

A Dicot Fossil Wood from the Deccan Intertrappean Beds of Wardha Maharashtra, India

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Abstract: A well-preserved dicot wood was collected from Samruddhi Highway in Wardha, Maharashtra. The wood is dicotyledonous, diffuse porous without growth ring, vessels mostly solitary and in radial multiples of two or three. Perforation plate simple. Intervascular pit pairs alternate, bordered, parenchyma paratracheal, vasicentric, wood rays mostly multiseriate to uniseriate, and multiseriate rays are homo to heterogeneous. Fibers short, thin walled, non-septate. The wood though shows some characters of the present-day families like Dipterocarpaceae, Lecythidaceae, Menispermaceae, Connaraceae, Flacaurtiaceae. It has close affinities with the members of the family Trigonaceae. It could not conclusively be traced to any particular genus but it broadly placed under the family Trigonaceae.

Keywords: Dicot wood, diffuse porous, ray multiseriate, Trigonaceae

I. INTRODUCTION

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. The first petrified dicot wood from the Deccan Intertrappean series was described by Rode (1934) as *Parajugloxyton mohgaonse*. In 1936, Rode redescribed this fossil wood in detail and transferred it to the non-committal genus *Dryoxylon* and named it as *Dryoxylon mohgaonse* showing its nearest affinity with the wood of family Combretaceae. Some notable fossil woods from Deccan Intertrappean Beds of India are *Dryoxylon mohgaonse* (U. Prakash, 1974); *Simarubaceoxylon mahurzari* and *Barringtonioxylon deccanese* (Shallom, 1959); *Tovomitiosioxylon wood* (Shallom, 1963); *Polyalthioxylon parapaniense* (Bande, 1971); *Ebenoxylon mohgaonse* (Chitale and Patil, 1972); *Syzygioxylon mandlaense* and *Vitexoxylon indicum* (Ingle, 1971); *Rhamnoxylon intertrappea* (Chitale and Kate, 1971); *Dryoxylon intertrappea* (Trivedi, 1974); *Burseraceoxylon baradense* (Sheikh M. T., 2011); *Lagerstroemioxylon* (Shukla et al., 2021). The fossil sample has been collected from the fossiliferous locality of Deccan Intertrappean series, Wardha near Sumruddhi highway, Lat 20.83°N and Long 78.81° E. This petrified material is well preserved, black in color and rough in texture. It has yielded fairly good peels.

II. MATERIAL AND METHOD

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.

III. DESCRIPTION

The wood is diffuse 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. (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. (Text Fig.1; Plate 1, Fig 1) These are small to moderate in size with the diameter varying between 240 μm and 245 μm. The vessel frequency is 17 to 20 sq/mm. The vessel member length varies from 324 μm and 406 μm (Text Fig 1,2,3; Plate1, Fig 4) Perforation plates are simple, mostly horizontal or oblique. (Text Fig 2; 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 40µm to 50µm (Text fig 1, 5; Plate 1 Fig 4)

Parenchyma: Parenchyma is well preserved. It is pentagonal to hexagonal in shape and single layered. Paratracheal vasicentric parenchyma forming 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 15 to 20 cells in height, homogenous, consisting of procumbent cells. The height and diameter vary between 567 µm to 610 µm and 138 µm to 142 µm respectively (Text Fig 7; Plate 1 Fig 5-6)

Fibres: Fibers are abundant forming the ground mass of the wood. They are of thick 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 30µm in height and 19µm in diameter.

IV. 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 dicotyledonous fossil wood from the various localities of

Deccan Intertrappean beds. fossil was compared with *Bridelioxylon ramanujam* (Upadhye E. V. & Patil G.V. 1978) had some similarities like paratracheal parenchyma which lie scattered among the fibers, vessels and medullary ray 2-3 seriate but in present case parenchyma though paratracheal vasicentric rays are uni to multiseriate therefore present fossil wood is different from.

In *Barringtonioxylon deccanense* (Shallom, 1959), 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 paratracheal cell varies from 32-40 µ., metatracheal parenchyma cell varies in diameter from 28-32 µ. Parenchyma abundant in part scattered and mostly as uniseriate lines joining two adjacent rays. Uniseriate rays fairly abundant; 17 µ in width, 8-46 cells or 401-500 µ height. Fibres non-libriform; non-septate, 17-22 µ in diameter, 1,000-2,300 µ in length, wall 3-6 µ thick.

