

A borassoid palm root from the Deccan Intertrappean beds of Wardha district, Maharashtra with critical remarks on fossil roots of *Eichhornia* *

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A new fossil palm root is described as *Rhizopalmoxyton borassoides* sp. nov. from the Deccan Intertrappean beds of Nawargaon, Wardha District, Maharashtra. In all its anatomical features the fossil root shows close similarity with that of *Borassus* and other borassoid palms. Based on the description and photographs critical remarks on the structure and affinities of a fossil root assigned to *Eichhornia* by Patil and Singh (1978) from Mohgaon Kalan, Chhindwara District have been made.

Key-words —*Rhizopalmoxyton*, Arecaceae, Deccan Intertrappean, Nawargaon, Late Cretaceous- Early Tertiary.

INTRODUCTION

THE occurrence of fossil plants in the Deccan Intertrappean beds around Nawargaon (20°1'N;78°35'E) in Wardha District is known since 1941 when Shukla first recorded a fossil palm wood, *Palmoxyton nawargaoensis*. Later, a few more palm woods were described by Shukla (1946), Sahni (1964) and Kulkarni and Patil (1977a,b). Since then a large number of plant remains including woods, leaves, roots, fruits and petioles etc. have been described from these beds and are listed by Bande (1987). The plant remains described after 1987 and those which could not be listed by him are *Culmites eleusineoides* Bonde (1986a) of Poaceae, *Scirpusoxyton indicum* Shete (1989) of Cyperaceae, *Palmocarpon coryphoidinum* Shete & Kulkarni (1985), *Palmoxyton decanense* Sahni (1964), *P. hyphaeneoides* Rao & Shete (1989), *Sabalophyllum livistonoides* Bonde (1986b) and a borassoid root of Palm (Ambwani, 1981). Keeping in view such a variety of plant remains occurring in this area, a field trip to Nawargaon area was undertaken by one of us (RCM) in 1983 and collected a large number of fossil woods including a few petrified roots. The latter have been studied in detail and are described in the present paper.

SYSTEMATIC DESCRIPTION

Family-Arecaceae

Genus-*Rhizopalmoxyton* Felix

Rhizopalmoxyton borassoides sp. nov.

Pl.1, figs 1, 3, 5; Pl. 2, figs 1-6.

The material consists of two pieces of well preserved roots, measuring 2-3 cm in length and 0.9-1.1 cm in diameter. Their preservation is fairly good.

Description- *Epiblema* represented by a dark layer. *Hypodermis* thick, about 680 µm in radial thickness, made up of sclerenchymatous cells (Pl. 2, fig. 1), cells polygonal, moderately thick walled, 16-20 µm in size (Pl. 2, fig. 2). *Cortex* distinguished into 3 zones, outer, middle and inner cortex (Pl. 1, fig. 1). *Outer cortex* 550-600 µm in radial thickness, made up of thin-walled parenchyma; cells rounded to oval, sometimes elongated also, 50-125 µm in size, a few cells filled with some inclusions (Pl. 2, fig. 3). *Middle cortex* 1-1.3 mm in radial thickness, relatively broader than the other zones, consisting of a number of air cavities irregularly arranged in 1-3 rows (Pl. 2, fig. 4); cavities varying 300-425 µm in length and 100-225 µm in width and separated from each other by 2-3 celled thick diaphragm; cells loosely

