

ALBIZZIOXYLON CHINJIENSIS SP. NOV., A NEW FOSSIL SPECIES OF THE FAMILY LEGUMINOSAE FROM CHINJI FORMATION SALT RANGE, PUNJAB PAKISTAN

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ABSTRACT: The present paper describes of anatomical details of petrified wood belonging to Chinji formation of Miocene age exposed at Chinji National Reserve. The three dimensional sections were prepared by standard technique. Microscopic attributes of the fossil wood such as vessels, parenchyma, fibers, and xylem rays were compared with modern and fossil wood. The wood under investigation was found comparable with the genus *Albizzia* of family leguminosae. Results showed that it has been described as new species and named as *Albizzioxylon chinjiensis* sp. nov. It is concluded that the epithet chinjiensis refers to its locality.

Key words: *Albizzioxylon chinjiensis* sp.nov. leguminosae , fossil wood, Chinji formation, Pakistan.

1. INTRODUCTION

The presence of fossilized plants were first time reported in Pakistan when Blanford in 1879[1] reported them while working on the Geology of Sindh region. But no attempt was done to identify these fossilized plants from sindh region until 1962. A large number of papers were published during that period by other Paleobotanist of the world.

A number of fossil wood species were reported from different fossiliferous localities by different authors including), Khan and Rehmatullah (1968, 1971,1972) [2] [3] [4] Khan and Rajput (1976) [5], Rehmatullah Ch. (1971)[6] Rehmatullah et al. (1984) [7]: Bhutto et al. (1992) [8] Ahmed et al. (1991-2007) [9-12] and Majeeda et al. (2007) [13] . They identified gymnosperm, monocot and dicot wood from Sindh region of Pakistan

Major part of the work has been done in Sindh province, a few reports are available from other provinces of Pakistan. Species of *Terminalioxylon*, (*T. burmense* and *T. sulaimanense*) de Franceschi et al. (2008) [14] were reported from the lower parts of the Chitarwal Formation (Zinda Pir Dome, Sulaiman Range, Eastern Baluchistan) *Ougenioxylon chinjiensis* soomro et al. (2014) [15] were reported from Punjab provinces.

In the present study the petrified wood samples were collected from the fossiliferous locality of Chinji National Reserve, district Khushab, which falls in the heart of the Salt Range 50 km from Khushab city and 175 km north-west of Faisalabad district of Pakistan. Petrified wood were buried in complete log of 6-7 meters and some scattered in the sedimentary rocks.

2. MATERIALS AND METHODS

The fossil wood (TR07 Fig-3) was collected by the first author from chinji National Reserve, district Khushab, Punjab Pakistan. The wood 9 cm long, 4 cm in wide, brown in color and silicified. Six different thin sections along the transverse, tangential and radial planes were made at Palaeobotany Lab. with ground thin section techniques after Weatherhead (1938) [16]. Preliminary investigations were made with the simple light microscope and Steriozome microscope Photographs were taken with Ortholux Microscope at the Institute of Plant Sciences University of Sindh. Jamshoro, Pakistan.

3. ANATOMICAL DESCRIPTION

3.1 Diagnosis of Species

Wood diffuse porous, growth ring present, delimited by thin lines of terminal parenchyma. Vessels are quite distinct to naked eye and medium to moderately large t.d. 115-280 µm, r.d. 145- 366 µm, they are mostly solitary or in radial multiples of 2-3 rarely 4, 3-6 per sq mm. Intervessl pits small, alternate, vestured. Parenchyma paratracheal and apotracheal; paratracheal parenchyma vasicentric, forming a wide sheath around the vessels, mostly aliform sometimes aliform –confluent .Apotracheal parenchyma repreented by a thin terminal lines of around the growth rings; xylem rays fine 1-4 seriate (mostly 3-4) homocellular, consisting of procumbent cells, 3-25 cells in height. Fibers septate thin walled and 9-13 µm in diameter.

