

## The genus *Orania* Zipp (Arecaceae) in New Guinea<sup>1</sup>

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*Orania* is a genus of about 16 species distributed from Malaya to the Philippines, New Guinea, and Australia, with the largest number of species in New Guinea, and with considerable gaps extending through much of Indonesia and West Irian. Most are robust canopy species, but a few have evolved as small understory palms. The species are for the most part poorly collected and poorly known, so the present effort at revision is clearly preliminary. Nothing is known of the reproductive biology of the genus, of its ecology, or of the factors governing distribution. Most species are rather restricted in range, often to a particular drainage basin or mountain range, but *O. lauterbachiana*, as presently interpreted, is distributed over a wide range of habitats and elevations throughout eastern New Guinea.

Little economic use is made of *Orania* in New Guinea. Fruits and buds of at least some species are said to be poisonous (Ridley 1925, McCurrach 1960, Whitmore 1973). The trunks are less desirable for construction purposes than most other species so that *Orania* is often abundant in disturbed forest near villages where other species have been logged.

The taxonomic history of the genus is simple. Beginning with Zippelius' brief announcement of the genus in 1829, the species have been described one by one as they have come to the attention of palm taxonomists. No revision or overview of the genus has been published, aside from Beccari's brief treatment of the Philippine species in 1919.

This paper is presented as a guide to the identification of the known species of *Orania* in New Guinea. Several new species are described, and a key to all the species is provided. I hope that this paper will stimulate others, especially botanists resident in New Guinea, to continue the study of this and other genera of palms native to that region.

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<sup>1</sup>Support of the National Science Foundation (Grants GB-20348X and DEB 77-17319) is gratefully acknowledged. Thanks are also extended to Mr. Michael Galore, Assistant Director Botany, Office of Forests, Papua New Guinea, for much assistance with the field work.

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CHARACTERS OF TAXONOMIC SIGNIFICANCE IN *ORANIA*

## Vegetative

There are rather few vegetative characters of taxonomic significance in this genus. All species are single-stemmed, but there are some differences in overall size that are important. *Orania parva*, *O. archboldiana* and *O. oreophila*, for example, are rather small understory palms, with stems less than 10 cm. in diameter. The other New Guinea species are larger, emergent palms with stems usually over 20 cm. in diameter. The regularly pinnate leaf form is fairly uniform throughout the genus, except for *O. archboldiana*, which has plumose leaves with irregularly arranged pinnae. *O. disticha* is distinctive by its two-ranked leaves. The indument of the sheath, petiole and rachis is uniform in type, but quite variable in intensity such that little taxonomic use can be made of it.

## Inflorescence

Characters of major significance are found in the inflorescence. Distinctive branching patterns, involving degree of branching, length of rachillae, and number of flower clusters per rachilla, are diagnostic for many species. *Orania parva* has small, simply branched inflorescences, with each rachilla bearing over 100 flower clusters. *Orania oreophila*, has a similarly small inflorescence, but which is twice branched, with a larger number of shorter rachillae, each bearing only 48-67 flower clusters. *Orania glauca* has a massive, three-times branched inflorescence with numerous short rachillae, each bearing only about 15 flower clusters. Most other species with large inflorescences are twice branched with elongate rachillae bearing many flower clusters. *Orania gagavu* is intermediate, however, with a large three-times branched inflorescence, but also with relatively long, many-flowered rachillae. Number of flower clusters per rachilla is not always directly proportional to the length of the rachilla, however. *Orania macropetala* and *O. gagavu* have flower clusters well spaced out along the rachillae, giving an average ratio of fewer than two clusters per centimeter of rachilla. In many other species, including *O. lauterbachiana* the flower clusters are packed closer together, giving a ratio of more than two clusters per cm. of rachilla. This factor may be directly related to flower size, as is true for *O. macropetala* which has large flowers. Flower size is not known for *O. gagavu*, however. In all species, clusters containing pistillate flowers are more widely spaced than those containing only staminate flowers. Pistillate flowers occur in the lower flower clusters of each or at least many of the rachillae in an inflorescence. In the New Guinea species, pistillate flowers occur generally in the lower  $\frac{1}{4}$  to  $\frac{1}{2}$  (somewhat more in *O. macropetala*) of the flower clusters. In the Malayan *O. sylvicola*, however, pistillate flowers occur nearly to the tip of the rachillae. How these various features relate to one another or what their adaptive value may be is unknown.

Finally, the indument of the inflorescence is very important. *Orania lauterbachiana* and others have a thick red-brown tomentum covering all axes. In some (*O. macropetala*), the tomentum has a whitish cast because of white woolly extensions emanating from the reddish scale bases. Several species show lesser manifestations of this tomentum, while some are nearly or quite glabrous. *Orania distcha* is glabrous and almost shiny, apparently with some subsurface sclerenchyma that maintains smoothness even after drying. *Orania glauca* has a distinct waxy bloom over the glabrous inflorescence axes.

### Flowers

There are several characters of potential importance, but their use is limited by the dearth of flowering collections. Flowering is markedly seasonal in *Orania*, and only occasionally encountered by collectors. Flower size has been used as a diagnostic character (*O. macropetala*, *O. micrantha*) and has much potential, but is unreliable at the present time, because where reasonable sample size has been available (as in *O. lauterbachiana*), flower size has been quite variable. This may be partially due to differences in maturity of flower collections. Some collections have been made by opening a nearly mature inflorescence, and there appears also to be some expansion of flowers after natural opening of the inflorescence.

Stamen number is important in distinguishing a few species: *Orania regalis* and *O. aruensis* have three stamens, *O. macropetala* has nine-fourteen, while all others that are known have six stamens. Most species have awl-shaped staminodes in the pistillate flowers, and little or no pistillode in the staminate flowers. *Orania sylvicola*, however, has staminodes with rudimentary anthers and conspicuous pistillodes. Several Philippine species have rather elongate staminate flowers, but in all the New Guinea species, where known, the staminate flowers are broadly lanceolate. Flowers are not known for several of the species, however.

### Fruit

Fruit characters have been used even less than floral characters because of paucity of material. In the New Guinea species, as far as is known, fruits are always spherical or slightly compressed, or if two- or three-seeded, then each lobe is approximately spherical. Several species from the Philippines have fruit that are narrowed toward the base, sometimes resulting in a subpyriform shape. Apparently the latter are rarely or never more than single-seeded. Size of the fruit has been used as a diagnostic character, but again, variation in moderate sample sizes suggests that caution should be used. Thickness of the mesocarp was used by Beccari (1919) to distinguish some species in the Philippines.

Fruit anatomy may ultimately prove to be of value in this genus. A preliminary look at a limited sample of fruits have revealed variation in density of the brachysclereid layer, in the distribution of tannin, in the density of radial fibrous bundles, in the distribution of vascular bundles, and in the thickness of the locular epidermis.

