

SEED QUALITY DETERIORATION OF SOME CHINA ASTER GENOTYPES DURING STORAGE

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Abstract

China aster [*Callistephus chinensis* (L.) Nees.] belongs to the family Asteraceae and is native of China. It is grown as cut flower, loose flower, bedding plant, for flower decoration, for preparation of bouquets and garlands. The objective of this study was to evaluate the potentiality of storage during storage. The experiments were conducted in 2016-17 in the Seed Testing laboratory, BCKV, Mohanpur Nadia, West Bengal, India. Four China Aster varieties were store in different storage containers like Aluminium foil packet, Polythene packet, Paper packet, Cloth bag and Earthen pot. Deterioration pattern were observed by germination percentage and vigour index change at just after harvesting and every four months interval upto eight months storage that means the next growing season. At four months after storage aluminium foil packet showed the highest germination (66.53%) and vigour index (403.87) than other treatments. So, at four months after storage aluminium foil packet i.e., aluminium foil packet is best. As at eight months after storage, seeds stored in aluminium foil packet recorded highest germination (46.54%) and vigour index (269.58), it can be recommended for storing seeds of China aster with maintenance of better seed quality storage. So, deterioration of China Aster is faster due to storage.

Key wards: China aster, deterioration, storage

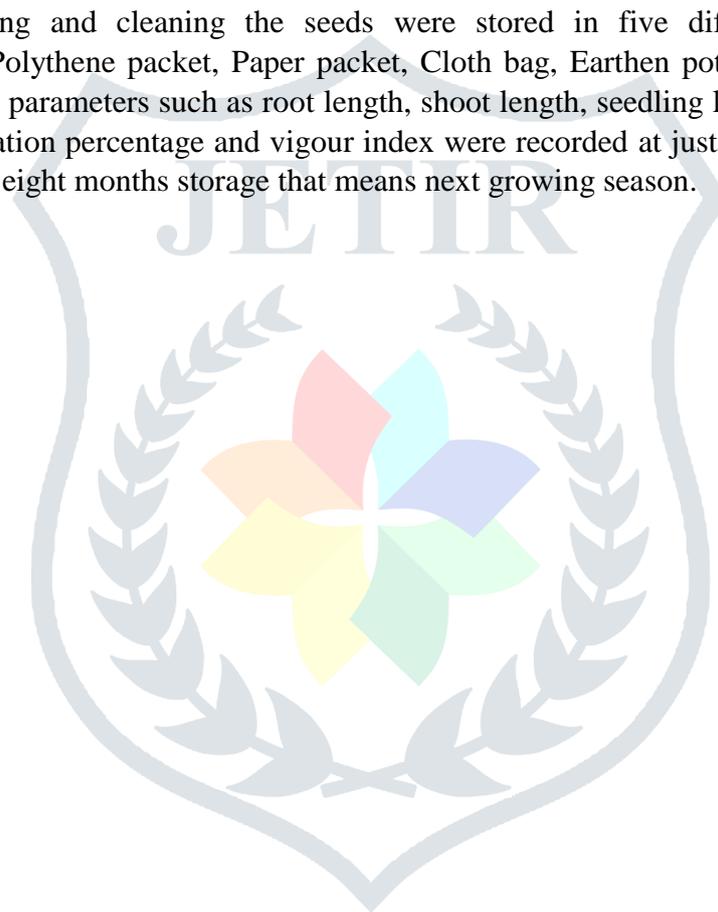
INTRODUCTION

China aster is one of the most important flower crops throughout the world. It is native to China and is one of the most important annual flower crops (Navalinskien *et al.*, 2005). It is commercially cultivated in India, France, Germany, Netherlands, U.K., Siberia, Russia, Japan, North America, Switzerland and Europe. In India, it is largely grown on commercial scale in Karnataka, Tamil Nadu, Andhra Pradesh, Maharashtra and West Bengal. China aster is ranked third next only to chrysanthemum and marigold. It has spread to Europe and other tropical countries during 1731 AD. The name of the genus 'Callistephus' has been derived from two Greek words 'kalistos' meaning 'most beautiful' and 'stephos', a crown, referring to the flower head. It belongs to the largest families of flowering plants, 'Asteraceae'. It is an erect, hispid, hairy and branched annual with ovate or triangular ovate leaves spirally attached to the stems (Cockshull, 1985). It is a long day plant (Hughes and Cockshull, 1969) and suitable for intercropping with fruit crops. It is widely cultivated due to its wide spectrum of attractive colours and comparatively longer vase life (Chaitra and Patil, 2007). It is grown as a potted plant and its dwarf cultivars are suitable for edges. Adaptation of genotypes to varying soil and climatic conditions is important for harnessing the best out of it in a particular area. Evaluation of genotypes, thus, gives an idea for its potential utilization by the growers. In China aster, sufficient numbers of genotypes are under cultivation but their performance related to seed yield varies based on changing agro climatic condition of the growing locations (Mahato *at al.* 2017). The quality of cut flowers as well as seed is primarily a varietal trait and is generally influenced by climatic conditions prevailed during the growing period at a particular place. It is very essential to study the performance of varieties mainly in relation to seed production and their storability at a particular place (Kumari *et al.* 2016). The objective of study was to evaluate the flowering behaviour as well as seed production potential of China aster in the gangetic new alluvial zone of West Bengal, India.

