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TWO NEW FOSSIL WOODS OF SAPINDACEAE FROM THE TERTIARY OF INDIA

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ABSTRACT

The present paper deals with two sapindaceous woods, viz., *Euphorioxylon indicum* gen. et sp. nov. and *Schleicheroxylon kachchhensis* gen. et sp. nov. These show closest resemblance with the woods of *Euphoria* and *Schleichera* respectively. The former is being reported from both the Kankawati Series of Kachchh and the Cuddalore Series near Pondicherry while the latter is from the Kankawati Series of Kachchh only.

Key-words — Xylotomy, *Euphorioxylon*, *Schleicheroxylon*, Kankawati Series, Cuddalore Series, Mio-Pliocene (India).

सारांश

भारत के तृतीयक युग से सैपिन्डेसी कुल की दो नवीन काष्ठाश्म – नीलाम्बर अवस्थी, जसवंतसिंह गुलेरिया एवं राजेन्द्रनाथ लखनपाल

प्रस्तुत शोध-पत्र सैपिन्डेसी कुल की दो काष्ठाश्मों अर्थात् यूफ़ोरिआॅक्सीलॉन् इंडिकम् नव प्रजाति व नव जाति तथा श्लीचेराॅक्सीलॉन् कच्छेन्सिस नव प्रजाति व नव जाति से सम्बन्धित है। ये यूफ़ोरिआ एवं श्लीचेरा की काष्ठों से क्रमशः घनिष्ठतम् समानता प्रदर्शित करती हैं। इनमें से पहली काष्ठ कच्छ की कन्कावती एवं पाण्डिचेरी के समीपस्थ कुडलोर दोनों ही श्रेणियों से अभिलिखित की गई है जबकि दूसरी काष्ठ केवल कच्छ की कन्कावती श्रेणी से अभिलिखित की गई है।

INTRODUCTION

THE family Sapindaceae is known from the Tertiary of India by three species of petrified woods. Two of them are described from the Deccan Intertrappean beds of Central India, viz., *Sapindoxylon schleicheroides* Dayal (1965) and *S. chhindwarensis* Chitaley & Shallom (1969), and the third, *Pometioxylon tomentosum*, is described by Prakash and Tripathi (1970) from the Tipam Series near Hailakandi, Assam. There is one more record known as *Sapindoxylon indicum* Navale (1957) from the Cuddalore Series near Pondicherry, but it has recently been found to be a wood of *Duabanga* of the family Sonneratiaceae and consequently renamed as *Duabangoxylon indicum* by Awasthi (1981).

In the present study of petrified woods from (i) the base of Kankawati Series of Mothala and Dhaneti in Kachchh, and (ii) the Cuddalore Series near Pondicherry, we have been able to recognize two more types of sapindaceous woods, one showing closest resemblance with that of *Euphoria* and the other with that of *Schleichera*. The former has been found both in Kachchh and Pondicherry while the latter in Kachchh alone. They are described here in detail.

The fossils were compared with the living woods at the Xylarium of the Forest Research Institute, Dehradun, for which we are thankful to the authorities of the Institute for all facilities received.

DESCRIPTION

Genus — ***Euphorioxylon* gen. nov.**

1. *Euphorioxylon indicum* sp. nov.

Pl. 1, figs 1-4

This species is represented by five small pieces, one from the Cuddalore Series near

Pondicherry and four from the Kankawati Series of Kachchh. They show fairly good preservation.

Topography—Wood diffuse-porous. *Growth rings* not seen. *Vessels* small to medium, solitary or in radial multiples of 2-5 (Pl. 1, figs 1, 2), rarely up to 10-12, evenly distributed, 9-14 per sq mm; tyloses absent; vessels sometimes filled with dark contents. *Parenchyma* paratracheal, sparse, limited to a few cells, forming at the most an incomplete or narrow sheath round the vessels (Pl. 1, fig. 2). *Rays* uniseriate, rarely biseriate mainly due to pairing of cells through the median portion (Pl. 1, fig. 3), 12-24 μm wide, 4-60 cells or 60-720 μm high, closely placed (Pl. 1, figs 2, 3), 12-18 per mm in cross section; ray tissue homogeneous; rays homocellular, consisting of procumbent cells only (Pl. 1, figs 3, 4). *Fibres* aligned in radial rows between the two consecutive rays (Pl. 1, fig. 2).

Elements — Vessels circular to oval in cross section (Pl. 1, fig. 2), t.d. 50-140 μm, r.d. 60-180 μm, thick-walled, common wall 8-20 μm in thickness; vessel members 120-600 μm in length with truncated ends; perforations simple; intervessel pits small, alternate, bordered, about 4-5 μm in diameter. *Parenchyma cells* round to oval in cross section, t.d. 20-32 μm. *Ray cells* round to oval in shape (Pl. 1, fig. 3), 10-20 μm in tangential height, 20-160 μm in radial length, infiltration dark. *Fibres* round to oval in cross section, 12-20 μm in diameter, thick-walled, wall about 3-6 μm, nonseptate to rarely septate.

