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

Consequently I refer here *Laurus quixos* Lam. to *Licaria* as *Licaria quixo* (Lam.) Kosterm., *comb. nov.*
At Kew I met Dr. Yan Prance (now at New York Bot. Garden), who was engaged in a revision of the Chrysobalanaceae, 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. have 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 be included some Asiatic ones of which several he had not seen). He recognized the following sections: *Petrocarya* (Schreber) Bentham (*Balanium* Desv.), *Sarcostegia* Bth. (wherein wrongly included *Petrocarya excelsa* Jack) and *Neocarya* (purely African).

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Miquel (Fl. Ind. bat. 1(1): 353. 1855) subdivided *Parinari* in: *Petrocarya* Bentham, *Macrocarya* Miquel, with the same scope as *Cyclandrophora* Hassk. and *Sarcostegia* Bentham, which covers Maranthes Bl. (Miquel recognized 4 different species, which I have combined, but included also *Farinaria* jackmanii, 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 for *Petrocarya excelsa* Jack = *Parinari* jackmanii 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) Bentham. (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 *Euparini* Haumann have stomatal areoles and often glands on the peltioles.

In the Asiatic species of *Pminari* the characteristic of the stomatal areoles does not hold true for *Euparini*, 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 *Euparini* 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 Chrysobalanaceae 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 Chrysobalanoidae 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 character 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 *Cyclandropha*, of which the fruit is ultimately one-celled with ruminate cotyledons. The "strong" character is the ruminate 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 *Cyclandropha* may be differentiated as follows.

<table>
<thead>
<tr>
<th></th>
<th>Parinari</th>
<th>Maranthes</th>
<th>Cyclandropha</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stipules</strong></td>
<td>membranous, fugacious</td>
<td>stiff, early caducous</td>
<td>stiff, carinate, subpersistent</td>
</tr>
<tr>
<td><strong>Branching</strong></td>
<td>flush drooping, branching normal</td>
<td>flush not drooping, branching normal</td>
<td>flush not drooping, branching zig-zag</td>
</tr>
</tbody>
</table>

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Flower petals thin; sepal unequal; fertile stamens 8-10; style as long as the stamens.

Flowers petals fleshy; sepals equal; fertile stamens 25-30; style much 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 ruminate.

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 reviving all genera of Rosaceae, to bring more clarity here.

**P A R I N A R I** Aublet

*PARINARI* Aublet, Hist. PL Guiane fr. 1: 514. 1775; 4: t. 204—06. 1775; de Jussieu, Gen. PL. 342. 1789; ed. Usteri 378. 1791 (Parhiarium); Schreber, Gen. 245. 1789 (a syn. of *Petroeurya* Schreber); Lamarr, Encycl. Meth. bot. 5: 17. 1804; Illustr. t. 429 (copied from Aublet); Suppl. 4: 301. 1816; St. Hilaire, Exp. Fam. 2: 194. 1804; Hedwig, Gen. 257. 1806; R. Brown in Tuckey, Narr. Exp. Riv. Zaire Cong. 433. 1818 et in Nees, R. Brown’s vermischte bot. Schriften 1: 206 07. 1825; Steudel, Nom. bot. 591. 1821; ed. 2: 2: 268. 1841; DC, Prodr. 2: 526. 1825;


Balantium Desvaux (non Kaulfuss = Pilices) in Hamilton, Prodr. Fl. Ind. occ. 34, 1825; Meissner, Gen. 102 (72). 1836—43; Steudel, Nom., ed. 2, 1: 181, 1840; Endlicher, Gen. 1252, 1841 (as a syn. of Hirtella L.); Miquel, FL Ind. bat. 1(1): 353, 1855; Müller in Walp. Ann. 4: 644, 1857 (as a syn. of Parinarium Aulet.); Bentham in Bentham & Hooker 1, Gen. 1: 607, 1865; Hooker f. in Martius, Le. 49, 1867; Baillon, Hist. PL 1: 435, 1869 (in adnot.); Durand, Index 111, 1888 (as a syn. of Parinarium Aulet.); de Dalla Torre & Harms, Le. 211, 1901; Post & Kuntze, Lexikon 58, 1904 (as a syn. of Petrolar) Barr.

