



Characterization of China aster (*Callistephus chinensis*) genotypes by using DUS guidelines

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Received: 06 May 2017; Accepted: 29 August 2017

ABSTRACT

China aster [*Callistephus chinensis* (L.) Nees] is commercially grown as annual flower crop for cut flower and loose flower. It is used for flower decoration, preparation of bouquets and garlands. It belongs to the family Asteraceae and is native of China. Morphological characterization of China aster genotypes was carried out in the division of Floriculture and Medicinal Crops, ICAR-IIHR, Bengaluru during 2015-16 and 2016-17 by adopting DUS guidelines developed by Protection of Plant Varieties and Farmers Rights Authority, New Delhi. A total of 42 genotypes were characterized for 21 traits belonging to vegetative and floral traits. Among these 21 traits, two were monomorphic, four dimorphic and 15 were polymorphic indicating their potential for varietal characterization. This characterization clearly established distinctness among the different genotypes for various traits. This study will be useful for breeders/farmers to identify and differentiate China aster genotypes and to pursue protection under PPV and FR Authority, New Delhi. The characterizations of genotypes will also results trait specific information which can be used in the development of superior genotypes in China aster.

Key words: Characterization, China aster, DUS guidelines and PPV& FR

China aster [*Callistephus chinensis* (L.) Nees.] belongs to the family Asteraceae and is a native of China. China aster is commercially grown as annual flower crop for cut and loose flower which are used in flower decoration, preparation of bouquets and garlands. In addition to their cultivation, China aster can be used in landscape gardening as a bedding plant to provide mass aesthetic effect. It is gaining fast popularity in India, because of its easy cultural practices, diversity of colours and varied uses (Bhargav *et al.* 2016).

Morphological characterization is very important tool to characterize a variety even though several methods are available including molecular markers. It is commonly known that morphological data can be of uncertain taxonomic reliability because of environmental interaction and the largely unknown mechanisms of genetic control of these traits (Ahmed *et al.* 2013). However, the expression of the particular trait is governed by the genes which are stable under optimal conditions. In order to develop an

efficient breeding program, it is necessary to characterize and understand diversity among various accessions available in the gene bank.

Government of India has enacted the Protection of Plant Varieties and Farmers Rights Act 2001 (PPV and FR Act) to encourage public/private investment in research and development of new plant genotypes by giving protection. The plant genotypes must fulfill the distinctiveness, uniformity and stability (DUS) criteria for protection under the Act and hence, there is a need to characterize China aster genotypes according to DUS test guidelines (Anonymous 2014). Characterization of genotypes is also useful to identify and avoid duplication. Qualitative characters being more stable over generations (Raut 2003), hence, are reliable for characterization of genotypes. Therefore, the present study was planned to characterize forty two China aster genotypes for qualitative and quantitative traits as per DUS guidelines.

MATERIALS AND METHODS

Twenty one genotypes and twenty one stabilized lines of China aster, *viz.* Arka Kamini, Arka Poornima, Arka Shashank, Arka Violet Cushion, Arka Aadya, Arka Archana, Phule Ganesh Pink, Phule Ganesh Purple, Phule Ganesh White, Phule Ganesh Violet, Matsumoto Yellow, Matsumoto White, Matsumoto Rose, Matsumoto Scarlet, Matsumoto Red, Matsumoto Pink, Local Pink, Local White, Local Violet, Milady Scarlet, Milady White, IIHRD5,

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IIHRC5, IIHRC42, IIHRC39, IIHRC5-1A, IIHRC31-2, IIHRJ3, IIHRJ22, IIHRI1, IIHRI66, IIHRC31A, IIHRG13, IIHR169-2, IIHRD2, IIHRC19, IIHRJ3-2, IIHR169, IIHRI16B, IIHRH3, IIHRE10 and IIHRC1 were evaluated at experimental block of Division of Floriculture and Medicinal Crops, ICAR-IIHR, Hessaraghatta, Bengaluru. Crop was grown during September to February for two consequent years (2015-16 and 2016-17) in a randomized block design with two replications. The seedlings were transplanted at 30 cm × 30 cm apart and maintained under uniform cultural practices. Ten plants of uniform size and vigour from each replication were selected for recording observations. Genotypes were evaluated for 21 traits, viz. plant height (cm), plant type, stem thickness (mm), density of branches, stem anthocyanin colouration of internode, leaf shape, leaf area, leaf dentations, leaf intensity of green colour, leaf midrib pigmentation, flower head number of whorls of ray florets, flower head diameter, ray floret length, ray floret shape, ray floret arrangement, ray floret shape in cross section, ray floret shape at tip, ray floret colour of inner side, disc floret colour of corolla lobe (RHS), days to first flower opening, type of flower head. The assessment of the characteristics was done at full flowering stage. Observations on vegetative parts were recorded on the one third portion from the base of the plant. Colour of vegetative parts were recorded on plants exposed to natural light. The observations on the leaf were recorded on leaves at the base of the lowest flowering branch. All observations on floral parts were recorded on terminal flower heads.

