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A FOSSIL DICOT CAPPARADACEOXYLON MAHURZARII GEN. ET SP. NOV., FROM THE DECCAN INTERTRAPPEAN BEDS OF MAHURZARI, NAGPUR, INDIA

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ABSTRACT

Mahurzari is a fossiliferous area with a wealth of fossil woods that are being closely examined for botanical identification. Determining the age of the Intertrappean beds, as well as the paleoclimate and paleogeography of the area, will undoubtedly be made easier with the proper interpretation of the fossil plants found there. The fossil sample was gathered from the Deccan Intertrappean Beds of Mahurzari, Barad. Wood is dicotyledonous, with diffuse porous vessels mostly solitary and in multiples of two. The perforation Platels straightforward. Intervascular pit pairs alternate & are bordered. The xylem parenchyma is paratracheal and vasicentric, while the wood rays are mostly triseriate and homogeneous. The fibers are non-septate, pointed at both ends, and are classified as libriform and storied. This species shows great resemblance to the family Capparadaceae, which is why it has been named *Capparadaceoxylon mahurzarii* gen. et sp. nov. The generic names have been assigned on the basis of their affinities with the families, and the specific name is after the locality.

INTRODUCTION

The first petrified dicot wood from the Deccan Intertrappean series was described by Rode (1934) as *Parajugloxylon mohgaonse*. In 1936, Rode redescribed this fossil wood in detail and transferred it to the non-committal genus *Dryoxylon* and named it *Dryoxylon mohgaonse,* showing its nearest affinity with the woods of the family *Combretaceae.*

Mahurzari, a fossil-rich area in the Deccan Intertrappean Beds, has become a paleobotanical hotspot because it has preserved woods from many different dicotyledonous lineages (Wheeler et al., 2017). The correct interpretation of the fossil plants discovered in the region is bound to throw light on deciphering the age of the Intertrappean beds and also the paleoclimate and paleogeography of this region.

Recent palynological studies from Mahurzari have confirmed that these sediments are from the Maastrichtian period. This supports the idea of a warm and humid paleoclimate with tropical evergreen plants (Tripathi & Srivastava, 2020).

The fossil sample has been collected from the fossiliferous locality of the Deccan Intertrappean Series, Mahurzari, Barad. This petrified material is well preserved, black in color, and rough in texture. It has yielded fairly excellent peels. From this locality, three other wood fossils were reported, namely, *Burseraceoxylon baradense, Chitaleyoxylondecanense* (Sheikh,1971), and *Polygonioxylon baradii* (Bhowal, 1998).

MATERIAL AND METHOD

The material is black in colour. 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 in three planes: T.S., T.L.S., and R.L.S. Slides were prepared. Anatomical features were observed using a light microscope, and camera lucida drawings were prepared to illustrate key diagnostic characters for identification and comparison.

Description

The wood is diffuse, porous, and decorated without any growth rings. Vessels are not visible to the naked eye. The anatomical details are as follows.

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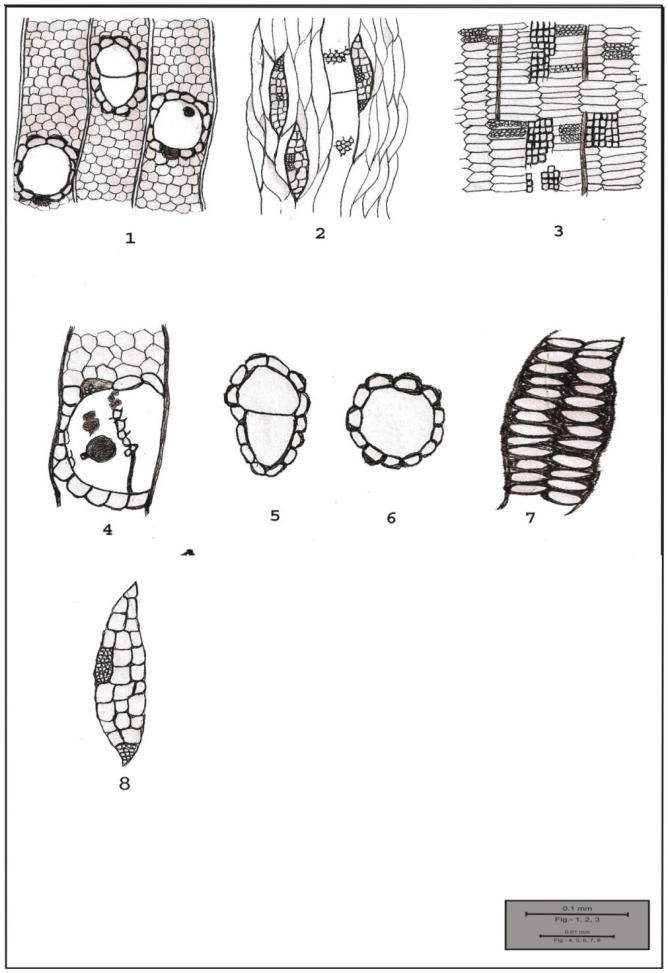
Vessels: They are predominantly solitary or in multiples of two in tangential plane (Platel -Fig. 1 & Text Fig. 1, 5, 6).Pores are nearly circular in cross section. Vessels are mostly large in size, with the diameter varying between 239 µm and 241 µm (Platel - Fig. 1, 4 & Text Fig. 1, 4, 6). The vessel frequency is 16 to 20 per sq. mm. The vessel member length varies from 322 µm to 401 µm. Some vessels exhibit specific types of deposition, as illustrated in Platel - Fig. 4 and Text Fig. 4.Vessels are contiguous, with rays on one side or on the other (Platel - Fig. 3; Text Fig. 2). Perforation plates are simple, obliquely placed (Platel-Fig.5 & Text Fig.2). Intervascular pittingsare alternate and very distinct, thick walled and bordered. Pit pores are elliptical with the diameter varying between 63µm to 70 µm. (Platel-Fig.6 & Text Fig.7)



