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## Morphological characterization of bougainvillea (*Bougainvillea* spp.) cultivars

Supriya N, Pooja Gupta, Nandan Mehta and Gaurav Sharma

### Abstract

The investigation carried out at Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.), India with objective to study morphological characters of 32 bougainvillea cultivars replicated thrice during the year 2018-19. The results revealed that there was significant variation observed and every cultivar got some diagnostic character which differs from each other. The cultivar Shweta showed reflexed bract type and cv. Zakiriana, Shubra, Queen Violet showed straight bract reflexion. The leaf shape of cv. Shweta and Magnifica noticed lanceolate type. The cultivar Gopal and Shweta recorded attenuate type of leaf base shape. The cultivars Scarlet O Hara and Zakiriana observed hairy leaf texture. The secondary leaf colour in cultivar Dr. Rao showed a yellow white around broad margin and cv. Thimma noticed yellow colour around midrib in leaf. The flower was absent in multiple bract type cultivars viz., Mahara, Cherry Blossom, Roseville's Delight and Bridal Bouquet. The internodal length was recorded maximum in cv. Dr. R. R. Pal (2.96 cm) and maximum leaf blade length recorded in Alick Lancaster (8.30 cm). The leaf blade width and petiole length was noticed maximum in cultivar Summer Time (5.06 and 1.98 cm, respectively). The thorn length and thorn diameter was recorded least in Torch Glow (0.37 and 0.104 cm, respectively). The floral characteristics viz., bract length and bract width of bougainvillea cultivars was recorded maximum in cv. Mary Palmer Special (4.90 and 3.40 cm, respectively), peduncle length was noticed maximum in cv. Cherry Blossom (5.51 cm) and longest inflorescence length was recorded in cv. Mahatma Gandhi (33.96 cm). Flourishing season of maximum cultivars of bougainvillea noticed from October to March month and few were recorded no flowering during the end of Jan to Feb month in Chhattisgarh plains. Based on the morphology of plants, maximum can be recommended has potted plant, climber and bonsai.

**Keywords:** Bougainvillea, characterization, DUS, floral parameters, RHS

### Introduction

Bougainvillea (*Bougainvillea* spp.) is a versatile ornamental thorny climbing shrub grown in tropical and sub-tropical conditions in the world. The wide popularity of plant is due to their beautiful lavishing colours of bracts like pink, magenta, red, orange, white, yellow, mauve, bicoloured and multicoloured (Pal and Swarup, 1974)<sup>[6]</sup>. Bougainvilleas are extensively used in garden for the hedges, bonsai, pergola, espalier, bush, standard, hanging basket, ground cover, potted plant and so on (Singh *et al.*, 2016a)<sup>[12]</sup>. The plants grown along the central verge in urban city road, due to their pollution tolerating nature and even flourish profusely. The shrub flowers year round with their beautiful bracts, growing in hardy and drought situations (Roy, 2019)<sup>[8]</sup>. There are plentiful varieties and cultivars that are significant from floriculture point of view. Most of the present day varieties have evolved through bud sports, chance crossing and induced mutation (Datta, 2004)<sup>[2]</sup>. They are majorly propagated by stem cuttings, budding and layering (Sindhu and Ram 2009)<sup>[11]</sup>.

Bougainvillea stroked the imagination of explorer Commerson, French botanist, initially collected them in Rio de Janeiro, Brazil in 1768 A.D (Roy *et al.*, 2016)<sup>[9]</sup>. The morphologically bougainvillea can be identified by the colour of bracts and some other diagnostic characters. The bougainvillea genus includes 18 species, among them four species *B. glabra*, *B. peruvian*, *B. spectabilis* and hybrid species *B x buttiana* are extensively used for the horticultural purposes (Singh *et al.*, 2016b, Prasad *et al.*, 2005)<sup>[13, 7]</sup>. Nowadays bougainvilleas are in extreme requirement in nurseries in view of the fact that there are large extent consumption in urban, highways and polluted areas (Janakiram *et al.*, 2012)<sup>[4]</sup>.

### Materials and Methods

The study was conducted at Department of Floriculture and Landscape Architecture, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) during year 2018-19.

The experimental design followed was Complete Randomized Design and material for investigation comprises of 32 Indian and exotic origin bougainvillea cultivars which are replicated thrice. The plants are maintained well in pots with proper management practices like irrigation, weeding regularly and free from pest and diseases. The qualitative and pseudo-qualitative characteristics are assessed visually by VS and VG (visual assessment of single or group of plants/parts of plants) and quantitative characteristics are assessed by MG and MS (measuring single plant or group of plants/plant parts) as per DUS guidelines (Anon., 2014) [1]. Based on their aesthetic value and growth habit cultivars were recommended for different purpose. The Royal Horticulture Society (RHS) colour chart was used to judge the colour of the calyx lobe and bracts in bougainvillea had 920 colours with each and every colour has code, number and in addition name.

### Result and Discussion

The morphological characterization of 32 bougainvillea cultivars was done as per DUS guidelines of bougainvillea CSIR-NBRI, Govt. of India (Anon., 2014) [1]. The results of the investigation revealed significant variation in most of the vegetative and floral characters among the cultivars (Table 1 and 2, respectively).