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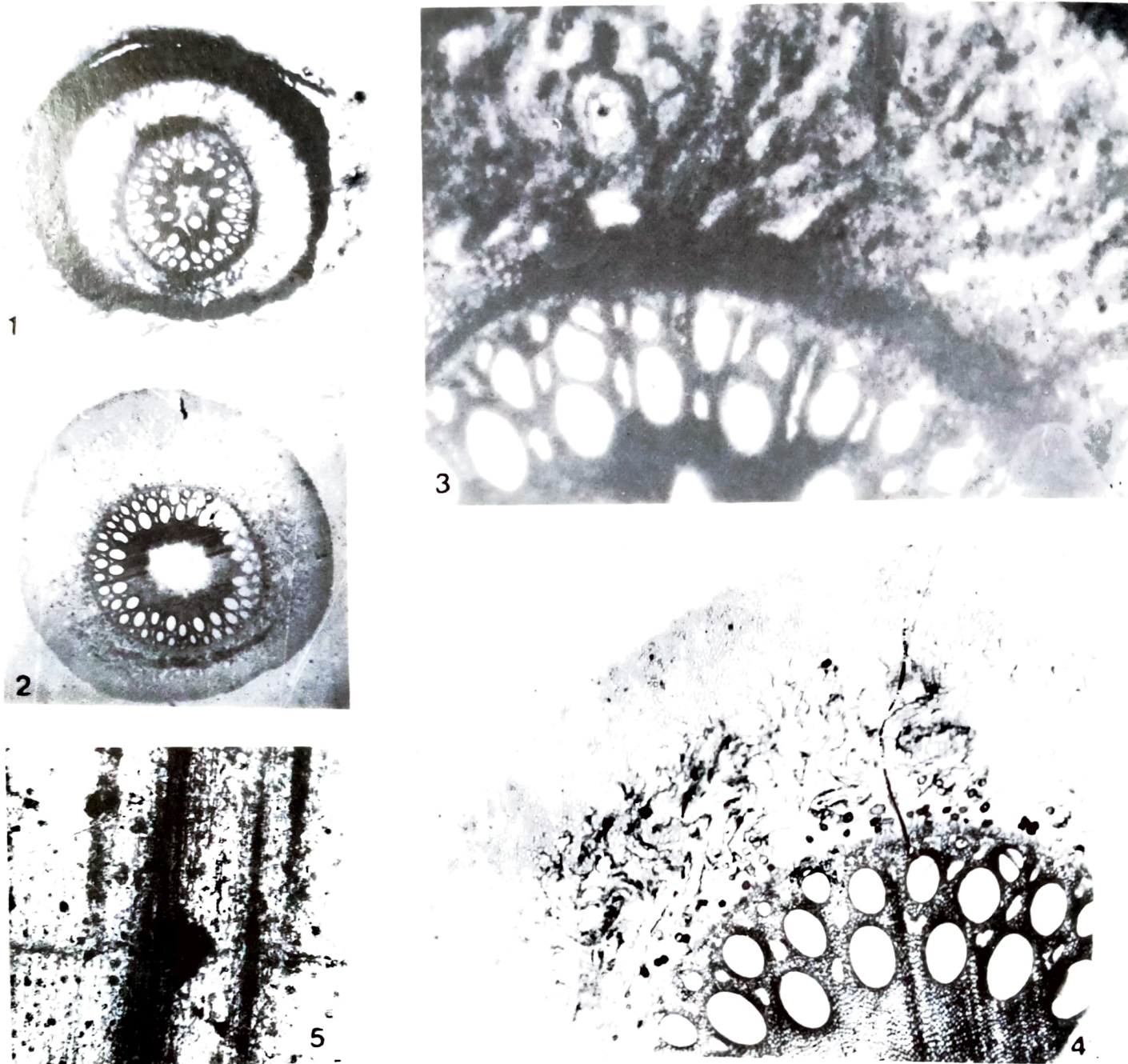


PLATE 1

1. *Rhizopalmoxyylon borassoides* sp. nov. - Cross section of the fossil root under low power. x 6; Slide no. BSIP 37417-I.
2. *Borassus flabellifer* - Cross section of the modern root in low power. x 4.5.
3. *Rhizopalmoxyylon borassoides* sp. nov. - A part of the fossil root under high power. x 105; Slide no. BSIP 37417-I
4. *Borassus flabellifer* - A part of the modern root in high power showing similar details. x 105.
5. *Rhizopalmoxyylon borassoides* sp. nov. - Tangential longitudinal section of the root showing simple perforation plates. x 40 Slide no. BSIP 37417-II.

