

**MANGIFEROXYLON PAKISTANICUM SP. NOV., A NEW  
FOSSIL SPECIES OF THE FAMILY ANACARDIACEAE  
FROM RANIKOT FORT AREA**

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**Abstract**

Petrified fossil wood resembling modern wood of the genus *Mangifera* of the family Anacardiaceae is described from Ranikot fort area, Dadu, Sindh, Pakistan. On the basis of xylotomical homologies, the fossil wood is named as *Mangiferoxylon pakistanicum* sp. nov., and reported for the first time from Pakistan.

**Introduction**

The present paper describes a new fossil wood belonging to the genus *Mangifera* of the family Anacardiaceae, which was collected from Ranikot fort area, district Dadu of Sindh, Pakistan.

The occurrence of petrified dicot and monocot fossil woods in the Tertiary succession of Western Sindh is known since the early report of Blanford (1876) and that of Pascoe (1963). First report of a fossil dicot wood from Laki formation exposed near Petaro, district Dadu was made by Khan & Rehmatullah (1968). Many fossil woods have also been reported from Rehman Dhoro and Ranikot fort area (Khan & Rehmatullah, 1971, Khan *et al.*, 1972; Khan & Rajput, 1976; Rajput & Khan, 1982, 1984; Rehmatullah *et al.*, 1984; Saced *et al* 1984; Rajput *et al.*, 1985). The present paper describes a new fossil wood belonging to the genus *Mangifera* of the family Anacardiaceae, which was collected from Ranikot fort area, district Dadu of Sindh, Pakistan.

**Material and Method**

A single piece of well preserved brown silicified stem, 12 X 9 cm of the genus *Mangifera* was collected from Ranikot fort area (Fig. 1A) (Lat 25<sup>o</sup>.45'-26<sup>o</sup>.00'. N Long. 67<sup>o</sup>.45' - 68.00' E.). Usual ground thin section method was applied for the preparation of three dimensional slides. Due to the presence of hydrated iron oxides the staining of the sections was not necessary.

**ANATOMICAL DESCRIPTION**

**Topography:** Wood diffuse porous (Fig.1 AB; Fig.2). Growth rings absent. Vessels mostly small to medium and few large sized; solitary as well as in radial multiples of

