

# THE ORIGIN OF COCONUT

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## ABSTRACT

The paper discusses the views on the origin of coconut, *Cocos nucifera* L. and its near related genera and species. It has been pointed out that besides the view that it is American in origin, and the second view that it is Indo-Malayan in origin, a third view that it may have been of Indo-African in origin is discussed in the light of the various genera related to the genus *Cocos*. The characteristic differences between the fruits of *Cocos nucifera*, and small fruited American species are pointed out. Whereas in *C. nucifera* the fruit has highly fibrous-pericarp, the small fruited species like *C. coronata*, *C. schizophylla* etc. are full of mucilage and have no fibres. The germination of the two types of *Cocos* species is also different. It is 'Admotive' in *C. nucifera* and 'Remotive' in small seeded species. The author is inclined to accept the third view that it arose on some islands in Indian archipelago, Ceylon, Nicobar or some extinct islands in the Indian Ocean near the coast of East Africa.

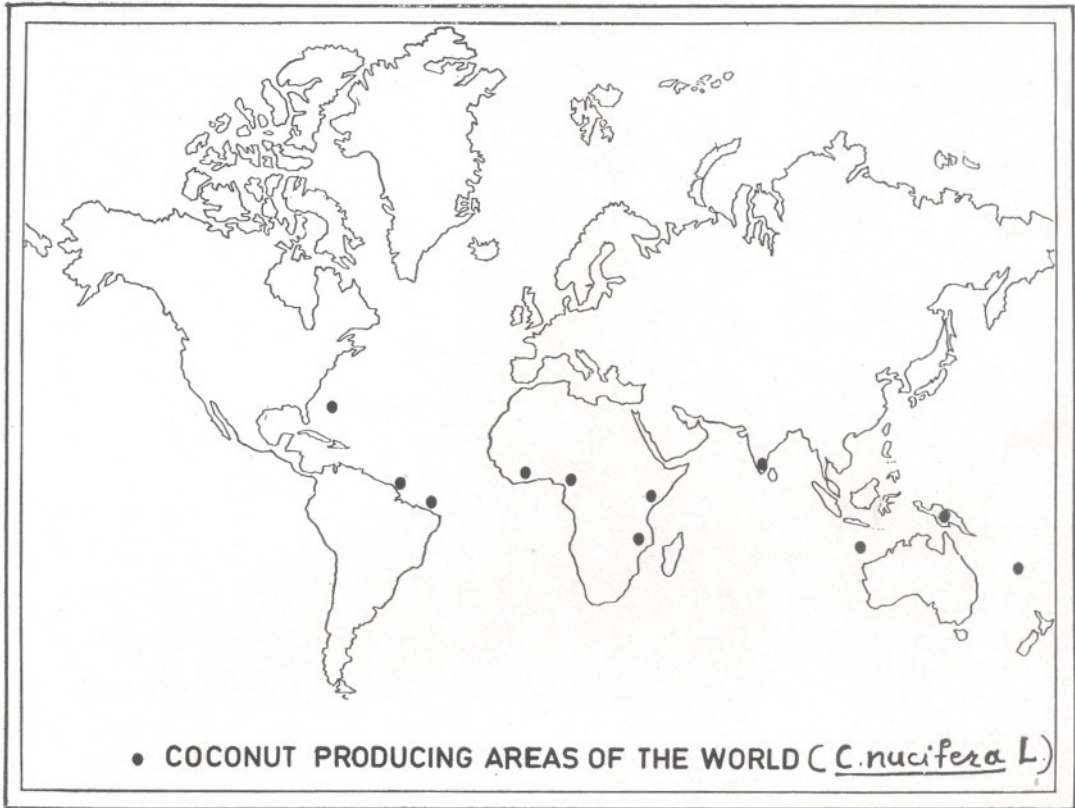
## INTRODUCTION

ORIGIN of coconut, *Cocos nucifera* L., is a matter of much controversy because only *Cocos nucifera* has a very large fruit 12-15 cm or even more in diameter, whereas the other species of *Cocos* such as *Cocos coronata*, *C. plumosa*, *C. yatai*, *C. ramonzoifianum*, *C. schizophylla*, *C. oleracea* have very small fruits, 1.5-2.5 cm in diameter. All of them have round seed with 3 eyes at the distal end, although the shape of fruit varies from ovoid to round. Thus two different types of fruiting habit appears to occur in the genus *Cocos* (Pl. 1, figs. 1-6; Pl. 2, figs. 7-29). These two types of species have entirely different pattern of distribution: *Cocos nucifera* having one, and the small fruiting species having another. Today, *Cocos nucifera* is pantropical. On the other hand, all small seeded species are restricted to South America (see Maps 1, 2, 3).