Affinities

Comparison with the modern woods — The important features of the present fossil are (i) vessels small to medium, (ii) parenchyma scanty paratracheal, (iii) xylem rays uniseriate to rarely biseriate due to paired cells, homocellular, and (iv) fibres thick-walled, nonseptate to rarely septate. Among various dicotyledonous families, the members of Sapindaceae and Sonneratiaceae (Metcalfe & Chalk, 1950) exhibit the above important characters.

The genus *Sonneratia* L. of the family Sonneratiaceae shows similarity with the fossil in gross features. However, the presence of tyloses, vestured intervessel pits and the absence of parenchyma differentiates it from the fossil.

The Indian sapindaceous woods have broadly been classified into two groups (Anonymous, 1963, p. 212) on the basis of the nature and distribution of parenchyma as given below:

Group I. Parenchyma (apart from that delimiting growth rings) abundant, distinctly visible to the eye and predominantly banded, e.g. *Allophylus*, *Erioglossum*, *Lepisanthes*, *Paranephelium* and *Sapindus*.

Group II. Parenchyma (apart from that delimiting growth rings) not abundant, indistinct to eye, usually scanty, vasicentric to aliform, e.g. *Arytera*, *Dodonea*, *Filicium*, *Harpullia*, *Mischocarpus*, *Nephelium**, *Pometia*, *Schleichera and Xerospermum*.

Since the parenchyma in the present fossil is scanty paratracheal, it should be compared with the genera included in Group II. After examining the available thin sections as well as the published descriptions and figures of the above genera, it was found that the fossil shows closest resemblance with the woods of *Euphoria* Comm. ex. Juss., particularly that of *E. longana* Lamk (Syn. *Nephelium longana* Camb.). The other woods of this group although quite similar to the fossil, differ in a few important characters.

In *Arytera*, *Filicium*, *Pometia*, *Schleichera* and *Xerospermum glabratum* (Wall.) Radlk. the growth rings are distinct, whereas in the present fossil they are not seen. *Mischocarpus* and *Arytera* also differ in having diffnse parenchyma while *Pometia* differs in having bigger vessels and apotracheal parenchyma lines. Similarly, *Otonephelium* can be differentiated from the present fossil in having mostly medium sized vessels. The parenchyma in *Harpullia* is predominantly aliform to aliform-confluent, and in *Dodonea* it varies from scanty paratracheal to aliform or locally confluent. The latter further differs in the frequency of vessels which are 10-50 per sq mm as compared to 9-14 in the present fossil. *Filicium* also differs in having greater

*Includes *Euphoria* Comm., *Litchi* Sonner., and *Otonephelium* Radlk (Anonymous, 1963, p. 224).

number of vessels, i.e. 12-31 per sq mm. *Blighia* (an African genus) and *Xerospermum ferrugineum* can also be differentiated from the present fossil in having comparatively lesser number of vessels. Similarly *Nephelium* (inclusive *Litchi*) also shows close similarity with our fossil. However, the species of *Nephelium* having aliform to confluent parenchyma and relatively bigger vessels can be distinguished easily from the present fossil.

Comparison with the fossil species — From outside India also the family Sapindaceae is known by a large number of woods, viz., *Frassia sapindoides* Unger (1850) from the Tertiary of Hungary, *Schmiedeliopsis zirkelii* Felix (1882) from the Tertiary of *Antigua*, *Sapindoxylon janssonii* Kräusel (1922) from the Miocene of Sumatra, *Sapindopsoxylon klitzingi* Pfeiffer & Heurn (1928, also see Edwards, 1931) from the Tertiary of Java, *Sapindoxylon stromeri* Kräusel (1939) from the Lower Oligocene of Egypt, *S. antioquiense* Schönfeld (1947) from the Tertiary of Columbia, *S. pleikuense* Boureau (1950) from the Neogene of Indochina (South Annam), *Sapindoxylon* sp. Hofmann (1952) from the Oligocene of Prambachkirchen (Austria), *Sapindoxylon lamegoi* Mussa (1959) from the Neogene or Quaternary of Brazil, *S. elattostachyoides* Grambast-Fessard (1966) from the Miocene of south-east France, *S. almelai* Koeniguer (1967) from the Miocene of Rio de Oro, West Africa, *S.* (?) *lapparenti* Koeniguer (1968) from the Mio-Pliocene of Tchad, Africa and *S. mbaense* Koeniguer (1973) from the Eocene of Senegal. Among the fossil woods of Sapindaceae described from India, only *Sapindoxylon schleicheroides* shows gross similarity with our fossil. However, a careful examination shows that they differ from each other in the nature and width of xylem rays. In *Sapindoxylon schleicheroides*, the rays are 1-3 seriate and weakly heterogeneous, while in the present fossil they are 1-2 seriate and homocellular.