The vegetative characteristics results are presented in Table 1. The plant growth habit was categorised into upright, semi-upright, climbing and spreading type. Among 32 cultivars, 16 cultivars were observed to be semi-upright, eight cultivars were upright, seven cultivars were spreading type and cv. Shubra witnessed climbing type of growth habit. The young shoot colour was grouped into four groups reddish, reddish green, light green and medium green. Leaf texture character was categorized into three groups, glabrous, slightly hairy and hairy. Out of 32 cultivars, 26 cultivars found glabrous, four cultivars slightly hairy and two cultivars were hairy leaf texture. Leaf persistence was categorized into two groups, persistent and non-persistent, maximum of the cultivars were non-persistent (25 cultivars) and rest seven cultivars had persistent. Petiole altitude in bougainvillea classified into three groups 13 cultivars recorded upwards altitude, 11

cultivars in downwards and eight cultivars were horizontal. Thorn strength was categorized into 3 groups, 14 cultivars witnessed under medium, 10 within strong and 14 cultivars within medium. Thorn curvature categorized into 3 groups, among them 12 cultivars each noted within straight, slightly curved and rest of the eight cultivars under curved. Young shoot colour of bougainvillea cultivars are characterized into reddish, reddish green, light green and medium green, 16 cultivars were noted reddish green, eight cultivars were light green, seven cultivars were medium green and Chitra cultivar witnessed reddish colour. Thorns were observed among the whole 32 cultivars. Leaf shape of bougainvillea were categorized into broad ovate, medium ovate, elliptical and lanceolate, 14 cultivars were noted broad ovate, 12 cultivars were medium ovate, four cultivars were elliptical and Magnifica and Shweta were observed lanceolate type.

Leaf apex shape character recorded maximum in acute type (17 cultivars) and remaining 15 cultivars were noted under acuminate type. Leaf base shape was categorised into acute, obtuse and attenuate, maximum of 22 cultivars were recorded obtuse, eight cultivars were acute and cv. Gopal and Shweta observed attenuate type. Young leaf colour was categorized into reddish green, medium green, light green and reddish, 12 cultivars were noted reddish green, 10 cultivars were light green, eight cultivars were reddish colour and Mary Palmer Special and Queen violet cultivars noted medium green. Leaf blade main colour was categorized into dark green, medium green and light green type, among them 17 cultivars were medium green, nine cultivars were dark green and five cultivars were light green colour. Leaf blade secondary colour noted yellow white in cultivars Bangalore variegata and Dr. Rao and yellow colour noted in cv. Thimma. Leaf distribution of secondary colour was absent in maximum cultivars, broad marginal in cultivars Bangalore variegata, Dr. Rao and around midrib was noted in cultivar Thimma. Leaf tertiary colour was observed none among all cultivars. Leaf undulation was categorized into strong, medium and absent, maximum cultivars noted absent, six cultivars were medium and three cultivars were strong.

**Table 1:** Morphological description of qualitative and pseudo-qualitative vegetative characteristics of bougainvillea cultivars

Varieties	Plant growth habit	Young Shoot Color	Thorn Presence	Thorns Density	Thorn Curvature	Thorn Strength	Leaf Shape	Leaf Apex Shape	Leaf Base Shape	Young Leaf Color	Leaf Blade Main Color
Alick Lancaster	Spreading	Reddish Green	Present	Medium	Straight	Strong	Broad Ovate	Acute	Obtuse	R. Green	D. Green
Bangalore Variegata	Upright	Light Green	Present	Medium	Curved	Strong	M. Ovate	Acuminate	Obtuse	L. Green	L. Green
Bridal Bouquet	Semi-Upright	Reddish Green	Present	Dense	Straight	Medium	M. Ovate	Acute	Acute	L. Green	D. Green
Carpet Purple	Upright	Reddish Green	Present	Sparse	Curved	Medium	Elliptical	Acuminate	Obtuse	L. Green	M. Green
Cherry Blossom	Semi-Upright	Reddish Green	Present	Dense	Straight	Medium	Broad Ovate	Acute	Obtuse	R. Green	D. Green
Chitra	Semi-Upright	Reddish	Present	Sparse	Straight	Strong	Broad Ovate	Acuminate	Obtuse	Reddish	D. Green
Dr. R. R. Pal	Spreading	Reddish Green	Present	Medium	Straight	Medium	Broad Ovate	Acute	Obtuse	Reddish	D. Green
Dr. Rao	Upright	Light Green	Present	Medium	Straight	Strong	Broad Ovate	Acuminate	Obtuse	L. Green	Y. Green
Fantasy	Upright	Reddish Green	Present	Medium	Straight	Strong	Broad Ovate	Acute	Obtuse	Reddish	D. Green
Formosa	Semi-Upright	Light Green	Present	Medium	S. curved	Medium	Broad Ovate	Acute	Acute	L. Green	L. Green
Glabra	Semi-Upright	Light Green	Present	Medium	S. curved	Medium	Elliptical	Acute	Obtuse	R. Green	D. Green
Golden Glow	Upright	Reddish Green	Present	Medium	Curved	Weak	Broad Ovate	Acute	Obtuse	R. Green	M. Green
Gopal	Spreading	Light Green	Present	Medium	Straight	Medium	M. Ovate	Acuminate	Attenuate	R. Green	M. Green
Magnifica	Upright	Light Green	Present	Sparse	Straight	Strong	Lanceolate	Acute	Acute	L. Green	M. Green

