



# COMPARATIVE ANALYSIS OF GROWTH AND FLORAL CHARACTERISTICS OF INDIAN BOUGAINVILLEA VARIETIES

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## Abstract

The present investigation was carried out at the Botanic Garden Division, CSIR-National Botanical Research Institute, Lucknow (U.P.), India to study the growth and flowering characteristics of Indian Bougainvillea varieties during 2013-14. Twenty five varieties were planted in open field condition. Growth and floral characteristics were recorded, analyzed and evaluated. There were significant variations for all the characters among the varieties studied. Maximum thorn density was recorded in Los Banos Variegata and Los Banos Variegata 'Silver Margin' (19.33) followed by Dr. H. B. Singh (18.33), Dr. P. V. Sane and Parthasarthy (18.00), Manohar Chandra Variegata and Pallavi (17.33). Maximum width of leaf blade was recorded in Chitra (8.10 cm) followed by Shubhra (6.60 cm), Mahatma Gandhi (6.53 cm), Los Banos Variegata 'Silver Margin' (6.03 cm), Mary Palmer Special (5.83 cm) and minimum width of leaf blade was recorded in Aruna (3.10 cm). Maximum length of bracts was recorded into Begum Sikander (4.50 cm) followed by Mary Palmer Special (4.33 cm), Parthasarthy (4.26 cm), Abhimanyu (4.20 cm), Krumbiegel (4.06 cm) and minimum length of bract was recorded in Pallavi (2.50 cm). The study indicates that performance of varieties viz., Shweta, Shubhra, Pallavi, Mary Palmer Special, Aida Variegata, Manohar Chandra Variegata, Dr. P.V. Sane, Dr. H. B. Singh, Chitra and Palekar was better in respect of growth and floral characteristics and recommended for bedding purpose in landscaping.

**Key words :** Bougainvillea, characteristics, floral, growth, varieties.

## Introduction

Bougainvillea belongs to Nyctaginaceae family and originated from Brazil. The name comes from Louis Antoine de Bougainville, a French navigator and military commander who was the first European to take note of the plant, in Brazil, in 1768 (Kobayashi *et al.*, 2007). Bougainvillea includes 18 species in which only three species (*B. glabra*, *B. spectabilis* and *B. peruviana*) and one natural hybrid species (*B. x buttiana*) are horticulturally important. In India, *B. glabra* species was introduced in Agricultural and Horticultural Society of India at Alipore, Calcutta in 1869 (Roy *et al.*, 2012). First developed variety of Bougainvillea in India was 'Scarlet Queen Variegata' in 1926 by S. Percy Lancaster (Roy *et al.*, 2015).

Bougainvillea is a most popular ornamental shrub of tropical and sub-tropical countries. It is a thorny and woody plant having different coloured viz., white, pink, purple, red, orange, yellow bracts. The ability of

Bougainvillea to grow under high polluted conditions like traffic islands, roadsides and around industries has made the plant popular among the planners and architects. Bougainvilleas are in great demand by soft landscape architects for development of home gardens, factory gardens, municipal gardens, multinational companies, indoor and outdoor landscape, slope of river bank, sides of railway track, railway station, airport surroundings and historical monuments. Bougainvillea floral bracts are the rich source of betalain pigments particularly betacyanin which can be used as a natural colourant in food industries (Sindhu *et al.*, 2015). Bougainvillea performs best in sunny, hot climate and high light intensity. Although, Bougainvillea had originated in Brazil, but approximately 50% of the present day varieties were developed and produced in India and has good collection of germplasm of Bougainvilleas. Many R & D institutions (National Botanical Research Institute, Lucknow; Indian Agricultural Research Institute, New Delhi; Indian Institute of Horticultural Research, Bengaluru; Bhabha Atomic Research Centre, Trombay, Mumbai and The

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Agri-Horticultural Society of India, Alipore Road, Kolkata) in India have been maintaining the authentic germplasm collections and doing research and improvement work.

