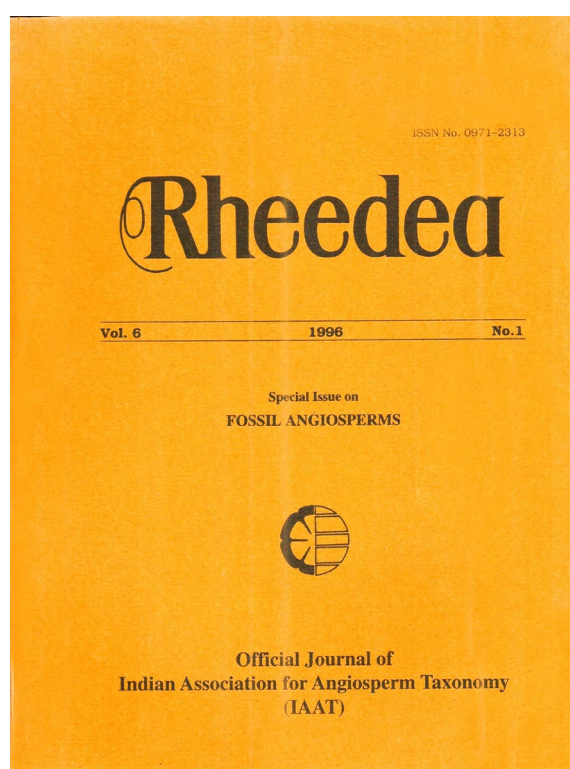




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## A New species and a new report of a species of petrified Angiosperm woods from the Cuddalore Sandstones, Tamil Nadu, India

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### Abstract

Two new taxa, *Holigarnoxylon assamicum* and *Pithcellobioxylon cuddaloreense* are added to the reports of about 75 dicot woods from the Cuddalore Sandstone formation. The former forms a new report of the species from the area, whereas the latter forms a report of a new genus and species from the area to science.

### INTRODUCTION

The occurrence of petrified woods in the Cuddalore Sandstones, though known for more than a hundred years, has been the subject of intense anatomical investigations only from the middle of this century. The woods of conifers, dicots and monocots (palms) have been reported from this formation. (Ramanujam, 1953, 1954a, 1954b, 1955, 1956a, 1956b, 1956c, 1959, 1960 & 1965; Ramanujam, & Rao, 1966a, 1966b, 1967 & 1969; Navale, 1955, 1956, 1958, 1960, 1962a, 1962b, 1962c, 1962d, 1963, 1968 & 1973; Lakhanpal & Awasthi, 1963 & 1964; Awasthi, 1965, 1967, 1968a, 1968b, 1968c, 1969a, 1969b, 1969c, 1972, 1973a, 1973b, 1975a, 1975b, 1977a, 1977b, 1978a, 1978b, 1984 & 1986; Awasthi, Guleria & Lakhanpal, 1981; Bande & Prakash, 1983; Awasthi & Anil Agarwal, 1986).

Among the collections made in recent years by the authors, two dicot woods differed from the hitherto known taxa of the Cuddalore Sandstone formation. One of them, has been identified as *Holigarnoxylon assamicum* Prakash et Awasthi (1969) which form a new record for this formation. Detailed study has revealed the other dicot wood to be a new taxon and hence described and named here as *Pithcellobioxylon cuddaloreense* gen. et sp. nov.

**Holigarnoxylon assamicum** Prakash et Awasthi (Fig. 1, A – C)

Specimen : TRM/12  
Repository : Laboratory of Palaeophytology, Madras Christian College  
(Autonomous), Tambaram, Madras – 600 059, India.

