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ORIGINAL ARTICLE

Identification of five species of *Beilschmiedia* using leaf architecture – an anatomical tool

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Abstract

The genus *Beilschmiedia* belongs to family Lauracaeae. For the present study five species of genus *Beilschmiedia* namely *Beilschmiedia assamica, B. gammieana, B. roxburghiana, Beilschmiedia brandisii* and *B. fagifolia* were collected. All five species of genus *Beilschmiedia* studied all show Pinnate Camptodromous festooned brochidodromous type of venation. The highest vein order is 6°. Based on the secondary veins angle of divergence and angle of origin of tertiary veins, the species can be further separated. There is very little work done on the the leaf architecture studies in this genus and so this present study was undertaken. The species are so intimate by their leaf morphological characters, it is often difficult to determine their nomenclature types. Hence attempt has been made to recognise the taxonomic value of laminar architecture of the species growing in India.

Keywords: Leaf architecture, *Beilschmiedia,* Pinnate Camptodromous, festooned brochidodromous.

Introduction

The family Lauraceae aromatic erect, trees or shrubs. Hooker (1883) separated Lauraceae generically on the character of 2 and 4 celled anthers into tribe Perseaceae which had shrubs or trees. Third row of stamens, if present, with the anther-cells opening outwards by valves. *Beilschmedia* belongs to it. The genus has evergreen trees or shrubs. Leaves are alternate or opposite and flowers are small, bisexual borne in fascicles or panicles or solitary. For the present study the species collected are *Beilschmiedia assamica,* Meissn., *Beilschmiedia brandisii,* HK. f., *Beilschmiedia fagifolia,* Nees., *Beilschmiedia gammieana,* King. and *Beilschmiedia roxburghiana,* Nees. *Beilschmiedia assamica* has opposite leaves which are elliptic ovate or lanceolate obtusely acuminate shining and reticulate on both surfaces. The leaves of *B. brandisii* are alternate, elliptic-oblong acuminate glabrous. While the leaves of *B. fagifolia* are elliptic or elliptic-lanceolate, obtusely acuminate. Those of *B. gammieana* are opposite, elliptic-oblong or ovate obtusely acuminate shining and reticulate on both sides. *B. roxburghiana* has ovate or ovate lanceolate or elliptic oblong, obtusely acuminate, shining and finely reticulate on both surfaces (Hooker, 1883).These species are difficult to identify morphologically and so leaf venation study could be an important tool in the separation of the species.

Materials and methods

The plant material for this work was collected from Shillong-Meghalaya. The duplicates of herbarium were collected from the herbarium section of B.S.I. Eastern Circle and A.R.I., Pune. The plant material which was collected was identified, checked and authenticated with the help of Standard Herbaria from A.R.I. Herbarium, Pune and B.S.I. Eastern Circle, Shillong.

For leaf clearing the method used was as described by Payne, (1969) and Mohan Ram and Nayyar, (1978) in which the mature leaves either fresh, dried or preserved were first cleared by keeping them in 5% sodium hydroxide solution at room temperature for 1-2 days. The decoloured leaves

