

PALMS AND THEIR DISTRIBUTION IN AFRICA

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ABSTRACT

In tropical climate, man's life seems linked with palms. The famous Linneaus expressed this, in his saying «Man dwells naturally within the tropics and lives on the fruit of the palm tree. He exists in other parts of the world and there makes shift to feed on corn and flesh».

Palms date back to the Cretaceous, and they have their own structure, unbranched stem, with one growing point and a cluster of large green leaves, fan or feather-shaped.

Palms are monocotyledonous plants, monoecious or dioecious, with fairly large, indehiscent fruits.

Every part of the palm is of some utility in the tropics. Palm starch «Sago» stored in the stems of some palms is used by natives for making their bread. Leaves are used for thatching and as source of fibres. Toddy of palm tree is a familiar beverage consumed daily by the natives. Palm fruit is a good source of food which may be sugary or oily.

Palms are grouped in one family : *Palmae*, distinguished into about 260,000 species, grouped in 235 genera.

Palmae is pan-tropics, but their genera are limited in distribution. Compared with the American and Eastern tropics, Africa is poor in their palm flora, but the African Islands in Indian Ocean is richer than the African mainland, and show a much great degree of endemism. Yet there are a few small tropical islands with no palms. This may be related to the destructive effect of man and his domestic animals.

Palms are distributed in all vegetation types with great numbers of genera and species in tropical rain forest, deserts are the poorest.

Africa is divided phytogeographically into 9 floristic regions within Kingdoms and Subkingdoms. According to Good (1947), Madagascar is a region within the African Subkingdom, but Takhtajan (1969) considers it a Subkingdom by itself. Its endemic palm flora favours this.

There is little relation between palm genera of west Africa rain forest and Madagascar rain forest. Palm genera of western African rain forest are more related to the genera of American rain forest (mainly Lepidocaryoid), and the Madagascar palms are related to the genera of Asian rain forest (mainly Arecoïd).

A rather similar pattern of distribution of other plant species is exemplified by Mangroove species.

Raphia (6 genera) is the largest genus in African rain forest, *Hyphaene* (25 spp.) in the drier parts. In Madagascar, a group of related genera (Tribe : Dypsidæ) each with large number of species grows mainly in rain forest.

INTRODUCTION

In tropical climate, people seem to have evolved in close association with palms. The famous Linneaus (cited by Mc Currach, 1960) expressed this in his saying «Man dwells naturally within the tropics and lives on the fruit of the palm tree. He exists in other parts of the world and there makes shift to feed on corn and flesh».

Of all land plants, the palm is most distinguished by its columnar stem crowned with giant leaves that are palmate or pinnate. Palms may have their name derived from the palmate-type leaf, because the leaf divisions radiate out like fingers from the human palm. Hence was the family name of palms «*Palmae* or *Palmaceae*» and the order «*Palmales*». The family *Palmae* has an alternative name *Arecaceae* within the order *Arecales*. This name has its origin from the generic name *Areca* which Linnaeus established in 1753 (Moore, 1959).

We prefer to use the names Palms and *Palmae* as they are morphologically more meaningful.

Palm Classification :

The palm seed has a single cotyledon : monocotyledonous type.

Corner (1966) considers the family *Palmae* very ancient, as old as if not older than any other form of flowering plants, with fossils in Cretaceous rocks, dating back 120 million years. This family comprises about 230 palm genera and 2640 species (Moore, 1960).

Fan and feather leaf, or palmate and pinnate, offer the readiest distinction for the classification of the palm. Yet it is not sufficient in itself, for there are two kinds of leaflet pattern in each of the two forms, namely the induplicate and the reduplicate. The former splits into Λ -shaped leaflets, the latter into V -shaped ones, we have no record of intermediate form between these two ways of splitting. It is this less obvious feature, therefore which gives the primary basis for the grouping of palms, then details of flower and fruit enter and it is customary now to distinguish nine subfamilies of palms.

The African palm genera belong to six subfamilies of the nine subfamilies of *Palmae* (Corner, 1966) :

- 1 — Subfamily Lepidocaryoid : It is represented by 25 genera and 500 species in the world palm flora. In tropical Africa, it is represented by five genera and fifteen species. The five genera are *Raphia*, *Oncocalamus*, *Eremospatha*, *Ancistrophyllum*, and *Calamus*. The last four genera are rattans (climbing palms), they are confined to region 12 (Tropical rain-forest).
- 2 — Borassoid subfamily : It is small subfamily comprising six genera and 42 species in the drier parts of the world. Africa has five genera, and they are found in both subkingdoms : *Hyphaene*, *Borassus*, *Medemia*, *Latania* and *Lodoicea*.
- 3 — Cocoid subfamily : It has only one genus (*Elaeis*) in Africa confined to western African rain-forest, and is the commercial palm in these regions.
- 4 — Arecoid subfamily with two monotypic genera in African mainland (*Podococcus* and *Sclerosperma*) and twelve genera in eastern African islands (region 15) : *Antongilia*, *Beccariophoenix*, *Chrysalidocarpus*, *Dypsis*, *Louvelia*, *Masoala*, *Neodypsis*, *Neophloga*, *Phloga*, *Ravenea*, *Sindroa* and *Vonitra*.
- 5 — Phoenicoid subfamily with one genus and three species in Africa.