Mahara	Spreading	Reddish Green	Present	Sparse	S. curved	Weak	M. Ovate	Acute	Obtuse	Reddish	M. Green
Mahatma Gandhi	Semi-Upright	Medium Green	Present	Medium	Straight	Strong	Broad Ovate	Acute	Obtuse	Reddish	D. Green
Mary Palmer Special	Upright	Medium Green	Present	Medium	S. curved	Medium	Broad Ovate	Acuminate	Obtuse	M. Green	L. Green
Mataji Agnihotri	Semi-Upright	Medium Green	Present	Medium	Curved	Weak	Broad Ovate	Acuminate	Obtuse	Reddish	M. Green
Partha	Semi-Upright	Light Green	Present	Dense	S. curved	Medium	M. Ovate	Acute	Acute	R. Green	M. Green
Pink beauty	Semi-Upright	Reddish Green	Present	Sparse	S. curved	Weak	M.Ovate	Acuminate	Obtuse	L. Green	M. Green
Queen Violet	Spreading	Reddish Green	Present	Medium	S. curved	Strong	M. Ovate	Acute	Acute	M. Green	D. Green
Roseville's Delight	Semi-Upright	Reddish Green	Present	Medium	Straight	Weak	Broad Ovate	Acute	Obtuse	Reddish	M. Green
Scarlet O Hara	Semi-Upright	Reddish Green	Present	Medium	Curved	Medium	Broad Ovate	Acute	Acute	R. Green	M. Green
Shubra	Climbing	Light Green	Present	Sparse	Curved	Strong	M. Ovate	Acuminate	Obtuse	L. Green	L. Green
Shweta	Semi-Upright	Medium Green	Present	Medium	Curved	Medium	Lanceolate	Acuminate	Attenuate	L. Green	M. Green
Sonnet	Semi-Upright	Medium Green	Present	Medium	Straight	Strong	Broad Ovate	Acuminate	Obtuse	R. Green	M. Green
Summertime	Semi-Upright	Reddish Green	Present	Sparse	Curved	Medium	Elliptical	Acuminate	Acute	R. Green	M. Green
Thimma	Upright	Reddish Green	Present	Sparse	S. curved	Weak	M. Ovate	Acuminate	Obtuse	R. Green	M. Green
Tomato red	Spreading	Medium Green	Present	Medium	Straight	Medium	M. Ovate	Acute	Obtuse	Reddish	M. Green
Torch Glow	Semi-Upright	Reddish Green	Present	Medium	S. curved	Weak	M. Ovate	Acuminate	Obtuse	L. Green	M. Green
Vishaka	Spreading	Reddish Green	Present	Sparse	Straight	Medium	Elliptical	Acuminate	Acute	R. Green	L. Green
Zakiriana	Semi-Upright	Medium Green	Present	Sparse	S. curved	Weak	M.Ovate	Acute	Obtuse	R. Green	M. Green

Varieties	Leaf Blade Secondary colour	Leaf Distribution of Secondary colour	Leaf Tertiary Colour	Leaf undulation	Leaf Texture	Petiole Altitude	Leaf Persistence
Alick Lancaster	None	Absent	None	Absent	Glabrous	Upwards	Non-Persistent
Bangalore Variegata	Y. White	Broad Marginal	None	Medium	Slightly Hairy	Horizontal	Non-Persistent
Bridal Bouquet	None	Absent	None	Absent	Glabrous	Upwards	Persistent
Carpet Purple	None	Absent	None	Absent	Slightly Hairy	Upwards	Persistent
Cherry Blossom	None	Absent	None	Absent	Glabrous	Downwards	Non-Persistent
Chitra	None	Absent	None	Absent	Glabrous	Horizontal	Non-Persistent
Dr. R. R. Pal	None	Absent	None	Medium	Slightly Hairy	Upwards	Non-Persistent
Dr.Rao	Y. White	Broad Marginal	None	Absent	Glabrous	Upwards	Non-Persistent
Fantasy	None	Absent	None	Absent	Slightly Hairy	Upwards	Non-Persistent
Formosa	None	Absent	None	Absent	Glabrous	Downwards	Persistent
Glabra	None	Absent	None	Medium	Glabrous	Downwards	Non-Persistent
Golden Glow	None	Absent	None	Absent	Glabrous	Horizontal	Non-Persistent
Gopal	None	Absent	None	Strong	Glabrous	Downwards	Non-Persistent
Magnifica	None	Absent	None	Absent	Glabrous	Horizontal	Non-Persistent
Mahara	None	Absent	None	Absent	Glabrous	Downwards	Persistent
Mahatma Gandhi	None	Absent	None	Absent	Glabrous	Horizontal	Non-Persistent
Mary Palmer Special	None	Absent	None	Absent	Glabrous	Downwards	Non-Persistent
Mataji Agnihotri	None	Absent	None	Absent	Glabrous	Horizontal	Non-Persistent
Partha	None	Absent	None	Absent	Glabrous	Upwards	Non-Persistent
Pink beauty	None	Absent	None	Absent	Glabrous	Downwards	Non-Persistent
Queen Violet	None	Absent	None	Absent	Glabrous	Downwards	Non-Persistent
Roseville's Delight	None	Absent	None	Absent	Glabrous	Upwards	Persistent
Scarlet O Hara	None	Absent	None	Medium	Hairy	Horizontal	Persistent
Shubra	None	Absent	None	Medium	Glabrous	Downwards	Non-Persistent
Shweta	None	Absent	None	Medium	Glabrous	Upwards	Non-Persistent
Sonnet	None	Absent	None	Strong	Glabrous	Upwards	Non-Persistent
Summer Time	None	Absent	None	Absent	Glabrous	Upwards	Non-Persistent
Thimma	Yellow	Around Midrib	None	Absent	Glabrous	Upwards	Non-Persistent
Tomato red	None	Absent	None	Absent	Glabrous	Horizontal	Non-Persistent
Torch Glow	None	Absent	None	Absent	Glabrous	Downwards	Persistent
Vishaka	None	Absent	None	Absent	Glabrous	Horizontal	Non-Persistent
Zakiriana	None	Absent	None	Strong	Hairy	Downwards	Non-Persistent

