# ***Original Research Article***

Evaluation Of Seed Germination, Establishment and Growth Of Different Adenium *(Adenium Arabicum)* Hybrids Under Prayagraj Agro-Climatic Conditions

**ABSTRACT**: An experiment was carried out during October 2021 to April 2022 in naturally ventilated polyhouse, Department of Horticulture, SHUATS, Prayagraj, in Completely Randomized Design (CRD), with five different adenium hybrids, replicated four times. Different hybrids used in this experiment were Ara Dok Dok, Mammoth, Snp, Kud Jung, Mkmk. From the present investigation it is concluded that hybrid Mammoth reported significantly better performance in all of the parameters like germination percentage(93.33%), seed vigour index(464), seedling height(5.05cm), seed viability index(93.33), Germination Speed Index (0.36), Survival percentage(93.33%), number of leaves per plant(11.17), estimated leaf area(3.69cm$^2$), taproot length(5.98cm) which is found to be at par with Kud Jung in germination percentage(93.33%), Seed viability(93.33%), Survival percentage(93.33%). Hence, the hybrid Mammoth could be recommended for Prayagraj agro-climatic conditions.

*Key words: Adenium, germination percentage, hybrids*



## 1.INTRODUCTION

*Adenium arabicum*, also known as desert rose, elephant's foot, and Adan bush, is a succulent shrub that is a member of the Apocynaceae family. A.arabicum Originally from Yemen and Saudi Arabia, has been introduced and naturalised all over the world. It is frequently used for bonsai and is grown for its glossy leaves, growth shape, and flowering features (TALUKDAR, 2012;[1] HOSSAIN, 2018) [2].

The flowers feature a floral tube made up of five sepals and five petals in various colours (DIMMITT et al., 2009;[3] McBRIDE et al., 2014) [4]. Flowers come in a variety of colours, from pink to scarlet, and shine in the sunlight. Even if the habit of the plant varies and the majority of plants grown now are hybrids, only a few cultivar names have meaningful descriptions. Both seeds and cuttings can be used to multiply the slowly growing desert

rose. In under 10 years, plants produced from seeds can generate caudexes in the most incredible shapes.

Although the plant has a wide variety of flowers, its caudex shape and development are what are most valued about it. The plant is marketed as seedlings or flowering plants and sold in vases or other similar containers. The use of the proper substrate is therefore important for the large-scale production of these species in order to give physical and chemical support, as well as to enable improved seed germination and seedling development. (SODRÉ & GOMES, 2019) [6] COLOMBO et al., 2015[5]

Florists report that the thickening of the stem base can be shaped and thus attain higher market value; however, this characteristic is not manifested when the plant is vegetatively propagated (STEGANI et al., 2019) [7]. To ensure the propagation of a species; and consequently, its sustainable exploitation, knowledge of its seed germination process is essential.

Adenium's commercialization occurred in a variety of ways. due to the high genetic variability found in the species, without being certain of the colour and shape of the flowers. Nowadays, the flower market has been organised, and plants, such as traditional potted plants, can be purchased at affordable prices in flower shops and supermarkets. Flowering plants of two to three years are common, but older plants with the most developed and sculptural caudex can also be found in some specialised florists. New hybrids are being developed, and their performance in various regions must be assessed.



## 2.MATERIALS AND METHODS

### 2.1 Experimental location, environmental conditions (climate and weather)

The field experiment entitled “Evaluation of seed germination, establishment and growth of different adenium *(Adenium arabicum)* hybrids under Prayagraj agro-climatic conditions’’ was carried out in naturally ventilated polyhouse, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj, during the season of 2021-2022. The experiment was laid out in Completely Randomized Design (CRD) with 5 hybrids and each hybrid was replicated four times.

The experimental site is being located at a latitude of 25.41º North and longitude of 81.84 º East, with an altitude of 98 meters above the mean sea level (MSL). The area of Prayagraj

comes under humid sub-tropical climate, which experiences warm humid monsoon, hot dry summer and cold dry winter. The annual mean temperature is 26.1ºC while monthly mean temperatures are 18-29ºC. The daily average maximum temperature is about 22ºC, and the minimum temperature is 9ºC. The average annual rainfall received is 1042.2 mm. At this location, the temperature reaches upto 46ºC-48ºC and the minimum temperature recorded was 4ºC-5ºC. The relative humidity ranges in this location ranges between 20-94%.

