

---

# *Arecoidocarpon kulkarnii* gen. et sp. nov., an arecoid palm fruit from Mohgaon Kalan, Madhya Pradesh

S. D. Bonde

---

Bonde, S. D. 1990. *Arecoidocarpon kulkarnii* gen. et sp. nov., an arecoid palm fruit from Mohgaon Kalan, Madhya Pradesh. In: Jain, K. P. & Tiwari, R. S. (eds)—*Proc. Symp. 'Vistas in Indian Palaeobotany'*, *Palaeobotanist*, **38** : 212-216.

The paper describes a petrified palm fruit embedded in a chert from Mohgaonkalan, District Chhindwada, Madhya Pradesh. It is a single-seeded, ovoid drupe, whose wall is characterized by a thin epicarp, fibrous mesocarp and hard endocarp. Fibre-fibrovascular bundles and brachysclereides are restricted to the inner layers of the pericarp. Endosperm is homogeneous, covered with two-layered seed coat, the outer one with reduced vascular strands and inner with tanniferous material. Embryo is apical and a shallow chalazal groove is protruding in the seed. Its affinity is suggested with non-ruminate arecoid palms.

**Key-words**—Megafossil, Palm fruit, Deccan Intertrappean beds (India).

S. D. Bonde, Department of Botany, Maharashtra Association for the Cultivation of Science, Law College Road, Pune 411 004.

## सारांश

मध्य प्रदेश में मोहगांवकलाँ से एक अरेकॉयडी ताड़ फल : अरेकॉयडीकार्पन कुलकर्णीई नव प्रजाति व जाति

एस० डी० बोंडे

मध्य प्रदेश में छिंदवाड़ा जनपद में मोहगांवकलाँ से एकत्र एक रामसैकाशम से एक अशमीभूत ताड़ फल का वर्णन किया गया है। यह एक बीज वाला अंडाकार बदरी फल है जिसकी भित्ति पतली बाह्यफलभित्ति, रेशोदार मध्यफलभित्ति तथा कठोर अन्तःफलभित्ति से अभिलक्षित है। ये तन्तुवाही बंडल एवं ब्रेकिस्क्लेरीड फलभित्ति की अन्तस्थ तहों तक सीमित हैं। भ्रूणपोष समांगी तथा बीजचोल की दो तहों से ढका हुआ है। बाहरी तह में कम वाली बंडल हैं तथा अन्दर वाली तह टैनिनमय पदार्थ से युक्त है। भ्रूण अगस्थ है तथा बीज में एक हल्का सा छाँचा विद्यमान है। इस अशिमत फल की अरुमिनेट अरेकॉयडी ताड़ों से सजातीयता प्रस्तावित की गई है।

PALM fruits from India have been described by Bande *et al.* (1982), Chitale (1960, 1960a), Chitale and Nambudiri (1969), Kaul (1951), Lakanpal (1952), Mahabale (1950), Mehrotra (1987), Nambudiri (1966), Patil and Upadhye (1983), Prakash (1954, 1960), Rode (1933), Sahni (1937), Shete and Kulkarni (1985) and Trivedi and Chandra (1971). They have been assigned to *Cocos*, *Hyphaeneocarpon*, *Nypa* (*Nipa*, *Nipadites*) showing affinities with extant genera *Cocos*, *Hyphaene* and *Nypa*, respectively. However, a large number of fruit specimens, whose affinities are not clearly understood, are assigned to form genus *Palmocarpon* Miquel.

A single specimen found embedded in a reddish-brown chert in the Intertrappean Bed at

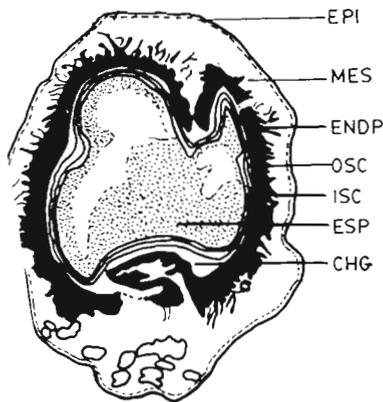
Mohgaonkalan, district Chhindwara, Madhya Pradesh, has been studied. The specimen was examined by usual thin-ground method. The preservation was found to be excellent showing all the essential anatomical characters, enabling its identification.

