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Effect of pinching and pot size on flower quality and pot presentability of china aster (*Callistephus chinensis*) cv. Arka Kamini

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Abstract
The present study entitled "Effect of pinching and pot size on flower quality and pot presentability of China aster (*Callistephus chinensis*) cv. Arka Kamini" was carried out during the *rabi* season of the year 2022-2023 at the College of Horticulture, Sri Konda Laxman Telangana State Horticultural University, Rajendranagar, Hyderabad. The data on flower quality parameters revealed that among various pinching levels, no pinching (A_1) noted maximum flower diameter (6.55 cm), weight of flower (5.38 g) and flower longevity (14.24 days), whereas in pot sizes, 10-inch pot (B_3) registered maximum flower diameter (5.81cm), weight of flower (4.61 g) and flower longevity (11.93 days). Regarding treatment combinations, no pinching in 10-inch pot (A_1B_3) recorded significantly maximum flower diameter (7.11 cm), weight of flower (5.60 g) and flower longevity (15.6 days). The results pertaining to pot presentability indicated that, the highest level of pot presentability (86.08) was recorded with double pinching (A_3) as compared to other pinching levels. Among the three pot sizes, the 10-inch pot (B_3) had the highest pot presentability (84.23). Regarding treatment combinations, double pinching in 10-inch pot (A_3B_3) had the highest value for pot presentability (88.69) than other treatment combinations.

Keywords: Pinching, china aster, flower characters, pot size

Introduction
China aster is a shallow-rooted plant that thrives well in rich, wet, well-drained soils in full sun to partial shade. It also comes in pots if only a few cultural conditions are satisfied. Potted china aster is a popular choice for decorating living spaces and balconies. Total area and production of loose flowers in India is 313 hectares and 2059 metric tonnes, respectively (NHB- 2019). Pinching is commonly used to regulate flowering time and improve the quality of flower production. It involves removal of terminal bud, stimulates the growth of lateral branches, resulting in a bushier and more compact plant in African marigolds. (Singh *et al*. 2015) [10]. By selectively pinching certain plants or groups of plants, growers can manipulate the flowering time and ensure a steady supply of flowers. (Jindal *et al*. 2018) [5]. Along with pinching, container size also has a significant impact on the growth, development and flowering of the plants, resulting in attractive potted plants. The rooting volume of the plant varies depending on the container size. Leaf area, shoot biomass and root biomass all generally grow linearly with container size (Deogade *et al*., 2020) [3]. Plants which are grown in containers typically have distinct root morphologies than crops planted in the ground. Root limitation and different container sizes have a significant influence on shoot development.

Materials and Methods
The experimental site, Rajendranagar is located at an altitude of 543.3 m above mean sea level on 78.23° East longitude and 17.90° North latitude. The area falls under the semi-arid tropical zone, characterized by hot and dry conditions for most of the year, with limited rainfall. The pure, bold and disease-free seeds of china aster cultivar Arka Kamini were used for conducting the study, procured from Floricultural Research Station, Rajendranagar, Hyderabad. Experimental Design was Factorial Completely Randomized Design (FCRD), Number of Factors- 2, Number of treatment combinations- 9, Number of Replications- 3, Number of pots per treatment- 5, Number of plants per pot- 2 Pot type - PVC Pot.

Treatment details

Factor 1 - Pinching levels	Factor 2 - Pot size
A_1 - No pinching	B_1 - 6 inch (15.24 cm)
A_2 - Single pinching	B_2 - 8 inch (20.32 cm)
A_3 - Double pinching	B_3 - 10 inch (25.4 cm)

Treatment No	Treatment Combinations
T_1	A_1B_1 (No pinching in 6-inch pot)
T_2	A_1B_2 (No pinching in 8-inch pot)
T_3	A_1B_3 (No pinching in 10-inch pot)
T_4	A_2B_1 (Single pinching in 6-inch pot)
T_5	A_2B_2 (Single pinching in 8-inch pot)
T_6	A_2B_3 (Single pinching in 10-inch pot)
T_7	A_3B_1 (Double pinching in 6-inch pot)
T_8	A_3B_2 (Double pinching in 8-inch pot)
T_9	A_3B_3 (Double pinching in 10-inch pot)

