

A REPORT OF DICOTYLEDONOUS WOOD *BURSRAOXYLON BHUTERII* SP. NOV. FROM DECCAN INTERTRAPPEAN BEDS OF BHUTERA, MADHYA PRADESH, INDIA

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Abstract: Many dicotyledonous fossil woods are known from the Deccan Intertrappean beds of Central India. The material for the present study was collected from Bhutera (Lat. 22°06.5' N, long 79°08.42' E) in Chhindwara district, Madhya Pradesh. The wood is diffuse-porous, dicotyledonous. The phellem cells are irregular, variously shaped, compactly arranged, and dead, lacking intercellular spaces. Vessels are small, solitary, circular, measuring 30-40 µm in radial diameter and 20-30 µm in tangential diameter; the frequency of vessels is 2 to 3 sq. /mm. Vessels are thin-walled, without tyloses. Perforation plates are simple; intervessel pits alternate. Parenchyma is paratracheal, vasicentric, and 1-4-layered, composed of cells around the vessels. It is pentagonal to hexagonal in shape. Fibers are thin-walled, compactly arranged without air spaces. They are non-storied and non-septate, measuring 160-300 µm in height and 20-30 µm in diameter. The wood rays are mostly biseriate and tri-seriate; they are fine, heterocellular, 11-27 cells high, very variable in height (90-450 µm) and size (40-60 µm in diameter), with procumbent cells. The frequency of rays is 10-12 per sq. /mm. This fossil specimen shows several similarities with the family Burseraceae present in the fossil material. The reported fossil woods do not compare with the present fossil wood. It is material collected from Bhutera. Hence, it is named *Bursraoxylon bhuterii* sp. nov.

Keywords: Dicotyledonous, Fossil Wood, Deccan Intertrappean, Bhutera.

INTRODUCTION

A large number of dicotyledonous fossil woods are known from Deccan Intertrappean beds of Central India. The material for the present study was collected from Bhutera (Lat. 22°06.5' N, long, 79°08.42' E) in Chhindwara district in Madhya Pradesh. So far many reported dicotyledonous wood from Deccan Intertrappean beds namely *Ochnaceoxylon tertiera* (Ramteke and Kapgate 2016), *Paraphyllanthoxylon deccanii* (Kapgate 2015), *Lythrecooxylon jabalpurii* (Meshram and Borkar 2014), *Aeschynomenoxydon mohgaonse* (Yadav, Bhowal & Narkhede 2013), *Moringaceoxylon baradii* (Narkhede, Bhowal and Yadav 2011), *Sheikhoxylon mahurzarii* (Pande, 2011), *Dracontomelumoxylon mangiferumoides* (Srivastava, 2010), *Capparadaceoxylon baradii* (Yadava, 2010), *Gesneriaceoxylon mahurzarii* (Nandeshwar, 2009) *Barringtonioxylon deccanense* (Srivastava, Kapgate & Chatterjee 2009), *Sonneratioxylon preapetalum* (Srivastava, 2008), *Lanneoxylon grandiosum* (Srivastava and Guleria 2004), *Anamirta pfeifferi* (Bonde 1997), *Grewioxylon canalisum* (Bande and Srivastava, 1995), *Terminalioxylon catappaii* (Wazalwar, 1990), *Thymaleoxylon takliensis* (Mahajan, 1987), *Paraphyllanthoxylon jaulkharaense* (Gayakwad, 1985) *Terminalioxylon ghoshii* (Satyanarayana and Mahabale, 1984), *Griasoxydon mahurzarii* (Senad, 1983) *Cassionoxylon mahurzarii* (Paradkar, 1972), *Grewioxylon indicum* and *Ailanthoxylon ghiareense* (Dayal, 1971), *Pavonioxylon mohgaonse* (Sheikh, 1971), *Polyalthioxylon parapaniense* (Bande, 1971), *Grewioxylon mahurzariense* (Prakash and Dayal, 1963), *Simarubaceoxylon mahurzari* (Shallom, 1959),

Ailanthoxylon Mahurzari (Shallom, 1959) A medium, coarse-textured, distinctly diffuse porous wood. Growth ring is faint. Pore are groups rarely present, tyloses are present. Parenchyma fairly abundant about the pore with lateral extension present and rays broad. But Rays are not broad, in present fossil wood. So, present the present fossil wood specimen is different.

