

DISTRIBUTION MAPS OF PACIFIC PLANTS

THE
PACIFIC
PLANT
SOCIETY
OF AMERICA
PUBLISHED BY THE
AMERICAN BOTANICAL SOCIETY

1. *Dolichandrone spathacea* (L. f.) K. Sch.

Name: *Dolichandrone spathacea* (L. f.) K. Sch., Fl. Kais. Wilh. Land (1889) 123.

Family: *Bignoniaceæ*.

Synonym: *Bignonia spathacea* L. f.

Habit: A small to medium-sized tree, with decussate, simply pinnate leaves.

Habitat: Inner side of the mangrove, on mud, within reach of the tidal zone, but sometimes in almost fresh water, e. g. in Perlis (N. Malaya).

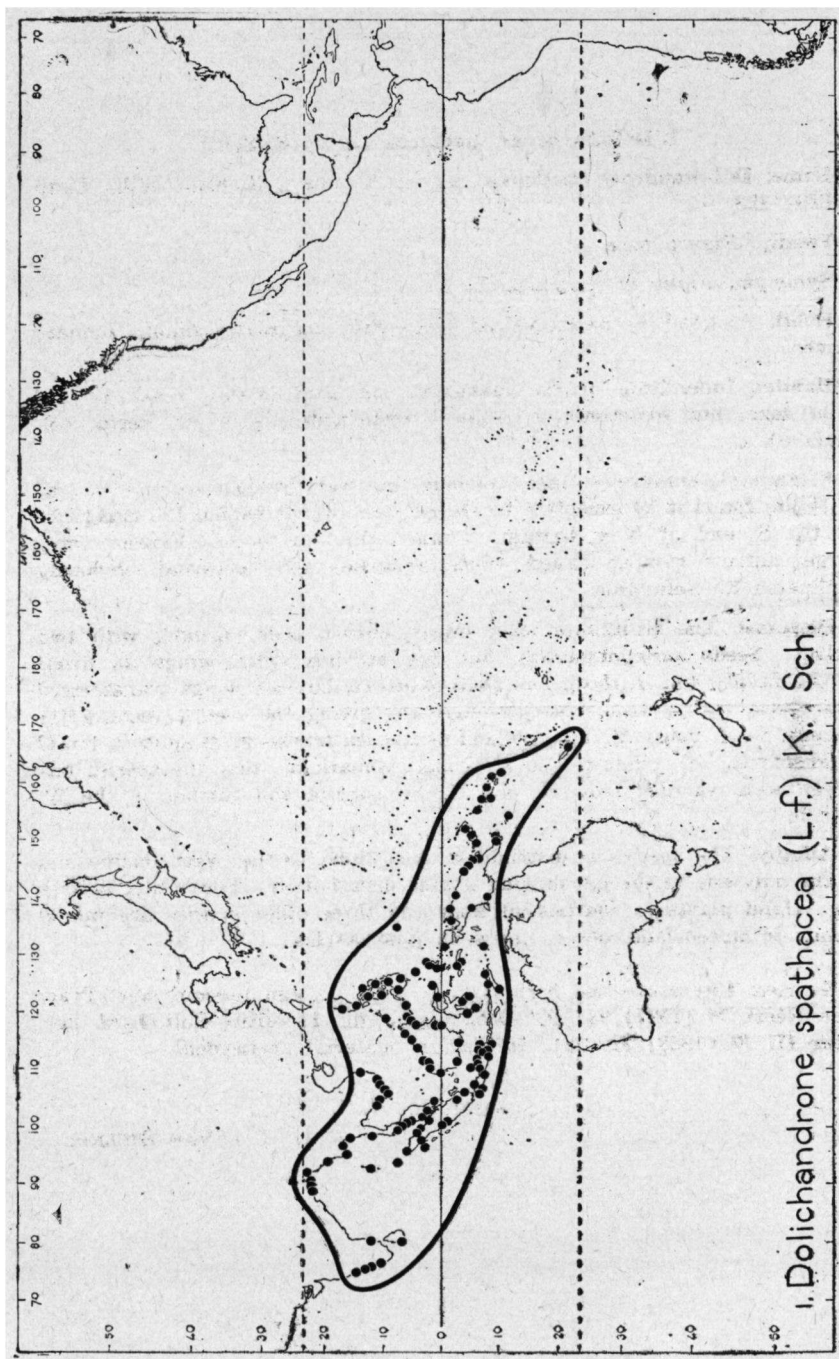
Ecology: A mangrove plant, common, but very seldom social. Mr. K. J. White found it by exception in almost pure stands behind the mangrove at the S. end of New Britain, 2 miles S of Girznam. Flowers very large, narrow-trumpet-shaped, white, fragrant and nocturnal, obviously pollinated by Sphingids.

Dispersal: The fruits are long, linear, curved pods, opening with two valves. Seeds very numerous, but not provided with wings as usual in the family and in the genus *Dolichandrone*, but the wings transformed into thick, corky, transverse prolongations giving the seed a rectangular shape. Seeds distinctly buoyant and fit for sea transport, frequently found in the drift. For that reason it is most remarkable that the species has never been recorded from N. and NE. Australia and further in the W. Pacific.

Affinity: The species is distributed from India to the West Pacific and is the only one in the genus with a wide distribution. Four other species are inland plants in continental Asia and three other species are inland plants in Queensland, one is native in East Africa.

Sources: Literature and herbaria; C. G. G. J. Van Steenis, Rec. Trav. Bot. Néerl. 24 (1927) 934, 937-945, map on fig. 11; ditto, Bull. Jard. Bot. Btzg III 10 (1928) 227-231; Herbarium material at Leyden.

C. G. G. J. VAN STEENIS.



2. *Rhizophora mucronata* Lamk

Name: *Rhizophora mucronata* LAMK, Encycl. Méth. 6 (1804) 189.

Family: *Rhizophoraceæ*.

Notes: This is the most common and widest spread species, distributed westward to East Africa, Madagascar, the Seychelles, and Mauritius, and northward to the Ryukyus. It is ecologically more tolerant than *R. apiculata* and plant-geographically and ecologically it occupies a position in *Rhizophora* similar to that of *Bruguiera gymnorhiza* in that genus.

Habit: Tree up to 27 m, sometimes over 30 m tall, with a diameter over 70 cm. In many respects very similar to *R. apiculata*.

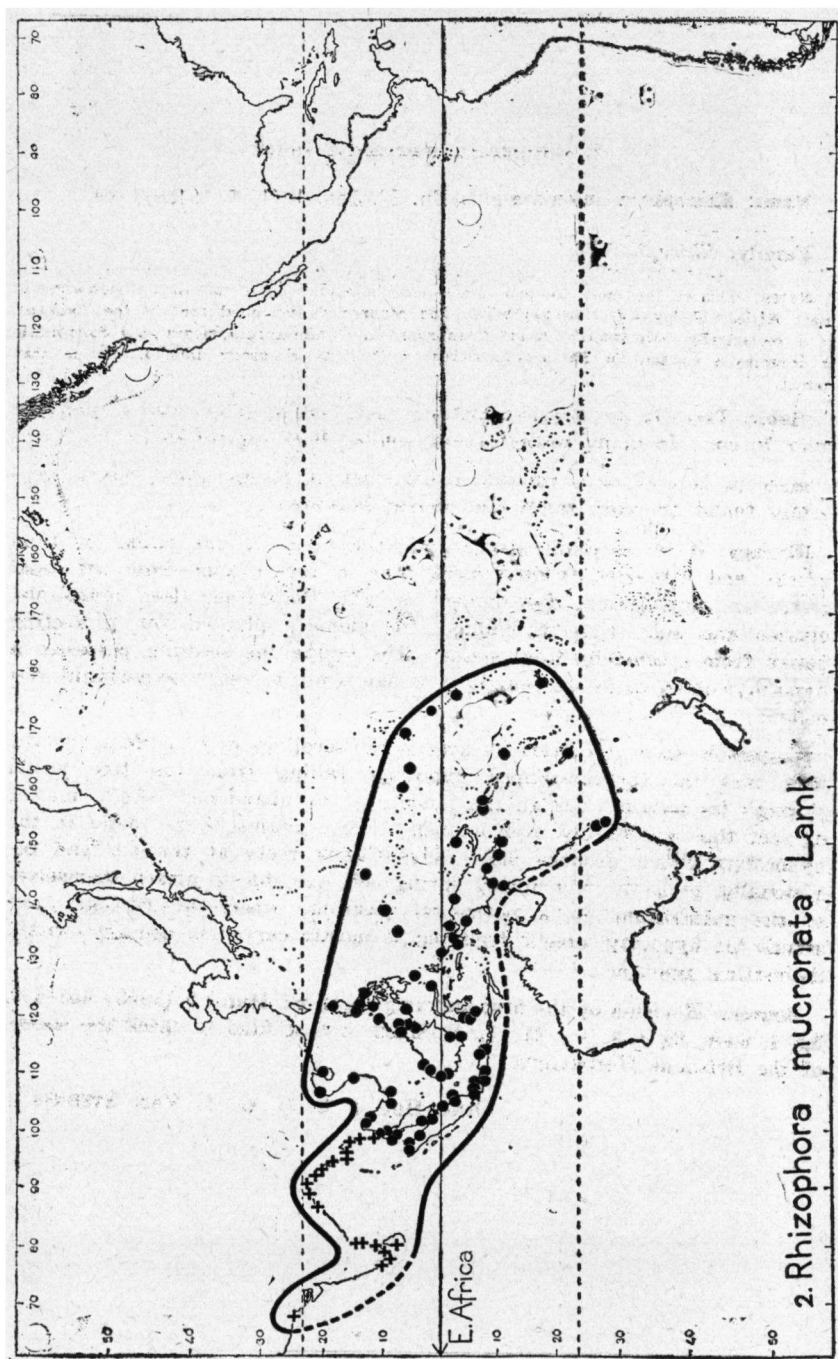
Habitat: It may occur in places like that of *R. apiculata*, but is generally found on more sandy and firmer bottoms.

Ecology: It is generally gregarious, near and on the banks of tidal creeks and estuaries, seldom more than a few chains from the tidal water and its optimal development is with the rather deep inundation classes and soils rich in humus. Occasionally planted for protecting banks from erosion by tidal water. The viviparous seedling possesses a hypocotyl of 36 to 64 cm length, it is said even to reach occasionally one meter!

Dispersal: As in the following species the seedlings drift or float, but the idea that the torpedo-shaped hypocotyl falling from the tree would through its weight stick in the mud must be abandoned. As a matter of fact this will hardly ever happen. Proof against it is found in the hypocotyls which produce small adventitious roots at the tip and occasionally, probably only during spring ebb, are able to attach themselves to the substratum, in a horizontal position; when the rootlets have struck the hypocotyl erects itself but is mostly curved in order to obtain its vertical position.

Sources: Revision by the first undersigned in Fl. Mal. I 5 (1958) 453-456, fig. 1, 6d-h, 8g-j, 9-10. Mr. L. S. Smith was so kind to check the sheets of the Brisbane Herbarium.

DING HOU & C. G. G. J. VAN STEENIS.



3. *Rhizophora apiculata* Bl.

Name: *Rhizophora apiculata* Bl., En. Fl. Jav. 1 (1827) 91.

Family: *Rhizophoraceae*.

Synonym: *Rhizophora conjugata* (non L.) Arn.

Notes: The name *R. conjugata* which has commonly been used for this species, but later for *Bruguiera gymnorhiza*, has been rejected, as the type appears to consist of a mixture of discordant elements which render it nomenclaturally invalid. It is most interesting that the family of *Rhizophoraceae* is absent in Hawaii, and rather scarce in the central Pacific. One might assume that plants dispersed by seawater would have had sufficient time to spread to all parts of oceans within their reach. However, this is distinctly not the case, the pace of spreading is obviously less fast than assumed. In *Rhizophora* and other marine members of the family there is a special reason for this: although the viviparous seeds are buoyant they can only land and settle in places where there is no heavy surf or swell, where there is a shallow coast, with accretion of mud or silt, and hence little wind. Such conditions are offered especially near the estuaries and lagoons near the mouths of rivers on large shelves. Steep, rocky coasts are hence avoided, but also islets or islands surrounded by coral reefs with heavy swell. In such places the tiny plumule on top of the rather heavy hypocotyls is easily damaged and therefore the seedlings can not reach suitable lagoons behind these reef bars. These ecological factors are possibly very important, or almost decisive for explaining the absence of *Rhizophoraceae* in large parts of the Pacific.

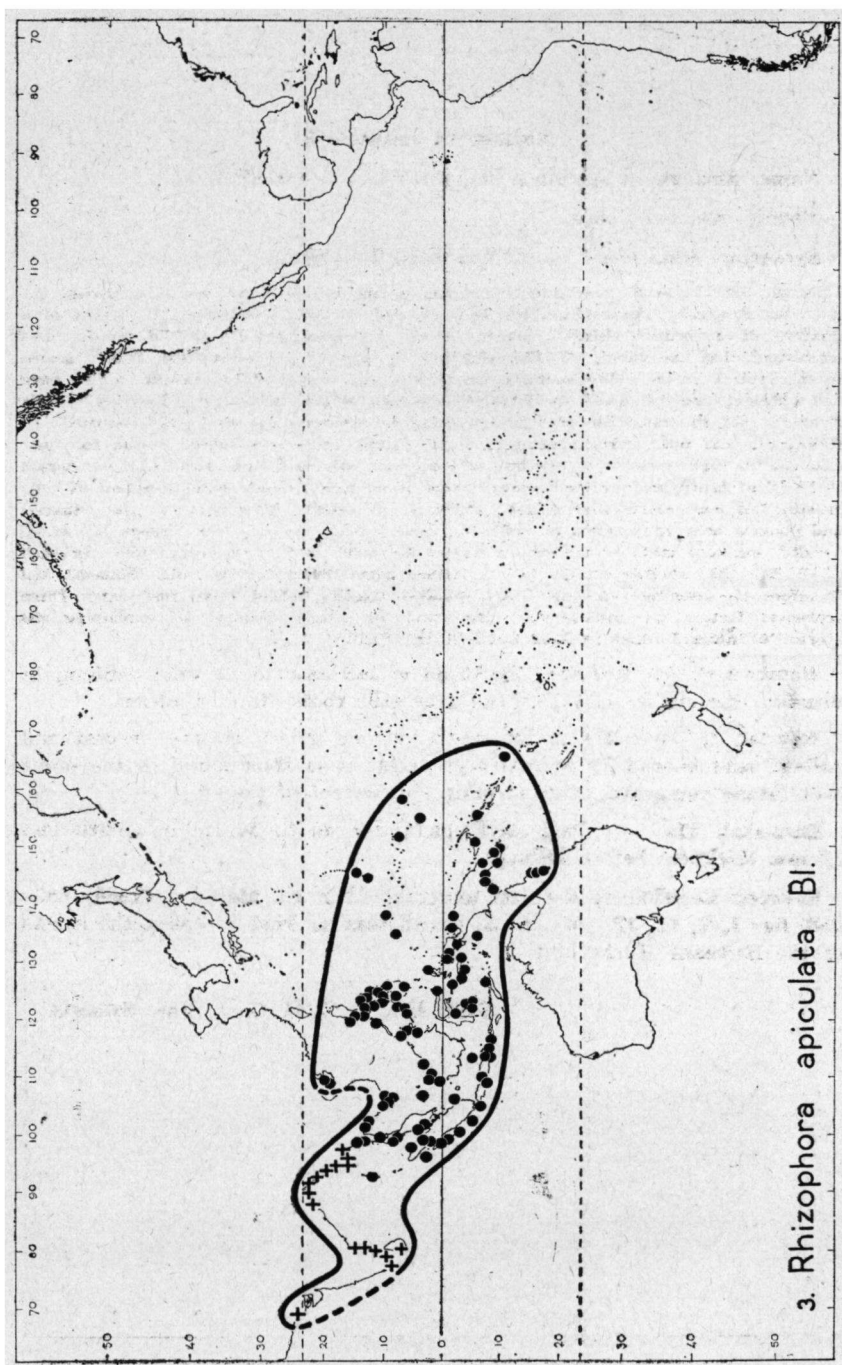
Habit: A rather tall tree, up to 30 m tall and 50 cm diam. Stem, as usual in the genus, sustained by large stilt roots; taproot absent.

Habitat: *R. apiculata* is the species which grows on the deepest and softest mud flooded by normal high tides; it is thus found in the outer zone of the mangrove, often forming 90 per cent of the crop.

Dispersal: The very long seedlings attain up to 40 cm in length and 12 mm thickness before falling.

Sources: Revision by the first undersigned in Fl. Mal. I 5 (1958) 452-453, fig. 1, 7, 11, 12. Mr. L. S. Smith was so kind to check the sheets of the Brisbane Herbarium.

DING HOU & C. G. G. J. VAN STEENIS.



4. *Rhizophora stylosa* Griff.

Name: *Rhizophora stylosa* GRIFF., Not. Pl. As. 4 (1854) 665.

Family: *Rhizophoraceæ*.

Synonym: *Rhizophora mucronata* var. *stylosa* Schimp.