Lepidocarpa Korthals in Nederl. Kruikd. Arch. 3: 385, 1855; Miquel, FL, Ind. 1855 (Lepidocarpia); Müller in Walp. Ann. 4: 644, 1857; in Flora 41(16): 255, 1858; Boerlage, Handl., Le. 1: 424, 1890; Koorders & Valeton, Le. 333, 1900; de Dalla Torre & Harms, Le. 211, 1901; Post & Kuntze, Lexikon 323, 1904 (correct.: Lepidocarpus; non Lepidocarpus Kald.).

Lepidocarya „Korthals“ Miquel, Fl. Ind. bat. 1(1): 353, 1855; Bentham in Bentham & Hooker f. Gen. PL. 1: 607, 1865; Hooker f. in Martius, Le. 49, 1867; Durand, Index 111, 1888 (as a syn. of Parinarium Juss.); Boerlage, Le. 1: 424, 1890; Koorders & Valeton, Le. 332, 1900; de Dalla Torre & Harms, Le. 211, 1901; Post & Kuntze, Lexikon 323, 1904.


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

Nea „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, spathulate, 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 stigmal 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, membraneous; 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 sm30th; 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 underlaying 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. mmida; 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 subcoriaceous 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 among 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 found 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. Duvgnaud (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. polynera), 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 leafsurface. The shape and dispersal of glands is in principle not different from that of species of Prunoideae (cf. Prunus and Pygeum,

The cylindrical pedioles 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 pedioles of a specimen. They are round, protruding, glossy black and very tiny. They are attached somewhat lateral at the upper side of the pediole, 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 may 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 hisrute 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 useful 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 thick, 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 hisrute 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 arranged 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 veinyets with small, deeply sunk areoles with a grey cobweb-like felt of hairs in between, 3

2a. Leaves elliptic to oblong or subovate-elliptic, 4.5 X 9.5 to 7 X 20.5 cm; lateral nerves 11—15 pairs. Panicles silvery silky, large, .......... 1. P. argenteeo-sericea
b. Leaves ovate, 3 X 4 to 5 X 8 cm; lateral nerves 7—10 pairs. Panicles sub-sericeous, .......... 2. P. canaridioide

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. polycarpa
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. purpurea
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, ............................. 3. 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-pilosse, ............................. 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. anamansae
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 - 4.5 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.
Folius subitus glabris nee areolatis. Species 1—2.

1. PARINARIA ARGENTEO-SERICEA Kosterm. — Fig. 1.
PARINARIA 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 filiforme, reticulation prominent or inconspicuous; lower leaf surface dull, paler, lateral nerves 11–15 pairs, erect-patent (the lower ones patent), secondary nerves rather lax, prominent; 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, glabrous.
Panicles terminal, up to 9–15 cm long, lax, densely white sericeo-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 indumentiform, gibbose, rather slender, densely white tomentellous, 2–3 mm long; lobes 1.5–1.8 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.


2. PARINARIA CANARIOIDEA Kosterm. — Fig. 2.

Tree, up to 60 m high and 100 cm in diam. Crown elongate or subglobose, dense. Buttresses 1.5–2.5 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 browned heartwood. Branchlets sparse, 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, 2–5.5 x 4–8 cm, petiole 2.5–5 x 4–8 mm, pubescent or rarely reticulate on both surfaces, base cordate (in young leaves' acute) or truncate, apex narrowly 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, inside densely, minutely pilose. Petals elliptic, obtuse, tapering to the apex, 2 mm long, outside glabrescent, inside 2 mm.