### Materials and Methods

The present experiment was carried out in the Botanic Garden Division, CSIR-National Botanical Research Institute, Lucknow during 2013-14. Twenty five varieties *viz.*, Abhimanyu, Aida Variegata, Aruna, Begum Sikander, Chitra, Dr. H.B. Singh, Dr. P.V. Sane, Dr. R.R. Pal, Gopal, Krumbiegel, Los Banos Variegata 'Silver Margin', Los Banos Variegata, Mahatma Gandhi, Manohar Chandra Variegata, Mary Palmer Special, Palekar, Pallavi, Partha, Parthasarthy, Shubhra, Shweta, Tetra Mrs. McClean, Vishakha, Wajid Ali Shah and Zakiriana Variegata were planted in open field condition. The experiments were laid out in randomized block design with three replications at spacing of 5 × 5 m. Well decomposed farm yard manure (5-7 kg), bone meal (250 g), neem cake (250 g), superphosphate (250 g) and potash (50 g) is mixed with the soil per plant basis (Lancaster, 1923). The experimental site was kept free of weed by periodical hand weeding. Regular irrigations were given as and when required, during crop growth period. Nuvan (Dichlorvos 76% EC) @ 0.2% spray to control the leaf eating caterpillar at 30 days intervals. Uniform package of practices were followed throughout the experiment to grow a healthy crop. Growth characteristics (Plant growth habit, internodes length, thorn length, thorn density, thorn diameter, thorn curvature, leaf blade length, leaf blade width, leaf blade shape, leaf blade main colour and leaf blade secondary colour) and floral characteristic (Inflorescence length, bract type, bract length, bract width, bract shape, bract colour, presence of flowers and number of bract clusters) and colour were recorded full bloom stage and statistically analyzed to draw conclusion.

### Results and Discussion

The experiment represented data in tables 1 and 2 showed that the varieties differed significantly. The wide variation was observed in all growth and floral characteristics of Indian Bougainvillea varieties.

#### Growth characteristics

The internodes length varied from 1.66 to 5.23 cm. Maximum internode length was observed in Shweta (5.23 cm) followed by Wajid Ali Shah (4.83 cm), Chitra (4.40 cm), Dr. H.B. Singh (3.43 cm) and Partha (3.40 cm). Minimum internodes length was observed in Abhimanyu (1.66 cm). Thorn character is a prominent character of this crop. Thorn length is varied from 0.73 to 2.23 cm. Minimum thorn length 0.73 cm was recorded in Pallavi,

Shweta and Tetra Mrs. McClean. Maximum thorn length 2.33 cm was recorded in Dr. H.B. Singh. Thorn diameter is varied from 0.10 to 0.43 cm. Minimum thorn diameter was recorded in Aruna (0.10 cm) and maximum in Wajid Ali Shah (0.43 cm). Maximum thorn density was observed in Los Banos Variegata and Los Banos Variegata 'Silver Margin' (19.33) followed by Dr. H.B. Singh (18.33), Parthasarthy and Dr. P.V. Sane (18.00) and Manohar Chandra Variegata and Pallavi (17.33).

Wide variation was observed in leaf blade length and width. Leaf blade length ranged from 5.40 to 11.33 cm and leaf blade width ranged from 3.10 to 8.10 cm. Maximum leaf blade length was recorded in Mahatma Gandhi (11.33 cm) followed by Palekar (10.43 cm), Parthasarthy (9.83 cm), Shweta (9.73 cm), Begum Sikander (9.66 cm), Dr. H.B. Singh (9.63 cm). Minimum leaf blade length was recorded in Aruna (5.40 cm). Maximum leaf blade width was recorded in Chitra (8.10 cm) followed by Shubhra (6.60 cm), Mahatma Gandhi (6.53cm), Los Banos Variegata 'Silver Margin' (6.03), Mary Palmer Special (5.86 cm), Parthasarthy (5.83 cm) and minimum leaf blade width was 3.10 cm in Aruna.

In qualitative growth characters study, four types of plant growth habits were recorded. One variety shown upright; 11 varieties shown semi-upright; 8 varieties shown spreading and 5 varieties showed drooping type growth habits. Two types of thorn curvature (straight and slightly curved) were recorded in present study. Straight thorn curvature founded in 20 varieties and slightly curved in five varieties. Four types of leaf blade shapes were recorded; elliptic (07 varieties), lanceolate (01 variety), medium ovate (13 varieties) and broadly ovate (04 varieties). Four types of leaf blade colours were recorded; light green (01 variety), grey green (01 variety), dark green (04 varieties) and medium green (19 varieties). Out of 25 Bougainvillea varieties only eight are variegated: three types of secondary colour recorded light green (3 varieties); yellowish white (3 varieties) and yellowish green (2 varieties).

#### Floral characteristics

In tables 1 and 2, it showed the wide variation in the floral characters of Bougainvillea in both quantitative and qualitative characters. Length of inflorescence was varied from 8.33 to 40 cm. Maximum length of inflorescence was recorded in Shweta (40 cm) followed by Shubhra (35 cm), Mahatma Gandhi (30.50 cm), Vishakha (28.33 cm), Dr. H. B. Singh (23.33 cm) and minimum length of inflorescence was recorded in Dr. R. R. Pal (8.33 cm). Bracts of Bougainvillea are an attractive and important character for its beauty and usefulness in landscaping.