MATERIALS AND METHODS

Four China aster varieties viz., Arka Archana, Arka Kamini, Arka Aadya and Arka Poornima were raised in individual plots with five replications at the Horticulture Research Station, Mondouri farm, BCKV, West Bengal during 2016-17. The field was located in the new alluvial zone. The varieties were collected from Indian Institute of Horticultural Research as a part of varietal evaluation programme. Seeds of all the varieties were grown in individual plots following standard agronomic practices and three weeks old seedlings were transplanted in the main field. A spacing of 40 cm between the rows, 40 cm between the plants was maintained. Each plot was of 2.5m length and 2m breadth. Fertilizer was applied in both the years as per standard recommendation. Farm yard manure was applied @2 kg plot⁻¹. Fertilizer dose of 10:26:26 (N:P:K mixed fertilizer) @ 150g plot⁻¹ was applied as basal dose. Top dressing should be done with 10:26:26 (mixed fertilizer) @ 50g plot⁻¹ after 20 days after transplanting. After harvesting seeds were threshed and clean properly.

Just after threshing and cleaning the seeds were stored in five different containers namely Aluminium foil packet, Polythene packet, Paper packet, Cloth bag, Earthen pot in the new alluvial zone. The different seed quality parameters such as root length, shoot length, seedling length, seedling dry weight and fresh weight, germination percentage and vigour index were recorded at just after harvesting and every four months interval upto eight months storage that means next growing season.



RESULT AND DISCUSSION**Table1: Just after harvest**

Treatments	Root length (cm) Mean±SD	Shoot length (cm) Mean±SD	Seedling length (cm) Mean±SD	Fresh weight (g) Mean±SD	Dry weight (g) Mean±SD	Germination (%) Mean±SD	Vigour index Mean±SD
Arka Archana	4.19 ^{BA} ±0.38	1.87 ^B ±0.24	6.06 ^{BA} ±0.014	0.85 ^A ±0.08	0.42 ^B ±0.02	89.1 ^A ±1.25	540.36 ^{BA} ±20.72
Arka Kamini	3.78 ^B ±0.13	2.04 ^{BA} ±0.21	5.82 ^B ±0.34	0.93 ^A ±0.05	0.40 ^B ±0.01	82.56 ^B ±2.72	481.30 ^B ±42.10
Arka Aadya	5.15 ^A ±0.32	1.98 ^{BA} ±0.15	7.13 ^A ±0.47	0.86 ^A ±0.11	0.53 ^A ±0.1	82.43 ^B ±2.12	588.89 ^A ±53.45
Arka Poornima	3.97 ^B ±0.91	2.26 ^A ±0.19	6.23 ^{BA} ±1.05	0.04 ^A ±0.18	0.40 ^B ±0.02	92.26 ^A ±2.47	573.42 ^{BA} ±83.72
SEm (±)	0.1624	0.489	0.141	0.024	0.014	1.382	11.02
LSD 0.05	NS	NS	NS	NS	NS	NS	NS

