



Study of Phenotypic Variability of *Kachnar* (*Bauhinia* spp.)

Damini Yadav, Samir Kumar Tamrakar* and G L Sharma**

Department of Floriculture and Landscape Architecture, College of Agriculture,
Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh 492012, India

ABSTRACT

An investigation to Study of phenotypic variability of *Kachnar* (*Bauhinia* spp.) was conducted in the Department of Floriculture and Landscape Architecture, IGKV Raipur, Chhattisgarh, during the *Rabi* season of 2021–2022. Five species for the study were *Bauhinia purpurea*, *Bauhinia acuminata*, *Bauhinia blakeana*, *Bauhinia tomentosa* and *Bauhinia variegata*. Different growth characteristics including plant, leaf, flower, and fruit traits, were recorded. According to the findings, *Bauhinia purpurea* had the tallest plants followed by *Bauhinia blakeana*, *Bauhinia variegata*, *Bauhinia acuminata*, and *Bauhinia tomentosa*. The longest and widest leaf was measured in *Bauhinia purpurea* 14.91 and 12.04 respectively. Smallest and narrowest leaf was recorded in *Bauhinia tomentosa* 4.71 and 4.20 respectively. Among all the five species of *Bauhinias* highly pubescent leaf was discovered in *Bauhinia tomentosa* only. The *Bauhinia acuminata*'s 3.96 long petiole had the record for being the longest while the *Bauhinia tomentosa*'s 2.10 petiole had the smallest. The *Bauhinia blakeana* flower measuring 13.160.07 cm had the largest flower diameter while *Bauhinia tomentosa* 3.91 0.41 cm was the smallest. The only *Bauhinia* species with a pubescent flower bud was *Bauhinia tomentosa*. Longest petal, stamen and pistil length recorded in *Bauhinia blakeana* measuring 7.09, 4.8 and 6.91 respectively. Maximum pod length measuring 29.33 and maximum number of seeds per pod 11.90 was recorded in *Bauhinia purpurea* and minimum pod length measuring 9.25 in *Bauhinia acuminata*. Minimum number of seeds per pod recorded in *Bauhinia acuminata*. *Bauhinia blakeana* did not produce any pods as these species were infertile. The maximum seed weight was recorded in *Bauhinia purpurea* 30±0.87g and minimum in *Bauhinia tomentosa* 3.35±0.44g.

Key Words: *Bauhinia*, Plant, Leaf, Flower, Fruit, Variability.

INTRODUCTION

Bauhinia is named by Linnaeus (Sharma and Kumar, 2013) in the honor of 16th century Swiss botanists John and Caspar Bauhin. They were twin brothers. The bilobed leaf of *Bauhinia* represents the two brothers John and Casper Bauhin. *Bauhinia* is also known as mountain ebony or simply orchid tree and *Kachnar* in India and Pakistan. *Bauhinia* commonly known as *Kachnar* in Hindi, *Kovidra* in Sanskrit. *Bauhinia* (*Bauhinia* spp.) belongs to the family Leguminosae. Leguminosae is the 3rd largest plant family in the number of species. The Leguminosae family accommodates 3 subfamilies (Caesalpinioideae, Mimosoidae and Papilionidae) and 35 tribes, *Bauhinia* is a genus of subfamily

Caesalpinioideae. Caesalpinioideae includes most of the flowering trees, shrubs but rarely herbs. Caesalpinioideae has 4 tribes, 56 genera and 650 species of the flowering plants. The genus is famous for the characteristic camel's foot shape of its leaves and bearing flowers ranging from white, yellow to purple. There are about two hundred species present in this genus and are distributed into the world.

