



Angiospermic fossil wood from the deccan intertrapean beds of Jabalpur, M.P. India

Ganaei MA¹, Nagdevte MN¹, Meshram SM², Burhan M Padder³

¹ Post Graduate, Department of Botany, RTMNU, Nagpur, Maharashtra, India

² Department of Botany, M B Patel College Sakoli, Bhandara, Maharashtra, India

³ Department of Botany, University of Kashmir Hazratbal, Srinagar, Jammu and Kashmir, India

Abstract

A well preserved dicot wood was collected from Jabalpur Highway in Jabalpur 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 Lecythidaceae, Dipterocarpaceae, Connaraceae, Flacaurtiaceae and Lythraceae. It has close affinities with the members of the family Lythraceae.

Keywords: dicot wood, diffuse porous, ray multiseriate, lythraceae

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 2004) [13]. 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 Intertrapean beds of India. *Simarubaceoxylon mahurzari* and *Barringtonioxylon deccanese* (Shallom, 1959) [12]; *Polyalthioxylon parapaniense* (Bande, 1973) [11]; *Ebenoxylon mohgaonse* (Chitale and Patil, 1972) [3]; *Syzygioxylon mandlaense* (Ingle, 1973) [9]; *Rhamnoxylon intertrapea* (Chitale and Kate, 1971) [2]. *Lagerstoemioxylon vasentricum*, *Lagerstoemioxylon eoflosregium*, *Lagerstoemioxylon harsolavense*, *Lagerstoemioxylon obliqueporantum*, *Lagerstoemioxylon eohypolucu*, *Lagerstoemioxylon royi*, *Lagerstoemioxylon parenchymatosum*, *Lagerstoemioxylon floribunda*, *Lagerstoemioxylon eohypolucum* (Harsh and Sharma, 1995) [7], *Lythreoxylon jabalpurii* (Meshram 2014) [11].

Materials 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 prepared. These were studied under the microscope and camera lucida sketches were drawn.

Description

The wood is diffusing porous, decorticated without any growth ring. 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) [5, 6, 4] The anatomical study is categorized as follows.

Vessels

They are predominantly solitary and in tangential or in radial multiples of two or three also.

(Fig. 1) These are small to moderate in size with the diameter varying between 220 μm and 225 μm . The vessel frequency is 18 to 21 sq/mm. The vessel member length varies from 320 μm and 400 μm (Fig. 4). Perforation plates are simple, mostly horizontal or oblique (Text Fig 2 and 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 30 μm to 40 μm (Fig 1, 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 (Fig 2, 4).

Wood Rays

The wood rays are uniseriate moderately numerous but some are multiseriate. It is 10 to 15 cells in height, homogenous, with of procumbent cells. The height and diameter vary between 550 μm to 600 μm and 130 μm to 140 μm respectively. (Fig 5-7).

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. (Fig 5-7). Fibre cells are non-septate. They measure 27µm in height and 16µm in diameter.



Fig 1: Enlarged unilocular fruit with seed. 450X

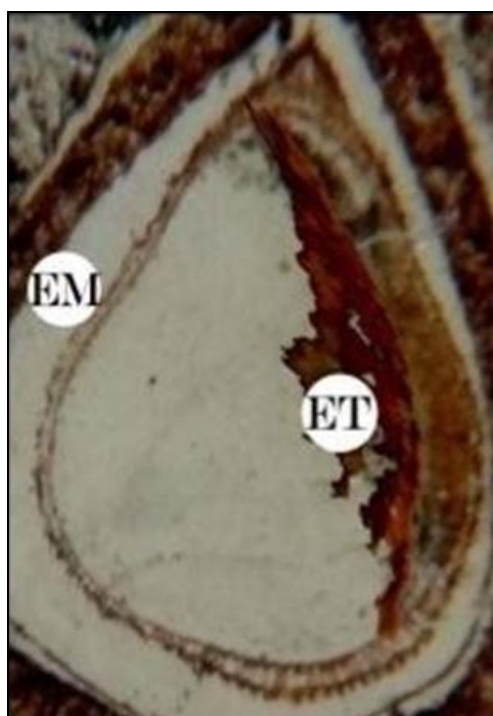


Fig 2: Single seed with embryo 450X;



