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Cocos nucifera like petrified fruit from the Tertiary of Amarkantak, M.P., India

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ABSTRACT

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Description is given of a petrified coconut like fruit measuring 13 x 10 x 6 cm collected from the Tertiary sediments of Amarkantak (M.P.), India. The fruit wall is thick differentiated into a narrow epicarp, a wide fibrous mesocarp and a sclerosed thick endocarp. Seed coat is 3-4 cells thick, adhered to or free from the endocarp. The pulp or endosperm of the seed is made of loosely arranged thin walled parenchyma. This is the first report of a *C. nucifera* like petrified fruit from India.

Key-words—Petrified, Coconut, Fruit, Tertiary, India.

सारांश

भारत के मध्य प्रदेश राज्य के अमरकंटक नामक स्थान से प्राप्त टर्शियरीयुगीन *कोकस न्यूसीफ़ेरा* की भाँति के अश्मित फल

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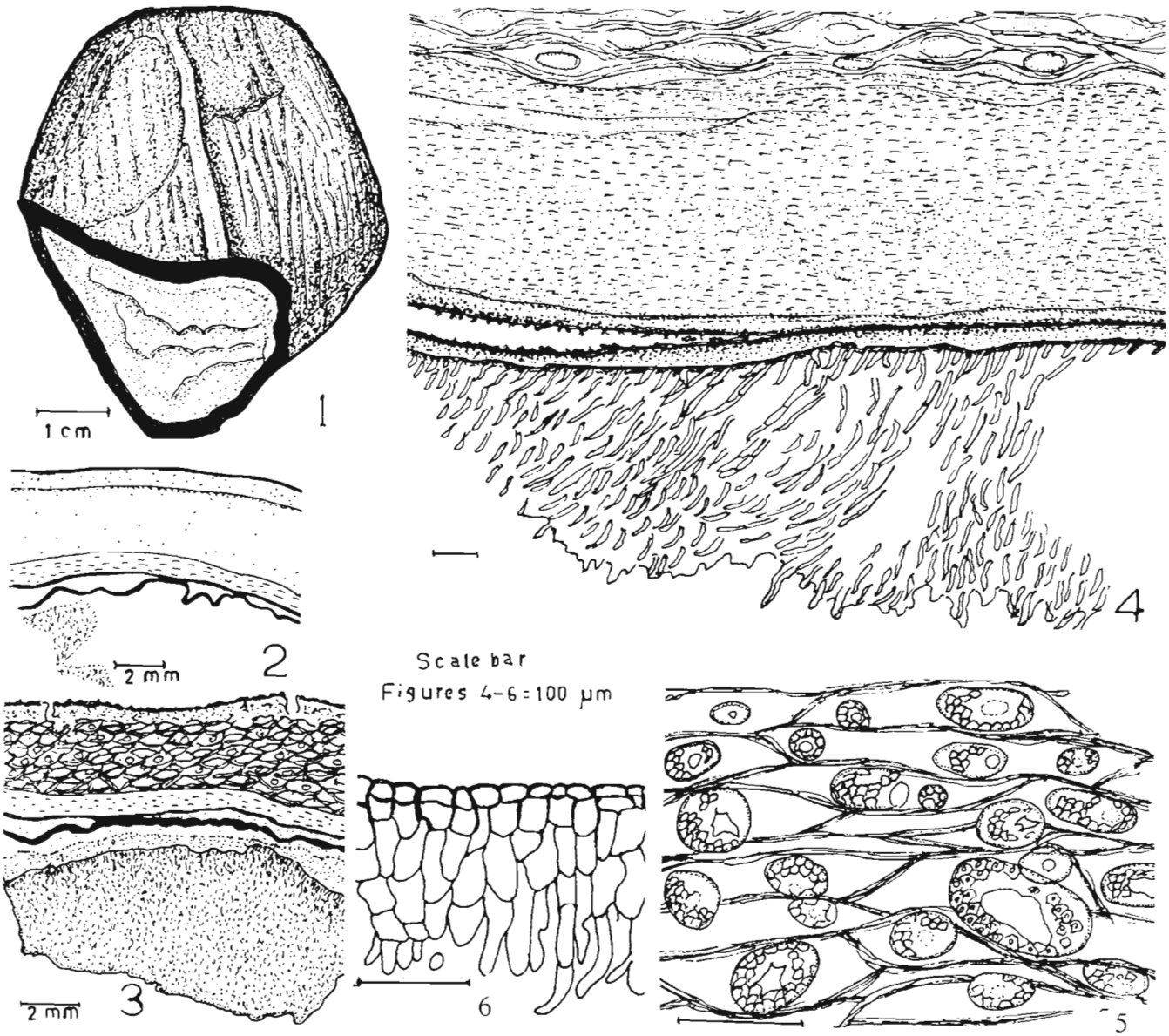
अमरकंटक के टर्शियरीयुगीन अवसादों से प्राप्त 13 x 10 x 6 सेमी. आमाप के नारियल की भांति के एक अश्मित फल का विवरण इस शोध पत्र में प्रस्तुत किया गया है। इस फल की फलभित्ति एक संकरी बाह्यफलभित्ति में स्थूलतः विभेदित हैं। इसमें एक चौड़ी तन्तुमय मध्यफलभित्ति है तथा एक दृढ़ स्थूल अन्तःफलभित्ति है। बीज आवरण 3-4 कोशिकाओं से युक्त तथा स्थूल है तथा यह अन्तःफलभित्ति से आसंजित अथवा मुक्त है। बीज का गूदा अथवा भ्रूणपोष शिथिलतः संयोजित पतले भित्तिमय मृदूतकों से निर्मित है। भारत में *कोकॅस न्यूसीफेरा* की भांति का यह अश्मित फल पहली बार अंकित किया गया है।