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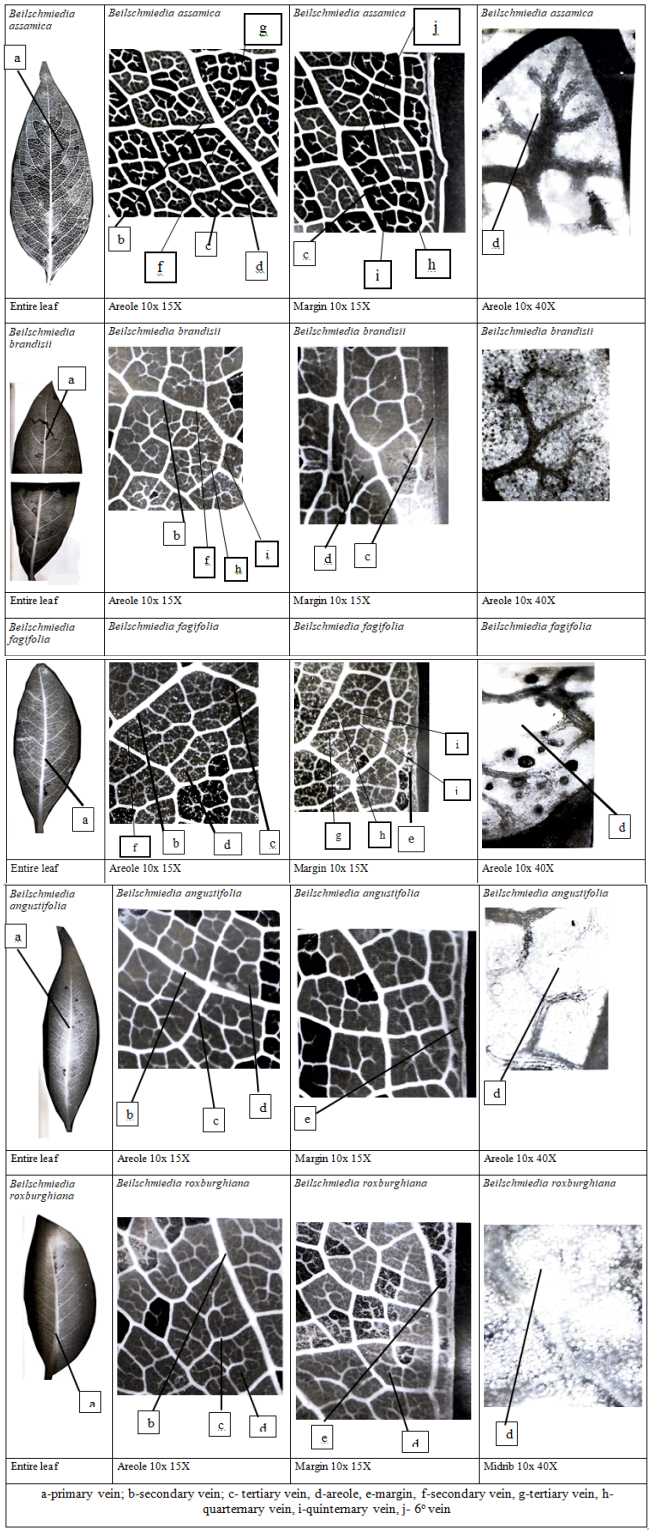

Figure 1: a-primary vein; b-secondary vein; c- tertiary vein, d-areole, e-margin, f-secondary vein, g-tertiary vein, h-quarternary vein, i-quinternary vein, j- 6o vein

were washed and transferred to 5% sodium hypochlorite till they were transparent. They were then thoroughly washed to remove acid traces and were stained with aqueous Saffranine by keeping them in it for 10-15 minutes. The leaves were then mounted in glycerine jelly. The terminology used in is in accordance with Hickey (1973, 1979), Hickey and Wolfe (1975), Dilcher (1974) and Melville (1976).

Observations and Results

Out of the five species of genus *Beilschmiedia* studied all show Pinnate Camptodromous festooned brochidodromous type of venation. The highest vein order is 5º in *Beilschmiedia assamica, B. gammieana* and *B. roxburghiana*. Secondary vein angle of divergence is acute moderate and pattern of tertiary veins is random reticulate in *B. gammieana* and *B. roxburghiana*. These two species can be further separated on the basis of angle of origin of tertiary veins OO/OR/OA/RO/RR in *B. roxburghiana* and OR/AR/RR/OO/RA in *B. gammieana*. The secondary veins angle of divergence are acute narrow and tertiary veins pattern is orthogonal reticulate with angle of origin of tertiary veins RR/RA/AR/AA/RO in *B. assamica*. In *B. assamica* the pattern is orthogonal reticulate. The higher order venation forming a reticulum in which vein orders are distinct. Quarternary veins (4^0) are thin; its course is orthogonal. Quinternary veins (5^0) are thin; its course is orthogonal. The highest vein order of leaf is 5^0. The marginal ultimate venation is looped. Areoles are well developed; arrangement is random reticulate and shapes are triangular, quadrangular, pentagonal polygonal. Veinlets are present and are branched three times.
Tracheoids present at the vein
endings.

