

PALMOPHYLLUM DAKSHINENSE SP. NOV. A PETRIFIED
FRAGMENT OF A PALM LEAF FROM THE DECCAN
INTERTRAPPEAN BEDS

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ABSTRACT

Transverse sections of the lamina of a fragmentary petrified monocot leaf are described in detail. As it shows many palm lamina characters it is referred to the genus *Palmophyllum* with a slight emendment of the diagnosis of the genus and is designated *Palmophyllum dakshinense*.

INTRODUCTION

THE literature on the fossil plants of the Deccan Intertrappean beds does not record the occurrence of many monocotyledonous leaves in a detached state. Leaves of *Cyclanthodendron sahnii* (SAHNI & SURANGE, 1953), two petrified aquatic monocotyledonous leaves (DWIVEDI, 1961), *Musocaulon indicum* Jain (RAO & MENON, 1963) and grass and palm leaf impressions (SAHNI, 1964) have been described from this area along with some petrified megafossils. A few transversely cut, possibly palm leaves (RAO & MENON, 1965) found in a silicified block Mz1, from this area, form the subject matter of this paper. The preservation is not good in general, yet, the structural features could be studied from one or two better preserved sections, further improved by staining with gentian violet.

DESCRIPTION

Genus *Palmophyllum* Conwentz emend.

Palmophyllum dakshinense sp. nov.

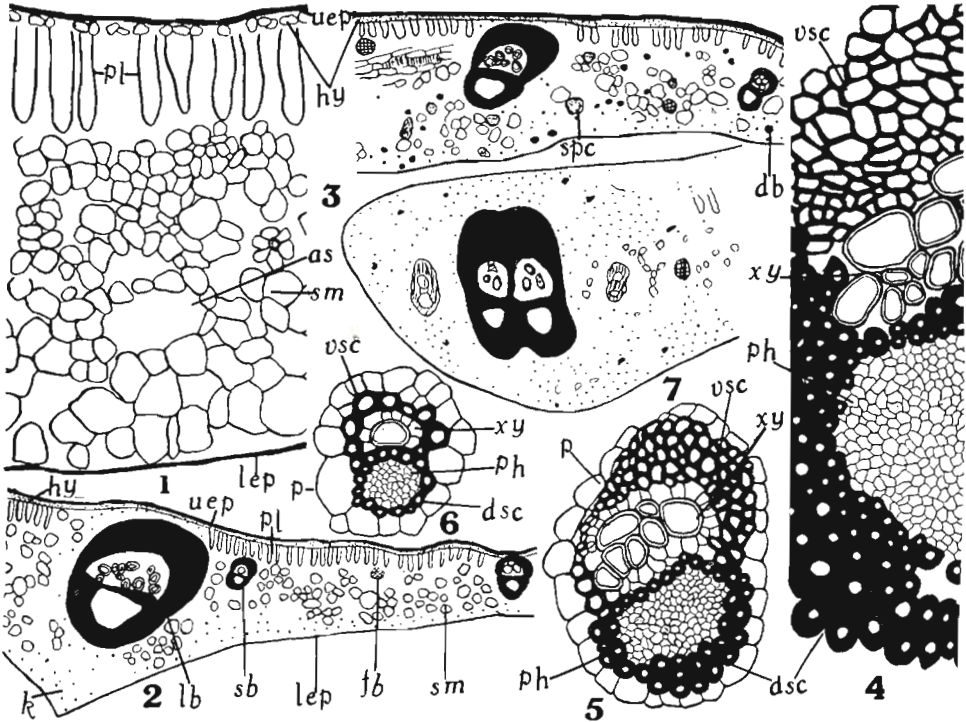
The lamina sections are thin, broad, plicated and keeled (PL. 1, FIGS. 1a, 1b, 1c) and measure 0.2-0.7 mm. thick, 15 to 18 mm. broad and 0.9 mm. thick in the keelar region.

