VOLUME 4 JUNE 1959 PART 4

REINWARDTIA

BEING A CONTINUATION OF THE

BULLETIN DU JARDIN BOTANIQUE DE BUITENZORG
(BULLETIN OF THE BOTANIC GARDENS, BUITENZORG)

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Published by
HERBARIUM BOGORIENSE
KEBUN RAYA INDONESIA

Reinwardtia Vol. 4, Part 4, pp. 465 - 583 BOGOR, June 1959

RBINWARDTIA
Published by Herbarium Bogoriense, Kebun Raya Indonesia
Volume. 4, Part 4, pp. 465-583 (1959).

A MONOGRAPH OF THE GENUS HERITIERA* Aiton** (StercuL)

(including *Argyrodendron* F. v. M. and *Tarrietia* Bl.)

A. J. G. H. KOSTERMANS***

SUMMARY

1. The genera Heritiera Ait., *Argyrodendron* F.v.M. and *Tarrietia* Bl. are united.

2. The genus comprises 29 species ranging from India, Malaysia, New Guinea and the Pacific region to tropical Australia (2 species, of which one extends to Celebes) and 2 species in tropical Africa.

3. The following ten species are described here for the first time: Heritiera arafurensis Kosterm., H. aurea Kosterm., H. burmensis Kosterm., H. catappa Kosterm., H. cordata Kosterm., H. globosa Kosterm., H. macroptera Kosterm., H. novoguineensis Kosterm., H. percoriacea Kosterm., and H. pterospermoides Kosterm.

4. The following ten new combinations are created: Heritiera actinophylla (Bailey) Kosterm. (basionym: *Tarrietia actinophylla* Bailey), H. albiflora (Ridley) Kosterm. (basionym: *Tarrietia albiflora* Ridley), H. borneensis (Merr.) Kosterm. (basionym: *Tarrietia borneensis* Merr.), H. densiflora (Pellegrin) Kosterm. (basionym: *Tarrietia densiflora* (Pellegrin) Aubreville et Normand), H. jaranica (Bl.) Kosterm. (basionym: *Tarrietia javanica* Bl.), H. kiinstleri (King) Kosterm. (basionym: *Tarrietia kunstleri* King), H. peralata (Domin) Kosterm. (basionym: *Tarrietia peralata* Domin), H. simplicifolia (Mast.) Kosterm. (basionym: *Tarrietia simplicifolia* Mast.), H. sumatrana (Miq.) Kosterm. (basionym: *Tarrietia sumatrana* Miq.), and H. trifoliolata (F. v. M.) Kosterm. (basionym: *Argyrodendron trifoliolatum* F. v. M.).

5. The following fifteen species are reduced to synonymy: *Argyrodendron amboinensis* Haberlandt; *Heritiera acuminata* Wall, ex Kurz, *H. annamensis* Lecomte, *H. minor* Lam., *H. tothila* (Gaertn.) Kurz, *H. vespertilio* Kurz; *Tarrietia actinodendron* Guilfoyle, *T. amboinensis* Hochr., *T. Argyrodendron* Benth., *T. carroni* Moore, *T. curtisii* King, *T. perakensis* King, *T. riedeliana* Oliv., *T. rubiginosa* Kosterm. and *T. - unifoliolata* Ridley.

6. The following seven species are excluded from the genus: *Heritiera attenuata* Wall., *H. grandis* Fisch. ex Steud., *H. spectabilis* Baill., *H. tinctoria* Blanco; *Tarrietia barteri* (Mast.) Hochr., *T. erythrosiphon* (Baill.) Hochr. and *T. perrieri* Hochr,

* Named after Ch. L. L' Heritier de Brutelle (1746-1800), who was murdered in the streets of Paris by unknown persons, a French civil servant, Member of the Institut de France, author of many botanical publications, especially on exotic plants. Part of the Dombey collections from S. America paid for by the Spanish Government were sold to 1' Heritier in exchange for a pension. When the Spanish Government heard this and objected to selling the collections, L' Heritier, afraid of being compelled to return the collection, fled with the plants to England where with the help of the herbarium and library of Banks he wrote a Flora of Peru that has not been published.

** Issued originally as Publication 1 of the Council for Sciences of Indonesia, Djakarta, April 24, 1959.

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7. The monograph gives full synonymy and exhaustive literature references, a key, complete descriptions, distribution, ecology, wood anatomy, vernacular names, use and habitat of each species.

8. A general introduction explains the position of Heritiera (including *Tarrietia)* in Sterculiaceae.

9. *Glablaria tersa* L., currently considered to belong to Lauraceae (Litsea) and later referred by Merrill to Bombacaceae, actually represents *Browlowia lanceolata* Benth. The necessary recombination Brownlowia tersa (L.) Kosterm. is coined.

10. Four new species are indicated, but not described.

11. Two new combinations are made in Hildegardia (H. erythrosiphon and H. perrieri).

Acknowledgement

I wish to extend my thanks to the Keepers-Directors of the herbaria at the Arnold Arboretum, Calcutta (Bot. Survey of India), Kepong, Kew, Leiden, Paris and Singapore for their cooperation in lending me material.

I have to thank here especially Mr L. L. FORMAN of the Kew Herbarium, who provided me often at his own expense with copies of papers not available at Bogor and who has been willing to investigate material for me at Kew.

I furthermore express my gratitude to Mr Sukirno, Mr Moh. Anwar and Mr Damhuri for preparing the drawings for the illustrations.

HERITIERA Aiton

HERITIERA Aiton (non Gmelin 1791 = Dilatris; non Retz. = Hellenia; non Michaux = Argolasia), Hort. Kew., ed. 1, 3: 456. 1789; Schreber, Gen. 1: 812. 1791; Lamarck, Encycl. bot. meth. 4: 228. 1797 (mollavi) ; Murray-Persoon, Syst. veg., ed. 15: 736. 1:797; Willdenow, Spec. PI. 4(2): 970. 1805; Persoon, Ench. 2: 591. 1807; Rees, Cyclop. 17(2). 1811; Sprengel, Anleit. 2(2): 690. 18:18; Syst. Veg. 3: 70. 1826; Gen. PI. 1: 544. 1830 *(Heriteria)* ; DC, Prodr. 1: 484. 1824 (excl. syn. *Samandura* L.); Reichenbach, Consp. 203. 1828; Nomencl. 202. 1841; Dumortier, Anal. Fam. 46. 1829 *(Heriteria);* Bartling, Ord. 340. 1830; G. Don, Gen. Hist. 1: 518. 1831 *(Heretiera)* (excl. syn. *Samandura* L.) ; Wight & Walker-Arnott, Prodr. 1: 63. 1831; Schott & Endlicher, Melet. bot. 32. 1832; Roxburgh, Fl. Ind., ed. Carey 3: 142. 1832 (reprint 506. 1874); Spach, Hist. Veg. Phan. 3: 503. 1834; Meissner, Gen. 30 (25). 1837; Endlicher, Gen. 119, 993. 1840; Suppl. 4(3): 61. 1850; Enchir. 516. 1841; Brogniart, Enum. Genres 78. 1843; Orbigny, Diet. Hist. nat. 5: 568. 1844; Brown in Bennet & Brown, PI. Jav. rar. 237. 1844; Jussieu in Orbigny, Diet. 7: 616. 1849; Miiller, Ann. Bot. 4: 321. 1857; Miquel, Fl. Ind. bat. 1(2): 179. 1859; Bentham, Fl. Hongkong. 36. 1891; Fl. Austral. 1: 231. 1863; in Benth. & Hook, f., Gen. PI. 1: 219. 1867; Masters in Oliver, Fl. Trop. Afr. 1: 225. 1868; in Hook, f., Fl. Brit. Ind. 1: 362. 1874; Baillon, Hist. PI. 4: 61, 123. 1872; Kurz in J. Asiat. Soc. Bengal 53 (2): 117. 1874; For. Fl. Brit. Burma 1: 140. 1877; Boerlage, Handl. Fl. N. Ind. 1: 124. 1890; King in J. Asiat. Soc. Bengal 60 (2) : 79. 1891; Trimen, Fl. Ceylon 1: 167. 1893; Schumann in Engl. & Prantl, Nat. Pfl. Fam. 3 (6): 99. 1895; Koorders & Valeton

in Meded. Lands PI. Tuin Buitenzorg 14: 170. 1895; F. M. Bailey, Queensl. Fl. 1: 141. 1899; Cooke, Fl. Bombay 1: 126. 1901; Brandis, Ind. Trees 85. 1906; Backer, Fl. Batavia 1: 168. 1907; Schoolfl. Java 139. 1911; Gagnepain in Lecomte, Fl. gen. Indoch. 1: 483. 1911; Koorders, Exkurs. Fl. Java 2: 595. 1912; Gamble, Fl. Madras 1: 103. 1915; Haines, Bot. Bihar and Orissa 2: 77. 1921; Ridley, Fl. Malay Pen. 1: 279. 1922; "Parkinson, For. Fl. Andaman Isl. 102. 1923; Merrill in Philipp. J. Sci. 29: 395. 1926; Domin, Bibl. Bot. 89 (I) 3, Dicot. 970. 1928; Lemee, Diet. Genres 3: 541. 1931; Pearson and Brown, Comm. Timb. India 1: 153. 1932; Corner, Wayside Trees Mai. 1: 612. 1940; Adelbert in Backer, Bekn. Fl. Java, Nooduitg., Fam. 107: 28. 1944; L. H. Bailey, Stand. Cyclop. Hort. 1476. 1947; Chittenden, Diet. Gard., ed. 2, 2: 988. 1950.

*Tarrietia** Blume, Bijdr. Fl. Ned. Ind., 5e Stuk 227. 1825; Rumphia 3: t. 172, f. 1, note; Meissner, Gen. 55 (39). 1837; Dietrich, Syn. 2: 1383, 1540. 1840; Endlicher, Gen. 1074. 1840; Enchir. 562. 1841; Reichenb., Nomencl. 199. 1841; Steudel, Nomencl. ed. 2, 1: 664. 1841; Lindley:, Veg. Kingd. 385. 1847; Miquel, Fl. Ind. bat. l'(2) : 179. 1859; Bentham, Fl. Austral. 1: 230. 1863; in Benth. & Hook, f., Gen. PL 1: 218. 1867; Baillon, Hist. PL 4: 61. 121. 1872; Diet. 4: 154. 1892; Masters in Hook, f., Fl. Brit. Ind. 1: 362. 1864; Pfeiffer, Nomencl. 2 (2): 1356. 1874; B.oerlage, Handl. FL Ned. Ind. 1: 124 1890; Schuman in Engl. & Prantl, Nat. Pfl. Fam. 3 (6): 97. 1895 (diagnosis partly wrong) ; Koorders & Valeton in Meded. Lands PL Tuin Buitenzorg 14: 166. 1895; F. M. Bailey, Queensl. Fl. 1: 140. 1899; Backer, Schqolfl. Java 139. 1911; Gagnepain in Lecomte, FL gen. Indoch. 1: 481. 1911; Koorders, Exkurs. FL Java 2: 599. 1912; Ridley, Fl. Mai. Pen. 1: 277. 1922; Corner, Wayside Trees Mai. 1: 621. 1940; Adelbert in Backer, Bekn. Fl. Java, Nooduitg., Fam. 107: 26. 1944; Thomas in Mai. For. Records 13: 20. 1950 (timber).

Argyrodendron F. v. Mueller (non Klotzsch 1861 = Croton L.), Fragm. 1: 2. 1858; 2: 177. 1860-61; 6: 173. 1867-1868; Bentham, Fl. Austr. 1: 231. 1863 (as a syn. of *Tarrietia) ;* Baillon, I.e. 61 (in nota) ; Bentham in Benth. & Hook, f., Gen. PL 1: 218. 1867 (as a syn. of *Tarrietia);* Edlin in New Phytol. 34: 10. 1935; Burtt-Davy in Trop. Woods 51: 19. 1937.

Balanopteris Gaertner, de Fruct. et Semin. 2: 94. 1791; DC, Prodr. 1: 484. 1824 (as a syn. of *Heritiera);* G. Don, Gen. Hist. 1: 518. 1831; Endlicher, Gen., Suppl. 4 (3) : 61. 1847-48; Benth. & Hook, f., I.e. 219.

Sutherlandia J. F. Gmelin (non R. Br.), Syst. 1027. 1791; Lindley, Veg. Kingd. ed. 3: 362. 1847 (as a syn. of *Heritiera)* ; Endlicher, Gen., Suppl. 4 (3) : 61. 1847-48; Baillon, Hist. PL 4: 61. 1872.

Fometica Rafinesque, Sylva Tellur. 75. 1838; Merrill, Index Rafin. 167. 1949.

Heritera Stokes (non Schrank = Liliac), Bot. Mat. Med. 2: 565. 1812.

Heriteria Dumortier, Anal. Fam. 46. 1829.

Samandara Linn, ex Roxburgh, Fl. Ind., ed. Carey 3: 142. 1832 (repr. 506. 1874), as a syn. of *Heritiera minor.*

Tothila et Tothya (Tothiia) Hermann, Mus. Zeyl. 48. 1717; Burman, Thes. Zeyl. 226. 1737; Linnaeus, Fl. Zeyl. 237. no 655. 1748; Trimen, I.e. -(according to Trimen this Singhalese name is properly applied to *Oroxylum indieum).*

Atunus Rumphius, Herb. Amboin. 3: 95-96, t. 63. 1743; Lamarck, Encyl. 4: 228. 1797; Endlicher, Gen., Suppl. 4 (3): 61. 1847-48; Lindley, Veg. Kingd., ed. 3: 362. 1847; Baillon, I.e. 61; Merrill, Interpr. Rumph. Herb. Amboin. 365. 1917.

* After the vernacular name tarrieti, which however is actually used either for *lithocarpus* or for *Parinari corymbosa.*

Nagam or *Cupajada* Rheede, Hort. Malab. 6: 37, t. 21. 1686; Lamarck, I.e. 228; Dennstedt, Schlüssel 13, 21, 32. 1818; Masters in Hook, f., Fl. Brit. Ind., I.e. 363.
Amygdalus Burman (non L.), Thes. Zeyl. 19. 1737 p.p.; Fl. Ind. 117. 1768; O. Kuntze, Rev. Gen. PI. 1: 75. 1891; Engler & Prantl., Nachtr. I-IV: 242. 1897 (as a syn. of *Heritiera).*

Trees, buttresses well-developed, thin. Bark usually pale brown red and spotted, no sap in the bark. Sapwood thin, usually merging into the red brown heartwood. Leaves unifoliolate or digitate, alternate, often congested near apex of branchlets, entire, chartaceous to rigidly coriaceous, as a rule subtriplinerved and the base attached above the petiole (pseudo-peltate), petioles thickened at both ends; the lower leaf surface and the young branchlets as a rule covered with adpressed, small, more or less fimbriate scales.

Inflorescences axillary, paniculate, peduncle and main ramifications adpressed-lepidote, the tomentum gradually changing to stellate hairs towards the ultimate ramifications. Pedicels articulate, short. Flowers very small, consisting of an urceolate or campanulate tube with 4 or 5 (rarely 6) explanate small lobes; inside and outside of tube as a rule stellate-pubescent. Petals none. Male flower with an androgynophore bearing at its apex the 8 or 10 anther-thecae either in a regular ring or in an irregular clump, topped by the minute sterile ovaries, or ovaries completely abortive (in the latter case the anthers in an irregular clump); anthers dehiscent by a longitudinal slit; torus well developed, convex, covered with granular papillae, often depressed in the centre. Female flowers hardly larger than male ones, with 4 or 5 (—6) sessile laterally compressed, conglutinate, minute, glabrous or lepidote ovaries, at base with sterile anthers in as many groups as and in between the ovaries, torus usually flatter than in male flowers; styles short, the upper part either perpendicularly spreading or incurved with minute stigmas.

Fruit a more or less developed samara with an ellipsoid to globose (often oblique) nut with a woody epicarp, at dorsal and ventral side provided with a more or less well-developed longitudinal ridge which enlarges apically into a more or less well-developed wing; in one case *(H. fomes)* a tranverse, horizontal ridge present. Seed (mature) enveloped in a rather thin seedcoat, cotyledons two, without albumen, the small radicle and plumule turned to the ventral side.

Type species.—*Heritiera littoralis* Aiton

Distribution.—Asiatic continent from India through Burma, Siam and Vietnam to Malaysia; Tropical Australia; Pacific region; Africa (Gold Coast, Congo) ; one coastal species practically pantropical *(H. littoralis).*

About ten years ago I became interested in the genera Tarrietia and Heritiera because of the difficulties encountered in identifying and collecting them. The reasons why these genera give so much trouble are the following: most species are rare to very rare; they have very hard wood and are usually lofty trees, hence not easy to collect and the flowers are extremely small; moreover the fruiting of many is scanty.

Several species are very similar in their leaf-shape and may be easily mistaken for another species in a sterile condition; this happened in the group of *H. littoralis, globosa, arafurensis, percoriacea, longipetiolata, novoguineensis, etc.* Within the species the leaves may vary enormously; in trees up to 15 to 20 m high they are often still completely different from those of mature trees (cf. *H. macroptera).*

Heritiera and Tarrietia are — with respect to wood characters — aberrant in Sterculiaceae and hence were placed by Edlin in a special subfamily.

As I have been able to revise most genera of Sterculiaceae proper now, I agree with those authors who prefer to separate Sterculiaceae from Buettneriaceae. In the former the fruits are apocarpous; in the latter they are syncarpous.

I am convinced, that the anthers are bilocular, as in female flowers of Heritiera there are as" many anthers (each with 2 thecae) as there are ovaries. They always occur in pairs. Because of chorisis in other genera it is very difficult to know whether the anthers have one or two thecae.

The subdivision of Sterculiaceae gives no trouble, if it is based on characters of the fruit. If *Sterculia* with its leathery, dehiscent carpels is assumed to be primitive, we have the following sequence: *Sterculia:* seeds attached along the entire margin of the open carpels, dispersed without the carpels (by birds) *; Firmiana,:* seeds along the entire margin of the carpels, the latter membranaceous, dispersal of the anemochorous seeds together with the carpels; *Scaphium* and *Pteroeymbium:* only one seed at the base of the membranaceous carpel, dispersal (by wind) with the carpels; *Hildegardia:* one seed at the base of the membranaceous (but already closed) carpel, which assumes the shape of a wing; *Heritiera:* one seed in the permanently closed carpel, which becomes fibrous, and at the same time develops a wing. In species of Heritiera dispersed by water the wings become short. Some of the upland species, however, also have hardly developed wings (H. *elata, H. arafurensis).* In *Pterygota* anemochory has developed in another way; the carpels are still similar to those of *Sterculia,* but the seeds have developed wings. The water-dispersed species as a rule have a larger seed than the upland species.

This same sequence of development is mentioned by Ridley (Dispersal of Plants 83. 1930).

A few decades ago it was still assumed that Heritiera was a typical seashore genus represented by a single species, but more and more species became known that grow far from the sea.

They were differentiated from *Tarrietia* by the absence of endosperm.

The genus *Tarrietia*, initially misplaced in Sapindaceae, Simarubaceae and Aceraceae on account of its samaras, was kept separate by some (of late Burtt-Davy and Edlin) from *Argyrodendron* on the basis of characters of minor importance (certainly not on a generic level). It has been established that the common *Argyrodendron trifoliolatum* occurs as far as Celebes and that the samaras are not different in any sense from those of other *Tarrietia* species.

The development of the wing of the samaras of Heritiera and *Tarrietia* shows all gradations from a small ridge via a rudder-like extension to a slender wing and ultimately to an enormous wing as in *H. macroptera*.

In *H. littoralis* the young seed is enveloped by a thick, spongy, juicy seedcoat, which becomes very thin and leathery in the mature fruit; no albumen was seen. I had the opportunity only to examine a few other Heritiera and *Tarrietia* seeds, but none contained any endosperm, and so — apart from the fact that, as was stressed also by Edlin, endosperm is no generic character—there is no reason whatever to keep *Tarrietia* and Heritiera as separate genera; all species show a very natural relationship. Of *H. utilis*, of which I had no seeds at my disposal, it is stated that there is a large endosperm.

Simple leaves are apparently derived from compound ones, as in many species with simple leaves in young trees compound leaves are usual. In several species compound and simple leaves are found together in mature specimens. From the reduction it is evident that the swollen apical part of the petiole of the simple leaf represents the petiolule. Scaliness is common, but in some species it is lacking almost entirely. In the inflorescence we may observe the gradual transition from scales to stellate hairs from the base of the inflorescence to the ultimate branches.

The trees are monoecious, male flowers being much more common than female ones. The flowers are usually small and thin. In *H. trifoliolata* they are more fleshy. Of several species the flowers are still unknown. The number or calyx-lobes is not constant, although there is usually a tendency towards the number 4 or 5.

There are apparently 8 or 10 thecae arranged either in a regular tube at the' top the androgynophore, or in an irregular clump. In the first case

the centre of the antherial tube surrounds the rudiments of the ovaries; in the latter there are often no rudiments. The androgynophore is usually very slender, pilose or glabrous and attached to a generally well developed torus, which is covered by glands visible in dried material as pale granules. The torus is as a rule convex. The female flower has sessile ovaries. These are laterally compressed, and provided with a very short style, of which the upper (stigma bearing) part is bent outwards, sometimes becoming horizontal. Between the ovaries there are 4 to 5 groups of 2 anther-thecae each, which may indicate that the anthers have 2 thecae. These anthers are either minute or very large (as in *H. trifoliolata)*.

The trees are usually heavily' buttressed, the buttresses are thin and very hard.

Samandura L. (Fl. Zeyl. 202 no. 433. 1748) based on Hermann's specimens has sometimes been monfused with Heritiera on account of the similar fruit. It represents *Samadera* Gaertn.. (Simarubaceae).

Practically all species have hard to very hard timber; the more common species are commercially important; *H. simplieifolia, H. javanica, H. borneensis* and *H. aurea* are much used in Malaya and N. Borneo and are exported to Singapore from Sumatra. *H. littoralis* is valuable for local markets; *H. utilis* and *H. densiflora* are exported from Africa. *H. fomes* is extensively used locally.

KEY TO THE SPECIES

1a. Leaves digitate (cf. also 24. *H. borneensis*) 2
b. Leaves simple or practically always so (cf. also 30. *H. densiflora*, 28. *trifoliolata* and 31. *utilis*) 6
2a. Samaras lepidote 3
b. Samaras glabrous 5
3a. Lower leaf surface glabrous . . . . . 29. *H. actinophylla*
b. Lower leaf surface with scattered scales . . . . . 30. *H. densiflora*
c. Lower leaf surface densely lepidote 4
4a. Nut 5 mm, wing up to 5 cm . . . . . 28. *H. trifoliolata*
b. Nut 25-30 mm, wing up to 8 cm . . . . . 31. *H. utilis*
5a. Lower leaf surface glabrous, but minute tufts of hairs in the axils of the lateral nerves. Anthers in an irregular clump . . . . . 25. *H. javanica*
b. Lower leaf surface glabrous. Anthers in a regular ring . . . 27. *H. albiflora*
c. Lower leaf surface lepidote and stellate-haired. Anthers in an irregular clump . . . . . 26. *H. sumatrana*
6a. Leaves bullate with impressed ribs on upper surface . . . 17. *H. im/pressinervia*
b. Leaves not bullate 7
7a. Nut of samara much larger than wing 8
b. Nut of samara smaller than, or at most as large as, wing 17

8a. Nut with a transverse circular ridge . . . . . 6. *H. fomes*
b. Nut without a transverse ridge 9
9a. Nut with a rudder-like crest, no special terminal wing 10
b. Nut with a distinct wing or rudder-like extension 11
10a. Plant of the mangrove-zone. Fruit glossy, smooth . . . . . 1. *H. Uttoralis*
b. Plant of hilly country. Fruit dull (?) . . . . . *7. H. dubia*
11a. Nut almost globose 12
b. Nut laterally compressed 15
12a. Fruit glabrous . . . . . *2. H. globosa*
b. Fruit lepidote 13
13a. Wing not folded . . . . . 3. *H. percoriaeea*
b. Wing folded 14
14a. Wing very short . . . . . 5. *H. longipetiolata*
b. Wing conspicuous . . . . . 4. *H. novoguineensis*
15a. Leaves elliptic-lanceolate to elliptic-oblanceolate . . . . . 8. *H. catappa*
b. Leaves elliptic to obovate-elliptic 16
16a. Wing (rudder) up to 15 mm long. Leaves rigidly coriaceous; petiole thick. . . . . 9. *H. data*
b. Wing (rudder) up to 5 mm. Leaves chartaceous to coriaceous; petiole slender. . . . . 10. *H. arafurensis*
17a. Fruit lepidote (unknown in *H. pterospermoides)* 18
b. Fruit glabrous 24
18a. Wing almost as long as broad . . . . . 27. *H. macroptera*
b. Wing much longer than wide 19
19a. Lateral nerves up to 8 pairs (in *H. kiinstleri* 6—10 pairs) 20
b. Lateral nerves more than 8 pairs 22
20a. Leaves rigidly coriaceous, rounded or subcordate at both ends . . 11. *H. cordata*
: b. Leaves chartaceous to stiffly chartaceous, acute or rounded 21
21a. Leaves 1.5—3.5 X 6—10 cm, acuminate or acute . . . . . 18. *H. parvifolia*
b. Leaves 5—9 X 10—18 cm, obtuse or obscurely acuminate, often emarginate . . . . . 16. *H. kiinstleri*
22a. Leaves coriaceous; anthers unknown . . . . . 14. *H. burmensis*
b. Leaves chartaceous to rigidly chartaceous; anthers in an irregular clump. . . 23
23a. Petiole thick, 5—7 mm . . . . . 15. *H. pterospermoides*
b. Petiole stout, 25—100 mm . . . . . 12. *H. macrophylla*
c. Petiole slender, 10—15 mm . . . . . 19. *H. sylvatica*
24a. Lower leaf surface glabrous or with scattered tiny scales 25
b. Lower leaf surface densely lepidote 26
25a. Leaves simple or sometimes up to 3-foliolate, top acute or acuminate, sometimes rather obtuse, almost glabrous. Petiole slender . . . . . 24. *H. borneensis*
b. Leaves always simple, top obtuse, truncate or emarginate; lower surface with scattered tiny scales. Petiole stout . . . . . *22. H. simplicifolia*
26a. Leaves rigidly chartaceous, narrowly oblong to ovate-lanceolate, acute or subacuminate. Petiole slender, 1.5—3.5 cm. Lateral nerves 8—12 pairs. Anthers in an irregular clump . . . . . 13. *H. angustata*

b. Leaves coriaceous, lanceolate to ovate-lanceolate, gradually acuminate. Petiole slender, 1—2.5 cm. Lateral nerves 4—5 pairs. Anthers in a regular ring . . . . . 20. *H. papilio*
c. Leaves rigidly coriaceous, elliptic to obovate - elliptic, apex rounded. Lateral nerves 12—15 pairs. Anthers unknown . . . . . 23. *H. aurea*

1. **Heritiera littoralis** Aiton — Fig. 1, 2

Heritiera littoralis Dryander in Aiton, Hort. Kew, 1st Ed. 3: 546. 1789; Lamarck, Encycl. bot. meth. 4: 228. 1797; Murray - Persoon, Syst. Veg., ed. 15: 736. 1797; Wildenow, Sp. PI. 4 (2): 971. 1805; Roxburgh, Hort. Beng. 1814, p.p. (n.v.); Fl. Indica (ed. Carey) 3: 142. 1832 (reprint 506. 1874); Steudel, Nomencl. 400. 1821; ed. 2, 1: 751. 1841; Blume, Catal. Gewassen PI. Tuin Buitenzorg 37. 1823; Bijdr. Fl. Ned. Ind., Tweede Stuk 84. 1825; Moon, Cat. Ceylon. 73. 1824; DC, Prodr. 1: 484. 1824; Perrottet in Mem. Soc. Linn. Paris 3: 12. 1825 *{I'Heritiera)* (n.v.); Sprengel, Syst. Veg. 3: 70. 1826 *(litoralis)*; Gen. PI. 1: 544. 1830; Sweet, Hort. Brittan. ed. 2: 66. 1830; Loudon, Encycl. 814. 1829 *(Heriteria)*; G. Don, Gen. Hist. 1: 518. 1831 *{Heretiera);* Wight & Walker-Arnott, Prodr. 1: 63. 1831; Sehott & Endl., Melet. bot. 32. 1832; Henschel, Clavis Rumph. 1833; Richard, Sert. Astrolabe 2: 47. 1834; Spach, Hist. Veg. phan. 3: 503. 1834; Decaisne, Herb. Timor. 108. 1835; Endlicher in Ann. Wien. Mus. Naturgesch. 1: 182. 1836; Graham, Catal. PL Bombay 18. 1839; Spanoghe in Linnaea 15: 173. 1841; Hooker & Walker-Arnott, Bot. - Capt. Beechey's Voyage 1841 (n.v.); R. Brown in Bennett & Brown, PI. Jav. rar. 237. 1844 (excl. syn. *H. fomes* Buch.); Hasskarl, Tweede Catal. PI. Tuin Buitenzrog. 202. 1844; J. Don, Hort. Cantabrig. ed. 13: 644. 1845; Voigt, Hort. Suburb. Calcut. 103. 1845; Walp., Rep. 5: 106. 1845-46; Ann. 4: 321. 1857 (excl. *H. fomes);* Asa Gray in Bot. U.S. Expl. Exped. 1: 184. 1854 (excl. syn. *H. fomes* Buch.); Griffith, Not. PI. Asiat. 532. 1854; Icones 4: 585 A III. 1854; Miquel, Fl. Ind. batav. 1 (2): 179 1859 (excl. syn. *H. fomes* Buch.); Suppl. Sumatra 165, 402. 1862; Bentham, Fl. Hongkong. 36. 1861; Fl. Austral. 1: 231. 1863; Dalzell & Gibson, Bombay Fl. 22. 1861; Seemann, Viti, App. 433. 1862; Fl. Viti 23. 1865; Bot$_v$ Herald 365. 1875; Hamilton in Mem. Werner. Nat. Hist. Soc. 5 (2): 362. 1862; Thwaites, Enum. 28. 1864; Drury, Handb. Ind. Fl. 89. 1864; Teijsmann & Binnendijk, Catal. Hort. Bogor. 197. 1866; F. v. Mueller, Fragm. 6: 173. 1868; First Census 15. 1882; Second Census 27. 1889 *(litoralis)*; in Victor. Nat. 3: 48. 1886; Masters in Oliver, Fl. Trop. Afr. 1: 225. 1868; in Hook, f., Fl. Brit. Ind. 1: 363. 1874 (excl. syn. *H. macrophylla* hort.); Kurz, Rep. Andaman Isl. (Ill), (3), (16). 1868; in J. As. Soc. Bengal 43.(2): 120. 1876 (reprint p. 80) (as a syn. of *H. tothila);* Prelim. Rep. Pegu: [XXII], (31). 1875; For. Fl. Brit. Burma 1: 140. 1877; Beddome, Fl. Sylvat. 1: pi. 75, t. 11, f. 6. 1872; Baillon in Adansonia 10: 164. 1871; Hist. PL 4: 61,'62, 113, 122. 1872; Diet. Bot. 3: 46, fig. 1892; in Bull. Soc. Linn. 1: 487. 1889; Scheffer in Ann. Jard. bot. Buitenzorg 1: 9. 1876; Teijsmann in Nat. Tijdschr. Ned. Ind. 36: 236, 254. 1876; ibid. 48: 92, 107. 1889; Baker, Fl. Maurit. 26. 1877; Chevalier in Ann. Jard. bot. Saigon (Catal.) fasc. 2: 69. 1878; Mason, Burma 2: 621. 1883; F. M. Bailey, Synops. Queensl. Fl. 37. 1883 (1884); Queensl. Woods 16. 1888; 21. 1899; Rep. Gvt. sci. Exped. Bell.-Ker 32. 1889; Cat. PL Queensl. 5. 1890; Queensl. Fl. 1: 141. 1899; Compreh. Catal. 296, 309, 311. 1885; F. Villars, Nov. App. 27. 1880; Vidal y Soler, Sinops., Atlas t. IS, fig. f. 1883. (n.v.); Phaner. Cuming. Philip. 98. 1885; Rev. PI. vase. Filip. 65. 1886; Hemsley, Bot. Challenger 3: 127, 288, 196, 309, 311. 1885; in J.

Linn. Soc. Bot. 30: 170. 1894; Forbes & Hemsley in J. Linn. Soc. 23: 90. 1886; Lanessan, PI: util. Colon, franc. 291, 244, 668, 720. 1886; Maximowicz in Engl. bot. Jahrb. 6: 61. 1885; Naumann in Engl. bot. Jahrb. 7: 466. 1886; Schumann in Engl. bot. Jahrb. 9: 209. 1888; in Engl. & Pr., Nat. Pfl. fam. 3 (6) : 99, f. 51, 1893 *(litoralis)* ; in Notizbl. bot. Gart. Berlin 2: 134. 1898; J. H. Maiden, Usef. nat. PI. Austr. 555. 1889; Pierre, Fl. for. Cochinch., fasc. 13: t. 203. 1889; Schumann & Hollrung, Fl. K. Wilhelmsl. 54, 1889; Dujard.-Beaumetz et Egasse, Fl. medic. 349, 350. 1889; Watt, Diet. econ. Prod. Ind. 4: 223. 1890; Schimper, Bot. Mitt. Tropen, Heft 3, t. 7. 1891; Warburg in Engl. bot. Jahrb. 13: 321. 1891; King in J. As. Soc. Bengal 60 (2) : 79. 1891; in Ann. Fac. Sci. Marseille 1: 126, 127. 1893 (n.v.) ; Trimen, Fl. Ceylon 1: 167. 1893; Heckei, Kolas Afr. 126, 127. 1893 (n.v.) ; Curtis in J. Str. Br. Roy. As. Soc. 25: 83. 1894;Talbot, Trees & Shrubs Bombay 22. 1894; For. Fl. Bombay 1: 145. 1909; Engler, Pfl. Welt Ostafr. H 10 & 12, B 330, C 272. 1895; Monogr. Afr. Pfl. Fam. 5, Sterc. Afr. 136, t. 90. 1900; Veg. Erde 9, Pfl. Welt Afr. 3 (2) : 469-470, f. 217. 1921; Koorders & Valeton in Meded. PI. Tuin Buitenzorg (Bijdr. 2 Booms. Java) 14: 170. 1895 (excl. cit. spec. Koorders 7699); Koorders, Minahassa in Meded. PI. Tuin Buitenzorg 19: 155, 361 (excl. cit. spec. div.). 1898; Exk. Fl. Java 2: 599. 1912; Boerlage in Ann. Jard. bot. Buitenzorg 2e Suppl. 137-142, t. 5. 1898; in Revue Hort. 1898. 286 (n.v.); Schumann & Lauterbach, Fl. deutsch. Schutzgeb. Sudsee 444. 1900; Ridley in J. Str. Br. Roy. As. Soc. 33: 53. 1900; in Agric. Bull. S. S. & F.M.S., New Ser. 1: 51. 1902; in Bull. Kol. Mus. Haarlem 27: 16. 1903; Fl. Mai. Pen. 1: 279. 1922; Ahern, Most Import. Timb. Trees. Philipp. Isl. 49, tab. 1901; Prain in Ann. Rep. Roy. bot. Gard. Calcutta 9: 9. 1901; Memoirs and Memor. 115, 282 (n.v.) ; Henry, List PI. Formosa 22 (n.v.); Cooke, Fl. Bombay 1: 126. 1901; Burkill in J. Linn. Soc. Bot. 35: 28. 1901; Volkens in Engl. bot. Jahrb. 31: 469. 1902; Merrill in Bull. 1, Dept. Inter., Bur. For. Philipp. 39. 1903; in Bull. 27, Dept. Int., Bur. Gvt. Lab. Phil. 24. 1905; in Philipp. J. Sci. 1, Suppl. 94. 1906; ibid. 3: 78. 1908; ibid. 29 (3) : 395. 1926; Interpr. Rumph. Herb. Amboin. 365. 1917; Enum. Born. PI. 381. 1921; Fl. Manila 328. 1912; Spec. Blanco. 262. 1918; Enum. Philipp. fl. PI. 3: 58. 1923; in Univ. Calif. Publ. Bot. 15: 194. 1929; in Lingnan Sci. J. 9: 40. 1930; in Brittonia 2: 189. 1936; in Bull. B.P. Bishop Mus. 144. 1939; in J. Arn. Arb. 31: 284. 1950; Safford in Contr. U.S. Nat. Herb. 9: 292, t. 52. 1905; in Trop. Agric. 25 (3): 496. 1905; Beccari, Nelle For Borneo 573. 1902; Perkins, Fragm. Fl. Philipp. 117. 1904; Hochreutiner, Catal. Bogor, novus 1: 35. 1904 (cum forma *microcarpa)*; New Phytologist 4: 52. 1905 (n.v.) ; Matsumura in Tokyo Bot. Mag. 15: 53. 1901; Matsumura & Hayata in J. Coll. Sci. Imp. Un. Tokyo 22: 59. 1906; Brandis, Ind. Trees 70 et 85. f. 41. 1906 (except, cit. sunder, sundri) ; van Eeden, Houts. Ned. O. Ind. 39. 1906; Moll & Janssonius, Mikrogr. Holz. 1: 449. 1906; Backer, Fl. Batavia 1: 168. 1907; Scchoolfl. 140. 1911; Trop. Agricult. 31: 581. 1908; Foxworthy in Philipp. J. Sci. Bot. 2: 383. 1907; 4: 500. 1909; in Mai. For. Rec. 1: 92. 1921; 8: 13. 1930; Timb. Br. N. Borneo 26 (n.v.); Troup, Ind. Woods 163. 1909; Silvicult. Ind. Trees 1: 159. 1921; Beille, Bot. Pharm. 2: 475. 1909 (n.v.); de Clercq, Nieuw Plantk. Woordenb. 254. 1909; Nordlinger, Holzschnitte XI: 46 (n.v.); Sim, For. Fl. Port. East Afr. t. 14. 1909 (n.v.) ; Ito & Matsumura, Tent. Fl. Lutch. 343 (n.v.) ; Kawakami, List PI. Formos. 13. 1910; Engl. & Drude, Veg. Erde IX (I) 1: 237, t. 10. 1910; Hartwich, Menschl. Genussm. 385. 1911 (n.v.) ; Kamerling in Teysmannia 22: 121, 129, 1911; Boulenger, Wood 281 (n.v.); Hayata, Icon. PL Formos. 1: 103. 1911; Willis, Rev. Catal. Ceylon 12. 1911; Gagnepain in Lecomte, Fl. gen. Indochine 1: 483. 1911, p.p.; Tardieu-Blot, Suppl. 1 (4): 410. 1945 (excl. specim. Poilane of Nui-han-heo =

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Balanopteris minor Gaertner, de Fruct. et Sem. 2: t. 98, f. 2. 1791; DC, Prodr. 1: 484. 1824; Roxburgh, Fl. Ind. 3 (ed. Carey): 142. 1832 (reprint 506. 1874); Steudel, Nomencl. ed. 2, 2: 751. 1840; Kurz in J. As. Soc. Bengal 43 (2): 118. (reprint p. 80). 1874.