RESULTS AND DISCUSSION

Morphological characters have been predominant tools used by breeders for distinguishing lines or cultivars because they are genetically expressed. Among the 42 China aster genotypes, considerable variation was recorded for all the important characters. Qualitative characters being more stable over generations (Raut 2003), hence, are reliable for characterization of genotypes. Out of 15 visually assessed DUS descriptors, two were found to be monomorphic, 4 characteristics were dimorphic and 9 characteristics were polymorphic and all 6 measurable traits, showed polymorphism. Among the morphological traits, 6 traits were identified as grouping traits, viz. plant height, plant type, flower head diameter, ray florets in outer rows- shape, ray floret in the outer rows- colour of inner side, type of flower head (Table 1).

Plant and leaf characteristics

The characteristics pertaining to the plant and leaf traits are presented in Table 2. The plant height ranged from short to tall, 11 genotypes had short (20-40 cm), 15 medium (41-60 cm) and 16 genotypes were recorded tall plants (>60 cm). Ramteke and Murlidharan (2012) also reported similar variation in plant height in soybean. Based on the plant type, 34 genotypes were erect, five were semi-erect and 3 were spreading plant type. Panwar *et al.* (2012) and Sood *et al.* (2011) characterized different genotypes based

on plant growth type in rose and capsicum, respectively. While, depending on the stem thickness, 8 genotypes had thin (<2.5 mm), 22 medium (>2.5 mm- 3.5 mm) and 12 genotypes had thick (>3.5 mm). On the basis of density of branches, genotypes were categorized into sparse (9), medium (7) and dense (26). The density of leaves in tuberose and pomegranate were studied by Bharti *et al.* (2015) and Singh *et al.* (2016), respectively. The stem anthocyanin colouration was found to be dimorphic and was absent in 14 genotypes and present in 28 genotypes. Stem anthocyanin colouration was also used for conforming distinctiveness of chrysanthemum genotypes by Asha *et al.* (2016).

Among all the genotypes, none observed as linear based on the leaf shape; however, 6 genotypes expressed as elliptic and 36 genotypes as ovate. Ramteke and Murlidharan (2012), Gupta *et al.* (2010) in soybean and Sood *et al.* (2011) in bell pepper used leaf shape as one of the descriptor for morphological characterization. Nine genotypes recorded short leaf lamina and 19 recorded medium leaf lamina, while, 14 genotypes recorded large leaf lamina. Joshi *et al.* (2011) studied leaf length and width in rice genotypes based on DUS morphological descriptors. All the 42 genotypes were observed to have leaf dentations on leaf margin. Asha *et al.* (2016) also observed leaf dentations in chrysanthemum and Choudhary *et al.* (2015) in muskmelon. The intensity of leaf green colour ranged from light to dark. It was observed that nine genotypes were having light colour, 21 medium and 11 genotypes showed dark green colour of the leaf. The leaf midrib pigmentation was observed to be monomorphic and in all the 42 genotypes it's absent.

Floral characteristics

The characteristics pertaining to floral traits are presented in Table 3. The genotype Arka Shashank stood distinct in 42 genotypes with one whorl of ray florets, two to three whorls of ray florets was recorded by four genotypes, while 37 genotypes recorded more than three. On the basis of flower head diameter, genotypes were grouped into three categories; viz. small (7), medium (2) and large (33). This was comparable with the study of Qu *et al.* (2013) in chrysanthemum.

