

tacular bractlets pale-stramineous, obovate, about 2 mm. long and 1 mm. wide, long-acuminate at the apex, long-ciliate from the widest part to the apex, otherwise glabrous; staminate florets: sepals 3, pale-stramineous, spatulate, about 1.1 mm. long and 0.3 mm. wide, densely pilose on the back and long-barbate at the rounded apex, united only at the base; petals 3, connate into a stramineous tube about 1.6 mm. long, the free portion short and erect; stamens 3; pistillate florets: sepals 3, white, separate to the base, oblong, about 1.6 mm. long and 0.3 mm. wide, densely white-barbate at the apex, otherwise glabrous; petals 3, exactly similar to the sepals, separate to the base; style stramineous, about 1 mm. long, glabrous; ovary subglobose, stramineous, about 0.6 mm. long and wide, 3-sulcate, 3-celled, 3-ovulate.

The type of this species was collected by John J. Wurdack and L. S. Adderley (no. 42861), who say that the plant was locally abundant in the Sabana Caname, on the left bank of the Cano Caname, Río Atabapo, below Guarinumo, at an elevation of 125 meters, Amazonas, Venezuela, on June 8, 1959, and is deposited in the Britton Herbarium at the New York Botanical Garden. The plant has very great habital resemblance to Syngonanthus savannarum Moldenke, but may be distinguished at once superficially by its aristate involuclral bractlets.

MATERIALS TOWARD A MONOGRAPH OF THE GENUS AVICENNIA. I

Harold N. Moldenke

This is the twenty-second in my series of works of monographic nature on the genera of Verbenaceae, Avicenniaceae, Stilbaceae, and Symphoremaceae. Previous genera so treated have all been verbenaceous: Aegiphila Jacq., Amasonia L. f., Baillonia Bocq., Bouchea Cham., Casselia Nees & Mart., Castelia Cav., Chascanum E. Mey., Citharexylum B. Juss., Cornutia Plum., Parodianthus Troncoso, Petitia Jacq., Petrea Houst., Priva Adans., Pseudocarpidium Millsp., Recordia Moldenke, Rehdera Moldenke, Rhaphithamnus Miers, Svensonia Moldenke, Tectona L. f., Vitex Tourn., and the New World and cultivated members of Callicarpa L. The present work is my first in the Avicenniaceae, and, since the family is monogeneric, completes the family.

Full explanation of the abbreviations employed herein for the names of the 254 herbaria whose material was examined in the preparation of this work will be found in Phytologia 5: 154-159 (1955) and 6: 242 (1958) with the following additions:

Bd = Herbarium Bradeanum, Rio de Janeiro, Brazil

Bs = Basler Botanische Gesellschaft, Basel, Switzerland

G1 = Museu Goeldi, Belém, Pará, Brazil

Mm = McGill University, Montreal, Quebec, Canada
 Ng = Department of Forests, Lae, New Guinea
 Um = University of Montreal, Montreal, Quebec, Canada
 Wp = University of Manitoba, Winnipeg, Manitoba, Canada

AVICENNIACEAE Endl. ex Schnitzlein, Icon. Fam. Nat. Reg. Veg. 2:
 [215--216], pl. 137**. 1856.

Synonymy: Avicenniaceae Endl., Gen. Pl. 632, 638, & 639 (1838)
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Shrubs or trees of maritime regions, mostly inhabiting the saline or brackish coastal mangrove lagoons, with pneumatophores; growth in diameter of trunks and stems brought about by concentric layers of mestome rings; branches, branchlets, and twigs commonly terete, prominently nodose, and articulate; leaves decussate-opposite, thick-textured, persistent, petiolate, exstipulate, the blades entire; inflorescence axillary or terminal, determinate and centrifugal (cymose), spicate or subcapitate, the axillary inflorescences mostly paired; flowers sessile, perfect, hypogynous, small; calyx composed of 5 nearly separate sepals, the segments ovate and plainly imbricate, unchanged in fruit, subtended by a pseudo-involucre composed of a scale-like bractlet and 2 alternate scale-like prophylla, which are slightly shorter than the calyx and are imbricate with each other and with the calyx-segments; corolla actinomorphic, gamopetalous at the base, campanulate-rotate, 4-parted; stamens 4, inserted in the throat of the corolla-tube, equal or subdidynamous; gynoec-

ium composed of 2 united carpels; ovary compound, but with a free central often more or less 4-winged placenta; ovules 4, pendent, orthotropous, hanging from the tip of the central columella; fruit a compressed oblique capsule, with a juicy and somewhat fleshy usually tomentellous exocarp, dehiscent by 2 valves, by abortion regularly only 1-seeded; seeds without a testa; embryo viviparous; radicle hairy; cotyledons 2, folded lengthwise.

The Black-mangrove Family comprises only a single genus, Avicennia, with 16 known living species and varieties, inhabiting the maritime regions of the tropics and subtropics of both the Old and New Worlds. It is one of the chief constituents of almost all coastal mangrove lagoons. Four fossil species are known -- 2 from the United States and 2 from Colombia. A modern species is almost known in the fossil form from Trinidad.

This family is often considered to be merely a tribe (Bentham) or a subfamily (Briquet) of the Verbenaceae, from whose tribes Viticeae or Teijsmanniodendreae it is usually regarded as having arisen, although some morphologists regard it as having arisen from the Dipterocarpaceae or Ancistrocladaceae. Its worthiness of being raised to family rank was pointed out by Sain-Hilaire in his *Pl. Usuel. Bras.* 1--4, pl. 40 (1826), by Endlicher in his *Gen. Pl.* 1: 394 & 638--639 (1838), by Schnitzlein in his *Icon. Fam. Nat. Reg. Veg.* 2: [215--216], pl. 137** (1856), by Bocquillon in his *Révue du Groupe des Verbénacées in Adansonia* 3: 181 (1862), by Eichler in his *Blüthendiagramme* 1: 231 (1875), by Van Tieghem in *Journ. de Bot.* 12: 199 & 345--365 (1898), by Warming in his *Frøplanterne* 396--404 (1912), and by Small in his *Fl. Miami* 150 & 161 (1913), *Shrubs Fla.* 110, 117, & 118 (1913), *Fla. Trees* 93 & 95 (1913), *Fl. Fla. Keys* 119 & 130 (1913), and *Man. Southeast. Fl.* 1079, 1144, & 1145 (1933). The researches of wood anatomists, like Record & Mell [*Timbers Trop. Am.* 528--529. 1924], and Panshin, morphologists, like Croizat, and pollen analysts, like Erdtman [*Svensk Bot. Tidsk.* 39: 284. 1945], all point to the same conclusion. Miquel in *Lehmann, Pl. Preiss.* 1: 353 (1845) regarded it as a family coordinate with the Verbenaceae, but which he designated as "Avicennieae Endl.", while Frey-Wyssling, *Stoffaus. Hsh. Pfl.* 233 (1935) also regarded it as a family ("Avicenniaceen") distinct from the "Verbenaceen". The family has been accepted, among others, by Buswell [*Native Trees & Palms S. Fla.* 38 & 45. 1945], by Alain [*Contrib. Ocas. Mus. Hist. Nat. Coleg. La Salle* 7: 79. 1946], by Hodge & Gutiérrez Villegas [*Revist. Fac. Nac. Agron. Medellin* 8: 415 & 426], by Karkley [*Revist. Fac. Nac. Agron. Medellin* 8: 176. 1948; 9: 46, 169, & 177. 1949], and by Den Berger [*Determinat. Houts. Mal. Fam.* 20 & 72. 1949]. It has been accepted by me in all of my publications dealing with members of this group from 1930 to the present. The late Dr. A. Pulle, in a letter to me dated October 2, 1937, says "I think it wise to adopt your division of the former Verbenaceae into Avicenniaceae and Verbenaceae s. str." Bullock [*Taxon* 8: 160. 1959] proposes Avicenniaceae for conservation, but credits it to Endlicher's "Ench. Bot. 314.

1841", where the name is actually spelled "Avicennieae". Bullock designates the type genus and species of the family as Avicennia L. and A. officinalis L.

August Saint-Hilaire in Mém. Mus. Hist. Nat. Paris 4: 398 (1818) says "MM. de Jussieu (Gen.) et Brown (Gen. rem.), ont placé l'avicenia parmi les verbenacées. It existe certainement de très-grandes différences entre ces plantes." In his Pl. Usuel. Bras., in 1826, under Verbena pseudogervae, he gives a discussion of the relation of the Verbenaceae and Lamiaceae and states that he is convinced that Avicennia does not belong in the Verbenaceae.

Eichler, in his Blüthendiagramme 1: 231 (1875), says "Avicennia bekannt als 'lebendiggebärend', d. i. bereits keimend, während die Frucht noch am Baum hängt.....soll sich von den Verbenaceen auch durch eine anfangs freie Central-Placenta unterscheiden. Sie bildet daher vielleicht besser den Typus einer eigenen Familie, wie von Endlicher bereits vorgeschlagen wurde; dieselbe würde sich zu den Verbenaceae etwa verhalten, wie die Lentibulariaceen zu den Scrophulariaceae." Record & Hess, in their "Timbers of the New World, pages 72--73 (1943) definitely accept the family Avicenniaceae, based on their study of its wood anatomy. Erdtman, in Svensk Bot. Tidsk. 39: 282 & 284 (1945), says "Avicenniaceae. A few words ought finally to be said about Avicennia. Arguments have recently been put forward for its being referred to Labiatae (Junell, l.c.). So much, however, does Avicennia deviate from the true Labiatae stock, pollermorphologically (cf. fig. 2), as well as in other respects, that it probably should be regarded as forming a family of its own."

In previous publications I gave the year "1843" as the date for the Schnitzlein publication cited above, by Bullock has pointed out in a letter to me dated May 20, 1959, that these pages were included in Heft XI which was reviewed in Bot. Zeit. 14: 863 on December 5, 1856, while Heft X was reviewed in the same work, vol. 13, p. 758, in 1855. The assumption, therefore, is that "1856" is the correct date of publication.

The true Verbenaceae are not lagoon plants and only very seldom are they found in mangrove swamps. They are herbaceous or woody, with normal trunk- and stem-growth without concentric layers of mestome-rings; branches, branchlets, and twigs commonly tetragonal and not articulate; the individual flowers usually not plainly involucrate; calyx mostly very plainly gamosepalous; corolla mostly very plainly gamopetalous, tubular to infundibular or hypocrateriform, often 2-lipped; the ovary more or less completely 2--5-celled, never with a free central placenta or columella; the ovules mostly basal or lateral and anatropous or hemi-anatropous; fruit mostly schizocarpous or drupaceous and with 2--4 pyrenes, the seeds testate, the embryo never viviparous, the radicle glabrous, and the cotyledons are parallel, not folded.

Adriance S. Foster, in a letter to me dated January 4, 1954, says "According to the fairly detailed description which you will find in Metcalfe and Chalke's 'Anatomy of the Dicotyledons', page

1038, Avicennia is distinguished by the fact that successive rings of bundles rather than a continuous cylinder of phloem and xylem occur in the stem. This means, in simplest language, that a succession of cambia arise in a centrifugal direction, each cambium giving rise to a separate cylinder of bundles. This distinctly is anomalous growth and might serve to illustrate clearly what Van Tieghem had in mind in his original description."

Leon Croizat, in letters to me dated June 25 and July 1, 1944, says "Avicennia is perfectly placed as the type of a new family of its own, and with the Verbenaceae it has in common but the superficialities of habit. Your family answers the basic 4-carpellary, 1-ovulate type of placentation that goes back to the oleaceous and cornaceous plexus, and finds in Convolvulus, certain Acanthaceae and the Borraginaceae its latest expression. Avicennia, on the contrary, is a degenerate member of the Rhizophora-Dipterocarpus affinity, that is, a TRUE MANGROVE. Here come also the Punicaceae and the Cactaceae, by the way. In Sonneratia you have definitely opposite leaves, as you have in Avicennia..... A strange thing is the enormous importance of the plants of the mangrove in evolution. Some of the most vital nodes of classification begin at the seashore, which is just as true of Avicennia as it is of Cactus and Celastrus. It seems that after you have followed a line of evolution (of which there are but few, not more than five in the whole of flowering plants, all traceable to some basic structure) you hit, sooner or later, the mangrove. In other words (and this is not strange): when lands emerged, they were colonized at first by the plants of the strands. This is but what one would expect, and, strange to say, it comes out true in precise phylogeny and systematic. I did not know of this, so I did not force my conclusions to reach it. It just happened. Sharp lines begin at the mangrove limit, as when plants of the very same genus have exceedingly different seeds, those of the Hypericaceae and those of the Euphorbiaceae, for instance, with very similar floral structures. Avicennia and Ancistrocladus are monotypes in this group, and their morphology is in no sense more obscure than that of the Sonneratiaceae and the Lecythidaceae, or their raison d'être more involved than that of the Dipterocarpaceae. The peculiarities of the ovule of Viscum match those of the ovule of Avicennia and Rhizophora.... Thus, the Avicennia plant is ABSOLUTELY! not of your family, but a strange child of the Dipterocarpaceae and the Ancistrocladaceae (which are most likely to be regarded as one family). Opposite leaves do not make it a verbenaceous plant, for such leaves occur in the Sonneratiaceae. The perianth is of a reduced type, but the disc still can be traced."

Van Tieghem in Journ. de Bot. 12: 345—365 (1898) gives a very detailed discussion of the Avicenniaceae in comparison to the Verbenaceae. He concludes "On voudrait montrer ici d'abord qu'il est nécessaire de la retirer des Verbénacées pour en faire

une famille autonome, les Avicenniacees, ensuite que cette nouvelle famille doit être rangée dans la sous-classe des Inséminées et dans l'ordre des Innucellées, c'est-à-dire très loin des Verbenacées, qui appartiennent, comme on sait, à la sous-classe des Séminées et à l'ordre des Tenuinucellées.....De tout ce qui précède il résulte que, par la structure de la tige, de la feuille et de la racine mais surtout par celle du pistil et du fruit, les Avicennies diffèrent des Verbenacées trop profondément pour qu'il soit possible de les conserver désormais dans cette famille. Le premier auteur qui les y a placées ne l'a fait d'ailleurs qu'avec doute. 'An genus verbenaceum?' se demandait déjà à leur sujet A.-L. de Jussieu [1806]. Plus tard, A. de Saint-Hilaire a reconnu qu'il existe certainement de très grandes différences entre les Avicennies et les Verbenacées [1818] et Endlicher ne les a classées que dans le voisinage de cette famille [1840]. Plus tard encore Bocquillon, sans s'expliquer autrement sur ce point, les a exclues de ce groupe [1863]. Tous les botanistes qui ont suivi n'en ont pas moins continué à les y maintenir. Il est même à remarquer que le dernier en date, M. Briquet, après avoir pour tant résumé les observations de M. Treub sur ces plantes, déclare qu'il ne subsiste aucun doute qu'elles n'appartiennent réellement à la famille des Verbenacées.