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Samandara Roxburgh, Fl. Ind. 3 (ed. Carey) : 142. 1832 (reprint 506. 1874).

Nagam Rheede, Hort. Malab. 6: 37, t. 21. 1686; Lamarck, Eneycl. I.e. 228; Masters in Hook, f., I.e. 363; Dennstedt, Schlussel 13, 21, 32. 1818; Roxburgh, Fl. Ind. 3 (ed. Carey) : 142. 1832 (reprint -506. 1874); Miquel, Fl. Ind. bat. 1 (2) : 180. 1859.

Tree 10—25 m tall, up to 60 cm in diam., low-branched, the branches thick, crooked, horizontal; crown dense; base of bole buttressed, the buttresses extending far out, wavy (snake-like), thin, plank-like, about 30 cm high. Bark grey-brown, vertically superficially fissured, roughish or smooth; outer bark 3 mm, inner 6 mm, brownish-pink, tough. Sapwood pale straw, well-defined or merging into the redbrown, hard truewood, which has ripple-marks. Branchlets rather rough, redbrown, towards apex adpressed lepidote. Stipules aciculate, 3—10 mm long, lepidote, caducous. Leaves alternate, coriaceous, elliptical to ovate-elliptical (in young plants la'nceolate with acute base), base rounded to cordate, often oblique,

apex rounded, mucronate to obscurely acuminate, 5—15 x 12—24 cm, upper surface smooth, glabrous, glossy, veins visible or invisible (in the pinkish young leaves the silvery, scattered scales are conspicuous on the upper leaf surface), lower surface with a dense layer of minute, fimbriate, silvery adpressed scales, midrib prominent, lateral nerves 8—10 (—15) pairs, curved, sometimes irregular, very slender, the lowest pair ascendant (subtriplinerved), secondary nerves parallel, obscure, the lowest pair (or pairs) of lateral nerves starting from the petiole insertion. Petiole rather stout, lepidote 5—10 (—20) mm long.

Inflorescences axillary, paniculate, up to 18 cm long, the base of the main peduncle and lower ramifications lepidote, the remainder densely stellate pubescent. Flowers dirty yellowish pale green at base, towards lobes flesh-coloured with grey hairs, campanulate, inside white at base, dark blood-red in the middle, the lobes with broad pinkish margin. Male flower 3—5 mm long, similar to the female ones, which are 3—7 mm long, outside densely stellate-pilose, inside at base with strigose hairs, which become stellate and shorter towards mouth of tube; lobes 4 (rarely 5), ovate-lanceolate, acute, 1—2.5 mm long; androgynophore white, up to 2 mm, rather stout (towards base conical), glabrous, the 8 anther thecae (rarely 10) in a regular tube-like ring, surmounted by the minute, sterile ovaries; torus convex covered with white granular glands. Pollen subprolate, about 22.5 x 18.5 JA (Erdtman). Pedicel 0.5—1 mm, articulate and as thick as the ramification to which it is attached. Female flower with sessile, glabrous ovaries, style conglutinate, as long as ovaries, stigmas curved outwards, sterile thecae in 4 groups of 2 at base of ovaries.

Fruit somewhat woody, tough, glossy light brown, ellipsoid, up to 9 cm, usually 5 cm long, ventral side flat with a hardly raised ridge, dorsal side convex with a high ridge, (5—7 mm) which apically ends in a very short rudderlike extension (wing). Wall woody, fibrous, 3—6 mm thick, inside densely shortly pilose. Seed semi-globose, the flat side turned to the ventral suture, testa (in ripe fruit) lightbrown, thin, the seed divided into two cotyledons by a vertical line perpendicular to the seed, the small radicle and purple plumule are basal, central.

Distribution. — Typical for the transient zone from mangrove to fresh water swamp, rocky and sandy coasts, behind mangrove, often in mangrove on dryer places; coast of E. Africa, W. and S. E. Indian Peninsula, S. W. Burma, Siam, Indochina, Malaysia, Hongkong (northern limit), Formosa, Pacific region, up to Hawaii and New Caledonia, Tropical Australia.

Vernac. names. — India: Sundri, Sunder (Beng.) ; Sundrichand, Kolland. (Bom. Mar.); Chandmara (Kan). Ceylon: Etuna (Singhalese), Choomuntiri (Tamil) ; Burma: Pinle Kanazo; Siam: Ngawn kai; Cambodia: Bey Sanleh, Dong Chen, Sprong; Vietnam: Huynh, Cui, Long; Formosa: Hamagurumi, Suogi, Sakishima-suwo; Philippines: Barit (Sul.) ; Baut (Sul.); Dognon (Bik) ; Dumdum (Ibn.); Dumon (Ibn., Neg.), Dungon (Ibn.. Tag., Bik., Bis., Lan.) ; Dungon-dagat (Bik.); Dungon-lalu (Tag.,); Dungon late (Tag., Bis., Sul.); Dungon-latian (Tag.) ; Dungon-mangle (C. Bis.) ; Magayau (Ibn.) ; Maladungon (Tag.) ; Malarungon (Tag.); Palugapig (Ibn.) ; Palungapoi (Ilk.) ; Ryukyu Isl.: Sakishima-Suonoki, Hamagurumi, Shiiwagii; Umanu tani, Akajumigii, Daimyo-ki.; Andaman Isl.: Mawtda; Malaya: Dungun, Buah peler kambing; Indonesia: Dungun (general) with variants as rungun, rumun, rorum, etc.; Lawanan kete (Alf.-Minahasa), Atuna laut (Amboina) ; Keko (New Guinea, Saraba Isl. language), Wami (New. Guinea, Goaribari language) ; Brunei: Itik-itikan (Dyak-Brunei); Miri (Ngiri) batu (W. Sumatra) ; Kenya (Africa) : Msikundari (Swahili, Kenya) ; Mkukushu (Swaheli-Vanga) ; Mkokoshi (Swahili-Alini).

Balanoptens minor Gaertn. was based on fruit collected by „Hermano, Professor Argentor" (probably Johann Hermann, 1738—1800, of Strassbourg) on the island of Mauritius. Dr. J. Leandri (Paris), who made this supposition, suggested to me towrite to the faculty of Pharmacy in Strasbourg. From there I received the information that the collection, which during World War II had been pillaged by the Germans, did not contain these fruit (any more?). As it is not uncommon that the ventral ridge of the fruit is lacking, or even that this suture is more or less sulcate (like in the drawing of *B. minor)* and as, moreover, *H, littoralis* is the only species ocurring in Mauritius, I am convinced that *B. minor* is conspecific with *H. littoralis.*

Roxburgh caused a lot of confusion, as his *H. minor* represents a mixture of *H. fomes* and *H. littoralis.* The Wallich number 1139 has been kindly examined by Mr. L. L. Forman, who informs me that at least 3 specimens are represented under this number, part of which are *H. littoralis,* part *H. fomes* and part uncertain, as only leaves are present. Without examining the specimens personally, I cannot say anything definitely. The sterile (young) specimens are often confused with *Brownlowia tersa* (L.) Kosterm.

Koorders & Valeton, I.e. mixed *H. percoriacea* with *H. littoralis* (cf. *H. percoriacea).*

Rumphius mentioned a form of *H. littoralis* found far from the sea shore, which he called the Bosch Atun (Bosch = forest). He suspected this

to be a different species. Koorders and Valeton supposed it to be conspecific with *H. littoralis.* I believe that it is either *H. arafurensis* or *H. novoguineensis.* Rumphius stated, however, that the fruit of the Bosch Atun are large, which it not the case in these two species. Perhaps still another, undescribed species is involved.

Masters, I.e. mixed the species with *H. macrophylla* and *H. dubia,* which occur further inland and Koorders confused *H. sylvatica,* occuring in N. Celebes with it (Minahasa, I.e.) :

Brown's plate suggests rather *H. globosa* than *H. littoralis.* It is quite likely that the former will be found in the Southern Philippines.

According to Gaertner the *Tothila* of Hermann (I.e.) is this; Trimen found no specimen in Hermann's herbarium and states that this Singhalese name is properly applied to *Oroxylum indicum.*

The germination has been studied by Boerlage (I.e.), from whose writings the following is extracted. The fruit floating in salt water by its hollow wall is impermeable to water. It floats always with the crest upwards. Thrown on the beach it remains in this same position. The base, which is rubbed and moistened continuously, weakens and moisture penetrates (animals that feed on the fruit also help). Its is mainly the pressure of the thick, hard radicle, which opens the hard fruit. The primary root penetrates deeply in the soil, but is also able to branch immediately if the soil is not deep enough. According to Mueller, the fruit occasionally ripens two seeds.

The characters of the timber have been treated extensively by Panshin (I.e.) and by Pearson and Brown. The following is copied from Pearson and Brown pp. 157—159.

"SUPPLIES. W. A. Robertson states that supplies are difficult to obtain from Tenasserim owing to lack of coastwise boat traffic. Rodger is of opinion that 1,000 tons or more are available from the Delta forests of Burma, while very considerable supplies are available from the Andamans. Like the timber of *H. fomes,* the question of extraction presents difficulties, which could, however, be overcome were a steady demand to arise and fair prices be offered.

GENERAL CHARACTERISTICS OF THE WOOD. Sapwood 2—3 1/2 in. wide, pale brown, merging gradually into the heartwood; heartwood light yellowish-red to dark red or reddish-brown, sometimes faintly streaked with black, dull, with the scent of old leather but without characteristic taste, heavy (sp. gr. approx. 0.81), even and straight- or some what interlocked-grained, fine-textured.

STRUCTURE OF THE WOOD. Growth rings faint, 8—10 per in. Vessels small to medium sized, open for the most part, the orifices discernable with the naked eye forming narrow vermiculate vessel lines along the grain, solitary or in linear, for the most part radial, rows of 2—6 (mostly 2—3), unevenly distributed, 0—19 per mm.^{2}; vessel segments thickwalled, 100—420μ long, truncate or shallowly oblique and rarely abruptly short-tailed on one or both ends, the largest 200—235 μ, in diameter; perforations simple, horizontal or somewhat oblique; pits as in *H. fomes*, tyloses absent; yellowish- or reddish-brown gummy deposits abundant, occasionally forming plugs completely obstructing the vessels, more often in parietal globules; chalky deposits frequent.

Parenchyma paratracheal and metatracheal; (a) paratracheal parenchyma sparse, confined to the immediate vicinity of the vessels, the maximum diameter 45—80 μ; *(b)* metatracheal parenchyma very abundant, evenly distributed, appearing punctate at low magnifications, storied longitudinally, (1) sparsely diffused, (2) narrowly zonate, forming a reticulum with the wood rays, and (3) in broader tangential bands (terminal?) at wider but frequent intervals; (2) parenchyma in ragged, often interrupted, often oblique, sometimes forking, uniseriate rows, which average 15—20 per mm. radially; cells orbicular or broadly oval, the long diameter 25—45 μ; crystals occasional; bands of (3) parenchyma ragged, 1—4 (mostly 1—2) seriate, at intervals of *Y2* to 2. mm.; yellowish- or reddish-brown gummy deposits common.

Fibres libriform, long attenuate, 660—2,000 μ long, 20—26 (mostly 20)µ wide; wall 3—8µ thick; pits sparse, slit-like.

Rays fine, not distinct with the naked eye 4—7 per mm., of the same colour as the background and hence not sharply distinct on the radial surface, somewhat variable in size on the tangential surface 1—7 (mostly 3—5) seriate, the largest 65—85 µ wide and 25 plus cells of 600 plus *yi* high, the smaller about the height of the rows of camMform parenchyma and storied with them; pits leading to vessels as in *H. forties;* crystals absent; reddish-brown gummy deposits very abundant, completely occluding many of the ray cells.

Ripple marks present, very inconspicuous, traceable to storied longitudinal parenchyma and the smaller wood rays, 90—110 per inch.

Gum canals very rare, in short tangential rows embedded in parenchyma; maximum diameter 70—700μ; gum orange-brown.

Summary. Similar to *H. fomes,* but generally slightly lighter in colour and weight, somewhat coarser-textured (larger pores), and with less copious organic infiltration (gum).

MECHANICAL PROPERTIES. Wt. at 12 per cent, moisture content 52 1b. per eft. A strong, hard, elastic timber. Gamble quotes the following figures for strength on experiments carried out by Professor Unwin, F. R. S., for the Imperial Institue, on Ceylon timber:

Shearing parallel to fibre	1.333 lb. per sq. in.
Crushing „ „	2.938 tons per sq. in.
Transverse strength	6.460 „ „
Coefficient of elasticity	737.2

The transverse strength of *H. littoralis* as compared with that of *//. fomes* is therefore as 14,470 lb. is to 17,925 lb. per sq. in.

SEASONING. The timber is liable to develop end-splits and some surface cracking. If good results are to be obtained, either careful air-seasoning or kiln-seasoning will be necessary.

DURABILITY AND ADAPTABILITY TO TREATMENT. A very durable timber, both on land and in water. No data are available as to its life when placed in varying conditions, but it has a good reputation for durability. It would not be necessary to treat this timber with antiseptics to increase its durability.

WORKING QUALITIES. A hard wood, which, like *H. fomes,* saws with some difficulty; it machines well and can be worked to a very fine surface on a lathe, taking a high finish sand polish. W. A. Robertson says that it is more knotty and twisted than sundri, and therefore more difficult to work than that species.

USES, PRESENT AND PROSPECTIVE. Used for similar purposes as the timber of *H. fomes,* but not nearly so well known in the market. It is used for boat-building, as knees and as piles of bridges in Burma. It is a most excellent firewood, having a high calorific value. In the Andamans the buttresses are sometimes used whole for boat rudders (W. A. Robertson) . It can be grouped with *H. fomes* for market purposes, though not such a high-class timber."

The inflorescences have usually almost solely male flowers, rarely almost all female flowers.

Backer gives the pedicel length as 3—5 mm and states, that it is articulate near the apex. I consider only the part above the articulation as the real, very short pedicel.

Baillon's figure of *H. littoralis* (fig. 88—94) is not of this species,

The specimen with lanceolate leaves mentioned by Koorders & Valeton is not an aberrant one. In seedlings the leaves are lanceolate and this kind of leaves is very often found in mature trees too on some branches.

Use. — Bark contains tannin to the extent of 14 percent of the dry matter, or 15.4 per cent (Wind), which is little. In the Philippines it is used for toughening fishing nets. The timber is used for masts, rudders, canoes, outriggers, house-posts, joints, presses, telegraph poles, wheel hubs, boat ribs; it is possibly the toughest of Malayan timbers (Foxworthy), moderately durable in the soil, resists Teredo; formerly used in

Malaya for building stockades to stop bullets, and the Malays raised the thwarts of their canoes with it.

In the Moluccas the extract of the seed is used for diarrhoea and dysentery. The twigs are used as tooth-brushes, it may be that the tannin does some good to the gums. The seeds are eaten (in the Moluccas and Borneo) with fish, when the true atun *(Parinari glaberrima)* cannot be obtained; also eaten in times of famine. The recipe for preparing is already given by Rumphius.

INDIA. Hort. Calcut., *Griffith-Lemann 18'45* (CAL), labeled *H. macrophylla.* BURMA. Bassein Distr., W. coast, Apr., ster., *Lace 3021* (SING) ; ibid., May, young fr., *Rogers s.n.* (CAL) ; ibid, Bassein R,, opposite Kanni village, May, young fr., *Rogers s.n.* <(CAL); Pegu cirele, Apr., fl., *sine coll.* (CAL); Ceylon, fl., *Thwaites 1US* (BO) ; SIAM. Locality not indicated, fl., *Kerr 2100* <CAL) ; *For. Dep. 986* (CAL) ; Vanpruk 986 (BKF) ; CAMBODIA, Kilom. 174, Road of Srimbell, Aug., young fr., *Poilane 4.51* (P) ; Kompang Smach, Nov., fr., *Poilane 22925* (P) ; HONGKONG, ster., *Turet 49* (P); FORMOSA. Kimpori-kaigan, May, fr., *Suzuki 3539* (BO, TAIWAN) ; loc. not. indie, *Fauri s.n.* (P) ; PHILIPPINES. Luzon, Cagayan Prov., Apr., fl., *Klemme F.B. 6659* (BO) ibid., ster., *Bernardo F.B. 24262* (BO) ; ibid., *Ahem U3'5* (BO) ; Prov. Tayabas, Oct., fl., *Manuel F.B. 24759* (BO) ; Apr., fl. *Duldulao F.B. 23851* (SING) ; ster., *Curran F.B. 10345* (BO) ; Rizal Proy., Bosoboso, Febr., ster., *Ramos F.B. 2137* (BO, SING); Camarines Prov., Sept., fl., *Simeon F.B. 28752* (SING); Pangasinan Prov., Dec, fr., *Curran & Merritt F.B. 8391* (SING) ; ibid., Dec, ster., *Curran & Merritt 8384* (BO) ; Basilan, Oct., fl., *Miranda, F.B. 18985* (P), Sept., fl., *Reillo B. Sc. 16298* (BO); Mindaao, Lamao Distr., Kolambugan, Sept., fl., *Garcia F. B. 30606* (SING, UC), ibid., June, fl., *Miranda F.B. 20625* (BO) ; Zamboanga, July, fl., *Babaran F.B. 26137* (BO); Lamao Distr., June, fl., *Miranda F.B. 20625* (BO) ; Mindoro, fl., *Bermejoz B. Sc. 1524* (BO); Ficao Is1., May-June, fl., *Clark F.B. 1047* (SING) ; Guimaras Isl., Nov., fr., *Camill F.B. 108* (SING) ; Culion Isl., Dec, fr., *Merrill 582* (SING) ; MALAYA. Kedah, N. coast, Dayang Bunting, Nov., fr., *Henderson S.F.N. 29169* (SING) ; Langkawi, Sept., fl., *Curtis s.n.* (SING) ; ibid., Sanatorium, Nov., fl., *Nauen s.n.* (SING); Perak, Matang, July, fr., *Wray 2495* (CAL, SING) et *2196* (SING); P. Jarajah, Sept., fl., fr., *Kilnstler 4959* (CAL, SING); ibid., Apr., ster., *Seimund s.n.* (SING) ; ibid., Nov., fr., *F.D. 4953* (SING) ; Isl. Rumbia, Mar., fl., *Seimund s.n.* (SING); Pangstore, fl., *Scortechini 1041* (CAL) ; loc. not indie, *Scortechini 58510* (CAL) ; Pahang. Kuala Rompin, July, fl., *Evans S.F.N. 13237* (SING) ; Kuantan, Sept., young fr., *F.D. 3707* . (SING) ; P. Tioman, Joara Bay, June, fr., *Burkill OSS* (SING)-; South Kemaman, June, fl., *Comer s.n.* (SING); Trengganu, P. Kapas, Apr., fl., *Corner s.n.* (SING); Penang, Nov., fl., *Curtis 517* (P, SING); Malacca, loc. not indie, *Griffith* anno 1845 (CAL) ; Pulau Undan, Febr., ster., *Alvins s.n.* (SING); Johore. Semindai R., ster. (SING); Mengkaloh, July, fl., *S.F.N. 5829* (SING); Sg. Tekong, July, fl., *Spare F. 791* (SING); Singapore. Tandjong Staba, fl., *J.S.G. s.n.* (SING) ; Tongkah, fl., *Hamid s.n.* (SING) ; ibid., Aug., fl., *Curtis' Coll. s.n.* (SING) ; P. Jahat, fl., fr., *Ridley 2049* (SING) ; Sg. Tengeh, fl., *Ridley 3985* (CAL, SING) ; loc. not indie, Apr., fl., *Hullet 537* (CAL, SING) ;' INDONESIA. Karimata Isl., P. Pelapis Tiangbalu, Mar., fl., *Mondi 125* (SING) ;

P

Sumatra. Atjeh, P. Beras, ster., *Koorders 10575* (BO); Simaloer. Aug., fr., *Achmad 1341* (A, BO, K, L, P, U, US) ; West Coast, Djaga, fl., *Teijsmann s.n.* (B.O.) ; E. Coast, Langkat, ster., *bb.9382;* (BO) ; P. Singkep, ster., *bb.3878;* (BO) ; Belawan Labuan Deli, Oct., fl., *Lorzing 16919* (BO, K, L) ; Isl. Selat Pandjang, fl., *Bruinier 144* (BO); Isl. Merbau, fl., *Bruinier 230* (BO) ; Isl. Tebing Tinggi, fl., fr., *Bruinier 83 et 248* (BO) ; *Bengkalis,* Oct., fl., *Beguin 420* (BO); Serdang, Rantau Pandjang, ster., *Lorzing, 3220* (BO, L) ; Engganu Isl., Teluk Kiowa, Apr., ster., *Lutjeharms 5206* (SING); Java. West Java P. Panaitan, ster., *B. Waalkes 502* (BO, L) ; *755* (A, BO, K, L) ; P. Peutjang, seedlings, *Kostermans s.n.* (BO, L) ; Bay of Djakarta, Edam Isl., Dee, ster., *Boschma, 264* (BO) ; Anambas Isl., Ranai ster., *van Steenis 1315* (BO, L, SING, U) ; Middelburg Isl., Aug., fl., *Hoogerwerf s.n.* (BO) ; Isl. Leiden, young tree, *Leeuwen-Reynvaan 7876* (BO); Antjol, Mar., fl., *Zeylstra s.n.* (BO) ; fl., fr., *Forbes 1182* (BO, CAL) ; Tandjong Priok, June, ster., *Hattier s.n.* (BO) ; Pasir Putih, N.W. of Pesing, W. of Djakarta, Febr., ster., *Backer 32931* (BO, L) ; R. Tjitespong, ster., *Backer 17551* (BO) ; Pulau Dua Isl., Dee, fl., *Backer 146* (BO) ; Sukabumi Distr., Balekampung, ster., *Koorders 7695* (BO, CAL) ; S. Priangan, Sandbay, Aug., ster., *Backer 25607* (BO) ; Central Java. Segara Anak, R. Djagadanda, May, fl., *Backer 31464* (BO) ; ibid., R. Karang Kobar, May, fr., *Backer 31412* (BO) ; Nusakambangan, fl., *Koorders 7697-7699* (BO); ibid., ster., *Koorders 20297, 21958, 27009* (BO); ibid., fr., *Kostermans & van Woerden 62* (BO); Pekalongan, Subah, May, fr., *Koorders 13539* (BO); ibid., *Koorders 11606* (BO, CAL, L) ; Djapara, Ngarengan, June, fl., fr., *Koorders 11605* (L) ; Banjumas Res., Tjilatjap, March, fl., 66. *s.n.* (BO); ibid., March, fl., fr., *Wolff von Wiilfing 63 (BO,* L); ibid., fr., *Meindersma 34* (BO) ; East Java. Nusa Barung Isl., May, fl., *Jacobs 4734* (A, BO, K, L, PNH, SING) ; Puger, March, fl., *Zollinger 2743* (BO, P) ; ibid., Dec, ster., *Backer 18136* (BO) ibid., March, ster., *Koorders 7700* (BO, L) ; ibid., Sept., fl., *Koorders 7701* (CAL, L); ibid., Sept., fl., *Koorders 7704* (CAL, US); ibid.,: June, fr., *Koorders 10242* (K) ; ibid., Dee, fr., *Koorders 12808* (BO) ; ibid., Jan., fr., *Koorders 16243* (L); ibid., March, fl., fr., *Koorders29911* (L) et *29929* (K, L) ; ibid., March.""fl'.', *Koorders 30076* (BO, L) ; Kediri, Prigi, Febr., fl., *Backer 11786* (BO) ; ibid., fr., *Lorzing 1058* (BO); Besuki, R. Pangpang, Sept., fl., *Becking 13* (BO); ibid., Tratas, sandy shore, Nov., ster., *Becking 41* (BO) ; ibid., Pasirputih, ster., *Koorders 7705* (BO, K, L) ; Banjuwangi, Rogodjampi, ster., *Koorders 7702* (L) ; ibid., *Koorders 7703* (BO) ; Mt. Tjapil near Gradjangan, Dee, fl., *Clason 219* (BO); Java, locality not indicated, ster., *Blume s.n.* (BO, CAL); fl., *Horsfield s.n.* (CAL); fl., *Hasskarl s.n.* (BO). BORNEO. Brit. N. Borneo. Kudah, Langkau R., March, ster., *San. A 3192* (BO, SING); Elopura, Sandakan, Sepilok For. Res., Dee, fl., *Kadir A 970* (BO, SING) ; Aug., ster., *San A 2624* (BO, K, SING) ;. ster., *B.NJB.F.D. 10165* (BO, K) ; Jan[1]., fr., *San. A. 706* (BO, SING) ; Oct.-Dee, fl., *Elmer 20C44* (CAL, DS, UC, SING) ; ibid., Sekong Besar, June, fl., *Apostol A 56* (SING) ; ibid., Sg. Penang, Jan. fl., *Mendoza C.F. 4034* (SING) ; ibid., Sempurna, P. Gaya, ster., *C.F. 5224* (SING) ; ibid., Kabili R. banks, May, fl., *Castro B.N.B.F.D. 7188* (BO, K, SING) ; Semporna, Pababag Isl., Aug., ster., *F.D. 7339* (SING) ; village Ongkilam, May, fl., *Apostol F.D. 7203* (SING) ; Sarawak. Kayangeran For. Res., Lawas, June, fl., *F.N. 00085* (SING) ; ibid., Kalong, riverbank, fl., *Haviland 1497* (SING) ; Telok Limo, Bake Nat. Park, May, young fr., *Purseglove P. 5084* (BO, SING) ; fl., *Native Coll. 2303* (BO); Indonesian Borneo. West Borneo, Kapuas R., Pakungin, fl., 66. *2117* (BO) ; Palo, fr., *Becking 13* (BO, L) ; East Borneo. Sangkulirang distr., Susuk R., June, fl., *Kostermans 6179* (A, BO, K, L) ; Mouth of Mahakam R., Sg. Tiram, mangrove, June, fl., *Kostermans 9549* (A, BM,

BO, CAL, CANB, L, LAE, NY); ibid., Aug., fl., *Meyer 1044* (BO); S. Borneo, Isl. Pulu Laut, fl., *Hombron s.n.* (P) ; ibid., fr., 66. *1115* (BO); Celebes, Kwandang, Titidu, Sept., fl., 66. *7499* (BO); Minahassa, ster., *Biedel s.n.* (BO); Gorontalo, ster., 66. *15126* (BO, K, L, U) ; Boalemo, Sept., fr., 66. *17194* (BO); Amurang, ster., *Koorders 1U77* (BO); Ratatoka, fr., *Koorders 19453* <BO) ; Makassar, ster., *Teijsmann 12845* (BO); Isl. Mima, Laiworo, ster., 66. *32374* (BO, L) ; Raha, ster., 66. *5427* (BO, L, P) et 66. *21122* (A, BO, L); MOLUCCAS. Sula Isl., Sanana, Kabouw, Aug., ster., 66. *28888* (SING); Isl. Obi, fl., *Atasrip 69* (A, BO, K, L, P) ; Laiwui, Kasna R., Nov., fr., *Nedi 587* (BO, L) ; Amboina, fl., *Webb (Labillardiere) s.n.* (P) ; fl. *de Vriese et Teijsmann s.n.* (BO, L) ; Tanimbar Ottimer, March, young fr., 66. *243S3* (SING); ibid., March, young fr., *Buwalda 4379* (A, BO, K, L) ; . Ternate, fr., *Beguin 929* (BO) ; Ceram, fl., *Eutten 20>16* (BO, L, U) ; Key Isl., Tual, fl., *Jensen 22* (BO) ; East Flores, ster., 66. *6996* (BO, L) ; Aru Isl., Dosinamalan, P. Kobroor, June, ster., 66. *25396* (SING) ; ibid., Isl. Wokam, May, fl., *Buwalda 5029* (A, BO, BRI, K, L, P, PNH, SING) ; NEW GUINEA. West New Guinea, fr., *Branderhorst 131* (BO) ; Merauke, July, fl., *Anta HO* (BO, L) ; Mimika, July, fr., 66. *32927* (BO); Andai, ster., *Sugiyama 28* (BO); North. Territory, Finschhafen, ster., *Weinland 247* (SING); Papua, West. Div., Apr., fl., *Brass 6439* (A, BO) ; S.W. of Miahi village in Sago-swamp, Gulf Distr., June, fl., fr., *Floyd et Gray N.GF. 8013* (BO) ; Upper Wassi Kussa R., Jan., fl. *Brass 8608* (A, BO, L) ; East. Div., Balesana near Samarai, Jan., fr., *Jackson N.G.F. 4107* (BO, LAE, SING); PACIFIC REGION. Guaham Isi., Maria-Anna, ster., *Mertens in herb. Bunge* '(Petrop., P), Agfayan Bay, Dec, ster., *Fosberg 39276* (BO, US); Maria, nnas, Saipan, July, fl., *Kanehira 2244* (P) ; *Hawaii,* Oahu, fl., *Fauri 301* (P); Caroline Isl., Palau group, Urukthapel Isl., March, ster., *Fosberg 32224* (BO, US); Truk group, Moen Isl., Nov., fr., *Anderson 727* (BO, US); Fiji, Kandavu, Oct., fr., *A. C. Smith 187* (BO, US) ; New Caledonia, fl., *Deplanche 427* (P); fl., *Balansa 457* (P) ; fl., *Pancher s.n.* (P) ; Balade, fl., *Vieillard 142* (P). AFRICA. Kenya Colony, fl., fr., *Elliot 885* '(SING) ; Zanzibar, Jan., fl., fr., *Saccleux 1127* (P) ; AMERICA, {cultivated). Martinique, *Plee s.n.* (P) ; Trinidad, fl., Herb. *Sieber 144* (L, P).

2. **Heritiera globosa** Kosterm., spec. nov.—Fig. 3, 29c, 31

Arbor ramulis dense minute lepidotis, ramis sulcatis griseis, foliis alternantibus rigide conaceis, late ellipticis ad ovato-elliptieis, basi acutis ad subcordatis, apice obscure brevissime acuminatis, supra glabris laevibus, subtus dense adpresse minutissime lepidotis nerviis lateralibus utrinque 7—9, basalibus ab insertione petiole adscendentibus, petiolo longo.

Inflorescentia axillaris permultiflora paniculata dense ferrugineo-velutina, floribus campanulatus tubo triplo quam lobis longiore. Fructus opacus subglobosus, ala ventrali minima, dorsali paulo majus evoluta, apicali triangulare plicataque.

Tree 20—35 m tall and up to 1 m in diameter; canopy dark brown. Bole, usually short; buttresses 2.5—3.5 m, ridge-like, snake-like, extending outward for 2 to 4 m. Bark 1—2 mm, grey brown, superticially cracked or smooth; living bark 10 mm, reddish or orange-red, inside white.

Sapwood 2—7 cm, white, heartwood reddish brown. Branches striate-sulcate, grey, glabrous; branchlets densely adpressed lepidote, scales minute. Leaves alternate rigid coriaceous, elliptical to ovate- elliptical, 5—9 x 8—18 cm, base acutish, rounded, truncate or subcordate, apex obscurely, shortly acuminate or apiculate; upper surface glabrous, smooth, midrib and primary nerves hardly prominent, lower surface covered with a dense layer of adpressed minute fimbriate scales (drying aureous or coppery), midrib prominent, lateral nerves 7—9 pairs, prominent, rather distant, the lowest pair originating from the petiole insertion, slightly ascendant, secondary veins prominulous or invisible. Petiole 2—4 cm long, slightly swollen at both ends. Stipules lanceolate, 1 cm long, lepidote, caducous, leaving distinct transverse scars on either side of the petiole insertion.

Inflorescences axillary, paniculate, densely rusty ferrugineously, velvety pilose, many-flowered, 3—10 cm. long. Flowers red, urceolate, about 4 mm long, tube somewhat longer than the 4 erect, lanceolate, acutish lobes, inside pilose (stellate hairs). Male flower with filiform androgynophore 1.5—2 mm long, slightly thickened towards base, basal part with long-fimbriate scales; disc flat, 1 mm diameter, covered with transparent granules (glands); anthers 4 (of 2 thecae each), arranged in a regular cylinder about 0.5—0.6 mm high; the sterile cylindrical gynaecium protruding, about half as long as the anthers. Pedicel 5—8 mm long, very slender, covered with long fimbriate scales (almost like stellate hairs). Female flower not seen.

Fruit subglobose, up to 4.5 cm long, 4 cm thick, dorsally convex with a small ridge, originating from the pedicel and enlarging to a keel-like, up to 1 cm high, always folded wing at the apex; ventrally less convex with a small ridge.

Typus: Teijsmann 123456 (BO).

The type specimen bears a fancy number (123456), which is, however, retained, to separate the sheet from other Teijsmann specimens, which have never an original number, but were numbered later in Bogor (not by Teijsmann).

The species, thus far known from Borneo only, grows, as does *Heritiera littoralis,* behind the tidal zone of the mangrove belt. Of the specimen Endert 1467 it is stated, that it was collected on the Djembajan R., which is about 70 km from the sea, where the water is always fresh, but, especially in the rainy season, the area is twice daily inundated because of the tide which prevents the water of the Mahakam R. to flow off. In sterile

condition it may be distinguished from the closely allied *H. littpralis* by the longer petioles and the coppery lower leaf surface (dried), in *H. littoralis* the lower leafsurface is always silvery (dried). The male flowers have a slender androgynophore, which is moreover in its basal part covered with long fimbriat scales; in *H. littoralis* the androgynophore is'thicker and glabrous; the torus in *H. globosa* is larger than that of H. *littoralis*.

The fruit of *H. globosa* is easily distinguished from that of *H. litto ralis* by its globose shape and the folded wing; it is not glossy.

The specimen seems in general apperance similar to *H. littoralis* and the snake likesharp low buttresses, which extend to several metres from the tree base, are likewise similar. This is perhaps the reason why it has not got much attention. It should be investigated whether it occurs also outside Borneo. It is possible (according to the plate) that H.. *littoralis*, as described by Brown (Minor Prod. Philipp. Forests, 1920) belongs here.

The timber is not easy to work, very hard, locally it is used for making rice poundin blocks and for native boats.