Bauhinia is a native to India, Burma, China, Malaysia, Tropics and South Africa, Zambia, Zimbabwe. In India, some of the species of this genus are distributed, such as *B. tomentosa*, *B. purpurea* and *B. variegata* and grows well in the drier parts of tropical and subtropical regions. It has been estimated that about 60% of people worldwide

Corresponding author's Email: daminiyadav7164@gmail.com

mainly use herbal medicine to cure dysentery, diarrhea, anthelmintic, snakebite and skin diseases and yellow bell orchid tree. It is used as a fat burner and it possesses antibacterial, antidiabetic, analgesic, anti-inflammatory, anti-diarrheal, anti-cancerous, nephroprotective, anti-ulcer. (Murugesan *et al*, 2017) The shape and size of flower and leaf are essential for species characterization. The trees reach up to a height of 6- 12 m, and their branches spread 3-6 m outwards. and generally, flowers have five petals in shades of red, pink, purple, orange or yellow with diameter of 7.5-12.5 cm and are often fragrant (Makwana *et al*, 2013). It is distinguished by the bifid (bilobed) leaves with showy flowers ranging. The lobed leaves are usually 10-15 cm across the leaves are simple, broad, entire or 2-lobed apically. The leaf base is swollen and pulvinate. The flower's corolla consists of five somewhat unequal petals that are usually narrowed into a claw. Stamens are 10 in number but sometimes reduced even to 3 and perhaps bearing sterile filaments. The number and infertility of the stamens are important characters in species identification (Baily, 1953; Sambamurty, 2005). The roots are also used for flatulence and dyspepsia (Bhatnagar *et al*, 1973; Kapoor and Kapoor, 1980). Root extracts (water and ethanol) of *B. variegata* have analgesic effects, which may be due to the presence of flavonoids, while antiulcer activity may be due to the probable association of prostaglandins (Kumar and Rajani, 2011). Dried buds have good antioxidant properties (Singh *et al*, 2016). They are used to treat dysentery, hemorrhoids, worms, eye diseases, liver disease, and diarrhea (Mali and Dhake, 2009). The flowers of *B. variegata* are considered a rich source of vitamin C. They are used for dysentery, dropsy (Malhotra, Moorthy, 1973).

MATERIALS AND METHODS

Present work was conducted at the Experimental area, Department of Floriculture and Landscape Architecture, IGKV Raipur, (Chhattisgarh), during the year of 2021-22 with *Kachnar* (*Bauhinia spp.*) The study was based on different *Bauhinia* species

present in IGKV campus, Raipur on the basis of vegetative and reproductive morphology. Trees were already planted at campus used for the study purposes. The list of available such as *Bauhinia purpurea*, *Bauhinia acuminata*, *Bauhinia blakeana*, *Bauhinia tomentosa* and *Bauhinia variegata*. 10 locations were chosen as per the availability of planting material for the morphometric study of *Bauhinia* spp. at IGKV campus, Raipur and each plant was coded by specific code. The data were statistically analyzed using mean, range, standard deviation.

RESULTS AND DISCUSSION

Plant characters

Maximum plant height was recorded in *Bauhinia purpurea* followed by *Bauhinia blakeana* and *Bauhinia variegata*. Singh *et al*, (2010). *Bauhinia tomentosa* and *Bauhinia acuminata* were shrubby in nature. The minimum plant height was recorded in *Bauhinia tomentosa*. According to the evolving crop descriptor list, the growth habits of all 5 species of *Bauhinia* were upright. All five of the *Bauhinia* species under study had zigzag branching patterns while they were young; as they became older, they turned straight. Singh *et al* (2010).