This sharp distinction in distribution and in the size of fruit and seed has tempted some authors to remove *Cocos nucifera* from the rest of them and put it separately. In fact, Beccari (1917) has split the genus *Cocos* and created several new genera and has put *Cocos nucifera* into one and the small seeded species into *Arecastrum*, *Syagrus*, *Arikuryroba*, *Rhyticocos*, and *Butia*. The fruits of these species are small, essentially Bactrioid. The fruits of *Cocos nucifera* are not comparable with them. The main

differences in them are the large size of endosperm full of oil or fat, very often with a small cavity in the centre but not necessarily. In a variety of *C. nucifera* called *Mekapuno*, *Cocos* of the Philippine islands, the fruit at the beginning is full of water in the centre and at maturity full of fat or butter; it has no cavity. But in all other varieties there is hollow cavity and fleshy endosperm which plays considerable part in germination. The pericarp also in *C. nucifera* and in small seeded *Cocos* species is different. It is highly fibrous and coloured in *C. nucifera* and full of mucilage with many mucilage cavities in small fruited species such as *C. coronata* etc., but there is no fibre (Text-figs. 1-18; Pl. 2, figs. 10-29). The mode of germination also of the two is different. It is 'Admotive' in *C. nucifera* and 'Remotive' in small seeded species (Saakov, 1954). These differences also reflect in their anatomical characters of stem as pointed out by Tomlinson (1961) and Kulkarni (1965).

In *C. nucifera* there are several varieties having different sizes of fruits and colour of pericarp (Mahabale, 1976). The largest size of copra is found in the large Andaman Giant, which has a fruit 15-20 cm, whereas in others especially growing on land and in semiarid situations, it is 6-7 cm only. Menon and Pandalai (1938) gave many cultivars of varieties or varieties with intergradation of sizes of fruits, and the seeds. In Malabar, there is even one variety which



MAP 1

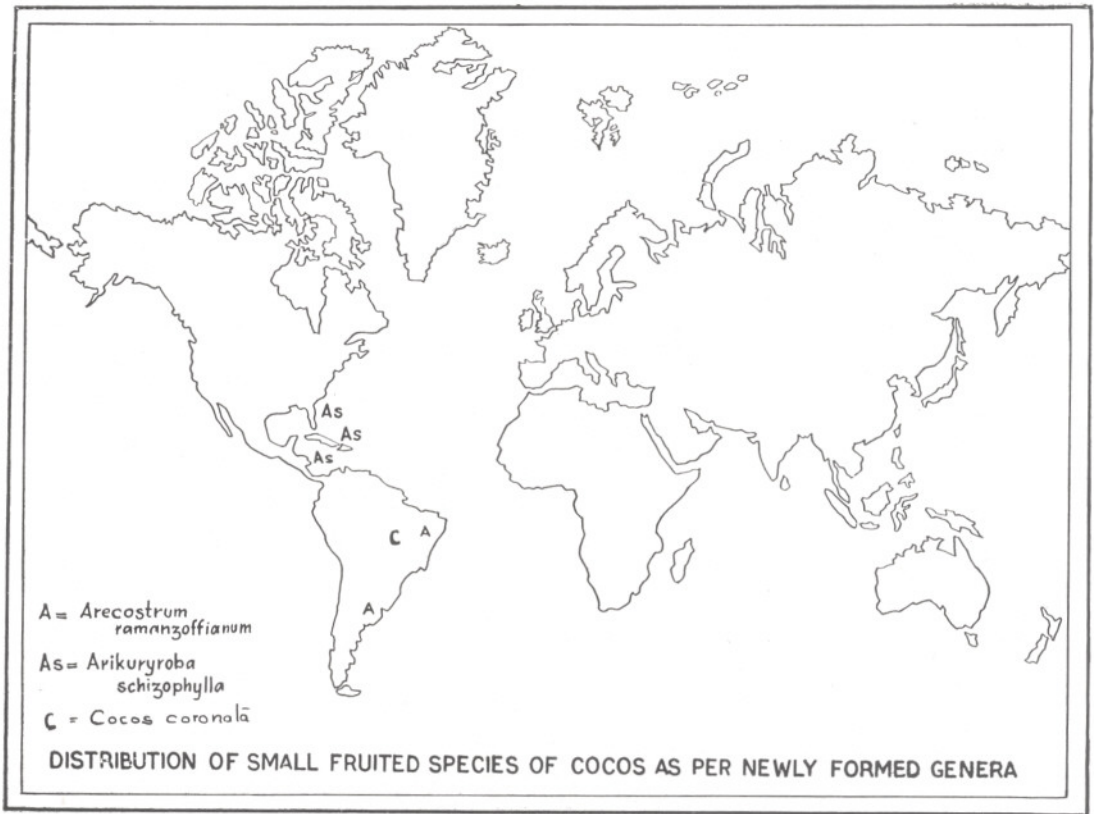
is bulbiferous. This has resulted in again and again discussion and revision of the systematic position of the genus *Cocos*, particularly of *Cocos nucifera*.

There are two distinct views about its origin. One view is held by Cook (1902) that the genus is of American origin, from coastal lands around Panama and Caribbean sea. Mortius (1823-1850), Griesbach (1864, 1866), Guppy (1906), Merrill (1936) support this view. The other view is held by Becari (1917), Vavilov (1935), Burkill (1935), Mayurnathan (1939), Patel (1938), Child (1953), and Hooker (1894) that it is of Asian origin. They believe that it arose somewhere in Indo-Pacific islands first. According to the first view it arose in the region of Panama and Caribbean sea islands and spread slowly with the help of ocean currents to Eastern Pacific and from there to Indo-Malesian islands, India, Ceylon and other eastern tropical islands, where it is

highly prosperous today. The main question is how it has developed such a large endosperm compared to other small seeded species, and whether it can travel thousands of miles (4000) with sea currents. This cannot be satisfactorily answered, even in the case of many cereals, the original parents of which — the grasses — have very small endosperm. Under what conditions and due to what factors, the present species of coconut, *C. nucifera* developed such a large endosperm defies answer; so we have to look back to the past history of the genus for the answer.