BRITISH N. BORNEO. Sandakan, Sagaliut R., May, ster., *Evangelista 711* (NY, SING) ; Betotan, back of mangrove, Jan., buds, *Valera B.N.B.F.D. 36394* (KEP) ; Brunei, Bukau, Weston, March, fl., *B.N.B.F.D. 2181* (BO, K); Klias, swamp, March', in bud, *Goklin B.N.B.F.D. 3036* (BO, K) ; Momong, Apr., fl., *Maklin B.N.B.F.D. 30400* (BO, KEP) ; INDONESIAN BORNEO. West Borneo. Kapuas R., fr., *Teijsmann 123A5.6* (BO, K, L, UC) ; ibid., young fr., *Teijsmann 8392* (A, BO, CANB, K, L, SING) ; Mam pawa, young fr., *Teijsmann 8718* (BM, BO, L) ; Kubu, Ambawang, March, ster., *bb. 8033* (BO, L) ; Kubu, Terentang, ster., 66. *7847* (BO, K, L) ; Kubu, March, fr., *de Jong 68/W. = bb. 6340* (BO, L) ; Sukadana, Febr., ster., 66. *9681* (BO) ; Kapuas, Paku angin, fl., 66. *2117* <(BO, L) ; East Borneo, Djembajan R., W. of Samarinda, alt. 3 m, June, fl., *Endert 1467* (A, BO, K, L) ; ibid., fl., *Endert 1419* (BO, K, L) ; Sg. Klambu, Sept., ster., 66. *9323* (BO); Tidung, Malinau, alt. 10 m, June, ster., 66. *17857* (BO); South Borneo, Sampit, fl., 66. *2046* (BO) ; Terantang, Sampit, Dec, fl., 66. *2086* <BO, L).

3. Heritiera percoriacea Kosterm., spec. nov.—Fig. 4

Heritiera littoralis (non Aiton) Koorders & Valeton, Bijdr. 2, Booms. Java in Meded. Lands PI. Tuin Buitenzorg 14: 171, 172. 1895, p.p. (quoad cit. specim. Koorders 7699).

Foliis H. macrophyllis peraffinis sed minoribus &rassioribusque. Sa mara globosa lepidota, ala praedita.

' Tree 15 m tall, bole 7 m, diam. 100 cm. Bark rough, deeply fissured, dark. Living bark thick,, dark red.,Leaves alternate, coriaceous to stiffly

coriaceous, shape and nervation as those of *H. macrophylla*, up to 10 X 18 cm, usually smaller. Petioles up to 7 cm long.

Samara globose, brown or grey lepidot(scales minute), 3.5 cm diam. Wing triangular, keelshaped, 1.5 cm long, at base 2 cm wide. Fruit wall thick. . . . . .

Typus.—Kostermans 14100 (BO).

Distribution.—Known only from type locality.

Valeton, in his description of *Heritiera littoralis* (Meded. Lands Pi. Tuin 14: 171—172. 1895), mentioned a specimen from Nusakambangan (Koorders 7699 *β)* which differed by its longer petioles, a character dismissed by that author as being insignificant. There was, however, another remark, which drew my attention. According to Koorders there should be an inland form of *Heritiera littoralis*, which should have a straighter bole and had a different local name (kaju lawang) in Nusakam bangan. I was almost sure, after reading this, that another species was involved.

I spent almost a year in trying to find the species, of which the Bogor Herbarium had only one sterile sheet (Koorders 7696 *P*, from S. W. Java) not mentioned by Koorders & Valeton; the Nusakambangan spe cimen could not be found.). After trying in vain to find it in S. Bali, Pasir Putih near Probolinggo, Banjuwangi, Nusakambangan, Pelabuhan Ratu, Pengandaran, and Mount Hondje in S. W. Java, I stumbled on two trees not far from the lighthouse of Java's First Point (Tandjung Lajar). We found old fruit under the tree, which confirmed my idea that is was different from *H. littoralis*. The species is very close to *H. macrophylla* from India and Indochina, of which I have not seen mature fruit, but ac cording to Kurz' and Curtis' plate, the wing of the fruit of *H. macrophylla* is much narrower than that of our species and differently shaped. The fruit (but for the wing) are similar to those of *H. globosa* and *novoguineen sis*, which are, however, less lepidote. The "land form" (Bosch Atjeh) des cribed by Rumphius from the island of Amboina, which Valeton suspected to be the same as *H. littoralis*, might, according to me, represent *H. arafu~ rensis, H. novoguineensis, H. percoriacea* or an undescribed species.

JAVA, S. W. Java, Prov. of Banten, Udjung Kulon near the lighthouse, Nov. 1958, old, fallen fruit, *Kostermans 14 100* (A, BO, CANB, K, L, P, SING) ; S. of Labuan, Batuhideung, Tjemara Udjung ster., *Koorders 7696 ft* (BO).

4. Heritiera novo-guineensis Kosterm., spec. nov.—Fig. 5

Arbor, foliis alternantibus rigide chartaceis vel ooriaceis subovato-oblongis, basi rotundatis, apice acutiusculis, supra glabris, subtus lepidotis, petiolo longo. Fructus subglobosus, glabrus, ala parva apicalibus.

Tree up to 25 m, up to 60 cm. in diam.; crown widely spreading; branchlets densely, minutely, adpressed lepidote. Stipules 1 cm long, elongate-ovate, acute, deciduous. Leaves alternate, rigidly chartaceous to coriaceous, subovate-oblong, apex acutish, base rounded, up to 8 X 23 cm, upper surface glabrous, smooth, midrib flat, lateral nerves filiform, lower surface with a dense layer of minute, fimbriate scales, midrib strongly prominent, lateral nerves 11—14 pairs, slender, prominulous, smooth, secondary nerves hardly visible. Petiole 2.5—4 cm., swollen at both ends. Infructescence 12 cm, stout, unbranched, stellate-pilose, apex swollen, angular. Fruit subglobular or elongate, depressed, 4—6 cm long, 4 cm thick, covered with minute scales; ventral ridge very low, dorsal ridge 2—3 mm high, thick, apical wing broadly, obliquely triangular, up to 1.5 cm long, usually folded at tip; fruitwall woody, 5—7 mm thick; cotyledons flat-convex, seed-coat thin.

Typus.—Salverda 73 = bb. 21866 (BO).
Vernac. name.—Geremo (Kamundan R.).

The species is related to *H. longipetiolata* Kanehira, The photographic reproduction of the fruits of the latter, kindly placed at my disposal by the Agricultural College of the Fukuoka University, shows them as having a shorter wing than those of *H. novoguineensis.* Until more material is available, I prefer to keep the two species separate.

The fruit resembles that of *H. globosa,* but is larger; the leaves are much larger than those of *H. globosa* and resemble those of *H. arasfurensis* and *H. longipetiolata.* The species grows apparently on inundated places (fresh water).

Jackson gives the following description on the label of the specimen N. G. F. 2735. Leaves dark green above, light brown below, giving rusty appearance to crown from below. Bark fairly smooth, lightbrown with bright green immediately below the outer bark, 1—2 mm thick, inner bark 3 mm thick, yellowish pink, no exudation. Sapwood pale straw colour, clearly defined, many large pores, 5 cm thick. True wood pink to red, large-pored. Fairly hard to cut in mature trees. Vernac. name: Tuapi (Oriomo dialect). Used for native building, has a reputation for durability.

The sterile specimen bb. 22487 represents a young branch, the petioles are up to 5.5 cm long, the tree is stated to be 50 m high with a diameter

of 80 cm., local name warasar; the same local name is used for another sterile specimen bb. 32660, which is a tree of 25 m height.

The Brass specimen (8207) has leaves of 12 X 30 cm with 4.5 cm long petioles.

There are several sterile specimens, which cannot be identified properly; one is from Misool isl., Waigama, collected by Teijsmann, it has the leaves of *H. novo-guineensis,* but narrower; two other specimens bb. 33290 and 33427 from West New Guinea are either *H. arafurensis* or *H. novoguineensis* or another unnamed species. They might belong to the same species as the following sterile specimens from Celebes: bb. 32484, from Manado, Koorders 18053, 18054 from Manado and Cel/V-278 from Malili and Teijsmann 12747 from Celebes.

NEW GUINEA. — West N. Guinea, Wermudena R., R. Kamundan, alt. 50 m, Dec, young tree of 10 m with detached fruit, *Salverda 73* = 66. *21866* (BO) ; Western Distr. of Papua, Oriamo R. near Wuroi, Dec, ster., *N.G.F. 2735* (BO, LAE); Inanwatan, Warasar Distr., May, ster., 66. *32660* (A, BO, L, SING) ; Lower Fly R., East bank, opposite Sturtevant Isl., Oct., fr., *Brass 8207* (A, BO).

5. Heritiera longipetiolata Kanehira.—Fig. 32, 33

Heritiera longipetiolata Kanehira in Trop. Woods 29: 4. 1932 (in observ.) ; in Bot. Mag. Tokyo 46: 487. 1932; Fl. Micronesia 229, fig. 103. 1933; in J. Dept. Agr. Kyushyu Univ. 4: 369. 1935. — Kanehira 1060 (FU) ; paratype: Irobe 1060 B (FU).

Tree up to 15 m high, 100 cm. in diameter. Branches stout, densely lepidote. Leaves chartaceous, ovate to ovate-rhombic, base truncate, obtuse or subcordate (in leaves of young specimens, which may be up to 26 cm long with up to 15 cm long petioles, the base may be acutish), apex obtuse to acutish, about 10 x 14—20 cm, upper surface obscurely reticulate, veins flush with surface; lower one densely silvery lepidote with darker points, midrib prominent, broad lateral nerves 6—12 pairs, rather irregular, prominulous, at base 2 pairs of lateral nerves originating from the petiole insertion, secondary nerves lax, prominulous. Petiole 4—7 cm, lepidote, glabrescent. Stipules ovate-acute, 5 mm, caducous.

Inflorescence and flowers as in *H. littoralis.* Fruit subglobose to ovoid, 5 cm long, 4 cm in diameter with a small keel-like ridge, pericarp thick, woody.

Distribution. — Micronesia.

Through the courtesy of the Director of the Dept. of Botany of the Fukuoka University, I have been able to examine a flowering specimen (Kanehira 2274) and a picture of the fruit (Irobe 1060 B).

In Leiden a sterile branch is conserved, collected by Hallier, which is likely to belong here.

The species is closely allied to *H. novoguineensis*, but differs by the smaller keel of the fruit. The leaves of Halier's specimen are much larger (up to 15 X 24 cm) and have shorter petioles.

MICRONESIA. Marianas Isl., Tinian July, fl., *Kanehira F.N. 1060* (= *SUO)* (FU, BISH) ; ibid., Jan., young fr., *Kanehira F.N. 1730'* (= 4029) (FU) ; ibid., July, fl., *Kanehira F.N. 2274* (= *5581)* (FU) ; Saipan, Febr., ster., *Uno s.n.* (TOFO) ; ibid., Aug., young tree., *Kanehira F.N. 3580* (= *7838)* (FU) ; Carolina Isl., Nanmatol Isl., Matalanim Distr., low, ster., *Fosberg 26383* (BO, US) ; Metalan R. near Lossner's Upperland, Aug., ster., *Hallier s.n.* (L); Guam, Ritidian Point, rough limestone, alt. 165 m., Dec, young fr., *Fosberg 39268* (BO, US) ; ibid., fr., *Thompson 91* (BISH) ; ibid., Aug., fl., *Moran 4647* (BISH), UC) ; ibid., ster., *Moran 4636* (UC) ; Merizo, low, ster., *Fosberg 25404* (BO, US) ; North End of Anao Mat. Conserv. Res., alt. 170 m., Dec, fl., *Fosberg 39202* (BO, US).

6. **Heritiera fomes** Buch.-Ham.—Fig. 6, 31

Heritiera fomes Buchanan-Hamilton in Symes, An account of an Embassy to the Kingdom of Av.a, ed. 2,3 : 319—320. 1800 (ed. gall. 3: 100), Illustr. t. 28. 1800; Willdenow, Spec PL 4: 972. 1805; Lamarck-Poiret, Encycl., Suppl. 5: 30. 1817; DC, Prodr. 1: 484. 1824; Sprengel, Syst. Veg. 3: 70. 1826; G. Don, Gen. Hist. 1: 518. 1831 (sphalm. *fomas);* Wallich, Catal. n. 1189, pp. 1832; Wight & Walker-Arnott, Prodr. 1: 6S. 1834; Walp. Ann. 4: 321. 1857; Repert. 5: 106. 1845—46 (as a syn. of *H. littoralis* Ait.); Steudel, Nomencl. ed. 2: 251. 1840; Asa Gray, U.S. Explor. Exp. 1: 184. 1854 (quoad nomen; sphalm. *Heretiera)* ; Masters.in Hook, f., Fl. Brit. Ind. 1: 363. 1874 (excl. *B. minor Gaertn.;* excl. cit. Silhet et Borneo) ; Kurz in J. Asiat. Soc. Bengal 43 (2) : 118. 1874 (reprint p. 80) (as a syn. of *H. minor* Lam.) ; Mason, Burma 2: 621. 1883 (as a syn. of *H. minor;* sphalm. *Junes)* ; Watt, Diet. econ. Prod. Ind. 4: 223. 1890; K. Schumann in Engl. & Prantl, Nat Pfl. fam. 3 (6); 99. 1893; Balfour, Cyclop. 2: 30 (n.v.) ; Brandis, Ind. Trees 701. 1906; Troup, Silvicult. Ind. Trees 1: f. 64, 66. 1921; Pearson in Ind. For. Bull. 29. 1915 (n.v.); Gamble, Ind. Timb., ed. 2: 97. 1922; Pearson & Brown, Commer. Timb. India 1: 154—157, tab. 1932; Burkill, Diet. eeon. Prod. Mai. Pen. 1: 1140. 1935; Rodger, Handb. For. Prod. Burma (36). 1936; Howard, Identif. Timb. 48, f. 527. 1942; Timb. World 246. 1951; Bor, Man. Ind. For. Bot. 161. 1053; Nordlinger, Holzschn. VI (n.v.); Pearson, Commerc. Guide For. Econ. Prod. Ind. 56, Troup, Ind. Trees 153; Ind. Woods 163; Winn, Timb. 93 (n.v., cited by Pearson & Brown). — Tab. 28 of Buch.-Ham. (K).

Heritiera minor (non Lam.) Roxburgh, Hort. Beng. 50. 1814; Fl. Ind. 3: 142. 1832 (reprint 506. 1874) (excl. *Balanopteris minor* Gaert., *Atunus litorea* Rumph.) ; Masters, I.e.; Kurz in J, Asiat. Soc. Bengal 43 (2) : 120. 1874 (reprint p. 80) ; Prelim. Rep. Pegu 31. 1875; Troup, Ind. Woods 163. 1909; Foxworthy in Philip. J. Sci. 4: 500: 1909; Gamble, Man., I.e. 97, p.p.; Trotter, Comm. Timb. Ind. 82. 1929.

Fometica punctata Rafinesque, Sylva Tellur. 75. 1838; Merrill, Index Rafin. 167. 1949. -

Amygdalus minor (Lam.) O. Kuntze, Rev. Gen. PI. 1: 75. 1891 '(quoad synom).

Tree. Buttresses present, innumerable blind rootsuckers under the trees about 1 ft high. Wood brownish to darkred, hard and close grained. Branchlets covered with very minute, adpressed, non fimbriate scales. Branches rough, pale-brown. Leaves alternate, stiffly coriaceous, elliptical to lanceolate, 3—9 x 7—18 cm, top tapering or rounded, mucronulate, base somewhat tapering, rounded, pseudo-peltate; upper surface glabrous, smooth, midrib and lateral nerves level with the surface or midrib slightly impressed; lower surface with a tightly adpressed layer of very small, hardly fimbriate, aureous scales, midrib prominent, lateral nerves very slender, 9—15 pairs, prominulous, reticulation faint or obscure; lower pair of lateral nerves more ascendant than the others. Petiole rather stout, lepidote, 7—15 mm.

Inflorescence axillary, laxly paniculate, 2—11 cm long, densely pale brown stellate pubescent, ramifications very slender. Flowers campanulate, orange-coloured (Masters), densely stellate-pubescent, 4—5 mm long; lobes 4, reflexed, ovate, 1—1.5 mm long; inside of flower stellate-pilose, towards base the stellate hairs longer; male flower with a convex torus, depressed in the centre, covered with white granular cells; androgynophore 1 mm, glabrous; the 8 thecae in a regular ring (tube), topped by the minute, sterile ovaries. Female flower somewhat thicker, ovaries glabrous, sessile. 1—2 mm; styles very short, glabrous, stigmas recurved; at base of ovaries the small sterile thecae in groups of two; torus convex.

Fruit about 4 cm long and wide, dorsal side flat without ridge, ventral side convex with a well developed ridge which broadens into a 8 mm high ridge towards apex; a third ridge girdling the fruit horizontally (slightly obliquely).

Distribution — Forest of the Sundarbans, the Ganges-Brahmaputra delta, chiefly in those of the Khuma district, east of the Raimagah R; coast forest of Burma in the Irrawaddy delta.

Vernac. names: Ye-kanazo (Burma, ex Mason) ; Pinlay kanazo (Rogers).

The species is restricted to the gulf of Bengal and the adjacent coast, it does not occur in Borneo nor in Silhet, as stated by Masters, who confused it with *H. dubia* and *H. littoralis.* Masters gives the colour of the flower as orange-red; as he mixed at least two species, this has to be confirmed.

The fruit are very characteristic by their transverse horizontal ridge, which does not occur in other Heritiera species.

Wight and Arnott cited *H. fomes* as a synonym of *H. littoralis.* As they did not examine specimens, they based their opinion apparently on the

remark of Buchanan-Hamilton concerning a Rumphius plant (Herb. Amb. 3, t. 63), to the effect that the Rumphius species represented H. *minor* of Lamark, of which Buchanan-Hamilton gave an account under *Heritiera fomes* in Syme's Journal to Ava and which that author also considered to be conspecific with *Balanopteris minor* Gaertner. The description of the flower, according to Buchanan-Hamilton refers to a *Niota* (= *Brownlotvia),* which in Bengal and Ava is known by the same name and which Buchanan-Hamilton proposed to name *Niota polyandra-*.

Masters considered *H. fomes* a proper species. Kurz was the first to refer *H. attenuata* to *Broionlowia lanceolata* Benth.

According to Brandis the Sunder or Sundri (Bengal) tree forms nearly pure forests of large extent. Masters was wrong that *H. littoralis* occurs in this region (cf. Prain) ; Mr. L. L. Forman wrote me, that Wallich 1189 is a mixture of *H. fomes* and *H. littoralis.*

' There is a plate (no. 1197) at Kew, which shows leaves as those of *H. fomes,* but the fruit figured is smooth with apparently a groove down one side. Mr. Forman informs me, that all fruit of *H. fomes* in Kew are not smooth, but knobby and have the additional ridge, which girdles the fruit.

The sundri tree gives its name to the Sundribans, i.e. wastes of the Sundri, of the delta of the Ganges and is also found extensively down the coasts of Burma and Tenasserim.

Wood redbrown, very hard, close-grained elastic and durable. It makes good charcoal and supplies much of the firewood of Calcutta (Pearson).

The starchy seed is used in times of famine, provided the tannin is first removed by treatment with cold water (Puran Singh in Rep. Board Sci Adv. Ind. for 1912—13, p. 26).

The tannin content makes it the second in importance of the tannin materials of the Gangetic delta.

The following is copied from Pearson and Brown, p.p. 154—157.

"TRADE AND VERNACULAR NAMES. Sundri. VERN. Beng. Sundri, Sunder; Burm. Pinle kanazo, ye-kanazo; Arak. Razo.

HABIT AND DISTRIBUTION. A large tree, from 3 ft. to 6 ft. in girth and over, in favourable localities. Trees over 6 ft. in girth are often faulty. It grows from 50 ft. to 80 ft. in height; the root system is not deep, but a peculiarity of this species is that it sends up perpendicular shoots from its roots (pneumatophores), a foot or more in length, which appear as points when the forests are submerged **at high** tide, and as **innumerable** pegs in the ground at low tide. Sundri occurs throughout the reserved

forests of the Sundarbans, especially in the Khulna Bagirhat forests, as narrow strips along the Chittagong tidal forests, and over large areas in Arakan, between the mouth of the Mayu and Kaleindaung Rivers, the most important forest being in the Kyaukpyu District. The tidal or delta forests of the Bassein Division of Burma contain large areas of sundri-forests, and these are probably the most important from the point of view cf supplies. On the Tenasserim coast sundri is found fringing the many islands and tidal creeks, especially in the Mergui District.

SUPPLIES. Forest Bulletin No. 29 of 1915 may be consulted for details of supplies. The Sundarban forests of Bengal yield large quantities of small size material, nearly all larger trees having been exploited in the past. A survey of the Arakan forests, carried out by J. D. Hamilton, showed that there existed 335 square miles of sundri forests, the rest being either mixed sundri and mangrove or pure mangrove forests. Based on enumeration plots in the 335 square miles it was found that 580,000 sundri trees over 5 ft. in girth were available. In the Bassein or Delta forests of Burma the tree is larger than elsewhere, and large supplies are available. From an estimate made based on a few sample plots, the number of mature trees was put at 1,152,000 stems. Quite recently an extensive aerial survey has been carried out over this area, from which more accurate data will be available. The difficulty in exploiting this valuable supply of sundri from the Delta forests of Burma is great, due to the dense nature of the forests right down to the edge of the tidal creeks. The Burmans, however, take out enormous quantities of this timber in billets as fuel. On the other hand the network of creeks may be the saving factor in the problem of extraction, as is the case in the Bengal Sundarbans.

GENERAL CHARACTERISTIC OF THE WOOD. Sapwood pale reddish-brown ; heartwood dark reel to reddish-brown, sometimes faintly streaked with black; dull, without characteristic odour or taste, heavy (sp. gr. approx. 0.84), even and somewhat interlocked-grained, fine-textured.

STRUCTURE OF THE WOOD: Growth rings faint, irregular in contour, delimited by darker zones of massed libriform fibres, 6—10 per inch.

Vessels small to medium sized, open for the most part, the orifices not discernible or scarcely visible with the naked eye, forming narrow vessel-lines along the grain which glisten in places (gums) by reflected light, solitary or in linear or double radial rows of 2—5 (mostly 2—3), unevenly distributed, 0—18 per mm^2; vessel segments thick-walled, 140-370 n long, truncate or shallowly oblique and rarely abruptly short-tailed at one or both ends, the largest 150-175 ,u in diameter; perforations simple, horizontal or somewhat oblique; pits leading to contiguous vessels, minute, crowded, with minute rounded orifices, occasionally confluent forming pseudo-spirals; pits

market, a trial consignment was sent some years ago from the Bassein Division in Burma to Calcutta, and the cost of extraction, conversion, transport, dock dues, sale charges, &c, only came to 49 per cent, of the timber fetched in the market.

INDIA: Culta in Hort. Calcutt., fl. *Pierre 3768* (P); fl., *Schouw 182i* (= *Wallich)* (BO) ; Herb. Wallich, fl. (no. 173) (BO, P) ; *Wallich s.n.* ex Mus. Brit., fl. (SING) ; fl.', *Wallich 1139* (DS) ; ster., culta Calcutta (BO) ; Along Ganges E., June, fl., *Pierre 3768* (P) ; BURMA. Moulmein, fl., *Falconer s.n.* (BO) ; Bassein Distr., May, young fr., *Rogers s.n.* (Cal) ; ibid. Kudat Chaung, Apr. in bud, *Lace 3006* (Cal) ; ibid., Thit yaung, Apr., fl. *Lace 3019* (Cal); Tenasserim, Si-daw, Thayet Choung, Jan., fl., *Manson 7U8* (Cal); Tenasserim Circle, Oct., fl., *Manson 89* (Cal) ; ibid., Maunglow, March, fl., *Meebold 1U02* (Cal) ; ibid., fl. *Heifer 60U* (Cal); Pegu, Rangoon, fl., *Kurz 123U* (Cal) ; ibid., fl., herb. Kurz (Cal) ; Moulmein, Febr. fl., *Falconer 87* (CAL) ; Irrawadi R., Bassein Distr., May, ripe fr., *Rogers s.n.* (Cal) ; Tavoy, Apr., ster., *Meebold H.073* (Cal); Mergui, Puttan Isl., Jan., ster., *Rogers U1S M* (Cal).

7. **Heritiera dubia** Wall. ex. Kurz.—Fig. 7

Heritiera dubia Wallich ex Kurz in J. Bot. 12: 65. 1874, cum fig.; Prain in Ann. Roy. Bot. Gard. Calcutta 9: 8, plate 11. 1901; Brandis, Ind. Trees 87. 1906; Kanjilal, PI. Assam 1 (1) : 156. 1934 — De Silva (Icon, in Herb. Calc).

A tree; leaves oblong or oblong-lanceolate or elliptic-oblong, 10—15 cm X 4—8 cm, base cuneate or obtuse, apex obtuse or acute or acuminate, when young sparingly covered with tawny hairs but soon quite glabrous above, densely silvery lepidote and sparingly brown-punctate beneath. Petiole rather stout, lepidote, 12—20 mm long.

Panicle axillary, much shorter than the leaves, pubescent with longish rusty hairs. Flowers small, urceolate-campanulate, brownish-green, pedicel slender, 4 mm long; calyx 5 mm long, puberulous externally and internally, shortly 4 lobed, lobes obtuse or subacute; staminal column considerably shorter than the calyx, tip slightly angled, anthers 7—10, sessile; mature carpels compressed, cuneate-oblong, 4 cm long, thickly winged towards the tip on one side, smooth, brown.

Distribution.—Khasia Hills at low elevations.

The description and figure are copied from Prain's. The specimen Gallatly 367 (not seen) seems to differ considerably from that depicted by Wallich and I doubt whether it belongs here. As stated by Kurz, the species shows much likeness to *H. littoralis* Ait.

.INDIA. Khasia Hills at low elevations, fr., *de Silva* (icon, in herb. Calcutt., non vidi) ; fl., *Gallatly 367* (?) (n.v.).

8. **Heritiera catappa** Kosterm., spec. nov.—Fig. 34

Arbor ramulis rugosis foliis cdternantibus rigide coriaceis elliptico-lanceolatis usque ad elliptico-oblanceolatis basi rotundatis apice obscure acuminatis supra glabris laevibus subtus perdense adpresse minuteque lepidotis nerviis lateralibus utrinque 6—9, basalibus adscendentibus, petiolo longo. Infructescentia axillaris lepidota fructu oblique ovoideo glabro, ruguloso, subcornpresso, ala subobscura ventro apiceque evoluta, basi angustata.

Tree 25 m tall; branches grey, rather rough. Leaves alternate, rigid coriaceous, elliptical-lanceolate to elliptical-oblanceolate, 12—20 x 4—6 cm, base abruptly rounded, apex obscurely acuminate; upper surface glabrous, smooth, midrib and primary nerves slightly impressed, thin; lower surface with a dense layer of adpressed, minute, fimbriate scales, midrib strongly prominent, lateral nerves 6—9 pairs, rather erect, the two lower ones starting immediately above the petiole, ascendant. Petiole 2—2.5 cm long, slender, thickened at both ends.

Infructescence laxly paniculate, 3—8 cm long, lepidote; main peduncle rather thick, ramifications few, distant. Fruit obliquely ovoid, laterally compressed, roughish, glabrous, 3.5—5 cm; base with a conspicuous neck, dorsally hardly winged, straight or slightly convex, ventrally with a small wing-like accrescence, the fruit ressembling remotely that of *Terminalia catappa.*

Typus.—San 16756 (SING).

The fruit resembles that of *H. elata,* but the leaves have a different shape, the fruit resembles still more that of *H. arafurensis,* but has a longer neck and is more compressed. It is possible that the specimen is merely a variety of *H. elata* Ridley.

BRITISH N. BORNEO. Sipitang, Ulu Mendalong, 6 miles S.S.E. of Malaman, alt. 400 m., Sept., fr., *Wood, San 16756* (A, BO, BRI, K, KEP, L, SING).

9. **Heritiera elata** Ridley—Fig. 8, 35

Heritiera elata Ridley in J. Asiat. Soc. Str. Br. 50: 112. 1908; Fl. Mai. Pen. 1: 280. 1922; Holttum in Gard. Bull. S.S. 11: 142. 1940; Burkill, Diet. econ. Prod. Mai. Pen. 1: 1140. 1935. — Ridlley 6015 (SING).

Large tree, up to 40 m tall, 60 cm in diam. Buttresses large, up to 2.5 m high, concave, out 1.5 m. Bark grey to yellowish, flaky. Living bark 10 mm, lightbrown. Sapwood 10 cm, white; heartwood darkred, very hard.

Branchlets covered with a dense layer of adpressed, very minute, non-fimbriate scales; branches dark grey, smooth, glabrous. Leaves alternate, rigid coriaceous, elliptical to obovate-elliptical, 3—8 (—11) x 6—13 (—22) cm, base rounded, pseudopeltate, apex shortly acuminate or obtuse, above smooth, midrib and the filiform lateral nerves almost level with the surface, lower surface covered with a dense layer of adpressed, grey to coppery, very minute, shortly fimbriate scales, midrib strongly prominent, lateral nerves 6—8 (—9) pairs, prominent, slender, the lowest pair slightly ascendant, secondary nerves numerous, prallel, somewhat prominent or inconspicuous. Petioles stout, 5—25 mm long, lepidote.

Inflorescences axillary, laxly, broadly paniculate, 2—10 cm long, the lower ramifications and peduncle adpressed lepidote, the ultimate ramifications rusty stellate-haired. Flowers white, thin, campanulate, densely stellate-haired-lepidote, glabrescent, 4 mm long; lobes 5, ovate, acute, 1 mm long; tube inside almost glabrous, but for tips of lobes which have scattered stellate hair-like scales. Androgynophore in male flower slender, glabrous, 1 mm, thecae in a regular ring; ovaries hardly visible; torus glabrous, convex, depressed in the centre. Female flowers not seen.

Samara almond-shaped, glabrous, 3—5 cm long, 2.5—3 cm across, dorsal and ventral ridges well developed. Apical wing subtriangular, up to 1.5 cm long or sometimes small.

Distribution.—Malay Peninsula, Borneo.

The species represents apparently a rare tree, it was described originally from a specimen in the Singapore Botanical Gardens, which is still alive.

The leaf size is extremely variable. In the (old) Singapore tree the leaves are 2—5 X 4—8 cm, but a flowering branch (Nur s.n.) has leaves of up to 8 x 13 cm, apart from the small leaves. The specimen Corner s.n. S.F.N. 37731 has very broad leaves (9 x 14 cm). The Penang specimen has small leaves of which the reticulation of the lower leaf surface is hardly visible. The specimen Kostermans 12612 from Borneo has leaves up to 11 X 24 cm, but also leaves of 3 x 6 cm. The flowers of this specimen match those of the Singapore specimen. The single fruit, found on this tree is bigger than usual and has a less developed wing. The sterile specimen bb. 11028 has the obscure reticulation of the Penang specimen, it has small and large leaves. The specimen bb. 2028 from South Borneo conforms in its flowers with the Singapore specimen; the leaves are rather damaged and are similar to those of the Penang specimen. The petioles differ enormously in length. Cf. Note under *H. catappa.*

MALAY PENINSULA. Isl. Penang, Waterfall, Sept., fr., *Haniff S.F.N. 12571* (BO, SING); Kemanan, B. Kajang, Nov., ster., *Corner s.n.* (SING); Johore, Sg. Sedili, (Sept., ster., *Ngadiman s.n.* (SING). Singapore, Gardens, Febr., fl., *Nur s.n.* (SING) ; ibid., near Carpenter's shed, Febr., fl., young fr., *Ridley 6015* (CAL, SING); ibid., March, fr., *Kostermans s.n.* (A, BM, BO, B, CANB, CAL, K, LAE, L, MEL, NY, P, PNH, SING); Bukit Tima, Mar., ster., *Corner s.n.* '(SING); Mandai Road, Aug., fr. *Corner S.F.N. S77S1* (BO, SING). BORNEO. East Borneo, W. Kutei, Tundjung Plateau near Djohan Asa, alt. 100 m, periodically inundated soil, Aug., fl., fr., *Kostermans 12612* (A, BO, BRI, CANB, K, L, LAE, NY, P, PNH, SING) ; S. Borneo, Kuala Kapuas, Aug., fl., *Abar bin Adan, bb. 2028* (BO, BZF, L) ; Puruktjao, village Kelapeh, alt. 200 m., ster., *bb. 11028* (BO, L).

10. Heritiera arafurensis Kosterm. spec. nov.—Fig. 9

? Bosch-atun, Rumphius, Herb. Aboin. (sub *Atunus litorea)* 3: 95. 1743; Runun Laumuri.

Arbor ramulis adpresse perdense minuteque lepidotis, squamulis vix fimbriatis, foliis alternantibus rigide chartaceis vel coriaceis ellipticis ad obovato-ellipticis basi rotundatis apice obscure acuminatis supra glabris nervo mediano costisque subplanis, subtus perdense adpresse lepidotis squamulis minutis vix vel non fimbriatis, nervo mediano valde prominentibus, costis utrinque 7—9 distantibus prominentibus, basalibus subadscendentibus, nerviis secundariis gracilis laxis prominulis. Fructus oblique ellipsoideus f errugineo-lepidotus, squamulis adpressis minutis, carina dorsalis vix evolutis, ventralis deest, apicalia parva; basi nucdfera breve angustata.

Tree 20—45 m, bole to 20 m, clear, straight, somewhat angular 35—45 cm in diameter above the buttresses; the latter up to 5 m high, out 3 m. Bark brown, 2—5 mm, peeling off a little in grey, large patches (2 X 2 cm) ; living bark 5—6 mm, light red. Sapwood 3—7 cm, pale yellow for 1—2 cm, the inner part redbrown; heartwood darkbrown. Branchlets with a dense layer of adpressed, minute, hardly fimbriate scales. Stipules lanceolate, 5 mm, acute, caducous. Branches grey, rough. Leaves alternate, rigid chartaceous or coriaceous, elliptical to obovate-elliptical, 5—9 X 11—21 cm, base contracted into petiole or rounded or truncate, apex obscurely, shortly acuminate with sharp tip; upper surface glabrous, main veins hardly prominulous, flattened; lower surface covered with a dense, tightly adpressed layer of tiny, not or hardly fimbriate scales, midrib strongly prominent, lateral nerves 7—9 pairs, often irregular, distant, prominent, slightly curved, the lowest pair slightly ascendant (a pair of short nerves below the ascendant ones almost marginal),

secondary nerves lax, rather irregular, prominulous. Petiole lepidote, 2—5 cm long, slender.

Fruit compressed, obliquely ellipsoid, 3—3.5 cm long, 2.5 cm in diameter, covered with the same indumentum as the leaf surface, rusty, base narrowed into a short neck; dorsal ridge faint, ventral one almost absent, apical wing 5 mm long, rudderlike, thick, merging into the nut.

Typus.—Beguin 2250 (BO).

Distribution.—Celebes, Eastern Moluccas, New Guinea (?), Lesser Sunda islands from Lombok to Timor.

Vernac. names.—Korumu (Halmaheira), Rorum (Morotai).

Inflorescences laxly paniculate, rusty pilose, up to 10 cm long. Flowers suburceolate, 2—3 mm long, tube slightly longer than the 4 ovate-lanceolate, acutish, at tip explanate lobes, inside pilose. Androgynophore of male flower slender, 1 mm long, glabrous, bearing the 4 anthers (of 2 thecae each) in a regular ring, surmounted by the knob-like, minute gynaecium; torus rather flat, (after the specimen: Jaheri 344, which may represent a distinct species).

The leaves resemble those of *H. macrophylla,* but are smaller and have less regular secondary veins. The fruit resembles that of *H. catappa,* but has a shorter neck. In a tree of 15 m there were no buttresses.

I collected the species several times in Morotai where it is quite common ; it was possible to obtain only seedlings with the seed still attached; these agree exactly with those of the type specimen. The variation of leaf size and shape is enormous.

Rumphius already differentiated the Bosch-atun (= Forest-Atun) from the Sea-atun, the former had a different name (Rumun Laumuri) and was a tree with a longer and straighter bole. Rumphius thought, that it was a variety of the common *H. littoralis* with its crooked bole. Rumphius' statement is cited in Heyne, Nuttige PI. Ned. Ind. 2: 1069. 1927. The leaves of *H. arafurensis* have longer petioles and are usually more chartaceous, the fruit is smaller and has a different shape. Rumphius states that the Bosch-atun is said to have a larger fruit, which does not fit with the description of *H. arafurensis.*

The vernacular names in Ambon (Rumun Laumuri), Morotai (rorum) and-in Celebes (rumun) are similar. Of course, they may represent only a variation of the name dungun, used in the Western parts of Indonesia.