"Il faut, au contraire, croyons-nous, les en séparer fortement et les considérer comme les types d'une famille bien distincte, les Avicenniacees.....

"Par tout les caractères qui l'éloignent des Verbenacées, notamment par la structure du pistil et du fruit, la famille ainsi constituée se rapproche des Santalacées et des autres familles qui se groupent autour d'elles pour former, comme on sait, autres familles qui se groupent autour d'elles pour former, comme on sait, dans la sous-classe des Climacorrhizes inséminées, l'ordre des Innucellées or Santalinées....Le fruit, en effet, y est dépourvu de graines: ce sont donc des Inséminées. L'ovule y est réduit au lobe ovulaire, sans différenciation de nucelle: ce sont donc des Innucellées. En outre, la placentation y est centrale et un seul des ovules s'y développe, comme chez toutes les autres Innucellées: de plus, l'ovaire y est pluriloculaire dans sa région inférieure, comme chez la plupart des plantes de cet ordre.

"D'un autre côté, par la structure secondaire si remarquable de la tige par la dualité des ovules dans chaque carpelle, par l'existence et le mode de croissance de la cellule cotyloïde, par l'embryon dressé et par l'absence d'albumen, les Avicenniacees diffèrent de toute les autres Innucellées et prennent dans cet ordre une place à part. Laquelle?

"Dans sa constitution actuelle, l'ordre des Santalinées comprend, on le sait, trois alliances: les familles où la fleur est dépourvue de corolle et qui sont vertes forment l'alliance des Santales, celles où la fleur est apétalé et qui sont dépourvues de chlorophylle f'alliance des Sarcophytals, celles où la fleur est pétalée l'alliance des Olacales. Chez les Olacales, la

corolle est presque toujours dialypétale: mais on y trouve cependant une petite famille, les Harmandiacées, ou elle est gamopétale. Les Avicenniées ayant une corolle gamopétale, c'est près des Harmandiacées qu'elles viennent se placer, prenant ainsi la tête de l'ordre tout entier.

"Des lors, puisque les Harmandiacées ne sont plus seules à posséder ce caractère, il devient nécessaire de distinguer, dans l'ordre des Santalinées une quatrième alliance, caractérisée par la gamopétalie, alliance qui comprendra des Harmandiacées et les Avicenniées, et qu'on pourra nommer les Avicenniales. Cette alliance nouvelle correspond à celle des Elytranthales dans l'ordre des Inuvulées or Loranthinées. Les Avicenniées s'y distinguent des Harmandiacées notamment par la structure de la tige et de la feuille, par la corolle et l'androcée hétéromères, par les étamines alternipétales, à quatre sacs polliniques s'ouvrant en long, par l'absence de disque nectarifère, par la dualité des ovules dans chaque carpelle, par l'embryon dressé et par l'absence d'albumen."

The family Avicenniaceae may be distinguished from the families with which it has so often hitherto been united by means of the following key:

1. Placenta central, free; ovules apically attached, pendulous, orthotropous.
2. Ovary incompletely 4-celled; cotyledons folded; typically saline lagoon shrubs or trees; growth in diameter of trunks and stems brought about by concentric layers of mestome rings; branches, branchlets, and twigs commonly terete, prominently nodose and articulate.
Family Avicenniaceae Endl.
- 2a. Ovary 2-celled to the middle; cotyledons not folded; typically woody vines of non-saline situations; trunk and stem-growth normal; branches, branchlets, and twigs commonly more or less tetragonal and not articulate.....
Family Symphoremaceae Moldenke.
- 1a. Placentae axial; carpels 2 or 4, each bearing 2 ovules, but one carpel often more or less aborted, the carpel-edges turning back from the middle of the ovary to the midrib of each carpel, making false-partitions; ovules basally or laterally attached, anatropous or hemi-anatropous, apotropous.
3. Seeds with endosperm.....Family Stilbaceae Lindl.
- 3a. Seeds without endosperm....Family Verbenaceae J. St.-Hil.

In connection with the emphasis laid on the characteristics of the wood anatomy of this group in contradistinction to those of other groups, it is interesting to note that F. B. H. Brown in Bishop Mus. Bull. 130: 352 (1935) advocates the validity of Campylothea as a genus, and points out the systematic importance of characters such as the arboreous habit, differences in the anatomy of the stem, the eventual occurrence of ducts containing ethereal oils or resin, and the nectar gland.

AVICENNIA L., Sp. Pl. ed. 1, 110. 1753; Gen. Pl., ed. 5, 49. 1754.

Synonymy: Bontia L. ex Loefl., Iter Hisp. 193. 1758. Donatia Loefl., Iter Hisp. 193, in syn. 1758. Upata Rheede ex Adans., Fam. Pl. 2: 12 & 201. 1763. Oepata Rheede ex Adans., Fam. Pl. 2: 201, in syn. 1763. Sceura Forsk., Fl. Aegypt.-arab. 37. 1775. Racka Bruce ex J. F. Gmel., Syst. Veg. 245, in syn. 1791; Wittstein, Etymol.-botan. Handwörterb. 749. 1852. Halodendrum Thou., Gen. Nov. Madagas. 8. 1806. Halodendron Roem. & Schult., Syst. Veg. 3: 485. 1818. Upata Adans. ex Schau. in Mart., Fl. Bras. 9: 302, in syn. 1851. Halodendron Thou. ex Schau. in Mart., Fl. Bras. 9: 306, in syn. 1851. Avicenia Griff., Notul. Pl. Asiat. 4: 173, sphalm. 1854. Racka J. F. Gmel. ex Jacks., Ind. Kew. 2: 679. 1895. Hilairanthus Van Tiegh., Journ. de Bot. 12: 357--358. 1898. Avicennea L. ex Moldenke, Prelim. Alph. List Invalid Names 5, in syn. 1940. Auicennia Sessé & Moc. ex Moldenke, Prelim. Alph. List Invalid Names 55, in syn. 1940. Avecinnia L. ex Moldenke, Suppl. List Invalid Names 1, in syn. 1941. Avicenna L. ex Moldenke, Suppl. List Invalid Names 1, in syn. 1941. Avixennia L. ex Moldenke, Alph. List Cit. 1: 285, sphalm. 1946. Avicennia Es-pinosa ex Moldenke, Résumé 236, in syn. 1959. Avicenuia L., in herb. Saltzmannia Roxb., in herb.

Literature: see under Avicenniaceae.

Glabrous or canescens shrubs or trees of maritime regions, mostly inhabiting the saline or brackish coastal mangrove lagoons, with wide-creeping roots and numerous erect pneumatophores; growth in diameter of trunks and stems brought about by concentric layers of mestome rings; branches, branchlets, and twigs commonly terete, prominently nodose, and articulate; leaves decussate-opposite, petiolate, exstipulate, persistent, variable, the blades coriaceous, entire, net-veined, glabrous or densely furfuraceous or tomentellous beneath; inflorescence axillary or terminal, determinate and centrifugal (cymose), spicate or subcapitate; cymes contracted, often capituliform, pedunculate, usually paired in the axils of the upper leaves or arranged in a short thyrses or trichotomous corymb at the apex of the branchlet; flowers small, sessile, perfect, hypogynous; calyx coriaceous, cupuliform, gamopetalous, short, deeply 5-partite, often sericeous, unchanged and not accrescent in the fruiting stage, the sepals nearly separate, the lobes varying from oblong to ovate or broadly ovate, plainly imbricate, usually rounded or obtuse at the apex, persistent, subtended by a pseudo-involucre composed of a scale-like bractlet ("bract") and two alternate scale-like prophylla ("bracteoles") which are slightly shorter than the calyx and are imbricate with each other and with the calyx-lobes; corolla gamopetalous at the base, actinomorphic, campanulate or campanulate-rotate, varying from white or whitish to yellow, its tube short, wide, cylindrical or infundibular, straight, the limb spreading, usually 4-parted, rarely 5-parted, the lobes subequal or the posterior one a little broader, usually obovate-oblong and rounded at the

apex; stamens 4, inserted in the throat of the corolla-tube, equal or subdidynamous; filaments short or very short, filiform; anthers ovoid, scarcely exerted, with parallel thecae; gynoeceum composed of 2 united carpels; style short, bifid or bilobate, the lobes stigmatiferous at the apex; ovary superior, sessile, compound but with a free central often more or less 4-winged placenta, imperfectly 4-celled ["1-celled" according to Standley]; ovules 4, pendent, orthotropous, hanging from the tip of the central columella, one in each imperfect cell [Baker says the ovary is "2-celled; ovules 2 in a cell, collateral"]; fruit a compressed, ovoid, oblique capsule, rarely symmetric, often mucronate or apiculate at the apex, with a dry or somewhat fleshy usually tomentellous or furfuraceous exocarp, dehiscent by 2 thickened valves ["coriaceous, indehiscent" according to Baker], by abortion regularly only 1-seeded; seeds without testa; embryo viviparous, naked because of the arrested development of the ovule integuments; radicle hairy, inferior, the plumula commencing to grow before the fruit falls; cotyledons 2, folded lengthwise, large.

The genus is named in honor of Abū Alī Husain Ibn Abd Allāh [Abu Ali Alhosiān Ben Sina] (980—1037), better known as "Ibn Sina" or "Avicenna", famous Persian physician, mathematician, philosopher, and naturalist, who probably lived at Bokhara. The type species of the genus is A. officinalis L.

Authors have misinterpreted many of the characters of this genus in the past. The ovary is said to be 1-celled by Standley, 2-celled by Baker, and 4-celled by other authors. The pendent orthotropous ovules are described as "collateral" by Baker, who also describes the fruit as "coriaceous" and "indehiscent". Many writers describe the stigma as sessile and bifid, while others say that there is a bifid style. Stilt-roots have been recorded by several collectors, especially for A. officinalis, but it is not certain to me that these reports are not the result of confusion with species of Rhizophora, since the two genera so uniformly grow together and stilt-roots are so characteristic of the latter genus.

Pearson and Briquet, following Schimper, recognized only 3 species in the genus. Baker, Watt, and Benthām recognized "3 or 4 species". Today we recognize 15 species and 5 varieties.

Avicennia L. is given as a valid genus in the Labiatae [Lamiaceae], section Verbeneae, by H. G. L. Reichenbach, Concept. Reg. Veg. 1: 117 (1828) with two subgenera, Avicennia and Halodendron. Adanson, in his Fam. Pl. 2: 201 (1763), reduced Avicennia to synonymy under Upata Rheede. The synonyms Bontia L. and Racka Bruce, cited above, are referred to the family Myoporaceae -- the former by Gerth van Wijk in his Dict. Plantnames (1911), the latter by Wittstein in his Etymol.-botan. Handwörterb. 749 (1852).

Common names for members of the genus as a whole include "avicenne" (Lamarck), "avicennée" (Necker), "Avicennie" (Willdenow), "black mangroves" (Small), "blackmangroves" (Harrar),

"Lebendiggebärend" (Eichler), "mangroves", and "Salzbaum".

That individuals of this genus sometimes attain large size is attested by David Fairchild's statement in his "Garden Islands of the Great East", p. 77 (1943): "Mrs. Archbold wandered out under an immense Avicennia tree [along the Krai Krai River on Biliran Island]".

Miss Green, in Kew Bull. 1935: 509 (1935), says that Ewart & Davies in their Fl. N. Terr. 239 (1917) reduce Tatea F. Muell. to synonymy under Avicennia by reducing Tatea subacaulis F. Muell to Avicennia officinalis L. Actually, they do no such thing in the reference cited, nor anywhere else as far as I can determine. The generic name Tatea is a synonym of Pygmaeopremna Merr. in the Verbenaceae.

Jackson, in Ind. Kew. 2: 1247 (1895) states that "Zanthoxylum piperitum Benn." in Daniell, Ann. & Mag. Nat. Hist., ser. 3, 10: 200 (1862) is actually a synonym of "Avicennae". Because of this statement, some authors have included this binomial in the synonymy of the genus Avicennia. Actually, Bennett, in the reference cited, discusses "Zanthoxylum piperitum L.", and what Jackson apparently meant to say was that this name is a synonym of Fagara avicennae Lam. in the Rutaceae.

Von Faber, in investigating the pull of water supply in trees, has measured in Avicennia a pressure of 163 atmospheres in the leaves and only 96 atmospheres in the roots. The endosperm morphology of Avicennia is discussed by A. C. Martin, Am. Midl. Nat. 36: 608 (1946) and the pollen morphology by Erdtmann, Svensk Bot. Tidsk. 39: 284 (1945). Junell, Symb. Bot. Upsal. 4: 140--146, 195, & 209 (1934), discusses the pynoecium morphology, while the wood anatomy is described by Record & Mell, Timbers Trop. Am. 528--529 (1924) and Record & Hess, Timbers New World 72--73 (1943). The mechanism of respiratory gas exchange in the roots is set forth in Biol. Abstr. 30: 3771 (1958), and the osmotic relation of the leaves by Bole & Bharucha in Journ. Univ. Bombay 22 (5): 50--54 (1954). In 1947, on my visit to him in his laboratory at São Paulo, Brazil, Dr. Felix Rawitscher told me that he has found that the pneumatophores of Avicennia have very thick-walled parenchyma cells and >-shaped fibers connecting the cells. He showed me his mounts proving this statement and was of the opinion that this fact had never before been reported in literature.

Stellfeld, in Arquiv. Mus. Paran. 7: 333, 335, 343, & 346 (1949), describes an ecologic zone called "avicenieta". Lindeman, Veget. Coast. Reg. Surin. 57 (1953), speaks of the formation "Avicennietum tomentosae", which he claims should be renamed "Avicennietum nitidae" (an now doubtless needs re-naming again!). The former of these two names was proposed by Dansereau in Rev. Canad. Biol. 6: 448--477 (1947). Lindeman states that this formation is identical with the "Avicennia consocias" of Davis [Carnegie Inst. Wash. Publ. 524, 1942] and of Chapman [Journ. Linn. Soc. Lond. Bot. 52: 407--448, 1944]. Cuatrecasas [Bol. Soc. Bot. Mex. 23: 90 & 91, 1958] speaks in detail of the formation "Avicen-

nietum", on pages 85 & 94 of "Avicennietum nitidae", and on page 91 of "Avicennietum marinae". The epidemiology of malaria map published by the American Geographic Society in 1951 states that malarial areas on the earth are characterized by the presence of Avicennia.

