OCCURRENCE OF FOSSIL *CYNOMETRA* FROM THE CUDDALORE SERIES NEAR PONDICHERRY, INDIA

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ABSTRACT

The paper deals with the anatomical studies of a fossil dicot wood from the Cuddalore Series. The structural details of the fossil specimen show closest affinities with the genus *Cynometra*. The specimen is described as *Cynometroxylon dakshinense* sp. nov.

INTRODUCTION

ROCKS of the Cuddalore Series are exposed in South India. They extend from Pondicherry to Madura along the Coromandel Coast, and from Warkala (=Warkalli) to Ratnagiri on the West Coast. Also scattered patches of this Series are exposed in Rajahmundry, Andhra Pradesh. Rocks are principally mottled, ferruginous, argillacious and gritty sandstones. The Cuddalore rocks have retained both micro- and megafossils in various localities. Jacob (1954), Rao (1954) and Vimal (1953) have reported number of spores and pollen grains from the lignites of the Cuddalore Series at South-Arcot and Warkalla. Apart from these microfossils a large number of fossil dicot woods have also been reported. Up till now the structural details of the woods of Leguminosae (RAMANUJAM, 1954), Dipterocarpaceae (RAMANUJAM, 1955), Combretaceae (NAVALE, 1955; RAMANUJAM, 1956), Sapindaceae (NAVALE, 1956), Sonneratiaceae (RAMANUJAM, 1956) and Euphorbiaceae (RAMANUJAM, 1956) have been described. Some woods of gymnosperms and palms have also been described; (SAHNI, 1931, RAMANUJAM, 1954). The present paper records the occurrence of a fossil wood resembling the genus *Cynometra* Linn.

The presence of abundant angiospermic remains in the Cuddalore sandstones doubtlessly indicates its Tertiary age. According to Wadia (1953), a greater part of it is believed to be of Pliocene age but some parts of it may be older. Krishnan (1956) considers this Series to be Miocene in age. According to him these areas overlie a fairly complete Lower Tertiary succession though there is a stratigraphical gap of varying magnitude beneath them. As they undoubtedly represent a marine transgression in the Mio-Pliocene, they are considered to be of Upper Miocene or Pliocene age.

The material was collected in the village Kashikuppam, near Pondicherry. The fossil specimen is highly variegated. The preservation is satisfactory and the internal details of the petrified wood clearly indicate its affinities.

Cynometroxylon Chowdhury & Ghosh 1946

Cynometroxylon dakshinense sp. nov.

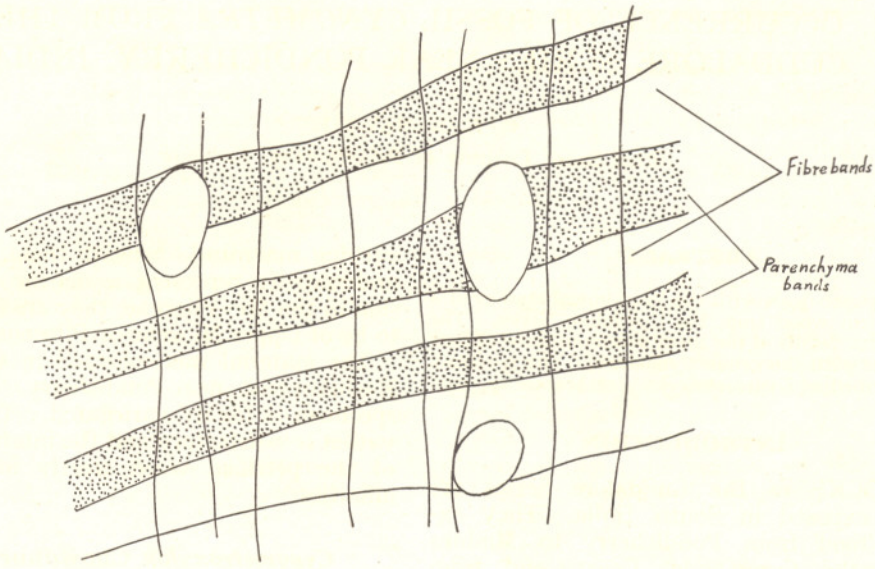
The fossil is a diffuse porous wood.