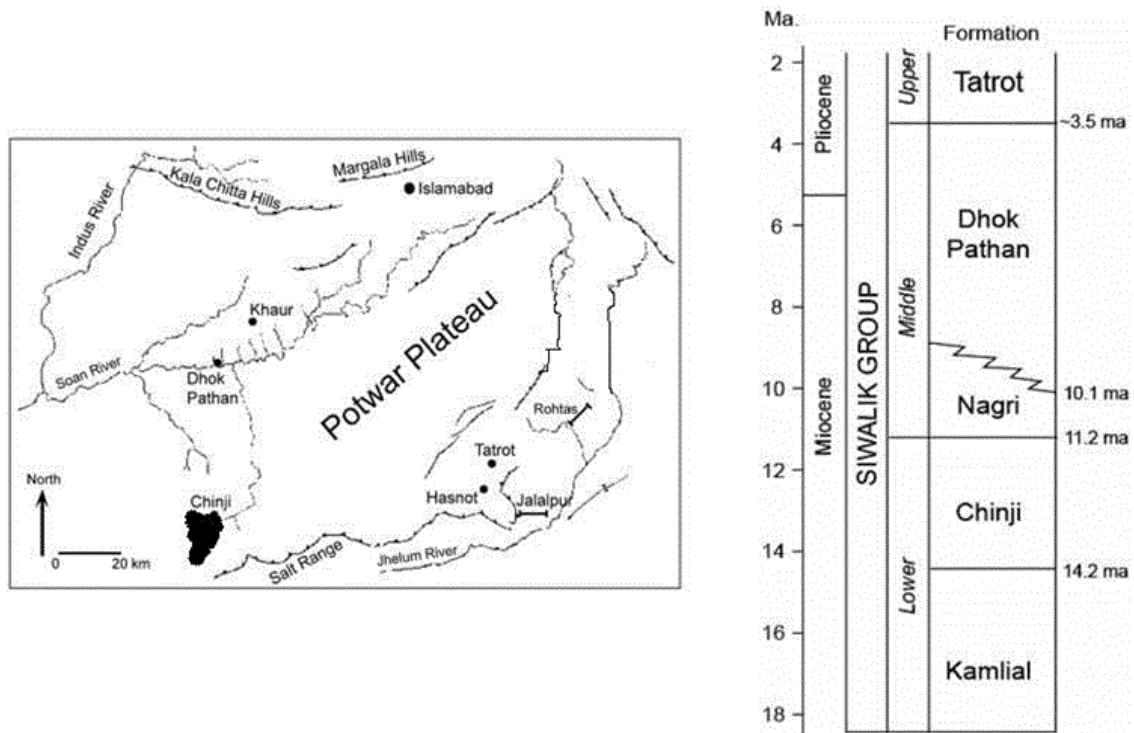


Fig.1 Location map showing Chinji Fossileferous locality with schematic profile

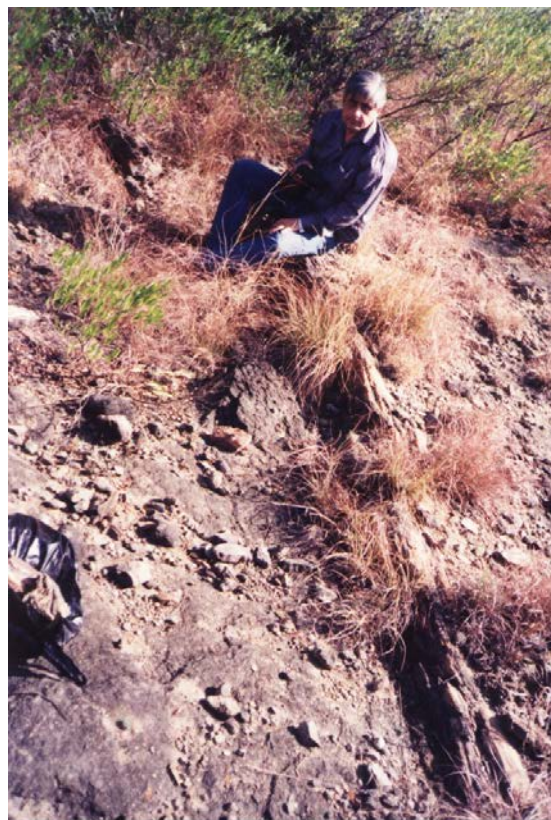


Fig.2 Showing huge log of fossil wood lying in the fossiliferous locality at chinji national reserve