## SYSTEMATIC DESCRIPTION

**Family—Palmae (Arecaceae)**

**Genus—*Arecoidocarpon* gen. nov.**

**Diagnosis**—Drupe unilocular, single seeded; pericarp thick, characterised by thin epicarp, fibrous mesocarp and hard endocarp; fibre-fibrovascular bundles and brachysclereides restricted to inner fruit wall layers; seed solitary, seed-coat two-zoned,



**Text-figure 1**—*Arecoidocarpum kulkarnii* gen. et sp. nov.—A longitudinal section of the fruit showing EPI-epicarp, MES-mesocarp, ENDP-endocarp, OSC-outer seed coat, ISC-inner seed coat, ESP-endosperm, and CHG-chalazal groove  $\times 1.5$ .

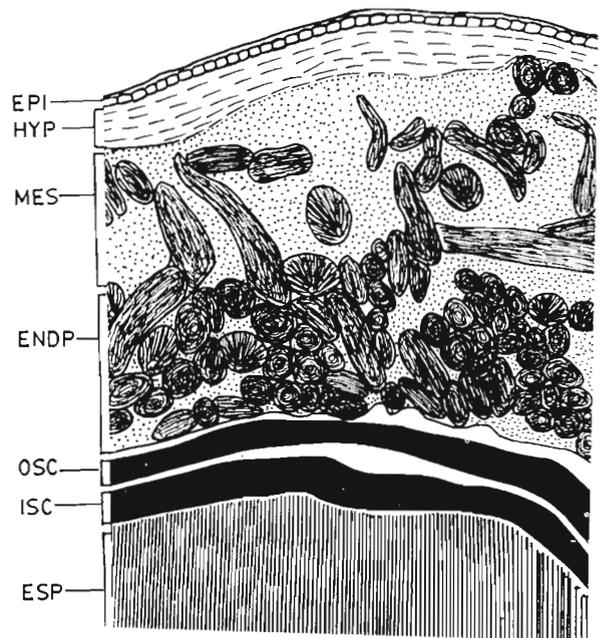
outer with reduced vascular strands, inner with tanniferous material; endosperm homogeneous or ruminant; chalazal groove shallow, irregular.

Type species—*Arecoidocarpum kulkarnii* sp. nov.

*Arecoidocarpum kulkarnii* gen. et sp. nov.  
Pl. 1, figs 1-4; Text-figs 1, 2

**Diagnosis**—A unilocular single-seeded, ovoid drupe; pericarp thick, divisible into epicarp, mesocarp and endocarp; epicarp 90-180  $\mu\text{m}$  thick. Epidermis single-layered, made up of rectangular to cubical cells; hypodermis 4-6 layered with squarish to rectangular compact cells. Mesocarp thick, with fibre-fibrovascular bundles and brachysclereides. Ground tissue parenchymatous with rectangular cells. Endocarp hard, with 5-6 rows of compact arrangement of fibre-fibrovascular bundles and brachysclereides with intermittent islets of thick-walled parenchyma. Locular epidermis made up of sclerotic-palisade cells. Seed solitary. Seed coat two-layered; outer 63-76  $\mu\text{m}$  wide, made up of thick-walled, rectangular, pitted cells traversed by a ring of reduced vascular strands; inner seed coat 63-85  $\mu\text{m}$  wide, made up of thick-walled, rectangular cells filled with tanniferous material. Endosperm homogeneous. Embryo cylindrical, apical. Shallow groove present at chalazal region.