PLATE 2

1. *Rhizopalmoxyylon borassoides* sp. nov. - Cross section of the fossil showing epiblema and hypodermis. x 105; Slide no. BSIP 37417-I.
2. *Rhizopalmoxyylon borassoides* sp. nov. - Cross section enlarged to show cells of hypodermis. x 125; Slide no. BSIP 37417-I
3. *Rhizopalmoxyylon borassoides* sp. nov. - Cross section enlarged to show cells of outer cortex. x 125; Slide no. BSIP 37417-I.
4. *Rhizopalmoxyylon borassoides* sp. nov. - Cross section enlarged to show air cavities. x 125; Slide no. BSIP 37417-I.
5. *Rhizopalmoxyylon borassoides* sp. nov. - Cross section enlarged to show inner cortex, endodermis pericycle and exarch xylem. x 125; Slide no. BSIP 37417-I.
6. *Rhizopalmoxyylon borassoides* sp. nov. - Pith region showing lacunae. x 125; Slide no. BSIP 37417-I.
7. *Borassus flabellifer* - Pith region showing lacunae. x 40.

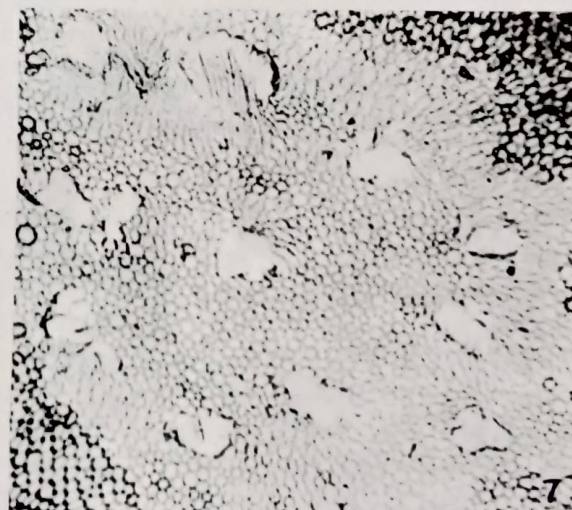
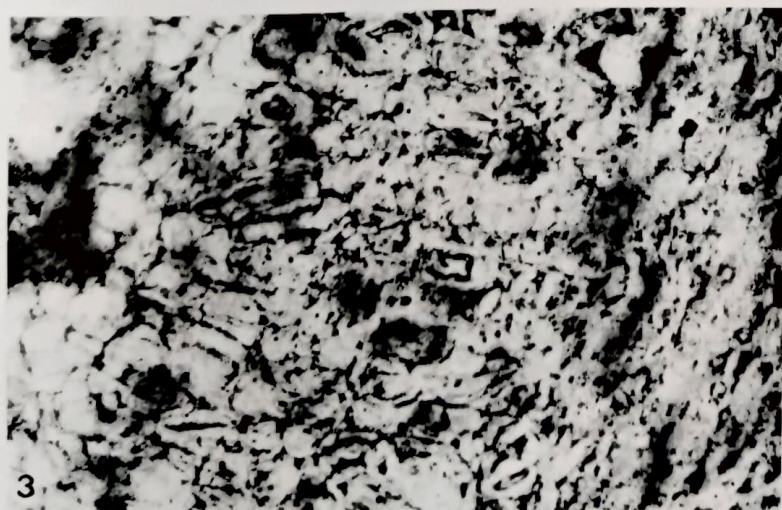
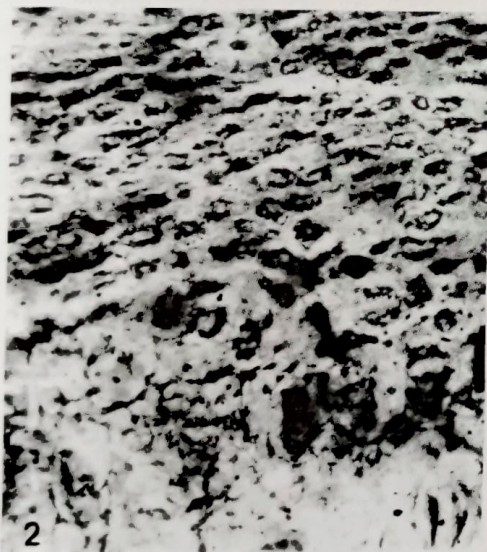
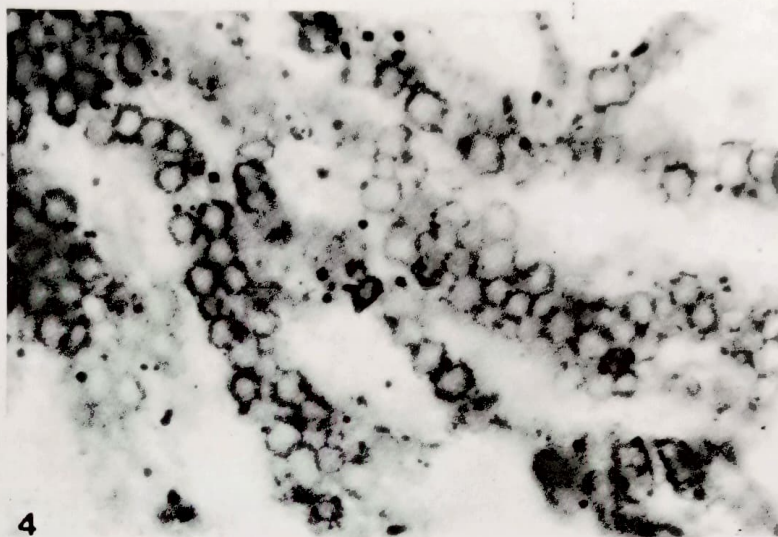
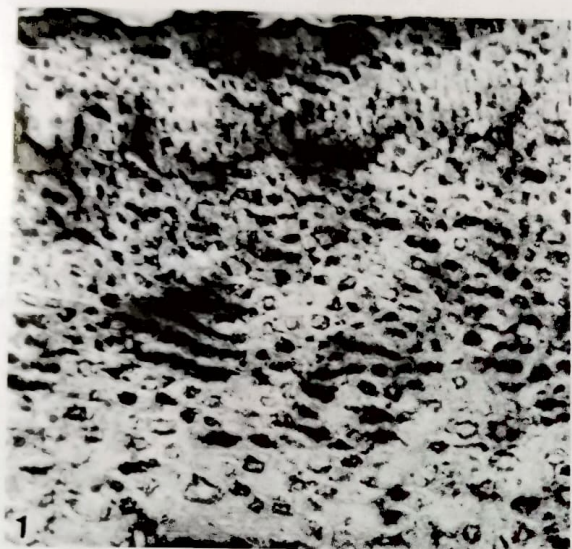


