

as a substitute for cinnamon. The sterile specimen of de Jussieu is exactly like the type specimen of *Laurus limbosa* R. & P. (cf. Kostermans, I.e. 647) which is *Licaria limbosa* (R. & P.) Kosterm. (Kostermans, I.e. 731).

Consequently I refer here *Laurus quixos* Lam. to *Licaria* as *Licaria quixos* (Lam.) Kosterm., *comb. nov.*

A MONOGRAPH OF THE GENUS *PARINARI* Aubl.
(Rosaceae-Chrysobalanoideae) IN ASIA AND THE PACIFIC REGION

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SUMMARY

1. In the area 20 species (one cultivated) are recognized; furthermore one undescribed species is discussed.
2. The genera *Cyelaiulophora* Hassk. and *Mara/tithes* Bl. are segregated from *Parinari* proper.
3. The genus is subdivided into 2 sections: *Parinari* and *Anareolala*.
4. *P. papuanum* C.T. White and *P. salomonense* C.T. White are reduced to synonymy of *P. nonda* F.v.M.; *P. albidum* Craib is considered to be conspecific with *P. anamense* Hance; *P. costata* (Korth.) Bl. is considered to represent a proper species and has been segregated again from *P. sumatrana* Miq.
5. *Arbor nigra maculosa* Rumphius, currently identified as a *Parinari* species, is referred to *Strychnos*.
6. *P. nitidum* Hooker f. (= *Coccomelia nitida* Ridley = *Triohocarya nitida* Miq.) is referred to *Licania* as *L. splendens* (Korth.) Prance & Kosterm., *comb. nov.*
7. *P. petiolatum* v. Malm is referred to *Polyosma* (Rutaceae).
8. *P. punctatum* Kurz represents perhaps *P. polyneura* Miq.
9. *P. plilippinense* Elmer is referred to *Licania splendens* (Korth.) Prance & Kosterm.
10. *P. scabrum*, var. *lanceolatum* Koorders represents *Hiptage* (Malpighiaceae).
11. The unnamed specimen, mentioned and described by Hooker f. (Fl. Brit. India 2: 311. 1878)*, belongs perhaps to *Tiliaceae*.
12. *Chrysobnlanus racemosus* Roxb. is perhaps partly *Cyclandrophora laurina* (A. Gray) Kosterm., *comb. nov.* (flowers); the fruit is not Rosaceous.
13. *P. tontoutense* Guill. and *P. myrsinoides* Schlecht. are referred to *Licania* as *Licania tontoutense* (Guill.) Kosterm. and *L. myrsinoides* (Schlecht.) Kosterm., *comb. nov.*
14. *P. gigantea* Kosterm. is new to science.

INTRODUCTION AND ACKNOWLEDGMENTS

Almost 6 years ago, I started revisional work on Asiatic and Pacific *Parinari*. The task proved to be far from easy and the final draft of the manuscript could be completed only, after I had had the opportunity to examine the extensive material at Kew, thanks to a grant of the British Council, to which I herewith express my feelings of profound gratitude.

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At Kew I met Dr. Yan Prance (now at New York Bot. Garden), who was engaged in a revision of the Chrysobalanoideae, mainly at the generic level. A fruitful cooperation developed and we both came to a similar conclusion that the scope of *Parinari* was not tenable and that the genus had to be split up. Well-defined groups like *Maranthes* Bl. and *Cyclandrophora* Hassk. could be segregated and the position of *Parinari* proper became better founded.

Dr. Prance laid down his conclusion in a thesis (Oxford), which after considerable delay, will be printed.

Meanwhile I myself proceeded with the revision on a specific level; the results of which are represented here (the monographs of *Maranthes* and *Cyclandrophora* will be published in *Candollea*; the MSS. has been forwarded to Geneva in July 1965).

The genus *Acioa* Aublet, in which I have included some species, formerly considered to be *Parinari*, has been treated in this volume of Reinwardtia. Dr. Prance considers it a genus different from American and African *Acioa*.

The revision of *Parinari* could never have been completed without the much appreciated cooperation of the Directors of the "Botanical Survey of India" who sent material and photographs, of the Royal Botanic Gardens, Kew, who extended hospitality to me in his Institute and who sent numerous photographs; of the Botanical Garden, Brisbane, who sent fragments of type specimens, of the Botanic Garden, Edinburgh (specimens), of the Institutes in Paris, Geneva, Leiden and others and of Dr. Yan Prance (specimens, photograph). To all of them I here extend my feelings of indebtedness and gratefulness.

DISCUSSION

The genus *Parinari* represents a heterogeneous group of species and the species inter se show differences of a greater magnitude than generic differences of genera allied to *Parinari*. The only character tying all species together is the ovary, which is attached laterally to the throat of the calyx tube.

Bypassing de Candolle, we may accept that Bentham (*in* Hooker, Fl. Nigrit. 335. 1849) established the first subdivision of *Parinari*, mainly based on African species (although he included some Asiatic ones of which several he had not seen). He recognized the following sections: *Petrocarya* (Schreber) Bentham (*Balantium* Desv.), *Sarcostegia* Bth. (wherein wrongly included *Petrocarya excelsa* Jack) and *Neocarya* (purely African).

Miquel (Fl. Ind. bat. 1(1): 353. 1855) subdivided *Parinari* in: *Petrocarya* Benth., *Macrocarya* Miquel, with the same scope as *Cyclandrophora* Hassk. and *Sarcostegia* Benth., which covers *Maranthes* Bl. (Miquel recognized 4 different species, which I have combined, but included also *Farinariwm jackiammi*, which actually belongs in subgenus *Macrocarya*).

J.D. Hooker (Fl. Brit. India 2: 309. 1878) remarked that the Indian *Parinari* species were probably referable to several genera, distinguishable by their fruit more than by any floral characters. He divided the Indian species in three subgenera (suggesting a fourth one for *Petrocarya excelsa* Jack = *Parinari jackianum* Bth., accepting Jack's misleading description of that species); he only named subgenus I (*Grymania* (Presl) Hooker), which has the same scope as *Petrocarya* (Schreber) Benth. (or *Eu-Parinari* of Haumann); subgenus II, unnamed, is monospecific and includes what is now known as *Angelesia splendens* Korth. (referred by Prance and me to *Licania*); whereas (unnamed) subgenus III covers the genus *Cyclandrophora* Hassk.

Shortly afterwards Miers (J. linn. Soc. Bot. 17: 333. 1880) criticized the scope of *Parinari* and again suggested to split this genus in segregates, based upon fruit characteristics. As most of the fruit were unknown to him and he accepted also Jack's misleading fruit description of *Petrocarya excelsa* (which belongs in *Cyclandrophora*), his suggestions were not followed.

Haumann (Bull. Jard. bot. Bruxelles 21: 184. 1951) discussed the generic limits of *Parinari*. He recognized for the African species the following subgenera: *Sarcostegia*, Bth. (our *Cyclandrophora*) and *Pellegriniella* (purely African). Both these subgenera are characterized by leaves lacking stomatal areoles on their lower surface and having often two glands at the base of the leaf. The other two subgenera: *Neocarya* (monotypical, African) and *Euparinari* Haumann have stomatal areoles and often glands on the petioles.

In the Asiatic species of *Parinari* the characteristic of the stomatal areoles does not hold true for *Euparinari*, as some species lack these (in this paper these are included in a separate subgenus).

Characteristics of less importance, like the fleshy and almost symmetric perianth in subgenus *Sarcostegia* as opposed to membranous, unequal perianth in *Euparinari* holds true also for Asiatic species.

Recently Prance laid down his conclusions on a new classification of Chrysobalanaceae in a thesis, which will be published soon. Prance accepts Chrysobalanaceae as a separate family, herein following K. Fritsch (1880 *).

*) Bate-Smith (*in* J. Linn. Soc. Bot. 58: 53. 1961) states, that except for the Chrysobalanoideae and *Potentilla anserina*, the trihydroxy representatives of leucoanthocyanins and flavonols are missing in the Rosaceae.

The philosophy underlying the classification is clear: species in a genus like *Parinari* are often more different from each other than genera of Chrysobalanoideae are differing from *Parinari*. Either all genera should be combined under *Chrysobalanus* or genera like *Parinari* should be split up in smaller genera. We choose the latter way and I believe that the general trend in developing taxonomy is to give to those small entities generic rank in preference to making huge genera to be sub-divided into sub-genera. There is no argument for or against one of these procedures as they both reflect phylogenetical views as far as they can be proved (and they cannot be proved). I have the feeling that only the argument of consistency (no genera with species which differ more amongst each other, than do the genera amongst each other) should preponderate here, if not the argument of practicability.

If swarms of species can be detected, characterized and separated from other swarms, even by a single character and provided that there are no intermediate cases for this single characteristic, i.e. the characteristic is a "strong" one, then there is no reason not to treat these as genera (which are certainly not less "natural" as "genera" based on more than one characteristic in case the latter characteristic are not so "strong" and more fluid).

Such a swarm of species is certainly *Cyclandrophora*, of which the fruit is ultimately one-celled with ruminant cotyledons. The "strong" characteristic is the ruminant cotyledons, not the one-celled fruit, as the fruit is initially two-celled as in all other *Parinari* species.

Maranthes differs from *Parinari* sensu strictu, mainly by the construction and shape of its fruit, furthermore by the two distinct glands at the base of the leaf blade. Furthermore it has fleshy perianth leaves. Malesian *Maranthes* is exactly matched in generic characteristics by some African species.

Parinari, *Maranthes* and *Cyclandrophora* may be differentiated as follows.

	Parinari	Maranthes	Cyclandrophora
Stipules:	membranous, fugaceous	stiff, early caducous	stiff, carinate, subpersistent.
Branching	flush drooping, branching normal	flush not drooping, branching normal	flush not drooping, branching zig-zag.

	¹ Paninari	Maranthes	Cyclandrophora
Leaves	usually with stomatal areolation on the lower surface; glands tiny, at the middle of the petiole or lower down; areoles with grey cobweblike hairs.	no stomatal areolation; glands distinct, at the apex of the petioles; leaves glabrous.	no stomatal areolation; inconspicuous, amorphous glandular tissue at the leaf blade base, or none; leaves glabrescent, nerves rough, caused by tiny holes with jagged rim.
Flowers	petals thin; sepals unequal; fertile stamens 8-10; style as long as the stamens.	petals fleshy; sepals equal; fertile stamens 25-30; style much longer than the stamens	petals thin; sepals unequal; fertile stamens 10-20; style as long or slightly longer than the stamens
Fruit	Exocarp of hyaline radial spindles; mesocarp bony, marmorate, outside irregular; endocarp thin, of concentric fibres, inner layer with cotton-wool like hairs; fruit 2-celled; fruit not dehiscent during germination. Fruit ellipsoid, laterally flattened, cotyledons not ruminant.	Exocarp thin, fleshy; mesocarp marmorate; endocarp thin with a dense layer of cotton-wool like hairs. Fruit 2-celled, not dehiscent during germination. Fruit clubshaped; cotyledons not ruminant.	Exocarp very thin, fleshy; mesocarp of radial fibres; endocarp very thin with hardly conspicuous hairs. During germination the fruit cracks irregularly. Fruit ellipsoid to subglobose; one-celled; cotyledons ruminant.

In a recent paper, the Old World species of *Primus*, subgen. *Laurocerasus* (Thesis 1965), Kalkman combined *Pygeum* with *Prunus*. As I am rather familiar in the field with *Pygeum*, I doubt, whether this lumping is acceptable.

Here, like in *Parinari*, the flower characteristics give no clue, but — according to me — not sufficient attention is paid to the fruit of *Pygeum* s.s., which differ from that of *Prunus*.

It is hoped, that Prance will be able, in revising all genera of Rosaceae, to bring more clarity here.

P A R I N A R I Aublet

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Mampata „Adanson" Steudel, Nom., ed. 2,2: 98. 1841.

Neou Adanson ex de Jussieu, Gen. PL 342. 1789; ed. Usteri 378. 1891; de Dalla Torre & Harms, I.e. 211. 1901; Post & Kuntze, Lexikon 386. 1904.

Neon „Adans." Daydon Jackson, Index Kewensis 2: 426. 1895.

Trees usually with small or no buttresses; bark usually grey. Wood reddish. Branchlets and new flush often drooping; the young leaves often limp; branchlets with many, tiny, round, pale lenticels. Leaves entire, spirally arranged, stipulate, chartaceous to stiffly coriaceous; upper surface glabrous, glossy, lower one either glabrous and reticulate or with a pronounced stomatal areolation, the areoles filled with a cobweblike felt of

hairs; lower leaf surface at both sides of the petiole insertion often with glands or glandular tissue. Petioles becoming corky, sometimes provided with tiny round glands near the middle or lower down, in the same specimen the glands may be present or absent. Stipules lateral to the petiole or in the axils, thin, early caducous.

Panicles axillary or terminal or both, pilose, bearing raceme- or spike-like ramifications. Flower and ramifications subtended by conspicuous bracts, which as a rule drop at anthesis. Calyx tube short or long, gibbose, slender or broad, pilose; lobes 5, pilose, shorter than the tube; petals 5, small, glabrous, spatulate, thin, caducous in an early stage. Stamens on a rim. at the throat of the calyx tube, consisting of 8 to 10 fertile ones and (opposite the style) staminodial ones, which are represented by short teeth on the rim. Filaments well-developed, usually laterally compressed; anthers 2-celled, longitudinally dehiscent. Ovary lateral near the throat of the calyx tube, adnate to the tube (which is here gibbose), densely hirsute. Style at the base of the ovary with an inconspicuous capitellate or truncate stigma; calyx tube below the ovary with a layer of inversely placed strigose hairs; the lower part of the tube empty. Ovary 2-celled; each cell with one ovule.

Fruit ellipsoid, globose, ovoid or obovoid, truncate, or rounded at apex, base (at least in submature stage) with a short neck. Exocarp thin, consisting of radial, translucent hyaline spindles; mesocarp of a marmorate (in cross section) tissue; endocarp thin, membranous; inside with a dense layer of woolly rusty hairs, which fill the cavities.

Fruit initially 2-celled; development of seed retarded in comparison with that of the fruit; often 2 seeds developing and the fruit permanently 2-celled (the hairs of the endocarp rusty cotton-wool like). Seed erect with membranous testa and large cotyledons; radicle small, inferior.

TYPE SPECIES: *Parinari campestre* Aublet

DISTRIBUTION: Many species forming an important part of tropical lowland rainforest up to 1300 m altitude; pantropical.

Bole. As far as indicated and of all the species which I could examine in the field, the free bole is well-developed; buttresses are short or lacking; they are thick and not forked. The bole has usually rings of protruding conspicuous lenticels. The bark is grey or greybrown and usually smooth; the living bark is red-brown.

Wood. The wood is reddish, hard, and has interlocked grain.

Branches. The flush is drooping, the branchlets are sub-angular and have a dense indumentum of rather coarse glossy, sub-adpressed hairs, there is often an underlying layer of grey, cobweblike hairs; the branches are glabrous, glossy, redbrown or purplish black when dried and have numerous, tiny, pale lenticels.

Stipules. These are fugaceous, lanceolate to ovate-oblong, thin in texture (membranous when dried) and well developed; the dorsal side is

densely pilose; the inner side is glabrous. Glands were only observed in *P. nmida*; they were very small, round and attached near the margin, only a few were present.

Leaves. The leaves are entire and either chartaceous or stiffly coriaceous, which is a useful specific characteristic. Their shape varies between elliptic to lanceolate and ovate; subobovate leaves are rare, the base is variable, in one species acutish, truncate and subcordate leaves may be found; the apex is as a rule acuminate, the length of the acumen is a useful specific characteristic, if normally developed leaves are present; leaves of specimens of poor and dry habitats have a shorter acumen or the latter may be lacking. The nervation is very uniform in all species and consists on the upper surface of a midrib, which is flat and slightly sunken along its middle line, the base of the midrib has the shape of a long triangle (its base near the petiole) and this part keeps its indumentum longest. The lateral nerves are very slender on the upper surface and show the same sunken midline in cured material; the secondary nerves are very slender, parallel and prominulous after drying; they show the same pattern as in *Shorea* species (Dipterocarpaceae) and hence *Parinari* in the field is often confused with *Shorea* and boles of *Parinari* are found¹ often among the marketable *Shorea* timber. The lower surface, which in the drooping flush state is densely covered with a white felt of cobweblike hairs (also on the upper surface, but there more fugaceous), shows in mature leaves a peculiar reticulation, consisting of very prominent, broad veins, enclosing small areoles. They are called here stomatal areoles. Duvignaud (*in Bull. Soc. Roy. Bot. Beige* 84: 87. 1951) gives an anatomical description of these areoles. The nerves are glossy, broad and their upper surface either rounded or flattened; the areoles contain often still the remnant of the cobweblike hair felt. There are only two species (*P. canarioides*, *P. argenteo-sericea*) where these stomatal areoles are missing. They are otherwise a generic characteristic.

Along the midrib exceptionally a thickened nerve is present (*P. polyneura*), which represents the decurrent primary nerves. Glands were found only in *P. nonda* near the margin. They are extremely small, round, glossy brown (in sicco) and sunk in the middle. Sometimes and for unknown reasons they develop into protruding, black (in sicco) tissue dots. I could observe some fungus-growth at the border of these dots; they might represent fungus growth on the exudate of the glands. The base of the leaf at both sides of the petiole may show some obscure glandular (swollen) tissue on the lower leaf surface. The shape and dispersal of glands is in principle not different from that of species of Prunoideae (cf. *Prunus* and *Pygeum*,

Dorsey and Freeman Weiss *in Bot. Gaz.* 69: 391. 1920 and Kalkman *in Blumea* 13: 15. 1965) and hence form an argument against the splitting off of Chrysobalanoideae as a separate family.

The cylindrical petioles are always well-developed; in young leaves they are densely pilose; they become later glabrous and corky with transverse cracks. In a young stage glands are visible, which are very characteristic for the entire genus. They are, however, not present on all petioles of a specimen. They are round, protruding, glossy black and very tiny. They are attached somewhat lateral at the upper side of the petiole, usually near or at its middle or farther down at unequal distances; there are never more than 2 glands.

Pilosity. The hairs are always simple. There are usually two layers of hairs, the fugaceous cobweb-like, grey hairs on young leaves and branchlets and flowers (where they are persistent) and on top of that stiff, glossy, more or less adpressed hairs. Typical are the white silky strigose hairs at the base of the ovary, which are inversely placed.

