



## Assessment of Dendrobium Orchid Varieties on Growth and Yield under Different Growing Conditions

Sudeep, H. P. \*, Seetharamu, G. K., Aswath, C, Munikrishnappa, P. M., Sreenivas, K. N., Basavaraj, G. and Gowda, D. M.

Department of Horticulture, College of Horticulture, Bengaluru-65,  
University of Horticulture Sciences, Bagalkot Karnataka

\*Corresponding Author E-mail: [sudeebesati@gmail.com](mailto:sudeebesati@gmail.com)

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### ABSTRACT

An investigation was carried out at orchidarium, Regional Horticultural Research and Extension Centre, University of Horticultural Sciences campus, GKVK, Bengaluru during October 2015 to June 2017 to study the comparative performance of eight varieties of dendrobium orchid viz. Ear Sakul, Mono Red, Charming White, Bubble Gum, Sonia-17, Burana Jade, Big White and Nopporn Pink under naturally ventilated polyhouse and 50 per shade house condition. Plants grown under polyhouse condition exhibited maximum plant height, number of shoots per plant, number of pseudobulbs per plant, number of leaves per plant, leaf area and chlorophyll content in leaves (20.06 cm, 3.39, 3.57, 8.23, 38.52 cm<sup>2</sup> and 47.64 spad units respectively) during crop growth period and it was minimum (17.66 cm, 2.68, 2.87, 7.04, 34.83 cm<sup>2</sup> and 44.85 spad units respectively) under shade house condition at 18 months after planting. With respect to varieties, maximum plant height (32.21 cm) was observed in var. Mono Red and minimum in var. Burana Jade (18.87 cm), number of shoots per plant and number of pseudobulbs per plant was highest in var. Big White (3.80 and 4.50 respectively). Number of leaves per plant was found maximum in var. Big White (9.75) and minimum in var. Charming White (6.33). Largest leaf area was noticed in var. Mono Red (44.45 cm<sup>2</sup>) and smallest was found in var. Charming White (30.42 cm<sup>2</sup>). Chlorophyll content in leaves was found highest in var. Sonia-17 (57.08 spad units) and lowest in var. Charming White (38.66 spad units) The number of spikes per plant and per meter square was found highest in var. Big White (1.77 and 61.83 respectively) and it was minimum in var. Burana Jade and Nopporn Pink ( 1.17 and 40.83 respectively). Relatively vase life was highest in var. Mono Red and Big White (40.00 days) and lowest was observed in var. Nopporn Pink (20.83 days).

**Key words:** Dendrobium, Varieties, Polyhouse, Shade house, Spikes.

### INTRODUCTION

Orchids are one of the most distinctive plants of nature and highly priced in the international flower trade due to their incredible range of

diversity in size, color, shape, forms, appearance and long lasting qualities of flowers.

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Orchids belong to the family orchidaceae; it is the largest family of flowering plants with 25,000 species belonging to 600-800 genera. Dendrobium is the second largest genera of orchids which consist of 1,400 species. Dendrobium orchids are commercially grown in green house condition, it requires shade with low temperature and high humidity. The performance of any crop or variety largely depends on genotypic and environmental interaction. As a result, varieties, which perform well in one region, may not perform same in other region of varying climatic conditions. Hence, it is necessary to collect and evaluate the available varieties under polyhouse and shade house condition to find out the suitable varieties for the specific region. Keeping this in view, the present investigation was undertaken to evaluate the performance of dendrobium varieties for growth and flower production under polyhouse and shade hose condition.

#### MATERIAL AND METHODS

The present investigation was carried out at orchidarium, Regional Horticultural Research and Extension Centre, , Bengaluru during October 2015 to June 2017 to study the comparative performance of eight varieties of dendrobium orchid *Viz.* Ear Sakul ( $V_1$ ), Mono Red ( $V_2$ ), Charming White ( $V_3$ ), Bubble Gum ( $V_4$ ), Sonia-17 ( $V_5$ ), Burana Jade ( $V_6$ ), Big White ( $V_7$ ) and Nopporn Pink ( $V_8$ ) under naturally ventilated polyhouse ( $G_1$ ), and 50 per shade house condition ( $G_2$ ),

