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### **Physical and Anatomical Properties of Selected Timber Species and Their Medicinal Uses**

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#### **ABSTRACT:**

The present study was conducted on 16 timber species namely *Alangium chinensis*, *Albizia lebbek*, *Albizia procera*, *Azadirachta indica*, *Bauhinia purpurea*, *Bombax ceiba*, *Cassia fistula*, *Cedrus deodara*, *Ficus benjamina*, *Ficus hispida*, *Mangifera indica*, *Mesua ferrea*, *Syzygium cumini*, *Terminalia arjuna*, *Terminalia bellerica* and *Thuja orientalis* with an aim to evaluate the wood characteristics and their medicinal uses. It was found that 13 no. of wood species were diffuse porous and only one was ring porous. The growth rings were distinct in *C. deodara* and *T. orientalis*. Rhomboidal crystals were observed in parenchyma of *T. bellerica*, *T. arjuna*, *C. fistula*, *M. indica* and *F. benjamina*. Latex ducts were present in rays of *F. hispida*. On the other hand, resin ducts and gum ducts were present in *C. deodara* and *M. indica* respectively. Also red, yellow and brownish deposits were reported in vessels, rays and parenchyma of other timber species. Medicinally, wood of *T. orientalis* is used against bacterial infection, diabetes, and inflammation and skin diseases. *C. deodara* wood is of great importance in anti- inflammation, rheumatism. *A. indica* is used in toothache while *T. arjuna* is used in blood pressure and hepatic problems. Other woods like *B. ceiba*, *A. lebbek* are utilized in diabetes, bacterial and viral infection. The present study revealed that utilization of these wood species for pharmaceutical purposes might be due to presence of gummy deposits, crystals, latex, resin or other deposits in wood.

**KEYWORDS:** Hardwoods, Softwoods, Growth rings, Crystals, Latex ducts.

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## INTRODUCTION:

Wood is one of the oldest natural resources that provide service to mankind through ages. It is of biological origin and versatile material. It is used for variety of purposes like timber, fuel etc. A perusal of literature shows that the bark, leaf, flower, and fruit are mainly exploited for medicines. Also, resins and gums obtained from trees have been utilized for medicinal purposes since time immemorial. Since gums contain high amount of sugar and are formed by the disintegration of internal plant tissues, therefore, these have been utilized in the preparation of drugs and other industrial applications<sup>1</sup>.

Very limited information is available regarding the importance of wood for medicinal uses apart from its timber utilization. Therefore, the present work has been undertaken to study the anatomical features and to determine the type of deposits present in different wood elements.

## MATERIALS AND METHODS:

Studies on wood samples of 16 timber species namely *Alangium chinensis*, *Albizia lebbek*, *Albizia procera*, *Azadirachta indica*, *Bauhinia purpurea*, *Bombax ceiba*, *Cassia fistula*, *Cedrus deodara*, *Ficus benjamina*, *Ficus hispida*, *Mangifera indica*, *Mesua ferrea*, *Syzygium cumini*, *Terminalia arjuna*, *Terminalia bellerica* and *Thuja orientalis* were collected from various parts of NE India.

## STUDY AREA



Figure 1: Location Map of study area.

Trees with straight bole and uniform crown were selected for each species and wood samples of size 5cm<sup>3</sup> were taken at breast-height. Each wooden block was cut into 2 cm<sup>3</sup> size and fixed in FAA for 24-48 hours, after which they were preserved in 50% alcohol. Cross, radial longitudinal section and tangential longitudinal sections were cut with the help of a sliding microtome. The slides were prepared by staining the sections in autostainer as per standard procedure. The slides were observed under research microscope and the terminology was used according to IAWA Committee (1989)<sup>2</sup>.