In this connection the following needs are to be considered. In the Palaeocene of India, in the Deccan Intertrappean beds at Sagar (M.P.) a species of *Cocos* has been found named, *Palmoxyton sundaram* Sæhni (Sæhni, 1946). This is a large piece of stem as large as the trunk in *Cocos nucifera* in width and height and shows anatomical

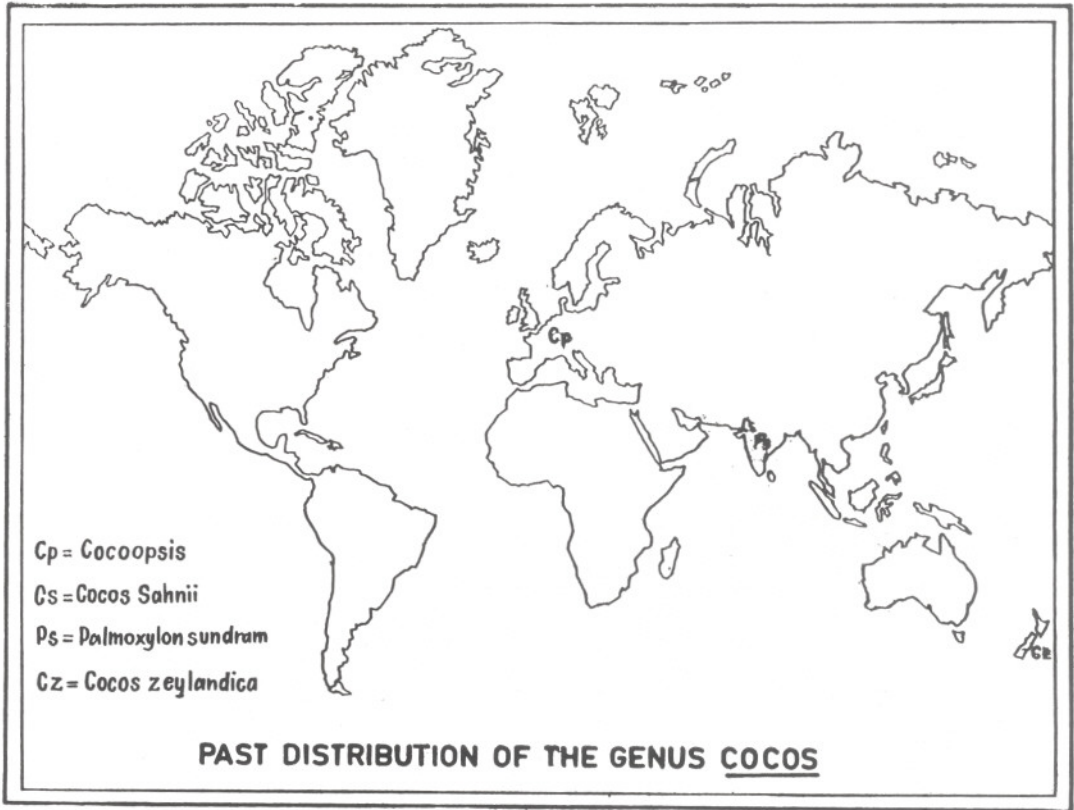




MAP 2

resemblance with the stem of modern *Cocos nucifera*. The stem structure of it fully agrees with modern *Cocos nucifera* stem, but no other parts of this very famous fossil coconut of India are known except roots which also resemble. The fossil fruits of another medium sized coconut, called *Cocos sahnii* Kaul (Kaul, 1951) resemble some of the small sized fruits of modern varieties of coconut, *C. nucifera*. As a matter of fact, there are as many as 20 varieties of modern *Cocos nucifera* which differ among other characters in the size of fruits. *C. sahnii* resembles some of them. This was found in the Miocene of Kapurdi beds in Rajasthan. The fruits of a large sized *Cocos* have not been found, but Flické (1896) had described a somewhat smaller fruit under the name *Cocopsis* from the Miocene of Argonne, France. Berry (1926) has also described a small fruit of *Cocos zylandica* Berry from New Zealand

from the Holocene-Miocene-Pliocene deposits. These fruits resemble the fruits of small fruited species of *Cocos coronata*, *C. plumosa*, *C. yatay* rather than with the larger fruits of *C. nucifera*. Berry (1929) has also described a fruit of another member of the subfamily Cocoideae belonging to genus *Attalea*, *A. palosoni* from the Tertiary deposits of South America. It is obvious that the tribe Cocoineae had a much wider distribution in the past than at present. Its present distribution is only a reminiscent of its distribution in the past. Mahabale (1950, 1965) has described a small fruit called *Palmocarpon insigne* Mahabale having the size of the small fruit of *Cocos schizophylla* or *C. coronata*. According to him it may be a member of the small size fruit of *Cocos* species. But excepting *Cocos sahnii* of lignitic beds of Kapurdi in Rajasthan, no other fruit resembles that of *Cocos nucifera* which is of a later period than