Inflorescence. This represents a panicle, which is leafy. We many consider the inflorescence to be terminal in almost all cases. The partial panicles in the axils are short and usually very dense; they have a dense indumentum of silky, rather coarse hairs. Before or even at anthesis the buds are completely covered by large, deciduous bracts and bracteoles, which are as a rule ovate, acute, strongly concave, densely hirsute outside and glabrous inside. The base of the developing inflorescence is surrounded by numerous bud scales of the same shape as the bracts.

The flowers are either sessile or very shortly pedicelled. The calyx has a definite shape, which is a usefull specific characteristic; it is either long and deep or shallow and cupshaped (*P. nonda*); at one side it shows a bulge (gibbose) near its throat, where the ovary is attached. The calyx is densely pilose outside, glabrous inside, except below the throat. The calyx lobes are pilose on both sides, they are explanate at anthesis. There are usually 7—8 fertile stamens (rarely 10), of unequal length, inserted on a short thin, stiff rim; the staminodes are represented by short teeth on the rim. The glabrous filaments are slender and bear the anthers, which dehisce longitudinally. The ovary is always hirsute and bears a short style (not or only slightly exceeding the anthers), which is glabrous or pilose in its lower part. The stigma is inconspicuous.

Fruit. The fruit are very characteristic and uniform in texture in the entire genus. Their shape varies between globose to laterally compressed ellipsoid or laterally compressed club-shaped; most common is the laterally compressed ellipsoid form; the apex is rounded, truncate or even sulcate

and usually unequal, sometimes there are a few obscure, thick, longitudinal ribs and often the fruit is irregularly bumpy. The outer, rather thin layer (of about 2—3 mm) consists of hyaline, radial spindles, which are soft and sugary when the fruit is fully ripe, the spindles are aranged radially. The outside of the fruit is covered with very thin, somewhat circular scurvy, small, pale spots, sometimes called scales (which they are not); apparently they develop from bases of the hairs, present on the ovary. The mesocarp shows in cross-section a marmorate appearance; this is caused by very coarse fibres and an intermediate layer of a more amorphous tissue. The endocarp is again thin and consists of a layer of concentric fibres. There are two cavities, each surrounded by these concentric fibre-layers. The inside of the endocarp has a very dense layer of cotton-wool like rusty brown felt, which fills the cavity, except for the spindle-like laterally flattened seed with thin seed-coat. Usually only one seed develops. After falling, the outer soft layer rots away or is eaten by animals, mostly insects, although horn-bills are also after the fruit; the bony meso- and endocarp remain intact. It is not known, how the germination starts.

The genus is divided here into two sections: § *Parinari* with stomatal areoles and § *Anareolata* without these.

KEY TO THE SPECIES *)

- 1a. Lower leaf surface glabrous, without stomatal areolation.....2
- b. Lower leaf surface with stomatal areolation, consisting of very broad, thickened, glossy veinlets with small, deeply sunk areoles with a grey cobweb-like felt of hairs in between.....3
- 2a. Leaves elliptic to oblong or subobovate-elliptic, 4.5 X 9.5 to 7 X 20.5 cm; lateral nerves 11—15 pairs. Panicles silvery silky, large.....1. *P. argenteo-sericea*
- b. Leaves ovate, 3 X 4 to 5 X 8 cm; lateral nerves 7—10 pairs. Panicles subsericeous.....2. *P. canarioides*
- 3a. Leaves with tiny glands along the margin of the lower surface. Calyx shallow, cup-shaped.....11. *p. nonda*
- b. Leaves without glands. Calyx long, trumpet-shaped or subcylindrical.....4
- 4a. Leaves with 23—33 pairs of lateral nerves, rigidly coriaceous, 5 X 15.5 to 9 X 20 cm. Panicles large, very robust, terminal, 10—22 cm long and 9—12 cm wide. Petioles 10—17 mm long.....8. *P. oblongifolia*
- b. Leaves with up to 24 pairs of lateral nerves**). Leaves chartaceous to coriaceous, usually smaller. Panicles slender, shorter. Petioles up to 8 mm long (except in *P. metallica*, where they are 12—20 mm long).....5
- 5a. Upper leaf surface with a metallic sheen. Petioles 12—20 mm long.....
3. *P. metallica*
- b. Upper surface without a metallic sheen. Petioles up to 8 mm long.....6

*) Not included: *P. walliehiana* and *P. gigantea*

**) The lateral nerves in the acumen are not included.

- 6a. Leaves lanceolate to ovate-lanceolate.....7
 b. Leaves ovate to elliptic or ovate-elliptic.....8
 7a. Panicles white-silvery, well-developed. The lateral nerves decurrent along the midrib; leaves chartaceous.....9. *P. polyncura*
 b. Panicles short, rusty; the lateral nerves not decurrent; leaves rigid
 10. *P. rubiginosa*
 c. Panicles reduced to bracteate racemes, short; lateral nerves not decurrent; leaves chartaceous.....4. *P. elmeri*
 8a. Leaves chartaceous.....5. *P. parva*
 b. Leaves rigidly chartaceous to rigidly coriaceous.....9
 9a. Leaves ovate with a long acumen.....10
 b. Leaves elliptic or elliptic-subovate with a short acumen.....11
 10a. Leaves rigidly coriaceous with 13—17 pairs of lateral nerves. . . . 7. *P. ashtonii*
 b. Leaves stiffly chartaceous to coriaceous with 8—13 pairs of lateral nerves.....
 18. *P. insularum*
 11a. Leaves large, 6 X 17.5 — 8.5 X 25 cm, rigidly coriaceous; branchlets grey-pilose
 6. *P. rigida*
 b. Leaves smaller, less stiff.....12
 12a. Leaves coriaceous; lower surface white. Inflorescences condensed
 12. *P. bicolor*
 b. Leaves rigid, inflorescences not condensed.....13
 13a. Inflorescences slender, large, terminal, open, pale brown rusty
 13. *P. anamsnse*
 b. Inflorescences axillary, small, grey.....14
 14a. Leaves with a long acumen, base subcordate.....14. *P. helferi*
 b. Leaves with a much shorter acumen, base rounded or acute.....15
 15a. Leaves with 12—15 pairs of lateral nerves. Stipules lanceolate or linear. Leaves distinctly acuminate, 2 x 4 — 4.X 9 cm.....17. *P. costata*
 b. Leaves with 9—11 pairs of lateral nerves; very shortly acuminate. Stipules oblong to ovate-oblong. Leaves very shortly acuminate, 3 x 7 — 7 X 12 cm ...
 15. *P. sumatrana*

Sectio Anareolata Kosterm., *sect. nov.*

Foliis subtus glabris nee areolatis. Species 1—2.

1. PARINARI ARGENTEO-SERICEA Kosterm. — Fig. 1.

PARINARI ARGENTEO-SERICEA Kostermans in Reinwardtia 7: 47, fig. 1. 1965 — *San 16175* (BO).

Tree 25—33 m tall and 25 cm and more in diam.; bark lenticellate, brown; outer bark hard; inner bark red, hard, 1.2 mm thick; cork cambium red; cambium yellow; branchlets dark purplish brown with numerous pale tiny lenticells, glabrous. Leaves glabrous, chartaceous, elliptic to oblong or subovate-elliptic, 4.5 x 9.5—7 x 20.5 cm, base rounded, apex shortly, often obscurely acuminate; upper surface glossy, midrib impressed (except for its basal 1—4 mm, which shows protruding tissue from the petiole), lateral nerves filiformous, reticulation prominulous or inconspicuous; lower leaf surface dull, paler, lateral nerves 11—15 pairs, erect-patent (the lower

ones patent), secondary nerves rather lax, prominulous; base of leaf below near the petiole insertion rarely with glandular tissue. Stipules lateral, lanceolate (base 2 mm wide), acute, adpressed strigose especially along its midline outside, 8 mm long, early caducous. Petiole 5—9 mm, glandless.

Panicles terminal, up to 9—15 cm long, lax, densely white sericeous-tomentellous (hairs more or less adpressed), except for peduncle and main branches which are more white tomentellous; bracts ovate, acute, densely white tomentellous outside, caducous. Pedicels 1—3 mm long; calyx infundibuliformous, gibbose, rather slender, densely white tomentellous, 2—3 mm long; lobes 1.5—3 mm long, ovate-lanceolate or narrowly triangular, densely white tomentellous outside, inside densely pilose; petals spatulate, 2 mm long; fertile stamens 7—8, 1.5 mm long on a 0.5—1 mm high rim, the sterile ones toothlike on an 1 mm high rim; style slightly shorter than the stamens, apex (stigma) truncate, somewhat triangular; ovary with a dense layer of long, white, glossy strigose hairs, which cover (in a reverse direction) also the upper part of the inside of the tube.

DISTRIBUTION: N. Borneo.

The species is outstanding by its glabrous, lower leaf surface and the terminal, silvery sericeous large panicles.

S a b a h (N. Borneo), Lahad Datu, Pangaruan Camp site, mile 6V2 on Kennedy Bay Timber Co's Rd., 15 miles E.E.W. of Lahad Datu, alt. 40 m, March, fl., *Wood, San 16175* (A, BO, BRI, K, KEP, L, SING); Sandakan, Cpt. 17, Sepilok For. Res., 15 miles W. of Sandakan, May, fl., *Wood, San 16535* (A, BO, BRI, K, KEP, L, SING); Sandakan, Jalan Kabili, boundary Sepilok For. Res., alt. 10 m, May, post anthesis, *Singh, San 21399* (BO, K); Pokul R. bank, alt. 7 m., March, buds, *Mail, B.N.B.F.D. 2875* (BO, K).

2. PARINARI CANARIOIDES Kosterm. — Fig. 2.

PARINARI CANARIOIDES Kostermans, New and crit. Mai. PL (Forestry Dept. Bureau of Planning, Indon.) 3: 25, t. 12. 1955. — *Kostermans 7152* (BO).

Tree, up to 60 m high and 100 cm in diam. Crown elongate or subglobose, dense. Buttresses 1.5—2.5 (—5) m high, extending 1—2 m over the ground. Bark rather smooth, irregularly fissured and flaking, pinkish grey to pale brown, pustular, 0.5 mm thick; living bark 10 mm., brown to orange brown, hard. Sapwood 1—6 cm, yellowish, merging into the brownred heartwood. Branchlets sparsely, minutely pilose (hairs patent). Stipules (only on the flush) linear, acute, slender, up to 5 mm long, hirsute, lateral to the petiole. Branches brown, slender, smooth, lenticelled. Leaves chartaceous to rigidly chartaceous or sub-coriaceous, glabrescent (in young leaves midrib on both surfaces sparsely hirsute), ovate, 2—5 x 4—8 cm, prominulously reticulate on both surfaces, base subcordate (in young leaves' acute) or truncate, apex broadly acuminate with acute tip; midrib and lateral nerves impressed on the upper, prominent on the lower surface, the slender lateral nerves 7—10 pairs, somewhat arcuate. Petiole 3—5 mm,

hirsute, glabrescent, glandless or glands small, round, about the middle of the petiole.

Panicles dense, axillary, up to 3 cm long, densely sub-sericeous. Bracts numerous, persistent at anthesis. Calyx tube narrowly funnel shaped, 3 mm; lobes narrowly elliptic, concave, acute, 2 mm, outside glabrescent, inside densely, minutely pilose. Petals elliptic, obtuse, tapering to the base, 2 mm. Fertile stamens about 8. Fruit ellipsoid, usually flattened, 1.5–2 cm in diam., up to 5 cm long, obscurely ribbed, smooth, partly or completely covered with numerous pale scabs; exocarp 1 mm, soft; mesocarp 5 mm, with marble-like spots and holes, endocarp thin; fruit with 2 cavities of which one contains a seed; cavities with a dense layer of brown, woolly hairs.

DISTRIBUTION: Sumatra, Borneo.

USE: The timber is of inferior quality, but was exported in great quantities from S. Sumatra (Lampongs) to Java (Gusdorf); the seeds are edible.

The species is often mistaken for a *Shorea* (Dipterocarpaceae) because of its leaves and stipules. Hence it is mixed with meranti (*Shorea* timber), but only in small quantities. It is outstanding by the lack of a stomatal areolation on the lower leaf surface.

S u m a t r a : Kuantan Distr., Tjerintji, ster., 66. 25221 (A, BO, L); Djambi Distr., Tebingtinggi, alt. 13 m, ster., *bb*, 13650 (BO); Lampong Distr., Tulangbawang, Menggala, alt. 10 m, Jan., fr., 66. 77U (BO, K, L); *ibid.*, Dec, fr., fl., *Gusdorf* 66 (BO); B o r n e o : Sarawak, Distr. Lundu, Mt. Gading, alt. 800 m, Oct., fr., *Anderson c.s.* 15386 (A, BO, K, L, SAN, SING); Brunei: Ulu Supon, Tutong, ster., *Ashton Brim.* 854 (K); *ibid.*, Kuala Belalong, ster., *Ashl.on Brim.* 5669 (K); W. K a l i m a n t a n (Indon. Borneo), Sambas Distr., Perigi Limus, Mt. Sedjudjuk, alt. 200 m, ster., 66. 7056 (BO, L); "E. Kalimantan, Nunukan Isl., N. part, sandy, alt. 20 m, Oct., fl., *Kostennans* 861+6 (A, JBISH, BM, BO, Bill, CAL, K, L, NY, P, PNH, SING); W. Kutei, Sebulu, alt. 20 m, ster., 66. 1571)7 (BO, L); *ibid.*, Kelumpang, alt. 30 m, ster., 66. 16921 (BO, L); E. Kutei, Sangkulirang Distr., Rantaubahan, alt. 18 m, ster., 66. 15256 (BO); Samarinda Distr., Loa Djanan, alt. 60 m, ster., 66. 3231^9 (A, BO, L); *ibid.*, Tandjong Bangko, Mouth of Mahakam R., sandy, June, fr., *Kostennans* 7152 (A, BISH, BO, Bill, CAL, CANB, K, L, LAE, MEL, NY, P, PNH, SING); Balikpapan Distr., Mentawir R., alt. 20 m, July, young- fr., *Kostermans* 10759 (A, BO, K, L, SING); *ibid.*, Febr., fl., *Koslermans* 10017 (A, BISH, BM, BO, BRI, CAL, CANB, K, KEP, L, LAE, NY, P, PNH, SING, SYD); Distr. Tanah Bumbu> Kampong Baru, alt. 25 m, Jan., fr., 66. 13312 (BO).

Sectio II: PARINARI; lower leafsurface with stomatal areoles. *)

3. PARINARI METALLICA Kosterm. — Fig. 3.

PARINARI METALLICA Kostermans in Reinwardtia 7: 49, fig. 3. 1965 — *Ashton, Brun.* 3267 (SAR).

*) *P. elmeri* does not show this areolation. In the material at hand only young leaves are present.

Understory tree ca 16 m tall, 25 cm in diam., clear bole to 12 m; bark smooth, purplish; crown broad lanceolate; branchlets stout, crooked, dark, brown, lenticellate; the youngest ones adpressed strigose, soon glabrous. Leaves rigidly chartaceous to coriaceous, elliptic, 3.5 x 8 to 9 x 17 cm, base rounded or shortly acute, apex very shortly acuminate, but usually obtuse, upper surface very glossy with a grey metallic sheen, midrib flat, lateral nerves filiform, prominulous, secondary nerves prominulous, but usually inconspicuous; lower surface in young leaves with a dense layer of woolly cobweblike, brown hairs, soon glabrous; in adult leaves a very dense and intricate areolation present with flattopped veins and hardly any interspace (which is pilose), midrib strongly prominent, lateral nerves 10–13 pairs, erect-patent, straight (curved at margin), prominent. Petioles 12–20 mm long, glabrescent, becoming corky. Stipules ovate-lanceolate, acute, densely brown pilose, ca 8 mm long, early caducous.

Panicles axillary, rather narrow, little branched, densely brown tomentellous, 4–10 cm long; base surrounded by numerous bud scales; bracts early caducous. Flowers cream; in dried condition rusty pubescent; calyx gibbose, 2–3 mm long; lobes lanceolate, acute, 1 mm long; petals lanceolate, glabrous, slightly longer than the calyx lobes; fertile stamens about 8; filaments ca 2 mm long; staminodial ones represented by short teeth; rim short; ovary densely silky strigose; style glabrous, as long as the stamens, stigma truncate.

DISTRIBUTION: Brunei.

Characteristic are the grey metallic upper surface, the long petioles, the obtuse leaves with the extremely dense areolation and the short axillary inflorescences.

The species falls within the alliance of *P. sumatrana* Bth.

B r u n e i : Andulau For. Res., undulating hills, yellow sandy loam, alt. 50 m, July fl., *Ashton Brun.* 3267 (BO, K, L, SAR); Bukit Teraja, mile 211/2, alt. 300 m, yellow, sandy clay, Sept., fl., *Ashton Brun.* 673 (BO).

4. PARINARI ELMERI Merr. — Fig. 4.

PARINARIUM ELMERI Merrill in Univ. Calif. Publ. Bot. 15: 92. 1929. — *Elmer* 20806 (UG).

Tree up to 10 m high and 20 cm in diam., without buttresses; crown lanceolate; bark pale cream or grey and white mottled, roughened by pale green excrescences; outer bark soft, thin, inner bark orange, hard, 2.5 mm thick; sapwood white, thin, heartwood straw, hard. Branchlets slender, brown, glossy, lenticels rather obscure; the youngest branchlets densely, minutely, pale brown tomentellous or villous. Leaves chartaceous, lanceolate to oblong-lanceolate, 1.5 x 5 to 7 x 18.5 cm, base contracted into the petiole, apex acuminate with a sharp tip; upper surface rather dull, scabrous to the touch, midrib slender, slightly impressed, pilose, glabres-

cent, veins very slender, rather obscure; lower surface covered with a dense felt-like tomentum of very fine, adpressed hairs, midrib prominent with strigose, adpressed hairs, lateral nerves 15—20 pairs, rather patent, straight, prominent, arcuate at margin; secondary nerves parallel, perpendicular to the lateral nerves, reticulation obscure. Petiole slender, pale brown tomentilous, 1.5—3 mm long, glandless. Stipules of the flush large, lanceolate, very acute (aciculate), tomentilous, up to 15 mm long, lateral. Panicles reduced, racemelike, axillary, 1.5—3 cm long, densely rusty or pale brown pubescent; bracts persistent, ovate, acute, pubescent, 2 mm long. Pedicel slender, 0.5—2 mm long, densely pubescent, without bracteoles. Mowers densely yellowish brown pubescent; calyx funnel shaped, gibbose, up to 3 mm long, like the ovate, acute, up to 2—3 mm long lobes outside covered with a very dense intertwined very fine woolly indumentum; petals white, oblong-obovate, 2—3 mm long, obtuse, narrowed towards the base; fertile stamens 7—10, almost 2 mm long, inserted one-sided on a very low rim; staminodes teeth-like; ovary densely villose; style glabrous, short, the truncate top level with the anthers.