INTRODUCTION

SAHNI (1946) described a palm trunk *Palmoxylon sundaram* from the Tertiary of Deccan Intertrappean beds which has the anatomy of a stem of *Cocos nucifera*. But, no petrified fruit of this taxon could be collected so far from India. Otherwise, also there are not many records of occurrence of fossil fruits of *Cocos* from India (Mahabale, 1978). Kaul (1951) reported *C. sahnii* preserved in Fuller's earth from the Eocene of Kapurdi, Barmer (Rajasthan). Patil and Upadhye (1984) described a petrified fruit of *C. intertrappea* from the Tertiary of Mohgaonkalan, Madhya Pradesh. The present material closely resembles *C. nucifera* in shape, size, anatomy of wall layers and endosperm, and is the first record of a *Cocos nucifera* like petrified fruit from India.

While discussing the origin of coconut, Mahabale (1978) described the anatomy of three wall layers of the fruit of *Co-*

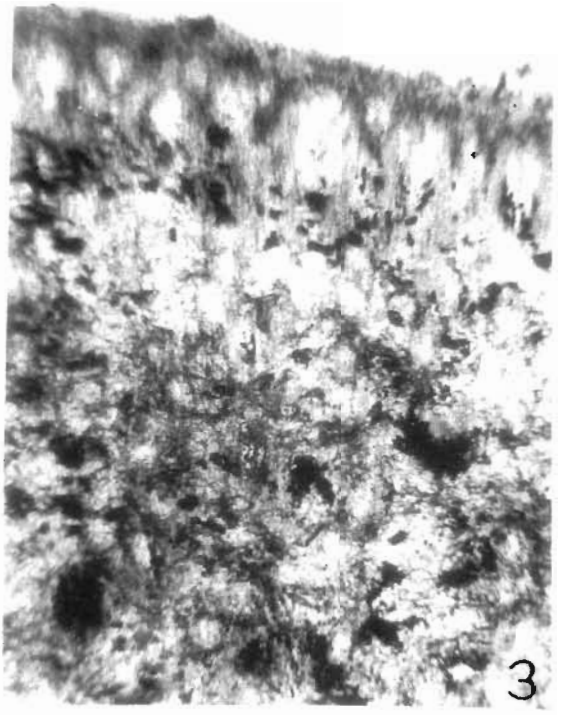


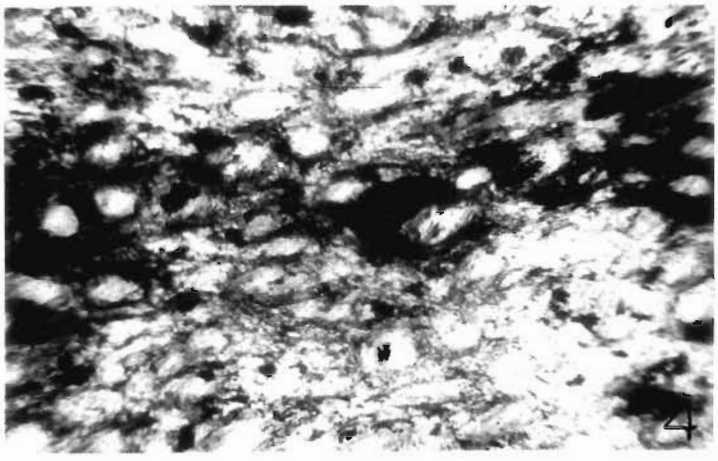
Text-figures 1-6— 1—*Cocos nucifera* like fruit. Specimen no. SNM/AMR-2. **2**— Three wall layers of fruit with seed coat free and adhered. **3**— Same. Enlarged. **4**—Same Enlarged. Note heterogeneous nature of endocarp, free and adhered positions of seed coat with endocarp. **5**—Fibres and fibrovascular bundles of mesocarp. **6**— Outer portion of seed coat with a distinct outer layer of cells.

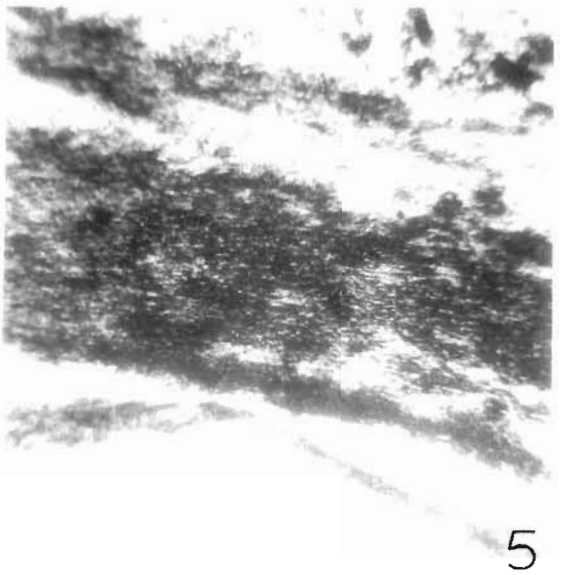
cos sp., i.e., epicarp, mesocarp and endocarp and differentiated species of *Cocos* on this character, e.g., *C. nucifera, C. coronata (Syagrus coronata), C. schizophylla (Arycuriroba schizophylla), C. plumosa (Arecastrum ramanzoffianum)* and *C. yatay (Butia yatay).* Except *C. nucifera* all others are small fruits and found in South America.