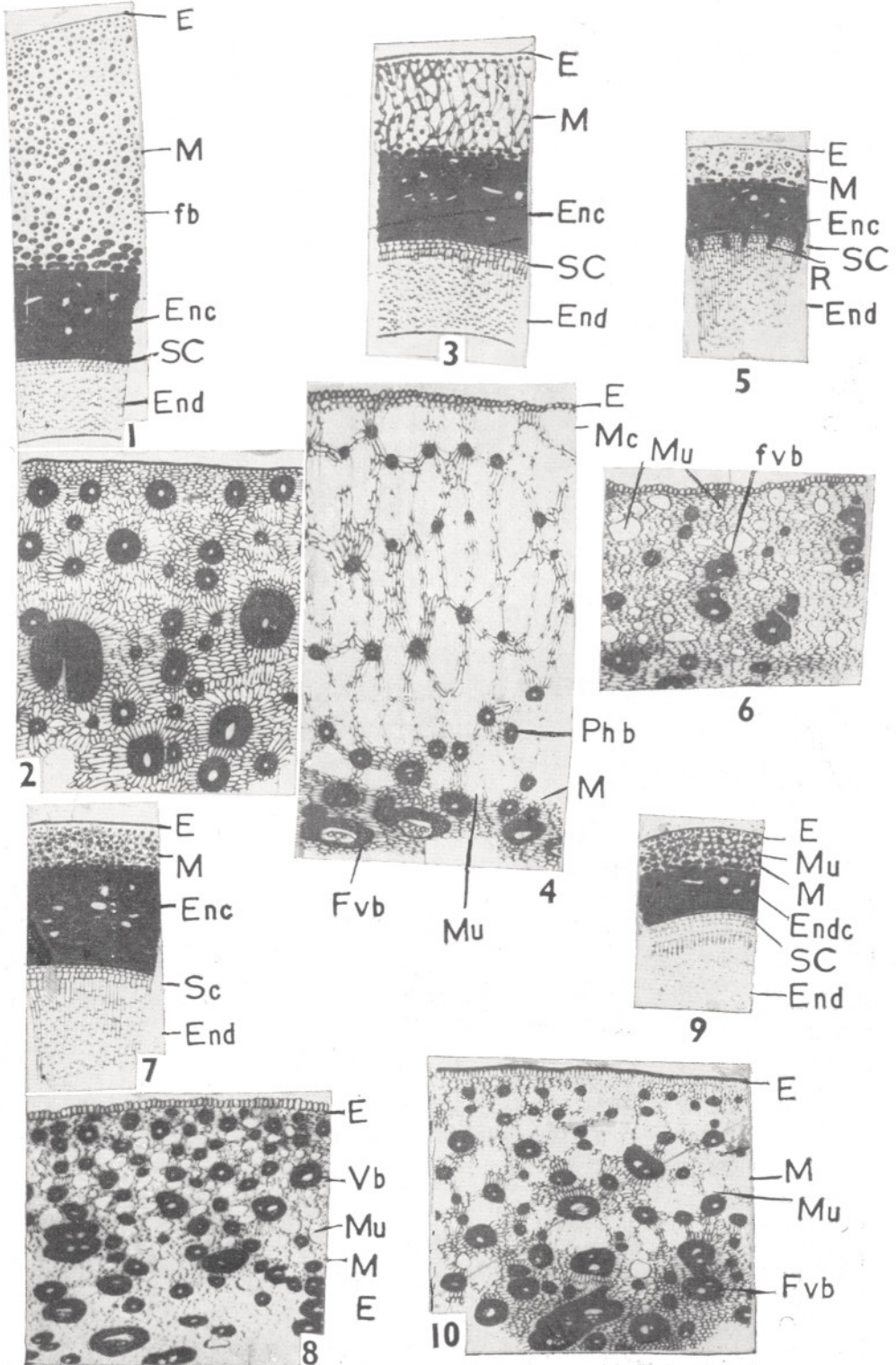


MAP 3

*P. Sundaram*. Possibly, the large sized and the small sized fruiting species both were growing together for sometime in India, but later on they seem to have migrated towards Pacific and Indonesian islands from India, and small seeded species disappeared, surviving only in South America. The genus not being homogeneous may have two or three centres of origin. It is futile to search, therefore, the origin of one from the other. The small seeded species have been developed under tropical and oceanic islands of the New World and the large size coconut species developed its modern characters somewhere near Malay Archipelago, Ceylon, India—a view also held by Hooker and Burkill. However, it is worthwhile noting here that small fruited coconut like *Cocos coronata*, *C. schizophylla* and large fruited *C. nucifera* have both the same 'n' number of bivalent-chromosomes, namely 16. This suggests common origin

in some very very distant past, before the two kinds of *Cocos* species parted company perhaps under the various influences that were at work, possibly when the Afro-American block of Gondwanaland got separated and migrated westwards towards the end of Gondwana Era. But since the time and place of the origin of angiosperms are not known, nothing very definite could be said on this point.