MATERIAL AND METHOD

The species is based on a single petrified wood piece measuring about 9.4 cm in length and 5 cm in width. The specimen is well preserved showing anatomical details. The material for the present study was collected from Bhutera. It was etched with hydrofluoric acid and washed under running water. Thin sections of fossil wood were prepared for the study of anatomical characters. The sections were oriented in transverse, radial longitudinal and tangential longitudinal planes. These sections were examined under the microscope. Camera Lucida sketched was drawn.

Description: - The fossil wood is a diffuse porous dicot wood. Fossil wood consists of phellem, vessels, xylem parenchyma, wood fibers and wood rays.

Phellem: The phellem cells are irregular and various in shaped structures. These are compactly arranged and lack intercellular spaces. These are dead cell (Text, I figs.7 and Plate I, Fig. 6).

Vessels: Vessels are small in size, solitary, circular, measuring 30-40µm in radial diameter and tangential diameter 20-30µm (Text, I figs.1&3 and Plate I, Fig.1).; vessels are very rare i.e. the frequency 2 to 3 sq. /mm. vessels are thin walled without any tyloses. Perforation plates are simple, intervacular pitting alternate, pentagonal to hexagonal in shape without any apertures.

Xylem parenchyma: Parenchyma is Paratracheal, vasicentric, as sheaths round the vessels, 1-4 layered cells around the vessels (Text, I figs.3). It is well preserved. It is pentagonal to hexagonal in shape.

Wood fibers: Fibers are thin walled and are compactly arranged without air spaces. It is non-storied and nonseptate, measuring 160-300µm in height and 20-30µm in diameter. Fibers often in regular radial rows; crystals are not shown in the fibers. They are long strand, thick-walled pits, hexagonal in shape.

Wood rays: The wood rays are mostly biseriate and tri-seriate, rays are fine (Text, I figs. 2 and Plate I, Fig. 2 & 4).; heterocellular rays 11-27 cells high, very variable in height measuring 90 - 450 µm and size 40-60 µm in diameter, procumbent cells. Frequency of ray is 10-12 per sq. /mm. heterogeneous with 1-3 rows of square or upright marginal cells (Text, I figs.3 and Plate I, Fig. 6).

IDENTIFICATION AND DISCUSSION

The characteristic features of present fossil wood are as follows. These are based on the key given by Metcalfe and Chalk (1957) Anatomy of the Dicotyledons (vol. I & II); Cornelia A. Reiners-Gouwentak (1949) Homogeneous and Heterogeneous Rays their characteristics and a Key for their Identification. Carlquist Sherwin (1984) Vessel grouping in Dicotyledon wood: Significance and Relationship to imperforate treachery elements. Schoch, Heller, Schweingruber, Kienast, (2004), Identification Key, wood anatomy of central European species. Edward Charles Jeffrey (1917) The Anatomy of Wood Plants; Alan Crivellaro Fritz Hans Schweingruber (2013) Atlas of wood, Bark and Pith Anatomy of Eastern Mediterranean trees and shrubs with special focus on Cyprus.

- The phellem cells are irregular and various in shaped.
- Vessels are small in size, solitary, circular, thin walled without any tyloses. Perforation simple, intervessel pits alternate.
- Parenchyma is Paratracheal vasicentric.
- Fibres are thin walled and are compactly arranged without air spaces. It is non-storied and nonseptate.
- The wood rays are mostly biseriate and triseriate, homogeneous to heterogeneous.

