental site was geographically located at $13^0$58' N latitude and 78^0 E longitude at an elevation of 890 m above mean sea level. Twenty China aster genotypes *viz.,* 'Kamini', 'Poornima', 'Shashank', 'Violet Cushion', 'Phule Ganesh Pink', 'Phule Ganesh White', 'Phule Ganesh Purple', 'Matsumoto Apricot', 'Matsumoto Red', 'Matsumoto Rose', 'Matsumoto Scarlet', 'Matsumoto Pink', 'Matsumoto White', 'Matsumoto Yellow', 'Local White', 'IIHR-H13A', 'IIHR-C1', 'IIHR-H 3', 'IIHR-I 1' and 'IIHR-G 13' were selected for study. Thirty two plants per replication of each genotype were planted at spacing of 30 cm x 30 cm. Uniform cultural practices were followed throughout the experiment. Five uniformly grown representative plants per replication were tagged for recording various observations. The data on various vegetative, floral and postharvest parameters were analysed statistically by Fisher's 'Analysis of Variance' technique (Fisher, 1950).

RESULTS AND DISCUSSION

Vegetative characteristics of China aster

The data presented in table 1 show that the various genotypes significantly differ with respect to their vegetative growth characteristics.

Vigorous plant growth as height was observed in genotype 'IIHR G13' in all stages of 30, 60 and 90 DAT. Maximum plant height at 30 DAT was recorded in 'PG Pink' (19.68 cm) on par with 'PG Purple' and 'IIHR G13' while minimum was recorded in 'Matsumoto White' (8.79 cm) on par with 'Matsumoto Red', 'Matsumoto Rose', 'Matsumoto Yellow', 'Matsumoto Apricot' and 'Kamini'. Maximum plant height at 60 DAT was recorded in 'IIHR G13' (57.96 cm) on par with 'Shashank' while minimum was recorded in 'Matsumoto Apricot' (22.44 cm) on par with 'Kamini'. Maximum plant height at 90 DAT was recorded in 'IIHR H3' (60.77 cm) on par with 'IIHR G13' and 'Shashank' while minimum was recorded in 'Matsumoto Apricot' (29.06 cm) on par with 'Matsumoto Yellow'. This variation in plant height among various cultivars may be due to the hereditary traits and the effect of prevailing environmental condition which resulted in varied growth rate. These results are in close agreement with the earlier findings of Patanwar *et al*. (2014) and Dilta *et al*. (2007) who observed similar variation in plant height among different cultivars. Maximum number of leaves/plant at 30 DAT was observed in 'PG Pink' (14.93) on par with 'Violet Cushion', 'Matsumoto White', 'Local White' and 'IIHR H3' while minimum in 'Shashank' (9.47) on par with 'PG White', 'PG Purple', 'Matsumoto Yellow' and 'IIHR G13'. Maximum number of leaves/plant at 60 DAT was observed in 'PG White' (68.53) while minimum was observed in 'Matsumoto Red' (19.80) on par with 'Matsumoto Apricot'. Maximum number of leaves/ plant at 90 DAT was observed in 'IIHR I 1' (258.33) on par with 'IIHR C1', 'IIHR H3' and 'IIHR G13' while minimum was observed in 'Matsumoto White' (128.86) on par with 'Matsumoto Apricot', 'Matsumoto Red', 'Matsumoto Rose', 'Matsumoto Scarlet', 'Matsumoto Pink' and 'Matsumoto Yellow'. The variation in number of leaves among different cultivars at different stage might be due to the distinguished varietal genetic make up of a particular genotype as a result of variations in phenotypic expression under prevailing environmental condition. Similar results were observed in marigold (Singh and Singh, 2005). Number of branches per plant are important characters, which signifies canopy shape and architecture of plant Among the evaluated genotypes maximum number of branches/plant was observed in 'Local White' (22.86) and minimum in 'Matsumoto Pink' (11.06) on par with 'Matsumoto Apricot', 'Matsumoto Red', 'Matsumoto Scarlet', 'Matsumoto White' and 'Matsumoto Yellow'. These findings are in accordance with those reported by Tirakannanavar *et al*. (2015) in China aster and Poonam and Kumar (2007) in chrysanthemum. Maximum plant spread was recorded in 'PG White' (32.23 cm^2) while minimum in 'Matsumoto Pink' (22.53 cm^2). This result is in accordance with findings of Zosiamliana *et al*. (2013) in China aster.

Flowering characteristics of China aster:

Data on table 2 indicated significant differences among the genotypes for various flowering parameters recorded.

