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A new species of *Wendlandia* (Rubiaceae) from Borneo

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Summary. A new species, *Wendlandia tombuyukonensis*, is described from Sabah, Borneo, so far known only from Mt. Tombuyukon. A key to the Bornean species of *Wendlandia* is provided.

The genus *Wendlandia* in the Rondeletieae section of the Rubiaceae was first proposed by Bartling in 1830 and later adopted by De Candolle in his Prodromus (1830). It was named in honour of Heinrich Ludolph Wendland who was the Curator of the Botanic Garden at Hanover. Although the name *Wendlandia* was used earlier by Willdenow (1799), it was applied to a different group of plants more correctly called *Cocculus* in the Menispermaceae. *Wendlandia* Willdenow, then, is rejected.

A genus of *c.* 70 spp., distributed from Indo-China and Southeast Asia to Queenland and 16 species in tropical Asia, *Wendlandia* Bartl. consists of shrubs or small trees. There is no comprehensive account of *Wendlandia* for the Bornean species. For Peninsular Malaysia, the genus was treated by Wong (1989). The two revisions by Cowan (1932 & 1936) are important references for *Wendlandia* in Malaysia (=Malesia). Cowan (1932) grouped all the 'Malaysian' (= Malesian) *Wendlandia* species into the series Subinclusae based on the characters of the stamen. In this series, the anthers are almost sessile and borne on very short filaments which arise between the corolla lobes. The series is divided into two subseries, i.e., Tintoriae and Paniculatae that are easily distinguished by the form of the stipules. The Tintoriae has stipule lobes that are pointed and adpressed together while the Paniculatae has rounded and reflexed stipules. In this revision of the genus for the *Tree Flora of Sabah and Sarawak*, all taxa in Borneo have been reviewed and they fall within the Paniculatae subseries. Two species are recognized for Borneo, of which one is new.

KEY TO *WENDLANDIA* SPECIES IN BORNEO

Inflorescence lax, 11.5–30 cm long, 10.5–28 cm wide; calyx lobes glabrous to very sparsely or densely appressed soft-hairy, 0.2–0.5 mm long; corolla tube *c.* 2.5–3 mm long, slightly or widely flared towards the top. Widespread species, distributed in Java, Sumatra, Malay Peninsula, Sumbawa, the Philippines, Sulawesi and Ceram. In Borneo, widespread in Sabah and Sarawak ..... **1. *W. paniculata***

Inflorescences compact, shorter, 8–10 cm long, narrower, 6.5–9.5 cm wide; calyx lobes minutely erect-hairy, 0.7–0.9 mm long; corolla tube shorter, *c.* 2 mm long, widely flared towards the top, confined to Mt. Tombuyukon, Sabah ..... **2. *W. tombuyukonensis***

Wendlandia tombuyukonensis *S. Suzana, J.T. Pereira & J.B. Sugau* **sp. nov.** *Wendlandiae nervosae similis, foliis maioribus (4.5–8 cm longis 2.4–4.3 cm latis) utrinque sparse minute erecto-pubescentibus, inflorescentiis minus compactis (8–10 cm longis 6.5–9.5 cm diam.), pedunculo et rhachide dense breviter pubescenti, calyce sparse erecto-pubescenti differt. Typus: Jamili Nais et al. SNP 3939, Sabah, Ranau, Kinabalu Park, Mt. Tomboyukon (holotypus SAN; isotypus SNP).*

(Fig. 1)

Small tree, *c.* 2 m tall. Twigs terete, drying dark brown, rather stout, densely minute-hairy. Stipules *c.* 3 mm wide, apex broadly orbicular, inner surface mostly densely pubescent at the base, outer surface sparsely hairy on the central part. Leaves subcoriaceous; upper surface smooth, glabrous; lower surface sparsely minutely erect-hairy, drying dark brown to black on both surfaces; elliptic-ovate to elliptic-oblong, 4.5–8 × 2.4–4.3 cm; base cuneate or somewhat rounded; apex short acuminate, acumen *c.* 0.5 cm long; midrib flattened, sparsely minutely erect-hairy above and below; lateral veins 6–8 pairs, densely hirsute on both surfaces, tertiary venation scalariform, distinct below, faintly indistinct above; petiole 0.3–0.8 cm long, sparsely minute erect-hairy. Inflorescences compactly arranged 8–10 × 6.5–9.5 cm, densely short-hairy on the rachis and peduncle; bracts 2–4 × 0.5–1 mm, sparsely short hairy on both sides, persistent. Flowers: calyx sparsely erect hairy, lobes 0.7–0.9 mm long; corolla tube *c.* 2 mm long, very short and widely flared towards the top, the corolla mouth wide, the throat hairy inside, glabrous outside, lobes ovate, 0.7–1.5 cm long; somewhat rounded at the apex; anthers almost sessile, *c.* 1 mm long; filaments short, *c.* 0.5 mm long, style 2.5–3 mm long. Fruits about 2 mm across, rather densely hirsute.

DISTRIBUTION. Rare and endemic to Borneo, only known from two collections from Mt. Tombuyukon in Kinabalu Park, Ranau District, Sabah.

ECOLOGY. Montane forest, on summit with ultramafic geology, up to 2600 m altitude.

SPECIMENS EXAMINED—BORNEO. SABAH: Ranau, Kinabalu Park, Mt. Tombuyukon, *Jamili Nais* et al., SNP 3939 (SAN, SNP), *Jamili Nais* et al., SNP 5580 (SNP), *Dolois Sumbin* et al., SNP 12032 (SAN, SNP).

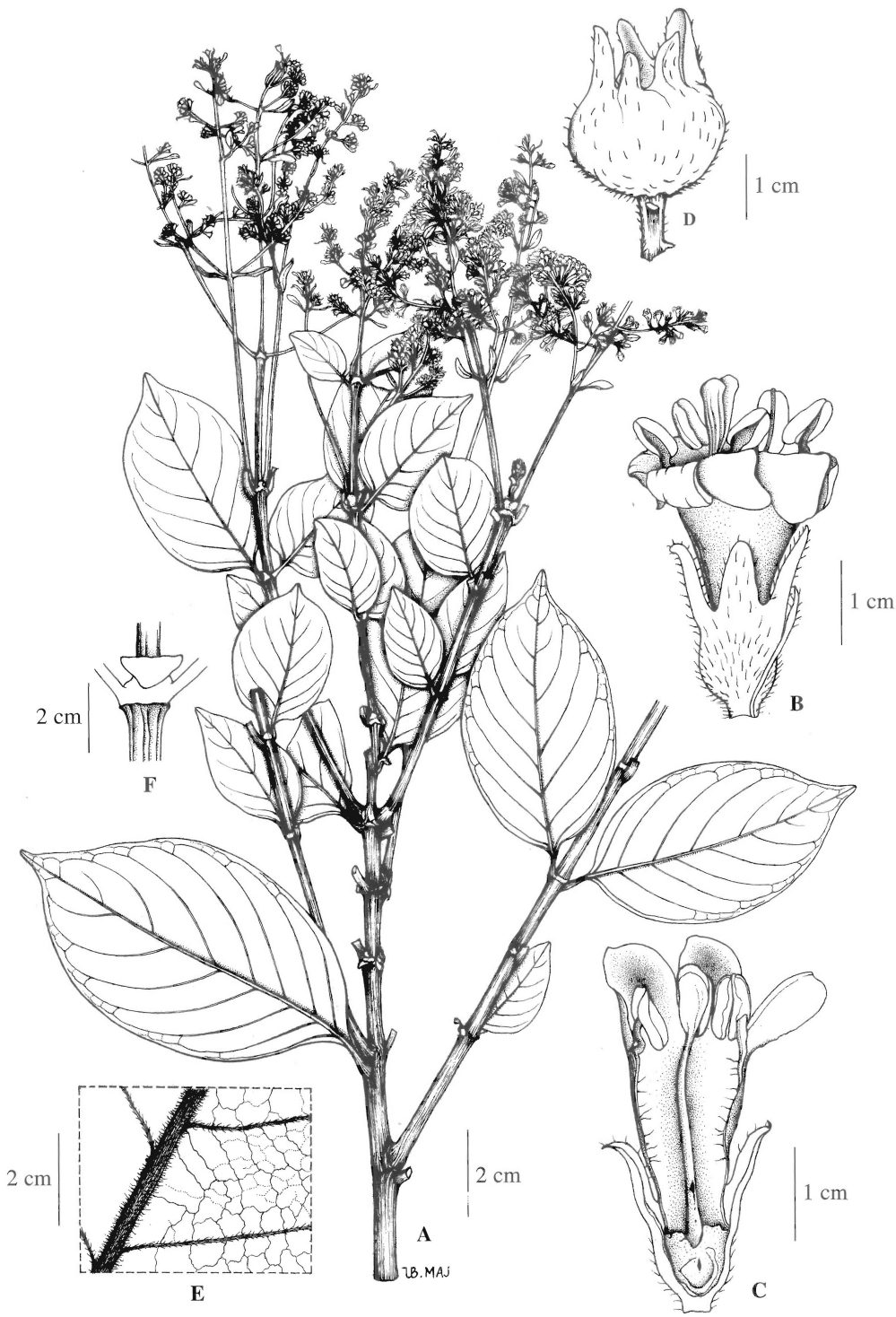

Fig. 1. *Wendlandia tombuyukonensis.* **A.** A leafy branch with inflorescence. **B.** Flower. **C.** Longitudinal section of flower. **D.** Fruit. **E.** Close-up of the lower leaf surface. **F.** Stipule. **A, B, C, E** and **F** from *SNP 5850*; **D** from *SNP 3939.*

The species epithet is named after Mt. Tombuyukon. This species is closely allied to *W. nervosa* Merrill from Mt. Tapulao, the Philippines, because of the small-sized leaves and inflorescence. However, *W. tombuyukonensis* differs from *W. nervosa* in several characters. In *W. tombuyukonensis,* the leaves are generally wide (2.4–4.3 cm), with almost flat nerves; the lower leaf surface is sparsely minute erect hairy (including the midrib and lateral veins); the inflorescence is generally longer and more lax (8–10 × 6.5–9.5 cm) with densely minute erect hairs on the peduncle and rachis and the calyx is sparsely minute erect hairy. In contrast, *W. nervosa* has typically narrower leaves (1.5–2.5 cm), with strongly impressed nerves; the lower leaf surface is densely short-erect hairy on the blade and hirsute on the midrib and lateral veins; the inflorescences are shorter and more compact (3–4 × 1.5–2 cm) with densely hirsute peduncle, inflorescence rachis and calyx.

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Enumeration and Notes on *Adinandra* (Pentaphylacaceae) in Borneo

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Summary. A total of 32 species of *Adinandra* are recognized for Borneo. *A. caudatifolia* Kobuski is reduced to a synonym of *A. acuminata* Korth.

Following the publication of twelve new species of *Adinandra* from Borneo (Sugau, 2005), the present paper enumerates the species for Borneo. This paper recognizes 32 species of *Adinandra* from Borneo. A key to all species of *Adinandra* in Borneo is available in Sugau (2005). A list of specimens of each species is also provided for reference.

Enumeration and notes on the species

1. Adinandra acuminata Korth., *Verh. Nat. Gesch. Bot.* ed. Temminck (1840) 109; Miquel., *Fl. Ned. Ind.* 1, 2 (1859) 478, *Ann. Mus. Bot. Lugd.-Bat*, 4 (1868) 103; Dyer in Hooker *f.*, Fl. Brit. Ind. 1 (1874) 282; King, J. As. Soc. Bengal 59, 2 (1890) 190; Szyszylowicz in *Nat. Pflanzenfam.* 3, 6 (1893) 189; Ridley, Fl. Malay Penin. 1 (1922) 194; Melchior in *Nat. Pflanzenfam.* ed. 2, 21 (1925) 144; Anderson, A Checklist of the Trees of Sarawak (1980) 329; Whitmore *et al.*, Tree Flora of Indonesia Check List for Kalimantan 2, 1 (1990) 344; Coode *et al.*, A Checklist of the Flowering Plants & Gymnosperms of Brunei Darussalam (1996) 317.

Type: *Korthals s.n.*, Mt. Melintang, Sumatra (Not seen).

Synonym: *A. caudatifolia* Kobuski J. Arn. Arb. 23 (1947) 72; Corner in Wong & Phillipps (eds.), Kinabalu Summit of Borneo (1996) 132; Meijer, Bot. News Bull., Sabah Forest Record No. 9 (1967) 84–85.

VERNACULAR NAME. *legai* (Iban).

DISTRIBUTION. Peninsular Malaysia, Sumatra and Borneo. In Borneo known from Sabah, Sarawak, Brunei and Kalimantan.

HABITAT. Hill mixed dipterocarp forest on ridges, at altitudes up to 1765 m. On clayey soils.