The ray floret length in the genotypes was expressed as short (8), medium (32) and long (2). Yadav *et al.* (2013) also reported similar results in mustard. On the basis of ray floret shape, genotypes were grouped into two categories, viz. narrow (17) and broad (25). As far as arrangement of ray florets is concerned, 27 genotypes were semi-upright, 10 horizontal and remaining five, viz. Arka Aadya, Arka Archana, Milady White, IIHRC42 and IIHRE10 were reflexed. Ray floret shape in cross section was concave in 32 genotypes, straight in five and convex in five. Shape of the ray floret at tip was pointed in 27 genotypes, while, it was blunt in 15 genotypes. The inner side of the ray floret colour was recorded by referring RHS (fifth edition) colour chart (Table 4). Singh *et al.* (2011) assessed the flower colour in gerbera using RHS colour chart. Two genotypes, viz. Arka Poornima and Arka Shashank had white colour

Table 1 Grouping traits of China aster genotypes based on DUS guidelines

Characteristics	States	Number of genotypes	Reference genotypes
Plant height	Short (20-40 cm)	11	Arka Aadya, Arka Archana, Matsumoto Yellow, Matsumoto White, Matsumoto Rose, Matsumoto Scarlet, Matsumoto Red, Matsumoto Pink Milady Scarlet, Milady White, IIHRE10
	Medium (>40- 60 cm)	15	Arka Kamini, Phule Ganesh Pink, IIHRD5, IIHRC5, IIHRC42, IIHRCC5-1A, IIHRCC31-2, IIHRJ3, IIHRJ22, IIHRI66, IIHRCC31A, IIHRG13, IIHR D2, IIHRI69, IIHR C1
	Tall (>60 cm)	16	Arka Poornima, Arka Shashank, Arka Violet Cushion, Phule Ganesh Purple, Phule Ganesh White, Phule Ganesh Violet, Local Pink, Local White, Local Violet, IIHRCC39, IIHRI1, IIHRI69-2, IIHRCC19, IIHRJ3-2, IIHRI16B, IIHRH3
Plant type	Erect	34	Arka Kamini, Arka Poornima, Arka Shashank, Arka Violet Cushion, Phule Ganesh White, Matsumoto Yellow, Matsumoto White, Matsumoto Rose, Matsumoto Scarlet, Matsumoto Red, Matsumoto Pink, Local Pink, Local White, Local Violet, Milady Scarlet, Milady White, IIHRD5, IIHRC5, IIHRCC39, IIHRCC5-1A, IIHRCC31-2, IIHRJ3, IIHRJ22, IIHRI1, IIHRI66, IIHRCC31A, IIHRG13, IIHRI69-2, IIHRD2, IIHRJ3-2, IIHRI69, IIHRI16B, IIHRH3, IIHRC1
	Semi-erect	5	Phule Ganesh Pink, Phule Ganesh Purple, Phule Ganesh Violet, IIHRC42, IIHRCC19
	Spreading	3	Arka Aadya, Arka Archana, IIHRE10
Flower head: diameter	Small (<4 cm)	7	Matsumoto Yellow, Matsumoto White, Matsumoto Rose, Matsumoto Scarlet, Matsumoto Red, Milady White, Matsumoto Pink
	Medium (>4 cm- 5 cm)	2	Arka Shashank, Milady Scarlet
	Large (>5 cm)	33	Arka Kamini, Arka Poornima, Arka Violet Cushion, Arka Aadya, Arka Archana, Phule Ganesh Pink, Phule Ganesh Purple, Phule Ganesh White, Phule Ganesh Violet, Local Pink, Local White, Local Violet, IIHRD5, IIHRC5, IIHRC42, IIHRCC39, IIHRCC5-1A, IIHRCC31-2, IIHRJ3, IIHRJ22, IIHRI1, IIHRI66, IIHRCC31A, IIHRG13, IIHRI69-2, IIHRD2, IIHRCC19, IIHRJ3-2, IIHRI69, IIHRI16B, IIHRH3, IIHRE10, IIHRC1
Ray floret: shape at tip	Pointed	27	Arka Violet Cushion, Phule Ganesh Pink, Phule Ganesh Purple, Phule Ganesh White, Matsumoto Yellow, Matsumoto White, Matsumoto Rose, Matsumoto Scarlet, Matsumoto Red, Matsumoto Pink, Local Pink, Local White, Local Violet, Milady Scarlet, IIHRD5, IIHR no C5, IIHRC42, IIHRCC51A, IIHRJ22, IIHRI1, IIHRG13, IIHRD2, IIHRCC19, IIHRI69, IIHRI16B, IIHRH3
	Blunt	15	Arka Kamini, Arka Poornima, Arka Shashank, Arka Aadya, Arka Archana, Phule Ganesh Violet, Milady White, IIHRCC39, IIHRCC31-2, IIHRJ3, IIHR-I66, IIHRCC31A, IIHRI69-2, IIHRJ3-2, IIHRE10, IIHR no C1
Ray floret: colour of inner side	Red group	2	Matsumoto Scarlet, Milady Scarlet
	Yellow group	1	Matsumoto Yellow
	White group	11	Arka Poornima, Arka Shashank, Arka Archana, Phule Ganesh White, Matsumoto White, Local White, Milady White, IIHRCC31-2, IIHRJ22, IIHRI66, IIHRH3
	Red Purple group	18	Arka Kamini, Arka Aadya, Phule Ganesh Pink, Matsumoto Rose, Matsumoto Red, Matsumoto Pink, Local Pink, IIHRD5, IIHRC5, IIHRC42, IIHRCC39, IIHRJ3, IIHRI1, IIHRD2, IIHRCC19, IIHRI16B, IIHRE10, IIHRC1
	Purple group	4	Arka Violet Cushion, IIHRCC31A, IIHRJ3-2, IIHRI69
Flower head: type	Violet group	6	Phule Ganesh Purple, Phule Ganesh Violet, Local Violet, IIHRCC5-1A, IIHRG13, IIHRI69-2
	Semi-double	38	Arka Kamini, Arka Aadya, Arka Archana, Phule Ganesh Pink, Phule Ganesh Purple, Phule Ganesh White, Phule Ganesh Violet, Matsumoto Yellow, Matsumoto White, Matsumoto Rose, Matsumoto Scarlet, Matsumoto Red, Matsumoto Pink, Local Pink, Local White, Local Violet, Milady Scarlet, Milady White, IIHRD5, IIHRC5, IIHRC42, IIHRCC39, IIHRCC31-2, IIHRJ3, IIHRJ22, IIHRI1, IIHRI66, IIHRCC31A, IIHRG13, IIHRI69-2, IIHRD2, IIHRCC19, IIHRJ3-2, IIHRI69, IIHRI16B, IIHRH3, IIHRE10, IIHRC1
	Powerpuff	4	Arka Poornima, Arka Shashank, Arka Violet Cushion, IIHRCC5-1A

