WOOD ANATOMY OF INDIAN SPECIES OF MICHELIA WITH PARTICULAR REFERENCE OF THEIR IDENTIFICATION
LUXMI CHAUHAN AND R. DAYAL

Wood Anatomy, Botany Division, Forest Research Institute, Dehra Dun (India)

Introduction

Michelle is one of the commercially important genera of the family Magnoliaceae. The wood finds a variety of uses such as posts, boards, veneers, decorative fittings, manufacture of plywood and light construction work. The timber is specified for ammunition boxes, plywood boxes, battens of internal fitting, jute hobbins, turnery articles, handles for brushes, decorative plywood and door, window and ventilator frames etc.

In India, Michelle is represented by 11 species. The woods of all the species are homogeneous in physical and gross anatomical features (Chowdhury and Ghosh, 1958) and are known as 'champ' in the trade (Anon, 1976). With a view to distinguish the different Michelle species for their effective utilisation, detailed anatomical studies have been undertaken on 8 species of Michelle available in the wood collection of Forest Research Institute, Dehra Dun. Anatomical characters such as shape, size and frequency of vessels, presence and absence of spirals, ray height and width, presence and absence of oil cells in the rays and shape of fibres as seen in cross section were taken into consideration for the separation of the species.

Material and Methods

The authentic samples of the following species available in the Wood collection (Xylarium) of the F.R.I were taken for the present study.

M. baillonii Finet and Gagnep. – DDw 7256 Assam.
M. champaca L. – DDw 5806 West Bengal, DDw 7265 West Bengal, DDw 7892 Bihar.
M. doltsopa DC. – DDw 60 0 West Bengal, DDw 8267 West Bengal.
M. kisopa Ham. ex DC. – DDw 8155 U.P.
M. mannii – DDw 7257 Assam, DDw 7488 Assam.
M. nilagirica Zenk– DDw 6078 Tamil Nadu, DDw 6399 Tamil Nadu.
M. oblonga Wall. – DDw 7411 Assam, DDw 7413 Assam, DDw 7314 Assam.
M. velutina DC. – DDw 3331 West Bengal, DDw 8290 West Bengal.

Cross, radial and tangential sections were prepared and stained with haematoxylin and safranin. The sections were mounted by following the usual laboratory procedure. For observations of crystals and silica, unstained sections were first bleached by sodium hypochlorite solution and then washed, dehydrated and mounted after treating with phenol crystals.
Table 1

Diagnostic anatomical features of *Michelia* species

<table>
<thead>
<tr>
<th>Species</th>
<th>Acc No.</th>
<th>Sp. gr.</th>
<th>% Solitary</th>
<th>Radial multiples</th>
<th>Frequency per mm²</th>
<th>Angular in cross section</th>
<th>Oval to circular in cross section</th>
<th>Max. Tang. Diameter</th>
<th>Bars on perforation plate</th>
<th>Tylodes</th>
<th>Spirals</th>
<th>Pits on radial walls</th>
<th>Circular to angular in cross section</th>
<th>Rectangular in cross section</th>
<th>Sensation</th>
<th>Max. width in μm</th>
<th>Max. height in μm</th>
<th>Oil cells</th>
<th>Diffuse</th>
<th>Concentric bands (Terminal)</th>
<th>Sensations</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>M. baillonii</em></td>
<td>7256</td>
<td>50-60 2-4 15-22 - +</td>
<td>160 3-6 + - + + + 1-4 55 800 + + + 2-6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>M. champaca</em></td>
<td>5806</td>
<td>50 2 4 11-17 - +</td>
<td>128 2-8 + - + + + 1-4 65 800 + + + 4-1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7265</td>
<td>60 2 4 25-35 + -</td>
<td>130 2-6 + - + + + 1-4 75 900 + + + 4-7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7892</td>
<td>60 2-5 15-20 - +</td>
<td>128 2-5 + - + + + 1-5 46 880 + + + 2-5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>M. doltsopa</em></td>
<td>6000</td>
<td>50 2-8 30-45 + -</td>
<td>80 5-12 + + + + + 1-4 65 650 + + + 3-6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>8267</td>
<td>50 2-7 30 50 + -</td>
<td>65 5-15 + + + + + 1-4 63 900 + + + 2-5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>M. kisopa</em></td>
<td>8155</td>
<td>30 2-10 40 80 + -</td>
<td>95 2-11 + + + + + 1-3 44 800 + + + 2-5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>M. manii</em></td>
<td>7257</td>
<td>50 2-4 14-20 - +</td>
<td>160 5-10 + - + + + 1-4 67 800 + + + 2-6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7488</td>
<td>60 2-4 10-22 - +</td>
<td>165 4-7 + - + + + 1-4 48 960 + + + 3-6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>M. nilagirica</em></td>
<td>6038</td>
<td>40 2-5 40-60 + -</td>
<td>128 2-5 + + + + + 1-3 41 640 + + + 2-5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6399</td>
<td>40 2-6 40-60 + -</td>
<td>120 2-8 + + + + + 1-3 55 960 + + + 2-5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>M. chlonga</em></td>
<td>7411</td>
<td>50 2 4 15-30 - +</td>
<td>144 2-5 + - + + + 1-3 44 850 + + + 2-5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7413</td>
<td>40 2-7 18-30 - +</td>
<td>144 2-5 + - + + + 1-4 62 850 + + + 2-6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7514</td>
<td>60 2-4 30-35 - +</td>
<td>112 2-5 + - + + + 1-4 52 850 + + + 2-5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>M. velutina</em></td>
<td>3331</td>
<td>40 2-4 30 50 + -</td>
<td>80 5-9 + + + + + 1-3 52 850 + + + 3-10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>8290</td>
<td>60 2-6 30-50 + -</td>
<td>65 2-9 + + + + + 1-3 48 850 + + + 3-10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The frequency (per mm²) and size of vessels have been recorded from cross sections. The detailed anatomical observations have been presented in Table 1.