**Note:** S. curved: Slightly curved  
M. ovate: Medium ovate  
L. green: Light green

M. green: Medium green  
D. green: Dark green  
R. green: reddish green

Y. green: yellowish green  
Y. white: Yellowish white

The results of floral and bract characteristics are presented in Table-2. Bract density was categorized into three groups, among 32 cultivars 17 cultivars observed to be sparse type, followed by 11 cultivars under medium and 4 cultivars under dense. Bract reflection was categorized into 2 classes, 31 cultivars recorded under normal or straight and Shweta

cultivar showed reflexed bract type. Presence of flower categorized into two groups, among them 28 cultivars belong to present and 4 absent (Mahara, Cherry Blossom, Bridal Bouquet and Roseville's Delight). The Bougainvillea bracts blooms only five-six weeks long and then they fall off (Gordon, 2002)<sup>[3]</sup>. Bract persistence categorized into 2 groups



among 32 cultivars, non-persistent contains 22 cultivars and 10 cultivars were persistent. Bract shape was categorized into broadly ovate, medium ovate, narrow ovate and circular, among them 13 cultivars were observed broadly ovate, nine cultivars were medium ovate, eight cultivars were noted narrowly ovate and Chitra and Fantasy cultivars noted circular bract shape. Arrangement of bract cluster was categorized

into terminal type and axillary and terminal type, maximum noted terminal (20 cultivars). Number of bracts/clusters was recorded medium in maximum cultivars of bougainvillea. Bract tip shape was categorized into obtuse and acute, maximum observed to be acute shape. Bract base shape was categorized into cordate and obtuse, maximum recorded cordate shape 19 cultivars and 13 cultivars were obtuse.

**Table 2:** Morphological description of qualitative and pseudo-qualitative floral characteristics of bougainvillea cultivars

Varieties	Bract Shape	Bract Persistence	Bract Reflection	Arrangement of Bract clusters	Number of Bract Clusters	Bract Density in cluster	Bract Tip Shape	Bract Base Shape	Presence of Flower	Bract type
Alick Lancaster	B. Ovate	Non Persistent	Straight	A and T	Many	Medium	Obtuse	Cordate	Present	Single
Bangalore Variegata	N. Ovate	Non Persistent	Normal	Terminal	Medium	Few	Acute	Obtuse	Present	Single
Birdal Bouquet	M. Ovate	Persistence	Normal	Terminal	Many	Dense	Acute	Obtuse	Absent	Multiple
Carpet Purple	N. Ovate	Non Persistent	Normal	Terminal	Medium	Medium	Acute	Cordate	Present	Single
Cherry Blossom	M. Ovate	Persistent	Normal	Terminal	Many	Dense	Acute	Obtuse	Absent	Multiple
Chitra	Circular	Non Persistent	Normal	Terminal	Medium	Few	Acute	Cordate	Present	Single
Dr. R. R. Pal	B. Ovate	Non Persistent	Normal	Terminal	Many	Medium	Acute	Cordate	Present	Single
Dr.Rao	B. Ovate	Non Persistent	Normal	Terminal	Medium	Few	Obtuse	Cordate	Present	Single
Fantasy	Circular	Non Persistent	Normal	Terminal	Medium	Medium	Acute	Cordate	Present	Single
Formosa	B. Ovate	Persistent	Normal	A and T	Medium	Few	Acute	Cordate	Present	Single
Glabra	N. Ovate	Non Persistent	Normal	A and T	Many	Medium	Acute	Obtuse	Present	Single
Golden Glow	B. Ovate	Persistent	Normal	Terminal	Medium	Few	Acute	Cordate	Present	Single
Gopal	M. Ovate	Non Persistent	Normal	Terminal	Many	Few	Acute	Cordate	Present	Single
Magnifica	N. Ovate	Non Persistent	Normal	A and T	Many	Medium	Acute	Obtuse	Present	Single
Mahara	B. Ovate	Persistent	Normal	Terminal	Many	Dense	Acute	Obtuse	Absent	Multiple
Mahatma Gandhi	B. Ovate	Non Persistent	Normal	A and T	Medium	Medium	Obtuse	Cordate	Present	Single
Mary Palmer Special	B. Ovate	Non Persistent	Normal	Terminal	Medium	Medium	Obtuse	Cordate	Present	Single
Mataji Agnihotri	B. Ovate	Non Persistent	Normal	Terminal	Medium	Medium	Obtuse	Cordate	Present	Single
Partha	M. Ovate	Non Persistent	Normal	Terminal	Medium	Few	Acute	Cordate	Present	Single
Pink beauty	N. Ovate	Persistent	Normal	Terminal	Many	Medium	Acute	Obtuse	Present	Single
Queen Violet	M. Ovate	Persistent	Straight	Terminal	Many	Few	Acute	Cordate	Present	Single
Roseville's Delight	N. Ovate	Persistent	Normal	Terminal	Many	Dense	Acute	Obtuse	Absent	Multiple
Scarlet O Hara	B. Ovate	Persistent	Normal	A and T	Many	Few	Acute	Cordate	Present	Single
Shubra	B. Ovate	Non Persistent	Straight	A and T	Many	Few	Acute	Obtuse	Present	Single
Shweta	N. Ovate	Non Persistent	Reflexed	A and T	Medium	Few	Acute	Obtuse	Present	Single
Sonnet	M. Ovate	Non Persistent	Normal	A and T	Medium	Few	Acute	Cordate	Present	Single
Summertime	B. Ovate	Non Persistent	Normal	A and T	Medium	Few	Acute	Cordate	Present	Single
Thimma	B. Ovate	Non Persistent	Normal	Terminal	Medium	Few	Acute	Obtuse	Present	Single
Tomato red	M. Ovate	Non Persistent	Normal	A and T	Medium	Few	Acute	Obtuse	Present	Single
Torch Glow	N. Ovate	Persistent	Normal	Terminal	Many	Medium	Acute	Obtuse	Present	Single
Vishaka	M. Ovate	Non Persistent	Normal	A and T	Medium	Few	Acute	Cordate	Present	Single
Zakiriana	M. Ovate	Non Persistent	Straight	Terminal	Medium	Few	Obtuse	Cordate	Present	Single