Seed characters appear to be quite uniform in the genus, and no taxonomic use has been made of them.

### Phylogeny

Little can be said about the phylogeny of this genus that is not highly speculative. The general uniformity of vegetative, floral and fruit characters, and the lack of infrageneric categories suggest a relatively recent origin for most of the species. Evolution has proceeded mainly in inflorescence characters that defy explanation. These include branching and flower-bearing patterns and type of indument. Only a few species display vegetative novelties (*Orania archboldiana* and *O. disticha*), and a few have departed from the generally large dimensions to become understory palms (*O. archboldiana*, *O. oreophila*, and *O. parva*). *Orania sylvicola* seems to be the most primitive member of the genus, with staminate and pistillate flowers possessing relatively well-developed pistillodes and staminodes. Stamen number appears to have been reduced in some species (*O. regalis*, with 3 stamens) and increased in others (*O. macropetala*, with 9-14 stamens), while most species retain the basic number of 6.

Among the New Guinea species, *O. regalis* and *O. glauca* each seem to stand well apart from the remaining species, which appear to form a more closely related complex. Both species have very distinctive inflorescence characteristics, and *O. regalis* has also the lowered stamen number. Floral characters are not known for *O. glauca* and fruit of neither has been examined anatomically.

The Philippine species, as a group, appear to be closely related to the main New Guinea group, again on inflorescence characteristics, but have not yet been carefully studied. *Orania appendiculata* has developed some peculiarities (congenitally open flowers, lack of sclerenchyma in the pericarp) through its isolation in Australia, but was likely derived from the New Guinea group. The isolated positions of *O. regalis* (and *O. aruensis*), *O. sylvicola*, and *O. glauca* might become clarified with new collections from poorly explored parts of West Irian and Indonesia, where it appears at present that *Orania* is totally lacking. These species may represent isolated stocks not closely related to the main New Guinea - Philippine line.

## TAXONOMIC TREATMENT

**Orania** Zipp. in Alg. Konst- Lett. - Bode. 1(19):297. 1829; Zipp ex. Bl., Rumphia 2:115. 1843; Becc. in Martelli in Nuovo Giorn. Bot. Ital. II. 42:64. 1935; Becc. & Pichi-Sermolli in Webbia 11:172. 1955; H. E. Moore in Principles 7:155. 1963.

*Arausiaca* Bl., Rumphia 2: praefatio, p.8, t. 119, 122. 1838-39 ('1836').

*Macrocladus* Griff. in Calcutta J. Nat. Hist. 5:489. 1845.

Small to large, unarmed, monoecious, pleoanthic, solitary palms; leaves with a broad, clasping sheath, not forming a crownshaft, gradually narrowing into an elongate petiole, the latter rounded below, channeled above, the blade pinnately divided, with the pinnae regularly arranged, spreading to semi-pendent, or irregularly arranged in groups and oriented at different angles; sheath, petiole, and rachis densely to sparsely red-brown to whitish-tomentose; pinnae linear-lanceolate, variously praemorse at the apex, the upper surface glabrous, the lower surface usually covered with a very fine whitish coating of undetermined nature, and dotted with minute red-brown punctiform scales; inflorescence simply to 3-times branched, with the axes glabrous, glaucous or red-brown - to whitish-tomentose; prophyll much shorter than the peduncular bract, tubular, open at the apex, usually badly frayed at maturity of the inflorescence; peduncular bract elongate, with a hard, rostrate tip, closed around the inflorescence in bud, narrowly boat-shaped after opening, with an indument similar to that of the leaf axis; bracts of the upper peduncle and subtending branches usually vestigial, but rarely conspicuous and up to 10 cm. long (*Orania oreophila*); rachillae short and few-flowered to elongate and many-flowered, usually markedly flexuous, bearing triads with central pistillate flower and two lateral staminate flowers in the lower parts and paired staminate flowers in the upper parts; flowers cream-white where known, the staminate and pistillate flowers similar, with the staminate flowers usually narrower and more elongate than the pistillate flowers, the petals broadly to narrowly lanceolate, loosely valvate in bud, sepals united into a low, 3-angled cupule; staminate flowers with 3, 6, or 9-14 stamens, the anthers elongate, auriculate at the base, dorsifixed, but erect and not versatile, with latrorse dehiscence, the pollen monosulcate with a finely reticulate exine (Thanikaimoni 1971, p. 67), the pistillode lacking in most species, but conspicuous in *O. sylvicola*; pistillate flowers with triangular-ovoid pistil with 3 linear-lanceolate stigmas held erect in bud, the staminodes 3-6, awl-shaped, with rudimentary anthers only in *O. sylvicola*; fruit orange where known, globose to pyriform when single-seeded, often 2- or 3- seeded, then each lobe globose, the endocarp thin but hard, sclerenchymatous, the mesocarp thick, parenchymatous with numerous, massive, radially oriented fibrous bundles (lacking in *O. appendiculata*), the exocarp, when present, a dense zone of brachysclereids; seed compressed-globose, the endosperm homogeneous; embryo small, lateral to apical.

**TYPIFICATION:** The type species for the genus is *Orania regalis* Zipp. The name was first published in a brief letter from Zippelius (1829) to Blume in which he refers to the 3 stamens characteristic of that species and to the fact that the fruit are like "orange-apples"... The genus was scarcely characterized by this brief description, but later, Blume (1843) used Zippelius' field notes and sketches to provide a more ample description. No type specimen is known. Apparently most of Zippelius' New Guinea collections were lost or badly damaged (Steenis-Kruseman 1950). *Arausiaca excelsa* was published erroneously by Blume as a *nomen nudum* in the Praefatio to volume 2 of Rumphia, apparently in 1837, and in plates labeled as such, published in 1838-39. Blume had confused Zippelius' genus *Orania* with a species of *Wallichia*, to which the name *Orania* refers in the Praefatio, and erected the new name *Arausiaca* for the actual material of *Orania*. Blume recognized his error before 1843, when he actually published volume 2 containing the text in which the new genus was correctly named and described. The genus *Macrocladus* was established for *M. sylvicola* from Malaya, which is now *Orania sylvicola*.

Beccari and Pichi-Sermolli (1955) erected two subgenera for the genus: *Orania* and *Oraniopsis*. The latter includes only *Orania appendiculata* from Australia, and is distinguished by the flowers being open in bud (never tightly closed), with stamens protruding from the petals. Since *Orania appendiculata* has not been studied critically, the subgeneric problem will not be considered here.

Key to species of *Orania* (including extra-New Guinea species)

Inflorescence markedly short and congested; stamens 3.

(West Irian: Triton Bay) ..... 1. *O. regalis*(Aru Islands) ..... 10. *O. aruensis*

Inflorescence usually well expanded; stamens, where known, 6 or more.

Rachillae bearing at most 20 flower clusters.