ANATOMY

Transverse sections of the lamina show a badly preserved upper and lower epidermis and also a lower and upper hypo-

dermis (PL. 1, FIG. 2; TEXT-FIG. 1). Below the upper hypodermal layer is a single cell thick layer of palisade cells (PL. 1, FIG. 2; TEXT-FIG. 1). Extending from this to the lower hypodermis is the slightly loose thin-walled spongy tissue containing air spaces (PL. 1, FIG. 2; TEXT-FIG. 1) and some specialized cells (PL. 1, FIG. 3; TEXT-FIG. 3) whose origin is not clear. The fibrovascular bundles occur in a single row (PL. 1, FIG. 2; TEXT-FIGS. 2 & 3) but they are unequal in size. The plicate lamina is keeled on the dorsal side once or twice and in such a keel generally occurs a large bundle nearer to the ventral side (TEXT-FIG. 2). In the other portions of the lamina slightly smaller bundles appear after every two or three still smaller bundles. In all these three types of bundles the dorsal and ventral sclerenchymatous arcs unite at the sides. A narrow bridge of the dorsal sclerenchyma separates the xylem and the well preserved phloem. The xylem is made up of several elements, but proto and meta-xylem cannot be differentiated. Between the fibrovascular bundles occur small fibrous bundles (TEXT-FIG. 2). Transverse sections of the lamina further show a number of dark bodies which obviously are not cell contents, but are some type of mineral deposit (PL. 1, FIG. 2; TEXT-FIG. 3).

In a large bundle (PL. 1, FIG. 3) the ventral sclerenchyma is made up of thick-walled lignified cells with fairly large lumen (TEXT-FIG. 4) while the dorsal sclerenchyma cells have very thick walls with very narrow lumen. The undivided phloem is very well preserved and shows the sieve tubes very clearly, but not the companion cells. The xylem elements number thirteen. The parenchyma is not preserved, nor could a bundle sheath be clearly made out. The bundles measure 0.42-0.54 by 0.45-0.71 mm. Their f/v ratio is 0.6/1.1-1/1.



TEXT-FIGS. 1-7 — *Palmophyllum dakshinense* sp. nov. 1. Transverse section of a part of the lamina enlarged. $\times 190$. 2. Keelar region of the lamina in transverse section with large bundle. $\times 40$. 3. Transection of the lamina showing the medium sized and small bundles. $\times 40$. 4. A portion of the large bundle enlarged with all particulars. $\times 190$. 5. One medium sized bundle enlarged. $\times 190$. 6. An enlarged small bundle. $\times 190$. 7. Margin of the lamina in transverse section. $\times 40$. (*as*, air space; *db*, dark body; *dsc*, dorsal sclerenchyma; *fb*, fibrous bundle; *hy*, hypodermis; *k*, keel; *lb*, large bundle; *lep*, lower epidermis; *p*, parenchyma; *ph*, phloem; *pl*, palisade; *sm*, spongy mesophyll; *spc*, specialized cell; *uep*, upper epidermis; *vsc*, ventral sclerenchyma; *xy*, xylem.)

In the medium sized bundle (PL. 1, FIG. 4; TEXT-FIG. 5) a parenchymatous sheath is evident. The phloem is well preserved with recognizable sieve tubes, but no companion cells are seen probably due to crushing during fossilization. The ventral sclerenchyma has thick-walled cells with large lumen, while the dorsal sclerenchyma is very little and is composed of thick-walled cells with narrow lumen. The xylem consists of six to seven elements, sometimes reduced to two or three. The bundles measure 0.13-0.25 by 0.17-0.48 mm. The f/v ratio is 1/1.1-8/1.

The smaller bundles (PL. 1, FIG. 3; TEXT-FIG. 6) have a parenchymatous sheath and measure about 0.08-0.24 by 0.1-0.2 mm. The dorsal and ventral sclerenchyma are only one cell thick. The xylem too is reduced to only one element. At the margin

of the leaf are two bundles, one small and the other big (TEXT-FIG. 7) as is seen in some of the palms like *Cocos* (VENKATANARAYANA, 1956), *Nipa* (Menon, Ms.), etc. But in the section studied here (TEXT-FIG. 7) the large bundle is also a fused bundle.