**Note:** M. ovate: Medium ovate N. ovate: Narrowly ovate  
B. ovate: Broadly ovate A and T: Axillary and Terminal

The results of quantitative character of both vegetative and floral are presented in Table 3. The internodal length was recorded maximum in cv. Dr. R. R. Pal (2.96 cm) and minimum was recorded in Pink Beauty (0.507 cm) and Torch Glory (0.476 cm) leaves are densely arranged on branches. The highly significant variation was observed in leaf blade length and width. The maximum leaf blade length observed in cv. Alick Lancaster (8.30 cm) and minimum was recorded in Pink Beauty (3.56 cm). The leaf blade width and petiole length were noticed maximum in cultivar summertime (5.06 and 1.98 cm, respectively) and minimum leaf blade width was recorded in Magnific (2.19 cm) and minimum petiole length was noted in Carpet Purple (0.49 cm). The thorn characteristic is prominent trait in bougainvillea. The thorn length recorded maximum in cv. Dr. R. R. Pal (1.56 cm) and minimum in cv. Torch Glow (0.37 cm) and thorn diameter was recorded maximum in Mary Palmer Special (0.31 cm) and least in Torch Glow (0.104 cm).

The floral characteristics have observed maximum significant

variation. The bract length and bract width of bougainvillea cultivars was recorded maximum in cv. Mary Palmer Special (4.90 and 3.40 cm, respectively). The least bract length was recorded in Pink Beauty (1.76 cm) and minimum bract width was recorded in cv. Torch Glow (1.29 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) [14]. The peduncle length was recorded maximum in cv. Cherry Blossom (5.51 cm) and least in cv. Torch Glow (0.38 cm). The longest inflorescence length recorded in cv. Mahatma Gandhi (33.96 cm) and shortest in cv. Carpet Purple (7.02 cm). The flower (Star) of bougainvillea was grouped in cymes of three and inconspicuous, adorned by vivaciously coloured modified leaves called bracts. The character star diameter (flower diameter) was observed maximum in cv. Chitra (0.77 cm) and flower was absent in multiple bract type cultivars viz., Mahara, Cherry Blossom, Roseville's Delight and Bridal Bouquet. The results obtained are in conformity with the findings of Singh *et al.*, 2016a [12].

**Table 3:** Mean performance of vegetative and floral characteristics of bougainvillea cultivars

Sl. No.	Varieties	Internodal length (cm)	Leaf blade length (cm)	Leaf blade width (cm)	Petiole Length (cm)	Thorn length (cm)	Thorn diameter (cm)	Bract length (cm)	Bract width (cm)	Peduncle length (cm)	Inflorescence length (cm)	Star diameter (cm)
1	Alick Lancaster	1.810	8.303	4.930	1.276	0.613	0.230	3.790	2.776	1.640	18.266	0.642
2	Bangalore Variegata	1.103	4.713	2.873	0.850	0.266	0.189	1.925	1.365	0.623	7.900	0.246
3	Bridal Bouquet	2.660	4.440	3.310	0.966	0.539	0.178	2.313	1.733	0.850	11.000	0
4	Carpet Purple	1.410	3.993	1.970	0.490	0.361	0.204	2.826	1.800	1.503	7.026	0.675
5	Cherry Blossom	2.410	6.54	4.146	1.233	0.628	0.209	2.650	1.89	5.510	10.033	0
6	Chitra	1.876	7.553	5.800	1.773	0.743	0.233	3.310	2.866	2.231	13.966	0.722
7	Dr. R.R. Pal	2.906	5.68	3.580	0.920	1.564	0.244	3.900	2.923	2.883	15.200	0.613
8	Dr. Rao	0.906	4.053	2.853	0.913	0.573	0.14	2.250	1.760	3.180	6.516	0.471
9	Fantasy	1.846	6.966	2.990	1.013	1.055	0.214	3.100	2.880	1.820	8.050	0.585
10	Formosa	1.616	5.506	2.753	0.940	0.903	0.16	3.963	2.733	2.456	11.233	0.652
11	Glabra	1.746	7.573	3.460	1.246	0.837	0.227	3.223	2.150	1.640	19.133	0.659
12	Golden Glow	2.293	5.843	3.923	1.213	1.145	0.167	2.556	2.160	3.733	10.066	0.641
13	Gopal	1.866	7.046	4.536	1.306	1.094	0.257	3.116	2.413	3.720	10.933	0.557
14	Magnifica	1.256	4.046	2.196	0.610	0.597	0.124	2.820	1.723	1.823	22.933	0.655
15	Mahara	0.963	3.926	3.086	0.773	0.437	0.24	2.320	1.726	1.075	9.933	0
16	Mahatma Gandhi	2.070	6.770	3.773	1.206	1.214	0.24	4.106	2.920	1.756	33.966	0.463
17	Mary Palmer Special	1.150	4.690	3.253	1.320	0.787	0.308	4.900	3.406	2.243	20.033	0.659
18	Mataji Agnihotri	2.016	7.840	4.793	1.336	0.870	0.247	4.260	3.280	1.973	23.133	0.675
19	Partha	2.020	5.606	2.740	1.000	1.228	0.224	3.823	2.833	2.276	17.733	0.652
20	Pink Beauty	0.503	3.566	2.763	1.186	0.465	0.108	1.763	1.330	0.566	9.493	0.471
21	Queen Violet	1.523	6.263	3.423	1.500	1.037	0.154	2.910	2.420	1.550	11.983	0.543
22	Roseville's Delight	2.366	3.700	2.610	0.976	0.703	0.256	2.070	1.391	3.300	8.633	0
23	Scarlet O Hara	1.343	5.583	3.856	1.156	0.967	0.201	3.046	2.266	2.173	17.433	0.555
24	Shubra	2.343	6.596	4.280	1.023	0.757	0.159	3.243	2.346	2.140	26.966	0.457
25	Shweta	2.330	6.550	3.520	1.545	0.483	0.170	4.256	2.243	2.246	12.200	0.655
26	Sonnet	2.036	7.440	4.793	1.303	0.843	0.225	3.973	3.843	2.963	19.066	0.717
27	Summertime	1.353	6.623	5.066	1.986	0.992	0.232	4.096	3.443	2.646	10.166	0.71
28	Thimma	1.136	6.500	4.030	0.976	0.894	0.162	3.560	2.646	1.836	12.066	0.647
29	Tomato Red	2.036	6.203	4.223	1.256	1.108	0.236	3.223	2.586	2.560	21.600	0.635
30	Torch Glow	0.476	3.616	3.790	1.190	0.371	0.104	1.840	1.298	0.386	13.000	0.422
31	Vishaka	2.043	5.506	2.090	0.740	0.485	0.258	3.700	3.27	3.006	10.400	0.492
32	Zakiriana	2.263	5.806	3.656	0.990	0.577	0.071	2.623	2.041	2.023	9.293	0.574
	S.Em±	0.60	1.33	0.91	0.31	0.30	0.05	0.68	6.36	1.04	0.22	0.80
	CV%	9.59	3.15	4.15	7.91	4.73	6.80	5.17	2.94	10.01	12.89	3.48