Actually, a good many diverse plants are known as "mangroves" in various parts of the world or grow in close association with them in so-called mangrove lagoons and swamps. Among these may be mentioned the following: in the Acanthaceae: Acanthus ebracteatus Vahl, A. ilicifolius L.; in the Arecaceae: Nipa fruticans Thunb.; in the Bombacaceae: Camptostemon philippinense Becc., C. schultzei Mast.; in the Combretaceae: Conocarpus erectus L., Laguncularia racemosa (L.) Gaertn. f., Lumnitzera coccinea Wight & Arn., L. racemosa Willd.; in the Fabaceae: Pterocarpus officinalis Jacq.; in the Meliaceae: Xylocarpus molucensis M. Roem., X. obovatus A. Juss.; in the Myrsinaceae: Aegialitis annulata R. Br., Aegiceras maius Gaertn. f.; in the Myrtaceae: Osbornia octodonta F. Muell.; in the Pteridaceae: Acrostichum spp.; in the Rhizophoraceae: Bruguiera caryophyllaeoides Blume, B. conjugata Merr., B. eriopetala Wight & Arn., B. gymnorrhiza Lam., Cassipourea spp., Cerriops candolleana Arn., C. roxburghiana Arn., Kandelia rheedii Wight & Arn., Rhizophora apiculata Blume, R. harrisonii Leechman, R. mangle L., R. mucronata Lam., R. racemosa G. F. W. Mey., R. samoensis (Hochr.) Salvosa; in the Rubiaceae: Scyphiphora hydrophyllacea Gaertn. f.; in the Sonneratiaceae: Sonneratia acida L. f., S. alba J. Sm., S. apetala Hamilt., and S. caseolaris Druce.

In the Linnean Herbarium at the Linnean Society, London, under Genus 813, Avicennia, there are the following sheets: Specimen number "1" is labeled "nitida" in Linnaeus' own handwriting and bears the notation "177" -- it is plainly what we now know as A. germinans (L.) Stearn. Specimen number "2" is unnamed -- it bears the notation "Br." [=Browne; Patrick Browne's herbarium was purchased for Linnaeus in 1758] -- Solander has written at the foot of the sheet and has placed a description on the reverse side -- the plant is A. germinans. Specimen number "3" is unnamed -- it bears a notation "cop. api api" and a stamp stating that it was from the herbarium of Linnaeus the younger -- it is A. marina (Forsk.) Vierh. Specimen number "4" is unnamed, but bears a notation "India" and there is a description overleaf -- it is A. officinalis L. Specimen number "5" is unnamed, but also bears a notation "India" and an indication that it came from the herbarium of Linnaeus the younger -- the plant is also A. officinalis.

The Hatch s.n. collection from Jamaica, distributed as "Avicennia" is actually Laguncularia racemosa (L.) Gaertn. f.

Biswas says, on page 165 of the work cited above: "Economically the Avicennias are not of much importance. The wood, which is very brittle, is chiefly used for fuel and sometimes for

house-making. The fruits are bitter and can be used medicinally as a poultice. The bark is employed as a tanning material." Actually, I would challenge the first sentence of this quotation: members of this genus are of tremendous economic importance to man and his economy because of their constant battle with the sea and their great success in extending and eventually building up the surface of the land adjacent to the sea in subtropical and tropical climes.

Avicennia latifolia Hornem. is something in the Myrtaceae.

In all, 4788 herbarium specimens and 173 mounted photographs and illustrations, including the type collections of most of the names involved, have been examined in the preparation of this work.

A tentative key to the species and varieties of Avicennia

1. Modern species.
2. Style normally very short or subobsolete; stigmas subsessile; corolla-limb mostly glabrous on the upper (inner) surface. Section 1. Upata (Rheede) Schau.
3. Natives of Africa, Asia, Australia, and Oceania.
4. Inflorescence elongate and subspicate or spicate.
 5. Leaf-blades usually decidedly whitish or silvery beneath, usually sharply acute at the apex; inflorescence 3--10 cm. long and wide, to 30-flowered, mostly compound, often dense; fruit obliquely conic or narrowly oblong to obversely spatulate.
 6. Mature leaf-blades usually oblong or elliptic-lanceolate to lanceolate, 1.5--5 cm. wide....A. alba.
 - 6a. Mature leaf-blades broadly elliptic, to 6.5 cm. wide.....A. alba var. latifolia.
 - 5a. Leaf-blades usually sordid-gray, flavidous, or brownish beneath, obtuse or rounded at the apex; inflorescence to 8 cm. long and 1 cm. wide, simple, 5--10-flowered, the flowers widely scattered; fruit ovate.....A. marina var. anomala.
- 4a. Inflorescence compact, usually capitate or subcapitate to pyramidal.
 7. Flowers mostly less than 6 mm. long, 2.5--5 mm. wide when expanded; ovary villous on the upper half, glabrous on the lower half.
 8. Leaf-blades sharply acute or acuminate at the apex.
 9. Leaf-blades elliptic-oblong.....A. marina var. resinifera.
 - 9a. Leaf-blades lanceolate or narrow-lanceolate.
 10. Leaf-blades broadly lanceolate, 2--3 times as long as wide; fruit not beaked; Sind to Bombay & Salsette Island.....A. marina var. acutissima.
 - 10a. Leaf-blades narrow-lanceolate, 3--5 times as long as wide; fruit beaked; Philippines to

- Australia.....A. eucalyptifolia.
- 8a. Leaf-blades mostly obtuse, rounded, or merely subacute at the apex.
11. Leaf-blades ovate or lanceolate to lanceolate-oblong or elliptic, usually rather abruptly acute (rarely sharply acute) at the apex.....A. marina.
- 11a. Leaf-blades obovate, rounded at the apex.
12. Petioles 1.5—3 cm. long.....A. marina var. rumphiana.
- 12a. Petioles mostly less than 1.5 cm. long.....A. lanata.
- 7a. Flowers mostly more than 6 mm. long, 10—15 mm. wide when expanded; ovary and style long-villous.....A. lanata.
- 3a. Natives of America.
13. Leaf-blades elongate-oblong, 3—5 times as long as wide, to 17 cm. long but only to 2.8 cm. wide; Costa Rica & Taboga Island to Colombia.....A. tonduzii.
- 13a. Leaf-blades not elongate-oblong, 2—3 times as long as wide, 1.7—13 cm. long and to 7 cm. wide.
14. Inflorescence congested, spicate; leaf-blades mostly oblanceolate or obovate, sometimes elliptic, to 3.8 cm. wide; Windward Islands and Trinidad to northern Uruguay.....A. schaueriana.
- 14a. Inflorescence wide-spreading, paniculate; leaf-blades broadly elliptic to elliptic-ovate or oval-ovate, to 7 cm. wide; Chipas to Panama and the Pearl Islands.....A. bicolor.
- 2a. Style usually manifest, exerted from the calyx when the corolla is shed; corolla-limb often tomentose on both surfaces. Section 2. Donatia (Loefl.) Schau.
15. Natives of Asia, Australia, and Oceania.
16. Fruit oblong, acorn-like, rounded at both ends; leaves lanceolate or narrow-elliptic, acute to long-acuminate or caudate at the apex; corolla-limb to 6 mm. wide during anthesis.....A. balanophora.
- 16a. Fruit broadly ovate, attenuate at the apex, asymmetric; leaves obovate or broadly oblong, rounded at the apex; corolla-limb 12—15 mm. wide during anthesis.....A. officinalis.
- 15a. Natives of America and western Africa.
17. West African; leaf-blades mostly narrow and elongate, to 24 cm. long, not nigrescent in drying.....A. africana.
- 17a. American; leaf-blades mostly shorter and relatively broader, 4.5—15 cm. long, usually nigrescent in drying.....A. germinans.
- 1a. Fossil species.
18. Known from fruit only, in the Eocene of Tennessee.....A. eocenica.

18a. Known from leaves only.

19. Leaf-blades somewhat falcate and inequilateral, from the Eocene of Mississippi.....A. nitidaformis.

19a. Leaf-blades not falcate nor inequilateral.

20. From the Quaternary (Pleistocene) of Trinidad.....A. germinans.

20a. From the Tertiary of Colombia.

21. Leaf-blades lanceolate; secondaries stout.....A. miocenica.

21a. Leaf-blades narrowly ovate or broadly lanceolate to subobovate; secondaries weak.....A. lanceolata.

AVICENNIA AFRICANA P. Beauv., Fl. Oware & Benin 1: 79—80, pl. 47. 1805.

Synonymy: Avicennia tomentosa var. owarensis Walp., Repert. 4: 133. 1845. ?Avicennia rhizophora Barter, Journ. Linn. Soc. Lond. Bot. 4: 22, nom. nud. 1860. Avicennia nitida var. africana (P. Beauv.) V. J. Champl., Journ. Linn. Soc. Lond. Bot. 52: 429, in obs. 1944. Avicennia agricana P. Beauv. ex Moldenke, Alph. List Cit. 4: 1137, sphalm. 1949.

Literature: P. Beauv., Pl. Oware & Benin 1: 79—80, pl. 47. 1805; R. Br., Prodr. Fl. Nouv. Holl., ed. 1, 1: 518. 1810; Walp., Repert. 4: 13. 1845; Hochst., Flora 28: 68. 1845; Schau. in A. DC., Prodr. 11: 699. 1847; Benth. in Hook. f., Niger Fl. 487. 1849; Schau. in Mart., Fl. Bras. 9: 305. 1851; Barter, Journ. Linn. Soc. Lond. Bot. 4: 22. 1860; Jacks., Ind. Kew. 1: 254. 1893; Durand & De Wild., Bull. Soc. Roy. Bot. Belg. 37: 125. 1898; Durand & Jacks., Ind. Kew. Suppl. 1: 48. 1901; J. Schmidt, Bot. Tidsskr. 26: 60. 1904; Engl. & Drude, Veget. Erde 9 (1): 2, pl. 45. 1910; H. H. W. Pearson in Thiselt.-Dyer, Fl. Cap. 5: 225. 1910; Glaz., Bull. Soc. Bot. France 58, Mém. 3: 548. 1911; A. Chev., Sudania 2: 47 & 52. 1914; Henriq., Bol. Soc. Broter. 27: 194. 1917; A. Chev., Expl. Bot. Afr. Occid. Franc. 1: 510. 1920; Hutchinson & Dalz., Fl. W. Trop. Afr. 2: 270 & 613. 1927; Crevost & Pételot, Bull. Econom. Indo-chine 37: 1297—1300. 1934; Walter & Steiner, Zeitschr. Bot. 30: 178, 181, 182, & 184—186. 1936; Moldenke, Geogr. Distrib. Avicenn. 30, 31, & 35. 1939; Moldenke, Alph. List Common Names 5, 6, 9, 13, 16, 21, 26, & 27. 1939; Monod, Contrib. Com. Et. Hist. & Sc. Afr. Occid. Franc., sér. B, 5: 204. 1940; Moldenke, Prelim. Alph. List Invalid Names 6. 1940; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 1], 46—48, 71, & 86. 1942; Moldenke, Alph. List Invalid Names 5. 1942; Moldenke, Phytologia 2: 92. 1944; Exell, Cat. Vasc. Pl. S. Tomé 39 & 265. 1944; Stellfeld, Arquiv. Mus. Paran. 4: 244. 1945; Moldenke, Alph. List Cit. 1: 4, 31, 33, 35, 40, 48, 50, 54, 74, 76, 78, 80, 82, 101—103, 117, 141, 145, 153, 155, 162, 163, 170, 172, 190, 236, 243, 270, & 276. 1946; Moldenke, Alph. List Invalid Names Suppl. 1: 2. 1947; Moldenke, Alph. List Cit. 2: 414, 416, 433, 436, 437, 490, 504, 558, 572, 577, 588, 593, 601, 615, 618, 620, 630, & 631 (1948), 3: 655. 698, 702, 706, 737—740, 770, 810, 825, 828, 865, 876, 878, 906,

934, & 952 (1949), and 4: 984, 994, 996, 1093, 1096, 1106, 1115, 1129, 1137, 1146, 1174, 1220, 1221, 1248, & 1298. 1949; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 2], 109--114, 118, 152, & 174. 1949; Moldenke, Phytologia 3: 368. 1956; Moldenke, Résumé 133, 136--140, 146, 213, 236, & 439. 1959; Moldenke, Résumé Suppl. 1: 8 & 15. 1959.

Illustrations: P. Beauv., Fl. Oware & Benin 1: pl. 47 (colored). 1805; Engl. & Drude, Veget. Erde 9 (1): pl. 45. 1910.