DISTRIBUTION: Brunei, N. and E. Borneo.

The species was not rare in the region around Teluk Bajur, although only a few collections exist in herbaria.

It is outstanding by its white felt-like tomentum of the lower leaf surface without having the areolation, usually combined with such a tomentum.

The inflorescence are strongly reduced and may have only 2 flowers.

The indumentum of the calyx is easily observed when the tube is torn apart in dissecting.

Brunei: Bukit Biang, Temburong, alt. 150 m, ster., *Ashton Brim. 497* (BO, K, SAR); Sabah (N. Borneo); Tawao, Elphinstone Prov., fl., *Elmer 20806* (BISH, BO, BR, C, DC, DS, F, GH, L, MO, P, S, UC); E. Kalimantan (Indon. Borneo); Bersyi, near Teluk Bajur, alt. 30 m, ster., *Kostermans s.n.* (BO, K, L).

5. PARINARI PARVA Kosterm. — Fig. 5.

PARINARI PARVA Kostermans in *Reinwardtia* 7: 52, fig. 5. 1965. — *Boden Kloss U+676* (K).

Tree, 8—10 m tall and 20 cm in diam. with dense, few-branched crown; bark dark grey, grey-mottled, smooth; bole fluted; branchlets glossy, dark purplish brown, lenticellate, the youngest branchlets densely rusty tomentilous. Leaves chartaceous, elliptic to oblong, 5.5 x 11 to 10 x 21 cm (to 11 x 30 cm), base rounded, apex shortly acuminate with sharp tip; upper surface glabrous (pilosity on midrib often sub-persistent), midrib flat, lateral nerves filiformous, reticulation obscure; lower surface prominently reticulate (veins not broad and not flattened above), areoles filled

with a mat of white, cobweb-like hairs, midrib prominent, adpressed pilose, lateral nerves prominent, 11—21 pairs, widely spaced, erect-patent, straight (except at margin), adpressed pilose. Petioles short, about 5—8 mm long, densely pale brown pilose; glands not seen. Stipules lateral, ovate-lanceolate, acute. 5—6 mm wide at base, 6—25 mm long, densely, shortly pilose and ribbed outside.

Panicles short (up to 5 cm long), hardly and shortly branched, raceme-like, densely pale brown tomentilous; bracts present at anthesis, those at the base of the ramifications ovate, acute, 5 mm long. Pedicels short, densely tomentilous, 1—1.5 mm long. Flowers dull pale-brown, calyx tube 3 mm long, lobes slender, ovate-lanceolate, acute, 1—1.5 mm long, densely, shortly pilose. Petals white.

Inflorescence 1.5—4 cm long with a single fruit, pilose. Fruit ellipsoid, rather slender, up to 2 x 4 cm, flattened laterally, sulcate, apex unequally emarginate and truncate, completely covered by a grey brown, scab-like substance.

DISTRIBUTION: Malay Peninsula, Sumatra.

The species is close to *P. sumatrana* by the characteristics of the fruit and stipules; it differs by the larger, chartaceous leaves, the number of lateral nerves, the pilosity of the leaves, the smaller and more slender fruit; the leaves are never ovate-elliptic as in *P. sumatrana*. The species is also near *P. elmeri* by the shape and size of the inflorescence with the persistent bracts, but the leaves are different.

Malay Peninsula: Pahang, Sg. Tahan, July, buds, *Kiah S.F.N. 31720* (SING); "ibid., Aug., fr., *Holtum S.F.N. 20065* (BO, E, SING); Sumatra: Mentawai Isl., Sipora, vicinity of Sioban, Oct., fl., *Iboet 368* (BO); ibid., Oct., fl., *Boden Kloss U676* (BO, K); Palembang, Lematang Ulu, Oct., fr., *Lambaeh 1229* (BO, K, L).

6. PARINARI RIGIDA Kosterm. — Fig. 6a, & b.

PARINARI RIGIDA Kostermans in *Reinwardtia* 7: 53, fig. 6. 1965. — *S.F.N. 40773* (SING).

Tree; branchlets with a grey felt of cobweblike hairs. Leaves rigidly coriaceous, elliptic or oblong, 6 x 17.5 — 8.5 x 25 cm; those near the inflorescence diminishing to 3 x 9.5 cm, base rounded, apex shortly, broadly acuminate with sharp tip; upper surface glossy, glabrous, sometimes obscurely bullate, midrib accompanied by two rows of small bumps (in sicco), flat, lateral nerves filiformous; secondary nerves visible; lower surface in young leaves rusty tomentilous; in adult leaves with stomatal areoles (not very deep) with a matting of white cobweblike hairs in the areoles; veins flat-topped or rounded; midrib strongly prominent, densely, minutely rusty pilose, glabrescent, lateral nerves prominent, rather spaced, about 17—20 pairs, erect-patent, slightly curved (more at margin); in young leaves obscure glandular tissue on the lower surface at both sides

of the midrib-base. Petioles stout, 5—8 mm long, bearing orbicular, tiny glands, grey-pilose, glabrescent, becoming corky and cracked.

Panicles narrow, terminal, densely fulvous, up to 13 cm long, lateral branches up to 2 cm long. Flowers densely villous, large, almost sessile; calyx infundibuliformous, 5 mm long; lobes 2—2.5 mm, elongate-triangular. Petals slightly longer than the calyx lobes, spatulate. Fertile stamens 6—8 with slender filaments, as long as the petals. Ovary densely silvery strigose; style slightly shorter than the stamens with swollen stigma.

DISTRIBUTION: Malay Peninsula.

The second collection is a flowering specimen. The leaves are somewhat smaller, but in other respects this specimen belongs certainly here. The species may be recognized by the branchlets with their grey felt and by the large flowers in narrow panicles and the short style.

Malay Peninsula: Kuantan, Pahang, July, fl., *Mahwood For. Dept. 8104* (SING); Trengganu, 34th m. Kuala Trengganu Besut Rd. (west side), lowland, Sept., young tree, *Sinclair & Kiak bin Salleh S.F.N. 40773* (SING).

7. PARINARI ASHTONII Kosterm. — Fig. 7.

PARINARI ASHTONII Kostermans in *Reinwardtia* 7: 53, fig. 7. 1965 — *Ashlon S. 17 281* (BO),

Tree 10—17 m tall, up to 20 cm in diam.; bark smooth, white mottled. Branchlets glabrous, dark purplish brown with tiny rather obscure lenticels, the youngest ones minutely 'adpressed pilose. Leaves rigidly coriaceous, ovate-oblong, 3 x 9 to 6 X 13 cm, base contracted into the petiole, apex gradually narrowed, acuminate, tip sharp; upper surface glossy, glabrous, midrib impressed (except near its base), lateral nerves filiform, impressed; reticulation dense, slightly bullate; lower surface areolate, but the nerves not flat, densely white cob-weblike, adpressed pilose (on the midrib adpressed strigose), midrib strongly prominent, lateral nerves 13—17 pairs, prominent, straight, erect-patent, curved at the margin; secondary nerves filiform, prominent, parallel. Petiole rather stout, pubescent, glabrescent, ca. 10 mm long, often with two small, dark round, slightly protruding glands on the upper surface, about the middle of the petiole.

Inflorescence with 2 rows of bud-scales at its base. Sepals ovate-lanceolate, 5 mm long; sterile stamens represented by broad, obtuse, almost 2 mm long, pubescent teeth, inserted on a thin, 1 mm high rim. Infructescence up to 13 cm long. Fruit irregularly ellipsoid, obtuse, 5 cm long, 3.5 cm in diam., with a pronounced basal neck; fruit more or less completely covered by a pale brown scaly substance.

DISTRIBUTION: Heath forest in Sarawak.

The species is related to *P. oblongifolia*, from which it differs by its leaf shape, the fewer lateral nerves and the different areolation of the

lower leaf surface; the fruit are smaller and of a different shape. The two known collection are from heath forest. • •

B o l' n e o : Sarawak; Bako National Park, sandstone plateau ca. 70 m alt., white sandy soil, June, fr., *Ashlon S. 17281* (A, BO, FHO, K, L, SAN, SING); 1 st. Div. Sampadi For. Res. off Batang Kayan, kerangas (heath forest) ridge, Aug., ster., *Sinclair & Kadim bin Tassim 10402* (BO, E, K, L, SAR, SING).

8. PARINARI OBLONGIFOLIA Hook. f. — Fig. 8.

PARINARIUM OBLONGIFOLIUM Hooker f. *Fl. Brit. India* 2: 309. 1878; King in *J. Asiat. Soc. Bengal* 66(2): 279. 1897; Ridley in *J. Roy. Asiat. Soc. Straits Br.* 30: 282. 1897; in *Agr. Bull. Straits & Fed. Malay St.* 1: 144. 1902; Mai. Timmerhout-soorten in *Bull. kolon. Mus. Haarlem* 27: 58. 1903; *Fl. Malay Pen.* 1: 668. 1922; Schneider in *Bull. 14, Bureau For. Philipp.* 114. 1916; Foxworthy in *Malay. For. Rec.* 3: 175 et 176, tab. 1927; Heyne, *Nuttige Pl. Ned. Ind.*, ed 2, 1: 698. 1927; ed. 3, 1: 698. 1950; Burkill, *Diet. econ. Prod. Malay Pen.* 2: 1667. 1935; Corner, *Wayside Trees Malaya* 1: 527. 1940. — *Ferolia ohlongifolia* (Hk. f.) O. Kuntze, *Revisio Gen. PL* 1: 216. 1891. — *Griffith s.n.* (K), holo-typus; *Maingay Kew Distr.* 623 (K), paratypus.

Parinarium borneense Merrill in *Univ. Calif. Publ. Bot.* 15: 93. 1929. — *Elmer 21396* (UC), holotypus; *VUlamil 28* (UC), paratypus.

Tree, up to 35 m high and 50—100 cm in diam., buttresses 60 to 200 cm high, thick, out 50—150 cm; bark smooth, grey or pale brown, paperthin, inside dirty white; living bark reddish-brown to brown, 6—12 mm thick. Sapwood 3—5 cm, white or pale yellow; heartwood reddish, hard. Branchlets stout, densely, minutely rusty tomentellous; branches brown, glossy with numerous pale, small, roundish lenticels. Leaves coriaceous to rigidly coriaceous, elliptical to oblong, 5 x 15.5 cm to 9 x 20 cm (to 13 x 30 cm in sapling), base suocordate or rounded, apex shortly, broadly acuminate; upper surface glossy, glabrous (except the long-persistent adpressed hairs on the flat-topped midrib), midrib in the same plane as the leaf surface, in dried specimen often sunken along the middle line, lateral nerves filiform; secondary nerves rather inconspicuous; lower surface either grey or green (living condition), in dried condition conspicuously areolate with broad, flat-topped veins; the stomatal areoles with a dense, felt-like, grey indumentum; midrib stout, prominent, glabrescent, lateral nerves 23—33 pairs, rather erect, slender, straight, curved at margin only; secondary nerves dense, parallel, prominulous, perpendicular to the lateral nerves; no glands and no axillary membranes. Petiole stout, rusty tomentellous, glabrescent, glandless, 1—1.7 cm long. Stipules ovate or lanceolate, acute, 2—4 cm long, inside glabrous, outside densely silky pilose, caducous in a very early stage of leaf development.

Panicles terminal, yellowish green (fresh), densely grey-yellowish tomentellous, up to 10—22 cm long and 9—12 cm wide with a stout peduncle, at base surrounded by numerous ovate, acute, pubescent, 3 mm long bud

scales; few, stout, stiff ramifications; bracts and bracteoles caducous at anthesis. Pedicel 1—3 mm long, slender, without bracteoles. Flowers white, scented, densely silky yellowish grey pilose; calyx infundibuliformous, somewhat gibbose, 3 mm long; lobes ovate, acute, unequal, 1.5—2 mm long; petals white or pale blue, spatulate or lanceolate, about 2 mm long, longer than the calyx lobes, glabrous, narrowed towards their base. Stamens about 10, as long as the petals, about 1.5 mm long, unilateral, inserted on a thin, short rim; the sterile stamens represented by short teeth; ovary densely adpressed strigose; style glabrous, short (as long as the stamens); stigma truncate, inconspicuous.

infructescence thick, consisting of the basal part of the inflorescence, 4—8 cm long, bearing only one or a few fruit. Fruit ellipsoid to broadly ellipsoid, somewhat flattened lateral, 3.5 x 8 cm (or 4 x 5 cm in the broad fruit), slightly tapered at base, apex rounded, slightly sunken along the median line on the flattened surface; more or less completely covered by small pinkish grey scale-like spots; 2-celled; exocarp leathery, 1.5—2 mm thick; mesocarp coarsely fibrous, 7—10 mm thick; endocarp membranous, covered with a dense layer of woolly, rusty hairs; seeds narrowly ellipsoid.

DISTRIBUTION: Malay Peninsula, Sumatra, Borneo, from sealevel to 450 m altitude, scattered.

VERNACULAR NAMES: Mengkudu (East Indon. Borneo); merbatu (Malay Peninsula).

The vernacular name of the Ridley specimen is indicated as balau; balau, however, is the proper name of a *Shorea* species. As *P. oblongifolia* is nowhere common, and apparently not used by natives, it is often mistaken for a *Shorea* species. Hence all the vernacular names on the labels of the Indonesian specimens are wrong.

The species is easily recognized by its large, stiff leaves with numerous lateral nerves, the subcordate base, the flat midrib on the upper surface, the lack of glands and by the stout branchlets and inflorescences.

Malay Peninsula: Pahang, 37.6 miles from Kuantan to Jerantut, low, Febr., fr., *Wood, Kep. 76128* (BO, SING); *ibid.*, Sg. Chenee, April, fr., *Fox 5026* (SING); *ibid.*, Kuala Lipis, Aug., fl., *Phillips C.F. 660* (K, SING); *ibid.*, Ulu Rompin, May, fr., *Foxworihy F.D. 3223* (K, SING); *ibid.*, Sg. Sat, Ulu Tembling, July, fr., *Henderson 21976* (E, K, SING); Perak, Ulu Bubong, open bamboo jungle, July, fl., *King's Coll. 10422* (BO, K, P, SING, US) et *10369* (LE, SING); Kelantan, Sg. Betis, S. Nenggiri, July, fl., *Henderson, S.F.N. 29670* (BO, GH, K, SING); *ibid.*, South end of Bukit Batu Papan, S. Lebir, low alt., July, fl., *Henderson, S.F.N. 29619* (BO, K, SING); Malacca, Sg. Udang, fl., *Ridley 933* (SING); *ibid.*, fl., *Griffith s.n.* (BO), distributed as *Hopea*; *ibid.*, fl., *Maingay Kew Distr. 623* (—3307) (K); Johore, Sg. Sedili, low, July, young fr., *Ngadiman, S.F.N. 36910* (BO, GH, SING); Singapore, Mandai Rd., ster., *Kiah s.n.* (SING); *ibid.*, Stagsmount, star., *Ridley s.n.* (SING); *ibid.*, E. End of Seletar Reservoir, swampy, small tree, ster., *Sinclair, S.F.N. iO635*

(E, K, SING) (leaves 16 X 30 cm, petioles 13 mm long); Sumatra: E. Coast, As'ahan, Huta Padang near the Continental Plant. Concess., Nov. Dec, young fr., *Krukoff 4324* (BO, BR, LE, MO, SING); Inderagiri, Muara Serangge, 40 alt., ster., 66. 30132 (A, K, L); Tapanuli, Angkola & Sipirok, ster., 66. 3145 (BO, K, L); North Borneo (Sabah), Elopura, Kabili Sepilok For. Res., Cpt. 15, alt. 20 m., July, buds, *Enggoh B.N.B. F.D. 10U7* (BO, GH, K, L) et June, fl., *Engyoh B.N.B. F.D. 72J,9* (SING); *ibid.*, Cpt. 3, Subcpt. 2, Bombay-Burma T.C. Concess. Area, Kalabakam, 30 miles W.N.W. of Tawao, May, fr., *Wood, San A 31,60* (SING); Tawao, fl., *Elmer 21396* (BISH, BO, BR, C, DC, DD, F, GH, M, K, L, MO, P, S, SING, UC); W. Kalimantan (Indon. Borneo): Melawi, Tjatit, alt. 450 m, ster., 66. 25119 (A, BO, L); E. Kalimantan, Tidung, ster., 66. 17767 (BO, L) et 18325 (BO, L, SING); *ibid.*, Tataban, Dec, ster., 66. 18282 (BO, L); Bulungan, Salimbatu, S. Rumah, alt. 100 m., ster., 66. 11284 (BO, L) et 11278 (BO); Berau, Betemu Aer, ster., 66. 19076 (BO) et 19089 (BO, L); *ibid.*, Domaring, alt. 150 m, ster., 66. 18855 (BO, L); *ibid.*, Tdg. Redeb, periodically inundated, low, Nov., fl., *Kostermans 21665* (A, BO, CANB, G, K, L, P, SING, US); Sangkulirang Distr., Karangan R., N.W. of Sangkulirang, alt. 20 m, Aug., young fr., *Kostermans 13572* (A, BO, K, L, P, SING); W. Kutei, Upper Mahakam R., Lirung pundung, alt. 50 m, Jan., ster., 66. 20630 (A, BO, K, L); E. Kutei, Loa Djanan near Samarinda, sandy, alt. 30 m, April, young fr., *Kostermans 65U* (A, BO, BRI, K, L, LAE, NY, P, PNH, SING); *ibid.*, April, young fr., *Kostermans 6615* (SING); Balikpapan Distr., Sg. Tunan, alt. 30 m., ster., 66. 25591 (A, BO, K, L, SING); *ibid.*, Sg. Wain, N. of Balikpapan, alt. 40 m, sandy, ster., *Kostermans 4491* (A, BO, K, L); *ibid.*, Pemaluan, alt. 70 m, ster., 66. 24730 (A, BO, L, SING); Tanah Bumbu, Kp. Baru, alt. 25 m, Jan., fl., 66. 13314 (BO, L).

9. PARINARI POLYNEURA Miq. — Fig. 9a. & b.

PARINARIUM POLYNEURUM • Miquel, Fl. Ind. bat. Suppl. Sumatra 115. 1860 et 306. 1862; Hooker f., Fl. Brit. India 2: 309. 1878; Filet, Plantk. Woordenb. Ned. Ind., ed 2: 95. 1888; King in J. Asiat. Soc. Bengal 60(2): 278. 1897; Koorders & Valetton, Bijdr. Kennis Boomsorten Java in Meded. 'sLands Pl.tuin Buitenzorg 3: 340. 1901; de Clercq, Nieuw Pl. Woordenb. Ned. Ind. 299. 1909. — *Ferolia polyneura* (Miq.) O. Kuntze, Revis. Gen. Pl. 1: 216. 1891. — *Teijsm H.B. 4537* (U), Goenoeng Batin, Lampong.