In this connection the following point is worthy of note. The fruits of American plants of *Cocos nucifera* are eaten when young by a Giant Crab called *Birgus latro*, also called "Robber crab". It not only eats young fruits fallen on the ground, but also climbs the trees and breaks open young fruits and eats copra or the meat. This crab is endemic to South America and is not found associated with *Cocos nucifera* in any of the Polynesian islands or islands in the Malay Archipelago, or Ceylon, or



TEXT-FIG. 1



India. This clearly shows that though wild plantation of *Cocos nucifera* were noticed by early sailors such as Columbus and others, they certainly should be considered as of secondary origin.

As regards the distribution of coconut by sea currents, the distribution of fruits of *Cocos nucifera* is possible from island to island, which are close by and not very distant as Ridley (1930) observed. Because their embryo does not get rotten on account of the thick fibrous pericarp for about 3-4 months in sea water. On the other hand, it helps them to float in sea water or fresh water, mucilage in their wall being absent. In the pericarp in small seeded coconut, fibres are absent. The mucilage in their pericarp helps the small seeded coconuts to germinate successfully in the wet soil of estuaries or river banks, even at a long distance, their germination being 'Remotive'. The germination in *Cocos nucifera* is direct, without throwing out a haustorial sheath: it germinates vertically *in situ* behind the marine beds, well drained with fresh water, its cotyledon remaining inside the coconut for a very long time. We have observed this haustorium remaining inside the fruit for 3 years, even after the plant has produced 3-4 large leaves, attached to the fruit in the soil till all the copra is exhausted and the plant is able to establish itself firmly by adventitious roots. Therefore, it is difficult to imagine that fruits of *Cocos nucifera* could migrate thousands of miles from American tropics to Indo-Malaysian region, or the islands of it. Thus it seems that the environmental factors which determine the

successful germination of small seeds of coconuts and the large fruited *Cocos nucifera* are quite different. It may be said that they are derived from same origin in very distant past but developed under different conditions later (Text-figs. 11-18).

The subfamily Cocoideae has 13 genera of which the nearest to genus *Cocos* are *Attalea*, *Syagrus*, *Butia*, *Arycuriroba*, *Rhyticocos* and *Arecastrum*. All these genera are of South American origin. Their leaves are similar to those of coconut, *C. nucifera*. They also have small fruits about 1 to 1.5 cm in diameter and horny endosperm, unlike the semifluid or pulpy endosperm of *Cocos nucifera*. They have mucilaginous pericarp and not fibrous. All these differences can not be considered as nearly secondary characters. As a matter of fact *C. schizophylla* has ruminated endosperm. Therefore, we have to consider the origin of *Cocos* very cautiously.

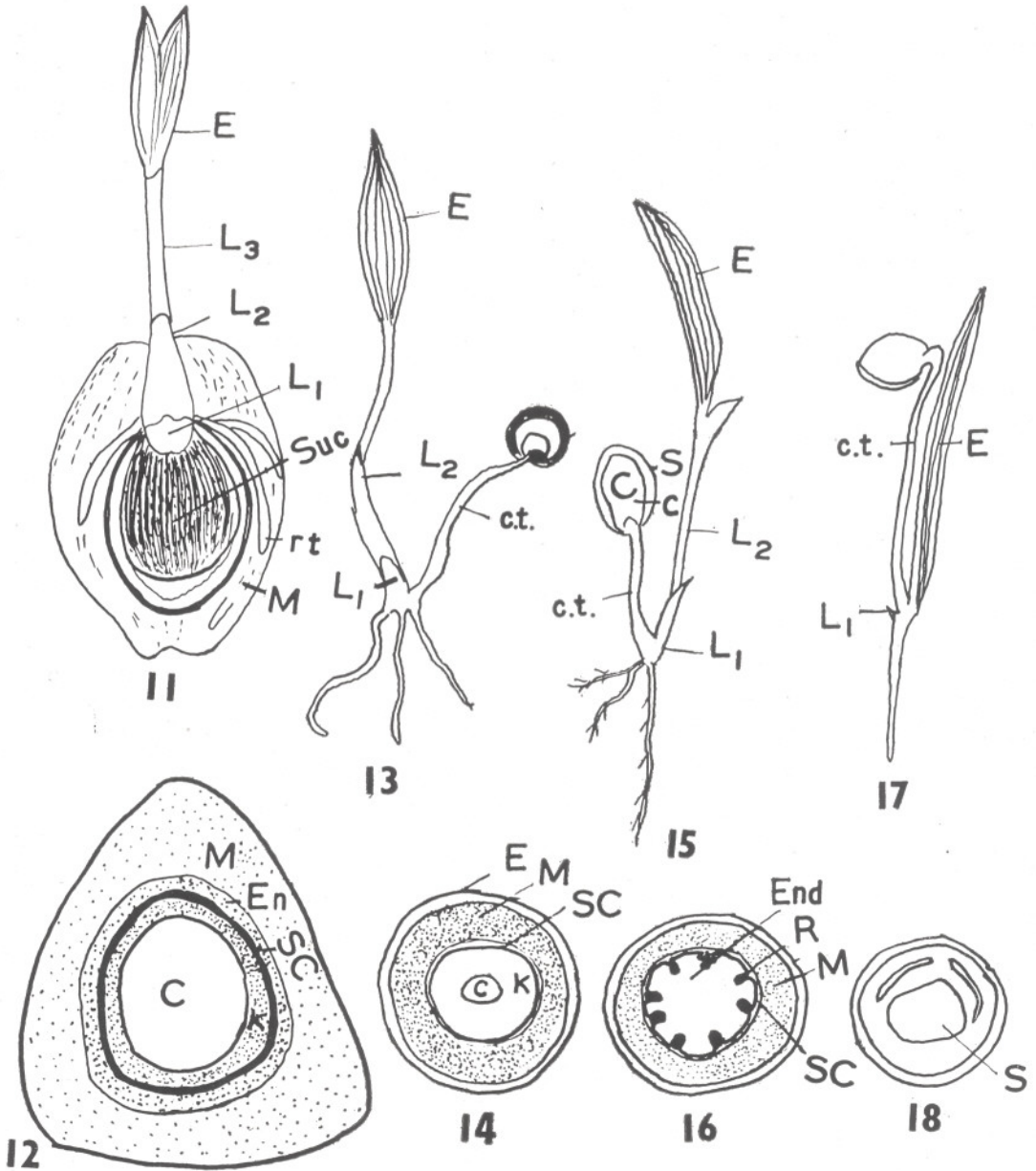
A third view, therefore, regarding the affinities of the genus *Cocos* has been brought forward. According to Beccari (1917) the nearest relation of *Cocos* is the south-east African monotypic genus *Jubeopsis*. This genus has only one species *J. caffra*. It has small fibrous fruits 3-5 cm large, resembling in many other characters including the endosperm with *C. nucifera*. They have hollow cavity in the centre as in *C. nucifera*, but they are small in size. The other related African genus is 'Double coconut' or *Lodoicea*, endemic to Seychelles, but its germination inspite of its very large sized fruit is 'Remotive' like that in small coconut species. It is also endemic to Africa. But

