

# *Rhizopalmoxyton macrorhizon* (Stenzel) Bonde et al. from the Deccan Intertrappean beds of Barbaspur, Dindori District, Madhya Pradesh, India

S. D. Bonde<sup>1</sup>, P. G. Gamre<sup>1</sup> and D. S. Nipunage<sup>2</sup>

<sup>1</sup>Agharkar Research Institute, G. G. Agarkar Road, Pune-411004, India

<sup>2</sup>K. M. C. College, Khopoli-410203, Raigad District, India

E-mail: bondesd@rediffmail.com; pggamre97@rediffmail.com; nipunageds@gmail.com

## ABSTRACT

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*Rhizopalmoxyton macrorhizon* (Stenzel) Bonde et al. is a large sized permineralized adventitious palm root described here from the Deccan Intertrappean beds of Barbaspur, Dindori District, Madhya Pradesh. The root is characterized with wide extrastelar and narrow vascular regions. The cortical region consists of single layered rhizodermis, 4-6 celled thick exodermis, thin outer and very wide inner cortex divisible into outer, middle and inner zones. The vascular region is narrow having a single layered pericycle, thick sclerotic zone embedding large number of xylem and phloem bundles enclosing small heterocellular pith with medullary bundles. The endodermis is characterized by Russow's 'C' type of thickenings. Many layered exodermis with thick-walled tanniferous cells, thick-walled one layered outer cortex, abundance of fibre cells and fibre bundles in the inner cortex and 1-3 medullary bundles suggest its affinity with coryphoid palms, especially *Corypha umbraculifera* L.

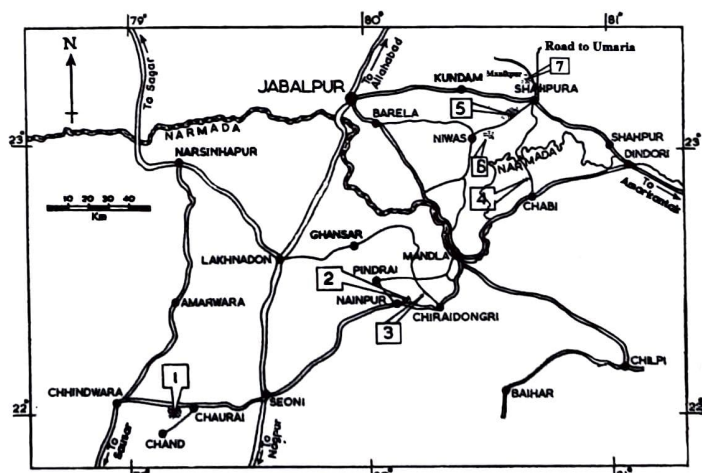
**Key-words:** Arecaceae, *Rhizopalmoxyton*, Deccan Intertrappean beds, Maastrichtian.

## INTRODUCTION

Permineralized remains belonging to the family Arecaceae (Palmae) from the Deccan Intertrappean beds of India have been described as stem (*Palmoxylon* Schenk), root (*Rhizopalmoxyton* Gothan), petiole (*Sabalocaulon* Trivedi & Verma, *Parapalmocaulon* Bonde, *Phoenicicaulon* Bonde et al.), lamina (*Sabalophyllum* Bonde), inflorescence axis (*Palmostroboxylon* Biradar & Bonde, *Arecoideostrobus* Bonde), fruits and seeds (*Palmocarpon* Miquel, *Nipadites* Bowerbank, *Hyphaeneocarpon* Bande et al., *Cocos intertrappeansis* Patil & Upadhye, *Areca intertrappea* Senad & Paradkar, *Eugeissonocarpon* Shinde & Kulkarni, *Arecoidocarpon* Bonde) and flower (*Deccananthus savitrii* Chitale & Kate) (Bonde 2008).

## MATERIAL AND METHOD

A piece of chert, 20 cm long and 16 x 7 cm wide, embodying compactly placed roots and minute rootlets was collected from the Deccan Intertrappean beds of



Text-figure 1. Deccan Intertrappean fossiliferous localities around Mandla, Madhya Pradesh. (1) Mohgaon Kalan, (2) Samnapur, (3) Mohgaon (4) Parapani, (5) Ghughua, (6) Umaria, (7) Barbaspur

Barbaspur in Dindori District, Madhya Pradesh (Text-figure 1).