MOLUCCAS. Halmaheira. W. Pitu, Nov., fr., *Beguin 2250* (BO, K, L), type; Weda, Tillope, Apr. ster., 66. *24-862* (BO, K, L, NY, SING); Morotai Isl., Tobelo, ialt. 60 m, July, seedlings, *Kostermans 232 A* = 66. *33902 A* (A, BO, K, L) ; ibid., July ster., *Kostermans 224=* 66. *33894* (BO, K, L); ibid., alt. 30 m, June, ster., *Kostermans 209* = 66. *33882* (A, BO, BRI, K, L, MEL, SING) ; ibid., ster., *Kostermans 218* (BO), epicormic leaves of 3 X 16 cm; Sangowo K., alt. 150 m., May, ster., *Kostermans 962 {A,* BO, K, K, L, SING); ibid., ster., *Kostermans 1424* (A, BO, K, L, SING); Tobelo, Mt. Tutuhu, alt. 75 m, March, ster., 66. *24575* (BO). CELEBES. Menado, Kwandang, ster., 66. *750%* (BO).

There are several sterile specimens in the Bogor Herbarium, which cannot be attributed with certainly to this species; they are from N. Celebes (bb. 32484, 31884) ; from Central Celebes (Cel/V-278, Teijsmann s.n.) ; from New Guinea (Brass and Versteegh 13588) and from the islands of Buru (Teijsmann s.n.), Tanimbar (bb. 24260). The flowering specimen Jaheri 344 (BO, K, L) from the Key islands is either this species or an undescribed, distinct one.

11. Heritiera cordata Kosterm., spec. nov.—Fig. 36

Heritiera littoralis (non Aiton) Tardieu-Blot in Lecomte, Fl. gen. Indochine, Suppl. 1: 410. 1945, p.p. (quoad spec. Poilane 4950).

Arbor mediocris ramis ramulisque crassis foliis aiternantibus subverticillatis crasse coriaceis late ellipticis obtusis basi cordatis supra glabris nitidis subtus dense adpresse aureo-lepidotis, petiolo longo. Infructescentia axillaris paniculata dense ferrugineo-lepidota, fructu immaturo ala galeata.

Tree 8 m tall, 70 cm in diam. with a dense crown and shert, thick grey branches. Stipules lanceolate, acute, 5—8 mm, thick, caducous. The branchlets very short, thick, lepidote, bearing large, round leaf scars. Leaves alternate, subverticillate, rigid coriaceous, elliptical to ovate-elliptical or more or less rectangular with rounded edges, 18—25 X 4.5— 11 cm, subacutish or rounded or emarginate, base cordate and quasipeltate, above glabrous, smooth, midrib and lateral nerves slightly impressed, lower surface with a dense layer of adpressed, small, aureous, fimbriate scales, midrib strongly prominent, lateral nerves 5—9 pairs, prominent, straight, curved near margin, the lower 2—3 pairs starting from the same point, secondary nerves prominulous. Petiole up to 12 cm long, lepidote, cylindrical, rather stout, slightly swollen at base.

Infructescence axillary, broadly paniculate, densely lepidote, 9—14 cm long with very thick main peduncle and distant, thick ramifications. The

immature fruit densely rusty lepidote (scales like stellate hairs) with a galeate wing; stipe 1—2 mm, stout.

Typus.—Poilane 4950 (P).
Distribution.—Annam.

The species is characterized by the broadly elliptical, cordate leaves on the thick branchlets and the lepidote (pilose) fruit with with a short wing.

The ultimate branchlets of the inflorescence, not bearing fruit, are very thin, they enlarge considerably, when the fruit sets.

ANNAM. Nui Han heo near Nhatrang, Oct., young fruit, *Poilane h950* (BO, P).
ANNAM. Nui Han Heo near Nhatrang, Oct., young fruit, *Poilane i950* (BO, P, UC).

12. Heritiera macrophylla Wall, ex Kurz.—Fig. 10

Heritiera macrophylla Wall., Catal. no. 1162. 1832; Hasskarl, Tweede Catal. Lands PI. Tuin Buitenzorg 203. 1844 (nomen) ; Voigt, Hort. suburb. Calc. 103. 1845 (nomen); Kurz in J. Asiat. Soc. Bengal 42 (2) : 61. 1873; ibid. 43 (2) : 118. 1874 (reprint p. 80) ; ibid. 45 (2) : 120. 1876; Prelim. Report Pegu 31. 1875; in J. Bot. 12: 66, t. 141, f. 7. 1874; Forest Fl. Br. Burma 1: 141. 1877; Teijsmann & Binnendijk, Catal. Hort. Bogor. 197. 1866; Hooker f. in Curtis Bot. Mag. t. 7192. 1891; Gard. Chron. ser. 2, XXV: 80, 111. 16. 1886 (n.v.); Stein in Gartenfl. XXXV: 117-118. 1886 (n.v.); Lanessan, PI. util. Colon, franc. 292. 1886; Mason, Burma 2: 621. 1883; Pierre, Fl. for. Cochinch., fasc. 13, t. 204 A, B, f. 1—9. 1889; Watt, Diet. econ. Prod. Ind. 4: 225. 1890; J. Luguet in Jardin VI: 51. 1891 (n.v.) ; King in J. Asiat. Soc. Bengal. 60 (2) ; 80. 1892; J. Gerome in Jardin VIII: 160-161. 1894 (n.v.); Prain in Ann. Roy. Bot. Gard. Calcutta 9 (1): 9. 1901; Brandis, Ind. Trees 86. 1906; Gagnepain in Lecomte, Fl. gen. Indochine 1: 485, f. 46, 1—5. 1911; Tardieu-Blot, Suppl. 1: 411. 1914 (quoad nomen); .Kanjilal &'Das, Fl. Assam 1: 155. 1934; Merrill in Lingnan Sci. J. 14: 38. 1935; Chittenden, Diction. Garden., ed. 2, 2: 988. 1950; Bor, Man. Ind. For. Bot. 161. 1953.

Trochetia ? contracta Wall. Cat. 1162 ex Hook. f. in Curtis Bot. Mag. I.e.; King in J. As Soc. Bengal 60 (2) : 85. 1892.

Amygdalus macrophyllus (Wall, ex Kurz) O. Kuntze, Rev. Gen. PL 1: 75. 1891.

Medium sized tree; branchlets rather stout, with a dense, aureous layer of adpressed, minute, fimbriate scales. Stipules lanceolate, acute 6—25 mm long, lepidote, caducous. Leaves alternate, chartaceous to rigid-chartaceous, elliptical to ovate-elliptical, 4—18 X 8—25 (—40) cm, apex acuminate with a sharp tip, leafblade above base often narrowed, base itself rounded, pseudo-peltate, sometimes truncate or pseudo-auricled, upper surface soon glabrous, midrib flat, lateral and secondary nerves slender, prominulous; lower surface with a dense layer of silvery, adpressed, fimbriate scales; midrib strongly prominent, large; lateral nerves

8—10 pairs, prominent, curved near margin, often irregular, secondary nerves parallel, filiform, prominulous, not horizontal, lowest pair of lateral nerves starting from the petiole insertion. Petiole rather stout, lepidote, 2.5—10 cm long.

Inflorescences axillary, near apex of branchlets, broadly, laxly pyramidal, up to 12 cm long, densely rusty stellate-haired. Pedicels filiform, 3—5 mm long. Flowers campanulate, white, centre crimson, densely stellate pilose inside and outside, 4—6 mm long. Calyx lobes 5, lanceolate or ovate, reflexed, 1—1.5 mm long. Male flower slightly smaller (less broad) than female one, androgynophore 1 mm long, glabrous, anthers in an irregular globose clump, ovaries abortive, disc with a sunken central part, glabrous or covered with white granules. Female flower with sessile, densely lepidote, 0.75 mm long, laterally flattened, sessile ovaries, the lepidote styles 0.75 mm long, conglutinate with kneelike, laterally flattened stigmas, which are bent outwards, base surrounded by minute, reduced sessile anthers.

Samara covered with a dense layer of stellate-hair-like scales and corky warts; the nut slightly oblique, ellipsoid, ventrelly with a distinct, dorsally with an obscure ridge, apical wing long, falcate.

Vernac. name: Tepop-pomik (Abor); Thing-ansil (Kuki).

The leaves are characterized by their silvery under-surface; the leaves from the lower part of the branches often have an acute base, whereas those near the inflorescence are often truncate. I had no opportunity to examine mature fruit. The species is close to *H. cmgustata* Pierre, the leaves are bigger and lack the horizontal parallel secondary nerves near the leaf-base, which are typical in *H. angustata* and are not triplinerved; the latter, moreover, has glabrous samaras. The tree grown in the Botanic Gardens in Bogor is leafless for a short period once a year. The young pink leaves have somewhat drooping petioles and hanging leaves at right angles with the petioles. According to Kanjilal the flowers are pink; the statement that the calyx is cleft to the base is wrong.

According to Kanjilal it is a large tree, widely buttressed at the base when old.

King, I.e. stated in 1891, that *Heritiera macrophylla* Wallich was originally named *Trochetia contracta* by Wallich (Catal. no. 1162) and that some authors (Masters) thought it to be conspecific with *H. littoralis*; according to King it was different from *H. littoralis.* It is queer, that King was not acquainted with Kurz' descriptions of *H. macrophylla* and *H. acuminata* (Wallich 7836).

The specimen Lau 243 from Hainan, mentioned by Merrill, represents possibly *H. angustata*; the specimen could not be examined by me.

The ripe samara is said to be globose, almost 4 cm across with an obliquely set, narrow winged beak about 4 cm long and 1 cm broad. The timber is said to be. hard with distinct annual rings and uniform medullary rays, joined by fine transverse lines; it takes a fine polish; it is used for posts. Kurz says that there or 5, rarely 7 lobes; I found a female flower with 4 and male one with 5 lobes.

INDIA. Cachar, ster., Herb. Hooker & Thompson (SING), Botanical Garden, Calcutta, June, young fr., *King s.n.* (BO) ; ibid, ex Herb. Hooker, March, fl. (CAL) ; Botanical Garden Singapore, Lawn O, M,ay, fl., *Noor s.n.* (SING), ibid., March, fl., *Nur s.n.* (BO, SING) ; near Plant House no 10, Sept., ster., *Noor s.n.* (SING) ; ibid., Apr., fl. (SING); ANNAM, on Mekong R. near Chaudoc and Soctrang, Aug., fl., herb. *Pierre 2769 A* (P) ; Botanic Garden, BOGOR, May ster., *Kostermans s.n.* (BO, L).

13. **Heritiera angustata** Pierre.—Fig. 11

Heritiera angustata Pierre, Fl. forest. Cochinchine, fasc. 13: t. 204 C. 1889; Gagnepain in Leeomte, Fl. gen. Indochine 1: 485. 1911; Notul. Syst. Paris 3: 3. 1914; Tardieu-Blot, Suppl. 1: 411. t. 47, f. 1—5. 1945; — Harmand, Herb. Pierre 2850 (P).

Amygdalus angustata (Pierre) 0. Kuntze, Rev. Gen. PL 1: 75. 1891.

Heritiera annamensis Leeomte in Notul. Syst. Paris 3: 3—6, f. 1—10. 1914; Tardieu-Blot, I.e. —• Eberhardt s.n. (P).

Heritiera macrophylla (non Kurz) Gagnepain, I.e. (quoad Balansa 3845) ; (non Kurz) Tardieu-Blot, I.e.

Tree or shrub, up to 9 m tall and up to 50 cm in diameter; branchlets rather slender, adpressed lepidote; branches rather rough, brown. Stipules small. Leaves alternate, rigid chartaceous, narrowly oblong to lanceolate, 1.5—7 x 6—24 cm, base rounded, apex acute or subacuminate; upper surface smooth, glabrous, primary and lateral nerves visible, filiform ; lower surface covered with a dense layer of adpressed, minute, fimbriate scales, midrib prominent, lateral nerves 8—12 pairs, rather erect, rather straight, prominent, the lowest pair from the petiole insertion, slightly ascendant, secondary nerves prominulous, those on both sides of main rib on the basal part of the leaf usually horizontal, parallel. Petiole 1.5—3.5 cm long, slender, lepidote.

Inflorescence broadly paniculate, 5—9 cm long, with sparse, minute, stellate-hair like scales. Flowers campanulate, 4 mm long, pilose out- and inside,'lobes 1 mm long, lanceolate, acute. In male flower androgynophore glabrous, 0.75 mm long, anthers in an irregular glomerule, ovaries abortive,

disc glabrous, sunken in the middle; female flower slightly broader with glabrous, sessile, 1 mm high ovaries, and distinct, conglutinous, glabrous styles with kneelike stigmas bent outwards, sterile sessile anthers at base in 5 groups.

Infructescence stout, lepidote, 5 cm, hardly branched. Samara glabrous, glossy, nut ovoid or ellipsoid 2.2—3.5 cm long, 18—25 mm in diameter with a small ventral ridge, dorsal ridge hardly developed, apical wing 1.5—3 cm long, 8—15 mm wide, stiff, the two sides almost parallel.

The species, allied to *H. macrophylla* differs by its narrower subtriplinerved leaves with horizontal secondary veins; the lax tomentum of the inflorescence, the glabrous ovaries and samaras and the glabrous androgynophore.

The Poilane and Balansa specimens, incorporated by Gagnepain and Tardieu-Blot in *H. macrophylla*, belong here.

Tardieu-Blot's drawing of the anthers-thecae is wrong, they are placed irregularly and not in two regular tiers.

It is possible, that Merrill's *H. macrophylla* (Lau 243) from Hainan (Merrill in Lingnan Sci. J. 14: 38. 1935) represents this species.

ANNAM. Col des Nuages, near Tourane, ,alt. 300 m, rocky soil, Sept., fr., *Poilane 7865* (P) ; Thua-Luu between Tourane and Hue, fl., *Eberhardt s.n.* (P) ; type of *H. annamensis* Lee; Linh Chien, June, fl., *Poilane 1589* (P, UC) ; CAMBODIA, along Mekong R. near Cratieh, Mar., fl., *Harmand,* Herb. *Pierre 3851* (P) ; TONKIN, valley of Langkok, Mont Bavi, Nov., fr., *Balansa 3845* (P).

14. **Heritiera burmensis** Kosterm., spec. nov.—Fig. 37

Arbor ramulis crassis dense adpresse minuteque lepidotis foiiis rigide coriaceis ellipticis acutis basi rotundatis supra nitida glabra, subtus dense minuteque lepidotis nerviis lateralibus adscendentibus. Infructescentia vix vel non ramosa lepidota fructu ovoideo alis brevibus galeata indumenta pulverulento obtecto.

Tree, branchlets stout, densely covered with an adpressed dense layer of tiny scales. Leaves alternate, rigid coriaceous, elliptical, 13—27 X 4.5—8 cm, base rounded or obscurely caudate, apex acute; upper surface glabrous, smooth, glossy, nerves flat; lower surface with a dense, adpressed layer of tiny, fimbriate scales, midrib prominent, lateral nerves 10—12 pairs,, rather erect, slightly curved, disappearing towards margin. Petiole 1.5—4 cm, stout, slightly swollen at apex. Infructescence hardly branched, 13 cm, lepidote. Fruit obliquely ovoid, 3.5 cm long, 2.5 cm in diameter, covered with a layer of rusty, tiny, long-fimbriate scales, base narrowed into a

neck of 7 mm, apex with a rudder-like wing (2 cm long, 5 mm wide in the middle), covered with a dense layer of rusty stellate-hair like scales.

Typus.—Lace 5134 (CAL).

The species is allied to *H. macrophylla* from which it differs by its leaf shape and the larger fruit with rusty indumentum.

BURMA, Katha Distr., Mokujin Reserve, alt. 30 m, Febr., fl., *Lace 5134* (CAL).

15. **Heritiera pterospermoides** Kosterm., spec. nov.—Fig. 12

Arbor ramulis dense adpresse minuteque lepidotis ramis cinereis verrucosis, foliis alternantibus rigide chartaceis oblongis vel obovato-oblongis acutiusculis basi subcordatis, supra giabris laevibus subtus dense adpresse lepidotis, squamulis fimbriatis, nerviis lateralibus utrinque 10—12, basalibus adscendentibus, petiolo breve.

Panicula axillaris dense stellato-pilosa, floribus rubris elongato urceolatis utrinque pilosis, lobis lanceolatis apice explanatis tubo Vz dimidiantibus, androgynophoros in floribus mascuiis minuto filiforme glabro, antheris 4 (bithecis) in glomerula irregularo dispositis, gynaecio abortivo producto.

Tree 15—20 m tall, up to 40 cm in diameter. Branchlets covered with a dense layer of minute, adpressed, hardly fimbriate scales, branches grey, rather rough. Stipules lanceolate up to 9 mm long, acute, caducous. Leaves alternate, rigid chartaeeous, oblong to obovate-oblong, 3.5—8 x 9—17 cm, apex shortly acuminate, base subcordate, upper surface glabrous, smooth, nerves filiform, slightly impressed, lower surface covered with a dense adpressed layer of fimbriate scales, midrib strongly prominent, lateral nerves 10—13 pairs, erect-patent, curved near margin, prominent, the lower pair starting from the petiole insertion, ascendant; secondary nerves parallel, prominulous. Petiole 5—7 mm, thick, lepidote.

Panicles axillary, densely stellate pubescent up to 6 cm long, broad, main peduncle rather stout, ramifications distant, rather stout. Pedicels filiform, 1—2 mm. Flowers dark claret inside and out, pilose, elongate urceolate, up to 5 mm long, the 4—5 lanceolate, acutish lobes explanate, about 1/3—14 the tube length. Androgynophore in male flower filiform, hardly 1 mm long, glabrous, bearing at its apex a glomerule of 4 anthers (each with 2 thecae) irregularly placed, topped by the rudiment of the gynaecium. Torus flat, white.

Typus.—King's Coll. 7056 (CAL).

Distribution.—Malay Peninsula, Sumatra.

The species resembles *H. macrophylla,* but has very short petioles. A specimen, collected from a young tree collected by Corner & Nauen in Kedah, G. Baling, nov., ster. (L, SING), belongs perhaps here, the shape and texture is similar, the leaves are much larger with longer petioles, which, however, is common in young trees. Another specimen, apparently belonging to this species was collected in Sumatra, Sibolangit, alt 500 m by Docters van Leeuwen 7709 (BO).

MALAY PENINSULA. Perak, Duisegan limestone hills near G.M., alt. 100—200 in, *King's Coll. 7056* (CAL, L).

16. **Heritiera kiinstleri** (King) Kosterm., comb. nov.—Fig. 13, 38

Tarrietia kiinstleri King in J. Asiat. Soc. Bengal 60 (2) : 77. 1891; Ridley, Fl. Mai. Pen. 1: 279. 1922. — King's Coll. 7581 (CAL).

Tarrietia rubiginosa Kosterm., New and crit. Mai. PL 3: 27, f. 13. 1955. — bb. 12522 (BO).

Tree 25—30 m tall, 50—100 cm in diameter. Buttresses up to 2 m high, out 50 cm, rather thin. Bark reddish, rather smooth, 1—1.5 mm thick. Living bark 10 mm, lightred, inside white. Sapwood 4 cm, white; heartwood red, hard. Branchlets, petioles and infructescence covered with brown minute stellate hairs; branches glabrous, smooth, cylindrical, rather slender. Leaves alternate, stiffly chartaeeous, ellipsoid to subobovate-elliptical (3—) 5—9 x 5—18 cm, obtuse or obscurely acuminate, often emarginate, base rounded or subcordate, quasi-peltate, upper surface glabrous, smooth, main nerves filiform, slightly impressed, lower surface sparsely, minutely, ferrugineously stellate-pubescent, glabrescent, midrib strongly prominent, lateral nerves 6—10 pairs, erect-patent, rather straight, slender, prominent, secondary veins parallel and irregular, lax, prominulous. Petiole 1.5—2.5 cm long, somewhat thickened at both ends. Flowers unknown. Infructescence 3—8 cm long, hardly or not branched. Samara red (fresh), brownish stellately pubescent; nut ellipsoid 2.5 cm long, 1.5 cm diam., apex with a 25 mm long, 10 mm wide, pubescent, falcate wing; wing with parallel lateral margins, base of nut showing a short neck of 5 mm, tapering into a thick 1 cm long petiole.

Distribution.—Malay Peninsula; North Sumatra.

Apparently the species is rare. It has never been recollected again in the Malay Peninsula. *Tarrietia rubiginosa* Kosterm. differs only by its leaves being smaller than those of the type specimen of *T. kiinstleri.* The specimen bb. 6248 was not collected in the Palembang region, as wrongly stated in my paper, but also in the Karo lands in E. Sumatra; its leaves

show a lax indumentum of rusty stellate hairs, which have more or less completely disappeared in the specimen bb. 12522; the type specimen of *H. kunstteri* has practically glabrous leaves, but traces of the former stellate indumentum may still be. found.

MALAYA. Perak. Larut Mt. Bobo, alt. 200—300 m, Mpy, fr., *King's Coll. 7581* (BO, K, SING) ; SUMATRA, East Coast. Karo Lands, For. Res. G. Salet, Kutabangun, alt. 900 m, Jan., ster., 66. *6U8* (BO, K, L) ; Lao Pengulu, Dec, fr., *bb. 12522* (BO, U, WAG.).

17. **Heritiera impressinervia** Kosterm.—Fig. 14

Heritiera impressinervia Kosterm., New and erit. Mai. PI. 3: 29, f. 14. 1955. — Suhaile, F.D. (Brunei) 37055 (KEP).

Tree, 40 m tall and 80 cm in diameter. Bark grey. Branchlets densely covered by aureous-brown, minute scales and hairs; buds sub-globose; branches glabrous, sulcate, rough, grey. Leaves alternate, rigid coriaceous, upper surface glabrous; lower one densely covered with aureous, minute scales, obovate, obtuse, base rounded; upper surface with slightly raised midrib and sunken primary and secondary veins, making the leaf a little bullate; lower surface with strongly prominent midrib and primary (5—6 pairs) nerves and prominulous secondary nerves. Petiole slender, covered with scales, 2—2.5 cm long. Inflorescence axillary and extra-axillary near apex of branchlets, slender, 4—8 cm long. Pedicels filiform, 1—4 mm long. Flowers ureeolate, 3—4 mm long, about 2—3 mm in diameter with scattered fimbriate scales and stellate hairs outside and at margin; inside with few stellate hairs; lobes 4—5, about 1 mm long, broadly triangular-ovate acutish. (Male) Flowers with a semi-globose discus; androphore about 1 mm long, slender, glabrous; anthers 5 (each with 2 parallel, oblong thecae) in one ring, glabrous,.sessile, hardly 0,25 mm long.

Distribution.—Only known from type locality.

By the shape of the leaves and the impressed nerves the species is-easily distinguished.

BORNEO. Brunei; 14.5 miles Tutong Road, State: Land, on hill, 17 March 1938, fl., *Suhaile, F. D. Brunei 37055* (KEPONG).

18. **Heritiera parvifolia** Merr.—Fig. 15

Heritiera parvifolia Merrill in J. Arnold Arb. 6: 137. 1925; — *Tarrietia parvifolia* (Merr.) Merr. & Chun in Sunyatsenia 2: 281, t. 60. 1935; in Lingnan Sc. Journ. '5: 128. 1927; Erdtmann, Pollen morphol. 420. 1952. — W.Y. Chun 2100 (Nanking).

Tree 5—30 m tall; branchlets sulcate, rather slender, covered with adpressed, minute, non fimbriate, coppery scales; branches rough, grey, glabrous. Leaves alternate, coriaceous, lanceolate-oblong or lanceolate, 1.5—3.5 X 6—10 cm, base rounded, apex acuminate or acute, upper surface glabrous, midrib and lateral nerves filiform, often slightly impressed, lower surface with a dense layer of adpressed, coppery, small, fimbriate, scales, midrib prominent, later nerves (3—) 5—8 (—8), slender, prominent, the lowest pair somewhat ascendant (subtriplinerved), reticulation obscure. Petiole slender, 1—2 cm long.

Inflorescences axillary, rather narrowly paniculate, up to 5 cm long, densely covered by minute, stellate-hair like scales; pedicels filiform, 3 mm. Flowers white or yellowish, broadly cup-shaped or campanulate, 3—4 mm long, densely stellate pilose inside and outside, lobes rather large, 1—2.5 mm long, acute. Male flowers with a glabrous, 1 mm long androgynophore, the 10 anther-thecae in a regular tube, topped by the reduced, sterile ovaries; torus convex, pilose; pollen subprolate, 20 X 17 μ (Erdtmann). Female flower with sessile, pilose ovaries and conglutinate styles with hooked stigmas. Ifructescence 4 cm, densely, shortly stellate pilose. Samara densely lepidote (scales minute, fimbriate) ; nut obliquely subglobose or ellipsoid, 1.5—2.5 cm long, often with a short neck at base; dorsal and ventral ridge developed, wing 2.5—5 cm long, up to 2.5 cm wide, rudder-like.

Distribution.—Hainan.

The specimen Wang 34885 (P) has abnormally large leaves (up to 6 X 13 cm), in other respects it is identical with the other specimens, is has been identified by Merrill as *H. macrophylla* which it certainly is not. The species is very close to *H. papilio* Bedd. and might prove identical.

HAINAN. Po Ting, alt. 400 m, July-Aug., fr., *How 73440* (A, BO, SING) ; ibid., July, fr., *How 73319* (A, BISH, SING); ibid.., May, fl., *How 72630* (A, SING) et *72361* (A, SING); Yaichow, young fr., *How 71047* (A, NY, P) ; Ngai Distr., Young Ling Shan, June, fl., *Lau 54* (A, NY, P, UC) ; locality not indicated, fl., *Wang 34885* (P); N. W. Slope of Five Finger Mountain, June, fl., *Woon Young Chun 2100* (A).

19. **Heritiera sylvatica** Vid.—Fig. **16,** 30a

Heritiera sylvatica Vidal y Soler, Rev. PL vase. Filip. 66. 1886; Sinops. Atlas t. 103. 14. 1883; Ahern, Most important Timb. Trees Philipp. Isl. 47, tab. 1901 (Manila), p.p. *(silvatica) ;* Merrill in Philip. Bureau Forestry Bull. 1: 38. 1903 (as a syn. of *Tarrietia sylvatica* (Vid.) Merr.); Enum. Philip, fl. PI. 3: 57. 1923; Perkins, Fragm. Fl. Philip. 116. 1904 (as a syn. of *T. sylvatica* Merr.). — *Tarrietia sylvatioa*

(Vid.) Merrill, I.e. 38; in Philip. J. Sci. 1, Suppl.: 4. 1906; Enum., I.e. 57; Foxworthy in Philip. J. Sci. Bot. 4: 502. 1909; Perkins, I.e.; Sasaki, Catal. Herb. Taihoku 345. 1930; K,anehira, Ident. Philip. Woods (13). 1924 — Vidal (K ?).

Heritiera papilio (non Beddome) Vidal, Sinops. 14; Indice Atlas XIV Resena 3 (n.v.).

Sterculia nobilis (non R. Br.) F. Villars, Villars, Nov. App. 27. 1880; Ahern, I.e.; Merrill, I.e. 38; Vidal, Revista, I.e. 66.

Tree, branchlets slender, sulcate, lepidote; branches slender, roughish, glabrous, brown. Leaves alternate, rigid chartaceous, ovate-elliptical or elliptical to lanceolate-elliptical, 2—6 (—8) X 6—15 (—17) cm, base rounded, pseudo-peltate, apex acute or acuminate; upper surface glabrous, smooth, the filiform lateral nerves slightly impressed, lower surface adpressed lepidote, scales minute, fimbriate, silvery, midrib prominent, lateral nerves 8—12 pairs, very slender reticulation prominulous or inconspicuous. Petiole slender, lepidote, 1—5 cm long.

Inflorescences axillary, laxly paniculate, 6—13 cm long, covered with minute stellate-hair like scales. Pedicels and ultimate branchlets filiform, 4 mm; peduncles and main branches adpressed lepidote. Flowers cup-shaped, 4—5 mm long, pilose inside and outside; lobes 1—2 mm, ovate, acute; male flower 3—4 mm with glabrous 1—1.5 mm long andragynophore, anthers in an irregular mass, torus convex, pilose. Female flower 5 mm, lobes 2 mm, ovaries sessile, lepidote, 1.5 mm long, styles short, lepidote; base of ovaries surrounded by the sessile sterile anthers in groups of 4 between the ovaries. Samara lepidote, nut obliquely ellipsoid, 1—1.5 cm long, wing 3—5 cm, up to 2 cm wide, base of nut often with a neck; ventral and dorsal ridge of nut hardly developed.

Distribution.—Philippines, Celebes (?), New Guinea (?).

Vernac. names.—Paronapin; Paranipin; Palonapin; Palogaping; Palonapoy; Paranapoi (Iloco, Pang., Sul, Philipp.) ; Dungon, Dungol, Dongon (Tagalog, Philipp.).

Ahern's plate is very crude; the leaves have not much likeness to those of *H. syvativa*, the fruit are entirely different and ressemble those of *H. littoralis*. Ahern stated, that the plate was made after living material. On page 48 he mentioned *Sterculia ambiformis*, apparently a misprint of *cymbiformis*, which is *H. littoralis*. Although the sterile specimens bb. 33277 and 33290 (BO, L) from New Guinea (West New Guinea, Ransiki, S. of Manokwari) and Teijsmann 12747 (BO, L) from Baleh-angien, Celebes, Cel/V-278 (BO) from Malili (Celebes) and Koorders 18052 (BO, L), 18053 (BO, L) and 18054 (A, BO, L) from Manado, Pinamorongan Mts.,

Celebes, resemble closely *H. sylvatica*, I cannot guarantee this identification (cf. *H. arafurensis*).

PHILIPPINES. Luzon, Ilocos Sur Prov., May, fr., *Paraiso F.B. 24147* (A, BO) ; Camarines, fl., *Ahern's Collector 88* (UC) ; Rizal Prov., Antipolo, Febr., fl., *Ahern's Collector 20* (A, BISH, DS, UC); Rizal Prov., fl., fr., *Ahern 885* (BO) ; ibid., March, fl., *Ahern's Collector F.B. 2703* (BO, SING); ibid., Montalban, March, fl., *Loher 12860* (UC) ; Bataan Prov., Jan., young- fr., *Curran F.B.5966* (SING); ibid., Nov.-Dec, fl., *Pascual F.B. 28786* (BO) ; Laguna Prov., Santa Maria Navitaz, Febr., ster., *Curran F.B. 1O098* (BO); Maquiling Nat. Park, Apr., young fr., *Sulit s.n.* (A, DS) ; ibid., May, fr., *sine coll.* (TOFO) ; Gagayan Prov., June, *Bernardo F.B. 15203* (BO); Mindoro, Iriron, Febr., young fr., *Merritt F.B. 8829* (BO, SING) ; Mariduque Isl., Apr., ster., *Rosenbluth F.B. 12167* (BO) ; Mindanao, Misamis Prov., March, fl., *Quimpo F.B. 30222* (A, UC).

20. **Heritiera papilio** Bedd.—Fig. 39

Heritiera papilio Beddome, Flora sylvatica t. 218. 1872; Masters in Hook, f, Fl. Brit. Ind. 1: 363. 1874; Pierre, Fl. forest. Cochinchine, fasc. 13: t. 204. (text); Watt, Diet. econ. Prod. Ind. 4: 223. 1890; Prain in Ann. Roy. bot. Gard. Calcutta 9: 9. 1901; Brandis, Ind. Trees 87. 1906; Troup, Ind. Woods (1909) 163 (as a syn. of *H. acuminata* Wall.); Gamble, Fl. Madras 1: 104. 1915; Man. 3: 23; Ind. Timb. 99. 1922; Erdtmann, Pollen morphol. 420. 1952. — *\Amygdalus papilio* '(Bedd.) O. Kuntze, Rev. Gen. PI. 1: 75. 1891; Bor, Ind. For. Man. 161. 1953. — Major Beddome 204 (K).

Heritiera vespertilio Kurz (sphalm). in J. of Bot. 12: 65. 1874 (nomen).

Heritiera acuminata Wallich ex Kurz in J. of Bot. 12: 65, t. 141, f. 1—3. 1874; Voigt, Hort. suburb. Calcut. 103. 1845 (nomen); King in J. As Soc. Bengal 60 (2): 80. 1891; Prain, I.e.; Brandis, I.e. 86; Gamble, Man. Ind. Timb., I.e.; Kanjilal, Fl. Assam 1: 155. 1934; Troup, Indian Woods 163. 1909. — Wallich 7836 (K).

Large tree. Branchlets stellately tomentose (Beddome). Leaves coriaceous, lanceolate or ovate-lanceolate, 7.5—12.5 x 3—5 cm, base obtuse, gradually, obscurely acuminate, upper surface smooth, glossy, soon glabrous (when young densely covered with fugacious close set scales, cf. Beddome), midrib and lateral nerves slender, prominulous lower surface with a dense, tightly adpressed layer of tiny silvery, fimbriate scales (the centre darker in dried specimens), midrib prominent, the few (4—5 pairs of lateral nerves rather erect, the lowest pair ascendant (subtriplinerved), the secondary nerves rather obscure, lax, parallel, often more or less horizontal. Stipules small, ovate-acute, deciduous. Petioles slender, lepidote, 1—2.5 cm long.

Panicles axillary, lax, broad, 4—5 cm long, the basal part lepidote, towards the ultimate ramifications rusty stellate pubescent. Male flowers cream-coloured (Beddome), densely rusty stellate pubescent exteriorly and interiorly, broadly campanulate, 4—5 mm long, the 5 (sometimes 4, cf.

Beddome) broadly ovate, acutish lobes about as long as the tube. Androgynophore short, slender, glabrous; anther-thecae 5 pairs arranged in a regular cylinder, pollen sub-oblate, about 20 x 23 μ, (Erdtmann) ; ovaries entirely abortive; torus convex, sunk in its centre, covered with papillae. Female flower similar to male one, 5—6 lobed (Beddome) with 5—6 sessile ovaries, sparingly covered when young with stellate scales, soon quite glabrous (Beddome), at base in between the ovaries pairwise arranged anther thecae; styles recurved (Beddome). Samaras glabrous, 7 cm long, consisting of an ellipsoid nut of about 2 cm length with a membranaceous wing with fan-like strong reticulation.

Distribution.—Tinnevelly, Travancore (Beddome) ; N. E. Bengal (Silhet) ; Cachar, Naraindar Punji, Juhri Gat, lower Lushai Hills (Prain).

Vernacular names.—Akhar (Cachar; ex Prain) ; Soundalay unnu (Tinnevelly ex Gamble) ; Thing-phelem (Kutri) ; Thing-saipho (Tipp.) ; Rashwet (Synt.) ; Chingren (Naga) ; Bondonthupang (Kach.).

The species which is closely related to *H. parvifolia* was named, but not described by Voigt in 1845 as *Heritiera acuminata* Wall. mscr. Kurz described the species after the specimen Wallich 7836 and after a drawing (which thus far has not been located), not being aware that it had been already described by Beddome as *H. papilio* (which Kurz cited erroneously as *H. vespertilio).* Through the courtesy of the Director of the Kew Gardens and with the much appreciated help of Mr. L. L. Forman, I had the opportunity to study fragments of the specimen Wallich 7836 and of Beddome 204 (a fragment of the latter is represented in the Paris Herbarium), together with photographs of the specimens Wallich 7836, originating from Silhet and identified (by Wallich?) as *Rottlera,* of Major Beddome no. 204, collected in Dec. 1871 and of Colonel Beddome, collected in Tinnevelly in 1872.

Comparison with Beddome's plate (no. 218) revealed, that the drawing was made from part of the specimen Beddome 204, which consequently represents the holo-type. Beddome stated, that the plate was made after fresh specimens; this seems to apply only to the analytical sketches of flower and fruit. The fruit was drawn apparently after the Tinnevelly specimen, which is hence considered the paratype.

Volume I of Beddome's Flora sylvatica (which contains plate 218) is marked 1869; this date must be wrong, as the plate was drawn from a specimen, collected in 1871. This specimen was collected by Major Beddome, the para-type by Colonel Beddome. As in volume I Beddome gives

himself the rank of Major, this volume must have been issued after December 1871 and before the end of 1872, the collecting date of the paratype, as I presume, that Beddome will have indicated his promotion in rank as soon as possible. This deduction confirms Steam's date as cited in van Steenis, Flora Malesiana 4 (1), where it is given as 1872.

Apparently the species was described after Beddome's Forester's Manual had been issued, according to Beddome's remark: "it has only recently been discovered and should be added to the Manual at page 33".

