# FOSSIL WOODS RESEMBLING *ELAEOCARPUS* AND *LEEA* FROM THE DECCAN INTERTRAPPEAN BEDS OF MAHURZARI NEAR NAGPUR

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## ABSTRACT

In this paper are described two new fossil woods from the Deccan Intertrappean Series at Mahurzari (21° 13′ N; 79° 1′ E) near Nagpur in Maharashtra state. These have been assigned to two new genera, *Elaeocarpoxylon* and *Leeoxylon* because of their strong resemblance with the modern woods of *Elaeocarpus* L. and *Leea* L. respectively.

## INTRODUCTION

THE present study is concerned with the description and interpretation of two fossil woods, one of *Elaeocarpus* and the other of *Leea*, from the Deccan Intertrappean beds of Mahurzari in Nagpur district. Both these genera are of interest anatomically and in their palaeogeographic distribution in the Tertiary of Deccan Plateau. The age of the Deccan Intertrappean beds, although a controversial matter, is now generally regarded as Early Tertiary, probably Eocene on the basis of plant remains found from the earliest Intertrappean beds of the series exposed in Nagpur and Chhindwara districts. (CROOKSHANK *et al.*, 1937; SAHNI, 1940).

The fossiliferous locality of Mahurzari is rich in fossil woods which are being intensively studied with regard to their botanical identification. A correct interpretation of a number of plants discovered here is bound to throw much light in deciphering the age of the Intertrappean beds and also the palaeoclimate and palaeogeography of the region.

So far only a few fossil woods have been described from this area. The first one to be described was a dicotyledonous wood, without a name, showing affinities to Burseraceae and Anacardiaceae (SHALLOM, 1958). Prakash (1958) described another wood as *Glochidioxylon sahnii* resembling the genera *Glochidion* and *Antidesma*. It has recently been renamed *Paraphyllanthoxylon sahnii* by Mädel (1962). In 1959, Shallom briefly described a Simaroubaceous wood under a new generic name — *Simarubaceoxylon* (*S. mahurzari**). However, later on she (SHALLOM, 1959a) transferred this wood to the genus *Ailanthoxylon* Prakash (1958). Shallom (1960) further described another wood as *Barringtonioxylon deccanense* resembling the modern genus *Barringtonia* of Lecythidaceae. Prakash (1962) has published a detailed account of a fossil wood of *Aeschynomene*. More recently Prakash and Dayal (1963) have described a fossil wood resembling *Grewia* Linn.

The preservation of structure of the fossil woods is unusually good although it has been generally seen that the percentage of organic matter retained in the Intertrappean silicifications is very low. Hence, it is apparent that the woods were mineralized at a stage when there was almost complete break down of the cellulosic component of the cell wall.

## DESCRIPTION

### Family — Elaeocarpaceae

*Elaeocarpoxylon antiquum* gen. et sp. nov.

The specimen described here consists of a piece of petrified secondary wood measuring about 6 cm. in length and 3·5 cm. in diameter. It is brown to rusty-brown in colour with good preservation.

*Topography — Wood* diffuse-porous (PL. 1, FIG. 1). *Growth rings* indistinct. *Vessels* appearing as minute dots with the naked eye, the orifices not easily distinguishable without a hand lens, small to medium-sized, commonly in radial multiples of 2-9 (mostly 3-4) cells (PL. 1, FIGS. 1, 3), occasionally solitary and in short double rows or small clusters, 5-14 per sq. mm., distributed without any definite pattern, usually with

*Correct form is *Simaroubaceoxylon mahurzariense*.

rays contiguous on one or both the sides; tyloses present (PL. 1, FIG. 7). *Parenchyma* paratracheal, limited to a few cells round the vessels, not easily recognized in the transverse sections, clearly seen in the tangential longitudinal sections. *Xylem rays* not visible with the naked eye, distinct with a hand lens, medium to fine, 1-3 cells and 12-80 μ broad, closely spaced, 12-18 per mm. (PL. 1, FIG. 7); ray tissue markedly heterogeneous (PL. 1, FIGS. 5-7); rays divisible on the basis of size and composition into two types, (a) narrow rays homocellular, uniseriate, 12-20 μ in width, consisting of upright cells only (PL. 1, FIGS. 6, 7), very variable in height; (b) broader rays heterocellular, 2-3 (mostly 2) seriate throughout the median thickened portion, with long uniseriate marginal extensions of upright cells at one or both the ends (PL. 1, FIGS. 6, 7); median portion 52-80 μ wide consisting of all procumbent cells. *Fibres* not aligned in distinct radial rows, however, at some places there appears to be a tendency to align themselves in vertical rows (PL. 1, FIG. 3). *Intercellular canals* vertical, traumatic, arranged in horizontal rows (PL. 1, FIG. 4).