Table 2 Morphological characterization of China aster genotypes for vegetative traits

Genotype	1	2	3	4	5	6	7	8	9	10
Arka Kamini	5	3	5	7	9	7	5	9	7	1
Arka Poornima	7	3	5	3	1	7	5	9	3	1
Arka Shashank	7	3	5	7	1	5	3	9	3	1
Arka Violet Cushion	7	3	5	5	9	7	5	9	7	1
Arka Aadya	3	7	5	3	9	7	5	9	5	1
Arka Archana	3	7	5	3	1	7	5	9	3	1
Phule Ganesh Pink	5	5	7	3	9	7	7	9	7	1
Phule Ganesh Purple	7	5	7	5	9	7	7	9	5	1
Phule Ganesh White	7	3	7	7	1	7	7	9	3	1
Phule Ganesh Violet	7	5	7	3	9	7	7	9	7	1
Matsumoto Yellow	3	3	3	7	1	5	3	9	5	1
Matsumoto White	3	3	3	7	1	5	3	9	5	1
Matsumoto Rose	3	3	3	7	9	5	3	9	5	1
Matsumoto Scarlet	3	3	3	7	9	7	3	9	7	1
Matsumoto Red	3	3	3	7	9	5	3	9	5	1
Matsumoto Pink	3	3	5	7	9	7	3	9	5	1
Local Pink	7	3	7	7	9	7	7	9	5	1
Local White	7	3	5	7	1	7	7	9	3	1
Local Violet	7	3	7	7	9	7	7	9	7	1
Milady Scarlet	3	3	3	7	9	7	3	9	5	1
Milady White	3	3	3	7	1	5	3	9	5	1
IIHRD5	5	3	7	7	9	7	7	9	5	1
IIHRC5	5	3	5	7	9	7	7	9	7	1
IIHRC42	5	5	5	3	9	7	5	9	5	1
IIHRCC39	7	3	5	5	9	7	5	9	5	1
IIHRCC5-1A	5	3	5	5	9	7	5	9	5	1
IIHRCC31-2	5	3	5	7	1	7	5	9	5	1
IIHRJ3	5	3	5	5	9	7	5	9	5	1
IIHRJ22	5	3	3	7	1	7	5	9	3	1
IIHRI1	7	3	7	7	9	7	5	9	7	1
IIHRI66	5	3	5	7	1	7	5	9	5	1
IIHRCC31A	5	3	5	5	1	7	5	9	3	1
IIHRG13	5	3	5	7	9	7	5	9	5	1
IIHRI69-2	7	3	7	5	9	7	7	9	5	1
IIHRD2	5	3	5	7	9	7	7	9	7	1
IIHRCC19	7	5	7	3	9	7	5	9	3	1
IIHRJ3-2	7	3	5	7	1	7	5	9	5	1
IIHRI69	5	3	5	3	9	7	7	9	7	1
IIHRI16B	7	3	5	7	9	7	5	9	7	1
IIHRH3	7	3	5	7	1	7	7	9	3	1
IIHRE10	3	7	7	3	9	7	5	9	5	1
IIHRC1	5	3	7	7	9	7	7	9	5	1