2.2 Biologic material

The experiment was conducted with 5 adenium hydrids viz. Ara Dok Dok, Mammoth, Snp, Kud Jung, Mkmk.

2.3 The experimental design and parameters determined

2.3.1 Experimental design

The trail was laid out in Completely Randomized Design (CRD) with 5 hybrids which have been replicated 4 times. 5 adenium hybrids were used. They were Ara Dok Dok ($H_1$); Mammoth($H_2$); Snp ($H_3$); Kud Jung($H_4$); Mkmk( $H_5$)

2.3.2 Seed germination Parameters

Germination percentage (%), Seed vigour index, Seed viability index, GSI (Germination Speed Index), Survival percentage (%).

2.3.3 Vegetative Parameters

Seedling height (cm), No. of leaves per plant, Estimated Leaf area ($cm^2$), Tap root length(cm)

2.4 Statistical analysis

The results and data were subjected to statistical analysis separately by using analysis of variance technique (ANOVA). The difference among treatments means was compared by using least significant difference test at 5% probability levels.

**3. RESULTS AND DISCUSSION**

3.1 Seed germination Parameters

Seed germination parameters are shown in table 1. The higher germination percentage was observed in the hybrid Mammoth (93.33%) which is found to be at par with Kud Jung

(93.33%) followed by Ara Dok Dok (86.67%), Mkmk (80%). While the lower germination percentage was observed in the hybrid Snp (60%). High germination percentages across a wide temperature range are an indication that it is unlikely that seeds exhibit dormancy. Similar results were recorded by Baskin and Baskin, (2004) [8].

The higher seed vigour index was observed in the hybrid Mammoth (464) which is found to be at par with Ara Dok Dok (445), Kud Jung (397). While the lower seed vigour index was observed in the hybrid Snp (261). Number of leaves, fresh mass, and dry mass variables are suitable for evaluating vigor based on seedling development and are used to complement the information obtained from germination test. Similar results were recorded by Barbosa et al., (2012) [9].

The highest seed viability index was observed in the hybrids Mammoth (93.33) and which is found to be at par with Kud Jung (93.33) followed by Ara Dok Dok (86.67), Mkmk (80). While the lowest seed viability index was observed in the hybrid Snp (60). Low seed viability may be related to inbreeding depression and reduced fitness resulting from homozygosity which can be severe enough to affect the viability of small and isolated wild populations. Similar results were recorded by Mattana et al., 2010 [10].

The highest germination speed index was observed in the hybrid Mammoth (0.36) which is found to be at par with Kud Jung (0.32), Ara Dok Dok (0.3), Mkmk (0.28). While the lowest germination speed index was observed in the hybrid Snp (0.18). There is a need for a germination pattern for each species because each one presents seeds with different characteristics regarding their germinative and physiological behaviours. On the other hand, GSI increased due to the germination temperature increase.Similar results were recorded by Wielewicki et al., 2006 [11].

The higher survival percentage was observed in the hybrids Mammoth (93.33%) and which is found to be at par with Kud Jung (93.33%) followed by Ara Dok Dok (86.67%), Mkmk (80%). While the lower survival percentage was observed in the hybrid Snp (60%). A germinated seed is highly vulnerable to lack of moisture for growth, fire, herbivores, burial under litter, being washed away by rain, and heat on bare soil, and hence up to 90% of released seed will not make it past the seedling stage. Similar results were recorded by Van der Walt, K.2017 [12].

3.2. Vegetative Parameters

The taller seedling height was observed in the hybrid Mammoth (7.83 cm) which is found to be at par with Ara Dok Dok (7.18 cm). While the shorter seedling height was observed in the

hybrid Snp (5.22 cm). The rate of plant growth is influenced by the substrates used. Similar results were recorded by R. C. Colombo et al.2017 [13].