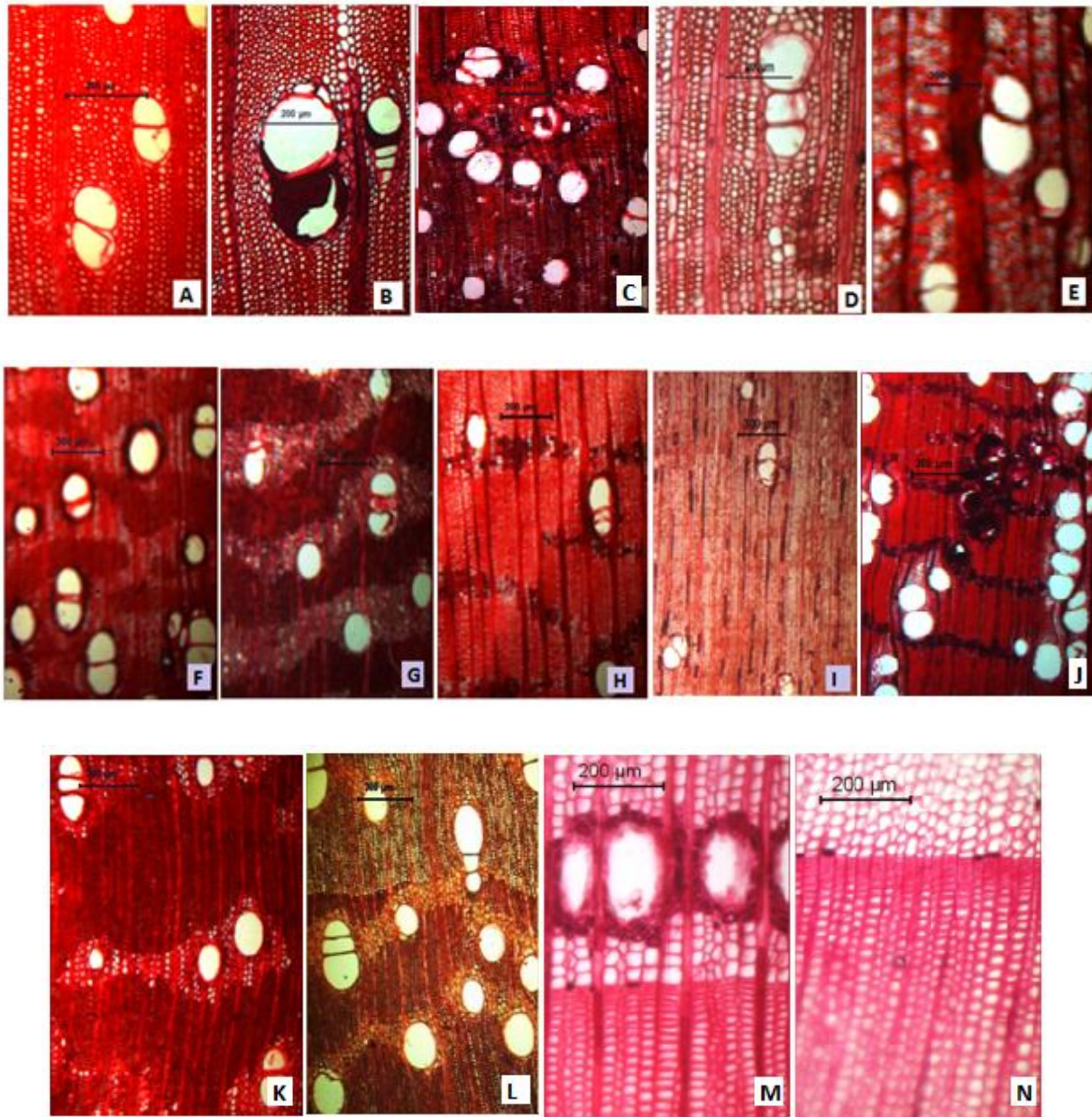
## RESULTS AND DISCUSSION:

The present study shows that all selected species have distinct heartwood and sapwood. The gross features of woods are given in Table 1 which show that the colour of the heartwood varies from yellowish white, brown to dark brown, yellowish brown to yellowish red, pinkish white, white, yellowish white to pale greyish brown, reddish white, creamy yellow, whitish to yellowish brown and whitish to brown. The wood is moderately hard in *A. lebbek*, *A. procera*, *B. purpurea*, *C. deodara*, *M. indica*, *T. bellerica* and *T. orientalis* while hard in *Azadirachta indica*, *Cassia fistula*, *Mesua ferrea* and *Terminalia arjuna*. The wood is soft in *Alangium chinensis*, *Bombax ceiba*, *Ficus benjamina* and *Ficus hispida*. The orientation of grain varies from coarse, medium coarse texture to fine texture. The rays features also varies from moderately broad to fine, fine to very fine.