Growth rings are hardly visible to the naked eye. They are very indistinct. In some sections of the fossil specimen, growth marks are faintly indicated due to the differentiation in the fibre cells.

Vessels are not clearly visible to the naked eye but can be easily recognized with the help of the hand lens (PL. 1, FIG. 1). They are medium-sized, single or radial in groups of 2-3, evenly distributed and with dark or whitish contents (PL. 1, FIG. 3). Vessels are thick-walled with somewhat oblique perforation. The inter-vessel pits are horizontal, small and many (PL. 1, FIG. 2). Vessel-ray pits and parenchyma pits are not visible due to the lack of preservation.

Parenchyma is seen as tangential bands even without the help of the microscope (PL. 1, FIG. 1). It is in concentric bands regularly alternating with fibre bands, resulting into a succession which is very characteristic of the specimen (PL. 1, FIG. 3 TEXT-FIG. 1). Parenchyma bands often enclose the vessels (PL. 1, FIGS. 3, 4; TEXT-FIG. 1). Occasionally these bands bifurcate and join with another. The bands are mostly 3-6 cells thick with intercellular spaces (PL. 1, FIG. 4). The parenchyma is of apotracheal type.

Rays are uniseriate or biseriate (PL. 1, FIG. 5; TEXT-FIG. 2). Uniseriate rays are many, each usually 22 cells high and made



TEXT-FIG. 1 — *Cynometroxylon dakshinense* sp. nov. Transverse section, showing the distribution of vessels and the alternate bands of fibres and parenchyma. ×*ca.* 70.

up mostly of procumbent cells (PL. 1, FIGS. 5, 6; TEXT-FIG. 2). Biseriate rays are also common, 20-22 cells high and consist of mostly procumbent cells (PL. 1, FIGS. 5, 6; TEXT-FIG. 2). Triseriate and multiseriate rays have not been observed.

Fibres are indistinct and lack good preservation. They are in tangential bands alternating with parenchyma bands (PL. 1, FIG. 3; TEXT-FIG. 1). Fibre bands are also made up mostly of 5-6 cells (PL. 1, FIG. 3; TEXT-FIG. 1) and at times up to 10 cells in thickness (PL. 1, FIG. 4). Fibre pits could not be traced due to poor preservation of the cells.

COMPARISON WITH THE LIVING SPECIES

Important features of the fossil specimen are the diffused type of vessels which are solitary or radial in groups of 2 or rarely 3 having uniform distribution, and the very characteristic tangential bands of parenchyma and fibres which regularly alternate forming successive rows of almost equal width. Chowdhury & Ghosh (1946) have grouped timbers having parenchyma and fibres in concentric and alternating bands, which in their opinion is a constant feature, into four main types. They are as follows:

GROUP 1 — Parenchyma cells form more or less a network with the wood rays and the irregular thin bands of parenchyma alternate with thick bands, e.g. *Juglans, Heritiera.*