EXPLANATION OF TEXT FIGS. 1 TO 8

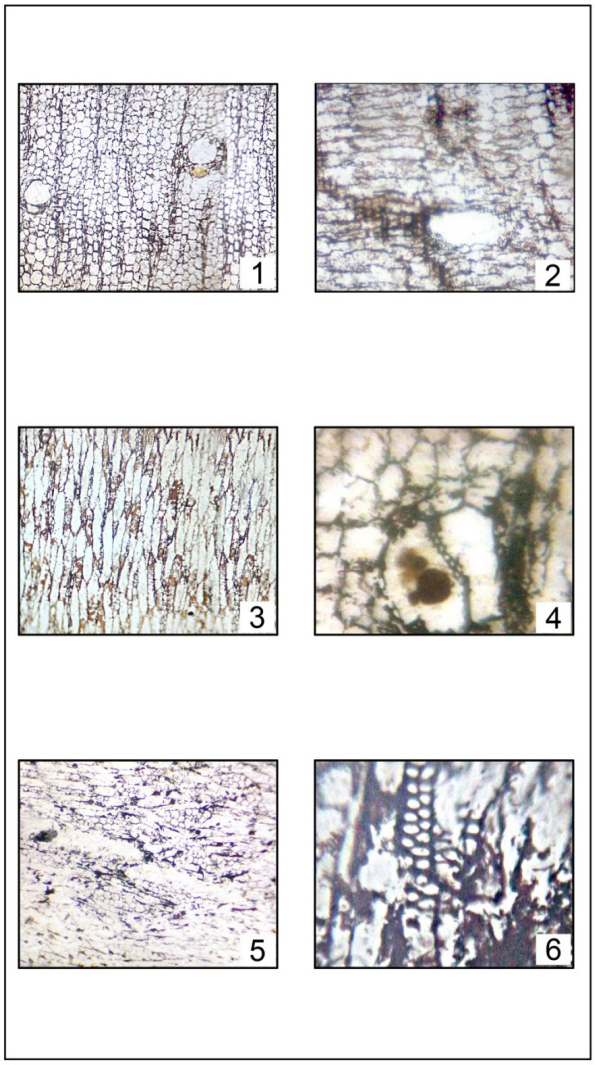
Fig. 1. T.S. of wood showing vessel solitary or in multiple of two. **Fig. 2**.T.L.S. of woo Platel d showing triseriate medullary rays, perforation plate simple obliquely placed. **Fig. 3**. R.L.S. of wood showing homogenous medullary rays & fibers with pits. **Fig. 4**. Solitary vessels showing pitting & deposition. **Fig. 5 & 6**: Vessels surrounded by paratracheal vasicentric parenchyma. **Fig. 7**. Inter vessel alternate pitting magnified. **Fig. 8**. Triseriate wood ray with pitting magnified.