*Elements — Vessels* thin-walled, the walls about 4 μ thick, t.d. 60-150 μ, r.d. 30-145 μ; circular to elliptical when solitary, those in radial multiples generally flattened at the places of contact (PL. 1, FIGS. 1, 3), their outline being irregular at a number of places due to compression during fossilization; vessel-members short to medium-sized, 280-630 μ long with tapered ends; perforations simple, perforation plates horizontal or slightly oblique; intervascular pit-pairs large, 8-12 μ in diameter, bordered, usually alternate, round to oval sometimes hexagonal due to crowding with lenticular, horizontal apertures (PL. 1, FIG. 2); vessel-parenchyma pits larger than the intervascular pits, several to each cell, with large horizontal apertures and distinct borders; vessel-ray pits not observed. *Parenchyma cells* thin-walled, t.d. 16-28 μ, height 40-68 μ. *Ray cells* thin-walled with infiltration, the walls about 4 μ thick; procumbent cells variously shaped, t.d. 16-20 μ, r.d. 24-36 μ; upright cells with t.d. 12-20 μ, r.d. 44-92 μ; crystals appear to be present in some ray cells. *Fibres* thin-walled, the walls 3-4 μ thick, septate, angular in the cross-section (PL. 1, FIGS. 3, 6); t.d. 12-32 μ, r.d. 12-28 μ; interfibre pits not observed.

## AFFINITIES AND DISCUSSION

Structural features of the fossil wood indicate, after extensive comparison, that its closest affinity is with the modern genus *Elaeocarpus* L. The fossil wood also shows a somewhat near resemblance to the mature secondary xylem of *Echinocarpus* Bl. However, the presence of a somewhat continuous line of parenchyma, delimiting the growth rings in many specimens of *Elaeocarpus*, serves to distinguish them from *Echinocarpus*, in which the parenchyma is diffuse, confluent and in narrow sheaths round the vessels (KUKACHKA & REES, 1943, p. 53; METCALFE & CHALK, 1950, p. 265; CHOWDHURY & GHOSH, 1958, p. 241). Besides, the intercellular canals of the vertical traumatic type have also been reported in *Elaeocarpus* (RECORD, 1925; DESCH, 1941, p. 154) but not found in *Echinocarpus*.

A survey of available woods of *Elaeocarpus* indicates that the nearest affinity of the fossil within this genus is with *Elaeocarpus ferrugineus* Bedd. and *E. ganitrus* Roxb., but more so with the former. Our survey included the study of thin sections of the woods of *Elaeocarpus robustus* Roxb., *E. lanceaefolius* Roxb., *E. ferrugineus* Bedd., *E. tuberculatus* Roxb., *E. stipularis* Bl., *E. braceanus* Watt, *E. floribundus* Bl., *E. ganitrus* Roxb., *E. lacunosus* Wall., *E. rugosus* Roxb., *E. serratus* Linn., *E. stapfianus* Gagnep., *E. varunua* Ham., *E. wallichii* Kurz, and published descriptions of nineteen other species. The latter are *E. apiculatus* Mast., *E. jackianus* Wall., *E. leptomischus* Ridl., *E. parvifolius* Wall., *E. sub-globosus* Merrill, *E. wrayi* King. (DESCH, 1941, pp. 153-154), *E. decipiens* Hemsl., *E. japonicus* S. et Z. (KANEHIRA, 1921, pp. 48-50, PL. 9, FIGS. 50-53), *E. calomala* (BLANCO) Merrill (KANEHIRA, 1924), *E. dubius* A. Dc. (LECOMTE, 1925, p. 108, PL. 31) and *E. oxypyren* Koord. & Valet., *E. obtusus* Bl., *E. pierrei* Koord. & Valet., *E. longifolius* Bl., *E. glaber* Bl., *E. grandiflorus* Sm., *E. petiolatus* Wall., *E. acronodia* Mast., *E. macrophyllus* Bl. (MOLL & JANSSONIUS, 1906, pp. 534-547).