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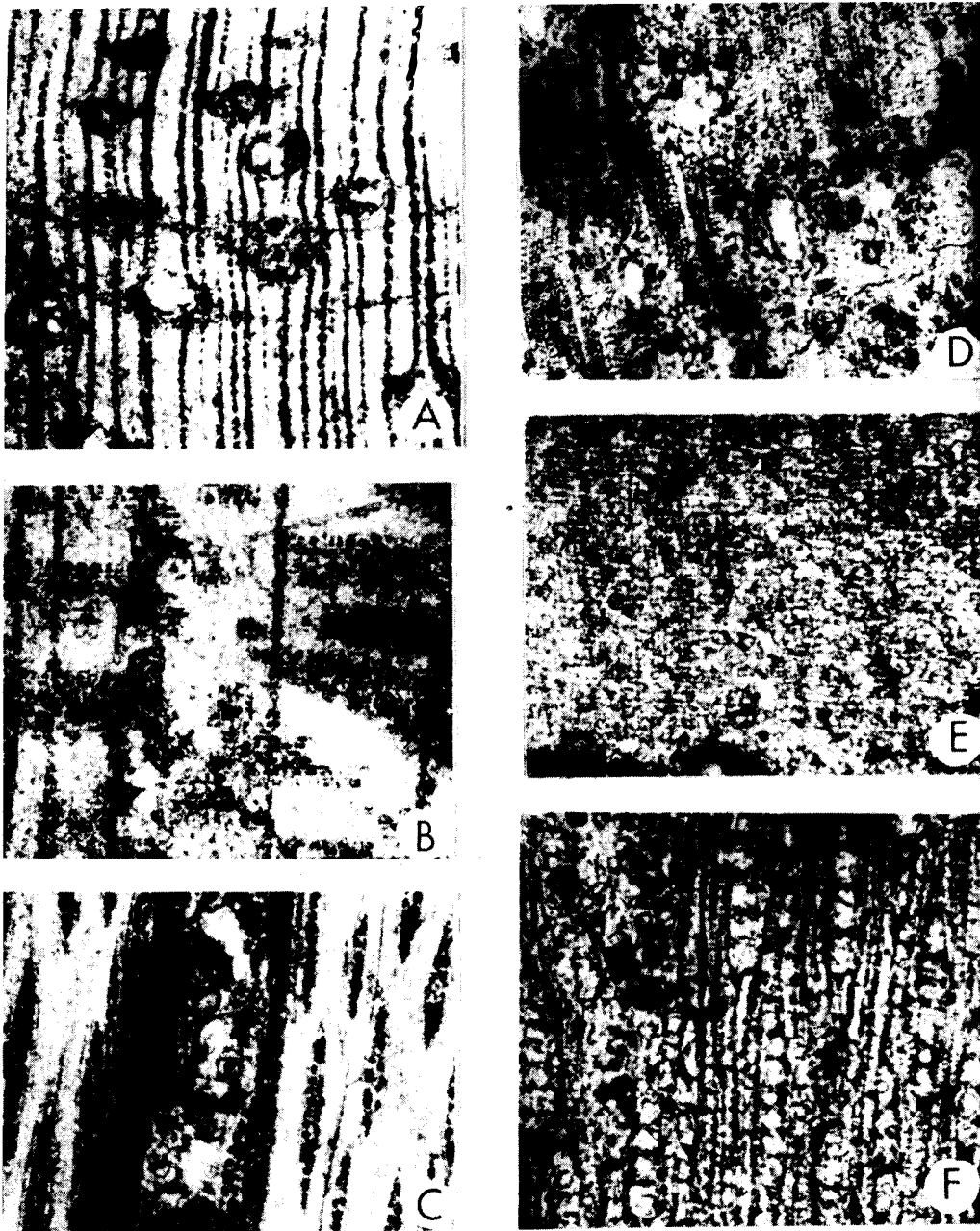


Fig. 1. Woods of *Holigarnoxylon assamicum* and *Pithecolobioxylon cuddaloreense* gen. et sp. nov. A. *Holigarnoxylon assamicum* - CS (x 30); B. *H. assamicum* - RLS (x 30); C. *H. assamicum* - TLS (x 60); D. *Pithecolobioxylon cuddaloreense* - CS (x 60); E. *P. cuddaloreense* - RLS (x 70); F. *P. cuddaloreense* - TLS (x 150).