Leaf characters

The longest leaf measured (14.91 ± 2.06 cm) in *Bauhinia purpurea*, which was near to *Bauhinia acuminata* (12.74 ± 1.17 cm) at the Herbal Garden. *Bauhinia tomentosa*'s leaves have the shortest recorded leaf length of (4.71 ± 0.43 cm). The size of the leaf depends on the breadth of the leaf blade. (Elbanna *et al*, 2016). The largest leaf blade width was measured as (12.04 ± 1.26 cm) in *Bauhinia purpurea*. *Bauhinia tomentosa*'s leaf blades have a minimum width of (4.20 ± 0.36 cm). In various locations, the petiole length (in cm) varied from 2.04 to 4.76 cm. The leaf with the longest petiole (measured in centimeters) was *Bauhinia acuminata* measuring 3.96 ± 0.45 cm. *Bauhinia tomentosa* has a minimum petiole length (cm) of 2.10 ± 0.08 cm. By looking at the grooves between the petioles, different

Study of Phenotypic Variability of *Kachnar* (*Bauhinia* spp.)

types of petioles were identified. The petioles of all five species of *Bauhinia* are canaliculate. When the leaves were at their finest and completely developed, the color of the leaves were noted with the help of the Royal Horticultural Society colour chart. All the species of *Bauhinia* leaf belong to the green group. *Bauhinia tomentosa* had dense hairs at lower surface while other species of *Bauhinia* were glaucous at both the surfaces. Only younger stages of leaves had trichomes on both the surfaces. Bhise (1977), Shu *et al* (2010) and Singh *et al* (2010)

Flower characters

The *Bauhinia blakeana* flower had petals that were the highest length (in centimeters), measuring $(7.09 \pm 0.04 \text{ cm})$. The *Bauhinia tomentosa* flower was determined to have a minimum petal length (cm) of $(2.85 \pm 0.02 \text{ cm})$. The longest stamen, measuring $4.8 \pm 0.1 \text{ cm}$, was discovered in *Bauhinia blakeana*. The *Bauhinia tomentosa*'s plant has a minimum stamen length (cm) of $1.90 \pm 0.08 \text{ cm}$. In *Bauhinia blakeana*, the maximum pistil length (cm) was measured to be 6.91 ± 0.07 . The *Bauhinia tomentosa* plant has a minimum pistil length (cm) of $2.62 \pm 0.22 \text{ cm}$. The *Bauhinia blakeana*, at $13.16 \pm 0.07 \text{ cm}$, has the largest flower diameter measured in centimeters. The *Bauhinia tomentosa* flower has a minimum flower diameter (cm) of 3.91 ± 0.41 . All the species of *Bauhinia* viz. *Bauhinia purpurea*, *Bauhinia acuminata*, *Bauhinia blakeana*, *Bauhinia tomentosa* and *Bauhinia variegata* had 5 petals. The two species, *Bauhinia acuminata* and *Bauhinia tomentosa*, had the largest number of stamens per

flower, both having a value of 10. Lowest no. of stamens was recorded in *Bauhinia purpurea*. All the species of *Bauhinia* had a fusiform bud shape. There was a little variation in the fusiform bud morphology across all *Bauhinia* species. *Bauhinia purpurea* had an obtuse apex while *Bauhinia acuminata* recorded acute apex. Bhise (1977) *Bauhinia tomentosa* had puberulent fusiform bud shape. *Bauhinia acuminata* was white, whereas *Bauhinia purpurea*, *Bauhinia blakeana*, and *Bauhinia variegata* were recorded as pink colored flowers. *Bauhinia tomentosa* had yellow-colored flowers.

Fruit characters

The largest pod measured $29.33 \pm 1.15 \text{ cm}$ and was discovered in *Bauhinia purpurea*. The shortest pod length, measuring $9.86 \pm 3.25 \text{ cm}$, was discovered in *Bauhinia tomentosa* while *Bauhinia blakeana* lack pod formation as these species are sterile *Bauhinia blakeana* is a hybrid between *Bauhinia purpurea* and *Bauhinia variegata*. The greatest pod width, $2.16 \pm 0.20 \text{ cm}$ was discovered in *Bauhinia purpurea*. The *Bauhinia tomentosa*, with a value of $1.41 \pm 0.07 \text{ cm}$, has the smallest pod width. Mature pods were chosen and analyzed for the pod colour. All of the pods had minor colour variation but they were all brown in tone. The pods of *Bauhinia purpurea*, *Bauhinia acuminata* and *Bauhinia tomentosa* were reddish brown, pale brown, and gray, respectively. The immature and developing fruits of *Bauhinia purpurea* were strap like and light green after ripening *Bauhinia purpurea*'s ripe fruits had an oblong, straight

Table 1. Phenotypic variability of *Kachnar* (*Bauhinia* spp.).