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ABBREVIATIONS: **E** — Epicarp, **M** — Mesocarp, **Enc** — Endocarp, **Fb** — Fibre bundle, **SC** — Seed coat, **K** — Kopra endosperm, **Phb** — Phloem bundle, **MU** — Mucilage cavity, **FVb** — Fibro-vascular bundle, **End** — Endosperm, **L1**, **L2**, **L3** — Successive scaly leaves, **S** — Seed, **C** — Central cavity, **R** — Ruminations.

TEXT-FIG. 1 — (Figs. 1-10) — **1**, *Cocos nucifera*: — A sector of pericarp enlarged  $\times 1.05$ ; **2**, Pericarp enlarged  $\times 1.05$ ; **3**, *Cocos coronata* — A sector of pericarp  $\times 1.05$ ; **4**, The same. T.S. of pericarp and seed sector enlarged: Note the large mucilage cavities — **MU** in mesocarp and phloem bundles — **Phb**  $\times 10.5$ ; **5**, Pericarp of *C. schizophylla*: Note very small mesocarp and ruminations — **R** intruding into the endosperm, i.e. Kopra  $\times 2.6$ ; **6**, *C. schizophylla* — Enlarged epicarp and mesocarp  $\times 10.5$ : Note the mucilage cavities — **MU** and lack of fibres; **7**, *C. plumosa* — T.S. of a sector of pericarp enlarged  $\times 2.2$ ; **8**, *C. plumosa* — Mesocarp enlarged: Note **MU** — the mucilage cavities one around each vascular bundle and **Ph.b.** — phloem bundle; **9**, *C. yatay* — A sector of pericarp  $\times 2.6$ ; **10**, *C. yatay* — Pericarp and seed coat cut transversely and enlarged: Note that there is very little or nil mesocarp  $\times 10.5$  (figs. 1-10 after Dr A. R. Kulkarni, 1965).



TEXT-FIG. 2 — (figs. 11-18, germination in *Cocos* spp.) — 11, Fruit of *Cocos nucifera* with seed germinating *in situ* admotively L1, L2, L3 successive leaf sheaths, E — Eophyll, Suc — Sucktorial haustorium, M — Fleshy mesocarp, Rt — root  $\times 1/6$  N.S.; 12, *Cocos nucifera* showing large fibrous mesocarp — M, stony endocarp — En, Kopra — K. and central cavity — C; 13, *Cocos coronata* — Seed germinating remotely. The seedling has a large cotyledonary tube — Ct, two leaf sheaths — L1, L2 and Eophyll — E  $\times 1.5$  N.S.; 14, *C. coronata* showing Kopra — K, cavity — C at the centre and large mucilagenous mesocarp — M and epicarp  $\times 2$  N.S.; 15, *Cocos schizophylla* — seedling with cotyledons showing remote germination by cotyledonary tube — Ct, successive leaf sheaths — L1, L2 and Eophyll — E, seed — S, and cotyledon — C  $\times 1/6$  N.S.; 16, *C. schizophylla* — T.S. of fruit  $\times$  N.S.: Endosperm — End, mesocarp — M, ruminations — R, and seed coat — SC; 17, *C. plumosa* — seedling: cotyledonary tube — Ct, leaf sheath — L1 and Eophyll — E  $\times 1/4$  N. S.; 18, *C. capitata* — T.S. of fruit  $\times$  N.S.: Note the fertile seed carpel — S and two abortive cavities.



