BORASSOID FOSSIL PALM ROOT FROM THE DECCAN INTERTRAPPEAN BEDS OF NAWARGAON IN WARDHA DISTRICT, MAHARASHTRA*

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ABSTRACT

The anatomy and affinities of a petrified palm root from the Deccan Intertrappean beds of Nawargaon in Wardha District, Maharashtra State has been described. Comparative studies indicate that the present fossil resembles the modern root of *Borassus flabellifer* Linn.

INTRODUCTION

The anatomy and affinities of a fossil palm root found in the detached condition from the Deccan Intertrappean beds of Nawargaon (21° 1′ North : 78° 35′ East) in Wardha District, Maharashtra State have been dealt with here. The specimen is well preserved, brown in colour, cylindrical in shape, measuring about 5 cm in length and 1.3 cm in diameter.

So far, most of the workers, viz. STENZEL (1904), SAHNI (1943, 1964), GOTHAN (1942), STOCKMANNS AND WILLERE (1943), SHUKLA (1946), OUGURA (1952), LAKHANPAL (1955), RAO AND MENON (1966) and TRIVEDI AND SURANGE (1970) have described the fossil palm roots in association with their stems without suggesting any affinities with modern taxa. However, VERMA (1974) and PRAKASH AND AMBWANI (1980) have recently described some more roots suggesting their resemblance with the modern forms. VERMA (1974) compared his specimen with the modern genus *Nypa* while PRAKASH AND AMBWANI (1980) indicated the affinities of a palm root studied by them with that of *Livistona*. The present fossil root has been compared with the modern palm roots which is closely comparable to that of the *Borassus*.

DESCRIPTION

Epiblema—It is represented by a dark opaque layer and the cellular details are not clear.

Hypodermis—It is about 7-8 cells thick layer and the cells are thick-walled, polygonal with a narrow lumen—probably sclerenchymatous in nature (Pl. 1, Fig. 4).

Cortex—It can be distinguished into three zones : (*a*) outer, (*b*) middle and (*c*) inner (Pl. 1, Figs. 1, 5, 6 & 7).

(*a*) *Outer cortex*—It is about 5-6 cells in thickness and composed of radially elongated, more or less rectangular as well as cylindrical parenchymatous cells. In the inner part of the outer cortex discontinuous patches of collenchymatous cells may be observed throughout the circumference of the root suggesting a character for an additional mechanical support to the root (Pl. 1, Fig. 5). Raphides and mucilagenous canals are frequently seen in this zone (Pl. 1, Fig. 3).

(*b*) *Middle cortex*—It is broader and highly lacunar, the cavities being arranged in

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3-5 rows. This region is about 25-30 cells broad having cells arranged in radial rows. They are generally round to oval in shape and parenchymatous in nature (Pl. 1, Fig. 6).

(*c*) *Inner cortex*—It is compact and narrower than the middle cortical zone. The parenchymatous cells are generally rounded to elongated in outline and are arranged in 5-6 layers. Raphides profusely occur in the cells. Sometimes dark organic substance, probably tanin, is seen filled in the cells (Pl. 1, Fig. 7).

Endodermis—It is a single layer of barrel-shaped cells lying below the inner cortical layer and shows casparian thickenings along the radial walls of the cells. These cells are more clearly seen in the longitudinal section under higher magnification (Pl. 1, Fig. 8).

Pericycle—It is represented by a dark line below the endodermis.

Stele—The stele consists of about 50-55 xylem strands arranged into two distinct rings, showing 'I' shaped arrangement. Below the pericycle a distinct conjunctive tissue is present in which the xylem and phloem strands alternate (Pl. 1, Figs. 2 & 7). The xylem vessels measure 100-280 μm in diameter and the end-walls show simple perforation (Pl. 1, Fig. 8). There is a zig-zag zone of somewhat thicker cells towards the pith which separates a few larger xylem strands abstricted in the pith (Pl. 1, Figs. 2 & 7), known as medullary bundles (Tomlinson, 1961).

Pith—It is about 2 mm wide and is composed of parenchymatous cells. Sometimes a few lacunae may be observed in the pith region whereas few medullary bundles are also seen in this region.

Medullary bundles—There are few larger medullary bundles visible in the central part of the pith. They measure $560 \times 960 - 640 \times 1120$ μm in size. Each medullary bundle is composed of a large xylem vessel surrounded by a patch of sclerenchymatous cells (Pl. 1, Fig. 7).