The reported fossil woods compare with present fossil wood, *Simarubaceoxylon mahurzari* (Shallom, 1959) Vessel medium size, solitary and radial rows of two usually filled with tyloses. Fossil vessel is not in radial rows of two usually filled with tyloses. Ray's broad to fine. But Rays are not broad in present fossil wood. *Ailanthoxylon Mahurzari* (Shallom, 1959) A medium, coarse-textured, distinctly diffuse porous wood. Growth ring is faint. Pore are groups rarely present, tyloses are present. Parenchyma fairly abundant about the pore with lateral extension present and rays broad. But Rays are not broad in present fossil wood. *Grewioxylon mahurzariense* (Prakash and Dayal, 1963) Xylem rays fine to broad. Rays tissue markedly heterogeneous, rays divisible on the basis of size and composition into two type, narrow rays 1-2 seriate and broader rays heterocellular, 3-12 cells. *Polyalthioxylon parapaniense* (Bande, 1971) parenchyma paratracheal and metatracheal. The paratracheal poorly developed. Forming 1-2 seriate sheaths around the vessels or vessel groups. Metatracheal parenchyma conspicuous well developed zonate. Xylem rays very prominent in t. s. the rays are fine to broad, 5 to 7 per mm., separated by 4 to 12 rows of fibers, 1-9 seriate (mostly 3-6 seriate), uniseriate and biseriate rays rare. *Terminalioxylon ghoshii* (Satyanarayana and Mahabale, 1984) a few filled with a dark brown substance and others profusely tyloses, perforation plate is simple, interval pitting alternate, pits in the ray parenchyma similar to the intervessel pitting, rays mostly uniseriate to biseriate. *Grewioxylon canalium* (Bande and Srivastava, 1995) parenchyma Paratracheal, vasicentric, forming 2-3 seriate sheath the vessels or vessel multiple. *Anamirta pfeifferi* (Bonde 1997) axis spirally twisted with ribs and furrows, primary xylem poles sixteen, placed in a ring around the pith, each pole consisting of 1-4 protoxylem and 6-10 metaxylem elements. Parenchyma conjunctive – broad bands forming concentric rings capping phloem from cortical side. Stone cells present. *Lanneoxylon grandiosum* (Srivastava and Guleria 2004) Parenchyma scanty, paratracheal, rays 1-4 seriate, heterocellular. Uniseriate rare short. Multiseriate with gum canals. Gum canals radial, sporadic, large, solitary. Fibers aligned in radial rows, semilibriform, septate. *Sonneratioxylon preapetalum* (Srivastava, 2008) Parenchyma absent, ray fine, uniseriate, rarely bicelled due to pairing of cells, homocellular to weakly heterocellular, made up of procumbent cells with interspersed upright or square cells. *Barringtonioxylon deccanense* (Srivastava, Kapgate & Chatterjee 2009) is diffuse – porous. Growth rings indistinct, marked by smaller vessels and denser fibers. *Gesneriaceoxylon mahurzarii* (Nandeshwar, 2019) vessels circular to sub circular and perforation plate are simple and oblique. Alternate bordered pits. Tyloses present. Parenchyma paratracheal vasicentric. Fiber aseptate and non-storied. Wood rays mostly rays are uni- bi – tri- seriate and homogeneous. *Capparadaceoxylon baradii* (Yadava, 2010) vessels predominantly solitary and in multiples of two vessels. Intervascular pit pair alternate, pore elliptical, parenchyma paratracheal vasicentric. Rays mostly Tri seriate, homogeneous with procumbent cell only. Fibers non-septate libriform, storied. *Dracontomelumoxylon mangiferumoides* (Srivastava, 2010) vessels members short. Rays 1-5 (mostly 3-4) seriate. heterocellular. Parenchyma abundant, paratracheal vasicentric forming 1-2 seriate sheaths round the vessels, occasionally extending laterally. *Sheikhoxylon mahurzarii* (Pandey, 2017) intervacular pit pair alternate, pore elliptical and parenchyma paratracheal vasicentric. Rays mostly Tri seriate, homogenous with procumbent cell. Fibers nonseptate, libriform. Storied. *Moringaceoxylon baradii* (Narkhede, Bhowal and Yadav 2011) wood rays, biseriate, heterogeneous, fibers nonseptate, non-storied, tylosis present. Where as in the present fossil, Radial gum canals present. *Aeschynomenoxydon mohgaonse* (Yadav, Bhowal & Narkhede 2013) Xylem parenchyma scanty with paratracheal vasicentric type, Intervascular pitting is simple and alternate. Perforation plate simple. *Lythreoxylon jabalpurii* (Meshram and Borkar 2014) wood rays mostly multiseriate and composed heterogeneous cells, fibers short, thin walled, nonseptate. Rays are homogeneous in present fossil wood so present fossil is different. *Paraphyllanthoxylon deccanii* (Kapgate 2015) slightly aliform metatracheal parenchyma. *Ochnaceoxylon tertia* (Ramteke and Kapgate 2016) perforation plate simple and oblique, intervacular pit pair opposite and bordered, xylem parenchyma paratracheal vasicentric, wood

ray heterogenous, bi to multiseriate, fiber nonseptate. Few are septate and storie. *Trigoniaceoxylon wardhensis* (Nagdevte and Meshram 2023) 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, all above fossil wood characters are different from present fossil wood.