The characterization will be useful for identifying the varieties and their use in ornamental gardening on the basis of morphological parameters (Sharma and Roy, 2000) <sup>[10]</sup> and recommended based on their character behaviour and blooming season are categorized and summarized in Table 4. The cultivars which observed growth habit is upright and variegated foliage viz., Carpet Purple, Dr. R. R. Pal, Glabra, Magnifica, Bangalore Variegata, Partha and Thimma can be recommended for hedge purpose. Bridal Bouquet, Chitra, Dr. R. R. Pal, Glabra, Mahatma Gandhi, Pink Beauty, Mahara, Roseville's Delight, Shubra and Torch Glow can grow as climbers and trained on fences, cascade, espalier and pergolas which intensify the beauty of garden as they have spreading growth habit. The bougainvillea shrubs suitable for bonsai should have characteristics like small leaves, short internodes, attractive bark, perpetual blooming and survive intense pruning. Suitable cultivars are viz., Carpet Purple, Dr. R. R. Pal, Glabra, Magnifica, Shubra, Summertime and Zakiriana. Bougainvillea bonsai will bestow immense pleasure and incentive due to its vibrant artistic display. The cultivars like Thimma, Glabra, Shubra and Dr. R. R. Pal are suitable for growing for beautifying lands with slopes and mounds in landscape. Floral arrangements made with bougainvillea inflorescence and foliage make a fascinating decoration on walls, the

cultivars which are potential for display are viz., Bridal Bouquet, Cherry Blossom, Mahara, Mahatma Gandhi, Partha, Roseville's Delight, Shubra, Thimma and Tomato Red. The cultivars which are double bracted are most preferred for decoration, inflorescence are densely arranged and can be laid down effortlessly on walls. The cultivars with spreading growth habit are suitable for bushes, mass planting and ground cover on banks viz., Dr. R. R. Pal, Glabra, Golden Glow, Queen Violet, Pink Beauty, Shubra, Scarlet O Hara, Shweta, Sonnet, Thimma and Vishaka. Bougainvillea can cover on difficult-to-maintain region; it cut down weed growth and excellent plant for vivid ground cover. The bougainvillea cultivars in investigation like Mary Palmer Special, Thimma and Shubra are suitable for standard specimen. The canopy can be pruned and trained in umbrella shape.

The bougainvillea cultivars like Shweta, Glabra, Formosa and Pink Beauty can be grown on hanging baskets. Due to its spreading and semi upright growth habit and profuse blooming, these cultivars can be recommended for hanging baskets. All the cultivars of bougainvillea suitable for growing as potted plant for beautifying balcony, verandah, rooms, balcony, corridors, terrace and various other places in landscaping and interior decoration.