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. sumatra**: Kuantan Dist., Tjerintji, ster., 66. 25221 (A, BO, L); Djambi Dist., Tebingtinggi, alt. 13 m, ster., bb. 13650 (BO); Lampong Dist., Tulpang Wang, Mengala, alt. 10 m, Jan., fr., 66. 77U (BO, K, L); ibid., Dec., fr., fl., *Gusdorf* 66 (BO); Borneo: Sarawak, Dist. 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., Ashton Brim. 5669 (K); W. Kalimantan (Indon. Borneo), Sambas Dist., Perigi Limus, Mt. Sedjudjuk, alt. 200 m, ster., 66. 7056 (BO), "E. Kalimantan, Nunukan Isl., N. part, sandy, alt. 20 m, Oct., fl., Kostermans 861+6 (A, JBISH, BM, BO, Bill, CAL, K, L, NY, P, PNH, SING); W. Kutei, Sebulu, alt. 20 m, ster., 66. 15717 (BO, L); ibid., Kelumpang, alt. 30 m, ster., 66. 16921 (BO, L); E. Kutei, Sangkulirang Dist., Rantaubahan, alt. 18 m, ster., 66. 15256 (BO); Samarinda Dist., Loe Lijana, alt. 60 m, ster., 66. 3219 (A, BO, L); ibid., Tandjong Bangko, Mouth of Mahakam R., sandy, June, fr., Kostermans 7152 (A, BISH, BO, Bill, CAL, CANB, K, L, LAE, MEL, NY, P, PNH, SING); Balikpapan Dist., Mentawir R., alt. 20 m, July, young- fr., Kostermans 10759 (A, BO, K, L, SING); ibid., Febr., fl., Kostermans 10017 (A, BISH, BO, BR, CAL, CANB, K, KEI, L, LAE, NY, P, PNH, SING, SYD); Distr. Tanah Bumbu, Kainon 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, prominent, secondary nerves promimulous, 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 flattened 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 rust 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 obstate leaves with the extremely dense areolation and the short axillary inflorescences.

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

**B. elmeri**: Andalu For. Res., undulating hills, yellow sandy loam, alt. 50 m, July fl., *Ashton Brun.* 3267 (BO, K, L, SAR); Bukit Teraja, mile 21½, alt. 300 m, yellow sandy clay, Sept., fl., *Ashton Brun.* 673 (BO).

4. **PARINARI ELMIERI** Merr. — Fig. 4.


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—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 tomentose, 15—3 mm long, glandless. Stipules of the flush large, lanceolate, very acute (acutulate), tomentellous, up to 15 mm long, lateral. Panicles reduced, racemelike, axillary, 15—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.

**B R U N E I:** 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. K A l i m a n t a n (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 Klass 11+676 (K).

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 tomentose; 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. Petioles narrow, terminal, densely fulvous, up to 13 cm long, lateral branches up to 2 cm long. Flowers densely villous, large, almost sessile; calyx infundibuliform, 5 mm long; lobes 2—2.5 mm, elongate-triangular. Petals slightly longer than the calyx lobes, spathulate. 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 at. Kuala Trengganu Besut Rd. (west side), lowland, Sept., young tree, Sinclair & Kiak bin Salleh S.F.N. 40773 (SING).

7. **Parinarium Ashtonii** Kosterm. — Fig. 7.

**Parinarium Ashtonii** Kostermans in Reinwardtia 7: 53, fig. 7. 1965 — Ashlon S. 1728 (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 young 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, 5 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. Inflorescence 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.


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, papery, 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 sucordate 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, prominent, perpendicularly to the lateral nerves; no glands and no axillary membranes. Petiole stout, rusty tomentellous, glabrescent, glabrous, 1—1.7 cm long. Stipules ovate or lanecolate, acute, 2—4 cm long, inside glabrous, outside densely silky pilose, caducous in a very early stage of leaf development.

Panicules 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 infundibuliform, somewhat gibbose, 3 mm long; lobes ovate, acute, unequal, 1.5–2 mm long; petals white or pale blue, spathulate 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, unlinear, 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.