The size and distribution of vessels in *Elaeocarpoxylon antiquum* nearly agrees with the distributional pattern in *Elaeocarpus ferrugineus*. Both in *E. ferrugineus* and the fossil the perforations are simple and the intervascular pit-pairs are usually alternate, bordered and the tyloses are present in the

vessels. However, the solitary vessels are more frequent in the modern species than in the fossil wood. Also the intervascular pit-pairs are separated and possess linear apertures in *E. ferrugineus* as against contiguous pit-pairs with lenticular apertures in the fossil wood which thus resembles the intervascular pit-pairs of *Elaeocarpus robustus*. Also in *E. ganitrus* the intervascular pit-pairs are contiguous and the apertures are linear to lenticular.

Although the distribution of parenchyma is different in the fossil and the modern wood of *E. ferrugineus*, the ray and fibre structure are basically similar in both. In *E. ferrugineus* the parenchyma is terminal forming faint lines at the rings but absent from many of them, whereas in the present fossil wood it is only scanty-paratracheal, somewhat similar to that of *E. floribundus* (METCALFE & CHALK, 1950, p. 264, FIG. 64 D) minus the terminal parenchyma. Pearson and Brown (1932) also report the absence of terminal parenchyma in *E. lanceaefolius*.

Although the fibre structure is almost identical in both, the fibres are rarely septate in *E. ferrugineus* but commonly septate in the fossil wood as is also known in *Elaeocarpus robustus* and *E. lanceaefolius* (PEARSON & BROWN, 1932, pp. 183-185).

The vertical intercellular canals of traumatic type are present both in the Intertrappean fossil wood, and the modern wood of *Elaeocarpus* (RECORD, 1925; DESCH, 1941, p. 154) although the authors have not been able to see these canals in the small specimens of the modern wood of *Elaeocarpus* available to them.

Thus it is evident from the above comparison that the fossil wood shows the closest resemblance in structural features with the modern wood of *Elaeocarpus* with a near approach to the species *E. ferrugineus*. Consequently, the present fossil wood has been named, *Elaeocarpoxylon* gen. nov. The specific name, *Elaeocarpoxylon antiquum* indicates its geological antiquity.

As far as known, the present finding forms the first record of the fossil wood of *Elaeocarpus* from India and abroad. Fruit remains of the genus are, however, known from the Tertiary of Australia as *Elaeocarpus mackayi* (F.v.M.) Kirchheimer (1935, p. 179). According to him (KIRCHHEIMER, loc. cit.) fossil remains from the European Tertiary, which were compared with *Elaeocarpus*, belonged to the family Cornaceae (see also GOTHAN & WEYLAND, 1954, p. 415) and those from the Tertiary of Japan (NATHORST, 1883, in KIRCHHEIMER, 1935) do not show any definite characters which indicate their unquestioned similarity with *Elaeocarpus*.

*Elaeocarpus* is a large genus of trees consisting of over a hundred species spread over a wide area, the majority being found in the Indo-Malayan region. It is also represented in Madagascar, Socotra, Cochin-China, the Philippines, Formosa, the Pacific islands, Australia and New Zealand. About 25 species occur in Indian region. The species *Elaeocarpus ferrugineus*, with which the fossil wood resembles most, occurs in the forests of Western Ghats, in the Nilgiris, Anamalais, Pulney hills as well as the high hills of Travancore (CHOWDHURY & GHOSH, 1958).

## DIAGNOSES

### *Elaeocarpoxylon* gen. nov.

*Wood* diffuse-porous. *Vessels* small to medium-sized, solitary and in radial multiples of 2-4 or more cells, open or sparsely plugged with tyloses; vessel-members short to medium-sized or long; perforations simple; intervascular pit-pairs large, bordered, alternate and opposite; vessel-parenchyma pits larger than the intervascular pits. *Parenchyma* paratracheal, limited to a few cells associated with the vessels, terminal parenchyma absent or present. *Xylem rays* medium to fine, divisible on the basis of size and composition into two types; ray tissue markedly heterogeneous. *Fibres* non-libriform, septate, thin-walled. *Intercellular canals* traumatic, vertical.