**Two pertified Angiosperm woods from Cuddalore Sandstones**

Type locality : Tiruchitrambalam near Pondicherry  
Stratigraphic Horizon: Cuddalore Sandstones

**Diagnosis**

Wood diffuse – porous. Growth rings absent. Vessels medium to large, circular to oval, mostly solitary and rarely in multiples of two, evenly distributed, 2–6 per sq mm, perforation simple, oblique and abundantly tylosed. Parenchyma paratracheal, vasicentric aliform to confluent, apotracheal also seen in thin lines; xylem rays 1–2– seriate, predominantly biseriate, heterocellular, composed of upright and procumbent cells. Fibres non-septate.

**Description**

Wood diffuse-porous. Vessels medium to large, t. d. about 201µm, radial diameter about 210 µm, circular to oval, mostly solitary (rarely in multiples of 2), evenly distributed, 2–6 per sq mm, vessel segments 200 µm in width and 600 µm in height, pittings not observed in the vessel members, perforation simple, oblique and abundantly tylosed. Parenchyma paratracheal vasicentric to aliform, occasionally confluent, with 2–5– celled parenchyma bands connecting the two aliform structures, parenchyma cells about 10µm in width, apotracheal parenchyma also seen as thin lines in some places. Xylem rays 1–2– seriate, predominantly biseriate, 6 to 13 cells in height, heterogenous, uniseriate rays 37% and biseriate rays 63%, heterocellular, composed of upright and procumbent cells, 1–6 horizontal rows of procumbent cells, 15–20 µm in height, upright cells 50 µm in height, non-storied, brown coloured deposits present in the ray cells, end cells of the rays triangular in shape. Fibres not well preserved to show fine details.

The family Anacardiaceae shows the following general xylotomical features. Wood diffuse – porous. Vessels medium to large circular to oval in outline with simple perforations. Axial parenchyma paratracheal, vasicentric to aliform to aliform confluent. Thin bands of apotracheal parenchyma occur in places. Xylem rays heterogeneous, 1–10 cells wide, mostly 2–3–seriate, sometimes accommodating gum ducts, rarely exclusively uniseriate, heterocellular with procumbent and upright cells. Ray cells commonly filled with dark substances or contain crystals. Fibres non-septate.

**Comparison**

Four fossil wood of the family Anacardiaceae have been described so far from the Cuddalore formation. These are *Anacardioxylon mangiferoides* (Ramanujam, 1960), *Glutoxylon burmense* (Awasthi, 1965, 1984 – from Neyveli lignite), *Glutoxylon cuddaloreense* (Awasthi, 1965) and *Mangiferoxylon scleroticum* (Awasthi, 1965). Of these, *Glutoxylon burmense*, *G. cuddaloreense* and *Mangiferoxylon scleroticum* differ from the present fossil specimen in possessing distinct growth rings. *Anacardioxylon mangiferoides* possess predominantly uniseriate rays in contrast to the present fossil wood which has heterogeneous ray system.

TABLE 1

Name of the fossil woods with author/s and year	Wood	Growth rings	Vessels						Axial Parenchyma	Xylem Rays	Gum Ducts
			Size	Shape	Distribution	Frequency	Pittings	Tylosis			
<i>Anacardiaceae mangiferoides</i> Ramanujam, 1960	Diffuse porous	Indistinct	170-275 $\mu$ m in diameter	Circular	Mostly solitary	3-6 per sq.mm.	Alternate, bordered, round & lenticular	Absent	Paratracheal, aliform, sometimes vasoentric apotracheal in initial bands 2-3 cells thick	1-2 seriate (mostly uniseriate) heterogenous homocellular, entirely of procumbent cells, 3-15 cells in height.	Absent
<i>Glutacylon caddabronae</i> Awasthi, 1966	Diffuse Porous	Present	t.d.180-375 $\mu$ m, r.d. upto 330 $\mu$ m	Circular to oval	Solitary as well as in radial multiples of 2 to 4	4-10 per sq.mm.	Alternate, circular to oval aperture lenticular	Present (Abundant)	Paratracheal & Apotracheal. Paratracheal forming scanty to vasoentric sheath of 1 to 3 cells, occasionally tending to become aliform. Apotracheal by concentric tangential bands	Exclusively uniseriate, homogenous, homocellular, woody of procumbent cells, 3-25 cells in height	Gum ducts at the rays
<i>Glutacylon burmensis</i> Awasthi, 1964	Diffuse porous	Present	t.d.40-300 $\mu$ m, r.d. 30-345 $\mu$ m	Circular to oval	Solitary as well as in radial multiples of 2-4	2-8 per sq.mm.	Alternate, bordered oval to orbicular with lenticular aperture	Present	Paratracheal & Apotracheal, paratracheal : Scanty to vasoentric, occasionally tending to form aliform. Apotracheal : as fine lines, bands also occur.	1-2 seriate (mostly one); 3-20 cells in height, homogenous, homocellular, consisting of procumbent cells only.	Gum ducts lined with single row or epithelial cells.