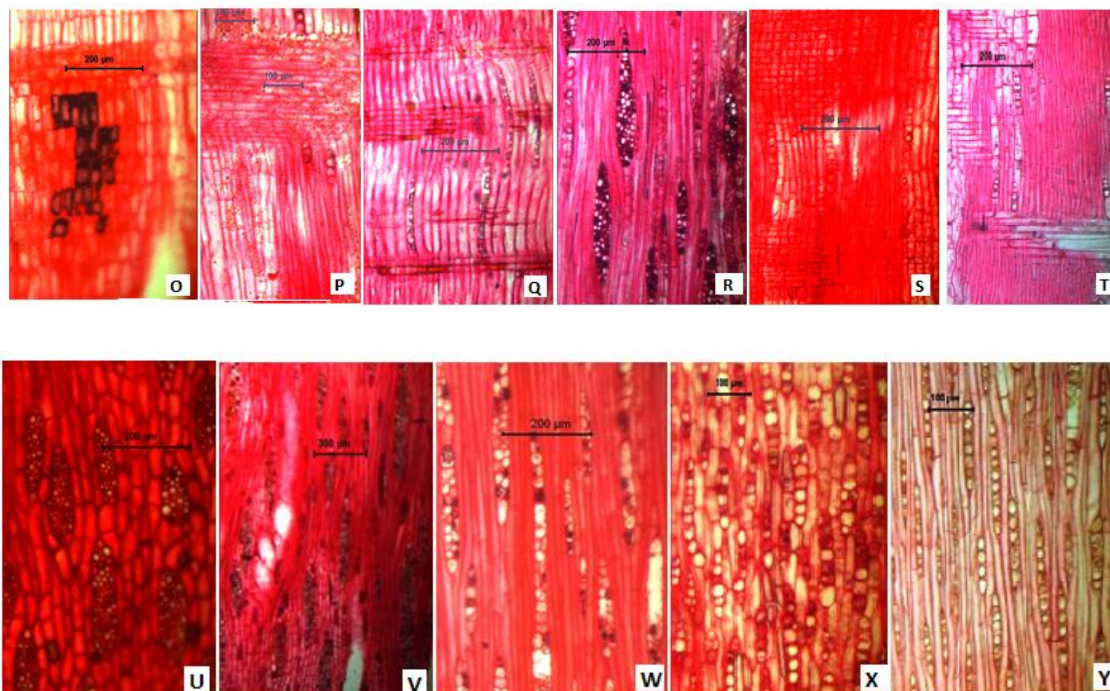
The anatomical features of the selected species are presented in Table 2. It shows that all species have diffuse-porous woods except *A. lebbek*, *A. indica* and *A. chinensis*. Growth ring boundaries are indistinct in all species except *A.chinensis*, *M. indica*, *T. bellerica* and *F. hispida*. Rays uniseriate, biseriata and multiseriate in all species except *M. indica*, *T. arjuna*, *T. bellerica*, *M. ferrea*, *F. hispida* and *A. indica*. Parenchyma vasicentric in *A. lebbek*, *A.indica*, scanty paratracheal in *M.ferrea*, *A. chinensis*, *B. ceiba*, *B. purpurea*, lozenge-aliform in *M. indica*, *T. arjuna*, *A. procera*, *F. hispida* and banded in *C. fistula*, *F. benjamina* (figure 2). Prismatic crystals are observed and found absent in *B. ceiba*, *A. chinensis*, *M. ferrea* and *F. benjamina* (figure 3). Black and yellow deposits are present in all selected species. Tyloses are present in all selected species except *A. procera*, *T. arjuna* and *T. bellerica*. Traumatic resin ducts are present in *C. deodara* (Figure 2).

Table 1: Gross physical features of selected timber species

Species name	Colour	Hardness	Heaviness	Grain	Texture	Rays
<i>Alangium chinensis</i> Lour.	White	Soft	Light	Straight grain	Medium coarse texture	Moderately broad to fine
<i>Albizia lebbek</i> Linn.	Yellowish white	Moderately hard	Moderately heavy	Interlocked grain	Coarse	Fine
<i>Albizia procera</i> Roxb.	Brown to dark brown	Moderately hard	Moderately heavy	Shallowly interlocked grain	Coarse	Fine
<i>Azadirachta indica</i> A.Juss.	Yellowish grey to reddish brown	Hard	Heavy	Interlocked grain	Medium coarse texture	Moderately broad to fine
<i>Bombax ceiba</i> Linn.	Creamy white	Soft	Light	Straight grain	coarse texture	broad to fine
<i>Bombax purpurea</i> Linn.	Pinkish white	Moderately hard	Moderately heavy	Straight to interlocked grain	Coarse	Fine
<i>Cassia fistula</i> Linn.	Yellowish brown to yellowish red	Hard	Heavy	Straight to Shallowly interlocked grain	Coarse	Fine to very fine
<i>Cedrus deodara</i> Roxb.	White to yellowish brown	Moderately hard	Moderately heavy	Straight and even grained	Medium fine texture	Very fine
<i>Ficus benjamina</i> L.	Greyish white to brownish grey	Soft	Light	Shallowly interlocked grain	Medium coarse texture	Moderately broad to fine
<i>Ficus hispida</i> Linn.	Whitish or greyish white	Soft	Light	Shallowly interlocked grain	Coarse	Moderately broad to fine
<i>Mangifera indica</i> Linn.	Yellowish white to pale greyish brown	Moderately hard	Moderately heavy	Straight to Shallowly interlocked grain	Medium coarse texture	Moderately broad to fine
<i>Mesua ferrea</i> Linn.	Greyish white to brick red	Hard	Heavy	Interlocked grain	Medium coarse texture	Fine
<i>Terminalia arjuna</i> (Roxb. ex Dc.) Wight & Arn.	Reddish white	Hard	Heavy	Interlocked grain	Coarse	Fine to very fine
<i>Terminalia bellerica</i> Gaertn.	Creamy yellow	Moderately hard	Moderately heavy	Straight grain	Coarse	Fine to very fine
<i>Thuja orientalis</i> Linn.	Whitish to brown	Moderately hard	Moderately heavy	Closed grain	fine texture	Fine



