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EUPHORIOXYLON THANOBOLENSIS SP. NOV. A NEW SPECIES OF FOSSIL WOOD FAMILY SAPINDACEAE FROM THANOBOLA KHAN DISTRICT JAMSHORO, SINDH, PAKISTAN

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Abstract

Euphorioxylon thanobolensis sp.nov., a new silicified wood has been described from Tertiary Manchhar formation exposed near Thanobola khan, district Jamshoro, Sindh, Pakistan. The xylotomical features of the present fossil show close resemblance to the genus *Euphoria* of the family Sapindaceae. The absence of growth rings indicates that plants were growing in tropical type of climate. This is the first report from this locality.

Introduction

Petrified woods in the upper Tertiary and Quaternary deposits of Sindh was first reported by Blanford (1879) while he was working on the geology of western Sindh. Eighteen fossil woods which have hitherto been identified and described from Sindh, Pakistan (Khan & Rahmatullah, 1968; Khan *et al*., 1971; Khan & Rahmatullah, 1972; Khan & Rajput, 1976; Rehmatullah *et al*., 1984; Rajput & Khan, 1982; Rajput & Khan, 1982; Rajput & Khan, 1984; Saeed *et al*., 1984; Rajput *et al*., 1985; Ahmed *et al*., 1989; Ahmed *et al*., 1991; Ahmed *et al*., 1991; Ahmed *et al*., 1991; Ahmed *et al*., 1993; Bhutto *et al*., 1993; Ahmed *et al*., 2000 and Ahmed *et al*., 2001). No systemic work has been done on the fossiliferous locality of Thanobola Khan.

The present work is the first study which deals with the anatomical description and the affinities of a fossil wood collected from Manchhar formation exposed near Thanobola Khan., district Jamshoro, Sindh, Pakistan (Lat. 67°.50' N. Long. 25°.21' E). The age of the rocks involved may be Late Miocene.