Inflorescence massive, 3-times branched, the axes glaucous; fruit 4.3-4.8 cm. in diameter

(New Guinea: Sepik Basin) ..... 9. *O. glauca*

Inflorescence small, twice-branched, the axes moderately tomentose; fruit about 2.5 cm.

in diameter (Australia) ..... 12. *O. appendiculata*

Rachillae bearing at least 40 flower clusters.

Pistillate flowers occurring nearly to the tips of the rachillae and containing staminodes with rudimentary anthers; staminate flowers with conspicuous pistillode; (Malaya) ..... 13. *O. sylvicola*

Pistillate flowers absent in the upper 1/3 to 3/4 of the rachillae and containing staminodes without rudimentary anthers; staminate flowers where known, lacking a conspicuous pistillode

Leaves plumose, the pinnae oriented in different directions (New Guinea: Fly Basin) ..... 5. *O. archboldiana*

Leaves not plumose, the pinnae regularly arranged.

Inflorescence axes densely and persistently tomentose.

Indument of inflorescence axes whitish; flower clusters averaging fewer than 2 per centimeter of rachilla; stamens 9-14. (New Guinea: Astrolabe coastal plain, Markham and Ramu Basins) ..... 2. *O. macropetala*

Indument of inflorescence axes red-brown; flower clusters averaging more than 2 per centimeter of rachilla; stamens 6.

Fruit of lobes of the fruit spherical (New Guinea) 3. *O. lauterbachiana*

Fruit narrowed at the base or subpyriform (Philippines)

17. *O. rubiginosa*

Inflorescence axes sparsely tomentose to glabrous.

Staminate flowers very narrow, 3-4 times longer than broad.

Fruit slightly narrowed at the base to subpyriform

(except in var. *montana*) (Philippines) ..... 16. *O. decipiens*Fruit spherical (Philippines) ..... 15. *O. paraguayensis*

Staminate flowers, where known, only about twice as long as broad.

Leaves distichous; inflorescence axes quite glabrous,

even when dry (New Guinea: Central Province) ..... 4. *O. disticha*

Leaves spirally arranged; inflorescence axes lined when dry.

Inflorescence simply branched; rachillae each bearing more than 100 flower clusters; stem less than 10 cm. in diameter (New Guinea: southern Sepik Rim) ..... 7. *O. parva*.

Inflorescence 2- or 3-times branched.

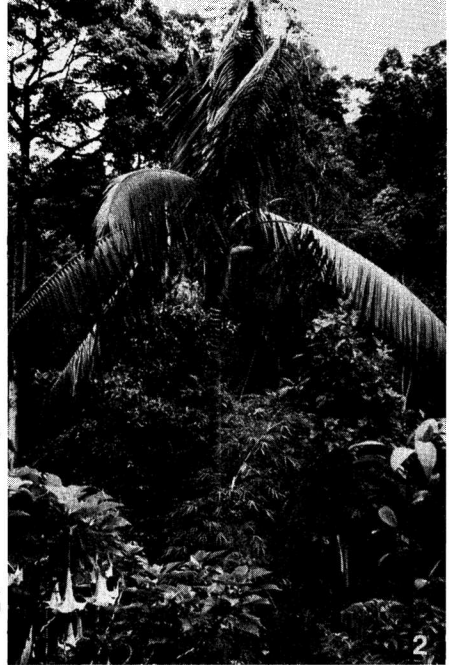
Inflorescence 3-times branched; rachillae each bearing about 80-90 flower clusters, or fewer than 2 flower clusters per centimeter of rachilla; large palm with stem more than 20 cm. in diameter (New Guinea: Milne Bay) ..... 8. *O. gagavu*

Inflorescence 2-times branched.

Rachillae each bearing 48-67 flower clusters; small palm with stem less than 10 cm. in diameter (New Guinea: eastern mountains and highlands) ..... 6. *O. oreophila*

Rachillae each bearing about 125 flower clusters; large palm with stem more than 20 cm. in diameter (Philippines)

..... 14. *O. palindan*





1. ***Orania regalis*** Zippelius, Alg. Konst- en Lett. - Bode 1(19): 297. 1829. *nom. nud.*; Zipp. ex Blume, Rumphia 2:116. 1843.

*Arausiaca excelsa* Blume in Rumphia 2, praefatio, p. 8, t. 119, 122. 1838-39 ('1836').

Palm to ca. 15 m. tall; leaves about 10, spirally arranged, graceful, spreading; pinnae regularly arranged, the largest 74-120 cm. long, 5.3-6.3 cm. wide, with the apex irregularly praemorse; inflorescence twice-branched, short, congested, about 120 cm. or more long (fide Zippelius); rachis 24-35 cm. long in Singapore specimen; axes subglabrous with remnants of brown scales; rachillae 10-12 cm. long, strongly flexuous, each bearing 46-84 flower clusters, of which 5-17 contain pistillate flowers; staminate flowers about 4.5 mm. long and 1.5 mm. wide; stamens 3(4); pistillate flowers 5 mm. long, 4 mm. wide; staminodes 3, subulate; fruit somewhat depressed-globose, 4.3-4.8 cm. high, 4.7-5.3 cm. wide.

**TYPIFICATION:** No authentic material collected by Zippelius is known to exist. Blume's description (and the plates), however, appear to be based upon the extensive notes and drawings made by Zippelius in the field. Therefore, the description by Blume is selected as the lectotype.

**DISTRIBUTION:** known only from Triton Bay in southwestern West Irian.

Singapore: Singapore Botanic Garden, Lawn 0, 23 August 1925 (*M. Nur s.n.*) (BH); 8 October 1929, *Nur s.n.* (BH); 10 January 1933, *Kiah Singapore Field No. 26189* (BH).

*Orania regalis*, the type species for the genus, is distinctive in its crowded inflorescence axes, short rachillae, and staminate flowers with three stamens. The specimens made from Singapore Botanic Garden agree well with the type description, and possibly were grown from seed collected by Zippelius or a second generation from plants cultivated at Singapore or at another Botanic Garden. *Orania aruensis* seems scarcely distinguishable from this species, but no judgement is made here since both species are so poorly known.

2. ***Orania macropetala*** Lauterbach & K. Schumann, Flora der deutschen Schützgebiete in der Südsee, p. 205. 1901.

Palm to about 20m. tall; stem 15-36 cm. in diameter; leaves about 12, spirally arranged, somewhat stiff and ascending, with pinnae spreading to pendant; sheath about 42 cm. long; petiole 1.2 m. long; blade about 3.5 m.