**Figure 2:** “A-N” C.S. of *A.chinensis*, *A.lebbek*, *A.procera*, *A.indica*, *B.ceiba*, *B.purpurea*, *C.fistula*, *F.benjamina*, *F.hispida*, *M.indica*, *M.ferrea*, *T.arjuna*, *T.bellerica*, *C.deodara* and *T.orientalis*. Growth rings indistinct in all selected species except *A.chinensis* (A), *T.bellerica* (L) and *M.indica* (J). Wood diffuse porous, vessels solitary and in radial multiples of 2-3 in all the above species except *A.chinensis*(A), *A.indica*(D) and *A.lebbek*(B), Parenchyma vasicentric in *A.lebbek*(B) and *A. indica* (D) scanty paratracheal in *A.chinensis*(A), *B.ceiba*(E), *B.purpurea*(F), *M.ferrea*(K) & lozenge aliform in *A.procera*(C), *F.hispida*(I), *M.indica*(J) and *T.arjuna*(K) and banded in *C.fistula*(G) and *F.benjamina*(H).



**Figure 3: “O-Y” R.L.S and T.L.S** of *A.chinensis*, *A.indica*, *A.lebbek*, *A.procera*, *B.purpurea*, *C.fistula*, *F.benjamina*, *F.hispida*, *M.indica*, *T.arjuna*, *T.bellerica* showing black deposits present in *A.chinensis* (O), *A.procera* (R), *F.benjamina* (U), *F.hispida* (V), *M.indica* (W) and *T.bellerica* (Y) and crystals present in fibres of *A. lebbek* (Q), *A.indica* (P), *B.purpurea* (S), *C.fistula* (T) and *T.arjuna* (X)

Available literature reveals that wood is also used for medicinal purposes. It is reported that the heartwood of *A. lebbek* is antibacterial<sup>3</sup>. The gums & resins present in the wood are used in urinary problems<sup>4,5,6,7</sup>, high blood pressure<sup>3</sup> and liver complaints<sup>8,9</sup>. The present selected woods are being used for curing many diseases like inflammation<sup>10,11</sup>, rheumatoid arthritis<sup>3,12,4,5</sup>, diabetes<sup>6,7,13,4,5</sup> and allergy<sup>14</sup>. The medicinal importance of these woods may be due to the presence of resins (*C.deodara*), deposits (*A. chinensis*, *A. lebbek*, *A. procera*, *A. indica*, *B. purpurea*, *C. fistula*, *F. benjamina*, *M. indica*, *M. ferrea*) and crystals in *A. lebbek*, *A. procera*, *A. indica*, *B. purpurea*, *C. fistula*, *F. benjamina*, *M. indica*, *T. arjuna* and *T. bellerica*.