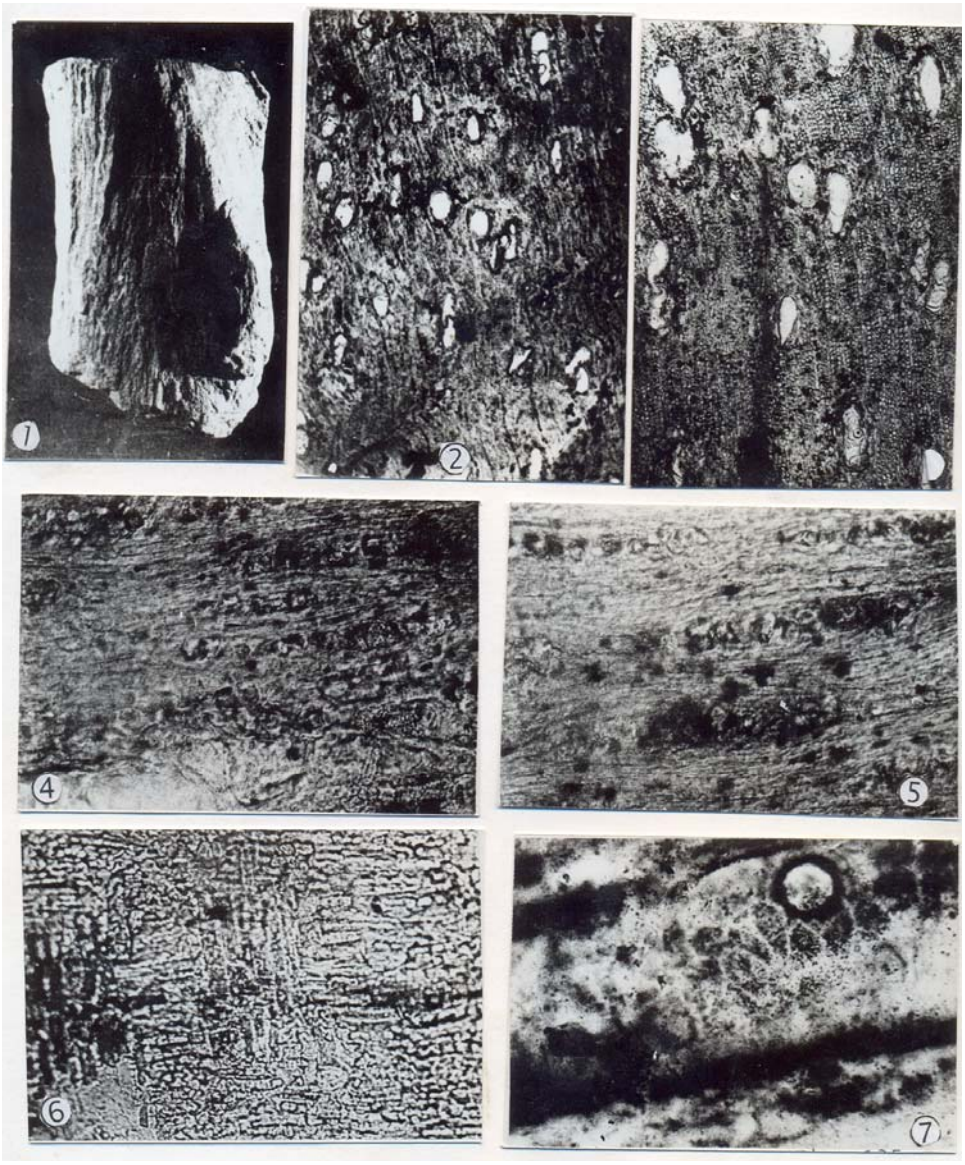
Materials and Methods

The specimen No. TB. 09. The material (TB. 09) silicified wood was collected by the first author from 10 Km in south-west of Thanobola Khan, district Jamshoro, Sindh, Pakistan.

The wood was a small piece of mature secondary xylem fossil about 7 cm., in length and 4 cm., in diameter. The colour of fossilized wood was brown (Plate No. 1, Fig. 1).

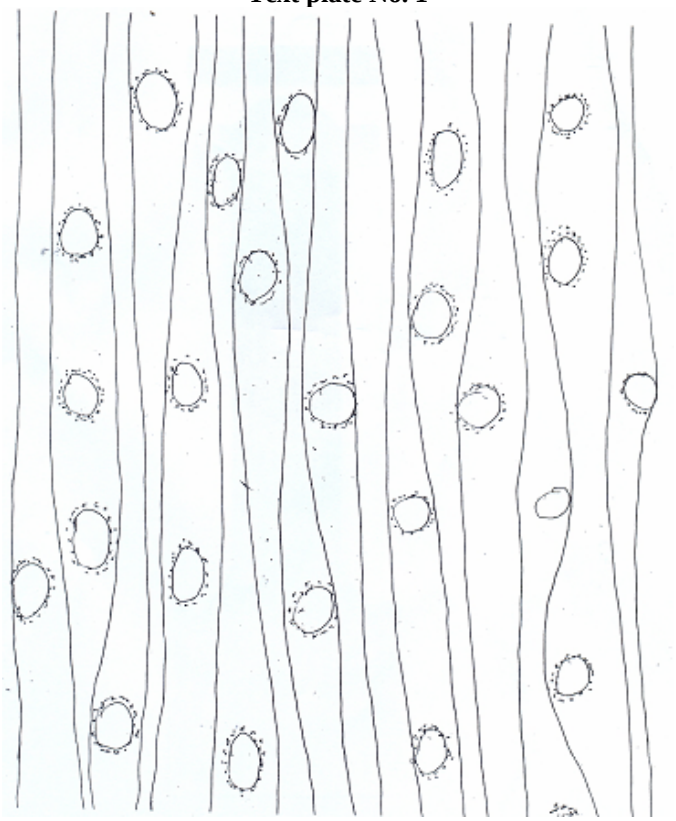
The anatomical sections, of required direction were prepared by the conventional Rock cutting and grinding technique (Weatherhead, 1938). Most of the preliminary investigations were made with the simple light microscope and Steriozoome microscope. Photographs were taken with Urtholux Microscope at the paleobotany lab. Institute of Botany, University of Sindh.