Associated with the above lamina bits, is a transverse section of a midrib (PL. 1, FIG. 5) which shows a number of fibrovascular bundles each with its own sheath and a general sclerenchymatous sheath covering the whole group. The midrib is tetragonal in section and the bundles are collateral with the dorsal and ventral sheaths united and with a solitary xylem element.

DISCUSSION

The collateral fibrovascular bundles arranged in a single series in the specimen

described shows that it was parallel veined and probably belonged to a monocot. A comparison with the other fossil monocot leaves from this locality may not be out of place here.

Sections of Mz1 resemble those of *Cyclanthodendron sahnii* (SAHNI & SURANGE, 1953) in showing similar structure of the fibrovascular bundles and the presence of a hypodermis. Palisade tissue present in Mz1 is absent in *Cyclanthodendron sahnii*. Big air spaces in the lamina and two to three series of fibrovascular bundles in the

broader part of the leaf of *C. sahnii* are not found in Mz1.

The following features present in *Musco-caulon indicum* Jain (RAO & MENON, 1963) are absent in the sections of Mz1. (1) The presence of a midrib with numerous scattered fibrovascular bundles, (2) presence of large air spaces, (3) several rows of fibrovascular bundles in the mature lamina and (4) uniform sized, closely placed fibrovascular bundles of the young lamina. In view of these differences Mz1, cannot be referred to either of the above mentioned species.

TABLE 1

CHARACTERS	GRAMINEAE	PALMAE	Mz1
Epidermis	Present	Present	Present
Palisade cells	"rarely exhibit a sharp differentiation into contrasting palisade and spongy portions."	Present, but not in all the palms	Present
Spongy mesophyll	Consists of two types of chlorenchyma-festucoid and panicoid, i.e. radiate and nonradiate respectively	Thin-walled, rounded, more or less uniformly isodiametric cells	Thin walled more or less isodiametric cells
Fibrous bundles	—	Present	Present
Xylem elements	Generally only one metaxylem in addition to the protoxylem.	Generally one metaxylem in addition to the protoxylem	Many xylem elements present, difficult to distinguish between metaxylem and protoxylem
Phloem	Undivided	"The phloem strand of each small vein is undivided, but that of large veins in many genera is divided into separate strands by sclerotic partitions"	Undivided
Thick-walled cells separating xylem and phloem	Xylem and phloem separated by parenchymatous tissue	Xylem and phloem separated by one or more layer of thin walled or sclerotic conjunctive parenchyma	Xylem and phloem separated by thick walled sclerenchymatous cells
Bundle sheaths	Outer parenchymatous and inner sclerenchymatous both single layered	Outer parenchymatous uniseriate and inner sclerenchymatous multiseriate. The outer one is complete only in the case of smaller bundles	Same as in the case of palms
Sclerenchyma	Sub-epidermal longitudinal strands or girders accompanying the vascular bundles. In some, sclerenchymatous islands above and below the vascular bundles. In others as girders extending from epidermis to the bundle sheath	Mostly the sclerenchymatous arcs joined together around the vascular bundle. Some times separated	Sclerenchymatous arcs joined, around the vascular bundle
Bulliform and colourless cells	Present	Present	Could not be made out
Surface ribs and grooves	Very clear	Not seen	Not seen

The two monocotyledonous petrified leaves described by Dwivedi (1961) are not in any way comparable to Mz1 as all the tissues are different in structure and distribution.

A general comparison is possible only with two families of monocots namely the Gramineae and Palmae. Fortunately characteristics of these two families are clearly enumerated by Metcalfe (1960) and Tomlinson (1961) respectively.

From Table I the lamina sections described in this paper show more features in common with the Palmae than the Gramineae. The keeled nature of the lamina coupled with plication, the differentiation of three types of bundles, the presence of multiple bundles in the midrib each with its own sclerenchymatous sheath, are all palm characters seen in my sections.