SPECIMENS EXAMINED—BORNEO. SABAH: Keningau, Crocker Range F.R., highland plantation, *Ahmad & Ejan* SAN 87031 (K, SAN); Ranau, Kinabalu National Park, Bundu Tuhan view trail, *Ansow & Rosenah* SNP 0947 (SNP); Penibukan, W. ridge jungle, *Clemens* 50377 (A, K, L); Ranau, Kinabalu National Park, 3 miles from Kg. Nalumad, *Daim* 455 (SNP); Ranau, Kinabalu National park, 4 miles from Kg. Nalumad, *Daim* 745 (SNP); Ranau, near Tenompok F.R., *Dolois* SNP 05222 (SNP); Pensiangan, Penontomon, *Fedilis & Sumbing* SAN 127954 (K, KEP, SAN); Kalabakan, Ulu Segama, *Fedilis* SAN 95586 (K, KEP, L, SAN, SAR); Kalabakan, Gunung Rara F.R., *Fedilis* SAN 94703 (K, L, SAN, SAR); Telupid, Hutan Simpan Tangkulap, *George Majawat* SAN 125933 (SAN); Ranau, Kinabalu National Park, Bundu Tuhan view trail, *Paul* et al., SNP 0944 (SNP); Ranau, Tenompok F.R., *Pereira* et al., JTP 13 (K, L, SAN); Ranau, Kinabalu National Park, proposed looped road, *Thomas & Paul* SNP 0503 (SNP); RSNB 4313 (SAN); SAN 46615 (SAN). **SARAWAK:** 4th Div., Tatau, Batang Anap, Ulu Sg. Kana, 240 m alt., *Abang & Othman* S. 41786 (K, KEP, L, MO, SAN, SAR); G. Dulit at Ulu Atun, *Asah* S. 22751 (A, BO, K, L, SAN, SING); G. Lundu, *Ashton* 18616 (A, BO, K, KEP, MEL, SAN, SAR, SING); 7th Div., Belaga, Linau-Balui, Sg. Jelini, *Bernard Lee* S. 39317 (E, K, KEP, L, SAN, SAR); 4th. Div., Gunung Mulu N.P., *Bernard Lee* S. 38087 (K, KEP, L, MO); 4th Div., G. Mulu N.P., 1180 m alt., *Bernard Lee* S. 38123 (K, KEP, L, MO, SAN, SAR); 4th Div., G. Mulu N.P. 1320 m alt., *Bernard Lee* S. 38868 (K, KEP, L, SAN, SAR, SING); Bintulu, Niah-Jelalong F.R., *Brunig* S. 8868 (A, K, L, SAR); Baram, G. Mulu, *Chew* CWL 404 (SAR, SING); 5th Div., Limbang, summit of Bukit Pagon, *Dayang Awa & B. Lee* S. 47962 (K, KEP, L, MO, SAN, SAR); 4th Div., Bario, route to Bt. Lawi, Ulu Sg. Limbang, *Dayang Awa & Bernard Lee* S. 50787 (K, KEP, L, MO, SAN, SAR); 1st Div., Simunjan, Serian-Simanggang road, 70th mile, Gunong Gaharu, *Ilias & Azahari* S. 35652 (K, KEP, L, MO, SAN, SAR); 1st Div., Simunjan, Serian-Simanggang road, 70th mile, Ulu Simpang Sabal Aping, Gunung Gaharu , *Ilias & Azahari* S. 35697 (K, KEP, L, MO, SAN, SAR); Lundu, G. Gading, *Ilias* S. 13563 (A, BO, K, L); 1st Div., Simunjan, Sabal F.R. Ulu Sg Sabal Aping, *Ilias* S. 38584 (K, KEP, L, MO, SAN, SAR); 7th Div., Kapit, Melinau, Ulu Sampurau, Bukit Sampadai, 1433 m alt., *Ilias* S. 40732 (K, KEP, L, MO, SAN, SAR); 7th Div., Kapit, Melinau, Ulu Sampurau, Bukit Sampadai, 1400 m alt., *Ilias* S. 40860 (K, KEP, L, MO, SAN, SAR); 2nd Div., Sri Aman, 85th mile, Ulu Sg. Silantek Kiri, path to G. Silantek, 300 m alt., *Ilias* S. 42565 (A, K, L, MO, SAN, SAR); 1st Div., Semantan, G. Pueh, *James* et al., S. 34484 (A, K, L, MO, SAN, SAR); 1st Div., Lundu, G. Pueh, 4000 ft., *James* et al., S. 34447 (A, K, L, MO, SAN, SAR); 1st Div., G. Gading,. *Martin* S. 37917 (K, KEP, L, MO, SAN, SAR); 4th Div., G. Mulu N. P., *Martin* S. 38910 (K, KEP, L, SAN, SAR, SING); Miri, Bt. Lambir, *Othman* S. 21389 (A, BO, K, L, SAN, SING); 4th Div., Tubau, dataran tinggi Merurung, along path to Bukit Skelap, *Othman* et al., S. 48959 (K, KEP, L,

SAN, SAR);4th Div., Tubau, dataran tinggi Merurong, along path to Bukit Skelap, *Othman* et al., S. 48964 (K, KEP, L); 2nd Div., Lubok Antu, Lanjak Entimau protected Forest, Bukit Peninjau, 2000' alt., *Paul* S. 33807 (K, KEP, L, MO, SAN, SAR); 2nd Div., Lubok Antu, Lanjak Entimau Protected Forest, Bukit Lanjak, 4200' alt., Paul S. 33817 (K, KEP, L, MO, SAN, SAR); 2nd Div., Lubok Antu District, Lanjak Entimau P. F., Bukit Peninjau, *Paul* S. 33901 (A, K, L, MO); 4th Div., Baram, Kelabit highland, along path to Pa Umor, Pa Ukat, *Paul* S. 35401 (A, K, L, MO, SAN, SAR); 7th Div., Ulu Sg. Melinau, Hose mountains, Bukit Selong, 900 m alt., *Paul* S. 37253 (K, KEP, L, MO, SAN, SAR); 4th Div., G. Mulu N.P., Sg. Mentawai, *Paul* S. 39754 (A, K, KEP, L, MO, SAN, SAR); Usun Apau plateau, R. Julan, *Pickles* S. 3706 (SAR); Lundu, *Smythies* 12604 (A, K, L, M); 4th Div., Baram, Ulu Sg. Tinjar, Bukit Sulit, *Sylvester* S. 34894 (K, KEP, L, MO, SAN, SAR); 7th Div., Batang Balleh, Sg. Melatai, Bt. Melatai, behind camp 2, *Yii* S. 48489 (K, KEP, L, MO, SAN, SAR); Lundu, G. Pueh, *sine coll.* S. 13632 (A, B, K, L, SAN). **BRUNEI:** Belait, Andulau F.R., *Ashton* H 815 (SAR). **KALIMANTAN:** West Borneo, Melawi, Tjatit B. Tengkoejoeng, b.b. 26348 (BO,L); Central E. Borneo, W. Koetai, near Mt. Kemoel, *Endert* 4140 (BO, L); E. Borneo, W. Kutai, Mt. Pamaton, near Tabang on Belajan river, *Kostermans* 12874 (A, CANB, K, L, SING); Borneo, peak of Balikpapan, Beoul, *Kostermans* 7283 (BO, L), *Kostermans* 7285 (BO, L); Borneo, peak of Balikpapan, G. Beratus, Berikan Bulu, *Kostermans* 7488 (BO, L); Borneo, Karimata, *Teysmann* 11236 (BO, L).

Kobuski (1947) distinguished *A. caudatifolia* from *A. acuminata* Korth. by its chartaceous, smallish (5–8 × 2.5–3.5 cm) and nearly 'flask-shaped' leaves with long-caudate apices and dark shining seeds. Korthals' original description of *A. acuminata* states that the leaf is coriaceous, ovate or oblong ovate, acuminate, mucronate acumens, about 12 cm long and 4 cm wide. Korthals' specimen HLB No. 908.247-711, which was cited by him as *A. acuminata* from Sumatra has also smallish (5–12 × 2.5–3.5 cm) and chartaceous leaves with sharply pointed acumens. This means that leaf size of *A. acuminata* ranges from 5 cm to 12 cm long and the width varies from 2.5 to 4 cm. Specimens from Peninsular Malaysia and Singapore have blunt caudate apices. Bornean specimens, however, display a wide range of variation that includes intermediates between *A. acuminata* and *A. caudatifolia*. With the specimens at SAN and specimens borrowed from BO, L, SAR and SING, morphological studies on these two taxa were carried out. For example, there are specimens with smallish and 'flask-shaped' leaves that are coriaceous. Leaf size is again ranging between both extremes (5–15 × 2.5–5(–6) cm). The position of bracteoles is also not a good character to distinguish *A. acuminata* and *A. caudatifolia* as both species have opposite (outer and inner) bracteoles less than 5 mm from each other. Specimens from Peninsular Malaysia and Singapore, *Ridley* 11334 and *Corner* 34932 respectively, which were cited as *A. acuminata* by Kobuski, have more-or-less opposite bracteoles. Most of the Bornean specimens have more-or-less opposite bracteoles though some have distinctly alternate bracteoles. The original description of *A. acuminata* does not mention the position of bracteoles, but the specimen from Sumatra (HLB No. 908.247-711) has opposite and more-or-less equal bracteoles.

Korthals' original description of *A. acuminata* does not mention the size and colour of the seeds but states that the seeds are 'plurima' or several and of horseshoe-like shape. The Sumatran specimen (HLB 908.247-711) has 2–3, dull blackish seeds, 8–10 mm across. Bornean specimens have dull to shining seeds, 5–10 mm across and of horseshoe-like or flattened discoid shape.

According to Kobuski (1947), *A. acuminata* does not occur in Borneo and the type of *A. acuminata* is *Korthals* s.n. collected from Sumatra in 1864. This must be a mistake because the species was described earlier by Korthals in 1840. Korthals based his species on a specimen collected by him from the forest on Mount Melintang in Sumatra, who, however, did not designate any type specimen nor provide any illustration for his species. Eventhough the type specimen of this species was not located, using the Sumatran specimen (HLB 908.247-711) that was identified by Korthals himself as *A. acuminata*, I could conclude that *A. caudatifolia* Kobuski and *A. acuminata* Korth. are not different.

2. Adinandra anisobasis Kobuski, J. Arn. Arb. 34 (1953) 125; Corner in Wong & Phillipps (eds.), Kinabalu Summit of Borneo (1996) 132; Meijer, Bot. News Bull., Sabah Forest Record No. 9 (1967) 84.

Type: *Clemens* 34154 British North Borneo (Sabah), Mt. Kinabalu, Penataran river basin, Penataran river, in jungle near Lobang (holotype BO; isotypes A, L).

Synonym: *Adinandra impressa sensu* Cockburn, Trees of Sabah 2 (1980) 110, *pro parte*, *non A. impressa* Kobuski (1947).

VERNACULAR NAME. Not known.

DISTRIBUTION. Endemic to Borneo, known from Sabah and Kalimantan.

HABITAT. Lower montane forest, up to 1335 m altitude, on ridges and slopes. On sandstone and mudstone soil.

SPECIMENS EXAMINED—BORNEO. SABAH: Sipitang, 4 miles from Kg. Mandalong to Kg. Meligan, *Aban* SAN 72910 (K, L, SAN); Mt. Kinabalu, Penataran river basin, Penataran river, *Clemens* 34154 (A, BO, L); Mt. Kinabalu, Penibukan, *Clemens* s.n. (BO); Ranau, Kinabalu Park, Pinusok Plateau, *Termiji & Bongsu* SAN 75854 (SAN); Ranau, Kinabalu Park, Pinusok Plateau, *Termiji & Bongsu* SAN 75862 (SAN). **KALIMANTAN:** Central East Borneo, W. Koetai, near Mt. Kemoel, *Endert* 4320 (BO, L).

The species is easily recognized by the asymmetric rounded base of its subsessile leaves. This species is rare, known only from six collections from the Kinabalu area in Sabah and W. Koetai in Kalimantan.

3. Adinandra argentifolia J.B. Sugau, *Sandakania* 16 (2005) 5.

Type: *Brunig* S. 1156, Borneo, Sarawak, Limbang, Bako (holotype SAR: sheet A; isotype SAR: other sheet).

DISTRIBUTION. Endemic to Borneo and restricted to Sarawak.

HABITAT. Hill mixed dipterocarp forest, at about 450 m altitude. On shallow sandstone-derived soils.

SPECIMENS EXAMINED—BORNEO. SARAWAK: Limbang, Bako, *Brunig* S. 1156 (SAR); Limbang, Sagan Range F.R., *Brunig* S. 1116 (SAR).

This species is rare, known only from two collections from the Limbang district in Sarawak. This species is easily recognized by its dull golden brown leaves when dry. Although it resembles *A. sarosanthera* in having oblong-elliptic leaves and large discoid seeds, it differs in having less than 20 pairs of lateral veins and shorter pedicels.

4. Adinandra borneensis Kobuski, J. Arn. Arb. 28 (1947) 81; Whitmore *et al.*, Tree Flora of Indonesia Check List for Kalimantan 2, 1 (1990) 344; Kessler *et al.*, Checklist for a Tree Flora of the Balikpapan-Samarinda Area, East Kalimantan, Indonesia (1992) 74; Argent *et al.*, Manual of the Larger and More Important Non Dipterocarp Trees of Central Kalimantan Indonesia 2 (1997) 625.

Type: *Neth. Ind. For. Serv.* b.b. 20641, Borneo, Kalimantan, upper Mahakam, Hitaja (holotype K; isotypes BO, L).

VERNACULAR NAME. *medang rawali* (Malay Banjar); *medang batu* (unknown dialect in East Kutai, Kalimantan).

DISTRIBUTION. Endemic to Borneo and confined to Kalimantan.

HABITAT. In lowland mixed dipterocarp forest, on ridges of undulating terrain, at altitudes up to 500 m. On yellowish loam-alluvial soils.

SPECIMENS EXAMINED—BORNEO. KALIMANTAN: Borneo, Kg. Pendreh, b.b. 11588 (BO, L); Above Mahakam Hitaja, *Neth. Ind. For. Serv.* b.b. 20641 (BO, K, L); Above Makaham [sic], Long Loeboeng, *Neth. Ind. For. Serv.* b.b. 20601 (A, BO, L); West Kutai, Sei-Ritan, b.b. 32502 (BO, L); W. Kalimantan, N. Masa village, NE of Pontianak, *Burley* et al., 3038 (L); Central East Borneo, West Koetai, L. Temelen, *Endert* 2869 (BO, L); South

Kalimantan, Jaro Dam, NE. of Muara Uya, *Katawinata* 783 (A, BM, BO, CANB, K, KEP, L, P, NY); East Kutai, Sg. Susuh (Sankulirang), *Kostermans* b.b. 34748 (BO, L); Central Kutai, Belajan river, *Kostermans* 13 (A, G, K, L, LAE, P, PNH, SAR, SING); Sangkulirang District, Karangan river, NW. of Sangkulirang, *Kostermans* 13585 (A, BO, BM, CANB, K, L, SING); East Borneo, E. Kutai, Sangkulirang Subdiv., Sg. Susuk region, *Kostermans* 5629 (BO, L); East Kutai, Sg. Susuk region, *Kostermans* 5564 (BO, L); Central Kutai, Belajan river, G. Kelopok, near Tabang, *Kostermans* 10555 (A, BO, CANB, K, L, P, SING); Balikpapan district, Mentawir river region, near G. Mentawir, *Kostermans* 10126 (A, BO, CANB, K, L, SING); West Kutai, Kalindjau river, near Melau, *Kostermans* 9650 (BO, L): East Kalimantan, East Kutai Reserve, vicinity of Sengata & Mentako rivers, *Leighton* 409 (BO, DAV, L); Subdistrict Balikpapan, village of Mentanior, *Sauveur* 30 (A, BO, K, L); Tumbangsah, km 96, Katingan river, *Wiriadinata* 3535 (L).

Anderson (1980) recorded this species from Mt. Tibang (Sarawak) at 933 m altitude. This is doubtful. The specimen from Mt. Tibang, Sarawak was not seen. In his key, Kobuski (1947) had wrongly stated that bracteoles were persistent in this species. This species is closely related to *A. myrioneura* in having caducous bracteoles but differs by its more hairy young parts of the branchlets, only slightly evenly spaced leaf lateral veins and bigger sepals. This species is common in the northeastern part of Kalimantan and may be found in the southern part of Sabah. Logging activity appears to be the main threat to the survival of this species.