Tree, to 18 m. tall; pneumatophores abundant, covering the ground abundantly; stilt-roots not present; branches rather stout; branchlets and twigs more slender, articulate, gray or brownish, subterete or very obscurely angled, very sparsely and not noticeably lenticellate, very finely and densely white- or gray-pulverulent or glabrate; nodes swollen, distinctly annulate; principal internodes 1.3--9.5 cm. long; leaves decussate-opposite; petioles rather slender, 1.2--3.5 cm. long, usually flattened and deeply sulcate above, convex beneath, greatly wrinkled and striate in drying, densely white- or gray-pulverulent throughout, very slightly ampliate at the base; leaf-scars inconspicuous; blades firmly chartaceous or subcoriaceous["very coriaceous" according to Baker], mostly large and elongate, mostly dull gray-green on both surfaces or more whitish beneath because of the whitish or drab furf, varying from lanceolate or oblong-lanceolate to oblong or narrowly elliptic, 4.7--24 cm. long (usually 13--17 cm. long), 1.7--7.9 cm. wide, acute or obtuse (rarely emarginate at the apex, entire, the margins often obscurely subrevolute in drying, acute or subcuneate at the base and gradually narrowed to the short petiole, glabrous and impressed-punctate above and usually very shiny, very densely appressed white- or gray-pulverulent beneath or glabrate and punctate; midrib flat or subprominent above, usually canaliculate for the lower 2/3 or 3/4 of its length above, rounded-prominent to the apex beneath; secondaries slender, 12--17 per side, irregularly placed, ascending at an angle of about 45°, uniformly prominent throughout on both surfaces, straight, plainly joined by a rather irregular and equally prominent collective vein at the margins; tertiaries irregular and more or less parallel to the secondaries and prominent like them on both surfaces; vein and veinlet reticulation rather coarse, only the larger portions prominent; inflorescence axillary and terminal, spicate or subcapitate-spicate, 1 or 2 in all the upper axils, 1.5--4 cm. long, 7--17 mm. wide at anthesis, often forming a small terminal panicle; flowers opposite, decussate, densely crowded, 1--6 pairs per spike, fragrant; peduncles slender, 1--3 cm. long, tetragonal, sulcate and striate in drying, more or less densely pulverulent or finely tomentose; bractlets ovate, 3--4 mm. long; calyx-segments small, oblong; corolla white or whitish, turning bluish in alcohol, pubescent on the inner surface, the limb 4-lobed, the upper lip and 2 lateral lobes borne at right angles to the tube, the lower lobe borne at an angle of 45° to the tube, the lobes as long as the tube, pubescent on both surfaces; stamens 4, the 2 outer ones at first longer than

the inner ones, later all equal in length; filaments white; anthers at first white, later gray, finally black; pistil 1, white, shorter than or equaling the filaments, equaling the corolla-tube; style 1.5--2 mm. long, glabrous; ovary conic, gradually attenuate above into the style, glabrous; fruiting-calyx 5-parted practically to the base, about 9 mm. in diameter, each lobe ovate, about 4 mm. long and 2 mm. wide at the base, obscurely strigillose or subglabrate on the back, the margins often slightly fringed toward the base, glabrous and shiny on the inner surface, acute or obtuse at the apex, imbricate; fruit elliptic, 1.7--2.8 cm. long, 1.1--2 cm. wide, long-acuminate-beaked at the apex, densely gray-pulverulent throughout and often sparsely appressed-strigose at the apex and on the apiculation; hypocotyl almost as long as the inner cotyledon, pubescent almost its whole length, mostly without visible side-rootlets in fruit; plumule not visible to the naked eye.

The species is based on an unnumbered collection of Baron Ambroise Marie François Joseph Palisot de Beauvois, deposited in the Delessert Herbarium at Geneva, collected somewhere in Guinea. The species is found in the brackish water of lagoons, and is common in the mangrove belt along the coasts. Deighton reports that in the Turtle Islands of Sierra Leone it is nearly as common in some places as Rhizophora. He says also that its bark is used in tanning and to make a red dye, just as is that of Rhizophora. Specimens have been confused with and misidentified as Rhizophora (e.g., Dewevre s.n.) and as something in the Myoporaceae. It has been collected in anthesis from August to June, and in fruit in October. Exell records it from Saint Tomé, while Baker cites a Vogel s.n. from Cape Palmas in Ivory Coast. Chevalier also records it from Ivory Coast (his no. 19908). He likewise cites his nos. 2760, 3009, and s.n. from Senegal and 13818 and 13823 from Ghana. His 2759 is cited by him from Senegal, but the Brussels specimen of this number is marked on its label as being from the French Soudan. The species is said by Dinklage to grow in association with Rhizophora racemosa G. F. W. Mey. in Liberia. Barter records an "Avicennia rhizophora" as occurring in Principe about the estuaries of small streams. Exell comments that "It is doubtful what he meant by the name 'Avicennia rhizophora'". It is possible that he meant to say that both Avicennia africana and Rhizophora racemosa occur together there.

The name "Avicennia tomentosa L." cited by me as a synonym of A. africana in my Alph. List Invalid Names Suppl. 1: 2 (1947) and Résumé 236 (1959) is actually a synonym of A. marina (Forsk.) Vierh., since it apparently started in Hochst., Flora 28: 68 (1845) where it is definitely applied to a Natal plant called "witte mengerhout".

The axillary inflorescences are sometimes borne on short twigs which bear one pair of reduced leaves and three spikes. Reniform leaf-blades are seen on Soyaux 60 due to some injury to the leaf-apex. The specific name of the binomial is often upper-cased in

older literature. Common names recorded for the plant include "afia-nunung", "amu-ati", "amu-tsi", "angma-tsho", "asokoro", "asokpolo", "asopro", "asukuru", "ata-nunung", "black mangrove", "boandjo", "boanjo", "bue", "bue", "bue-dinte", "bue-dinte", "buwe", "common white mangrove", "ě-bure", "ede", "ehrodo", "garigari", "gbeleti", "gbéleti", "grigri", "jaia-guli", "jaia-guwi", "ka-bure", "lagoon tree", "mbougand", "mofuri", "mutuku-tsho", "nja-wului", "nvandi", "odonumon", "ogbun", "roanjo", "saanar", "samar", "sana", "tarrafe", "tra-tsho", "ufiri", "waterside tree", and "white mangrove". Btugen calls attention to the fact that the name "boanjo" is not to be confused with the very similar "boango", which applies to an entirely different plant. It is worthy of note that the name "grigri" is applied also to the American Vitex heptaphylla A. L. Juss.

Glaziou 11323, from Espirito Santo, Brazil, is cited by the collector, in the reference cited above, as A. africana with a question, but is actually A. schaueriana Stapf & Leechman.

The species is admittedly very closely related to the American A. germinans (L.) Stearn, formerly known as A. nitida Jacq. It is accepted as a valid species, however, by Bentham (1849), Schauer (1851), Durant & De Wildeman (1898), Baker (1900), and Exell (1944). Schauer says "Proxima Av. nitidae diversa tamen; foliis obtusis, supra minus nitidis (neque siccitate nigrescentibus) subtus neque niveis neque (quantum equidem cognovi) calvescentibus. Quad floris fabricam cum illa fere convenit." Baker says "Perhaps not distinct specifically from the American A. nitida". Briquet, Stapf, Hutchinson & Dalziel, Darlington & Janaki Ammal, and Walter & Steiner all sink it into synonymy under A. nitida. It is referred to an "A. tomentosa L., R. Br. Prodr. 1: 518. 1810" by Döllinger. Bentham says "Probably not distinct from the American A. nitida. Pearson, on the other hand, reduces it to A. officinalis L., which is utterly out of the question!

The N. W. Thomas specimen at Kew actually exhibits leaves with the puberulence disappearing beneath, leaving just patches of it here and there, as is seen so often in A. germinans. The condition is, however, apparently unusual in A. africana. The narrow elongated leaf-blades, so characteristic of the African plant, are seen only occasionally in America. In fact, it is perhaps possible that the American plants with such leaves may actually be A. africana, and that we are including too much in the present concept of A. germinans.

In all, 234 herbarium specimens, including the type, and 19 mounted photographs and sheets of notes have been examined.

Henry Millen's name is incorrectly given as "H. Millon" by me in my Alph. List Persons 87 (1950).

Citations: FRENCH WEST AFRICA: Mauritania: Chudeau 48 (P). Senegambia: A. Chevalier 2760 (K); Collector undesignated s.n. [Senegambia] (Le, V); Herb. Bernhardt s.n. [Senegambia] (E-118607); Heudelot s.n. [Senegambia] (Cb); Perrottet 184 (Dc), s.n. [1824] (Dc). SAINT LOUIS ISLAND: Brunner 1 (K). SENEGAL: Bojer s.

n. (Cl); Brunner s.n. [Senegal] (Cb); A. Chevalier 2759 (B, Br, N—photo, Z—photo); Döllinger 73 (K), s.n. [Senegal] (Cl, Vt); Herb. Zuccarini s.n. (Mu—1067); Leprieur s.n. [Ile de Jafal, Oct. 1825] (Cb, Cb), s.n. [1829] (V), s.n. [1830] (V), s.n. [Senegal] (Le); Perrottet 654 (Cb, V, X), s.n. [15 Feb. 1825] (Cb), s.n. (Bm); Roger 75 (K). GAMBIA: M. T. Dawe 72 (K); G. Don s.n. (Bm); Herb. Shuttleworth 16 (Bm). GUINEA: P. de Beauvois s.n. (Cb—type, Cb—-isotype, Cb—-isotype, Cb—-isotype, Dc—-isotype, N—photo of type, Z—photo of type); Bové 31 (Cb); Isert s.n. [Ada, 1784] (Cp, Cp); Thonning s.n. (Cp, Dc, S). FRENCH GUINEA: Debeaux s.n. [24 Avril 1902] (P). SIERRA LEONE: Afzelius s.n. (B, S, Us, Us, Us); Burbridge 584 (K); Dalziel 970 (Bm, K, N); Don 168 (K); G. F. S. Elliot 4120 (Bm, K); Glanville 246 (K, K); Hooker f. 618 (Us); Lane-Poole 320 (K); G. Mann vii (K); N. W. Thomas 7070 (K); Vogel 168 (Cl); Wilford s.n. (Cl). TURTLE ISLANDS: F. C. Deighton 2362 (K). LIBERIA: Dinklage 1910 (B, B, B, Bm, Br, Ed, Gg—237833, N, N, V, Vu), 2593 (B, B, N—photo, Z—photo); H. H. Johnston s. n. [Sinoe basin] (K). GHANA: Chipp 175 (K); H. H. Johnston 984 (K); Krause 60 (B), 87 (B); J. W. Newberry s.n. (K). TOGOLAND: Warnecke 63 (B, B, Bm, Mu—3986, N—photo, Z—photo). NIGERIA: Southern Nigeria: Barter 46 (K); Bels 92 (Ut—5491b); Chief Conservator of Forests 1 (N), 1a (N), 1b (N), 2 (N), 2a (N), 2b (N), 3 (N), 3a (N), 3b (N), 4 (N), 4a (N), 4b (N), 4c (N), 5 (N), 5a (N), 5b (N), 6 (N), 6a (N), 6b (N); Dalziel 970 (Ed); W. MacGregor 341 (K, K, K, K, K); Mildbraed s.n. [Jan. 1929] (B, B, N, N—photo, Z—photo); Millen 184 (B, Br); Rosevear M.16 (K); J. W. Rowland s.n. [Nr. Lagos] (K); Talbot & Talbot 3087 (Bm), s.n. [Eket district] (Bm, K); Vogel 101 (K, K, N), s.n. [Gd. Bassa] (K); Wudin 56 (K, N—photo, Z—photo). CAMEROONS: G. L. Bates 195 (K); Besser 15 (B), 26 (B); Buchholz s.n. (B); Busgen 354 (B, B); Deistel 40 (B, Mu—3819, N), 172 (B, N); Dusén 347 (B, B—notes, Lu, N, S), s.n. (X); Hückstädt 19 (B); Jungner 263 (Us); Kwankam CAM.2/38 (N, N, N), CAM.3/38 (N, N, N); Maitland 30 (K); Preuss 1191 (B, Bm); Schorkopf 65 (B, N, N—photo, Z—photo). FERNANDO PO: G. Mann 231 (B, K, P); Mildbraed 6971 (B, B, N, N—photo, S—photo, Z—photo); Milne s.n. (K). FRENCH EQUATORIAL AFRICA: Gabun: Büttner 345 (B, Ca—616067, V); Klaine 106 (B), s.n. (B). Middle Congo: Thollon 208 (B). PORTUGUESE CONGO: Gossweiler 8264 (Bm, K, K); Soyaux 60 (B, B). BELGIAN CONGO: Bequaert 587 (Br, Br), 754 (Br, Br), 7992 (Br, Br); Buchner 573 (B); Dewevre 48 (Br, Br), s.n. (Br); Dupuis s.n. (Br); Gillet 3170 (Br), 3993 (Br); Henrard s.n. [Banane, Jan. 1935] (N, N), s.n. [Banane, Fevrier 1939] (Br); Schouteden, Schouteden-Wery, & Poma 63 (Br, N); Vanderyst 27363 (Br), 27406 (Br), 27421 (Br); Vermoesen 2511 (Bm, Br, Br, K, N), 2595 (Br, Br). ANGOLA: Benguela: H. Bolus 12459

(Ct). Loanda: Collector undesignated s.n. [Angola] (P); Gossweiler 178 (B, Bm, K), s.n. (K); Soyaux 60 (K); Welwitsch 5641 (B, Bm, Bm, Cp, K, P), 5709 (Bm, K), 5726 (B, Bm, Cp, K, N, P). CULTIVATED: Cameroons: Versuchsanstalt Kamerun 205 (B); H. Winkler 380 (B, B). LOCALITY OF COLLECTION UNDETERMINED: Afzelius s.n. [Westafrika] (B); Collector undesignated s.n. (B, Br); Herb. Martius s.n. (Br); Koeler 39 [Bonna] (V); Sieber, "Fl. Nov. Holl. 19" (B). MOUNTED ILLUSTRATIONS: Sousa, Fl. de Guinea s.n. (Cp).

AVICENNIA ALBA Blume, Bijdr. Fl. Ned. Ind. 14: 821. 1826 [not A. alba Karst., 1907, nor Wight, 1921].

Synonymy: Anacardium C. Bauhin, Pinax Theatr. Bot., ed. 1, 511. 1623. Avicennia resinifera Griff., Trans. Linn. Soc. Lond. Bot. 20: 6, pl. 1 (1846) & Notul. Plant. Asiat. 4: 186. 1854 [not A. resinifera Forst., 1786]. Avicennia officinalis var. alba (Blume) C. B. Clarke in Hook. f., Fl. Brit. Ind. 4: 604. 1885. Avicennia spicata Kuntze, Rev. Gen. Pl. 2: 502. 1891. Avicennia tomentosa Blume apud H. Hallier, Meded. Rijksherb. Leid. 37: 87, in syn. 1918 [not A. tomentosa Blanco, 1845, nor R. Br., 1851, nor Jacq., 1760, nor L., 1826, nor L. & Jacq., 1783, nor G. F. W. Mey., 1818, nor Nutt., 1947, nor Nutt. & Br., 1832, nor Roxb., 1835, nor Schau., 1940, nor Sieber, 1944, nor Sw., 1864, nor Vahl, 1921, nor Weigelt, 1851, nor Willd., 1822]. Avicennia marina var. alba (Blume) Bakh., Bull. Jard. Bot. Buitenz., sér. 3, 3: 204 & 207--210. 1921. Avicennia officinalis H. J. Lam ex Moldenke, Prelim Alph. List Invalid Names 5, in syn. 1940 [not A. officinalis L., 1753, nor Maxim., 1932, nor Millsp., 1930, nor Schau., 1856]. Avicennia acuminata Cornwall ex Moldenke, Résumé 235, in syn. 1959. Avicennia albida Blume, in herb.