Plate No. 1



Euphorioxylon thanobolensis sp. nov.
Fig. 1. Macrophotograph of fossil wood
Fig. 2. Cross section showing general distribution of vessels and parenchyma. X 40.
Fig. 3. Cross section showing vessels with aliform parenchyma. X 63.
Fig. 4. Tangential longitudinal section showing distribution of xylem rays. X 150.
Fig. 5. Tangential longitudinal section showing nature of xylem rays. X 150.
Fig. 6. Radial longitudinal section showing xylem ray cells. X 250.
Fig. 7. Radial longitudinal section showing pits on the wall of the vessel. X 400.

Text plate No. 1



Euphorioxylon thanobolensis sp. nov
Cross section showing general distribution of vessels, rays and parenchyma.

Anatomical description

Euphorioxylon thanobolensis sp. nov

Cross section
Plate No. 1. Figs. 2 & 3. Text Plate No. 1

Wood difuse porous. Growth rigns absent. Vessels small to large sized, oval to elliptical in shape, those in radial multiples flattened at the place of contact, unevenly distributed in ground mass, solitary as well as in radial multiples of 2-3. Vessels are mostly empty rarely filled with brownish deposits; tangential diameter of the vessel ranges from 60-150 µm, radial diameter ranges from 90-250 µm; length of the radial multiples of 2 is 170-330 µm, length of radial multiples of 3 is 320-420 µm. Distribution of vessel 4-7 per sq. mm. Tylosis present in most of the vessels. Wood parenchyma paratracheal, scanty vasicentric forming 2-4 seriate sheath around the vessel, occasionally with lateral extension; diameter of the parenchyma cells ranges from 25-35 µm. Xylem rays fine uniseriate occasionally biseriate forming canal like structure on the either side of the vessels and diffused in ground mass, each is separated by 2-5 tangential row of fibres. Fibres polygonal, thick walled, aligned in radial row.

Text plate No. 2

Euphorioxylon thanobolensis sp. nov
Tangential longitudinal section showing distribution of xylem rays and end walls.

Tangential longitudinal section
Plate No. 1. Figs. 4-5. Text Plate No. 2 & 3

Vessel composed of elongated cells having truncate ends, vessel member length ranges 200-750 μm and breadth ranges 60-150 μm; vessels are mostly irregularly distributed; perforation simple, vessel end transverse; inter-vessel pits are large 8-10 μm in diameter, vestured, alternate. Xylem rays are fine, uniseriate occasionally biseriate 13-22 per mm., ray tissue heterogeneous; ray heterocellular to homocelloular; homocellular rays consisting of wholly procumbent cells, while hetrocellular rays consisting of procumbent cells and a few upright cells present at the margin of one or both ends; rays 80-420 μm and 6-22 cells high, diameter of procumbent cells ranges from 15-25 μm and tangential diameter of upright cell ranges from 20-45 μm and radial diameter ranges 40-60 μm. Crystals occasionally present. Fibres non-septate 8-20 μm in diameter and length of the fibre cells ranges 420-850 μm.

Text plate No. 3

Euphorioxylon thanobolensis sp. nov
Tangential longitudinal section showing enlarged xylem rays and fibres.

Radial longitudinal section
Plate No. 1. Figs. 6 & 7

Vessels composed of elongated cells, vessel member length ranges 22-750 μm; perforation simple vessel ends transverse 2-4 layers of parenchyma cells found around each vessel. Ray cells are rectangular, procumbent cells are 40-60 μm long and 15-25 μm broad; upright cells are 60-75 μm long and 40-55 μm broad. Fibres are elongatd, non-septate, thin walled, diameter ranges from 10-22 μm; length of the fibres is 420-850 μm inter-fibre pit are not seen.