Name of the fossil woods with author's and year	Wood	Growth rings	Vessels						Axial Parenchyma	Xylem Rays	Gum Ducts
			Size	Shape	Distribution	Frequency	Pittings	Tylosis			
<i>Mangiferoxylon scleroticum</i> Awasthi, 1966	Diffuse Porous	Present	t.d.45- 270 $\mu$ m r.d.45 - 300 $\mu$ m	Circular to oval	Solitary as well as in radial multiples of 2-4 or more	2-8 per sq.mm.	Alternate, bordered with linear to lenticular aperture.	Abundant (Sclerotic)	Paratracheal & Aptracheal. Paratracheal: Vasicentric to aliform, occasionally aliform to confluent. Aptracheal: 2-6 cells wide bands, usually delimiting the growth rings	1-2 seriate (mostly one) heterogenous, heterocellular 2-25 cells in height	Absent
<i>Holigarnoxylon assanicum</i> Prakash & Awasthi, 1969	Diffuse Porous	Absent	r.d.30- 240 $\mu$ m t.d.50- 256 $\mu$ m	Circular to oval	Solitary as well as in radial multiples of 2-6 (mostly 2)	4 per sq.mm.	Alternate with lenticular apertures.	Present	Paratracheal, Vasicentric, forming 2-3 seriate sheath around the vessels, aliform to confluent, joining 2-3 neighbouring vessels	1-3 (mostly 2) seriate, heterogenous, heterocellular, upto 20 cells in height.	Absent
TRM/12 present fossil wood	Diffuse porous	Absent	r.d.100- 260 $\mu$ m t.d.100- 275 $\mu$ m mostly medium sized	Circular to oval	Mostly solitary and rarely in multiples of 2	2-6 per sq.mm. (Average 4 per sq.m.)	Not Preserved	Abundant	Paratracheal, Vasicentric, aliform to confluent	1-2 (mostly 2) seriate, heterogenous, hetero cellular, 6-13 cells in height	Absent

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Hence, the present specimen does not resemble any of the above mentioned species. However, there is close resemblance of the present specimen with the fossil wood reported from Assam viz., *Holigarnoxylon assamicum* Prakash & Awasthi (1969). Hence, the fossil wood is assigned to the above named species. A comparison of characters of the present fossil specimen and those fossil woods of Anacardiaceae reported earlier is given in table 1. In all the species the perforation of vessels is simple, gum ducts are absent, and fibres are non-septate. In the present new species the fibres are not preserved well.

2. *Pithecellobioxylon cuddaloreense* Jeyasingh & Devadass gen. et sp. nov. (Fig. 1, D–F)

Holotype	:	TRM/4
Respository	:	Laboratory of Palaeophytology, Madras Christian College (Autonomous), Tambaram, Madras – 600 050, India
Type locality	:	Tiruchirambalam near Pondicherry
Stratigraphic horizon	:	Cuddalore Sandstones
Etymology	:	Genus after <i>Pithecellobium</i> ; species after the sedimentary formation of its occurrence.

## Diagnosis

Wood diffuse-porous. Growth rings absent. Vessels small to medium, solitary as well as in radial multiples of two, oval, perforation simple, tyloses present; parenchyma paratracheal, vasicentric to aliform, xylem rays heterogeneous, 1–2-seriate, predominantly uniseriate, rarely biseriate, heterocellular. Fibres septate.