The material has been studied by preparing thin sections using the usual ground thin section method employed for silicified material. The sections were observed under Nikon Labophot-2 microscope attached with Fx-35 DX camera and Leica S6D microscope along with Canon Powershot S45 digital camera. The description has been given as per the system recently proposed by Bonde (2009) for the resolution of fossil monocotyledonous roots to the natural taxa.

### SYSTEMATIC DESCRIPTION

Family: *Arecaceae*

Genus: *Rhizopalmoxyton* Gothan 1942

*Rhizopalmoxyton macrorhizon* (Stenzel) Bonde et al. 2009

Plate 1, figures 1-4; Plate 2, figures 1-5

The root wood exhibits adventitious roots and rootlets of various sizes and shapes (Plate 1, figures 1-2, Plate 2, figure 2). Rhizodermis single layered without any appendages and composed of rectangular thick-walled cells, 22x22  $\mu\text{m}$  in size. Exodermis is 5-8 layered and 300-400  $\mu\text{m}$  wide with tanniferous cells. Cells polygonal, compactly arranged without intercellular spaces. Cortex is divisible into two regions. Outer cortex is single-zoned, 300-450  $\mu\text{m}$  wide and made up of compactly arranged polygonal thick-walled cells with very small intercellular spaces. Inner cortex is very wide occupying almost two third width of the cortex. It is divisible into three zones. Outer zone is 220-350  $\mu\text{m}$  wide, composed of small thin-walled cells having small intercellular spaces. Its cells are 22 x 35  $\mu\text{m}$  in size. Middle zone is 1100-1500  $\mu\text{m}$  wide and its cells are radially elongated forming large intercellular spaces. Air cavities are radially elongated, arranged in 8-13 radial rows. These air cavities are bounded by one to two layered parenchymatous diaphragms. The inner zone is 5-8 celled (250-300  $\mu\text{m}$ ) wide and its cells are 30 x 40  $\mu\text{m}$  in size and are arranged in 3-7 concentric rings with small intercellular spaces. Fibre cells and fibre bundles are frequent. Endodermis single layered without

any passage cells. It is having characteristic Russow's 'C' type thickening (Plate 1, figures 3-4). Pericycle is the outermost layer of the stele. It is single layered and made up of tangentially elongated thin-walled cells of 15 x 30  $\mu\text{m}$  size. Inside the pericycle is a sclerotic ring enclosing 17-25 xylem (90x180 - 110x180  $\mu\text{m}$ ) and phloem (90 x 110 - 110 x 110  $\mu\text{m}$ ) bundles alternate to each other (Plate 2, figure 1). Pith is small 270-670  $\mu\text{m}$  in diameter and is enclosed in the sclerotic ring. It is heterocellular with small intercellular spaces. In older roots the pith is represented by a cavity. Medullary bundles are 1-3, measuring 90 x 180 - 110 x 180  $\mu\text{m}$ . The cortical cells in the longitudinal section are arranged in vertical rows (Plate 2, figure 3). Sclerotic cells are abundant in the cortical and pith regions. Vessels possess 6-9 bars in the endplate (Plate 2, figures 4-5). Smaller rootlets measuring 110-220  $\mu\text{m}$  in diameter are abundant in the chert matrix. They are characterized with a rhizodermis without hairs, cortex with large air spaces in rings and poorly developed stele (Plate 2, figure 2).