This implies that the Forest Manual antedates the Flora sylvatica. In his description Beddome stated that the tree flowers in August and September (not that it was in fruit). It is possible that the flowers, which were described from living material were collected in August or September, the young fruit were apparently from the specimen Beddome 204; from the figures 3 and 11 one should get the impression, that the flowers are glabrous internally, but figure 1 shows a flower with the inside of the lobes pubescent.

Prain enumerated several other specimens, which I had no opportunity to examine.

Heritiera attenuate Wall Cat. 1140; Brown, PL Jav. rar. 237; Masters in Hook f. Fl. Br. Ind. 1: 363. 1874 is a species of *Niota.*

Hooker in Hook f., Fl. Br. Ind. 1: 517. 1974 states: *Niota* is now merged in *Samadera* in Simarubaceae. Wallich's plant may be certainly identified with *Brownlowia lanceolate/,* Benth. Steudel (Nom., ed. 2: 196. 1848) quoting from Wall. Cat. p. 157 the Mscr. name *Niota? polyandra* has misread the authority H. Ham. (Herb. Hamilt.) as Wight & Arnott, and has further referred the plant to *Vitmannia polyandra* Steudel. (cf. Excluded species).

INDIA. Silhet, *Wallich 7836* (K); Travancore (?) fl., young fr., Dec, *Maj. Beddome* 204 (K, P.); Tinnevelly, *Col. Beddome s.n.* anno 1872 (K).

21. **Heritiera macroptera** Kosterm., spec. nov.—Fig. 17

Arbor magna ramulis gracilibus squamulis vix fimbriatis minimis perdense adpresseque obteetis, foliis alternantibus chartaceis ovatis basi rotundatis supra mox glabris (nervo medzano excepto) nitidis, sublaevibus, nerviis vix conspicuis, subtus squamulis minutis breve fimbriatis adpressis dense obteetis, petiolo gracile longo. Samara ellipsoidea glabra apice in alam magnam producta.

Large tree, up to 50 m tall with dense, darkgreen canopy; clear bole up to 25 m, up to 80 cm in diameter. Buttresses up to 3 m, thin, out 2—3 m.

Bark hard, smooth, brownish-grey with orange spots where it has peeled off; living bark red, 10 mm, inner layer yellow; sapwood 2 cm; pale yellowish brown; heartwood red; centre very dark and hard. Branches grey, rather smooth; branchlets slender, covered with a dense layer of adpressed, minute, not or hardly fimbriate scales. Stipules lanceolate, 2 mm, acute, deciduous. Leaves alternate, chartaceous, ovate, top acute, base rounded or subcordate, 2.5—6 x 4—10 cm, upper surface soon glabrous (but for the lepidote midrib), glossy, smooth, veins faintly visible; lower surface covered with a dense, adpressed layer of minute, shortly fimbriate scales, midrib prominent, lateral nerves about 10 pairs, very slender, slightly arcuate, prominulous, secondary nerves hardly visible. Petiole slender, 1.5—2.5 cm, thickened at both ends.

Samara lepidote with an ellipsoid nut, about 1.5 cm long and 12 mm diam., slightly compressed, surrounded by a thin small wing, which enlarges towards apex into a very broad, 4 cm long and broad, rudderlike wing with a straight, slightly thickened upper and a thin outer part, veins fan-shaped.

Typus.—Kostermans 13820 (BO).
Distribution.—Borneo.
Vernac. names.—Simpul (Bassap-Mandu, Dyak), Mengkebanir (Bassap-Mapulu).

The leaves and samaras of this species resemble those of *H. parvifolia*, of which the leaves have fewer lateral nerves and of which the samaras are lepidote. The tree reaches an enormous size, but seems to be rare; it grows in moist places. The leaves of a young tree of 10 m are lanceolate-elliptical, acuminate and tapering at base with thick petioles, they are up to 8 x 27 cm. The name mangkebanir means: provided with buttresses and simpul is equally a name not to be trusted.

INDONESIA. Borneo. E. Borneo, Berouw, Mt. Has Bungaan, limestone and clay, Nov., fr., *Kostermans 13820* (A, BO, BRI, BM, CAL, CANB, K, KEP, L, NY, P, SING).

22. Heritiera simplicifolia (Mast.) Kosterm., comb. nov.—Fig. 18, 29a

Tarrietia simplicifolia Masters (basionym) in Hook, f., Fl. Brit. Ind. 1: 362. 1874; Maingay in Kew Bull. 1890: 116; King in J. Asiat. Soc. Bengal 60 (2) : 78. 1891; Ridley in Agric. Bull. S. S. & F. M. S., New Ser. 1: 50. 1902; in Bull. Kolon. Mus. Haarlem 27: 16. 1903; Fl. Mai. Pen. 1: 278. 1922: Burkill & Henderson in Gard. Bull. S. S. 3: 351. 1925; Henderson in Gard. Bull. S. S. 14: 225. 1926-29; Foxworthy in

Mai. For. Rec. 3: 145, plate. 1927; Foxworthy and Woolley in Mai. For. Ree. 8: 22. 1930; Burkill, Diet. econ. Prod. Mai. Pen. 2: 2126. 1935; Watson in Mai. For. Rec. 6 (3): 76, 95, 101, 188. 1936; Trop. Woods 48: 38. 1936; Howard, Man. Timb. World, Sd ed. 365. 1951; Browne, For. Trees Sarawak and Brunei 331. 1955; A Handbook of Hardwoods (Dept. sci. & industr. Research, London) 150. 1956. — Maingay s.n. [K], *Tarrietia javanica* (non Bl.) Desch, Man. Commerc. Timb. C. 10. 1951.

Large tree, up to 50 m high and 40 cm in diam.; buttresses large, (up to 3 m) out up to 2 m., thin. Bark a yellowish-orange with darker. spots, 2—3 mm, fissured or smooth, peeling off in strips (3 x 20 cm) ; living bark 5—8 mm, pink to brown. Sapwood 3—5 cm, yellowish; heartwood light brownred. Twigs densely, microscopically lepidote; branchlets grey, sulcate. Stipules lanceolate, acute, up to 15 mm long, caducous, leaving conspicuous transverse scars at either side of the petiole. Leaves alternate, more or less confined to the upper part of the branchlets, rigid coriaceous, broadly elliptical or somewhat obovate elliptical, (3.5—) 4.5 —. 10 (—13) x (6—) 7.5—17 cm, top obtuse, truncate or emarginate (the midrib protruding as a short mucro), base subacute; upper surface glabrous, microscopically pitted, midrib somewhat raised in a groove, lateral nerves flush with the surface or slightly sunk, the numerous parallel secondary veins very slender, hardly raised; lower surface dull, covered with scattered, tiny, star-like scales, midrib strongly prominent and like the (12—16) pairs of rather patent, prominent lateral nerves densely covered by minute stellate scales, marginal part of lateral nerves arcuate, secondary veins numerous, prominulous, parallel, almost at right angles with the lateral nerves; the lower pair of lateral nerves as a rule more ascending as compared to the others. Fallen leaves leave conspicuous, raised, circular scars. Petiole very long, 2.5—6 cm, thickened at apex and base, densely, minutely stellate lepidote. Young leaves up to 13 x 23 cm; in a very young stage the upper leaf surface covered with a dense layer of scales.

Inflorescences axillary, densely ferrugineously pilose (indumentum of microscopical stellate scales), paniculate, 3—9 cm long; main peduncle stout, ramifications distant, slender, the basal ones up to 2 cm long; the secondary, etc. branches very short and slender, rather dense. Flowers violet, densely shortly grey-pilose, 1.5—2 mm long, bell-shaped; calyx 0.5 mm long, urceolate; the 5 ovate, acute, thick lobes about 0.5—1 mm long, at anthesis explanate, inside densely pilose (hairs long, white) ; tube inside almost glabrous. Male flowers with a very short (1/4 mm) androgynophore, bearing a comparatively large, globular irregular clump of anthers; torus convex, covered with papillose glands. Female flower as

large as male one with sessile, laterally compressed ovaries, glabrous at base, stellate-pilose towards apex, the very short styles at right angles (horizontal).

Infructescence up to 10 cm long, densely covered by stellate scales. Samara greenish-red, glabrous; the nut obliquely ovoid, smooth, up to 15 mm long and 12 mm in diam.; ventrally and dorsally with a very small ridge, which enlarges to a wing up to 9 cm long and 3 cm wide at its broadest part. The fruit similar to that of *H. javanica*, and *H. aurea.*

Distribution.—Malay Peninsula, Sumatra, and Borneo from 0—300 m altitude. It is widely distributed but occurs always scattered on well-drained soils.

Vernac. names.—Mengkulang, Mengkeluang (Malay Peninsula); Teraling (Sumatra); Mempatar putih (Bangka) ; Tabajang (Bassap Dyak); Karai (Sandakan-Borneo); Serikaja (Sangkulirang-Borneo); Pangaitan (Dusun-Dyak).

On a tree of 8 m high and 20 cm diam. growing in East Borneo (Kostermans 9879) and one of 10 m (Kostermans 6147), I found, that the lower branches had still digitate leaves (5—6-f oliolate), the middle branches had leaves with 2—3 folioles, whereas the apical branches had unifoliolate leaves, mixed with 2—3-foliolate leaves. The folioles in this stage were still lanceolate, acute, up to 40 cm long with up to 30 cm long petiolules. The swollen, apical part of the unifoliolate leaves represents the original petiolule.

The tree flowers at the beginning of the rainy season, but not every year.

Foxworthy's statement (in Bull. 1, Dep. For. Brit N. Borneo, p. 64), that the fruits can be used against fever, refers to *Scwphium macropodum* and not to *H. simplicifolia.* Browne mixed it with *Heritiera aurea.*

Use.—The timber is of the same quality as that of *H. javanica.* It is much exported from the Riouw Archipelago to Singapore; the grain is medium, fairly hard, but splitting slightly in drying. It is not very durable (samples buried in the soil were destroyed in two and a half years).

MALAY PENINSULA, Pahang, Temerloh, Belingo, Sept., 11., *C.F. 2691* (SING); 6 miles Pulau Manis, July, fr., *Sohor F.D. 6607* (SING) ; Kuantan, Apr., buds, *F.M. 6659* (SING) ; Trengganu, 23rd mile Trengganu-Besut Rd., Belara For. Res., July, ster., *S.F.N. 39927* (BO, SING), ibid., ster., *Sinclair & Kiah S.F.N. 39927* '(BO, SING); Kemaman, Bukit Kajang, Nov., ster., *Corner s.n.* (SING); Negri Sembilan, Kopis For. Ees., Apr., fl., C.F. *1860* (SING); G. Angsi For. Res., Dec, young fr., *Osman & Tachon S.F.N. 23762* (SING);

S. Menyala For. Res., May, fr., *Whitmore 291* (BO, K, L, SING); Malacca. Sikukeling, July, fr., *Holmberg 829* (CAL, SING); Bukit Senggeh For. Res., fl., fr., *C.F. 2066* (SING); Merlinau, Compt. 3, March, fl., *F.D. 25215* (SING); ibid., Apr., ster., *Holmberg 703* (SING); Bukit Sedaman For. Res., Apr., fl., fr., *C.F. 2060* (SING); Paya Keladi, Sg. Udang, Sept., fl., *Holmberg 825* (SING); ibid., fr., *Holmberg 865* (SING); Merlimau For. Res., March, fl., *Kep. 25215* (BO, KEP); locality not indicated, herb. Kurz, fl. (BO); fl., *Miller s.n.* (BO, P, SING); fl., in herb. *Pierre 3779* (P); fl., *Griffith s.n.* (CAL); fl., fr., *Mainga.y 1720 = Kew Distr. 231* (BO, CAL); Johore. 14th mile Jemaluang Rd., May, fl., *Corner S.F.N. 37026* (A, BO, SING); Jerangau, Sg. Dungun, Aug., fl., fr., *Kep. 16671* (BO, KEP); Kluang For. Res., Oct., fl., *Kep. 71307* (BO, KEP); Mersing, Nov., ster., *Kep. 74155* (KEP); Singapore. Garden Jungle, June, fl., *Nur 1026* (BO, SING); SUMATRA. Riouw Archipelago, Pulau Singkep, Sg. Marak Tua, Jan., ster., *Amat 20* and *32* (BO; L); Sg. Raya, alt. 5 m, Sept., ster., 66. *4057* (BO); Djago, alt. 35 m, July, ster., 66. *3944* (BO); Bakung, Dec, ster., *Kassim 10* (BO); ibid., May, ster., 66. *2044* (BO); ibid., Aug., ster., 66. *22942* (A, K, L, NY, BNH); Sg. Aer Tawar, alt. 50 m, ster., 66. *2069* (BO, L); ibid., Jan., ster., 66. *20* (BO, L) ; Tdg. Sembilan, alt. 30 m, Febr., ster., 66. *2699* (BO); Manggu, March, ster., 66. *4073* (BO, L, P); Bukit Aer Igan, alt. 50 m., Aug., ster., 66. *22943* (A, BO, L, SING); Lingga, Langkap, alt. 25 m., Nov., ster., 66. *26537* (BO, BRI, P) et *26536* (A, BO, K, L, NY) et *26538* (BO, B, BISH, BM, CAL) et *26539* (A, BO, L, LING, NK, U, H); Pulau Selajar, alt. 100 m, July, fr., 66. *13669* (BO, L); Bangka, Lobok Besar, Sept., fl., *Kostermans 143* = 66. *34214* (A, BISH, BO, L, LAE, NY); ibid. *Kostermans 130* = 66. *34067* (A, BO, K, L); ibid., Sept., fl., *Kostermans 828* (A, BO, K, KEP, L, LAE, P, PNH, SING, SYDN) ; Perlang, alt. 100 m, Sept., fl., *Kostermans 187* = 66. *34121* (A, BO, K, L); G. Pading near Lobok Besar, alt. 20 m., Sept., fl., *Kostermans 1003* (A, BO, K, NY, P, PNH, SING) ; G. Maras, alt. 200 m, Oct., fl., *Kostermans 1345* (BO); Sg. Liat, G. Maras. alt. 300 m, March, ster., 66. *1956* (BO, L); Muntok, Aer Limau, Dec, ster., 66. *7830* (BO); Djebus, ster., *Teijsmann H.B. 7243* (BO); G. Mangkol, Sept., fl., *Kostermans 808* (A, BO, CANB, K, L, LAE, PNH, SING). British N. Borneo, Sandakan, Kabili-Sepilok For. Res., July, buds, *Castro A 818* (SING); ibid., Nov., fr., Saw *A 619* <SING); ibid., July, young fr., *San A. 1689* (BO, K); ibid., ster., *F.D. 4115* (KEP) ; ibid., Nov., ster., *San 17265* (A, BO, BRI, K, KEP, L, SING); ibid., Gemantung, Sept., fl., *Cuadra A 2115* (SING) ; ibid., Compt. 15, Sept., fr., *B.N.B.F.D. 10631* (BO, K); ibid., July, fl., fr., *B.N.B.F.D. 10445* (BO, K); ibid., June, fr., *B.N.B.F.D. 7138* (BO, K); Beaufort, 1 mile N.E. of Beaufort Township, Aug., fr., Saw. *16839* (A, BO, BRI, K, KEP, L); Indonesian Borneo. West Borneo. Sg. Landak, alt. 12 m., Nov., ster., 66. *14796* (BO) et Dec, ster., 66. *14817* (BO); Sg. Sambas, Parigi Limus, alt. 200 m, Aug., ster., 66. *7071* <BO, L); E. Borneo, Tidung, near Para Ihong, Aug., ster., 66. *17838* (BO); Malinau, July, ster., 66. *17818* (BO, L) ; Berouw, Inaran, alt., 25 m, Apr., ster., 66. *18439* (BO, L) (this might also represent *H. borneensis);* ibid., Betemuan, May, ster., 66. *19025* (BO, L); ibid., June, ster., 66. *19095* <BISH, BO, BRI); Sangkulirang Distr., Sg. Susuk, treelet, *Kostermans 6174* (BO, K, L) ; id. *Kostermans 5668* (BO, K, L) ; ibid., June, ster., 66. *31718* (BO, L) et *34718* (BO, K, L) ; ibid., July, ster., 66. *34741* (BO, K, L) et *34757* (BO, K, L), ibid., July, ster., 66. *14796* <BO); West Kutei, Balajan R., Muara Antjalong, March, ster., 66. *16549* (BO, BRI, SING); Sebulu, Oct., ster., 66. *15804* (BO, L); Kembang Djangut, Oct., ster., 66. *15652* (BO, K, L); Long Bleh, alt. 30 m, Nov., ster., 66. *16095* (BO, BISH, P)

et *16108* (BO, NF) ; Long Puhus, Telen R., alt. 100 m, Nov., fl., *Endert 48A5* <BO, K, L). East Kutei, Loa Djanan, W. of Samarinda, treelet, *Kostertnans 9879* (BO, L); Balikpapan Distr., Sg. Wain, alt. 50 m, Oct., ster., 66. *34332* (BO, L) ; South Borneo, Sampit Distr., Tekang, alt. 12 m, July, ster., 6b. *10219* (BO).

23. Heritiera aurea Kosterm., spec. nov.—Fig. 40

Tarrietia simphelfolia (non Mast.) Browne, For. Trees Sarawak and Brunei 331. 1955 (p.p., quoad descript.).

Arbor ra/mulis sulcatis perdense minutissime velutino-lepidotis, squamis profunde laciniatis, laciniis erecto-patentibus, ramis verrucosis; foliis alternantibus apice ramulorum versum confertis, rigide coriaceis, ellipticis ad obovato-ellipticis, apice emarginatis basi rotundatis, supra glabra (nervo media/no excepta) costis venulisque vix prominulis gracilibus, subtus perdense adpresse aureodepidotis, squamis fimbriatis, minimis, nervo mediano costique utrinque 12—15 prominentibus, nerviis secimdariis supparalellis prominulis, petiolo longo, lepidota. Samara glabra ellipsoidea apex in alam longum producta.

Tree up to 30 m tall with 20 m clear bole, 50 cm in diam. Buttresses large, 1—2 m high, out 1 m, rather thin; crown open. Bark reddish brown with grey patches, irregularly, longitudinally ifissured, peeling off in elongated pieces about 1—6 mm tick; living bark reddish, 8 mm, finely fibrous. Sapwood lighter coloured than heartwood, 1 cm; heartwood light-red. Branchlets sulcate, densely, ferrugineously pilose; the covering consisting of minute, long-fimbriate scales, of which the fringe is turned in all directions. Branches grey, rough, with large, round, protruding leaf-scars with a horizontal line on each side of the leaf-scar, representing the scar of the stipules. The latter lanceolate, acute, up to 1 cm long, soon deciduous. Leaves alternate, grouped near the apex of the branchlets, rigid coriaceous, elliptical to obovate-elliptical, 5—8 x 7—11 cm (in young trees 16 x 28 cm), base rounded, apex rounded or emarginate (in the latter case the midrib protruding as a small mucro) ; upper surface glabrous, but for the midrib, which shows the same indumentum as that of the branchlets, midrib, lateral and secondary nerves slender, slightly prominulous; lower surface covered with a dense, adpressed layer of minute, aureous, long-fimbriate scales, midrib stout, prominent, lateral nerves 12—15 pairs, prominent, rather straight, curved near margin, secondary nerves parallel, prominulous. Petiole stout, 3— 5 (—10 in epicormic leaves) cm long, swollen at both ends.

Fruit a glabrous samara; nut ellipsoid, up to 2 cm long, 1.5 cm in diam., ventrally and dorsally with a low, thin ridge, which enlarges at the apex into a wing (to 10 cm long), with almost straight, thickened back and thin, rudderlike ventral side, veins fan-shaped; stipe 6—8 mm long, slightly bent.

Typus.—Forest Dept. Sarawak 374 (KEP).
Distribution.—Borneo.

Vernac. name.—Papungu merah (Bulungan; dubious name; merah = red).

The type specimen has leaves probably taken from an epicormic shoot as is also the case with the specimen bb. 21221, of which the leaves are 16 x 28 cm, with 10 cm long petioles. Normal leaves, as represented in the specimen bb. 11271 are elliptical, 5—8 X 7—11 cm with a rounded or slightly cordate base, a rounded or emarginate apex, the petiole about 3 cm long. Browne (For. Trees Sarawak and Brunei 331) apparently confused it with *H. simplicifolia.*

The leaves are similar to those of *H. simplicifolia,* but for their indumentum. The samaras are like those of *H. simplicifolia* and *H. javanica.*

It is stated, that the tree is common.

BORNEO. Sarawak. Semengoh Forest Reserve, 1st. Div., Oct., fr., *For. Dept. 374* (KEP); ibid., Nov., fr., *Yacoup 8908* (BO, SAR); Indonesian Borneo. East Borneo, Bulungan, Salimbatu, R. Rumah, alt. 150 m., Apr., ster., 66. *11271* (BO); South Borneo, Puruktjahu, Muara Djoloi, alt. 200 m., July, ster., *bb. 21221* (BO, L, B).

24. Heritiera borneensis (Merr.) Kosterm., comb. nov.—Fig. 19, 20, 30b

Tarrietia borneensis Merrill (basionym) in Philip. J. Sci. Bot. 13: 84. 1918; Enum. Bornean PI. 381. 1921. — Villamil 3 (A).

Tarrietia unifoliolata Ridley in J. Asiat. Soc. Str. Br. 82: 173. 1920; Fl. Mai. Pen. 1: 279. 1922. — Derry s.n., Malacca (K).

Tree up to 34 m tall, up to 60 cm diameter. Buttresses none or small. Bark 1 mm thick, reddish, deeply fissured; living bark 3 mm, white. Sapwood 3 cm white, heartwood red. Apex of branchlets with adpressed, very minute, fimbriate scales (pulverulent), soon glabrous; branches glabrous, smooth or rough, grey. Leaves alternate, consisting of one to three folioles, rigid chartaceous to coriaceous, glabrous (or rarely midrib and petiole with the same powderlike layer of scales as the branchlets), pitted under the lens, lanceolate to elliptical, 2.5—9 X 7—19 cm, top acute or acuminate, sometimes somewhat blunt and mucronulate, base acute, oblique. Upper surface rather smooth, the filiform main nerves visible,

lower surface with prominent midrib and filiform 12—18 pairs of prominulous lateral nerves, which are abruptly curved near margin, secondary veins parallel, numerous, faintly visible. Petiolule 3—15 mm long, usually glabrous; petioles slender, usually glabrous, 2—9 cm long, thickened at both ends; in unifoliolate leaves the thickened apical part represents the petiolule.

Inflorescences axillary, laxly paniculate, up to 18 cm long, many flowered, the main ramifications with a powdery layer of scales, towards the ultimate branchlets intermingled with scattered, longer hairs. Flowers very small (2 mm), densely pulverulent-lepidote, campanulate, lobes 5, about 1/3 —14 the tube length, ovate, acute, reflexed. Other characters as those of *H. javanica*. The stigma-arms slightly longer.

Samaras similar to those of *H. javanica*, perhaps the nut more transverse.

Distribution.—Malay Peninsula, Sumatra, Borneo, ? Celebes.

As Ridley already stressed, the species is very near to *H. javanica*, from which it may be distinguished by the presence of unifoliolate leaves (or bi- or trifoliolate), in *H. javanica* they are never unifoliolate. The scales are smaller than those in *H. javanica* and the species lacks the hairs in the axils of the lateral nerves. The inflorescence is less pilose. The flowers are similar and so are apparently the samaras. Merrill's remark, that the lateral nerves are fewer in number, than those in *H. simplicifolia* could not be confirmed. The Bukit Timah specimens differ by their lanceolate, acuminate, acute leaflets; but as broader ones occur too, this discrepancy is probably attributable to the stage of development (leaves ndar the in-,florescence always differ).

MALAY PENINSULA. — Pahang. Mentakab, Febr., ster., *F.D. 7933* (KEP); Pondok Tandjong, Aug., ster., F.D. *37376* (KEP) ; Kedah. Kubang chendor, Dec, ster., *F.D. 7742* (KEP) ; Kluang, Kluang For. Res., alt. 70 m., Sept., ster., *Kep. 71327* <KEP); Trengganu, 51st mile Kuala Trengganu Besut Rd., G. Tebu For. Res., Sept., ster., *Sinclair et Kiah S.F.N. 40796* (A, BO, K, L, SING) ; Johore East, Mersing, G. Arong For. Res., Nov., ster., *Kep. 35952* {KEP) ; Singapore. Bukit Timah Res., fr., *Ngadimcm s.n.* (Tree n 37) (SING); id., Dec, fl., *Ngadiman S. F. N. 34617* (SING); INDONESIA. Sumatra. Atjeh, Tamijang Distr., village Perupuk, May, ster., 66. *979,5* (BO, L) ; ibid., Singkal Distr., alt. 150 m, ster., 66. *9314* (BO) ; Tapianuli, Barus, 25 m, Oct., ster. 66. *29530* {A, BO, L) ; ibid., Sihorho, Nov., ster., 66. *26398* (BZF); Riouw Arch., Isl. Karimun, Teluk Sidjambul, alt. 50 m, June, fr., 66. *21528* (A, BO, L) ; West Coast, Lubuksikaping, Tandjong Bungo, alt. 375 m, Aug., ster., 66. *5984* (BO) ; BORNEO. W. Borneo, Kubu, Ambawang, Sept., ster., 66,. *7147* (BO, L) (leaves 20 X 22 cm); E. Borneo, Tidung Lands, Kalunsajan, alt. 14 m, Jan., ster., 66. *18290* <BO, L); W. Kutei, Munjup, alt. 35 m., Aug., ster., 66. *16828* (BO, BRI, CANB) and *16831* (BO, L) ; Kembang Djangut, Oct., ster., 66. *15680* (BO, K, L) ; Berouw, alt. 35 m, Apr., ster., 66. *18439* (BO, L) (this might represent *H. simplicifolia)* ; Tidung, alt. 40 m, Jan., ster., 66. *182290* (BO, L); S. Borneo: Tewai Baru. Lower Dayak, alt. 40 m, March, ster., 66. *8175* (BO, L); SULA ISL., Samana, alt. 150 m, Aug., ster., 66. *28872* (A, L, SING) (leaves 12 X 20 cm.) (identif. uncertain).

25. Heritiera javanica (Bl.) Kosterm., comb. nov.—Fig. 21, 22, 29b, 41

Tarrietia javanica Blume (basionym), Bijdr., Fl. Ned. Ind., 5e stuk 227. 1825; Rumphia 3: 194 (in adnot), t. 172 C, f. 1. 1847; . Hasskarl, Tweede Catal. Lands PI. Tuin Buitenzorg 226. 1844 (sub Sapindaceae); Aanteekening. Nut 82. 1845 {quoad nomen); Steudel, Nomencl., ed. 2, 2: 664. 1840; Miquel, Fl. Ned. Ind. 1 (2) :179. 1859; Teijsmann & Binnendijk, Catal. Hort. Bogor. 197. 1866; Chevalier in Ann. Jard. bot. Saigon, fasc. 2 (Catal.) 84. 1878; Lanessan, PL utiles Colon, franc. 292. 1886; Koorders & Valeton, Bijdr. Boomsoort. Java 2 in Meded. Lands PI. Tuin Buitenzorg 14: 166. 1895; Atlas 3: tab. 419. 1915; Moll & Janssonius, Mikrogr. Holz. 1: 444. 1906; Hcchreutiner in Ann. Inst. bot. Buitenzorg 19: 23. 1904; PL Bogor. exsicc. IV. I. 54. 1904; Backer, Schoolfl. 139. 1911; Foxworthy in Philip. J. Sci. Bot. 3: 171, t. 1—3. 1908; id. 4: 502. 1909; in Bull. 1 Dept. For. Brit. N. Borneo 64 (n.v.) ; Koorders, Exkurs. Fl. Java 2: 599. 1912; Merrill, Enum. Philip, fl. PL 3: 57. 1923; Gagnepain in Lecomte, Fl. gen. Iadoch. 1: 478, f. 45. 1910; Tardieu-Blot, Suppl. 1: 410. 1945; Craib, Fl. Siam. Emm. 1: 170. 1912; Kanehira, Identif. Philipp. Woods by anat. charact. (13). 1924; Sasaki, Catal. Gvt. Herb. Taihoku 345. 1930; Valencia in Philipp. J. Sci. 18: 490. 192.1; Heyne, Nuttige PL N. Ind., ed. 2, 2: 1068. 1927; Rodger, Handb. For. Prod. Burma (15). 1936 (quoad nomen); Melville in Kew Bull. 1936: 195; Adelbert in Backer, Fl. Java, Nooduitg., Fam. 107: 27. 1944; Kraemer, Trees West Pacific Region 250, f. 249. 1951; Howard, Ident. Timb. 55, f. 571. 1942; Man. Timb. World, ed. 3: 281, 313. 1951; Mangenot in Bull. Jard. bot. Bruxelles 27: 652. 1957; Bois tropicaux (Plaquette document., edite par le Centre techn. for. trop. France) 51. 1957; Hout 1: 115 (no date).

Tarvietia cochinchinensis Pierre, Fl. for. Cochinch., fasc. 13: t. 205. 1889; Gagnepain, I.e. 482 t. 45, f. 6—8 (as a doubtful syn. of *Tarrietia javanica) ;* Craib, I.e.; Chevalier, Catal. Jard. bot. Saigon 18. 1919; Foxworthy in Philip. J. Sci. Bot. 4, I.e.; Merrill, I.e. 57; Melville, I.e.; A Handbook of Hardwoods (Dept. Sci. & industr. Research, London) 76. 1956; Receuil Fiches anatom. Dalat (without page and date). — Pierre s.n. (P).

Tarrietia sumairand (non Miquel) Koorders & Valeton, I.e. et f. 418 (quoad specim. & Java) ; (non Miq.) Koorders, Exkurs, FL, I.e. 599; (non Miq.) Backer, Schoolfl., I.e. 139; (non Miq.) Adelbert, I.e. 27.

Tarrietia riedeliana (non Oliver) Merrill in Philipp. **J.** Sci. Bot. **2:** 424. **1907;** Enum, I.e. 57.

Distribution.—-Siam, Vietnam, Malay Peninsula, Java, Sumatra, Borneo, N. Celebes, Philippines.

Vernac. names.—Cay huynh (Vietnam) ; Chumprak (Siam) ; Dungon (Sul.), Gisang (Sul.), Lumbayau (Sub., Sul.), Lumbaya bat. (Sul.) (Philippines); Mengkulang (Malaya).

Tree up to 45 m tall and 80 cm in diameter; buttresses 1—2 m high, out 1.5 m, thin, hard. Bark either smooth or usually fissured, beige to lightbrown, strips 2 cm wide, 3 mm thick. Living bark 5 mm, reddish. Sapwood 5—10 cm, brownish. Heartwood dark beefy red, fatty to the touch. Branchlets powdery, densely pilose; branches with conspicuous round protruding leafscars. Stipules lanceolate, acute, densely pale brown powdery pilose, up to 15 mm long, caducous, leaving large, transverse scars. Leaves alternate, digitate. Petiole 5—10 cm, slightly enlarged at base, swollen at apex, densely, minutely pilose, glabrescent; petiolules 1—2 cm long, slender, swollen at base; folioles 5—7, stiffly chartaceous, elliptical or obovate-elliptical, 3—5 (—8) x 8—13 (—19) cm, base acute or cuneate, often unequal, apex shortly acuminate or rounded; upper surface glabrous, glossy, minutely areolate, nerves slightly prominent; lower surface more dull, midrib prominent, lateral nerves 12—16 pairs, slender, prominulous, secondary veins filiform, hardly prominulous; the lower surface of very young leaves with a dense layer of brown hairs, in older leaves glabrous, but for characteristic tufts of hairs in the axils of the secondary nerves. Young leaves up to 13 x 25 cm with up to 23 cm long petioles.

Inflorescences axillary, paniculate, grey pilose or lightbrown, up to 13 cm long, much branched, many flowered; peduncle rather stout, branches distant, the lower ones up to 6 cm long; ramifications filiform. Flowers campanulate 1—1.5 mm long; lobes 5, ovate, acute, erect, stellate-haired outside, densely pilose inside; tube slightly longer than lobes, sparsely stellate-haired inside, densely pilose outside. Androgynophore in male flower 0.1—0.2 mm long, thick, covered with papillae and a few stellate hairs, topped by an irregular clump of thecae, which surround the minute sterile ovaries. Female flowers with sessile ovaries with horizontally bent styles. Pedicels merging into the filiform ultimate branchlets. Samaras glabrous, consisting of an ellipsoid nut, up to 2 cm long with a large, veined wing up to 10 cm long and 5 cm wide.

Distribution.—Malay Peninsula, Sumatra, Borneo, Java, Philippines Sula Islands, North Celebes, Indochina.

The ki tarrieti of Hasskarl, Nut, represents probably a species of *Lithocarpus*. The statement of Foxworthy (in Bull. 1, Dept. For. Brit. N. Borneo, p. 64) that the fruit is used againt fever, refers to *Scaphium macropodum*, not to *Heritiera javanica*.

The wood is redbrown with violet tinge, somewhat fatty to the touch, soft and semi-heavy (0.63—0.80 at 12 percent moisture), elastic and easily bent, when heated.

The Javanese specimens, enumerated by Koorders and Valeton as belonging to *Tarrietia sumatrana*, are actually *H. javanica*. They were all collected from immature trees. Backer already suggested their proper identity in *H. javanica*.

The samaras may differ considerably in size. The tiny flower, the filiform branches of the inflorescence and the tufts of hairs in the axils of the lateral nerves on the lower leaf surface, are typical and so is the short and broad androgynophore.

Male flowers are far more common in the inflorescence than female ones.

The vernacular names, as enumerated by Backer, are of no value at all; the tree is too seldom used, to have a vernacular name.