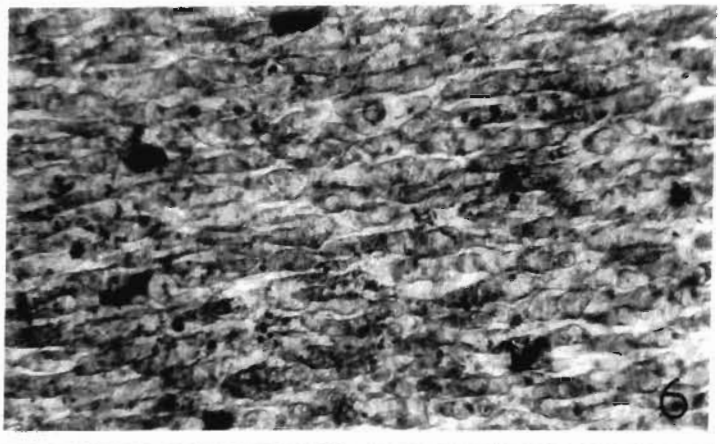
PLATE 1

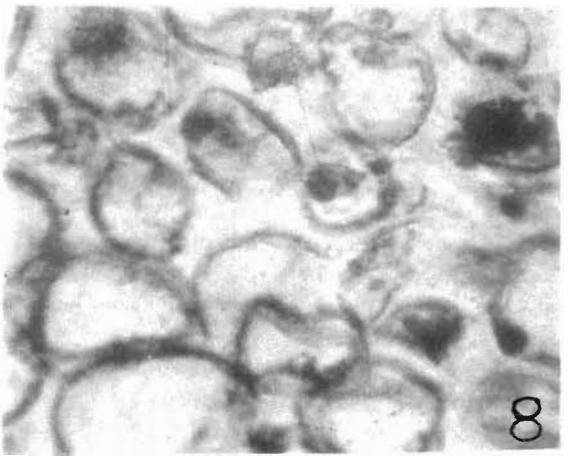
1. *Cocos nucifera* like fruit. Specimen no. SNM/AMR-2. Note external morphology of the fruit. x ca 1/2.
2. Cross section of the fruit showing three wall layers and the central cavity. x ca 1/2.
3. Cross section of pericarp showing epicarp (outerside) with alternating smaller and larger bundles (cavities) and wide mesocarp with scattered bundles and fibres. x 60.
4. Mesocarp with scattered bundles (cavities) and pseudo network of fibres. x 60.
5. A portion of mesocarp and distinct endocarp made up of closely packed sclerenchyma. Free seed coat is also seen. x 60.
6. Endosperm or pulp in peripheral portion is made of elongated cells. x 300.
7. Endosperm central portion made up of loosely packed parenchyma. x 400.
8. Same, Enlarged. x 800.











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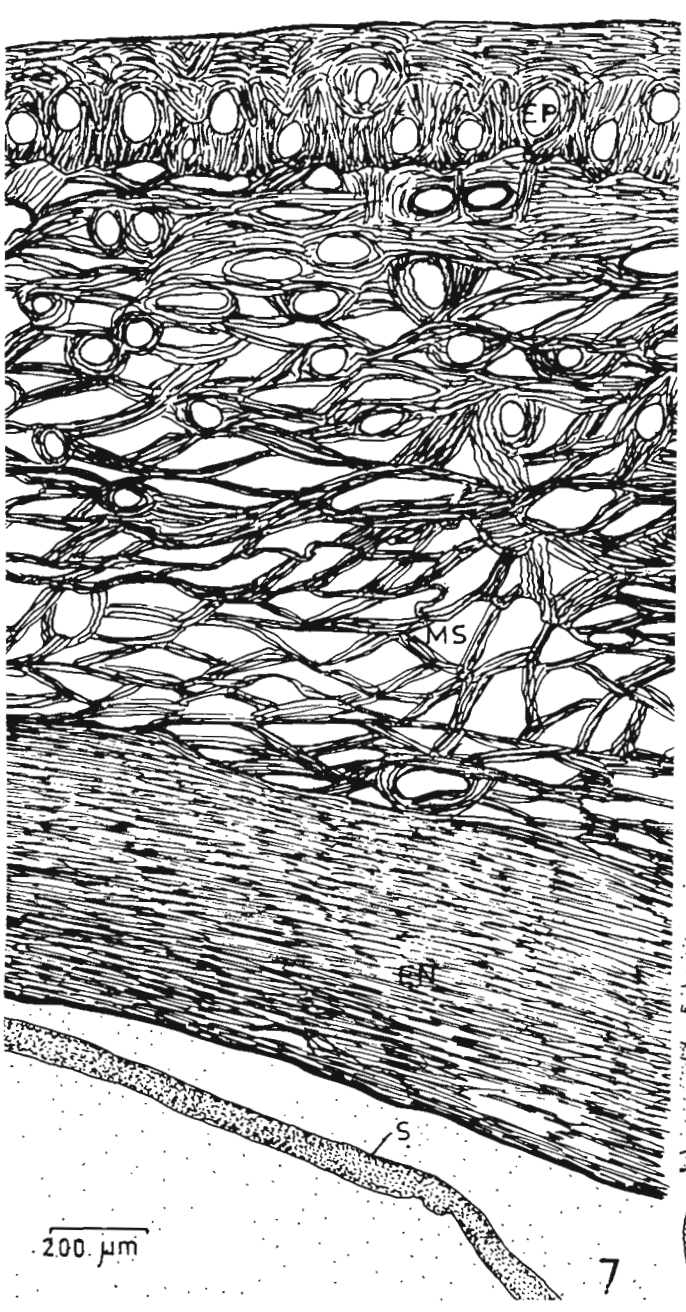