### COMPARISON AND DISCUSSION

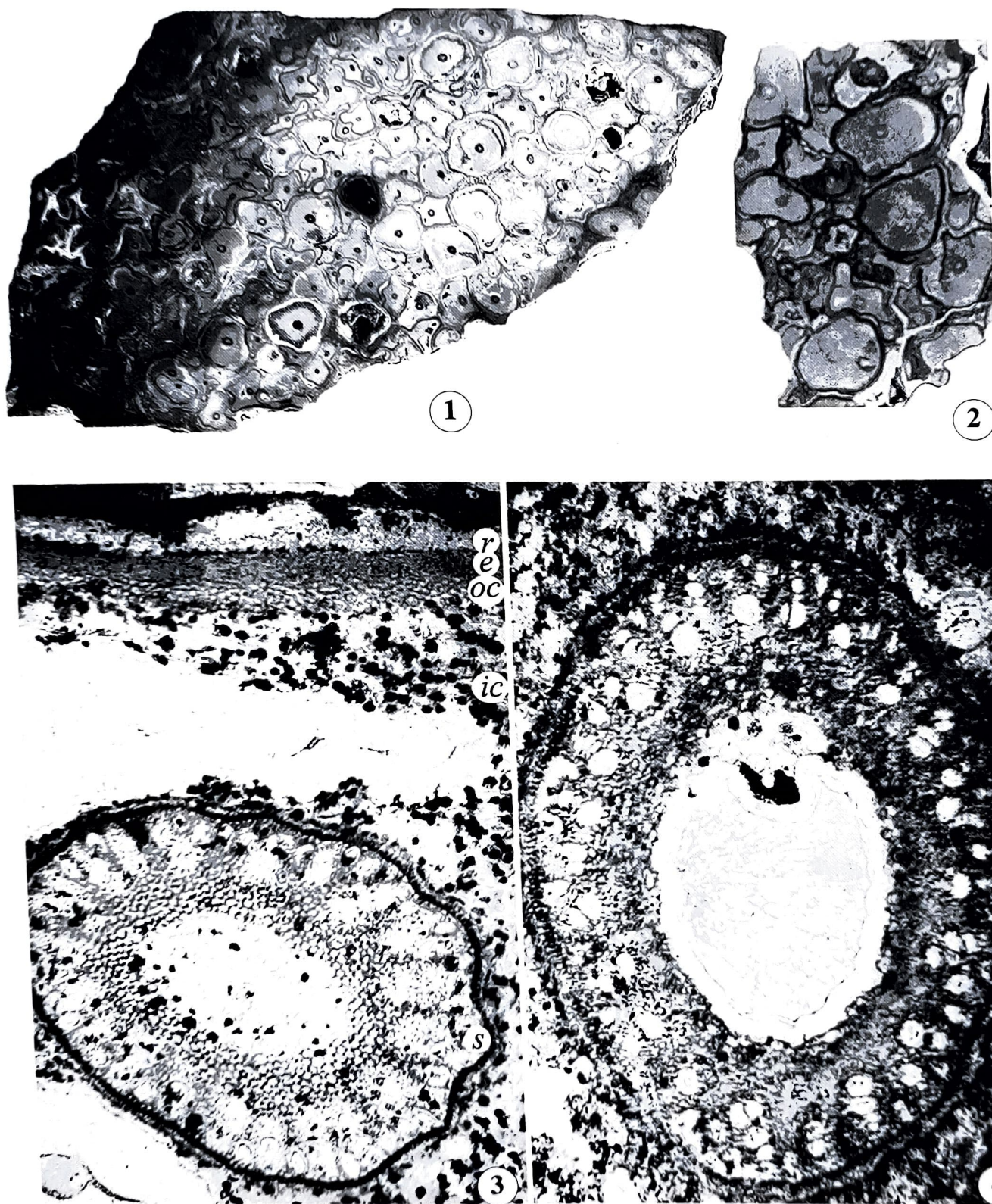
The characteristic features of the present root are wide cortex, inner cortex with elongated air spaces in 7-9 concentric rings, 17-25 xylem bundles alternating with phloem bundles, presence of medullary bundles and abundance of sclerotic cells and silica depositions. These suggest their affinity with the family *Arecaceae* (Mohl 1845, 1849, Mahabale & Udwardia 1960, Seubert 1996a, b, 1997, 1998a, b).

The fossil root has been compared with the extant palms. Many layered exodermis with thick walled tanniferous cells, one layered outer cortex with thick walled cells and fibre bundles in the inner cortex suggest its closest resemblance with *Corypha umbraculifera* L. (Mahabale & Udwardia 1960, Seubert 1997).

The anatomical characters of the present fossil root resemble with those of *Rhizopalmoxyton macrorhizon* (Stenzel) Bonde et al. (2009) described from the Tertiary of Germany and hence it is placed in the same species. The species exhibits affinity with the roots of *Corypha umbraculifera* L.