## Description

Wood diffuse porous. Growth rings not present. Vessels small to medium, solitary as well as in radial multiples of two, more or less evenly distributed, 5 vessels per sq mm, oval in shape, tangential diameter 98  $\mu\text{m}$ , radial diameter 178  $\mu\text{m}$ , brown or black coloured deposits often present, perforations simple, end-wall oblique, pittings on the lateral walls of vessels alternate and angular, vessel segments 336  $\mu\text{m}$  in height, 81  $\mu\text{m}$  in width, tyloses present. Parenchyma paratracheal, vasicentric to aliform, joining 2 to 3 neighbouring vessel. Rays heterogeneous, 95% uniseriate, rarely biseriate; uniseriate rays 3–18 cells high (average 6 cells), biseriate rays 6–17 cells in height, rays heterocellular composed of procumbent cells 25  $\mu\text{m}$  in height, arranged in 4–5 horizontal tiers with 1 to 2 marginal rows of upright cells, shape of the upright cells elliptical, occasionally brown coloured deposit present in the ray cells. Fibres septate, about 10  $\mu\text{m}$  in diameter.

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#### Comparison and Discussion

Comparison with fossil woods:

During recent years, about 75 well preserved fossil woods have been described from the Cuddalore Sandstones. Of these, *Albizinium pondicherriensis*, *Bridelioxylon cuddaloreense*, *Bischofioxylon miocenicum*, *Duabangoxylon indicum*, *Holopteloxylon indicum* and *Pahudioxylon arcotense* shows resemblance with the present fossil wood in having vasicentric to aliform axial parenchyma. Of these, the wood of *Holopteloxylon indicum* differs from the present fossil specimen in having distinct sotried alignment of the rays.

The fossil woods of *Albizinium pondicherriensis*, *Bridelioxylon cuddaloreense*, *Bischofioxylon miocenicum* and *Pahudioxylon arcotense* show dissimilarities with the present fossil wood by the presence of predominantly multiseriate rays in all of them. Moreover, *Albizinium* also possess apotracheal parenchyma in terminal lines which is not seen in the present fossil wood. However, *Duabangoxylon indicum* shows resemblance with the present wood in possessing predominantly uniseriate rays; but it differs in having non-septate fibres. Thus the present wood shows distinctive characters of its own.

The presence of solitary or radial groups of pores with uniform distribution, abundant paratracheal vasicentric parenchyma forming dark patches, heterogeneous rays, septate fibres, the short vessel segments with simple perforations, common occurrence of gummy or solid deposits in the vessel lumen and vested pittings on the lateral walls of vessels, are the xylotomical characters that characterise the family Leguminosae.

About 18 fossil woods of Leguminosae have been described from the Cuddalore Sandstones so far, out of which none shows the combination of characters seen in the present fossil.

Comparison with the extant woods :

The gross structure and other minute anatomical characters of the fossil wood described above, indicate some affinities with the woods of *Albizia*, *Afzelia*, *Pahudia*, *Pithecellobium* (= *Pithecolobium*, orth. var.) and *Tamarindus* of Leguminosae as given by Metcalfe and Chalk (1950), Ramesh Rao and Purkayastha (1972) and Trotter (1982). All these genera possess vasicentric to aliform axial parenchyma. However, *Afzelia* and *Tamarindus* differ in having non-septate fibres. But septate fibres are present in the genera *Albizzia*, *Pahudia* and *Pithecellobium* as in the fossil wood. However, growth rings are present in *Pahudia* and *Albizia* whereas they are not seen in *Pithecellobium*. The fossil wood also does not possess growth rings. Thus the present fossil wood comes close to the extant wood of the genus *Pithecellobium*.

Comparing the fossil wood with the woods of a number of modern species of *Pithecellobium* available (*P. affine*, *P. dulce*, *P. saman*, *P. bigeninum* and *P. lobatum*) at the Forest Research Institute, Dehra Dun, it was found that the fossil resembled the wood of *Pithecellobium saman* to a greater extent.