5. Adinandra calciphila J.B. Sugau, *Sandakania* 16 (2005) 5.

Types: *Anderson* S. 30856, Borneo, Sarawak, Baram, Tutoh, Ulu Melinau, G. Api (holotype SAR; isotypes A, E, K, L).

DISTRIBUTION. Endemic to Borneo and confined to Sarawak.

HABITAT. Forest on limestone-derived soils, at altitudes up to 850 m.

SPECIMENS EXAMINED—BORNEO. SARAWAK: Baram, Tutoh, Ulu Melinau, Gunung Api, *Anderson* S. 30856 (A, E, K, L, SAR); 4th Div., G. Mulu National Park, Gunung Buda, *Paul Chai* S. 39899 (A, K, KEP, L, MO, SAN, SAR).

This species is rare, known only from the limestone area in Baram district in Sarawak. Anderson (1980) identified the specimen *Anderson* S. 30856 from Gunung Api as *A. clemensiae* Kobuski. This species differs from *A. clemensiae* in having glabrous sepals. *A. clemensiae* has appressed hairy sepals. This species also resembles *A. colombonensis* in having obovate-elliptic leaves but differs by its more-or-less symmetric leaf bases and longer pedicels.

6. Adinandra clemensiae Kobuski, J. Arn. Arb. 23 (1947) 77; Corner in Wong & Phillipps (eds.), Kinabalu Summit of Borneo (1996) 132; Meijer, Bot. News Bull., Sabah Forest Record No. 9 (1967) 84; Cockburn, Trees of Sabah 2 (1980) 108; Anderson, A Checklist of the Trees of Sarawak (1980) 329; Coode *et al.*, A Checklist of the Flowering Plants and Gymnosperms of Brunei Darussalam (1996) 317.

Type: *Clemens* 34480, Borneo, Sabah, Mt. Kinabalu, Colombon river (holotype A; isotype L).

Synonym: *A. magniflora sensu* Anderson, A Checklist of the Trees of Sarawak (1980) *pro parte*, *non A. magniflora* Kobuski (1947).

VERNACULAR NAME. *abu* (Kenyah); *pito* (Iban).

DISTRIBUTION. Endemic to Borneo and known from Sabah, Sarawak, Brunei and Kalimantan.

HABITAT. Mixed dipterocarp forest to lower montane forests, at altitudes up to 1833 m, on ridges. On yellow clayish sandstone soils.

SPECIMENS EXAMINED—BORNEO. SABAH: Ranau, sample plot, Bundu Tuhan view trail, 5400' alt., *Aban* SAN 49404 (SAN), *Aban* SAN 57566 (SAN); Ranau, KNP, mile 35, Ranau road, Liwagu trail, 5450' alt., *Aban* SAN 56313 (A, BISH, SAN); Ranau, KNP, Agathis sample plot, mile 35, Ranau, road, 5300' alt., *Aban* SAN 56627 (BISH, SAN), *Aban* SAN 56634 (SAN), *Aban* SAN 56647 (SAN); Ranau, KNP, Kiau view trail, *Aban* SAN 56684 (SAN); Ranau, KNP, 5300' alt., *Aban* SAN 57704 (BISH, KEP, SAN, SAR); Ranau, KNP, mile 35, Ranau road, 500'alt., *Aban* SAN 57758 (KEP, SAN, SAR), *Aban* SAN 57810 (SAN), *Aban* SAN 57817 (SAN), *Aban* SAN 60793 (SAN); Ranau, Sosopodon, 4500' alt., *Aban* SAN 62214 (KEP, SAN, SAR); Ranau, sample plot Sosopodon, *Aban* SAN 64015 (KEP, SAN, SAR, SING); Ranau, KNP, *Aban* SAN 76536 (SAN), *Aban* SAN 76589 (SAN); Ranau, KNP, below club house, *Aban* SAN 78535 (K, L, SAN, SAR); Ranau, KNP, above power station, *Aban* SAN 79522 (K, L, SAN); Ranau, Kinabalu National Park, *Aban & Meijer* SAN 93798 (L, SAN, SNP); Ranau, Sosopodon, 4800' alt., *Adam* SAN 56387 (SAN); Ranau, Sosopodon, 4500' alt., *Adam* SAN 57559 (SAN), *Ahmad* SAN 52902 (SAN), *Ahmad* SAN 52904 (SAN); Lahad Datu, Bakapit, Silabukan falls, 1500'alt., *Ahmad* SAN 52907 (SAN), *Ahmad* SAN 52962 (SAN), *Ahmad* SAN 52988 (SAN), *Ahmad* SAN 52992 (SAN), *Ahmad* SAN 52998 (SAN); Keningau, Ulu Sg. Ranau, Ulu Sg. Lakimut, *Amin* et al., SAN 110501 (A, K, KEP, L, SAN, SAR, SING); Kataran Sook, *Awang Nordin* SAN 86085 (K, KEP, L, SAN, SAR, SING); Nabawan, Sg. Maadun, Logged area, Sykt. Benawood, *Asik* SAN 104299 (SAN); Kota Belud, Marai Parai, *Berhaman* SAN 134898 (A, E, KEP, SAN, SAR, SNP); Ranau, Ranau, Sosopodon, 5300' alt., *Binideh* SAN 64164 (K, L, SAN); Ranau, Mesilau river, 5000' alt., *Chew &*

Corner RSNB 4150 (SAN), *Chew & Corner* RSNB 4313 (SAN); Ranau, Bambangan river, 5000' alt., *Chew & Corner* RSNB 4484 (SAN), *Chew & Corner* RSNB 4597 (SAN), *Chew & Corner* RSNB 4902 (SAN), *Chew & Corner* RSNB 4960 (SAN); Tambunan, Crocker range, G. Alab, *Chow & Aban* SAN 65023 (A, K, L, SAN, SAR, SING); Mt. Kinabalu, Dallas, *Clemens* 29359 (BO); Mt. Kinabalu, Dallas, *Clemens 30194* (BO); Mt. Kinabalu, Colombon river, *Clemens* 34480 (A, L); Lamag, G. Lotung, S.E. of Inarat, *Cockburn* SAN 83109 (K, KEP, L, SAN, SAR); Lahad Datu, Ulu Sg. Danum, 1400' alt., *Cockburn* SAN 85029 (K, L, SAN, SAR); Penampang, 4th mile, path from Kg. Babagon to Ulu Terian, 2100' alt., *Cockburn* SAN 68425 (SAN); Lahad Datu, Ulu Sg. Danum, 1400' alt., *Cockburn* SAN 85014 (K, KLU, L, SAN); Sandakan, mile 85, Telupid road, *Dewol* SAN 71480 (SAN); Sandakan, mile 81, Labuk road, *Dewol, Madani & Shea* SAN 74592 (K, L, SAN, SAR, SING); Sandakan, mile 81, Labuk road, *Dewol* et al., SAN 74977 (A, K, L, SAN, SAR, SING); Tambunan, Sri Usukan Hap Seng logging area, *Fedilis & Sumbing* SAN 88987 (K, L, SAN, SAR); Nabawan, Sg. Milian, *Fedilis* SAN 118555 (K, SAN); Kalabakan, G. Rara F.R., *Fedilis* SAN 94703 (K, L, SAN, SAR); Penampang, Tunggol F.R., km 45, Kota Kinabalu road, *Fidilis & Asik* SAN 115895 (K, L, SAN), *Fidilis* SAN 114645 (SAN); Keningau, Sepulut, Sg. Saburan, *Fedilis & Omar* SAN 106886 (K, L, SAN, SAR); Ranau, KNP, Mesilau cave trail, 4500' alt., *Francis Sadau* SAN 49724 (K, L, SAN); Tambunan, Trusmadi F.R., above river Kionop, 5000' alt., *George Mikil* SAN 32075 (K, KEP, L, PNH, SAN, SAR); Ranau, along road to Kamburongoh, 5200' alt., *George Mikil* SAN 33925 (K, KEP, L, SAN, SAR, SING); Ranau, Sosopodon, 4500' alt., *George Mikil* SAN 38672 (K, L, SAN, SAR); Ranau, Kundasang, Sosopodon, 4700' alt., *George Mikil* SAN 46747 (SAN); Tambunan, Trusmadi F.R. above Kaingaran river, *George Mikil* SAN 41759 (K, L, SAN); Sandakan, Bukit Malawali, 700' alt., *George Mikil* SAN 46615 (SAN); Keningau, Ulu Sg. Rampon, *Joseph* et al., SAN 124049 (SAN); Telupid, Tawai F.R., *Kamarudin* et al., KMS 3326 (SAN); KNP, park headquarter, 5500' alt., *Kanis & Sinanggol* SAN 51492 (K, L, SAN); Ranau, Kinabalu, Pinosok, 1650 m alt., *Kitayama* K 730 (SAN); Ranau, KNP, Liwagu trail, 1600 m alt., *Kokawa* 6207 (SAN); Ranau, Kundasang, near golf course, *Madani* SAN 111614 (K, KEP, SAN); Ranau, KNP, Carson trail, *Lajangah* SAN 44788 (SAN); Ranau, KNP, Carson trail, 4300' alt., *Lajangah* SAN 44793 (A, NY, SAN); Ranau, Kinabalu, Ulu Sg. Liwagu, 5000' alt., *Mujin* SAN 33853 (SAN); Sandakan, Telupid, mile 81, 500' alt., *Madani & Amin* SAN 75371 (A, K, L, SAN, SAR, SING); Tawau, Tawau hill park, *Madani & Sigin* SAN 111483 (SAN); Tawau, Tawau hill park, *Madani* et al., SAN 133937 (K, KEP, L, SAN, SAR, SING); Beluran, Bidu-Bidu F.R., *Madani* SAN 130693 (SAN); Sipitang, Meligan F.R., 4500' alt., *Madani* SAN 132714 (A, E, K, KEP, L, PNH, SAN, SAR), *Madani* SAN 132841 (K, KEP, L, SAN, SAR); Telupid, Karamuak, Mt. Tawai, *Mansus & Francis* SAN 108464 (SAN); Ranau, Kinabalu, Bundu Tuhan trail, 4000' alt., *Meijer & Adam* SAN 57504 (SAN); Telupid, Tawai F.R., 500–1000' alt., *Meijer & Madani* SAN 131961 (A, BISH, E, K, KEP, L, PNH, SAN, SAR); Ranau, Kinabalu above Kundasang, 4500–5000' alt., *Meijer* SAN 28591 (SAN); Ranau, Bukit Tambuyokon, 6–7000' alt., *Meijer* SAN 34632 (K, L, SAN, SAR); Ranau, Sosopodon, *Agathis-Phyllocladus* ridge, 4500' alt., *Meijer* SAN 42777 (SAN); Ranau, Jalan Sosopodon, 4500' alt., *Meijer* SAN 48072 (SAN); Ranau, KNP, HQ, 5000'alt., *Meijer* SAN 57888 (SAN);

Ranau, Kinabalu, Bundu Tuhan trail, 5000' alt., *Meijer* SAN 57900 (SAN); Ranau, Kinabalu, Mamut road trace, 4200' alt., *Meijer* SAN 62706 (SAN); Ranau, Kinabalu, Sosopodon, Jalan Ulu Liwagu, 5000' alt., *Mujin* SAN 38403 (K, KEP, L, SAN, SAR, SING); Keningau, Tambulanon area, *Patrick & Kumin* SAN 68899 (K, L, SAN); Ranau, Sosopodon, *Prot Badak* SAN 32318 (K, KEP, L, SAN); Lahad Datu, G. Silam, *Proctor* SAN 98169 (SAN), *Proctor* SAN 101013 (SAN), *Proctor* SAN 101021 (SAN); Ranau, KNP, *Saikeh* SAN 74120 (K, L, SAN, SAR, SING); Ranau, mile 38.3, Ranau road, Sosopodon, 5000' alt., *Sario* SAN 32248 (K, KEP, L, SING); Labuk Sugut, Sg Sasau, 1500' alt., *Sigin & Amin* SAN 67573 (SAN); Ranau, Kinabalu, 4500' alt., *Sinaggol* SAN 38296 (K, L, SAN, SAR); Ranau, KNP, Bukit Burung and Liwago cave track junction, 1646 m alt., *Stevens* et al., 597 (SAN); Tambunan, KK- Tambunan road, km 56, G. Alab, *Sumbing* SAN 121834 (SAN); Penampang, Penampang-Tambunan road, km 45, Tunggol F.R., *Sumbing* SAN 131307 (SAN); Sipitang, W. ridge of G. Lumaku, 4500' alt., *Wood* SAN 16707 (A, BO, BRI, K, KEP, L, SAN, SING). **SARAWAK:** Kapit, Batang Balleh, Nanga Balang, *Anderson & Ilias* S. 28328 (A, E, K, L, MEL); just below summit ridge of Bungoh range, *Anderson* S. 29046 (A, E, K, L, SING); G. Dulit at Ulu Atun, 1300 m alt., *Asah* S. 22751 (A, BO, K, KEP, L, MEL, SAN, SAR, SING); Gunung Lundu, 700 m alt., *Ashton* S. 18616 (A, BO, K, L, SAN, SAR, SING); Miri, Lambir hill F.R., *Dan* S. 3032 (A, K, L, SAN, SAR); 5th Div., Limbang, summit of G. Pagon, *Dayang Awa & B. Lee* S. 47962; Lundu, Gunung Gading, 1800' alt., *Ilias* S. 13563 (A, B, K, L, NB, SAR); 7th Div., Kapit, Melinau, path from Ulu Sampurau to Ulu Melinau, 1400 m alt., *Ilias* S. 40943 (K, L, SAN, SAR); 4th Div., G. Mulu N.P., 1180 m alt., *Martin* S. 38171 (K, KEP, L, MO, SAN, SAR); Miri, base of Bukit Lambir, 50 m alt., *Othman* S. 21389 (A, BO, K, L, SAN, SAR, SING); Lundu, G. Lundu, *Smythies* S. 12604 (A, B, K, L, SAR); Lundu, G. Pueh F.R., 3000' alt., *Smythies* S. 15662 (A, B, K, L, SAR); 4th Div., G. Murud N.P., 2200 m alt., *Yii* S. 44611 (E, K, KEP, L, SAN); Lundu, G. Pueh, 3000' alt., *s.coll.* S. 13632 (A, K, L, SAR). **BRUNEI:** G. Pagon Periok, 1500 m alt., *Ashton* BRUN 1872 (BRUN, SAR); Temburong, Amo, *Dransfield* JD 7204 (BRUN); Belalong, Temburong, 1480 m alt., *Wong* WKM 1813 (BRUN). **KALIMANTAN:** East Borneo, near L. Biak Beng, *Endert* 3074 (BO); M. E. Borneo, near L. Petak, *Endert* 3135 (BO); Central E. Borneo, W. Kutai, near Mt. Kutai, *Endert* 3702 (BO, L); E. Borneo, W. Kutai, Mt. Palimasan, near Tabang on Belajan river, *Kostermans* 12904 (BO, L).