Short (20-40 cm) - 3
Medium (> 40- 60 cm)-5
Tall (>60 cm)- 7
Erect - 3
Semi-erect- 5
Spreading- 7
Thin (<2.5 mm)- 3
Medium (>2.5 mm- 3.5 mm)- 5
Thick (>3.5 mm)- 7
Sparse- 3
Medium- 5
Dense- 7
Absent- 1
Present- 9
Linear-3
Elliptic-5
Ovate-7
Small- 3
Medium-5
Large-7
Absent- 1
Present- 9
Light-3
Medium-5
Dark-7
Absent- 1
Present- 2

1. Plant height (cm), 2. Plant type, 3. Stem thickness, 4. Density of branches, 5. Stem anthocyanin colouration of internode, 6. Leaf shape, 7. Leaf area, 8. Leaf dentations, 9. Leaf intensity of green colour, 10. Leaf midrib pigmentation

Table 3 Morphological characterization of China aster genotypes for floral traits

Genotype	11	12	13	14	15	16	17	18	19	20
Arka Kamini	7	7	5	5	3	5	5	3	5	3
Arka Poornima	7	7	5	5	5	3	3	1	5	5
Arka Shashank	3	5	3	5	5	3	5	1	5	5
Arka Violet Cushion	7	7	5	3	3	3	3	7	5	5
Arka Aadya	7	7	5	5	7	7	5	3	1	3
Arka Archana	7	7	5	5	7	7	5	3	1	3
Phule Ganesh Pink	7	7	5	3	3	3	3	3	3	3
Phule Ganesh Purple	7	7	5	5	5	3	3	3	5	3
Phule Ganesh White	7	7	5	5	3	3	3	3	5	3
Phule Ganesh Violet	7	7	5	5	3	7	5	3	3	3
Matsumoto Yellow	5	3	3	3	3	3	3	3	1	3
Matsumoto White	7	3	3	5	3	3	3	3	1	3
Matsumoto Rose	7	3	3	5	3	3	3	3	1	3
Matsumoto Scarlet	7	3	3	5	3	3	3	3	1	3
Matsumoto Red	7	3	3	5	3	3	3	3	1	3
Matsumoto Pink	7	3	3	5	3	3	3	3	1	3
Local Pink	7	7	5	3	3	3	3	3	3	3
Local White	7	7	5	3	3	3	3	3	3	3
Local Violet	7	7	5	3	3	3	3	3	5	3
Milady Scarlet	7	5	3	3	3	3	3	3	1	3
Milady White	7	3	5	5	7	7	5	3	1	3
IIHRD5	7	7	5	3	3	3	3	3	5	3
IIHRC5	7	7	5	3	3	3	3	3	5	3
IIHRC42	7	7	5	3	7	5	3	3	3	3
IIHRCC39	7	7	7	5	3	3	5	3	1	3
IIHRCC5-1A	7	7	5	3	3	3	3	7	5	5
IIHRCC31-2	7	7	5	5	5	3	5	3	1	3
IIHRJ3	7	7	5	5	3	5	5	3	3	3
IIHRJ22	5	7	5	5	5	3	3	3	1	3
IIHRI1	7	7	5	3	3	3	3	3	5	3
IIHRI66	7	7	5	5	5	3	5	3	1	3
IIHRCC31A	7	7	5	5	5	3	5	3	1	3
IIHRG13	7	7	5	3	3	3	3	3	5	3
IIHRI69-2	7	7	5	5	3	5	5	3	3	3
IIHRD2	7	7	5	3	3	3	3	3	3	3
IIHRCC19	5	7	5	5	5	3	3	3	3	3
IIHRJ3-2	7	7	5	5	3	5	5	3	3	3
IIHRI69	7	7	5	3	3	3	3	3	1	3
IIHRI16B	7	7	5	3	3	3	3	3	3	3
IIHRH3	5	7	5	5	5	3	3	3	3	3
IIHRE10	7	7	7	3	7	7	5	3	1	3
IIHRC1	7	7	5	5	3	3	5	3	1	3