The present fossil wood also compared with the *Tovomitopsis wood* (Shallom, 1963). It shows close resemblances with the present fossil wood. It shows vessel member length solitary vessels, vessels frequency 15 to 20 per sq. mm. paratracheal vasicentric parenchyma and heterogenous wood. The genus *Tovomitopsis* had scalariform perforation plate and mostly multiseriate wood rays, whereas the present fossil shows biseriate wood rays.

In *Ebenoxylon mohgaonse* (Chitley & Patil, 1971), 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 38.62µ, radial diameter 38-69µ; vessel segments 200-250µ long; perforations simple; intervessel pits bordered, alternate, hexagonal, contiguous and 4-5 µ in diameter. Protoxylem with spiral and metaxylem with reticulate and pitted thickenings. Parenchyma paratracheal and diffuse; paratracheal 1-2 cell thick around vessel pore. Xylem rays 16-20 per mm, 1-2(2) seriate, heterogenous with erect cells at the margins, 10-20 cells high, 250-400 µ in length and 15-25 µ in width. Fibres aseptate, 20-25 per mm, 280-400 µ in length, 10-20 µ wide and thin walled. So, differs from the fossil under study in almost all the characters.

In *Syzygioxylon mandlaense* (S. R. Ingle, 1971), wood diffuse-porous, vessels large to medium sized, mostly solitary or in radial rows of 2 to 4 (mostly 2 or 3), evenly distributed. Parenchyma paratracheal zonate parenchyma forming 1-5 (mostly 2 or 3) seriate, continuous, wavy, concentric bands separated by wider bands of fibrous tissue. metatracheal parenchyma fairly abundant, cells solitary or 2 to several contiguous. Xylem rays fine to medium heterogeneous, 1 to 4 (mostly 2 or 3) seriate. Fibres broad bands alternating with narrower bands of parenchyma, occasionally septate.

Vitexoxylon indicum (Ingle, 1971), wood diffuse porous. Growth rings distinct, delimited by crowding of vessels. Vessels not visible to the naked eyes, small to medium- sized, mostly solitary, sometimes in radial groups of 2-3, circular to oval in cross section with flat contact walls when in groups, with contiguous rays on one or both the sides, sheathed with parenchyma, evenly distributed 8-20 per sq. mm. Xylem rays 1 to 6 (mostly 2 to 4) seriate, separated by 4 to 8 rows of fibres, 30 to 80 µ broad and 120 to 1200 µ in height, marginal uniseriate extensions from two different rays join up. The ray tissue homogenous, the cells 10 to 40 µ in diameter. Fibres non-libriform to semi-libriform, non-storied, septate, rounded to angled in cross section, arranged in row between the rays, 280 to 450 µ in length, 14 to 30 µ in average diameter.

In *Rhamnoxylan intertrappea* (Chitaley & Kate, 1971), wood diffuse porous. Vessels in tailed radial multiples of 10 to 18, pitting alternate, frequency 60 to 70 per sq. mm. Vessel segment 276 μ long and 33 μ in tangential and 26 μ in radial diameter, vessels round to oval; perforation plate simple and oblique; intravascular pitting small. Alternate, bordered and contiguous with elliptical pit pores.

In *Polyalthoxylon parapaniense* (Bande, 1971), wood diffuse porous, growth rings not distinct; vessels medium sized, mostly solitary or in radial rows of 2 to 4, sometimes in clusters of 2 to 4, evenly distributed. Parenchyma paratracheal and metatracheal. The paratracheal forming sheath around the vessels; the metatracheal in the form of 1-2 seriate, tangential, irregular concentric bands forming a reticulum with the wood rays. Xylem rays fine to broad, 1-9 seriate; ray tissue homogeneous. Sheath cells absent; Fibres non-libriform. Non-septate and non-storied.

In *Dryoxylon intertrappea* (Trivedi, 1974), vessels mostly solitary, occasionally in pairs, medium sized; 100-200 μ broad, vessel element 300-900 μ in length. Pits to vessels contiguous and hexagonal. Parenchyma sparse, vascentric, xylem rays mostly uniseriate, heterocellular; less than 25 cells in height, 5-15 cells in height. Fibers simple, thick walled and storied.