6 — Coryphoid subfamily : It has only one monotypic genus of *Wissmannia*, which is confined to Somalia in east Africa.

Ethnobotany of Palms :

Every part of palms is of some use in the tropics, e.g., 800 uses have been recorded for *Borassus* in Africa and Asia, and more than 800 uses for date-palm «*Phoenix dactylifera*» in drier regions. Roots are used to cure diseases. The stem is a source of wood.

Sago palm (*Metroxylon* sp.) is a source of starch stored in the trunk. In New-Guinea, the average yield of sago palm is reported as 250 pounds per tree (Barrou, 1960). Such palms are the main source of starch (bread) for marsh dwellers in the tropics.

The spongy nature of the central cylinder of palms with their starch content allows felled palms to decay easily in the wet tropics and become favourable habitate for some kind of beetles and larvae, that are consumed by natives as a delicacy and a source of animal protein. A fair-sized palm tree will yield three or four pounds of grubs, some of them as large as a mouse. The grubs are wrapped in small packages of leaves and placed in the hot coal to roast, they taste very much like bacon (Anderson, 1978).

The stem-apex (palm bud, cabbage) is an excellent emergency food everywhere in the moist tropics, it has a nutty flavour when eaten fresh, but a smoother asparagus-like texture when cooked.

Toddy (sweet freshly fermented sap) of palm tree is a familiar beverage consumed daily by the natives. If left for longer time, it becomes alcoholic. The sap is a source of palm-sugar or «Jaggery». The sugar content of palm sap varies, it is 10% in *Borassus* palm and 17% in *Nypa* palm.

Palm leaves have many uses. Wax is extracted from young leaves of *Copernicia* and other wax palms in boiling water. They provide fibres for binding and a variety of articles made from midrib such as baskets and other containers. Thatch from palm leaves is an ubiquitous roofing material in the tropics.

Palm fruits are fairly large, indehiscent, with one seed. Sugary or oily fruits provide storage organs for the greater part of leaf photosynthate and offer man and his domestic animals a valuable source of food.

World Distribution of Family Palmae :

In discussing the geography of families, it is convenient to arrange them according to the extent of their ranges. Widespread cosmopolitans are at one extreme whereas other families may have restricted areas of distribution (endemic), in-between there are families that are either tropical or temperate in distribution.

The geographical range of the family *Palmae* is very distinct, being limited by climatic condition and almost entirely within the tropics. Indeed, the *Palmae* is one of the exclusively tropical families. Such climatic limitation is never absolute in a family of such size, and the *Palmae* is no exception having a slight representation in several subtropical regions, but this emphasizes the tropical character of the family as a whole.

This pantropical family has subtropical extensions into California, North Carolina, Chile, Argentina, Italy, Greece, Asia Minor, and across north India and China to Korea and south Japan, New Zealand and south Africa. The extreme limits of distribution are from 44° N latitude in Europe to 44° S in the Chatham islands of New Zealand (Map. 1). Present limits mark the frost line where frost damage to living tissues becomes serious enough to impede palm growth in competition with other vegetation (Corner, 1966).

Present Distribution of Palm Genera :

Palms are land plants. The land surface of the globe comprises several geographical units, that is, America (New World), Africa, Asia and the Pacific Islands, in addition, there is a large number of islands, continental or oceanic. Palm genera are not equally distributed among the tropics of the world. America (New World) has the highest number of palm genera (91), Asia plus Australia have 67 genera, islands of Pacific Ocean have 64 genera, but Africa is the poorest with only 38 genera. This could be related to the relatively narrow extent of tropical rain forest in Africa with the Congo basin far from the maritime climate favoured by palms.

Map (2) shows the relative number of genera distributed in the continents (mainland) and nearby islands. For New world 84 genera for mainland, and 20 genera for island; Africa 15:29; Asia 38:57.

Most tropical islands are renowned for their abundant and peculiar palms, though there are remarkable exceptions such as the Galapagos island, Eastern Island, Socotra, Laccadive and Maldiva islands, Ascension and St. Helena islands with no palms.

Palms are prevalent in narrow rain forest in the tropics between latitudes 5° N and 5° S, but the astonishing fact is the relative poverty of palms in the rain forest of the Congo. This might show the importance of the maritime effect within the rain forest belt.

The more usual limits of palm distribution are given by the zone in which *Cocos nucifera* is successfully cultivated between latitudes 20° N and 20° S. With regard to extratropical distribution of palm genera, the present limits mark the frost line. Several are remarkably cold-resistant and can withstand winter temperatures down to (-7°C), for instance, *Chamaerops* in the Mediterranean basin, *Trachycarpus* in the Himalayas and Japan, *Washingtonia* in California, *Jubaea* in Chile and *Rhopalostylis* in New Zealand.

There are a few palm genera with wide range of distribution among continents and islands, but by contrast there are large numbers of palm with narrow ranges (endemics). Island life, especially in volcanic regions has led to development of endemic palm species. The distribution of palm genera and species in the African islands of Indian Ocean is a good example of the high endemism of islands.