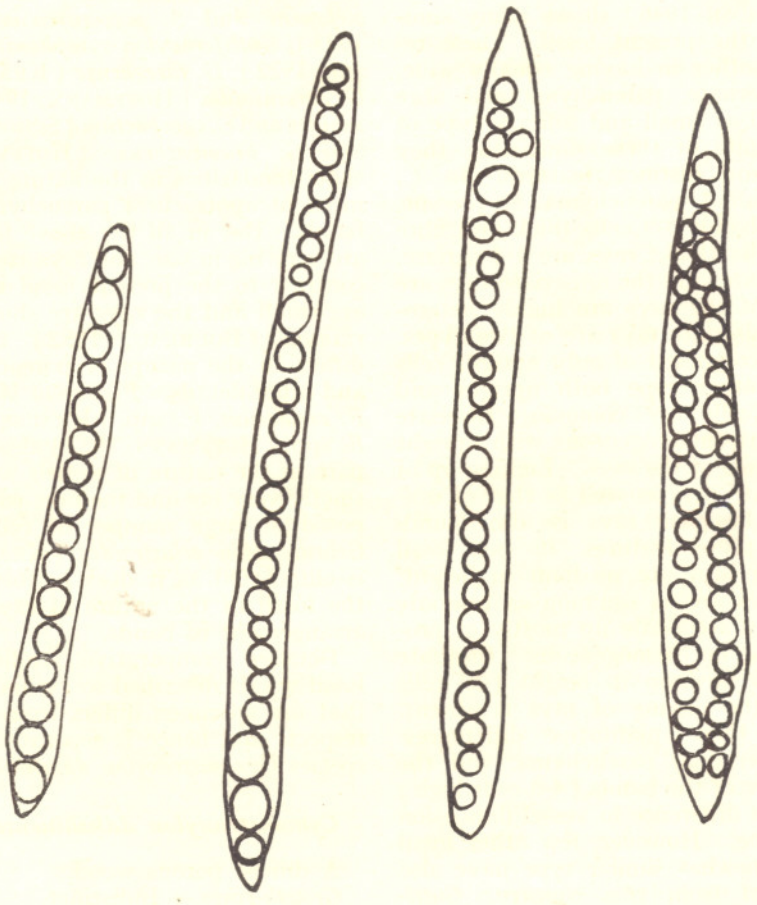
GROUP 2 — Thin bands of parenchyma alternate with thick bands of fibres and the parenchyma bands are narrower being 2-4 cells wide, whereas the fibre bands are broader, having 30 cells, e.g. *Lophopetalum, Alstonia,* etc.

GROUP 3 — Parenchyma and fibre bands have equal width, e.g. *Ficus, Bauhinia, Cynometra.*

GROUP 4 — Parenchyma bands are broader than the fibre bands, e.g. *Erythrina, Pongamia, Sterculia.*

My specimen in view of the equal width of parenchyma and fibre bands refers to group 3 above. Chowdhury & Ghosh (loc. cit.) have listed timbers of 16 families with 40 genera in this group. Among these, the woods of Guttiferae (*Garcinia, Kayea, Rheedia* and *Symphonia*) resemble my specimen in having fibre and parenchyma bands of equal width. However, they differ distinctly in having broad and high rays. Few members of Urticaceae (*Ficus, Malaisia Aphananthe*) are also comparable with the fossil as they too have fibre and parenchyma

bands of equal width, but the large variation in the size of the vessels, rays and the presence of tracheids keep them apart. *Terminalia belerica* although possesses alternate bands of parenchyma and fibres, yet it differs conspicuously in having exclusively uniseriate rays and vestured pits. Among the many comparable genera of Meliaceae, only *Amoora* and *Chisocheton* are considered as the others differ distinctly in many features. Even these two genera can be eliminated due to the fundamental differences in the nature of rays and pits. The genus *Cordia* agrees in many features with the fossil specimen but differs in having broad and high rays. In Leguminosae, *Bauhinia, Erythrina, Pongamia, Cynometra, Clitoria* and *Baphia* are comparable with my fossil. The genera *Erythrina* and *Pongamia* can be eliminated as they have thicker parenchyma bands (IV GROUP: CHOWDHURY & GHOSH, 1946). Also *Bauhinia* can be discarded due to its characteristic ripple marks. Considering the remaining three genera, namely *Baphia, Clitoria* and *Cynometra,* the present fossil does not match with *Clitoria,* as the later distinctly possesses two distinct types of vessels; one large and the other small. Similarly *Baphia* can be excluded as it possesses homogeneous and storied arrangement of ray cells. It is only with *Cynometra* that the fossil under investigation resembles in most of the anatomical details. Comparisons made with the sections of the Indian species of *Cynometra* (*Cynometra ramiflora, C. polyandra, C. travancorica*) and with the anatomical details of *Cynometra* spp. described by Metcalfe and Chalk (1951), Chowdhury



TEXT-FIG. 2 — *Cynometroxylon dakshinense* sp. nov. Tangential section, showing the uniseriate and biseriate rays. × *ca.* 140.

(1932, 1942, 1945, 1946), Chowdhury & Ghosh (1946), Dadswell & Eckersley (1938), Gamble (1922), Kanehira (1921, 1926), Moll & Janssonius (1906, 1928), Pearson & Brown (1932) and Henderson (1953) clearly indicate that the fossil specimen resembles the genus *Cynometra*, in particular *C. polyandra*, in most of the anatomical details. The generic name *Cynometroxylon* has been proposed by Chowdhury & Ghosh (1946) for fossil woods resembling *Cynometra*. As such the present fossil specimen is referred to the genus *Cynometroxylon*.

