



## A NEW ANGIOSPERMIC PETRIFIED FOSSIL WOOD FROM THE DECCAN INTERTRAPEAN BEDS OF JAMSAVLI M.P. INDIA.

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Communicated : 11.11.19

Revision : 19.12.19 &  
01.01.2020

Published: 30.01.2020

Accepted : 19.01.2020

### ABSTRACT:

A well preserved dicot wood was collected from Jamsavali M.P. The wood is dicotyledonous, diffuse porous, vessels mostly solitary and in radial multiples of two. Perforation plate simple. Intervascular pit pairs alternate, bordered, parenchyma paratracheal, vasicentric, wood rays mostly multiseriate and composed of heterogeneous cells, uniseriate rays mostly homogenous. Fibres short, thin walled, nonseptate. The wood though shows some characters of the present day families like Dipterocarpaceae, Lecythydaceae, Connaraceae, Flacaurtiaceae, Lythraceae and Bombacaceae. It has close affinities with the members of the family Bombacaceae. It could not conclusively be traced to any particular genus but it broadly placed under the family Bombacaceae.

**Key words:** - Dicot wood, diffuse porous, ray multiseriate, Bombacaceae.

### INTRODUCTION:

Recent developments have provided a better understanding of the history, evolution and relationships of the angiosperms. In addition, the fossil record, as representative of the history of life, holds the potential for clarifying relationships among extant taxa by revealing extinct mosaic taxa that link modern ones, in addition to providing the general pattern of evolution of taxa through time. Historically, and in the context of evolutionary biology, the fossil record has played both informative and corroborative roles and continues to be called upon to do both. However, the advent of modern methodologies for comparative studies of extant taxa invites a reassessment of the primacy and scope of the fossil record in addressing questions of evolution and systematic relationships (William L.2004). The wood being comparatively more resistant than the other plant parts is often

better preserved depending on the extent of degradation of cellulose layers of cell wall. Some notable fossil woods reported from Deccan Intertrappean beds of India. *Simarubaceoxylon mahurzari* and *Barringtonioxylon deccanese* (Shallom, 1959); *Polyalthioxylon parapaniense* (Bande, 1973); *Ebenoxylon mohgaonse* (Chitale and Patil, 1972); *Syzygioxylon mandlaense* (Ingle, 1973); *Rhamnioxylon intertrappea* (Chitale and Kate, 1971). *Lagerstoemioxylon vasicentricum*, *Lagerstoemioxylon eoflosregium*, *Lagerstoemioxylon harsolavense*, *Lagerstoemioxylon obliqueporantum*, *Lagerstoemioxylon eohypolucu*, *Lagerstoemioxylon royi*, *Lagerstoemioxylon parenchymatosum*, *Lagerstoemioxylon floribunda*, *Lagerstoemioxylon eohypolucum* (Harsh and Sharma 1995), *Lythrecooxylon jabalpurii* ( Meshram 2014), *Meliaceoxylon jabalpurii* (Meshram 2016).

The fossil wood has been collected from the fossiliferous locality of Deccan Intertrappean series of M.P. This petrified material is well preserved, black brown in color and rough in texture. It has yielded fairly good peels.

#### **MATERIAL AND METHODS:-**

The material was thoroughly ground to make the surface even. It was etched with Hydrofluoric acid and washed under running water. Peels were then taken out and slides were prepared. These were studied under the microscope and camera Lucida sketches were drawn.

**Description:** The wood is diffused porous, decorticated without any growth rings. Vessels are not visible to the naked eye. The anatomical study of this fossil wood is done with the help of available literature on anatomy and living section. (Esau 1965, Fahn 1989, Eames and MacDaniels 1972) The anatomical study is categorized as follows.