This species is very close to *A. magniflora* Kobuski except for its smaller flowers (petals and sepals) and bracteoles. Easily recognised by its appressed hairy sepals (calyx). This species is widespread in Borneo.

7. Adinandra collina Kobuski, J. Arn. Arb. 28 (1947) 76; Keith, Preliminary List of North Borneo Plants Names, 2nd ed. (1952) 278; Corner in Wong & Phillipps (eds.), Kinabalu Summit of Borneo (1996) 132; Meijer, Bot. News Bull., Sabah Forest Record No. 9 (1967) 85; Cockburn, Trees of Sabah 2 (1980) 107; Whitmore *et al.*, Tree Flora of Indonesia Check List for Kalimantan 2, 1 (1990) 345.

Type: *Haviland* 852, Borneo, Sarawak, Kuching (holotype G; isotype L).

Synonym: *A. dumosa sensu* Cockburn, Trees of Sabah 2 (1980) 108 &110, *pro parte, non A. dumosa* Jack (1822).

VERNACULAR NAME. *bangkou* (Dusun-BunduTuhan).

DISTRIBUTION. Endemic to Borneo and known from Sabah, Sarawak and Kalimantan.

HABITAT. Hill mixed dipterocarp forest to lower montane forest at altitudes up to 1665 m. Also found in kerangas forest. On slopes and ridges. On sandstone soils.

SPECIMENS EXAMINED—BORNEO. SABAH: Ranau, copper mine area, *Aban* SAN 50726 (K, L, SAN); Ranau, KNP, mile 35, Ranau road, 5000' alt., *Aban* SAN 60760 (SAN); Tambunan, Kota Kinabalu-Tambunan road, km 62, *Amin & Lideh* SAN 60842 (SAN); Ranau, Bambangan, *Amin* et al., SAN 114368 (E, KEP, L, SAN); Ranau, Bt. 7, Jalan Mamut, *Amin* et al., SAN 123305 (SAN); Tambunan, G. Trusmadi, *Asik & Sumbing* SAN 125616 (K, SAN); Mt. Kinabalu, Mt. Bungol, *Clemens* 11209 (BO); Mt. Kinabalu, Dallas, *Clemens* 26853 (BO); Penampang, 4–5th mile, path from Kg. Babagon to Ulu Terian, *Cockburn* SAN 66046 (SAN); Ranau, Bundu Tuhan, Kebayau, Kg. Himbaan, *Doinis* 278 (SAN, SNP); Ranau, Kg. Bundu Tuhan, Bukit Lugas, Kg. Waang, *Doinis* 752 (SAN, SNP); Beaufort, Beaufort hill, *George Mikil* SAN 31973 (SAN); Kota Belud, Kg. Lobong-Lobong, *Joseph & Suali* SAN 108968 (K, KEP, L, SAN, SAR); Tambunan, Kg. Nambayan, *Joseph & Donggop* SAN 113708 (SAN); Weston, Mt. Siunggau, *Jumatin* SAN 72539 (K, L, SAN); Kota Belud, Kg. Kiau Teburi, *Jusimin* 480 (SNP); Kota Belud, Kg. Kiau Nuluh, Kinapasawon, *Jusimin* 184 (SNP); Ranau, Kundasang, Ulu Liwagu, *Lajangah* SAN 32400 (SAN); Kota Belud, Kg. Melangkap Tomis, 3 km from Tomis, *Lorence* 1130 (SAN, SNP); Sipitang, VJR Siunggau Weston, *Madani & Ismail* SAN 111463 (K, L, SAN); Ranau, Mt. Kinabalu, mile 14, Tenompok road, *Meijer* SAN 22107 (SAN); Kota Belud, Kiau Teburi I, Jln Ranau, 1700 m alt., *Noorazmi* AZ 0021 (SAN); Ranau, Kinabalu, HQ, along main road, 1500' alt., *Patrick & Fui Lian* SNP 4128 (SNP); Kota Kinabalu, Bukit Padang, *Sato* 1358 (SAN, UKMB); Papar, Kimanis, *Sato* et al., 1292 (SAN, UKMB); Tambunan, *Sato* et al., UKM 1598 (SAN, UKMB); Keningau, Sepulut, *Sigin* et al., SAN 107929 (K, L, SAN); Tambunan, Kg. Pahu, *Soinin* et al., SAN 101938 (K, KEP, SAN); Tambunan, Tontolob Liwan, *Soinin* et al., SAN 124978 (K, SAN); Ranau, Kinabalu National Park, loop road, *Tom & Gimpoton* SNP 0468 (SAN, SNP). **SARAWAK:** Bario, Ulu Baram, *Anderson* S. 20218 (A, K, L, SAR); Kuching/Simanggang road, 54th mile, Sg. Engkabong, *Anderson* S. 26884 (K, SAR); *Brooke* 10656; Matang, *Burley & Lee* 314 (A, SAN, SAR); Bako N.P., Padang and Bt. Tambi, *Carrick & Enoch* JC 152 (K, KLU, L, SAR); Mt. Matang, *Clemens* 20986 (BO); 7th Div., Belaga, Dulit range, Ulu Sg. Kayan, *Dayang Awa & Yii* S. 46835 (K, KEP, L, MO, SAN, SAR); 1st Div., Semenggoh, *Ding Hou* 588 (BO, SAR); 4th Div., Segan F.R., Naga Sepulau, *Erwin Wright* S. 27134 (K, L, SING); Semenggoh F. R., *Frodin* et al.,

2115 (SAR); Kuching, Arboretum, *Ghazali* S. 13406 (A, K, L, SAN, SAR); Kuching, *Haviland* 852 (G, L); Kuching, Selang F.R., *Ilias* S. 8458 (SAN, BO); Bau, Bungoh range, *Ilias & J.D. Mamit* S. 29011 (A, E, K, L, MEL, SAN, SING); 1st Div., Semenggoh arboretum, *Ilias & Lee* S. 37951 (SAR); 2nd Div., Simanggang, Batu Lintang, *Ilias & Munting* S. 48665 (SAR); 4th Div., Bintulu, Semilajau. *Ilias & Peter* S. 32052 (BO, K, L, SAN, SAR, SING); Kuching, Selang F.R., 100 ft alt., *Ilias* S. 8458; Mt. Matang, *Jacobs* 5564 (B, CANB, G, K, L, S, SAR, US); 1st div., Lundu, Sg. Batu, *James Mamit* S. 35232 (A, K, L, MO, SAN, SAR); Kuching, 1st Div., G. Santubong, 470 m alt., *Martin* S. 37134 (A, K, KEP, L, SAN); Bako N.P., *Paul & Ilias* S. 17258 (A, BO, K, L, MEL, SAN, SING); 4th Div., Bintulu, Segan F.R., *Paul Chai* S. 31731 (K, KEP, L, SAN, SAR, SING); 7th Div., Ulu Sg. Melinau, Hose Mountain, Bt. Salong, *Paul Chai* S. 37249 (K, KEP, L, MO, SAN, SAR); Telok Paku, Bako N.P., *Paul Chai* S. 18018 (A, BO, K, KEP, L, MEL, SAN, SING); Usun Apau Plateau, R. Julan, *Pickles* S. 3898 (SAR); Bau, *Purseglove* P 4460; Nyabau, catchment area, *Sibat ak Luang* S. 24505 (A, BO, FHO, K, KEP, L, MEL, SAN, SAR, SING); Kuching, Semenggoh arboretum, *Sibat ak Luang* S. 5363 (A, BO, K, KEP, L, MEL, P, SAN, SING); Serian road, 70th mile, near Sabal sawmill Sdn. Bhd., *Sylvester Tong* et al., S. 34283 (K, KEP, L, MO, SAN); 4th Div., Marudi, Ulu Sg. Tinjar, Dulit range, near Nanga Koyan, *Sylvester Tong* S. 34873 (K, KEP, L, MO, SAN); 1st Div., Tebakang/Tebedu road, G. Hujan, *Yii & Othman* S. 46249 (K, KEP, L, MO, SAN, SAR); 1st Div., Bau/Lundu road, 24th mile, *Yii* S. 38960 (SAR); 4th Div., Niah N.P., Sg. Sekaloh, 80 m alt., *Yii* S. 40137 (K, L, MO, SAN, SAR); 1st Div., Kuching, Bako N.P., Tg. Melano, *Yii* S. 42256 (K, KEP, L, MO, SAN, SAR); 1st Div., Bau, G. Raya, *Yii* S. 45930 (K, KEP, L, MO, SAN). **KALIMANTAN:** Borneo, W. Koetai, b.b. 16153 (BO); S. E. Borneo, Subdistrict Balikpapan, sungai Wain, *Achmad* b.b. 34336 (BO), *Achmad* b.b. 34334 (BO); Borneo, Sanggau, *Hallier* 950 (BO); Borneo, Amai Ambit, *Hallier* 3190 (BO); E. Kalimantan, Sebulu, *Kato & Wiriadinata* 6864 (BO); Borneo, Sg. Wain region, NE. of Balikpapan, *Kostermans* 4126 (BO); E. Borneo, W. Koetai, Mt. Palimasan, near Tabang, on Belajan river, *Kostermans* 12745 (A, BO, CANB, K, L); Borneo. Tdg. Bangko, near Mahakam river estuary, *Kostermans* 7102 (BO); Borneo, Bukit Raya, *Nooteboom* 4487 (BO); Kalimantan Barat, Sanggau, *Peter & Susanto* 1138 (BO); Borneo, *Teijsmann s.n.* (HLB No. 908.247-749)(BO); Borneo, *Teijsmann s.n.* (HLB No. 908.247-750)(BO); Borneo, Loa Lompong, Blajun river, Samarinda, *Vedi* 770 (BO); Borneo, Kayoep, *Winkler* 2155 (BO); *Winkler* 2305 (BO).

The channeled or grooved leaf midrib on the lower leaf surface is the main diagnostic character of this species, which distinguishes it from its close species, *A. dumosa.* This species is widespread in Borneo.

8. Adinandra colombonensis Kobuski, J. Arn. Arb. 28 (1947) 59; Corner in Wong & Phillipps (eds.), Kinabalu Summit of Borneo (1996) 132; Meijer, Bot. News Bull., Sabah Forest Record No. 9 (1967) 84; Cockburn, Trees of Sabah 2 (1980) 108; Whitmore *et al.*, Tree Flora of Indonesia Check List for Kalimantan 2, 1 (1990) 345.

Type: *Clemens* 34237, Borneo, Sabah, Mt. Kinabalu, Colombon basin (holotype A; isotype L).

Synonym: *A. impressa sensu* Cockburn, Trees of Sabah 2 (1980) 110, *pro parte, non A. impressa* Kobuski (1947).

VERNACULAR NAME. Not known.

DISTRIBUTION. Endemic to Borneo and known from Sabah and Sarawak

HABITAT. Primary submontane forest, mostly on ridges, at altitudes up to 1665 m. On blackish clayey soils.

SPECIMENS EXAMINED—BORNEO. SABAH: Ranau, Lohan Ulu, *Amin & Suin* SAN 123268 (SAN); Kota Belud, Kinabalu, Marai Parai, *Berhaman* et al., SAN 134758 (SAN); Mt. Kinabalu, Colombon basin, *Clemens* 34237 (A, L); Southern slope of Mt. Kinabalu, *Fuchs & Collenette* 21388 (A, G, K, L, SAN, SAR); Ranau, Kinabalu, along road to Kambarango, *George Mikil* SAN 38619 (K, L, SAN, SING); Ranau, Kundasang, Mantaki, *Ignasius* SAN 139053 (SAN); Ranau, Tenompok, mile 35, 5000' alt., *Sario* SAN 28533 (SAN). **SARAWAK:** 4th Div., Bario, route to Bukit Lawi, Ulu Limbang, Sg. Pa Mario, *Dayang Awa & B. Lee* S. 50738 (K, KEP, L, MO, SAN, SAR); Div., Kapit, Melinau, Ulu Sampurau, Bukit Sampadai, *Ilias* S. 41189 (K, KEP, L, SAN, SAR); Kapit, Balleh, Ulu Mengiong, Sg. Entejum, *Othman* et al., S. 56413 (K, KEP, L, MO, SAN).

This species is closed to *A. anisobasis* except for its more-or-less cuneate leaf base and glabrous petals. Both species have asymmetric leaf base. This species is common in the Kinabalu area and recorded by a few collections from Sarawak.

9. Adinandra cordifolia Ridl., Kew Bull. Misc. Inform. (1938) 173; Masamune, *Enumeration Phanerogamarum Bornearum* (1942) 471; Kobuski, J. Arn. Arb. 28 (1947) 65; Corner in Wong & Phillipps (eds.), Kinabalu Summit of Borneo (1996) 132; Meijer, Bot. News Bull., Sabah Forest Record No. 9 (1967) 83; Cockburn, Trees of Sabah 2 (1980) 107; Anderson, A Checklist of the Trees of Sarawak (1980) 329; Whitmore *et al.*, Tree Flora of Indonesia Check List for Kalimantan 2, 1 (1990) 345; Coode *et al.*, A Checklist of the Flowering Plants and Gymnosperms of Brunei Darussalam (1996) 317; Argent *et al.*, Manual of the Larger and More Important Non Dipterocarp Trees of Central Kalimantan Indonesia 2 (1997) 626.

var. cordifolia Ridl.

Type: *Haviland* 134 (HLB No. 908.249-15), Borneo, Sarawak, Kuching (holotype K; isotypes G, L).

VERNACULAR NAME. *legai* (Iban-Kapit); *merampak, kerampak* (Iban-Engkari and Iban-Brunei); *pangang buang* (Dayak Darat); *para* (Bidayu).

DISTRIBUTION. Endemic to Borneo and known from Sabah, Sarawak, Brunei and Kalimantan.

HABITAT. Mixed dipterocarp forests on ridges and hills, at altitudes up to 2266 m. On sandstone soils.