Six months old healthy rooted tissue culture plants were taken for experiment. Before planting plants were treated with 0.3 per cent bavistin solution for 15-20 minutes to avoid fungal infection. Plants were planted in five inch size plastic pots and placed on iron bench system. The iron bench is made up of GI pipes have mesh with the size of 2 meter length and 1.5 meter width and having two feet height from the ground. In shade house, plants were potted and placed on the bench system using locally available bamboo materials. The trial was conducted in form of a factorial experiment following completely

randomized design with three replications. Dendrobium plants require equal quantities of Charcoal, Brick pieces and Coco peat (1:1:1) were used as a growing media. During vegetative phase N, P and K at the ratio of 3:1:1 and during flowering blooming phase 1:2:2 were provided. The commercially available water soluble fertilizers of different grade were used as a source for nutrients and applied through foliar spray. Temperature, Relative humidity and light intensity under different growing environments were measured at weekly interval during the experimental period. All the cultural management practices were followed throughout the experiment to grow a successful crop. Five plants were selected at random in each replication for recording the observations. Various flowering, flower quality and spike production parameters were periodically recorded and analyzed statistically.

#### RESULT AND DISCUSSION

The results obtained from the present investigation are summarized below:

**Performance of growth parameters:** Data on plant height, number of shoots per plant and number of pseudobulbs per plant recorded at 18 months after planting (MAP) of growth period as influenced by growing conditions, varieties and their interaction effects are presented in Table 1.

At 18 MAP, plant height was significantly influenced by growing conditions. Plants grown under polyhouse ( $G_1$ ) recorded maximum plant height, number of shoots per plant and number of pseudobulbs per plant (20.06 cm, 3.39 and 3.57 respectively) during crop growth period and it was minimum (17.66 cm, 2.68 and 2.87 respectively) under shade house condition ( $G_2$ ). This may be due to desirable environmental conditions like optimum temperature, humidity and intensity of light provided in the polyhouse condition it helps to change in the metabolic activities like photosynthesis and respiration. In polyhouse, the short wave length range is filtered by the

polythene sheet otherwise these waves would have restricted the plant growth, whereas in the shade house, the complete filtration of short wave length could not be possible. Dendrobium grown under polyhouse with fan and pad cooled system performed better growth compare to shade house condition. Similar variation for plant height between the growing conditions was also reported by Kallihal<sup>2</sup> in carnation and Shwetha<sup>10</sup> in gerbera. These trends of results were reported by Mohanty *et al.*<sup>6</sup> in rose and Naik and Kumar<sup>7</sup> in dendrobium orchid.

Significant effect on plant height was observed in dendrobium varieties at 18 months after planting. Variety Mono Red (V<sub>2</sub>) produced highest plant height of 32.21 cm followed by var. Big White (V<sub>7</sub>) (31.92 cm). Whereas, it was observed lowest in var. Burana Jade (V<sub>6</sub>) (18.87 cm respectively). Dendrobium varieties showed significant effect for shoot production. The var. Big White (V<sub>7</sub>) produced highest number of shoots per plant of (3.80) at 18 MAP, and which was statistically on par with var. Mono Red (V<sub>2</sub>) (3.70). Whereas, var. Burana Jade (V<sub>6</sub>) which produced lowest number of shoots per plant of (2.40). Varieties had showed significant differences with respect to pseudobulb production at 18 MAP. The var. Big White (V<sub>7</sub>) recorded highest number of pseudobulbs per plant (4.50) and it was on par with var. Sonia-17 (V<sub>5</sub>) (4.13). The lowest number of pseudobulbs per plant was emerged in var. Burana Jade (V<sub>6</sub>) (2.39). This variation may be due to genetic makeup of the varieties. Similar variation in plant growth was also observed previously in dendrobium by Ramachandradu<sup>9</sup>, Sugapriya *et al.*<sup>11</sup>, Kumar and Sharma<sup>4</sup>, Gopal *et al.*<sup>1</sup> and Mehraj *et al.*<sup>5</sup>.

Plant height showed significant interaction between growing conditions and varieties. Highest plant height was recorded in G<sub>1</sub> x V<sub>2</sub> (Polyhouse x var. Mono Red) (36.01 cm) at 18 months after planting. Whereas, it was lowest in G<sub>2</sub> x V<sub>6</sub> (Shade house x var. Burana Jade) (18.01 cm). The maximum number of shoots per plant was recorded in G<sub>1</sub> x V<sub>7</sub> (Polyhouse x var. Big White) (4.90) at 18

MAP and it was on par with G<sub>1</sub> x V<sub>2</sub> (Polyhouse x var. Mono Red). Whereas G<sub>2</sub> x V<sub>6</sub> (Shade house x var. Burana Jade) was produced lowest number of shoots per plant (2.07). Pseudobulb production had showed significant interaction between growing conditions and varieties. The maximum number of pseudobulbs per plant was recorded in G<sub>1</sub> x V<sub>7</sub> (Polyhouse x var. Big White) (5.44) at 18 MAP and it was on par with G<sub>1</sub> x V<sub>5</sub> (Polyhouse x var. Sonia-17) (4.93). The minimum pseudobulb production was recorded in G<sub>2</sub> x V<sub>6</sub> (Shade house x var. Burana Jade) treatment combination. The polyhouse had favored better growth of plants than shade house might be due to desirable environmental conditions like optimum temperature, humidity and light provided in the polyhouse. Similar variation for plant height was also reported by Kallihal<sup>2</sup> in carnation, Mohanty *et al.*<sup>6</sup> in rose, Shwetha<sup>10</sup> in gerbera and Naik and Kumar<sup>7</sup> in dendrobium orchid.

