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PM Nighut
Post Graduate Student, Department of Floriculture and Landscaping, College of Horticulture, Pune, Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahmednagar, Maharasthra, India

MB Shete
Floriculturist, All India Co-ordinated Research project on Floriculture, Zonal Agricultural Research Station, Ganeshkhind, Pune, Maharasthra, India

P Naveen Kumar
Principal Scientist, ICAR-Directorate of Floricultural Research, Mundhwa, Pune, Maharasthra, India

AA Bhagat
Assistant Professor, Department of Statistics, Zonal Agricultural Research Station, Ganeshkhind, Pune, Maharasthra, India

SG Bhalekar
Associate Professor, Department of Horticulture, College of Agriculture, Pune, Maharasthra, India

Corresponding Author:
PM Nighut
Post Graduate Student, Department of Floriculture and Landscaping, College of Horticulture, Pune, Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahmednagar, Maharasthra, India

Evaluation of improved genotypes of aster (*Callistephus chinensis* L.) for pot culture

PM Nighut, MB Shete, P Naveen Kumar, AA Bhagat and SG Bhalekar

Abstract
An investigation on "Evaluation of Improved Genotypes of Aster (C*allistephus chinensis* L.) for Pot Culture" was carried out at All India Co-ordinated Research project on Floriculture, Zonal Agricultural Research Station, Ganeshkhind, Pune-67, during the year 2021-22 on 20 genotypes of aster, including Arka Aadya, Phule Ganesh White, Phule Ganesh Pink, Phule Ganesh Violet, Phule Ganesh Purple as a check for pot culture. Randomized block design with 20 treatments and 2 replications were used. The results revealed that variety Phule Ganesh Pink and Code-1 required minimum number of days for bud emergence; Code-4 required less number of days for bud to full opening of flower; Arka Aadya and Code-15 recorded highest number of flowers per plant; Code-4 recorded maximum flower head diameter; Phule Ganesh Pink recorded minimum flower disc diameter; Phule Ganesh Pink recorded maximum number of ray florets and duration of flowering.

Keywords: Aster, pot culture, improved genotypes

Introduction
Aster, also known by its scientific name *Callistephus chinensis* L. and a member of the Asteraceae family, is one of the most widely grown seasonal flower crops in India. Centre of origin of aster is China. The word "Callistephus" comes from the Greek words "Kalistos", which means "most beautiful" and "Stephos" which means "a crown," and refers to the flower head. Contains two diploid chromosomes i.e., 2 n = 18. Aster, an annual flower crop, is extensively grown for its diverse range of attractive colours, consisting of a variety of pleasant shades, which including violet, dark purple, reddish purple, several kinds of pink, pure white, milky white, creamy white, soft azure and dark blue colour including round center (yellow colour) attracted many pollinators and larger vase life. It is greatly used as flower beds or herbaceous borders in landscape gardening also dwarf exotic cultivars were used in pot culture, according to chaitra and Patil (2007) [4]. Aster crop propagated by sexual method i.e., seed. Temperature ranges between 20-30 ºC in day and 15-17 ºC in night with 50-60% relative humidity ideal condition for aster crop. It also used commercially loose as well as cut flower by most of farmer. It grows up to the height of 75 to 90 cm. It has erected branching habit having triangular ovate to only ovate leaves and alternatively attached to main stem. Spreading type of aster mostly used in bedding purpose. Cut flower of aster also used in vases and flower arrangements. Asters create beautiful bedding blooms when grown in big groups and are useful for bridging gaps in mixed herbaceous borders. For floral décor, bouquets, and garland creation, loose flowers are frequently utilized since they have a considerably longer vase life (2 weeks). It grown in open field condition also successfully grown in polyhouse condition. By creating the ideal control environmental conditions in the greenhouse, we can take crop production whole year.

Currently, the business and organization sectors are expanding. Although all people's choice is to live in nature, doing so has grown to be quite challenging owing to population growth and fast urbanization. In urban area there were less land available of garden or for growing flower crops. As a result, the idea of pot culture will spread, and there is an increase in high value for diverse potted vegetation and blooming species for aesthetic purposes in house and in office. Hence increase in scope for gardener to grow it in house or also it used in terrace gardening. Currently no defined standard for pot culture all over the world. The crop should be 1.5 to 2 times the height of the pot (Sachs *et al*., 1976). Pot plant with large number of flowers, more branching, ideal plant height, maximum plant spread, medium to large flower diameter, small disc diameter and longer duration of flowering such character we taken in consideration for growing crop.