SPECIMENS EXAMINED—BORNEO. SABAH: Beaufort, Ulu Sg. Lingkungan, *Aban* SAN 66623 (K, L, SAN, SING); Beaufort, Kg. Bambangan area, *Aban* SAN 66852 (SAN); Beaufort, Klias, *Ahmad* SAN 80687 (SAN); Sandakan, Telupid road, mile 80.5, 500' alt., Ahmad *& Termiji* SAN 62411 (BO, SAN, SING); Keningau, Bukit Kitau, *Amin* SAN 95481 (K, L, SAN, SAR); Pensiangan, Kayu F.R., *Asik* SAN 135939 (K, KEP, L, SAN); Keningau, Mile 26, Jalan Crocker range, *Awang Abas* SAN 85967 (BO, K, KEP, L, SAN, SAR, SING); Kinabalu, Eastern shoulder, 6500' alt., *Chew, Corner & Stainton* RSNB 165 (SAN); Mt. Kinabalu, Colombon, *Clemens* 32434 (BO); Mt. Kinabalu, Colombon rivers, *Clemens* 34482 (BO); Lamag, S. ridge of G. Lotung, above lake, *Cockburn* SAN 83367 (A, K, KEP, L, SAN, SAR, SING); Lahad Datu, Malua F.R., *Dewol* SAN 129729 (E, KEP, SAN, SAR); Sandakan, Karamuak, Bukit Tawai, 450' alt., *Dewol & Alexius* SAN 88682 (K, KEP, L, SAN, SAR, SING); Keningau, Nabawan, *Dewol & Karim* SAN 77970 (SAN); Keningau, Nabawan, *Dewol & Karim* SAN 78344 (SAN); Beaufort, Kg. Karangan, *Dewol & Karim* SAN 78182 (SAN); Beaufort, mile 60, Montinior, *Dewol & Karim* SAN 80258 (SAN); Keningau, Nabawan, *Dewol* SAN 78337 (SAN); Sandakan, mile 79.5, Labuk road, 450' alt., *Dewol, Madani & Shea* SAN 71191 (K, L, SAN, SING); Keningau, Pinangah F.R., *Fidilis & Asik* SAN 110266 (SAN); Keningau, Sg. Tibou, *Fidilis & Sumbing* SAN 105283 (SAN); Ranau, Kinabalu, 6800' alt., *George Mikil* SAN 29201 (K, KEP, L, SAN, SAR, SING); Beaufort, Inuman, *George Mikil* SAN 30227 (K, L, SAN, SAR); Ranau, Kinabalu, Kamburongoh, 7000' alt., *George Mikil* SAN 38457 (SAN); Tambunan, Trusmadi F.R., Ulu Kaingaran river, 5000' alt., *George Mikil* SAN 41782 (SAN); Ranau, Kundasang, Sosopodon, 4500' alt., *George Mikil* SAN 46785 (SAN); Togudon, Sg. Imbak, 500' alt., *Wong* WKM 2317 (SAN); Beaufort, mile 9, Mentenior road, *Madani* SAN 35245 (K, SAN); Beaufort, mile 10.5, Mentenior road, *Madani* SAN 36751 (K, L, SAN); Ranau, Sosopodon, *Meijer & Poore* SAN 42747 (SAN); Sipitang, Mesapol, *Saikeh* SAN 73365 (K, L, SAN); Beaufort, Kg. Kamburongoh, 1000' alt., *Stephen* SAN 49254 (SAN); Sepulut, Sg. Saburan, *Sumbing & Omar* SAN 107023 (SAN); Nabawan, Witti range, *Sumbing* SAN 110171 (K, L, SAN, SAR); Sipitang, Ulu Moyah, 17 mile SE. of Sipitang, 2750' alt., *Wood* SAN 16571 (A, BO, BRI, K, L, SAN); Sipitang, Ulu Mayah, 8 miles SE. of Malaman, 3250' alt., *Wood* SAN 16956 (BO, BRI, K, KEP, L, SAN, SING). **SARAWAK:** 4th Div., Tatau, Ulu Anap, *Abang Mokhtar & Othman* S. 44873 (K, KEP, L, MO, SAN, SAR); Pelagus rapids F.R., near Bukit Raya, *Anderson & Ding Hou* 510 (BO); Hose Mountain, Bt. Kajang carapa, *Ashton* S. 19081 (K, L, SAR, SING); Miri, Lambir, proposed N.P., *Awang Morshidi* S. 24111 (A, BO, K, L, SAN, SAR); Matang, *Burley & Bernard Lee* 316; 7th Div., Belaga,

Linau Balui, Sg. Abang, 800 m alt., *Bernard Lee* S. 40004 (E, K, KEP, L, SAN, SAR); 2nd Div., Betong, Batang Layar, Sg. Engkabang, *Bernard Lee* S. 41970 (K, KEP, L, MO, SAN, SAR); Betong, Rh. Penurin, *Bernard Lee* S. 55648 (A, K, KEP, SAN, SAR); 7th Div., Kapit, Pelagus, *Bernard Lee* S. 40612 (K, KEP, L, MO, SAN, SAR); Matang, between G. Serapi and G. Bawang, 2250' alt., *Burley & Lee* B 316 (SAR); Nanga Pelagos, *Daud & Tachun* SFN 35643 (SAR, SING); 4th Div., Bario route to Bt. Lawi, *Dayang Awa & B. Lee* S. 50505 (K, KEP, L, SAN, SAR); 5th. Div., Limbang, G. Pagon, *Dayang Awa & B. Lee* S. 47992 (K, KEP, L, SAN, SAR); Kuching, *Haviland* 134 (G, K, L); 1st. Div., 25th Mile Bau/Lundu road, Sampadi F.R., Bukit Sinbong, *Ilias* S. 25294 (A, E, K, L, SING, SAR); Bau, Bungoh range, *Ilias & Mamit* S. 29013 (A, E, K, KEP, L, MEL, SING); Lawas, 500' alt., *Ilias* S. 30682 (A, BO, K, KEP, SAN, SAR, SING); Lawas, Mt. Murut, Ulu Sg. Belaban, 4400' alt., *Ilias* S. 26430 (K, L, SAN, SAR, SING); Serian, Tebakang road, Lobang Mawang, Bukit Ebapan Ra'a, near Bukit Selabor, *Ilias* S. 28100 (A, E, K, L, MEL, SAR, SING); 4th Div., Miri, Suai, Bintulu Lumber Co. area, Block no. 17, 450 m alt., *Ilias* S. 39189 (B, K, KEP, L, SAN, SAR); 1st Div., Simunjan, Sabal F.R., Ulu Sg. Sabal Aping, *Ilias* S. 38591 (K, KEP, L, SAN, SAR, SING); 4th Div., Miri, Niah, Ulu Sg. Batu, 600' alt., *Ilias* S. 39015 (B, K, KEP, L, SAN, SAR); 2nd Div., Saratok, Ankudu, Rh. Isa, *Ilias* S. 48297 (K, KEP, L, SAR); 1st Div., Bau/Lundu road, 26th mile, Sampadi F.R., 650' alt., *Ilias* S. 826183 (A, E, K, L, SAN, SAR); Simanggang, Ulu Sekarang, path to Bukit Sadok, *Ilias* et al., S. 44910 (K, KEP, L, SAN, SAR); 1st Div., Padawan, Stabut, *James Mamit* S. 29823 (E, K, KEP, L, SAR, SING); 1st Div., Kuching, Kampung Sadir, *James Mamit* S. 33373 (K, KEP, L, MO, SAN, SAR); 1st Div., Lundu, G. Gading, *James Mamit* S. 35177 (K, L, SAR); 1st Div., G. Gading, 860 m alt., *Martin P.J.* S. 37904 (K, KEP, L, MO, SAN, SAR); 7th Div., Ulu Kapit, Pelagus protected area, *Paul Chai* S. 33148 (A, K, KEP, SAN, SAR); 5th. Div. Ulu Lawas, *Paul Chai & Ilias Paie* S. 30682 (A, BO, K, KEP, L, SAN, SING); 2nd Div., Lubok Antu, Lanjak Entimau, Bukit Peninjau, 2800' alt., *Paul Chai* S. 33920 (K, KEP, L, MO, SAN, SAR); 7th Div., Kapit, Ulu Sg. Kapit, 110 m alt., *Paul Chai* S. 36041 (K, KEP, L, MO, SAN, SAR); 4th Div., Lambir N.P., *Rena* S. 40423 (K, L, SAR); Miri, 6.5 mile, Bakam road, *Sibat & Ilias Paie* S. 24734 (A, BO, K, KEP, L, SAN, SAR, SING); 1st Div., Tebakang/Tebedu road, 10 km, G. Hujan, *Yii & Othman* S. 46247 (K, KEP, L, MO, SAN, SAR); 1st Div., Tebakang, G. Mejar, *Yii & Othman* S. 46296 (SAR); 1st Div., G. Buri, *Yii* S. 44198 (K, KEP, L, MO, SAN, SAR). **BRUNEI:** G. Pagon Periok, *Ashton* BRUN 2504 (BRUN, SAR); Lamunin, Kuala Abang road, mile 8.5, *Ashton* BRUN 84 (BO, BRUN); Temburong, Kuala Belalong, *Wong* WKM 218 (BRUN, SAN). **KALIMANTAN:** W. Borneo, Grayau-Selimbau, *Afriastini* 1115 (BO); W. Kalimantan Province, G. Bentuang area, *Burley, Tukirin* et al., 2456 (BO); Kalimantan Barat, Pontianak, Bentiang, south of Kg. Madamag, *Gary Shea* 23752 (A, BO, CANB, K, L, P); Kalimantan Barat, Pontianak, Bentiang, NE. of Kg. Semame, *Gary Shea* 26275 (BO, CANB, L); Kalimantan Barat, Pontianak, Bentiang, near Kg. Semame, *Gary Shea* 26003 (BO, K, L); Kalimantan Barat, Pontianak, Bentiang, G. Malei, *Gary Shea* 27353 (BO, CANB, K, L); Kalimantan Barat, Bentiang, NE of Kg. Semame, *Gary Shea* 26190 (BO, CANB, L); Kalimantan Barat, Pontianak, Bentiang, near Kg. Semame, *Gary Shea* 26537 (BO, CANB, K, L); Kalimantan Barat, Pontianak, Bentiang, 2 km SE of Kg. Sejanjang, *Gary Shea* 23027 (BO, CANB, K,

L, P); Kalimantan Barat, *Hallier* 682 (BO); Landak, *Teysmann* 11230 (BO); Borneo *Teijsmann s.n.* (HLB 908.240-44) (BO); Landak, *Teysmann s.n.* (HLB 933.332-170) (BO).

The typically large leaves with cordate base and sepals densely covered with short yellowish brown appressed hairs are among the distinguishing characters of this species. This variety is widespread in Borneo.

var. strigosa Kobuski, J. Arn. Arb. 28 (1947) 66.

Type: *Clemens* 26229, Borneo, Sabah, Mt. Kinabalu, Dallas (holotype A; isotype L).

VERNACULAR NAME. *legai* (Iban).

DISTRIBUTION. Endemic to Borneo and known from Sabah, Sarawak and Brunei.

HABITAT. Hill to submontane forests on ridges and slopes, at altitudes up to 1550 m. On loam sandstone soils.

SPECIMENS EXAMINED—BORNEO. SABAH: Mt. Kinabalu, Dallas, *Clemens* 26229 (A, L). **SARAWAK:** 7th Div., Belaga, Dulit range, Ulu Sg. Kayan, *Dayang Awa & Yii* S. 46752 (K, KEP, L, SAR); Lawas, Ba Kelalau, Ulu Ugong, *Ilias* S. 26026 (K, L, SAN, SAR, SING); 2nd Div., Lubok Antu, Lanjak Antimau P.F., near Bukit Sengkajang, Sg. Jelok, *Paul Chai* S. 33993 (K, KEP, L, MO, SAN, SAR). **BRUNEI:** Amo, Bukit Belalong, *Dransfield* JD 7118 (BRUN).

Permanent strigose-hairs on the lower surface of the leaves is the main distinguishing character of this variety from *A. cordifolia* var. *cordifolia*. This variety is somewhat widespread in Borneo. However, it is threatened by logging activities and shifting cultivation in Sabah and Sarawak.

10. Adinandra crassifolia J.B. Sugau, *Sandakania* 16 (2005) 8.

Types: *Aban & Dewol* SAN 91608, Borneo, Sabah, Labuk Sugut, Meliau Range F.R. (holotype SAN; isotypes K, L).

DISTRIBUTION. Endemic to Borneo and known only from Sabah.

HABITAT. Hill forest on ultramafic soils, at altitudes up to 650 m.

SPECIMENS EXAMINED—BORNEO. SABAH: Labuk-Sugut, Meliau Range F.R., *Aban & Dewol* SAN 91608 (K, L, SAN); Sandakan, Telupid, upper Sg. Meliau, *Zainudin* 4932 (K, KEP, L, SAN, UKMB); Sandakan, Telupid, *Zainudin* 4924 (K, KEP, L, SAN, UKMB); Telupid, Karamuak, Bt. Tawai, *Mansus & Francis* SAN 108487 (SAN).

This species is rare, so far only found in areas of ultramafic geology near Telupid in Sabah. Superficially, it is very close to *A. dumosa* in having inconspicuous or hardly visible lateral veins on the lower leaf surface but differs by its thicker leaves and smaller flowers.

11. Adinandra dumosa Jack, Malay Misc. 2 (7) (1822) 50; Merrill, Str. Br. Roy. As. Soc. (1921) 391; Keith, Preliminary List of North Borneo Plant Names, North Borneo Forest Record No. 2 (1939) 11 & 116; Masamune, *Enumeration Phanerogamarum Bornearum* (1942) 471; Kobuski, J. Arn. Arb. 28 (1947) 55; Keith, Preliminary List of North Borneo Plant Names, North Borneo Forest record No. 2 (1952) 278; Browne, Forest Trees of Sarawak and Brunei (1955) 212; Hassan & Ashton, A check list of Brunei Trees (Anon) 54 & 88; Corner in Wong & Phillipps (eds.), Kinabalu Summit of Borneo (1996) 132; Meijer, Bot. News Bull., Sabah Forest Record No. 9 (1967) 83; Keng, Tree Flora of Malaya 3 (1978) 273; Cockburn, Trees of Sabah 2 (1980) 110; Anderson, A Checklist of The Trees of Sarawak (1980) 330; Whitmore *et al.*, Tree Flora of Indonesia Check List for Kalimantan 2, 1 (1990) 345; Kessler *et al.*, Checklist for a Tree Flora of the Balikpapan-Samarinda Area, East Kalimantan, Indonesia (1992) 74; Kessler *et al.*, Trees of the Balikpapan-Samarinda Area, East Kalimantan, Indonesia. A Manual to 280 Selacted Species (1994) 223; Argent *et al.*, Manual of the Larger and More Important Non-Dipterocarp Trees of Central Kalimantan Indonesia 2 (1997) 626.