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**Figures 1-4.** 1. *Orania regalis*, from the Singapore Botanic Garden, showing the congested inflorescences; 2. *Orania lauterbachiana*, from the locality of *O. clemensiae* (Essig & Young LAE 74012); 3. *Orania disticha* from type locality (photo by L. J. Brass, courtesy Arnold Arboretum); 4. *Orania disticha*, leaf and inflorescence (Essig LAE 55177).

long; pinnae regularly arranged, 59-60 on each side of the rachis, the largest 79-148 cm. long, 6.5-7 cm. wide, with the apex bluntly praemorse or briefly bifid; inflorescence twice branched, to about 1.5 m. long; axes white tomentose over red-brown scale bases; rameal bracts small, triangular; rachillae 30-38 cm. long, 4-5 mm. thick near the base, tapering to 1.5 mm in the upper part, flexuous, strongly lined when dry, bearing 30-50 flower clusters, or fewer than 2 per cm. of rachilla, of which the lower 1/2-2/3 may contain pistillate flowers; staminate flowers 15-16 mm. long, 5mm. wide; stamens 9-14, unequal in size, about 2/3 the length of the whole flowers; pistillate flowers about 9 mm. long, 6-7 mm. wide; staminodes 3-4, subulate; fruit globose, to 5.4 cm. in diameter (7-7.5 cm. *vide* Lauterbach & Schumann - fresh?), sometimes two-lobed.

**TYPIFICATION:** Three specimens were cited in the protologue to this species. The first two, cited after the main description, can be considered syntypes. Of these, *Lauterbach 2835* is selected as the lectotype, as it is a fruiting specimen that presumably illustrates the large, persistent, pistillate petals at the base of the fruit from which the species derives its name. *Lauterbach 2001* then becomes a paratype. The third specimen cited, *Lauterbach 970*, has been segregated out as the type for *Orania lauterbachiana*. All specimens were lost at Berlin during the Second World War, but fragments were preserved at FI.

**DISTRIBUTION:** Swamp forests to hillsides, Astrolabe coastal plain, Ramu and Markham river drainages.

Papua New Guinea. **MADANG PROVINCE:** Erima, Astrolabe Plain, alluvial swamp forest, *Lauterbach 2001* (FI, fragments of paratype, photo at BH); Bonu, alt. 100 m., *Croft et al. LAE 71098* (BH); Bismarck Mountains, in high forest on the Schumann River, alt. 200 m., *Lauterbach 2835* (FI fragments of lectotype, photo at BH); in forest at Djamu, 20 April 1908, *Schlechter s.n.* (L, photo at BH); "Monsun gebiete," *Schlechter 17580* (B?, photo at FI, BH); several km. northeast of Usino, common on mountain slope, alt. 600 m., *Essig & Young LAE 74001* (LAE, USF); **MOROBE PROVINCE:** Wampit, 35 miles from Lae on road to Bulolo, swampy forest, *Moore & Womersley 9269* (BH, LAE).

*Orania macropetala* is distinctive for its large, widely spaced flowers, of which the staminate possess 9-14 stamens. It appears to occupy a wide range of habitats, as does *O. lauterbachiana*, which seems to overlap in range. The ecological distinction between these two species is not known, though they are easily separated morphologically.

### 3. *Orania lauterbachiana* Becc. in Bot. Jahrb. Syst. 52:36. 1914.

*Orania micrantha* Becc. in Bot. Jahrb. Syst. 52:36. 1914.

*Orania brassii* Burret in Notizbl. Bot. Gart. Berlin-Dahlem 13:68. 1936.

*Orania clemensiae* Burret in Notizbl. Bot. Gart. Berlin-Dahlem 15:8. 1940.

Palm to 25 m. in height; stem 13-30 cm. in diameter; leaves about 10, spirally arranged or rarely distichous, spreading; sheath-petiole 1-2 m. long;

blade 240-400 cm. long; pinnae regularly arranged, 29-49 on each side of the rachis, the largest 66-135 cm. long, 3.2-7 cm. wide, with the apex irregularly praemorse; inflorescence twice-branched, 125-250 cm. long, rachis somewhat longer than the peduncle; axes densely red-brown-tomentose, at least in the lower parts; rameal bracts rudimentary, triangular, to 1 cm. long; rachillae 13-66 (mostly 30-50) cm. long, 2-4 mm. thick near the base, tapering to less than 1 mm. near the tip, flexuous, deeply lined when dry, each bearing 46-150 (mostly more than 100) flower clusters, or more than 2 clusters per centimeter on the average, of which the lower 1/3 contain pistillate flowers; staminate flowers 6-11 mm. long, 2-2.5 mm. wide, stamens 6(7), about 3/4 the length of the petals; pistillate flowers 4-5 (7) mm. long, 3-4 mm. wide; staminodes 3-6, subulate; fruit globose, 3.2-5.5 cm. in diameter, sometimes 2-3-lobed.

**TYPIFICATION:** The type for the species was *Lauterbach 970*, which has been lost, but photographs of the fragments of the specimen are at FI and BH. The same is true for the type of *Orania micrantha*, *Schlechter 17739*. *Orania brassii* is typified by *Brass 5489*. Burret designated no holotype for the latter species, but he did annotate the specimen at NY, so it is chosen here as the lectotype. The type for *Orania clemensiae* was given as *Clemens 8713* from Boana. I have not seen this specimen; perhaps it too was lost.

**DISTRIBUTION:** on hilly or well-drained terrain, up to about 1500 m. elevation, from northern West Irian, throughout mainland Papua New Guinea and on several islands of the D'Entrecasteaux group.

Papua New Guinea. **MADANG PROVINCE:** Gogol River, *Lauterbach 970* (photo of fragments of holotype at FI and BH); Mt. Kani, alt. 800 m., *Schlechter 17739* (photograph of part of type of *Orania micrantha* at FI and BH); **MOROBE PROVINCE:** near Lae, alt. 30 m., *Henty NGF 10576* (LAE, BH); Mt. Kawea, Buso, alt. 800 m., stunted lowland forest on exposed ridge, ultrabasic series, *Streimann & Foreman NGF 24435* (LAE, BH); Gurakor, along Lae-Bulolo Road, steep mountainside forest with oaks, alt. 500 m., *Essig & Katik LAE 55004* (LAE, BH); Markham Valley, near Lae, alt. 60 m., *Womersley s.n.*, May 1960 (LAE); Buso River, lowland rain forest behind swamp ultrabasic series, alt. 2m., *Streimann NGF 24480* (LAE, BH); Boana, mountain bush, alt. 1100 m., *Clemens 11363* (BH); mountains south of Boana, along road, near Mangulem Village, 1200 m., left standing in garden, *Essig & Young LAE 74012* (LAE, USF); **MILNE BAY PROVINCE:** Peria Creek, Kwagira River, common in the rain forest, *Brass 24105* (A, BH, CANB); Peria Creek, frequent in the rain forest, *Essig LAE 55218* (LAE, BH); Fergusson Island, track between Aululuai and Agamoia, alt. 720 m. *Croft et al. LAE 68645* (BH); Normanby Island, Mt. Solomonai, west of Esa'ala, alt. 700 m., *Croft et al. LAE 68947* (BH); Woodlark Island, hillside forest near sea, Suloga Point, alt. 16 m., *Gillison NGF 25340* (LAE, BH); **CENTRAL PROVINCE:** Boridi, forest at 1100 m., *Carr 14884* (BH); Mafulu, scattered through all types of primary forest, alt. 1250 m., *Brass 5489* (NY lectotype of *Orania brassii*, isotype at A); **WESTERN PROVINCE:** Fly River, 528 mile camp, sporadic in ridge forest substage,