Xylem Parenchyma: Parenchyma is well preserved. It is predominantly paratracheal vasicentric type. It is one celled thick forming a single layered sheath around the vessels. Cells of parenchyma are mostly flattened.(Platel-Fig.1 & Text Fig.1, 5, 6)

Wood Fibres: They are abundant forming the ground mass of the wood. In transverse section they are pentagonal to hexagonal in shape and 5 to 6 in layers (Platel-Fig.1 & Text Fig.1). They are of thick walled and are compactly arranged in radial rows between the rays without any intercellular space (Platel-Fig.2,3& Text Fig.2,3). Fibres are non-septate, pointed from both the ends, libriform and storied (Platel-Fig.2,3 & Text Fig.2, 3). Bordered pits are present on the fibre wall. The thickness of fibre wall is 28 µm to 35 µm. (Platel-Fig.2,3 & Text Fig.2,3)

Wood Rays: The wood rays are multiseriate mostly triseriate in nature (Platel-Fig.3 & Text Fig.2,8).The height of the wood rays is 9 to 12 cells. Ray system is homogenous consisting of procumbent cells only. Rays are contiguous with vessels (Platel-Fig.2,3& Text Fig.3). Frequency of ray is18 to 20 per sq. mm. Height of ray is 584.22 µm to 699.93 µm and breadth is about 134.20 µm to141.65 µm. Simple pits are seen on ray cells. (Platel-Fig.3 & Text Fig.2,8)

PLATE - I



EXPLANATION OF PLATE-I, FIGS. 1 TO 6

Fig. 1. T. S. of wood showing solitary vessels, rays & fibers (100X); **Fig. 2**. R.L.S. of wood showing homogenous medullary rays with fibers (100X); **Fig. 3**. L.S. of wood showing medullary rays & libriform fibers (100X);**Fig. 4**. Solitary vessels shows pitting & deposition (400X); **Fig. 5**. T.L.S. of wood showing perforation plate simple obliquely placed (100X); **Fig. 6**.T.L.S. of wood showing inter vessel alternate pitting (400X).

IDENTIFICATION AND DISCUSSION

On the basis of the above distinguishing characters, the studied fossil wood was compared with earlier reported wood from this locality.

Burseraceoxylon baradense (Sheikh, 1971), shows some similarities like parenchyma vasicentric, rays uni- to biseriate, intervascular pitsalternate, and bordered with elliptical pores. But they vary greatly in respect of vessel number, frequency, and diameter. In the studied fossil, parenchyma is typically paratracheal vasicentric, pit pore is simple, and rays are triseriate only. In *Chitaleyoxylon deccanense* (Sheikh, 1971), the vessels are solitary, intervascular pores are circular to oval, and parenchyma is paratracheal vasicentric aliform to confluent and metatracheal. Rays are usually multiseriate. Fibres aseptate with intercellular spaces. None of these characters are present in the studied fossil specimen. *Polygonioxylon baradii* (Bhowal, 1998), also shows some similarities, like vessels mostly solitary and in multiples of two and a perforation plate simple. Intervascular pit pairs alternate. Differences encountered are mainly with respect to the parenchyma in *Polygonioxylon baradii,* where it is paratracheal vasicentric sparse while the studied fossil wood shows paratracheal vasicentric only. Thus, no appreciable affinities were observed between the earlier reported fossil woods with the present one.

Accordingly, the modern-day families were explored to place the wood fossil under any of them. (Metcalfe & Chalk, 1950; Shallom, 1963; Esau, 1965). Comparisons are made with the modern living families like *Menispermaceae, Erythroxylaceae*, *Dipterocarpaceae, Quinaceae*, *Lecythidaceae, Capparadaceae & Annonaceae.*

Menispermaceae was ruled out due to the presence of conjunctive apotracheal diffuse parenchyma and interfascicular rays, which contrast with the paratracheal vasicentric parenchyma and homogeneous rays observed in the fossil.

The family *Dipterocarpaceae,* although agreeing with the fossil in certain general characters like vessels usually medium-sized, exclusively solitary or with multiples of 2 or 3, perforation simple, intervascular pitting alternate. However, it differs sharply from the given fossil in the following characters:Parenchyma in the studied fossil specimen is paratracheal vasicentric; in *Dipterocarpaceae,* it is paratracheal and apotracheal. Rays are triseriate in the fossil, whereasin *Dipterocarpaceae*, they are multiseriate and found in the pattern of uni-,tri-, and pentaseriate. Fibers are storied, exclusively non-storied in *Dipterocarpaceae*.

Lecythidaceae shares features like simple perforation plates and alternate pitting but differs in parenchyma type—apotracheal bands versus paratracheal vasicentric in the fossil.