### *Elaeocarpoxylon antiquum* sp. nov.

*Vessels* small to medium-sized, t.d. 60-150 μ, r.d. 30-145 μ, commonly in radial multiples of 3-4, sometimes up to 9 cells, thin-walled, sparsely tylosed, 5-14 per sq. mm.; vessel-members short to medium-sized, 280-630 μ long with tapered ends; perforations simple, perforation plates horizontal to slightly oblique; intervascular pit-pairs usually alternate, occasionally opposite, with round to oval borders sometimes hexagonal due to crowding with lenticular, horizontal apertures. *Parenchyma* as few cells associated with the vessels; terminal parenchyma absent; cells thin-walled. *Xylem*

*rays* 1-3 cells and 12-80 μ broad, 12-18 per mm.; uniseriate rays homocellular, of upright cells only; multiseriate rays heterocellular consisting of procumbent cells throughout the median thickened portion, with long uniseriate marginal extensions of upright cells at one or both the ends. *Fibres* non-libriform, commonly septate, thin-walled, angular in the cross-section, t.d. 12-32 μ, r.d. 12-28 μ. *Intercellular canals* traumatic, vertical.

*Holotype* — B.S.I.P. Museum No. 32734.

*Locality* — Mahurzari, Nagpur district, Maharashtra, India.

*Horizon* — Deccan Intertrappean series.

*Age* — Early Tertiary (probably Eocene).

**Family — Vitaceae**

*Leeoxylon multiseriatum* gen. et sp. nov.

The following description is based on a piece of a petrified wood measuring about 4 cm. in length and 4-4·5 cm. in diameter. The present specimen is fairly well-preserved and consists of secondary xylem only. The general appearance of the fossil suggests that either it comes from a small branch of a tree or belongs to a shrub. The fossil wood shows considerable distortion of the tissues which commonly occurs where a branch is being given off. This is also associated with the climbing nature of the plant.

*Topography — Wood* diffuse-porous, coarse-textured. *Growth rings* not observed either with a hand lens or under the microscope (Pl. 2, Figs. 11, 15). *Vessels* visible as small dots with the naked eye against the ground mass of the wood, small to medium-sized, mostly moderately small, solitary and in radial multiples of 2-3 or more cells (Pl. 2, Figs. 11, 15), occasionally in clusters, 8-15 per sq. mm., evenly distributed, sometimes contiguous to the rays; tyloses present (Pl. 2, Fig. 13). *Parenchyma* present in limited amount as few cells associated with some vessels (entirely absent from others), recognizable in the radial longitudinal sections only. *Xylem rays* quite prominent as broad lines on the cross-surface of the wood (Pl. 2, Figs. 11, 15), 1-18 cells and up to 525 μ broad, closely spaced, 2-3 per mm. (Pl. 2, Figs. 12, 14); ray tissue markedly heterogeneous (Pl. 2 Figs. 12, 14, 17); uniseriate rays rare, homocellular, consisting wholly of upright cells, up to 6 cells and 192 μ high; multiseriate rays 4-18 cells and 120-525 μ wide and 375-2775 μ high, often showing various stages of dissection into smaller units (Pl. 2, Fig. 14), often very much inflated near the knot (Pl. 1, Fig. 8; Pl. 2, Fig. 14); heterocellular, consisting of 1-3 marginal rows of upright cells and multiseriate part of mixed procumbent and square cells, with sheath cells at the flanks (Pl. 2, Figs. 12, 14). *Fibres* not well preserved, aligned in distinct radial rows between the two consecutive xylem rays (Pl. 2, Fig. 9). Almost in all the cells secondary wall not preserved, only primary wall giving the shape of the fibre in cross-section.

*Elements — Vessels* thin-walled, the walls about 4 μ thick; t.d. 45-120 μ, r.d. 60-120 μ; round to oval in cross-section, those in radial groups flattened at the place of contact (Pl. 2, Fig. 9); vessel-members of medium-size, 495-600 μ long with tapered ends; perforations simple (Pl. 2, Fig. 16), perforation plates slightly horizontal to oblique; intervascular pitting scalariform (Pl. 2, Fig. 10) rarely opposite, bars often branched; vessel-ray and vessel-parencyma pits similar to the intervascular pitting. *Parenchyma cells* thin-walled, t.d. 20-24 μ, height 44-56 μ. *Ray cells* thin to slightly thick-walled; cells of various shapes and sizes ranging from very small to large and elongated as seen in the tangential longitudinal sections (Pl. 2, Figs. 12, 14); procumbent cells circular or angular, t.d. 12-32 μ, r.d. 16-48 μ; marginal upright cells t.d. 32 μ, r.d. 40 μ; sheath cells t.d. 20-45 μ, r.d. 72-80 μ; pits of the ray cells not observed. *Fibres* septate, thin to slightly thick-walled with large lumina (Pl. 2, Figs. 9, 12, 14), circular or angled in the cross-section; t.d. 20-36 μ, r.d. 16-36 μ; interfibre pits not observed.