Pometioxylon tomentosum needs no comparison since it belongs to the genus *Pometia* which is quite different from *Euphoria* especially in having 1-3 seriate heterocellular rays and apotracheal parenchyma lines.

Sapindoxylon chhindwarense is also quite different in having xylem rays 2-9 cells high, consisting of erect (upright) cells only. But in our fossil the rays are 4-60 cells high and composed of procumbent cells only. It is important to point out here that the affinities of *Sapindoxylon chhindwarense* with the woods of Sapindaceae are doubtful since it possesses such features which are not characteristic of Sapindaceae. The xylem rays in this fossil are uniseriate, 2-9 cells high and composed wholly of upright (erect) cells, and the fibres are short, thin-walled with wide lumen, as seen in the tangential longitudinal section (Chitaley & Shallom, 1969, p. 39, fig. 2). On the other hand, in Sapindaceous woods the homocellular rays are always composed wholly of procumbent cells but not of upright cells and the fibres are long, moderately thick to thick-walled with narrow lumen.

Of the foreign species, *Sapindoxylon almelai*, *S. antioquiense*, *S. lamegoi*, *S.* (?) *lapparenti*, *S. mbaense* and *S. stromeri* show some similarity with our fossil. However, they differ in one or more important characters. *S.* (?)*lapparenti*, *S. mbaense*, *S. stromeri*, *S. antioquiense* and *S. lamegoi* differ from the present fossil in the frequency of vessels. In the first three species the frequency of vessels per sq mm varies from 13-50 as compared to the present fossil in which they are 9-14. The last two species can also be differentiated in having lesser number of vessels, i.e. 4-7 per sq mm. *S. stromeri* and *S. antioquiense* further differ in having shorter rays (1-10 cells in height) as against up to 50 cells in the present fossil. Further, in *S. mbaense* and *S. lamegoi* the xylem rays are homo- to weakly heterocellular. The latter further differs in the presence of diffuse parenchyma. In *S. almelai* the vessels are relatively more frequent (11-20 per sq mm), bigger in size (80-240 μm) and the rays are shorter (2-20 cells high).

From the above comparison with the living and fossil species it is evident that the present fossil wood is very similar to that of *Euphoria* and is quite different from all the known species of *Sapindoxylon*. Hence, it is placed under a new genus *Euphorioxylon*. This genus represents the fossil woods resembling *Euphoria* as well as those species of *Nephelium* (inclusive *Litchi*) which are anatomically similar to *Euphoria longana*. Specifically, it is being named as *Euphorioxylon indicum* sp. nov.

The genus *Euphoria* consists of about 15 species (Santapau & Henry, 1973, p. 66)

of shrubs and trees, distributed from Burma to Indochina and western Malaysia. In India, it is represented by a single species, viz., *Euphoria longana* Lamk. (syn. *Nephelium longana*) with which the present fossil resembles most. It is found throughout the Western Ghats from the Konkan southwards extending to Sri Lanka up to 900 m. In north-east India, it is found in the hills of Assam. It also occurs in South China, Burma and Malaya (Anonymous, 1963, p. 225).

Generic Diagnosis

Euphorioxylon gen. nov.

Wood — Diffuse-porous. *Growth rings* indistinct or absent. *Vessels* small to medium, solitary or in radial multiples of 2-5 or more, uniformly distributed; perforations simple; intervessel pits small, alternate, bordered; tyloses absent. *Parenchyma* scanty paratracheal to vasicentric, forming at the most an incomplete or narrow sheath round the vessels. *Rays* fine, uniseriate, rarely biseriate mainly due to pairing of procumbent cells through the median portion, usually up to 60 cells or 720 μm high; ray tissue homogeneous; rays homocellular, consisting of procumbent cells. *Fibres* thick-walled, nonseptate to septate.

Genotype — *Euphorioxylon indicum* gen. nov.

Specific Diagnosis

Euphorioxylon indicum sp. nov.

Wood — Diffuse-porous. *Growth rings* not seen. *Vessels* small to medium, t.d. 50-140 μm, r.d. 60-180 μm, solitary or in radial multiples of 2-5, rarely up to 10-12, 9-14 per sq mm; intervessel pits simple, nearly horizontal to oblique, alternate, bordered; tyloses absent. *Parenchyma* paratracheal, sparse, limited to a few cells, forming at the most an incomplete or narrow sheath round the vessels. *Rays* predominantly uniseriate, rarely biseriate due to mainly pairing of procumbent cells through the median portion, 4-60 cells or 60-720 μm high, homocellular, consisting of procumbent cells only. *Fibres* thick-walled, nonseptate to septate.

