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Effect of paclobutrazol on morphological traits in different *Adenium* varieties and genotypes

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Abstract

The present experiment entitled “Effect of paclobutrazol on morphological traits in different *Adenium* varieties and genotypes”. The experiment was conducted at Natural Ventilated Poly House, Hi-Tech Horticulture Park, Department of Horticulture, College of Horticulture, Junagadh Agricultural University, Junagadh during 2024. The experiment was laid out in Completely Randomized Design (Factorial) with twenty treatment combinations, consisting of ten level of varieties and genotypes i.e., Sunny Bunny (V1), Dancing Santa (V2), Beauty Queen (V3), Dragon Blood (V4), Butterfly Dream (V5), ADWB-78 (V6), ADWB-1 (V7), ADWB-22 (V8), ADWB-4B (V9) and ADWB-50 (V10) and two level of drenching with paclobutrazol 500 ppm (C1) and 1000 ppm (C2) four times at an interval of 40 days. The treatment was replicated two time. The results revealed that the variation due to different varieties and genotypes was found significant at 100 and 180 days after potting, minimum plant height (25.52 and 27.34 cm) was observed in Dragon Blood (V4). highest caudex girth (13.87 and 14.30 cm) was observed in Beauty Queen (V3) and highest leaf area (18.59 and 17.33 cm²) was observed in Dragon Blood (V4). Highest number of leaves (64.06 and 69.68) were found in ADWB-22 (V8) and highest number of branches (7.33 and 7.66) were recorded in ADWB- 4B (V9). The results indicated that the variation in response to different concentrations of paclobutrazol was statistically significant at 100 and 180 days after potting, minimum plant height (26.88 and 28.14 cm) was observed in 1000 ppm paclobutrazol (C2). Maximum number of branches (6.28 and 6.53) and number of leaves (58.80 and 62.61) were also recorded in 1000 ppm paclobutrazol (C2). While maximum caudex girth (13.38 and 14.00 cm) and leaf area (16.49 and 15.15 cm²) was observed in 500 ppm concentration (C1). The interaction effect of different varieties/genotypes and paclobutrazol concentration was found non-significant for all parameter except leaf area. highest leaf area (24.88 and 23.11 cm²) was noted in treatment combination of Dragon Blood with 500 ppm paclobutrazol concentration (V4C1) at 100 and 180 days after potting. From the results, it can be concluded that minimum plant height was noted in Dragon Blood with drenching 1000 ppm paclobutrazol at 100 and 180 days after potting, four times at an interval of 40 days in *Adenium*.

Keywords: *Adenium*, varieties, genotypes, paclobutrazol

1. Introduction

Adenium obesum (Forssk.) Roem. and Schult., also known as desert rose, mock azalea, impala lily and sabi star. It belongs to the Apocynaceae family. It is spectacular succulent and has been a very popular ornamental plant since decades. *Adenium obesum*, is a highly variable taxon in growth and flowering habit and found across all Africa, South Sahara, Kenya and from Senegal to Sudan (Dimmitt and Hanson, 1991) ^[5]. This plant has gained the Royal Horticultural Society's Award of Garden Merit. In Thailand, the interest for growing it as a pot plant has been specifically increasing as a result of an increasing demand of plants for landscape and indoor decoration (Wannakrairoj, 2008) ^[25].

Adenium obesum is a semi-evergreen plant, if kept warm in winter and well-watered. They can also combat a drought or cold induced dormancy of several months, which is one of the genetic strengths of *Adenium obesum*. Despite their beauty and ease of culture, *Adeniums* are not nearly as popular as one might expect. Perhaps they simply haven't received the exposure they deserve. The plant retains its beauty even during dormancy due to the trunk of an interesting shape having a thickening below caudex. *Adenium* is one of the popular low maintenance flowering pot plants, with great relevance in the ornamental market due to its sculptural aspect, resistance to drought stress. They can be grown for many years in a pot and are commonly used for making bonsai. Compact growth habit, thick trunk like structure with

showy caudex, good branching and flowering with high level of divergence for flower colour makes *Adenium* a desirable pot plant to display in balconies, in verandas as well as is excellent plant for xeriscaping and roof top gardens (Chavan *et al.*, 2016) [4].

The significant plant growth inhibitor that slows down plant growth and raises the aesthetic and financial value of many attractive crops used in floriculture is paclobutrazol. Early research identified it as PP333 and it was marketed commercially under the trade names Bonzi, Paczol, Cultar and Parlay (Lever, 1986) [12]. It inhibits the oxidation of kaurene to kaurenoic acid and is a strong regulator of gibberelin production (Rademacher, 2000) [19]. It also act as an anti-gibberelin, preventing gibberelins from acting yet, cell division occurs but cell enlargement is inhibited, resulting in slowed plant growth. This regulates plant height and vegetative growth (Latimer, 1991) [11] and encourages flowering (Koranski *et al.*, 1979) [9]. According to Lever (1986) [12], it competes for the same active site rather than inhibiting the activity of applied exogenous or endogenous GA3. Additionally, it makes woody plants more drought-tolerant (Swietlik and Miller, 1983) [23].