**Description**—Fruit single seeded, ovoid drupe with rounded apex (Text-fig. 1; Pl. 1, figs 1, 2), 1.65 cm long and 1.2 cm wide. Persistent structures like perianth not observed at the base. Fruit wall 1520-2170  $\mu\text{m}$  thick, 5580  $\mu\text{m}$  thick at the chalazal region; differentiated into thin epicarp, fibrous mesocarp and hard endocarp. Epicarp 90-180  $\mu\text{m}$  thick,



**Text-figure 2**—*Arecoidocarpum kulkarnii* gen. et sp. nov.—A portion of the fruit magnified to show EPI-epidermis, HYP-hypodermis, MES-mesocarp, ENDP-endocarp, OSC-outer seed coat, ISC-inner seed coat, and ESP-endosperm  $\times 25$

comprising a single layered epidermis made up of rectangular to cubical ( $13 \times 17 \mu\text{m}$ ) cells, covered with a thick cuticular layer and a 4-6 layered hypodermis. Hypodermal cells squarish to rectangular and compactly arranged. Mesocarp 900-1200  $\mu\text{m}$  thick, composed of fibre bundles, fibrovascular bundles, brachysclereides in the thin-walled rectangular, parenchymatous cells. Fibre bundles  $108 \times 126-162 \times 198 \mu\text{m}$  in size and rounded to elongated in shape. Fibrovascular bundles  $198 \times 234-288 \times 396 \mu\text{m}$ , elongated to spindle-shaped with reduced vascular elements. Stegmata abundant. Endocarp very hard, 625-800  $\mu\text{m}$  thick consisting of 5-6 rows of compactly arranged fibre-fibrovascular bundles and brachysclereides. Islets of thick-walled ground parenchyma cells present intermittently in this layer. Locular epidermis made up of sclerotic-palisade cells. Tanniferous cells and raphide sacs present in all the three layers of the fruit wall (Text-figs 1, 2; Pl. 1, figs 1-3). Seed elongated,  $11 \times 9 \text{ mm}$ , occupying entire fruit cavity except basal region; completely filled with endosperm tissue and covered with two-layered seed coat (Text-fig. 2; Pl. 1, figs 3-4). Outer seed coat layer 63-76  $\mu\text{m}$  thick, consisting of compactly arranged thick-walled, rectangular, pitted cells, traversed by a ring of reduced vascular strands (Pl. 1, fig. 4). Inner seed coat as thick as the outer layer, 63-85  $\mu\text{m}$ , with