Holotype — B.S.I.P. Museum Specimen no. 35359.

Localities — Murattandichavadi near Pondicherry; Mothala, about 66 km SW of Bhuj, on the Bhuj-Naliya Road and Dhaneti, about 24 km east of Bhuj, on the Bhuj Bhachau Road, district Kachchh, Gujarat.

Horizon & Age — Cuddalore Series, Mio-Pliocene; Kankawati Series, ?Pliocene.

Genus — *Schleicheroxylon* gen. nov.

2. *Schleicheroxylon kachchhensis* sp. nov.

Pl. 2, figs 5-7; Pl. 3, figs 9, 11, 12

This species is represented by two pieces of fairly well-preserved petrified woods, measuring 12·5 ×4·0 cm and 10·0 ×4·0 cm.

Topography — *Wood* diffuse-porous (Pl. 2, fig. 5). *Growth rings* present, undulating delimited by dark and dense fibre cells (Pl. 2, figs 5, 7). *Vessels* small to medium, solitary or in radial multiples of 2-5, frequently solitary (Pl. 2, fig. 7), some crossing the boundary of rings, rarely forming clusters, more or less evenly distributed, 11-14 per sq mm; tyloses wanting; vessels filled with dark contents. *Parenchyma* paratracheal and apotracheal; paratracheal parenchyma sparse, usually confined to the tangential walls of the vessels due to contiguous xylem rays, occasionally forming incomplete to complete 1-celled sheath round the vessels (Pl. 2, figs 6, 7); apotracheal parenchyma scanty, diffuse, concentrated only towards the inner part of the ring. *Rays* fine, 1-2(3) seriate, mostly 1-seriate or 12-32 μm wide, 2-30 (mostly 8-16) cells or 40-600 μm high (Pl. 3, fig. 9); 11-16 rays per mm; ray tissue homogeneous; rays homocellular, consisting of procumbent cells only (Pl. 3, figs 9, 12). *Fibres* aligned in radial rows between the two consecutive rays.

Elements — *Vessels* circular to oval in cross section (Pl. 2, figs 6, 7), t.d. 60-152 μm, r.d. 60-200 μm; thick-walled, common wall 8-20 μm in thickness; vessel members 160-500 μm in length with truncated ends; perforations simple; intervessel pits small, alternate, bordered (Pl. 3, fig. 11), about 4 μm in diameter; vessels filled with dark gum plugs. *Parenchyma cells* round to

oval in cross section, t.d. 12-24 μm. *Ray cells* round to oval in shape, 12-24 μm in tangential height, 48-80 μm in radial length; infiltration dark. *Fibres* round to oval in cross section, t.d. 6-12 μm, wall thickness 3-6 μm, septa not clearly seen.

Affinities

Comparison with the modern woods — The important features of the fossil are (i) vessels small to medium, (ii) growth rings present, (iii) parenchyma scanty, paratracheal and diffuse, (iv) xylem rays 1-2(3) seriate, mostly 1-seriate, homocellular, and (v) fibres thick-walled and probably septate. These features are characteristic of certain woods of the family Sapindaceae. Since in the present fossil the paratracheal parenchyma is scanty vasicentric, its modern equivalent can be searched among the genera included in Group II of this family (see p. 13).

Considering all the characters collectively, it was found that the present fossil wood shows closest resemblance with that of *Schleichera oleosa* (Lour.) Oken (Syn. *Schleichera trijuga* Willd). The other genera of this group which also show similarity with the present fossil can be differentiated in one or more important characters. *Dodonea* and *Harpullia* differ from the present fossil in having aliform to aliform-confluent parenchyma. Further, the vessels in *Dodonea* are small to very small and their frequency is also very high (10-50 per sq mm) as compared to the present fossil in which the vessels are 11-14 per sq mm. Similarly, *Arytera*, *Filicium* and *Pometia* differ from the present fossil either in the frequency or the size of vessels. The frequency of vessels in *Arytera* and *Filicium* is 8-24 and 12-31 per sq cm respectively. *Pometia* differs in having bigger and lesser vessels, i.e. the frequency of vessels is 3-7 per sq mm. The presence of pith flecks (which are very common and often large) in *Mischocarpus* differentiates it from the fossil. The anatomical data of two Indian species of *Xerospermum*, viz., *X. ferrugineum* Fisher and *X. glabratum* (Wall.) Radlk. are available. Of these, the former differs in the absence of distinct growth rings and lesser number of vessels, i.e. the vessels being 4-9 per sq mm. The latter though being closer to the fossil differs in having small to very small vessels. *Nephelium* (sensu lato) no doubt shows close similarity. However, those species of *Nephelium* in which growth rings are indistinct, vessels are bigger in size and parenchyma relatively more (i.e. aliform to confluent), can easily be differentiated from the fossil. The remaining species can be separated only on the basis of rays which are 1-2 seriate in *Nephelium* and 1-3 seriate in the fossil.