Table 2: Anatomical features of selected timber species

Species name	Porosity	Growth ring	Vessel type	Tyloses	Type of Parenchyma	Deposits	Crystals	Parts used	Medicinal use
<i>Alangium chinensis</i> Lour.	Ring – porous	Distinct due to fibres	Solitary ,in radial multiples of 2 -3	Present	Scanty paratracheal	Black deposits	Absent	Stem	Blood tonic, rheumatism, carminative, contraceptive, traumatic injuries <sup>3</sup> .
<i>Albizia lebbek</i> Linn.	Semi–ring porous	Indistinct	Solitary, in radial multiples of 2 -6	Present	Vasicentric	Black and yellow deposits	Present in rays	Heartwood	Antibacterial <sup>3</sup> .
<i>Albizia procera</i> Roxb.	Diffuse-porous	Indistinct	Solitary, in radial multiples of 2 -3	Absent	Vasicentric, lozenge-aliform	Black and yellow deposits	Present in rays	Heartwood	Reddish brown gum, Anticancer <sup>15</sup> .
<i>Azadirachta indica</i> A.Juss.	Semi–ring porous	Indistinct	Solitary, in radial multiples of 2 -6	Present	Vasicentric	yellow deposits	Present in rays	Twigs	Cough, asthma, piles, toothache, intestinal worms, obstinate urinary disorders, diabetes <sup>6</sup> .
<i>Bombax ceiba</i> Linn.	Diffuse-porous	Indistinct	Solitary, in radial multiples of 2	Present	Scanty paratracheal	Black and yellow deposits	Absent	Heartwood , Stem	Antidiabetic, antidiarrhoal, boils, heart tonic, heart burning, kidney stone <sup>7</sup> .
<i>Bauhinia purpurea</i> Linn.	Diffuse-porous	Indistinct	Solitary, in radial multiples of 2 -6	Present	Scanty paratracheal	Black deposits	Present in parenchyma, fibres	Stem	Antidiabetic. <sup>13</sup>
<i>Cassia fistula</i> Linn.	Diffuse-porous	Indistinct	Solitary, in radial multiples of 2 -6	Present	Banded	Black deposits	Present in parenchyma	Heartwood	Anthelmintic <sup>3</sup> .

* <i>Cedrus deodara</i> Roxb.(Softwood)	Diffuse- porous	Distinct	Absent	Absent	Absent	Absent	Absent	Wood	Fevers, flatulence, pulmonary and urinary disorders, rheumatism, piles, kidney stones, insomnia, diabetes <sup>45</sup> .
<i>Ficus benjamina</i> L.	Diffuse- porous	Indistinct	Solitary, in radial multiples of 2 -3	Present	Banded	Black and yellow deposits	Present in parenchyma	Twigs	Insect repellent <sup>16</sup> .
<i>Ficus hispida</i> Linn.	Diffuse- porous	Distinct due to fibres	Solitary, in radial multiples of 2	Present	lozenge- aliform	Absent	Absent	Twigs	Earache and liver troubles <sup>89</sup> .
<i>Mangifera indica</i> Linn.	Diffuse- porous	Distinct due to fibres	Solitary, in radial multiples of 2-4	Present	lozenge- aliform forming bands	Black and yellow deposits	Present in parenchyma	Trunk	Scabies, cracks in skin of feet <sup>14</sup> .
<i>Mesua ferrea</i> Linn.	Diffuse- porous	Indistinct	Solitary, in radial multiples of 2	Present	Scanty paratracheal	Black and yellow deposits	Absent	Heartwood	Anti-inflammatory <sup>10,11</sup> .
<i>Terminalia arjuna</i> (Roxb. ex Dc.) Wight & Arn.	Diffuse- porous	Indistinct	Solitary, in radial multiples of 2 -3	Absent	lozenge- aliform, confluent- aliform	Absent	Present in parenchyma, rays	Stem	Cardio tonic <sup>17</sup> .
<i>Terminalia bellerica</i> Gaertn.	Diffuse- porous	Distinct due to fibres	Solitary, in radial multiples of 2-3	Absent	confluent winged aliform	Absent	Present in parenchyma	Stem	Antibacterial <sup>18</sup> .
* <i>Thuja orientalis</i> Linn(Softwood)	Diffuse- porous	Distinct	Absent	Absent	Absent	Absent	Absent	Stem, Twigs	Cough, cold, dysentery, rheumatism and parasitic skin diseases <sup>12</sup> .



## CONCLUSIONS:

The selected species have both distinct and indistinct growth rings. It was observed that all the above-mentioned wood species were diffuse-porous, semi-ring porous in *A. lebbek* and *A. indica* and ring –porous in both species of softwood. Rhomboidal crystals were observed in parenchyma, rays in all selected species except in *S. cumini*, *M. ferrea*, *F. hispida*, *A. chinensis* and *B. ceiba*. Resin ducts and gum ducts were present in *C. deodara* and *M. indica*. Presence of yellow, brownish deposits were reported in vessels, rays and parenchyma of the above mentioned except *T. bellerica*, *T. arjuna* and *F. hispida*. The utilization of the wood species for pharmaceutical purposes might be due to presence of gummy deposits, crystals, latex, resin or other deposits in the wood.

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