Parinarium costatum (non Bl.) King in J. As. Soc. Bengal, I.e. 278 (quoad specim. *King's Coll. 5227*).

Tree, up to 30 m tall and 40 cm in diam. Buttresses small; free bole up to 20 m long. Branchlets pale brown or black, glossy, with numerous tiny, round, pale lenticels; young branchlets densely shortly puberulous. Leaves rigidly chartaceous, oblong to lanceolate, rarely ovate, 1.5 x 4.5 to 4.5 x 12 (—16) cm, base contracted into the petiole, apex acuminate; above glabrous, glossy, lateral nerves filiformous, somewhat prominulous, reticulation rather obscure; lower surface with a dense stomatal areolation, pilose within the areoles, glabrescent, midrib prominent, lateral nerves erect-patent, straight (arcuate only near margin), 15—24 pairs, bases with axillar membranes, which continue along the midrib as a narrow, thin band (high magnification!); secondary nerves numerous, parallel, perpen-

dicular to the lateral nerves, with a broad upper surface like the nerves; margin of the leafbase near the petiole often with irregular, scanty glandular tissue. Petioles short, 3—5 mm, without glands, densely puberulous, glabrescent. Stipules not seen, apparently broad-based; caducous in an extremely early stage.

Panicles terminal and axillary; densely grey, silky, adpressed pilose, 6—10 cm long; flower buds completely covered by ovate-acute silky pilose, caducous bracts. Flowers almost sessile; calyx densely silky adpressed pilose, about 4 mm long with infundibuliform, assymetric tube and about 1 mm long ovate, acute lobes, which are silky on both surfaces; petals spatulate, glabrous, longer than the calyx lobes, narrowed towards the base; stamens about 10, one-sided on a short rim; anthers 1.5—2 mm long with large anthers; filaments shorter than the petals; ovary densely strigose-silky; style glabrous, shorter than the stamens with a round disk like stigma.

Infructescence stout, bearing only a few fruit, up to 6 cm long. Fruit pedicel 5 mm long and 5 mm in diam., covered with the same scaly substance as that of the fruit. Fruit oblong-, somewhat tapered towards the base, compressed laterally, covered with a more less continuous layer of a scaly grey substance; fruit with irregular wide furrows and bulges, apex truncate or saddle-shaped. Fruit 2-celled, consisting of a dark glossy outer-layer, 1—1.5 mm thick (green when alive) of which the inner % consists of fibres perpendicular to the wall; mesocarp very coarse-fibred, 6—8 mm thick; endocarp very thin with a dense layer of brown, long, woolly hairs; fruit cells two; seed ellipsoid; seedcoat brown.

DISTRIBUTION: lowland of the Malay Peninsula, Sumatra.

Malay Peninsula: Perak, Gopeng, July, fl., *King's Coll.* 4624 (SING); ibid., May, fr., *King's Coll.* 6087 (K, P); Larut, Nov., young-fr., *King's Coll.* 5227 (P); locality not indicated, buds, *Griffith s.n.* (BO, L); S u m a t r a: Inderagiri Upper Lands, Keritang, alt. 40 m, ster., *bb.* 28645 et 28662 (BO, L); Belimbing, alt. 6 m, ster., 66. 28500, 28559 et 28548 (A, BO, L); Palembang, Banjuasin & Kubu regions near Bajunglintjir, alt. 15 m, March., fr., *Thorenaar 45 T. IP.* 58 (BO, L); id., Febr., buds, *45 T. IP.* 58 (BO); ibid., Aug., fr., *45 T. IP.* 58 (BO); ibid., Dec, fr., *Grashoff 898* (BO, L); Lampong Distr., Mt. Batin, ster., *Tepsmann H.B.* 4537 (BO, U).

The species is very close to *P. rubiginosa*, which has coriaceous leaves with longer petioles with often 2 round glands near the apex and a different indumentum of the inflorescences and flowers. *P. rubiginosa* may represent only a mountain variety of *P. polyneura*.

10. PARINARI RUBIGINOSA Ridley — Fig. 10.

PABINARIUM RUBIGINOSUM Ridley in *3. Asiat. Soc. Straits Br.* 75: 29. 1917; Fl. Malay Pen. 1: 668. 1922; Foxworthy in *Mai. For. Rec.* 3: 175 et 176. 1927; Burkill, *Diet. econ. Prod. Mai. Pen.* 2: 1667. 1935. — *Parinarium, costatum* BL, var. *rubiginosum* Ridley in *J. Feder. Malay St. Mus.* 6: 143. 1915 — Padang across Tehu, *Ridley* (SING).

Tree up to 40 m high and 90 cm in diam.; free bole up to 25 m tall; bark smooth, slightly cracked, grey, 0.5 mm; living bark 6 mm, pale reddish; wood pale brown, darker towards centre; branchlets brownish or brownish black with numerous tiny, pale lenticels; the youngest branchlets densely, minutely yellowish brown tomentellous. Leaves coriaceous to stiffly coriaceous, ovate-lanceolate to lanceolate, 1.5 x 5 to 4.5 x 12 cm, base acutish or contracted into the petiole, apex acuminate or obscurely acuminate; upper surface glossy, glabrous, lateral nerves filiformous, prominulous, midrib flat or slightly impressed, minutely tomentellous, glabrescent; lower surface yellowish or brownish grey, densely tomentellous; lateral nerves 12—20 pairs, slender, erect-patent, straight (at margin arcuate), axil-membranes hardly developed, no membrane along the midrib, reticulation (stomatal) dense; secondary nerves dense, parallel, filiformous. Petiole 6—8 mm long, densely tomentellous, often with 2 round, small glands on the upper, flattened surface near the middle of the petiole. Panicles axillary and terminal, densely, minutely yellowish or rusty tomentose (the hairs not adpressed), up to 3—6 cm long; the large ovate, acute, concave bracts enveloping the buds, caducous. Flowers densely rusty tomentellous; calyx 2.5 mm long, lobes 1.5—2 mm, ovate, acute, pilose on both surfaces, petals spatulate, narrowed at base, shorter than the calyx lobes. Fertile stamens 10, about 1.5 mm, shorter than the petals; ovary villous; style short, villous at base. Fruit pedicel thick, up to 7 mm in diam. at apex, 5 mm long. Fruit ellipsoid, flattened laterally, up to 5 cm long, 3.8 cm wide and 2 cm thick, smooth, glossy, with tiny non-confluent, pale scale-like dots; apex truncate or rounded, a longitudinal depression in the middle of the flattened surface.

DISTRIBUTION: Malay Peninsula and Borneo in montane forest.

VERNAC. NAME: Mengkudur (Balikpapan).

Very close to *P. polyneura* from which it differs by the slightly longer petioles (except in the specimen: *Clemens 50081*) with round glands and especially by the reddish or yellow villous tomentum of branchlets and inflorescences; the tomentum is silky and adpressed in *P. polyneura*.

The way Ridley keys out *P. rubiginosa* and *P. polyneura* is ridiculous:

Leaves 5 in. long, elliptic, wide.....*P. polyneurum*
Leaves stiffly coriaceous, 3 to 4 in long, thick, yellow woolly, panicles very short.....*P. rubiginosum*.

In some specimens the apical inflorescences are stunted and form together a kind of corymb.

Stipules could not be discovered in the material at hand; they drop apparently in a very early stage, contrarily to those of *P. costata* and *P. mmatrana*, which are also closely allied.

The species is also very close to *P. bicolor*, from which it differs by the longer petioles, the shape of the leaf and the typical reticulation of

the lower leaf surface. The specimen *Kostermans 7588* may as well belong to *P. gigantea*.

Malay Peninsula: Pahang, Selangor Border, Fraser's Hill, Oct., buds, *Raub 22548* (SING); *ibid.*, 1300 m, Sept., fl., *Moh. Nur 11301* (SING); *ibid.*, Sg. Yet, alt. 1250 m, Sept., buds, *Moh. Nur 11147* (BO, L, SING); Pahang, Cameron Highlands, Boh Plantation, alt. 1300 m, ster., *Moh. Nur 32665* (BO, GH, MO, L); Borneo: Sabah (N. Borneo), Mt. Kinabalu, Penibukan Ridge, E. Dahobong R., alt. 1300 m, Nov., buds., *Clemens 50081* (L, UC); Sandakan, Aug., young fr., *Puasa 669* (SING); E. Kalimantan (Indon. Borneo), Peak of Balikpapan, alt. 900 m, July, buds, *Kostermans 767 U* (A, BO, BRI, CAL, K, L, LAE, NY, P, PNH, SING); *ibid.*, July, fr., *Kostermans 7295* (BO, K, L); *ibid.*, July, fr., *Kostermans 7588* (BO, K, L, SING).

11. PARINARI NONDA F.V.M. ex Bth. — Fig. 11a. & b.

PARINARIUM NONDA F.V. Mueller ex Bentham, PI. Austral. -2: 426. 1864; Banks & Solander, Botany Cpt. Cook's Voyage 1: t. 92. 1900; Bailey, Queensl. Fl. 524. 1900; Compreh. Catal. Queensl. PI. 167. 1909; Pulle in Nova Guinea 8(2), But. 367. 1910. — *Ferolia nonda* (F.v.M. ex Bth.) O. Kuntze, Revisio Gen. PI. 1: 216. 1891. — *F.v. Mueller s.n.* (K).

Parinari papuanum C.T. White in J. Arnold Arb. 31: 86. 1950 — *Smith N.G.F. 100i*, holotypus; *N.G.F. 1019*, fr., paratypus (BRI).

Parinari salomonevse C.T. White in J. Arnold Arb. 31: 87. 1950. — *Walker & White B.S.I.P. Hffa*, holo-typus; *H9*, para-typus (BRI).

Parinari sp., C.T. White in J. Arnold Arb. 31: 87. 1950. — *Smith N.G.F. 1193 (BRI)*

Tree, 6 to 34 m tall and up to 55 cm in diam; stem of the savannah (fire climax!) form often comparatively thick for the size of the tree. Buttresses rounded, unbranched, up to 1 m high, but usually much smaller. Bark grey or grey to yellowish brown, shallowly fissured (or deeply fissured and corky in the savannah form), with prominent lenticels. Living bark brown or redbrown; wood yellow-red or red, hard, with interlocked grain. Branchlets drooping, somewhat angular, covered with a more or less dense layer of coarse, somewhat adpressed, rather long hairs, upon a layer of grey, cobweblike hairs; branches glabrous, purplish brown to black, glossy, with numerous, tiny, pale lenticels. Stipules (*bb. 31328*) membranous, fugaceous, lanceolate, acute, up to 2 cm long and 2—3 mm wide at base, sometimes with a few, tiny, round glands along the margin of the upper, silky pilose surface, inside glabrous. Leaves rigidly chartaceous to coriaceous, elliptic to ovate-elliptic, rarely lanceolate-elliptic, varying from 2 x 4 (or 1.5 x 6) to 7.5 x 15 cm, base rounded or acutish, rarely subcordate, apex distinctly to obscurely acuminate; upper surface glossy, midrib flat or sulcate in its upper part, pilose at base; lateral nerves very slender, secondary nerves parallel, very slender, prominulous; lower surface (in young leaves white) with stomatal areoles; reticulation prominent, rounded; midrib strongly prominent, lateral nerves 16—20 (—27) pairs, rather patent,

slender, straight, arcuate at margin; along the margin scattered tiny round glands or protruding black (in sicco) small glandular tissue dots. Petiole rather stout, densely pilose, glabrescent, 3—6 (—9) mm long, usually with two small, black, glossy, protruding, round glands at the middle, or lower down. Panicles slender, open, terminal and axillary, up to 6—10 cm long, densely adpressed pilose and with long, less adpressed light brown, silky hairs. Bracts and bracteoles caducous at anthesis. Flowers brownish yellow, scented. Calyx shallow, cupshaped, broad, 1.5—2 mm high, densely sericeous; lobes triangular to lanceolate-triangular, 1—1.5 mm long, densely pilose on both sides. Petals slightly longer than the calyx lobes, thin, spatulate. Fertile stamens ca 8, unequal in length, about as long as the petals; the sterile ones (6—10) tooth like, on an 1 mm high, stiff rim. Style shorter than the longest stamen, glabrous, top (stigma) truncate. Pedicel short, slender.

Fruit globose, ovoid or ellipsoid, often flattened laterally, up to 3 cm long, rather bumpy and irregular, covered with a dense layer of pale scabs; 2-celled; cavities brown-woolly.

DISTRIBUTION: NW. Guinea, Solomon Islands, N. Australia, N. Queensland, from 6—1300 m altitude, occurring in the moist rainforest, but also as a substage tree in savannahs.

VERNACULAR NAMES: Wobbreeka (Manikiong, near Oransbari); Mala one (Kwara-ae, Solomon Isl.); Ranna (Morehead R.); Wo'inya (Cooktown); Wiepa (Mabuiag Isl.).

With the formerly scanty material at hand, it was impossible to identify the numerous sterile sheets. Since then numerous specimens from the Solomon Islands, collected by Whitmore and his Staff, could be studied. The result is, that we combined *P. nonda*, *papuanum* and *salomonense*. Although the variation in leaf size is such, that combination seems to be not warranted, we have found all intermediate stages between the small-leaved mountain form (*Carr 14351*) and the type specimen of *P. papuanum* (*Smith N.G.F. 1004*) and the large-leaved lowland specimens. C.T. White himself hinted already to the large-leaved specimens being lowland forms of *P. papuanum*. The savannah specimens lack an acumen, which is not unusual in specimens of a dry and unfavourable habitat. The main reasons, why we combined these species are: the constant number of lateral nerves; the typical marginal leafglands, present in all specimens and the unusual shallow, cuplike calyx. In sterile condition the specimens cannot be separated from those of *P. sumatrana*, but for the leaf glands. From *P. insularum*, its nearest relative, it may be distinguished by the leafshape.

New Guinea. W. Irian, Tamurik, near marsh, Aug., fl., *Anta* (Expedition Wentholt) 233 (BO, L); Idenburg R., alt. 80 m., Apr. fr., *Brass & Versteegh 13541* (fruit bumpy subglobose; a frequent tree) (BO, GH, L); Ransiki Distr. (Manokwari),

Oransbari, ster., *BW. 1141 et 1957* (BO, L); Hollandia, Pionnier Bivouac, ait. 30 m, Oct., ster., *bb. 31104*. (stipules with glands) (BO, L) et *bb. 31473* (A, BO, L); Nov., ster., *bb. 31328 et 31381* (BO, L); Babo, alt. 15 m, ster., *bb. 21822* (BO, L); South Coast, Okaba near Ginu, Aug., fr., *Branderhorst 15* (K, L) and buds, *Pringyo 15* (BO); locality not indicated, fr., *Jaheri s.n.* (BO); Papua, Middle Fly R., lake Daviumbu, plenty in Banksia-Grevillea savannahs, Sept., *Brass 7891* (A, BO, GH, L); Western Div., Mabaduan, savannah forest, rarer substage tree, April, young fr., *Brass 6571* (A, BO, GH, L); Dagwa, Oriomo R., March, young fr. and buds, *Brass 5979* (BO, GH, K, L), this specimen has leaves with numerous glands; Kokoda, 300 m. fr., *Carr 16479* (L); Boridi, 1300 m, buds, *Carr 14351* (L); locality not indicated, buds, *Banks & Solander s.n.* (P); Sudest Isl., Joe Landing, alt. 100 m, Aug., fl., *Brass 27725* (A, BO, K, L); *ibid.*, Mt. Riu, W. slopes, alt. 300 m, Aug., fl., *Brass 27920* (A, K, L); Solomon Isl., Vanganu Isl., near Kaikose R., lowland, Sept., buds, *Walker & White B.S.I.P. 149* (BRI, BO); Rendova Isl., New Georgia group, W. coast, 1 mile behind Kenelo Plant., ridge top, alt. 30 m, Sept., young fr., *Whitmore B.S.I.P. 1877* (L); Gizo Isl., secondary forest, alt. 70 m, April, buds, *Whitmore's Collector B.S.I.P. 5633* (L); Gatukai Isl., Dec, buds, *Whitmore B.S.I.P. 1250* (L); Baga Isl., Febr., fl., *Whitmore B.S.I.P. 2904* (L); Sante Ysabel, Allardyce Harbour, Jan., fl., fr., *Whitmore B.S.I.P. 3666* (L); E. Choiseul, W. of Taora Passage and N. of Roka R., alt. 30 m, March, fl., *Whitmore's Collector B.S.I.P. 5280* (L); North Australia, Cape York, Oct., fl., *McGillavry 432* (K); Padine R., fl., *Hill 138* (K); Gilbert R., fl., fr., without collector's name (GH); Prince of Wales Isl., ster., *Brown 6339* (K); Wednesday Isl., fl., *Moseley s.n.* (K); Albany Isl., Aug., fl., *Mueller s.n.* (GH, K); N. Queensland, Bloomfield, fl., *Petrie 39* (GH); Mt. Glory, fl., *Hooker s.n., anno 1850* (K).

12. PARINARI BICOLOR Merr. — Fig. 12.

PARINARIUM BICOLOR Merrill in Philipp. J. Sci. Bot. 10: 309. 1915; Enum. Philipp. flow. PI. 2: 235. 1923. — *Razon, For. Bur. 23022*.

Tree, about 10 m high; branches brown, glossy, lenticellate; youngest branchlets densely ferruginously tomentellous. Leaves rigidly coriaceous, ovate-elliptic, 4—7 x 2—3 cm, base rounded or subacute, apex shortly, rather inconspicuously acuminate, tip broad; upper surface glabrous, except the minutely pilose, impressed midrib, brown or black when dried, lateral nerves filiformous; lower surface with a dense felt of whitish and rusty hairs, midrib strongly prominent, rusty-tomentellous, lateral nerves 11—15 pairs, straight, arcuate at margin, prominent; areolation dense, prominent, veins not flat-topped. Petiole 3—5 mm long, stout, densely rusty tomentellous. Stipules large, lateral, ovate-oblong, acuminate, up to 7 mm long, inside glabrous, outside rusty tomentellous, only present on the (limp) flush.

Panicles terminal (and axillary), dense, densely rusty tomentose, up to 8 cm long, often corymb-like; bracts oblong-ovate, acuminate, pubescent, concave, up to 4 mm long, covering the flowerbuds, caducous at anthesis. Flowers yellowish brown, densely rusty villous; calyx about 3 mm, gibbose, densely rusty villous; lobes oblong, acute, up to 2 mm long; petals oblong-ovate, about 2—2.5 mm long, shorter than the calyx lobes. Fertile stamens

10, about 2 mm long, on a short rim, sterile stamens tooth-like; ovary densely pilose, style short, stigma discoid.