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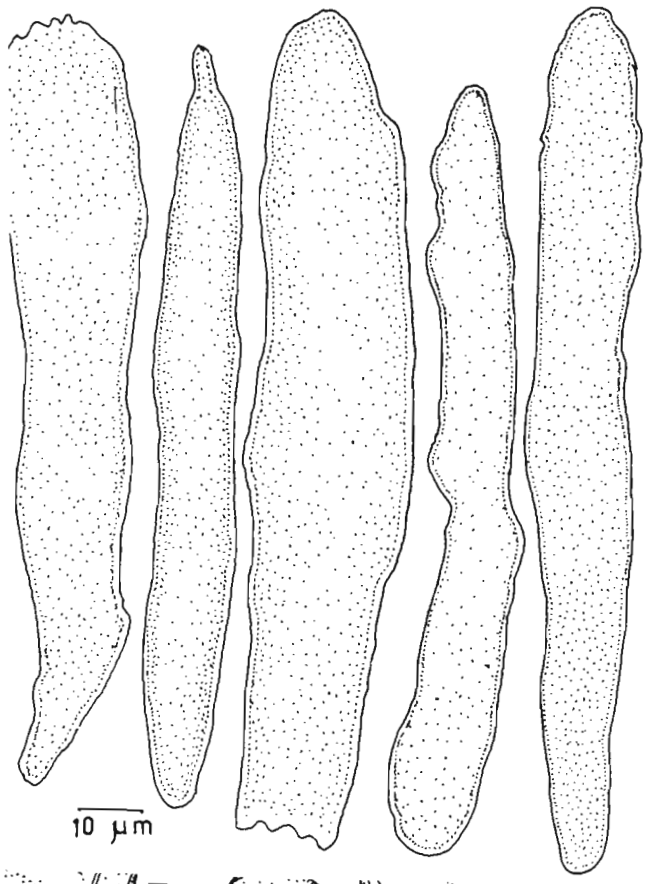

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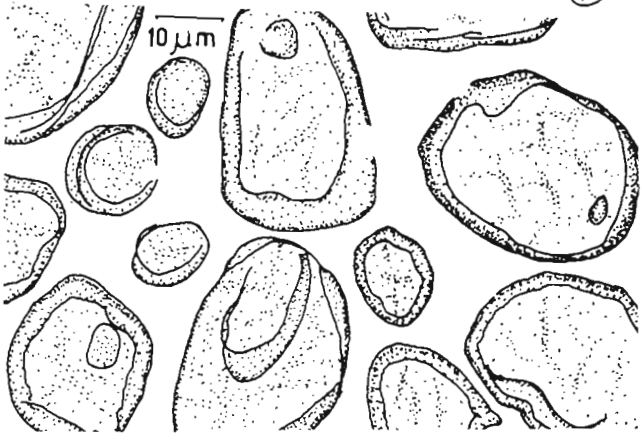

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Text-figures 7-9— 7—*Cocos nucifera* like fruit. C.S. pericarp showing narrow epicarp with alternating two rows of bundles (cavities), wide mesocarp with bundles and reticulum of fibres and distinct endocarp made up of closely packed sclerosed parenchyma. Seed coat is free from pericarp (EP=Epicarp, MS= Mesocarp, EN=Endocarp, S=Seed coat). **8**—Elongated cells in peripheral portion of endosperm. **9**—Loosely placed cells in central portion of endosperm. Note nucleus like structure in some of the cells.