Comparison with living species: The fossil under investigation specimen shows certain similarities in its anatomical structures with some members of the modern families such as Anacardiaceae, Burseraceae, Rutaceae, Simarubiaceae, Aceraceae, Combretaceae and Sapindaceae (Metcalf & Chalk, 1950; Pearson & Brown, 1932).

Few members belonging to Anacardiaceae resemble the fossil in having medium type of vessels, scanty nature of parenchyma and uniseriate rays. However, this family stands apart owing to the invariable occurrence of intrecellular canals in the secondary wood and also in the arrangement of vessels and the rays. Generally in this family, vessels are ring porous type and rays are multiseriate.

Wood of Burseraceae have small to medium sized vessels with hexagonal plates, paratracheal, vasicentric, scanty parenchyma rays which are uniseriate and few. These features are comparable to those of the fossil, although the woods of Bursraceae differ in having intercellular canals in the secondary wood.

The radial type of vessels with simple perforation, exclusively uniseriate rays and the septate fibres of meliaceous woods are like those in the fossil specimen but their characteristic, paratracheal, vasicentric, aliform, confluent parenchyma constitutes a major difference, apart from other variations.

The typical multiple vessels and the exclusively uniseriate rays are the features of the family Rutaceae which can be compared with those of the fossil but the woods of Rutaceae differ in the nature of their parenchyma which is usually paratracheal, vasicentric and the fibres which are non-septate and simple.

The genus *Terminalia* of Combretaceae resembles the fossil in having multiple vessels, uniseriate rays, but the nature of parenchyma and the pits in the two are different. In Terminalia, parenchyma is generally paratracheal, vasicentric as well as aliform and the pits are vestured in contrast to fossil wood under discussion, where the parenchyma are very scanty, almost restricted to a few cells and pits are simple.

Some woods of Simarubiaceae show certain features in common with the fossil in question. However, they differ in having ring porous type of vessels and multiseriate nature of rays.

Woods of Aceraceae also show certain similarities to the fossil under investigations but they generally have multiseriate rays with cells of different sizes and spiral parenchyma.

The important features of the present fossil wood viz., Vessel small to medium, parenchyma scanty paratracheal, xylem rays uniseriate to rarely biseriate due to paired cells, homocellular, and fibres thick walled non-septate to rarely septate. Among various dicotyledonous families, the Sapindaceae (Metcalfe & Chalk, 1950) exhibit the above important characters.

Since the parenchyma in the present fossil wood is scanty paratracheal, it should be compared with the genera *Arytera, Dodonea, Harpullia, Mischocarpus, Nephelium (*including *Euphoria, Litchi* and *Otonephelium), Pomitia, Schleichera* and *Xarospermum.* After survey of available literature and figures of above genera, it was found that the fossil wood shows closest resemblance with the wood of *Euphoria* comm. ex. Juss. The other woods of this group although quite similar to the fossil, differ in a few important characters.

The woods in the genus *Arytera* matches well with the fossil the parenchyma is usually scanty, confined to the region of vessels rays mostly uniseriate, homogeneous and the fibres which form the ground mass of the wood are libriform. It differs from our fossil in having small vessels, 25-30 per sq. mm., and scattered cells of parenchyma in the ground mass of the wood.

The parenchyma in *Harpullia* is predominantly aliform, aliform to confluent, and in *Dodonea* it varies from scanty paratracheal to aliform or locally confluent.

Table 1. Comparison of fossil wood related to organ genus *Euphorioxylon* Awasthi 1982, alongwith Geographical and stratigraphical break-up.