Sr. No.	Plant species	Seed length (cm)	Seed width (cm)	Seed thickness (cm)	seed weight (100seeds) (g)	No. of seeds per pod
1	<i>Bauhinia purpurea</i>	1.67	0.12	0.24	30	11.90
2	<i>Bauhinia acuminata</i>	0.81	0.55	0.29	10.66	7.32
3	<i>Bauhinia blakeana</i>	0	0	0	0	0
4	<i>Bauhinia tomentosa</i>	0.57	0.54	0.20	3.35	7.90
5	<i>Bauhinia variegata</i>	1.66	1.54	0.32	18.77	7.80

Table 2. Phenotypic variability.

Sr. No.	Plant species	Plant height (m)	Leaf blade length (cm) Mean SD	Leaf blade width (cm) Mean SD	Petiole length (cm) Mean SD	Flower diameter (cm) Mean SD	Stamen length(cm) MeanSD	Pistil length (cm) Mean SD	Petal length (cm) Mean SD
1	<i>Bauhinia purpurea</i>	8 to 12 m	14.91	12.04	3.47	9.44	4.38	5.25	4.48
2	<i>Bauhinia acuminata</i>	4 to 6 m	12.74	9.55	3.96	7.87	1.83	3.98	4.34
3	<i>Bauhinia blakeana</i>	6 to 9 m	13.23	10.531.87	3.73	13.16	4.8	6.91	7.09
4	<i>Bauhinia tomentosa</i>	4 to 6 m	4.71	4.20	2.10	3.91	1.90	2.62	2.85
5	<i>Bauhinia variegata</i>	Up to 6 m tall	11.23	9.35	2.55	10.91	3.60	5.16	4.88

form. The *Bauhinia tomentosa* pod was flat and linear, the *Bauhinia acuminata* fruits were linear and oblanceolate, and the *Bauhinia variegata* had a woody valve. All the species of *Bauhinia* viz. *Bauhinia purpurea*, *Bauhinia acuminata*, *Bauhinia tomentosa*, and *Bauhinia variegata* all possessed pods that were just acutely curled at the tip. The *Bauhinia purpurea* plant had the most seeds per pod, totaling 11.9 ± 0.150 . *Bauhinia acuminata* had the fewest seeds per pod with a score of 7.32 ± 0.66 .

The *Bauhinia purpurea*, measuring 1.67 ± 0.12 cm, had the longest seeds on record. *Bauhinia tomentosa* had seeds that were the shortest possible length, measuring 0.57 ± 0.007 cm. The *Bauhinia variegata* was discovered to have seeds with a maximum width of 1.54 ± 0.014 cm. The smallest seed width, measuring 0.54 ± 0.007 cm was discovered in *Bauhinia tomentosa*. *Bauhinia variegata* had the thickest seeds, measuring 0.32 ± 0.007 cm. *Bauhinia tomentosa* has seeds that were the thinnest, measuring 0.20 ± 0.004 cm. *Bauhinia purpurea* had the heaviest seeds (30 ± 0.87 g), whereas *Bauhinia tomentosa* had the lightest seeds (3.35 ± 0.44 g). *Bauhinia acuminata* had dark yellow brown seeds, *Bauhinia tomentosa* had black seeds and *Bauhinia purpurea* had dark

reddish-brown seeds. *Bauhinia purpurea* seeds were compressed suborbicular form, *Bauhinia acuminata* seeds were circular, *Bauhinia tomentosa* seeds were oblong, and *Bauhinia variegata* seeds were round.