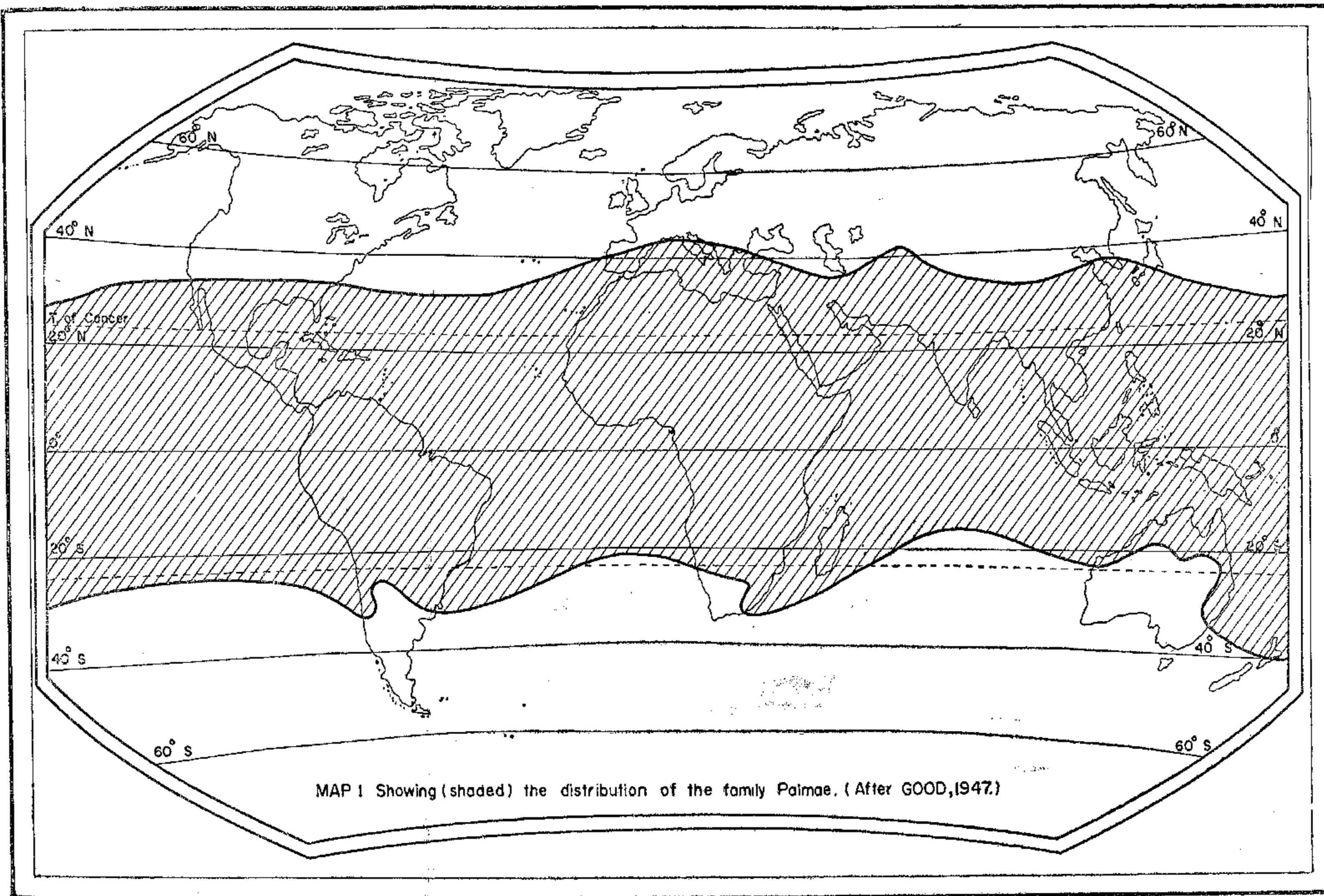
Distribution of Palms in Africa

Africa extends for about 5000 miles from north to south, and a similar distance from east to west, and the continent is remarkable for its latitudinal symmetry about the equator reaching to 37°N and 35° S; So that a very large proportion of the continent lies between the tropics. It is also remarkable for the vast extent of hot desert in the northern hemisphere which extends tropical conditions over a large extra-tropical area from the Atlantic to the Red Sea. Temperate conditions are confined to the northern and southern extremities of the continent.