**Table 4:** List of morphological description, suitability and blooming season of bougainvillea

Sl. No.	Cultivars	Related Species	Morphological Description	Suitability	Blooming season
1.	Alick Lancaster	<i>B. x buttiana</i>	Spreading plant habit, glabrous leaves, broad ovate magenta purple bracts and leaves. Thorns are strong and medium density. Obtuse tip and cordate base bracts.	Potted plant	Oct-Dec and Feb-March
2.	Bangalore Variegata	–	Leaves are variegated, secondary colour pale yellow distributed broad margins; bracts are small and purple colour.	Hedge, Topiary, Potted plant	Feb-April
3.	Bridal Beauty	–	Medium ovate, glabrous leaves & semi-upright plant. The bracts are multiple, densely arranged and pink to white colour bracts.	Climber, Pergola, Espalier and pot plant	Oct-Dec and Feb-March
4.	Carpet Purple	–	The plant is upright, leaves are elliptical, acuminate tip and leaves are persistent. Bracts are electric violet colour, narrowly ovate and long inflorescence.	Potted plant, Bonsai and Hedge	Oct-Dec and March-April
5.	Cherry Blossom	<i>B. x buttiana</i>	The bracts are multiple, densely arranged, colour is pink to light pink. Climbing type and spreading branches.	Pergola, Potted plant	Oct-Dec and Feb-March
6.	Chitra	<i>B. x buttiana</i> and <i>B. peruviana</i>	Plants is semi-upright, leaves are broadly ovate, are large coppery and glabrous. Circular bract and colour of bract is white in midrib and red around midrib. Floral tube swollen at base.	Bushy climbing shrub, along highways, potted plant	Oct-Dec and Feb-March
7.	Dr. R. R. Pal	<i>B. x buttiana</i>	Plants are spreading, dark green colour leaves & broadly ovate. The bracts are red purple group.	Potted plant, Bonsai, Climber, Cascade, Espalier, Ground cover and Hedge	Oct-Dec and Feb-March
8.	Dr. Rao	<i>B. x buttiana</i>	The plant is upright, leaves are broadly ovate and secondary colour pale yellow broad margins. Bracts are carmine red and star is non-prominent.	Potted plant	Oct-Dec
9.	Fantasy	<i>B. peruviana</i>	Plant is upright, slightly hairy and broadly ovate leaves. Bracts are red purple group.	Potted plant	Oct-Dec
10.	Formosa	–	Plant is semi-upright, broadly ovate, persistent leaves and bract. The bracts are floral purple colour, cordate at base of bract.	Potted plant and Hanging basket	Feb-March
11.	Glabra	<i>B. glabra</i>	Profuse flowering, bracts are purple, semi-upright plant, elliptical leaves and dwarf growing.	Potted plant, Bonsai, Bush, Cascade, Ground cover, Climber, Hanging basket and Hedge	Oct-Dec
12.	Golden Glow	<i>B. x buttiana</i>	Amber orange colour bracts, plant is upright, broad ovate leaves.	Potted plant and ground cover	Oct-Dec and Feb-March
13.	Gopal	<i>B. glabra</i>	Spreading plant, medium ovate, glabrous leaves and magenta colour bracts.	Potted plant	Oct-Dec and Feb-March
14.	Magnifica	<i>B. glabra</i>	Plant is upright, leaves are elliptical, bracts are reflexed, horizontal petiole altitude, and bracts are purple colour.	Hedge, Cascade, Bonsai, Highways divider, best potted plant	Oct-Dec and Feb-March
15.	Mahara	<i>B. x buttiana</i>	Bracts are multiple type, densely arranged, bract and leaves are persistent, colour of bract is crimson red and plant is spreading.	Pergola, Potted plant,	Oct-Dec and Feb-March
16.	Mahatma Gandhi	<i>B. peruviana</i>	The plant semi-upright, large leaves, broadly ovate, bracts are undulated and magenta purple colour.	Potted plant, Pergola, Climber and on divider	Oct-March
17.	Mary Palmer Special	<i>B. peruviana</i>	Upright, broadly ovate leaves, bracts are patched dual colour lime green young bract and parchment white colour.	Standard, Potted plant	Feb-May
18.	Mataji Agnihotri	–	Semi-Upright plant, broadly ovate, dark green colour leaves, bracts are broadly ovate and magenta colour.	Potted plant	Oct-March
19.	Partha	<i>B. peruviana</i>	Plant is semi-upright, pink colour and medium ovate bracts,	Hedge, Potted plant	Oct-Dec
20.	Pink Beauty	–	Bract is narrowly ovate, leaves are densely arranged on main branch, purple red colour bracts, plant is semi-upright, bract and leaves are persistent.	Climber, Pergola, Espalier and Hanging basket	Oct-Dec and Feb-March
21.	Queen Violet	–	Bracts are dark purple colour, medium ovate, leaves are glabrous leaves and plant Spreading.	Potted plant and Ground cover	Oct-Dec and Feb-May
22.	Rosevillea's Delight	<i>B. x buttiana</i>	Plant is semi-upright, bracts are multiple, orange red colour bracts densely arranged and leaves are broadly ovate.	Arch, Climber and on dividers	Feb-May
23.	Scarlet O Hara	–	Leaves are coppery hairy, bracts are red and pink colour, persistent, young leaf is reddish green and plant is semi-upright.	Potted plant and Bush	Oct-Dec and Feb-March
24.	Shubra	<i>B. peruviana</i>	Plant is climbing, leaves are glabrous, vigorous growth, bract white colour, and profuse flowering.	Climber, Bushes, Ground cover, Bonsai, Cascade, Espalier and on pergola	Oct-March
25.	Shweta	<i>B. glabra</i>	Plant is dwarf, semi-upright, bracts are white, green colour and bracts are reflexed in nature.	Hanging basket, Ground cover and potted plant	Oct-May
26.	Sonnet	<i>B. x buttiana</i>	The bracts are magenta colour, profuse flowering, leaves are broadly ovate and semi-upright growth.	Potted plant and ground cover	Oct-Dec and Feb-March
27.	Summertime	<i>B. spectabilis</i> x <i>B. x buttiana</i>	Plant is semi-upright growth, flowers are red colour, elliptical and glabrous leaves.	Shrub and Bonsai	Feb-May
28.	Thimma	<i>B. peruviana</i>	The leaves are variegated yellow white colour around the midrib,	Hedge, Potted, Standard,	Oct-Dec and