Number of leaves per plant, leaf area and chlorophyll content in leaves of dendrobium recorded at 18 months after planting as influenced by growing conditions, varieties and their interaction effects are furnished in Table 2. Plants grown under polyhouse (G<sub>1</sub>) recorded maximum number of leaves per plant, leaf area and chlorophyll content in leaves (8.23, 38.52 cm<sup>2</sup> and 47.64 spad units respectively) during crop growth period and it was minimum (7.04, 34.83 cm<sup>2</sup> and 44.85 spad units respectively) under shade house condition (G<sub>2</sub>). This might be due to availability of optimum climatic condition like temperature, humidity and light. Light promotes cell division and cell elongation eventually led more number of leaf production, larger leaf area and chlorophyll content in leaves throughout the growth period. The results are in close conformity with the findings of Kaveriamma<sup>3</sup> in phalaenopsis. These findings are also in findings Mohanty *et al.*<sup>6</sup> in rose and Naik and Kumar<sup>7</sup> in dendrobium.

On the other hand at 18 months after planting of dendrobium varieties, the maximum number of leaves per plant was

recorded in var. Big White (V<sub>7</sub>) (9.75) and it was on par with var. Mono Red (V<sub>2</sub>) (8.92). While, minimum number of leaves per plant (6.42) was noticed in var. Nopporn Pink (V<sub>8</sub>). The var. Mono Red (V<sub>2</sub>) showed highest leaf area (44.45 cm<sup>2</sup>) and lowest leaf area (30.42 cm<sup>2</sup>) was recorded in var. Charming White (V<sub>3</sub>). Maximum chlorophyll content in dendrobium leaves (57.08 spad units) was found in var. Sonia-17 (V<sub>7</sub>) and it was on par with var. Big White (V<sub>7</sub>). The minimum content of chlorophyll (38.86 spad units) was noticed in var. Charming White (V<sub>3</sub>). This variation in leaf production, leaf area and chlorophyll content helps in better synthesis of photosynthesis activity and their utilization for building up of new cells. Such variation in leaf production among varieties may be governed by its varietal expression. These results are in agreement with the reports of Ramachandradu<sup>9</sup>, Sugapriya *et al.*<sup>11</sup>, Kumar and Sharma<sup>4</sup> and Gopal *et al.*<sup>1</sup> in dendrobium. The interaction between growing conditions and varieties were found non-significant with respect to leaf production, leaf area and chlorophyll content in leaves at 18 months after planting.

#### **Spike yield attributes:**

The data on spike yield per plant and per meter square in dendrobium orchid as influenced by growing conditions, varieties and their interaction are presented in Table 3. In the present investigation, plants grown under polyhouse environment recorded highest number of spikes per plant and per m<sup>2</sup> (1.48 and 51.63 respectively) as compare to shade house (1.28 and 44.92 respectively). This variation might be due to desirable optimum light intensity in combination with warmer environment and higher relative humidity inside the polyhouse. The polyhouse might have increased number of flowers had positive and significant correlation with shoots and pseudobulbs production. Thus, the increased number of leaves, leaf area on plant growth helped in better way to synthesis of carbohydrates and their utilization to give up extra growth, thereby increasing the production of spikes as compare to shade

house. These results are in close conformity with the findings of Negi<sup>8</sup> and Kaveriamma<sup>3</sup> in phalaenopsis. These findings are also in findings Mohanty *et al.*<sup>6</sup> in rose and Naik and Kumar<sup>7</sup> in dendrobium.