Inflorescence 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 sea level 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., Foxworthy 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 10869 (LE, SING); Kelantan, Sg. Betis, S. Nenggiri, July, fl., Henderson, S.F.N. 29570 (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., Malangkew Distr. 623 (—3307) (K); Iohore, Sg. Sedili, low, July, young fr., Ngadiam, S.F.N. 36910 (BO, GH, SING); Singapore, Mandai Rd., ster., Kiah s.n. (SING); ibid., Stagsmount, ster., Ridley s.n. (SING); ibid., E. End of Setelar Reservoir, swampy, small tree, ster., Sinclair, S.F.N. i0635

**KOSTERMANS:** Genus Parinari

(E, K, SING) (leaves 16 X 30 cm, petioles 13 mm long); *Sumatra:* E. Coast, As'ahan, Huta Panag 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), Elopuru, Kabili Sepilok For. Res., Cpt. 15, alt. 20 m., July, buds, Eengoh B.N.B. F.D. 1017 (BO, GH, K, L) et June, fl., Eengoh B.N.B. F.D. 7219 (SING); ibid., Cpt. 3, Subdept. 2, Bombay-Burma T.C. Concess. Area, Kalabakam, 30 miles W.N.W. of Tawau, May, fr., Wood, San A 31,60 (SING); Tawau, fl., Elmer 21396 (BISH, BO, BR, C, DC, DD, F, GH, M, K, L, MO, P, S, SING, UC); W. Kallimantan (Indon. Borneo); Melawi, Tjatit, alt. 450 m, ster., 66. 25119 (A, B, L); E. Kalimantant, Tidung, ster., 66. 17767 (BO, L, SING); ibid., Tataban, Dec., ster., 66. 18282 (BO, L, SING); Bulungan, Salimbatu, S. Rumah, alt. 100 m., ster., 66. 11284 (BO, L) et 11278 (BO); Berau, Betemue Auer, ster., 66. 19076 (BO) et 19089 (BO, L, SING); 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. Kutai, 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.


**Parinari costatum** (non Bl.) King in J. As. Soc. Bengal, Ie. 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 axillary 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, scantly 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, assymmetric tube and about 1 mm long acute, which are silky on both surfaces; petals spathulate, glabrous, longer than the calyx lobes, narrowed towards the base; stamens about 10, one-sided on a short rim; anthers L–5–2 mm long with large anthers; filaments shorter than the petals; ovary densely striose-silky; style glabrous, shorter than the stamens with a round disk like stigma.

Infrutescence 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 tapering towards the base, compressed laterally, covered with a 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 long; 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.

*M. rubiginosa* (BO, L) ; Lampong Dist., Mt. Batin, ster., Tepsman H.B. 4537 (SING) ; locality not indicated, buds, Griffith s.n. (BO, L) ; Sumatra : Inderagiri Upper Lands, Keritang, alt. 40 m, ster., Blimbing, alt. 6 m, ster., 66. 25890, 25859 et 25848 (A, BO, L) ; Palembang, Banjauin & Kubu regions near Bajunglintjir, alt. 15 m, March, *Thorens* 45 T. IP. 58 (BO, L) ; id., Febr., buds, 45 T. IP. 58 (BO); ibid., Aug., 45 T. IP. 58 (BO); ibid., Dec., Grashoff 898 (BO, L) ; Lampong Distr., Mt. Batin, ster., Tepsman H.B. 4537 (BO, L).

The species is very close to *P. rubiginosa*, which has coriaceous leaves with longer petioles with oval 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. **P. rubiginosa** Ridley — Fig. 10.

**P. polyneura** (Parinarium rubiginosum Ridley in *J. Feder. MalaySt. Mus.* 6: 143. 1915 — Padang across Tehu, Ridley (SING).)