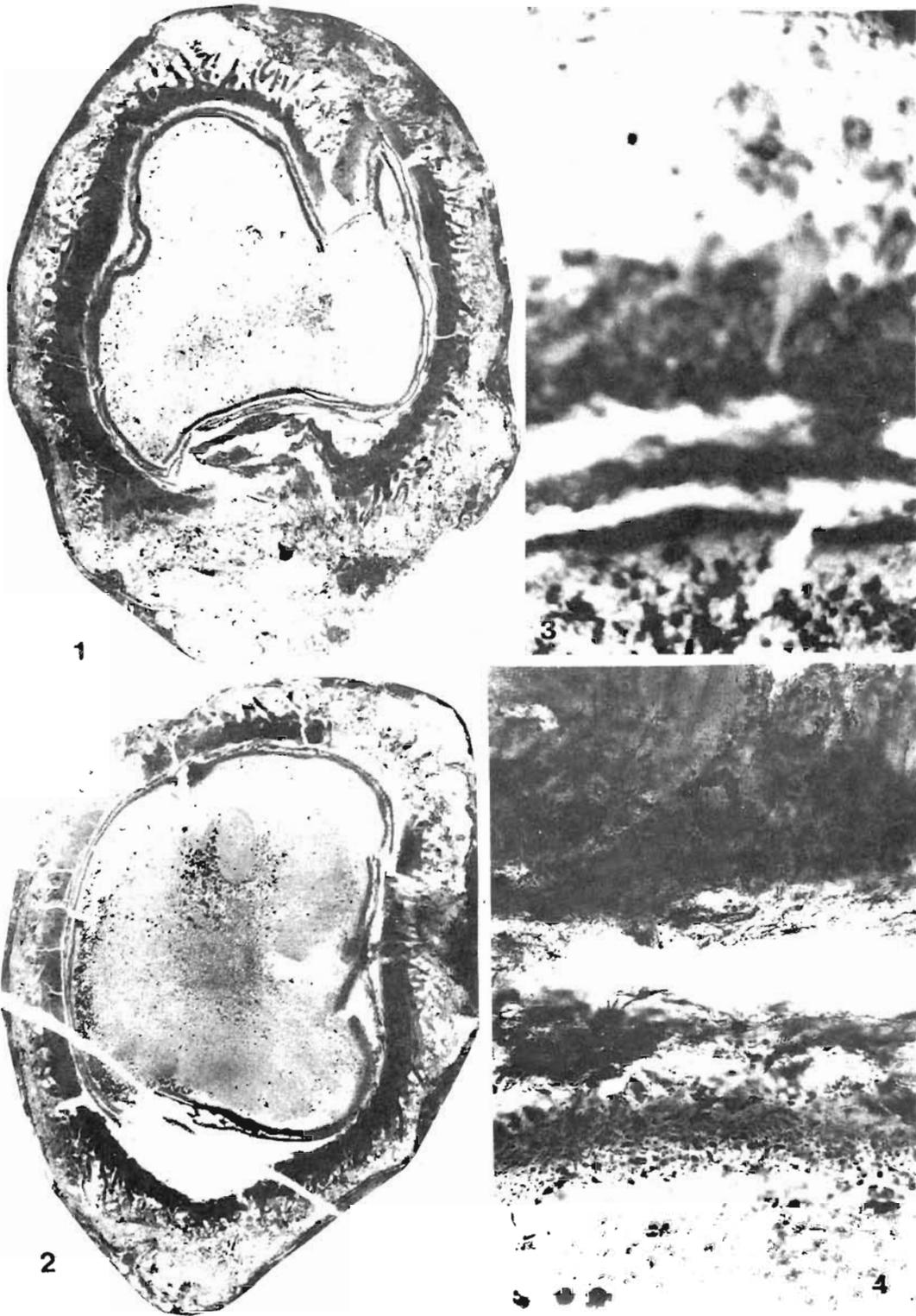


PLATE 1

compact arrangement of thick-walled, rectangular cells filled with tanniferous material. Endosperm homogeneous (non-ruminate), having 1-2 layers of outer squarish to rectangular cells. Radial files of inner cells converging into the centre of the seed (Pl. 1, figs 1-2). Cells thick-walled, reserve food material obscure. Embryo cylindrical,  $1875 \times 1000 \mu\text{m}$  in size with oval to elongated  $12.6 \times 21 \mu\text{m}$  cells, being present at the apical region of the seed (Pl. 1, fig. 2). A shallow groove present at the chalazal region (Text-fig. 1; Pl. 1, fig. 1).

*Holotype*—Pl. 1, fig. 1; Slide nos. MK-26, MK-27, MK-28, Department of Botany, M.A.C.S. Research Institute, Pune.

*Type locality*—Mohgaonkalan, district Chhindwada, Madhya Pradesh, India.

*Type horizon*—Deccan Intertrappean beds.

*Age*—Early Eocene.

### DISCUSSION

The important characters of the present fruit are, (i) single seeded ovoid drupe, (ii) fruit wall differentiated into thin epicarp, fibrous mesocarp and hard endocarp, (iii) fibre-fibrovacular bundles and brachysclereides restricted to mesocarp and endocarp layers, (iv) locular epidermis made up of tangentially elongated sclerotic cells, (v) two-layered seed coat, outer with pitted cells and reduced vascular strands and inner with tanniferous cells, (vi) homogeneous endosperm, and (vii) shallow chalazal groove. These characters suggest its affinity with Arecoid group of palms.