Results and Discussions

Flower diameter (cm): Upon observation, it was noted that there was existed discernible variation in the size of flowers based on the level of pinching. It was found that plants that did not undergo any pinching (A_1) significantly exhibited the largest flower diameter (6.55 cm). Conversely, plants that underwent double pinching (A_3) significantly displayed the smallest flower diameter (4.11 cm). It is notable that the size of the pot has a considerable impact on the diameter of the flowers. Based on the observations, the 10-inch pot labeled (B_3) significantly yielded the largest value (5.81 cm), while the 6-inch pot labeled (B_1) significantly produced the smallest flower diameter (4.82 cm). The study found a notable difference in the way pinching levels and pot size interacted with each other, affecting the diameter of the flowers. The largest flower diameter (7.11 cm) was observed in the group of no pinching in 10-inch pot (A_1B_3), while the smallest flower diameter (3.16 cm) was seen in the group of double pinching in 6-inch pot (A_3B_1). No pinching (A_1) recorded maximum flower diameter which might be due to energy sharing was limited to the flower developing only on the main branch. Least flower diameter was recorded in double pinching (A_3) was due to the energy shared by the developing side branches. Dorajeerao and Mokashi (2012) [4] in carnation reported that pinching practice encourages the production of synthetic compound (Benzyl adenine) which positively affect cell division and formation, resulted in improve number of petals and their expansion or both of them. Maximum flower diameter was recorded in the 10-inch pot (B_3) which might be due to the same pot size registered best figures with respect to vegetative and flowering attributes than other pot sizes. This outcome is consistent with a study in rose conducted by Kazeroonian *et al*. (2012) [6].

Table 1: Effect of pinching and pot size on flower diameter (cm) of china aster cv. Arka Kamini

Flower diameter (cm)				
Pinching levels (A)	**Pot size (B)**			
	6 inch (B_1)	**8 inch (B_2)**	**10 inch (B_3)**	**Mean**
No pinch(A_1)	6.24	6.31	7.11	6.55a
Single pinch (A_2)	5.07	5.25	5.63	5.32b
Double pinch (A_3)	3.16	4.47	4.70	4.11c
Mean	4.82c	5.34b	5.81a	
Factors	SEm ±		CD at 5%	
A	0.10		0.29	
B	0.10		0.29	
A x B	0.17		0.51	

Weight of flower (g)

It was observed that different levels of pinching had a significant impact on weight of flower. Among them, no pinching plants (A_1) recorded significantly heaviest flower (5.38 g), whereas double-pinched plants (A_3) produced the lightest flower (3.23 g). The weight of the flower was significantly influenced by the size of the pot it was grown in. Significantly largest flower, which weighed (4.61 g), was noted in the 10-inch pot (B_3), while the smallest flower, weighing (4.05 g), recorded in the 6-inch pot (B_1). The interaction between these factors is statistically significant. The treatment combination of no-pinching in a 10- inch pot (A_1B_3) significantly resulted in the heaviest flower (5.60 g). On the other hand, the treatment combination of double pinching the flower in a 6-inch pot (A_3B_1) resulted in the lowest weight flower (2.80 g). The heaviest flower was recorded in the no pinching (A_1) which was due to the fact that the same pinching level registered the maximum flower diameter. The other reason might be that energy sharing was found to be restricted to the bloom that was only growing on the main branch in plants that were not pinched. The light weight of flower was recorded in double pinching (A_3) might be due to the energy shared by the growing side branches was the main contributor to the decrease in floral weight. Sailaja and Panchbhai (2014) [9] in china aster, reported that unpinched plants had the heaviest flowers and pinched plants had the lightest. Baskaran and Abirami (2017) [1] in marigold and Ullah *et al.* (2019) [11] in zinnia also found comparable results.