NOTES: Several authors have treated this species as a mere variety of *R. mucronata*, which is its closest ally indeed. It should then, however, have been given the status of subspecies, as it shows a typical ecological replacement. And it must be admitted that the differentiating characters are smaller than is usual between other species. However, as Doctor Backer has shown (vide infra) it seems to be a good species, which can always readily be distinguished morphologically and ecologically; intermediary specimens have never been found, as should have been the case if they were subspecies (races).

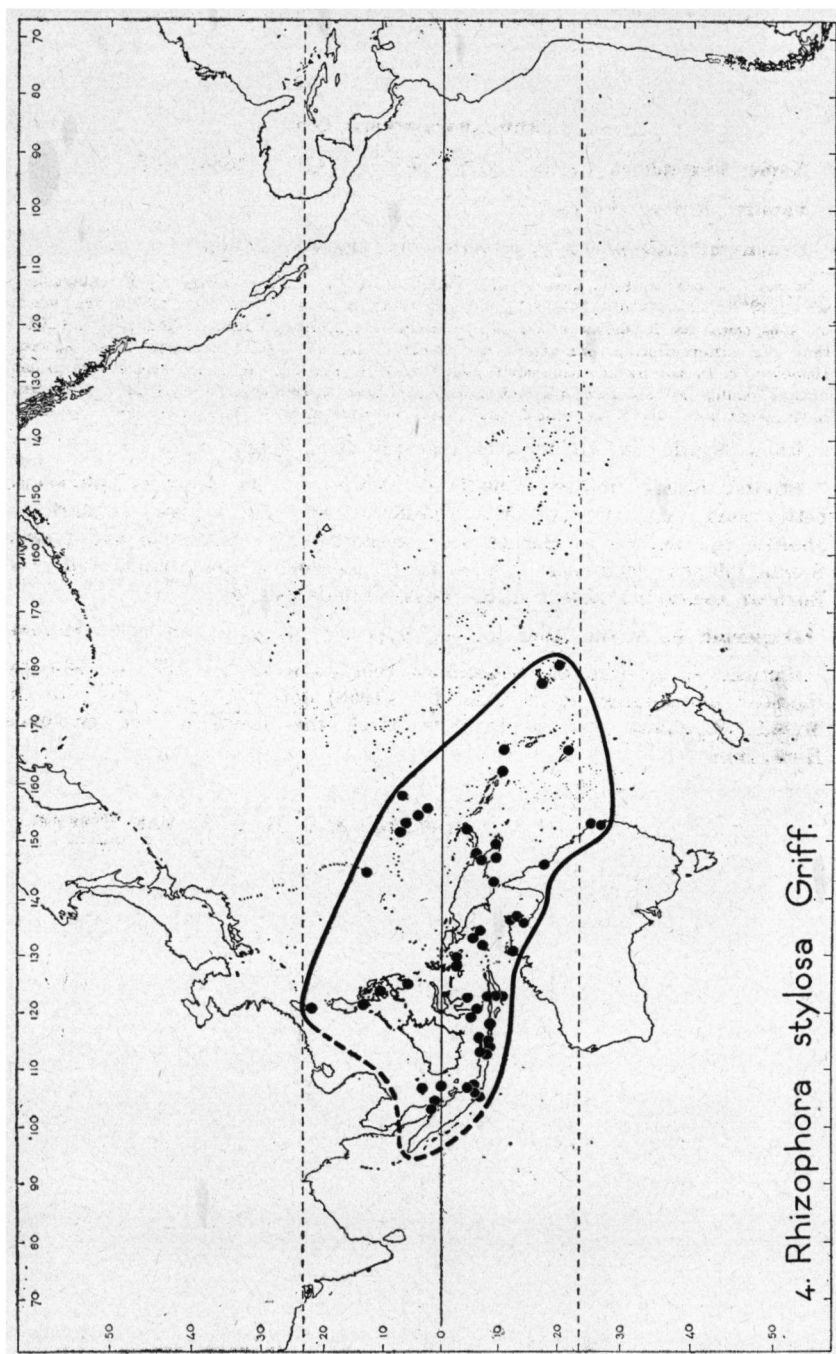
Habit: Small tree, hardly ever reaching 10 m height.

Habitat: Sandy shores, sometimes close to coral terraces, obviously better surf-resistant than other species. This may explain in part its absence e.g. scarcity in Borneo and presence in the Moluccas and Lesser Sunda Islands; mud-coast species as *R. mucronata* are abundant on the Bornean coasts but absent in the Lesser Sunda Islands.

Dispersal: As in the other species; hypocotyl up to 54 cm by 12-16 mm.

Sources: C. A. BACKER, Schoolflora voor Java (1911) 482; revision by the first undersigned in Fl. Mal. I 5 (1958) 456-457, fig. 5, 8a-f, 13-14. Mr. J. S. Smith was so kind to check the sheets of the Brisbane Herbarium.

DJUNG HOU & C. G. G. J. VAN STEENIS.



5. *Rhizophora mangle* L.

Name: *Rhizophora mangle* LINNÉ, Sp. Pl. 1 (1753) 443.

Family: *Rhizophoraceæ*.

Synonyms: *Rhizophora mangle* var. *samoensis* Hochr., *Rhizophora samoensis* (Hochr.) Salvoa.

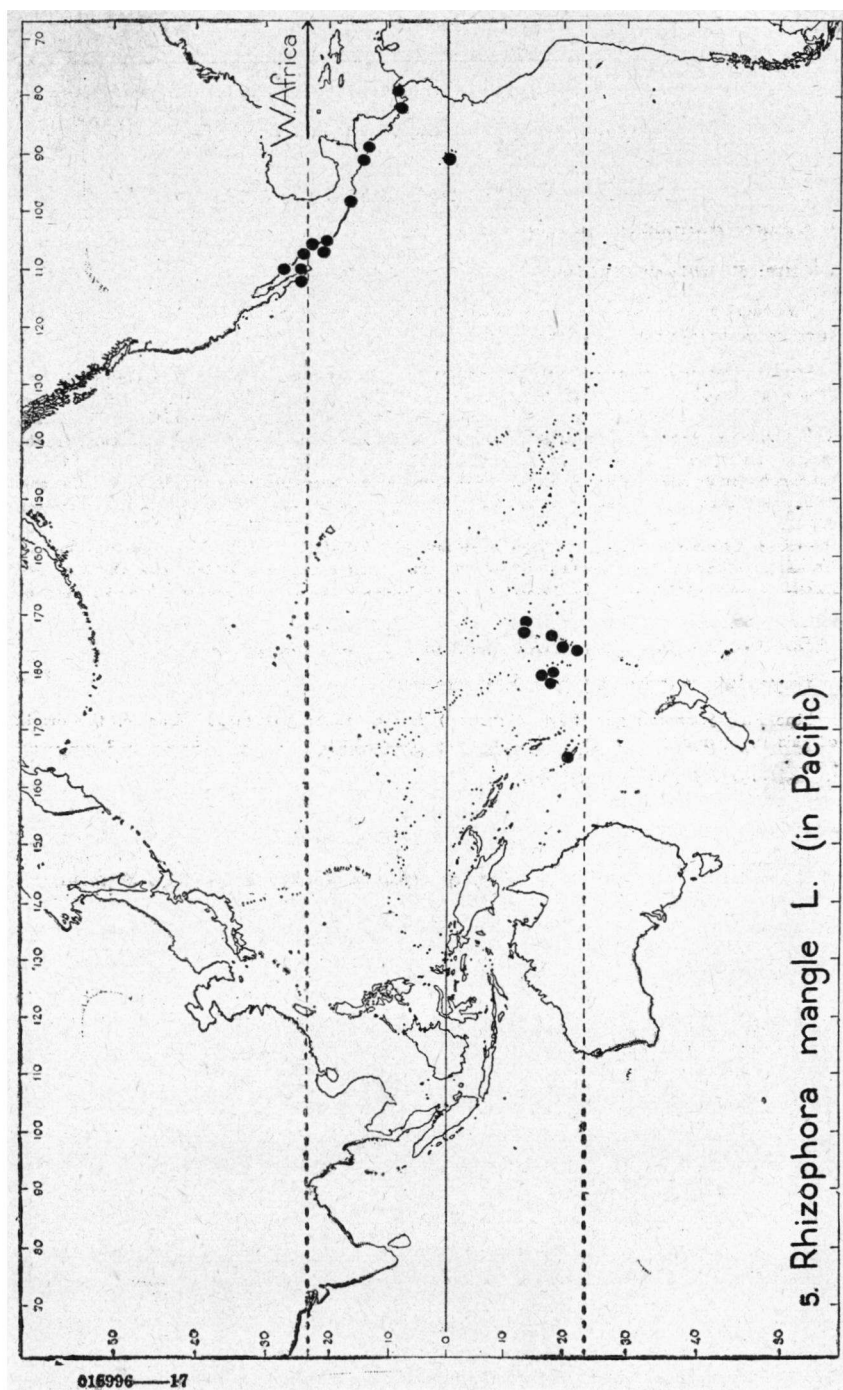
NOTES: The occurrence of this species—which was originally only with certainty known from the tropical coasts of the Atlantic in Africa and America—in the Pacific has frequently been suggested, specially by Guppy. This has now been verified (*vide infra*). This, and the other two 'Atlantic' species, differ from the 'Indo-Pacific' species by the leaf tip which is not acute or mucronate but blunt and frequently inrolled. This is extremely remarkable in so far as the species of the Atlantic and Indo-Pacific show an other, crosswise affinity, in pairs, if we compare the morphology of the inflorescence and flowers, one of each pair occurring in different oceans! The latter characters are, therefore, obviously due to parallel development. Besides it has now appeared that at least one other species, besides *R. mangle* also occurs in the Pacific, and the last one which is still unrecorded (*R. racemosa*) will probably be detected on the Pacific coast of America.

Habitat: In the more saline portions of the mangrove.

Dispersal: Similar as in other species.

Sources: KEAY, Kew Bull. (1953) 123, fig. B-B1, JONKER, Act. Bot. Neerl. 8 (1959) 59-60, and the revision of *Rhizophora* by the first undersigned in Blumea 10 (1960) 630-632.

DING HOU & C. G. G. J. VAN STEENIS.



6. *Rhizophora lamarckii* Montr.

Name: *Rhizophora lamarckii* MONTR., Mém. Ac. Sc. Lyon 10 (1860) 201.

Family: *Rhizophoraceæ*.

Synonym: *Rhizophora pachypoda* Baillon, *Rhizophora conjugata* var. *lamarckii* Guillaumin.

Notes: Endemic on the island of New Caledonia. It is allied to *R. spiculata* but differs in several characters.

Ecology: Inadequately known.

Dispersal: As in the other species.

Source: Revision of the genus by the first undersigned in *Blumea* 10 (1960) 629-630.

7. *Rhizophora harrisonii* Leechm.

Name: *Rhizophora harrisonii* LEECHMAN, Kew Bull. (1918) 8.

Family: *Rhizophoraceæ*.

Synonym: *Rhizophora brevistyla* Salvosa.

Notes: This cannot be kept apart from the 'Atlantic' *R. harrisonii*. Only the Pacific localities have been drawn on the map; it occurs both in the Caribbean and on the coast of West Africa, according to Keay. It is my assumption that whereas now 6 out of the 7 species of *Rhizophora* are found in the Indian and Pacific oceans and marine *Rhizophoraceæ* generally (4 genera) are restricted to the Indo-Pacific, the origin of this group must have occurred in the Indo-Malaysian area. This leads to the inevitable assumption that the genus *Rhizophora* must have spread towards the Atlantic Ocean from the Pacific at the time that the isthmus of Panama was not yet closed. A remarkably similar conclusion was reached earlier for other marine plants of the genus *Halophila*, which shows a similar distribution pattern of its species.

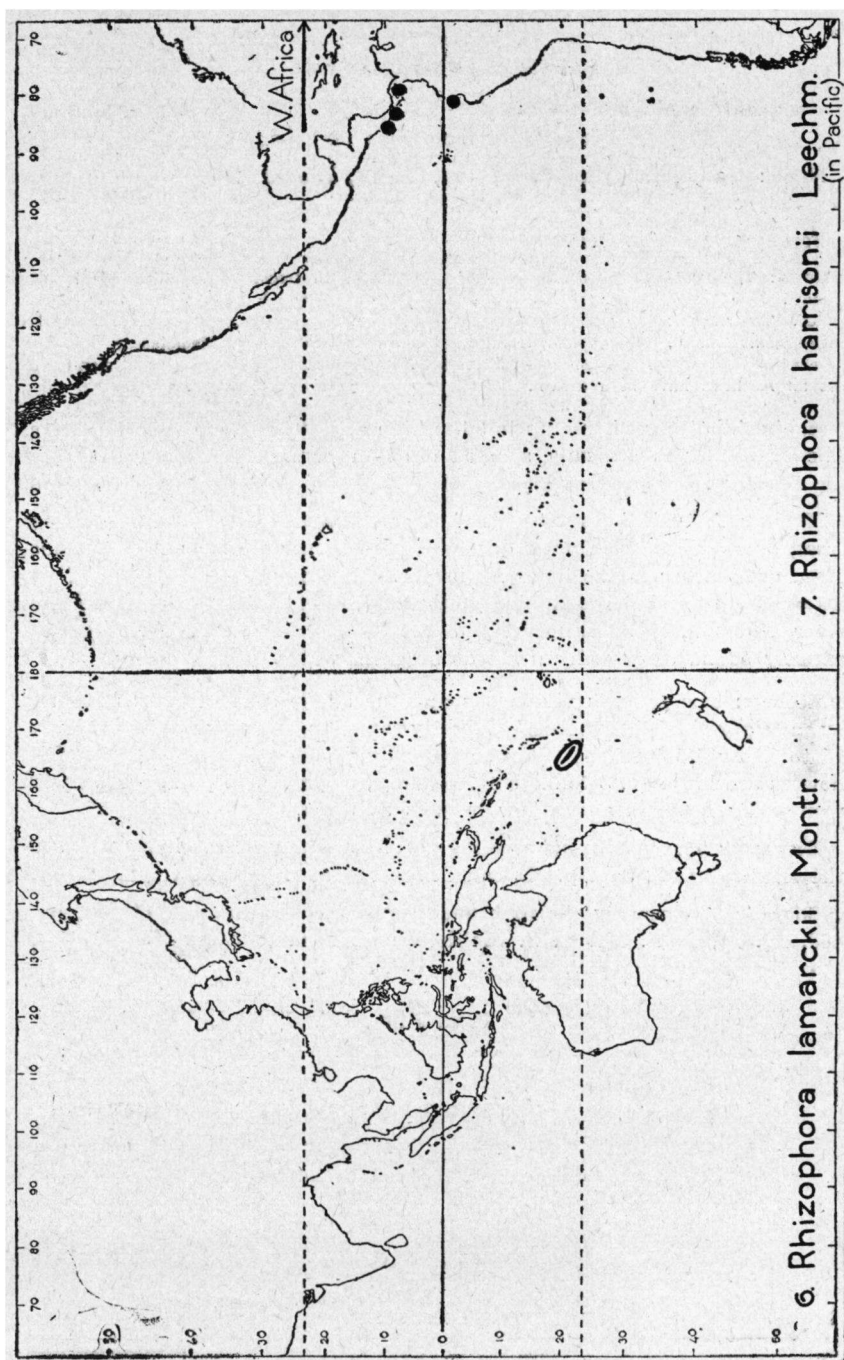
Habit: Stilt-rooted tree up to 25 m, in West Africa only up to 7 m.

Habitat: In the Atlantic and Caribbean in the less saline habitats in the lower courses of the large rivers.

Dispersal: Not different from the other species of the genus.

Sources: KEAY, Kew Bull. (1953) 124, fig. 1 B-B1; JONKER, Act. Bot. Neerl. 8 (1959) 59-60; and the revision of *Rhizophora* by the first undersigned in *Blumea* 10 (1960) 632-633.

DING HOU & C. G. G. J. VAN STEENIS.



8. *Bruguiera gymnorhiza* (L.) Lamk

Name: *Bruguiera gymnorhiza* (L.) LAMK, Encycl. Méth. Bot. 4 (1797 or 1798) 696.

Family: *Rhizophoraceae*.

Notes: The genus *Bruguiera* consists of six species, all trees; its area extends in the tropical zone from East Africa to the Pacific basin in which two species have penetrated. The present one has the largest distribution of all species, and covers almost the entire generic area, being found from tropical and South Africa, Madagascar, and the Seychelles onto the Ryukyus, the Marshalla, and Samoa. In the Indo-Malaysian area not all localities have been drawn.

Habit: A buttressed tree up to 36 m high and 40 to 65 cm stem diameter. The branching is typically sympodial as in many other mangroves and the shallow roots produce kneed pneumatophores sticking out of the mud.