Comparison with the fossil woods — Out of a large number of fossil woods described under the genus *Sapindoxylon* Kräusel (1922), *S. almelai* Koeniguer (1967), *S. antioquiense* Schönfeld (1947), *S. lamegoi* Mussa (1959) and *S. schleicheroides* Dayal (1965) show resemblance with the present fossil. However, it can be separated from them in having some significant differences.

The vessels in *S. almelai* are 80-240 μm in diameter and the rays are 4-7 per mm as compared to the present fossil in which vessels are 60-152 μm in diameter and the rays 11-16 per mm. In *S. antioquiense* the vessels are 4-7 per sq mm and the rays are 2-10 cells in height while in the present fossil the vessels are 11-14 per sq mm and the rays are 2-30 cells in height. Similarly, *S. lamegoi* also differs in having lesser number of vessels (4-6 per sq mm).

Sapindoxylon schleicheroides, although exhibiting general similarity with the present fossil differs in having indistinct growth ring, absence of apotracheal diffuse parenchyma and the presence of weakly heterogeneous rays. On the contrary, the growth rings in our fossil are distinctly marked, the apotracheal or diffuse parenchyma is concentrated towards the inner part of the growth ring and the rays are homogeneous.

Regarding the affinities of *Sapinodoxylon schleicheroides*, Dayal (1965) considered it similar to *Schleichera oleosa* in shape, size and distribution of vessels, the type of intervascular pitting, vasicentric parenchyma, 1-3 seriate xylem rays and septate fibres. At the same time he differentiated it from *Schleichera oleosa* in the absence of distinct growth rings, diffuse parenchyma and relatively thin-walled fibres. We have also checked and found that in *Schleichera* (*S. oleosa*. the only species) the growth rings are fairly distinct, regular, undulating, delimited by dark and denser fibres and diffuse

parenchyma cells. Such growth rings are lacking in *Sapindoxylon schleicheroides*. Besides, the rays are homogeneous to weakly heterogeneous in this fossil whereas they are exclusively homogeneous in *Schleichera*. Hence, it cannot be regarded as *Schleichera* although its apparent similarity with this genus perhaps led Dayal to name it as *S. schleicheroides*.

Since the present fossil wood shows closest resemblance with that of *Schleichera* and differs from all the known fossil woods of Sapindaceae, it is placed under a new genus, *Schleicheroxylon*, and named as *Schleicheroxylon kachchhensis* sp. nov., after the district Kachchh from where it was collected.

The genus *Schleichera* consists of a single species, *S. oleosa* (Lour.) Oken, found in the Indomalayan region (Willis, 1973, p. 1042). In India, it occurs in the sub-Himalayan tract up to 900 m, from the Sutlej eastward (except perhaps Assam, Bengal and the Andamans), Central India and western Peninsula in the deciduous forests.

Generic Diagnosis

Schleicheroxylon gen. nov.

Wood diffuse-porous. *Growth rings* distinct, undulating, delimited by denser fibres and diffuse parenchyma cells. *Vessels* small to medium, solitary or in radial multiples of 2-5, more or less evenly distributed; perforations simple; intervessel pits small, alternate, bordered; tyloses absent. *Parenchyma* paratracheal, vasicentric, sparse, forming incomplete to complete, 1-celled sheath round the vessels; apotracheal parenchyma scanty, diffuse, cells concentrated towards the inner part of the ring. *Rays* fine, 1-2(3) seriate, homocellular, consisting of procumbent cells, up to 30 (mostly 8-16) cells or 600 μm high. *Fibres* thick-walled, probably septate.

Genotype — *Schleicheroxyon kachchhensis* gen. nov.

Specific Diagnosis

Schleicheroxylon kachchhensis sp. nov.

Growth rings distinct, undulating, delimited by denser fibres and diffuse parenchyma cells. *Vessels* small to medium, solitary and in radial multiples of 2-5, frequently solitary, t.d. 60-152 μm, r.d. 60-200 μm, about 11-14 vessels per sq mm, intervessel pits simple, alternate, bordered, small; tyloses absent; vessels filled with dark contents. *Parenchyma* paratracheal, sparse, usually confined to the tangential wall of the vessels, occasionally forming incomplete to complete, 1-celled sheath round the vessels; apotracheal parenchyma scanty, diffuse cells concentrated towards the inner part of the ring. *Xylem rays* fine, 1-2(3) seriate, mostly 1-seriate or 12-32 μm wide, 2-30 (mostly 8-16) cells or 40-600 μm high, 11-16 rays per mm, homocellular, consisting of procumbent cells. *Fibres* thick-walled, probably septate.