Plate 1, Fig. 5 shows a remarkable similarity with a transverse section of *Nipa fruticans* lamina midrib. From these intertrapean deposits have been described roots resembling those of *Nipa* (*Rhizophalmozylon indicum* Sahni; MAHABALE & UDWADIA, 1960), fruits of *Nipa hindi* (SAHNI & RODE, 1937) and *Nipa* spp. (CHITALEY, 1960). But the data available does not allow any further comparison. But there seems to be no doubt that the lamina bits referred to above, belong to a palm leaf. But the generic designation of this specimen presents certain difficulties. Conwentz (1886) instituted the genus *Palmophyllum* for the reception of impressions of palm leaves and their remains. My petrified sections cannot, therefore, be referred to this form genus. At the same time, as far as I am aware, there is no generic name for petrified palm leaves. It will be unwise to institute a new generic name on the basis of this rather badly preserved imperfectly known petrified fragment of a leaf. I, therefore, refer it to the genus *Palmophyllum* with this emendment to the

genus that it should include not only impressions but also incrustations and petrifications of the laminar part of a palm leaf with uncertain affinities.

DIAGNOSES

Palmophyllum Conwentz emend.

Impressions, incrustations and petrifications of the remains of the lamina of palm leaves with uncertain affinities.

Palmophyllum dakshinense sp. nov.

Lamina thin and narrow plicated and keeled with uniseriate fibrovascular bundles of different sizes, the largest ones found in the keelar regions, fibrous bundles between the fibrovascular bundles. Dorsal and ventral sclerenchyma sheaths joined surrounding the xylem and phloem in all the bundles, a bridge of dorsal sclerenchyma separating the xylem elements from the phloem. Xylem elements number many in the large bundles, fewer in the median sized bundles and reduced to only one in the smallest bundles. Numerous fibrovascular bundles in the midrib, each with its own sheath and a general sclerenchymatous sheath covering the whole group.

Holotype — Slides Mz1, Department of Botany, University of Lucknow.

Locality — Mohgaon Kalan, Chhindwara district, Madhya Pradesh.

Age — Eocene.

ACKNOWLEDGEMENTS

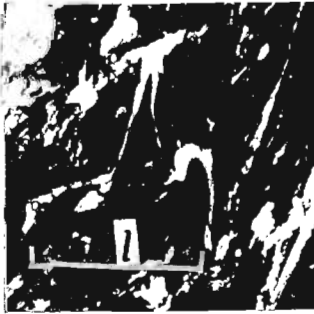
I am highly grateful to Prof. A. R. Rao for his kind and valuable guidance. My thanks are also due to the authorities of the Birbal Sahni Institute of Palaeobotany, Lucknow, for permission to consult their library. I am also indebted to Prof. T. S. Mahabale who examined my work and confirmed my conclusions.