**DISTRIBUTION:** lowland of the Malay Peninsula, Sumatra.

M. rubiginosa (BO, L) ; locality not indicated, buds, Griffith s.n. (BO, L) ; Sumatra : Inderagiri Upper Lands, Keritang, alt. 40 m, ster., Blimbing, alt. 6 m, ster., 66. 25890, 25859 et 25848 (A, BO, L) ; Palembang, Banjauin & Kubu regions near Bajunglintjir, alt. 15 m, March, *Thorens* 45 T. IP. 58 (BO, L) ; id., Febr., buds, 45 T. IP. 58 (BO); ibid., Aug., 45 T. IP. 58 (BO); ibid., Dec., Grashoff 898 (BO, L) ; Lampong Distr., Mt. Batin, ster., Tepsman H.B. 4537 (BO, L).

The species is very close to *P. rubiginosa*, which has coriaceous leaves with longer petioles with oval 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*.

**P. polyneura** (Parinarium rubiginosum Ridley in *J. Feder. MalaySt. Mus.* 6: 143. 1915 — Padang across Tehu, Ridley (SING).)

**DISTRIBUTION:** lowland of the Malay Peninsula, Sumatra.

*P. polyneura* (Parinarium rubiginosum Ridley in *J. Feder. MalaySt. Mus.* 6: 143. 1915 — Padang across Tehu, Ridley (SING).)

**DISTRIBUTION:** lowland of the Malay Peninsula, Sumatra.

10. **P. rubiginosa** Ridley — Fig. 10.

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 leavesurface. The specimen Kostermans 7588 may as well belong to P. gigantea.

Malya Peninsula: Pahang, Selangor Border, Fraser's Hill, Oct., buds, Raub 22548 (SING); ibid., 1300 m, Sept., fl., Moh. Nur 111301 (SING); ibid., Sg. Yet, alt. 1250 m, Sept., buds, Moh. Nur 111417 (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, Penibukatan 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, LENS, P, PNH, SING); ibid., July, Kostermans 7295 (BO, K, L); ibid., July, fr., Kostermans 7588 (BO, K, L, SING).

11. Parinaria Nonda F.V.M. ex Bth. — Fig. 11a. & b.


Tree, 3 to 4 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 (hb. 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 subacute, apex distinctly to obscurely acuminat; upper surface glossy, midrib flat or sulcate in its upper part, pilose at base; lateral nerves very slender, secondary nerves parallel, very slender, prominent; 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, 5—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, spathulate. 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: Wobbecka (Manikiong, near Oransbari); Mala one (Kwara-ae, Solomon Isl.); Ranna (Morehead R.-); Wo'inya (Cooktown); Wiepa (Mabuig 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 salomonensis. 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) 253 (BO, L); Idenburg R., alt. 80 m., Apr., fl., Brass & Versteegh 13541 (fruit bumpy subglobose; a frequent tree) (BO, GH, L); Ransiki Distr. (Manokwari), 1965]
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. 31228 et 31381 (BO, L); Babo, alt. 15 m, ster., bb. 21822 (BO, L); South Coast, Okaba near Giniu, Aug., fr., Branderhorst 15 (K, L) and buds, Pringo 15 (BO); locality not indicated, fr., Jafari s.n. (BO); Papua, Middle Fly R., lake Dativum, plenty in Banksia-Grevillea savannahs, Sept., Brass 7891 (A, GH, L); Western Div., Mabadaun, savannah forest, rarer substage tree, April, young fr., Brass 6571 (A, BO, GH, L); Dagwa, Oromo, March, young fr. and buds, Brass 5979 (BO, GH, L, K), this specimen has leaves with numerous glands; Kokoda, 300 m., fr., Carr 16479 (L); Boridi, 1300 m, buds, Carr 14551 (L); locality not indicated, buds, Banks & Solander s.n. (P); Sudest Isl., Joe Landing, alt. 100 m, Aug., fl., Brass 27725 (A, BO, L); id., Mt. Rtu, W. slopes, alt. 300 m., Aug., fl., Brass 27920 (A, K, L); Solomon Isl., Vanganu Isl., near Kaikose, L., 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); Gatukasi Isl., Dec., buds, Whitmore B.S.I.P. 1250 (L); Baga Isl., Fl., Whitmore B.S.I.P. 2904 (L); Sante Ysabel, Allardce Harbour, Jan., fl., fr., Whitmore B.S.I.P. 3666 (L); E. Choisneul. 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., McGillyvray 432 (K); Padine R., fl., Hill 138 (L); Gilbert R., fl., 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.


