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Study of leaf venation in some species of genus *Bauhinia* L.

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Abstract

The present study deals with the venation of 6 species of genus *Bauhinia* L. *Bauhinia* shows two types of venation: Actinodromous (*B. racemosa* L., *B. roxburghiana* Voigt.) and Campylodromous (*B. hookeri*, *B. Blakeana*, *B. purpurea*, *B. variegata*). The results showed the existence of leaf venation patterns based on number of veins, position of secondary veins, course, and vein islet number. This study emphasized the taxonomic importance of venation and its usefulness in classification in taxon. Species specific variations have been recorded with respect to shape of leaf, leaf apex and base in general and venation pattern in particular. Authentication key based on these variations has been formulated.

Keywords: *Bauhinia* L., Venation pattern, Actinodromous, Campylodromous, Authentication

1. Introduction

The particularly wide variation in leaf venation patterns of angiosperm has been classified by for e.g. (Ettingshausen, 1861) [3], (Melville, 1976) [8] and (Hickey, 1979) [6]. In recent studies of venation pattern of leaf, the Hickey's system is widely used and its terminology is adopted. Whereas (Ettingshausen, 1861) [3] only considered leaf venation, the scheme of (Hickey, 1973) [6] also uses other characters or elements of leaf architecture in the classification process, such as leaf shape or the structure of the leaf margin. The classification of an angiospermic venation patterns start with the primary vein or if more than one primary veins is present, with all primary veins entering the leaf from the petiole and the secondary veins branching off the primary veins (Roth-Neblelsick *et al.*, 2001) [11]. Primary and secondary veins are termed the major vein class and represent lower order veins. The classification proceeds with progressively higher order veins until the areolation which terminates the vein system (Roth-Neblelsick *et al.*, 2001) [11].

The angiosperm flora exhibits a wide range of leaf architecture. Although foliar architecture as a taxonomic tool has been in use since a long time, the coherent classification of dicotyledonous leaf architecture by (Hickey, 1973) [6]. (Foster, 1961) [4] emphasized the need for extensive and intensive study of the venation pattern of dicotyledonous leaves is significant in dealing with the systematic of angiosperms particularly at the species level (Gupta and Bhambe, 1979) [5].

The present study deals with venation of some species of *Bauhinia* L.; *Bauhinia* L. shows two types of venation i.e. actinodromous and compylodromous (Seetharam and Kotresha, 1998) [12]. *Bauhinia* L. is an extremely variable genus of shrubs and medium sized or large trees of more than 200 species in the sub family Caesalpiniodeae of the large flowering family Leguminosae (Fabaceae) with a pantropical distribution (Albert and Sharma, 2013) [1].

2. Materials and Methods

The plant material was collected from Agharkar Research Institute, Empress Botanical garden and Savitribai Phule Pune University. These 6 species was identified with the help of Flora of Maharashtra and Flora of presidency of Bombay. The names of species of genus *Bauhinia* L. is as follows:

1. *Bauhinia racemosa* L.
2. *Bauhinia hookeri* F. Muell.
3. *Bauhinia blakeana* Dunn.
4. *Bauhinia purpurea* L.
5. *Bauhinia variegata* (L.) Benth.
6. *Bauhinia roxburghiana* Voigt.

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The fresh leaves of plant *Bauhinia* L. were immersed in 80% ethanol for 48-72 hrs with several changes of solvent in order to remove chlorophyll pigments. The leaf samples were washed and treated with 3-5% NaOH at 60 °C for 24-36 hrs. The leaves were kept in water for 15 to 20 days. These leaves were thoroughly washed with water. The digested leaf tissue was carefully brushed out to obtain the leaf skeleton, stained with safranin, blotted with blotting paper and permanent slides were prepared in DPX.

3. Result and Discussions

The leaf morphology shows that the compylodromous venation is observed in many species while the actinodromous only in two species i.e. *Bauhinia racemosa* L. and *Bauhinia roxburghiana* Voigt. Leaf base, apex and margin are same in all the species (table-1). The primary vein number is different for all the species, *Bauhinia racemosa* L. (8), *Bauhinia hookeri* F. Muell. (10), *Bauhinia blakeana* Dunn. (8), *Bauhinia purpurea* L. (9), *Bauhinia variegata* (L.) Benth.