Holotype — B.S.I.P. Museum Specimen no. 35358.

Locality — Dhaneti, about 24 km east of Bhuj, on the Bhuj-Bhachau Road, district Kachchh, Gujarat.

Horizon & Age — Kankawati Series, ?Pliocene.

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EXPLANATION OF PLATES

PLATE 1

Euphorioxylon indicum gen. et sp. nov.

1. Cross section showing gross features. × 30. B.S.I.P. Museum slide no. 6101.
2. Cross section magnified to show the nature and distribution of vessels, parenchyma (scanty paratracheal). × 90. B.S.I.P. Museum slide no. 6101.
3. Tangential longitudinal section showing xylem rays. × 120. B.S.I.P. Museum slide no. 6102.
4. Radial longitudinal section showing homocellular rays. × 120. B.S.I.P. Museum slide no. 6103.

PLATE 2

Schleicheroxylon kachchhensis gen. et sp. nov.

5. Cross section showing gross features. × 7. B.S.I.P. Museum slide no. 6104.
6. Cross section magnified to show the vessels and scanty paratracheal parenchyma. × 80. B.S.I.P. Museum slide no. 6104.
7. Another cross section showing the nature and distribution of vessels, parenchyma and growth rings. × 30. B.S.I.P. Museum slide no. 6104.

Schleichera oleosa

8. Cross section showing the vessels, scanty paratracheal parenchyma and growth rings similar to those in the fossil as shown in fig. 7. × 30.

PLATE 3

Schleicheroxylon kachchhensis gen. et sp. nov.

9. Tangential longitudinal section showing xylem rays. × 120. B.S.I.P. Museum slide no. 6105.

Schleichera oleosa

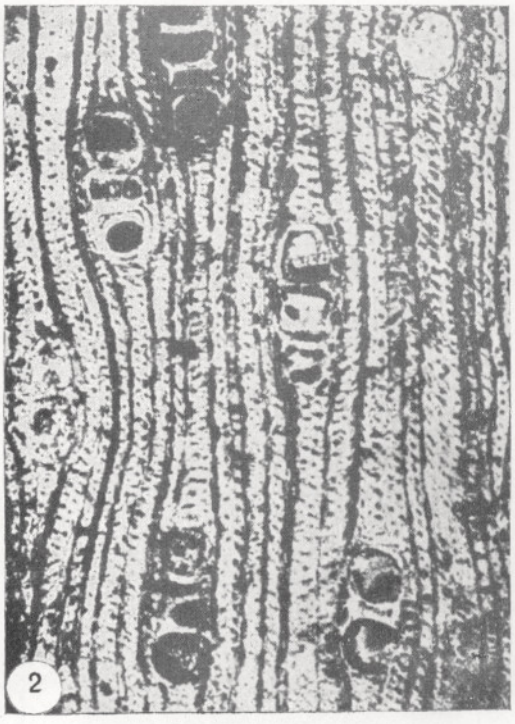
10. Tangential longitudinal section showing xylem rays similar to those in the fossil shown in fig. 9. × 120.

Schleicheroxylon kachchhensis gen. et sp. nov.

11. Intervessel pits. × 550. B.S.I.P. Museum slide no. 6105.
12. Radial longitudinal section showing homocellular rays. × 120. B.S.I.P. Museum slide no. 6106.