Varieties showed significant influence for spike yield per plant which was ranged from 1.77 to 1.13. The var. Big White (V<sub>7</sub>) recorded highest number of spikes per plant (1.77) and it was on par with var. Mono Red (V<sub>2</sub>) followed by var. Bubble Gum (V<sub>4</sub>) (1.60 and 1.43 respectively). Whereas, it was lowest (1.17) in var. Burana Jade (V<sub>6</sub>) and var. Nopporn Pink (V<sub>8</sub>). Maximum spike yield per square meter (61.83) was recorded in var. Big White (V<sub>7</sub>) and it was on par with var. Mono Red (V<sub>2</sub>) followed by var. Bubble Gum (V<sub>4</sub>) (56.00 and 50.17 respectively). While, minimum number of spikes per square meter (40.83) was found in var. Burana Jade (V<sub>6</sub>) and var. Nopporn Pink (V<sub>8</sub>). It could be due to influence of genetic makeup of the varieties. Increased number of flowers had positive and significant correlation with shoots, pseudobulbs, leaf length and leaf width. Thus, the increased number of leaves, leaf area on plant growth helped in better synthesis of carbohydrates and their utilization to build up extra growth, thereby increasing the production of flowers. Similar kinds of results were reported in dendrobium by previous authors like Ramachandradu<sup>9</sup>, Sugapriya *et al.*<sup>11</sup> Gopal *et al.*<sup>1</sup>, Kumar and Sharma<sup>4</sup>, Naik and Kumar<sup>7</sup> and Mehraj *et al.*<sup>5</sup>.

In polyhouse condition, var. Big White recorded maximum spike yield per plant and per meter square (2.07 and 72.33 respectively) and minimum spike yield (1.13 and 39.67 respectively) was noticed under shade house in Burana Jade and Nopporn Pink. Variation in spike yield might be due to interaction of varieties with varying genetically controlled character and environmental factors. Similar variation was also observed previously by Negi<sup>8</sup> and Kaveriamma<sup>3</sup> in phalaenopsis, Mohanty *et al.*<sup>6</sup> in rose and Naik and Kumar<sup>7</sup> in dendrobium.

Data indicates that the vase life results were differed significantly. There was a

statistical difference in the vase life of growing conditions. Relatively longer vase life was recorded in flower grown under polyhouse condition (31.38 days) than shade house condition (29.058 days). Similar findings were previously observed by Mohanty *et al.*<sup>6</sup> in rose and Naik and Kumar<sup>7</sup> in dendrobium. Varieties showed significant influence on vase life of

spikes. Var. Mono Red and Big White had longest vase life (40.00 and 40.00 days each respectively) followed by Ear Sakul (32.50 days). While shortest vase life of 20.83 days was recorded in var Nopporn Pink.

Higher vase life probably due to strong genetic makeup of the variety. These results are in accordance with earlier reports of Ramachandradu<sup>9</sup>, Sugapriya *et al.*<sup>11</sup> and Gopal *et al.*<sup>1</sup>. Growing conditions and varieties had shown significant influence on vase life of spikes. Relatively longest vase life was recorded in Mono Red and Big White (40.00 and 40.00 days each respectively) spikes grown under polyhouse, While shortest vase life of 19.33 days was recorded in variety Nopporn Pink under shade house.

**Table 1: Plant height, number of shoots per plant and number of pseudobulb per plant of dendrobium as influenced by growing conditions, varieties and interaction effect at 18 months after planting**

Varieties (V)	Plant height (cm)			Number of shoots per plant			Number of pseudobulbs per plant		
	G <sub>1</sub>	G <sub>2</sub>	Mean	G <sub>1</sub>	G <sub>2</sub>	Mean	G <sub>1</sub>	G <sub>2</sub>	Mean
V <sub>1</sub> -Ear Sakul	27.93	24.30	26.12	3.27	2.73	3.00	2.88	2.61	2.75
V <sub>2</sub> -Mona Red	36.01	28.41	32.21	4.27	3.13	3.70	4.00	2.97	3.48
V <sub>3</sub> -Charming White	28.69	25.05	26.87	2.80	2.33	2.57	2.77	2.13	2.45
V <sub>4</sub> -Bubble Gum	23.65	21.08	22.36	3.40	2.80	3.10	3.05	3.21	3.13
V <sub>5</sub> -Sonia-17	28.98	26.12	27.55	3.67	3.00	3.33	4.93	3.34	4.13
V <sub>6</sub> -Burana Jade	19.74	18.01	18.87	2.13	2.07	2.10	2.45	2.33	2.39
V <sub>7</sub> -Big White	35.78	28.06	31.92	4.67	2.93	3.80	5.44	3.55	4.50
V <sub>8</sub> -Nopporn Pink	23.16	19.61	21.39	2.93	2.47	2.70	3.07	2.80	2.94
Mean	27.99	23.83	25.91	3.39	2.68	3.04	3.57	2.87	3.22
	G	V	G X V	G	V	G X V	G	V	G X V
S.E.M. <sub>±</sub>	0.32	0.63	0.90	0.08	0.17	0.23	0.12	0.23	0.33
CD (P=0.05)	0.91	1.82	2.58	0.24	0.48	0.68	0.34	0.68	0.96