Minimum days to first flower opening was recorded in 'Matsumoto White' (55.66 d) on par with 'Matsumoto Apricot' and 'Matsumoto Red' recorded while maximum was recorded 'PG White' (87.66 d). These findings are in agreement with the finding of Tirakannanavar *et al*. (2015). Minimum days to reach 50 % flowering stage was recorded in 'Matsumoto White' (62.11d) on par with 'Matsumoto Pink', 'Matsumoto Rose', 'Matsumoto Apricot' and 'Matsumoto Red' while maximum in 'PG White' (97.00 d) on par with 'Violet Cushion'. The

Table 1: Mean performance of twenty genotypes of China aster for vegetative characters

Genotypes	Plant height (cm)			Number of leaves/plant			Number of branches/ plant	Plant spread (cm)
	30 days	60 days	90 days	30 days	60 days	90 days		
Kamini	10.12	23.46	50.40	10.26	31.40	149.66	14.40	24.13
Poornima	16.82	47.76	49.23	10.93	30.66	150.26	16.33	26.98
Shashank	15.26	55.55	58.30	9.467	48.13	226.66	15.46	26.75
Violet Cushion	14.21	42.85	44.03	13.40	32.66	228.66	12.66	29.51
PG Pink	19.68	47.18	50.23	14.93	27.46	180.73	12.86	30.53
PG White	15.00	32.10	36.23	9.733	68.53	184.46	13.40	32.23
PG Purple	19.36	49.86	53.46	10.46	32.20	185.33	13.80	30.98
Matsumoto Apricot	10.45	22.44	29.06	11.66	21.53	133.80	11.46	26.48
Matsumoto Red	9.96	28.17	32.80	12.60	19.80	133.60	11.46	24.79
Matsumoto Rose	10.12	32.31	34.66	12.26	32.13	131.00	12.40	25.01
Matsumoto Scarlet	8.92	30.42	34.30	13.00	24.53	134.33	11.26	24.91
Matsumoto Pink	11.81	34.36	37.73	11.93	24.26	132.00	11.20	22.53
Matsumoto White	8.79	28.31	33.03	14.40	25.40	128.86	11.40	24.83
Matsumoto Yellow	10.04	29.04	31.90	10.80	32.53	135.40	11.13	25.21
Local White	15.16	49.52	51.20	13.53	42.60	242.13	22.86	29.63
IIHR H 13A	11.58	41.23	46.00	12.86	42.60	235.33	18.20	30.21
IIHR C1	15.30	44.45	46.88	12.73	41.46	256.06	18.13	28.89
IIHR H3	16.08	37.80	60.77	13.20	33.26	247.13	19.33	29.09
IIHR I 1	12.25	28.75	51.23	11.26	44.66	258.33	20.93	29.39
IIHR G13	18.88	57.96	60.75	10.80	41.86	251.93	19.73	29.24
SEm ±	0.67	1.61	1.24	0.64	1.10	4.70	0.23	0.42
CD at 5%	1.93	4.63	3.55	1.84	3.16	13.46	0.67	0.84

Table 2: Mean performance of twenty genotypes of China aster for flowering and yield characters

Genotypes	Days to 1st flower opening	Days to 50% flowering	Flowering duration (days)	Stalk length (cm)	Flower diameter (cm)	Number of flowers /plant	Weight of flowers /plant (g)	Number of ray florets/ flower	Number of disc florets /flower	Vase life (days)	Shelf life (days)
Kamini	83.88	91.55	23.44	29.86	5.88	61.77	122.11	107.26	145.73	7.33	3.33
Poornima	81.88	89.88	27.78	25.00	6.05	64.77	176.44	131.13	208.40	6.50	3.66
Shashank	71.00	81.66	28.66	25.66	4.66	78.77	162.55	40.33	249.40	8.33	4.00
Violet Cushion	83.55	94.66	32.11	21.40	5.39	57.22	112.35	113.06	181.60	7.16	3.83
PG Pink	76.00	81.66	30.33	25.29	6.58	36.66	66.66	135.13	149.13	8.66	3.00
PG White	87.66	97.00	25.33	26.00	8.19	33.33	109.44	140.40	153.80	7.83	3.16
PG Purple	80.44	90.00	28.55	31.06	7.35	48.33	103.00	121.06	255.06	8.00	3.66
Matsumoto Apricot	57.66	63.55	27.33	16.46	3.84	29.55	72.22	99.46	123.13	6.66	3.00
Matsumoto Red	57.55	62.14	27.11	17.20	3.83	29.66	44.89	117.20	132.26	6.16	3.50
Matsumoto Rose	58.44	64.00	28.55	16.06	3.75	26.77	70.44	121.46	177.26	7.00	3.63
Matsumoto Scarlet	59.88	68.44	26.11	16.46	3.78	23.77	34.66	99.46	162.40	7.50	3.83
Matsumoto Pink	58.77	62.66	26.22	16.33	3.79	27.00	53.89	102.33	178.66	6.33	3.83
Matsumoto White	55.66	62.11	30.44	16.33	3.90	22.44	52.55	65.06	232.26	6.16	2.93
Matsumoto Yellow	62.22	71.44	24.77	16.00	3.77	25.33	45.55	69.60	174.40	6.00	3.06
Local White	67.77	81.55	29.89	21.66	5.82	81.89	143.66	113.86	237.46	5.83	3.16
IIHR H13A	66.00	78.22	30.33	39.77	5.36	75.88	178.16	120.00	199.53	7.33	4.66
IIHR C1	67.55	80.11	28.11	39.36	5.76	68.44	154.91	100.40	157.13	7.33	3.83
IIHR H3	71.77	84.77	30.19	38.05	6.48	79.89	174.30	149.06	183.20	7.00	4.16
IIHR I 1	74.89	83.77	26.77	37.25	5.50	50.44	132.20	120.40	210.40	7.83	3.66
IIHR G13	65.77	71.67	28.89	42.48	5.14	72.88	123.73	153.33	175.73	8.16	3.83
SEm±	0.88	1.12	0.72	0.67	0.05	3.22	3.79	3.40	4.79	0.25	0.16
CD at 5%	2.52	3.21	2.14	1.94	0.14	9.22	10.85	9.75	13.73	0.72	0.47