Table 2: Four months after storage

Treatments	No of varieties	Root length (cm) Mean±SD	Shoot length (cm) Mean±SD	Seedling length (cm) Mean±SD	Fresh weight (g) Mean±SD	Dry weight (g) Mean±SD	Germination Mean±SD	Vigour index Mean±SD
Aluminium foil packet	4	4.15 ^A ±0.63	1.93 ^A ±0.61	6.08 ^A ±0.56	0.87 ^A ±0.09	0.43 ^A ±0.06	66.53 ^A ±5.58	403.87 ^A ±38.52
Polythene packet	4	4.07 ^A ±0.63	1.86 ^A ±0.17	5.94 ^A ±0.54	0.82 ^{BA} ±0.09	0.43 ^A ±0.05	64.86 ^A ±5.69	384.75 ^{BA} ±37.99
Paper packet	4	4.01 ^A ±0.64	1.84 ^A ±0.19	5.86 ^A ±0.54	0.80 ^{BA} ±0.1	0.42 ^A ±0.06	63.95 ^A ±5.11	374.95 ^{BA} ±40.51
Cloth bag	4	4.10 ^A ±0.6	1.76 ^A ±0.2	5.87 ^A ±0.59	0.76 ^{BA} ±0.1	0.43 ^A ±0.05	62.44 ^A ±5.13	368.19 ^{BA} ±54.82
Earthen pot	4	3.83 ^A ±0.62	1.68 ^A ±0.1	5.51 ^A ±0.50	0.70 ^B ±0.08	0.40 ^A ±0.04	61.03 ^A ±5.21	336.56 ^B ±39.28
SEm (±)		0.1624	0.489	0.141	0.024	0.014	1.382	11.02
LSD 0.05		NS	NS	NS	NS	NS	NS	NS

Just after harvesting, mean value of root length ranged from 3.78 cm to 5.15 cm among the genotypes. The deviation from mean also varied within a range between 0.13 to 0.91. Maximum mean value of root length was found in Arka Aadya (5.15cm) but the deviation from mean was maximum in Arka Poornima (0.91). Minimum mean value was found in Arka Kamini (3.78cm), but the deviation from mean was minimum in Arka Kamini (0.13). Varieties were laid in two groups i.e. A and B. Root length did not vary significantly among the varieties. While considering root length, Arka Archana was under BA group, Arka Kamini and Arka Poornima was under B group and Arka Aadya was under A group. Mean value of shoot length ranged from 1.87cm to 2.26 cm. The deviation from mean also varied with a range between 0.15-0.24. Maximum mean value of shoot length was recorded in Arka Poornima (2.26cm) but the deviation from mean was maximum in Arka Archana (0.24). Minimum mean value was noted in Arka Archana (1.87cm) but the deviation from mean was minimum in Arka Poornima (0.19). Varieties were also laid in two groups i.e. A and B. Shoot length did not vary significantly among the varieties. On consideration of root length, Arka Archana was under B group, and the others were under A group. In case of seedling length mean value ranged from 5.82 cm to 7.13 cm. The deviation from mean also varied with a range between 0.014-1.05. Maximum mean value of seedling length was found in Arka Aadya (7.13 cm) but the deviation from mean was maximum in Arka Poornima (1.05). Minimum mean value was recorded in Arka Kamini (5.82 cm), but the deviation from mean was minimum in Arka Archana (0.014). Varieties were laid in two groups i.e. A and B. Seedling length did not significantly variation among the varieties. While considering seedling length, Arka Archana was under BA group, Arka Kamini was under B, Arka Aadya and Arka Poornima was under A group.

Just after harvesting, mean value of fresh weight was from 0.04g to 0.93g. The deviation from mean also varied within a range between 0.05 to 0.18. Maximum mean value of fresh weight was found in Arka Kamini (0.93g), but the deviation from mean was recorded as maximum in Arka Poornima (0.18). Minimum mean value was found in Arka Poornima (0.04 g), but the deviation from mean was minimum in Arka Kamini (0.05). Fresh weight did not significantly vary among the varieties. While considering fresh weight of seedlings, all varieties were under A group. Among the genotypes mean value of dry weight ranged from 0.40g to 0.53g. The deviation from mean also varied within a range between 0.01 to 0.1. Maximum mean value of dry weight was found in Arka Aadya (0.53g) and the deviation from mean was also maximum in Arka Aadya (0.1). Minimum mean value was found in Arka Kamini & Arka Poornima (0.40g) and the deviation from mean was minimum in Arka Kamini (0.01). Varieties were laid in two groups i.e. A and B. Dry weight did not vary significantly among the varieties. In consideration of dry weight Arka Archana, Arka Kamini, Arka Poornima varieties were under B group and Arka Aadya was under group A. In case of germination percentage, it ranged from 82.43 to 92.26. The deviation from mean varied with a range between 1.25- 2.47. Maximum mean value of germination percentage was found in Arka Poornima (92.26) and the deviation from mean was also maximum in Arka Poornima (2.47). Minimum mean value was found in Arka Aadya (82.43), but the deviation from mean was minimum in Arka Archana (1.25). Genotypes were laid in two groups i.e. A and B. Significant variation among the genotypes was noted for germination percentage. While consideration of germination percentage, Arka Archana & Arka Poornima were under A group and Arka Kamini & Arka Aadya were under B group. Among the genotypes mean value of vigour index were varied within a ranged from 481.30 to 588.89. The deviation from mean also varied with a range from 20.72- 83.72. Maximum mean value of vigour index was determined for Arka Aadya (588.89) but the deviation from mean was maximum in Arka Poornima (83.72). Minimum mean value was determined for Arka Kamini (481.30) but the deviation from mean was minimum in Arka Archana (20.72). Genotypes were laid in two groups i.e. A and B. Varieties significantly varied among themselves for this parameter considering. Arka Archana was under BA group, Arka Kamini was under B group and Arka Aadya & Arka Poornima under were A group during consideration of this parameter.