**Table 1 :** Comparative analysis of quantitative growth and floral characteristics of Indian Bougainvillea varieties.

Varieties	Internodes length (cm)	Thorn			Leaf Blade		Inflorescence length (cm)	Bract	
		Length (cm)	Density	Diameter (cm)	Length (cm)	Width (cm)		Length (cm)	Width (cm)
Dr. H.B. Singh	3.43	2.33	18.33	0.26	9.63	5.13	23.33	3.76	2.56
Los Banos 'Silver'	2.96	1.10	19.33	0.16	7.93	6.03	17.66	2.96	1.86
Margin Parthasarthy	3.03	1.56	18.00	0.23	9.83	5.83	16.00	4.26	3.10
Zakariana Variegata	3.16	1.46	13.66	0.23	9.16	5.66	13.67	3.56	2.43
Aida Variegata	3.26	1.86	12.00	0.16	6.83	4.73	12.67	3.56	2.96
Manohar Chandra Variegata	1.83	1.56	17.33	0.26	8.66	5.40	13.33	3.53	2.66
Abhimanyu	1.66	1.93	16.66	0.23	7.06	3.33	13.33	4.20	2.63
Los Banos Variegata	1.76	0.76	19.33	0.13	5.63	4.50	15.67	2.76	1.86
Aruna	3.23	1.23	13.66	0.10	5.40	3.10	13.33	2.56	1.73
Begam Sikandar	3.33	1.16	13.00	0.26	9.66	5.16	12.00	4.50	2.93
Chitra	4.40	1.73	9.33	0.36	8.93	8.10	9.67	4.00	3.33
Dr. R.R. Pal	3.03	1.13	11.66	0.16	5.76	3.63	8.33	3.56	2.66
Mary Palmer Special	2.06	1.70	15.33	0.30	8.23	5.86	16.00	4.33	3.53
Vishakha	2.16	1.06	15.66	0.26	8.33	4.26	28.33	3.30	2.43
Gopal	2.80	1.03	10.33	0.16	9.46	5.30	14.00	3.20	2.73
Mahatma Gandhi	2.80	1.13	11.66	0.23	11.33	6.53	30.50	3.26	4.03
Palekar	2.56	1.23	15.33	0.16	10.43	5.70	18.67	3.63	2.40
Partha	3.40	1.26	7.66	0.23	5.93	3.23	11.33	4.03	2.76
Shubhra	2.66	1.66	11.33	0.23	9.56	6.60	35.00	3.56	2.66
Shweta	5.23	0.73	14.33	0.16	9.73	4.83	40.00	3.93	2.30
Tetra Mrs. McClean	2.50	0.73	11.66	0.16	7.73	5.50	14.00	3.13	2.83
Wajid Ali Shah	4.83	0.93	9.66	0.43	6.60	4.00	11.33	3.86	2.90
Dr. P. V. Sane	3.00	1.16	18.00	0.23	8.33	5.46	16.00	3.93	2.63
Kumbiegel	3.00	0.96	10.66	0.23	7.20	4.26	20.33	4.06	3.36
Pallavi	2.23	0.73	17.33	0.20	7.26	4.76	17.00	2.50	1.10
SEm±	0.26	0.08	1.21	0.03	0.33	0.19	1.77	0.27	0.07
CD(0.05)	0.75	0.23	3.45	0.09	0.94	0.54	5.06	0.77	0.21

The Bougainvillea bracts blooms only five-six weeks long and then they fall off (Gordon, 2002). Size and colour of bracts is highly important, desired and sought after traits (Saifuddin *et al.*, 2009). Length of bract was varied from 2.50 to 4.60 cm. Maximum bracts length was recorded into Begum Sikander (4.50 cm) followed by Mary Palmer Special (4.33 cm), Parthasarthy (4.26 cm), Abhimanyu (4.20 cm), Krumbiegel (4.06 cm). Minimum bract length was recorded in Pallavi (2.50 cm). Maximum bract width was recorded in Mahatma Gandhi (4.03 cm) and minimum

in Pallavi (1.10 cm). Such a wide range of variability for bracts size in Bougainvillea varieties is due to environmental, physiological and soil factors (Tewari and Arya, 2006).