CONCLUSION

From the above findings, it may be concluded that under IGKV premises different *Bauhinia* spp. may be used for different purposes. The *Bauhinia tomentosa* species, which is best suited for small home gardens as a specimen tree, because it had the smallest plant height of all the five species that were found in the IGKV grounds. A unique tree known as *Bauhinia blakeana* lacks pod since these are infertile because these trees lack pods, they are less likely to draw animals and insects. The biggest blossom of the five species is that of the *Bauhinia blakeana*, which makes it the ideal specimen tree for large parks. The best places to grow *Bauhinia blakeana* are in dividers or as a divider plant.

Bauhinia purpurea trees are deciduous and absorb all the dust and pollutants before losing their leaves, they are ideal for planting in industrial areas because they have the biggest leaves. The biggest pods and best appearance are both features

Study of Phenotypic Variability of *Kachnar* (*Bauhinia* spp.)

of *Bauhinia purpurea*. *Bauhinia purpurea* may be an excellent option if we want to bring movement to the garden or landscaping area. In the IGKV grounds, *Bauhinia acuminata* is a shrubby plant with white flowers that bloom from spring until the rainy season. It is ideal for moon gardens.

REFERENCES

- Albert S and Sharma B (2013). Comparative foliar micromorphological studies of some *Bauhinia* (Leguminosae) species *Turkish J Bot* **37**: 276-281.
- Baily L H (1953). *The Standard Cyclopedia of Horticulture*. New York: The Macmillan Company.
- Bhatnagar L S, Singh V K and Pande G (1973). Medico-botanical studies on the flora of Ghatigaon forests, Gwalior, Madhya Pradesh. *J Res Ind Med* **8**(2):67-100.
- Bhise V Ratnaprabha (1977). *Studies on the genus Bauhinia* Linn. Ph.D. thesis, submitted to The University of Poona, India.
- Kapoor S L and Kapoor L D (1980). Medicinal plant wealth of the Karimnagar district of Andhra Pradesh. *Bull Med Ethnobot Res* **1**:120-144.
- Kumar Y R and Rajani G P (2011). Analgesic and anti-ulcer activities of ethanol and aqueous extracts of roots of *Bauhinia variegata* Linn. *Int J Pharm* **7**(5):616-622.
- Lau C P, Ramsden L and Saunders R M (2005). Hybrid origin of "*Bauhinia blakeana*" (Leguminosae: Caesalpinioideae), inferred using morphological, reproductive, and molecular data. *Am J Bot* **92**(3): 525-533.
- Lau C P Y, Saunders R M K and Ramsden L (2009). Floral biology, breeding system and population genetic structure of three climbing *Bauhinia* species (Leguminosae: Caesalpinioideae) in Hong Kong, China. *J Trop Eco* **25**:147-159.
- Makwana P, Albert S, Contractor K and Singh A K (2013). Morphological characterization in interspecies of *Bauhinia* species. *Curr Hort* **2**(1): 28-33.
- Malhotra S K and Moorthy S (1973). Some useful and medicinal plants of Chandrapur district (Maharashtra State). *Bull Bot Surv Ind* **15**:13-21.
- Mali R G and Dhake A S (2009). *Bauhinia variegata* Linn. (Mountain Ebony): a review on ethnobotany, phytochemistry and pharmacology. *Orient Pharm Exp Med* **9**(3):207-216.
- Murugesan S K, Dhanapaul V and Rakkan P (2017). Comparison of two *Bauhinia* species Based on the morphological, antimicrobial and protein markers. *J Pharmacognosy and Phytochem* **6**(6): 306-309.
- Sambamurthy A. (2005). *Taxonomy of Angiosperms*. IK International Pvt Ltd.
- Singh K L, Singh D K and Singh V K (2016). Multidimensional uses of medicinal plant kachnar (*Bauhinia variegata* Linn.). *Am J Phytomed Clin Ther* **4**(2):58-72.

Received on 11/8/2022

Accepted on 23/10/2022