Tree, about 10 m high; branches brown, glossy, lenticellate; youngest branchlets densely ferrugineously 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 filiformious; 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 (lump)

flush.

Panicicles 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-obovate, 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.


13. PARINARI ANAMENSE Hance — Fig. 13.


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. Piloosity 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 leafsurface 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, Makmne Thalawk (Siam); Quelo (Kmer); Cay Cam (Viet); Thlok (Cambodia); Phok (Laos); Enay (near Ban-Me-Thuot); Bua Day or Ndi or Tald (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 distribution area should be continued 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 leavesurface; 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., Teisjmann s.n. (K); fl., fl., Teisjmann H.B. 6008 (BO, G, L, U); E. and S.E. Siam: Chantabun, ster., Vesterdal s.n. (BO, C, SING); ibid., Nov., fl., fr., Lakanakarana 4891 (K); Chantaburi, Makkam, Ban Ang, Nov., fl., Chit Nophakdi 146 (BKF); Pitsanulok, Pamak, fl., Kerr 8912 (P, UC); ibid., April, fl., Kerr 2559 (K); fr., Kerr 2309 (K); Trat, Huay Raeng, Dung-Maduca, young fr., Smitinand 1361 (= For. Dept. 7277); (BKF), BO; Prachinburi, Aran Prathet, Nawng Waeng, Jan., fl., Put Phraimirind 45, very common (BKF); Chawcan, Ratburi, March, fl., Kerr 10642 (K); Siracha near Na Prov, April, fl., Collins 874 (BISH, C, K, L, US); ibid., Be弗., fl., Collins 331 (K, P, US); ibid., March, fl., Collins 970 (K, US); Korat, Pak Tong-Chai, Dec, fl., Kerr 8103 (K); Surin, fl., Put 656 (K); Ubol, Bang Boong, June, fl., fr., Lakanakarana 891 (K); Laos: Basin of R. Se-Moung, Dec, fr., Harmond 1002 (P); Cambodia: Kang Chon, Kang Sowai, March, fl., Bejaud 396 (P); Chamcar-Ta-Man, Prov. of Kuang Chiuang, March, fl., Chevalier 36991 (BOP); Kampong Thom, Tonle Sap, fl., Service for. (P); Road of Trimbell, Km 180, Aug., ster., Poilane in Herb. Chevalier 436 (BO, P); Phnom Penh, fl., Bejaud 746 (P); Siem Reap, Dengrek Mts., Nov., fl., Poilane 13867 (K); Kampong Chuan, fl., Chevalier 31943 (P); ibid., fl., fr., Cardot s.n. (K); ibid., For. Reserve

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Kranlanh, fl., Chevalier 31747 (P); Mt. Thral, Pierre s.n. (P); Prayle Triek, Chhlong, March, fl., Chevalier 40691 (L, P); locality not indicated, fr., Godefoy s.n. (P); fl., Hahu s.n. (P); A.annami: 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); fl., 49224 (BO, L, P) et 4094 (BO, P); ibid., For. Reserve Chuai-Cat, Sept., fl., Fleurty in Herb. Chevalier 39049 (BO, P); Prov. Phanrang, Ca-Na, March, fr., Poilane 5383 (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-Lacourt 345, 346 (P); locality not indicated, fr., Robinson 1493 (P); fl., GOUT gaud s.n. (P); Cachini: Cuan Tri, Jan., fr., Poilane 11874 (P); Prov. Thuanmot, For. Reserve Chon Tanh, Jan., fr., Fleini in Herb. Chevalier 30011 (BO, P); id. 39357 (P); ibid., Tai-Tinh, Bien Hoa, fl., Thorel 1002 (BO, DC, GH, L, P); Bienhou, Tran-Nhuani, Febr., fl., Vinot s.n. (P); Road of Baloath, Jan., fl., Lefereve 290 (P); Road Saigon-Bienhoa, Sept., young fr., Lefereve 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 39222, (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., Lefereve 360 (P); ibid., Febr., fr., Muller 901 (P); Khone, fl., Harmond 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 HELFERN Hook. f. — Fig. 14.