(12), *Bauhinia roxburghiana* Voigt (9) (table 2). The position of secondary vein is alternate to sub opposite and abruptly curved in *Bauhinia racemosa* L. and *Bauhinia hookeri* F. Muell., opposite to sub opposite in *Bauhinia blakeana* Dunn., *Bauhinia purpurea* L. and *Bauhinia roxburghiana* Voigt and alternate in *Bauhinia variegata* (L.) Benth. The *Bauhinia blakeana* Dunn. *Bauhinia purpurea* L. and *Bauhinia variegata* (L.) Benth. The secondary vein course is recurved while in *Bauhinia roxburghiana* Voigt is abruptly curved. The behavior of loop forming branches is obtuse obtuse in *Bauhinia racemosa* L. and *Bauhinia roxburghiana* Voigt. While Acute obtuse in *Bauhinia hookeri* F. Muell. (Table-3). The tertiary veins are same in all the species except in vein islet number (table-4). Like many other sources of characters, the venation pattern also shows the close affinity between the species of *Bauhinia* L. The leaf architecture in all species is unique particularly with reference to morphology of leaf, secondary vein position, course, number of veins and tertiary veins which set apart the species.

Table 1: Morphology of leaf

Sr. No.	Name of Species	Area of leaf (cm) ²	Lamina	Base	Apex	Margin
1	<i>B. racemosa</i> L.	21	Texture- coriaceous, Leaf shape- bifoliolate, venation- actinodromous, leaf surface- glabrous	Cordate	Emarginate	Entire
2	<i>B. hookeri</i> F. Muell.	23	Texture- coriaceous, leaf shape- bifoliolate, venation- campylodromous, leaf surface- glabrous	Cordate	Emarginate	Entire
3	<i>B. blakeana</i> Dunn.	44	Texture- coriaceous, leaf shape- bifoliolate, venation- campylodromous, leaf surface- glabrous	Cordate	Emarginate	Entire
4	<i>B. purpurea</i> L.	79	Texture- coriaceous, leaf shape- bifoliolate, venation- campylodromous, leaf surface- glabrous	Cordate	Emarginate	Entire
5	<i>B. variegata</i> (L.) Benth.	72	Texture- coriaceous, leaf shape- bifoliolate, venation- campylodromous, leaf surface- glabrous	Cordate	Emarginate	Entire
6	<i>B. roxburghiana</i> Voigt.	118	Texture- membranous, leaf shape- reniform, venation- actinodromous, leaf surface- glabrous	Cordate	Rounded	Entire

Table 2: venation patterns and characters of primary veins

Sr.no	Name of Species	Venation type	Primary vein		
			Course	Size	No. of primary veins
1	<i>B. racemosa</i> L.	AD	MD	S	8
2	<i>B. hookeri</i> F. Muell.	CD	MD	S	10
3	<i>B. blakeana</i> Dunn.	CD	MD	S	8
4	<i>B. purpurea</i> L.	CD	MD	S	9
5	<i>B. variegata</i> (L.) Benth.	CD	MD	S	12
6	<i>B. roxburghiana</i> Voigt.	AD	MD	S	9

Note: AD- Actinodromous, CD- Campylodromous, MD- Multicostate Divergent, S- Stout

Table 3: Characters of secondary veins

Sr. No	Name of species	Secondary veins					
		Position	Angle	Course	No. of 2 ^o veins	Distance (cm) ²	Behaviour of loop forming branches
1	<i>B. racemosa</i> L.	AS	50-125°	AC	13	1.2	OO
2	<i>B. hookeri</i> F. Muell.	AS	30-155°	AC	19	0.9	AO
3	<i>B. blakeana</i> Dunn.	OS	40-145°	RC	38	1.2	-
4	<i>B. purpurea</i> L.	OS	50-130°	RC	26	1.5	-
5	<i>B. variegata</i> (L.) Benth.	A	60-145°	RC	43	1	-
6	<i>B. roxburghiana</i> Voigt.	OS	35-140°	AC	18	2.2	OO

Note: A- Alternate, AS- Alternate to sub opposite, OS- Opposite to sub opposite, AC- Abruptly curved, RC- Recurved, OO- Obtuse: Obtuse angle, AO- Acute Obtuse.

Table 4: characters of tertiary veins of leaf lamina and vein islet no.