Table 2: Effect of pinching and pot size on weight of flower (g) of china aster cv. Arka Kamini

Weight of flower (g)				
Pinching levels (A)	**Pot size (B)**			
	6 inch (B_1)	**8 inch (B_2)**	**10 inch (B_3)**	**Mean**
No pinch (A_1)	5.15	5.38	5.60	5.38a
Single pinch (A_2)	4.21	4.38	4.68	4.42b
Double pinch (A_3)	2.80	3.35	3.55	3.23c
Mean	4.05b	4.37ab	4.61a	
Factors	SEm ±		CD at 5%	
A	0.03		0.10	
B	0.03		0.10	
A x B	0.05		0.17	

Flower longevity (days): It was observed that significantly the flowers with the longest lifespan, lasting (14.24 days), were found in the group of plants that did not undergo any pinching (A_1). On the other hand, significantly shortest lifespan, lasting (8.35 days), were found in plants that were pinched twice (A_3). Significant influence was noted among different pot sizes on this parameter. It was observed that the pot measuring 10 inches (B_3) provided significantly maximum longevity (11.93 days), whereas the pot measuring 6 inches (B_1) significantly resulted in minimum lifespan (10.18 days). It was found that the flower's ability to withstand wear and tear was significantly influenced by the interaction between the level of pinching and the size of the pot. The group that demonstrated the longest lifespan, lasting for a period (15.6 days) (A_1B_3) was recorded in the plants that did not undergo any pinching and were grown in a spacious 10-inch pot. On the other hand, the group that exhibited the shortest lifespan, lasting (7.26 days) (A_3B_1) was double pinching in 6-inch pot. The accumulation of more assimilates in no pinching

treatment with fewer blooms stays longer duration on the plant. Both Sailaja and Panchbhai (2014) [9] and Moon *et al*. (2017) [7] showed comparable results in china aster and gaillardia, respectively. The flower longevity was increased with pot size. Considering that plants grown in small pots have less root volume than those grown in larger pots, they receive limited water and nutrients. Therefore, it is expected that the vegetative and reproductive growth of these plants be less than plants grown in the bigger space. Van Iersel (1997) [11] reported that the use of larger pots and increasing plant rooting space increased salvia flowering period which is consistent with our results.

Table 3: Effect of pinching and pot size on Flower longevity on plant (days) of china aster cv. Arka Kamini

Flower longevity (days)				
Pinching levels (A)	**Pot size (B)**			
	6 inch (B_1)	**8 inch (B_2)**	**10 inch (B_3)**	**Mean**
No pinch (A_1)	13.13	14.00	15.60	14.24a
Single pinch (A_2)	10.16	10.73	11.00	10.63b
Double pinch (A_3)	7.26	8.60	9.20	8.35c
Mean B	10.18c	11.11b	11.93a	
Factors	SEm ±		CD at 5%	
A	0.12		0.37	
B	0.12		0.37	
A x B	0.21		0.65	

Pot presentability (Score): It was noted that those plants that underwent double-pinching (A_3) significantly exhibited the highest level of pot presentability, achieving a score (86.08). However, those plants that received no pinching (A_1) significantly demonstrated the lowest level of pot presentability. Based on the analysis, it was found that out of the three different pot sizes, the 10-inch pot (B_3) achieved the highest pot presentability score (84.23), while the 6- inch pot (B_1) scored the lowest value (77.25). The research findings indicated that the plants that were double-pinched and placed in a 10-inch pot (A_3B_3) had the highest pot presentability score (88.69). On the other hand, the plants that were not pinched and placed in a 6-inch pot (A_1B_1) had the lowest pot presentability score. It appears that the china aster plants displayed varying degrees of presentability, depending on the level of pinching they received. Number of smaller sized flowers will have good presentability rather than have few larger flowers Double-pinched plants have maximum pot presentability due to an increase in plant leaf area, shoot biomass and root biomass. Similar finding was observed by Bhargavi *et al*. (2021) [2] in zinnia.

Table 4: Effect of pinching and pot size on pot presentability (Score) of china aster cv. Arka Kamini

Pot presentability (Score)				
Pinching levels (A)	**Pot size (B)**			
	6 inch (B_1)	**8 inch (B_2)**	**10 inch (B_3)**	**Mean**
No pinch (A_1)	65.30	70.40	78.30	71.33^{c}
Single pinch(A_2)	83.20	84.10	85.70	84.33^{b}
Double pinch(A_3)	83.26	86.29	88.69	86.08^{a}
Mean	77.25^{c}	80.26^{b}	84.23^{a}	
Factors	SEm ±		CD at 5%	
A	0.67		1.99	
B	0.67		1.99	
A x B	1.16		3.45	

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