*Comparison with living palms*—Guerin (1949), Murray (1973), Essig (1977), Essig and Young (1979), Padmanabhan and Regupathy (1981), Kulkarni and Pande (1983) and Reddy and Kulkarni (1985) have studied the anatomy of extant Arecoid palm fruits.

There are 760 species belonging to 88 genera in the Arecoid palms (Moore, 1973). Fibrovacular bundles with thick fibrous sheath, hard endocarp composed of fibre bundles and brachysclereides, irregular shallow chalazal groove and homogeneous endosperm suggest the affinity of presently

described fruit with non-ruminate Arecoid palms, like *Areca triandra*, *Chrysalidocarpus*, *Rhopalostylis*, *Veitchia* and *Ptychosperma*. *Areca triandra* and *Chrysalidocarpus* species possess a sclerotic cylinder in the mesocarp formed by sclereides and brachysclereides. In *Rhopalostylis*, fibre bundles in the mesocarp are arranged in 2-3 concentric rows and the outer seed coat is massive. *Veitchia* and *Ptychosperma* differ from the fossil in having fibre bundles in the epicarp. Moreover, the seed in *Ptychosperma* is angular.

*Comparison with fossil palms*—The only palm fruit so far considered to bear any resemblance with the extant genus *Areca* or Arecoid palms is *Palmocarpum arecoides* Mehrotra 1987, however, the structure of seed coat, an important character to decide affinity with *Areca*, or with any other Arecoid palm, is not observed in the latter. Moreover, it does not show compact arrangement of fibre-fibrovacular bundles constituting hard endocarp. Beside this, nothing is known about the endosperm in *P. arecoides*. Therefore, *P. arecoides* cannot be considered to be a fruit of *Areca* or even any other Arecoid palm.

### ACKNOWLEDGEMENT

The author is thankful to Professor A. R. Kulkarni, University of Bombay for going through the slides and helpful suggestions. He is also thankful for making available his collection of anatomical preparations of extant palm fruits.

### REFERENCES

- Bande, M. B., Prakash, U. & Ambwani, K. 1982. A fossil palm fruit *Hyphaeneocarpon indicum* gen. et sp. nov. from the Deccan Intertrappean beds, India. *Palaeobotanist* **30** (3) : 303-309.
- Chitale, S. D. 1960. A new specimen of *Nipa* fruit from Mohgaon cherts. *Nature* **186** : 495.
- Chitale, S. D. 1960a. *Nipa* fruit from the Deccan Intertrappeans of India. *Bull. bot. Soc., Nagpur* **1** : 31-35.
- Chitale, S. D. & Nambudiri, E. M. V. 1969. Anatomical studies of *Nypa* fruits from Deccan Intertrappean beds of India. *Monograph: Recent advances in the anatomy of tropical seed plants* : 235-248, Delhi.

### PLATE 1

*Arecoidocarpon kulkarnii* gen. et sp. nov.

- 1 Longitudinal section of fruit showing single seed, two-layered seed coat and fruit wall. Shallow groove is seen at the basal region of the seed  $\times 6$ .
- 2 Longitudinal section of fruit showing small cylindrical embryo

at the apical region and chalazal groove at the base of the seed  $\times 6$ .

- 3 Longitudinal section showing epicarp, mesocarp, endocarp, two layered seed coat and endosperm  $\times 30$ .
- 4 Longitudinal section showing outer seed coat with group of reduced vascular strands in the outer seed coat layer  $\times 92$ .