Plate 2

arranged, thin walled, round to oval, 30-55 μm in size. *Inner cortex* compact, made up of more than 10 layers, about 280 μm in radial thickness (Pl. 2, fig. 5); cells tangentially elongated, 15-120 μm in length and 20-40 μm in width, sometimes dark coloured deposits seen inside the cells. *Endodermis* single layered (Pl. 2, fig. 5); cells angular to barrel shaped, about 20 μm in size. *Pericycle* not well preserved; cells thin walled about 32 μm in size. *Stele* consisting of about 22-26 xylem strands arranged in 3 distinct rows (Pl. 1, fig. 3), protoxylem exarch; phloem not well preserved, patches seen alternating with xylem strands; vessels 160-360 μm in diameter with simple perforation plates (Pl. 1, fig. 5); ground mass or conjunctive tissue made up of thin-walled angular cells, measuring about, 20 μm in size. *Pith* made up of thin walled parenchymatous cells, about 1 mm in diameter, lacunae observed (Pl. 2, fig. 6).

Holotype- Specimen no. BSIP 37417.

Paratype- Specimen no. BSIP 37418.

Horizon- Deccan Intertrappean beds.

Locality- Nawargaon, Wardha District, Maharashtra.

Age- Late Cretaceous - Early Tertiary.