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### CONCLUSION

Of the 75 and odd dicot woods which are known through complete descriptions in the literature as occurring in the Cuddalore Sandstone formation (including the Neyveli lignite), four species belong to the Anacardiaceae and 21 species to the Leguminosae. The other families represented are Polygalaceae, Guttiferae, Dipterocarpaceae, Sterculiaceae, Simaroubaceae, Sapindaceae, Rosaceae, Rhizophoraceae, Combretaceae, Lecythidaceae, Lythraceae, Sonneratiaceae, Ulmaceae and Fagaceae.

Based on the study of fossil wood remains it has been concluded that the Neogene vegetation that occurred in the Cuddalore Sandstone region during late Tertiary times was of the moist evergreen forest type (Ramanujam, 1995). The occurrence of dicot woods resembling *Pithecellobium* of Leguminosae in the Cuddalore Sandstones indicates the rich diversity of the arboreseent plants that made up the Neogene flora in this region about 25 million years ago.

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### Literature cited

- Awasthi, N. 1965. (iss. 1966). Fossil Woods of Anacardiaceae from Tertiary of South India. *Palaeobotanist* 14 : 131-143.
- Awasthi, N. 1967. Fossil Wood resembling that of *Millettia* from the Tertiary of South India. *Curr. Sci.* 36 (7) : 180-181.
- Awasthi, N. 1968a (iss. 1969). A fossil wood of *Sonneratia* from the Tertiary of South India. *Palaeobotanist* 17 : 254-257.
- Awasthi, N. 1968b (iss. 1969). A new fossil wood resembling the genus *Parinarium* of the family Rosaceae from the Tertiary of South India. *Palaeobotanist* 17 : 317-320.
- Awasthi, N. 1968c (iss. 1969). A new fossil wood belonging to the family Alangiaceae from the Tertiary of South India. *Palaeobotanist* 17 (3) : 322-325.
- Awasthi, N. 1969a (iss. 1970). On the occurrence of two new fossil woods belonging to the family Lecythidaceae in the Tertiary rocks of South India. *Palaeobotanist* 18 (1) : 67-74.
- Awasthi, N. 1969b (iss. 1970). A fossil wood of Ebenaceae from the Tertiary of South India. *Palaeobotanist* 18 (2) : 192-196.
- Awasthi, N. 1969c (iss. 1971). Revision of some Dipterocarpaceous woods previously described from the Tertiary of South India. *Palaeobotanist* 18 (3) : 226-233.
- Awasthi, N. 1972 (iss. 1974). Occurrence of some Dipterocarpaceous woods in the Cuddalore Series of South India. *Palaeobotanist* 21 (3) : 339-351.