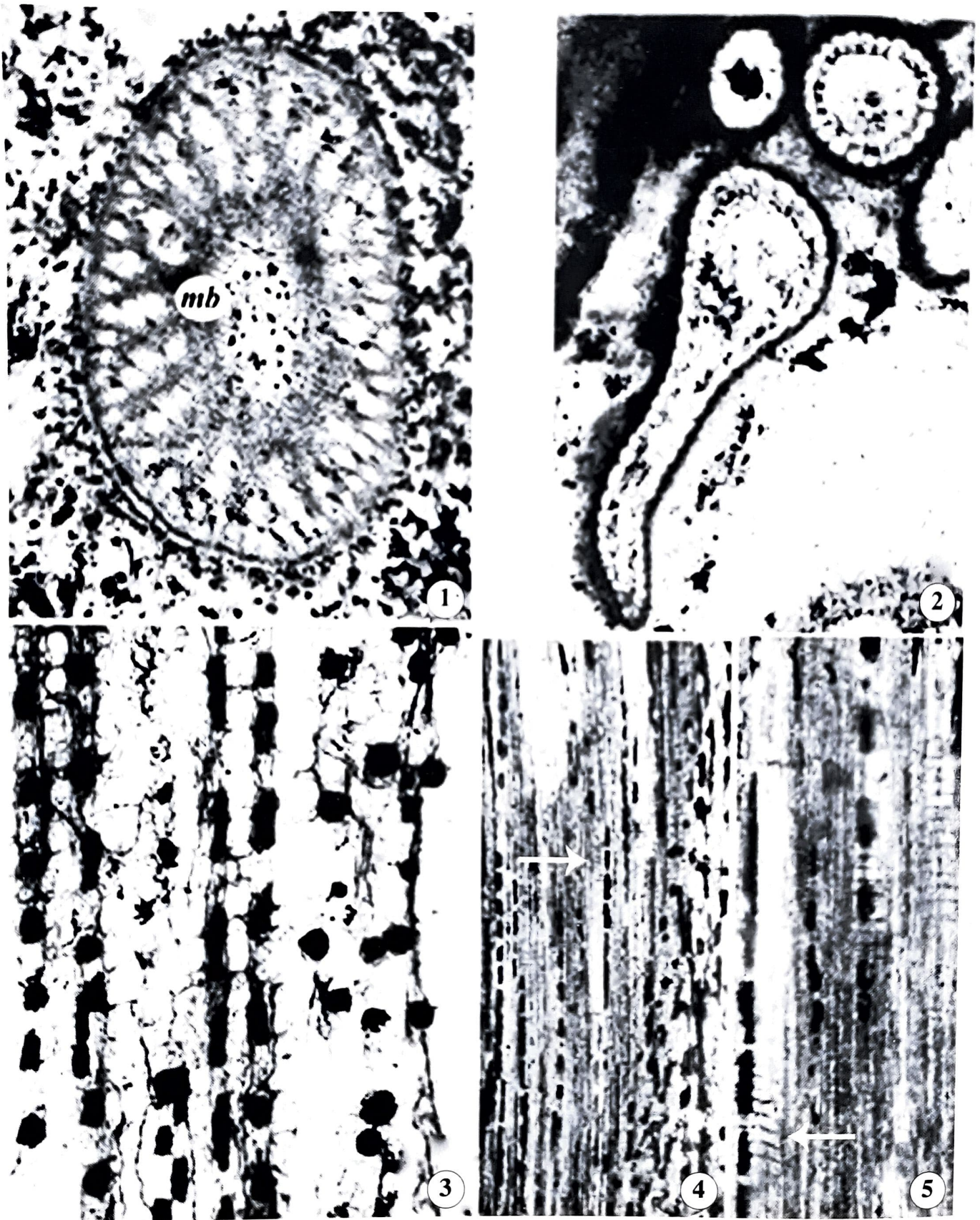
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**Plate 1**

*Rhizopalmoxylon macrorhizon* (Stenzel) Bonde et al. 1. Transverse section of chert showing compact arrangement of adventitious roots, x0.85. 2. The same, chert showing matured roots and young rootlets, x1.5. 3. T.S. of young root showing rhizodermis-r, exodermis-e, outer cortex-oc, inner cortex-ic and stele-s, x50. 4. The same, showing sclerotic ring with xylem and phloem bundles and pith, x60.



### Plate 2

*Rhizopalmoxylon macrorrhizon* (Stenzel) Bonde et al. 1. T.S. of stele of mature root showing medullary bundles-*mb*, x60. 2. T.S. of rootlets showing poorly developed cortex and stele, x175. 3. L.S. showing radial arrangement of ground parenchyma: Note the dark depositions in some cells, x60. 4-5. L.S. showing vessel length. Note the endplate with many bars, x175.

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