MALAY PENINSULA. Pahang Tembeling, July, fr., *Henderson S. F. N. 21807* (BO, SING); Kedah. Langkawi, Apr., ster., *F. D. 67855* (KEP); Paja Besar, Dec, fl., *F.D. 42281* (KEP); Selangor. Sg. Bulan For. Res., Pebr., ster., *F.D. 14848* (KEP); ibid., fr., /. *G. 1425* (CAL); Ulu Gombak For. Res., Nov., fl., *Symington F. D. 49802* (KEP); Sg. Lalang, Nov., ster. *F.D. 53640* (KEP); Kepong, Nov., fr., *Symington F. D. 24809* (KEP); Kuala Lumpur, Sg. Lalang, Apr., ster., *F. D. 63539* (KEP); ibid., Sept., fr., *F.D. 66623* (KEP); Perak Ijoh For. Res., Febr., ster., *F.D. 4.8635* (KEP); Bubu For. Res., July, buds, *Speldewinde F.D. 16748* (KEP); B. Arang For. Res., June, ster., *F.D. 35952* (KEP); Trengganu. P. Laut Tengah, June, fr., Barnot *F. D. 30960* (KEP); Kelantan. Bukit Tualang Pelam, ster., *Walton, F. D. 32738* (KEP); Chabang Tungkat, Dec, fr., *F.D. 52907* (KEP); Johore, N. Kluang, Mar., ster., *F.D. 69772* (KEP); Kuala Kangsan, Pa'h Lasah, fr., *F.D. 8842* (KEP); G. Raya For. Res., Nov., ster., *F.D. 66430* (KEP); INDONESIA. Sumatra. Inderagiri, Peranap, alt. 40 m, Sept., ster., 66. *30115* <(*A*, BO, L); East Coast, Simelungun, Bosar Maligas, alt. 50 m, Febr., fl., *bb. 26838* (BO, L); ibid., Jan., ster., *bb. 26607* (BO, L); Palembang Res., Lematang Hilir, G. Megang, Tj,aban For. Res., Sept., ster., 66. *35185* (BO, K, L); ibid. Sept., fr., *Kostermans 12069* (A, BM, BO, K, L); ibid., July, ster., *bb. 32272* (A, BO, L); ibid., Aug., ster., *195 T. 3 P. 942* (BO, L); same tree, Febr., fl., (BO, L); ibid., Apr., ster., *195 T. 3 P. 573 (*BO); Bengkulu, Kur.otidur, ster., *bb. 7349* (BO); Lampong Districts, Sukadana R., Febr., ster., 66. *32543* (A, BO, L, SING); locality not indicated, buds, *Forbes 2829* (L); Island Bangka, Perlang, alt. 60 m, Sept., buds, *Kostermans 154 = bb. 34088* (A, BO, K, L); Lobok Besar, Sept., fl., *Kostermans & Anta 857* <A, BISH, BO, CANB, K, KEP, L, LAE, NY, P, PNH, SING, SYD); Rindik, ster., 66. *12715* (BO, L); G. Maras, treelet of 4 m, *Kostermans 1349* (BO); Bitung, Mt. Menumbing, ster., *Teysmann s.n.* (BO, L); Java West Java, Depok, ster., *Backer 35232* (BO, K, L); ibid., July-Aug., ster., *Koorders 31070* (BO, L) et *33434* (A, BO, K, L); Janlappa near Bogor, Oct., ster., *Ja. 10402 (*BO); et *Ja 6444* (BO, L); Bogor, June-July, ster., *Koorders 30409, 30411* (BO, L); Labak, March, ster., *Ja. 4068* (BO, L); Pelabuhanratu, fl., *Koorders 7964* (BO, CAL, L); ibid., road

of Tjisolok to Tjisaruwa, May, 11., *Koorders 7963* (BO); July, ster., *Koorders 7965* (BO, L); Banten, Mt. Hondje, young tree, *Kostermans s.n.* (BO, L); Batuhideung, S. of Labuan, June, ster., *Koorders 7916* (BO, L) ; ibid., July, ster., *Koorders 7913* (BM, BO, K, L, PNH, UC) ; ibid., Aug., ster., *Koorders 791k* (BO, K, L) ; ibid., June, ster., *Koorders 7912* (BO, K, L) ; ibid., Aug., ster., *Koorders 7915* (A, BO, L, P, UC) ; locality not indicated, fr., *Blume s.n.* (BO, L), type; fl., *de Vriese s.n.* (CAL); culta in Hortus Bogoriensis sub *X D 8k,* fl. (BO, K, *V); IV I 5k* et *a,* fl., fr. (BO, SING); July, fl,, *Kostermans 11005* (A, BO, L). BORNEO. Brit. N. Borneo, Sandakan, mile 6, Jan., fr., *B. N. B. F. D. 275k* (BO, K); Elopura, Batu Lutung For. Res., Mar., ster., San *\A 3196* (SING); Indonesian Borneo. West Borneo. Melawi, Tjatit, Mt. Bansa, alt. 400 m, Nov., ster., 66. *26352* (A, BO, L) et *26kkk'*(SING).;. East Borneo. Sangkulirang Distr., June, fl., fr., *Kostermans 5531* (BO, K, L); West Kutei, Telen R., Long Hut, Aug., buds, *Endert 2656* (BO, K, L); Kembang-Djangut, Belajan R., Oct., ster., *bb. 15656* (BO, L) ; 66. *15836* <BO) et *15838* (BO); Segoi R., June, fr., *Kostermans 9678* (BO); East Kutei, S,amarinda region, Loa Djanan, Apr., fl., *Kostermans 6590* (A, BO, K, L, PNH); ibid., Apr., buds, *Kostermans 6575* (A, BO, BRI, CAL, K, L, NY, P, PNH, SING); Balikpapan region, Sg. Tiram, alt. 30 m, Apr., buds, *Kostermans 26* = 66. *35037* (A, BO, K, L, SING); Peak of Balikpapan (G. Beratus), alt. 700 m, July, fl., *Kostermans 7395* (A, BO, K, L) et *7571* (A, BO, BRI, CAL, K, L, LAE, NY, P, PNH, SING); South Borneo. Martapura, Djungur, alt. 350 m, Sept., ster., 66. *10k02* (BO); Tanah Bumbu, Kp. Baru, alt. 25 m., Jan., ster., 66. *13381* (BO); Pleihari, Asam-asam Djorong, Nov., ster., 66. *9507* (BO, L). PHILIPPINES. Mindanao, Zamboanga Prov., Naga-naga, Dec, fl., *F.B. 27399* (A, SING) ; ibid., May, fl., *Colinario F.B. 303k9* (UC); ibid., Dec, fl., *F.B. 2k962* (A); ibid., Sept., fr., *F.B.229U0* (A, BO, L, SING, UC) ; ibid., May-June, fr., *Foxworthy, Demesa & Villamil F.B. 13790* (L) ; Prov., Misamis, May, fr., *Klemme F.B. 19550* (L) ; locality not indicated, Febr., ster., *Makil F.B. 29k31* (A, UC); Basilan, S. Fabiawan, June, fl., *Mendoca F.B. 272k7* (A, SING); ibid., Oct., fr., *F.B. 26kl8* (A); Olutanga Isl., June, fl., *F.B. 2U68* (A); Moluccas. Sula Isl. Mangoli, Kimakol Lampau, Oct., ster., 66. *29886* (A, BO, L) ; Isl. Taliabu, Oct. ster., 66. *29944* (A, BO, L) et *29958* (A, BO, L); Celebes. Manado Prov., Boalemo, Batumotoluhu, Sept., ster., 66. *15713'* (L) et *13828* (BO) ; Poso, Kalora, alt 15 m, Aug., ster., 66. *28730* (A, BO, L) ; INDOCHINA. Annam: near Hue, Back Ma, *Poilane 29980* (P) ; Cambodia, Kamput, Mt. Camchay, Apr., fr., herb. *Pierre Ik55* (P). SIAM. Chanburi, Makhan, *Put 37k* (BKF); Surat, Nasan, Khlang Khot, *Mangkorn s.n.* (BKF).

26. **Heritiera sumatrana** (Miq.) Kosterm., comb. nov.—Fig. 23, 24

Tarrietia sumatrana Miquel (basionym), Fl. Ind. Batav., Suppl. Sumatra 165 et 401 (descr.). 1860; Koorders & Valeton, Bijdf. Booms. Java 2 in Meded. Lands PI. Tuin Buitenzorg 14: 168. 1895 (quoad nomen tantum, specim. exclud.) — Teijsmann s.n., Palembang, Muara dua (U).

Tarrietia perakensis King in J. Asiat. Soc Bengal 60 (2) : 77. 1891; Curtis in J. Str. Br. R. As. Soc. 25: 83. 1894; Ridley, Fl. Mai. Pen. 1: 278. 1922; Burkill & Henderson in Gard. Bull. Str. Settl. 3: 351. 1925 '(sphalm. *Tarretia)* ; Henderson in id. 14: 225. 1926—29. — King's Coll. 3184 (CAL), type; King's Coll. 3439 (CAL), paratype.

Tarrietia eurtisii King, I.e. 78; Curtis, I.e.; Ridley, I.e.; Dispersal Plants 84, t.. 5.1930. — Curtis 1427 (GAL).

Tree up to 45 m tall, up to 70 cm in diameter. Buttresses up to 3 m high, 2 m out, thin. Bark reddish brown, superficially fissured, 1 mm thick; strips 2—3 cm wide, inside white, peeling off; living bark 10 mm, light brown. Sapwood 1—5 cm, white to pale red, merging into the brown-red to red heartwood. Branchlets with a dense rusty tomentum; branches brown, smooth. Leaves digitate, alternate, rigid chartaceous, folioles 3—5 (usually 5, in young trees up to 7), elliptical, the middle one much larger than the others, 2—6 (—9) x 4—12 (—17) cm, base contracted into petiole, apex obscurely acuminate or mucronate, both surfaces pitted under the lens, upper surface glabrous, lateral nerves filiform, flat; lower surface with sparse stellate (especially on nerves) and simple hairs with long arms, glabrescent, midrib strongly prominent, lateral nerves 12—14 pairs, straight, prominent, slender, secondary nerves filiform, parallel or hardly conspicuous; petiolules varying enourmously in size, 4—7 (—30) mm, densely tomentulose, glabrescent; petiole 2—5 (—11) cm long, tomentose, often glabrescent, thickened at both ends.

Inflorescences axillary, congested below the apical leaf bud, 6—15 cm long, paniculate, densely hirsute, dull dirty red with white hairs (fresh), peduncle stout, final ramifications very slender. Pedicel filiform, 5 mm. Flowers red, densely hirsute inside and outside, urceolate or campanulate, about 4 mm long, lobes five, 1—2 mm long, lanceolate, acutish. Male flower hardly smaller than female one, with a 0,75 mm long, glabrous, rather thick androgynophore, bearing at its top an irregular clump of anthers, ovaries obsolete. Female flower with sessile, 1 mm long, glabrous ovaries, near apex pilose with conglutinate short styles and laterally flattened hook-like stigmas, base surrounded by minute, sterile anthers.

Infructescence thick, glabrescent, ramifications thick, bearing at their much thickened apex 1—3 samaras. Samara glabrous, usually glossy; nut ellipsoid to ovoid-ellipsoid, dorsally and ventrally flattened, 2.5—3 cm long, 2 cm diam. with hardly developed ridges dorsally and ventrally; apical wing 3—5 cm long, 1—1.5 cm wide with a straight ventral margin; venation fan-like; stipe thick, 1—2 mm long.

King's key to the species of Tarrietia is rather mixed up. *T. penangiana* (in the key), which does not exist, would, according to the characters mentioned in the key be *T. perakensis,* whereas *T. perakensis* in the key actually represents *T. curtissi.* Ridley copied the key verbatim only changing *T. penangiana* into *T. eurtisii,* not being aware that the characters of the two were still mixed up.

According to a note under *T. eurtisii* of which King- saw a single specimen (Curtis 1427), the main difference between *T. eurtisii* and

T. perakensis is to be found in the tomentum of the lower leaf surface, persistent, stellate hairs in the former, as opposed to the deciduous, simple hairs in the latter. The other differential characters (size of leaflets, etc.) fall within the range of variation. From the examination of the numerous specimens, it became evident that on all leaves stellate and simple hairs occur, the former are more restricted to the nerves. The leaves may ultimately become completely glabrous.

The type specimen of *T. sumatrana* Miquel consists of leaves only, apparently picked from a very young tree. The folioles (7 on each leaf) are up to 32 cm long; they show, however, already the characteristic stellate hairs intermingled with simple hairs. A Bogor iso-type sheet (marked H.B. 3602) consists of 4 loose leaflets.

Koorders and Valeton mistook Javanese specimens, picked from young trees, which resemble in size and shape those of young *H. sumatrana*, leaves, for he latter species. Actually these spcimens represent *H. javanica*, which is proved by their tomentum of scale-like stellate hairs. Recently I Collected myself leaves of a young specimen of *H. javanica*, growing under the mature tree (in S.W. Java), they match Koorders and Valeton's material perfectly. Apparently *H. sumatrana* does not occur in Java.

The nut of the samara is much larger than that of *H. javanica* and is differently shaped (flattened dorsally and ventrally, like the nuts of *H. littoralis)* ; the wing shows a wide range of variation, it is either narrow and sword-like or broad; apparently different trees produce different fruit, these might be considered different varieties.

The first leaves of the seedling are almost orbicular with cordate base and emarginate apex, they are covered with simple hairs.

There are no proper vernacular names for this tree; those enumerated in the List of vernac. tree names of the Forest Research Inst. Bogor, are all referable to fantasy of the tree finders. The timber is rarely used and then apparently for "lesung (= pestles for rice pounding) only.

MALAY PENINSULA. Penang Isl., alt. 800 m, July, fl., *Curtis 2229* (CAL, SING) ; ibid., May, fr., *Curtis s.n.* (SING); Moniots Rd., alt. 300 m, June, fr., *Curtis 1427* (CAL, SING); ibid., *s.n.*, May, fr. (SING); ibid., June, fr., *Haniff 3773* -(SING), narrow-winged samaras, wing 5 X 0.5 cm; ibid., July, fr., *Burkill and Foxworthy S.F.N. 3302* (SING, UC) ; Penara Bukit, Pebr., fl., *Forest Guard 12713* (BO, SING); ibid., June, fr., *S.F.N. 21447* (BO, KEP, SING); Gvt. Hill, June, fl., *Curtis 1327* (CAL, SING); ibid., Febr., fl., *Curttis 2229* (CAL, SING), according to Curtis from the same tree as *Curtis H27;* between Aer Hitam and the Balik Pulau Rd., March, young fr., *Haniff 3429* (SING) ; Botanic Garden, behind Office, Sept., ster., *Noor s.n.* (SING) ; Muka Head, Apr., young fr., *Curtis 1427* (CAL, SING) ; Kedah, Baling Distr., Teloi For. Res., *Kep. 66393* (KEP); Perak, Dindings, Simpang tiga manong-, *Kep. 77617* (BO, KEP); Larut, Aug., fl., *King's Coll. 3184.* (CAL, SING); ibid., Oct., young fr. *King's Coll. 3439* (CAL, SING); ibid., fr., *King's Coll. 3719* (CAL) ; loc. not indicated, fr., *Scortechini s.n.* (CAL, UC); Selangor, Public Gard. Kuala Lumpur, June fr., *Foxworthy 2367* (SING) ; ibid., June, fr., *C.F. 2367* (KEP) ; Kemaman, Bukit Kajang, alt. 150 m, Nov., ster., *Corner s.n.* (SING); Johore North, Kluang, March, ster., *F.D. 69762* (KEP); Sg. Sedili, July, ster.,. *Corner s.n.* (SING); SUMATRA, Atjeh, Langsa Distr., G. Caoutchouc Estate, Jan., ster., 66. *2580* (BO); Palembang, ster., *Teijsmann s.n. = H.B. 3602* (BO, L, U), type; Palembang, Lematang Hilir, G. Megang, alt. 75 m., Dec, fr., *112 T. 3 P. 110* (BO, K, L, SING) ; fr., *112 T. 3 P. 110* (BO, SING); ibid. Oct., ster., *112 T. 3 P. 110* (BO, BZF) ; ibid., Jan., fr., *12 T. 3 P. 110* (A, BO, K, L, SING); ibid., Aug., fl. buds, *T. 110* <BO, L), ibid., ster., *Gmshoff 1136* (BO, L); Padang, Lufouk Minturun, alt 250 m, Aug., ster., *bb. 17696* (BO, L, SING). BRITISH NORTH BORNEO. Sandakan, Kabili Sepilok For. Res., June fr., *F.D. 41269* (KEP) ; ibid., March, ster., *F.D. 41161* (KEP) ; ibid., March, ster., *F.D. 7026* (SING); ibid., June, ster., *F.D. 7134* (SING); Sipitang Distr., Ulu Mendalong, 6 miles S.S.E. of Malaman, Oct., fr., *Wood San 16806* (A, BO, BRI, K, KEP, L, SING); BRUNEI, Bukit Ratan, July, fr., *B.N.B.F.D. 48128* (KEP); INDONESIAN BORNEO, East Borneo, Nunukan Isl., young tree, *Kostermans 8640 A* (A, BO, K, L) ; Bulungan, Mensapa, alt. 2 m, July, ster., *bb. 26249* (A, BO, L) ; Kabiran alt. 100 m., Aug., ster., 66. *11742* (BO, L); W. Kutei, Telen R., Long Puhus, alt. 100 m, Nov., ster., *Endert 5021* (BO, L) ; South Borneo, Puruktjahu, alt. 140 m, June, ster., 66. *9952* (BO). SIAM. Nakhawn Srithamarat, Chawang, Khuan Thiae, *Thawornmas 6* (BKF).

27. Heritiera albiflora (Ridley) Kosterm., comb. nov.—Fig. 25, 26

Tarrietia albiflora Ridley (basionym) in Kew Bull. 1938: 225. — Haviland 2262 (K).

Tree up to 30 m tall, bole up to 17 m, diam. up to 40 cm. Buttresses up to 4.5 m high, out 130 cm, thin. Bark smooth, reddish to dark brown with grey spots, 0.5—2 mm thick; living bark 4—6 mm, yellowish to yellow-red. Sapwood 1—3 cm, yellow to pink; heartwood dark brown. Top of the youngest branchlets and stipules of terminal bud covered with lightbrown scale-like stellate hairs, soon glabrous and then sometimes with an opaque white film; branches glabrous, glossy, striate. Leaves alternate, palmately pinnate, grouped near the apex of the branchlets, trifoliolate; folioles usually unequal, soon glabrous, rigid coriaceous, obovate-elliptical to oblanceolate, (1.5—) 3—4 (—6) x (4—) 6—8 (—12) cm, base cuneate, apex shortly acuminate to rounded and mucrolunate, upper surface smooth, lateral nerves filiform, impressed, lower surface smooth, midrib prominent, lateral nerves 9—13 pairs, parallel, curved near margin, slender, prominent, secondary nerves not visible. Petiolule about 5 mm, wrinkled, often swollen; petiole (2—) 5—7 cm, rather slender, swollen at base, covered with scale-like, minute, stellate hairs.

Inflorescence narrowly paniculate, axillary, densely stellately tomentose, 6—13 cm long; ramifications distant, short. Pedicel 1—3 mm, pilose. Flowers white, malodorous, tomentose outside and inside, campanulate, up to 5 mm long; lobes 4—5, lanceolate, acute, explanate at apex, one third to one half the length of the tube. Male flower with a slender, glabrous, 0.5 mm long androgynophore, bearing the 5 (each with 2 thecae) anthers of 0,5 mm length in a regular cylinder at its top. Female flower with 5 sessile, conglutinate, semi-ellipsoid carpels with recurved, short stigmas and 5 abortive anthers at their base. . .

Infructescence rather slender, pilose; young samaras similar to those of *H. javanicu,* glabrous, nut obliquely ellipsoid, wing large.

Distribution.—Borneo.

A sterile specimen: bb. 26444 (A, BO, L, SING), collected in West Indonesian Borneo (Melawi district), although closely related, differs in leaf shape, texture and each leaf has 5 folioles. It represents an undescribed species.

BORNEO. Brunei, Badas, Mar., young fr., *B.N.B.F.D. 3U21* <KEP) ; Sarawak near Kuching, Jan., fl., *Haviiand 2262* (L). Indonesian Borneo. W. Borneo, Mempawa, Mandor, alt. 5 m, June, ster., *bb. 15339* (BO, L); Landak, alt. 10 m, Apr., ster., *bb. 6372* (BO); South Borneo, Muara Teweh, June, ster., *bb. 29210* (BO, L).

28. Heritiera trifoliolata (F.v.M.) Kosterm., comb, nov.—Fig, 27, 30c

Argyrodendron trifoliolatum F. v. Mueller (basionym), Fragm. 1: 2. 1858; id. 2: 177. 1860—61; 9: 43. 1875 <as a syn. of *Tarrietia trifoliolata* F. v. M.); Walp. Ann. 7: 421. 1868; Baillon, Hist. PL 4: 61. 1872 (in nota 2) ; Pierre, Fl. for. Cochinch. 13, t. 195. 1889; Boas, Comm, Timb. Austr. 227. 1947; Francis, Austr. Rainforest Trees 294, f. 177, 178 (2). 1951 (cum var.). — *Tarrietia trifoliolata* F. v. Mueller, Fragm. 9: 43. 1875; First Census 15. 1882; Second Census 27. 1889; F.M. Bailey, Synops. Queensl. Fl. 37. 1883; Queensl. FL: 140. 1899; Moore, Census PL N.S. Wales 8. 1884; Francis in Proceed. Roy. Soc. Queensl. 36: 30, t. 4. 1925. — W. Hill (Brisbane R.) and F. v. Mueller (Pine R.) (? Melbourne).

Tarrietia argyrodendron Bentham, Fl. Austr. 1: 230. 1863, p.p. (cum var. *grandiflora,* I.e. 231); Walp. Ann. 7: 421. 1868; F. v. Mueller, Fragm. 6: 173. 1868 id. 9: 42. 1875; First Census 15. 1882; Second Census 27. 1889; F.M. Bailey, Synops. Queensl. Fl. 37. 18S3; Queensl. Woods 15. 1888; Report Gvt. sci. Exped. Bell.-Ker 32. 1889; Cat. PL Queensl. 5. 1890; Queensl. Fl. 140. 1899; Moore, Census PL N.S. Wales 8. 1884; Handb. Fl. N.S. Wales 63. 1893; K. Schumann in Engl. & Prantl, Nat. Pfl. Fam. 3 (6): 97, f. 49 E. 1893; Proceed. Linn. Soc. N.S. Wales, ser. 2, .7 (3): f 5. 1893 (cum var. *typica) ;* Boyd in Queensl. Agric. J. 2: 154. 1898; Guilfoyle, Austr. PL 315. 1911; Baker, Cabinet Timb. Austral. 25, pi. I. 1913; Hardwoods Austr. 44, pi. 4, XXI. 1919; Maiden, Forest Fl. N. S. Wales 7: 326-27, t. 255. 1921; Domin, Bibl. Bot. 89 (5): (416) 970, f. 168. 1929; Francis in Queensl. Agr. J. 51: 271. 1939 (Pamphlet 60: 22. 1939); Austr. Rainfor. Trees 294. 1951. (as a syn. of *A. trifoliolatum);* Howard, Ident. Timb. 34, f. 300. 1941; Man. Timb. World 161. 1950.

Sterculia foetida (non L.) Bentham, I.e. 226, p.p. (quoad specim. Beckler of Hastings R., cf. F. v. M., Fragm. 6: 173. 1868).

Tarrietia carroni Moore, Census PL N.S. Wales 8. 1884 (nomen); Handb. Fl. N.S. Wales 63. 1893 (diagnosis); Domin, I.e. (416) 970 (as a syn. of *T. argyrodendron,* var. *typica.*

Tarrietia riedeliana Oliver in J. Linn. Soc. 15: 98. 1876 (1877); Koorders, Minahassa 364. 1898. — Riedel s.n. (Dresden).

Tarrietia amboinensis (Teijsmann) Hochreutiner in Bull. Inst. bot. Buitenzorg 19: 22. 1904; PI. Bog.or. exsicc. 11. 1904 (cum forma *trifoliolata, typica* et *cuprica)*; in Ann. J. Bot. Buitenzorg Suppl. 3, 2: 824. — *Argyrodendron amboinensis* Haberlandt, Bot. Tropenreise 91. 1893. — III C 2, Hort. Bogor (BO).

Tarrietia argyrodendron, var. *typica* Domin, Bibl. Bot. 89 (5): (416) 970. 1929.

Tarrietia argyrodendron, var. *trifoliolata* (F. v. M.) F. M. Bailey, Catal. 29; Queensl. Fl. 140. 1899; Compreh. Catal. Queensl. PL 62. 1909; Francis in Proe. Roy. Soc. Queensl. 36: 30, t. 4. 1925.

Tarrietia argyrodendron, var. *grandiflora* Bentham, I.e.; Bailey, Queensl. Fl. 140; Compreh. Cat. Queensl. PL 62. 1909; Francis, I.e. 294. 1951. — *Argyrodendron trifoliolatum,* var. *grandiflorwm* (Benth.) Burtt-Davy in Trop. Woods 51: 19. 1937.

Tarrietia argyrodendron, var. *angustifolia* Bailey, Cat. Queensl. Woods 29 b; Occ. Papers on Queensl. Fl. no. 1. 1886; Compreh. Catal. Queensl. PL 62. 1909; Francis, I.e. — *Agyrodendron trifoliolatum,* var. *angustifolium* (F. M. Bailey) Burtt-Davy in Trop. Woods 51: 19. 1937. — Bailey, Endeavour R. (Melbourne?).

Tarrietia argyrodendron, var. *macrophylla* Bailey, Botany Bull. IX, 5; Compreh. Catal. Queensl. PL 62. 1909; Francis, I.e.

Medium sized tree, 20—30 m tall, 1 m in diameter, butresses large. Bark grey to brown, rough in fairly long, tesselate lines; in large trees there is a tendency to scaliness. Wood with large, conspicuous rays. Branchlets dark, sulcate, glossy, lepidote or glabrous; terminal leafbud small, covered by ovate, acute, caducous, lepidote or almost glabrous scales. Leaves alternate near apex of branchlets, digitate, as a rule 3-folioled (in younger plants up to 5-folioled, near inflorescence sometimes 2 or even 1-folioled) ; folioles rigid coriaceous or coriaceous, lanceolate to suboblanceolate, sometimes very slender (1.5 x 8 cm), 1.5—3 x 6—14 cm (in young trees up to 4.5 x 15 cm), top acuminate to obscurely acuminate, base tapering; upper surface glossy, densely areolate, midrib either prominent or impressed, lateral nerves impressed or prominulous, lower surface densely coppery or silvery lepidote, midrib strongly prominent, lateral nerves numerous, parallel, straight, prominulous, curved near margin, reticulation prominulous or obscure. Petiolule 8—10 mm, slender, channeled on the upper side, lepidote or almost glabrous. Petioles slender, 2—7 cm long (in young trees up to 20 cm long), lepidote or almost glabrous.

Panicles axillary, loose, many flowered, densely adpressed silvery lepidote, up to 15 cm long; unbranched part of main peduncle 3—4 cm long, branchlets rather stout. Flowers whitish, inside yellowish white, at base green, rotate-campanulate, about 10 mm in diameter; tube rather shallow, shorter than the triangular-ovate, acutish, up to 3 mm long lobes, inside of tube and lobes sparsely stellate-haired, margin of lobes densely woolly stellate hairy. Androgynophore in male flower slender 3 mm long, swollen in the middle, pilose, bearing the large anthers in a rather irregular, globose clump; inside the anthers the rudimentary ovaries on a short, thick stalk; torus flat. Female flower with almost sessile, pilose ovaries, surrounded by the large anthers; stigmas pilose, bent downwards.

Samara densely coppery lepidote, consisting of an almost globose nut (up to 5 mm in diam.) and a very large, thin, broad wing, 5 cm long, 2 cm wide; ridges on nut small or absent.

Distribution.—From Celebes, Amboina and Ceram to New Guinea and Tropical Queensland and N. S. Wales from sea level to 2000 m; rather common in Australia.

Vernac. names.—Crowfoot elm; common or silvery-leaved stave wood; rumo (Padoe language Malili, Celebes).

There is no reason to maintain *Argyrodendron* (as advocated by Burtt-Davy), the samaras are exactly like those of the other Heritiera species.

In young trees, the folioles are up to 7 x 20 cm, with up to 20 cm long petioles. These young specimens have as a rule 5-folioled leaves, reduction starts in old trees and especially near the inflorescence.

The different varieties, recognized by leaf shape, are, according to me, not well tenable. In all Heritiera species the variability of the leaves is enormous, on the same specimen and also during development. Perhaps they may be recognized as forms, but only after thorough investigation. The length of the petiole varies on the same plant, as is demonstrated on the specimen White s.n. from Theebine, where the folioles of the young plant are very short, of the mature tree very long.

The colour of the lower leaf surface is either coppery or grey; this character is of no specific value. We do not know yet, to which cause this difference in colour is attributable. It occurs in practically all species with scaly surface: *Durio , Aglaia,* etc.).

The fruit wing is very characteristic (rounded apex, and contracted at base). There is much variation in the size of the nut, those cultivated

in the Bogor Botanic Garden are about 1 cm in diameter, those of Queensland only 0.5 cm. In the larger fruit the constriction is not so conspicuous as in the smaller fruit. In general outline both types of samaras are exactly the same.

The Clemens specimen from Jarraman has different flowers, the calyx is deep, urceolate and the lobes small. This is likely to represent another species. Whether it is *H. peralata,* I am not able to decide for the moment, as the material, available for examination is too scanty.

Wood light-coloured, close-grained, tough and firm; may be used as a substitute for English beech.

INDONESIA. Celebes, Malili Distr., Kawata, alt. 400 m, July, ster., *Cell V-362* (BO, BRI, L) ; ibid. *CellV-363* (BO, BRI, SING) ; ibid. *CellV-364* (BO, CANTON) ; ibid. *Cel/V-365* (BO); ibid. *Cel/V-259* (BO) ; ibid., Jan., young fr., *Waturandang Cel/V-365* (BO) ; Malili Distr., Tawako, alt. 600 m, Mar. ,ster., *bb. 24096* (A, BO, L) ; Manado, Poso, Dono, alt. 30 *m,* Mar., young fr., 66. *31857* (BO, L) ; Manado, Boalemo, Bilatto, alt. 300 m, Dec, ster., 66. *15046* (BO) ; Manado, Ratahan near Liwutang, alt. 350 m, Mar., ster., *Koorders 194.60* (BO); Manado, Ratatotok, Mar., ster., *Koorders 18085 -18086 -18087 -18088* (BO, L) ; Bonthain, Loka, alt. 1200 in, Mar., ster., 66. *5162* (BO, K, L); Kendari, Batusanga, alt. 70 m, July, ster., 66. *2499* (A, BO, L); Island Muna, alt. 20 m, Dec, fl. buds, 66. *21701* (A, BO, L); Gorontalo, fl., *Riedel s.n.* (BO, P), type of *T. riedeliana* Oliv.; Amboina, ster., *Teijsmann H.B. 5558* (BO, K, L); fl., *Binnendijk 14617* (BO, L, UC) ; Saleier Islands, Lembang-Lembang, alt 250 m, June, ster., 66. *22945* (BO, K, L) ; Djampea, alt. 25 m, Apr., ster., 66. *24116* (A, BO, L) ; Ceram, Mannula lama, tanah gugur, on the way to Hoale Pass, Dec, fl., *Eyma 2357* (A, BO, K, L, SING) ; W. New Guinea, Idenburg R., Bernhard Camp, alt. 750 m, Apr., ster., *Brass & Versteegh 13504* (A, BO) ; Territory of New Guinea, East. Highlands, Okapa Patrol, alt. 2000 m, Febr., ster., *K. J. White N.G.F. 9578* (BO, LAE); Papua, Laca R., alt. 1500 m, Febr., fl., *Carr 15704* (BO); Java, Bogor Botanic Garden, Culta, VI I 52 a, Oct., fl. (BO); id., Apr., fl., *Kostermans s.n.* (BO, K, L, PNH); id., Nov., fr., *Kostermans 11088* (A, BISH, BM, BO, CAL, CANB, K, L, MEL, NY, P) ; IV I 71, fl., *Winkier 1051* (BO) et ster. (BO) ; IV I 64, ster. (BO) ; III C 2, Dec, fl. (BO), type of *T. amboinemsis* Hochr. AUSTRALIA, Queensland, Benarkin, 62 miles N.W. from Brisbane, May, fl., *Bick & Francis s.n.* (SING); Mt. Lindsay, border of N. S. Wales and Queensland, Oct., young fr., *White s.n.* (A) ; S. E. Queensland, Roberts Plateau, National Park, May, buds, *White 6076* (A) ; Theebine, Nov., fr., *White s.n.* (A) ; Springbook, alt. 1000 m, Sept., young fr., *White 6260* (A) ; Atherton Tableland, alt. 500 m, Lake Barrine, Nov., fl., *Kajewski 1353* (A, DS, SING); Bunya Mts, Mar., fl., *M.S. Clemens 43901* (A); Yarraman, For. Res., alt. 500 m, Aug., fl., *M.S. Clemens s.n.* (BO, BISH, UC) ; Clarence R., fl., *Mueller s.n.* (BO); Port Mackay, fr., *Mueller s.n.* (BO) ; Rockingham Bay, fr. (BO); Moreton Bay, fl., *Mueller s.n.* (P); New South Wales, Whian whian state Forest, June, fl., *White 12845* (BO) ; Lismore, Oct., fr., Herb. *Maiden 91* (A); Tweed R., fl., *Mueller s.n.* (BO) ; Bot. Garden Sydney, fl., *Camfield s.n.* (UC) ; ibid., May, fl., *Tate s.n.* (A); Bellinger R., Apr., fl., *Swain s.n.* (UC) ; Casino, July, fl., *Auliffe s.n.* (UC).

28a. Heritiera peralata (Domin) Kosterm., comb. nov.

Tarrietia peralata (basionym) Domin, Bibl. bot. 89. (5) : (416) 970, f. 168 dexter. 1928; Howard, Man. Timb. 424. 1950. — *Argyrodendron peralata* (sphalm.: *perasatal)* (Domin) "Edling", Boas, Comm. Timb. Austral. 228. 1947. — Bailey (?).

Tarrietia trifoliolata, var. *peralata* F.M. Bailey, Occ. Papers Queensl. Fl. no. 1. 1886; Second Suppl. Syn. Queensl. Fl. 10. 1888; Rep. Gvt. sci. Exp. Bell.-Ker 32. 1889; Catal. Queensl. PL 5. 1890; Queensl. Woods 21. 1889; in Queensl. Agr. J. 28: 195. 1912; J. F. Bailey in Queensl. Agr. J. 5: 392. 1899; Domin, I.e. 970 (as a syn. of *T. peralata* Dom.).

Tarrietia argyrodendron, var. *peralata* Bailey, Occ. Papers no. 1; Catal. 29c; Queensl. Fl. 40. 1899; Compreh. Catal. Queensl. PI. 62. 1909; Domin, I.e. 416 (as a syn. of *T. peralata* Dom.) ; Francis, Austr. Rainfor. trees fig. 266. 1951; Jolly in Forestry Bull. 1, Dept. Public Lands Queensl. fig. 43. 1917.

Argyrodendron trifoliolatum, var. *peralatmn* (Bailey) Burtt-Davy in Trop. Woods 51: 19. 1917.

Of this species I saw only one specimen: *Kajewski 1036* from Gadgarra, Atherton. The only difference between this and *H. trifoliolata,* is that the leaves may be 1—3-foliolate. Apparently the main difference lies in the samara, according to the name, but I had no opportunity to examine a fruiting specimen.

29. Heritiera actinophylla (Bailey) Kosterm., comb. nov.—Fig. 28

Tarrietia actinophylla F.M. Bailey (basionym), Synops. Queensl. Fl. 37. 1883; Queensl. Woods 16. 1888; id. 21. 1899; Catal. Queensl. PI. 5. 1890; Queensl. Fl. 1: 141. 1899; in Queensl. Agr. J. 28: 195. 1912; Compreh. Catal. Queensl. PI. 62. 1913; J. H. Maid, Usef. nat. PI. Austr. 604. 1889; C. Moore, Handb. Fl. N.S. Wales 63. 1893; Baker, Hardwoods Austral. 47. 1919; Maiden, For. Fl. N.S. Wales 7: 442—43, t. 267. 1921; Francis in Proc. Roy. Soc. Queensl. 36: t. 4. 1925; Austr. Rainfor. Trees 269—271. i919; 291. 1951 (as a syn. of *Argyrodendron aetinophyllum);* Domin, Bibl. Bot. 89. (5): (416) 970. 1928 '(as a syn. of *T. argyrodendron,* var. *actinophylla);* Dadswell & Eckersly in Bull. 90, Counc. sci. and industr. Research 57, f. 45. (Melbourne) 1955. •— *Argyrodendron aetinophyllum* (Bailey) H.L. Edlin in New Phytologist 34: 10. 1936; Boas, Comm. Timb. Austr. 227. 1947; Francis, Austr. Rainfor. Trees 294, f. 179, 180. 1951.

Tarrietia argyrodendron, var. *actinophylla* F. v. Mueller, Fragm. 9: 42. 1875; Domin, I.e., f. 168.

Tarrietia argyrodendron, F. v. Mueller, I.e., p.p.

Argyrodendron trifoliolatum F. v. Mueller, Fragm. 1: 2. 1859, p.p.; Domin, I.e.

Tarrietia actinodendro-n Guilfoyle, Austr. PI. 91. 1911 (sphalm. cf. Index Londinensis).

Tree. Leafbuds and tip of branchlets covered with long-ciliate scales. Stipules lepidote, ovate, acute, 5 mm, caducous. Leaves alternate congested near apex of branches, digitate, glabrous (only in initial stage with scattered scales). Folioles 3—9, chartaceous to subcoriaceous, oblanceolate, 2—6 X 8—19 cm, base tapering, top obscurely acuminate, both surfaces glossy, densely reticulate with prominent midrib and lateral nerves, the latter numerous, slender, often forked towards margin. Petiolules 2—30 mm long, slender, somewhat alate; petioles 3—14 cm long, slender, cylindrical.

Inflorescences axillary, loose, paniculate with a long peduncle with scattered scales. Flowers thin, campanulate, densely lepidote (scales almost like stellate hairs), 5—6 (—10) mm in diameter. Calyx lobes ovate, about as long as the tube. Female flower with sessile, densely lepidote ovaries with large recurved stigmas; at base with conspicuous anther-thecae.

Samaras 2.5—5 cm long, including the wing, which is from 1.5—2.5 cm broad (Bailey).

Distribution.—Australia in the jungle brushes from Gloucester, New South Wales, northwards into southern Queensland; one of the most frequent species in the mountain forests south of Brisbane.

Names.—Blush tulip oak, Black jack, Tulip oak, Ironwood.

Use.—This and other timbers of the genus are being used increasingly in panelling, flooring, interior fitting, plywood, cabinet work, etc. Wood lightbrown, mottled on the quarter by darker coloured rays, near pith much darker, almost red, moderately heavy in weight, appr. 51 lb./cub. foot, airdry; grain straight or slightly interlocked; texture medium to coarse; wood fairly fissile radially; pleasing figure on back-sawn surface due to bands of soft tissue (Dadswell & Eckersley).

Note. I could only examine a few specimens. The flowering one has conspicuously domatiferous leaves (axils of lateral nerves on lower surface). The species is easily distinguished from *H. trifoliolata* by its non-lepidote leaves.