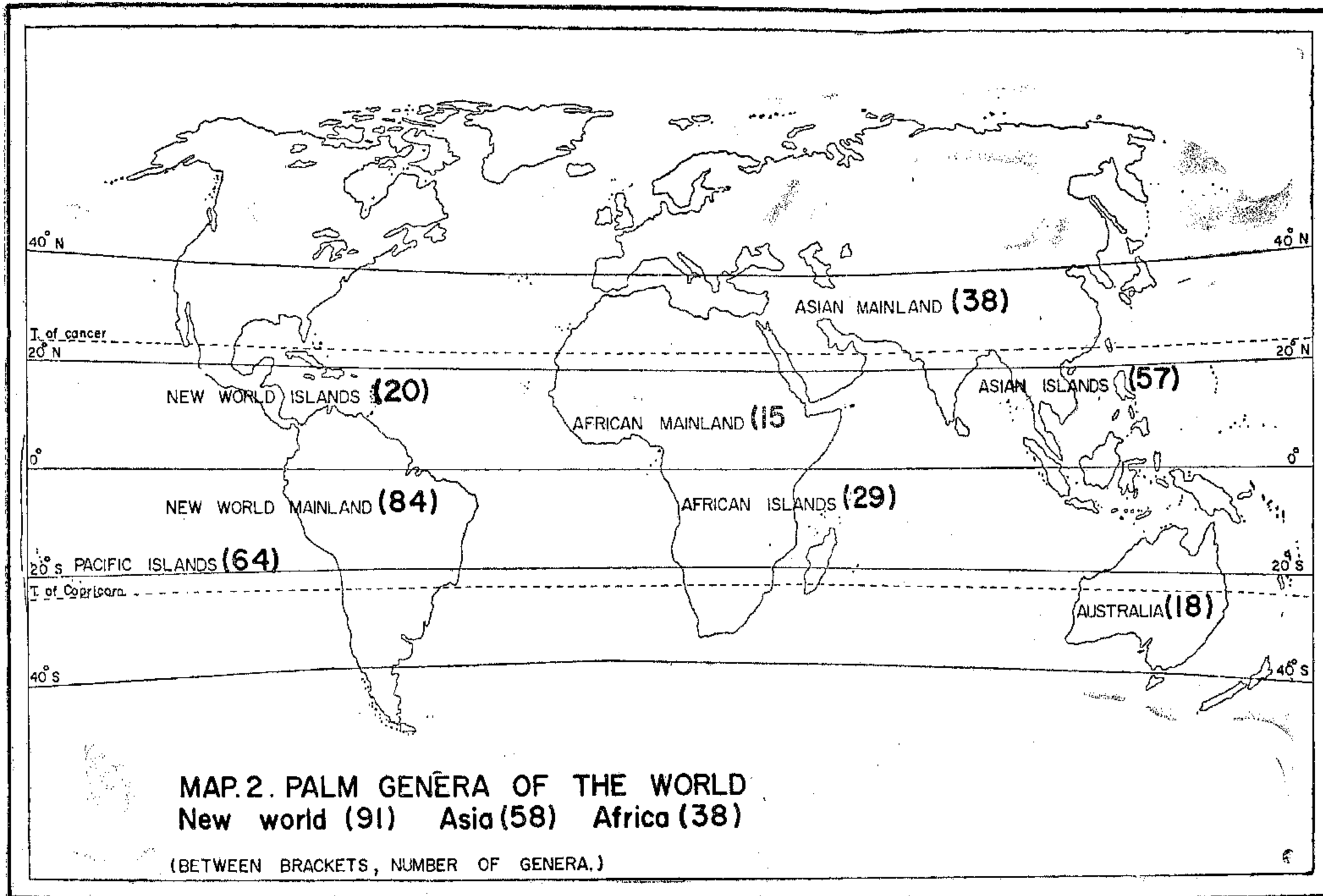
Floristic Divisions of Africa

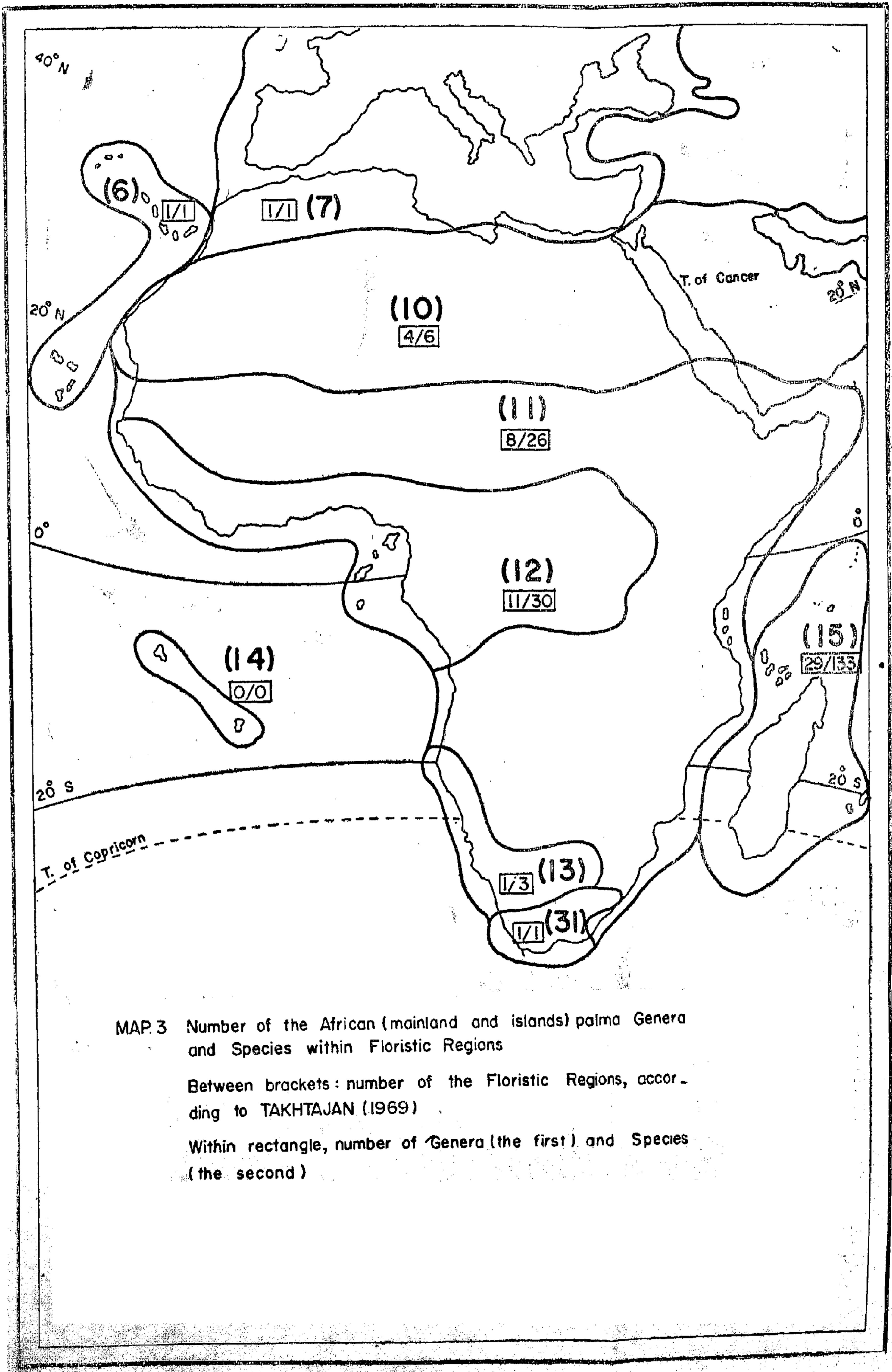
Phytogeography has its terms that are used for the classification of floristic units. *Kingdom* (or *Empire*) is the highest floristic unit and is mainly delimited by broad climatic belts of the world. The Kingdom may include a few subkingdoms. Second, is a *Region* which is a geographical entity delimited by seasonal climatic factors such as duration and pattern of the rainy season. Third, is the *Domain* (or *Province*) which is a natural floristic physiognomic and climatic subdivision of a region.