COMPARISON WITH THE FOSSIL SPECIMENS

Cynometroxylon indicum (CHOWDHURY & GHOSH, 1946), described from Nailalung, Assam, is the only species described from India. *Cynometroxylon indicum* (CHOWDHURY & GHOSH 1946) shows many similarities with the present fossil. These resemble each other in having equally wide, regularly alternate, parenchyma and fibre bands as well as small and solitary type of vessel. In spite of these similarities they differ in some distinct features. In *C. indicum* terminal parenchyma is present, parenchyma bands 3-9 cells thick and fibre bands 5-9 cells thick; rays are 1-4 seriate, usually biseriate, and the uniseriate rays are rare. Cells of the rays are highly heterogeneous. Uniseriate rays are of two types. One type is composed of only upright cells and in the other type both upright and procumbent cells are common. Biseriate rays are mostly heterogeneous with upright cells at the ends of the rays. Linking up of some uniseriate rays as well as that of uniseriate and biseriate rays is also found. Considering these features, in my fossil specimen the rays are medium in height, uniseriate rays are as common as biseriate rays and they are made up mostly of procumbent cells, i.e. homogeneous. Biseriate rays are also medium in height (20 cells high), and the linking of rays is absent. Apart from these qualitative differences, absence of terminal parenchyma, and the thinner nature of the bands (4-6 cells high) as well as the difference in vessel dimension is also striking. However, few other fossil woods of somewhat similar type have also been reported from this country. *Guttiferoxylon indicum* (RAMANUJAM, 1954), *G. speciosum*, *G. surangeii*, and *G.* spp. (UTTAM PRAKASH, 1956) show some similarities with the present fossil but the nature of the rays which are abundant and higher and the parenchyma and fibre bands which are of unequal width eliminate them. *Kayeoxylon assamicum* (CHOWDHURY & TANDON, 1949) resembles in the arrangement of parenchyma and fibre bands. However, it differs in the nature of pitting, rays and vessels. In *Kayeoxylon assamicum* vessels are large, radial with oblique type of arrangement. The pits in the fibre walls are abundant, with round border and verticle or oblique orifice. *Terminalioxylon sahnii* (NAVALE, 1956) described from South India neither shows any regular succession of parenchyma and fibre bands nor heterogeneous rays.

The present fossil specimen has also been compared with such fossil woods as have been described from outside this country and show resemblance. *Symphonioxylon stefanini* and *S. scec-gurensis* (CHIARUGI, 1933), *Guttiferoxylon symphonioides* (KRÄUSEL, 1922), *G. fareghense* (KRÄUSEL, 1939), *G. garcinioides* (HOFFMANN, 1944), *G. platonioides* and *G. compactum* (SCHÖNFELD, 1947) and *G. prambachense* (HOFFMANN, 1952) show similarities in the nature and arrangement of apotracheal parenchyma and fibre bands. But in all the above fossils, vessels are very big in size, and rays are very high in contrast to the present fossil where vessels are small and the rays are short. *G. saharianum* (BOUREAU, 1952) conspicuously differs in the nature of parenchyma, fibres and other details. *Ficoxylon blanckenhornii*, *F. cretaceum*, *F.* spp. (KRÄUSEL, 1939) and *F.* spp. (HOFFMANN, 1952) also do not compare in the nature of vessels which are distinctly very big and the rays which are composed of large number of cells in height. *Celastroxylon celastroides* (KRÄUSEL, 1939) is eliminated as it does neither agree with the fossil in the nature of rays nor in the arrangement of bands.

Detailed comparative studies with the fossil woods described so far indicate clearly that my specimen differs from all in many respects and hence is separated into a new species *Cynometroxylon dakshinense* sp. nov.

Cynometroxylon dakshinense sp. nov.

A diffuse porous wood.

Growth-rings — Indistinct.