Adenium, a widely admired ornamental plant, is valued for its unique caudex and adaptability to arid conditions. However, excessive vegetative growth can reduce its aesthetic appeal and delay flowering. Paclobutrazol, a plant growth retardant, is known to inhibit gibberellin biosynthesis, leading to compact growth, enhanced branching and early flowering. By evaluating different concentrations and application methods, this research aims to identify the most effective treatment for improving plant form and floral display.

Materials and Methodology

The present investigation was carried out to study the “Effect of paclobutrazol on morphological traits in different *Adenium* varieties and genotypes” during the year 2024 at Natural Ventilated Poly House of 9.5 m x 21.35 m size erected at Hi-tech Horticulture Park, College of Horticulture, JAU, Junagadh was used to conduct the experiment. U.V. stabilized 200 µm thickness polyhouse film was used as cladding material. Geographically, Junagadh is situated at 21.50 N latitude and 70.50 E longitude and an altitude of about 60 meters above the mean sea level (MSL). This station is about 80 kilometres away from the Arabian Sea shore and on the Western side at the foothill of Mount Girnar. The experiment was laid out in Completely Randomized Design (Factorial) with twenty treatment combinations, consisting of ten level of varieties/genotypes and two level of paclobutrazol was drenched four times at an interval of 40 days. The treatment was replicated two time. The present investigation was conducted on six months old grafted different *Adenium* varieties and genotypes. Earthen round pot were used with top diameter 30 cm and pot height 25 cm. Growing media viz., Cocopeat: FYM: Garden soil: Sand in composition of 1:1:1:1 (v/v) were thoroughly mixed and used for experimentation. The planting was done in the last week of January 2024. Following planting, the *Adenium* was defoliated and trimmed to a uniform height of 20 cm. The observations were recorded at 100 and 180 days after potting.

Result and Discussion

Effect of varieties and genotypes

The effect of different *Adenium* varieties and genotypes found significant in morphological traits. Minimum plant height (25.52 and 27.34 cm) at 100 and 180 days after potting in Dragon Blood (V4). However, it was found at par with Dancing Santa (V2) at 100 days after potting and Sunny bunny (V4) was found at par at 100 and 180 days after potting. Highest caudex girth (13.87 and 14.30 cm) was observed in Beauty Queen (V3) at 100 and 180 days after potting, which was at par with Dancing Santa (V2), ADWB-1 (V7) and ADWB-22 (V8) at 100 and 180 days after potting. Meanwhile Dragon Blood (V4) only found at par at 180 days after potting. The ADWB-4B (V9) had the maximum branches (7.33 and 7.66) at 100 and 180 days after potting. Significantly maximum number of leaves (64.06 and 69.68) found in ADWB-22 (V8) at 100 and 180 days after potting. Meanwhile, it was at par with Dancing Santa (V2) and Dragon Blood (V4) at 100 days after potting and Beauty Queen (V3) at 100 and 180 days after potting. Highest leaf area (18.59 and 17.33 cm²) was observed in Dragon Blood (V4) at 100 and 180 days after potting.

Difference in morphological traits of *Adenium* different varieties and genotypes due to its combination of genetic factors, age, environmental conditions and care practices. As dwarfism of the plant is the favourable character of *Adenium* and which is the objective of the study. Number of branches, number of leaves and leaf area are important characters, which signifies canopy shape and architecture of plant. This result might be due to the genetic makeup of the cultivars. These findings are similar with those Singh *et al.* (2017) [22] and Kalpana and Fatmi (2020) [8] in *Adenium*, Parashuram *et al.* (2018) in Nerium, Baskaran *et al.* (2004), Rajivkumar *et al.* (2007) and Yadav *et al.* (2007) in Chrysanthemum [1, 16, 20, 21].



Dragon Blood



ADWB-50

Plate 1: Effect of varieties/genotypes and paclobutrazol on plant height

Table 1: Effect of varieties/genotypes and paclobutrazol on the plant height, caudex girth, number of branches, number of leaves and leaf area in *Adenium*