In India there is no any variety released for pot culture for aster crop; hence the present investigation entitled "Evaluation of Improved Genotypes of Aster (C*allistephus chinensis* L.) for Pot Culture" has been proposed with the objective: To evaluate the improved genotypes of aster for pot culture.

Material and Methods

The present investigation entitled "Evaluation of Improved Genotypes of Aster (C*allistephus chinensis* L.) for Pot Culture." was conducted at the All-India Co-ordinated Research project on Floriculture, Zonal Agricultural Research Station, Ganeshkhind, Pune -67, during the year 2021-22.

The plastic pots of size 21.5 cm x 19.0 cm were used for growing aster crop for this experiment. Each pot was filled with a media mixture of Soil: FYM of 1:1 proportion. Before pot filling, the pot was clean. The healthy planting material i.e., seeds were obtained from the All India Co-ordinated Research Project on Floriculture, Zonal Agricultural Research Station Ganeshkhind, Pune. Twenty genotypes of aster namely Code-1, Code-2, Code-3, Code-4, Code-5, Code-6, Code-7, Code-8, Code-9, Code-10, Code-11, Code-12, Code-13, Code-14, Code-15 including Arka Aadya, Phule Ganesh White, Phule Ganesh Pink, Phule Ganesh Purple, Phule Ganesh Violet as a check. The experiment was laid out in a Completely Randomized Design. There was total twenty treatments, each treatment with two replications and 10 pots under each replication.

Standard cultural practices like weeding and irrigation were followed. Fertilizers were also applied manually at planting and one month after planting in pots. The raised beds of size 1m x 0.90 m x 0.15 m were prepared for raising seedlings of different genotypes of aster. Well rot decomposed FYM was added in the soil. Fungicide (Captan) was applied to the beds to avoid the incidence of fungal diseases. Seeds were sown and then covered with fine soil. Water was applied immediately after sowing with rose water can. Watering was done sufficiently as per need of crop. Seedlings were ready for transplanting after 35-40 days of sowing, Seedlings were transplanted. Observations for flowering character such as, days required for bud initiation from transplanting (days), days to open the first flower (days), flower diameter (mm), disc diameter (mm), number of ray florets per flower, number of flowers per plant, duration of flowering (days), (from blooming of first flower to senescence of last flower) and colour of flower were recorded for all plants of all replication. Data was statistically analysed by the method suggested by Panse and Sukhatme (1995) [15].

Results and Discussion

Mean performance of 20 aster genotypes is presented in Table.1 and Table.2 indicate significant variation among different genotypes.

Number of days required for bud emergence

The minimum days required for bud emergence was observed in Phule Ganesh Pink (43.73 days) which was at par with Code-1 (48.00 days), Code-4 (48.50 days) Code-5 (49.00 days) and Code-7 (49.50 days). The maximum days required for bud emergence (68.10 days) was recorded in Phule Ganesh Purple. Similar results were reported by Naikwad D. *et al.* (2019) [14], Zosiamliana *et al*. (2013) [25], Lal *et al.* (2019) [12], Martolia and Rao (2018) [13] in aster.

Number of days required for bud to full opening of flower

The minimum days required for bud to full opening of flower was recorded in Code-4 (12.10 days) which was at par with Code-7 (13.70 days), Code-8 (13.50 days), code-9 (13.90 days) and Code-2 (14.40 days). The maximum days required for bud to full opening of flower was recorded in Phule Ganesh White (25.70 days). Similar results were reported by Chavhan *et al*. (2010) [5], Savitha *et al*. (2016) [22], Aditya *et al*. (2019) [1], Lal *et al*. (2019) [12], Chowdhuri *et al.* (2016) [6] and Dilta *et al.* (2007) [7] in aster crop.

Number of flowers per plant

The maximum number of flowers per plant was significantly recorded in Arka Aadya (62.10). The minimum number of flowers per plant was recorded in Code-4 (13.20). Similar results were reported by Anita Hosalli *et al* (2019), Pratiksha Kumari *et al* (2017) [18], Swaroop *et al*. (2004) [24], Chavan *et al*. (2010) [5], Poornima *et al*. (2006) [16], Jagtap (2013) [9], Savitha *et al.* (2016) [22], in China Aster.