So, just after harvesting Arka Poornima showed highest germination percentage and Arka Aadya showed highest vigour index.

Four months after storage the mean value of treatments over varieties of root length varied between 3.83 cm and 4.15cm and the deviation from mean ranged from 0.60 to 0.64. Highest mean value of root length was recorded after aluminium foil packet (4.15cm) but the deviation from mean was maximum

for cloth bag (0.64). Minimum mean value was found for earthen pot (3.83cm), the deviation from mean was minimum for cloth bag (0.60). Root length did not significantly vary among the genotypes. All the varieties were considered under same group. Among the treatments averaged over varieties, mean value of shoot length ranged from 1.68 cm to 1.93 cm. The deviation from mean also varied within a range between 0.1 and 0.61. Maximum mean value of shoot length was found for aluminium foil packet (1.93 cm) and the deviation from mean was also maximum for aluminium foil packet (0.61). Shortest shoot was found in earthen pot (1.68 cm) and minimum deviation from mean was also found for earthen pot (0.01). Shoot length also did not significantly varied among the varieties. Leading to consideration of all the varieties were under same group. Mean value of seedling length ranged from 5.51 cm to 6.08 cm and the deviation from mean varied within a range between 0.50 and 0.59. Longest seedlings were recovered for aluminium foil packet (6.08 cm) but the deviation from mean was maximum for cloth bag (0.59) while seedlings were shortest for earthen pot (5.51cm) for the deviation from mean was also minimum for earthen pot (0.50). Similar to root and shoot length, seedling length did not significantly vary among the varieties, which ultimately considered the varieties within the same group.

Among the treatments averaged over varieties, mean value of seedling fresh weight ranged from 0.70g to 0.87g. The deviation from mean varied within a range between 0.08 and 0.1 Maximum mean value of seedling fresh weight was recorded as 0.87g for aluminium foil packet, but the deviation from mean was maximum for paper packet & cloth bag (0.1). While both the mean value and deviation from mean were minimum for earthen pot. Though the treatments did not vary significantly among themselves for this parameter, these were grouped as aluminium foil packet was in A group polythene packet, paper packet and cloth bags were under BA group, and earthen pot was under B group. Mean value of dry weight ranged from 0.40 g to 0.43 g, and the deviation from mean varied within 0.04-0.06. Average seedling dry weight was as maximum as 0.43 g for aluminium foil packet, Polythene packet & paper packet, and the deviation from mean was maximum for aluminium foil packet & paper packet (0.06). Minimum mean values as well as maximum deviation from mean were recorded as minimum for earthen pot. Dry weight of seedling also did not significantly vary among the varieties leading to formation of a single group with the treatments. Treatment mean values of germination percentage varied from 61.03 to 66.53 and the deviation from mean ranged between 5.11-5.69. Mean germination percentage was found as maximum as 66.53 for aluminium foil packet, but the deviation from mean was maximum for polythene packet (5.69). Minimum mean value was recorded for earthen pot (61.03) but minimum deviation from mean was noted for paper packet (5.11). All the treatments constituted a single group only, probably may be due to non-significant variation within the treatments for germination percentage. The range of mean value of vigour index was 336.56 to 403.87 and the deviation from mean ranged between 37.9 and 54.8. Mean value of vigour index was found as maximum for aluminium foil packet (403.87), but the deviation from mean was maximum for cloth bag (54.8). It was of minimum value for earthen pot (336.56) and the deviation from mean was minimum for polythene packet (37.9). Though significant treatments could not be assigned, the treatments were grouped as aluminium foil packet under A group polythene packet, paper packet & cloth bag was under BA group and earthen pot under B group.