Literature: Linschotten, Part 4, Ind. Or. C. 29. 1596; C., Bauhin, Pinax Theatr. Bot., ed. 1, 511. 1623; Rumph., Herb. Amboin. 3: 115--116, pl. 76. 1750; Lam., Tabl. Encycl. Méth. Bot. Suppl. 1: 329--330 (1783), pl. 540. 1810; Blume, Bijdr. Fl. Ned. Ind. 14: 821. 1826; Decaisne, Nouv. Ann. Mus. Hist. Nat. Paris 3: 402--403. 1834; Decaisne, Herb. Timor 74. 1835; Fresenius, Flora 21 (2): 607. 1838; Dietr., Syn. Pl. 3: 619. 1843; Griff., Trans. Linn. Soc. Lond. Bot. 20: 6, pl. 1. 1846; Wight, Icon. Plant. Ind. Orient. 4: pl. 1482. 1849; Wight, Illustr. Ind. Bot. 2: 217. 1850; Griff., Notul. Plant. Asiat. 4: 186. 1854; Miq., Fl. Ned. Ind. 2: 913. 1856; Hassk., Neue Schlüss. 57. 1866; C. B. Clarke in Hook. f., Fl. Brit. Ind. 4: 604. 1885; Kuntze, Rev. Gen. Pl. 2: 502. 1891; Jacks., Ind. Kew. 1: 254. 1893; Briq. in Engl. & Prantl, Nat. Pflanzenfam. 4 (3a): 181. 1894; Koord. & Val., Bijdr. Booms. Java 7: 217--222. 1900; Volkens in Engl., Bot. Jahrb. 31: 474. 1901; Prain, Bengal Pl. 2: 838. 1903; J. Schmidt, Bot. Tidsskr. 26: 60. 1904; Cooke, Fl. Pres. Bombay 436. 1908; King & Gamble, Mat. Fl. Mal. Penins. 1078. 1909; Warming & Vahl, Ecol. Pl., ed. Groom, 235--236. 1909; Talbot, For. Fl. Bombay 2: 363. 1911; H. Hallier, Meded.

Rijksherb. Leid. 37: 87. 1918; H. J. Lam, Verbenac. Malay. Arch. 340--341. 1919; Bakh., Bull. Jard. Bot. Buitenz., sér. 3, 3: 205 & 207--210, pl. 15. 1921; Cowan, Rec. Bot. Surv. Ind. 11: 199, 200, 203, 219, & 220. 1928; Domin, Bibl. Bot. 89 (6): 1116. 1928; J. G. Wats., Malayan Forest Rec. 6: 61 & 62. 1928; Ridl., Dispersal Pl. 310. 1930; Mullan, Journ. Ind. Bot. Soc. 11: 302--303, pl. 2. 1932; Warming & Graebn., Lehrb. Oekol. Pflanzengeogr., ed. 4, 473. 1933; Junell, Symb. Bot. Upsal. 4: 140--142 & 144, figs. 221 & 223--229. 1934; Biswas, Notes Roy. Bot. Gard. Edinb. 89: 159--166, pl. 245 & 246. 1934; Crevost & Pételot, Bull. Econom. Indo-chine 37: 1297--1300. 1934; Moldenke, Alph. List Common Names 3, 11, 14, 18, 21, 27, 30, & 31. 1939; Moldenke, Geogr. Distrib. Avicenn. 32--34. 1939; Moldenke, Suppl. List Common Names 2 & 4. 1940; Moldenke, Prelim. Alph. List Invalid Names 5 & 6. 1940; Kanehira & Hatusima, Bot. Mag. Tokyo 56: 112. 1942; Moldenke, Alph. List Invalid Names 4 & 5. 1942; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 1], 54--56, 58--61, 63--67, 69, & 86. 1942; Moldenke, Phytologia 2: 92. 1944; Moldenke, Alph. List Cit. 1: 9, 16, 26, 30, 35, 36, 42, 46, 49, 52, 71, 80, 101, 112, 116, 117, 120, 124, 128, 135, 191, 192, 196, 197, 209, 210, 247, 248, 252--254, 256, 266, 267, 270, 276, & 319. 1946; Moldenke, Alph. List Invalid Names Suppl. 1: 2. 1947; Moldenke, Alph. List Cit. 2: 353, 354, 404, 426, 433, 437, 449, 463, 464, 500, 501, 538, 557, 560, 576, 585, 602, 603, 607, 608, 614, 615, 619, 624, 625, 629, & 630 (1948), 3: 673, 685, 702, 706, 716, 724, 739, 745, 751, 756, 763, 774, 779, 794, 795, 815, 824, 827, 838, 866, 878, 879, 895, 902, & 903 (1949), and 4: 983, 984, 987, 1014, 1029, 1036, 1067, 1081, 1097, 1100, 1105, 1129, 1148, & 1154. 1949; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 2], 124, 125, 128, 129, 135, 137--140, 142--146, 148, 150, 152, & 174. 1949; Santapau, Pl. Saurashtra 31. 1953; Moldenke, Phytologia 4: 192 & 195. 1953; Lindeman, Veget. Coast. Reg. Surin. 52. 1953; Bole & Bharucha, Journ. Univ. Bombay 22 (5): 50--54. 1954; Biol. Abstr. 29: 170 (1955) & 3118. 1957; Moldenke, Résumé 158, 160, 165, 166, 175, 177, 179, 182, 186, 187, 189, 191--194, 196, 198, 200, 204, 207, 234--236, & 440. 1959; Moldenke, Résumé Suppl. 1: 12 & 13. 1959.

Illustrations: Rumph., Herb. Amboin. 3: pl. 76. 1750; Lam., Tabl. Encycl. Méth. Bot. pl. 540. 1810; Griff., Trans. Linn. Soc. Lond. Bot. 20: pl. 1. 1846; Wight, Icon. Plant. Ind. Orient. 4: pl. 1482. 1849; Wight, Illustr. Ind. Bot. 2: 217. 1850; Talbot, For. Fl. Bombay 2: 363. 1911; H. J. Lam, Verbenac. Malay. Arch. pl. 3 M, N, & O. 1919; Bakh., Bull. Jard. Bot. Buitenz., sér. 3, 3: pl. 15. 1921; J. G. Wats., Malayan For. Rec. 6: 61 & 62. 1928; Mullan, Journ. Ind. Bot. Soc. 11: 302--303, pl. 2. 1932; Junell, Symb. Bot. Upsal. 4: figs. 221 & 223--229. 1934; Biswas, Notes Roy. Bot. Gard. Edinb. 89: pl. 245 & 246. 1934.

Shrub or large tree, to 25 m. tall, often branching from near the base of the trunk; crown broad; trunk with a girth rarely to 1.5 m., sometimes to 1 m. in diameter at breast height, usually only to 20 cm. in diameter, often with a bole 4 m. clear of branches, blooming when very young; bark 1--5 mm. thick, the

outer bark greenish-black or dark-brown to dark black-brown or blackish, warty or smooth, often with many short longitudinal fissures or reticulate lines forming very small scales and with numerous, small, circular, pale-brown, lenticellate nodules, the under bark cream-colored with green reticulation, the inner bark green on the back, cream-colored within, spongy in texture, about 6 mm. thick; wood soft, distinctly layered, yellow-brown or creamy with brownish concentric wavy bands containing spirally arranged white fiber strands, the fiber in every other layer longitudinal, alternating with oblique fiber, the sapwood not defined or about 2--3 cm. deep and straw-colored, the heartwood slightly darker; pneumatophores 5--22 cm. long, slender, about as thick as a pencil, surrounding the tree; branches spreading; branchlets spreading, drooping, terete, smooth, sparsely and obsoletely lenticellate, sparsely resinous-punctate, furfureaceous-tomentellous on the youngest parts, eventually glabrescent; leaves decussate-opposite; petioles short, 0.5--3 cm. long, densely pulverulent-tomentellous; leaf-blades oblong or elliptic-lanceolate to lanceolate, rarely short and ovate-elliptic, 3--16 cm. long, 1.5--5 cm. wide, acute at the base and apex or rarely subobtuse at the apex, sometimes suddenly tapering at the base, slightly revolute along the margins, glabrous and glossy above, shiny-green, very minutely impressed-glandulose-punctate, grayish or silvery to whitish-pulverulent or white-tomentose beneath (decidedly whitish or canescent in drying), resinous-punctate; midrib appressed-tomentellous; secondaries 7--15; veinlet reticulation plain on both surfaces; inflorescence terminal, paniculate, almost compound, subfoliose, rarely in dense heads, green when fresh except for the corollas, 3--10 cm. long and wide, the panicles terminal and borne in the upper leaf-axils, solitary or paired, short, subpinnate, compact, often interrupted, pedunculate, usually not glabrescent, composed of 1--3 pedunculate branches; subfoliaceous bracts rarely present; cymes spiciform, more or less dense and elongate, 0.5--2 cm. long, 0.7--1 cm. wide, composed of 10--30 opposite flowers; peduncles tetragonal or terete, densely appressed-furfureaceous, ashy-gray, often with an orange tinge, sulcate in drying, densely but inconspicuously resinous-punctate and sparsely and obsoletely glandulose; bractlets small, concave, sessile, ovate or orbicular, green or slightly orange-tinged, obtuse at the apex, densely rufous-tomentellous on the outside, deciduous; prophylla 2, oblong, obtuse at the apex, 3--5 mm. long, 2--3 mm. wide, ciliate-margined, furfureaceous-tomentellous toward the base outside, with a prominent midrib, glabrous within or sparsely white-pilose at the middle; flowers small, sessile, sweet-smelling; calyx small, the 5 lobes slightly unequal, rounded-ovate, 3--5 mm. long, 2--3 mm. wide, densely ciliate on the margins, green and rugulose on the outer surface, soon becoming scarious, densely white-tomentellous toward the base, glabrous and shiny toward the apex, glabrous and shiny on the inner surface, sparsely resinous-punctate on both surfaces; corolla small, rather thick-textured, yellow or dull-yellow to orange-yellow or orange, regular, 4--5 mm. long, about

5 mm. in diameter, split to the middle, dropping after anthesis, the tube campanulate or cylindric, equaling or shorter than the calyx, 1.2--2 mm. long, 1.5--2 mm. wide at the mouth, glabrous outside, the 4 lobes uniform, rather obtusely oblong or lingulate, radially spreading, 2--2.5 mm. long, 1.5--2 mm. wide, very densely white-villosulous with glistening hairs on the outer surface, glabrous on the inner surface; stamens 4, yellow, scarcely exerted, 1.5--2 mm. long, much shorter than the corolla-lobes; filaments short, 0.5--0.7 mm. long; anthers very small, subrotund, 0.7--1 mm. wide, yellow at first, later becoming deep-purple or black; pollen white, spherical when fresh, 28--30 μ in diameter, with 3 hyaline protuberances; pistil shorter than the corolla-tube; ovary ovoid or oblong, glabrous at the very base, densely whitish-pilose with appressed hairs toward the apex, densely resinous-punctate, imperfectly bilocular, the dissepiment not reaching the apex, longitudinally alate at the middle, a single ovule between the wings; style very short and stout or obsolete, 0.5--1.5 mm. long, somewhat contracted at the base, glabrous, hardly changed after anthesis, included by the calyx; stigma plain, equally bifid, the branches accrescent after anthesis and soon recurved, equaling the calyx or somewhat exerted; fruit capsular, medium-sized, greenish-yellow, obliquely conic or narrowly oblong to obversely spatulate, laterally compressed, not beaked, gray-tomentose; cotyledons medium-sized, 2.5--3.5 cm. long, 1.2--2 cm. wide, subcordate, purplish-green; the young plants purplish-green; hypocotyl small or medium, teretely cylindric, rather densely long-setaceous at the very base, otherwise glabrous; primary leaves medium, oval to oblong or obovate, obtuse or rounded at the apex.

This is in general a very well-marked species, abundant in mangrove swamps. In Papua Brass found it common at the outer edge of very tall mangrove forests, leaning out over the water. It has been collected in anthesis in every month of the year. In Java it fruits mostly in February and March. In India it blooms generally from April to June, and the fruits ripen in August and September. It is said to be a common tree in the mangrove belt in Papua. Some collectors describe the tree as "red", but what is meant by this is not clear. Specimens have been misidentified as A. intermedia Griff., A. marina (Forsk.) Vierh., and A. officinalis L. The Holtze s.n. from Australia was actually determined as A. officinalis by Baron F. Mueller. Briquet sinks the species into the synonymy of A. officinalis, while Clarke considered it to be a variety of A. officinalis and Bakhuizen van den Brink made it a variety of A. marina. The Herb. Bogor. 16968 collection is actually a mixture of A. alba and A. officinalis. Maingay 1209 and 1765 were annotated by Kuntze as A. spicata.

Domin, who follows Clarke in reducing A. alba to varietal status under A. officinalis, says (1928): "KOORDERS und VALETON unterscheiden in Bijdr. Booms. Java VII. p. 217--222 (1900) zwei Arten aus Java und zwar A. officinalis L. und A. alba Blume, zu welch letzterer sie die A. resinifera Griff. als Synonym ziehen;

trotz der grossen Unterschiede der typischen Formen scheint mir jedoch, wenigstens nach dem südafrikanischen, polyneisischen und australischen Materiale zu urteilen, die spezifische Abtrennung der letzteren kaum ratsam zu sein." On the other hand, Bakhuizen van den Brink, who regarded it as a variety of A. marina and drew his description from living plants in Java, states that "this variety is very constant" and shows only a few differences in the size of its leaves. "It is immediately recognizable by its appearance like a Willow, the white-silvery under-surface of the leaves, its rich inflorescence consisting of straight spikes, but especially from the conical form of the fruit and the seedlings. The seeds may be found sprouting in the full fruiting season...drifting in great quantities in the marshes of the beach, or scattered along the coast." Wherever these seedlings congregate, they form bunches with their roots strongly entangled, resembling a monstrosity which is called in Dutch "rattenkoning" or "rat's-king", resembling a large number of rats with their tails entwined. At other times "they may form long strings, united by fibrous remnants of plants. The hypocotyls of the seedlings are provided with well-developed, hooked hairs", which cause the seedlings to become bunched into floating masses, not easily separable. "The first little leaves of the seedlings, with their violet-brown cotyledons and petioles, in total opposition with the later lanceolate, pointed leaves of the full-grown tree are oval or oblong, often even obovate, always obtuse or rounded at their top,and generally of a slight purple hue."