**Vessels:** They are predominantly solitary and in tangential or in radial multiples of two or three also (Plate 1, Fig 1). These are small to moderate in size with the diameter varying between 215  $\mu\text{m}$  and 220 $\mu\text{m}$ . The vessel frequency is 15 to 19 sq/mm. The vessel member length varies from 310 $\mu\text{m}$  and 390 $\mu$  (Plate 1, fig 4). Perforation plates are simple, mostly horizontal or oblique (Plate1 Fig 4). Vessels are thick walled without any tyloses. They are associated with wood rays contiguous on either side. Intervascular bordered pits are very distinct. They are thick walled, alternate and the pit pores are generally elliptical with the diameter varying between 24 $\mu\text{m}$  to 35 $\mu\text{m}$  (Plate 1 Fig 4).

**Parenchyma:** Parenchyma is well preserved. It is pentagonal to hexagonal in shape and in single layer. Paratracheal vasicentric parenchyma forms a single layered sheath around the vessels (Text Fig 4; Plate 1 Fig 2).

**Wood Rays:** The wood rays are uniseriate moderately numerous but some are multiseriate. It is 9 to 13 cells in height, homogenous, with of procumbent cells. The height and diameter vary

between 520  $\mu\text{m}$  to 580  $\mu\text{m}$  and 120  $\mu\text{m}$  to 130  $\mu\text{m}$  respectively (Plate1 Fig 5-6).

**Fibres:** Fibers are abundant forming the ground mass of the wood. They are thin walled and are compactly arranged in radial rows between the rays without any intercellular space. (Text Fig 7; Plate 1, fig 5-6). Fibre cells are non septate. They measure 25 $\mu\text{m}$  in height and 15 $\mu\text{m}$  in diameter.

#### **RESULTS AND DISCUSSION**

Xylem parenchyma, xylem rays and the diffuse porous nature of the vessels along with the intervacular pit pairs are the distinguishing characters of the fossil. The studied fossil was compared with earlier reported fossil woods from the various localities.

In *Barringtonioxylon deccanense* (Shallom, 1959), vessels are with radial and tangential diameters varying from 100-150  $\mu$  and 78- 100  $\mu$  respectively; mostly in radial rows of two and three, angular tyloses present; vessel segments 200-400  $\mu$ ; intervessels pits alternate, diameter varying from 11-14  $\mu$ . Parenchyma was abundant in part scattered and mostly as uniseriate lines joining two adjacent rays. Uniseriate rays fairly abundant. Fibres non-libriform; non-septate. Hence present fossil is different.

In *Ebenoxylon mohgaonse* (Chitley & Patil, 1972), wood was diffuse porous, vessels 40-45 per sq. mm.; solitary or in radial groups of 2-5, oval to rounded in tangential diameter and 38.62  $\mu$ , radial diameter 38-69  $\mu$ ; vessel segments 200-250  $\mu$  long; perforations simple; intervessel pits bordered, alternate, hexagonal, contiguous and 4-5  $\mu$  in diameter. Protoxylem with spiral and metaxylem with reticulate and pitted thickening. Parenchyma paratracheal and diffuse. So, differs from the fossil under study in all the characters.

*Syzygioxylon mandlaense* (S. R. Ingle, 1973), *Rhamnoxylan intertrappea* (Chitale & Kate, 1971), *Polyalthoxylon parapaniense* (Bande, 1973), differs from the present wood mostly in the

anatomical characters with respect to the vessels number frequency and nature of parenchyma.

***Lagerstoemioxylon vasicentricum***, (Harsh and Sharma 1995) rays are mostly uni to biseriate, small to large and homo to heterogeneous rays, vessels small, vasicentric parenchyma. Present wood shows uniseriate to multicariate ray therefore it is different.

***Lagerstoemioxylon eoflosregium***, (Harsh and Sharma 1995) wood semirinf, porous, growth ring distinct, vessels large, 7-9 cell wide band of initial parenchyma and thick walled fibres. vessels solitary, arrangement in distinct tangential lines, tyloses absent, paratracheal parenchyma almost aliform but at growth ring in the form of 8-12 cells wide bands. Rays are uniseriate rarely biseriate, almost homogenous consist of procumbent cells with an average height of 66.6 to 747.8 $\mu$  in length fibres commonly septate with crystals. Present wood shows uniseriate to multicariate ray and crystal absent therefore it is different.