Observations and Discussion

From the samples and sections the following properties and characteristics were observed. The colour of wood varies from yellowish-white to olive-green or olive-brown. They are soft to moderately hard, light to moderately heavy and medium fine-textured. The woods are diffuse-porous with distinct growth rings. The vessels are small to moderately large, 15-60 per mm² in frequency, solitary or in short (Pl. 1, Fig. 1) to long, radial multiples and clusters (Pl. 1, Figs 2, 3 and 4) with scalariform perforation, spiral thickening are present in some species (Pl. 2, Figs. 7 and 9), intervacular pitting is large and scalariform and the pits to rays and parenchyma are large and simple. Unilaterally compound (Pl. 2, Fig. 8) tyloses are often present. The parenchyma is terminal 2-10 cells wide (Pl. 1, Fig. 1). The rays are 1-4 seriate composed of upright and procumbent and square cells, heterogeneous (Pl 2, Figs. 5 and 6) with 1-4 rows of upright and square cells. Oil cells are present in some species (Pl. 2, Figs 5, 6) and fibre wall 3-5µm thick. Crystals are absent. Silica is present in some species as lining the vessel walls and tyloses (Fig. 11).

Plate 1

Fig. 1 — Michelia champaca L. Cross section showing moderately large, vessels arranged solitary or in short radial multiples and terminal band of parenchyma ×14.

Fig. 2 — M. doltsopa DC. Cross section showing small to very small vessels arranged in short to long radial multiples ×14.

Fig. 3 — M. kisopa Ham ex DC. Cross section showing small to very small vessels arranged in radial multiples and clusters ×14.

Fig. 4 — M. nilagirica Cross section showing small to moderately large very numerous vessels arranged in short to long radial multiples and clusters ×14.

Plate 2

Fig. 5 — M. baillonii Gagnep and Finet. — Radial section showing oil cells in rays and spirals in vessels ×80.

Fig. 6 — M. baillonii Tang. Section ×80.

Fig. 7 — M. doltsopa DC. Radial section showing tyloses and spirals in vessels ×80.

Fig. 8 — M. doltsopa DC. Radial section showing scalariform perforation and ray-vessel pitting ×80.

Fig. 9 — Same Tang. Section ×80.

Fig. 10 — M. champaca L. Radial section showing non-septate fibres with small bordered pitting.

Fig. 11 — M. kisopa DC. Tang. section showing silicified tyloses.
Wood anatomy of Indian species of *Michelia* with particular reference of... 925

Plate 1
Pearson and Brown (1932) have given a key for identification of three commercial species by using vessel diameter, range of radial multiples, ray height and presence/absence of spiral thickening. The quantitative anatomical features recorded in the present study (Table 1) indicate that percentage of radial multiples, number of bars on scalariform perforation plate, ray width and height are of limited value in specific delimitation. The features such as frequency, shape and maximum tangential diameter of vessels, presence/absence of oil cells in rays and presence/absence of spirals in vessels are of diagnostic value in identification of different species studied. A tentative key has also been prepared and is given below.

**Key to the Species**

1. (i) Max. tangential diameter of vessels > 100μm — 2  
2. (ii) Max. tangential diameter of vessels < 10μm — 5
3. (i) Oil cells in rays present — 3  
4. (ii) Oil cells in rays absent — *M. oblonga*
5. (i) Spirals in vessels present — 4  
6. (ii) Spirals in vessels absent — *M. champaca, M. manii*
7. (i) Frequency of vessels 40-60 per mm³ — *M. nilagirica*  
8. (ii) Frequency of vessels 15-20 per mm³ — *M. baillonii*
9. (i) Frequency of vessels 50-80 per mm³ — *M. kisopa*  
10. (ii) Frequency of vessels 30-50 per mm³ — 6
11. (i) Silica (viterous) in vessels present — *M. lanuginosa*  
12. (ii) Silica (viterous) in vessels absent — *M. excelsa*

**SUMMARY**

The wood structure of eight Indian species of *Michelia* have been studied in detail with a view of determining features of diagnostic value for their identification. The study indicate that various anatomical characters viz. frequency, size and shape of vessels, presence/absence of oil cells in rays and presence/absence of spirals in vessels are likely of value for their specific delimitation. A tentative key has also been given.

अभिज्ञान के विदेश संबंध में माइकेलिा: जाति की भारतीय वृक्ष जातियों का कांप-कारोर  
लक्ष्मी नोहान व आरो दयाल  
सारात  
माइकेलिा जाति की आठ भारतीय प्रकाश जातियों की कांप सर्जना का विभूत  
अथवा अभिज्ञान के पहचान पर मूल न रुयु सर्जना विशिष्टताओं का निर्णय करने की दृष्टि से
References