Fig 3: Pericarp shows woody projections on fruit wall.450X



Fig 4: Details of Embryo (EM). 450X

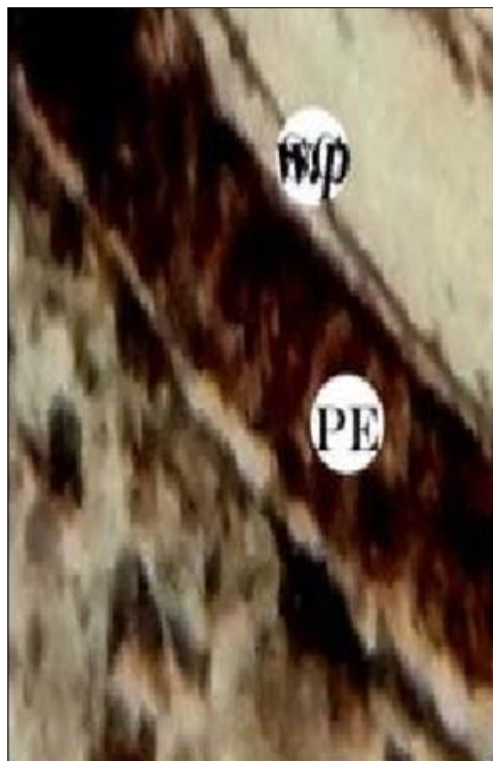


Fig 5: Pericarp (Pe) differentiated into epicarp, mesocarp, and endocarp and Seed coat (S.C) 450X

Results and Discussion

Xylem parenchyma, xylem rays and the diffuse nature of the vessels along with the intervascular 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) [12], vessels are with radial and tangential diameters varying from 100-150 μ and 78- 100 μ respectively; mostly in radial rows of two and three, angular tyloses present; vessel segments 200-400 μ ; intervessels pits alternate, diameter varying from 11-14 μ . Parenchyma was abundant in part scattered and mostly as uniseriate lines joining two adjacent rays. Uniseriate rays fairly abundant. Fibres non-libriform; nonseptate. Hence present fossil is different.

In *Ebenoxylon mohgaonse* (Chitley and Patil, 1972) [3], 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 μ , radial diameter 38-69 μ ; vessel segments 200-250 μ long; perforations simple; intervessel pits bordered, alternate, hexagonal, contiguous and 4-5 μ 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* (Ingle, 1973) [9], *Rhamnoxylon intertrappea* (Chitale and Kate, 1971) [2], *Polyalthoxylon parapaniense* (Bande, 1973) [1], differs from the present wood mostly in the anatomical characters with respect to the vessels number frequency and nature of parenchyma.

Lagerstoemioxylon eoflosregium, (Harsh and Sharma, 1995) [7] 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 μ in length fibres commonly septate with crystals. Present wood shows uniseriate to multiciliate ray and crystal absent therefore it is different.

Lagerstoemioxylon harsolavense (Harsh and Sharma, 1995) [7] 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 multiciliate ray therefore it is different.

Lagerstoemioxylon vasicentricum, (Harsh and Sharma, 1995) [7] rays are mostly uni to biseriate, small to large and homo to heterogeneous rays, vessels small, vasicentric parenchyma. Present wood shows uniseriate to multiciliate ray therefore it is different.

Lagerstoemioxylon obliqueporantum (Harsh and Sharma, 1995) [7] 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 vecentric, 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 multiciliate ray with 10 to 15cells in height therefore it is different.

Lagerstoemioxylon eohypolucum, (Harsh and Sharma, 1995) [7] 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 μ in average length, frequency 18 to 21/mm², fibres-septate with crystals. Present wood shows uniseriate to multiciliate ray with 10 to 15cells in height therefore it is different.

Lagerstoemioxylon royi, (Harsh and Sharma 1995) [7] 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 multiciliate ray with 10 to 15cells in height therefore it is different.

Lagerstoemioxylon parenchymatosum, (Harsh and Sharma, 1995) [7] 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 multiciliate ray with 10 to 15cells in height therefore it is different.

Lagerstoemioxylon floribunda, (Harsh and Sharma 1995) [7] 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 multiciliate ray with 10 to 15 cells in height therefore it is different.

Lythreoxylon jabalpurii (Meshram 2014) [11] Wood, 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. 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 and Lythraceae (Metcalf and Chalk, 1950) [10].

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 vasicentric.

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) [10]. 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 Lythraceae, 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, vasicentric, aliform to oblique confluent with 4 to 9 vessels, apotracheal prominent as solitary cells, xylem rays uniseriate to multiseriate, mostly heterogenous with height 2 to 50 cell per rays. Present wood shows resemblances in xylem rays uniseriate to multiciliate with 10 to 15 cells in height.

On the above discussion it is clear that fossil wood resemblance only Lythraceae like vessels nature, perforation plate simple, paratracheal parenchyma, vasicentric, 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 Lythreaceae; hence it is named as *Lythreoxylon jabalpurii* gen. et. sp. nov. The generic name is after the family Lythreaceae and the specific name is after the locality from Deccan Interrappean beds of India where the sample was collected.

Diagnosis

Lythreoxylon deccanii 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, vasicentric, wood rays mostly multiseriate and composed of heterogeneous cells, uniseriate rays mostly homogenous. Fibres short, thin walled, nonseptate.

Lythreoxylon deccanii gen. et. sp. nov.

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 vasicentric. 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.

Holotype

MG/ ANG.W1/ Deposited at Department of Botany, RTMNU, Nagpur

Locality

Jabalpur

Horizon

Deccan Interrappean Series of India.

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