Schleichera oleosa

13. Radial longitudinal section showing xylem rays similar in the fossil as shown in fig. 12. × 120.



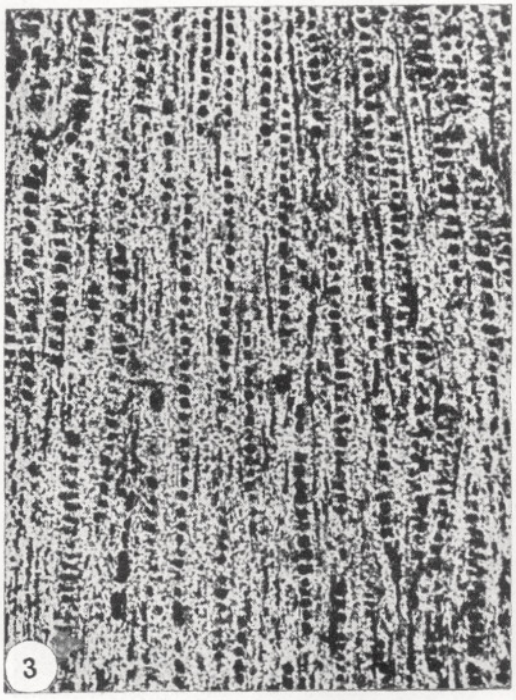
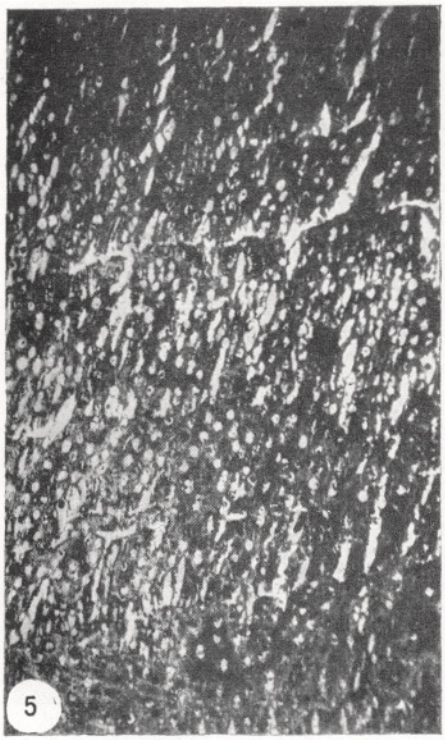
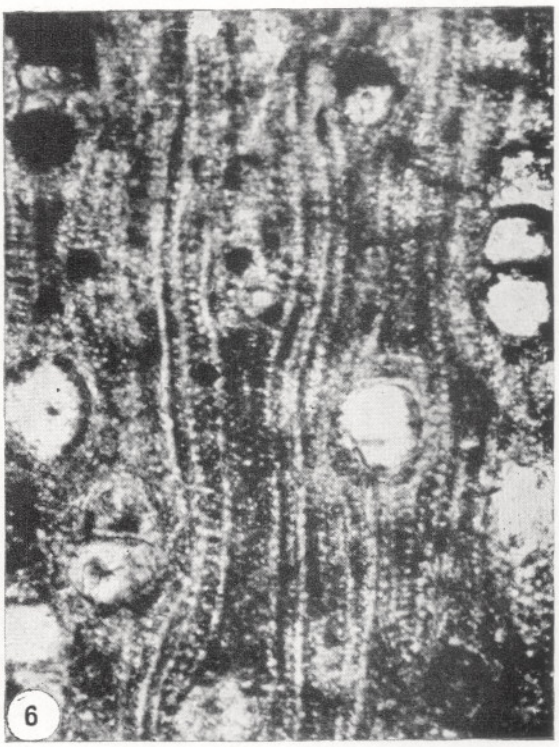
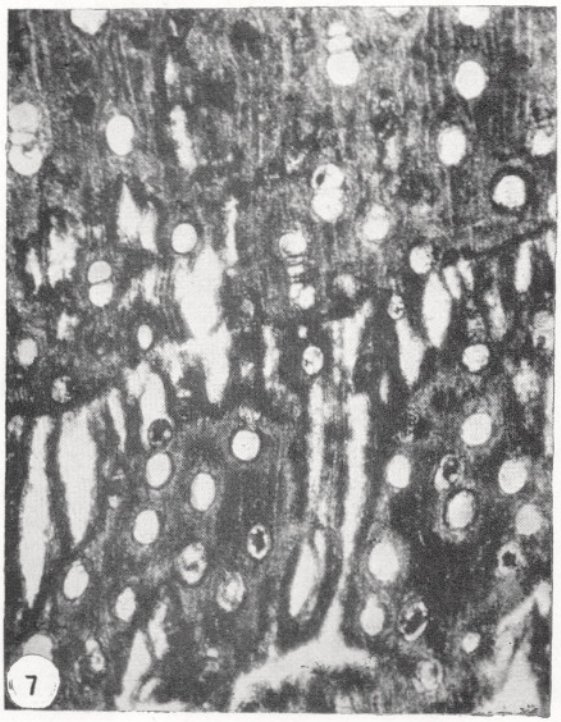