Several floristic classifications have been suggested. According to Takhtajan's (1969) classification, Africa and near-by islands have nine floristic regions (Map 3) that belong to three Kingdoms as follows :



MAP 1 Showing (shaded) the distribution of the family Palmae. (After GOOD, 1947.)





MAP. 3 Number of the African (mainland and islands) palma Genera and Species within Floristic Regions

Between brackets: number of the Floristic Regions, according to TAKHTAJAN (1969)

Within rectangle, number of Genera (the first) and Species (the second)

(I) HOLARCTIC KINGDOM

(B) Tethyan (Ancient Mediterranean) Subkingdom :

6. *Macaronesian Region* :

Azores, Maderia, Canaries, Cap Verdes islands.

7. *Mediterranean Region* :

The larger part of the Iberian peninsula, North Mediterranean Coast and islands, Morocco, North Algeria, Tunisia, North-Western Tripolitania, Cyrenaica, North-West Egypt, a large part of Palestine, Lebanon, Western Syria, West and South Anatolia.

(II) PALAEOTROPICAL KINGDOM

(A) African Subkingdom :

10. *Saharo-Sindian Region* :

From the Atlantic Coast of North Africa, through the Sahara, the Sinai Peninsula, most of Arabia except the south, more than half of Palestine, part of Syria, South Iraq, South Iran, part of Southern Baluchistan, Sind in Western Pakistan and Rajasthan in India.

11. *Sudano-Angolan Region* :

Senegal eastwards to Sudan, North-East and East Tropical Africa, Socotra, South-West Arabian Peninsula, Mozambique, Zambia, Malawi, Rhodesia, Transvall, Natal, most of Angola, parts of Bechuanaland, South-West Africa, Orange Free State and Cape Province.

12. *West African Rain-Forest Region* :

Upper Guinea, Cammeron and Islands, Gaboon, Congo Basin.

13. *Namib Karroo Region* :

Western part of South-West Africa and the Karroo.

14. *Region of Ascension and St. Helena* :

(B) Madagascan Subkingdom :

15. *Madagascan Region* :

Madagascar, Comoros, Aldbra, Seychelles and Mascarenes islands.

(IV) CAPE KINGDOM

31. *Cape Region* :

The coast zone from Clanwilliam on the west to the neighbourhood of Port Elisabeth on the East.

Takhtajan's classification for Africa is similar to that of Good (1947), the only difference is with regards to the Madagascan region of Good which is regarded as subkingdom by Takhtajan (1969).

Palm Distribution within African Floristic Regions

Table (1) shows the distribution of the African mainland palm genera within floristic regions and near-by islands. It is compiled from the standard works and floras of Africa : Andrews (1956), Bailey (1949), Blatter and Milford (1926), Corner (1966), Dalziel et al., (1968), Eggeling (1951), Exell (1973), Furtado (1970) and (1967), Hooker et al. (1849), Hutchinson and Dalziel (1937), Irvine (1961), Jumelle (1945), Mc Currach (1960), Moore (1962), Muschler (1912), Purseglove (1972), Täckholm and Drar (1950), Thiselton-Dyer et al. (1902), Tomlinson (1962), and Wickens (1976).

The extratropical regions are dealt with separately from the main tropical regions of Africa.