Flower head diameter

The maximum flower head diameter recorded in Code-4 (71.50 mm) which was at par with Phule Ganesh White (70.40 mm), Code-7 (69.70 mm), Code-6 (69.00 mm) and Code-3 (67.40mm). The minimum flower head diameter recorded in Arka Aadya (51.30 mm). Similar results were reported by Aditya *et al* (2019) [1], Kumar *et al.* (2017), Zosiamliana *et al*. (2013) [25], Jagtap (2013) [9], Prasanth *et al*. (2020) [17] and Rai *et al*. (2016) [19] in China Aster.

Flower disc diameter

The minimum disc diameter was significantly recorded in Phule Ganesh Pink (10.98 mm). The maximum flower disc diameter was recorded in Code-7 (24.60mm). Similar results were investigated by Ghimiray and Sarkar (2015) [8] and Sil *et al.* (2017) [23] in Gerbera.

Number of ray floret

The maximum number of ray floret was significantly recorded in Phule Ganesh Pink (311). The minimum number of ray floret recorded in Code-8 (90). A flower greater number of ray florets or double type flower is ideal for pot cultivation. Similar results were reported by Kale (2002) [10] and Agale (2012) [2] Agale in Gaillardia.

Duration of flowering

Cultivar with longer duration of flowering were suitable for pot culture. The maximum duration of flower was significantly recorded in Phule Ganesh Pink (62.67 days). The minimum duration of flower was recorded in Phule Ganesh Purple (46.10 days). Similar results were reported by Zosiamliana *et al*. (2013) [25], Savitha *et al.* (2016) [22], Lal *et al.* (2019) [12], Martolia and Rao (2018) [13] in aster crop and Roopa *et al*. (2018) [20] in chrysanthemum.

Colour of flower

In the present research, a genotype of potted aster flower showed a broad colour diversity. Out of twenty genotypes, five genotype have milky white colour (Code-1, Code-2, Code-3, Code-4 and Code-15), three genotype have white colour (Code-5, Code-7 and Phule Ganesh White); one genotype have slightly creamy white colour (Code-6); Code-8 has strong purplish red C colour; Code-10 has deep purplish

red A colour; Code-11 has strong purplish red 13 colour; Code-12 has vivid reddish purple B colour; Code-9, Code-13 and Code-14 have vivid reddish purple A colour; Arka Aadya has deep purplish red A colour; Phule Ganesh Pink has moderate purplish red A colour; Phule Ganesh Purple has brilliant violet C colour; Phule Ganesh violet has deep purple A colour. Variation in flower colour associated with plant genetic composition and may be environmental factor. Similar results were reported by Negi and Raghava (1983) and Jagtap (2013) [9] in China aster; Agale (2012) [2] in Gaillardia.