since we know so little about *Jubeopsis caffra*, it would be difficult to assert that the genus *Cocos* has arisen from it, although Corner (1966) would favour this view. It should need much detailed work, not only on *C. nucifera*, but on all species of small *Cocos* and other related genera mentioned

above. Therefore, we should not forget that the genus *Cocos* may be of multiple origin. May be that it arose in some islands in Indian Archipelago, Ceylon, Nicobar or some islands in Arabian sea or Indian Ocean, now extinct as Corner (1966) suggests.

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## EXPLANATION OF PLATES

(Different species of *Cocos*, their seeds and fruits; all figs. are after Dr A. R. Kulkarni, 1965)

## PLATE 1

(Species of *Cocos*)

1. *Cocos plumosa* Hook. Growing in the Victoria Garden, Bombay.
2. *Cocos coronata* Mart. Growing in the Botanical Garden, Poona University. Note the bunch of small fruits at the end of the inflorescence.

3. *Cocos yatay* Mart. Growing in Victoria Gardens, Bombay.
4. *Cocos capitata*. Growing at the Botanical Gardens at Batumi, U.S.S.R. (= *Butia capitata* Mart.)
5. *Cocos nucifera* L. growing at Bombay.
6. *Cocos schizophylla* Mart. Growing in Botanical Garden, Botany department, University of Poona: Note the small fruits.



## PLATE 2

(Inflorescence, fruits and seeds in the genus *Cocos*)

7. *C. coronata*: A secondary branch on a branch of a peduncle; note the numerous female flowers from base upwards.  $\times 1/4$  N.S.

8. A secondary branch in an inflorescence of *C. coronata* showing the arrangement of male and female flowers—mainly at the base.  $\times$  N.S.

9. *Cocos nucifera*: A portion of secondary axis of inflorescence showing a single large female flower at the base and several male flowers above  $\times$  N.S.

10. *Cocos coronata* showing a fruiting axis with racemose arrangement of young small fruits.  $\times 1/2$  N.S.

11. The same with more developed fruits.  $\times 1/2$  N.S.

12. *Cocos nucifera*: A fruited peduncle with developing fruits covered by a spathaceous bract behind.  $\times 1/6$  N.S.

13. Fruit of *Cocos nucifera* with pericarp.  $\times 1/7$  N.S.

14. Fruit of *Cocos nucifera*; side view with fibrous husk (mesocarp) removed to show two sterile eyes and one eye of the fertile carpel at the posterior end.  $\times 1/7$  N.S.

15. The same from the side view showing the carpellary ridge on the endocarp and the fibres of the inner-most layer sticking to hard endocarp.  $\times 1/7$  N.S.

16. Entire fruit of *Cocos capitata* with wrinkled pericarp.  $\times$  N.S.

17. The endocarp exposed showing three eye not posteriorly situated but somewhat medially and the ridge of the carpel.  $\times$  N.S.

18. Small fruit of *Cocos coronata*.  $\times$  N.S.

19. Endocarp exposed; note that there are no fibres.

20. Fruit cut transversely showing thick mucilaginous mesocarp and stony endocarp with a very small cavity in the centre.  $\times$  N.S.

21. *Cocos schizophylla*—fruit.  $\times$  N.S.

22. *C. schizophylla*—endocarp exposed.  $\times$  N.S.

23. *C. schizophylla*: T.S. of fruit showing very thick endocarp, mesocarp and ruminated endosperm.  $\times$  N.S.

24. *C. plumosa*;—fruit.  $\times$  N.S.

25. *C. plumosa*;—endocarp exposed.  $\times$  N.S.

26. *C. plumosa*;—fruit showing thin mesocarp, thick endocarp and stony endosperm.  $\times$  N.S.

27. *C. yatay*;—fruit.  $\times$  N.S.

28. *C. yatay*;—endocarp exposed.  $\times$  N.S.

29. *C. yatay*;—showing thick pericarp and small stony endosperm. In the living specimen this is orange coloured.