AUSTRALIA. N. S. Wales, Coneac Distr., Febr., fl., *Fraser & Vickery s.n.* (A, UC); S. E. Queensland, Mistake Range, Oct., ster., *White s.n.* (A); Brisbane, Botan. Gard., Apr., fl., *Boorman s.n.* (A); Bot. Gard., Sydney, fl., *Boorman s.n.* (UC); Adelaida, Bot. Gard., Jan., fl. (A).

30. Heritiera densiflora (Pellegr.) Kosterm., comb. nov.

Tarrietia densiflora (Pellegrin) Aubreville et Normand (basionym) in Bull. Soc. bot. France 104: 459, t. 1, f. 3—4. 1957 (Jan. 1958). — *Tarrietia utilis* Sprague, var. *densiflora* Pellegrin in Bull. Soc. Bot. France 88: 380. 1941 (descript. gall.); Aubreville et Normand, I.e. — Rabourdi s.n. (P).

Tree. Leaves simple or palmately 3—5-lobed. Scales of lower leaf surface not contiguous, hence the leaves are more greenish (fresh) as compared with those of *H. utilis.*

Distribution.—Gabon (Africa).
Vernacular name.—Ogooue

I had no access to the specimens cited by Aubréville et Normand and I have copied here the characters differing from those of *H. utilis,* as cited by these authors.

31. Heritiera utilis (Sprague) Sprague

Heritiera utilis Sprague in Kew Bull. 1909: 348; Chevalier, Explor. bot. Afr. oce. frang., Part 1, Enum. PI. recoltees 83. 1920; Aubréville et Normand, I.e.; Thompson, Rep. For. Gold Coast t. 3. 1910 — *Triplochiton utile* Sprague in Kew Bull. 1908: 257; Aubreville et Normand in Bull. Soe. Bot. France 104: 495, t. 1, f. 1—2. 1957 (1958), as a syn. of *Tarrietia utilis* Sprague — *Tarrietia utilis* (Sprague) Sprague in Kew Bull. 1916: 85; Chipp, Forest off. Handb. Gold Coast t. 3. 1922; Hutchinson & Dalziel, Fl. W. Trop. Afr. 1: 257. 1928; Trop. Woods 27: 49. 1931; Burtt-Davy and Hoyle, Draft first descr. Checklist Gold Coast 141. 1937; Pellegrin in Bull. Soc. foot. France 88: 380—381. 1941; Michelson, Trois Essences interess. du Kivu (Etudes for., Comm. nat. Kivu, Nouv. ser. 2) 5—26. 1952; Knuchel, das Holz 402. 1954; E. Schmidt, Uberseeholzer no. 20, 4 plates. 1951; Normand, Atlas Bois Cote d'lvoire 243, pi. 105. 1955; Meniaud, J., Nos Bois colon. (Exposit. intern. Paris) 258—260 (no date); Hout, p. 209. t. 117 (no date); Handb. Hardwoods (Dept. sci. industr. Research, London) 162—164. 1956; Bois tropicaux (Plaquette documentaire, edit, par le centre techn. for. trop., France) 65. 1957; Aubreville et Normand, I.e. — Thomson 1 (K.).

Cola proteiformis A. Chevalier, Veg. util. Afr. trop. franc.. 5: 250. 1909 (descript. gall.); ibid. 6: 60, f. 9. 1911; Sprague in Kew Bull. 1916: 85; Aubréville et Normand, I.e. — Chevalier 16232 (P.).

Tarrietia utilis, var. *laxiflora* Pellegrin in Bull. Soc. bot. France 88: 381. 1941 (descript. gall.) ; Aubreville et Normand, I.e.

Tree, up to 30 m tall and up to 1 m in diam. The roots intermediate between curved buttresses and prop types, resembling the former in being flat and the latter in that they raise the tree clear of the ground. Heartwood pale pink to reddish brown, not clearly demarcated from the pale-coloured sapwood, which is commonly about 3 cm wide; the grain is commonly interlocked. Branchlets lepidote, branches grey, sulcate. Leaves alternate, coriaceous, 1—5-folioled; folioles elliptical, 5—9 x 12—22 cm, base acute or cuneate, top slender acuminate with a sharp tip, both surfaces laxly obscurely reticulate, upper one areolate under the lens, main nerves slender, slightly impressed; lower surface densely adpressed lepidote (scales ciliate), midrib strongly prominent, lateral nerves 14—16 pairs, slender, curved near margin. Petiolule 5 mm, thickened at base, petiole 1.5—4 cm, thickened at base. Stipules 4—5 mm long, caducous.

Panicles lax, pyramidal, up to 23 cm long, main peduncle lepidote, branches stellate pubescent, rather short; bracts large, densely pubescent, ovate, acute, caducous. Flowers broadly campanulate, not seen.

"Samaras densely lepidote; nut ellipsoid, compressed, 2.5—3 cm long, the wing almost at right angle, up to 8 cm long and 3 cm wide with fan-like veins. Seed pendulous, testa papery, hilum 6—7 mm, cotyledons foliaceous, nervose, same size and shape as the enveloping endosperm."

Distribution.—Gold Coast and Ivory Coast (Africa).
Vernac. name.—Niangon, Niankom, De-orh, Nyanwer (Aowin, Gold-coast) ; Nyanwune (Nzima, Goldcoast); Attabini (Ashanti).

In young trees (Cooper 253) the leaves are 12 X 30 cm with 5 cm long petioles. The folioles have a long drawn-out acumen, which is absent in Aubréville and Normand's drawing, but distinct in Chevalier's plate. Simple and pluri-folioled leaves occur on the same tree; simple usually on seedlings and flowering twigs; otherwise digitate.

A valuable reddish timber, floats, exported as "mahogany".

AFRICA. Gold Coast, Dec, fr., *Krukoff SO* (UC); Ivory Coast, Kaumasi Alepe, ster., *Krukoff 60* (UC).

Heritiera species **nova no 1**

Isl. Buru, Kajeli-Angusta, ster., *Teijsmann s.n.* (A, BO, CANB, K, L, P).

In leaf size and shape similar to *H. novoguineensis,* but leafbase and texture are different.

Heritiera species nova no 2

Isl. Sumbawa, Bukit Dulang, alt. 750 m, ster., *bb. 14048* (BO); West Lombok, Bentek, Panaman, alt. 70 m., ster., *bb. 21400* (BO, L).

Resembling *Heritiera sylvatica,* but with much larger leaves.

Heritiera species nova no 3

Westcoast Sumatra, Painan, Barung-barung belantai, alt. 650 m, ster., *bb. 6130* (BO, K, L).

Resembling *Heritiera species nova 2,* but with short petioles.

Heritiera species nova no 4

Westcoast Sumatra, Ophir, Batas Tjibudak, alt. 1100 m, ster., *bb. 5180* (BO, K, L).

Resembling *H. pterospermoides*, but with much longer petioles.

SPECIES EXCLUDENDAE

Heritiera attenuata Wallich, Catal. 1140. 1832; Wight & Arnott, Prodr. 63. 1834; Bennett & Brown, PI. Jav. rar. 237. 1840; Walp. Rep, 5: 106. 1845—46; Steudel, Nomencl. ed. 2, 1: 750. 1840; Kurz in J. As. Soc. Beng. 42 (2): 62. 1873. Syn.: *Vitonannia polyandra* Steudel, I.e. 778; *Brownlowia, lanceolata* Benth. in J. Linn. Soc. Bot. 5, Suppl. 57. 1861; *Niota polyandra* Wight & Arnott (not valiadly published in Prodr. 1: 63, because W. & A. had no intention of publishing a new name); *Glabraria tersa* L., Mantissa 2: 276. 1771 p.p. (descript. quoad specim. typ., syn. exclud.) = Brownlowia tersa (L.) Kosterm., comb. nov.

Glabraria tersa L. has been a puzzle for a long time. Generally accepted as being synonymous with *Litsea*, it has been referred to that genus as *Litsea tersa* (L.) Merrill (in Philipp. J. Sci. Bot. 1, Suppl. 57. 1906). In 1917 the type specimen was examined by Gamble on Merrill's request (Merrill, Interpret. Herb. Amboin 235. 1817), who identified it as a species of *Boschia* (Bombac). Recently I asked Mr. J. E. Dandy to inspect the type specimen; he wrote me as follows:

"Under *Glabraria, tersa* Linnaeus cites a description and plate by Eumphius, but it is clear from the detailed description given on p.p. 276—277, Mantissa, Alt. (for the species) and p. 156 (for the genus *Glabraria)* that Linnaeus was dealing with material other than published by Rumphius. Nevertheless the description is certainly composite as on p. 156 he quotes the statements about the fruit and seed as from Rumphius.

There is no specimen in the Linnaeus Herbarium named *Glabraria* by Linnaeus himself, but there is one (sheet no. 938/1) named *Glabraria tersa* by Smith (cf. Savage, Linn. Herb. 218) which agrees largely with Linnaeus' generic description of *Glabraria;* there can be no doubt that the specimen is the primary basis (obvious lectotype) of *Glabraria*, the Rumphian plant being a syntype.

The specimen in the Linnaeus Herbarium is *Brownlowia lanceolata* Benth."

Heritiera fischeri Rgl. et Rach, Ind. Sem. Hort. Petropol. 45. 1858; Walp. Ann. 7: 1868 = ?

Heritiera grandis Fisch. ex Steudel (nomen), Nomencl., ed. 1: 400; Walp. Ann. 7: 421. 1868 = ?

Heritiera lanceolata A. Gray, Botany United States Explor. Exped. 1: 184"(lapsu = *Brownlowia lanceolata* ex Index Kew.).

Heritiera spectabilis Baillon, Hist. PL 4: 62. 1872 = Octolobus spectabilis.

Heritiera tinctoria Blanco, Fl. Filip. ed. 1: 653. 1837 = Pteroeymbium tinctorium (Blanco) Merrill.

Tarrietia barteri (Mast.) Hochr. = Hildegardia barteri (Mast.) Kosterm.

Tarrietia erythrosiphon (Baill.) Hochr. = Hildegardia erythrosiphon (Baill.) Kosterm., comb. nov. (basionym: *Stermlia erythrosiphon* Baillon in Bull. Soc. Linn. Paris 1: 486. 1885).

Tarrietia perrieri Hochr. (in Candollea 3: 147. 1926) = Hildegardia perrieri (Hochr.) Kosterm., comb. nov.

INDEX OF COLLECTOR'S NUMBERS

The number after: indicates the number of the species in the text.

INDEX

New species and combinations are printed bold face; synonyms are in *italics*.

Fig. 1. — *Heritiera littoralis* Ait.

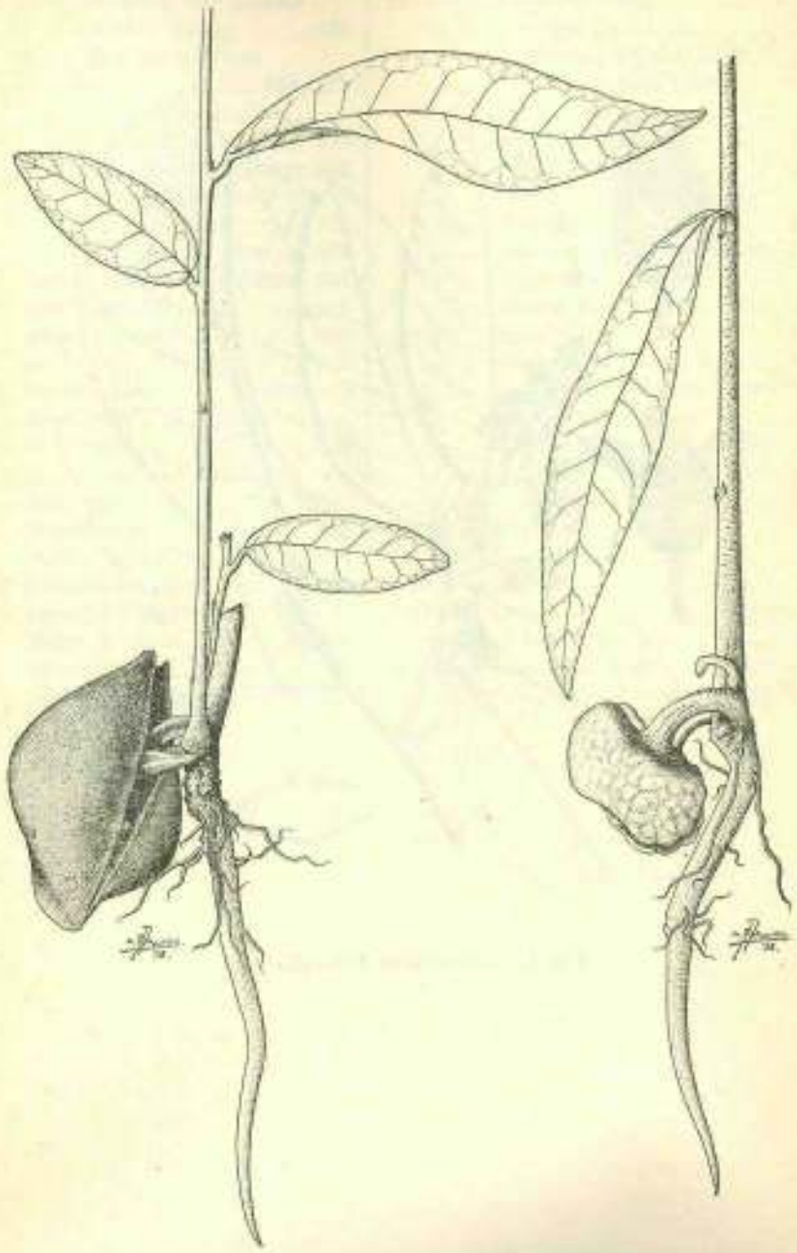


Fig. 2. — *Heritiera littoralis* Ait.; seedlings.

Fig S. —• *Heritiera globosa* Kosterm.; after b.b. 6340 (BO).

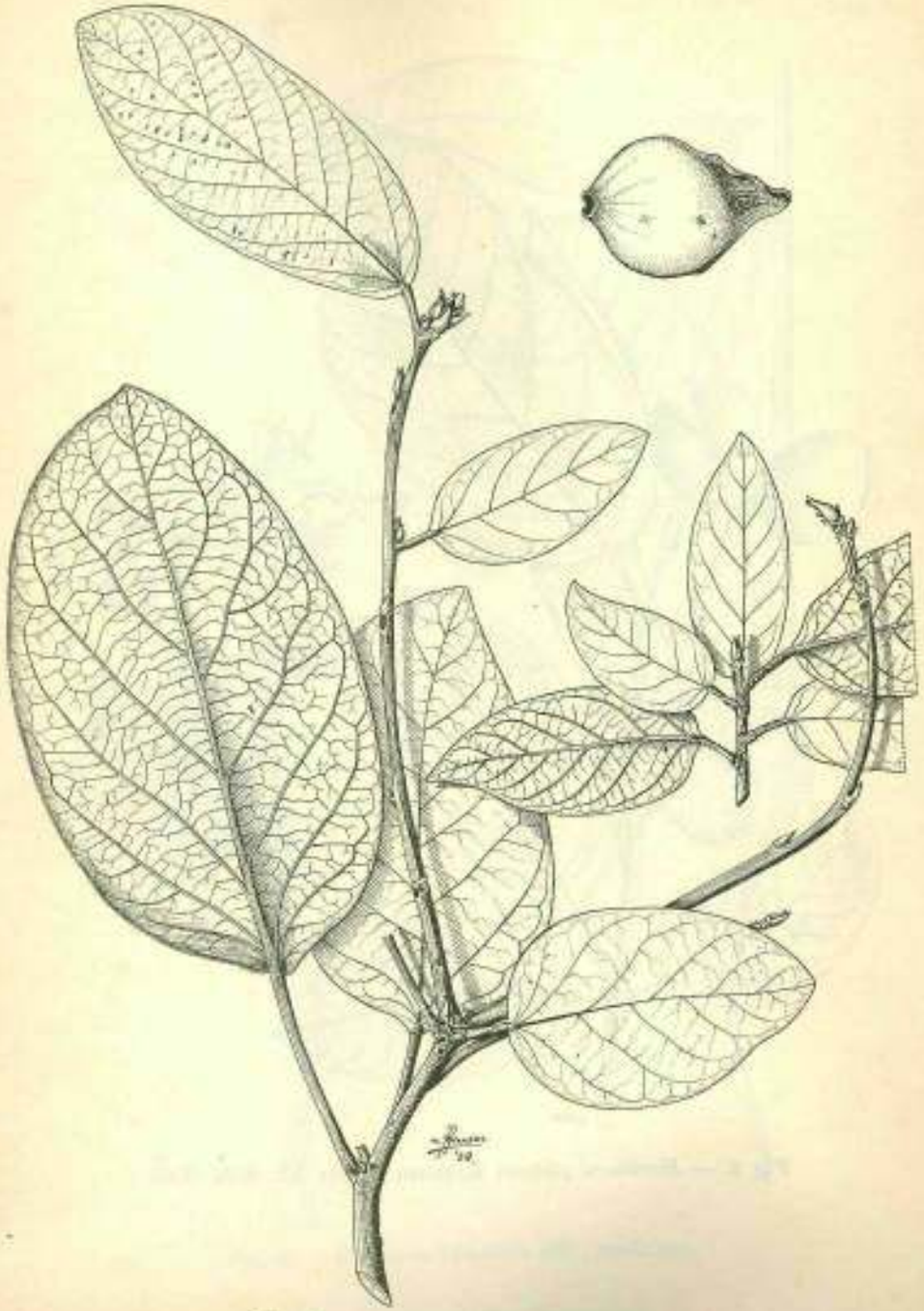


Fig. 4. *Heritiera percoriacea* Kosterm.

Pig. 5. *Heritiera novo-guineensis* Kosterm.; type.

Fig. 6 _ *Heritiera fomes* Buch.-Ham.; after Pierre 3768 (P).

Fig. 7. — *Heritiera dubia* Wall, ex Kurz (after Prain).

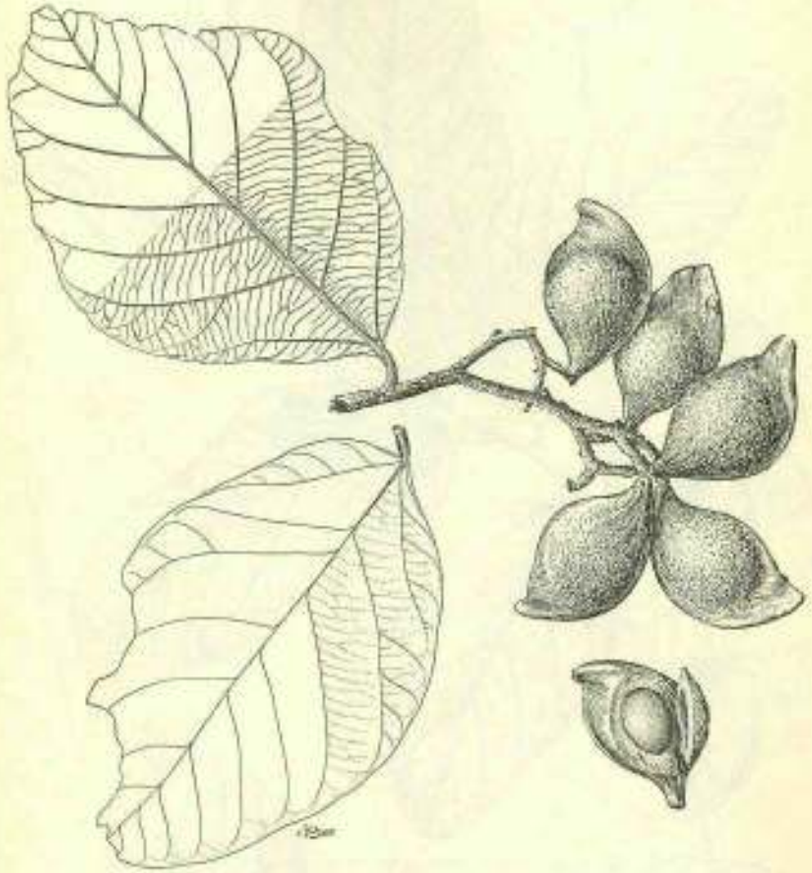
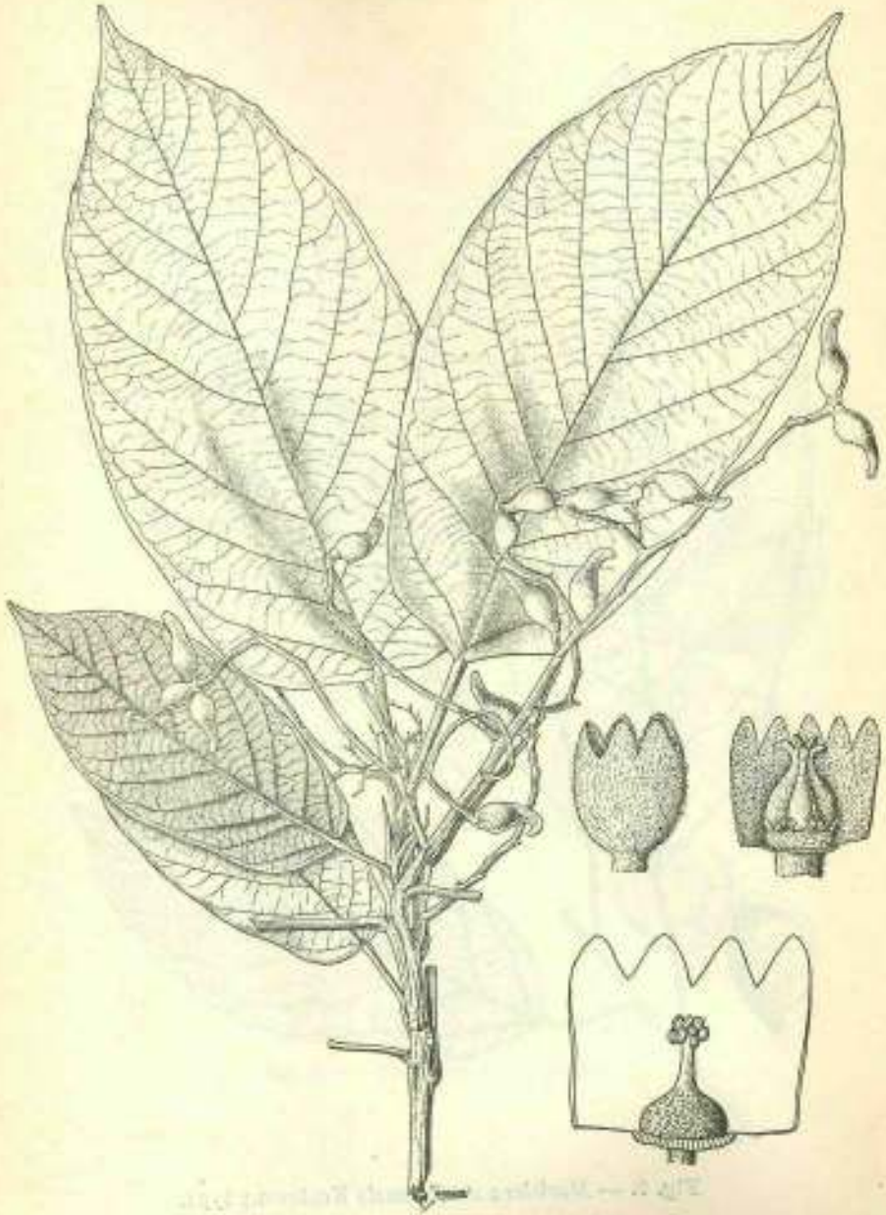


Fig. 8. — *Heritiera elata* Ridley.

Pig. 9. — *Heritiera arafurensis* Kosterm.; type.



Pig. 10. — *Heritiera macrophylla* Wall, ex Kurz; after King s.n. (BO).

Fig. 11. — *Heritiera angustata* Pierre; after Harmand 2851 (P).

Fig. 12. — *Heritiera pterospermoides* Kosterm.; type.

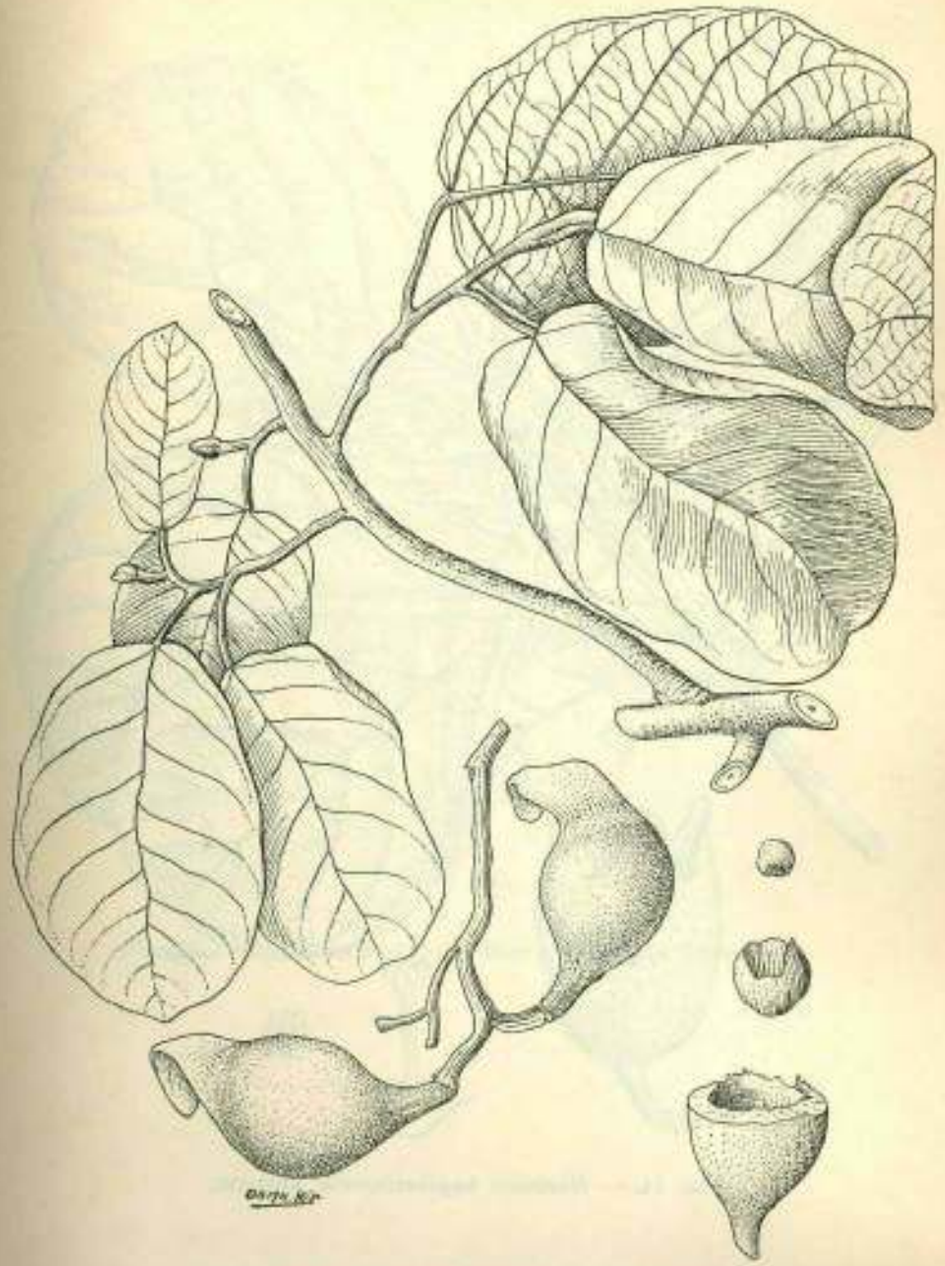


Fig. 13. — *Heritiera kiinstleri* (King) Kosterm.

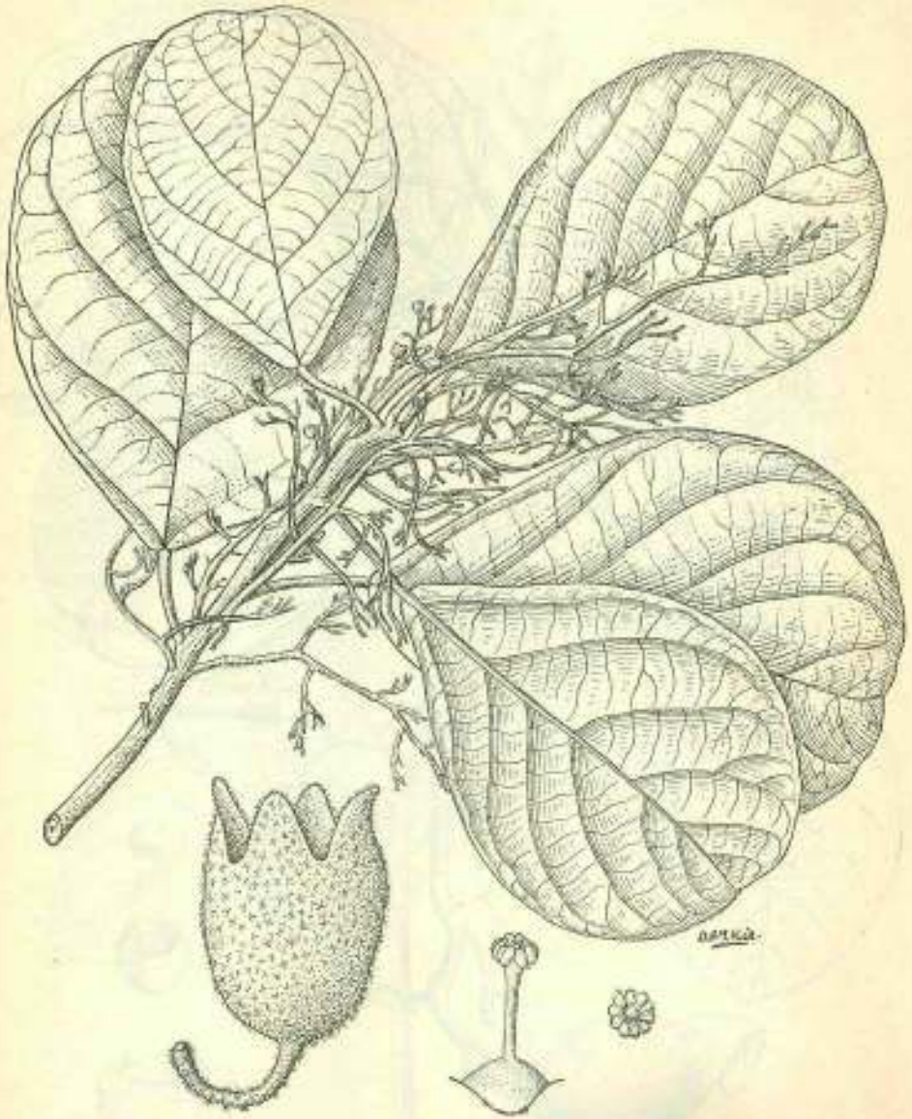


Fig. 14. — *Heritiera impressinervia* Kosterm.

Fig. 15. — *Heritiera parvifolia* Merr.; after How 73440 (BO)

Fig. 16. - *Heritiera sylvatica* Vid.; after Pascual F.B. 28786 (BO); fruit after Ahem 885 (BO).

Pig. 17. — *Heritiera macroptera* **Kosterm.**; **type.**

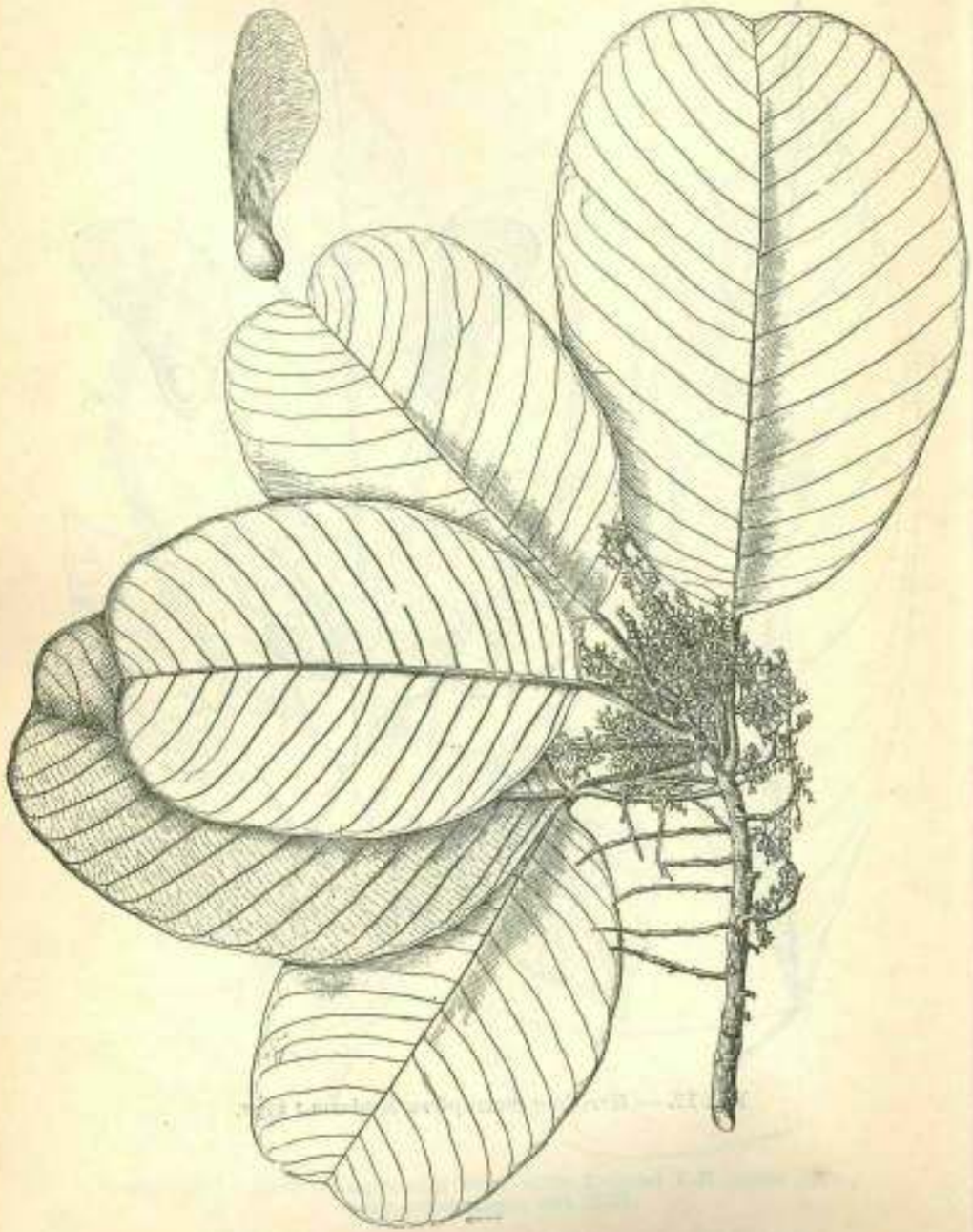


Fig. 18. — *Heritiera simplieifolia* (Mast.) Kosterm.; after Nur 1026 (BO).