alt. 80 m., *Brass* 6610 (A); 5 km. north of Kiunga on Kiunga-Rumginae Rd., lowland ridge forest, *Streimann & Lelean* NGF 34162 (LAE, BH); EAST SEPIK PROVINCE: 5 miles southwest of Wewak, in logging area, common in flat, forested land, subject to flooding by river, alt. 16 m., *Essig* LAE 55130 (LAE, BH); WEST SEPIK PROVINCE: near Frieda River base camp of Carpentaria Exploration Company, down from helicopter pad on Antap Mountain, undisturbed montane forest, alt. 1380 m., *Essig & Young* LAE 74064 (LAE, BH, USF).

Indonesia. WEST IRIAN: Idenburg River, 4 km. southwest of Bernhard Camp, occasional in the rain forest of the river plains, alt. 850 m., *Brass* 13375 (L, A); 15 km southwest of Bernhard Camp, common in rain forest substage, alt. 1500 m., *Brass* 12407 (A); near Dalman, 45 km. inward of Nabire, in *Agathis* forest, alt. 500 m., *Kanehira & Hatusima* 12128 (A); near Waren, 60 miles south of Manokwari, in high rain forest, alt. 5 m., *Kanehira & Hatusima* 12967 (A).

*Orania lauterbachiana*, as interpreted here, is a widely distributed and rather variable species. Diagnostic characters are in the inflorescence: the relatively elongate rachillae bearing numerous flower clusters, and the dense red-brown tomentum that covers the young axes. Vegetatively, the species is unspecialized, with regularly pinnate leaves that are spirally arranged. One specimen (*Brass* 12407) was reported as distichous, however. Leaf, flower, and fruit dimensions are quite variable. Stamen number is essentially constant at 6, though individual flowers have been seen with 7 stamens.

*Orania micrantha* is poorly known, but seems to belong here. Fragments in the photography at FI agree well with *O. lauterbachiana*, especially with respect to rachillae length and number of flower clusters. The nature of the indumentum cannot be determined however. The supposed diagnostic feature, pistillate flower size, is meaningless in view of the variability in *O. lauterbachiana*.

New collections from near the type locality of *O. clemensiae* were made in 1978 (*Essig & Young* LAE 74012). Mature flowers and fruit were not available, but inflorescence characters agree with *O. lauterbachiana*. In comparing the two species, Burret mentioned differences in the attachment of the staminate flowers and in the shape and thickness of the rachillae. This is not an adequate basis for recognizing a new species, so *O. clemensiae* is submerged.

*Orania brassii* also does not differ in any significant way from *O. lauterbachiana*. Burret pointed out the dense red-brown tomentum of the inflorescence axes, comparing it only with the glabrous *O. disticha*. The obvious comparison with *O. lauterbachiana* was ignored. No other distinctive characteristics are evident from the type, from Burret's description, or from more recently collected materials, so the name is here placed in synonymy.

One specimen cited above (*Essig & Young* LAE 74064), from the West Sepik Province, may represent a new taxon, possibly a new species or

subspecies of *O. lauterbachiana*. Inflorescence axes and flowers of this specimen were dark green, while in the few instances where color information has been given in other specimens of *O. lauterbachiana*, flowers have been described as whitish or pale yellow. Much more information about coloration of inflorescence parts needs to be gathered for this species, for it may turn out to be a basis for recognizing finer taxa.

4. ***Orania disticha*** Burret in Notizblatt Bot. Gart. Berlin-Dahlem 12:321. 1935.

Palm to 20 m. tall; stem 20-23 cm. in diameter; leaves 7-12, distichous; sheath-petiole 130-170 cm. long, blade 240-350 cm. long; pinnae regularly arranged, 50-70 on each side of the rachis, the largest 105-150 cm. long, 5.5-7 cm. wide, with the apex obliquely praemorse; inflorescence twice-branched, 120-180 cm. long, including peduncle 80-90 cm. long; axes glabrous, subglossy; rameal bracts rudimentary; rachillae 37-50 cm. long, 2.5-5 mm. thick near the base, tapering to ca. 1 mm. near the tip, flexuous, smooth, not shriveled or lined when dry, each bearing 74-110 flower clusters, of which the lower third may contain pistillate flowers; staminate flowers 11-15 mm. long, about 5 mm. wide; stamens 6, about 2/3 the length of the flowers; pistillate flowers 8-19 mm. long, 4.5-6 mm. wide; staminodes 6, subulate; fruit 6.5-7.5 cm., in diameter, often 2- or 3-lobed.

**TYPIFICATION:** Type for the species is *Brass 5599*. Burret did not designate a holotype, nor did he annotate one of the syntypes at A and NY. The specimen at A is chosen as lectotype, as it is more likely the one that Burret studied. He did annotate a number of other specimens from that herbarium.

**DISTRIBUTION:** in lowland rain forest of the Central Province, Papua New Guinea.

Papua New Guinea. **CENTRAL PROVINCE:** Kubuna, in rain forest alt. 100 m., *Brass 5599* (A lectotype, NY isotype); Maipa, on edge of tall forest at airstrip, alt. 48 m., Kairuku subprovince, *Darbyshire 906* (CANB); Veiya, forest at sea level, *Carr 11, 705* (A, CANB); between Veimauri and Kuriva Rivers, along logging road off Brown River Road, alt. 30 m., *Essig LAE 55177* (LAE, BH); Port Moresby Subprovince, on logging road near Kuriva sawmill, Hiritano Highway, road leading into company docks, tropical lowland forest on ridge, alt. 200m., *Laravita & Maru LAE 70596* (LAE, BH).

*Orania disticha* is easily recognized by its distichous habit. More importantly, it is characterized by its glabrous, almost shiny inflorescence axes that hardly shrivel or become lined even when dried.



5. ***Orania archboldiana*** Burret in J. Arnold Arbor, 20:198. 1939.

