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LEAF VENATION ANATOMY – A USEFUL TOOL IN THE INDENTIFICATION OF TEN SPECIES OF GENUS *MACHILUS* OF FAMILY LAURACEAE

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The present work deals with the venation studies in the genus *Machilus* of family Lauraceae. The family Lauraceae is commonly called Laurel family which is of great economic importance**.** Ten species of *Machilus* are studied namely *M. bombycina, M. clarkeana, M. dutheii, M. gamblei, M. globosa, M. khasyana, M. kingii, M. odoratissima, M. parviflora, M. villosa.* The type of venation found is pinnate camptodromous with festooned brochidodromous secondaries. The further separation of the species can be done based on tertiary veins, highest vein order, angle of divergence of secondary and veins, angle of divergence of tertiary veins. Accordingly, and a key has been prepared. The species are so intimate by their leaf morphological characters, such thatit is often difficult to determine their nomenclature types. Hence attempt has been made to recognise the taxonomic value of laminar architecture.

Key Words: *Machilus,* venation, pinnate camptodromous, festooned brochidodromous.

Machilus belongs to family Lauraceae and tribe Perseaceae. *Machilus bombycina* is used for rearing Muga silk worms, *Machilus globosa* is an important source of timber, *Machilus villosa* is used for fuel wood (Hooker, 1883). The classifications by Nees (1836) , Bentham and Hooker (1880), are all based on the following characters within genera: inflorescence paniculate versus umbellate; number of anther cells (2 versus 4); number of stamens ; fruit enclosed in perianth versus seated in a cup or free; and flowers unisexual or bisexual. these classifications are strongly influenced by the choice of the most important character, and differences between the classifications are a result of such choices and are not based on new or better data. Hooker (1883) separated Lauraceae generically on the character of 2 and 4 celled anthers. Hall and Melville (1951, 1954) proposed veinlet termination number as a technique for testing the purity of fragments of a particular leaf type for pharmacognostical properties. System of descriptive terminology and leaf architecture have been presented by Walther (1972) and others, Krusmann (1960), Stace (1965) and Mouten (1960, 1967).The present study is aims at making a key based on the venation patterns so that the species can be identified.

MATERIAL AND METHODS

The plant material for the present work was personally collected from Shillong-Meghalaya; Kodaikanal, Kolli Hills-Tamilnadu. The duplicates of herbarium were collected from the herbarium section of B.S.I. Eastern Circle and A.R.I., Pune. The identification of fresh material was checked with the help of Standard Herbaria from B.S.I. Shillong and B.S.I. Yercaud and A.R.I. Herbarium, Pune.

For the study of leaf architecture, the method used was as described by Payne, (1969) and Mohan Ram and Nayyar, (1978). The terminology used in anatomical studies is in accordance with Hickey and Wolfe (1975), Melville (1976), Hickey (1973, 1979) and Dilcher (1974).

OBSERVATIONS

Ten species of *Machilus* are studied

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namely *M. bombycina* King ex. Hook.f., *M. clarkeana* King ex. Hook.f., *M. dutheii* King, *M. gamblei* King ex. Hook.f., *M. globosa* Das, *M. khasiana* Meisn, *M. kingii* Hook.f., *M. odoratissima* Nees, *M. parviflora* Meisn, *M. villosa* (Roxb.) Hook.f..

Type of venation is pinnate camptodromous with festooned brochidodromous secondaries. Highest vein order of the leaf is 5° seen in eight species of *Machilus* namely *M. bombycina, M. dutheii, M. gamblei, M. globosa, M. khasyana, M. kingii, M. parviflora, M. villosa* (Fig. 1,2 &3).

The secondary veins are acute narrow present in *M. dutheii, M. globosa, M. parviflora, M. villosa.* However the angle of origin of tertiary veins varies. It is OR/RR/OA/RO/RA in *M. dutheii* and RR/OR/RA/OO/RO/AA in *M. villosa*. Pattern of tertiary veins is percurrent and tracheoids present in M. parviflora with angle of origin of tertiary veins AR/OR/RR/OA/RO/AA in *M. parviflor*a. Pattern of tertiary veins is random reticulate with angle of origin of tertiary veins OO/RR/0R/RO/RA observed in *M. globosa.* Thus, all four species are separated.