Species	Wood	Vessels	Wood parenchyma	xylem	Fibres
Euphorioxylon indicum Awasthi *et al.*, 1982 Kachchh, India Pliocene	Diffuse porous	Small to medium solitary as well as radial multiples of 2-5, td 50-140 µm, rd 60-180 µm, tylosis absent	Scanty paratracheal	Uniseriate rarely biseriate, homogeneous, 12-18 per mm. 4- 60 cells high	Septate to non-septate
Euphorioxylon deccanense Mehlotra, 1987 M.P, India Early Tertiary	Diffuse porous	Small to medium solitary as well as radial multiples of 2-4, td 40-120 µm, rd 40-140 µm, tylosis present	Scanty paratracheal	Uniseriate rarely biseriate, homogeneous to heterogeneous, 7-10 per mm. 2- 42 cells high	Semi-libriform, non-septate
Euphorioxylon thanobolensis sp. nov Thanobola Khan Pakistan Late Miocene to Pleistocene	Diffuse porous	Small to medium solitary as well as radial multiples of 2-3, td 60-150 µm, rd 90-250 µm, tylosis present	Scanty paratracheal	Uniseriate rarely biseriate, homogeneous to heterogeneous, 13-22 per mm. 6- 22 cells high	Non-septate

In *Pometia* the woods resemble the fossil under consideration in some features, such as in having scanty paratracheal parenchyma, mostly uniseriate, homogeneous rays, and libriform fibres, but at the same time they differ sharply in the nature of the vessels and the parenchyma. In *Pometia*, the vessels are usually solitary, large in size, ranging up to 280 μm with distinct striations due to coalescent appertures and the parenchyma slightly metatracheal in addition to the scanty paratracheal type.

Woods of *Mischocarpus* also agree in same feature such as the scanty nature of parenchyma, uniseriate homogeneous rays and thick fibres. However, they differ in having smaller vessels, larger number of vessels which are usually grouped together and also in having scattered cells of parenchyma along with the scanty paratracheal type of parenchymatous cells in the region of the vessels.

The genus *Schleichera* resembles in most of the strucural details with the fossil in question. The resembling features are the medium sized vessels, scanty paratracheal parenchyma, extremely fine, mostly uniseriate, homogeneous rays and thick walled fibres. Although the fossil agrees in many features with this genus, yet some differences are also noticed in the nature of the rays and the fibres and the presence of growth ring in *Schleichera*.

Form the above comparison with the living genera it is evident that the present fossil wood is very similar to that of *Euphoria*. Hence, it is placed under the organ genus *Euphorioxylon* (Awathi, Guleria & Lakhanpal, 1982.)

The genus *Euphoria* consists of about 15 species of shrub and trees distributed from Burma to Indo-China and western Malaysia (Santapau & Henry, 1973). In Pakistan including Sindh no living species of this genus is reported (Stewart, 1972).

Comparison with the fossil record: From the detailed comparison of the reported fossil woods of organ genus *Euphorioxylon* which is in the Table 1, it can be observed that the species under investigation is quite distinct from already reported taxa. However, these differences are good enough to assign it to a new species. As such the present species is named *Euphorioxylon thanobolensis* sp. nov.

The specific epithet refers to the locality from where the fossil specimen was collected.

Diagnosis of the new species: Wood diffuse porous. Growth rigs absent. Vessels small to medium, solitary as well as radial multiples of 2-3; oval to elliptical; t.d. 60-150 μm, r.d. 90-250μ um, thin walled; vessel member length ranges 200-750 μm, 4-7 vessels per sq. mm., perforation simple, tylosis present; intervessel pits large 8-10 μm, circular, vestured. Parenchyma scanty vasicentric, forming 2-4 seriate sheath around the vessels, occasionally extending side ways. Xylem rays 1-2 (mostly 1) seriate, homogeneous and heterogeneous, homogeneous rays consisting wholly of procumbent cells, heterogeneous rays consisting of procumbent cells and 1-2 marginal row of upright cells at the one or the both ends; crystals present, rays 6-22 cells or 80-420 μm in height. 13-22 mm. Fibres aligned in radial rows, angular, nonseptate, thin walled.

Horizon: Manchhar Formation.

Age: Late Miocene to Pleistocene.

Holotype: Thanobola Khan 22 km. in west from District Jamshoro Pakistan. Basir Ahmed, T B-09, 1991 (Paleobotany museum, University of Sindh, Jamshoro, Sindh, Pakistan).

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