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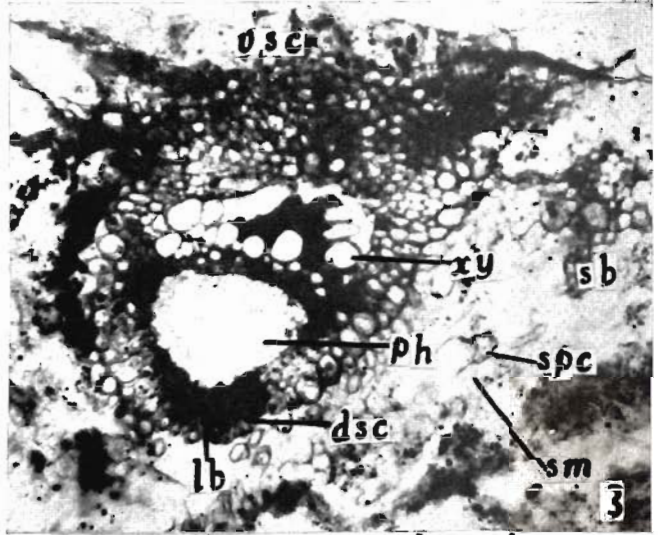
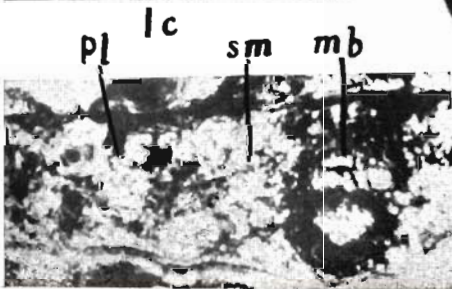
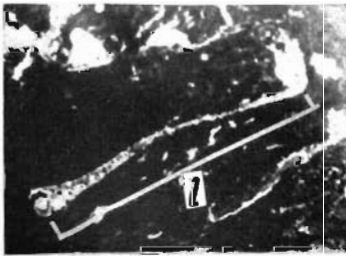
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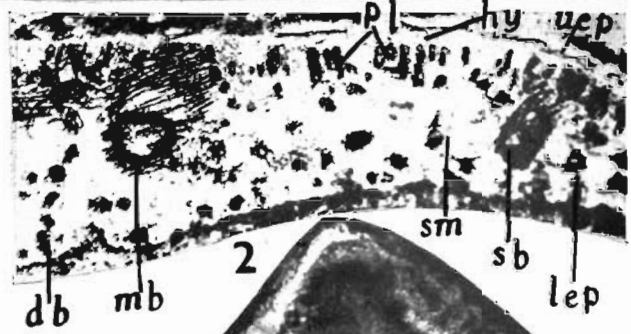
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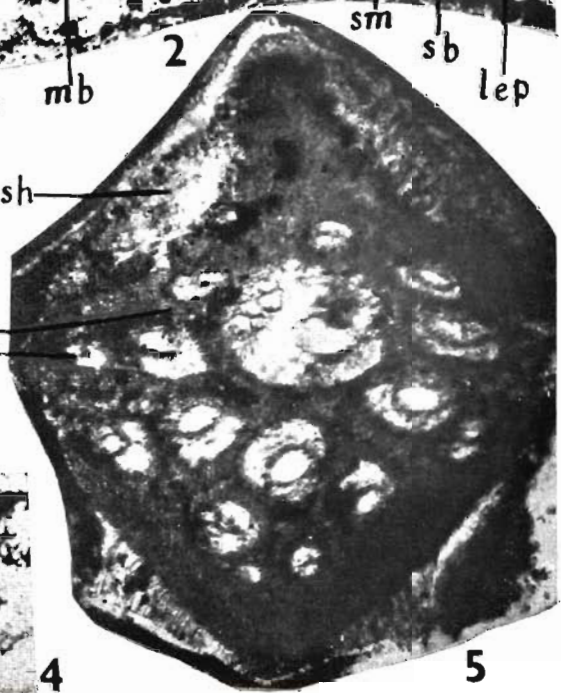
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EXPLANATION OF PLATE

PLATE 1

Palmophyllum dahshinense sp. nov.

- 1a, 1b & 1c. Transsections of the lamina showing plications. $\times 6$, $\times 4.8$, $\times 5.7$, respectively.
2. A portion of the lamina in transverse section showing parallel veins. $\times 51$.
3. Large and small bundles enlarged, $\times 31$.
4. Transsection of the lamina showing a medium sized bundle. $\times 28$.

5. Transsection of the midrib portion of lamina showing a group of bundles surrounded by a general sclerenchyma sheath. $\times 16$. (*db*, dark bodies; *dsc*, dorsal sclerenchyma; *fvb*, fibrovascular bundles; *gsh*, general sheath; *hy*, hypodermis; *k*, keel; *l*, lamina; *lb*, large bundle; *lep*, lower epidermis; *mb*, medium sized bundle; *ph*, phloem; *pl*, palisade; *sb*, small bundle; *spc*, specialized cells; *sm*, spongy mesophyll; *uep*, upper epidermis; *usc*, ventral sclerenchyma; *xy*, xylem.)