## Two pertified Angiosperm woods from Cuddalore Sandstones

- Awasthi, N. 1973a (iss. 1975). *Millettioxylon indicum*, A fossil wood of Leguminosae from the Cuddalore series of South India. *Palaeobotanist* 22 (1) : 47-50.
- Awasthi, N. 1973b (iss. 1975). Revision of some Dicotyledonous woods from the Tertiary of South India. *Palaeobotanist* 22 (3) : 186-191.
- Awasthi, N. 1975a (iss. 1977). On two new Fossil woods resembling *Chrysophyllum* and *Holoptelea* from the Cuddalore series near Pondicherry. *Palaeobotanist* 24 (1) : 21-25.
- Awasthi, N. 1975b (iss. 1977). Revision of *Hopexylon indicum* Navale and *Shoreoxylon speciosum* from the Cuddalore series near Pondicherry. *Palaeobotanist* 24 (2) : 102-107
- Awasthi, N. 1977c (iss. 1979). Three Leguminous woods from the Cuddalore Series near Pondicherry. *Palaeobotanist* 26 (2) : 157-166.
- Awasthi, N. 1977b (iss. 1980). Two new Dipterocarpaceous woods from the Cuddalore series near Pondicherry. *Palaeobotanist* 26 (3) : 248-256.
- Awasthi, N. 1978a (iss. 1981). Reinvestigation of *Sapindoxylon indicum* Navale from the Cuddalore series near Pondicherry. *Palaeobotanist* 27 (2) : 161-165.
- Awasthi, N. 1978b (iss. 1981). Fossil woods belonging to Sterculiaceae and Lythraceae from the Cuddalore series near Pondicherry. *Palaeobotanist* 27 (2) : 182-189.
- Awasthi, N. 1984. Studies on some Carbonised woods from the Neyveli Lignite Deposits, India. *Geophytology* 14 (1) : 82-95.
- Awasthi, N. 1986 (iss. 1987). Fossil wood of *Xanthophyllum* from the Cuddalore Sandstone near Pondicherry. *Palaeobotanist* 35 (3) : 314-317.
- Awasthi, N., J. S. Guleria & R. N. Lakhnupal. 1981 (iss. 1982). Two new fossil woods of Sapindaceae from the Tertiary of India. *Palaeobotanist* 30 (1) : 12-21.
- Awasthi, N. & Anil Agarwal. 1986 (iss. 1987). A Carbonised wood resembling *Paranari* from the Neyveli Lignite deposits, India. *Palaeobotanist* 35 (1) : 57-60.
- Bande, M. B. & U. Prakash. 1983 (iss. 1984). Evolutionary trends in the secondary xylem of woody dicotyledons from the Tertiary of India. *Palaeobotanist* 32 (1) : 44-75.
- Lakhnupal, R. N. & N. Awasthi. 1963. (iss. 1964). *Mesuoxyylon arcotense* gen. et sp. nov., a fossil dicotyledonous wood from the Tertiary of South Arcot District, Madras, India. *Palaeobotanist* 12 (3) : 260-264.
- Lakhnupal, R. N. & N. Awasthi. 1964 (iss. 1965). Fossil woods of *Calophyllum* from the Tertiary of South India. *Palaeobotanist* 13 (3) : 328-336.
- Metcalf, C. R. & L. Chalk. 1950. *Anatomy of Dicotyledons*. Vols. 1 & 2. Clarendon Press, Oxford.
- Navale, G. K. B. 1955 (iss. 1956). On two new species of *Terminalioxylon* Schonfeld from the Tertiary beds of South India. *Palaeobotanist* 4 : 35-39.
- Navale, G. K. B. 1956 (iss. 1957). *Sapindoxylon indicum* sp. nov., a new fossil wood from the Tertiary beds of South India. *Palaeobotanist* 5 (2) : 73-77.
- Navale, G. K. B. 1958 (iss. 1959). *Cynometra* from the Cuddalore series near Pondicherry, India. *Palaeobotanist* 7 : 6-11.