Vessels — Small, solitary or radial of 2 or 3, tangential diameter 108 μ, radial diameter

180 μ, filled with dark contents; shape elliptical; perforation plate simple; intervessel pits minute, in horizontal rows; vessel ray and parenchyma pits not visible.

Parenchyma — Distinct, in regular concentric bands alternating with fibres; apotracheal type, partially or totally encircling vessels; bands often bifurcate; mostly 4-6 cells thick, each cell 18 μ in diameter, intercellular spaces present.

Rays — Moderately numerous, uniseriate and biseriate rays equally common, usually 22 cells high, ray cells mostly procumbent in uniseriate as well as biseriate type.

Fibres — Banded, alternating with parenchyma bands, mostly 5-6, sometimes up to 10, fibre cells angular, small in cross-section, fibre pits indistinct.

Holotype — No. 26381 at the Museum of the Birbal Sahni Institute of Palaeobotany.

ACKNOWLEDGEMENTS

I am deeply indebted to Dr. D. C. Bharadwaj for his guidance during the progress of the work. Also I express my gratefulness to Prof. K. A. Chowdhury for his helpful suggestions and to Mr. S. S. Ghosh of the Forest Research Institute, Dehra Dun, for sending me many living wood specimens for purposes of comparison.

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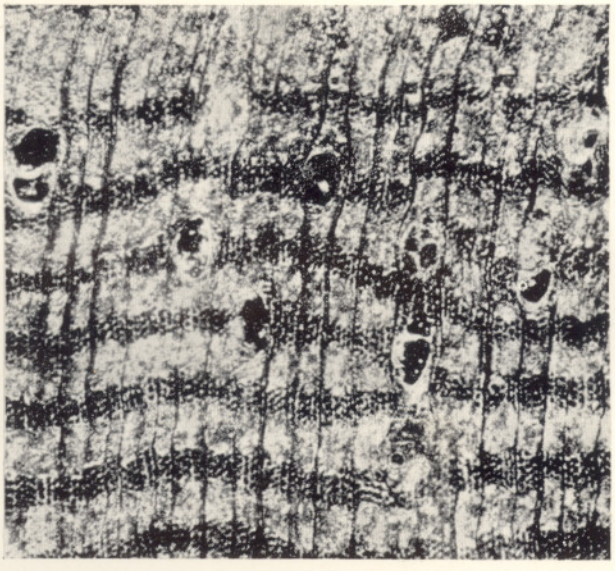
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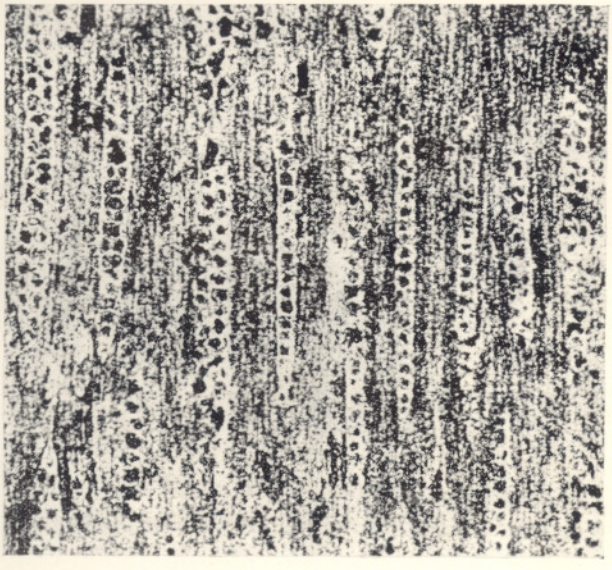
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EXPLANATION OF PLATE 1

Cynometroxylon dakshinense sp. nov.

1. Cross-section, showing the gross features of the wood. × 3.

2. Tangential section, showing the inter-vessel pits. Note the size, shape and arrangement of pits. × 250.

3. Transverse section to show the distribution of vessels, their contents, alternate bands of fibres and parenchyma cells. × 35.

4. Transverse section magnified to show the arrangement of parenchyma and fibre cells. × 100.

5. Tangential section, showing the uniseriate, biseriate and homogeneous nature of rays and their distribution. × 100.

6. Radial section, showing the nature of ray cells. × 100.