The fossil wood resembles the woods of *Erythroxylaceae in* having solitary to few smallvessels in multiples, simple perforation, and alternate intervascular pitting. Fibers bordered. However, it differs from *Erythroxylaceae* in the followingcharacters: - Parenchyma paratracheal vasicentric only, parenchyma predominantly paratracheal vasicentric, aliform, or confluent in *Erythroxylaceae*. Ray homogenous and triseriate, in *Erythroxylaceae* rays heterogenous and uniseriate. *Quinaceae*was excluded due to its exclusively apotracheal parenchyma. *Annonaceae* exhibits overlapping traits such as simple perforation, alternate pitting, and fibers with bordered pits, yet it differs in the presence of apotracheal parenchyma, heterogeneous rays, and often storied fibres.

The studied fossil wood shows a large number of characters similar to that of *Capparadaceae,* like vessels solitary and in multiples of two, perforation simple, alternate intervascular pitting, similar pits to parenchyma, parenchyma paratracheal vasicentric, and storied fibers. The rays are up to 2-5 cells wide, multiseriate, and uniform. The only difference encountered is in respect of fiber septation and pitting. In the studied fossil wood, fiber is aseptate with bordered pits.

The family *Cappardaceae* is characterized by a large number of woody genera like *Isomeris*, *Boscia*, *Morisonia,Cleome, Apophyllum,* and *Crataeva*. Though the fossil shows many similarities with the family *Capparadaceae*as cited above, however, it differs from its genera because of the typical distinguishing characters as enumerated: - In *Isomeris*, vessels are tiny with radial multiples and arranged in clusters, parenchyma with fusiform cells, whereas in the studied fossil they are solitary or in small multiples of two, without fusiform cells. In *Boscia,* vessels are typically marked with a radial pattern, but the given fossil shows solitary vessels in small multiples of two. Likewise, *Morisonia differs* from the fossil in certain typical characters, like the presence of septate fibers, which are not observed in the studied fossil. In *Cleome,* the vessels are typically solitary but can also be found in clusters. And some *Cleome* members show the presence of spiral thickening, butthe given fossil differs in having solitary vessels in multiples of two and in the absence of spiral thickening. *Apophyllum* differs from the fossil in certain typical characters, like the presence of solitary vessels in clusters, which are not observed in the studied fossil. In *Crataeva*, vessels are medium-sized and solitary in short multiples, parenchyma is sometimes more abundant and aliform or confluent, and in some species of *Crataeva,* parenchyma is present in the form of terminal bands, but the studied fossil shows solitary vessels in multiples of two, and parenchyma is typically paratracheal vasicentric, but only one character is common between *Crataeva*and studied fossil, that is the presence of fibres.

From the above discussion it can be concluded that though the given fossil specimen shows several similar characters with the family *Capparadaceae,* it varies greatly from its living genera. Thus, it is clear that the studied fossil wood might have been an extinct genus of the family *Capparadaceae.* Hence, it is named as *Capparadaceoxylon mahurzarii* gen. et sp. nov. The generic name is after the family *Capparadaceae,* to which the extinct fossil wood is assigned,whereas the specific name is after the hill locality Barad, Mahurzari, Nagpur, India.

Diagnosis

The species is Capparadaceoxylon gen. nov.

Wood, dicotyledonous, diffuse porous vessels are typically found solitary or in multiples of two. The perforation plate appears straight forward. Intervascular pit pairs alternate, bordered. Xylem parenchymna paratracheal vasicentric, wood rays mostly triseriate, homogenous. Fibres non-septate pointed from both the ends and libriform, storied.

Capparadaceoxylon mahurzarii gen. et sp.nov.

Vessels are predominantly solitary and in multiples of two vessels diameters, varying between 239 µm and 241 µm; the frequency is 16 to 20 per sq. mm, and the member length varies from 322 µm to 401 µm. Intervascular pit pairs alternate, are elliptical, and have a diameter of 63 µm to 70 µm. The parenchyma is paratracheal vasicentric. Rays mostly triseriate, homogenous with procumbent cells only, 9 to 12 cells high. The frequency of rays is 18 to 20 per sq. mm. The height of the ray is 584.22 µm to 699.93 µm, and the breadth is about 134.20 µm to 141.65 µm. Fibers non- septate, libriform,storied.

Holotype : AMY. / Wood-1. Department of Botany, Institute of Science Nagpur.

Locality : Mahurzari, Nagpur.

Horizon : Deccan Intertrappean Series of India.

Age : ? Upper Cretaceous.

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