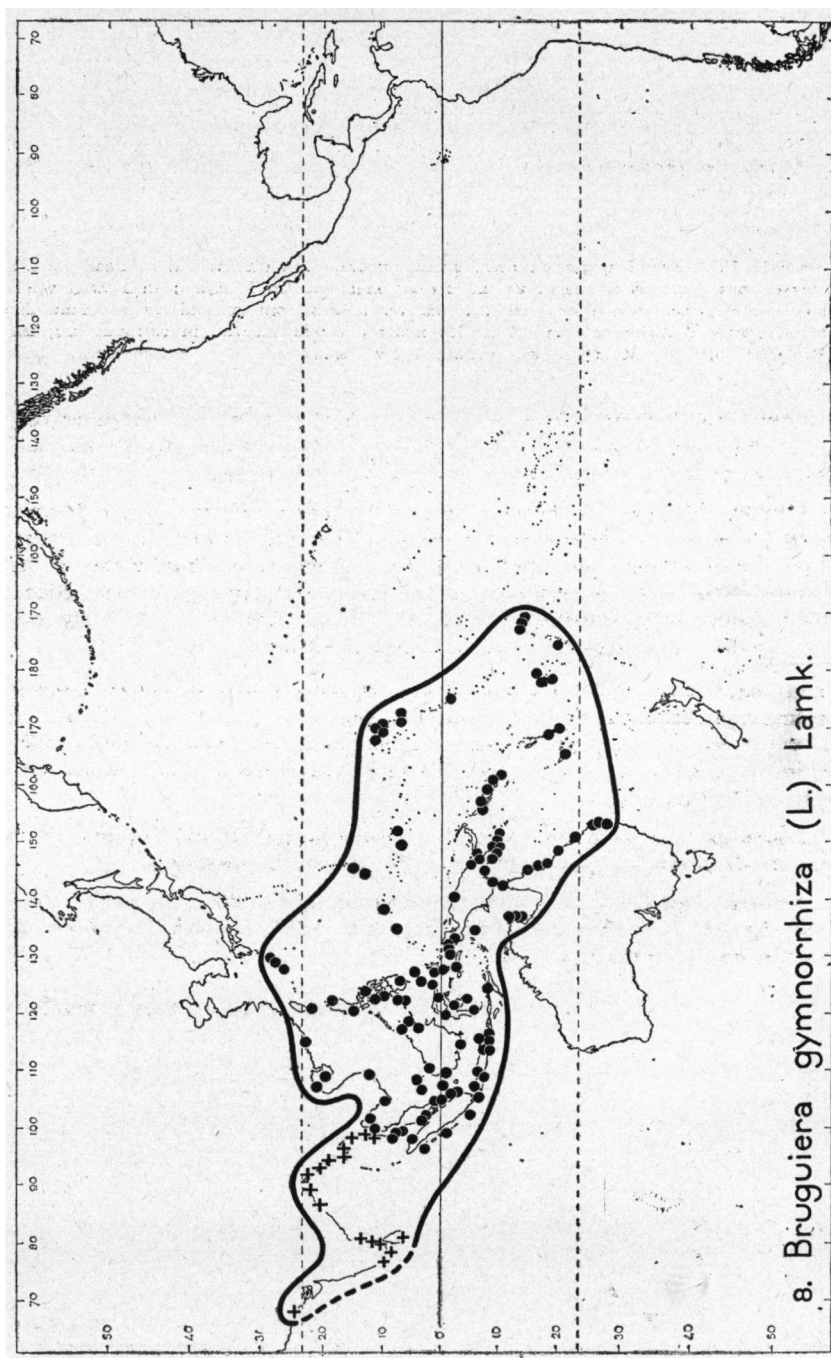
Habitat: A typical constituent of the mangrove and one of its largest trees, as a rule on somewhat dry, well aerated soil towards the land-side, often dominating in the inner mangrove. It marks the final stage of the littoral forest and the beginning of the transition to inland forest. Along river banks it is sometimes found far inland and it is obviously not entirely bound to growth in salt or brackish water.

Ecology: The fruit is viviparous and the single seed protrudes from it by a cigar-shaped hypocotyl, slightly angular, narrow club-shaped, c. 15 to 25 by 1.5 to 2 cm. It soon becomes detached from the fruit. The flowers are large (c. 3 to 3.5 cm), nodding; calyx red to pink, corolla with white-silky margins and a few bristles at the apex.

Dispersal: The viviparous seedling consists largely of the hypocotyl with the small plumule on top. It can drift or float in seawater.

Sources: Revision by the first undersigned in Fl. Mal. I 5 (1958) 461-463, fig. 16, 17 n. Mr. L. S. Smith was so kind to check the sheets of the Brisbane Herbarium.

DING HOU & C. G. G. J. VAN STEENIS.



8. *Bruguiera gymnorhiza* (L.) Lamk.

9. *Bruguiera parviflora* (Roxb.) W. & A.

Name: *Bruguiera parviflora* (Roxb.) W. & A. ex Griff., Trans. Med. Phys. Soc. Calc. 8 (1836) 10.

Family: *Rhizophoraceae*.

Notes: This species has a much smaller distribution than *B. gymnorrhiza* as it does not occur in E. African-Malagassian area, extending from India to the West Pacific. It is very curious that this is one of the most common species in Malaysia; in Hawaii where no *Rhizophoraceae*, marine or inland, is native, it has been planted by the Hawaiian Sugar Planters' Association in 1922, with many other mangroves, in salt marshes near Heeia, Oahu, where it is obviously growing very well.

Habit: A rather small tree, up to 15 to 30 m by 15 to 30 (to 55) cm. The flowers are the smallest in the genus, the ribbed calyx tube being only c. 8 mm long.

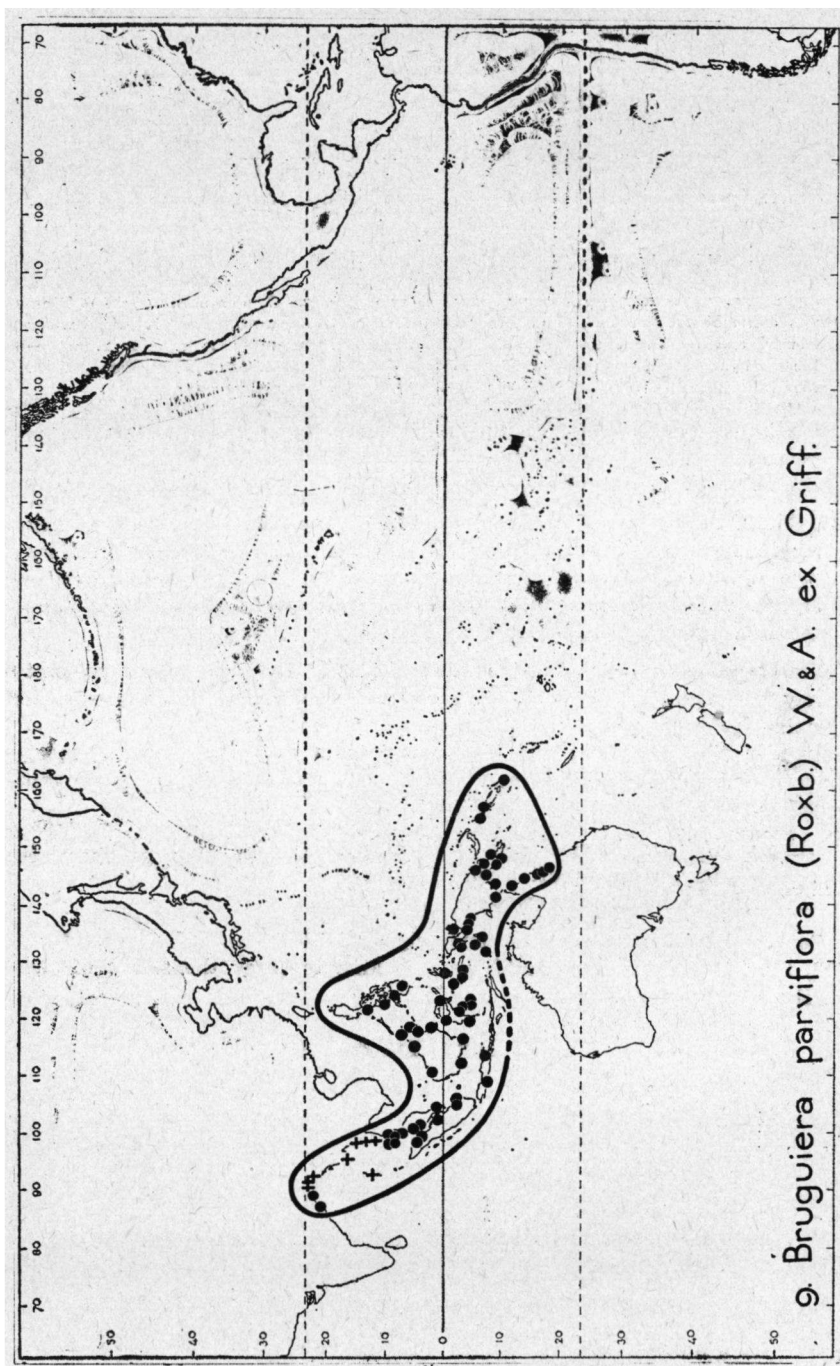
Habitat: Mostly on the inner side of the mangrove, often undergrowth under *B. gymnorrhiza*, but also sometimes associated with *B. cylindrica* or *Rhizophoras*, occasionally in pure, solid stands. It distinctly increases in number after exploitation of immature areas, establishing itself on soils previously occupied by *Rhizophoras*. For that reason often frequent on banks of river mouths.

Ecology: The fruit often does not detach itself from the hypocotyl and the plumule pierces the base of the fruit which remains as a cuff round the seedling.

Dispersal: Seed one per fruit, viviparous, the hypocotyl cylindric, smooth, 7.5 to 13 by 0.5 cm, adapted to dispersal by seawater.

Source: Revision by the first undersigned in Fl. Mal. I 5 (1958) 464-466, fig. 6a, 20-21. Mr. L. S. Smith was so kind to check the sheets of the Brisbane Herbarium.

DING HOU & C. G. G. J. VAN STEENIS.



9. *Bruguiera parviflora* (Roxb) W.&A. ex Griff.

10. *Ceriops tagal* (Perr.) C. B. Rob.

Name: *Ceriops tagal* (Perr.) C. B. Rob., Philip. Jour. Sc. 3 (1908) Bot. 306.

Family: *Rhizophoraceæ*.

Notes: The genus *Ceriops* consists only of two species. *C. decandra* (Griff.) Ding Hou is distributed from India and Indo-China to New Guinea. *C. tagal* is much wider distributed and its entire area could not be drawn on the map; it extends from the Pacific westwards through Indo-Malaysia to the Seychelles, Madagascar, and East Africa. In the Indo-Malaysian area the density of localities is much greater than drawn.

Habit: Shrub or small tree, up to 15, rarely to 25 m by 20 cm diam., degenerating into a bushy shrub under unfavorable conditions. Stem-base sometimes with small stilt roots.

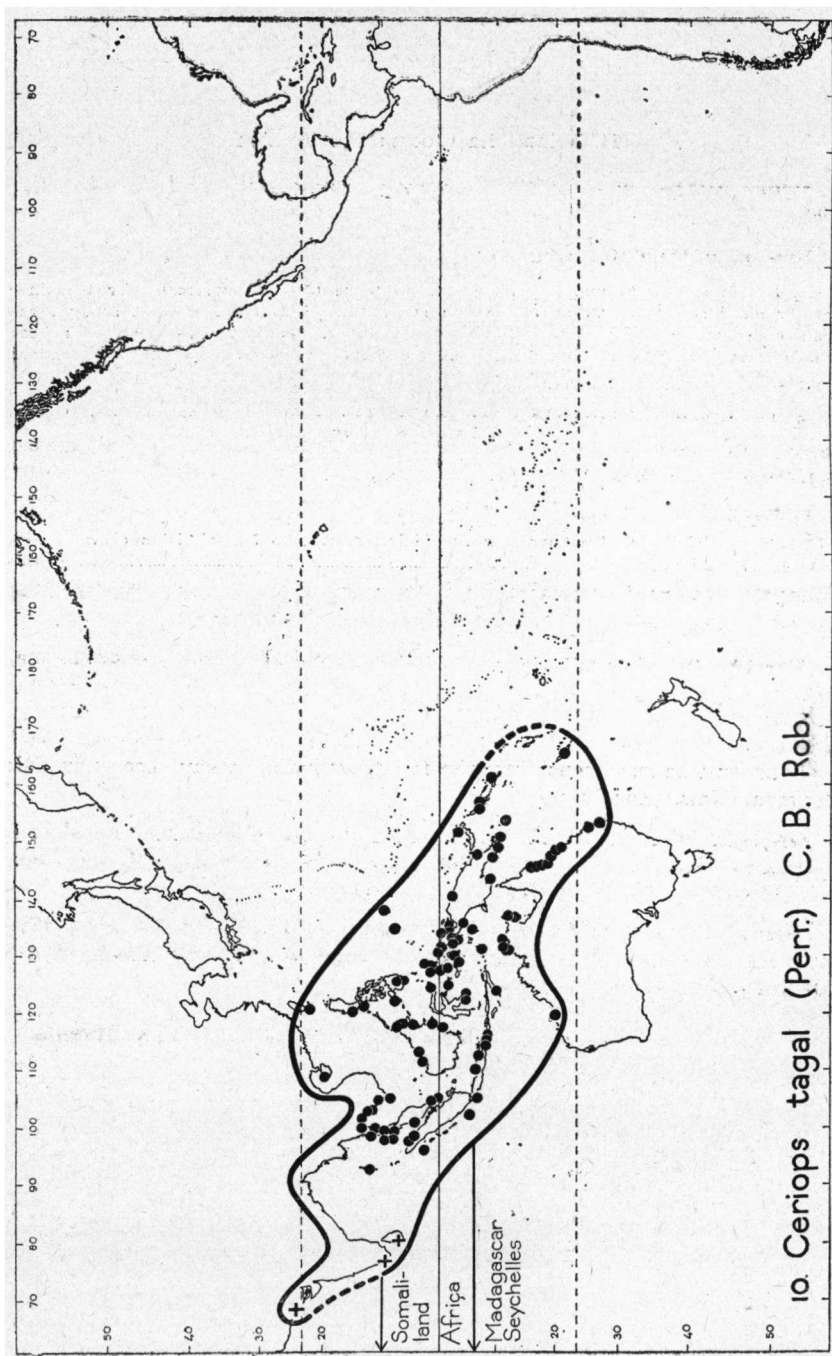
Habitat: Both species are constituents of the mangrove, where they occur in rather well-drained soils, within the reach of occasional tides in the inner mangrove. It occurs sometimes as undergrowth in taller mangrove forest of *Rhizophora* or *Bruguiera*, but in other places it is found in very dense, thin-stemmed, monospecific stands.

Ecology: As in other marine *Rhizophoraceæ* the fruit contains one, rarely two seeds, which are viviparous which means that the normal germination takes place in the fruit on the tree by which the hypocotyl protrudes from the fruit and lengthens into a long, often falcate, more or less club-shaped green organ without stomata. Fruit and seed fall together when mature.

Dispersal: The viviparous fruit consists largely of a linear, club-shaped but acute, sharp-angular, often curved hypocotyl 15 to 25 (to 35) cm long, which drifts or floats in seawater.

Source: Revision by the first undersigned in Fl. Mal. I 5 (1958) 468-472, fig. 24-25. Mr. L. S. Smith was so kind to check the sheets of the Brisbane Herbarium.

DING HOU & C. G. G. J. VAN STEENIS.



11. *Triumfetta procumbens* Forst. f.

Name: *Triumfetta procumbens* FORST. f., Prod. (1786) 85.

Family: *Tiliaceæ*.

Synonym: *Triumfetta fabreana* Gaudich.