One- 3

Two to Three-5

More than three- 7

Small (<4 cm)- 3

Medium (>4 cm- 5 cm)- 5

Large (>5 cm)- 7

Short (<2 cm)- 3

Medium (>2 cm - 3 cm)- 5

Long (>3 cm)- 7

Narrow- 3

Broad- 5

Semi-upright- 3

Horizontal- 5

Reflexed- 7

Concave- 3

Straight- 5

Convex- 7

Pointed- 3

Blunt- 5

White- 1

Yellow- 3

Purple- 7

Early (60-70)- 1

Medium (>70-80)- 3

Late (>80)- 5

Semi-double- 3

Powerpuff- 5

11. Flower head number of whorls of ray florets, 12. Flower head diameter, 13. Ray floret length (outer row), 14. Ray floret shape, 15. Ray floret arrangement, 16. Ray floret shape in cross section, 17. Ray floret shape at tip, 18. Disc floret colour of corolla lobe, 19. Days to first flower opening, 20. Flower head type

Table 4 Colour of inner side of ray florets as per RHS colour chart

Genotype	RHS colour group
Arka Kamini	Red Purple group N74A; Fan2
Arka Poornima	White Group NN155D; Fan 4
Arka Shashank	White Group NN155D; Fan 4
Arka Violet Cushion	Purple group 77A; Fan 2
Arka Aadya	Red Purple group 61C; Fan 2
Arka Archana	White Group NN155D; Fan 4
Phule Ganesh Pink	Red Purple group N74A; Fan2
Phule Ganesh Purple	Violet group N87A; Fan 2
Phule Ganesh White	White Group NN155D; Fan 4
Phule Ganesh Violet	Violet group 86A; Fan 2
Matsumoto Yellow	Yellow group 2D; Fan 1
Matsumoto White	White Group NN155D; Fan 4
Matsumoto Rose	Red Purple group N74B; Fan 2
Matsumoto Scarlet	Red group 46A; Fan 1
Matsumoto Red	Red Purple group 71B; Fan 2
Matsumoto Pink	Red Purple group 62C; Fan 2
Local Pink	Red Purple group 61C; Fan 2
Local White	White Group NN155D; Fan 4
Local Violet	Violet group 83A; Fan 2
Milady Scarlet	Red group 53B; Fan 1
Milady White	White Group NN155D; Fan 4
IIHRD5	Red Purple group 61B; Fan 2
IIHRC5	Red Purple group N74A; Fan 2
IIHRC42	Red Purple group N78A; Fan 2
IIHRCC39	Red Purple group 71D; Fan 2
IIHRCC5-1A	Violet group N no 87B; Fan 2
IIHRCC31-2	White Group NN155D; Fan 4
IIHRJ3	Red Purple group 73A; Fan 2
IIHRJ22	White Group NN155D; Fan 4
IIHRI1	Red Purple group N74A; Fan 2
IIHRI66	White Group NN155D; Fan 4
IIHRCC31A	Purple group 75D; Fan 2
IIHRG13	Violet group 84A; Fan 2
IIHRI69-2	Violet group N no 87A; Fan 2
IIHRD2	Red Purple group 61B; Fan 2
IIHRCC19	Red Purple group 74B; Fan 2
IIHRJ3-2	Purple group 75A; Fan 2
IIHRI69	Purple Violet Group N81B; Fan 2
IIHRI16B	Red Purple group 64B; Fan 2
IIHRH3	White Group NN155D; Fan 4
IIHRE10	Red Purple group N74C; Fan 2
IIHRC1	Red Purple group 67A; Fan 2

corolla lobe of disc florets and 38 genotypes had yellow however, purple colour of disc florets was observed in Arka Violet Cushion and IIHRCC5-1A. The days to first flower opening was recorded early in 17 genotypes, medium in 12 and late in 13 genotypes. Two types of flower heads were observed, semi-double in 38 genotypes and four genotypes depicted powderpuff type.

The China aster genotypes characterized as per DUS test were categorized into different groups for individual plant which could be used as reference collection. This will be useful for breeders/farmers to identify and differentiate China aster genotypes and seek protection under PPV and FR, New Delhi. The present study concluded that the existence of wide variations for vegetative and floral traits in different China aster genotypes offered a good scope of selecting the suitable genotypes for desirable traits which can be used in breeding of new China aster genotypes.

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