## AFFINITIES AND DISCUSSION

Most of the anatomical features of the present fossil wood are limited to only a few families of the modern dicotyledons. The two important characters of the present fossil, viz., the scalariform intervascular pitting and conspicuously broad rays, are so limited in distribution that most of the dicotyledonous families are eliminated and the comparison of the fossil wood is restricted only to the following (Record, 1936, p. 16, 23; Tupper, 1927; Dadswell & Record, 1936).

| | |
|---|---|
| Aquifoliaceae | Monimiaceae |
| Araliaceae | Rhizophoraceae |
| Chloranthaceae | Symplocaceae |

| | |
|---|---|
| Cornaceae | Vacciniaceae |
| Fagaceae | Violaceae |
| Flacourtiaceae | Vitaceae |
| Greyiaceae | |

On a closer anatomical comparison between the present fossil wood and the above families it has been found that the fossil exhibits its nearest approach to the members of the family Vitaceae (Ampelidaceae), where it shows the closest resemblance with the genus *Leea* L. (HESS, 1936, p. 30; DADSWELL & RECORD, 1936, pp. 29, 30, PL. 2, FIG. 5; METCALFE & CHALK, 1950, pp. 414-418; ADKINSON, 1913). Although with the available material, the authors have not been able to find any modern species of *Leea* resembling very closely or identical with the fossil wood, the general agreement in, as well as the numerous microscopic details of, anatomical structure provide sufficient evidence to identify the present Intertrappean fossil wood as a species of *Leea*. Our survey included the study of thin sections of *Leea angulata* Korth., *L. sambucina* Willd., *L. alata* Edgew., *L. brunoniana* C.B. Clarke, *L. philippinensis* Merrill, *L. indica* Merrill, and *Leea* sp. (from Madagascar) and published descriptions of *Leea sundaica* Miq., *L. javanica* BL. (MOLL & JANSSONIUS, 1908, p. 314, 315), *L. gigantea* Griff. (DESCH, 1941, p. 5) and *L. guineense* Don. (METCALFE & CHALK, 1950, p. 414, FIG. 95C).

The present fossil wood combines the specific characters of *Leea indica* and *L. angulata*, resembling *L. indica* in parenchyma distribution, fibre structure and in vessel size and their distribution and *L. angulata* in the type of rays with a somewhat similar composition and dissection. However, the rays of *L. angulata* are not so wide as those of the present fossil wood which approaches in ray width to a species of *Leea* from Madagascar. Raphides, although commonly seen in the ray cells of a number of species of *Leea* (HESS, 1936, p. 30), are absent from the present fossil wood and also in the extant wood of *Leea alata* examined by the authors. Moll and Janssonius (1908, pp. 314, 315) also report the absence of raphides from *Leea javanica* and *L. sundaica*.

Thus it is evident that the present fossil wood, although showing features of the genus *Leea*, does not match exactly with any of the species so far examined by us. As the fossil wood shows anatomical characters of the genus *Leea* it has been assigned to a new genus *Leeoxylon*. The specific name, *Leeoxylon multiseriatum*, is after the broad rays seen in the fossil wood.

Not many fossil woods of the family Vitaceae are so far known. The four species known from Europe are *Ampeloxylon cineritarum* Fliche (1899) from Pliocene of Cantal, France; *Vitoxylon cohenii* Schuster (1911) from the Lower Eocene of south-east Rügen, Prussia; ? *Vitis* sp. Kräusel (1920) from the Miocene of Opplen, Silesia and *Vitoxylon ampelopsoides* Schönfeld (1930) from the Miocene of south-west Germany, agreeing most closely with the genus *Ampelopsis*. Edwards (1931) suggested synonymy of *Vitoxylon* Schuster with *Ampeloxylon* Fliche on grounds that the latter genus had priority over *Vitoxylon*. From United States of America, Brown (1942) described *Vitoxylon opalinum* from the ? Upper Miocene of Virgin Valley beds in Northwestern Nevada indicating its resemblance with *Vitis*. Watari (1951) described a fossil wood, *Leea eojaponica* from the Lower Miocene of Simane, Japan. This is the only record of a fossil wood of *Leea* known to the authors. This Japanese fossil wood although resembling slightly with *Leeoxylon multiseriatum*, differs from it in having large vessels which are upto 220 μ in tangential diameter, in vasicentric parenchyma forming a layer of nearly complete sheath and in possessing less broad, only 4-10 seriate, xylem rays with the cells containing raphides. However, in *L. multiseriatum* the rays are more wider, 1-18 cells broad and the raphides are absent from the ray cells.