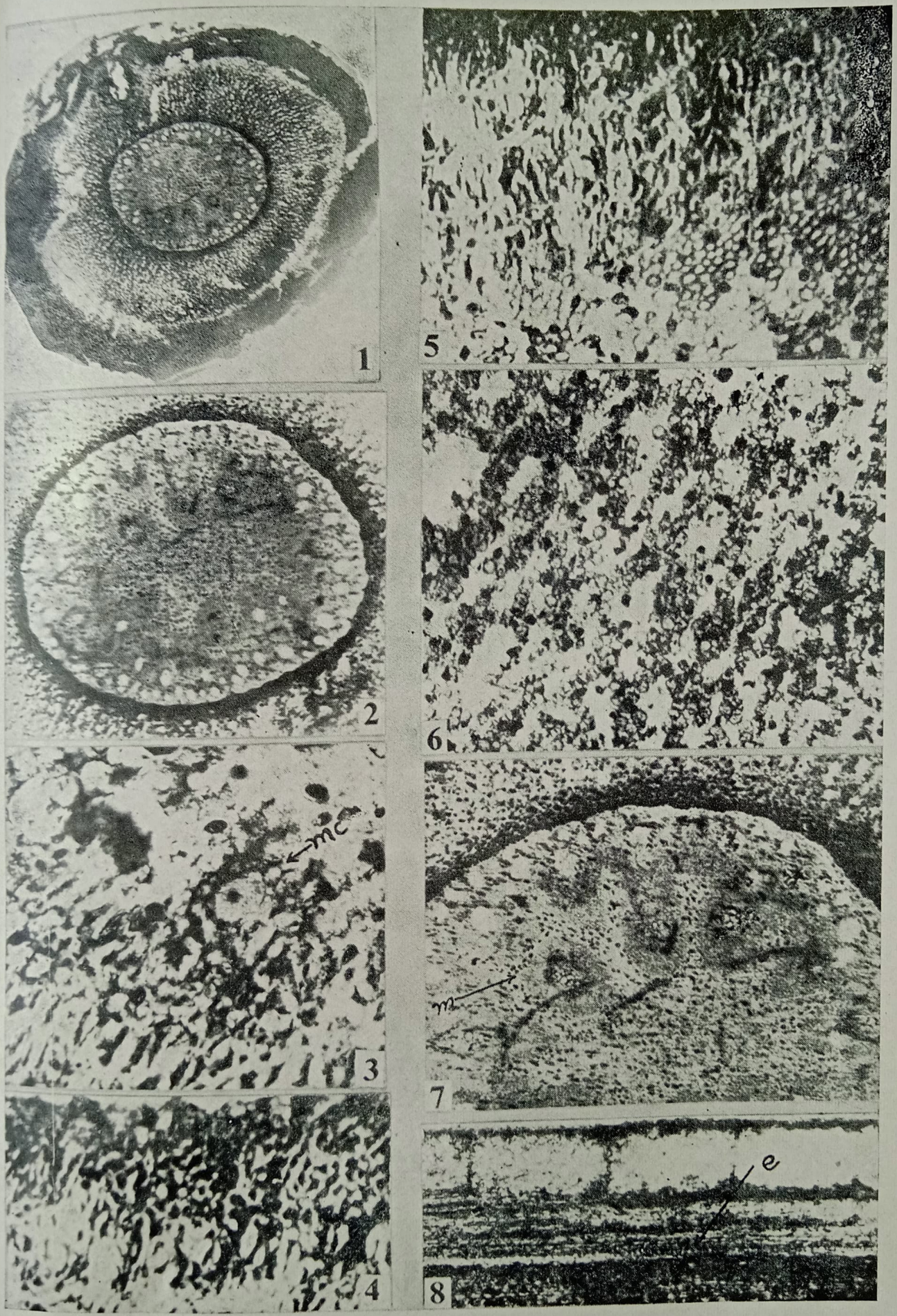
AFFINITIES

A comparison of the present fossil palm root with those of living palm species described by Drabble (1904), Mahabale and Udwadia (1960), Tomlinson (1961) and the thin root sections available at the Birbal Sahni Institute indicates that it closely resembles the root of the extant species *Borassus flabellifer*. Epiblema, as usual is made up of a single layer of cells while the hypodermis is made up of thick-walled cells in both the fossil as well as living species. The cortex is divisibe into three zones; outer, middle and inner. The outer and the inner zones are compact, while the middle is highly lacunar. Presence of raphides and mucilagenous canals in the outer cortex has been observed. Endodermis and pericycle are present in both the cases. The number of the xylem strands in the fossil species is about 50-55 which is more or less similar as observed in the root of *Borassus flabellifer*. Presence of zig-zag zone of somewhat thicker cells which separates some bundles towards the inner side of the pith as well as the medullary bundles has been recorded both in the fossil and the root of *Borassus flabellifer* (Mahabale & Udwadia, 1960 ; Tomlinson, 1961). Pith has also air chambers in both the species.

Apart from the similarities, an important anatomical difference has also been observed in the fossil and living root of *Borassus flabellifer*. The presence of a discontinuous ring of collenchymatous cells between the outer and the middle cortex is noted in the fossil while it has not been observed in the living species.

From the above observations it is quite obvious that the present fossil root closely resembles the root of the extant genus *Borassus*.

Occurrence of a borassoid palm leaf-impression comparable to *Borassus* has recently been reported from the Deccan Intertrappean beds of Mohgaon Kalan by Trivedi and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CHANDRA (1971) which also supports the presence of *Borassus*-like palms in the Deccan Intertrappean.

The genus *Borassus* consists of eight species which are palaeotropical in distribution (WILLIS, 1973). As the fossil resembles the root wood of *Borassus flabellifer* it can be presumed that a species similar to *Borassus flabellifer* might have been growing in the Deccan Plateau during the Eocene times in India.

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EXPLANATION OF PLATE 1

1. Transverse section of fossil root × 8. Slide No. 6293/35406.
2. T. S. of fossil root showing stelar region ×20. Slide No. 6293/35406.
3. T. S. of fossil root showing mucilagenous canal (mc.) in the outer cortex ×100. Slide No. 6293/35406.
4. T. S. of fossil root showing thick walled cells in the hypodermal region ×60. Slide No. 6293/35406.
5. T. S. of fossil root showing discontinuous patches of thick walled cells ×60. Slide No. 6293/35406.
6. T. S. of fossil root showing lacunae in the middle cortical zone ×60. Slide No. 6293/35406.
7. T. S. of fossil root showing a portion of stele with medullary bundle (m) ×30. Slide No. 6293/35406.
8. Longitudinal section of fossil root showing endodermis (e) ×60. Slide No. 6294/35406.