***Lagerstoemioxylon harsolavense*** (Harsh and Sharma 1995) wood semiring porous, growth ring present, demarcated larger early wood pores, perforation plate simple, apotracheal diffuse to zonet in short bands, xylem rays exclusively uniseriate 4 to 15 cell high, measuring 106 to 565 micron in length, homogenous, fibre septed having crystles. Present wood shows predominantly solitary vessels; uniseriate to multicariate ray therefore it is different.

***Lagerstoemioxylon obliqueporantum*** (Harsh and Sharma 1995) wood partial semiring porous, growth ring present, delimited by little larger vessels, change in vessels size almost negligible giving an impression of a diffused porosity, vessels large, oval, tangential diameter, 179 to 183 micron and radial 293 to 301 micron meter, exclusively solitary, arrangement obliquely, perforation plate simple, palatracheal parenchyma vececentric, aliform to oblique confluent with 4 to 9 vessels, apotracheal prominent as solitary cells, xylem rays exclusively uniseriate, mostly heterogenous with 1

to2 upright cell per rays, crystals present. Present wood shows uniseriate to multicariate ray with 10 to 15cells in height therefore it is different.

***Lagerstoemioxylon eohypolucum***, (Harsh and Sharma 1995) wood typically ring porous, growth ring present demarcated by larger vessels inclosed in wide bands of parenchyma and thick walled fibre zone, vessels narrow oval, exclusively solitary, arrangement only in tangential lines, parenchyma paratracheal and apotracheal, paratracheal mostly aliform to aliform confluent forming 6 to 8 cells wide bands, apotracheal diffuse, rarely zonate of 5 to 10 cells, xylem rays- exclusively uniseriate, 3-27 high, mostly homogeneous, procumbent cells 27  $\mu$  in average length, frequency 18 to 21/mm<sup>2</sup>, fibres-septate with crystals. Present wood shows uniseriate to multicariate ray with 10 to 15cells in height therefore it is different.

***Lagerstoemioxylon royi***, (Harsh and Sharma 1995) wood semi ring porous with a tendency towards diffuse porosity, growth ring distinct, delimited by dark thick walled fibres and an initial parenchyma band of 3-4 cells width, vessel-moderately small to large, oval, solitary, perforation plate simple, end wall transverse, xylem rays- exclusively uniseriate, 4 to 19 cells high, fibres septate, crystals present. Present wood shows uniseriate to multicariate ray with 10 to 15cells in height therefore it is different.

***Lagerstoemioxylon parenchymatosum***, (Harsh and Sharma 1995) wood ring porous, growth rings distinct, larger vessels, circular to oval, paratracheal parenchyma, mostly aliform, xylem rays exclusively uniseriate 2-50 cell in hight. Present wood shows solitary vessels; uniseriate to multicariate ray with 10 to 15cells in height therefore it is different.

***Lagerstoemioxylon floribunda***, (Harsh and Sharma 1995) wood semi ring porous, growth rings distinct, delimited by larger vessels, thick walled fibres and interrupted terminal parenchyma, vessels extremely small to large, perforation plate simple with oblique end walls, inter vessel pits opposite and angular parenchyma paratracheal

and terminal, vesicentric, xylem rays mostly uniseriate, rarely biseriate, fibres septate with crystals. Present wood shows uniseriate to multicriate ray with 9 to 13 cells in height therefore it is different.