**Table 2: Number of leaves per plant, leaf area and chlorophyll content in leaves of dendrobium as influenced by growing conditions, varieties and interaction effect at 18 months after planting**

Varieties (V)	Number of leaves per plant			Leaf area (cm <sup>2</sup> )			Chlorophyll content in leaves (Spad units)		
	G <sub>1</sub>	G <sub>2</sub>	Mean	G <sub>1</sub>	G <sub>2</sub>	Mean	G <sub>1</sub>	G <sub>2</sub>	Mean
V <sub>1</sub> -Ear Sakul	7.17	6.33	6.75	34.61	33.19	33.90	45.92	40.44	43.18
V <sub>2</sub> -Mona Red	10.00	7.83	8.92	49.07	39.82	44.45	48.30	45.63	46.96
V <sub>3</sub> -Charming White	6.83	5.83	6.33	31.15	29.70	30.42	40.82	36.51	38.66
V <sub>4</sub> -Bubble Gum	7.83	7.50	7.67	40.76	37.00	38.88	43.49	38.27	40.88
V <sub>5</sub> -Sonia-17	7.67	7.00	7.33	40.29	37.03	38.66	57.37	56.79	57.08
V <sub>6</sub> -Burana Jade	8.17	7.67	7.92	43.99	37.64	40.82	44.04	44.28	44.16
V <sub>7</sub> -Big White	11.33	8.17	9.75	35.59	34.66	35.13	56.40	53.95	55.18
V <sub>8</sub> -Nopporn Pink	6.83	6.00	6.42	32.67	29.57	31.12	45.15	42.93	44.04
Mean	8.23	7.04	7.64	38.52	34.83	36.67	47.69	44.85	46.27
	G	V	G X V	G	V	G X V	G	V	G X V
S.E.M. <sub>±</sub>	0.21	0.43	0.61	0.47	0.93	1.32	0.71	1.42	2.00
CD (P=0.05)	0.62	1.24	NS	1.34	2.69	3.80	2.04	4.08	NS

**Table 3: Number of spikes per plant, spike yield per square meter and vase life of dendrobium as influenced by growing condition and varieties**

Varieties (V)	Number of spikes per plant			Number of spikes per square meter			Vase life (Days)		
	G <sub>1</sub>	G <sub>2</sub>	Mean	G <sub>1</sub>	G <sub>2</sub>	Mean	G <sub>1</sub>	G <sub>2</sub>	Mean
V <sub>1</sub> -Ear Sakul	1.33	1.33	1.33	46.67	46.67	46.67	34.00	31.00	32.50
V <sub>2</sub> -Mona Red	1.80	1.40	1.60	63.00	49.00	56.00	40.00	40.00	40.00
V <sub>3</sub> -Charming White	1.33	1.20	1.27	46.67	42.00	44.33	26.33	24.67	25.50
V <sub>4</sub> -Bubble Gum	1.60	1.27	1.43	56.00	44.33	50.17	35.00	29.67	32.33
V <sub>5</sub> -Sonia-17	1.27	1.33	1.30	44.33	46.67	45.50	27.67	26.00	26.83
V <sub>6</sub> -Burana Jade	1.20	1.13	1.17	42.00	39.67	40.83	25.67	22.00	23.83
V <sub>7</sub> -Big White	2.07	1.47	1.77	72.33	51.33	61.83	40.00	40.00	40.00
V <sub>8</sub> -Nopporn Pink	1.20	1.13	1.17	42.00	39.67	40.83	22.33	19.33	20.83
<b>Mean</b>	1.48	1.28	1.38	51.63	44.92	48.27	31.38	29.08	30.23
	<b>G</b>	<b>V</b>	<b>G X V</b>	<b>G</b>	<b>V</b>	<b>G X V</b>	<b>G</b>	<b>V</b>	<b>G X V</b>
<b>S.E.M.<sub>±</sub></b>	0.03	0.06	0.09	1.09	2.18	3.09	0.16	0.31	0.44
<b>CD ( P=0.05)</b>	0.09	0.18	0.25	3.14	6.29	8.89	0.45	0.90	1.27

### CONCLUSION

Results from the present investigation, it can be concluded that improvement in growth and cut flower production was found superior under polyhouse as compare to shade house condition. Variety Mono Red and variety Big White was found superior with respect to growth parameters like plant height, shoot and leaf production. Variety Sonia-17 had showed highest chlorophyll content in leaves. Variety Big White and Mono Red were found were found promising for cut flower production under eastern dry zone condition of Karnataka

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