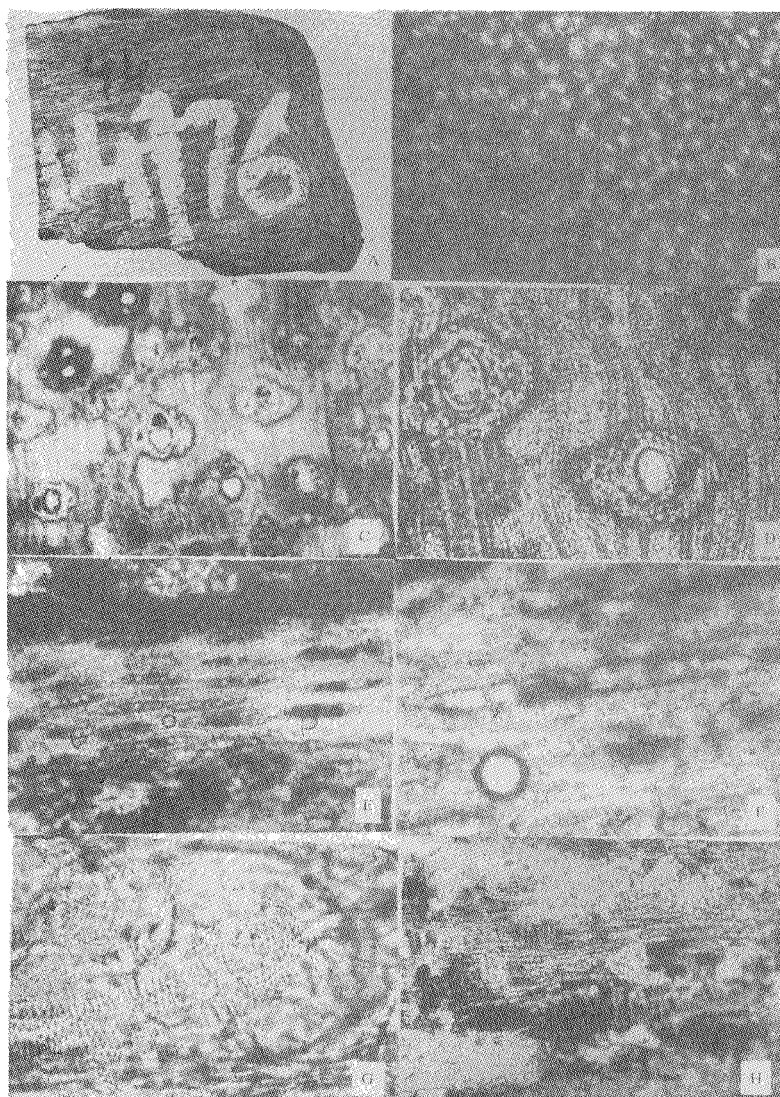


Fig.1. A- *Mangiferoxylon pakistanicum* sp. nov. Macrophotograph of the fossil wood.  
 B- Polished surface of cross section showing distribution of the vessels and parenchyma. X 100.  
 C- Cross section showing type and distribution of vessels and aliform to confluent parenchyma. X 350.  
 D- Cross section showing enlarged vessels and general distribution of rays and fibres. X 877.  
 E- Tangential longitudinal section showing distribution of exclusively uniseriate heterogeneous xylem rays. X 877.  
 F- Tangential longitudinal section showing enlarged heterogeneous xylem rays x 3500.  
 G- Tangential longitudinal section showing vestured intervessel pits. x 3500.  
 H- Radial longitudinal section showing heterocellular xylem rays. x 3500.

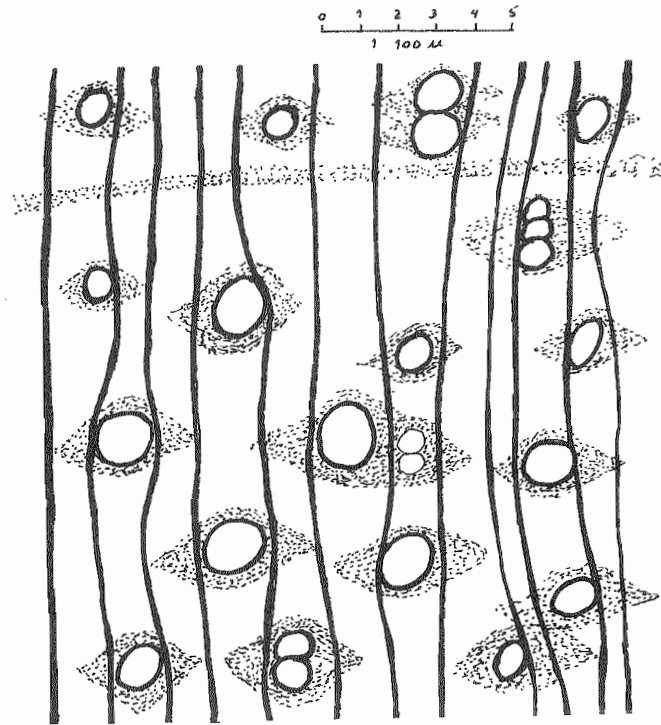


Fig.2. Cross section showing distribution of vessels, wood parenchyma and xylem rays.

2-3; unevenly distributed in ground mass, distribution of the vessels 5-8/sq. mm., lumen of vessels mostly empty, sometime filled with dark deposits. Tylosis absent (Fig.1 B,C; Fig.2 & 3). *Parenchyma* apotracheal and paratracheal, apotracheal parenchyma in the form of 2-6 cells thick initial bands, paratracheal parenchyma vascentric to aliform and aliform to confluent, forming 3-8 cell thick sheath around the vessel (Fig.1 CD; Fig.2,3 & 4). Xylem rays uniseriate 3-16 cells or 55-300  $\mu\text{m}$ . high, 10-16 rays per mm.; ray tissue heterogeneous; rays homocellular to heterocellular; homocellular xylem rays consisting wholly of procumbent cells while heterocellular rays consisting of procumbent cells in the middle and a few upright cells present at the margin of the one or the both ends; ray cells are commonly filled with dark brown deposits (Fig.1 EF; Fig.3 & 4). Fibres aligned in rows.

**Elements:** Vessels thin walled, tangential diameter 70-160  $\mu\text{m}$ ., radial diameter 90-230  $\mu\text{m}$ ; round to oval in shape, those in radial multiples, flattened at the contact places; vessel members 220-530  $\mu\text{m}$ . in length with truncate ends; perforation simple; intervessel pit pairs small simple; vessel ray and vessel parenchyma pits are not preserved, parenchyma 35-55  $\mu\text{m}$  in length, 20-35  $\mu\text{m}$  in diameter. Ray cells thin walled, procumbent cells 14-20  $\mu\text{m}$  in tangential height and 40-62  $\mu\text{m}$ . in radial length, upright cells 20-30  $\mu\text{m}$  in tangential height and 50-80  $\mu\text{m}$  in radial length, cells frequently crystalliferous. Fibres libriform, walls 5  $\mu\text{m}$  thick, septate, angular in cross section, 10-16  $\mu\text{m}$ , in diameter, 450-900  $\mu\text{m}$  in length, interfibre pits not preserved.