Extra-tropical Floristic Regions of Africa

Floristic Regions (6), (7), and (31)

These three regions represent extra-tropical extensions of palms. Region (6) and (7) are north of the Equator, region (31) is south of the Equator.

Region (6) has only one species *Phoenix canariensis* which is endemic to this region, in region (7) grows only one monotypic genus of Coryphoid subfamily *Chamaerops humilis*, the only palm species in Europe, and has an affinity with the Asian *Rhapis* of southern China, *Nannorrhops* of the mountains of Afghanistan, *Trachycarpus* of China and Japan also Himalayas, and *Washingtonia* of north America. All belong to the coryphoid subfamily, and they are cold resistant.

Coryphoid palms have developed strongly in central and north America, and this northern extension is reflected in the preponderance of Coryphoid palms in Europe and north Asia.

The north African Magreb (Morocco, Algeria, and Tunisia) is more related to Europe (Church et al. 1967) and dominated by *Chamaerops humilis* palm. This may provide explanation of the poor representation of the Coryphoid palms in Africa.

Floristic Regions of Tropical Africa :

These regions come under two subkingdoms according to Takhtajan's (1969) classification : Afro-tropical subkingdom and Madagascan subkingdom.

Afrotropical Subkingdom :

Region (14) :

The two islands, Ascension and St. Helena in the Atlantic Ocean make up region (14). This region has no palm flora (Corner, 1966). The absence of palms in this region is more related to the devastation of the original vegetation of the two islands by man and his domestic animals (Good, 1947).

Floristic Regions (10), (11), (12), and (13) :

Tropical Africa is the African subkingdom within the Palaeotropical Kingdom. Floristic region (12) represents the rain forest in west Africa, and region (11) represents the gradation from rainforest to desert in regions (10) and (13). Thus, region (11) will start from woodland to savanna and end with steppes closer to the adjacent desert in the north (region 10) and in the south (region 13). These regions show a gradual dryness and sparseness of vegetation cover from region (12) to (11), (10), and (13).

Table (1) also shows that region (12) (rain-forest) is richer than any of the other regions, it has 11 genera and 30 species.

Region (11), the savanna, comes next and has eight genera and 26 species. But region (10) has four genera and six species. The poorest is the Namib desert in south west Africa (Region 13) with only one genus and three species.

Madagascan Subkingdom (Region 15) :

This covers Madagascar, the Comoros, Aldebra, Seychelles and the Mascarenes islands. These East African Islands in Indian Ocean are considered by Good (1947) as a region within the African subkingdom.

Takhtajan (1969) raises the rank of this region to a subkingdom by itself on grounds of the great numbers of endemics, most of them are found in Madagascar itself.

The total number of palm genera in both subkingdoms is 38 genera (Map 2), seven genera (about 20%) are common in both subkingdoms (*Borassus*, *Chrysalidocarpus*, *Elaeis*, *Hyphaene*, *Medemia*, *Phoenix*, and *Raphia*).

Every island has its own palm genera, thus the endemism of palms is more than 75% in each island.

Madagascar has the highest number of palm genera (18 genera), other islands have a few palm genera compared with Madagascar. Comoros has 3 palm genera, Seychelles with six genera, and the Mascarenes with five genera.

Distribution of Palm Genera and Species within the Vegetation Types in Madagascar and Comoros Islands :

Map (4) and Table (2) show the types of vegetation cover and the number of genera and species of Madagascan palms in each vegetation types.

As in other parts of the world, the rain forest is very rich in palm genera and species, followed by the woodland and savanna. The least number of palm genera and species is in the drier parts in the south-west of the island.

Madagascar (227, 736 sq. miles) lies 250-500 km off south-east African Coast, and is very varied geologically. Madagascar was isolated from Africa since the early Tertiary period. Divided by the Mozambique channel, the sedimentary rocks of Madagascar and Mozambique dip towards each other and the channel.

The east and north-west coasts are warm, the east humid as well and has a tropical marine climate. The west coast is drier and subject to great variation of temperature, that is, similar to the tropical continental climate of the wetter savannas of the mainland. The southwest is exceedingly hot and dry like the drier savannas or steppes of the mainland. The general climate of the eastern part of the island is tropical marine, with no true dry season, while the rest of the island has a tropical continental climate with dry winter.

The Comoros islands stand as a land bridge between the main island Madagascar and the islands of Pemba and Zanzibar. The Comoros are steep volcanic islands. They have a total area of only 850 sq. miles.

TABLE 1
Distribution of mainland palm genera in the African floristic regions.