The angle of divergence of secondary veins is acute moderate in the remaining six species, M. bombycina, *M. clarkeana, M. gamblei , M. khasyana, M. kingii, M. odoratissima*. However, the highest vein order of the leaf is 5° which is present in four species *M. bombycina, M. gamblei, M. khasyana, M. kingii*. Pattern of tertiary veins is percurrent and tracheoids absent in *M. gamblei* and *M. kingii.* These two species are separated on the basis of the angle of origin of tertiary veins RA/OR/RR/OO/OA in *M. gamblei* and RR/RO/AA/RA in *M. kingii*. Pattern of the tertiaries is random reticulate and tracheoids absent in *M. bombycina* and *M. khasyana*. These two species are separated on the basis of angle of origin of tertiary veins OO/AO/RR/AR/AA/OR in *M. bombycina* and RR/RA/RO/OO/OA in *M. khasyana* (Fig. 1,2 &3)

The highest vein order is 6° and the pattern of tertiaries is random reticulate and tracheoids absent in only two species *M. clarkeana* and *M. odoratissima.* The angle of origin of tertiary veins is OA/AR/RR/OR/AA M. clarkeana and RR/OO/AA/RA/OR/AO in *M. odoratissima*

KEY TO VENATION

Pinnate camptodromous with festooned brochidodromous secondaries.

The angle of divergence of secondary veins is acute narrow

Pattern of tertiary veins is percurrent

Angle of origin of tertiary veins is OR/RR/OA/RO/RA

Tracheoids absent -- ***M. dutheii***

Angle of origin of tertiary veins is RR/OR/RA/OO/RO/AA

Tracheoids absent --***M. villosa***.