Lamarck, on page 330 of the reference cited above, describes an "Avicennia tomentosa L. & Jacq." which he cites to "Jacq., Amer. p. 178, pl. 112, f. 2". Actually, Linnaeus' plant, according to herbarium specimens seen by me bearing that binomial, is A. africana P. Beauv., while Jacquin's plant is A. germinans (L.) Stearn. The other synonyms which he cites also apply to the latter species, except for Oepata Rheede, which is A. officinalis. Lamarck's plate, however, appears to be A. alba.

Kusche says that in the Solomon Islands "The natives use the roots of this tree for sexual diseases by burning the wood of [the] root and eating the ashes left. This will cure all sexual sickness." The osmotic relation of the leaves is discussed by Bole & Bharucha in the 1954 reference given above, while Junell (1934) discusses the gynoeceium morphology.

The Teijsmann s.n. from Banka and the Labohm 1964 from Borneo exhibit some leaves which vary toward those of var. latifolia. The Domin s.n. [III.1910] from Stradbroke Island, Queensland, cited by him in *Bibl. Bot.* 89 (6): 1116 (1928) as "eine sehr breitblättrige Form" may be var. latifolia. I have not as yet seen this collection. He cites also Dietrich 1313 and 2354 and Domin s.n. [XII.1909] from Queensland as typical A. alba.

Common names recorded for this species are "api-api", "api-api hitam", "arir", "bani", "bina", "bities", "black api-api", "borbor", "bowak daoen ketjil", "djambéj", "dudhi bæn", "dudli

bàen", "elava", "faba malaccana", "gundu mada", "kajoe api-api", "kajoe bakan laki-laki", "kaisseru", "kala baen", "kauwsia", "ki api-api", "kowak", "lame-ah-net", "lameh", "lamet", "mada", "mame", "marne", "nalla mada", "oepata", "padjapih", "reng-gouw", "rosrosan", "samair dam", "tarul baen", "telia baen", "thamé", "tivar", "ton samair", "unte unte", and "white mangrove". It is worthy of note that the name "api-api" is also applied to A. marina var. rumphiana (H. Hallier) Bakh. and "lamet" to A. officinalis L.

Bakhuizen van den Brink reports that "The wood is used everywhere by the people living on the coast and [by] sailors as firewood, for which reason the plant has been named Api-api. More seldom one finds the wood being mentioned as being used for building purposes, especially for the interior of houses, or as in Borneo (according to LABOHN) in the mines; according to KURZ, it has been used in the Andaman Islands for rice-mills and rice-stampers. The fruit is often eaten by the inhabitants of the coast, and this not only in times when food is scarce, as it has been often claimed. — According to fishermen of Tandjong-Priok, Batavia, the seeds are first well-cooked for this purpose, then dried in the sun, and only after this operation are they eaten in the state of pulp." He goes on to say that the seeds of A. alba and of A. officinalis seem to be the most suitable for this purpose, according to native sayings, while those of A. marina are considered inferior, or, at any rate, have to remain one week submerged in water before being suitable for consumption. According to Linschoten, as quoted by Bauhin, the unripe fruit is preserved by the natives either in salt or vinegar.

Bakhuizen van den Brink further states that the species occurs in Sind and in China, but I have not as yet seen any material of it from those countries, nor does he actually cite any from there. His Sind record seems to be taken from Cooke. Biswas says that A. alba "is the predominant species along the margins of creeks, khāls, and rivers in Chittagong."

Biswas states, further, that the "leaves in the seedling stage all more linear than lanceolate". It is the only Indian species, by the way, for which he adopted the same specific name as is adopted by me!

In all, 348 herbarium specimens and 1 mounted illustration have been examined,

Citations: INDIA: Bombay: Feilberg s.n. [Oct. 1868] (Cp). Madras: Cornwell 2 (Dd); Foulkes 103 (Cl, Cl), 105 (Cl, Cl); Lushington s.n. [Nizampatan] (K). Orissa: Haines 4142 (K). West Bengal: Biswas 742 (Cl, Cl, Cl); J. M. Cowan 763 (Ed), s.n. [Chittagong, 14/4/27] (Ed); Herb. Forest Research Instit. Dehra Dun 4358 (A, N, Y), 4360.1 (N); Lace 2336 (Dd, Ed, Ed, K); Nath 332a (Dd), 337 (Dd), 4135 (Dd, Dd, Dd), 4135a (Dd); D. Prain s.n. [Aug. 5, 1902] (Bz—16967, Cl, Cl, Cl, Dd, K, W—516515), s.n. [Aug. 7, 1902] (Cb, Cl, Cl, Cl, Cl, K, Na—19556, V, Vu); Sarkar IIIa (Cl), IIIb (Cl), IV (Cl). State undetermined: Collector un-

designated s.n. [Takwapar, 8.7.27] (Cl, Cl); Roxburgh XIV (Ed, Ed), s.n. (Ed). BURMA: Tenasserim: H. Falconer 241 (Cb, Cl, Le, Mu--1068); W. Griffith 6071 (B, Cl, K, P); Khant 11361 (Dd, Dd); Meebold 14301 (B); C. S. Parker 2772 (Dd); C. E. Parkinson 2024 (Dd, Dd, K); C. G. Rogers 169 (Cl, Cl), 417m (Cl). PATAW ISLAND: R. N. Parker 2772 (B, Cb, V). INDO-CHINA: Cochin-china: Chevalier 36391 (P); Germain 17 (Cb, Cb, Cb), 20 (Cb, P), s.n. (B); Harmand 725 (P); Pierre 825 (P), 1863 (Bm, Le, P), s.n. [Baria] (B, P, S); Poilane 501 (B, P); Talmy 1 (P). THAILAND: Herb. Roy. Forest-ry Dept. Siam 2 (N); A. F. G. Kerr 4027 (K); Lakshnakara s.n. [Smae Dam, July 14, 1934] (F--752076, N); Marcant 82 (Bm), 689 (Bm); J. Schmidt 141 (Cp, Mu--4168). MALAYA: Lumut Island: Herb. Forest Dept. F. M. S. 16708 (A, N), 36618 (A, N), 36619 (A, N), 36620 (A, N), 36621 (N), 36622 (N), 36623 (N), 36624 (N). Malacca: Burkill 1305 (K); Collector undesignated s.n. (Cb); W. Griffith s.n. [Malacca, 1845] (K), s.n. [Malacca] (Br, K); Maingay 1209 (K), 1765 (K). Negri Sembilan: Usop s.n. [Herb. Forest Dept. F. M. S. 554] (K). Pahang: Murdock 322 (Cl). Penang: Forest Ranger s.n. [Herb. Forest Dept. F. M. S. 16716; timber spec. 2440] (N), s.n. [Herb. Forest Dept. F. M. S. 16718; timber spec. 2442] (N). Pulau Island: Ahmad s.n. [Herb. Forest Dept. F. M. S. 3889] (K). Selangor: Cubitt s.n. [21 Feb. 1917] (K, K); Ujang s.n. [Herb. Forest Dept. F. M. S. 4722] (K). Singapore: T. Anderson 177 (Cl); Burkill & Shah 405 (Ng--16858); Furtado 18642 (Bz--16966); Herb. Bogor. 16968, in part (Bz); King's Collector 1152 (Cl, Cl); H. Kunstler 1152 (K); Kuntze 6045 (N); S. Mayer s.n. [III.1896] (V); Nur s.n. [Sungai Benban, May 29, 1934] (F--752070, N); J. Schmidt s.n. [Singapore, 1/4/1900] (Cp). Wellesley: F. T. Brooks 7 (K). PHILIPPINE ISLANDS: Mindanao: Bolster s.n. [Suriyas, Sept. 22, 1906] (Ca--239723); Elmer 12006, in part (Ut); W. I. Hutchinson s.n. [Philip. Forest. Bur. 3947] (B, K, N, N, W--706218); D. P. Miranda s.n. [Philip. Forest. Bur. 17958] (Ka--64783, Mi, Mi). CAROLINE ISLANDS: Korrör: Kanehira A.1752 (N). Pelew Islands: Kanehira 349 (N). Yap: Volkens 193 (B). RIOUW ARCHIPELAGO: Bintan: Bünemeyer 6504 (B, K, Le, P, Ut, V). Riouw: Desman 8 [Boschproefst. BB.10735] (Bz--16961, Bz--16962). SUMATRA: Boschprofst. C.C.14464 (Le); Gusdorf 8 (Le); Hagen s.n. [7/6/91] (V); Koorders 10591b (Bz--16951, Bz--16952); Lörzing 6029 (Bz--16949, Bz--16950, Le), 7285 (Le); H. S. Yates 1110 (B, Bm, Bz--16943, Ca--244233, Cb, P, V, W--1505729). JAVA: C. A. Backer 7293 (Bz--16858, Bz--16859), 7746 (Bz--16905), 21443 (Bz--16860, Bz--16861, Bz--16862, Bz--16863, Bz--16864, Bz--25448), 32872 (Bz--16902, Bz--16903), 32875 (Bz--16893), s.n. [Oct. 1904] (Le, P); Bakhuizen van den Brink 947 (Bz--25451), 1172 (Bz--16865, Bz--16866, Bz--16867, Bz--25452, Bz--25453, Bz--25453, Le, Ut), 1190 (Bz--17125, Bz--17126, Bz--25463), 1191 (Bz--16870, Bz--16871,

Cl, Le, P, Ut, Ut--34039a), 1421 (Le, Ut--24863a), 1718 (Bz--16856), 1719 (Bz--16855), 1720 (Bz--16857), 1721 (Le), 1722 (Le), 2112 (Bz--16869), 6767 (Le); Bijhouwer 190 (Bz--16836); Blume 1700 (Le, Le, Le); Boschma s.n. [Dec. 1921] (Bz--25454); Boschproefst. 2197 (K, Le); Collector indig. 7 (Cl); 16 (Ut--21031); Collector undesignated s.n. [Java] (Le); F. C. Faber s.n. [Rigi] (Mu--4324); H. Hallier s.n. [12-11-1894] (Le); Herb. Blume s.n. (Le); Herb. Bogor. 16868 (Bz); Hillebrand s.n. (B, B, B, B); Horsfield 27 (Bm), s.n. (Bm, K); Jeswiet s.n. [1916] (Ut); Karsten 1 (Le); Koorders 9694b (Le), 9695b (Le), 9696b (Cl, Le), 20022 (Le), 22009b (Cl), 24112b (B, Bz--25449, Le), 27613b (B, Le, P, X); Kuntze 5921, in part (K, N); Müller s.n. [2.1897] (S, S); Schins 1 (Le); Wolff von Wülffing W.64 (Bz--16904); Zippelius s.n. (Le); Zollinger 2969 (B, Bm, Cb, Cb, Cb, P, S, X). BRITISH NORTH BORNEO: Elmer 21250 (B, Bm, Br, Bz--16847, Ca--312132, Cb, Cp, Du--176072, E--959207, F--567366, Mu, N, P, S, Ut); Tahir 1232 (K). SARAWAK: Beccari 1770 (B, K, P); Foxworthy 292 (W--713265); Haviland & Hose 3268 (K), 3268b (Bm). BORNEO: Boschwezen 1974 (Bz--16848, Bz--16849, Ca--227874, Le); Collector undesignated 5a (Bz--16854); Draaisma 67 [Boschproefst. BB.7983] (Bz--16852, Bz--16853); Haviland 641 (K), 3268 (Cl), s.n. (Cl); Jong 478 [Boschproefst. BB.8293] (Bz--16832); Laboim 1964 (Bz--16850, Bz--16851); Motley 1275 (K); Orolofo 690 (N); Van Neurs 17 [Samarinda 93; Boschproefst. BB.9339] (Bz--17231, Bz--17232). CELEBES: Barclay s.n. [Macassar, 1840] (Bm); Boschproefst. CC.14440 (Le, P); Kjellberg 2576 (S); Rachmat 357 (Le); Teijsmann 13766 (Bz--16940, Bz--16941, Le, Le). LESSER SUNDA ISLANDS: Bali: Becking 39 (Le). Banka: Teijsmann s.n. (Bz--16955). Timor: Collector undesignated s.n. [Timor] (Cp); Herb. Mus. Paris s.n. [Timor] (Cb). MOLUCCA ISLANDS: Ceram: Buwalda 617 [Boschproefst. BB.25962] (Bz--16840). NEW GUINEA: Dutch New Guinea: Lundquist 213 [Boschproefst. BB.32932] (Bz--72945), 215 [Boschproefst. BB.32934] (Bz--72946); Salverda 32 [Boschproefst. BB.21827] (Bz--16844), 46 [Boschproefst. BB.21840] (Bz--16846); Teijsmann 7459 (Cp, K, Le). Northeastern New Guinea: Mair 1808 (Ng--6497); Moszkowski 177 (B, B). Papua: Brass 28889 (S); Hellwig 212 (B, K); Hoogland 4184 (Cb, Ng--16831, Ng); Schacht 2777 (Ng--6498); L. S. Smith 1370 (Ng--6495). BISMARCK ARCHIPELAGO: New Ireland: Peekel 201 (Bz--17240). SOLOMON ISLANDS: Island undetermined: Kusche s.n. [Nov. 1--Dec. 28, 1920] (Gg--34494). AUSTRALIA: Northern Territory: N. Holtze s.n. [vicinity of Port Darwin] (Cm). Queensland: Wilhelmi s.n. [Rockhampton] (V). LOCALITY OF COLLECTION UNDETERMINED: Collector undesignated s.n. (Ut--43826); Kapadia 48 [Sewari] (Cp). MOUNTED ILLUSTRATIONS: Lam., Illustr. pl. 540 (B).

AVICENNIA ALBA var. LATIFOLIA Moldenke, Geogr. Distrib. Avicenn.

34, nom. nud. (1939); Phytologia 1: 410--411. 1940.

Literature: Domin, Bibl. Bot. 89 (6): 1116. 1928; Moldenke, Geogr. Distrib. Avicenn. 34. 1939; Moldenke, Phytologia 1: 410--411. 1940; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 1], 65 & 86 (1942) and [ed. 2], 146, 147, & 174. 1949; Moldenke, Alph. List Cit. 3: 773 (1949) and 4: 1097. 1949; Moldenke, Phytologia 4: 193, 195, & 196. 1953; Moldenke, Résumé 187, 194, & 440. 1959.