NOTES: It seemed to me very interesting to make distributional maps for the three closely allied species of *Triumfetta*, which are all bound to the accrescent sandy beach and occur under almost identical habitat conditions. As they have sometimes been confused in herbaria the following key is produced for the convenience of identification:

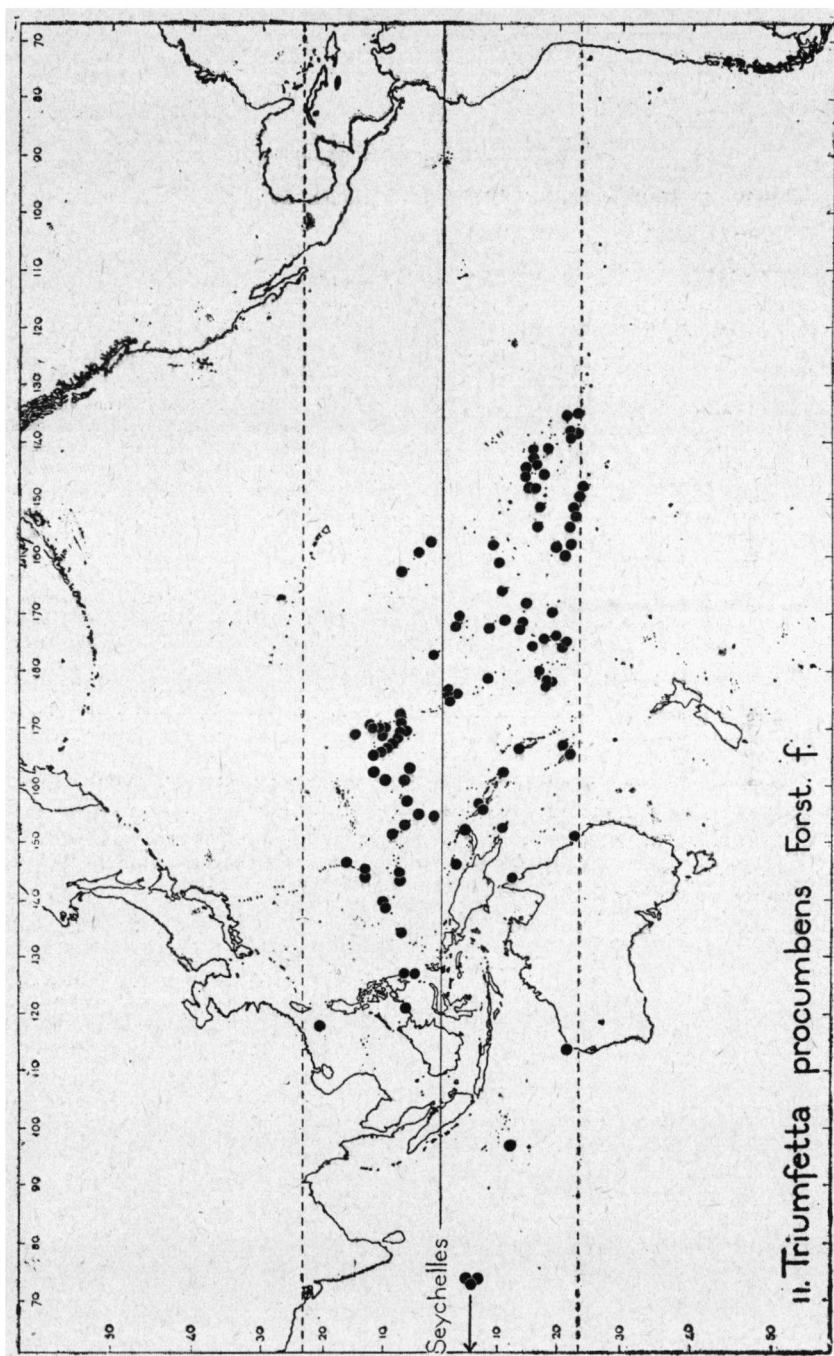
1. Branches not rooting. Fruit bodies c. $\frac{1}{2}$ cm diam., including the spines c. $\frac{1}{2}$ cm diam. Spines glabrous, their mucro hooked. Leaves coarsely toothed, oblong, simple or deeply 3 to 5-lobed, lobes oblong, subglabrous, rather thin. Fruit cells 1-seeded. Plant slender *T. grandidens*
1. Branches rooting. Fruit bodies c. $\frac{1}{2}$ to $1\frac{1}{2}$ cm diam., including the spines c. 1 to $1\frac{1}{2}$ cm diam. Mucro of the spines obliquely erect. Seeds 2 per cell. Leaves rather thickish. More robust.
 2. Spines glabrous. Leaves a few simple but most 3 to 5-lobed, lobes obovate, with sparse stellate hairs *T. repens*
 2. Spines hairy. Leaves not lobed, sometimes shallowly 3-lobed and occasionally a few fairly deeply 3-lobed, broad-ovate or broader than long, densely hairy underneath *T. procumbens*

For Habit, Habitat, Ecology, and Dispersal: see the next species.

Map: Outside the map it occurs in the Seychelles (A(d)mirante, Providence, Galega, Derroches, and Coral Islands).

Sources: The specimens from the following herbaria have been mapped: Leyden, Kew, Honolulu, Brisbane, and Melbourne thanks to the kind collaboration of Messrs H. K. Airy Shaw, F. R. Fosberg, B. C. Stone, L. S. Smith, and J. H. Willis. Mr. M. M. J. van Balgooy assisted in locating records on the map.

C. G. G. J. VAN STEENIS.



12. *Triumfetta repens* (Bl.) Merr. & Rolfe

Name: *Triumfetta repens* (Bl.) MERR. & ROLFE, Philip. Jour. Sc. 3 (1908) Bot. 111.

Family: *Tiliaceæ*.

Synonyms: *Porpa repens* Bl., *Triumfetta radicans* Bojer, *T. subpalmata* Sol. ex Hemsl., *T. humifusa* Hassk.

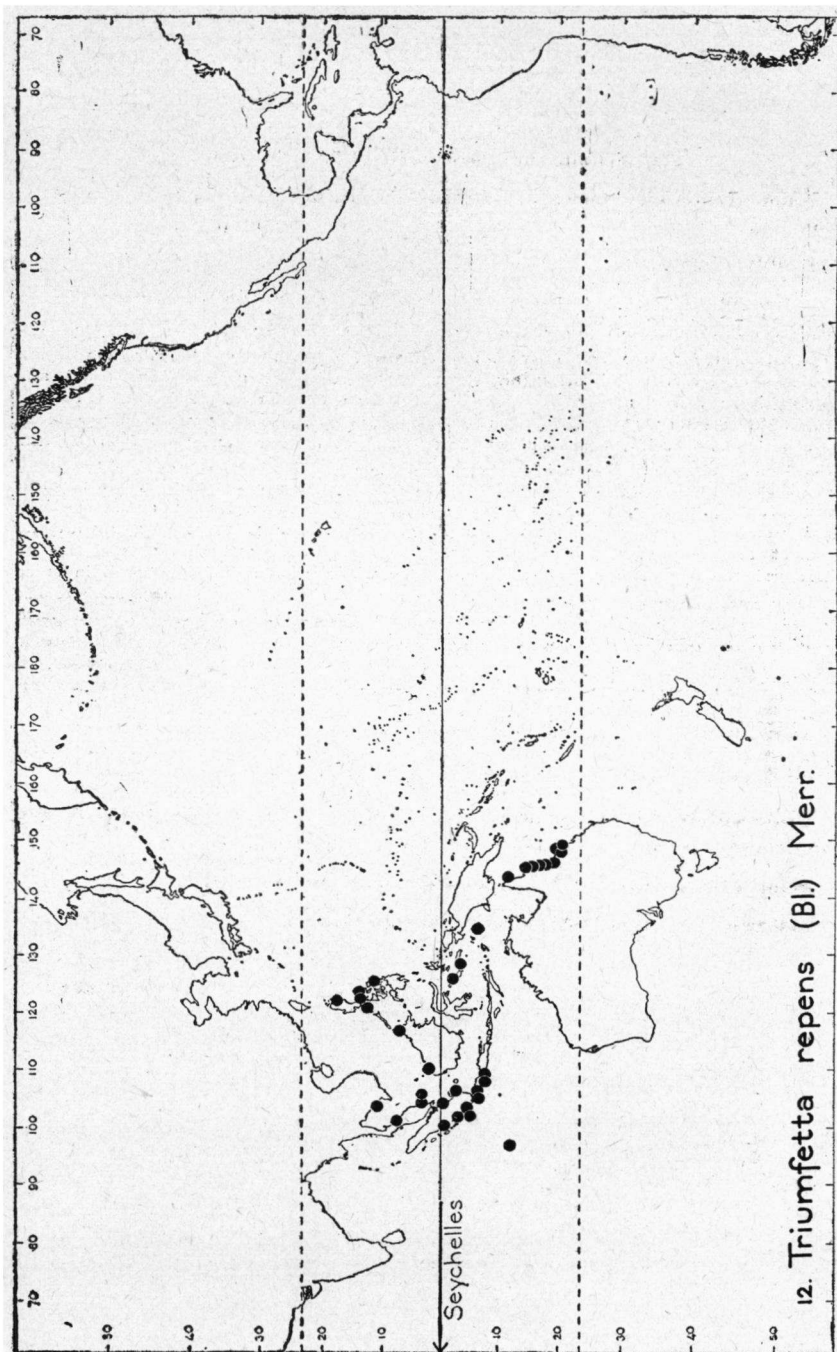
Notes: Although this and the following species have as yet not been collected in the Pacific the problem of the distribution of the three species should be considered together. Westwards it occurs through the Indian Ocean as far as the Seychelles (no locality, Horne 419, K; Mahé). In comparing the maps of *T. procumbens* and *T. repens* it appears that they largely exclude each other, *T. repens* being common in Malaysia, and *procumbens* largely in the Pacific, although in both cases they reach the Seychelles in the west. There seems no instance where they have been found together in exactly the same spot. This would lead to the conclusion that, although accrescent beaches look very similar, there might be a subtle difference in their biotopes. It might be that *T. procumbens* favours more calcicolous beach sand than *T. repens*, as many Malaysian localities of the latter are not rich in chalk. However, it would then appear strange that *T. procumbens* fails on certain Malaysian beaches which are rich in calcium. Another difference between the two areas is the fact that the localities of *T. procumbens* are largely on the small islets, whereas those of *T. repens* are more concentrated on the beachlines of large islands or continents. This would point to correlation with some speciality of small islands, as has been demonstrated for *Pisonia grandis* with bird colonies. It might be possible that here is a similar case, or that the fruits of *T. procumbens*, of which the spines are hairy, which is not the case in *T. repens*, are better suited to epizoid dispersal than those of *T. repens*. A detailed analysis, together with planting experiments, might lead to interesting conclusions and it might serve as a test case for dispersal ecology.

Dispersal: It can be assumed that fruits are diplochorous, buoyant and waterborne as well as suitable for epizoid dispersal.

Map: The locality in the Seychelles could not be drawn.

Sources: The same as under *T. procumbens*.

C. G. G. J. VAN STEENIS



12. *Triumfetta repens* (Bl.) Merr.

13. *Triumfetta grandidens* Hance

Name: *Triumfetta grandidens* HANCE, Jour. Bot. 15 (1877) 329.

Family: *Tiliaceæ*.

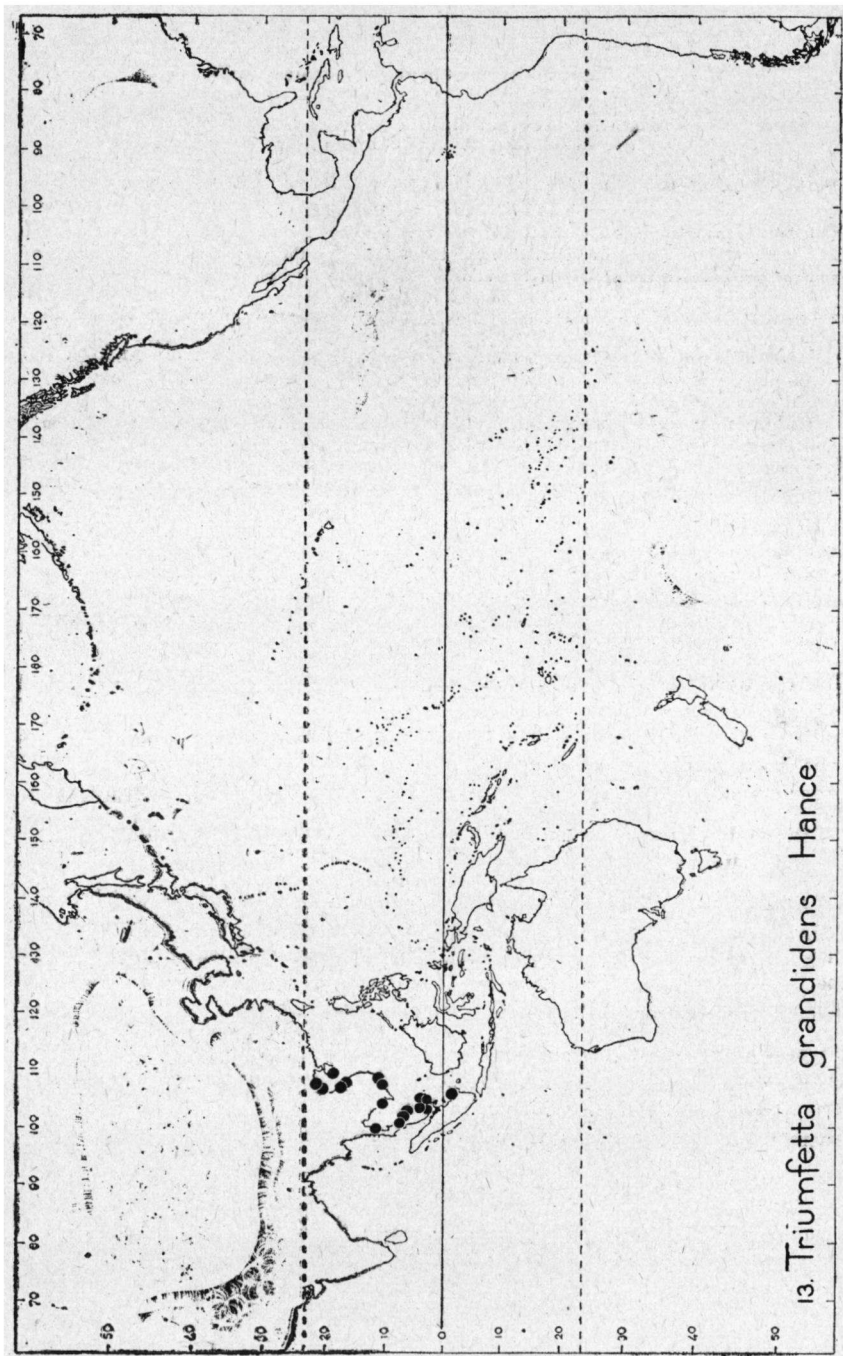
Synonym: *Triumfetta dunalis* O. K.

Notes: This species has a very restricted area and has been found only along the western shores of the South China Sea; it is absent from ocean swept beaches. Though in its typical prostrate habit very much alike the other two species, its non-rooting branches or stems would bring along much less resistance against heavy surf and shifts of sand, as its only anchorage is the main or taproot. It has also thinner leaves. The locality pattern suggests that its dispersal, though probably diplochorous (seaborne and epizoid), cannot bridge large distances overseas, but proceeds along the length of the shore. According to the Age and Area hypothesis of Willis the solution would be very simple: *T. procumbens* would represent the oldest species, from which has sprung *T. repens*, with less time to spread and hence a smaller area, which in turn would have produced by mutation *T. grandidens*, the youngest species with the smallest area. However, the case seems more complicated and partly ecological or structural (dispersal mechanism) and besides the whole genus should be studied in order to get an idea about the question whether the three sand-beach bound *Triumfettas* belong to one close affinity, or whether the beach biotope has been beset by species which have originated independently from different inland species.

Dispersal, etc.: See the foregoing species.

Sources: The same as mentioned under *T. procumbens*.

C. G. G. J. VAN STEENIS.



14. *Campnosperma brevipetiolatum* Volk.

Name: *Campnosperma brevipetiolatum* VOLK., Bot. Jahrb. 31 (1901) 466.

Family: *Anacardiaceæ*.

Notes: This species is much resembling the West Malaysian *C. auriculata* (Bl.) Hook f. and has been confounded with it in New Guinea by Merrill & Perry [J. Arn Arb. 22 (1941) 585]; it can be recognized from that species by the very wide-attenuate leaf-base and the presence of red scales on the undersurface of the leaves. *C. brassii* M. & P. from Ysabel (Solomons) is based on a hairy specimen but appears specifically not distinct (indicated on the map with a vertical line through the dot).

Habit: A buttressed tree of mostly moderate size up to c. 36 m high and c. 60(-175) cm diam.

Habitat: In rain-forests both on dryland and in swamps.

Ecology: In Micronesia it is an important component of gallery forests (rain-forest) along the streams up to c. 80 m altitude, together with *Semecarpus venenosa*, *Buchanania engleriana*, *Inocarpus edulis*, *Pterocarpus carolinensis*, and *Pentaphalangium volkensii*. *Barringtonia racemosa* is sometimes predominant as a substage, with *Vavaea pauciflora* and *Timonius albus* as shrubs. The third stratum is formed by small *Pandanus*. Where the forest floor is moist the ground is covered by *Scirpodendron ghaeri*. These forests have abundant epiphyte communities.