Angle of origin of tertiary veins is AR/OR/RR/OA/RO/AA

Tracheoids present --- ***M. parviflora***

Pattern of tertiary veins is random reticulate

Angle of origin of tertiary veins is OO/RR/0R/RO/RA

Tracheoids absent --***M. globosa.***

The angle of divergence of secondary veins is acute moderate

Pattern of tertiary veins is percurrent

Angle of origin of tertiary veins is RA/OR/RR/OO/OA

Conventional tracheids present, Tracheoids absent ------------***M. gamblei***

Angle of origin of tertiary veins IS RR/RO/AA/RA

Tracheoids absent--- ***M. kingii.***

Angle of origin of tertiary veins is RR/RA/RO/OO/OA

Tracheoids absent ---***M. bombycina***

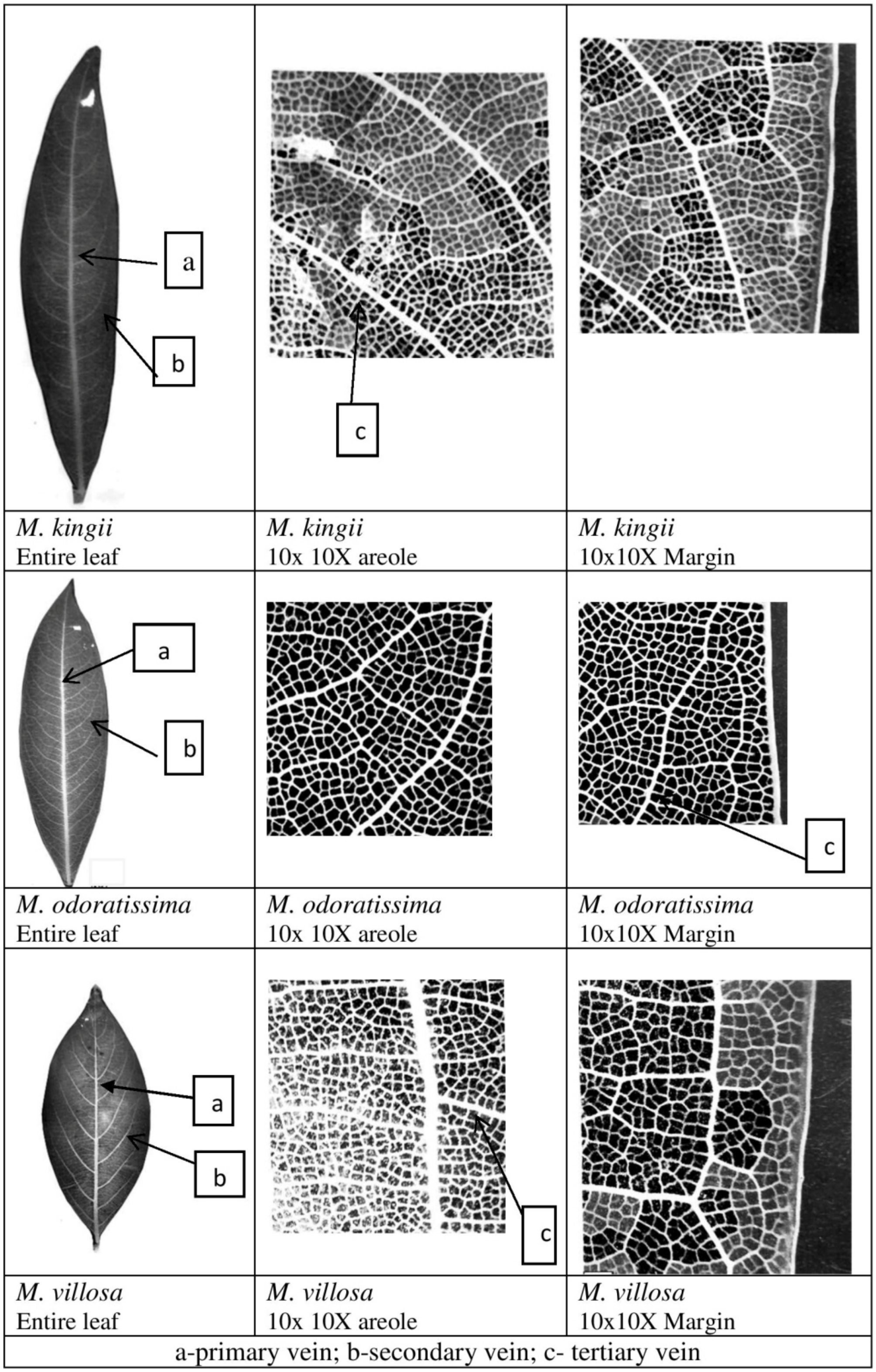
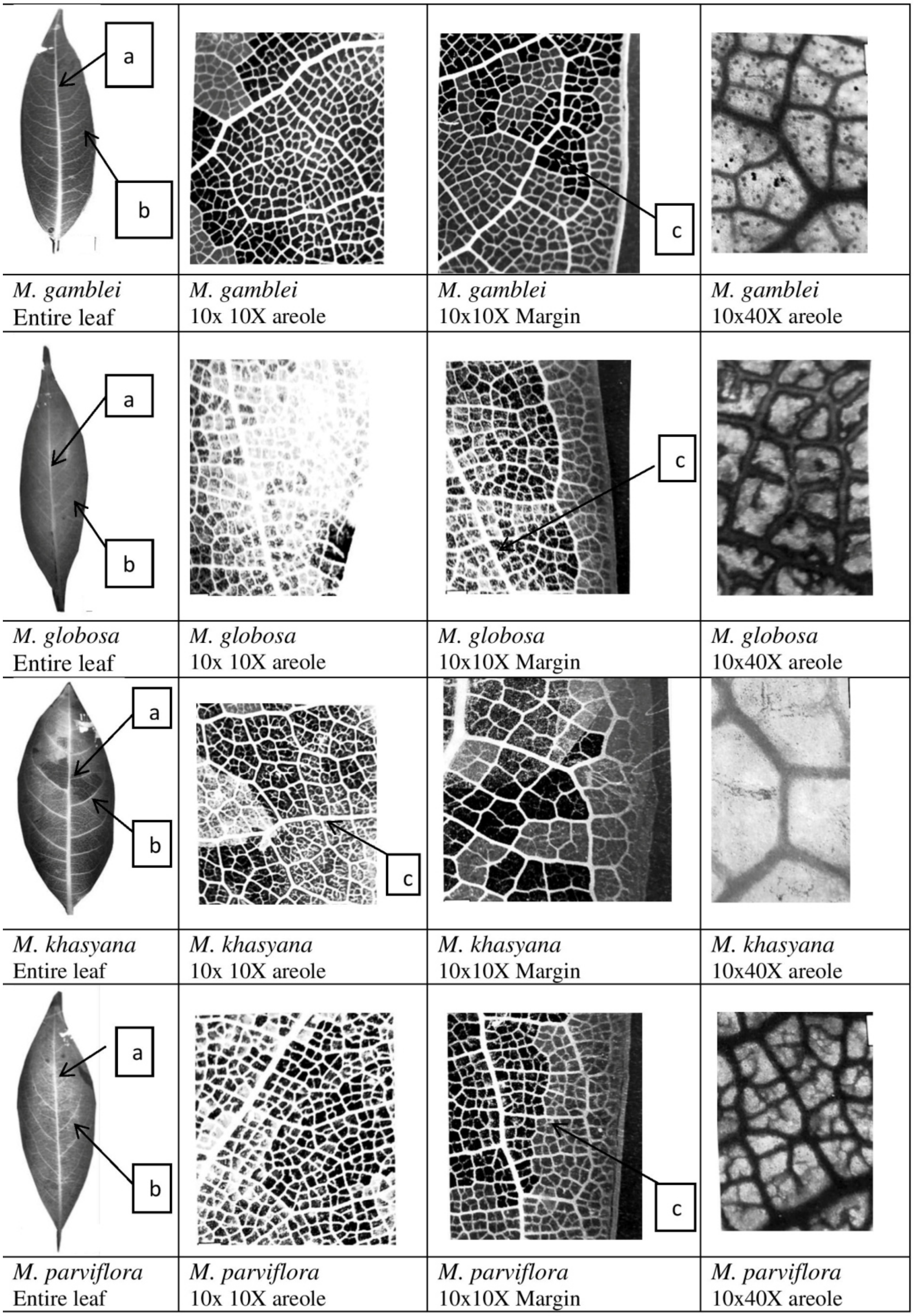
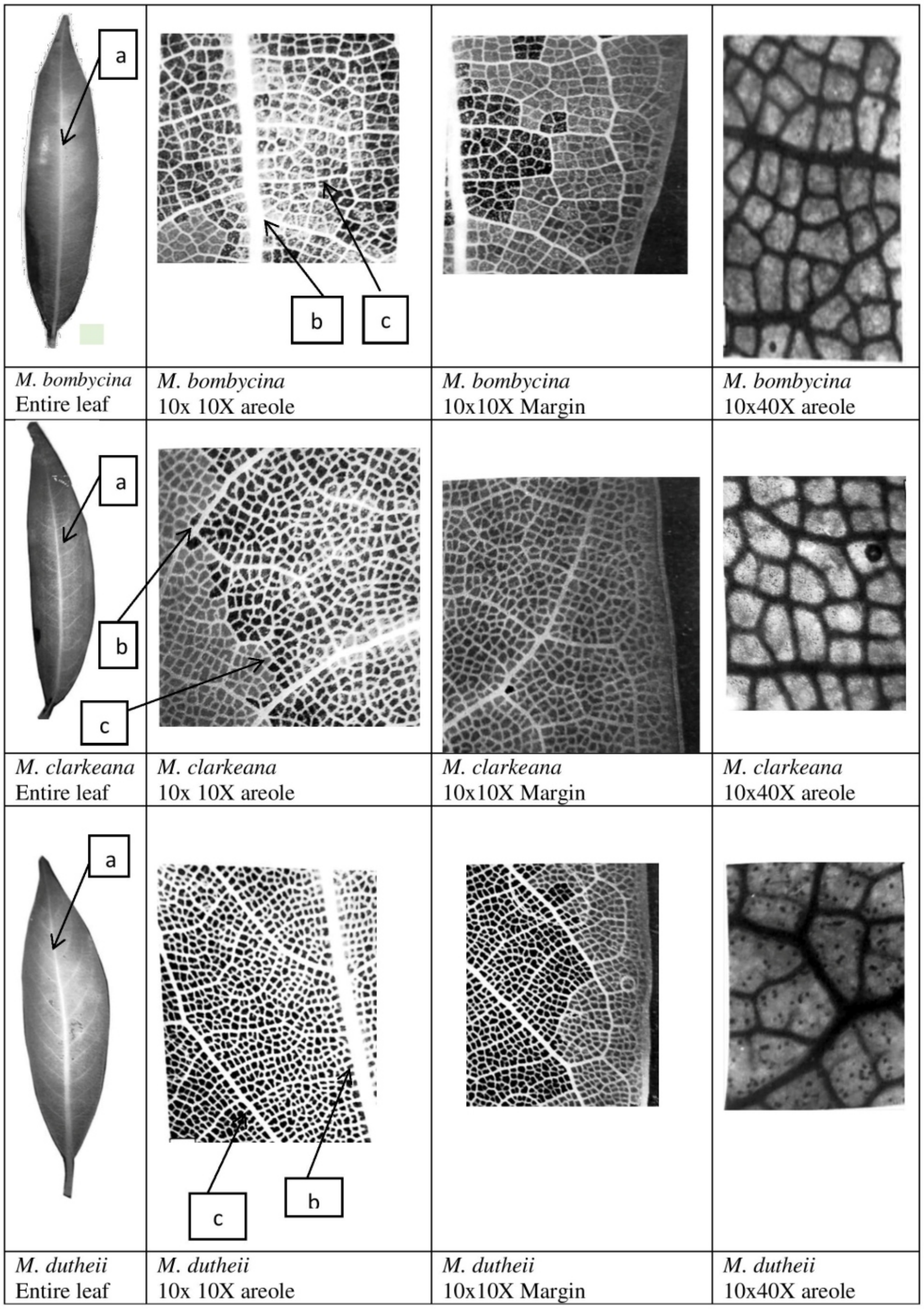