4. Anatomical description

4.1 Cross section (Fig: 4-6)

Wood diffuse porous delimited by the thin lines of apotracheal parenchyma, vessels easily seen under the microscope medium to large sized. Mostly solitary or in radial pairs or group of 2-3 occasionally 4 the vessels thick-walled, round to oval, usually plugged with a dark coloured deposits. evenly distributed, 3-6 per sq mm. Tylosis absent, tangential diameter ranges from 115-280µm, radial diameter ranges 145- 366 µm, Height of radial multiple of two ranges 130- 498 µm, and radial multiple of 3 is 220- 455µm.

Wood parenchyma apotracheal and paratracheal. Apotracheal parenchyma characterized by thin terminal lines of 1-3 cells wide. Paratracheal parenchyma vesicentric, aliform to confluent, The sheath of parenchyma cells around the vessels 3-7 cells thick, round, oval to elliptical in cross section The t.d diameter 18-28 µm. Rays canal like, diffuse in ground mass 16-35 µm thick, present on the both sides of vessels. Fibers aligned in radial rows, circular to oval in cross section t.d. 12-20 µm.

4.2 Tangential Longitudinal Section, (Fig ,7,8,9)

Vessels composed of elongated cells with truncate ends; length of vessel element 245-460 µm long 146-289 µm wide, perforation simple; intervessel pits oval to elliptical 4-6 µm, bordered elliptical alternate, vestured. Xylem rays fine 1-4 seriate mostly (3-4) or 14-86 µm broad, 7-10 rays per mm. Ray cells homogenous, homocellular, composed of wholly procumbent, uniseriate rays 9-12 µm wide and 60-148 µm high or 4-8 cells high, biseriate rays 25-30 µm wide and 180-310 µm long and 5-14 cells high, Triseriate rays 36-52 µm wide and 260-343 µm long and 16-22 cells high, infiltration dark. Fibres long, septate, libriform 9-13 µm in diameter 356-540 µm long.

4.3 Radial Longitudinal section, (Fig 12,11)

Vessels segments elongated, having truncate ends. Length of vessel member 234-465 µm 138-290 µm broad, vessel ends transverse with simple perforation. Walls 8-10 µm. thick intervessel pits well preserved simple, alternately arranged average diameter Ca.3 µm. Parenchyma cells found around vessels, arranged in 2-3 layers. 25- 135 µm long 15-31 µm broad. Xylem rays cells 30-53 µm long and 4-7 µm broad. Fibers elongated, septate libriform, 9-13 µm in diameter; Interfibers pits are visible in some places.



Fig. 3 Macrograph of the fossil wood



Fig. 4 Cross section showing general distribution of vessels and parenchyma. X 200

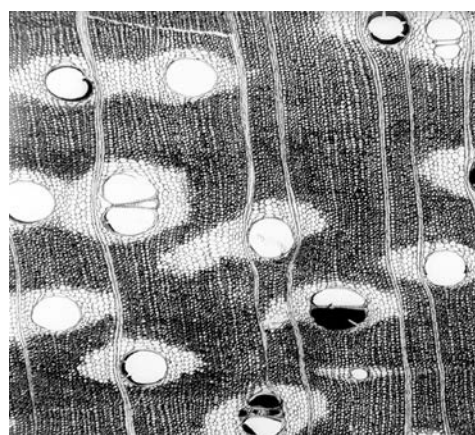


Fig.5 Cross section showing similar distribution of modern wood of *Albizzia* (photograph taken from inside wood)