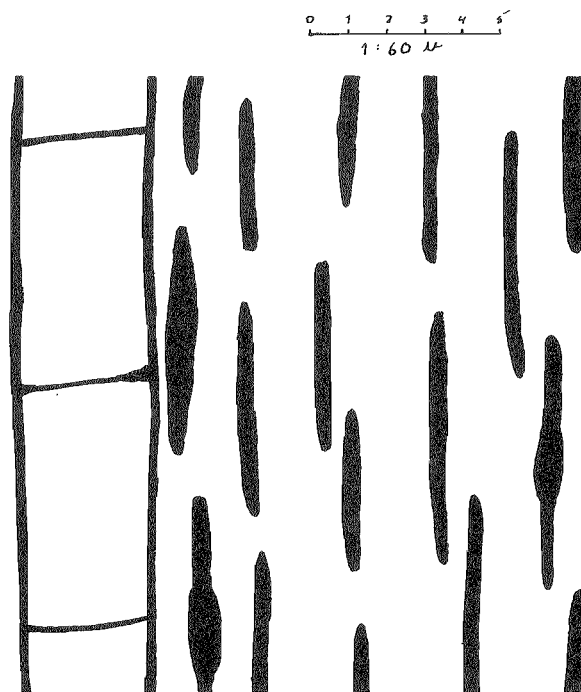


Fig.3. Tangential longitudinal section showing distribution of xylem rays and end walls.

### COMPARISON WITH MODERN FAMILIES

The combination of the characters found in the present fossil wood invite comparison with the member of Leguminosae, Combretaceae, Lythraeae and Anacardiaceae.

In Leguminosae the genus *Azalia* and *Tamarindus* are comparable with the fossil under investigation. In size, shape and distribution of the vessels, fibres and to some extent the wood parenchyma. In the wood of *Azalia* the parenchyma and xylem rays are storeyed. Besides, the rays in this genus are homogeneous and 2-3 seriate. The wood of *Tamarindus* while showing general similarities with the fossil, differs in possessing smaller vessel, 1-3 seriate xylem rays which are homogeneous and show tendency of storeyed alignment and the terminal band of parenchyma.

In the family Combretaceae the wood type of *Terminalia* show some significant similarities with the fossil wood under investigation. In genus *Terminalia* the intervessel pits are of the vestured type and ray cells contained single crystal. Furthermore xylem although paratracheal is of various type in the wood of *Terminalia* (Pearson & Brown 1932; Metcalfe & Chalk, 1957.).

In the family Lythraceae the genus *Lagerstroemia* show close resemblance with fossil wood under investigation in the characters of parenchyma and the xylem rays, but the fossil under investigation is diffused porous wood, heterogeneous xylem rays, whereas *Lagerstroemia* has ring porous wood and homogeneous rays.

In the family Anacardiaceae there are many taxa showing the superficial resemblance with the wood structure of fossil under investigation, in shape, size and the

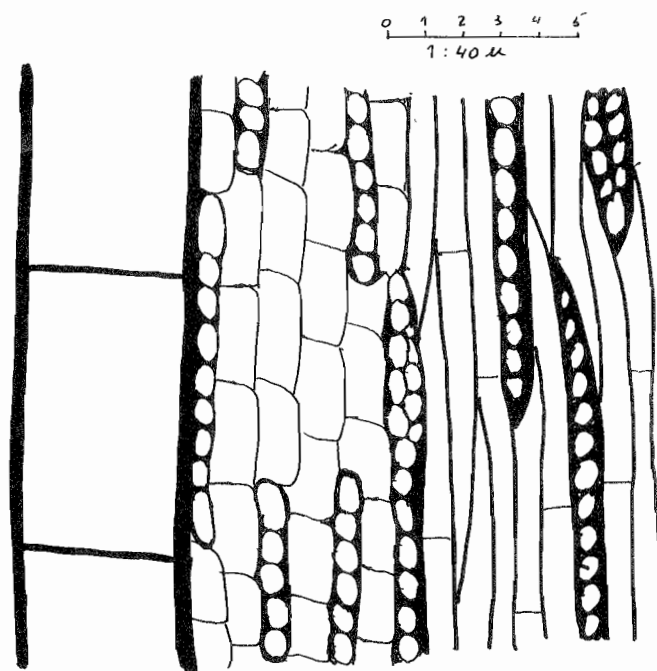


Fig.4. Tangential longitudinal section showing enlarged xylem rays and fibres.

arrangement of the vessels, inter-vessel pitting and distribution of the parenchyma, but the wood of *Mangifera* agree quite closely with the fossil under investigation, therefore the fossil under investigation has been assigned to *Mangiferoxylon* Awasthi 1966.