Affinities- The important characters of the fossil root are : hypodermis well developed; cortex divisible into 3 zones, middle cortex having air chambers, radial vascular bundles; protoxylem exarch, xylem strands 22-26, arranged in 3 concentric rings and pith small with a few lacunae. These indicate the affinity of the fossil with the roots of borassoid palms (Drabble, 1904; Mahabale & Udawadia, 1960; Tomlinson, 1961). However, the absence of fibres in the cortical region suggests its close similarity with that of the genus *Borassus* Linn. (Tomlinson, 1961). Among the species of *Borassus*, thin sections of the root of *B. flabellifer* Linn. (Herb. slide no. BSIP 2464) was available for comparison. This species shows some similarities with our fossil but differs in having lesser concentric rings of xylem strands (only 2) and slightly larger pith (Pl. 1, fig. 2; Pl. 2, fig. 7).

Felix (1883) instituted the genus *Rhizopalmoxyton* for naming the fossil palm roots. Since the present fossil root is identified as a borassoid palm, it can be placed under the same genus. From the Deccan Intertrappean beds of India Rode (1934) reported *R. penchiensis* from Mohgaonkalan, Chhindwara District. Unfortunately, the author did not give any description and photographs etc., hence it was treated as *nomen nudum* (Lakhanpal *et al.*, 1976). Sahnii (1964) also reported a number of palm roots without any description and illustrations. The only valid species of *R. hizopalmoxyton* from the Indian Tertiary sediments is *R. sundaram* Mahabale (Mahabale & Rao, 1973), which differs from

our fossil root mainly in the absence of air chambers. Besides, Ambwani (1981) also described a borassoid palm root from Nawargaon but did not assign it to any species. However, it differs from our fossil in a number of anatomical characters. The air chambers in our fossil root are arranged in 1-3 rows, xylem strands are 22-26 in three concentric rings and pith is 1mm wide without medullary bundles, where as in the already known species air chambers are arranged in 3-5 rows, xylem strands are 50-55 arranged in 2 concentric rings and pith is 2 mm wide with a few medullary bundles surrounded by a patch of sclerenchymatous cells. Our fossil also shows some resemblance with the roots described under *Palmoxyton surangei* Lakhanpal (1955), known from the Deccan Intertrappean beds of Mohgaonkalan, Chhindwara District, Madhya Pradesh. However, the latter differs in the absence of cortical fibrous bundles and medullary bundles. In view of this the present fossil is being described as *Rhizopalmoxyton borassoides* sp. nov., the specific name signifies its affinities with *Borassus* - like palm roots.

Borassus is a genus of about 7 species distributed in India, Madagascar, East Africa and Abyssinia. *B. flabellifer* with which our fossil shows some similarities, is found in northwest India and Andaman & Nicobar Islands. Immense groves of it are found on the Malabar coast and Coromandel coast. It also grows in Bengal, Sri Lanka and Myanmar especially near the sea coast (Blatter, 1926; Mahabale, 1982). Thus, the occurrence of *Borassus*, a coastal palm, provides an additional evidence for the presence of coastal conditions during the Deccan Intertrappean sedimentation and also supports the view that an arm of Tethys sea was extended upto central India during Deccan volcanism.

Critical comments on fossil roots of Eichhornia- While going through the fossil record we came across a root described as *Eichhornia* by Patil and Singh (1978) from the Deccan Intertrappean beds of Mohgaonkalan, Chhindwara District. They have described two types of roots and compared with that of *Eichhornia*, one having middle cortex of storied air chambers giving cob-web like appearance (Patil & Singh, 1978, Pl. 2, fig. 23) and the other showing large radially elongated air chambers extending from hypodermis to inner cortex (Patil & Singh, 1978, Pl. 2, fig. 17). The photograph of the modern root of *Eichhornia* given by the authors (Patil & Singh, 1978, Pl. 2, fig. 22) indicates that the fossil root of 1st type does not resemble it due to its characteristic pattern of air chambers. Though they have mentioned that radially elongated air chambers are developed in older roots due to the gradual disappearance of the terminal walls of air chambers of the cob-web type, yet their assump-

of air chambers of the cob-web type, yet their assumption is neither supported by any fact nor they have given any photograph of the older root of *Eichhornia* showing such features. In view of this the affinities of the above type of root are questionable and hence it needs reinvestigation.

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