Sr. No.	Name of species	Tertiary veins		Relationship of midvein	arrangement	Vein islet no.
		Angle of Origin	Course			
1	<i>B. racemosa</i> L.	RR	Sinuous	Oblique	ALOP	59
2	<i>B. hookeri</i> F. Muell.	AA	Forked	Oblique	ALOP	28
3	<i>B. blakeana</i> Dunn.	RR	Convex Sinuous	Oblique	ALOP	70
4	<i>B. purpurea</i> L.	RR	Convex	Oblique	ALOP	68
5	<i>B. variegata</i> (L.) Benth.	RR	Convex	Oblique	ALOP	51
6	<i>B. roxburghiana</i> Voigt.	AA	Convex	Oblique	ALOP	34

Note: RR-Right: Right angle, AA-Acute: Acute, ALOP- Alternate and opposite.

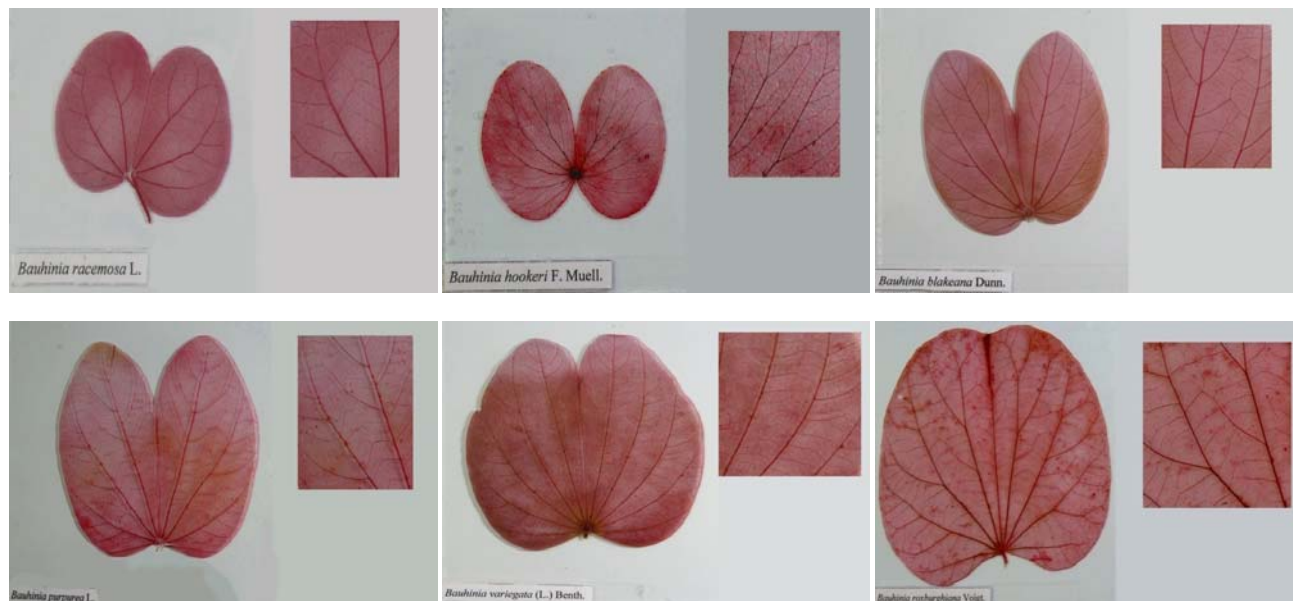


Plate-1: Leaf venation patterns in Genus *Bauhinia* L.

The following authentication key was formulated on the basis of the morphology of leaf and variations in internal characteristics of primary, secondary and tertiary veins of leaves.

3.1 Key

Leaf lamina Actinodromous
 Apex emarginated.....*auhinia racemosa*
 Apex rounded.....*Bauhinia roxburghiana*
 Leaf lamina campylodromous
 Course of secondary vein abruptly curved....*Bauhinia hookeri*
 Course of secondary vein recurved Position of secondary vein alternate*Bauhinia variegata*
 Position of secondary vein opposite to sub opposite
 Course of tertiary vein convex sinous.....*Bauhinia blakeana*
 Course of tertiary vein convex.....*Bauhinia purpurea*

4. Conclusion

The presence of variable patterns of the leaf venation is significant because it can be used as an additional piece of data, especially in the group identification of species and also to directly differentiate some *Bauhinia* species. We concluded that from above key, it will be useful in future for the classification of angiosperm plants.

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