variations in flower bud initiation and flower opening may be due to genetic trait (Kumar and Yadav, 2003). The duration of flowering is an important factor in determining the availability of flower for marketing. Maximum flowering duration was observed in 'Violet Cushion' (32.11 d) on par with 'Matsumoto White', 'Local White', 'IIHR H13A' and 'IIHR H3' while minimum in 'Kamini' (23.44 d) on par with 'PG White' and 'Matsumoto Yellow'. Similar variations due to varietal trends were also observed in China aster by Poornima *et al*. (2005) and in gerbera by Kumar and Yadav (2003). It is an important characteristic for a cut flower which determines its quality and marketability. The stalk length is longest in 'IIHR G13' (42.48 cm) while shortest in 'Matsumoto Yellow' (16.00 cm) on par with 'Matsumoto Apricot', 'Matsumoto Red', 'Matsumoto Rose', 'Matsumoto Scarlet', 'Matsumoto Pink' and 'Matsumoto White'. The variations in stalk length among the cultivars had also been reported in China aster (Poornima *et al*., 2006). Maximum flower diameter was observed in 'PG White' (8.19 cm) and minimum in 'Matsumoto Rose' (3.75 cm) on par with 'Matsumoto Apricot', 'Matsumoto Red', 'Matsumoto Scarlet', 'Matsumoto Pink', 'Matsumoto White' and 'Matsumoto Yellow'. Variation in flower diameter might be due to the genetic makeup of the varieties and their interaction with prevailing genotype and environment. Present findings are in agreement with the finding of Rao and Pratap (2006). Maximum number of flower was recorded 'Local White' (81.89) on par with 'IIHR-H 3', 'IIHR H13A', 'IIHR G13' and 'Shashank' which may be due to their more number of branches per plant with good number of developed flower buds on the branch. While minimum number of flower per plant was recorded in 'Matsumoto White' (22.44) on par with 'Matsumoto Apricot', 'Matsumoto Red', 'Matsumoto Scarlet', 'Matsumoto Pink', 'Matsumoto Rose' and 'Matsumoto Yellow'. Similar kind of variation was observed by Poornima *et al*. (2005) in China aster and Patanwar *et al*. (2014) in Chrysanthemum. Flower weight/plant was found maximum in 'IIHR H13A' (178.16 g) on par with 'Poornima' and 'IIHR H3' while minimum in 'Matsumoto Scarlet' (34.66 g) on par with 'Matsumoto Red'. Similar findings have been reported in China aster by Tirakannanavar *et al*. (2015). The number of ray florets per flower head ranged from 40.33 in 'Shashank' to 153.33 in 'IIHR-G 13'. The number of disc florets per flower ranged from 123.13 in 'Matsumoto Apricot' to 255.06 in 'PG Purple'.

Postharvest characteristic of China aster

Longer vase life is an important characteristic of a cut flower. Longest vase life among the genotypes was recorded in 'PG Pink' (8.66 d) on par with 'Shashank', 'IIHR G13' and 'PG Purple' while shortest in 'Local White' (5.83 d) on par with 'Matsumoto Pink', 'Matsumoto White' and 'Matsumoto Yellow'. The variation in vase life may be due to the inherited trait of better storage of photosynthates. These results are in close agreement with the earlier findings of Singh *et al*. (2003), Tiwari *et al*. (2010), Bharathi *et al*. (2015) and Makwana *et al*. (2015). Long shelf life is a quality prerequisite for a loose flower. Longest shelf life was recorded in 'IIHR H13A' (4.66 d) while shortest shelf life in 'Matsumoto White' (2.93 d) on par with 'Kamini', 'PG Pink', 'PG White', 'Matsumoto Apricot', 'Matsumoto Yellow' and 'Local White'. The variation in shelf life of flowers must be due to the differences in senescing behaviour of the cultivars by producing higher amount of ethylene forming enzymes. Similar kind of shelf life variation among genotype is also reported by Bharathi *et al*. (2014) in marigold.

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