Type: Jack did not designate any type specimen for his species. He only mentioned that the species was abundant in thickets throughout Sumatra and various parts of the Malay island.

Synonyms: *A. trichocoryna* Korth., *Verh. Nat. Gesch. Bot.* ed. Temminck (1840) 107; Miquel, *Fl. Ned. Ind.* 1 (2) (1859) 477; Merrill in J. Str. Br. Roy. As. Soc. (1921) 391; *A. jackiana* Korth., *Verh. Nat. Gesh. Bot.* ed. Temminck (1840) 106; *A. cyrtopoda* Miq., *Fl. Ned. Ind. Suppl.* 1 (1862) 478; *A. stylosa* Miq., *Fl. Ned. Ind. Suppl.* (1862) 478; *A. glabra* Miq., *Fl. Ned. Ind. Suppl.* (1862) 479; *A. trichocoryna* Korth. var. *parvifolia* Miq., *Ann. Mus. Bot. Lugd.-Bat.* 4 (1868) 103; *A. trichocoryna* Korth. var. *glabra* Miq., *Ann. Mus. Bot. Lugd.-Bat.* 4 (1868) 103; *A. tricocoryna* Korth. var. *stylosa* Miq., *Ann. Mus. Bot. Lugd.-Bat.* 4 (1868) 104; *A. trichocoryna* Korth. var. *cyrtopoda* Miq., *Ann. Mus. Bot. Lugd.-Bat.* 4 (1868) 104.

VERNACULAR NAME. *boh telikan* (Dusun-Brunei); *layau* (Kutai); *legai* (Iban); *marinkau* (Dayak Benung); *medang berunok* (Brunei-Tutong); *medang penagil* (Malay-Indonesia).

DISTRIBUTION. Sumatra, Peninsular Malaysia, Java, and Borneo. In Borneo, known from Sabah, Sarawak, Brunei and Kalimantan.

HABITAT. Mixed dipterocarp to montane forests, at altitudes up to 2160 m, on ridges and slopes. On sandstone-derived soils.

SPECIMENS EXAMINED—BORNEO. SABAH: Beluran, Bongaya F.R., *Aban & Kodoh* SAN 81963 (SAN), *Aban & Kodoh* SAN 81863 (SAN); Tawau, Ulu Sg. Serudong, *Aban* SAN 30646 (BO, K, KEP, L, PNH, SAN, SAR, SING); Jesselton, Pulau Gaya F.R., 250' alt., *Aban* SAN 42019 (A, NY, SAN); Tuaran, Kg. Suaman, 350' alt., *Aban* SAN 42049 (SAN); Ranau, KNP, sample plot summit trail, 6300' alt., *Aban* SAN 54214 (SAN), *Aban* SAN 54215 (SAN); Ranau, KNP, Agathis plot, *Aban* SAN 57723 (SAN); Ranau, Bukit Hampuan, 3500' alt., *Aban* SAN 61793 (SAN); Ranau, Kinabalu, summit trail, 6500' alt., *Aban* SAN 639974 (SAN); Ranau, Mt. Kinabalu, *Aban* SAN 76509 (K, L, SAN, SAR); Ranau, KNP, *Aban* SAN 79516 (SAN); Ranau, KNP, above power station, *Aban* SAN 79525 (A, K, KEP, L, SAN, SAR, SING); Beaufort, Mentanior, *Ahmad & Marsal* SAN 86121 (K, KEP, L, SAN, SAR, SING); Beaufort, Mentanior, *Ahmad & Marsal* SAN 84771 (K, KEP, L, SAN, SAR, SING); Beaufort, Weston, Bukit Siunggau, *Ahmad* SAN 80578 (K, L, SAN, SAR); Beaufort, Klias, *Ahmad* SAN 80721 (K, KEP, L, SAN, SAR, SING); Beaufort, Lumat, *Ahmad* SAN 84520 (K, L, SAN, SAR); Sandakan, Sepilok F.R., *Ah Wing* SAN 39045 (SAN); Sipitang, Merintaman SFI, *Amin & Heya* SAN 86253 (SAN); Sandakan, Kebun China, 500' alt., *Amin & Donggop* SAN 75561 (K, KEP, L, SAN, SAR, SING); Beaufort, H. S. Sipitang, *Amin* SAN 102654 (E, K, KEP, L, SAN); Weston, Forest near Brunei bay, *Amin* SAN 103079 (E, K, KEP, L, SAN); Beaufort, Jalan Laboh, Weston, 30 m alt., *Amin* SAN 103228 (SAN); Weston, Sianggau F.R., *Amin* SAN 105164 (E, K, KEP, L, SAN); Weston, Siunggau F.R., 35 m alt., *Amin* SAN 105971 (K, KEP, L, SAN); Sipitang, Melakis F.R., *Amin* SAN 114829 (E, K, L, SAN); Beaufort, mile 58, *Amin* SAN 114923 (K, KEP, L, SAN); Weston, Siunggau F.R., *Amin* SAN 98752 (SAN); Beaufort, Batu 56, 25 m alt., *Amin Sigun* SAN 126373 (E, K, KEP, L, SAN, SAR); Kota Belud, Kinabalu National Park, Marai-parai, *Anthea* et al., SNP 1739 (SAN, SNP); Sandakan, Sibuga forest, 150' alt., *Bakar* SAN 27718 (K, L, SAN); Ranau, KNP, Power station, summit trail, *Binideh* SAN 65177 (A, SAR, SING), *Binideh* SAN 65180 (SAN); Sandakan, Kebun China, *Binson & Hendry* SAN 62118 (SAN); Sandakan, Kebun Cina, 200' alt., *Binson & Hendry* SAN 61717 (SAN); Sandakan, Leila F.R., 250' alt., *Binson* SAN 61745 (SAN); Tawau, Membalua F.R., 150' alt., *Binson* SAN 63920 (SAN, SING); Sipitang F.D. Seungau, *Caudra* A 4065 (BO); Kinabalu, Bembangan river, 5000' alt., *Chew & Corner* RSNB 4445 (SAN); Mt. Kinabalu, Nunkok, *Clemens* 32724 (BO); Ranau, Kg. Nalumad, near Sg. Nalumad, *Daim* 867 (SAN, SNP); Papar, Ulu Kimanis, *Dewol & Talib* SAN 80513 (A, KEP, SAN, SAR, SING); Beaufort, Bukit Klias, *Dewol* SAN 80204 (SAN); Kalabakan, NBT logging area, *Fedilis* SAN 94737 (L, SAN, SAR); Kalabakan, Luasong road, mile 19, *Fedilis* SAN 96029 (K, L, SAN); Beaufort, Beaufort hill, 90' alt., *George Mikil* SAN 28068 (SAN); Beaufort, Kg. Inuman, 75' alt., *George Mikil* SAN 30223 (KEP, SAN, SAR); Jesselton, Pulau Gaya, *George Mikil* SAN 33761 (K, L, SAN); Penampang, Sunsuran trail, 980' alt., *George Mikil* SAN 37753 (BISH, K, L, SAN, SAR); Ranau, Kundasang, Sosopodon, 6600' alt., *George Mikil* SAN 38618 (K, L, SAN); Sandakan Mt. Walker, sample plot, *Singh* SAN 61600 (SAN); Ranau, Kinabalu National Park, riverine to Silau-silau trail, *Jamili* et al., SNP 0491 (SAN, SNP); Ranau, KNP, near HQ, 5500' alt., *Kanis & Sinaggul* SAN 51495 (SAN); Beaufort, Kg. Kaingaran, *Karim* SAN 78207 (K, L, SAN,

SAR, SING); Ranau, Mt. Kinabalu, *Kitayama* 3639 (SAN); Sandakan, northern hill of Sandakan city, 50–100 m alt., *Kokawa* 6415 (SAN); Jesselton, Bukit Padang, 300' alt., *Lajangah* SAN 33095 (BO, K, KEP, L, SAN, SAR, SING); Papar, Mandahan, Kimanis F. R., *Lajangah* SAN 33614 (BO, K, KEP, L, SAN, SAR, SING); Sandakan, Sepilok F.R., *Patrick & Sairin* SAN 64611 (SAN); Penampang, forest opposite Kg. Dungkahang, *Madani & George* SAN 120841 (E, K, KEP, L, SAN); Ranau, Tenompok, 4500' alt., *Madani* SAN 36781 (K, L, SAN); Sandakan, Sepilok F.R., *Madani* SAN 64545 (SAN); Beluran, Bidu-Bidu F.R., *Maikin* et al., SAN 130708 (SAN); Telupid, Bt. Tawai, Keramuak, *Mansus & Francis* SAN 108487 (SAN); Sandakan, Kebun Cina, *Meijer* SAN 122716 (SAN); Jesselton, Bukit Padang, *Meijer* SAN 19950 (SAN); Tawau, Agricultural station, mile 13 Apas road, 100' alt., *Pereira* SAN 44246 (SAN); Sandakan, Telupid road, mile 93, *Pitty & Binson* SAN 61717 (SAN); Beaufort, Lumat, *Binideh* SAN 63215 (K, L, SAN); Jesselton, Bukit Padang, 500'alt., *Putan & Tikau* SAN 33727 (K, KEP, L, SAN, SAR, SING); Jesselton, Bukit Padang, *s.coll* SAN 22644 (SAN); Sipitang, Merintaman F.R., *Saikeh* SAN 72329 (K, KEP, L, SAN, SAR, SING); Lumat estate, *Saikeh* SAN 73209 (K, L, SAN); Sandakan, Leila F.R., 400' alt., *Sam P.P.* SAN 20634 (SAN); Kota Kinabalu, Bukit Padang, 100 m alt., *Sato* 1356 (SAN); Keningau, Sepulut, *Sigin* et al., SAN 107929 (K, L, SAN); Jesselton, Pulau Gaya, 150' alt., *Sinanggol* SAN 40135 (K, L, SAN); Sandakan, Telupid, south of Agricultural station, 200' alt., *Sinanggol* SAN 53706 (SAN); Sandakan, near Sibuga road, 300'alt., *Sinanggol* SAN 38386 (A, BISH, KEP, SAN, SAR,SING); Sandakan, along north boundary Sepilok F.R., *Sing* SAN 34735 (SAN); Tawau, Tanjung F.R., 300'alt., *Singh* et al., SAN 48864 (SAN); Tambunan, Crocker Range, *Sugau* JBS 71 (A, E, HAST, K, KEP, L, PNH, SAN, SAR); Beaufort, Jimpanga Teck Hing Long logging area, 200' alt., *Termiji* SAN 90943 (K, KEP, L, SAN, SAR, SING); Ranau, Kinabalu National Park, proposed loop road, *Thomas & Patrick* SNP 0491 (SNP). **SARAWAK:** 4th Div., G. Mulu N.P. 1700 m alt., *Bernard* S. 38221 (K, KEP, L, MO, SAN, SAR); 4th Div., Mulu N.P., *Bernard* S. 38816 (K, KEP, L, MO, SAN, SAR); Bintulu, Marurong plateau, *Brunig* S. 8790 (K, L, SAR); Miri, Lambir hill F.R., *Dan* S. 4371 (SAR); 4th Div., Miri, Bintulu road, 20th mile Lambir Hill, Ulu Sg. Labau, 1210 m alt., *Ilias & Yeo* S. 38412 (K, KEP, L, MO, SAN, SAR); 5th Div., Lawas, Meligan range, path to Merapok along Sg. Masia, 3700' alt., *Ilias* S. 32874 (BO, K, KEP, L, SAN, SAR); Lawas, path to Mt. Murut, *Ilias* S. 26443 (E, K, L, SING); 5th Div., Lawas, Bukit Batanga at Meligan range, 4900' alt., *Ilias* S. 33033 (BO, K, KEP, L, SAN, SAR); 4th Div., Baram, Tutoh, G. Mulu N.P., *Martin* S. 37092 (K, KEP, L, MO, SAN, SAR); 4th Div., Tubau, Dataran tinggi Merurong, along path to Bukit Skelap, *Othman* et al., S. 48954 (K, KEP, L, MO, SAN, SAR); 4th Div., G. Mulu N.P., *Martin* MUS 185 (SAR); Bako N.P., path to Telok Pandan Kechil, 60 m alt., *Paul & Ilias* S. 17288 (A, BO, K, KEP, L, MEL, SAN, SAR, SING); 4th Div., G. Mulu N.P., Sg. Mentawai, *Paul* S. 39681 (A, K, KEP, L, MO, SAN, SAR); 1st Div., Lundu/Bau road, G. Raya, 380 m alt., *Yii & Jegong* S. 45987 (K, KEP, L, MO, SAN, SAR). **BRUNEI:** Belait, Andulau F.R., Compt. 7, near Sg. Liang, *Coode* 6773 (BRUN, L, SAR); Belait, Bukit Teraja, 290 m alt., *Coode* 6885 (BRUN, K, SAN); Belait, Labi road near start of track to Andulau F.R. *Niga* NN 39 (BRUN, SAN); Belait, Bukit Teraja, 275 m alt., *Sands* 5496 (BRUN); Tasik Merimbun,

Wong WKM 329 (BRUN, SAN). **KALIMANTAN:** Sampit, *Alston* 13161 (BO, L); W. Borneo, Singkawang, Zanpadang, *Dunselman* 106 (BO, L); Central E. Borneo, W. Koetai, summit of Mt. Kemoel, *Endert* 4393 (BO, L); Central E. Borneo, W. Koetai, *Endert* 4837 (BO, L); Kalimantan Tengah, Barito Ulu, *Kade* PBU 109 (BO, L); Borneo, *Korthals s.n.* (HLB 908.249-186) (BO, L); Borneo, *Korthals s.n.* (HLB 992.233-285) (BO, L); *Korthals s.n.* (HLB 908.249-181) (BO, L); *Korthals s.n.* (HLB 908.249 -182) (BO, L); Nunukan island, *Kostermans* 9063 (BO, L, SAN); Bulungan, Sg. Sebakis region, *Kostermans* 9257 (BO, SAN); W. Kutai, Mt. Palimasan, near Tabang, on Belajan river, *Kostermans* 12944 (A, BO, L); NE Borneo, Bt. Nunukan, *Kostermans* 9014 (BO, L); NE. Borneo, Nunukan island, *Kostermans* 8927 (BO, L), *Kostermans* 8967 (BO. L); E. Borneo, Tarakan, *Meijer* 2486 (BO; L); Nunukan, N. of Tarakan, near new forest garden, *Meijer* 2280 (BO, L); SE. Borneo, Nunukan, Subdistrict Tarakan, *Payamans* b.b. 34520 (BO, L); Borneo, *Ramli* 1986 (BO, L).