The genus *Leea* includes about 60 species (WILLIS, 1957) of small trees, herbs or shrubs, most abundant in the tropics of Asia and Africa and rare in Australia. Of the 22 species native to India nine are shrubs or small trees. *L. aspera* Wall. is very common in deciduous forests all over India; *L. sambucina* Willd. is common in Darjeeling Terai and throughout the hotter parts of India; *L. robusta* Roxb. a large shrub in Sikkim Himalayas and Khasia Hills, Northern Circars and West Coast; *L. umbraculifera* C. B. Clarke, a small tree grows in forests of Sikkim Himalayas, Terai and also perhaps in N. Circars (GAMBLE, 1902); *L. alata* Edgew. occurs in tropical Himalayas from Garhwal to Sikkim; *L. integrifolia* Roxb. occurs in Western Peninsula (moist valleys in the Circars); *L. hirta* Roxb. occurs in Sikkim Himalayas, Assam, Silhet, the Khasia hills,

East Bengal, Chittagaon, Pegu and Andaman islands; *L. bracteata* C. B. Clarke, occurs in Sikkim and is very common in Oudh Terai areas and *L. indica* Merrill, is common throughout the hotter parts of India (HOOKER 1872; GAMBLE, 1902; DUTHIE, 1911).

## DIAGNOSES

*Leeoxylon* gen. nov.

*Wood* diffuse-porous. *Vessels* mostly moderately small, solitary and in radial multiples of 2-3 or more cells; vessel-members of medium-size; perforations simple; intervascular pitting opposite and scalariform. *Parenchyma* scanty paratracheal. *Xylem rays* 1-18 cells wide; ray tissue markedly heterogeneous. *Fibres* septate, thin to slightly thick-walled.

*Leeoxylon multiseriatum* sp. nov.

*Vessels* moderately small, t.d. 45-120 μ, r.d. 60-120 μ, thin-walled, 8-15 per sq. mm.; tyloses present; vessel-members of medium size, 495-600 μ long with tapered ends; perforations simple, perforation plates slightly horizontal to oblique; intervascular pitting opposite and scalariform. *Parenchyma* scanty-paratracheal; parenchyma cells thin-walled, t.d. 20-24 μ, height 44-56 μ. *Xylem rays* 1-18 cells and up to 525 μ wide; uniseriate rays rare; multiseriate rays common, heterocellular, consisting of 1-3 marginal rows of upright cells and multiseriate part of mixed procumbent and square cells, with sheath cells at the flanks. *Fibres* septate, thin to slightly thick-walled with large lumina; t.d. 20-36 μ, r.d. 16-26 μ.

*Holotype* — B.S.I.P. Museum No. 10392.

*Locality* — Mahurzari, Nagpur district, Maharashtra, India.

*Horizon* — Deccan Intertrappean series.

*Age* — Early Tertiary (probably Eocene).

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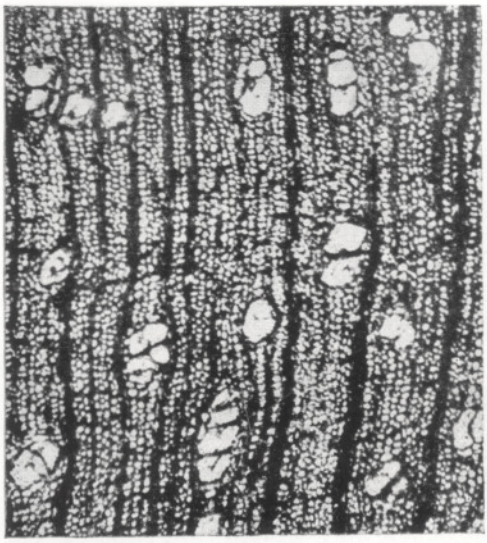