The highest vein order is 6º, tertiary veins pattern is random reticulate and observed in *Beilschmiedia brandisii* and *B. fagifolia*. These two species are separated on the basis of angle of origin of tertiary veins which is AO/AR/RR/RA/RO/OO in *B. fagifolia* and OO/OR/RR/RO/AO in *B. brandisii*. In *B. brandisii* the pattern is random reticulate. The higher order venation forming a reticulum in which vein orders are distinct. Quarternary veins (4^0) are thin; its course is orthogonal. Quinternary veins (5^0) are thin; its course is orthogonal. The highest vein order of leaf is 6^0. The marginal ultimate venation is looped. Areoles are well developed; arrangement is random reticulate and shapes are triangular, quadrangular, pentagonal, polygonal. Veinlets are present and are branched three times. Tracheoids present at the vein endings.

Key to the species

Pinnate Camptodromous, with festooned brochidodromous venation
Highest vein order 5º
Secondary veins angle of divergence acute narrow
Pattern of tertiary veins orthogonal reticulate
Angle of origin of tertiary veins RR/RA/AR/AA/RO……
……*B. assamica*
Secondary veins angle of divergence acute moderate
Pattern of tertiary veins random reticulate

Angle of origin of tertiary veins is OR/AR/RR/OO/RA ……..*B. roxburghiana*
Angle of origin of tertiary veins is OO/OR/OA/RO/RR ……..*B. gammieana*
Highest vein order 6°
Secondary veins angle of divergence acute narrow
Pattern of tertiary veins random reticulate
Angle of origin of tertiary veins is OO/OR/RR/RO/AO ……..*B. brandisii*
Secondary veins angle of divergence acute moderate
Pattern of tertiary veins random reticulate
Angle of origin of tertiary veins is AO/AR/RR/RA/RO/OO ……..*B. fagifolia* Figure 1 (A-T).

Discussion

Leaf architectural study is found to be useful for taxonomic purpose. Kerner and Oliver (1895) had worked out systems of classification based on foliar venation. Later Foster (1953) published paper dealing with foliar venation. Hall and Melville (1954) proposed veinlet termination number as a technique for testing the purity of fragments of a particular leaf type for pharmacognostical properties. Meyerhoff (1952) and Klucking (1962) worked on venation features of angiosperm leaves. Rao and Bhupal (1973) have studied the sclereids. Rao and Das (1979) presented a resume on the morphological features of tracheoids. The use of cuticular features in taxonomy have been described (Metcalfe and Chalk, 1950; Kasapligil, 1962; Avita and Inamdar, 1980; Ravindran et al, 1991,1993; Christophel *et al.* 1996; Baruah and Nath, 1997).

Vaidya & Agharia (2015) have completed the pharmacognostic studies of *Calophyllum* in which the venation study was an important part.

Chodankar and Vaidya (2021 a, b, c) have already studied the leaf architecture in *Machilus, Phoebe* and *Cinnamomum*. Vaidya (2014, 2015 a & b) has studied the venation and trichomes and stomata (2016a & b) in the species of *Litsaea* which also belongs to family Lauraceae.

Conclusion

The species of *Beilschmiedia* can be separated morphologically based on leaves being pubescent or tomentose, coriaceous and clustered or not clustered. Inflorescence being glabrous, or pubescent and so it is difficult to identify the correct species. Even though all the five species showed pinnate camptodromous, with festooned brochidodromous venation they can be separated with the help of venation pattern, and correctly identified. Thus, anatomy will be a beneficial tool in the identification of the species.

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