Out of 25 varieties, 21 varieties have flowers and in three varieties flower are absent. In this studies, two types of bracts; single (21 varieties) and multiple (3 varieties) were recorded. Four types of bracts shape; narrowly ovate (3 varieties), medium ovate (15 varieties), broadly

**Table 2:** Comparative analysis of qualitative growth and floral characteristics of Indian Bougainvillea varieties.

Varieties	Plant growth habit	Thorn Curvature	Leaf Blade			Bract			Presence of Flowers	Number of Bract clusters
			Shape	Main colour	Secondary colour	Type	Shape	colour		
Pallavi	Spreading	Straight	Medium ovate	Medium green	Light Green	Multiple	Medium ovate	Pink	Absent	Few
Dr. P.V. Sane	Upright	Slightly curved	Medium ovate	Medium green	Yellowish green	Single	Medium ovate	Pink	Present	Medium
Los Banos Variegata 'Silver Margin'	Spreading	Straight	Broadly ovate	Medium green	Light green	Multiple	Narrowly ovate	Pink	Absent	Many
Parthasarthy	Semi-upright	Straight	Elliptic	Medium green	Yellowish white	Single	Medium ovate	Pink	Present	Few
Zakiriana Variegata	Semi-upright	Straight	Medium ovate	Medium green	Yellowish green	Single	Medium ovate	Pinkish-orange	Present	Few
Aida Variegata	Spreading	Straight	Medium ovate	Medium green	Yellowish green	Single	Broadly ovate	Magenta	Present	Medium
Manohar Chandra Variegata	Semi-upright	Straight	Medium ovate	Medium green	Light green	Single	Medium ovate	Pink	Present	Many
Abhimanyu	Spreading	Straight	Elliptic	Grey green	Yellowish white	Single	Medium ovate	Pink	Present	Many
Los Banos Variegata	Drooping	Slightly curved	Broadly ovate	Dark green	Yellowish white	Single	Narrowly ovate	Pink	Absent	Many
Aruna	Drooping	Straight	Medium ovate	Medium green	None	Single	Medium ovate	Orange	Present	Few
Begum Sikander	Semi-upright	Straight	Medium ovate	Medium green	None	Multiple	Broadly ovate	White	Present	Few
Chitra	Semi-upright	Straight	Broadly ovate	Dark green	None	Multiple	Broadly ovate	Magenta	Present	Medium
Gopal	Semi-upright	Slightly curved	Medium ovate	Medium green	None	Single	Medium ovate	Magenta	Present	Many
Mary Palmer Special	Semi-upright	Straight	Broadly ovate	Dark green	None	Single	Broadly ovate	Greenish white and Pink	Present	Medium
Vishakha	Semi-upright	Slightly curved	Elliptic	Medium green	None	Single	Medium ovate	Pink	Present	Medium
Dr. H. B. Singh	Drooping	Straight	Elliptic	Medium green	None	Single	Medium ovate	Mauve	Present	Medium
Mahatma Gandhi	Spreading	Slightly curved	Medium ovate	Medium green	None	Single	Broadly ovate	Pink	Present	Medium
Palekar	Drooping	Straight	Elliptic	Medium green	None	Single	Medium ovate	Pink	Present	Medium
Partha	Spreading	Straight	Elliptic	Medium green	None	Single	Medium ovate	Pink	Present	Many
Shubhra	Semi-upright	Straight	Medium ovate	Medium green	None	Single	Medium ovate	White	Present	Many
Shweta	Drooping	Straight	Lanceolate	Dark green	None	Single	Narrowly ovate	White	Present	Many
Tetra Mrs. McClean	Semi-upright	Straight	Medium ovate	Medium green	None	Single	Circular	Pinkish-orange	Present	Few
Wajid Ali Shah	Semi-upright	Straight	Medium ovate	Light green	None	Single	Medium ovate	White	Present	Medium
Dr. R. R. Pal	Spreading	Straight	Medium ovate	Medium green	None	Single	Medium ovate	White	Present	Few
Krumbiegel	Spreading	Straight	Elliptic	Medium green	None	Single	Broadly ovate	Magenta	Present	Medium

ovate (6 varieties) and circular (01 variety) were recorded. There is a wide variation in Bougainvillea bracts colour. Out of 25 varieties, seven colour were recorded viz., 12 varieties have pink colour, magenta and white were represented by four varieties each, two varieties have pinkish-orange, orange, mauve and greenish white were represented by one variety each. The bracts cluster is also varied from few clusters to many clusters, seven varieties showed few clusters, ten varieties showed medium clusters and eight varieties showed many cluster of bracts in inflorescence.

The present investigation showed that each variety has a great diversity of their morphological characteristic under open field conditions. For the identification, breeding and landscape purpose it is very important to know the peculiar characters of varieties, to overcome the confusion of the varieties which are developed by a breeder, nurserymen or a scientist. These parameters are the ideal for the characterization purpose.

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