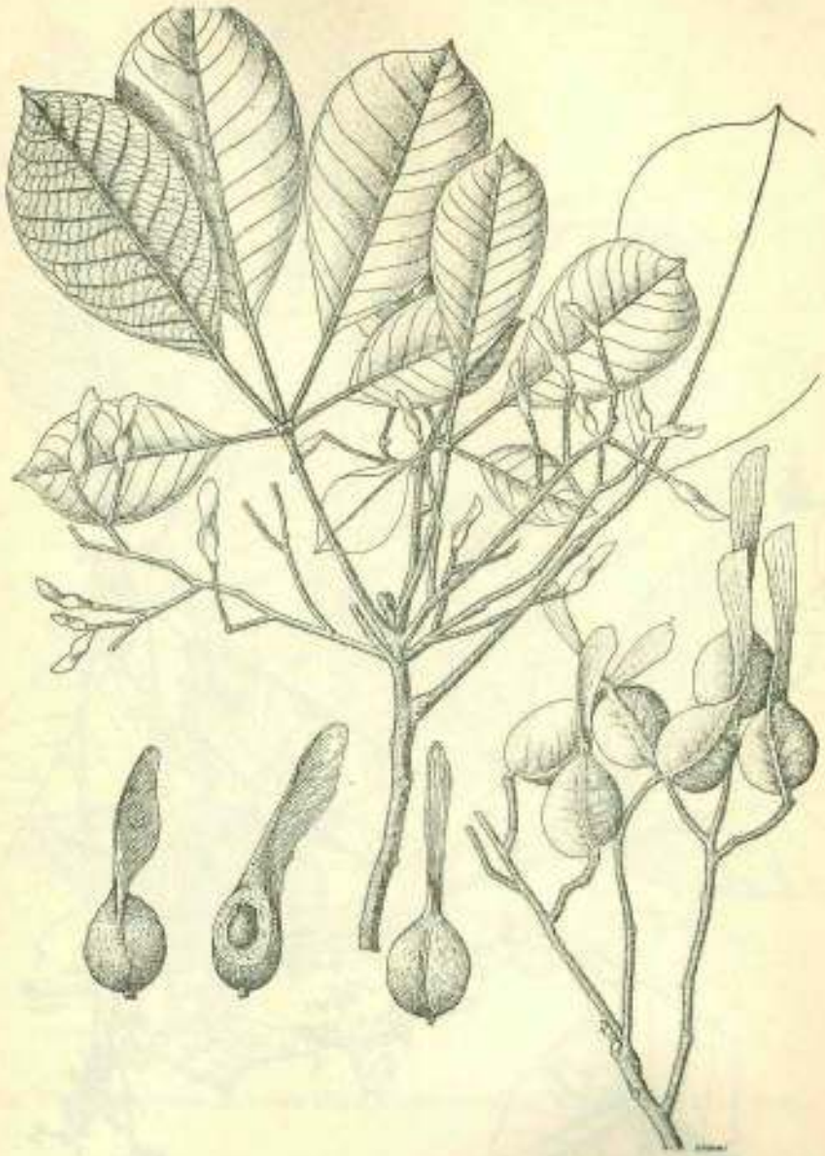
Fig[1]. 19. — *Heritiera borneensis* (Merr.) Kosterm.

Fig. 20. — *Heritiera borneensis* (Merr.) Kosterm.; upper after S.F.N. 34617; lower after S.F.N. 40796.

Fig. 21. — *Heritiera javanica* (Bl.) Kosterm.; after Kostermans 5531 (BO).

Fig. 22. — *Heritiera javanica* (Bl.) Kosterm.; after B.N. B.F.D. 2754 **(BO).**

Fig. 23. — *Heritiera sumatrana* (Miq.) Kosterm.; after **Pulau Penang, Penara Bukit 12713 (BO).**



Pig. 24. — *Heritiera sumatrana* (Miq.) Kosterm.; after Künstler (CAL).

Fig. 25. — *Heritiera albiflora* (Ridley) Kosterm.; after Haviland 2262 (L) ; the broad foliole after bb. 6372 (BO).

Fig. 26. — *Heritiera albiflora* (Ridley) Kosterm.; after Flemmich F.D. Brunei 34421 (KEP); the broad leaflets after bb. 372.

Fig. 27. — *Heritiera trifoliolata* (F. v. M.) Kosterm.; after living- material.

Fig. 28. — *Heritiera actinophylla* (Bailey) Kosterm.; after Boorman s.n. (A).

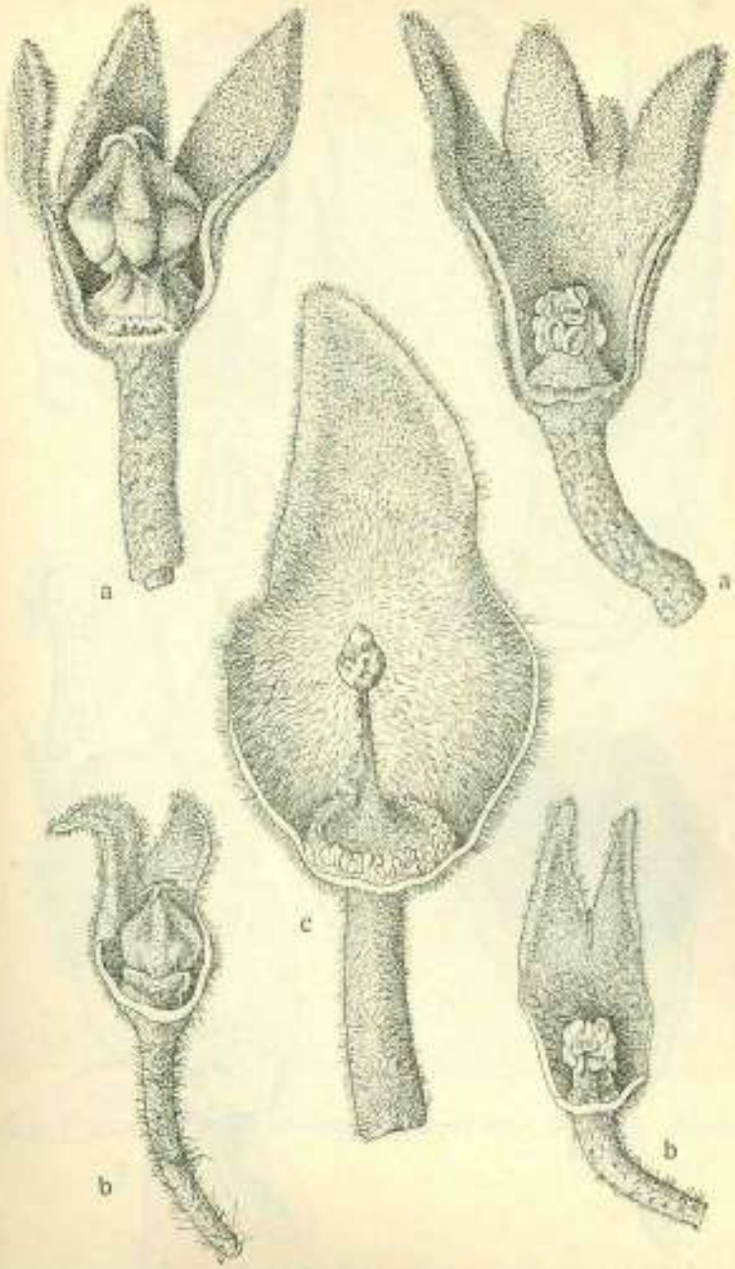


Fig. 29. — a. *Heritiera simplieifolia* (Mast.) Kosterm.; b. *H. javanica* (Bl.) Kosterm.; c. *H. globosa* Kosterm.

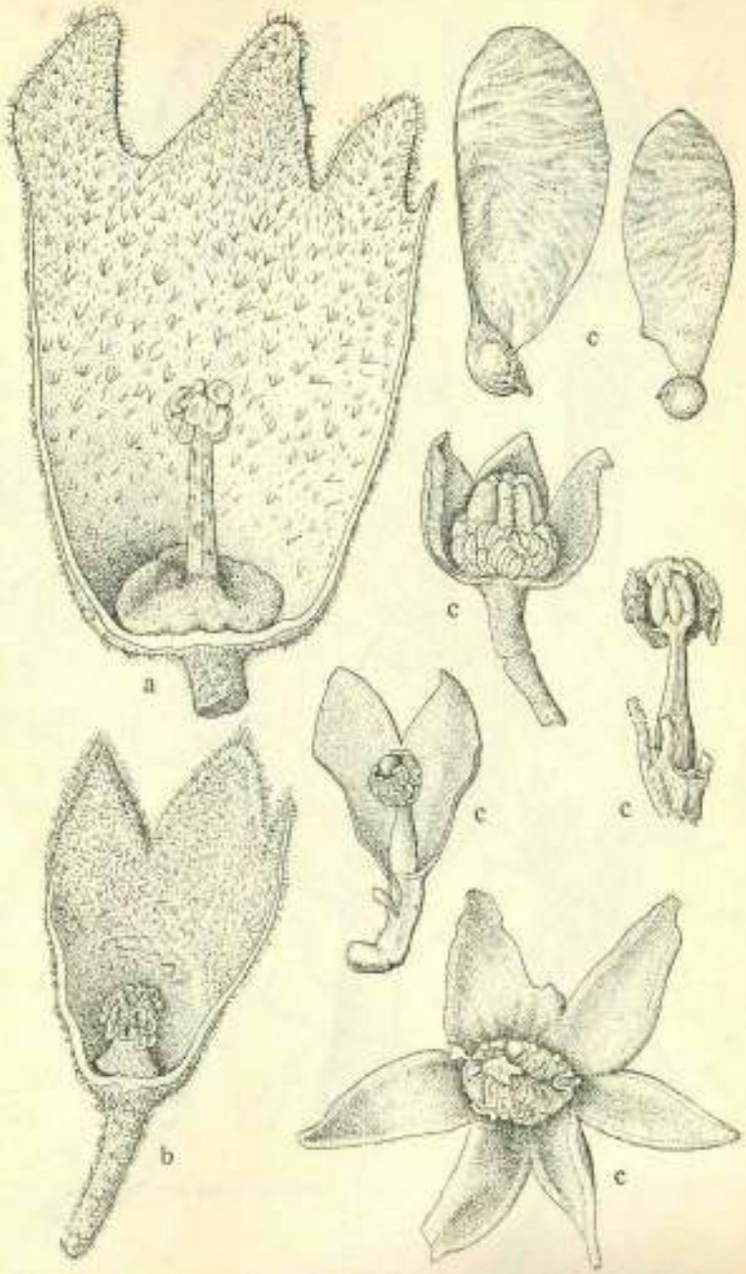


Fig. 30. — a. *Heritiera sylvatica* Vid.; b. *H. borneensis* (Merr.) Kosterm.; c. *H. trifoHolata* (F.v.M.) Kosterm.

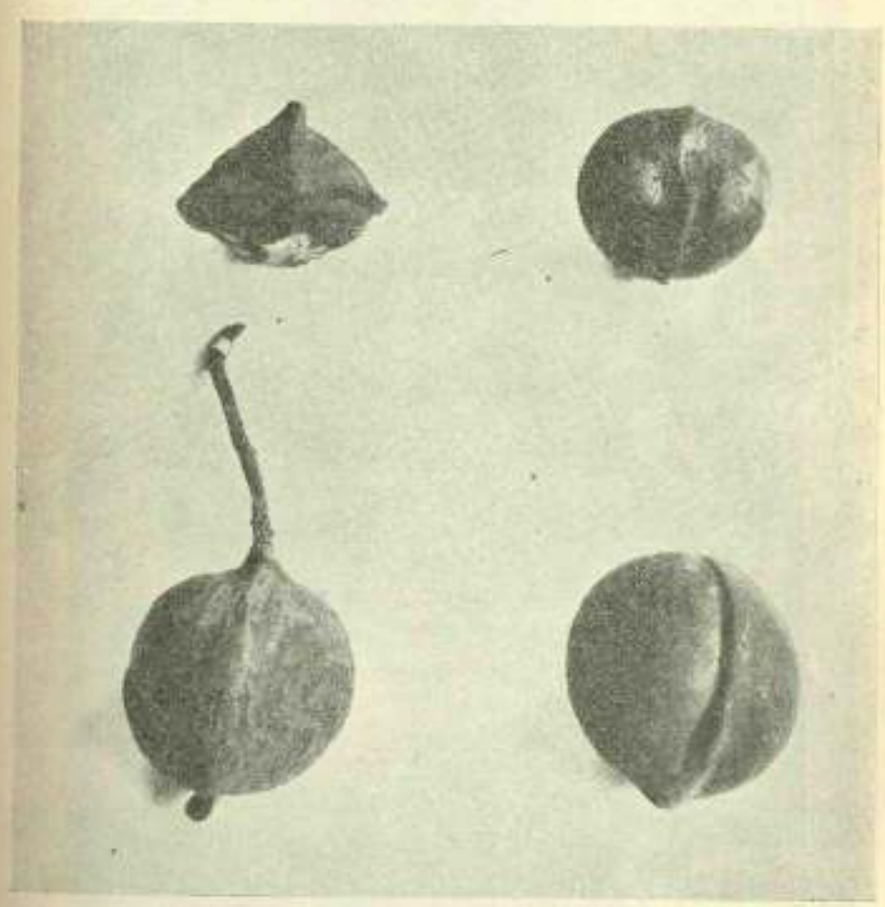


Fig-. 31. — Fruit of *H. fomes* Buch.-Ham. (upper left), *H. globosa* Kosterm.

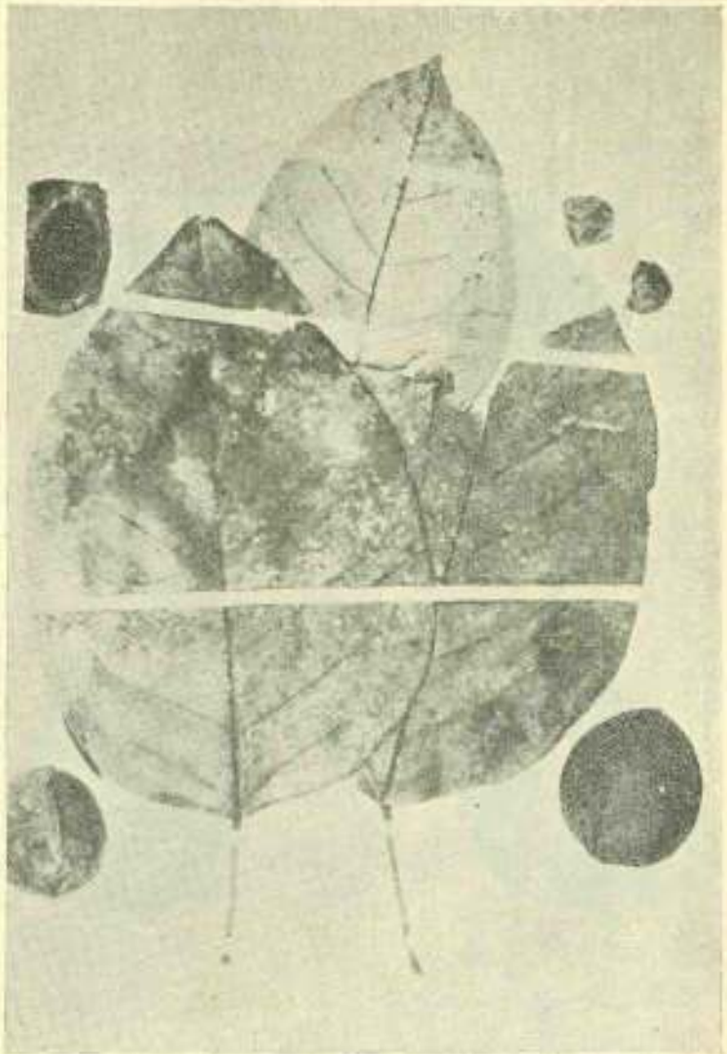


Fig-. 32. —• *Heritiera longipetiolata* Kaneh.

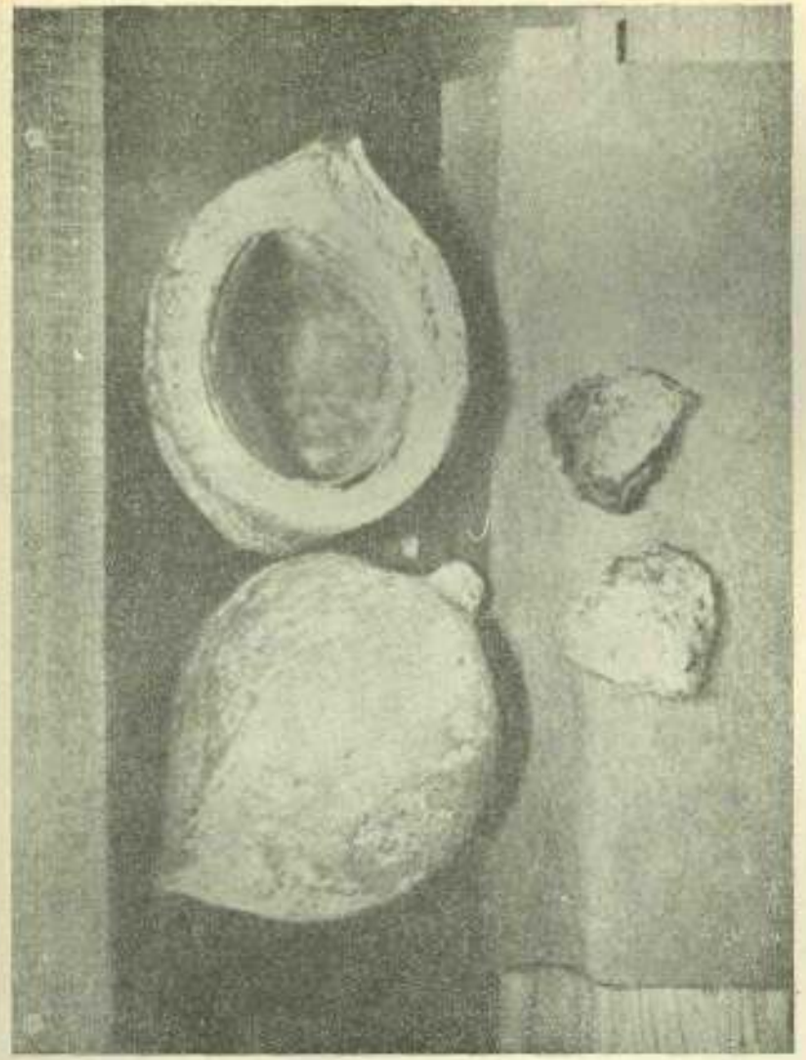


Fig. 33. — *Heritiera longipetiolata* Kan.

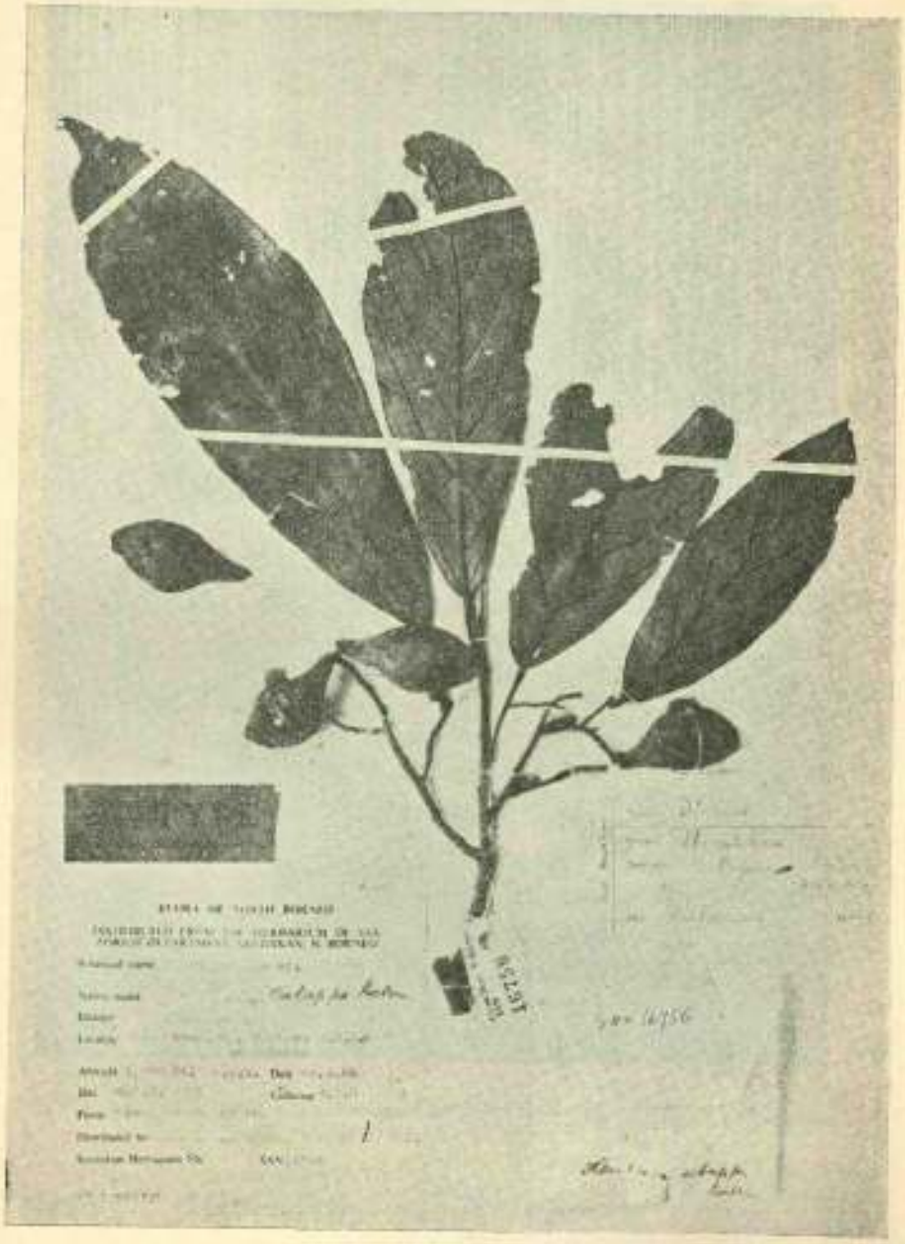


Fig. 34. — *Heritieru catap-pa* Kosterm. —- Type.

Fig. 35. — *Heritiera elata* Ridley.

Fig. 36. —• *Heritiera cordata* Kosterm. — Type.

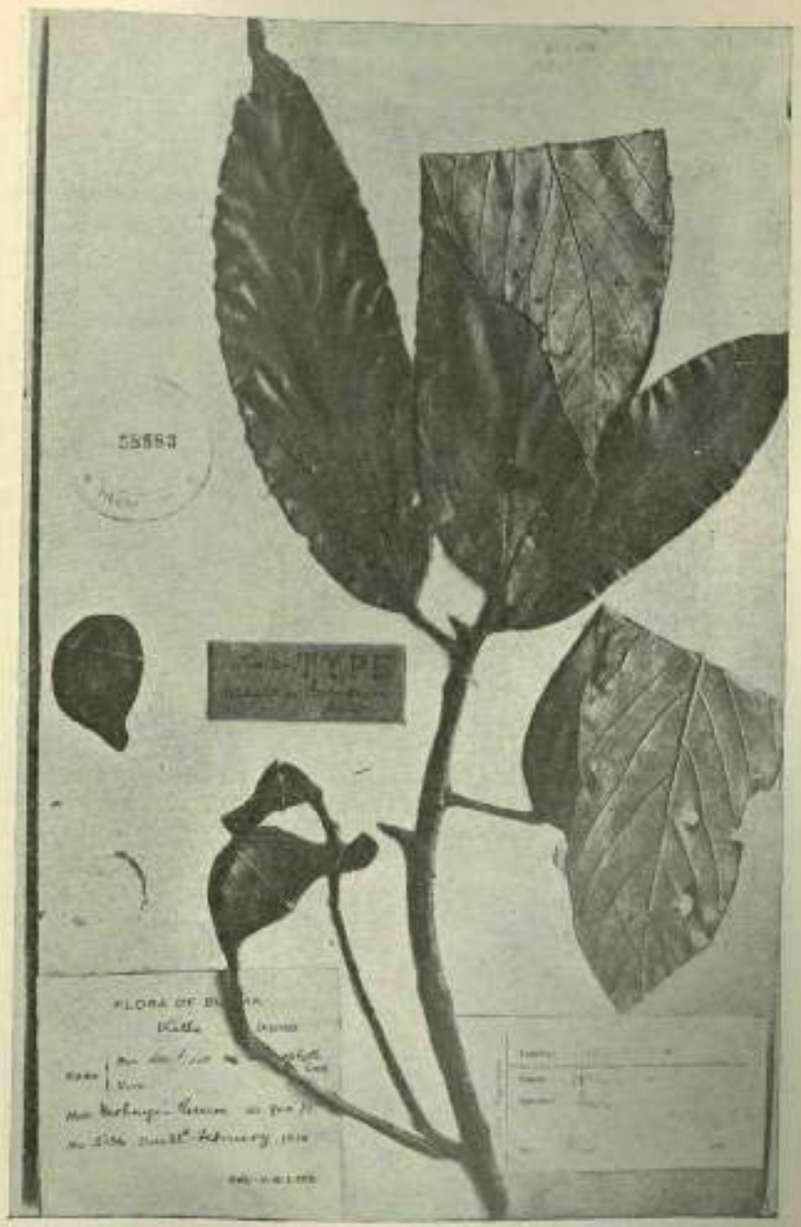


Fig. 37. —. *H'eritiera burmensis* Kosterm. — Type.

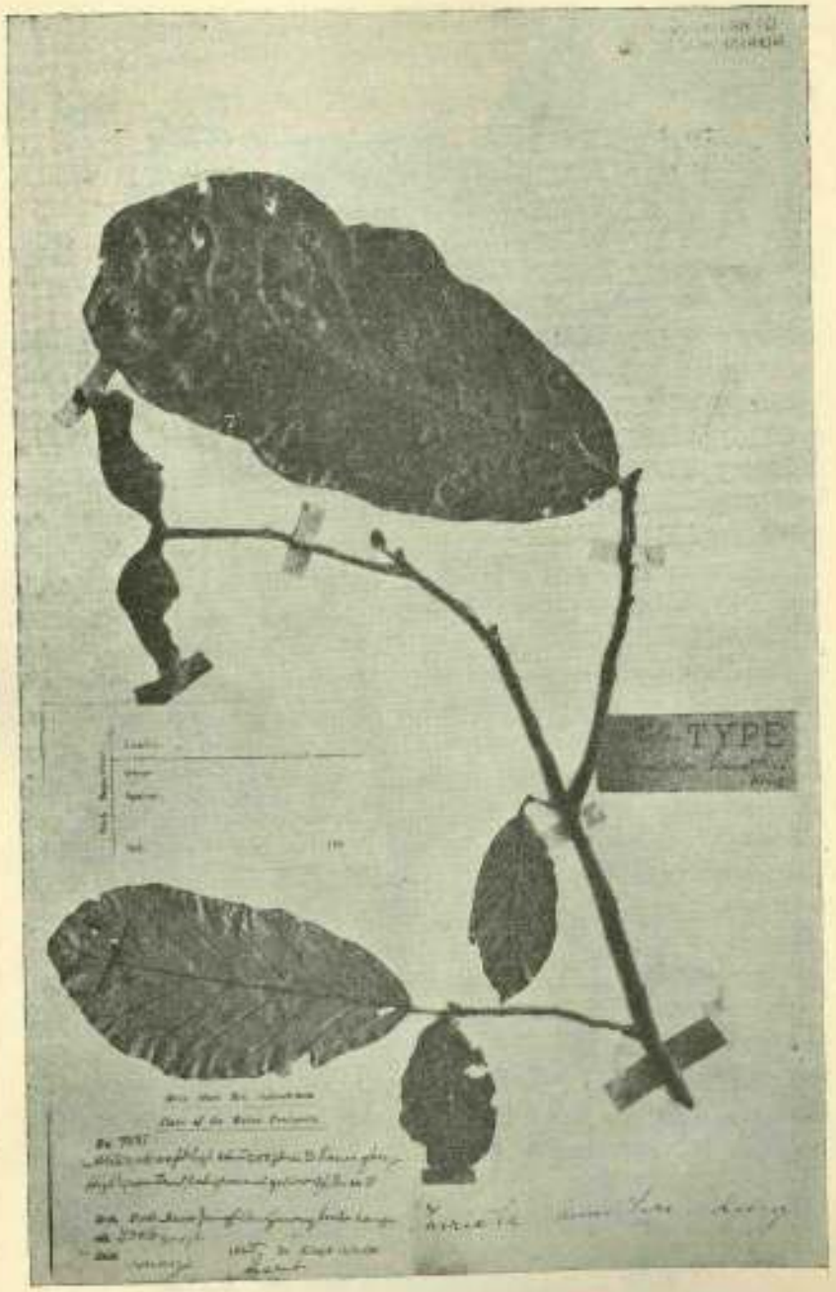


Fig. 38. — *Heritiera kunstleri* (King) Kosterm. — Type.

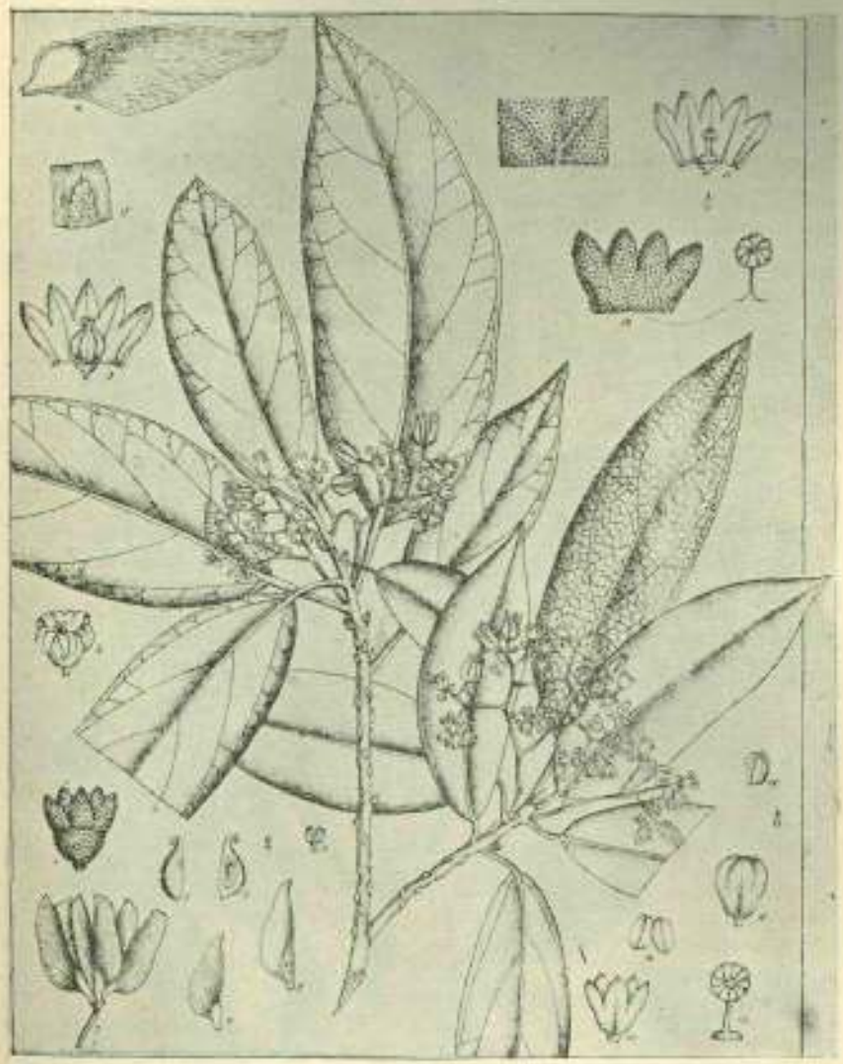


Fig. 39. — *Heritiera papilio* Bedd. — After Beddome.

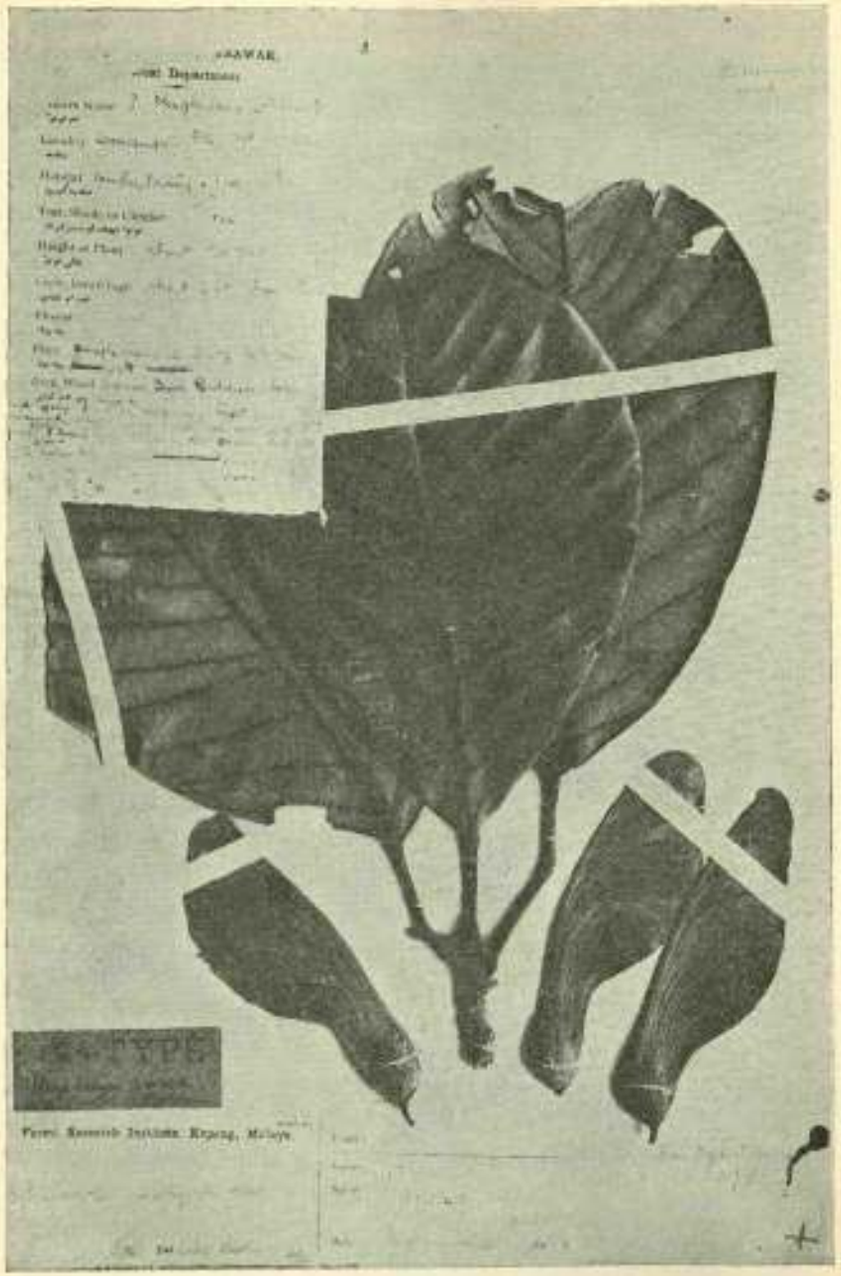
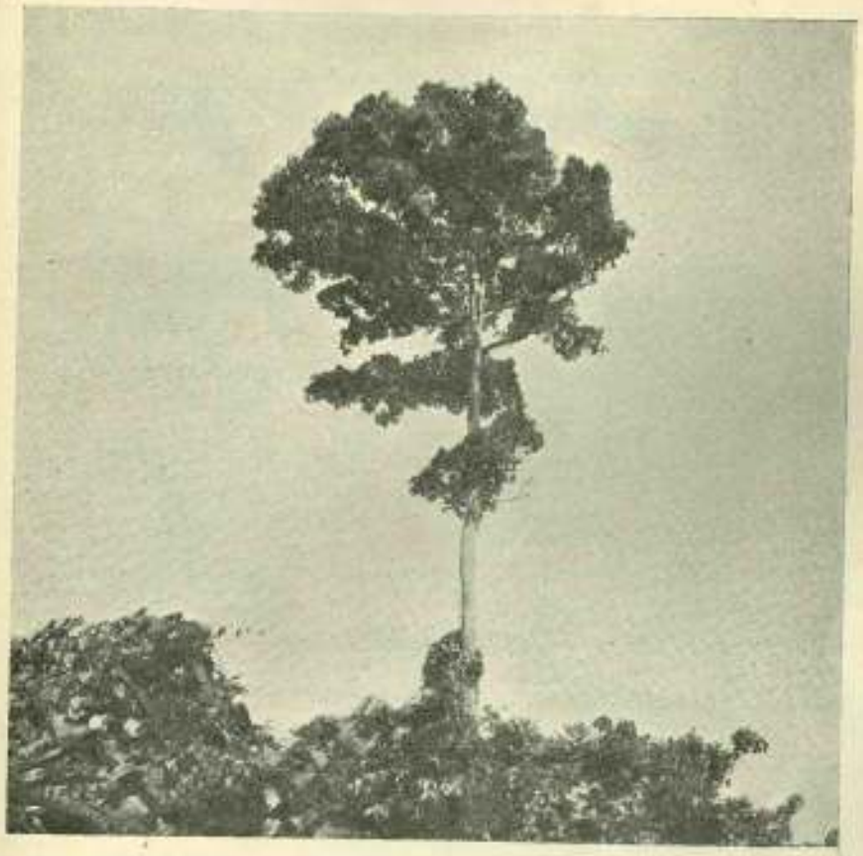


Fig. 40. — *Heritiera aurea* Kosterm. — Type.



Pig. 41. — *Heritiera javanica* (Bl.) Kosterm. left standing in cut-over forest, Nusa-kambangan; photo Kostermans. (height of tree about 40 m.).