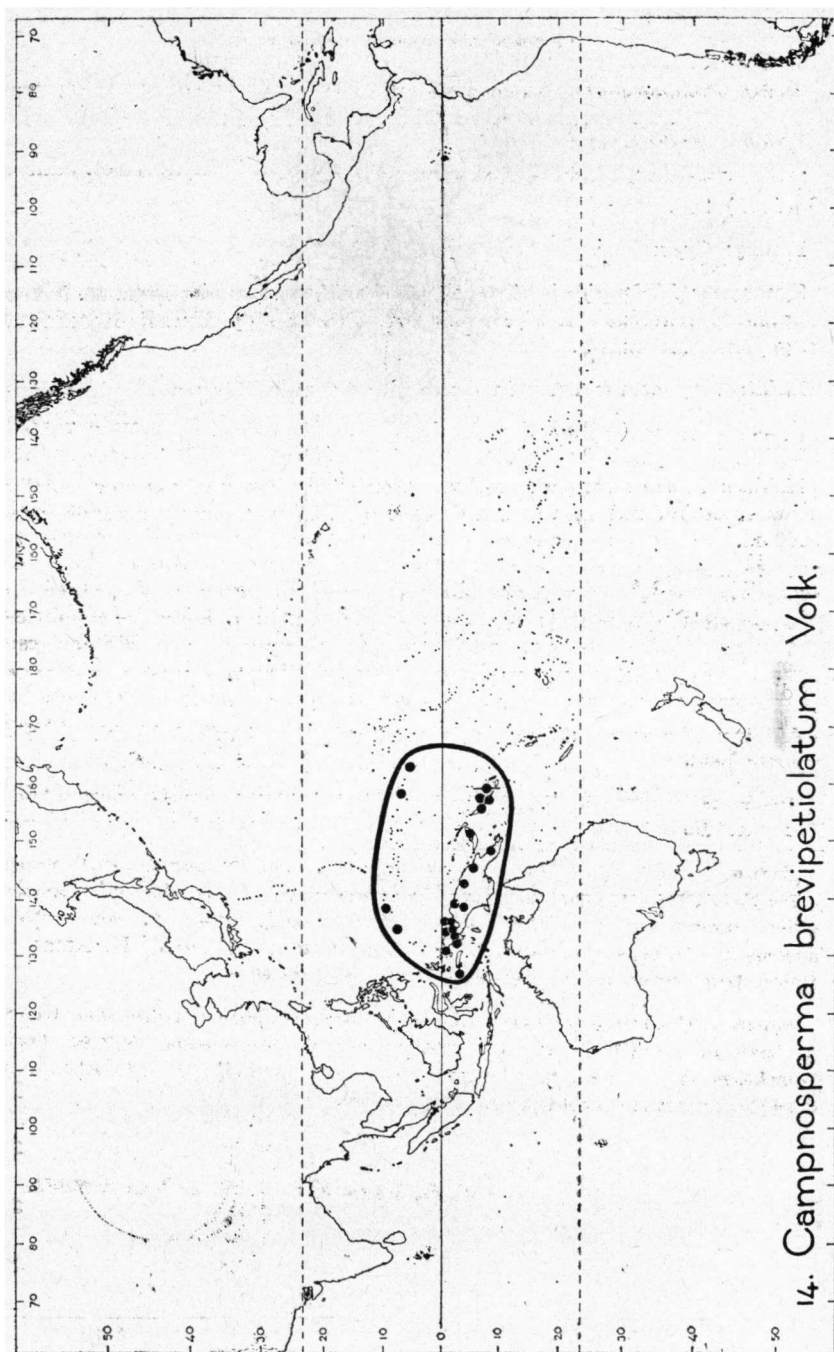
In other places the *Campnosperma* is associated with *Bentickiopsis ponapensis* and dominates the upper canopy. This type ranges in Ponape to c. 680 m. Hosokawa has proposed *Campnosperma brevipetiolata* as the name bringing species for a sociological alliance *Campnospermion brevipetiolatæ*.

Dispersal: Unknown, the fruits are small, globular, finally black drupes c. 5 mm diam.

Affinity: *C. brevipetiolata* Volk. belongs to a smallish genus which occurs throughout the tropics (scarce in S. America). It is the only species which occurs in the Pacific area. It is closely allied to some other species in Malaysia, notably to *C. auriculata* (Bl.) Hook f., which is found from Sumatra to Celebes, in similar places.

Sources: Preliminary survey of the Malaysian species; collections Rijks-herbarium, Leyden. Data on distribution in Micronesia derived from Hosokawa, Mem. Fac. Sc. Kyushu Univ. E. 1 (1954) 219-243 and from personal communications from Prof. Hosokawa.

J. H. KERN & C. G. G. J. VAN STEENIS.



14. *Campnosperma brevipetiolatum* Volk.

15. *Mapania macrocephala* (Gaudich.) K. Sch.

Name: *Mapania macrocephala* (Gaudich.) K. SCH. in Warb., Bot. Jahrb.
13 (1891) 265.

Family: *Cyperaceae*.

Synonyms: *M. longifolia* (Boeck.) Clarke, *M. pandanacea* Ridl., *M. lactea* Kük., *M. geelvinkensis* Ohwi, *M. margaritae* Ohwi, *M. palauensis* Hosokawa, *M. yapensis* Hosokawa.

Habit: Very coarse herb, in dense clumps, resembling a stemless pandanus, stem (culm) up to 120 cm high, the leaves 1 to 4 m long, 2 to 6 cm wide, bearing on top a very dense head 5 to 9 cm diam.

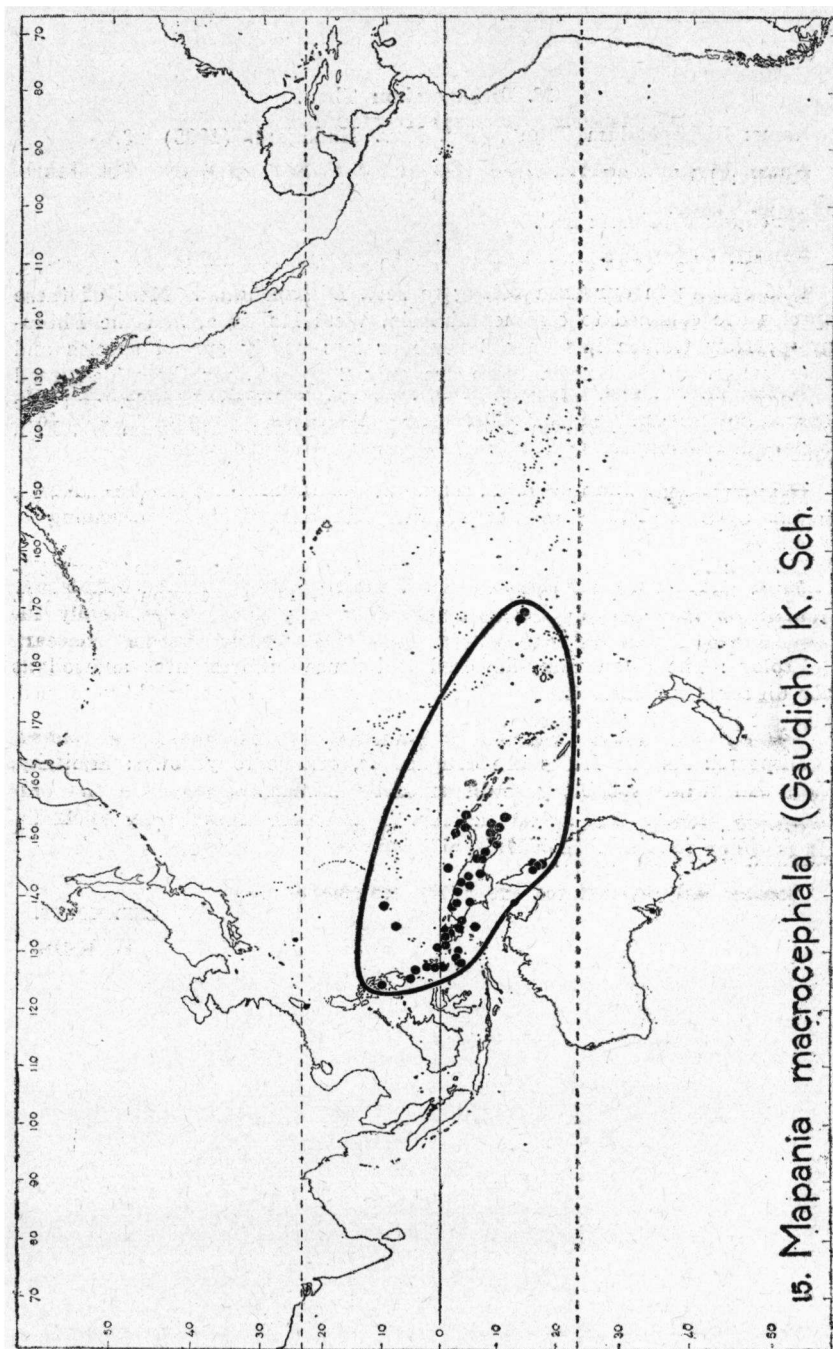
Habitat: Dense swampy rain-forests, on shady banks of streams usually below 1,000 m, but in the Arfak Mts (W. New Guinea) ascending to 2,000 m.

Fruit: Like in other *Mapanias*; the pyriform nuts, 5 to 7 by 3 to 5 mm, remain on the decaying inflorescence for a long time; when finally the greyish-brown exocarp has rotted away the whitish harder endocarp becomes visible. It is not impossible that these kernels may occasionally be dispersed by water.

Affinity: The genus *Mapania* is pantropically distributed. *M. macrocephala* belongs to sect. *Cephaloscirpus* (Kurz) B. & H. which comprises only one other species in New Guinea. *M. macrocephala* is the only *Mapania* found in Pacific Islands and the only one known from Australia. It is allied to some other Malaysian species.

Source: MS revision for the Flora Malesiana.

J. H. KERN.



16. *Dichapetalum* Thou.

Name: *Dichapetalum* THOU., Gen. Nov. Madagasc. (1808) 23.

Family: *Dichapetalaceæ* (=Chailletiacæ).

Synonym: *Chailletia* DC.

Species: The genus comprises about 200 species, arranged into 4 sections. All 16 species in our area belong to sect. *Dichapetalum*. Most of these species are confined to continental Asia, West Malaysia, and the Philippines; New Guinea has only 2 more or less widely spread species and 2 endemics. In Melanesia there are only 2 species, viz the wide-spread *D. papuanum*, which reaches as far as the Solomon Islands, and the endemic *D. vitiense*, known from the New Hebrides (Aneityum I.), Fiji, and Tonga.

Habit: Usually scrambling or creeping (more rarely erect) shrubs or lianas, not rarely treelets, sometimes medium trees.

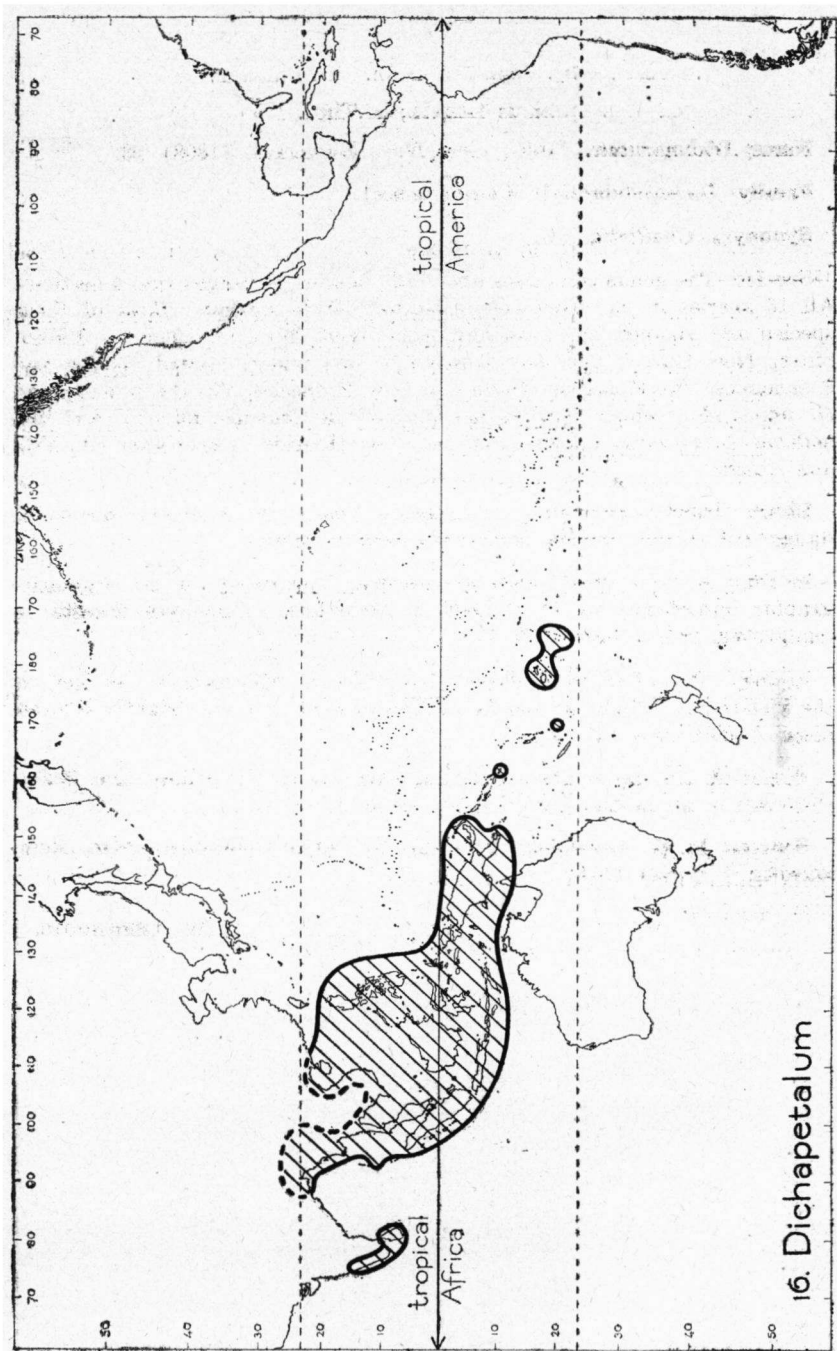
Habitat: A rain-forest substage element, apparently of no vegetatographic importance, up to c. 1,800 m; sometimes in monsoon forests, in mangroves, and in bamboo-forests.

Ecology: The often many-flowered and dense inflorescences as well as the disk-scales, which are nearly always present and are brightly colored, suggest pollination by insects.

Dispersal: As the fruits are drupaceous, orange to yellow, and fleshy, they will in all probability be dispersed by animals.

Sources: P. W. Leenhouts, Fl. Mal. I 5 (1957) 305-316; ditto, Reinwardtia 4 (1956) 75-87.

P. W. LEENHOUTS.



16. *Dichapetalum*

17. *Rourea* subg. *Palliatius* Leenh. sect. *Palliatius* Leenh.

Name: *Rourea* sect. *Palliatius* LEENH., Fl. Mal. I 5 (1958) 512.

Family: *Connaraceæ*.

Synonym: *Santaloides* L.

Species: The genus *Rourea*, with about 80 to 90 species, can be subdivided as follows:

Subg. *Jaundea* (Gilg) Leenh., mainly African, in Malaysia represented by one species in Annam and Sumatra.

Subg. *Rourea*, mainly restricted to Central and South America, but with one species in West Africa.

Subg. *Palliatius* Leenh.: this subgenus can further be subdivided in the two following sections:

Sect. *Palliatius*, restricted to Malaysia and the Pacific, comprising about 30 species.

Sect. *Afrosantaloides* (Schellenb.) Leenh., mainly restricted to Africa and Madagascar, with one species in the Deccan and the Malay Peninsula, and probably a second one in Borneo.

Habit: Large lianas, scrambling or erect shrubs, rarely treelets.

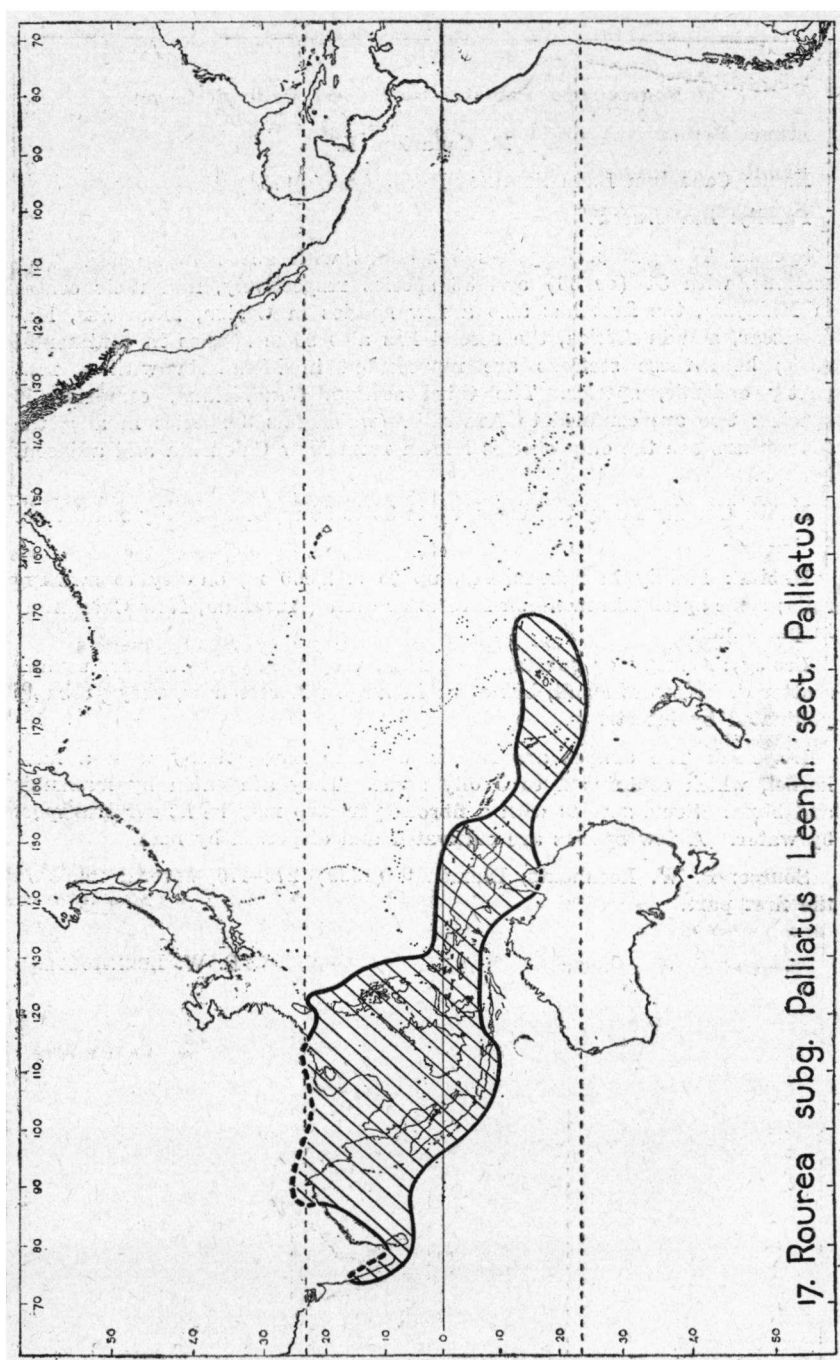
Habitat: Usually in and especially along the edges of rain-forests, on river-banks, along roads, etc.; sometimes in shrubberies, in Java also in teak-forest.