***Lythreoxylon jabalpurii*** Vessels predominantly solitary and also in radial and tangential multiples of 2 or 3. Vessel diameter varies between 220µm to 225µm, frequency 18 to 21 sq/mm., member length varies between 320µm to 400µm. Intervascular pit pairs alternate, pore elliptical, and diameter 30µm to 40µm. Parenchyma scanty, paratracheal vesicentric. Rays mostly multiseriate and uniseriate. Multiseriate rays are homo to heterogeneous, 10 to 15 cells high, uniseriate rays are homogeneous, and 4 to 10 cell high. Fibres nonseptate, non-storied 27µm in height and 16µm in diameter. But present fossil shows many differences like vessels, fibres, wood parenchyma, therefore its is different wood.

***Meliaceoxylon jabalpurii*** Vessels predominantly solitary and also in radial and tangential multiples of 2 or 3. Vessel diameter varies between 210µm to 215µm, frequency 15 to 20 sq/mm., member length varies between 310µm to 380µm. Intervascular pit pairs alternate, pore elliptical, and diameter 25µm to 30µm.

Thus no appreciable affinities were observed between the earlier reported wood fossil with the present one. Accordingly, the modern day families were explored to place the wood fossil under any one of them.

Comparisons with the modern families with living section have shown that the fossil wood has some similarities with families like **Lecythidaceae**, **Dipterocarpaceae**, **Connaraceae**, **Flacaurtiaceae**, **Lythraceae** and **Bombacaceae** (Metcalf and Chalk 1950).

The family **Dipterocarpaceae**, although agreeing with the fossil in certain general characters like vessel usually medium sized, exclusively solitary or in multiples of 2 or 3 cells, perforation plate simple, intervacular pitting alternate, But it differs,

sharply from the given fossil in the arrangement of parenchyma, In **Dipterocarpaceae**, parenchyma is usually abundant and includes both paratracheal and apotracheal types, whereas in the studied fossil the parenchyma arrangement is paratracheal vesicentric.

The family **Lecythidaceae**, although agreeing with fossil in certain characters like perforation simple and intervacular pitting alternate but it differs sharply from the given fossil in the arrangement of vessels and presence of parenchyma. In **Lecythidaceae**, parenchyma is in typical apotracheal bands whereas in the studied fossil vessels are medium sized and parenchyma is ample and the arrangement is typically paratracheal vesicentric.

The present fossil wood differs from wood of **Flacaurtiaceae** in nature of parenchyma. In **Flacaurtiaceae** parenchyma is mostly absent or very sparse, and when present usually limited to isolated cells touching the vessels (Metcalf and Chalk, 1950).

The fossil wood differs from **Connaraceae** because in **Connaraceae** vessels are large (more than 200µ) with simple pitting whereas in this fossil wood vessels are medium sized with bordered pitting.

In **Bombacaceae**, wood partial semiring porous, growth ring present, delimited by little larger vessels, change in vessels size almost negligible giving an impression of a diffused porosity, vessels large, oval, tangential diameter, exclusively solitary, arrangement obliquely, perforation plate simple, paratracheal, parenchyma, vesicentric, aliform to oblique confluent with 4 to 9 vessels, apotracheal prominent as solitary cells, xylem rays uniseriate to multiseriate, mostly heterogeneous with height 2 to 50 cell per rays. Present wood shows resemblances in xylem rays uniseriate to multicriate with 7 to 15 cells in height.

On the above discussion it is clear that fossil wood resemblance only **Bombacaceae**.like vessels nature, perforation plate simple, paratracheal parenchyma, vesicentric, xylem rays exclusively

uniseriate, mostly heterogenous with height 2 to 50 cell per rays

From the above discussion it can be concluded that present fossil wood is different from living genera, on basis of certain anatomical characters. It resembles the family, on certain general characters, thus it is placed under the family **Bombacaceae**; hence it is named as **Bombacaceaeoxylon jamsavlii** gen. et. sp. nov. The generic name is after the family **Bombacaceae** and the specific name is after the locality Jamsavali from where the sample was collected.