Table 1: Mean performance of aster genotypes for flowering characters

Treatments	Days required for first bud after transplanting	Days from bud to the full opening of flowers (days)	Total number of flowers per plant	Diameter of flower head (mm)	Flower disc diameter (mm)	No. of ray florets	Duration of flowering
Code-1	48.00^{ab}	17.50^{de}	25.70^{bcdef} 5.16	54.40^{abc}	18.70^{bcde}	91.70^{a}	52.50^{cdefg}
Code-2	49.40^{ab}	14.40^{abc}	18.80^{abcd} 4.45	56.50^{bcde}	22.20^{efgh}	95.20^{ab}	50.80^{cde}
Code- 3	50.10^{ab}	16.60^{cd}	21.60^{bcde} 4.74	67.40^{ijk}	22.10^{efgh}	117.00^{cd}	54.30^{defgh}
Code-4	48.50^{ab}	12.10^{a}	13.20^{a} 3.77	71.50^{k}	24.20^{gh}	112.60^{bcd}	54.00^{defgh}
Code-5	49.00^{ab}	16.50^{cd}	22.30^{bcde} 4.82	66.50^{ij}	22.90^{fgh}	116.00^{cd}	54.10^{defgh}
Code-6	50.20^{ab}	15.70^{bcd}	32.30^{fg} 5.76	69.00^{jk}	21.30^{defgh}	109.50^{abc}	56.40^{gh}
Code-7	49.50^{ab}	13.70^{abc}	18.05^{abc} 4.36	69.70^{jk}	24.60^{h}	124.70^{cd}	49.90^{abc}
Code-8	51.30^{ab}	13.50^{ab}	17.40^{ab} 4.29	52.30^{ab}	15.40^{b}	90.00^{a}	51.60^{cdef}
Code-9	50.70^{ab}	13.90^{abc}	25.20^{bcdef} 5.11	59.40^{efg}	18.30^{bcd}	106.60^{abc}	50.50^{bcd}
Code-10	51.80^{ab}	19.85^{ef}	26.20^{cdef} 5.21	58.70^{cdef}	16.90^{bc}	200.00^{i}	55.00^{fgh}
Code-11	50.60^{ab}	21.40^{fg}	21.20^{bcde} 4.69	58.80^{cdef}	16.70^{bc}	184.50^{hi}	54.00^{defgh}
Code-12	51.00^{ab}	23.60^{gh}	27.50^{def}5.30	54.90^{abcd}	17.10^{bc}	173.35^{gh}	57.80^{h}
Code-13	52.50^{b}	23.20^{gh}	22.90^{bcdef}4.89	63.40^{ghi}	18.80^{bcde}	145.50^{ef}	56.30^{gh}
Code-14	52.20^{b}	22.90^{gh}	28.80^{ef}5.46	63.30^{ghi}	21.20^{defgh}	168.90^{gh}	53.20^{cdefg}
Code-15	50.20^{ab}	18.00^{de}	41.70^{g}6.33	66.00^{hij}	21.10^{defgh}	108.70^{abc}	53.80^{cdefg}
Arka Aadya	60.80^{c}	16.60^{cd}	62.10^{h}7.94	51.30^{a}	16.10^{b}	119.60^{cd}	46.60^{ab}
Phule Ganesh White	64.50^{c}	25.70^{h}	29.60^{ef}5.53	70.40^{jk}	22.40^{fgh}	131.30^{de}	55.20^{fgh}
Phule Ganesh Pink	43.73^{a}	21.17^{fg}	22.17^{bcde}4.77	61.67^{fgh}	10.98^{a}	311.00^{j}	62.67^{i}
Phule Ganesh Purple	68.10^{c}	24.10^{gh}	28.70^{ef}5.45	59.90^{efg}	20.10^{cdef}	120.10^{cd}	46.10^{a}
Phule Ganesh Violet	66.80^{c}	21.20^{fg}	30.30^{ef}5.58	59.20^{defg}	21.00^{defg}	157.40^{fg}	54.60^{efgh}
Mean	52.94	18.58	20.78	61.71	19.60	139.18	53.46
SE (m)±	2.77	0.99	0.30	1.50	1.20	6.89	1.33
C.D. at 5%	8.23	2.93	0.90	4.44	3.57	20.48	3.95

Note: Treatment means having common super script are statistically non-significant otherwise significant

Table 2: Flower colour variation in genotypes of aster crop

Sr. No.	Genotypes	Colour of flower
1.	Code-1	Milky White
2.	Code-2	Milky White
3.	Code- 3	Milky White
4.	Code-4	Milky White
5.	Code-5	White
6.	Code-6	Slightly Creamy White
7.	Code-7	White
8.	Code-8	Strong Purplish Red C
9.	Code-9	Vivid Reddish Purple A
10.	Code-10	Deep Purplish Red A
11.	Code-11	Strong Purplish Red B
12.	Code-12	Vivid Reddish-Purple B
13.	Code-13	Vivid Reddish-Purple A
14.	Code-14	Vivid Reddish-Purple A
15.	Code-15	Milky White
16.	Arka Aadya	Deep Purplish Pink A
17.	Phule Ganesh White	White
18.	Phule Ganesh Pink	Moderate Purplish Red A
19.	Phule Ganesh Purple	Brilliant Violet C
20.	Phule Ganesh Violet	Dark Purple A

Conclusion

To select the genotype that was best for pot culture, the twenty genotypes were assessed for vegetative and flowering characteristics. From overall findings it is concluded that Code-4 (Milky White), Code-6 (Slightly creamy White), Code-7 (White), Code-10 (Deep Purplish Red A) and Code-11 (Strong Purplish Red B) were identified as the best performing ornamental china aster genotypes for pot size 21.5 cm ×19 cm and can be recommend for pot culture and suitable for further research work.

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