Ecology: The flowers are small, fragrant, and usually creamy-white; they are united in often rather large inflorescences and will probably be pollinated by insects.

Dispersal: The fruits are fairly showy: red, with a partly protruding seed, which is enveloped by a red fleshy arillode; they are eaten by birds and monkeys.

Source: P. W. Leenhouts, Fl. Mal. I 5 (1958) 510-520.

P. W. LEENHOUTS.



18. *Canarium* L.

Name: *Canarium* L. in STICKM., Herb. Amb. (1754) 10.

Family: *Burseraceæ*.

Species: The genus comprises 3 sections with about 75 species. Two sections, with 31 (or 33) and 36 species respectively, find their centre in Malaysia, the first has also a few species in Ceylon, Mauritius, Madagascar, and in Africa, the second has also some species in continental Asia; both these sections are represented in Melanesia with a few, partly endemic, species. The third section, *Canariellum*, comprises 6 species: two are confined to Australia (which has 3 species in all), the four others are the only species known from New Caledonia and adjacent islands.

Habit: Usually fairly tall trees, up to 30 to 50 m, occasionally small trees or shrubs.

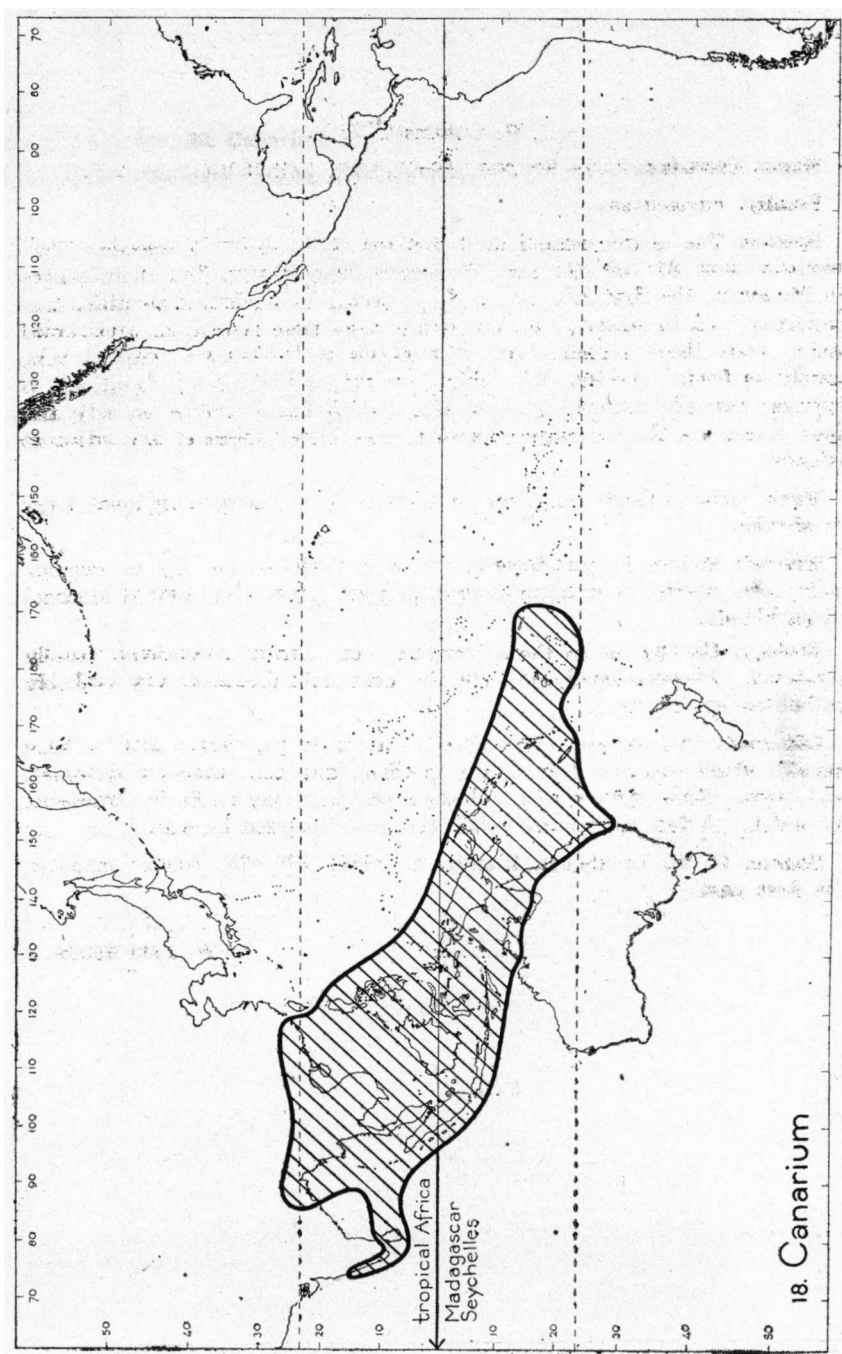
Habitat: Mainly in rain-forests, up to c. 2,000 m, on dry to swampy soils; some species in monsoon forests or even (Australia, New Caledonia) in parklands.

Ecology: Canopy or substage elements, very rarely gregarious, usually scattered. Flowers small, but often in large inflorescences, very probably pollinated by insects.

Dispersal: The drupes are rather small to large, fleshy with a hard kernel, which contains 1 to 3 oily seeds. They are eaten by mammals and birds. Some species with a fibrous pericarp may be fit for transport by water. A few species are cultivated and dispersed by man.

Source: P. W. Leenhouts, *Blumea* 9 (1959) 275-475, several maps in the first part.

P. W. LEENHOUTS.



19. *Gonystylus* T. & B.

Name: *Gonystylus* Teysm. & Binnend., Bot. Zeit. 20 (1862) 265.

Family: *Thymelaeaceae*, subfam. *Gonystyloideae*.

NOTES: The genus *Gonystylus* is the largest one of the subfamily, there being only two other monotypic genera, *Amyxa* and *Astozylon*, both endemic in the island of Borneo. In *Gonystylus* 19 species have been recognized in the latest monographic treatment by Airy Shaw (vide infra) and the distribution of the number of species over the area has been indicated on the map, the majority being in or confined to Borneo, which is obviously the focus of speciation of the genus. The only records in the Pacific are from the Solomon Islands and Fiji. The species occurring in New Guinea is *G. macrophyllus* (Miq.) Airy Shaw, which occurs throughout the area, westwards to the Nicobars. The Fijian species is a local-endemic: *G. punctatus* A. C. Smith, that of the Solomons is *G. megacarpus* C. T. White; both are probably forms of *G. macrophyllus*.

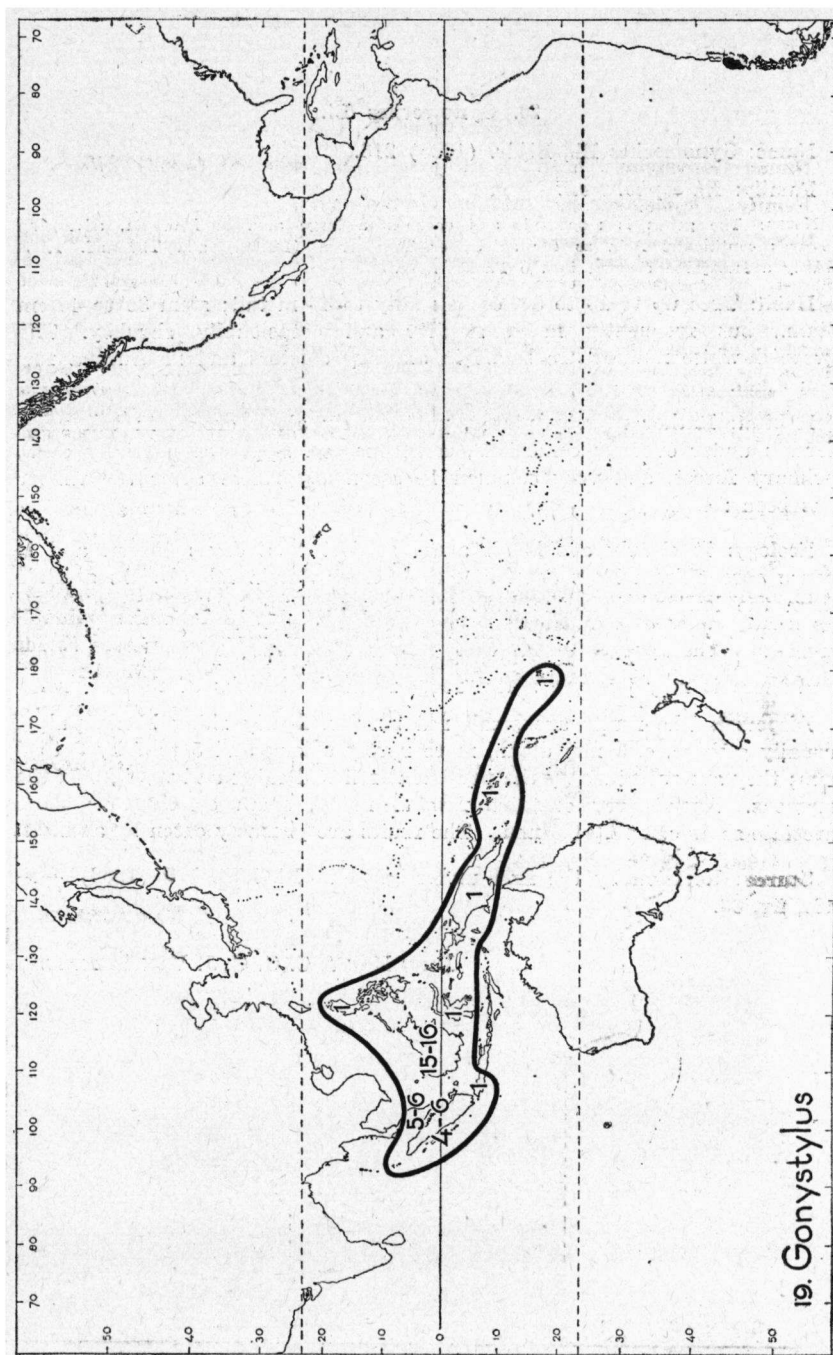
Habit: Trees of moderate to large size.

Habitat & Ecology: Confined to rain-forests at low altitude, but occasionally found between 500 and 1,000 m, and even recorded up to 1,500 m. Some species are most abundant in peaty or sandy grounds (kerangas-podsolized lowland sands) and the timber (ramin in Borneo) is locally in West and North Borneo valued as one of the most valuable timbers. The absence in the eastern half of Java and the Lesser Sunda Islands shows the preference for the everwet rain-forest climate.

Dispersal: The fruits are rather hard, finally 2-5-valved, roundish, large (3 to 10 cm), and provided with a woody pericarp. Seeds 1 to 5, large, with smooth, softly coriaceous testa, and thin dorsal aril arising from the fleshy funicle.

Source: H. K. Airy Shaw, *Thymelaeaceae-Gonystyloideae* [Fl. Mal. I 4 (1953) 349-361, fig. 1-4].

C. G. G. J. VAN STEENIS.



19. *Gonystylus*

20. *Gynotroches* Bl.

Name: *Gynotroches* Bl., Bijdr. (1825) 218.

Family: *Rhizophoraceae*.

Notes: The genus is monotypic and occupies a large area in Malaysia, advancing towards continental Asia as far as Upper Tenasserim (Burma) and Thailand. It is clearly a Malaysian element in the Pacific flora.

Habit: Tree up to 15 to 30, occasionally to 45 m tall; stem 30 to 45 cm diam., but frequently much smaller and occasionally shrubby. The greenish-white flowers are borne in axillary clusters and measure a few mm diam.

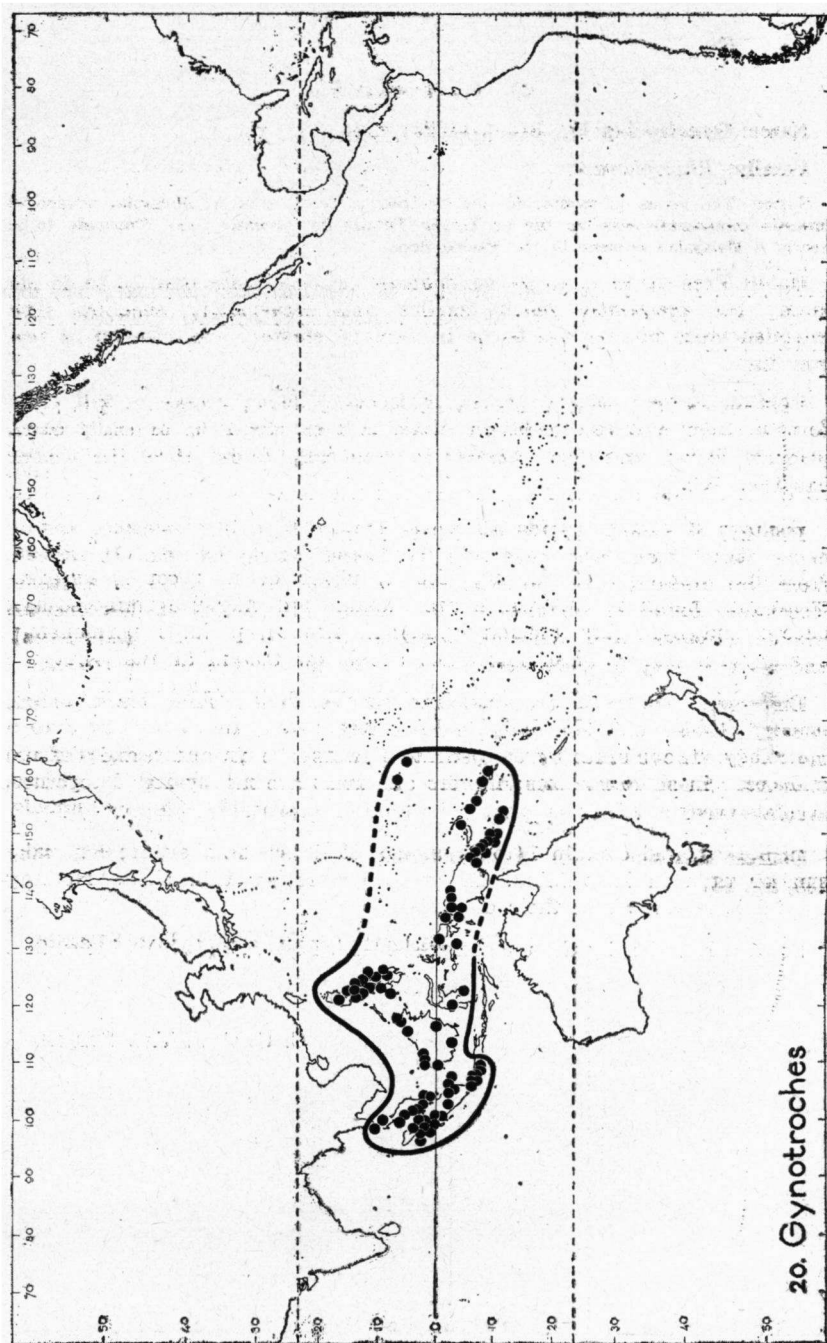
Habitat: Rather marshy places, particularly along creeks in tall rain-forests under everwet conditions, sometimes on slopes of partially open, primary forest, and very common in secondary forest after the timber has been felled.

Ecology: It clearly avoids all areas subject to a dry monsoon and is hence absent from East Java and the Lesser Sunda Islands. It ascends from the lowland into the hills and is found up to 2,250 m altitude. Hosokawa found it common in the mossy hill forest of Micronesian islands (Ponape and Kusaie), together with tree ferns (*Alsophila*) and there it may produce aerial roots from the boughs of the crowns.

Dispersal: The fruits are small red berries, finally shiny black, pulpy, usually globose, c. 3 mm diam., more rarely oblong and 5 to 7 by 3 to 5 mm; they are sustained by the persistent reflexed calyx and vestiges of the stamens. Each berry contains few to many, small oblong to globose areolate seeds c. 1.5 by 0.5 mm. The fruits are probably eaten by animals.