In fossil wood of *Burseraceoxylon barbadense* (Sheikh M. T. 2011) had some similarities like parenchyma vascentric rays uni to biseriate, intervacular pit alternate bordered with elliptical pore. But vary greatly in respect of vessel number, frequency and diameter. Parenchyma though vascentric in both but in the studied fossil it was paratracheal. Therefore, studied fossil is different. The divergences are quite pronounced in *Ebenoxylon mohgaense* (Chitley & Patil, 1972). In this fossil, vessel solitary or in radial groups of 2-5, oval to rounded, perforation simple; intervessel pits bordered, alternate, hexagonal, contiguous. Parenchyma paratracheal; 1-2 cell thick around vessel pore. But present fossil wood shows alternate pits and circular to elliptical, parenchyma single layer around vessel pore. Therefore, present fossil wood is different. 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 have shown that the fossil wood has some similarities with families like Menispermaceae, Lecythidaceae, Dipterocarpaceae, Connaraceae, Flacaurtiaceae and Trigoniaceae. (Shallom 1963, Metcalfe and Chalk 1950). The family Dipterocarpaceae, although agreeing with the fossil in certain general character like vessels usually medium sized, exclusively solitary or with 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 usually abundant and includes both paratracheal and apotracheal types, whereas in the studied fossil the parenchyma arrangement is paratracheal vascentric.

The fossil is not a member of family Menispermaceae because nature of parenchyma is conjunctive and apotracheal, diffuse or in short bands. Rays interfascicular only where as in the present fossil parenchyma is paratracheal and rays are homogenous.

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 where as in the studied fossil vessels are medium sized and parenchyma is ample and the arrangement is typically paratracheal vascentric.

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 (Metcalfe and Chalk, 1950). The fossil wood differs from Connaraceae because in Connaraceae vessels are large (more than 200 μ) with simple pitting whereas in this fossil wood vessels are medium sized with bordered pitting.

The family Trigoniaceae, agrees with the fossil in certain general characters like vessels usually medium sized, vessels solitary, perforation simple, parenchyma paratracheal, vascentric and aliform. Rays with 3 to 5 cells wide, uniseriate. Fibers with bordered pit, of medium length.

The present fossil wood shows large number of characters similar to that of Trigoniaceae. Thus, the fossil wood was compared with its genus *Trigonia*, where the perforation is simple, intervacular pitting extremely rare. In *Trgniastrum*, rays up to 4 cells wide, uniseriate moderately numerous, heterogeneous. In genus *Lightia*, parenchyma paratracheal, vascentric with aliform extensions which may connect as many as four or five vessels.

From the above discussion it can be concluded that Present fossil wood is differ from living genera. *Lightia*, *Trigonia* and *Trigoniastrum*, on the basis of present anatomical character. It resembles the family, on certain general characters, thus it is placed under the family Trigoniaceae, hence it is named as *Trigoniaceoxylon gen. nov.*

IV. DIGNOSIS

Trigoniaceoxylon 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. fibers short, thin walled, non-septate,

Trigoniaceoxylon wardhensis gen. et. sp. nov.

Vessels predominantly solitary and also in radial and tangential multiples of 2 or 3. Vessel diameter varies between 240 µm to 245 µm, frequency 17 to 20 sq./ mm., member length varies between 324 µm to 406 µm. Intervascular pit pairs alternate, pore elliptical, and diameter 40µm to 50µm. Parenchyma scanty, paratracheal vasicentric. Rays mostly multiseriate and uniseriate. Multiseriate rays are homo to heterogeneous, 9 to 15 cells high, uniseriate rays are homogeneous, and 4 to 10 cells high. Fibers non-septate, non-storied 30 µm in height and 19 µm in diameter.

Holotype: M.N /ANGF/Deposited at Department of Botany RTMNU, Nagpur.

Locality: Samruddhi highway Wardha, Maharashtra

Horizon: Deccan Intertrappean Series of India.

Age : ? Upper Cretaceous.