More number of leaves per plant was observed in the hybrid Mammoth (11.17) which is found to be at par with Ara Dok Dok (10.83), Kud Jung (10.17), Mkmk(10.17). While the lesser number of leaves per plant was observed in the hybrid Snp (9). A higher number of leaves in adenium is related to more vigorous seedlings because of greater germination potential; and consequently, higher speed of leaf formation. Similar results were recorded by Mondo et al., (2012) [14].

The maximum leaf area was observed in the hybrid Mammoth (3.69$cm^2$) which is found to be at par with Ara Dok Dok (3.24$cm^2$), Kud Jung (2.69$cm^2$). While the minimum leaf area was observed in the hybrid Snp (1.56$cm^2$).

The highest taproot length was observed in the hybrid Mammoth(5.98cm) which is found to be at par with Ara Dok Dok (5.72cm), Kud Jung (4.55cm), Mkmk (4.33cm). While the lowest taproot length was observed in the hybrid Snp (3.1cm). Variations in root growth in the different substrates were attributed to their particle size conditions, which may or may not enable rooting, depending on the aeration conditions. Similar results were recorded by Silva et al ;2017 [15].



| Notation | Name of the hybrid | Germination percentage | Seed vigour index | Seed viability index | Germination speed index | Survival percentage |
|---|---|---|---|---|---|---|
| H1 | Ara Dok Dok | 86.67 | 302.33 | 86.67 | 0.3 | 86.67 |
| H2 | Mammoth | 93.33 | 326.00 | 93.33 | 0.36 | 93.33 |
| H3 | Snp | 60 | 109.67 | 60 | 0.18 | 60 |
| H4 | Kud Jung | 93.33 | 193.00 | 93.33 | 0.32 | 93.33 |
| H5 | Mkmk | 80 | 174.67 | 80 | 0.28 | 80 |
| | F-TEST | S | S | S | S | S |
| | SE.d (±) | 10.33 | 35.89 | 10.33 | 0.05 | 10.33 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | $CD_{0.05}$ | 23.31 | 81.00 | 23.31 | 0.11 | 23.31 |
| | CV | 15.3 | 19.88 | 15.3 | 21.09 | 15.3 |

**Table 1. seed germination parameters of different adenium hybrids**

**Table 2. Vegetative parameters of different adenium hybrids**

| Notation | Name of the hybrid | Seedling height | | | | | No.of leaves per plant | | | | | Estimated leaf area | Taproot length |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 60 DAT | 90 DAT | 120 DAT | 150 DAT | 180 DAT | 60 DAT | 90 DAT | 120 DAT | 150 DAT | 180 DAT | | |
| H1 | Ara Dok Dok | 3.47 | 4.55 | 5.13 | 6.17 | 7.18 | 3.17 | 5.5 | 7 | 9.33 | 10.83 | 3.24 | 5.72 |
| H2 | Mammoth | 3.55 | 4.64 | 5.17 | 6.53 | 7.83 | 3.17 | 5.67 | 8 | 10.5 | 11.17 | 3.69 | 5.98 |
| H3 | Snp | 1.78 | 2.85 | 3.88 | 4.42 | 5.22 | 2.17 | 3.5 | 6.17 | 7.83 | 9 | 1.56 | 3.1 |
| H4 | Kud Jung | 2.08 | 3.08 | 4.22 | 4.67 | 5.63 | 2.83 | 5.33 | 7 | 8.93 | 10.17 | 2.69 | 4.55 |
| H5 | Mkmk | 2.18 | 3.35 | 4.25 | 4.73 | 5.48 | 2.33 | 5 | 6.77 | 8.5 | 10.17 | 1.58 | 4.33 |
| | F-TEST | S | S | S | S | S | S | S | S | S | S | S | S |
| | SE.d (±) | 0.31 | 0.31 | 0.43 | 0.56 | 0.7 | 0.3 | 0.62 | 0.47 | 0.75 | 0.62 | 0.67 | 0.8 |
| | $CD_{0.05}$ | 0.7 | 0.71 | 0.96 | 1.27 | 1.58 | 0.67 | 1.41 | 1.06 | 1.69 | 1.39 | 1.51 | 1.81 |
| | CV | 14.18 | 10.38 | 11.53 | 13.01 | 13.68 | 13.36 | 15.28 | 8.21 | 10.14 | 7.33 | 32.16 | 20.71 |