GENERA	No. of spp.	Floristic regions										
		Extra-tropical					Tropical					
		31 Ma.	6 Isl.	7 Ma.	12 Ma. Isl.	11 Ma. Isl.	10 Ma.	13 Ma.	14 Isl.	15 Isl.		
1. <i>Ancistrophyllum</i>	2	—	—	—	2	2	—	—	—	—	—	—
2. <i>Borassus</i>	1	—	—	—	1	1	1	—	—	—	—	—
3. <i>Calamus</i>	1	—	—	—	1	—	—	—	—	—	—	—
4. <i>Chamaerops</i>	1	—	—	1	—	—	—	—	—	—	—	—
5. <i>Chrysalidocarpus</i>	1	—	—	—	—	—	—	1	—	—	—	—
6. <i>Elaeis</i>	1	—	—	—	1	1	—	—	—	—	—	1
7. <i>Eremospatha</i>	3	—	—	—	3	—	—	—	—	—	—	—
8. <i>Hyphaene</i>	25	—	—	—	9	—	17	1	1	3	—	1
9. <i>Jubaeopsis</i>	1	1	—	—	—	—	—	—	—	—	—	—
10. <i>Medemia</i>	2	—	—	—	—	—	2	—	—	—	—	—
11. <i>Oncocalamus</i>	3	—	—	—	3	1	—	—	—	—	—	—
12. <i>Phoenix</i>	3	—	1	—	2	—	2	—	2	—	—	1
13. <i>Podococcus</i>	1	—	—	—	1	1	—	—	—	—	—	—
14. <i>Raphia</i>	6	—	—	—	6	2	2	1	—	—	—	1
15. <i>Sclerosperma</i>	1	—	—	—	1	1	—	—	—	—	—	—
16. <i>Wissmannia</i>	1	—	—	—	—	—	1	—	—	—	—	—
Total Number :		53	1/1	1/1	1/1	11/30	8/26	2/3	1/3	0/0	18/114	
genera/spp.												

Ma. = Mainland.

Isl. = Islands.

MAP 4. PALM GENERA AND SPECIES OF THE AFRICAN ISLANDS IN INDIAN OCEAN.

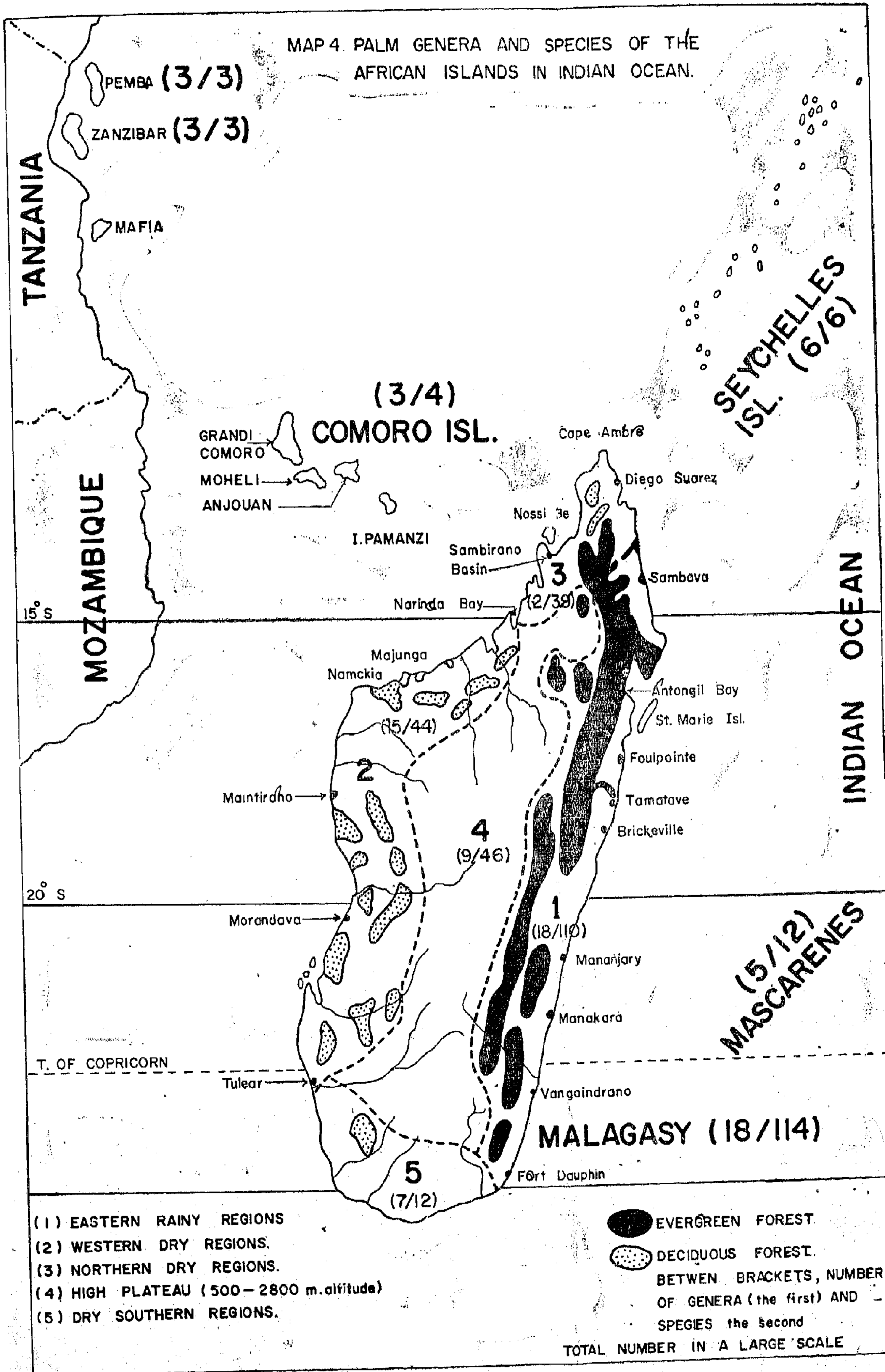


TABLE 2

Madagascar palm genera and their distribution according to
vegetation types.