"Fruit hard, irregular, dark brown, somewhat ovoid, about 3 cm long and 2.3 cm in diam.; apex rounded" (Merrill).

DISTRIBUTION: Philippines.

The species is closely related to *P. rubiginosa* Ridley, but differs in leaf size, tomentum and stipules. Still it might be only a form of *P. rubiginosa*.

The type specimen is cited by Merrill as *Razon 28022*; in the material at hand it is, however, *23022*.

Merrill did not mention the number of stamens, which is an important characteristic in *Parinari*.

PHILIPPINES: Mindanao, Prov. of Surigao, Genituan Isl., alt. 30 m., Oct., fl., *Razon, For. Bur. 23022* (BO, GH, K); *ibid.*, June, fl., *Ramos & Pascasio 34721* (GH, K); *ibid.*, Febr., fl., *Ponce 25075* (GH, K, US); Distr. of Davao, March, fl., *Ceballos, For. Bur. 26600* (K); Bucas Grande Isl., June, fl., *Ramos & Pascasio, Bur. Sci. 35041* (BO, GH, K, US).

13. PARINARI ANAMENSE Hance — Fig. 13.

PARINARIUM ANAMENSE Hance in J. of Bot. 15: 333. 1877; Lanessan, PI. utiles Col. fr. 284. 1886 (*anamense*); Perrot & Hurrier, Mat. Med. et pharmac. sino - annamite. 1907; Cardot in Lecomte, FL gen. Indoch. 2: 615, fig. 17. 1920; in Bull. Mus. Hist. nat. Paris 28: 193. 1922; Menaut, Mat. medic. Cambodge in Bull. econ. Indoch. 1929; Heim de Balzac et al. in Agence gen. Colon. 23: 310—21, 3 tab. 1930 (Sér. 3, 3: 66. 1930); Craib, Fl. Siam. Enum. 1: 563. 1931; J. Roi, Atlas Pl. méd. chin., Univ. Aurora. Chang-hai. 1946; Petelot, PI. med. Cambodge, etc. 1: 302. 1952; Vidal in Adansonia, N.S. 4: 142. 1964 (*anamensis*). — *Pierre s.n.* (K).

Parinarium albidum Craib in Kew Bull. 1912: 152; Contr. Fl. Siam II in Aberdeen Univ. Studies 57: 79. 1912; Fl. Siam. Enum. 1: 563. 1931 (as a syn. of *P. anamense* Hance); Cardot in Lecomte, l.e. 616 — *Kerr 604*.

Parinarium sumatranum (non Miq.) Kurz in J. As. Soc. Bengal 45(2): 302. 1876; Craib, Fl. Siam. Enum 1: 563. 1931. — *Brandis s.n.*

Tree, 6—30 m tall, with a short, plump bole of 3 m and less on poor soils and a straight and slender bole, 30—70 cm in diam. and up to 10 m long on better sites. Crown very dense; the young branchlets with limp leaves, drooping. Bark grey; living bark yellowish. Pilosity of branchlets as in *P. sumatrana* but more yellowish brown. Leaves exactly as those of *P. sumatrana*, but with a tendency to be larger near the inflorescence and with a more truncate or subcordate base; the number of lateral nerves 14—18 pairs; pilosity of lower leaf surface more yellowish brown. Stipules slightly narrower than those of *P. sumatrana*. Leaves variable in shape from broadly elliptical (6.5 x 9 to 7.5 x 13.5 cm) to oblong (3.5 x 9 to 5 x 12.5 cm); the flush has leaves with white lower surface, but intermingled with

the white are also yellow-brown hairs. Panicles as a rule terminal, without leaves, densely yellow-brown pilose, longer than the leaves, 8—15 cm long, pyramidal. Flowers smaller than in *P. sumatrana* with a wider, shorter tube, 2—2.5 mm long, gibbose; calyx lobes 1.5 mm long.

Fruit as a rule subglobose, compressed, 30 x 28 mm, rarely ellipsoid, 40 x 28 cm.

Other characteristics as in *P. sumatrana*.

DISTRIBUTION: Siam, Laos, S. Vietnam, up to 700 m. altitude.

VERNAC. NAMES: Maphawk, Karawk, Makmue Thalawk (Siam); Quêlo (Kmer); Cay Cam (Viet); Thlok (Cambodia); Phok (Laos); Enay (near Ban-Me-Thuot); Bua Day or Ndi or Taldi (Moi).

USE: Very common in Cambodia and S. Vietnam, rarer in Central Vietnam and Laos, absent in N. Vietnam. The thin outer pulp of the fruit is rich in sugar and edible; it is used as food in poorer regions. The seed is inedible but is rich in a drying oil, perhaps good for soap. The timber is rather poor, but of trees with well-shaped boles it is much used.

The species is very close to *P. sumatrana* and if its distributional area should be continuous with the former, it would be perhaps better to include it in *P. sumatrana* as a subspecies.

But there are constant differences, like the shape of the long terminal panicle; the colour of the indumentum of inflorescence, branchlets and lower leaf surface; the smaller flowers and the usually more rounded fruit.

I disagree with Vidal (1964), that *Parinari* and *Parinarium* are different names and hence do not believe that the binomials of *Parinari* are new combinations.

North Siam: Doi Sutep, April, fl., *Kerr 604* (K, US); W. Siam: Kanburi, fl., *Teijsmann s.n.* (K); fl., fr., *Teijsmann H.B. 6008* (BO, G, L, U); E. and S.E. Siam: Chantabun, ster., *Vesterdal s.n.* (BO, C, SING); *ibid.*, Nov., fl., fr., *Lak-sanakarna 483* (K); Chantaburi, Makkam, Ban Ang, Nov., fl., *Chit Nophakdi 146* (BKF); Pitsanulok, Pamak, fl., *Kerr 8912* (P, UC); *ibid.*, April, fl., *Kerr 2559* (K); *ibid.*, Febr., fr., *Kerr 2309* (K); Trat, Huay Raeng, Dong-Maduca, young fr., *Smitinand 1361* (= *For. Dept. 7277*) (BKF, BO); Prachinburi, Aran Prathet, Nawng Waeng, Jan., fl., *Put Phraimirind 45*, very common (BKF); Chawn Bung, Ratburi, March, fl., *Kerr 10642* (K); Sriracha near Na Prow, April, fl., *Collins 874* (BISH, C, K, L, US); *ibid.*, Febr., fl., *Collins 331* (K, P, US); *ibid.*, March, fl., *Collins 970* (K, US); Korat, Pak Tong-Chai, Dec, fr., *Kerr 8103* (K); Surin, fl., *Put 656* (K); Ubol, Bang Boong, June, fl., fr., *Lakmnakarna 891* (K); Laos: Basin of R. Se-Moun, Dec, fr., *Harmand 1002* (P); Cambodia: Kang Chon, Kang Soai, March, fl., *Bejand 396* (P); Chamcar-Ta-Man, Prov. of Kuang Chhuang, March, fl., *Chevalier 36991* (BO, P); Kampong Thom, Tonle Sap, fl., *Service for.* (P); Road of Trimbell, Km 180, Aug., ster., *Poilane* in Herb. *Chevalier 436* (BO, P); Pnom Penh, fl., *Bejand 746* (P); Siem Reap, Dengrek Mts., Nov., "fr., *Poilane 13867* (P); Kampong Chuan, "h, fl., *Chevalier 31943* (P); *ibid.*, fl., fr., *Cardot s.n.* (K); *ibid.*, For. Reserve

Kranlanh, fl., *Chevalier 31747* (P); Mt. Thral, *Pierre s.n.* (P); Praley Triek, Chhlong, March, fl., *Chevalier 40691* (L, P); locality not indicated, fr., *Godefroy s.n.* (P); fl., *Hahu s.n.* (P); Annam: Prov. Tharang, Jan., fr., *Poilane 9458* (P); *ibid.*, Dec, ster., *Poilane 9294* (P); *ibid.*, Jan., fl., *Poilane 9497* (P); Prov. Nhatrang, Hoa Tan, June, young fr., *Poilane* in Herb. *Chevalier 46* (BO, CANB, P); *41* (P), *39224* (BO, L, P) et *4094* (BO, P); *ibid.*, For. Reserve Chuai-Cat, Sept., fr., *Fleurtf* in Herb. *Chevalier 39049* (BO, P); Prov. Phanrang, Ca-Na, March, fr., *Poilane 5835* (P); E. of Ca-Na, rocky, open, Nov., young fr., *Evrard 2457* (P); *ibid.*, alt., 700 m, March, fr., *Poilane 5727* (P), common; *ibid.*, Ka-Rom, alt. 500 m, March, fr., *Poilane 9912* (P); *ibid.*, March, ster., *Poilane 9909* (P); Isl. Phu-quoc, June, fl., *Contest-Lacour 345, 346* (P); locality not indicated, fr., *Robinson 1493* (P); fl., *GOUT gaud s.n.* (P); Cochinchina: Cuang Tri, Jan., fr., *Poilane 11874* (P); Prov. Thudanmot, For. Reserve Chon Tanh, Jan., fr., *Fleiny* in Herb. *Chevalier 30011* (BO, P); *id.* *39357* (P); *ibid.*, Tai-Tinh, Bien Hoa, fl., *Thorel 1002* (BO, DC, GH, L, P); Bienhoa, Tan-Nhuani Febr., fl., *Vinot s.n.* (P); Road of Baloah, Jan., fl., *Lefevre 290* (P); Road Saigon-Bienhoa, Sept., young fr., *Lefevre 308* (P); Gia Ray near Bienhoa, Febr., fr., *Poilane* in Herb. *Chevalier 2561* (P); Trang-Bom, May, fr., *Chevalier 40904* (BO, P) et Nov., fr., *Chevalier 3922J*, (BO, L, P); Gia Lau Me, Sept., fr., *Pierre 339* (P) et *s.n.* (CANB, DC, GH, K); Thu Due near Saigon, fr., *Pierre 339* (BO, GH, K, L, P, US); Cay Cong, April, fl., fr., *Pierre s.n.* (GH, P); Song Dinh, For. Reserve of Gia Huynh, fl., *Chevalier 40923* (BO, P); Tay-Ninh, April, fl., *Lefevre 360* (P); *ibid.*, Febr., fr., *Muller 901* (P); Khone, fr., *Harmand 109* (L); Bot. Garden, Saigon fl., fr., *Chevalier 36667* (P); Pulo Condor, Cook's Third Voyage, buds (P); *ibid.*, sine coll., fr., (P); Ongbom, fr., *Phung-Van Diem 90* (P).

14. PARINARI HELPERI Hook. f. — Fig. 14.

PARINARIUM HELPERI Hooker f. Fl. Brit. India 2: 311. 1878 (excl. cit. *P. sumatranum* Kurz); Brandis, Ind. Trees 278. 1906. — *Heifer s.n.* Tenasserim (K).

Large tree; branchlets densely pale brown pilose; branches glossy with numerous tiny round, pale lenticels. Leaves stiffly chartaceous, elliptic to subovate-elliptic, 4 X 9 to 6 x 15 cm, base rounded or truncate to subcordate, apex conspicuously acuminate (acumen up to 15 mm long); upper surface glossy, midrib flat, lateral nerves filiformous, prominulous, reticulation filiformous, dense, prominulous; lower surface with stomatal areoles, midrib strongly prominent, lateral nerves 18—20 pairs, straight (curved at margin); areoles with a white felt of thin hairs. Petioles 6—10 mm, densely fulvous, glabrescent, with two tiny round glands about the middle (leafbase sometimes with glandular tissue near the petiole insertion).

Panicles terminal, leafy, up to 5 cm long, densely pale brown pilose; bracts and bracteoles caducous at anthesis.

Flowers sessile, densely villous; calyx tube broadly cylindrical, subcampanulate, 3—4 mm long; calyx lobes 1.5 mm, narrowly ovate, acute, somewhat unequal; petals 2 mm, membraneous, sub-spathulate, acutish. Stamens 8, unequal, filaments up to 1.5 mm long. Ovary densely villous; style 2 mm long, densely villous (except tip).

DISTRIBUTION: Lower Burma.

The species is closely related to *P. anamense* from which it differs by its more elongate leaves with a long acumen.

Hooker added in synonymy *P. sumatranum* (non Miquel) Kurz, although with doubt; this represents *P. anamense* Hance.

Lower Burma: Tenasserim R., March fl., *Heifer s.n.* (K); Myaungmya Distr., Labwuta, March, fl., *Lace 2983* (E).

The unnamed specimen, described by Hooker f. (p. 311 and 312, I.e.), which he believed to be allied to *P. helferi*: *Griffith 2048*, Palor in Mergui (K, P), is not Rosaceous, as the hairs on the petioles are stellate. Moreover, the very young axillar inflorescences do not conform with those of *Parinari*. It might be Tiliaceous.

15. PARINARI SUMATRANA (Jack) Benth. — Fig. 15a, b, c.

PARINARIUM SUMATRANUM (Jack) Benth in Hooker, Niger Fl. 335. 1849; Miquel, Fl. Ind. bat. 1(1): 353. 1855 et 1084. 1858; Suppl. Sumatra 115. 1860 et 306. 1862; Blume, Mus. bot. Lugd. bat. 2: 97. 1856; Mueller in Walp. Ann. 4: 644. 1857; in Flora 41(16): 255. 1858; Benth in Hooker f., Gen. PL 1: 607. 1865; Hooker f., Fl. Brit. India 2: 309. 1878; Miers in J. Linn. Soc. Bot. 17: 336. 1879¹; Filet, Plantk. Woordenb. Ned. Ind., ed. 2: 37. 1888; Koorders & Valetton., Bijdr. Kennis Boomsorten Java 5 in Meded. 's Lands PL tuin Buitenzorg 33: 340. 1900 (excl. syn.: *P. costatum* Bl.); Koorders in Gedenkboek Junghuhn 169. 1910; Backer, Schoolfl. Java 1: 445. 1911 (as a syn. of *P. costatum* Bl.); Heyne, Nuttige Pl. Ned. Ind., ed. 2, 1: 697 1927; ed. 3, 1: 697. 1950; Meeuse & Adelbert in Backer, Fl. Java (emergency Ed.), Fam. 116: 26. 1943; Merrill in J. Arnold Arb. 33: 239. 1952; Backer & Bakhuizen v.d. Brink Jr., Fl. Java 1: 522. 1964 (excl. cit. spsc. *P. costatum*) — *Petrocarya sumatrana* Jack, Malay Miscell. 2: 67, no. 7. 1822; reprint in Hooker's Compan. bot. Mag. 1: 221; reprint in Calcutta J. Nat. Hist. 4: 165. 1843; reprint in Truebner Miscell. Papers relating to Indochina 2, 2: 280. 1887; Mueller in Walp. Ann. 1: 271. 1848-49; 4: 644. 1857; in Flora 41(16): 255. 1858; Miquel, FL, I.e. 353. 1855; Hooker f., FL, I.e. 309; Miers, I.e. 336; Koorders & Valetton, La. 340; Burkill in J. Straits Br. Roy. Asiat. Soc. 73: 200. 1916. — *Ferolia sumatrana* (Jack) O. Kuntze, Revisio Gen. Pl. 1: 216. 1891. — Lectotypus: *Teijsmann H.B. 4554* e Tarabangi, Palembang (U); para-lectotypus: *Teijsmann H.B. 3795* e Derma Enim, Palembang (U).

Parinarium ovale (Korth.) Blume ex Miquel, Fl. Ind. bat. 1(1): 353. 1855 — *Lepidocarpa ovalis* Korthals in Nederl. Kruldk. Arch. 3: 386. 1855; Blume, Mus. bot. Lugd. bat. 2: 97. Febr. 1856; Mueller in Walp. Ann. 4: 644. 1857; Miquel, Fl. I.e. 353 (*Lepidocarya*) et 1084 (*Lepidocarpa*); Koorders & Valetton, I.e. 340 (*Lepidocarya*).

Tree, up to 30 m high and 50 cm in diam. with cylindrical, hoopringed, smooth, grey or brownish grey bole; lenticels in concentric rings; dead bark 0.5 mm thick, white inside; living bark lightbrown, 5 mm; sapwood dirty white. Buttresses none or small, up to 50 cm high and 60 cm out, thick (40 cm) or thin. The flush limp and drooping. Branchlets densely lightbrown tomentellous; branches glabrous, glossy, brown or black with

numerous tiny, pale lenticels. Stipules (only in the flush) lateral to the petiole, large, oblong or ovate-oblong, acute, membranous, longitudinally ribbed, base truncate, outside densely pilose, glabrous inside, 5—12 mm long, base 3—5 mm wide. Leaves rigidly chartaceous, elliptic or oblong or ovate elliptic, 3 x 7 to 7 x 12 cm, apex obtuse to broadly, very shortly acuminate; base obtuse to truncate, rarely subcordate; upper surface glabrous, midrib flat or slightly impressed (pilose at base), lateral nerves filiformous, prominulous, secondary nerves parallel, prominulous; lower surface with conspicuous stomatal areoles (the nerves not flattened, at last more or less glabrous), the areoles with a felt of white-grey cobweb-like hairs, midrib prominent, lateral nerves 9—14 pairs (usually ca 9—11), erect-patent, straight, arcuate near the margin, prominent; secondary nerves prominent. Petiole 4—7 mm long, glabrescent, usually with two small, round, protruding, glossy glands slightly below the middle on the upper surface.

Panicles axillary, shorter than the leaves, up to 5 cm long, densely grey-brown pilose, ramifications few, up to 1.5 cm long, subtended by bracts similar in size and shape to the stipules; bracts and bracteoles deciduous at anthesis. Pedicel very short, subtended by a bract. Calyx tube funnel-shaped, slender or rather broad, 3 mm long, densely pilose; lobes elongate-triangular, narrow, 2 mm long, acute, pilose. Petals spatulate, as long as the calyx lobes; fertile stamens 8, unequal, slightly shorter than the calyx lobes; ovary densely pilose; style glabrous, as long as the stamens with a small, truncate stigma. Sterile stamens represented by short teeth on the staminal ring.

Fruit ellipsoid, laterally flattened, top obtuse or somewhat truncate, up to 2.5 x 4 cm, completely covered by grey or brown-grey scabs; exocarp 3—4 mm., consisting of hyaline, soft narrow spindles, tapering and obtuse at both ends, mesocarp marble spotted in cross-section, hard, 5 mm thick; endocarp membranous. Fruit with 2 cavities, seed only developing in one of them; the cavity filled with lightbrown very fine, cottonwool-like, densely packed hairs; cotyledons flat-convex, white, oily.