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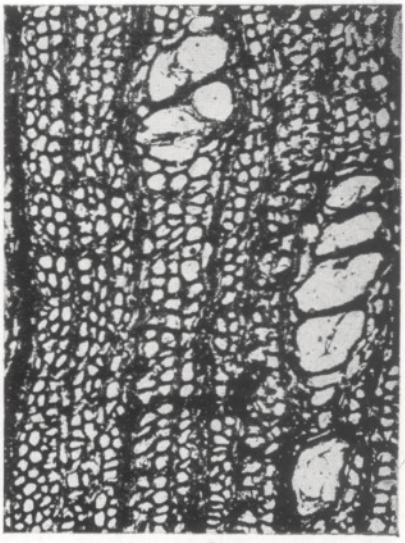

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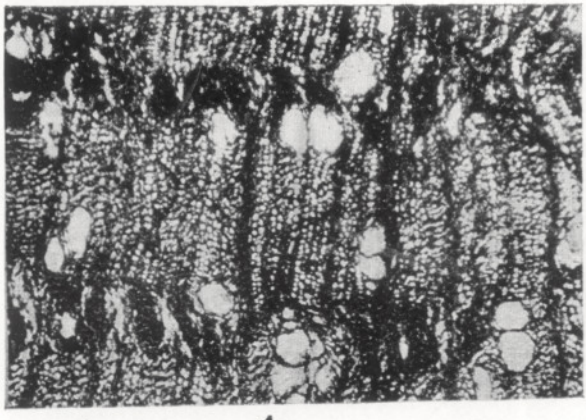

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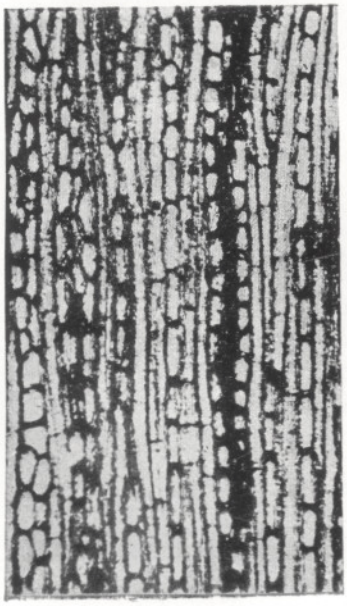

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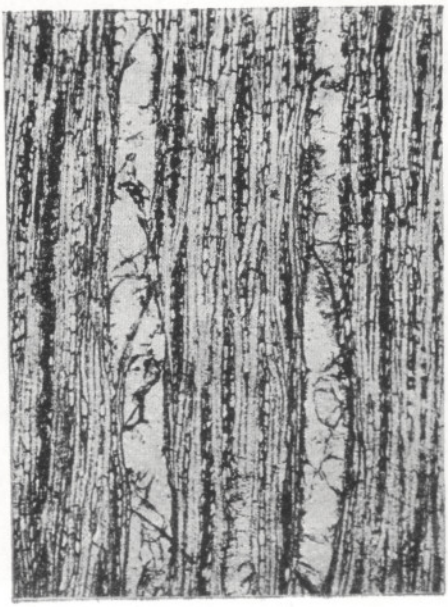

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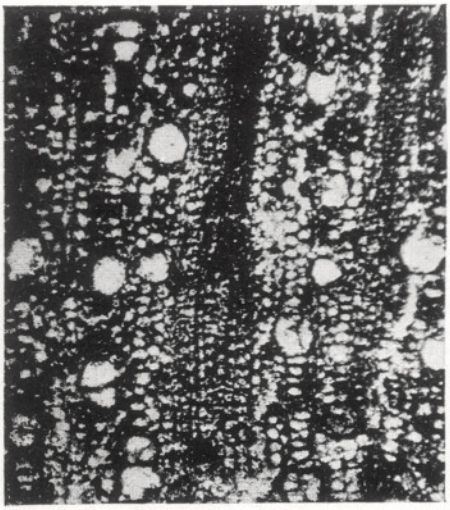

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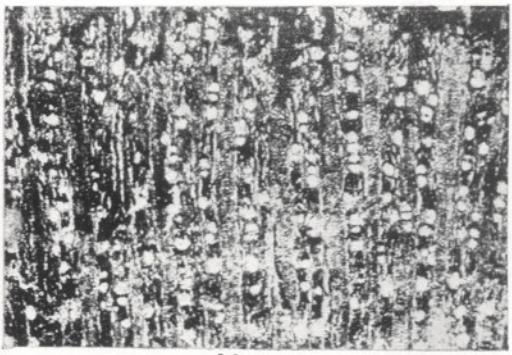