A study of the specimens borrowed from L showed that all Korthals' collections (*A. trichocoryna* Korth. HLB No. 908.249-193; *A. trichocoryna/obtusa* Korth. HLB No. 908.249-180; *A. trichocoryna* Korth. var. *acuta* bar code No. L. 0097477; *A. trichocoryna* Korth. var. *angustata* HLB No. 908.249-192; *A. trichocoryna* var. *obtusata* HLB No. 908-249-187) from Borneo belong to *Adinandra dumosa* Jack. This species is common in Borneo and the most widespread in Indo-Malesia.

This is the most widespread species of the genus and all the while had been identified based on Jack's original description.

12. Adinandra endertii Kobuski, J. Arn. Arb. 34 (1953) 126.

Type: *Endert* 4138, Borneo, Kalimantan, W. Koetai, near Kemoel (holotype A; isotypes BO, L).

VERNACULAR NAME. Not known.

DISTRIBUTION. Endemic to Borneo and confined to Kalimantan.

HABITAT. Submontane forest at altitudes up to 1600 m. Soil type not known.

SPECIMENS EXAMINED—BORNEO. KALIMANTAN: W. Koetai, near Kemoel, *Endert* 4138 (A, BO, L); Central East Borneo, W. Koetai, near Mt. Kemoel, *Endert* 4289 (BO, L).

This species is distinguished by its smallish and chartaceous leaves. The colour of the corolla is unknown. The number of series of the stamens is not certain. This species is rare, known only from two collections from W. Koetai, Kalimantan.

13. Adinandra excelsa Korth., *Verh. Nat. Gesch. Bot.* ed. Temminck (1840) 109; Miquel, *Fl. Ned. Ind.* 1, 2 (1859) 477; Szyszylowicz in *Nat. Pflanzenfam.* 3, 6 (1893) 189; Stapf in Trans. Linn. Soc. London 4 (1894) 133 (Flora Mt. Kinabalu); Merrill, J. Str. Br. Roy. As. Soc. (1921) 391; Melchior in *Nat. Pflanzenfam.* ed. 2, 21 (1925) 144; Masamune, *Enumeration Phanerogamarum Bornearum* (1942) 471; Kobuski, J. Arn. Arb 28 (1947) 59; Corner in Wong & Phillipps (eds.), Kinabalu Summit of Borneo (1996) 132; Meijer, Bot. News Bull., Sabah Forest Record No. 9 (1967) 85; Cockburn, Trees of Sabah 2 (1980) 110; Anderson, A Checklist of the Trees of Sarawak (1980) 330; Whitmore *et al.*, Tree Flora of Indonesia Check List for Kalimantan 2, 1 (1990) 345; Coode *et al.*, A Checklist of the Flowering Plants and Gymnosperms of Brunei Darussalam (1996) 317; Argent *et al.*, Manual of the Larger and More Important Non Dipterocarp Trees of Central Kalimantan Indonesia 2 (1997) 626.

Type: *Korthals s.n.*, Borneo, Kalimantan, Mt. Sakoembang and Pamatton (holotype L; isotypes G, NY).

VERNACULAR NAME. *boh telikan* (Dusun-Brunei); *medang berunok* (Brunei-Tutong); *tegewon, togowon* (Dusun-Kiau).

DISTRIBUTION. Endemic to Borneo and known in Sabah, Sarawak, Brunei and Kalimantan.

HABITAT. Mostly in hill mixed dipterocarp forest on ridges at altitudes up to 1734 m. Sometimes in the lowlands near forest fringes. On brownish black clay soils.

SPECIMENS EXAMINED–BORNEO. SABAH: Ranau, Kinabalu N.P., mile 35 Ranau road, 4500'alt., *Aban* SAN 60565 (SAN); Ranau, Kg. Kilimu, 2.5 miles off Ranau, along Poring road, 2000' alt., *Aban* SAN 60721 (SAN); Sipitang, 4 mile from Kg. Mandalong to Kg. Meligan, *Aban* SAN 72910 (K, L, SAN); Kota Marudu, near Kg. Torintidon, *Aban* SAN 99534 (SAN); Ranau, Paka, *Amin & Francis* SAN 116156 (SAN); Ranau, Mamut, *Amin & Francis* SAN 121085 (SAN); Ranau, Rugading, *Amin & Jarius SAN 116040* (E, K, KEP, L, PNH, SAN); Ranau, Lohan, *Amin & Jarius* SAN 120421 (SAN); Ranau, Kipolupu, *Amin & Soinin* SAN 129206 (K, SAN); Ranau, Ulu Tongod, *Amin & Soinin* SAN 95297 (K, L, SAN); Ranau, Mamut, *Amin & Suin* SAN 121472 (K, SAN); Ranau, near SIB church Ranau, *Amin & Suin* SAN 123286 (K, SAN); Ranau, Kituntul, *Amin* et al., SAN 123590 (K, KEP, L, SAN); Tawau, Ulu Apas, *Bakar* SAN 28607 (K, KEP, L, SAN, SAR, SING); Kinabalu eastern shoulder, *Chew, Corner & Stainton* RSNB 919 (SAN); Ranau, Bembangan river, *Chew & Corner* RSNB 4409 (SAN); Kinabalu, Mesilau cave, *Chew & Corner* RSNB 4690 (SAN); Kinabalu, eastern shoulder, 4000' alt., *Chew, Corner & Stainton* RSNB 41 (SAN); Ranau, Bembangan river, *Chew, Corner & Stainton* RSNB 1286 (SAN); Mt. Kinabalu, Dallas, *Clemens* 26165 (BO); Upper Kinabalu, *Clemens* 30202 =29073 (A); Sugut, Ulu Sg. Kaindangan, *Cockburn* SAN 82528 (A, BO, KEP, OXF, SAN,

SAR, SING); Lamag, Inarat, near draining G. Lotung, *Cockburn* SAN 83344 (A, K, KEP, L, SAN, SAR, SING); Sipitang, G. Lumaku F.R., *Dewol & Karim* SAN 77700 (A, K, L, SAN, SAR, SING); Keningau, Nabawan, *Dewol & Karim* SAN 78278 (SAN); Kota Belud, Kinabalu N.P. boundary, Kg. Podi, *Dolois & Paul* SNP 4253 (SAN, SNP); Ranau, Padang Pentululungon, *Francis & Stephen* SAN 49776 (SAN); Ranau, KNP, Kundasang, Mesilau trail, 4800'alt., *Francis Sadau* SAN 42831 (SAN); Ranau, KNP, near Kg. Nalumad, 1400' alt., *Francis Sadau* SAN 53852 (SAN); Southern slope of Mt. Kinabalu, *Fuchs & Collenette* 21399 (A, BO, CANB, G, K, L, SAR); Keningau, Trusmadi F.R., *Joseph* et al., SAN 124002 (SAN); Kota Belud, Kg. Kiau Nuluh, *Jusinin* 352 (SAN, SNP); Ranau, Bembangan, *Kitayama* 628 (SNP); Ranau, Nalumad, *Lajangah* SAN 28545 (SAN, BO); Ranau, Kinabalu, Hot Spring, *Lajangah* SAN 33886 (SAN); Ranau, Nalumad, 8 miles NE. of Ranau, 1700' alt., *Lajangah* SAN 28545 (BO, K, KEP, L, PNH, SAN, SAR); Ranau, Kinabalu, 6 miles to Hot Spring, 5200' alt., *Lajangah* SAN 33886 (K, KEP, L, SAN, SAR, SING); Ranau, mile 55.8, Poring road, 4500' alt., *Lajangah* SAN 44736 (K, L, SAN); Kota Belud, Melangkap, Tomis, 2 km from Melangkap Tomis, *Lorence* 2245 (SNP); Lamag, G. Lutong, near camp, south of lake, *Madani* SAN 88809 (K, L, SAN, SAR); Ranau, Kinabalu, N.P., 4 miles NE. of Poring, 2000' alt., *Meijer & Sadau* SAN 49780 (K, SAN); Ranau, Kg. Nalumad, 2000' alt., *Meijer* SAN 26486 (L, SAN); Ranau, KNP, Jalan Sosopodon, 4200' alt., *Meijer* SAN 48059 (SAN); Ranau, Mt. Tambuyukon, *Meijer* SAN 34639 (K); Beluran, Ulu Sg. Ogan, *Soinin* et al., SAN 107374 (K, L, SAN); Penampang, km 45 Tunggol, Penampang-Tambunan road, *Sumbing* SAN 131441 (E, KEP, L, SAN, SAR); Kota Belud, Kandasan, *Wood* et al., SAN 16213 (A, BO, BRI, K, KEP, L, SING). **SARAWAK:** 3rd. Div., Kapit, Balang/Balleh ridge, Bukit Tibang, *Ilias* S. 28755 (A, E, K, L, MEL); 4th Div., Baram, Kelabit, foot of Apo Duat, 1180 m alt., Paul S. 35499 (A, K, L, MO, SAN, SAR). **BRUNEI:** Temburong, Temburong river valley, *Johns* 7190 (BRUN, K, SAN). **KALIMANTAN:** E. Kalimantan, Secuoi road area, *Ambriansyah* AA 850 (BO); Borneo, Goenoeng Tjemara, *Abdul Rashid* 32445 (L); E. Borneo, Subdiv. W. Koetai, near Kg. Djembajan, *Endert* 1422 (L); E. Borneo, Subdiv. W. Koetai, near L. Iboet, *Endert* 2534 (L); E. Borneo, Subdiv. W. Kutai, near the Kemoel, *Endert* 4143 (L); Central E. Borneo, W. Kutai, *Endert* 4604 (L); E. Borneo, near Biham, Batoe Beng, *Endert* 2219 (L); Kalimantan Timur, S. foot of G. Batu Linanit, north of Long Bawan, Krayan, *Kato* et al., 10303 (L); Kalimantan Timur, G. Loan Api, NW of Long Bawan, Krayan, *Kato* et al., B 8164 (L); E. Kalimantan, NC area, road to Lubuk Tutung Jln. Beruang, *Kessler* et al., PK 1341 (BO); Borneo, *Korthals s.n.* (HLB 3) (L); Borneo, *Korthals s.n.* (HLB 908.249-194) (L); Borneo, *Korthals* s.n. (HLB 908.249-196) (L); Borneo, G. Pamatton, *Korthals s.n.* (HLB No. 908. 249-197) (G, L, NY); Borneo, *Korthals s.n.*, Carpologia *3088* (HLB 992.233-257) (L); Peak of Balikpapan, Beoul, *Kostermans* 7317 (L); Loa Haur, W Samarinda, *Kostermans* 6799 (L); Peak of Balikpapan, *Kostermans* 7375 (L); East Borneo, Sangkulirang district, Karangan river, *Kostermans* 13539 (L); E. Borneo, Loa Haur region, near Samarinda, *Kostermans* 9529 (A, BO, L, K, L, P, SING); Borneo, *Lam s.n.* (HLB 908.225.1268) (L); Borneo, *Lam s.n.* (HLB 908.225-12551) (L); E. Kalimantan, E. Kutai Reserve, vicinity of Sengkata & Mentoko river, *Leighton* 250 (L); E. Kalimantan, Lempaka, Tanah Merah,

Maskuri 180 (BO, K, L); Borneo, Bosch Sanggoel, *Soeriodikkerto* z.o.b 2425 (L); South Borneo, Desa Lano, Muara Uya, Kab. Tabalong, *Niniek Mulyati Rahayu* 680 (BO, L); Borneo, *Teijsmann s.n.* (HLB 908.225-1267) (L); Kalimantan, *van Balgooy* 5846 (BO); Borneo, Sungei Tarik, *Winkler* 3069 (L).

The specimen, *Korthals s.n.*, HLB No. 908. 249-197 from G. Pamatton, Kalimantan has subopposite (only 1 mm apart, not really 5 mm apart) bracteoles. This species, as well as its variety, shows an interesting leaf development. The leaf size is larger during the early development and becomes smaller when older. This species is also close to *A. sarosanthera* and *A. endertii* but differs by its less than 15 pairs of lateral veins from the former, and by its coriaceous and typically larger leaves from the latter. This variety is widespread in Borneo.

14. Adinandra inaequalis J.B. Sugau, *Sandakania* 16 (2005) 10.

Types: *Anderson* et al., S 15435, Borneo, Sarawak, Lundu, Bukit Gebong (holotype SAN; isotypes A, B, K, L, SAR).

DISTRIBUTION. Endemic to Borneo, only known from the type locality in Sarawak.

HABITAT. Lowland mixed dipterocarp forest, at about 100 m altitude.

SPECIMENS EXAMINED—BORNEO. SARAWAK: Lundu, Batang Gebong, *Anderson* et al., S. 15435 (A, B, K, L, SAN, SAR).

This species is rare, known only from the type locality from Batang Gebong in Sarawak. Vegetatively, it resembles *A. sarosanthera* in having oblong-elliptic leaves but can be easily distinguished by its distinctly unequal bracteoles. The distinctly unequal bracteoles are the main distinguishing character of the species.

15. Adinandra impressa Kobuski, J. Arn. Arb. 28 (1947) 54; Corner in Wong & Phillipps (eds.), Kinabalu Summit of Borneo (1996) 132; Meijer, Bot. News Bull., Sabah Forest Record No. 9 (1967) 84; Cockburn, Trees of Sabah 2 (1980) 110; Whitmore *et al.*, Tree Flora of Indonesia Check List for Kalimantan 2, 1 (1990) 345.

Type: *Clemens* 30202, Borneo, Sabah, Upper Mt. Kinabalu (holotype A; isotype K).

VERNACULAR NAME. Not known.

DISTRIBUTION. Endemic to Borneo and known only from Sabah.

HABITAT. Submontane to montane forest on Mt. Kinabalu at altitudes up to 2333 m. On ultramafic soils.