DISTRIBUTION: Sumatra, W. Java.

There is no type specimen of *P. sumatrana* extant, but Jack's description is so elaborate that it is almost certain, that Miquel's interpretation of the species was right. The species is one of the most common ones in S. Sumatra where Jack collected his material. I therefore accept the specimens enumerated and described by Miquel as the holo-, respectively the paratypes (lectotypes).

The species is extremely close to *P. anamense* (cf. there). It is also closely related to *P. costata* and has been usually confused with the latter species, which shows, however, constant, although small differences.

As in all *Parinari* species the leaves differ enormously in size and leaves of a sapling (10 x 21 cm, ovate with a rounded base or oblong,

5 x 12.5 cm, gradually acute, the top broadly acuminate) can hardly be differentiated from those of *P. parva* and *P. costata*. Very young leaves have a dense golden brown woolly tomentum on their upper surface, which wears off very quickly.

Of the fruit I was able to study mature material. The exocarp, which in dry condition is a black, amorphous mass, consists in fresh condition of radial hyaline spindles, soft and juicy with a slightly sweetish taste; the mesocarp consist of an amorphous mass, irregularly divided by fibrous material and showing holes (marbled).

Sumatra: E. coast, Pakanbaru, Tenajan R., Aug., buds, *Soepadmo* 92 (BO); Palembang Distr., Komering hilir, Kaju-Agung, o m, Jan., fl., *bb.* 13600 (BO, BZF); Palembang, Derma Enim, fl., *Teijsmann* 3795 *H.B.* (BO, K, U); *ibid.*, Ogan ulu, Tubuan, young fr., *Teyßmann* 3802 *H.B.* (BO, K); Lampong Districts, Siring Kebau (Kebouw), fr., *Teyßmann* 4U1 *H.B.* (BO, K, U); *ibid.*, Tarabangi, •fr., *Teijsmann* U55U *H.B.* (BO, K, L, U); S. W. Java: Ujungkulon Reserve, Peutjang Isl., alt. 20 m, coral limestone, Febr., fl., *Kostermans* 23 A (A, BO, K, L, P); *ibid.*, Nov., fl., *Kostermans* (Unesco) U (A, BH, BISH, BKF, BM, BRI, CAL, CANB, G, K, L, LAE, NY, PNH, SING, SYD, US); *ibid.*, Aug., fr., *Kostermans & Kuswata* 57 (BO); *ibid.*, mainland, Tjibunar, alt. 50 m, Dec, fr., *Wirawan* 67 (A, BO, G, K, L, LAE); *ibid.*, near lighthouse, Dec, fl., *Kostermans* 21859 (A, BO, G, K, L, LAE, P, PNH, SAR) et fr., *Kostermans* 21885 (A, BO, G, K, L, LAE, P, PNH, SING, SAR); *ibid.*, Bantam, foot of Mt. Hondje, Dec, ster., *Kostermans* 19289 (A, BH, BO, C, CANB, G, K, L, P, US); *ibid.*, Tjemara Ujungkulon, Distr. Batuhideung near Menes, July, young fr., *Koorders* 8562 (BO, K) et ster., *Koorders* 8563 (BO), leaves 7.5 X 25 cm with up to 17 pairs of lateral nerves; Djampang kulon, Tjiratjap, Distr. Sukabumi, *Koorders* 7966 (BO); Central Java: Isl. Nusakambangan, ster., *Koorders* 8563 (BO); *ibid.*, June, fr., *Koorders* 30270 (A, BO, K, L, ¥); *ibid.*, Mt. Batu near Perdjana, June, fl., *Koorders* 30331 (BO, G, K, L); culta in Hort. Bogor. sub IV H 20, sapling (BO); sub IV H 19, ster. (BO) (leaves ovate-oblong-, 5 X 12.5 cm, gradually acute); in Hertekamp Hort. Bogor, fl., *H.B.* 2J+9U (A, BO, K, L).

16. PARINARI WALLICHIANA R. Br. — Fig. 16.

PARINARIUM WALLICHIANUM R. Brown in Wallich, Catal. no. 7520. 1832 et ex Hooker f., Fl. Brit. India 2: 311. 1878. — *Wallich Cat.* 7520 (K).

This species is represented only by a sterile branch. In venation it resembles *P. oblongifolia* Hk. f., but is has broader leaves, which are thinner, but this branch is from a flush, where the leaves are always thinner. The lower leaf surface is covered by a very dense white felt of cobweblike hairs. The only other specimen (also sterile) which it resembles is *Ridley* 6774-. Additional flush material of *P. oblongifolia* may prove eventually, whether *P. wallichiana*, is conspecific with it. Another specimen, sterile (R.R.I. 6, Selangor, Belata R. estate) has stipules like those of *P. sumatrana* (SING).

17. PARINARI COSTATA (Korth.) Blume — Fig. 17a. & b.

PARINARIUM COSTATUM (Korthals) Blume (Melanges bot. ined., Sept., 1855) ex Miquel, Fl. Ind. bat. 1(1): 354. 1855 et 1084. 1858; Suppl. Sumatra 115. 1860; Mueller in Walp. Ann. 4: 644. 1857; in Flora 41(16): 255. 1858; Hooker f., Fl. Brit. India 2: 309. 1878; Filet, Plantk. Woordenb. Ned. Ind., ed. 2: 286. 1888; King in J. Asiat. Soc. Bengal 66(2): 277. 1897; Ridley in Agr. Bull. Straits & Fed. Malay St. 1: 145. 1902 (quoad rcmen); Maleische Timmerhoutsoorten in Bull. kolon. Mus. Haarlem 27: 60. 1903; Fl. Malay Pen. 1: 666. 1922 (var. *nibiginosum* excepta); Brandis, Ind. Trees 278. 1906; Backer, Schoolfl. Java 1: 445. 1911 (as a syn. of *P. sumatramim* Benth.; quoad nomen tantum); Moll & Janssonius, Mikrogr. Holz. Java 3: 229. 1914 (quoad nomen tantum); Burkill in J. Straits Br. Roy. As. Soc. 73: 200. 1916; Diet. econ. Prod. Malay Pen. 2: 1667. 1935; Merrill in J. Straits Br. Roy. As. Soc. 76: 81 1917; Bibliogr. Enum. Born. PL 290. 1921; Enum. Philipp. flow. Pl. 2: 236. 1923; in J. Arnold Arb. 32: 200. 1951; Heyne, Nuttige Pl. Ned. Ind., ed. 2, 1: 697 et ed. 3, 1: 697. 1950, p.p. — *Lepidocarpa costata* Korthals in Nederl. Kruidk. Arch. 3: 387. 1855; Miquel, Flora, I.e. 354 (*Lepidocarya*) et 1084 (*Lepidocarpa*); Mueller, I.e. 644 et 255. 1858. — *Ferolia costata* (Korth.) O. Kuntze, Rev. Gen. Pl. 1: 216. 1891. — *Korthals s.n.* (L).

Tree, up to 60 m high and 90 cm in diam. Buttresses up to 2 m high. Bark smooth or roughish, greyish or brown, cracked, up to 2 mm thick; Jiving bark 10 mm, redbrown with pale spots. Wood brown. Branchlets very slender, black, brown or redbrown, glossy, with tiny, round, pale lenticels; the branchlets of the drooping flush with a dense tomentum of relatively long, partly adpressed, partly erect or semi-erect hairs. Young leaves with a dense goldenbrown woolly tomentum on the upper surface, the lower surface with a felt of white cobweblike hairs. Stipules only present in the flush, narrowly lanceolate, membraneous, curved and partly folded lengthwise, densely pilose outside, 3—7 mm long. Mature leaves coriaceous or rigidly chartaceous, elliptic or subovate-elliptic to lanceolate-elliptic, base roundish or acutish; top conspicuously acuminate, 2 x 4 to 4 x 9 cm; upper surface glossy, smooth, midrib, veins and reticulation slender, prominent; lower surface with a prominent midrib, (8—) 12—15 pairs (usually 12) of slender, prominent, towards margin arcuate lateral nerves and a stomatal dense areolation; the lower leafsurface at last practically glabrous, except the cobweblike hairs in the areoles; the nerves surrounding the areoles stout, but not or hardly flattened. Petiole 3—8 mm long, slender, usually glandless; glands (if present) small, round, protruding, about the middle of the petiole.

Panicles axillary, narrow, up to 9 cm long, few-flowered, with the same indumentum as that of the branchlets; flowers in few-flowered corymbs. Pedicel hardly 1 mm long, tomentellous with two narrowly lanceolate, acute, pilose, 2 mm long bracts at different heights. Bracts and bracteoles narrower than in *P. sumatrana*, deciduous. Bracts at the base of the primary ramifications slender, up to 6 mm long. Calyx tube densely grey-brown pilose, ventricose laterally, trumpet shaped, 3—3.5 mm long; lobes 1.5—2 mm long, ovate, acute, outside densely pilose, inside more sparsely, patent at anthesis; throat of tube at the ovary insertion with a

dense layer of silky, strigose, erect hairs. Petals white, spathulate or elliptic-spathulate, membranous, 1.5—2 mm long, early caducous. Fertile stamens 7—8, slightly unequal, up to 1.75 mm long; filaments white, flattened, glabrous; sterile stamens inconspicuous. Ovary mottled; style glabrous, slightly longer than the stamens, flat-topped (stigma).

Fruit ellipsoid to ovoid-ellipsoid, obscurely ribbed (dried), up to 2 x 3.5 cm (usually smaller), as a rule with scattered scabs, rarely completely covered with scabs, flattened laterally, apex rounded, truncate or emarginate (dried); outer layer 2 mm, fleshy; mesocarp marbled; endocarp thin; fruit 2-celled, one cell usually empty; both cells with a dense mass of brown cottonwool like hairs.

DISTRIBUTION: Malay Peninsula, Sumatra, W. Borneo; Philipines (ex Merrill).

The species is very close to *P. sumatrana* and has been more or less consistently combined with it. Recent acquisitions made it possible to find out the differences; the leaves are smaller and are distinctly acuminate; the stipules are slender, lanceolate or linear; the number of lateral nerves is 12—15 pairs; the fruit have as a rule a less dense layer of scabs.

Merrill's Bornean and Philippine specimens were not available for examination.

The leaves of the sapling specimen *Sinclair-S.F.N. 40208* are up to 5 X 15 cm, but in the same specimen leaves of only 2.5 x 5 cm are also present.

The specimen *King's Coll, 5227* has a controversial statement on its label, which reads: Penang and also Perak, Larut.

Malay Peninsula: Penang Isl., Penang Hill, Chalet, alt. 350 m, July, fr., *Moh. Nur 3788* (BO, SING); *ibid.*, Tunnel Rd., alt. 750 m, May, fl., *Henderson S.F.N. 21431* (BO, SING); *ibid.*, W. Bungalow, Sept., fr., *Curtis 2163* (SING); *ibid.*, Batu Teringgi, fl., *Ridley s.n.* (SING) et fl., *Curtis 259* (SING); *ibid.*, Telok Bahang, June, fl., *Curtis 259* (SING); *ibid.*, locality not indicated, fl., *Curtis s.n.* (SING) (this specimen has one large leaf); fl., *Forest Guard 12580* (SING) et young fr., *Curtis 3152* (SING); Pahang, Temerloh, Sept., fl., *Bonar F.D. 6340* (E, SING); Selangor, lower part of Bukit Kutu, June, fl., *Ridley s.n.* (SING); Belata River Estate, Aug., ster., *R.R.I. 8* (SING); Kemaman, Bukit Kajang, alt. 150 m, Nov., ster., *Corner s.n.* (SING) (some leaves only 1 x 2.5 cm); Johore, Sg. Sedili, low, July, fr., *Ngadiman S.F.N. 36915* (BO, SING); *ibid.*, Febr., ster., *Corner S.F.N. 34674* (SING); 6th Mile Mawai Rd., low, April, ster., *Corner s.n.* (SING); *ibid.*, 13% Mile Mawai-Jemaluang Rd., Sept., fl., *Corner s.n.* (SING); Mawai, Jan., fr., *Ngadiman S.F.N. 34765* (SING); *ibid.*, 11 1/2 Miles Mandai Rd., Febr., ster., *Sinclair S.F.N. 40,208* (BO, L, SING); Malacca, Sg. Udang, ster., *Cant ley's Coll. (Alvins) 13* (SING); *ibid.*, fl., fr., *Maingay 621/2* (L); Singapore Isl., West End Selatar Reservoir, Upper Mandai, Aug., ster., *Sinclair S.F.N. 39700* (BO, L, SING); Chan Chun Kang, fr., *Ridley 3901* (SING); Sumatra: East Coast, Upper Langkat, Batang Lembosa, 40 m. alt., ster., *bb.9152* (BO); Pakanbaru, Tenajan R., Aug., fr., *Soepadmo 206* (BO,

L) et Aug., fl., *Soepadmo 84* (BO); Palembang Distr., Mulah hulu, April., *Grashoff 298* (BO, K, L); Tandjong Neng, R. Bliti, alt. 200 m, young fr., *Forbes 2837* (= 123) (BO, L); Sumatra's West Coast, Painan, fr., *S.W.K. 1-31*, (A, BO, K, L); locality not indicated, ster., *Korthals s.n.* (L); Bangka: Djebus, ster., sine coll. (BO, L); Borneo: Sarawak, Rambangan, hills, Sept., fl., *Omar 171* (= *F. 00117*) (SAR); Brunei: Bukit Teraja, alt. 250 m, May, fl., *Ashton S. 7889* (L).

The following specimens are difficult to assign either to *P. costata*, *P. polyneura* or *P. sumatrana*: Sumatra: Indragiri Upper Lands, Keritang, ster., *bb. 28662* (BO) with broad stipules like those of *P. sumatrana*, but the leaves are acuminate, are 5 x 10 cm and have 14 pairs of nerves; Palembang Distr., Belimbing, ster., *bb. 28548* (BO) with large, acuminate leaves and 12 pairs of nerves and *ibid.*, *bb. 28500* (A, BO, L, SING) with acuminate leaves, 14 pairs of nerves and stipules as in *P. costata*. Do they represent hybrids? Or are they youth forms? I have included them in *P. polyneura*,

18. PARINARI INSULARUM A. Gray. — Fig. 18.

PARINARIUM INSULARUM A. Gray, Bot. Cpt. Wilkes United St. Explor. Exped. 1: 488. 1854; Atlas 1: t. 54. 1857; Burkill in J. Linn. Soc. Bot. 35: 36. 1901 (var.); Ridley, Dispersal Pl. World 208. 1930; Wilder in Bishop Mus. Bull. 184: 40. 1945. — Cpt. Wilkes, Feejee Isl., fr. (K).

Tree ca 10—20 m. high; branchlets densely rusty tomentellous; branches glabrous, black or brown, lenticellate. Leaves stiffly chartaceous to coriaceous, ovate, 2.5 X 7 to 6.5—14 cm or lanceolate, 2.5 X 9 cm, base rounded or rarely sub-cordate, apex gradually acute with sharp tip; upper surface glabrous, the flattened midrib with a long-persistent pilosity, lateral nerves very slender, hardly raised; lower surface densely stomatal-areolate, the areoles covered with pale brown to grey cobweb-like woolly hairs, midrib prominent, minutely, densely pilose, lateral nerves 8—13 pairs, slender, prominent, erect patent, straight or slightly arcuate (arcuate at margin). Petiole short, 2—8 mm long, densely tomentellous, glabrescent, deeply sulcate above with two tiny, protruding round glands about the middle on the upper surface (or the glands lacking). Stipules thin, lanceolate, up to 8 mm long, at base 2.5 mm wide, tomentellous, caducous.

Panicles terminal (and lateral), densely rusty tomentellous, up to 9 cm long, the lateral ramifications subracemiformous. Bracts ovate, acute, concave, 4 mm long, densely tomentellous, caducous at anthesis. Calyx broadly funnelshaped, 2—2.5 mm, lobes 1.5 mm, ovate-triangular, acute, inside shortly pilose. Petals white, spathulate, shorter than the calyx lobes. Fertile stamens 8, unequal in length, slightly exceeding the petals; sterile ones teeth-like. Style glabrous, about as long as the stamens, stigma minute, truncate.

Fruit ellipsoid, bumpy and irregularly, broadly, longitudinally ribbed, smooth, black with numerous pale, tiny spots, up to 2.5 x 5 cm, olive coloured (fresh).

DISTRIBUTION: Fiji, Samoa, Tonga.

VERNAC. NAME: Sa, Seera or Seea (Fiji).

FIJI: Kandavu, above Namalata and Ngaloa Bays, alt. 200—400 m, Oct., fl., *Smith 196* (BISH, BO, GH, K, P, S, UC); vicinity of Wairiki, Taviumi, ster., *Gillespie 4369* (BISH, GH); near Nasimu, 9 miles from Suva, alt. 100 m., ster., *Gillespie 3580* (BISH, UC); *ibid.*, Oct., fr., *Gillespie 3619* (BISH, D, K, UC); Suva, Central Rd., *Toihill 8S* (K), *Chaillelia vitiensis*-Seemann; Macuata Prov., July, fl., *Sykes 70* (K); Nandarivatu, valley of the Singatoka R., Nov., fr., *Gillespie 3885* (BISH, BO); *ibid.*, March, fr., *Mead 1992* (K); Vanua Levu, slopes of Mt. Numbuiloa, open forest, Oct., fr., *Smith 6U31* (BISH, GH, K, LE, S), fruit flattened, 1.8 X 1.4 inch, bumpy with brown spots on black field; Vanue Levu, Mathuata, Seanggangga, Nov., fl., *Smith 6655* (BISH, BO, GH, K, LE, S); Viti Levu, May, fr., *Parks 20.136* (BISH, UC); Viti Levu, Tailevu, fl., *Parham 2674* (GH); Takaundrove, Savu-Savu Bay region, Jan., fr., *Degener & Ordonez 14049* (BISH, GH, K); Suva, Lamy Mts, ster., *Meebold 17045* (BISH, K); Viti Levu, Rewa Prov., Korombambu Mts., Kasi, alt. 300—400 m, May, fl., *Smith 1824* (BISH, BO, GH, K, P, S, UC); locality not indicated, fl., *Seemann s.n.* (K) et fr., *Seemann H6* (K); fr., *Cpt. Wilkes s.n.* (K, P); fr., *Home 1062* (GH, MO); fl., *Home 92* (K); fl., *Home 1069* (BO, K, LE); June, fl., fr., *Storck s.n.* (GH, K, LE); March, fl., *Tohill 534* (K); Samoa: Pago-Pago, Dec, fr., *Garbler s.n.* (K); Safai, Oct., fl., *Vaupel 484* (K); Upulo Isl., ster., *Luerssen 1353 et 1557* (K); Upolo, Vailele Mts., Aug., fr., *Christophersen F.N. 351 (= 2211)* (BISH); Uvea, 15 m, Nov., fl., *Burrows 1&2U* (BISH); locality not indicated: Aug., fl., *Whitmee 19* (K); fl., *Powell 218* (K); fr., *Mckee 2928* (K); fr., *Daniels HI* (K); fr., *Greenwood 520 A et B et 520* (K); Tonga Isl., Vavau, fl., *Crosby 226 et 227* (K); Eua Isl., fr., *Parks 16339* (K).