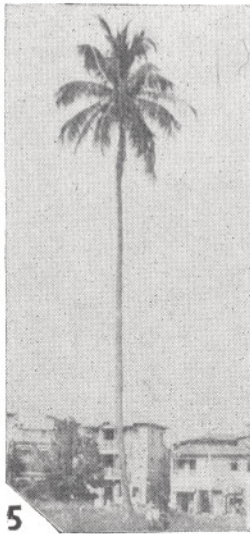
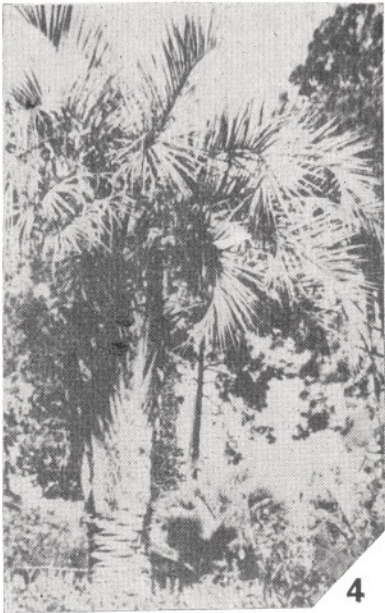
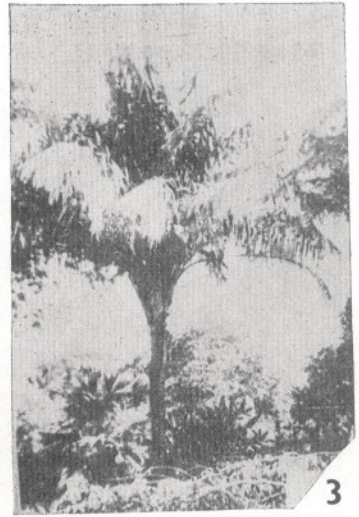


PLATE 1



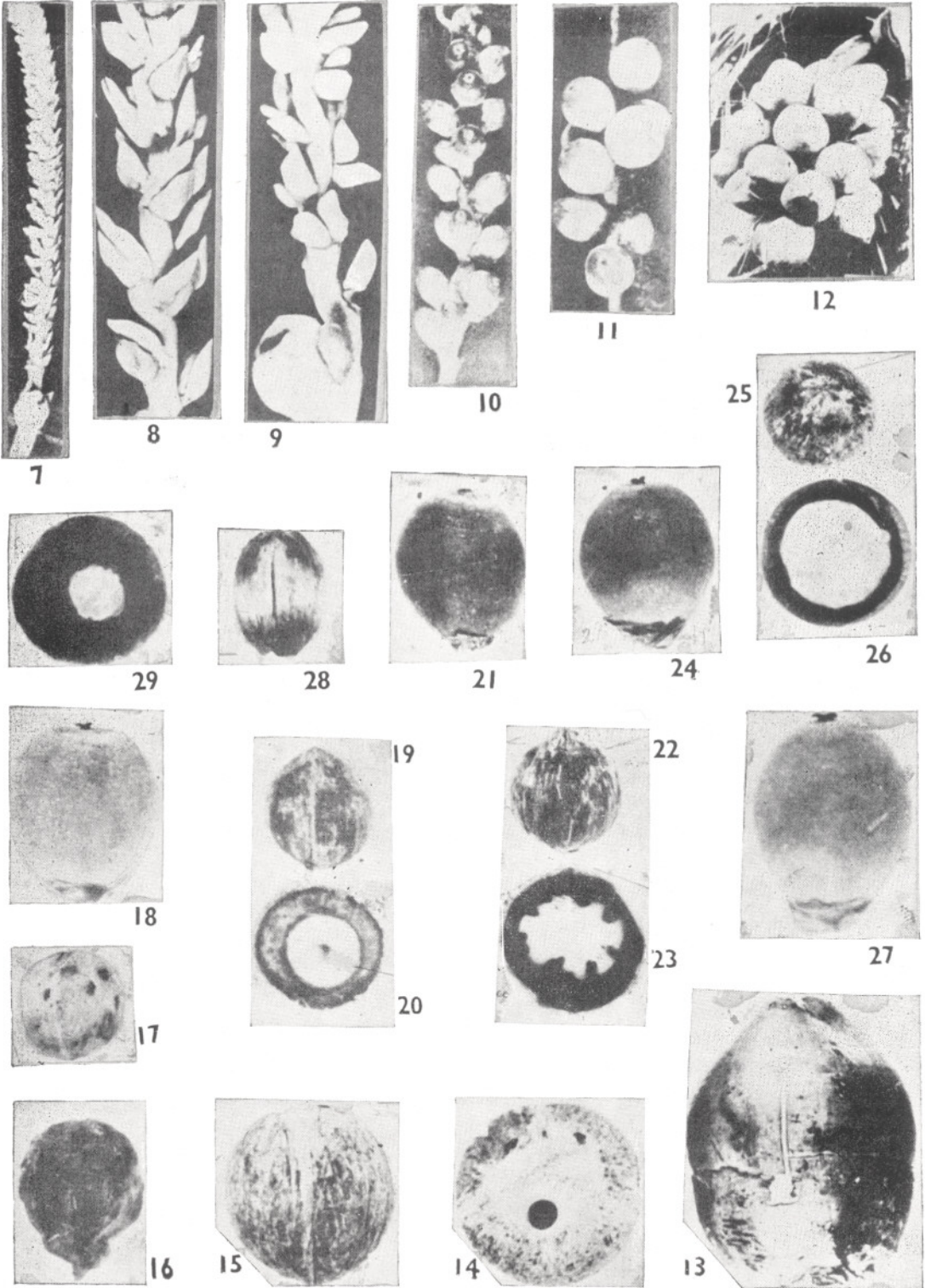


PLATE 2