These are comparing with living family as follows.

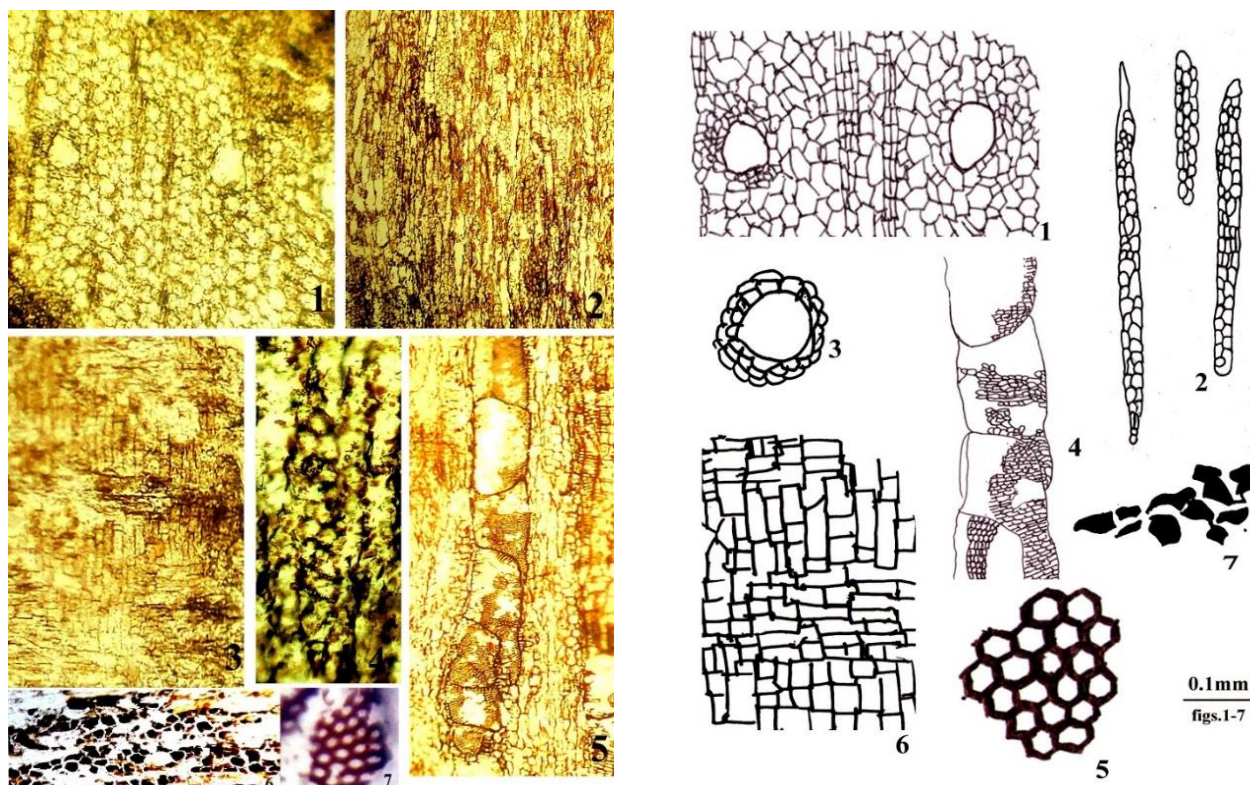
Sr. No.	Family	Anatomical character According to Metcalf and Chalk (1957), Cornelia A. Reiniers-Gouwentak (1949), Cariquist Sherwin (1984), Schoch, Heller, Schweingruber, Kienast, (2004), Alan Crivellaro Fritz Hans Schweingruber (2013).
1	Connaraceae	All solitary, Perforations simple, Intervascular pitting alternate, the tyloses sclerosed, Parenchyma typically scanty paratracheal. Gummy contents. Fibers with simple pits.
2	Bignoniaceae	Vessels Solitary and small multiples of 2 or 3 cells. Intervascular pitting alternate, parenchyma paratracheal. Rays homogeneous and heterogeneous. Fibers with simple pits.
3	Simaroubaceae	Vessel's multiples of 2 or 3 cells. Intervascular pitting alternate, parenchyma paratracheal. Rays homogeneous and heterogeneous. Cell containing gum canal. Fibers with simple pits.
4	Cneoraceae	Vessel's multiples, Parenchyma paratracheal. Rays are homogeneous to heterogeneous. Fibers with numerous simple pits on the radial walls. Walls thick.
5	Burseraceae	Layers of cork, peeling off like paper, vessels solitary, perforation plate simple, intervacular pitting alternate. Parenchyma paratracheal; Rays heterogeneous 2-3 cells wide. Fibers often thin walled, sometimes containing gum.
6	Moringaceae	Vessels medium sized, perforations simple, Intervascular pitting alternate, Parenchyma Paratracheal, vasicentric, Rays are uniseriate, homogeneous.
7	Leguminosae, Mimosaceae	Typically solitary, Perforations simple. Intervascular pitting alternate, Parenchyma usually abundant, and predominantly paratracheal, Rays mostly 2 cells wide; exclusively uniseriate or with only a few biseriate rays homogeneous and heterogeneous rays in <i>Caesalpinia sappan L.</i> ; Fibers with few, small, simple pits, more Mimosaceae from the Caesalpinaceae; sometimes with a gelatinous inner layer and sometimes containing starch or gum-like contents.
8	Simaroubaceae	Vessel solitary, Paratracheal in origin, moderately heterogeneous rays cells containing dark gum in <i>Irvingia</i> and <i>Kirkia</i> .
9	Guttiferae	Vessels moderately small, solitary, Parenchyma typically paratracheal, vasicentric Rays usually of two distinct widths, the larger up to 4-9 (mostly 4-6) cells wide and typically more than 1mm. high (often considerably more than 2 mm.); uniseriate typically numerous and composed of high upright cells, abundant gum-like deposits.
10	Oleaceae	Vessel exclusively solitary, intervacular pitting alternate; parenchyma paratracheal, rays 2-3 cells wide, heterogeneous to homogeneous, fibers simple or indistinctly border pits.
11	Bignoniaceae	Vessel solitary, perforations typically simple, intervacular pitting alternate. parenchyma paratracheal. Rays typically homogeneous, but slightly heterogeneous. Fibers typically septate in the climber.
12	Present fossil wood	The phellem or cork cells are present. Wood diffuses porous; Vessels are small in size, thin, solitary, oval to rounded, Perforation simple, Intervessel pits are alternate. Parenchyma is paratracheal parenchyma vasicentric. Fibers are simple, gum canal present.