19. Parinari gigantea Kosterm., spec. nov. — Fig. 19.

Arbor alta ramulis jerrugineis lenticellatis foliis coriaceis ellipticis basi rotundatis apice obscure acuminatis nervis lateralibus 20—28 paribus, fades inferioribus perdense areolatis glabrescentibus; infructescentiis parvis fructibus magnis.

Tree 35—40 m tall, free bole 21—27 m long and 60 cm in diam. Bark dirty grey, smooth, 0.5 mm thick, lenticellate. Living bark 10—20 mm thick, red-brown. Wood pale redbrown, alternating with paler parts. Branches glossy redbrown with numerous, tiny lenticels; branchlets with a closely adpressed dense matting of long hairs. Stipules lanceolate to linear, up to 2.5 cm long, 3 mm wide at base, acute, membranous, inside glabrous, outside with a dense layer of tiny, adpressed hairs. Leaves coriaceous, elliptical, 5 x 9 to 8 x 17 cm, base rounded, top obscurely acuminate; above glabrous, midrib flat (sulcate in its upper part), lateral nerves prominulous, secondary veins dense, parallel, slightly prominulous; lower surface with a dense stomatal areolation, midrib prominent, pilose, glabrescent; lateral nerves 20—28 pairs, erect-patent, parallel, straight, the veins not very broadened. Petiole stout, 5—7 mm, pilose, glabrescent; glands small, round, at the middle.

Infructescence lateral, 3—5 cm long, glabrous. Fruit dull brown to grey, smooth, large, irregularly ellipsoid, usually tapered towards base, laterally flattened and somewhat bumpy, up to 4 x 6.5 cm; exocarp juicy, of hyaline spindles, outside with tiny scabs; mesocarp bony, strongly, irregularly ribbed; cells two, with brown, woolly hairs.

Typus: *Kostermans 10396* (BO).

The species is related to *P. ashtonii*, but has differently shaped leaves with more lateral nerves; it is also related to *P. oblongifolia* but differs by the less numerous lateral nerves and the shorter infructescences, which are lateral; the indumentum is also different. It comes also near *P. rubiginosa*.

The fruit and infructescence exactly match those of the specimens of *P. rubiginosa* from the Balikpapan Peak, but the latter have narrow leaves. It is possible that the two represent varieties of the same species and that *P. gigantea* is a lowland variety of *P. rubiginosa*.

DISTRIBUTION: Indonesian E. Borneo.

E. KALIMANTAN, Belajan R. near Long Bleh, sandy loam, low, rather rare, April, fr., *Kostermans 10306* (A, BO, K, L); E. Kutei, Menubar R. region, alt. 60 m., June, ster., *Kostermans 54.02* (A, BO, K, L, LAE, P, PNH, SING); *ibid.*, June, ster., *Kostermans bb. 34697* (BO, K, L).

20. PARINARI EXCELSA Sabine.

PARINARI EXCELSA Sabine in Trans. Hort. Soc. 5: 451. 1824; Perrottet & Richard, Fl. Senég. Tent. t. 62. 1830—33; G. Don, Gen. Syst. 2: 479. 1831; Graham, Cat. Pl. Bombay 66. 1839 („Malomla"); Hooker f, Fl. Brit. India 2: 312. 1878; Dalzell & Gibson, Bombay FL, Suppl. 32. 1861; Lisboa in Gazetteer Bombay Pres. Bot. 25: 154. 1886; Hutchinson & Dalziel, Fl. West trop. Afr. 1: 317. 1928.

Introduced in Goa by the Jesuites from Mozambique (according to Sir Royen das Feria).

A specimen, collected by Roberty, no 5012 (G), and identified by him as a new variety of *P. indicum* Bedd., might represent *P. excelsa* Sabine.

21. PARINARI, spec. nov. 1.

Tree, 25 m high; bark grey, pustular. Branchlets with fine cobweblike hairs. Young leaves with adpressed, cobweblike hairs on the lower surface and adpressed, strigose, thin hairs on the leafbase and on basal part of the midrib of the lower surface. Leaves chartaceous, obovate-oblong or narrowly oblong, 3 x 13 to 8 x 21 cm, base rounded to subcordate, apex shortly, broadly acuminate; upper surface glabrous, midrib impressed (pilose at base), lateral nerves filiformous, prominulous; reticulation prominulous; lower leaf surface glabrous, prominulously reticulate without stomatal are-

oles, midrib prominent, lateral nerves 13—20 pairs, slender, arcuate at the margin, prominent. Petiole densely lightbrown hirsute, glabrescent, stout, 5 mm long.

SINGAPORE ISL.: S. side of MacRitchie Reservoir, 22 Febr. 1957, ster., *Sinclair 8918* (BO, L).

The species is related to *P. canarioides* Kosterm. by its glabrous, non areolate leaves; it has, however, obovate oblong, large leaves with more lateral nerves.

On the Bogor specimen a loose stipule was found, which belongs probably to this species; it is oblong-rectangular, obtuse, almost 2 cm long and 8 mm wide, with a truncate base, pilose outside.

SPECIES EXCLUDENDAE

1. *Parinarium dillenifolium* R. Brown in Wallich, Catal. no 7520. 1832; Hooker f, FL, Brit. India 2: 312. 1878. — *Petrocarya dillenifolia* Steudel, Nomencl. bot., ed. 2,2: 309. 1841 = *Dipterocarpus cornutus* Dyer.

2. *P. coccineum* Elmer, *Pygeum coccineum* (Elmer) Elmer = *Primus fragrans* (Elmer) Kalkman.

3. *P. fragile* Teijsmann & Binnendijk, Catal. Hort. Bogor. 253. 1866 (nomen) = **Licania splendens** (Korth.) Prance & Kosterm., *comb. nov.* (basonym: *Angelesia splendens* Korthals); type specimen in herbarium Firenze from a specimen, cultivated in the Bogor botanic Garden.

4. *P. nitidum* Hooker f, *Coccolobium nitidum* Ridley, *Trichocarya nitida* Miq., *Ferolia nitida* O. Ktze. = *Licania splendens* (Korth.) Prance & Kosterm.

5. *P. petiolatum* von Malm (in Notizblatt Bot. Gart. Berlin 11: 630. 1932; in Fedde, Rep. 34: 276. 1934), *Rensch U*, Mbudju, Flores (not Mboedjæ, as von Malm misspells it; in his article he, more or less consistently, misspells oe as ae; the Dutch oe is the equivalent of the German u; the Sumbawanese village Batudulang is misspelled Batoedaelang) is lost. The description is very poor and salient characters, characteristic for *Parinari* are missing. The specimen certainly does not belong in *Parinari* because of the serrate leaves and long petiole. It represents perhaps *Polyosma* (Rutaceae), which has leaves, exactly like those as v. Malm describes, the young leaves of *Polyosma* are somewhat warty (tuberculate) when dried. It might also represent *Eriobotrya bengalensis*, which sometimes has racemelike inflorescences. Also *Helicia* is not excluded. Several other identifications in v. Malm's article are dubious or wrong!

6. *P. philippinensis* Elmer, Leaflets Philipp. Bot. 10: 3809. 1939 = *Licania splendens* (Korth.) Prance & Kosterm.

7. *P. punctatum* Kurz, based on *Elaeocarpus punctatus* Wallich, Catal. 2676, represent perhaps *Parinari polyneura* Miq.

8. *P. scabrum*, var. *lanceolatum* Koorders in Gedenkboek Junghuhn 169. 1910; Hallier in Beih. bot. Centr. Bl. 39(2): 161. 1921 = *Hiptage* (Malpighiaceae).

9. *Chrysobalanus racemosus* Roxb. is inadequately described and unidentifiable without specimen. The description fits *Cyclandrophora laurina* (A. Gray) Kosterm., *comb. nov.* (basonym: *Parinarium laurinum* A. Gray), but the fruit (drupe with a 5-furrowed, 5-valved nut) does not fit in *Parinari*.

10. A specimen, collected by Roberty in the Ghats W. of Poona, no 5012 (G) and considered and named by him as a new variety of *P. indicum* Bedd., probably represents *Parinari excelsa* Sabine. The specimen consists of a few, loose leaves and a detached inflorescence in bud.

11. *Parinarium species*, allied to *P. helferi* Hk. f, Fl. Brit. India 2: 311. 1878. The type specimen, collected near Palor, Mergui (K, P) does not belong to Rosaceae; the petioles have stellate hairs. Perhaps Tiliaceae?

12. *Arbor nigra maculosa* Rumphius, Herb. Amboin. 3: 12, t. 4, fig. 1, 1741; Merrill, Interpret. Rumph. Herb. Amb. 227. 1917; Heyne, Nuttige PI. Nederl. Ind., ed. 2,1: 697. 1927, currently interpreted as representing *Parinari*, belongs, perhaps to *Strychnos*.

13. *Parinarium myrsinoides* Schlechter in Engl. Bot. Jahrb. 39: 133. 1906 = **Licania myrsinoides** (Schl.) Kosterm., *comb. nov.*

14. *Parinarium tontoutense* Guillaumin in Mem. Mus. Hist. nat. Paris, Ser. Bot. 8: 139. 1959 = *Licania tontoutense* (Guill.) Kosterm., *comb. nov.*

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- Garbler s.n.: 18; Gillespie 3580, 3619, 3885 et 4369: 18; Godefroy s.n.: 13; Gourgaud s.n.: 13; Grashoff 298: 17; 898: 9; Greenwood 520 A et B: 8; Griffith 204: Tiliaceae; s.n.: 8; s.n.: 9; Gusdorf 66: 2.
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- Iboet 368: 5.
- Jaheri s.n.: 11.
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Fig. 1. *Parinari argenteo-sericea* Kosterm.



Fig. 2. *Parinari canarioides* Kosterm.; after Kostermans 10017 (BO).



Fig. 3. *Parinari metallica* Kosterm.; holo-typus.



Fig. 4. *Parinari elmeri* Merr.; after Elmer 20806 (BO).

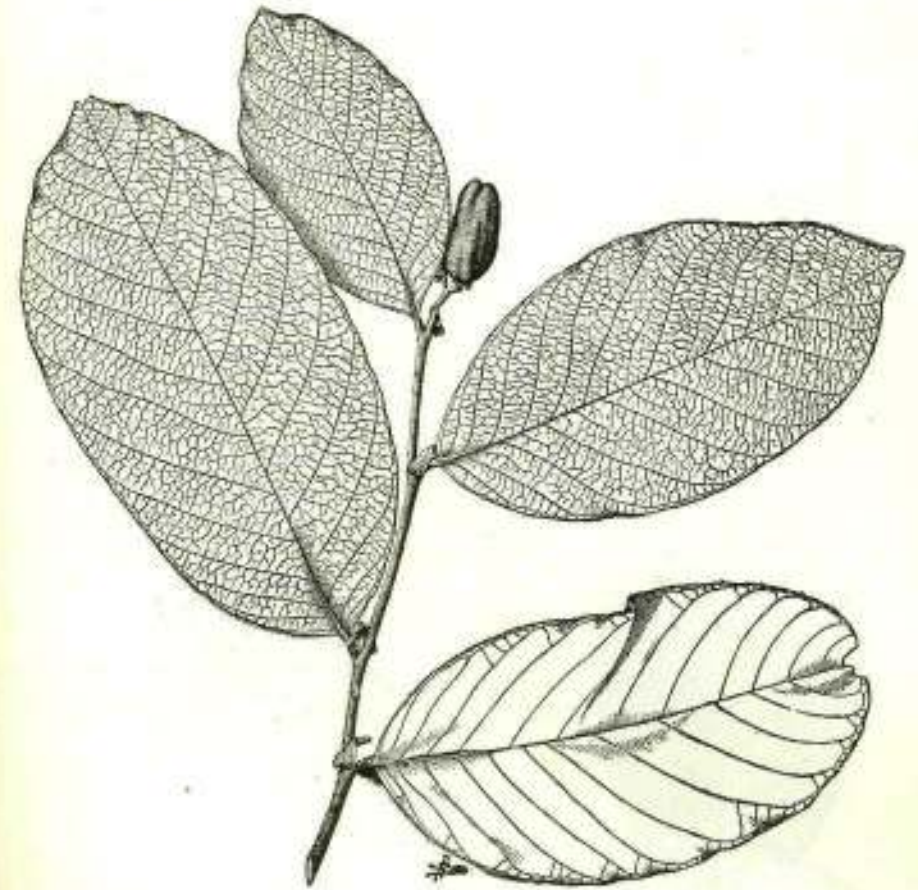


Fig. 5. *Parinari parva* Kosterm.; after Lambach 1229 (BO).

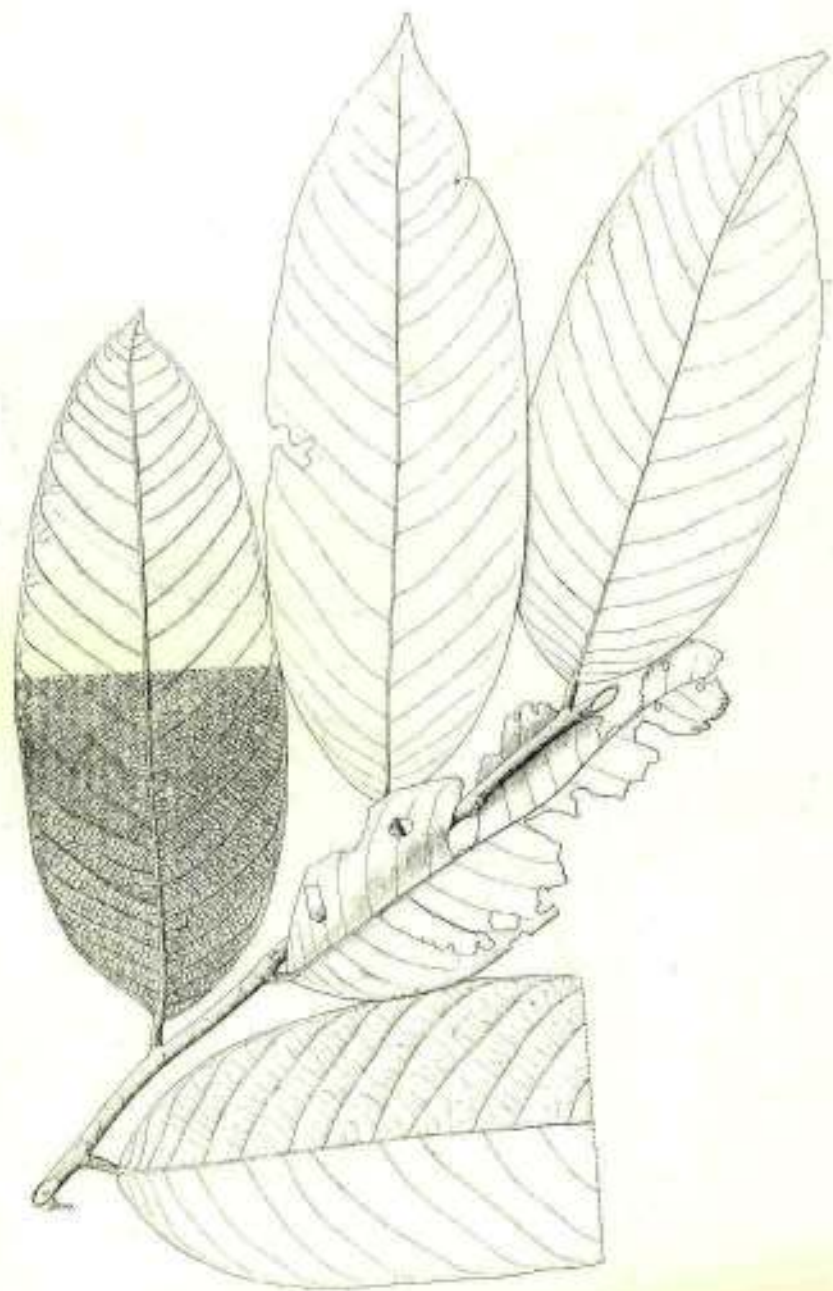


Fig. 6a. *Parinari rigida* Kosterm.; holo-typus.



Fig. 6b. *Parinari rigida* Kosterm.; after Mahwood 8104 (SING).



Fig. 7. *Parinari ashtonii* Kosterm.; liolo-typus.

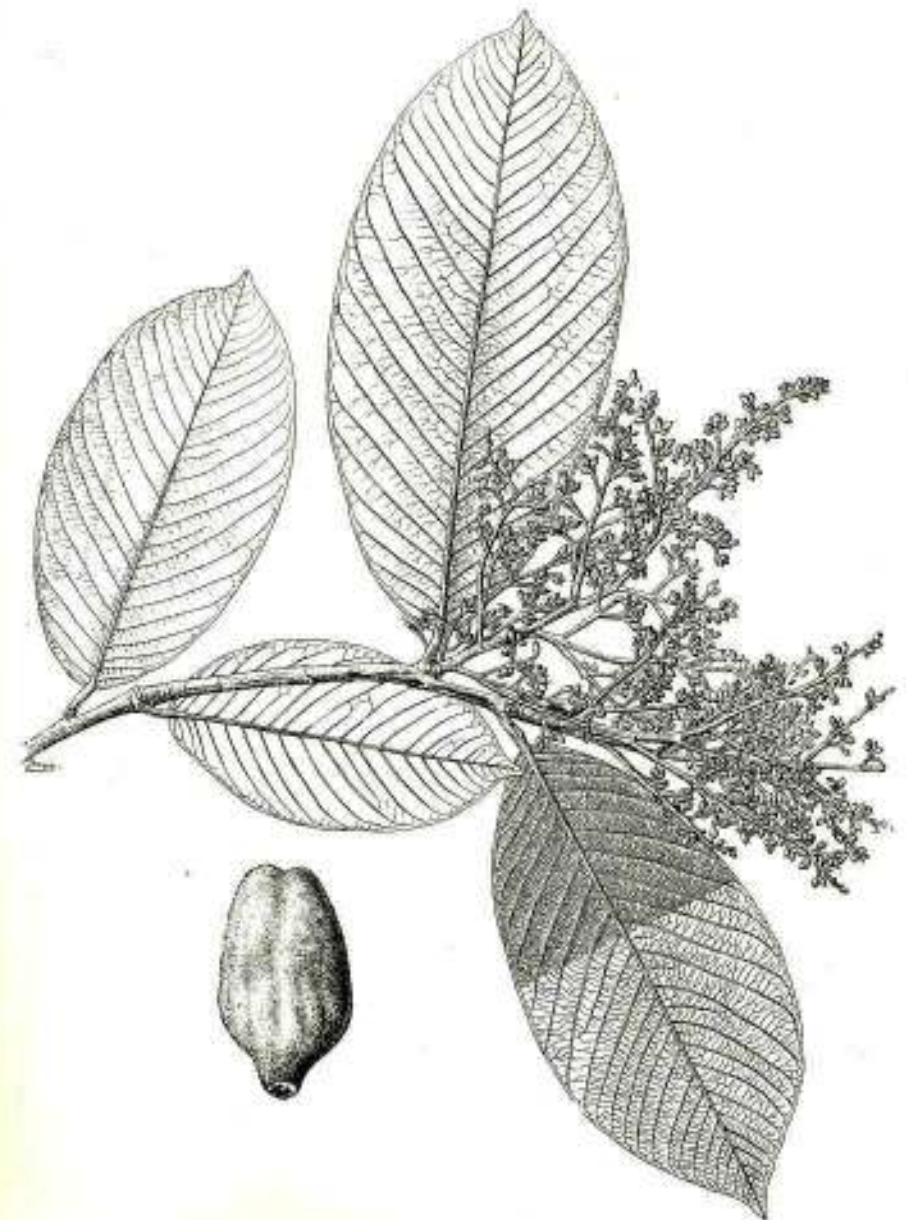


Fig. 8. *Parinari oblongifolia* Hk. f.; after Elmer 21396 (BO).