Source: Revision by the first undersigned in Fl. Mal. I 5 (1958) 483-489, fig. 33.

DING HOU & C. G. G. J. VAN STEENIS.



21. *Styrax agrestis* (Lour.) G. Don

Name: *Styrax agrestis* (Lour.) G. DON, Gen. Syst. 4 (1837) 5.

Family: *Styracaceae*.

Synonyms: *Cyrta agrestis* LOUR., Fl. Coch. (1790) 778; *Styrax warburgii* PERK., Pfl. Reich Heft 39 (1907) 27; *Styrax ledermannii* PERK., Notizbl. Berl.-Dahl. 10 (1928) 457; *Styrax rostratum* HOSOKAWA, Trans. Nat. Hist. Soc. Formosa 28 (1938) 65.

Notes: The genus *Styrax* comprises over 100 species; it is distributed over the tropics and subtropics of S. Europe, Asia, and the Americas, showing a marked centre in SE-E. Asia. In Malaysia it is only well-represented in the Malay Peninsula and Sumatra. In N. Luzon a Japano-Formosan species is found. The only species occurring in the Pacific is found westward to Tonkin and Annam in Indo-China in a rather coherent area. Its closest relatives are also found in tropical SE. Asia where it obviously originated.

Habit: Evergreen, small tree, c. 3 to 12 m.

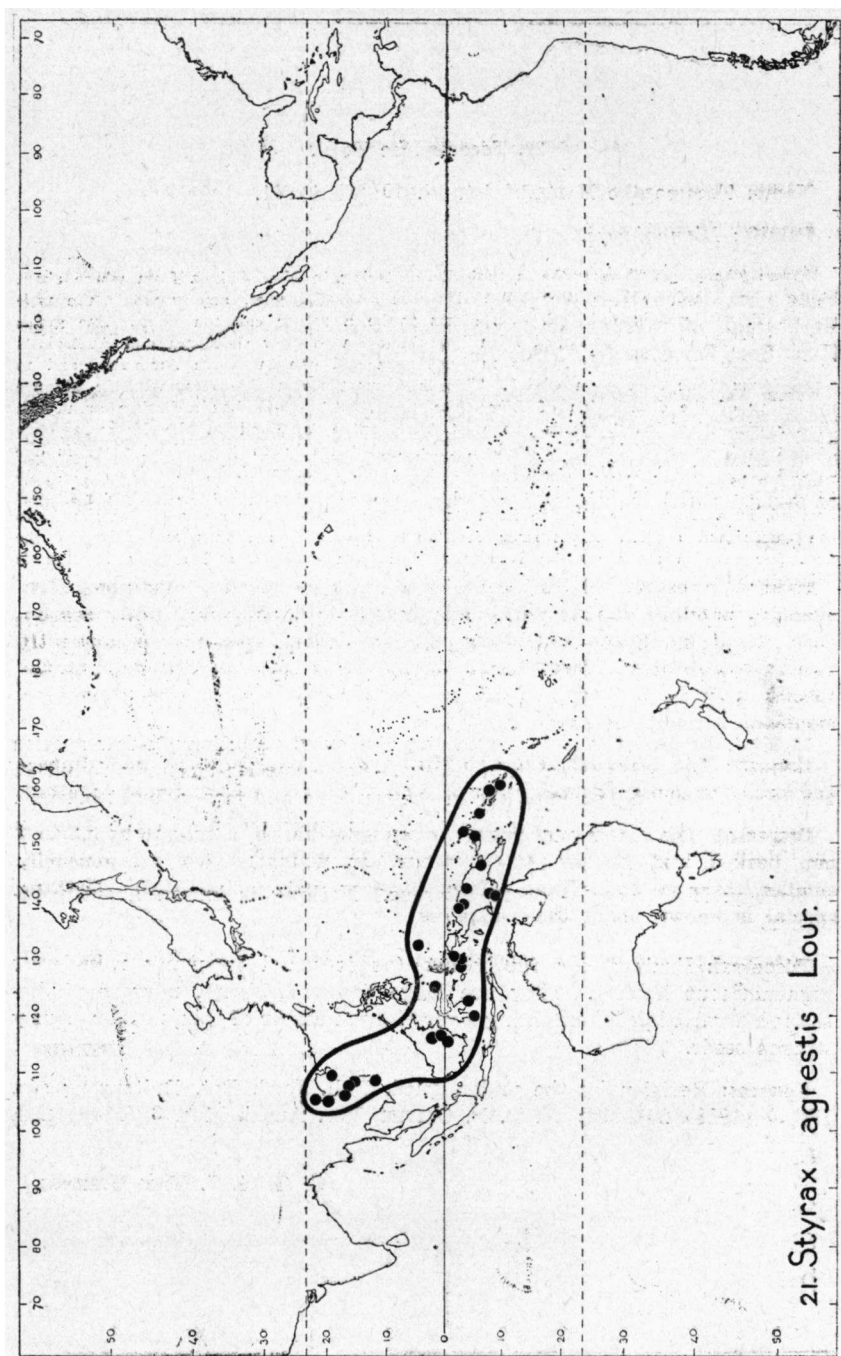
Habitat: Substage of the rain-forest, under everwet conditions, frequently found in forests which are inundated during the rainy season, once found by Brass (Idenburg R.) in flooded, perhaps permanently swampy rain-forest. Most localities are below 300 m. altitude, but the species ascends to 700 m, and in the Solomons it is even found on mountain summits at 1,000 to 1,200 m.

Ecology: The bisexual creamy-white flowers are fragrant and diurnal and occur in short racemes; flowers and fruit are mostly found together.

Dispersal: The indehiscent fruits are spindle-shaped, c. 8 to 18 by 3.5 to 7 mm, beaked, and contain 1(to 2) seeds. In Malaysia they are generally smaller than in Indo-China. They have a rather thin shell. Nothing special is known about their dispersal.

Source: Revision by the undersigned in Fl. Mal. I 4 (1949) 51, fig. 2-3.

C. G. G. J. VAN STEENIS



22. *Tecomanthe* Baill.

Name: *Tecomanthe* BAILL., Hist. Pl. 10 (1891) 41.

Family: *Bignoniaceæ*.

NOTES: The genus *Tecomanthe* is typically centering in New Guinea from where about a dozen species have been described and where several species, among which the type species *T. dendrophila* (Bl.) K. Sch. seems to be a rather common plant. The genus is allied to *Pandorea* (distributed from East Malaysia to New Caledonia and Australia), to the genus *Campsis* (one species in East Asia and one in North America), and to *Campsidium* (one species in Chile). This is a most remarkable circum-Pacific alliance reminding of the distribution of *Libocedrus* (sens. lat.) which has a broken area with similar discontinuities. Towards the west *Tecomanthe* is found in the Moluccas (two species in Ternate, Halmahera, Ambon, Aru, and Ceram); in Queensland there is one species [*T. hillii* (F. v. M.) Steen.] and another (*T. speciosa* W. R. B. Oliver) is found as a local-endemic in the Three King's Islands, at the extreme N. corner of New Zealand, at a remarkable distance from its congeners. The latter seems closely related to the Queensland species. My former revision was based on scanty materials; in the past few decades much additional material has been collected and a new revision is envisaged.

Habit: Medium to large, woody climbers, with imparipinnate decussate leaves, some high-mountain species creeping in heathland. Flowers large and showy (7 to 15 cm), tubular, red, carmine, or purple, rarely creamy, in rather short, corymbiform racemes.

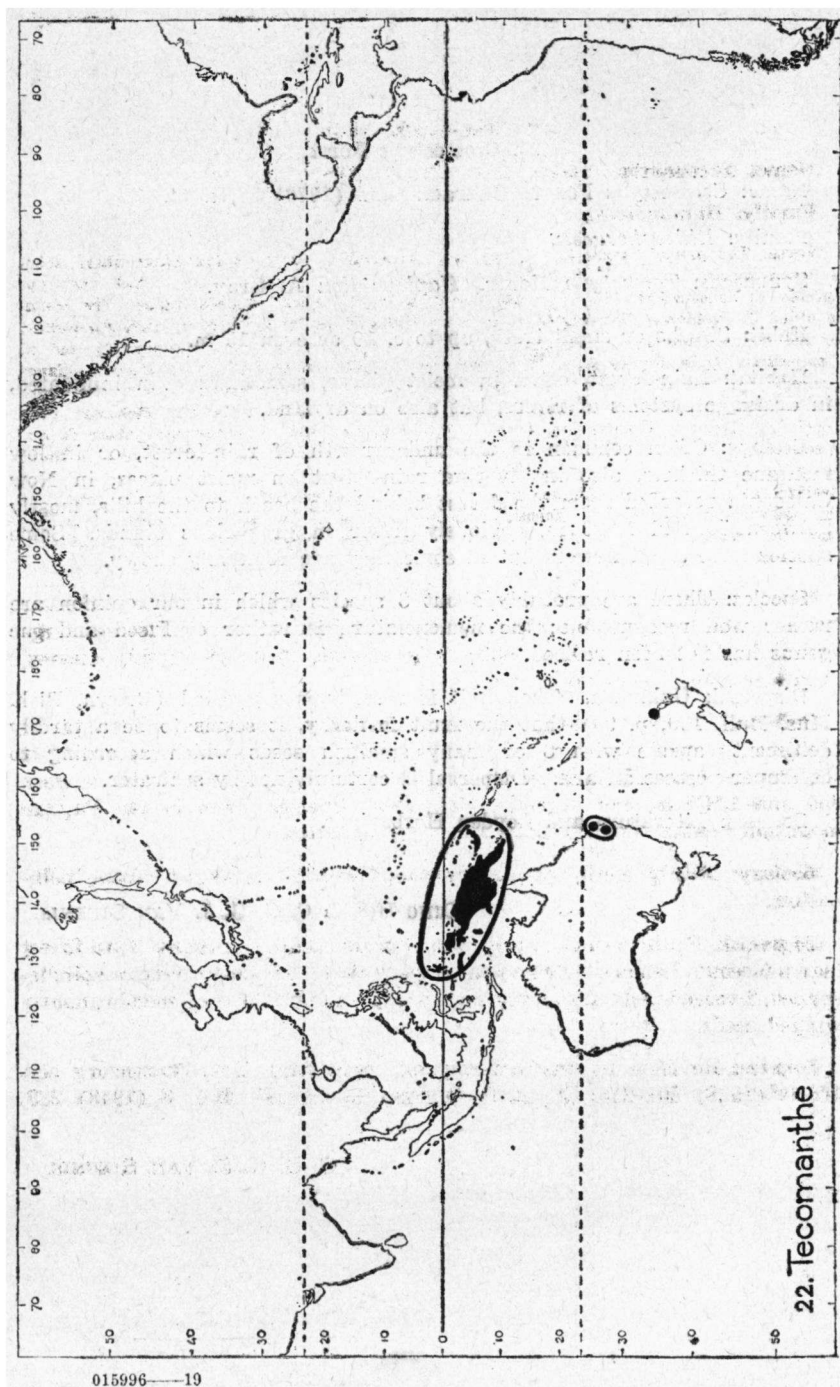
Habitat: Exclusively under everwet, rain-forest conditions, a few species creeping in open high-mountain heaths. Some species are only found in the tropical lowland, some others in the montane and mossy forest between 850 and 1,500 m, and a few microphyllous species occur in the Papuan mountain heaths between 2,500 and 3,100 m altitude.

Ecology: Mostly cauli- or ramiflorous. Nothing is known about pollination.

Dispersal: Fruit seems rarely set (as is usual in many rain-forest bignoniaceous lianas). They are large (10 to 15 cm), narrow-spindle-shaped, 2-valved pods containing a very large number of thin, membranously winged seeds.

Sources: Revision by the undersigned, Bull. Jard. Bot. Buitenzorg sér. III 10 (1928) 201-216; W. R. B. OLIVER, Rec. Auckl. Mus. 3 (1948) 233.

C. G. G. J. VAN STEENIS.



23. Crossostylis Forst.

Name: *Crossostylis* FORST., Charact. Gen. (1776) 88, t. 44.

Family: *Rhizophoraceæ*.

Synonyms: *Tomostylis* Montr., *Haplopetalon* A. Gray.

Habit: Shrubs or small trees, up to c. 10 or even 15 m.

Habitat: Rain-forest, often in moist places, sometimes even inundated, in drainage systems of rivers, but also on dryland.

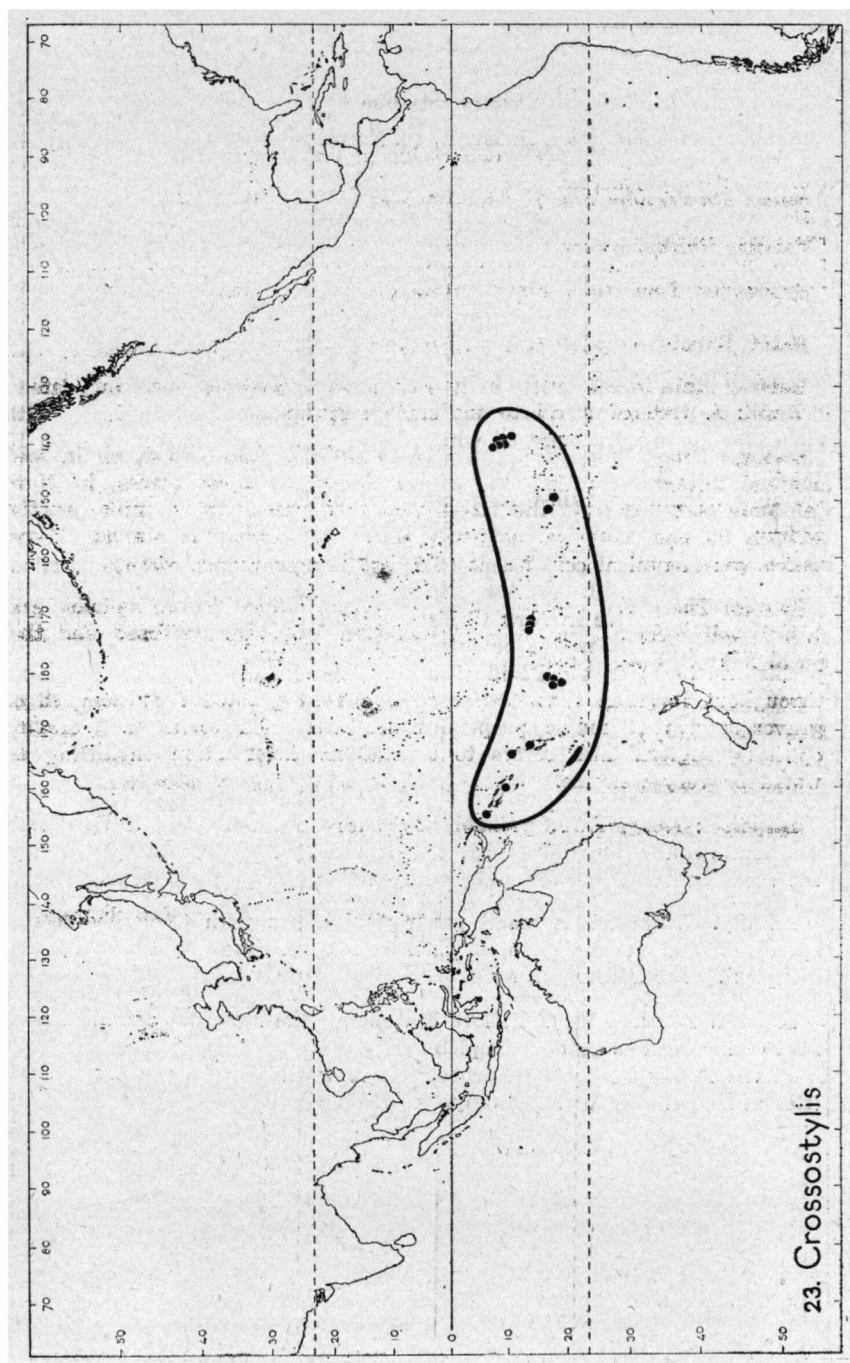
Ecology: Often common in the undergrowth of rain-forest, or in low montane thickets, also in riverine rain-forest on moist places, in New Caledonia recorded from the forest behind the beach to the hills, mostly between 50 and 1,300 m, obviously never in gregarious stands. Some species have small flowers but in some they are relatively showy.

Species: There are probably about 8 species which in our opinion are rather well recognizable; the nomenclature is rather confused and the genus has not been revised.

Dispersal: Unknown. Though it is sometimes suggested (Brown, Bish. Mus. Bull. 130, p. 93) that the fruit is fleshy, it seems to be a tardily dehiscent capsule with 8 or many smallish seeds which according to Schimper possess an aril. Dispersal is certainly not by seawater.

Sources: Literature and Leyden Herbarium.

DING HOU & C. G. G. J. VAN STEENIS.



24. *Crateva religiosa* Forst. f.

Name: *Crateva religiosa* FORST. f., Pl. Escul. Ins. Oc. Austral. (1786) 45.

Family: *Capparidaceæ*.