Palm to 15 m. tall; stem 6-10 cm. in diameter; leaves about 6-10, plumose, arching; sheath-petiole 90-120 cm. long; blade 160-225 cm. long with pinnae irregularly grouped and oriented in different planes, 41-44 on each side of the rachis, the largest 70-125 cm. long, 4-7.5 cm. wide, with the apex obliquely praemorse; inflorescence twice-branched, 96-135 cm. long, with the peduncle slightly more than 1/3 of that length; lower axes white-to red-brown lepidote-tomentose, the rachillae often essentially glabrous; rameal bracts vestigial; rachillae 17-38 cm. long, 1.5-2.2 mm. thick near the base, tapering to less than 1 mm. in upper part, mildly flexuous, moderately lined when dry, each bearing 68-137 flower clusters, of which up to 2/3 may contain pistillate flowers; staminate flowers 5-7 mm. long, 1.5-2 mm. wide; stamens 6; pistillate flowers 2-3.5 mm. high, 1.5 mm. wide, staminodes 6, subulate; fruit globose, 3.5-4 cm. in diameter.

TYPIIFICATION: Burret cited three specimens in the protologue to this species. *Brass 8225* was cited after the main description, and was clearly intended as the type. *Brass 8184* and *7403* were each appended with a description of additional material, and are thus paratypes.

DISTRIBUTION: Fly River basin, southwestern Papua New Guinea.

Papua New Guinea. WESTERN PROVINCE: Fly River, east bank opposite Sturt Island, rain forest, scattered in undergrowth on ridge, *Brass 8225* (A holotype), and *Brass 8184* (A); Fly River, Oroville Camp, common in rain forest substage, *Brass 7403* (A); Kiunga, lowland forest flats, alt. 24 m., *Streimann & Katik LAE 51793* (BH, LAE); Pawa Village on the Oriomo River, rain forest, alt. 6m., *Foreman & Stocker LAE 60431* (LAE, BH); near Nomad, in rain forest on low, hilly terrain, alt. ca. 90 m., *Essig & Young 74014* (LAE, BH, USF).

*Orania archboldiana* is distinctive particularly for its plumose foliage, a unique feature in the genus. Otherwise, the dimensions are on the small side, but characters of the inflorescence suggest some affinity with *O. lauterbachiana*.

6. ***Orania oreophila*** Essig *sp. nov.*

Palma parva; folia spiraliter disposita, regulariter pinnata, 22-24 pinnis in quoque latere gerentibus; inflorescentia 2-plo ramosa, subglabra, rachillis 16-23 cm. longis, 48-67 fasciculus florum gerentibus.

A small palm; stem about 5 cm. in diameter; leaves few, stiff, spirally

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Figures 5-8. 5. *Orania archboldiana* near Nomad; 6. *Orania archboldiana*, infructescence and leaf (*Essig & Young LAE 74014*); 7. *Orania oreophila* in the Eastern Highlands; 8. *Orania parva*, infructescence and leaf (*Essig & Young LAE 74046*).

arranged; sheath-petiole 120-140 cm. long; blade 155-170 cm. long with pinnae regularly arranged, held out horizontally, 22-24 on each side of the rachis, the largest 61-78 cm. long, 4.8-5 cm. wide, with the apex obliquely praemorse; inflorescence twice-branched, sometimes with prominent bracts on the upper peduncle and subtending the branches; axes subglabrous, with very sparse red-brown scales; rachillae 16-23 cm. long, 2.5-3 mm. thick near base, tapering to 1.5 mm. in the upper part, flexuous, deeply lined when dry, each bearing 48-67 flower clusters, of which the lower 22-37 contain pistillate flowers; mature flower dimensions unknown, stamens 6; fruit about 3.6 cm. in diameter.

**TYPIFICATION:** The type is designated here as *Essig LAE 55147* from the Eastern Highlands.

**DISTRIBUTION:** known from the Eastern Highlands, Bismarck Mtns., and mountains of the western Morobe Province, at elevations of 1370-1615 m.

Papua New Guinea. **EASTERN HIGHLANDS PROVINCE:** Saboa, Andandara, Kainantu Subprovince, in *Castanopsis* dominated forest, alt. 1615 m., *Essig LAE 55147*, (BH holotype, isotype at LAE); Bismarck Mtns., near Sipapi Haus Kiap, Simbai Valley, in virgin forest, alt. 1370 m., *Clarke 89* (LAE, BH); **MOROBE PROVINCE:** near Angabena, a few km. east of Aseki, on track to Bulolo, montane rain forest, alt. 1450 m., *Essig LAE 55142* (BH, LAE).

This is a distinctive species, similar in dimensions to *O. parva* but with a twice-branched inflorescence, and shorter, fewer-flowered rachillae. One of the specimens cited (*Essig LAE 55142*) is most unusual in having large, well-developed bracts on the upper peduncle and subtending the branches. The other two specimens, however, possess the usual rudimentary bracts, so the taxonomic significance of this character is not certain.

## 7. *Orania parva* Essig *sp. nov.*

Palma parva; folia spiraliter disposita, regulariter pinnata, 23 pinnis in quoque latere gerentibus; inflorescentia 1-plo ramosa, glabra, rachillis 8-10, ca. 30 cm. longis, plus quam 100 fasciculus florum gerentibus.

A small, solitary palm, about 4 m. tall; stem 8 cm. in diameter; leaves spirally arranged; blade 204 cm. long; pinnae regularly arranged, 23 on each side of the rachis, the largest 95 cm. long, 5.2-5.3 cm. wide, with the apex praemorse; inflorescence 118 cm. long, simply branched into 8-10 rachillae; peduncle much longer than the rachis; axes nearly glabrous; rameal bracts rudimentary; rachillae to 30 cm. or more long, 3-3.5 mm. thick near base, tapering to about 2.5 mm. in the upper part, each bearing about 128 flower clusters, of which the lower 25-30 bear pistillate flowers; flowers and mature fruit unknown.



**TYPIFICATION:** The species is typified by *Essig & Young LAE 74046*.

**DISTRIBUTION:** known only from the type locality.

Papua New Guinea. WEST SEPIK PROVINCE: Frieda River, several km. south of Carpentaria Company airstrip, near "Clearwater Creek", well-drained slopes, alt. ca. 60 m., *Essig & Young LAE 74046* (LAE holotype, isotypes at BH, USF).

Though only the type collection was made, a number of individuals were seen in the vicinity that agreed well with the type. All were small, often flowering within arm's reach, and all had small, simply branched inflorescences. It is amply distinct, one of the most diminutive species of *Orania* in New Guinea.

8. ***Orania gagavu* Essig sp. nov.**

*Palma grandis*; folia spiraliter disposita, regulariter pinnata, 52 pinnis in quoque latere gerentibus; inflorescentia 3-plo ramosa, rachillis subglabris, 55-65 cm. longis, 80-90 fasciculus florum gerentibus.