## D. E. P. Jeyasingh &amp; M. Devadass

- Navale, G. K. B. 1960 (iss. 1962). *Phyllanthinium bangalamodense*, a new species of fossil euphorbiaceous wood from the "Cuddalore Series" of India. *Palaeobotanist* 9 (1-2) : 11-16.
- Navale, G. K. B. 1962a (iss. 1963). Fossil woods of Leguminosae from the Tertiary rocks of the Cuddalore series near Pondicherry, India. *Palaeobotanist* 11 (1-2) : 54-65.
- Navale, G. K. B. 1962b (iss. 1963). Some silicified dipterocarpaceous woods from Tertiary beds of Cuddalore series near Pondicherry, India. *Palaeobotanist* 11 (1-2) : 66-81.
- Navale, G. K. B. 1962c (iss. 1964). *Castanoxylon* gen. nov. from Tertiary beds of Cuddalore series near Pondicherry, India. *Palaeobotanist* 11 (3) : 131-137.
- Navale, G. K. B. 1962d (iss. 1964). *Anogeissusoxylon indicum* gen. et sp. nov. from the Tertiary rocks of the Cuddalore series near Pondicherry, India. *Palaeobotanist* 11 (3) : 154-158.
- Navale, G. K. B. 1963 (iss. 1964). *Ailanthoxylon pondicherriense*, sp. nov. from Tertiary beds of the Cuddalore series near Pondicherry, India. *Palaeobotanist* 12 (1) : 68-72.
- Navale, G. K. B. 1968. Woody tissue resembling the woods of Ebenaceae in the Microstructure of Neyveli Lignite. *Palaeobotanist* 16 (1) : 91-94.
- Navale, G. K. B. 1973. Some contribution to the Paleobotany of Neyveli Lignite, South India. *Palaeobotanist* 20 (2) : 179-189.
- Prakash, U. & N. Awasthi. 1969 (iss. 1970). Fossil woods from Tertiary of Eastern India 1. *Palaeobotanist* 18 (1) : 32-44.
- Ramanujam, C. G. K. 1953. Fossil woods resembling *Magifera*, *Shorea*, *Albizzia* in Tertiary rocks of India. *Curr. Sci.* 22 : 336-337.
- Ramanujam, C. G. K. 1954a. Fossil woods belonging to Guttiferae, Celastraceae, Leguminosae, Sonneratiaceae and Euphorbiaceae from the Tertiary rocks of South Arcot, Madras. *J. Sci. Ind. Res. India* 13 (b) : 146-147.
- Ramanujam, C. G. K. 1954b. On some silicified woods from, near Pondicherry, South India. *Palaeobotanist* 3 : 40-50.
- Ramanujam, C. G. K. 1955 (iss. 1956). Fossil woods of Dipterocarpaceae from the Tertiary of South Arcot district, Madras. *Palaeobotanist* 4 : 45-46.
- Ramanujam, C. G. K. 1956a (1957). On the occurrence of fossil wood of *Sonneratia* : *Sonneratioxylon dakshinense* sp. nov. from the Tertiary of South Arcot District, Madras. *Palaeobotanist* 5 (2) : 78-81.
- Ramanujam, C. G. K. 1956b. On two new species of *Terminalioxylon* Schonefeld from the Tertiary of South Arcot district, Madras. *J. Ind. Bot. Soc.* 35 (1) : 103-113.
- Ramanujam, C. G. K. 1956c. Fossil woods of Euphorbiaceae from the Tertiary rocks of South Arcot district, Madras. *J. Ind. Bot. Soc.* 35 (3) : 284-307.
- Ramanujam, C. G. K. 1959 (iss. 1961). A fossil dicotyledonous wood resembling the modern *Tamarindus* from the Tertiary rocks of South Arcot district, Madras. *Palaeobotanist* 8 (1-2) : 38-42.
- Ramanujam, C. G. K. 1960. Silicified woods from the Tertiary rocks of South India. *Palaeontographica* 106B : 99-140.

**Two pertified Angiosperm woods from Cuddalore Sandstones**

- Ramanujam, C. G. K. 1965 (iss. 1966). A further investigation of the ligneous fossils of Combretaceae from South India. *Palaeobotanist* 14 : 246-255.
- Ramanujam, C. G. K. 1995. Diversity in Floristic Composition of Neogene and modern forest types in the Pondicherry – Neyveli area of Tamilnadu – its impact on climatic and phytogeographic considerations. (Abstract). National Symposium on "New directions in Plant biodiversity research". Bharathidasan University, Tiruchirapalli, India.
- Ramanujam, C. G. K. & M. R. R. Rao. 1966a. The occurrence of *Cynometroxylon indicum* Chowdhury and Ghosh from the Cuddalore Sandstone series. *Curr. Sci.* 35 (6) : 158-159.
- Ramanujam, C. G. K. & M. R. R. Rao. 1966b. A fossil wood resembling *Bauhinia* from the Cuddalore series of South India. *Curr. Sci.* 35 (22) : 575-577.
- Ramanujam, C. G. K. & M. R. R. Rao. 1967. A new species of *Shoreoxylon kraeuseli* sp. nov., from the Tertiary of South India. *Curr. Sci.* 36 (16) : 439-441.
- Ramanujam, C. G. K. & M. R. R. Rao. 1969. *Shoreoxylon kraeuseli* sp. nov., a new dipterocarpaceous wood from the Cuddalore series of South India. In : H. Santapau, et al. (Eds.), *J. Sen. Memorial Volume*, Bot. Sco. Beng. Calcutta. pp. 253-258.
- Ramesh Rao, K. & S. K. Purkayastha. 1972. *Indian Woods*, Vol. III. Manager of Publications, Delhi-6.
- Trotter, H. 1982. *The common commercial timbers of India and their uses*. Controller of Publications, Delhi.