This variety differs from the typical form of the species in its mature leaf-blades being broadly elliptic, to 6.5 cm. wide.

The type of the variety was collected by Noerkas (no. 58) on the Van Vuuren Expedition at Kap Wadjo, Celebes, and is deposited in the Rijksherbarium at Leiden. Some Banka and Borneo specimens cited by me under A. alba Blume have leaves that approach this.

Domin, in the work cited above, refers to a collection of his from Stradbroke Island, Queensland, made in March, 1910, as "eine sehr breitblättrige Form." I have not as yet seen this collection; it may possibly represent var. latifolia.

In all, 7 herbarium specimens, including the type, and 3 mounted photographs have been examined.

Citations: SUMATRA: Boschwezen 85 [Koorders 10592b] (Bz--16953, Bz--16954). CELEBES: Noerkas 58 (Bz--16934--isotype, Bz--16935--isotype, Bz--16936--isotype, E--photo of type, Le--type, N--isotype, N--photo of type, Z--photo of type).

AVICENNIA BALANOPHORA Stapf & Moldenke ex Moldenke, Geogr. Distrib. Avicenn. 34, nom. nud. (1939); Phytologia 1: 409--410, 1940.

Synonymy: Avicennia balanophora Ridl., Dispersal Pl. 310, nom. nud. 1930. Avicennia balanophora Moldenke apud E. J. Salisb., Ind. Kew. Suppl. 10: 26. 1947.

Literature: MacGillivray, Narr. Voy. Rattlesnake Bot. 212. 1852; Ridl., Dispersal Pl. 310. 1930; Moldenke, Geogr. Distrib. Avicenn. 34. 1939; Moldenke, Phytologia 1: 409--410. 1940; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 1], 69 & 86. 1942; E. J. Salisb., Ind. Kew. Suppl. 10: 26. 1947; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 2], 152 & 174. 1949; Moldenke, Alph. List Cit. 3: 721 & 752. 1949; Moldenke, Résumé 207 & 440. 1959; Moldenke, Résumé Suppl. 1: 14 & 15. 1959.

Small tree; branchlets and twigs very slender, subterete, densely grayish-farinaceous, becoming glabrous in age, obscurely or not at all lenticellate; nodes swollen, annulate, articulate; principal internodes 2.8--6.5 cm. long; leaves decussate-opposite; petioles rather slender, 0.8--2 cm. long, densely pulverulent-puberulent with gray or yellowish hairs, flattened above, wrinkled longitudinally beneath in drying, slightly amplate at the base; leaf-blades firmly chartaceous or subcoriaceous, dark-green and rather shiny above, incanous or flavidous beneath, lanceolate or narrowly elliptic, 2.5--9.3 cm. long, 6--24 mm. wide, varying from acute (on young leaves) to long-acuminate or caudate (on mature ones) at the apex, entire, attenuate or long-acuminate into the petiole at the base, very obscurely fine-

pulverulent or glabrate above, very densely pulverulent-puberulent and incanous or flavidous beneath; midrib slender, slightly prominent above and usually canaliculate to the apex or to $1/2$ or $3/4$ the length from the base, rounded-prominent beneath; secondaries very slender, ascending, slightly prominent on both surfaces, arcuately joined in many loops at the margins, mostly obscure beneath; vein and veinlet reticulation sparse, the larger portions subprominent on both surfaces, mostly obscure or hidden beneath; inflorescence axillary and terminal, the axillary ones solitary or paired, capitate, 1.4--5 cm. long, 5--19 mm. wide, several-flowered, the terminal one often 3-branched at the apex and there conspicuously bracteate; bracts, when present, foliaceous, very narrowly elliptic, short-stipitate or sessile, 17--25 mm. long, 4--6 mm. wide, densely pulverulent-puberulent with incanous or flavidous furf on both surfaces, acute at the apex, attenuate or acuminate at the base; flowers small, the corollas about 6 mm. wide during anthesis; fruiting-calyx practically unchanged, densely short-pubescent, its segments and the similar bractlets and prophylla mostly brown-margined, closely appressed to the base of the fruit; fruit oblong, acorn-like, 6--8 mm. long, 4--4.5 mm. wide, rounded at both ends, very densely puberulent with grayish-flavidous hairs, apiculate at (usually) the exact center above.

The type of this species was collected by Baron Ferdinand von Mueller along the Brisbane River, Queensland, Australia, and is deposited in the herbarium of the Royal Botanic Gardens at Kew. The collector says "This is not the species from Bass Straits or from St. Vincent Gulf! I shall give an account of this plant hereafter." However, I cannot find that Mueller ever did get around to describing this plant. The species was found again by John MacGillivray on Keppel's Islands, Queensland, on December 2, 1847. The species was regarded as *A. officinalis* L. by Bentham, but Stapf recognized it as undescribed, named it, but never validly published it as far as I can ascertain. In all, 3 herbarium specimens, including the type, and 5 mounted photographs have been examined.

Citations: AUSTRALIA: Queensland: *MacGillivray s.n.* [Keppels Isles] (K, Mi--photo, N, N--photo, Z--photo); *F. Mueller s.n.* [Brisbane River] (K--type, N--photo of type, Z--photo of type)

AVICENNIA BICOLOR Standl., Journ. Wash. Acad. Sci. 13: 354. 1923.

Literature: Standl., Journ. Wash. Acad. Sci. 13: 354. 1923; J. A. Clark, Card Index issue 101. 1924; Hill, Ind. Kew. Suppl. 7: 23. 1929; Moldenke, Geogr. Distrib. Avicenn. 16 & 17. 1939; Moldenke, Alph. List Common Names 20. 1939; Calderón & Standl., Fl. Salvad., ed. 2, 235. 1941; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 1], 21, 23, & 86. 1942; Moldenke, Phytologia 2: 92. 1944; Moldenke, Alph. List Cit. 1: 9 (1946), 2: 530 & 571 (1948), 3: 784 & 818 (1949), and 4: 1036, 1046, & 1133. 1949; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 2], 28, 38--40, & 174. 1949; Cuatrecasas, Bol. Soc. Bot. Mex. 23: 94. 1958; Moldenke, Résumé 34, 45--47, 49, & 440. 1959.

Shrub or tree, to 13 m. tall; trunk to 25 cm. in diameter; young branchlets glabrous; petioles very stout, 4--15 mm. long; leaf-blades broadly elliptic to elliptic-ovate or oval-ovate, 7--13 cm. long, 3.5--7 cm. wide, rounded or obtuse at the apex, entire, obtuse at the base and usually abruptly short-decurrent, glabrous and lustrous above and with prominent venation, densely covered with a minute whitish tomentum beneath; inflorescence spicate, opposite, the rachis elongate and the pairs of individual flowers 5--8 mm. distant from each other, the spikes numerous, forming lax panicles 5--17 cm. long, the branches of the panicle minutely tomentose; bracts and bractlets rounded, obtuse at the apex, tomentulose; corolla about 4 mm. long, its tube glabrous, the lobes obovate, subtruncate at the apex, sericeous on the outer surface, glabrous within; style nearly obsolete.

The type of this very distinct species was collected by Henri François Pittier de Fábrega (no. 4968) in a mangrove swamp at Aguadulce, Coclé, Panama, on December 5, 1911, and is deposited in the United States National Herbarium at Washington. It has been collected in anthesis also in January. The common name "mangle negro" is recorded for it by Calderón & Standley in the reference cited above. This name is also applied to A. germinans (L.) Stearn. The same authors say that the salt exuded by the leaves of A. bicolor is called "madre-sal".

In all, 21 herbarium specimens, including the type, and 4 mounted photographs have been examined.

Citations: MEXICO: Chiapas: Matuda 16353 (W--1889845). EL SALVADOR: Ahuachapán: Padilla 333 (W--1084693, W--1084694). COSTA RICA: Guanacaste: J. T. Howell 10242 (Gg--272324). PANAMA: Canal Zone: Heriberto 206 (N, W--1084422). Coclé: H. Pittier 4968 (Bm--isotype, Cp--isotype, F--636788--isotype, K--isotype, N--isotype, N--photo of type, N--photo of isotype, P--isotype, W--715141--isotype, W--715142--type, Z--photo of type, Z--photo of isotype). Province undetermined: Andersson s.n. [April, 1852] (S, S, S); R. S. Williams 78 [Porto Pasada] (N).

AVICENNIA EOCENICA Berry, U. S. Geol. Surv. Prof. Paper 91: 347, pl. 104, fig. 6. 1916.

Literature: Berry, U. S. Geol. Surv. Prof. Paper 91: 347, pl. 104, fig. 6. 1916; Knowlton, U. S. Geol. Surv. Bull. 696: 108. 1919; Moldenke, Geogr. Distrib. Avicenn. 41. 1939; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 1], 75 & 86. 1942; H. N. & A. L. Moldenke, Pl. Life 2: 42. 1948; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 2], 166 & 174. 1949; Moldenke, Résumé 226 & 440. 1959.

Illustrations: Berry, U. S. Geol. Surv. Prof. Paper 91: pl. 104, fig. 6. 1916.

Twigs, leaves, and flowers not known; fruit capsular, ovate, slightly oblique in outline, widest in the median portion and narrowing almost equally in both directions, truncate proximad, shortly apiculate distad, greatly compressed, 2.7 cm. long, about 1.35 cm. wide; pericarp thin, coriaceous, feebly ridged with 2 or

3 slight longitudinal elevations, longitudinally striate.

The type of this species was collected by Edward Wilber Berry in the Lagrange formation, in beds of Wilcox (Eocene) age, at Puryear, Henry County, Tennessee, and is deposited in the United States National Museum at Washington. According to Berry "The identification of the present form with the capsule of Avicennia is not conclusively proved, although the resemblance between the fossil and a single valve of the tardily dehiscent capsule of such a modern form as A. nitida Jacquin amounts as nearly to proof as is possible with detached parts of fossil vegetation, especially as Avicennia-like leaves are also present at this horizon. This form is slightly smaller and more nearly symmetric than a valve of a capsule of the black mangrove; otherwise the resemblance is complete. It is possible that the Wilcox species of Citharexylon [C. eoligniticum] based on foliage may be the foliage of Avicennia eocenica, although the form appears to be more closely allied with Citharexylon."

AVICENNIA EUCALYPTIFOLIA Zipp. ex Miq., Fl. Ned. Ind. 2: 912, in syn. (1856); Ridl., Dispersal Pl. 310, nom. nud. (1930), sp. nov.

Synonymy: Avicennia officinalis var. eucalyptifolia Valet., Bull. Dep. Agric. Ind. Néerl. 10: 53. 1907. Avicennia alba Karst. ex Valet., Bull. Dep. Agric. Ind. Néerl. 10: 53, in syn. 1907 [not A. alba Blume, 1826, nor Wight, 1921]. Avicennia alba var. acuminatissima Merr., Philip. Journ. Sci. Bot. 11: 311. 1916. Avicennia officinalis var. acuminata Domin, Bibl. Bot. 89 (6): 1116. 1928.

Literature: Miq., Fl. Ned. Ind. 2: 912. 1856; Valet., Bull. Dep. Agric. Ind. Néerl. 10: 53. 1907; Pulle in Lorentz, Nova Guinea 8: 403. 1910; Prain, Ind. Kew. Suppl. 4: 21. 1913; Merr., Philip. Journ. Sci. Bot. 11: 311. 1916; H. J. Lam, Verbenac. Malay. Arch. 341--343 & 361, pl. 3, L, P, Q, R, S, T, & U. 1919; Bakh., Bull. Jard. Bot. Buitenz., sér. 3, 3: 203, pl. 16, fig. b & c. 1921; Domin, Bibl. Bot. 89 (6): 1116. 1928; Ridl., Dispersal Pl. 310. 1930; Moldenke, Geogr. Distrib. Avicenn. 33--35. 1939; Moldenke, Prelim. Alph. List Invalid Names 5 & 6. 1940; Moldenke, Alph. List Invalid Names 5. 1942; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 1], 61, 63, 66, 67, 69, 70, & 86. 1942; Moldenke, Alph. List Cit. 1: 13, 16, 34, 57, 115, 141, 191, 270, & 316 (1946), 2: 403, 412, 449, 603, & 617 (1948), 3: 752, 776, 823, 858, 902, 906, 912, 952, & 969 (1949), and 4: 985, 1021, 1037, 1083, 1093, 1105, 1110, 1148, & 1154. 1949; Moldenke, Known Geogr. Distrib. Verbenac., [ed. 2], 140, 143, 147, 148, 152, 155, 156, & 174. 1949; Moldenke, Phytologia 3: 381 & 382 (1950), 4: 86 & 87 (1952), and 4: 195 & 197. 1953; Moldenke, Résumé 182, 187, 196, 198, 200, 202, 203, 207, 211, 235, 236, & 440. 1959; Moldenke, Résumé Suppl. 1: 13 & 14. 1959.

Illustrations: H. J. Lam, Verbenac. Malay. Arch. pl. 3, L, P, Q, R, S, T, & U [as A. officinalis]. 1919; Bakh., Bull. Jard. Bot.

Buitenz., sér. 3, 3: pl. 16, figs. b & c [as A. marina var. resinifera]. 1921.

Arbor, foliis lanceolatis vel anguste lanceolatis, 4--16 cm. longis, 1--4.2 cm. latis, ad apicem longe attenuato-acuminatis vel caudatis, ad basin acutis vel acuminatis usque ad attenuatis supra glabris nitidisque et impresso-punctatis, subtus dense albo-pulverulentis.