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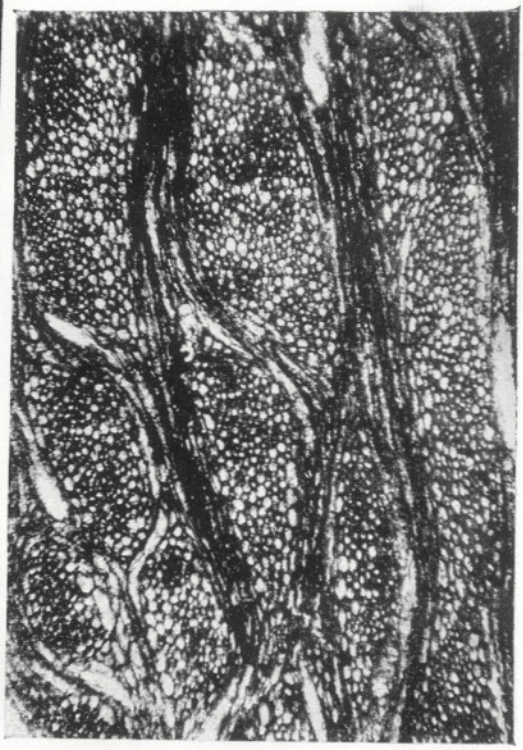

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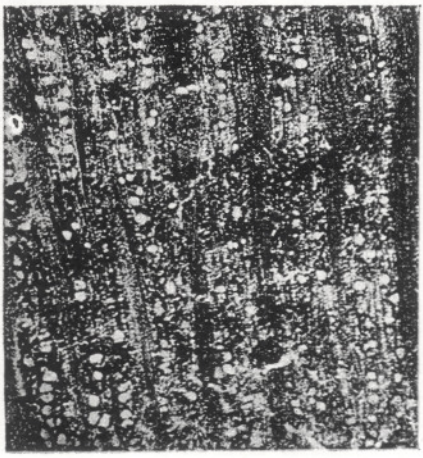

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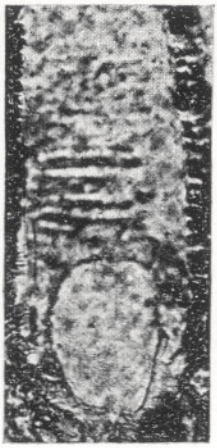

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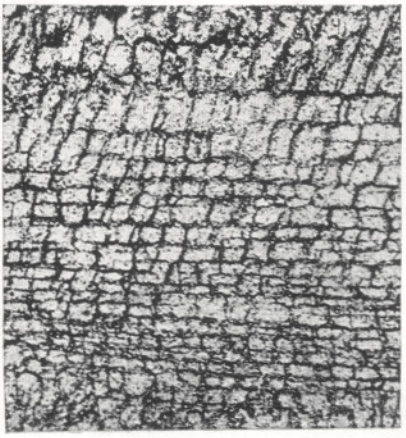

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*Correct form is *Ailanthoxylon mahurzariense*

## EXPLANATION OF PLATES

### PLATE 1

*Elaeocarpoxylon antiquum* gen. et sp. nov.

1. Cross-section showing vessel distribution, their shape and size. × 40.
2. Intervascular pitting. × 250.
3. Cross-section magnified to show the vessels and fibre distribution. × 90.
4. Cross-section with traumatic intercellular canals. × 40.
5. Radial longitudinal section showing heterogeneous ray tissue. × 85.
6. Tangential longitudinal section magnified to show the ray structure. × 100.
7. Tangential longitudinal section in low power showing shape and size of xylem rays. × 40.

*Leeoxylon multiseriatum* gen. et sp. nov.

8. Tangential longitudinal section showing xylem rays near a knot (K). Note the inflated rays (IF). × 15.

### PLATE 2

*Leeoxylon multiseriatum* gen. et sp. nov.

9. Cross-section slightly magnified to show shape and size of the vessels. × 50.
10. Scalariform intervascular pitting. × 190.
11. Cross-section in low power to show vessel distribution. × 15.
12. Tangential longitudinal section showing long rays away from the knot. × 27.
13. Part of a vessel in longitudinal section showing tyloses. × 220.
14. Another tangential longitudinal section showing inflated rays. × 37.
15. Another cross-section showing vessel distribution and xylem ray dissection. × 15.
16. Simple perforation. × 220.
17. Radial longitudinal section showing heterogeneous ray tissue. × 80.