			bracts are dual coloured white and magenta colour and plant is upright.	Ground cover, Bush, slopes and mounds	Feb-March
29.	Tomato Red	<i>B. spectabilis</i>	The young leaves are coppery, leaves are glabrous, bracts are dark red colour and plant is spreading	Potted plant	Oct-Dec and Feb-March
30	Torch Glow	–	Plant is semi-upright, vigorous growth, leaves are densely arranged, bracts are profuse blooming, bracts are orange red coloured, persistent bracts and leaves.	Espalier, Climber, Slopes and Hanging basket	Oct-Dec and Feb-March
31.	Vishaka	<i>B. peruviana</i>	Plant is spreading, bracts are red coloured, glabrous and petiole altitude is horizontal.	Ground cover, Potted plant	Jan – March
32.	Zakiriana	<i>B. spectabilis</i>	The leaves are undulated, light green coloured leaves, bracts are orange red and it is semi-upright growth.	Potted plant and Bonsai	Oct-May

Bougainvillea has excellent capacity to thrive in cities and helps in mitigating air pollution thereby increasing air quality besides its ornamental value. The cultivars like Carpet Purple, Chitra, Formosa, Glabra, Magnifica, Mahatma Gandhi, Mary Palmer Special, Pink Beauty, Roseville's Delight, Shubra, Sonnet, Thimma, Tomato Red, Golden Glow and Mataji Agnihotri have potential to tolerate pollution, can be planted in highways, traffic islands, central verge and a range of other ways in cities like Raipur and even noticed profuse blooming in extreme summer.

Numerous bougainvillea cultivars viz., Alick Lancaster, Bridal Bouquet, Cherry Blossom, Chitra, Dr. R. R. Pal, Golden Glow, Gopal, Mahara and Torch Glow recorded blooming in Oct-Dec and Feb-March in Chhattisgarh. The bougainvillea cultivars bracts flourish in different seasons depending on the cultivars. Flowering in cultivars Carpet Purple and Magnifica recorded in Oct-Dec and March-April. Dr. Rao, Fantasy, Glabra and Partha bloomed during Oct-Dec. Bangalore Variegata, Formosa, Mary Palmer Special, Roseville's Delight, summertime, Vishaka cultivars were beautifully bloomed in summer (Jan-May) months. Mahatma Gandhi, Mataji Agnihotri, Shubra, Shweta and Zakiriana

noticed flowering from Oct-May. The cultivars like Pink Beauty, Queen Violet, Scarlet O Hara, Sonnet, Thimma, Tomato Red recorded flowering in Oct-Dec and Feb-May. There was no bloom witnessed from end of December to February month in maximum of bougainvillea cultivars because, the shrubs are sensitive to chilling injury and plants undergo dormant stage during winter months.

Bract colour is most eminent part of the character for better identification of cultivars and suitability in landscape. Comparing the different parts of the bract and flower part with Royal Horticulture Society colour chart they are grouped according to their colour groups as per DUS guidelines of Bougainvillea in Table 5. There is a wide variation in Bougainvillea bracts colour. The results revealed that maximum of cultivars are grouped into Red Purple group (11 cultivars), followed by Pink-Red purple group (five cultivars), Purple group (four cultivars), White Green - Red Purple (three cultivars), Orange Red - Red Purple (three cultivars), White-Yellow Green group (Shubra and Shweta) and least in Greyed Orange (Golden Glow) and Red Purple-Greyed Red (Pink Beauty). The results obtained are in conformity with the findings of Kumar *et al.*, 2014<sup>[5]</sup>.

**Table 5:** Grouping of bougainvillea cultivars based on the RHS colour chart

Sl. No.	Colour groups	No. of cultivars	Cultivars
1	Pink – Red purple	5	Mataji Agnihotri, Alick Lancaster, Partha, Vishaka, Bridal Bouquet
2	White- Yellow Green	2	Shubra, Shweta
3	White, Green - Red Purple	3	Chitra, Mary Palmer Special, Thimma
4	Orange Red - Red Purple	3	Torch Glow, Zakiriana, Roseville's Delight
5	Greyed Orange	1	Golden Glow
6	Red, Purple-Greyed Red	1	Pink Beauty
7	Red Purple	11	Dr. R. R. Pal, Dr. Rao, Gopal, Mahatma Gandhi, Scarlet O Hara, Fantasy, Summertime, Sonnet, Tomato Red, Cherry Blossom, Mahara
8	Purple	4	Bangalore Variegata, Formosa, Magnifica, Queen Violet
9	Purple-violet – Violet	2	Carpet Purple, Glabra

## Conclusion

The diversity among bougainvillea varieties is very wide so far as vegetative and floral characters are concerned. Moreover, hundreds of cultivars having varied leaf characters, thorn characters and bract characters. Morphological characterization and identification of suitability of bougainvillea by growth habit, floral characters, bract colour, usage and blooming season may be helpful for the breeders and landscape architects for improvement and utilization in landscape. It can be grown as potted plant and trained on pergola depending on the purpose bougainvillea has great potentiality and a brilliant choice for garden. Due its pollution tolerant nature, being versatile profuse blooming in summer and thorny they can be recommended for industries, highway center verge and railway station in Raipur.

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