5. DISCUSSION

5.1 Affinites of the Fossil with living wood

Following anatomical details were used in determining the affinities of this fossil medium to large vessels vestured intervessel pit pairs, parenchyma vasicentric, mostly aliform, aliform to confluent and terminal Parenchyma 1-4 seriate homogenous xylem rays and septate fibers. From

above attribute it becomes increasingly evident that the fossil wood can be easily compared with the wood of leguminosae. Among the Leguminosae the genera more comparable were *Tamarindus*, *Intsia*, *Afzelia* and *Acacia*. The genus *Acacia* can easily be separated by comparing our petrified wood with the wood of *Acacia*. In the genus *Acacia* parenchyma is mostly vesicentric in the species like *Acacia catechu*, *Acacia modesta* Chowdhury (1945) [17]. Moreover the vessels form cluster in *Acacia* and with relatively narrower rays.



Fig.6 Cross section showing vessels with aliform to confluent parenchyma

The xylotomical character of *Afzelia*, *Tamarindus* and *Intsia* also illustrate similarity with the fossil wood under examination in the nature and distribution of parenchyma but difference can be seen in these living wood with the present fossil wood *Tamarindus* and *Afzelia* usually possess terminal bands of Parenchyma, in addition to the aliform type. The parenchyma of *Afzelia* mostly storied, while in *Tamarindus* a tendency towards that alignment was noticed. The parenchyma in *Afzelia* and *Tamarindus* numerous and narrower as compared in our fossil wood under investigation.

The fossil wood in question shows the close similarity with the modern wood of *Albizia*. (Fig-10,13) specially *A. odoratissima* Benth. and *A. amara* Biovin. in shape, size, and number of rays the fossil wood show similarity with the living wood of *Albizia amara* whereas *A. odoratissima* Benth shows closest resemblance with the fossil in the size of vessels. Thus the present fossil resemble to the characters of both. *A. amara* and *A. odoratissima*. In genus *Albizia* 145 species, distributed in tropical and subtropical region of the world. In Pakistan it is represented by 7 species. Willis 1988[18]

5.2 Comparison with the recorded Fossil wood

Prakash & Barghoora (1961) [19] described a fossil wood as *Albizia vantagiensis* from the

Miocene beds of Columbia Basalt, U.S.A. which has, however, been transferred to *Tetrapleuroxylon* by Mullar-Stoll and Madel (1967)[20]. Fossil wood *Albizzioxylon humgaricum* Greguss (1969) was described from the Mid-Miocene of Hungary which he thought to be comparable to the genus *Acacia*. However, due to the occurrence of septate fibres in the fossil he named it as *Albizzioxylon*. Khan & Rehmatullah (1971) [3] described a fossil wood from the Tertiary deposits (Palaeocene) of Sindh exposed at Rehman Dhoro, showing affinities with genus *Albizia*, and they named it *Albizzioxylon dhaproense*. Since the fossil woods of *Albizia* was named as *Albizinium* Prakash, (1975) [21]. So far only four species of *Albizzioxylon* are known from different part of the world.

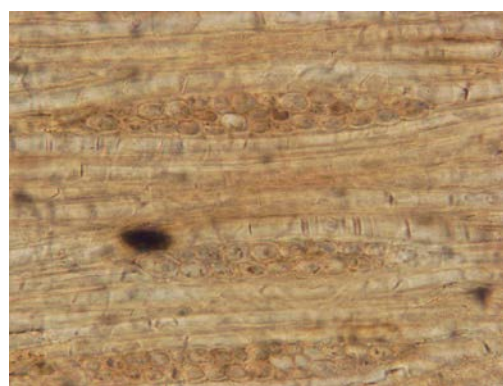


Fig. 7 Tangential longitudinal section showing distribution of xylem rays and end wall of vessels. X 100



Fig. 8 Tangential longitudinal section showing arrangement of xylem rays. X 200

Albizzioxylon dhaproense (Khan & Rehmatullah) showing similarity in nature and distribution of vessels and xylem rays, but it differs in size of vessels medium in *Albizzioxylon dhaproense* in comparison to *Albizzioxylon chinjiensis* where vessels are medium to large. Parenchyma is confluent in *Albizzioxylon dhaproense* whereas vasicentric, aliform to confluent, moreover, apotracheal parenchyma also present as terminal bands.