- Essig, F. B. 1977. A systematic histological study of palm fruits-I. The *Ptychosperma* alliance. *Syst. bot.* **2** : 151-168.
- Essig, F. B. & Young, B. E. 1979. A systematic histological study of palm fruits-II. The *Areca* alliance. *Syst. Bot.* **4** : 16-28.
- Guerin, H. P. 1949. Contribution a l'etude du fruit et de la graine des palmiers. *Ann. des. Sci. Nat. Bot.*, 11 ser. **10** : 21-69.
- Kaul, K. N. 1951. A palm fruit from Kapurdi (Jodhpur, Rajasthan desert): *Cocos sabnii* sp. nov. *Curr. Sci.* **20** : 138.
- Kulkarni, A. R. & Pandey, S. B. 1983. Trends of organization of the endocarp in palm fruits. in : Sharma, A. K. *et al* (eds)—*Evolutionary botany & biostratigraphy* (A. K. Ghosh Comm. Vol.) : 185-193, Calcutta.
- Lakhanpal, R. N. 1952. *Nypa sabnii*, a palm fruit in the Tertiary of Assam. *Palaebotanist* **1** : 289-294.
- Mahabale, T. S. 1950. Central provinces, Mohgaonkalan (Chhindwara District), in : *Palaebotany in India—VII. J. Indian bot. Soc.* **29** : 31-33.
- Mehrotra, R. C. 1987. Some new palm fruits from the Deccan Intertrappean beds of Mandla District, Madhya Pradesh. *Geophytology* **17** (2) : 204-208.
- Moore, H. E. 1973. The major groups of palms and their distribution. *Gentes Herb.* **11** (2) : 27-140.
- Murray, S. G. 1973. The formation of endocarp in palm fruits. *Principes* **17** : 91-102.
- Nambudiri, E. M. V. 1966. More *Nypa* fruits from the Deccan Intertrappean beds of Mohgaonkalan. *Curr. Sci.* **35** : 421-422.
- Padmanabhan, D. & Regupathy, D. 1981. Studies on *Bentinckia condapanna*-I. The fruit and seed. *Principes* **25** : 172-177.
- Patil, G. V. & Upadhye, E. V. 1983. *Cocos*-like fruit from Mohgaonkalan and its significance, towards the stratigraphy of Mohgaonkalan Intertrappean beds. in : Sharma, A. K. *et al.* (eds)—*Evolutionary & Biostratigraphy* (A. K. Ghosh Comm. Vol.) : 541-554, Calcutta.
- Prakash, U. 1954. *Palmocarpon mohgaense* sp. nov., a palm fruit from the Deccan Intertrappean Series, India. *Palaebotanist* **3** : 91-96.
- Prakash, U. 1960. On two palm fruits from the Deccan Intertrappean beds of Mohgaonkalan. *Curr. Sci.* **29** : 20-21.
- Reddy, G. N. & Kulkarni, A. R. 1985. Contribution to the anatomy of palm fruits—Arecoid palms. *Phytomorphology* **35** (1-2) : 25-33.
- Rode, K. P. 1933. A note on fossil angiospermous fruits from the Deccan Intertrappean beds of central provinces. *Curr. Sci.* **2** : 171-172.
- Sahni, B. 1937. Fossil plants from Mohgaonkalan. (In: Fossil plants from the Intertrappean beds of Mohgaonkalan, in the Deccan, with a sketch of the geology of the Chhindwara District by B. Sahni & K. P. Rode). *Proc. natn. Acad. Sci. India* **7** (3) : 165-174.
- Shete, R. H. & Kulkarni, A. R. 1985. *Palmocarpon coryphoidum* sp. nov., a Coryphoid palm fruit from the Deccan Intertrappean beds of Wardha District, Maharashtra. *J. Indian bot. Soc.* **64** : 45-50.
- Trivedi, B. S. & Chandra, R. 1971. *Palmocarpon splendidum* sp. nov. from the Deccan Intertrappean beds of Mohgaonkalan, Chhindwara District, Madhya Pradesh. *Palaebotanist* **20** : 339-343.