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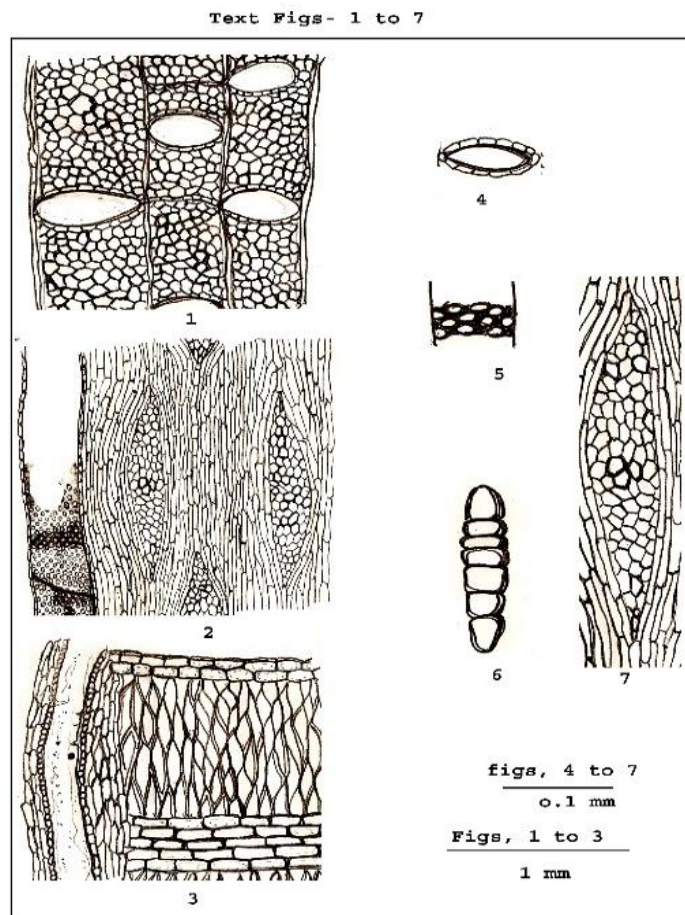


Fig. 1: T. S. of wood showing solitary multiple of two vessels.

Fig.2: T.L.S. of wood showing triseriate medullary rays, perforation plate simple obliquely placed.

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

Fig.6-7: Uniseriate and multiseriate wood ray

Plate 1, Figs - 1 to 6

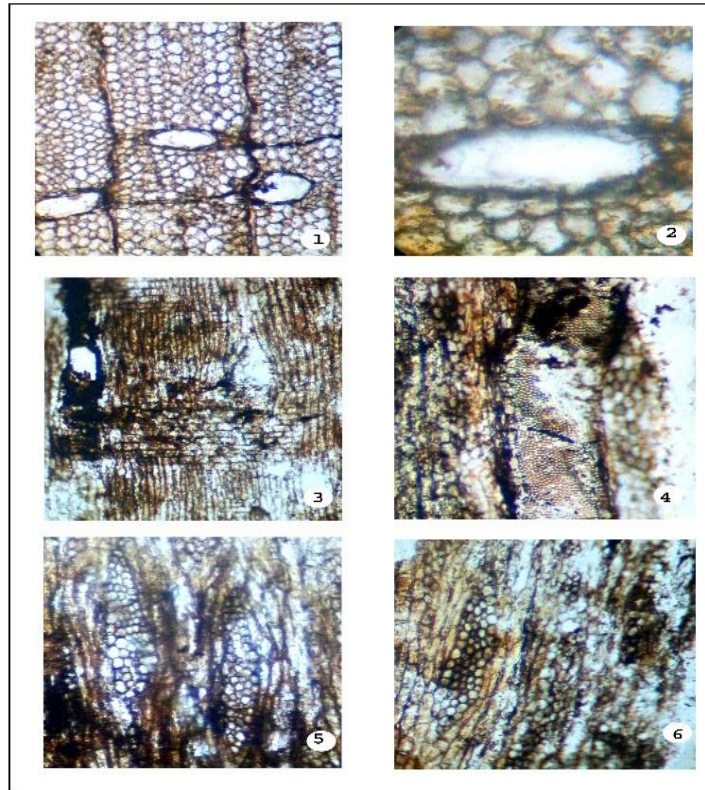


Plate No. 1, Fig. 1-6

Fig. 1: T. S. of wood showing solitary vessels, rays & fibers. 100X

Fig.2: Solitary vessels showing pitting & deposition. 400X

Fig.3: R. L.S. of wood showing homogenous medullary rays with fibers. 100X

Fig.4: T. L. S. of wood showing intervessel alternate pitting. 400X

Fig.5-6: T. L.S. wood showing rays & fibers. 100X