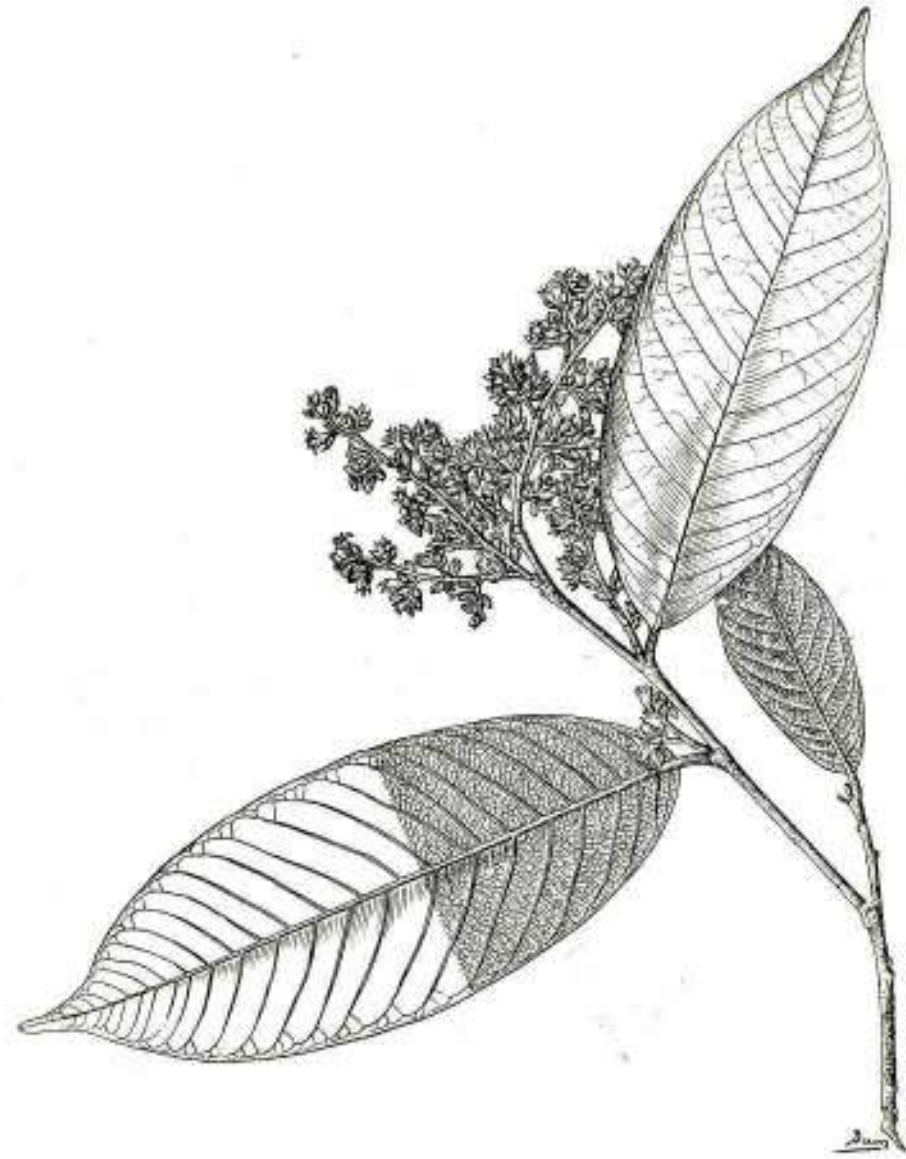


Fig. 9a. *Parinari polyneura* Miq.; after King's Coll. 4624 (BO).

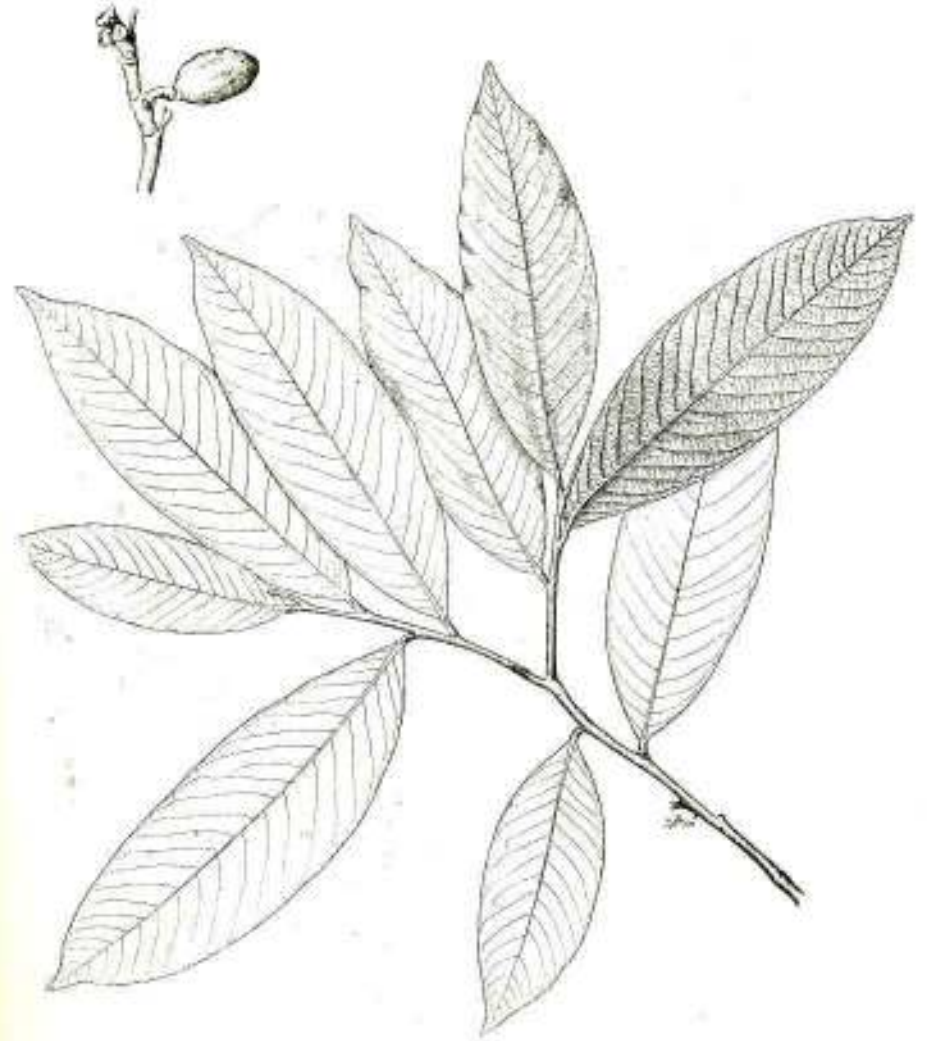


Fig. 9b. *Parinari polyncura* Miq.



Fig. 10. *Parinari ruhiginosa* Ridley; after Nur 11147 (BO).



Fig. 11a. *Parinari nonda* F.v.M.; after Brass 7891 (BO).



Fig. 11b. *Parinari novda* P.v.M.; Iso-type of *P. salomonense* C. T. White.



Fig. 12. *Parinari bicolor* Merr.; after Ramos & Pascasio B.Sc. 35041 (BO).



Fig. 13. *Parinari anamense* Hance; after Lecomte & Finet s.n. (P).



Fig. 14. *Parinari helferi* Hk. f.; after Lace 2983 (E).



Fig. 1Ba. *Parinari sumatrana* (Jack) Benth.



Fig. 15b. *Parinari sumatrana* Benth.; after Kostermans & Kuswata 57 (BO).

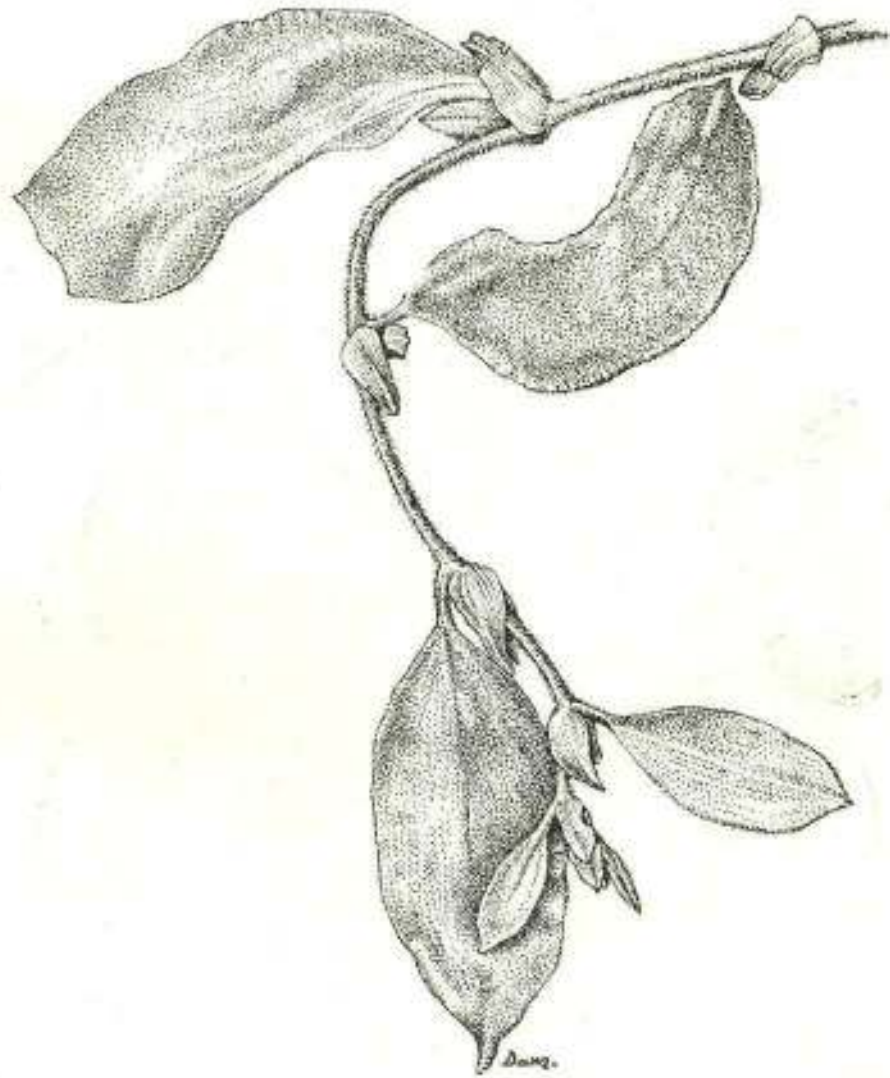


Fig. 15c. *Parinari sumatrana* (Jack) Bth.; young flush, after Kostermans, Unesco 44 (BO).

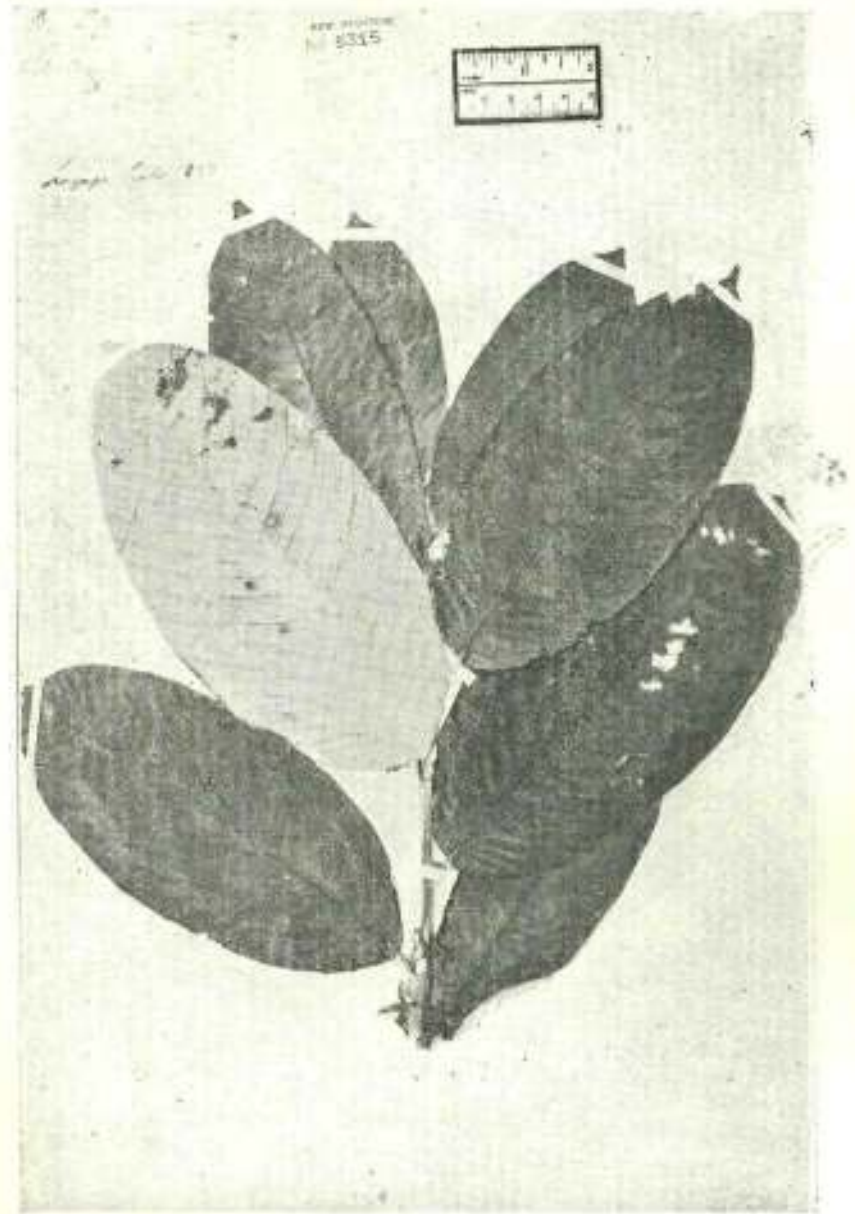


Fig. 16. *Parinari wallichiana* R. Br.; holo-typus.



17a. *Parinari costata* BL; after Soepadmo 84 (BO).



Fig. 17b. *Parinari costata* BL; holo-typus.



Fig. 18. *Parinari insidarum* A. Gray; after A. C. Smith 196 (BO).

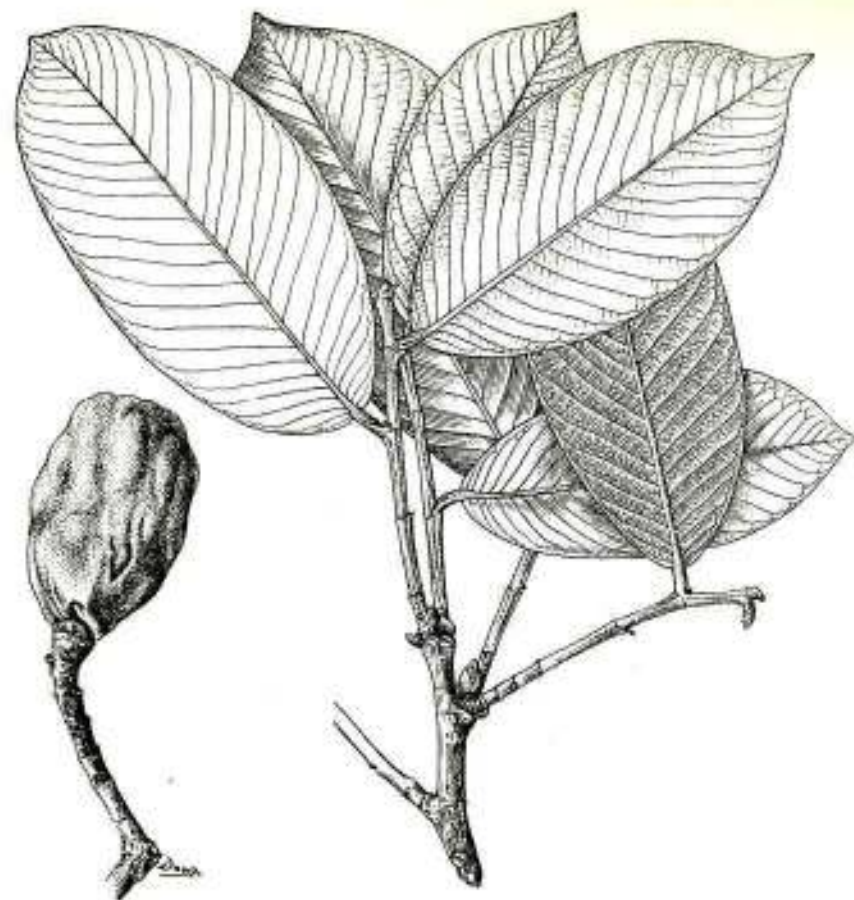


Fig. 19- *Parinari gigantea* Kosterm.; holo-typus.