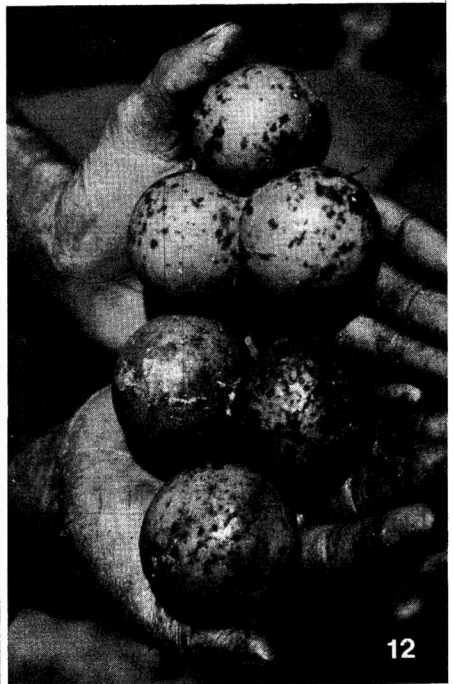
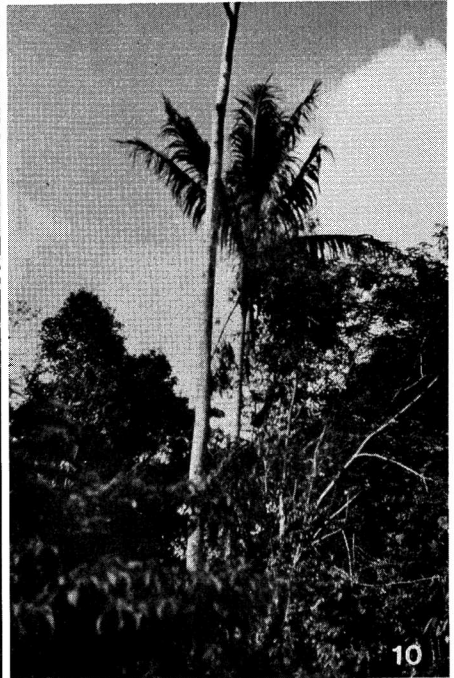
A large palm; stem 20-25 cm. in diameter; leaves spirally arranged; sheath-petiole 1 m. long; blade 3 m. long pinnae regularly arranged, 52 on each side of the rachis, the largest 110-120 cm. long, 5.5 cm. wide, with the apex praemorse but longest on the midrib; inflorescence 3 times branched, 2.5 m. long, including peduncle 1 m. long, with 36 primary branches; axes nearly glabrous, with traces of white wool in protected angles, rameal bracts rudimentary; rachillae 55-65 cm. long, about 2 mm. wide near the base, less than 1 mm. wide in the upper part, flexuous, lined when dry, each bearing 80-90 flower clusters, of which about 20-25 contain pistillate flowers; flowers and fruit unknown.

**TYPIFICATION:** The species is typified by *Essig & Young LAE 74096*.

**DISTRIBUTION:** known only from the type locality.

Papua New Guinea. MILNE BAY PROVINCE: on the slopes of Mt. Daraia, several km. north of Kaporika village, Alotau subprovince, rain forest, alt. 400 m. *Essig & Young LAE 74096* (LAE holotype, isotypes at BH, USF).

It is unusual to describe a new species with neither flowers nor mature fruit (the type specimen was in early fruit), but the species is quite distinct in characters of the inflorescence: i.e. the tertiary branching, the subglabrous axes, and the fact that the rachillae are elongate but with flower clusters widely spaced, giving a ratio of less than two clusters per centimeter. These three characters amply separate the species from the widespread *O. lauterbachiana* and no other species are comparable.



9. *Orania glauca* Essig sp. nov.

Palma grandis; folia spiralter disposita, regulariter pinnata, 60 pinnis in quoque latere gerentibus; inflorescentia 3-plo ramosa, rachillis glabris, glaucis, 9-12 cm. longis, 12-15 fasciculus florum gerentibus; fructibus 4.3-4.8 cm. diametro.

A tall, robust palm with stem 30 cm. in diameter, leaves about 8-10, spirally arranged, stiff, ascending; sheath-petiole 140 cm. long; blade 320 cm. long; pinnae regularly arranged, 60 on either side of the rachis, the largest 84 cm. long, 7 cm. wide, with the apex convexly praemorse; inflorescence 3-times branched, with peduncle 80 cm. long and rachis 180 cm. long, with 53 primary branches; axes pale green, glabrous and lightly glaucous; rachillae numerous, short, 9-12 cm. long, about 1.5 mm. thick near the base, tapering to less than 1 mm. in the upper part, each bearing 12-15 flower clusters, of which about half contain pistillate flowers; flowers unknown; fruit 1-, 2-, or 3-lobed, each lobe globose, 4.3-4.8 cm. in diameter.

TYPIIFICATION: The type for the species is *Essig LAE 55089*.

DISTRIBUTION: Known only from the type locality.

Papua New Guinea. WEST SEPIK PROVINCE: near Amanab in disturbed forest, *Essig LAE 55089* (BH holotype, isotype at LAE).

*Orania glauca* is one of the largest members of the genus, and very distinctive in its highly ramified inflorescence with numerous short rachillae and glaucous axes. No affinity with other species is evident.

Extra-New Guinea species

The species of *Orania* occurring outside of New Guinea are discussed briefly below. They have not been studied critically. Information concerning the Philippine species is largely from Beccari (1919). The essential character of these species in comparison with the New Guinea species can also be seen in the taxonomic key at the beginning of the taxonomic section.

10. *Orania aruensis* Becc., Malesia 1:76. 1877.

Known only from the Aru Islands in eastern Indonesia, this species seems hardly distinct from *Orania regalis*. Neither species is well known, but they do share the congested form of inflorescence and the staminate flowers with 3 stamens. It is likely that the two species will be combined when more is known about them.

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Figures 9-12. 9. *Orania gagavu*, leaf and young infructescence (*Essig & Young LAE 74096*); *Orania glauca*: 10. habit near Amanab; 11. Inflorescence (past flower); 12. Fruit, showing single, double and triple seeded examples (*Essig LAE 55089*).

11. **Orania moluccana** Becc. in Ann. Jard. Bot. Buitenzorg 2:163. 1885.

This species was described from a plant in cultivation at Bogor, on the basis only of leaf fragments. Apparently, flowers or fruit were never collected. The species is thus inadequately circumscribed. The species was said to have been collected by Teysmann and De Vriese from Batjan, a small island near Halmahera in northeastern Indonesia. It is thus well isolated from other species, but new, complete material must be collected to establish its identity and legitimacy.

12. **Orania appendiculata** (F. M. Bailey) Domin in Biblioth. Bot. 85: 498. 1915.

*Areca appendiculata* F. M. Bailey in Queensland Dept. Agric. Bot. Bull. 4:18 1891; F. M. Bailey, The Queensland Flora 5:1672. 1902.

*Orania beccarii* F. M. Bailey in Queensland Agric. J. 23:35. 1909; F. M. Bailey., Comprehensive Catalogue of Queensland Plants, p. 566. 1909.