GENERA	No. of spp.	Dry western		
		Eastern moist forest	forest and savanna	Drier west- ern parts
1. <i>Antongilia</i>	1	1	—	—
2. <i>Beccariophoenix</i>	1	1	1	—
3. <i>Borassus</i>	2	—	2	—
4. <i>Chrysalidocarpus</i>	20	17	11	2
5. <i>Dypsis</i>	22	22	4	1
6. <i>Elaeis</i>	1	1	1	—
7. <i>Hyphaene</i>	1	—	1	—
8. <i>Louvelia</i>	3	3	—	—
9. <i>Masoala</i>	1	1	—	—
10. <i>Medemia</i>	1	—	1	1
11. <i>Neodypsis</i>	14	13	8	—
12. <i>Neophlegma</i>	29	27	6	3
13. <i>Phloga</i>	2	2	—	—
14. <i>Phoenix</i>	1	—	1	1
15. <i>Raphia</i>	1	1	1	—
16. <i>Ravenea</i>	9	7	6	1
17. <i>Sindroa</i>	1	1	—	—
18. <i>Vonitra</i>	4	4	—	—
Total number : genera/spp.	18/114	14/101	12/43	6/9

The palm flora of the Comoros include three genera with four endemic species. The species are *Chrysalidocarpus humblotianus* and *C. lanceolatus*, but the second genus (*Phoenix*) is represented by a variety of *P. reclinata* var. *comorensis*, fourth species is *Ravenea hildebrandti*. The three species (not the variety) grow in the mountain forest at Combani.

Pemba has also a similarly poor palm flora, three genera with three species (*Chrysalidocarpus*, *Hyphaene*, *Raphia*). *Chrysalidocarpus pembana* is recently identified as endemic species in Pemba island (Moore, 1962). But oil palm (*Elaeis guineensis*) is cultivated both in Pemba and Madagascar, date palm is also cultivated.

Palm Flora of Mascarenes Islands :

Reunion, Mauritius, Rodrigue, and a number of smaller islands comprise the Mascarenes group. Reunion is entirely volcanic and lying 640 km. south east of Madagascar (Map 4). Mauritius lying 192 km. north-east of Reunion, is likewise volcanic, built in three volcanic phases between the mid-Tertiary and Pleistocene.

Mascarenes islands have their own endemic palms, five genera with 12 species, *Acanthophoenix*, *Dictyosperma*, *Mascarena*, all with two species, *Hyophorbe*, and *Latania* with three species respectively.

All genera are endemic and belong to the Arecoïd subfamily, except one (*Latania*) a Borassoid which is related to the African and Madagascan *Medemia*.

According to Corner (1966), the two closely allied Arecoïd genera, *Hyophorbe* and *Mascarena* (which are now combined into one genus *Hyophorbe* according to Moore, 1976) may connect with the Madagascan *Dypsis*. The Arecoïd *Dictyosperma* seems essentially east Malaysian. The genus *Acanthophoenix* also Arecoïd and perhaps related to the Malayan *Oncosperma* or more directly to the thorny Arecoïd palms of the Seychelles.

Palm flora of Mascarenes islands are more influenced by the destructive impact of man and his domestic animals.

The Seychelles and their Palm Flora :

These comprise some of 90 islands between 4° and 10° south the Equator, and they are the emergent granite bosses of a submarine plateau.

According to Udvardy (1975), the Seychelles is a province within the Indomalayan Realm. Along with this, the affinity of its palm flora of six endemic genera with six species appears to be entirely with west Malaysia (Corner, 1966). It has one Borassoid genus, the renowned double coconut (*Lodoicea*) which is thought to be related to the Malayan *Borassodendron* and five spiny Arecoid genera *Phoenicophorium* (*Stevensonia*), *Deckenia*, *Roscheria*, *Nephrosperma* and *Verschaffeltia*, which are related with *Oncosperma* of Ceylon and Malaysia.

Palm floras of the African islands in Indian Ocean (Madagascar, Comoros, Mascarenes, and Seychelles) with the prevalence of Arecoid palms, and their affinity to Malaysian Arecoid palms might favour considering the group of islands as a subkingdom by itself as Takhtajan (1969) classified them.

There is no common palm genera between west African rain-forest and Madagascan rain forest. The palm genera of western Africa are more related to the genera of the American rain-forest (mainly Lepidocaryoid). But the palm genera of Madagascan subkingdom are related to the palm genera of the Asian rain-forest (mainly Arecoid).

A rather similar pattern of distribution of other plant species is exemplified by Mangrove species. According to Ridely (1930), the Mangroves have two separate areas : One, the largest, extends from Polynesia through the Malay region to Ceylon and southern India, and up the Malay Peninsula, from Ceylon to the Mascarene islands, touching south Africa, and along the coast of east Africa to Arabia. The other area with a different set of species is found on the coasts of tropical America and across Atlantic to the opposite coast of Africa. Ridely adds that the species of the east coast of America has reached the west coast of Africa, but the Asiatic Mangroves have only reached the east coast of Africa, and the west African ones have not yet reached the east coast.

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