From the above discussion it can be concluded that though the given fossil specimen shows a number of similarity characters with the family Burseraceae are present in present fossil material. The reported fossil woods not compare with present fossil wood. It is collected material from the Bhutera. Hence, it is named as *Bursraoxylon bhuterii* sp. nov.

DIAGNOSIS

Bursraoxylon gen. nov. Wood diffuses porous. Growth ring indistinct, vessel oval, small to large, solitary perforation simple, intervessel pits alternate, Parenchyma is Paratracheal vasicentric to aliform, occasionally confluent joining adjacent vessels. Rays are heterogeneous, 2-3 seriate, made up of procumbent cells. Fiber arranged in regular radial rows in between the xylem rays. Fibers are rectangular to polygonal in shape, non-septate. The phellem or cork cells are tangentially to form irregularly shaped structures. These are compactly arranged and lack intercellular spaces.

***Bursraoxylon bhuterii* sp. nov. Plate and Text, Fig. 1-7**



Explanation of Plate, Fig. 1. T.S. wood showing solitary vessels X100. **Fig. 2.** T.L.S. of wood showing medullary rays X100. **Fig. 3.** R.L.S. of wood showing procumbent, square and homologous medullary rays X100. **Fig. 4.** Medullary ray X225. **Fig. 5.** Strand with intervessel pits alternate X100. **Fig. 6.** Cells phellem X225. **Fig. 7.** Magnified intervessel pits alternate X225.

Explanation of Text, Figs. 1-7 **Fig. 1.** T.S. wood showing solitary vessels. **Fig. 2.** Medullary rays. **Fig. 3.** Solitary vessel. **Fig. 4.** Strand shows intervessel pits alternate. **Fig. 5.** Magnified intervessel pits alternate. **Fig. 6.** R.L.S. of wood showing procumbent, square and homologous medullary rays. **Fig. 7.** Cells phellem.

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