Treatment	Plant height (cm)		Caudex girth (cm)		Number of branches		Number of leaves		Leaf area (cm ²)	
	100 DAP*	180 DAP*	100 DAP*	180 DAP*	100 DAP*	180 DAP*	100 DAP*	180 DAP*	100 DAP	180 DAP
Factor A - Varieties and Genotypes										
V1 - Sunny Bunny	25.62	27.65	9.63	10.20	3.74	4.16	46.08	48.72	10.23	9.07
V2 - Dancing Santa	27.07	29.11	12.74	13.42	5.41	6.24	59.67	62.44	11.73	10.51
V3 - Beauty Queen	28.37	29.58	13.87	14.30	4.83	5.33	63.74	66.44	11.90	10.86
V4 - Dragon Blood	25.52	27.34	12.46	13.20	4.41	5.41	59.24	62.04	18.59	17.33
V5 - Butterfly Dream	28.57	29.87	11.36	12.07	5.33	6.00	50.83	56.11	14.03	13.11
V6 - ADWB-78	27.42	29.07	10.97	11.40	4.50	4.83	34.58	36.22	11.43	11.22
V7 - ADWB-1	28.48	29.89	12.56	13.07	4.33	4.83	37.33	39.76	13.20	11.50
V8 - ADWB-22	28.21	29.76	12.64	13.17	5.08	5.50	64.06	69.68	13.41	12.42
V9 - ADWB-4B	27.96	29.29	12.00	12.79	7.33	7.66	43.33	47.16	10.83	9.89
V10 - ADWB-50	29.61	31.34	11.84	12.6	4.91	5.41	45.83	49.97	13.04	12.16
S.Em.±	0.632	0.556	0.468	0.461	0.202	0.192	1.865	1.873	0.390	0.389
C.D. at 5%	1.86	1.64	1.38	1.36	0.60	0.57	5.50	5.52	1.15	1.15
Factor B - Paclobutrazol										
C1 - 500 ppm	28.49	30.45	13.38	14.00	3.67	4.55	42.14	45.09	16.49	15.15
C2 - 1000 ppm	26.88	28.14	10.63	11.25	6.28	6.53	58.80	62.61	9.19	8.46
S.Em.±	0.283	0.249	0.209	0.206	0.090	0.086	0.834	0.838	0.175	0.174
C.D. at 5%	0.83	0.73	0.62	0.61	0.27	0.25	2.46	2.47	0.52	0.51
Interaction: V × C										
S.Em.±	0.894	0.787	0.661	0.651	0.286	0.272	2.638	2.649	0.552	0.551
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	1.63	1.62
C.V. %	4.57	3.8	7.79	7.30	8.11	6.94	7.39	6.96	6.08	6.59

*DAP: Days after Potting

Effect of paclobutrazol

Effect of different paclobutrazol concentration on *Adenium* found significant at 100 and 180 days after potting, four time each at an interval of 40 days. Lowest plant height (26.88 and

28.14 cm) was noted in drenching of paclobutrazol 1000 ppm (C2), Highest caudex girth (13.38 and 14.00 cm) and leaf area (16.49 and 15.15 cm²) was observed in drenching 500 ppm paclobutrazol (C1). Highest number of branches (6.28 and 6.53) and numbers of leaves (58.80 and 62.61) was noted in 1000 ppm paclobutrazol (C2).

The reduction in plant height, caudex girth and leaf area might be due to because it blocks the GA₃ biosynthesis which causes reduction in speed of cell division and cell elongation of apical meristematic cells. Increase in number of branches and leaves might be explained by the fact that increasing the endogenous level of cytokinins led to increasing the formation of number of branches and leaves. Similar findings have been reported by Takane *et al.* (2019) [24] in *Adenium*, Chauhan *et al.* (2019) [3] and Lailaty and Nugroho (2022) [10] in chrysanthemum, Nader and Amani (2022) [15] in *Zinnia*, Rajiv *et al.* (2018) [20] in *Nerium*, Youssef and Abd El-Aal (2013) in *Tagar* and El-Sadek, Z. H. (2016) [6, 26] in *hibiscus*.

Interaction effect.

The data revealed that the interaction effect of varieties/genotypes and paclobutrazol was found non-significant with respect to plant height, caudex girth and number of leaves per plant at 100 and 180 days after potting except leaf area.

Interaction effect of varieties/genotypes and paclobutrazol on leaf area was reported significant at 100 and 180 days after potting. Highest leaf area (24.88 and 23.11 cm²) was noted in treatment combination of Sunny Bunny with 500 ppm paclobutrazol (V4C1). The result might be due to increasing paclobutrazol doses shows linearly reduction in leaf area has also been observed by Carvalho-Zanão *et al.* (2018) [2] in *Rose*.



V9C2



V1C1

Plate 2: Effect of varieties/genotypes and paclobutrazol on number of branches



V4C1



VIC2

Plate 3: Effect of varieties/genotypes and paclobutrazol on leaf area

Conclusion

Based on the experiment and foregoing discussion the Dragon Blood variety shows the most favourable results for reduced plant height and maximum leaf area. Highest caudex girth was observed in Beauty Queen variety, number of leaves were found in ADWB-22 genotype and highest number of branches were recorded in ADWB-4B genotype. Similarly, drenching of paclobutrazol 1000 ppm four times with an interval of 40 days showed better results for reduced plant height, maximum number of branches and leaves. Meanwhile, Paclobutrazol 500 ppm gives good results for maximum caudex diameter and leaf area. In case of interaction, drenching of 1000 ppm paclobutrazol in Dragon Blood variety given best outcomes for reduced plant height and same variety with 500 ppm paclobutrazol gives better for maximum leaf area. Hence, it is concluded that Dragon Blood variety should be drench with 1000 ppm paclobutrazol four times at an interval of 40 days for obtaining dwarfism in *Adenium*.

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