Fig. 9 Radial longitudinal section showing the nature of xylem rays. X 40

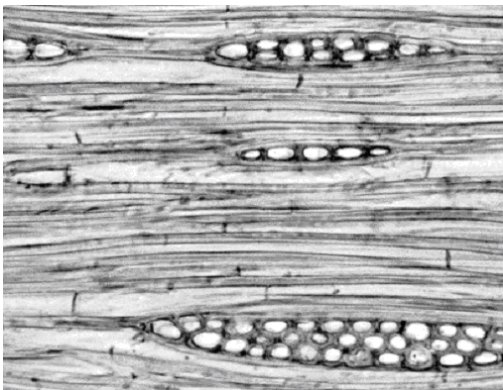


Fig.10 Radial longitudinal section showing the same pattern of modern wood

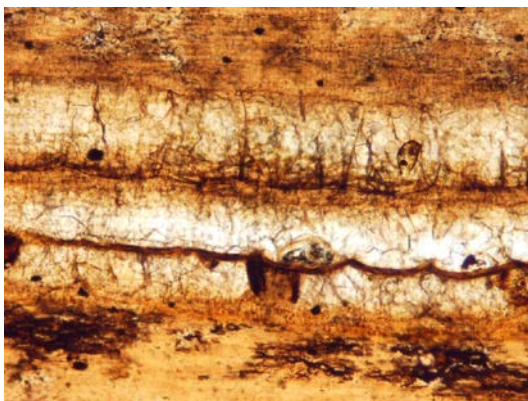


Fig. 11 Tangential longitudinal section showing distribution of xylem rays and end wall of vessels. X 40

Albizinium hangarinum (Greguss) exhibits its characters in small to large vessels, paratracheal aliform parenchyma, 1-4 seriate xylem rays which are 20-25 cells high. By comparing these characters it shows resemblance with *Albizzioxylon ranikotensis* but difference in nature of parenchyma which are aliform to confluent and in height of xylem rays which are 4-22 cells high in *Albizzioxylon ranikotensis*.

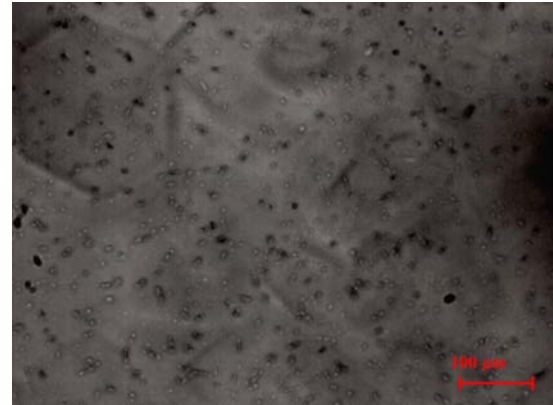


Fig. 12 Radial longitudinal section showing the nature of xylem rays. X 160



Fig.13 Radial longitudinal section showing the pits on the wall of vessels of modern wood

Albizinium pondicherriensis Awasthi reported from Pondichery, India, (Awasthi, 1979) [22] *Albizinium pondicherriensis* is similar with *Albizzioxylon chinjiensis* in gross features, but differs in xylem rays which is 1-2 seriate in *Albizinium pondicherriensis*.

Albizinium colebbekianu Prakash reported from Himachal Pradesh, (Prakash, 1975) [23] *Albizinium colebbekianu* differs in nature of parenchyma which is as wide halo around the vessels ending bluntly joining parenchyma of neighboring vessels of similar extensions.

Detailed comparative studies with the known fossil species of *Albizzioxylon* indicates that fossil specimen under investigation differs from the already described woods in many respects as discussed above and therefore can be identified as new species *Albizzioxylon chinjiensis* sp. nov.

The epithet is indicating locality from which fossil wood was collected.

6. CONCLUSION

The anatomical characters of the fossil wood *Albizzioxylon chinjiensis* such as diffuse porous wood and the growth rings are absent or indicated by terminal parenchyma. These characters indicate tropical type of climate prevailed in that region.

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