Tree, to 16.5 m. tall; pneumatophores to 15 cm. tall; trunk generally with a small bole or the latter to 1.5 m. high, not straight, to 46 cm. in diameter at breast height; branches rather stout, obtusely tetragonal; bark smooth, greenish-gray or gray-brown to green-blue or grayish-green, peeling off in thin flakes, 1 mm. thick, the under bark pale-brown, the inner bark straw-colored; wood straw-colored or white; branchlets and twigs slender, numerous, gray, acutely or obtusely tetragonal, articulate, densely whitish- or grayish-pulverulent or subglabrate in age; nodes swollen, distinctly annulate; principal internodes 1.3--4.6 cm. long; leaf-scars small and inconspicuous, not corky; leaves decussate-opposite; petioles slender, 5--12 mm. long, densely white- or gray-pulverulent, flattened but usually not sulcate above, convex beneath, sometimes slightly wrinkled in drying, very slightly or not at all ampliate at the base; leaf-blades firmly chartaceous or subcoriaceous, light- to dark-green or brownish-green above, gray or grayish beneath, slightly shiny or glossy above, lanceolate or narrow-lanceolate, 4--16 cm. long, 1--4.2 cm. wide, 3--5 times as long as wide, long attenuate-acuminate or caudate at the apex, rarely merely acute, entire, very slightly revolute along the margins in drying, acute or acuminate to attenuate at the base, glossy-glabrous and impressed-punctate above, densely whitish- or grayish-pulverulent beneath; midrib slender, flattened or slightly prominent to the apex above, usually canaliculate for one-half to three-quarters its length from the base, rounded-prominent or somewhat flattened and canaliculate toward the base beneath; secondaries slender, 6--12 per side, arcuate-ascending, only very slightly prominent on both surfaces or obscure beneath, joined rather indistinctly in many loops at the margins, the collective vein usually rather indistinct; vein and veinlet reticulation sparse, the larger portions slightly prominent above, mostly obscure beneath; inflorescence axillary and terminal, capitate or subspicate, 1--2.5 cm. long, 4--12 mm. wide, 2--7-flowered, the flowers usually densely congested, decussate-opposite, the axillary inflorescence confined to the 1--3 upper axils, 1 or 2 per axil, sometimes borne on very short axillary twigs; peduncles mostly sharply tetragonal, densely grayish-pulverulent, 6--21 mm. long; bracts usually numerous, foliaceous, lanceolate, mostly more or less falcate-recurved, very decidedly revolute with the edges curled in to the midrib, densely grayish-pulverulent on both surfaces, stipitate, sometimes reduced, 0.8--6 cm. long; calyx pale-green; corolla white or yellow to "orange, in older flowers with purplish tips"; stamens deep-purple or brown; ovary orange-yellow; fruiting-calyx deeply 5-parted almost to the base, the lobes erect, ovate, about

5 mm. long, about 2 mm. wide at the base, densely strigose-puberulent on the outer surface, the margins fringed, acute at the apex, glabrous on the inner surface, imbricate in cupuliform fashion; fruit ovate or somewhat cordate, 1--3 cm. long, 0.5--2.2 cm. wide, beaked at the apex, densely grayish-pulverulent.

Brass describes this species as a "large tree mangrove, often above the tide mark". It has been found at the edges of tidal areas, on rocky coral shores, in the muddy parts of sea lagoons, and in clayey soil of mangrove forests. Hoogland says that it forms pure stands in the inner zone of the mangroves, at an altitude of 1 meter. It has been collected in anthesis in April, June, August, September, November, and December, and in fruit in January. Herbarium material has been widely confused with and misidentified as A. alba Blume, A. marina var. resinifera (Forst.) Bakh., and A. officinalis L.

Brass, on the label of his no. 21841, described the flowers as "brown", while Floyd & Gray state that the flowers are borne "in short axillary cymes". Vernacular names recorded for the species are "bibi", "biobio", "bu-bula", "jaafjaaf", "moro", "pa xi", and "pipin". The Koch s.n. [Meranke] collection is a mixture with A. marina var. resinifera.

The type of A. alba var. acuminatissima was collected by Charles Budd Robinson (no. 1862) on Amboina, while the type of A. officinalis var. acuminata is an unnumbered collection made by Domin in the vicinity of the mouth of the Russell River in north-eastern Queensland, Australia, in January, 1910. Domin describes the plant well when he says "Excellit foliis elongatis, anguste lanceolatis, longe sensim tenuiter acuminatis usque ad 16 cm. longis sed tantum 2.3 cm. latis....durch die Blattform sehr auffallend!"

Valeton based his A. officinalis var. eucalyptifolia on the Zippelius a.n. and Spanoghe s.n. collections in the Leiden and Paris herbaria [the Zippelius 87, cited below, may possibly be part of one of these cotype collections]. He gives the name "Avicennia eucalyptifolia Zipp., in herb." in synonymy. Pulle (1910) accepts Valeton's trinomial. Prain (1913) lists "A. eucalyptifolia" as a synonym of A. officinalis L.

It is worthy of note here that the Low Island on which this species has been collected is located in the Great Barrier Reef off the coast of Queensland, and is not in Tasmania as cited by me in my Geogr. Distrib. Avicenn. 35 (1939). The Sumatra record for this species as given by me in previous publications was based on the Conservatoire et Jardin Botanique, Geneva, sheet of Yates 1110, which I now feel is A. alba.

In all, 92 herbarium specimens, including the type collections of most of the names involved, and 11 mounted photographs have been examined.

Citations: PHILIPPINE ISLANDS: Mindanao: Elmer 11990, in part (Cb, Cl, Ed, Le, V, W--779701). LESSER SUNDA ISLANDS: Timor: Baudin s.n. (Cb); Collector undesignated s.n. [Muséum de Paris,

1821] (Dc); Herb. Jussieu s.n. (S); Herb. Lugd.-Bat. 908267-918 (Le); Herb. Mus. Paris. 23 (Le), s.n. [1836] (K); Karsten 2 (Le); Schins 2 (Le); Spanoghe s.n. (Le-908265-613-cotype); Zippelius s.n. (Le-908265-623-cotype, Le-cotype). MOLUCCA ISLANDS: Amboina: C. B. Robinson 1862 (B, Bm, Bz--17059, Cl, F-478619, K, Le, N-photo, P, S-photo, W--775248, Z-photo). Tanimer Islands: Buwalda 115 [Boschproefst. BB.24334] (Bz--16841). NEW GUINEA: Dutch New Guinea: Branderhorst 227 (B, K, Le, Ut); J. W. R. Koch s.n. [8/10/1904] (Le, Le), s.n. [Meranke] (Bz--17069, in part); Lundquist 95 (Bz--16842); Salverda 18 [Boschproefst. BB.22097] (Bz--16845), 29 [Boschproefst. BB.21824] (Bz--16843); Stefels B. W. 3199 (Ng--20203, Ng); Versteeg 1893 (B, Bz--17067, Bz--17068, K, Le, Mi-photo, N-photo, Ut, Ut, Z-photo); Zippelius 87 [87d] (Le). Papua: Bauerlen 606 (Mb); Brass 794 (B, Bz--17064, K, P), 882 (B, I-photo, K, N, N-photo, P, Z-photo), 21841 (Ng-17093); Cavanaugh 11 (Ng--6496); Chalmers s.n. [Port Moresby, 1880] (Mb); Hoogland 4699 (Cb, Ng-16826); J. C. Saunders 139 (Ng-16824); Waterhouse 342 [Yale Herb. 29467] (N). Uramu Island: Floyd & Gray 8005 (Ng-16891, Ng). AROE ISLANDS: Wamar: Buwalda 5579 (Bz--72565). LOUISIADE ARCHIPELAGO: Heigh: W. MacGregor s.n. [1889] (Mb, N). KRAKA ISLAND: Aet 173 (Bz--72564, Er). SOLOMON ISLANDS: Malaita: Kajewski 2344, in part (Bm). AUSTRALIA: North-ern Territory: Armstrong 515 (K, K); Herb. Torrey s.n. (T); Rich. Schomburgk s.n. [North Australia] (Br); F. Schultz 593 (B, K, N-photo, Z-photo). Queensland: F. M. Bailey s.n. [Brisbane River] (W--59281); Daemel s.n. [Cape York] (Bm, V); Michael 724 (Bm); F. Mueller s.n. [Dec. '55] (K), s.n. [Queensland] (C); Podenzana s.n. [Cooktown, 1891-1893] (Bm); Warburg 18756 (B). State undeterm-ines: Oldfried s.n. [1866] (X). LOW ISLAND: Tandy 542 (Bm). WOODY ISLAND: T. A. Stephenson 605 (Bm). SPURS ISLAND: Henne s.n. (K, N-photo, X, Z-photo). HOWICK GROUP ISLANDS: F. Mueller s.n. (K). THURSDAY ISLAND: Podenzana s.n. [Thursday Isl.] (Bm).

AVICENNIA GERMINANS (L.) Stearn, Kew Bull. 1958: 34--36. 1958.

Synonymy: Mangle laurocerasi foliis flore albo tetrapetalo Sloane, Voy. Jamaic. 2: 66. 1725. Bontia ? foliis integris oblongis oppositis, petiolis crassis brevissimis subamplexantibus, floribus racemosis P. Browne, Civil & Nat. Hist. Jamaic., ed. 1, 263. 1756. Donatia Loefl., Iter Hisp. 133. 1758. Bontia germinans L., Syst. Nat., ed. 10, 2: 1122. 1759. Avicennia nitida Jacq., Enum. Syst. Pl. Carib. 25. 1760 [not A. nitida Blanco, 1837]. Avicennia tomentosa Jacq., Enum. Syst. Pl. Carib. 25. 1760 [not A. tomentosa Blanco, 1845, nor Blume, 1918, nor R. Br., 1851, nor L., 1826, nor Roxb., 1835, nor Schau., 1940, nor Vahl, 1921, nor Willd., 1800]. Avicennia nitida L. & Jacq. ex Lam., Tabl. Encycl. Méth. Bot. 1: 330. 1783. Avicennia tomentosa L. & Jacq. ex Lam.,

Tabl. Encycl. Méth. Bot. 1: 330. 1783. Bontia germinans Mill. ex Lam., Tabl. Encycl. Méth. Bot. 1: 330, in syn. 1783. Avicennia tomentosa var. cumanensis H.B.K., Nov. Gen. & Sp. Pl., ed. fol., 2: 229, & ed quart. 283. 1818. Avicennia tomentosa var. campechensis H.B.K., Nov. Gen. & Sp. Pl., ed. fol., 2: 229--230, & ed. quart. 284. 1818. Avicennia tomentosa var. guayaquilensis H.B.K., Nov. Gen. & Sp. Pl., ed. fol., 2: 230, & ed. quart. 284. 1818. Avicennia tomentosa G. F. W. Mey., Prim. Fl. Esseq. 221. 1818. Avicennia elliptica Holm in Thunb., Pl. Bras. Dec. 3: 37. 1821. Avicennia tomentosa Nutt. & Br. ex Raf., Atl. Journ. 148, in syn. 1832. Avicennia floridana Raf., Atl. Journ. 148. 1832. Avicennia tomentosa Sieber (in part) ex Presl, Bot. Bemerk. 98--99, in syn. 1844. Avicennia meyeri Miq., Linnaea 18: 262. 1844. Avicennia nitida Rodsch. ex Miq., Linnaea 18: 262, in syn. 1844. Avicennia lamarckiana Presl, Bot. Bemerk. 99. 1844. Avicennia elliptica Thunb. ex Schau. in A. DC., Prodr. 11: 700, in syn. 1847. Avicennia oblongifolia Nutt. ex A. W. Champl., Fl. South. U. S. 310. 1860. Avicennia tomentosa Sw. apud Griseb., Fl. Brit. West Ind. 502, in syn. 1864. Avicennia officinalis α nitida (Jacq.) Kuntze, Rev. Gen. Pl. 2: 502. 1891. Avicennia officinalis β lanceolata Kuntze, Rev. Gen. Pl. 2: 502. 1891. Avicennia nitida Sessé & Moc., Fl. Mex., ed. 2, 142--143. 1894. Hilairanthus nitidus (Jacq.) Van Tiegh., Journ. de Bot. 12: 357. 1898. Hilairanthus tomentosus (Jacq.) Van Tiegh., Journ. de Bot. 12: 357. 1898. Avicennia floridana Gandoger, Bull. Soc. Bot. France 65: 64. 1918. Avicennia germinans L. apud Bakh., Bull. Jard. Bot. Buitenz., sér. 3, 3: 218, in syn. 1921. Avicennia officinalis Millsp. apud Standl., Field Mus. Publ. Bot. 3: 399, in syn. 1930 [not A. officinalis L., 1753, nor H. J. Lam, 1940, nor Maxim., 1932, nor Schau., 1856]. Avicennia papulosa Ørst. ex Moldenke, Prelim. Alph. List Invalid Names 6, in syn. 1940. Avicennia americana Nutt. ex Moldenke, Prelim. Alph. List Invalid Names 5, in syn. 1940. Avicennia angustifolia Hornem. ex Moldenke, Prelim. Alph. List Invalid Names 5, in syn. 1940. Avicennia officinalis var. lanceolata Kuntze ex Moldenke, Prelim. Alph. List Invalid Names 6, in syn. 1940. Avicennia nitida Jacq. ex Moldenke, Prelim. Alph. List Invalid Names 5, in syn. 1940. Avicennia officinalis var. nitida (Jacq.) Kuntze ex Moldenke, Prelim. Alph. List Invalid Names 6, in syn. 1940. Avicennia tomentosa var. campechiensis H.B.K. ex Moldenke in Pulle, Fl. Surin. 4 (2): 323, in syn. 1940. Bontia foliis oppositis, pedunculis spicatis L. ex Moldenke, Prelim. Alph. List Invalid Names 7, in syn. 1940. Bontia folius subtus tomentosus Jacq. ex Moldenke, Prelim. Alph. List Invalid Names 7, in syn. 1940. Bontia laurocerasi foliis, etc. Sloane ex Moldenke, Prelim. Alph. List Invalid Names 7, in syn. 1940. Lippia glauca

Rose ex Moldenke, Prelim. Alph. List Invalid Names 31, in syn. 1940. Mangle laurocerasifolius, etc. Sloane ex Moldenke, Prelim. Alph. List Invalid Names 32, in syn. 1940. Avicennia nitida Jacq. ex Moldenke, Suppl. List Invalid Names 1, in syn. 1941. Avicennia nitida var. angustata Forsström ex Moldenke, Suppl. List Invalid Names 1, in syn. 1941. Avicennia tomentosa var. acutifolia Blanchet ex Moldenke, Suppl. List Invalid Names 1, in syn. 1941. Avicennia nitida Jacq. ex Moldenke, Alph. List Invalid Names 5, in syn. 1942. Avicennia nitida Sessé & Moc. ex Moldenke, Alph. List Invalid Names 5, in syn. 1942. Avicennia tomentosa Jack apud Stellfeld, Arquiv. Mus. Paran. 4: 239, sphalm. 1945. Avicennia officinalis nitida Kuntze ex Roig, Plant. Med. Cub. 449, in syn. 1945. Avicennia tomentosa Nutt. ex Moldenke, Alph. List Invalid Names Suppl. 1: 2, in syn. 1947. Avicennia nitida L., in herb. Avicenuia tomentosa L., in herb.

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