## 4.CONCLUSION

It is concluded from the present investigation that the 5 adenium hybrids under study showed significant variation in all the parameters observed. The hybrid Mammoth reported significantly better performance in all of the parameters like germination percentage(93.33%), seed vigour index(464), seedling height (5.05cm), seed viability index (93.33), Germination Speed Index (0.36), Survival percentage (93.33%), number of leaves per plant (11.17), estimated leaf area (3.69cm$^2$), taproot length (5.98cm) which is found to be at par with Kud Jung in germination percentage(93.33%), Seed viability(93.33%), Survival percentage(93.33%). Hence, the hybrid Mammoth could be recommended for Prayagraj agro-climatic conditions.

## REFERENCES


1.Talukdar, T. (2012). Development of NaCl-tolerant line in an endangered ornamental, Adenium multiflorum Klotzsch through in vitro selection. *International Journal of Recent Scientific Research.* **3**(10): 812-821.

2. Hossain, A. (2018). A review on Adenium obesum: A potential endemic medicinal plant in Oman. *Beni-Suef University Journal of Basic and Applied Science.* **7**(1): 559–563.

3. Dimmitt, M.; Joseph, G.; Palzkill, D (2009). Adenium: Sculptural Elegance, Floral Extravagance. Tucson: Scathingly Brilliant Idea: 152

4. Mcbride, K.M.; Henny, R.J.; Chen, J.; Mellich, T.A. (2014). Effect of light intensity and nutrition level on growth and flowering of Adenium obesum 'Red' and 'Ice Pink'. *HortScience,* **49**(4): .430-433

5. Colombo, R.C., Favetta, V., Yamamoto, L.Y., Alves, G.A.C., Abati, J., Takahashi, L.S.A., De Faria, R.T. (2015). Biometric description of fruits and seeds, germination and imbibition pattern of desert rose [*Adenium obesum* (Forssk.), Roem. & Schult.]. *Journal of Seed Science*. **37**(4): 206-213.

6. Sodré, G. A.; Gomes, A. R. S (2019). Cocoa propagation, technologies for production of seedlings. *Revista Brasileira de Fruticultura,* **41**(2): 782.

7. Stegani, V., Alves, G.A.C., de Melo, T.R., Colombo, R.C., Biz, G., de Faria, R.T. (2019). Growth of fertigated desert rose in different nitrate/ammonium proportion. *Ornamental Horticulture*.**25**(1): 18-25.

8. Baskin, J.M. and Baskin, C.C. (2004) A Classification System for Seed Dormancy. *Seed Science Research*, 14, 1-16.

9. Barbosa, R. M.; et al. (2012). Electrical conductivity and water content in peanut seeds. *Ciência Rural,* **42**(1): 45-51.

10. Mattana, E., Daws, M.I., Bacchetta, G., (2010). Comparative germination ecology of the endemic Centranthus amazonum (Valerianaceae) and its widespread congener Centranthus ruber. *Plant Species Biology* **25**(3): 165–172

11. Wielewicki, A.P.; Leonhardt, C.; Schlindwein, G.; Medeiros, A.C.S. (2006). Proposed germination patterns and water content for seeds of some forest species present in the southern region of Brazil. *Magazine Brasileira de Sementes,* **28**(3): 191-197.

12. Van der Walt, K., Witkowski, E.T.F. (2017). Seed viability, germination and seedling emergence of the critically endangered stem succulent, *Adenium swazicum*, in South Africa. *South African Journal of Botany*. **10**: 237-245

13. Colombo, R.C., Favetta, V., De Carvalho, D.U., Da Cruz, M.A., Roberto, S.R., De Faria, R.T. (2017). Production of desert rose seedlings in different potting media. *Ornamental Horticulture.* **23**(3): 250-256.

14. Mondo, V. H. V.; et al. (2012). Maize seed vigor and plant performance. *Revista Brasileira de Sementes,* **34(**1): 143-155.

15. Silva, C. B.; et al. (2017). Accelerated aging as vigor test for sunn hemp seeds. *Ciência Rural,* **47**(1): 1-6