**Diagnosis:**

**Bombacaceaeoxylon jamsavlii** gen.nov.

Wood, dicotyledonous, diffuse porous, vessels mostly solitary and in radial multiples of two. Perforation plate simple. Intervascular pit pairs alternate, bordered, parenchyma paratracheal, vascicentric, wood rays mostly multiseriate and composed of heterogeneous cells, uniseriate rays mostly homogenous. Fibres short, thin walled, nonseptate.

**Bombacaceaeoxylon jamsavlii** gen. et. sp. nov.

Vessels predominantly solitary and also in radial and tangential multiples of 2 or 3. Vessel diameter varies between 215 µm to 220 µm, frequency 15 to 19 sq/mm., member length varies between 310µm to 390µm. Intervascular pit pairs alternate, pore elliptical, and diameter 24µm to 35µm. Parenchyma scanty, paratracheal vascicentric. Rays mostly multiseriate and uniseriate. Multiseriate rays are homo to heterogeneous, 9 to 13 cells high, uniseriate rays are homogeneous, and 4 to 10 cell high. Fibres nonseptate, non-storied 25µm in height and 15µm in diameter.

**Holotype:** SMM/ ANG.W4/ Deposited at Department of Botany, Institute of Science, Nagpur

**Locality :** Jamsavli

**Horizon :** Deccan Intertrappean Series of India .

**Age :** ? Upper Cretaceous.

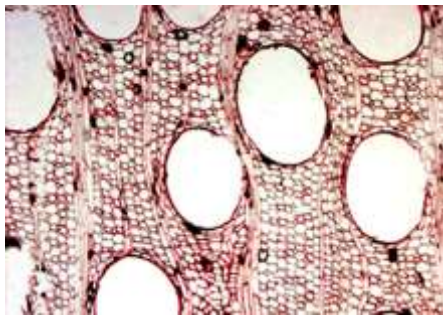
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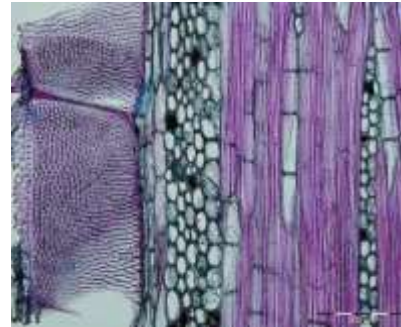


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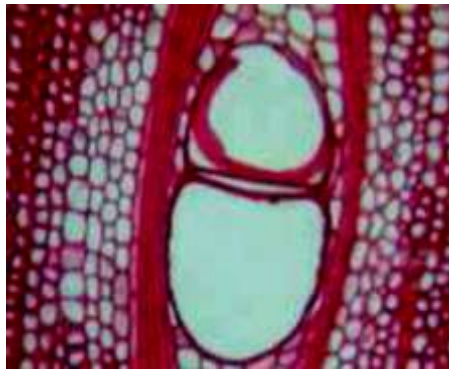
**Plate fig. shows Living section (T.S. And T.L.S.) Of Family Bombacaceae ,  
Dipterocarpaceae & Connaraceae**



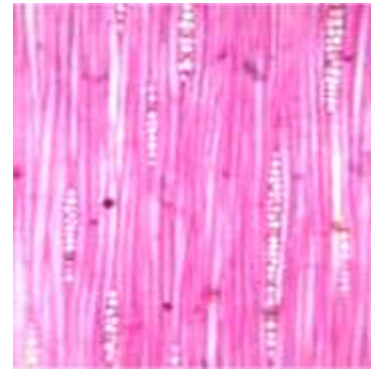
1, T.S. of wood in Bombacaceae  
(by Duvall, C.S., 2011)



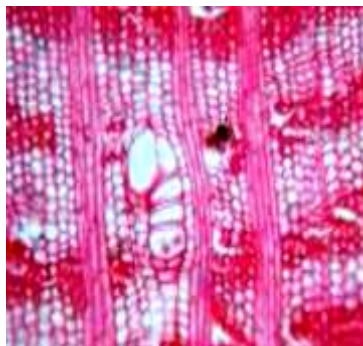
2, T.L.S. of wood in Bombacaceae (By Sint, Khin et.al)