At four months after storage aluminium foil packet showed the highest germination and vigour index than other treatments. So, at four months after storage aluminium foil packet i.e., aluminium foil packet is best. So, deterioration of China Aster is faster due to storage.

Table3: Eight months after storage

Treatment	No of varieties	Root length (cm) Mean±SD	Shoot length (cm) Mean±SD	Seedling length (cm) Mean±SD	Fresh weight (g) Mean±SD	Dry weight (g) Mean±SD	Germination (%) Mean±SD	vigour index Mean±SD
Aluminium foil packet	4	3.99 ^A ±0.65	1.81 ^A ±0.19	5.81 ^A ±0.53	0.78 ^A ±0.1	0.42 ^A ±0.062	46.54 ^A ±5.55	269.58 ^A ±31.41
Polythene packet	4	3.98 ^A ±0.65	1.72 ^A ±0.21	5.61 ^A ±0.54	0.72 ^A ±0.08	0.41 ^A ±0.057	44.94 ^A ±5.78	251.69 ^{BA} ±32.98
Paper packet	4	3.86 ^A ±0.65	1.70 ^A ±0.10	5.56 ^A ±0.54	0.71 ^A ±0.08	0.41 ^A ±0.061	43.51 ^A ±5.86	241.61 ^{BA} ±32.88
Cloth bag	4	3.80 ^A ±0.62	1.65 ^A ±0.22	5.46 ^A ±0.50	0.67 ^A ±0.08	0.40 ^A ±0.039	41.91 ^A ±5.71	228.24 ^{BA} ±31.13
Earthen pot	4	3.72 ^A ±0.62	1.57 ^A ±0.22	5.29 ^A ±0.53	0.66 ^A ±0.09	0.39 ^A ±0.034	41.28 ^A ±5.15	217.69 ^B ±26.18
SEm (±)		0.165	0.054	0.0136	0.021	0.011	1.45	8.009
LSD (0.05)		NS	NS	NS	NS	NS	NS	NS

Eight month after storage significant variation could not be observed among the performance of storage containers for germination (%) and both fresh and dry weight of seedlings, while it was significant only for vigour index. Average weight of seedlings produced from seeds stored in different containers ranged from 0.66g to 0.78g within the deviation from mean a range of 0.08-0.1 Maximum fresh weight was found for aluminium foil packet (0.78g) and the deviation from mean was also maximum for aluminium foil packet (0.1) while minimum seedling fresh weight was found for earthen pot (0.66g) with moderate the deviation from mean (0.09). A single group was formed within the storage containers with regard to production of average seedling fresh weight ranged from 0.39 g to 0.42 g. Average seedling with a deviation from mean ranging between 0.034-0.062 Maximum dry matter accumulation seedlings produced was found in aluminium foil packet (0.42g) with the maximum deviation of aluminium foil packet (0.062) while minimum dry matter accumulation in seedlings was found from earthen pot (0.39) with the deviation from mean minimum as earthen pot (0.034). Similar to seedling fresh weight, all the storage containers constituted a single group for seedling dry weight, when average was made over varieties. Mean germination percentage ranged from 41.28-46.54 with the deviation from mean ranging between 5.15-5.86. Maximum (46.54) recorded for seeds germination percentage was stored in aluminium foil packet followed by those stored in polythene packet and paper packet. Deviation from mean was maximum for paper packet (5.86) followed by that for polythene packet and cloth bag. A single group was constituted with all the storage containers for maintenance of germination (%) after eight months of storage. When average was made over varieties, the performance of storage containers for vigour index ranged from 217.69 for earthen pot to 269.58 for aluminium foil packet. The deviation from mean varied with a range between 26.18 for earthen pot and 32.9 for polythene packet. Vigour index was identified as the single seed quality parameter for which significant variation could be noticed in performance of storage containers which may lead to group it selves as: aluminium foil packet was A group, polythene packet, paper packet and cloth bag under BA group and earthen pot under B group.

As at eight months after storage, seeds stored in aluminium foil packet recorded highest germination and vigour index, it can be recommended for storing seeds of China aster with maintenance of better seed quality storage.

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