Figure 1: Showing primary and secondary venation in *Machilus Kingi, M. Ordoratissima* and *M. villosa*



a- primary vein; b- secondary vein; c- tertiary vein

Figure 2: Showing primary and secondary venation in *Machilus gamblei, M. globora, M. khasyana* and *M. parviflora*



a- primary vein; b- secondary vein; c- tertiary vein

Figure 3: Showing primary and secondary venation in *Machilus bombycina, M. clarkeana* and *M. dutheii*

Angle of origin of tertiary veins is RR/RA/RO/OO/OA

Tracheoids present ---***M. khasyana***

Pattern of tertiary veins is random reticulate

Angle of origin of tertiary veins is OA/AR/RR/RA/OR/AA

Tracheoids absent ---***M. clarkeana***

Angle of origin of tertiary veins is RR/OO/AA/RA/OR/AO

Tracheoids absent ------------------

------------------------------***M. odoratissima***

[R- Right angle; O-Obutse angle; A – Acute angle]

DISCUSSION

The present work is of venation study and the key to separation of the species has been made. Leaf architectural study is found to be useful for taxonomic purpose. Ettingshausen (1854, 1872) pioneered the leaf architectural studies. Later Foster (1953) published paper dealing with foliar venation. Vein islets area as criteria for classification was first applied by Levin (1929). Foster (1946, 1955); Nicholson (1960); De Roon (1967); have studied the sclereids. Rao and Das (1979) presented a resume on the morphological features of tracheoids. According to them tracheoids in angiosperms are not only of morphological interest but may also help in various ways in taxonomy if they are spread as generic or group characters in relation to particular taxon. This may serve as a diagnostic feature in certain species. Vaidya & Agharia (2015) have studied the venation pattern studies of the medicinally important plant *Calophyllum inophyllum* Linn. and Vaidya & Guleria (2015) has studied the pharmacognosy and anatomy of *Schleichera oleosa* (Lour)Oken. Verma & Vaidya (2014) have also studied the anatomy of *Carica papaya* L. Vaidya (2014 & 2015) has studied the leaf architecture patterns in different species of *Litsaea*, Lamk.

CONCLUSION

Since the plants studied are difficult to identify based on the morphological key, the present work will be a helpful tool for identification of species and play an important role of the use of anatomy in taxonomy.

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