This species is the sole representative of *Orania* in Australia, occurring in Queensland rain forests. The name is derived from the supposed presence of triangular appendages on the inside of the petals, presumably of the pistillate flowers. This undoubtedly refers to the subulate staminodes that are characteristic of most of the genus. The affinities of this species are obscure.

13. **Orania sylvicola** (Griff.) H.E. Moore in Principes 5:44. 1962.

*Macrocladus sylvicola* Griff. in Calcutta J. Nat. Hist. 5:490. 1845.

*Orania macrocladus* Martius, Historia Naturalis Palmarum 3:186, t. 177, ed. 2, 1849, *nom. illeg.*

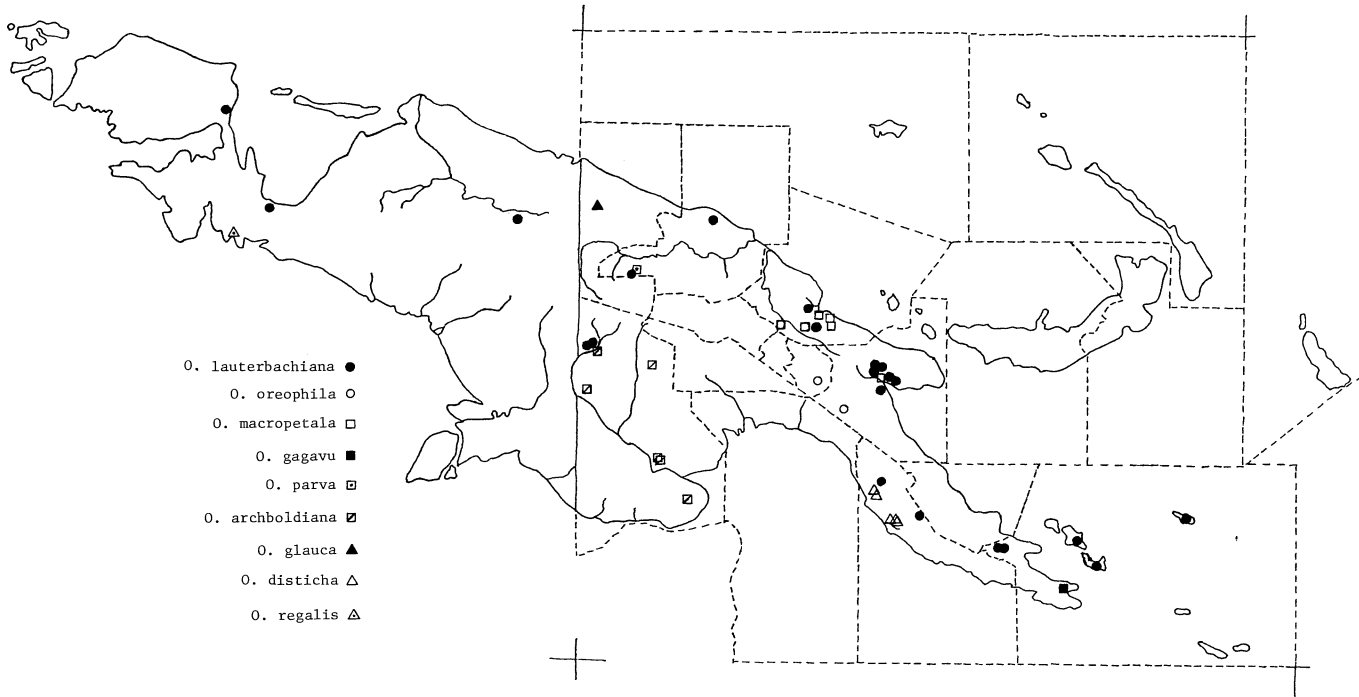
This species appears to be the most primitive in the genus in several respects: the staminate flowers possess a conspicuous pistillode, the staminodes in the pistillate flowers have rudimentary anthers, and the flower clusters contain pistillate flowers nearly to the tips of the rachillae. Elsewhere in the genus, pistillodes are lacking, staminodes are rudimentary, and pistillate flowers are confined to at most the lower 2/3 of the rachillae. *Orania sylvicola* occurs in Malaya and western Indonesia.

14. **Orania palindan** (Blanco) Merrill in U.S. Dept. of Interior, Bureau of Government Laboratories Publ. 27:88. 1905.

*Caryota palindan* Blanco, Flora de Filipinas, ed. 2, p. 513. 1845.

*Orania philippinensis* Scheff. ex Becc. in Ann. Jard. Bot. Buitenzorg 2:156, t. 14. 1885; Becc. in Webbia 1:335. 1905.

This species occurs on Luzon and the small island of Sibuyan in the Philippines. It is distinguished by a combination of characters: inflorescence



Map: Distribution of the species of *Orania* in New Guinea.

with elongate rachillae and axes lightly scaly to glabrous, flowers broadly lanceolate, with the 6 stamens occupying 1/2 to 2/3 the length of the petals, and spherical fruit. Beccari considered the species to be closely related to *O. regalis*, but the basis for that conclusion is obscure.

15. ***Orania paraguayensis*** Becc. in *Webbia* 1:335. 1905.

This species, from Palawan in the Philippines, and also from Borneo, was considered by Beccari to be very close to *O. palindan*, differing in the longer, narrower flowers, (4 times as long as broad), with correspondingly long anthers nearly equalling the petals.

16. ***Orania decipiens*** Becc. in *Philippine J. Sci.* 4: Bot. 614. 1909.

This species is distinguished by relatively small fruit (31-42 mm. in diameter) with a thick pericarp. Several varieties have been described from Mindoro and Mindanao. Beccari considered the species to be closely related to *Orania sylvicola*, apparently because of the small fruits.

17. ***Orania rubiginosa*** Becc. in *Philippine J. Sci.* 14:333. 1919.

This species resembles *Orania lauterbachiana* from New Guinea, in that in inflorescence axes are densely red-brown lepidote-tomentose. This is probably due to convergence, however, as in other characters there is affinity with other Philippine species: the flowers are very narrow and elongate, and the fruit tend to be subpyriform in shape. The species occurs on Luzon.

Excluded and dubious species

*Orania nivea* Hort. Linden ex. W. Wats. in *Gard. Chron.* 2:157. 1887. = **Ceroxlon?**

This is a horticultural name of no botanical standing. The name is based on juvenile material in cultivation that was never adequately circumscribed.

*Orania nicobarica* Kurz in *J. Bot.* 13:331. 1875. = **Bentinckia nicobarica** Becc. in *Ann. Jard. Bot. Buitenzorg* 2:165. 1885. Nicobar Islands.

*Orania porphyrocarpa* Martius, *Historia Naturalis Palmarum* 3:190, t. 157. 1849. = **Arenga porphyrocarpa** (Martius) H.E. Moore in *Principes* 4:114. 1960. Java.

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