Large tree; branchlets densely pale brown pilose; branches glossy with numerous tiny round, pale lenticels. Leaves stiffly chartaceous, elliptic to subobovulate-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, prominent, reticulation filiformous, dense, prominent; 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, membranous, sub-spathulate, acutish. Stamens 8, unequal, filaments up to 1.5 mm long. Ovary densely villous; style 2 mm long, densely villous (except tip).
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. sumatrana (non Miquel) Kurz, although with doubt; this represents P. anamense Hance.

Lower Burma: Tenasserim R., March fl., Heifer s.n. (K); Myaunmya 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 petals are stellate. Moreover, the very young axillary inflorescences do not conform with those of Parinari. It might be Tilliacous.

15. Parinari sumatrana (Jack) Bentham. — Fig. 15a, b, c.


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, membraneous, 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, prominent, secondary nerves parallel, prominent; 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.

Panicules 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 spathulate, 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 obnivorous 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 holotype, 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).

S. sumatrae: E. coast, Pakenbaru, Tenajan R., Aug., buds, Soepadmo 92 (BO); Palembang Dist., Komering hilir, Kaju-Agung, o m, Jan., fl., bb. 13600 (BO, BZF); Palembang, Derma Enim, fl., Teijssmann 3795 H.B. (BO, K, U); ibid., Ogan ulu, Tubuan, young fr., Teijssmann 3802 H.B. (BO, K); Lampong Districts, Sting Kebau (Kebouw), fr., Teijssmann 401 H.B. (BO, K); ibid., Tarabangi, •• fr., Teijssmann 855 H.B. (BO, K, L, U); S. W. Java: Udjungkulon Reserve, Peutjantg Isl., alt. 20 m, coral limestone, Febr., fl., Kostermans 23 A (A, BO, K, L, P); ibid., Nov., fl., Kostermans c. S. sumatrae (Unesco) U (A, BH, BISH, BKF, BM, BRI, CAL, CANB, G, K, L, LAE, NY, PNH, SING, SYD, US); ibid., Aug., fl., 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 (BO, G, K, K, L, LAE, P, PNH, SAR) et fr., Kostermans 21885 (BO, A, BO, G, K, L, LAE, P, PNH, SING, SAR); ibid., Bantarat, foot of Mt.بونج, Dec, ster., Kostermans 19289 (BO, BH, BO, C, CANB, G, K, L, P, US); ibid., Tjema Udjungkulon, Dist., Batuhdeun near Menes, July, young fr., Koorders 8562 (BO, K) et ster., Koorders 8563 (BO, K), leaves 7.5 X 25 cm with up to 17 pairs of lateral nerves: Djampang kulo, Tjiratjap, Distr. Sukabumi, Koorders 7966 (BO, K, L, U); Central Java: Isl. Nusakambangan, ster., Koorders 8563 (BO); ibid., June, fr., Koorders 30270 (A, BO, K, L, Y); 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. 22+964 (A, BO, L, K).

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


This species is represented only by a sterile branch. In venation it resembles P. oblongifolia Hk. f., but is 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).

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 or brownish 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 acute, top conspicuously acuminate, 2.4 to 4.9 cm; upper surface glossy, smooth, midrib, veins and reticulation slender, prominent; lower surface with a prominent midrib, 8—15 pairs (usually 12) of slender, prominent, towards margin arcuate lateral nerves and a stomatic 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.