*Mangifera* L., comprises of 41 species confined mainly to the Indo-Malayan region. The western limit of its distribution is Ceylon, India and Pakistan, the northern limit being the Himalayas and Yunan in China. In the east, it extends upto Philippines, New Guinea and Vietnam, and in the south in the Sunda and Sulu Archipelago in the Indian Ocean (Gamble, 1902).

#### COMPARISON WITH FOSSIL RECORDS

A large number of fossil woods belonging to the family Anacardiaceae are known from India and other countries but those supposed to show affinities with *Mangifera* are *Anacardioxylon mangiferoides* (Ramanujam, 1960), *Mangiferoxylon scleroticum* (Awasthi, 1966) and *Mangiferoxylon assamicum* (Prakash & Tripathi, 1970).

## DIAGNOSIS

*Mangiferoxylon pakistanicum* sp. nov.

Wood diffuse-porous. Growth rings absent, usually delimited by terminal parenchyma. Vessels small to medium usually solitary as well as in radial multiples of 2-3, round to oval, t.d. 70-160  $\mu\text{m}$ ., r.d. 90-230  $\mu\text{m}$ , vessel member length 220-530  $\mu\text{m}$ ; perforation simple; intervessel pits alternate, bordered; tylosis absent. Parenchyma paratracheal and apotracheal; paratracheal parenchyma mostly vasicentric to aliform, sometimes aliform to confluent; apotracheal parenchyma in bands of 2-10 cells, usually delimiting the growth rings. Xylem rays 1-2 (mostly 1) seriate; ray tissue heterogeneous and homogeneous. Heterocellular ray consist of procumbent cells through the medial portion and 1-4 (mostly 1) marginal row of upright cells at one or at both ends, homocellular rays consisting wholly of procumbent cells; rays 3-16 cells or 55-300  $\mu\text{m}$  high; 10-16 rays per mm. Fibres nonlibriform, rarely septate.

Holotype: RK.44/1976, Ranikot Fort Area. M.T.M. Rajput & K.M. Khan.  
Paleobotany Museum, Department of Botany,  
University of Sind, Jamshoro, Sind, Pakistan  
Horizon: Dada Formation.  
Age: Subrecent.

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The fossil wood under investigation can be compared with *Anacardioxylon mangiferoides*, *A. mangiferoides* having uniseriate homogeneous xylem rays. Prakash & Tripathi (1969) pointed out that these characteristic features which are mentioned by Ramanujam (1960) are not present in the family Anacardiaceae, but Metcalfe & Chalk (1957), described the same characters under the family Anacardiaceae especially in genus *Mangifera*. Heimsch (1942) has pointed out, many species of the *Mangifera* which have uniseriate rays and bands of parenchyma than any other anacardian wood. Metcalfe & Chalk (1957) indicate that *Mangifera* may possess exclusively uniseriate or occasionally biseriate xylem rays.

The already described species of *Mangiferoxylon* can also compared with the recorded fossils, the details of which are given in Table 1. It would indicate that the fossil wood under investigation is different from already described species of *Mangiferoxylon* therefore it is assigned to a new species and named as *Mangiferoxylon pakistanicum* sp. nov. The specific epithet indicates the country from where the fossil was collected.

**Table 1. Comparison of the Fossil Wood with already reported species of Genus *Mangiferoxylon*.**

Species	Wood	Vessel	Parenchyma	Xylem Rays
<i>Mangiferoxylon scleroticum</i> Awasthi 1966	Diffuse porous.	Small to large, solitary as well as in radial multiples of 2-3 bands 2-6 cells thick t.d. 40-128 um. r.d. 45-300 um.	Patracheal, aliform, aliform to confluent, apotracheal, terminal	1-2 seriate, (mostly 1), heterogeneous, heterocellular, homocellular.
<i>Mangiferoxylon assamicum</i> Prakash & Tripathi, 1970.	Diffuse porous.	Small to medium, solitary as well as in radial multiples of 2-3 bands 2-10 cells thick t.d. 40-128 um r. d. 40-180 um.	Patracheal, aliform, aliform to confluent, apotracheal, terminal heterocellular,	1-3 seriate, (mostly 2), heterogeneous, homocellular.
<i>Mangiferoxylon Pakistanicum</i> sp. nov.	Diffuse porous	Small to large, solitary as well as in radial multiples of 2-3, t.d. 50-160 um. r.d 90-230 um.	Patracheal, aliform, aliform to confluent, apotracheal, terminal bands 2-6 cells thick.	1-2 seriate, (mostly 1), heterogeneous, heterocellular, homocellular.

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