Rigby (1995) described a fruit of *C. nucifera* from the Pliocene of Queensland (Australia) but without internal details. The present material preserves all anatomical structures of the wall layers and of endosperm. These are compared with those of *C. intertrappea* Patil & Upadhye (1984) and *C. nucifera* (Kulkarni, 1965-unpublished; Murray, 1973; Robertson, 1977; Kulkarni & Pandey, 1984; Kulkarni & Mulla, 1997).

DESCRIPTION

Specimen no. SNM/AMR-2 (Text-figure 1) measures 13 x 10 x 6 cm, oval in shape with an ill-defined third ridge on a lateral side (Pl. 1, fig. 1). The surface has fine longitudinal striations of fibres of the epicarp (Text-figure 1). The distal end of the fruit is blunt while the proximal end is obtuse. A

cross section of the fruit shows a multilayered wall surrounding a large, central cavity measuring 6 x 4 cm in size (Pl. 1, fig. 2.) The shape of the fruit in cross section looks more or less biconvex due to pressure exerted during the process of fossilization, otherwise, it should have been trilobed to circular in outline.

The wall of the nut is 6-15 mm thick and is differentiated into three distinct layers, i.e., outer epicarp, middle mesocarp and inner endocarp (Text-figure 2). Epicarp is narrow, 0.5 to 2 mm wide, consists of fibres and two alternate rows of vascular bundles (Pl. 1, fig. 3; Text-figures 3, 7). The outer row has smaller bundles than those of the inner row. Details of bundles remain unclear for want of good preservation of tissues of epicarp.

Mesocarp is wide, 2 to 5 mm thick and consists of fibres and fibrovascular bundles (Pl. 1, figs. 3, 4; Text-figures 5, 7). The fibres are oriented longitudinally or in little oblique directions giving a false network like appearance (Pl. 1, fig. 4; Text-figures 4, 7). Details of fibrovascular bundles could be seen only in a few peels/slides (Text-figure 5). The bundles are of various shapes and sizes (Pl. 1, fig. 4; Text-figure 5).

The third innermost layer of the fruit wall is hard, well developed, sclerosed layer known as endocarp (Pl. 1, fig. 5; Text-figures 4, 7). It is heterogeneous, 0.4 to 1.5 mm thick and consists of closely packed, tangentially oriented thick walled sclerosed parenchyma cells. The inner layer is narrower and has different types of cells, probably fibrovascular bundles (not clear) (Text-figure 4).

Inside the endocarp, there is a distinct seed coat which either adheres or is free from the endocarp (Pl. 1, fig. 5; Text-figures 2, 3, 4, 7). The seed coat is 40 to 85 µm thick and is made up of squarish parenchyma arranged in 2-3 rows without intercellular spaces (Text-figure 6). The pulp or endosperm is made up of loosely arranged elongated parenchyma (Pl. 1, fig. 6; Text-figures 4, 8) which measure 75 x 12 to 180 x 24 µm in size. Adjacent to the seed coat these cells are oriented radially and give filament like appearance and are packed little closely, whereas, in the central portion the cells are vertical to irregular and are placed loosely (Pl. 1, fig. 7). In cross section the cells are seen circular to irregular in shape with thick or thin walls. In some of these cells doubtful nuclei like bodies are also seen (Pl. 1, figs 7, 8; Text-figure 9).

The present *C. nucifera* like fruit differs from all other known species of *Cocos* including *C. intertrappea* of Patil and Upadhye (1984) in its bigger size and anatomy of pericarp (Mahabale, 1978). Epicarp is thin, mesocarp is fibrous and wide, and endocarp is well developed, hard, heterogeneous made up of sclerosed parenchyma and fibrovascular bundles. In external morphology the present material resembles Queensland specimens described by Rigby (1995) from the Pliocene horizon.

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