PLATE 1







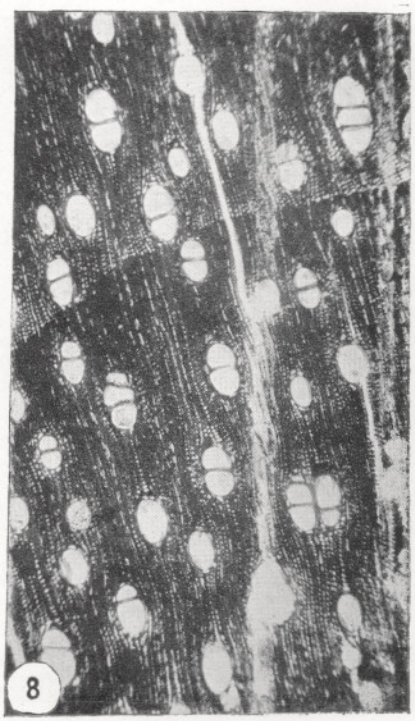
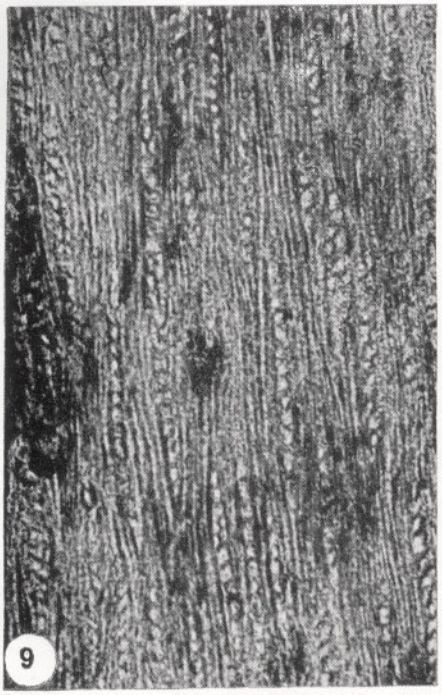
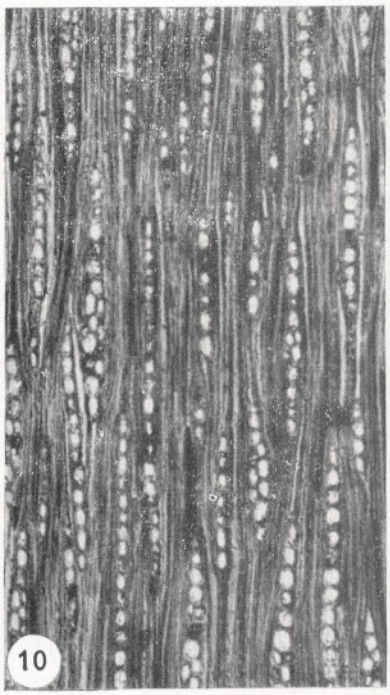
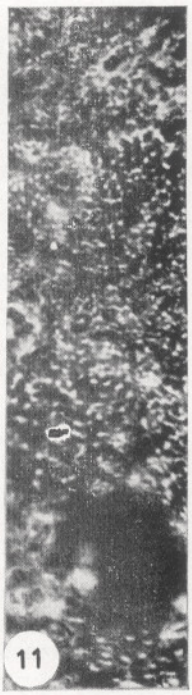
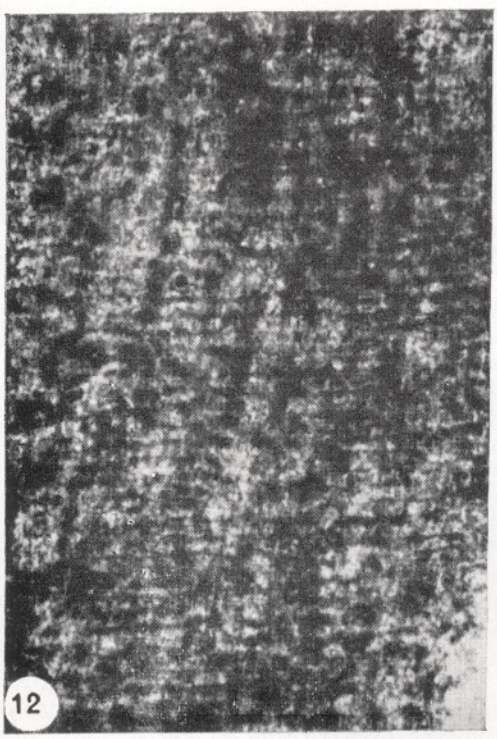


PLATE 2









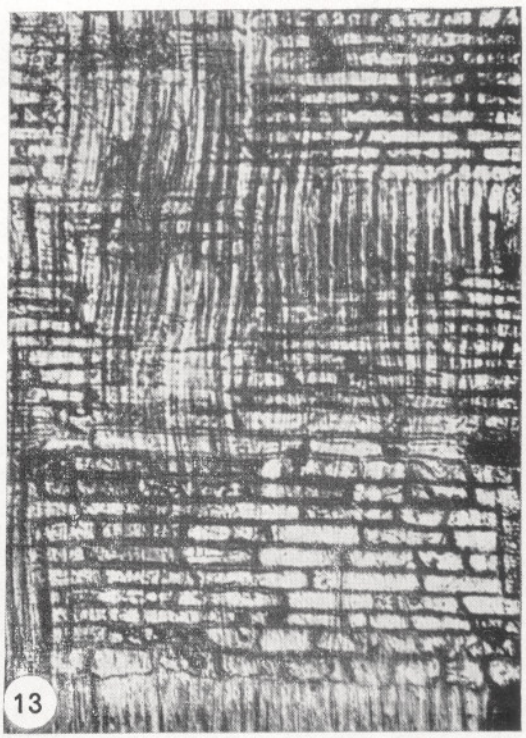


PLATE 3