1, T.S. of wood in Dipterocarpaceae



2, T.L.S. of wood in Dipterocarpaceae



1, T.S. of wood in Connaraceae



2, T.L.S. of wood in Connaraceae

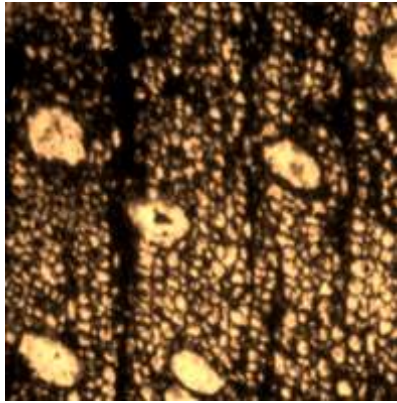
**Explanation of Plate 1, Figs. 1-6**

Fig. 1: T.S of wood showing solitary or less in multiple of two vessels, Fig. 2: T.L.S of wood showing triseriate medullary rays, Fig. 3: R.L.S of wood showing homogenous medullary rays, Fig. 4: Solitary, vessels surrounded by paratracheal vascentric parenchyma.

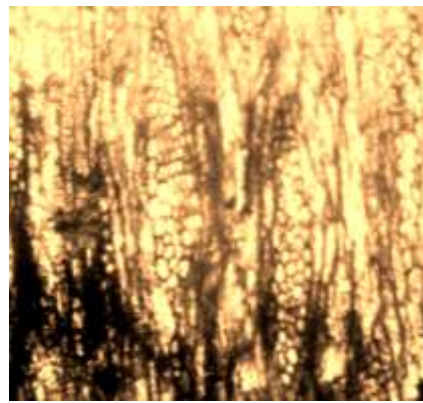
Fig. 5: Intervessel alternate pitting magnified, perforation plate simple obliquely placed.

Fig. 6: Uniseriate and multiseriate wood ray.

**Pate 1 Figs.1- 6 ( *Bombacaceaeoxylon jamsavlli* )**



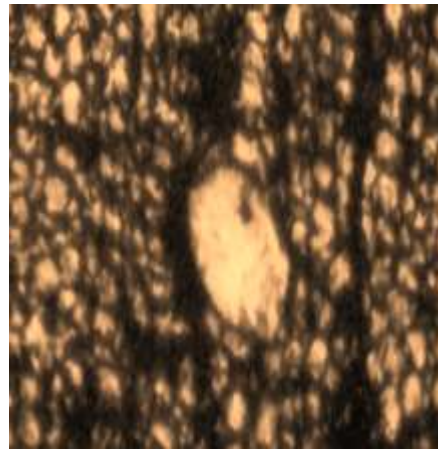
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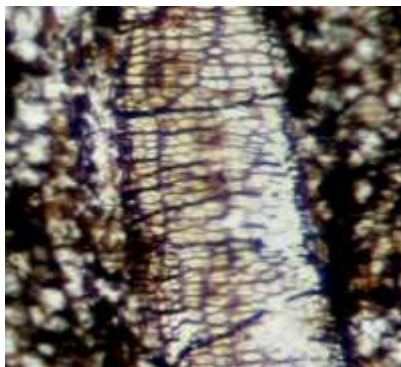
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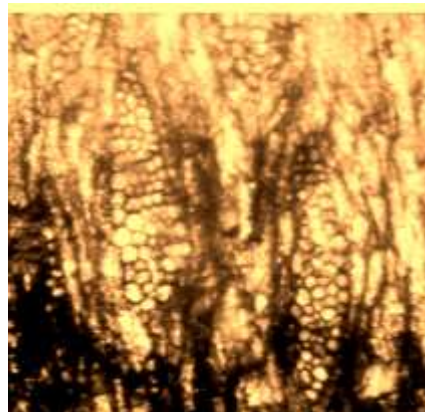
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6