Panicules axillary, narrow, up to 9 cm long, fewflowered, with the same indumentum as that of the branchlets; flowers in fewflowered corymbbs. Pedicel hardly 1 mm long, tomentellous with two narrowly lanceolate, acute, pilous, 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 greybrown pilose, ventricose laterally, trumpet shaped, 3—3.5 mm long; lobes 15—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-spatulate, membranous, 15—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 scars, rarely completely covered with scars, 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.

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 scars.

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, Curtis s.n. (SIN); ibid., Tunnel Rd., alt. 750 m, May, fl., Henderson S.F.N. 21431 (BO, SING); ibid., W. Bungalow, Sept., fl., 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, Kg. Sedili, low, July, fl., Ngadiman S.F.N. 36915 (BO, SING); ibid., Febr., ster., Corner S.F.N. 48474 (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., fl., 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., Cantley's Coll. (Alvins) 13 (SING); ibid., fl., Maingat 621/2 (L); Singapore Isl., West End Selat Rovervoir, Upper Mandai, Aug., ster., Sinclair S.F.N. 39700 (BO, L, SING); Chan Chun Kang, fl., Ridley 3901 (SING); Sumatra: East Coast, Upper Langkat, Batang Lombosa, 40 m alt., ster., bb.9152 (BO); Pakanbaru, Tenjaw R., Aug., fl., Soepadmo 206 (BO, L) et Aug., fl., Soepadmo 84 (BO); Palembang Dist., Mulah hulu, April, Grashoff 298 (BO, K, L); Tandjong Neng, R. Bliti, alt. 200 m, young fr., Forbes 2837 (l = 123) (BO, L); Sumatra's West Coast, Payan, 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. 7089 (L).

18. **Parinari insularum** A. Gray. — Fig. 18.


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 acutte with sharp tip; upper surface glabrous, the flattened midrib with a long-persistent pilosity, lateral nerves very slender, hardly raised; lower surface densely stomat-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 subracemiform. Bracts ovate, acute, concave, 4 mm long, densely tomentellous, caducous at anthesis. Calyx broadly funnel-shaped, 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 25 x 5 cm, olive coloured (fresh).
19. Parinari gigantea Kosterm., spec. nov. — Fig. 19.

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

Tree 35—40 m tall, free bole 21—27 m long and 60 cm in diameter. Bark dirty grey, smooth, 0.5 mm thick, lenticellate. Living bark 10—20 mm thick, red-brown. Wood pale red-brown, alternating with paler parts. Branches glossy red-brown 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 prominent, secondary veins dense, parallel, slightly prominent; 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. asthonii, 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.


20. PARINARI EXCELSA Sabine.


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

A specimen, collected by Roberts, 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 cobwebleike 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 filiform, prominent, reticulation prominent; lower leaf surface glabrous, prominently 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**


5. *P. petiolatum* von Malm (in Notizblatt Bot. Gard. Berlin 11: 630. 1932; in Fedde, Rep. 34: 276. 1934), *Rensch U*, Mbadju, Flores (not Mboedja, as von Malm misspell it; in his article he, more or less consistently, misspelt oe as ae; the Dutch oe is the aequivalent of the german u; the Sumbawanese village Batudulan is misspelt 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 serrat e leaves and long petiole. It represents perhaps *Polysoma* (Rutaceae), which has leaves, exactly like those as v. Malm describes, the young leaves of *Polysoma* are somewhat warty (tuberculate) when dried. It might also represent *Eriobotrya banglensis*, which sometimes has racemelike inflorescences. Also *Helicia* is not excluded. Several other identifications in v. Malm's article are dubious or wrong!

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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.

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

Fig. 9b. *Parinari polyneura* Miq.
Fig. 10. *Parinari ruhiginosa* Ridley; after Nur 11147 (BO).

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

Fig. 12. *Parinari bicolor* Merr.; after Ramos & Pascassio B.Sc. 35041 (BO).
Fig. 13. *Parinari anamense* Hanee; 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 insidarium* A. Gray; after A. C. Smith 196 (BO).

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