Notes: This species can be recognized by the thin leaves which in the herbarium mostly retain the greenish colour on both sides and have 7 to 11 pairs of nerves. The fruit is rough, in the eastern part of the area elongate, in the western part more globular in shape.

The locality in the Marianas could not be specified. The species has also been reported from Kyushu in S. Japan, but that material belongs to another species, as could be verified in material borrowed from the Tokyo Herbarium. It has also erroneously been recorded from Africa.

Habit: A tree of small to moderate size up to c. 30 m high, with trifoliolate leaves, racemes of white flowers, and hanging fruits 6 to 15 cm long.

Habitat: Primary rain-forest, rarely secondary forest, mostly below 100 m.

Ecology: A typical constituent of forest along streams, often on periodically inundated soil. A few records are from dryland forest. Most probably it is native in New Guinea and the Solomons. It is difficult to state whether it is native or introduced (probably in pre-Columbian or prehistoric time) in the Pacific islands. It is known from several places throughout its area that *Cratevas* have been planted near temples or graves, and that magic properties are attributed to them. Forster's epithet 'religiosa' also refers to this. More information on this point would be very welcome.

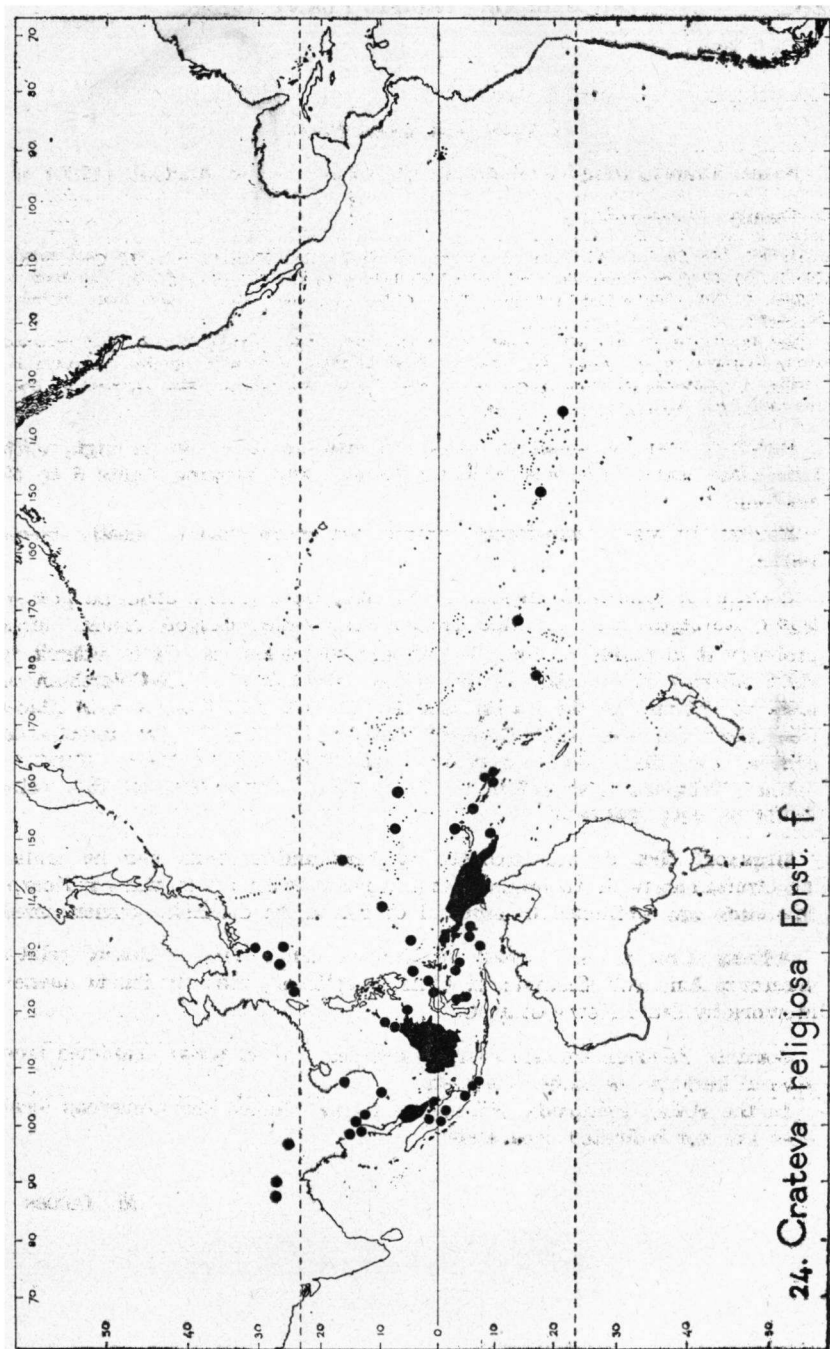
Dispersal: Not known, probably by bats and/or hogs and by water. The fruits can be found dropped when ripe; they have a leathery pericarp; the seeds are embedded in pulp which has a disagreeable sourish smell.

Affinity: *Crateva* is a small pantropical genus with 3 closely related species in Asia and Malaysia, of which *C. religiosa*, the only Pacific species, occupies by far the largest area.

Sources: Revision for the Flora Malesiana; the material examined from several herbaria is rather complete.

In the Malay Peninsula, Borneo, and New Guinea the numerous localities are not indicated separately.

M. JACOBS.



25. *Sanicula* L.

Name: *Sanicula* Tourn. ex LINNÉ, Gen. Pl. ed. 5 (1754) 109.

Family: *Umbelliferae*.

NOTES: There seems considerable measure of agreement that the tribe *Saniculeae* represents a comparatively primitive stock of the *Umbelliferae*, being somewhat intermediate between the subfamilies *Hydrocotylodeae* and *Ligusticoidae*. Linnaeus recognized three species in *Sanicula*. In the recent monograph by Ren Hwa Shan & L. Constance (vide infra) 37 species are distinguished which belong to the following 5 sections:

Sect. 1. *Tuberculatae* Drude, 3 spp., West China to Japan;

Sect. 2. *Pseudopentagnia* W. Wolff, 6 spp., Eastern Asia;

Sect. 3. *Sanicula*, 13 spp., Eurasia to Africa & Malaysia, East and Central North America to South America;

Sect. 4. *Sandwicensis* Shan & Constance, 3 spp., endemic in the Hawaiian Islands;

Sect. 5. *Sanicoria* DC., 12 spp., western North America and southern South America.

Habit: Biennial or perennial herbs.

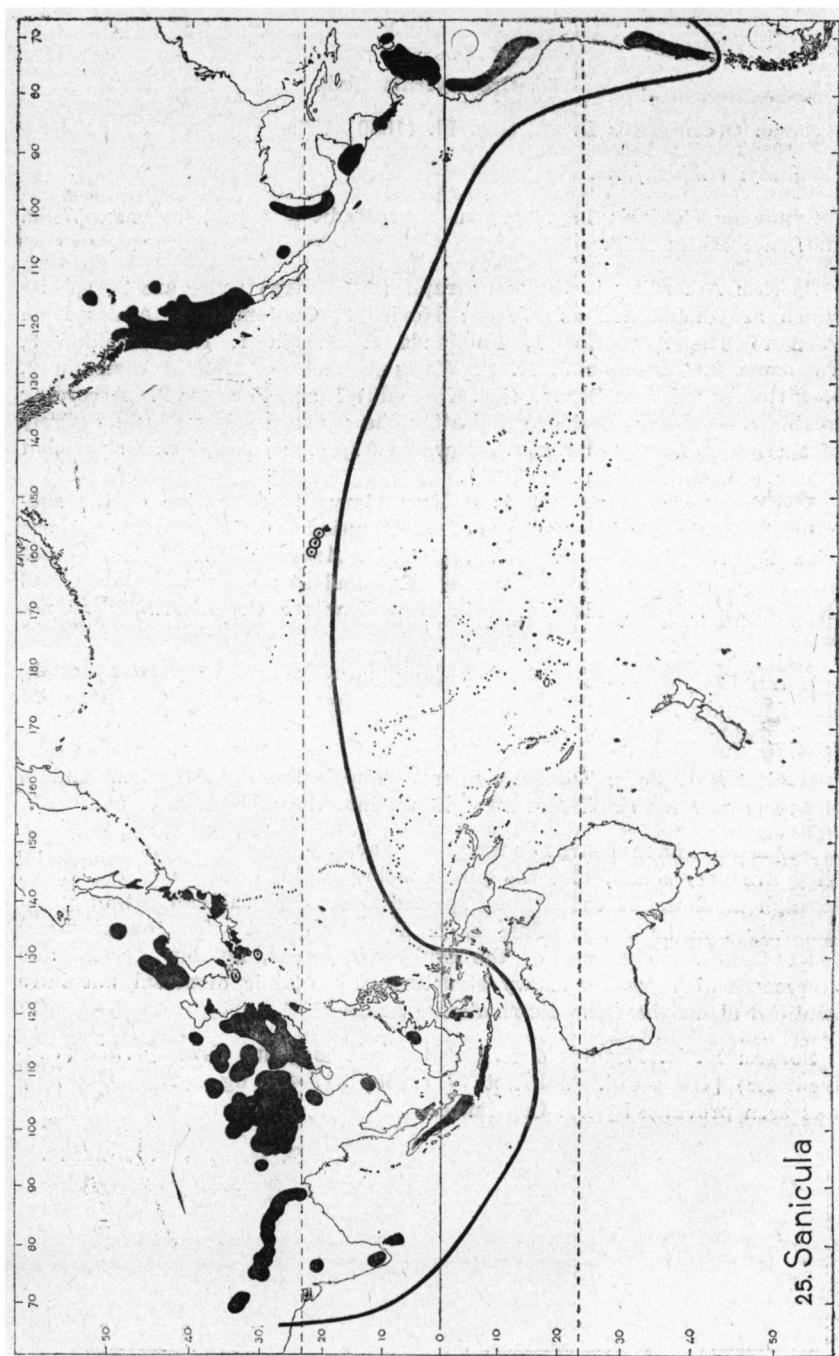
Habitat: Forests and semi-open country in the temperate and cold regions, in the tropics ascending the mountains.

Distribution: In sect. *Sanicula* the East American species are closely allied with both the Eastern Asian and European. The sect. *Sandwicensis* is quite separated and there are no clear indications of its affinities.

Dispersal: The fruits are characterized by being tuberculate, prickly, lamellate, squamose or costate. Their dispersal seems effected epizooically. This assumption and its impact on the history of the present geographical area of distribution led Ridley (Dispersal, 1950, 591-592) to speculations on the history of the genus. Constance reported *S. graveolens* and *S. crassicaulis* from both California and Chile and adds (l. c. p. 14) "these species have bristly fruits that may be suited to long-distance dispersal by birds or other agents". On the other hand it is most remarkable that even in Hawaii the 3 species have replacing areas which is not in favour of very intensive dispersal over medium distances. There are also other species with restricted ranges.

Sources: Ren Hwa Shan & L. Constance, The genus *Sanicula* in the Old World and the New [Univ. Cal. Publ. Bot. 25 (1951) 1-78, fig. 1-52]. The map of this contribution was provided by Dr. Constance; a few additions for Malaysian localities were derived from Buwalda's work [Fl. Mal. I 4 (1949) 125-126]; the legend was mostly abstracted from the cited monograph by the editor.

C. G. G. J. VAN STEENIS.



26. *Oreomyrrhis* Endl.

Name: *Oreomyrrhis* ENDL., Gen. Pl. (1839) 787.

Family: *Umbelliferae*.

Synonym: *Caldasia* Lag. Amoen. Nat. Madr. 2 (1821) 99, non Willd. 1807, nec Mutis 1810.

Species: According to the monograph (vide infra) there are 23 species which are distributed as follows: Mexico 2, Guatemala 1, Andes from Peru to The Argentine 1, Falklands & Fuegia 1, New Zealand 3, Tasmania 2, Tasmania & N. S. Wales & Victoria 3, SE. Australia 2, New Guinea 5, North Borneo (Mt. Kinabalu) 1, and Formosa 2. According to this concept for specific delimitation the genus consists almost entirely of species of restricted range. Buwalda's specific concept was somewhat larger (Fl. Mal. I, 4: p. 128-131).

The distributional pattern is an exemplary demonstration of the sub-antarctic-South Pacific pattern of distribution. It is almost equiform with that of *Acaena*, *Oreobolus*, *Uncinia*, *Araucaria*, *Nothofagus*, etc., although the latter two genera are not found at northern latitudes, and the former two are also found in Hawaii where *Oreomyrrhis* does not occur.

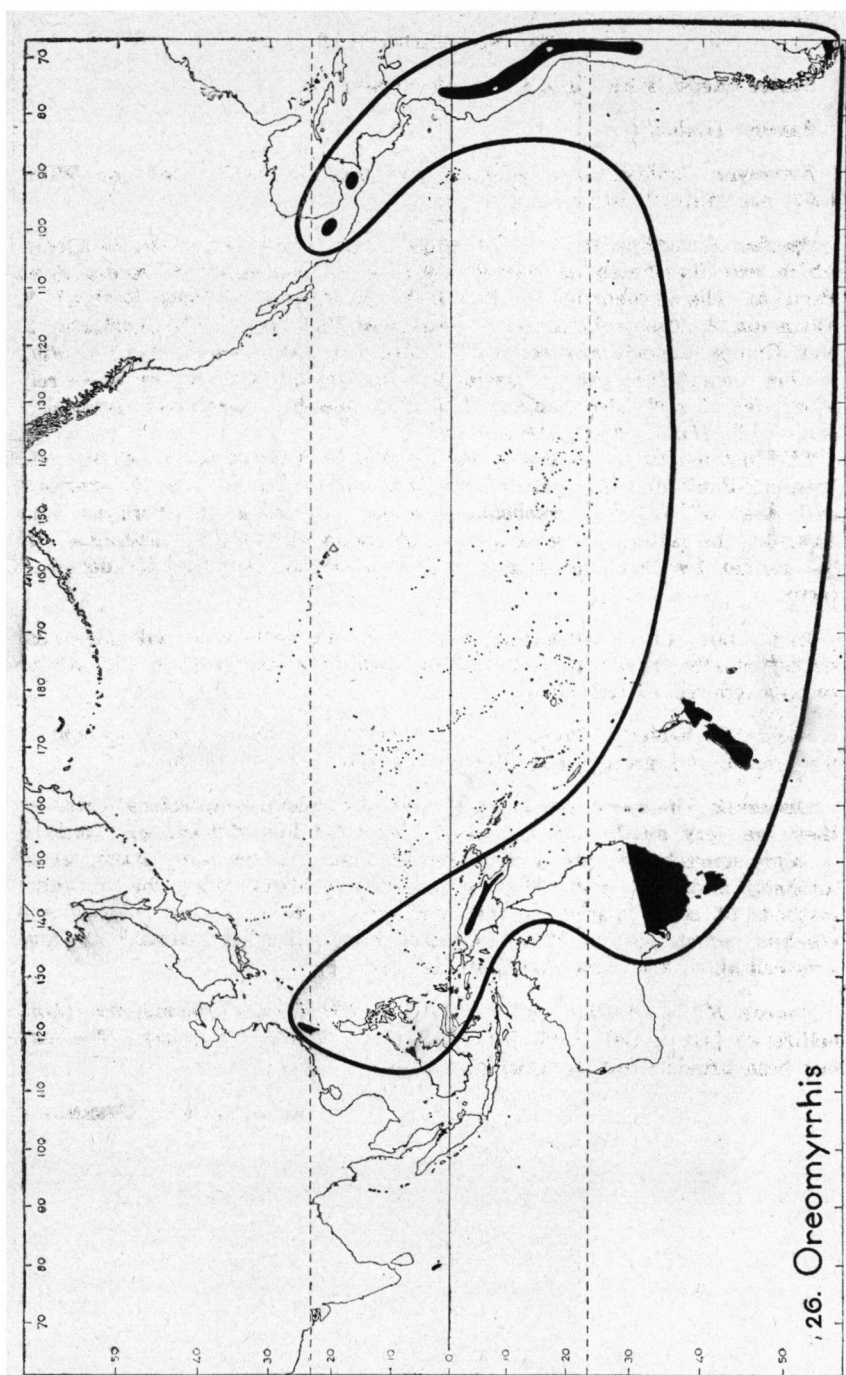
Habit: Low, often caespitose or pulvinate to moderately tall perennial herbs, usually from taproots. Leaves usually pinnatisect, in high-alpine species reduced to phyllodes.

Habitat & Ecology: Typically microtherm, in temperate regions and in the tropics at high altitudes straight up into the alpine zone.

Dispersal: The mericarps do not possess any special adaptational features, they are very small, and the plants being of low stature and confined to high summits, it cannot be expected that dispersal can attain great intensity and be rapid. This is in sharp contrast with the dispersal methods of some species of the equiformal areas, notably *Acaena* and *Uncinia*, which possess showy structures for epizoid dispersal but have attained about the same distributional area.

Source: M. E. Mathias & L. Constance, The genus *Oreomyrrhis* (*Umbelliferae*) [Univ. Cal. Publ. Bot. 27 (1955) 347-416, fig. 1-25]. The map has been provided by Dr. Constance.

C. G. G. J. VAN STEENIS.



26. *Oreomyrrhis*