SPECIMENS EXAMINED—BORNEO. SABAH: Eastern shoulder, Kinabalu, *Chew, Corner & Stainton* RSNB 919 (SAN, SING); Ranau, Bembangan river, *Chew, Corner & Stainton* RSNB 1286 (SAN, SING): Mesilau cave, *Chew & Corner* RSNB 4690 (SAN, SING); Bembangan river, *Chew & Corner* RSNB 4409 (SAN, SING); Upper Kinabalu, *Clemens* 30202 (A, K); Ranau, Kinabalu, along road to Kamburongoh, 5500' alt., *George Mikil* SAN 38619 (K, L, SAN, SING); Ranau, Bambangan, *Kitayama* 682 (SNP); Ranau, Mt. Tambuyukon, *Meijer* SAN 34639 (SAN); Ranau, Kinabalu, Mesilau route, *Meijer* SAN 38053 (SAN); Ranau, Kinabalu, Mesilau route, 7000' alt., *Meijer* SAN 38053 (SAN); Ranau, Mt. Kinabalu, Mesilau, *Sugau* JBS 407 (E, K, KEP, L, SAN); Ranau, Mesilau river, *Chew & Corner* RSNB 4205 (SAN, SING); Ranau, Mesilau cave, *Chew & Corner* RSNB 4795 (A, K, SAN, SING); Ranau, Bambangan camp, *Chew & Corner* RSNB 4563 (SAN, SING); RSNB 4982 (SAN, SING).

The type specimen (*Clemens* 3020) consists of two entities; *A. impressa*, mounted on the left hand side and *A. clemensiae* on the right hand side. This species is close to *A. quinquepartita* except for its typically smaller leaves and dark purple colour of petals. This species is rare, known only from the Kinabalu area. The proposed new variety in Sugau (2001) falls under this taxon.

16. Adinandra kostermansii J.B. Sugau, *Sandakania* 16 (2005) 12.

Type: *Kostermans* 13458, Borneo, Kalimantan, Sangkulirang district, Mt. Medadam, N. of Sangkulirang (holotype L; isotypes A, BO, CANB, K, P, SING).

DISTRIBUTION. Endemic to Borneo and only known from the type locality in Kalimantan.

HABITAT. On limestone-derived soils at about 450 m altitude.

SPECIMENS EXAMINED—BORNEO. KALIMANTAN: East Borneo, Sangkulirang district, Mt. Medadam, N. of Sangkulirang, *Kostermans* 13458 (A, BO, CANB, K, L, P, SING).

This species is rare, so far known only from the type locality on limestone on Mt. Medadam, Kalimantan. It resembles *A. colombonensis* in having obovate-elliptic leaves but differs by its larger ovoid fruit and more-or-less symmetric leaf base.

The species is named after A. Kostermans, botanist in Bogor from 1938–1994 who collected the specimen.

17. Adinandra lenticellata J.B. Sugau, *Sandakania* 16 (2005) 14.

Type: *George Mikil* SAN 30284, Borneo, Sabah, Beaufort, Kawang, Kawang F.R. (holotype SAN; isotype K).

DISTRIBUTION. Endemic to Borneo and known from Sabah, Sarawak and Brunei.

HABITAT. Mixed dipterocarp forest, on hill sides and riverbanks, at altitudes up to 913 m. On sandstone-derived soils.

SPECIMENS EXAMINED—BORNEO. SABAH: Tambunan, Sg. Tikolod, *Binideh* SAN 55819 (SAN); Sipitang, Mandulong, *Ignasius* SAN 138902 (SAN); Kota Belud, Bukit Matindok, *Lajangah* SAN 32169 (BO, SAN); Beaufort, Beaufort Hill, *George Mikil* SAN 31973 (SAN, SAR); Beaufort, Kawang, *George Mikil* SAN 30284 (K, SAN). **SARAWAK:** Lubok Antu, Ulu Sg. Engkari, near Nanga Tibu School, *Paul Chai* S. 34122 (K, KEP, L, MO, SAN, SAR). **BRUNEI:** Temburong, Amo, Bukit Belalong, *Prance* 30563 (BRUN, SAN).

This species is somewhat widespread in the northwestern part of Borneo (Sabah, Sarawak and Brunei). The taxon was previously wrongly identified as *A. dumosa* in many herbaria. This species resembles *A. dumosa* in having only slightly conspicuous lateral veins but differs by its conspicuously lenticellate branchlets and typically large, oblong elliptic leaves with more than 20 pairs of lateral veins.

18. Adinandra longipedicellata J.B. Sugau, *Sandakania* 16 (2005)16.

Types: *Kodoh & Termiji* SAN 83617, Borneo, Sabah, Telupid, Telupid road, mile 87.5 (holotype SAN; isotypes K, L).

DISTRIBUTION. Endemic to Borneo and confined to Sabah.

HABITAT. In forest near riverbanks, at altitudes up to 2500 m altitude, on ultramafic soils.

SPECIMENS EXAMINED—BORNEO. SABAH: Telupid, Sg. Kun-Kun, Tangkulap, *Dewol & Maidil* SAN 124646 (K, SAN); Sandakan, Telupid, Telupid road, mile 87.5, *Kodoh & Termiji* SAN 83617 (K, L, SAN); Sandakan, Telupid road, mile 87.5, *Madani & Taha* SAN 83523 (K, L, SAN, SAR, SING); Beluran, Sg. Meliau, *Rahim* et al., SAN 99827 (K, L, SAN); Beluran, Ulu Tungud Forest Reserve, Sg Solonsong, *Sugau* SAN 145674 (K, KEP, L, SAN).

This species is rare, known only from the Telupid and Beluran area with ultramafic geology in Sabah. It resembles *A. excelsa* superficially but differs in its long and slender pedicels.

19. Adinandra magniflora Kobuski, J. Arn. Arb. 28 (1947) 79; Corner in Wong & Phillipps (eds.), Kinabalu Summit of Borneo. A revised and expanded ed. (1964) 132; Meijer, Bot. News Bull., Sabah Forest Record No. 9 (1967) 85; Whitmore *et al.*, Tree Flora of Indonesia Check List for Kalimantan 2, 1 (1990) 346.

Type: *Clemens* 32931, Borneo, Sabah, Mt. Kinabalu, Head of Dahobang (holotype A; isotype L).

Synonyms: *A. clemensiae sensu* Cockburn, Trees of Sabah 2 (1980) 108, *pro parte*; *A. clemensiae sensu* Anderson, A Checklist of Trees of Sarawak (1980) *pro parte., non* Kobuski (1947). *A. hullettii sensu* Anderson, A Checklist of Trees of Sarawak (1980) 330; *A. hullettii sensu* Whitmore *et al.*, Tree Flora of Indonesia Check List for Kalimantan 11, 1 (1990) 340, *non* King (1890)

VERNACULAR NAME. Not known.

DISTRIBUTION. Endemic to Borneo and known in Sabah, Sarawak and Kalimantan.

HABITAT. Mixed dipterocarp forest to submontane forest, at altitudes up to 2000 m, on ridges and slopes. On sandstone soils.

SPECIMENS EXAMINED—BORNEO. SABAH: Kota Belud, Kinabalu, Head of Dahobang, *Clemens* 32931 (A, L). **SARAWAK:** 1st Div., Lundu, G. Kanyi, *Dayang Awa & Ilias* S. 47344 (SAR); Kuching, G. Serapi, *Smythies* S. 12628 (A, K, KEP, L, SAN, SAR). **KALIMANTAN:** West Kalimantan, south of Pontianak, Palung Nature Reserve, *v. Balgooy & v. Setten* 5316 (L); Borneo, G. Kenepai, *Hallier* 1864 (L); Kalimantan Tengah, Barito Ulu, *Kade* PBU 211 (BO); Kalimantan Tengah, Barito Ulu, *Kade* PBU 335 (BO).

This is the only species with six petals. *A hullettii* King in Whitmore *et al.* (1990) which refers to *A. hulletti fide* Anderson (1980), is actually *A. magniflora* Kobuski. This species is close to *A. clemensiae* Kobuski except for its larger calyx.

20. Adinandra mendamitensis J.B. Sugau, *Sandakania* 16 (2005) 18.

Type: *Erwin & Othman* S. 32557, Borneo, Sarawak, 5th Div., Limbang, Ulu Mendamit (holotype SAN; isotypes BO, K, L, SAR, SING).

DISTRIBUTION. Endemic to Borneo and only known from the type locality in Sarawak.

HABITAT. Mixed Dipterocarp Forest, on the lower slopes of ridges, at about 305 m. On clay loam soils.

SPECIMENS EXAMINED—BORNEO. SARAWAK: 5th Div., Limbang, Ulu Mendamit, *Erwin & Othman* S. 32557 (BO, K, L, SAN, SAR, SING).

This species is rare, known only from the type locality in Sarawak (Ulu Mendamit). It superficially resembles *A. excelsa* but differs by its hairy young parts of the branchlets and longer pedicels. Although it is related to *A. longipedicellata* in having long pedicels, it differs by the hairy young parts of the branchlets.

It is named after Mendamit, the collection locality.

21. Adinandra meratusensis J.B. Sugau, *Sandakania* 16 (2005) 18.

Type: *de Vogel* 2039, Borneo, South Kalimantan, Meratus Mountains, ridge near G. Sarempaka (holotype L; isotype BO).

DISTIRIBUTION. Endemic to Borneo and only known from the type locality in Kalimantan.

HABITAT. On bare limestone rock, at about 1000 m altitude.

SPECIMENS EXAMINED—BORNEO. KALIMANTAN: Kalimantan Selatan, Meratus Mountains, ridge near G. Sarempaka, *de Vogel* 2039 (BO, L).

This is one of several species found on limestone. It is rare, known only from the type locality in Kalimantan (Meratus Mountains). This species is easily recognized by its widely obovate-elliptic leaves and hairy fruit. Vegetatively, it is close to *A. clemensiae* in having obovate-elliptic leaves but differs by its glabrous sepals.

22. Adinandra myrioneura Kobuski, J. Arn. Arb. 28 (1947) 83; Keith, Preliminary List of North Borneo Plant Names, North Borneo Forest Record No. 2. Second ed. (1952) 278; Meijer, Bot. News Bull., Sabah Forest Record No. 9 (1967) 83; Cockburn, Trees of Sabah 2 (1980) 108; Whitmore *et al.*, Tree Flora of Indonesia Check List for Kalimantan 2, 1 (1990) 346.

Type: *Puasa Angian* (BNBFD) 3885, Borneo, Sabah, Tambunan, Tambato (holotype A; isotype K).

VERNACULAR NAME. Not known.

DISTRIBUTION. Endemic to Borneo and known in Sabah, Sarawak and Kalimantan.

HABITAT. Lowland and hill mixed diptercarp forest at altitudes up to 1000 m. On ridges and slopes of undulating lands. On sandstone soils.

SPECIMENS EXAMINED—BORNEO. SABAH: Tenom, foot of G. Lumaku, *Ahmad & Binideh* SAN 65324 (SAN); Keningau, Crocker Range F.R., *Ahmad & Ejan* SAN 85408 (KEP, SAN, SAR); Tawau, Sg. Dumpas Umas 2, *Binideh* SAN 61405 (SAN); Tawau, Luasong, mile 27, main road, *Bongsu* SAN 63932 (SAN); Lamag, SE. of G. Lotung, Lake, Inarat, *Cockburn* SAN 83318 (A, K, KEP, KLU, SAN, SAR, SING); Ranau, Kinabalu National Park, 4 mile from Kg. Nalumad, *Daim* 510 (SAN, SNP); Kimanis, Crocker Range park, road to Keningau, *Dolois & Madi* SNP 07751 (SNP); Kalabakan, Luasong, km. 41, Imbak road, *Fedilis & Sumbing* SAN 95670 (KEP, L, SAN, SAR); Keningau, Ulu Sg. Pingas-Pingas, *Fedilis & Asik* SAN 110933 (SAN); Nabawan, *Ignasius* SAN 139658 (K, KEP, L, SAN, SAR); Lamag, Kinabatangan, camp Tengkong, mile 15, *Lasan* et al., SAN 70709 (SAN); Beaufort, Halogilat, Padas Gorge, *Madani* SAN 40469 (SAN); Kalabakan, km 24, Kalabakan road, *Matin & Sumbing* SAN 101459 (SAN, UKMB); Keningau, Trusmadi, *Meijer* SAN 122577 (SAN); Sandakan, Segaliud Lokan, *Nasrah & Clement* SAN 140472 (SAN); G. Lumaku, *Nooteboom* 1174 (SAN); *Puasa Angian* BNBFD 3885 (A, K); Keningau, Sapulut, *Sumbing* SAN 101320 (SAN); Keningau, Mendalom F.R., *Sumbing* SAN 125354 (K, SAN). **SARAWAK:** Baram, Ulu Melinau, *Ashton* BRUN 3225 (BO). **KALIMANTAN:** SE. Borneo, Nunukan, Subdistrict Tarakan, *Payamans* b.b. 34521 (L); SE. Borneo, Nunukan, Subdistrict Tarakan, *Payamans* b.b. 34509 (L).

A. myrioneura differs from *A. borneensis* by its evenly spaced lateral veins, less hairy on the young part of the branchlets, and smaller (4–6 mm long) and thinner sepals. This species is easily recognised by its numerous leaf lateral veins, growing abundantly in the lowland mixed dipterocarp forest in the central and southern parts of Sabah. It can reach a timber size tree. This species is also recorded for the first time from Ulu Melinau, Baram, Sarawak. This species is common in the southern part of Sabah to north eastern part of Sarawak and northern part of Kalimantan. Logging activity is the main threat to this species.

23. Adinandra nunkokensis Kobuski, J. Arn. Arb. 28 (1947) 70; Corner in Wong & Phillipps (eds.), Kinabalu Summit of Borneo (1996) 132; Meijer, Bot. News Bull., Sabah Forest Record No. 9 (1967) 85; Whitmore *et al.*, Tree Flora of Indonesia Check List for Kalimantan 2, 1 (1990) 346.

Type: *Clemens* 32900, Borneo, Sabah, Mt. Kinabalu, Mt. Nunkok (holotype A; isotype L).

VERNACULAR NAME. Not known.

DISTRIBUTION. Endemic to Borneo and restricted to Sabah. It is known only from the type specimen.

HABITAT. Submontane to montane forest on ridges and slopes, at altitudes up to 2500 m. On granite derived soils.

SPECIMENS EXAMINED—BORNEO. SABAH: Mt. Kinabalu, Mt. Nunkok, *Clemens* 32900 (A, L).

This species resembles *A. subsesilis* but differs by its ovate and broadly acute apex of the sepals, young part of branchlets covered with short hairs and leaves with less than 10 pairs of lateral veins which are not arching near the margin. This species is rare, known only from one collection from Mt. Nunkok in the Kinabalu area in Sabah.

24. Adinandra pangiensis J.B. Sugau, *Sandakania* 16 (2005) 21.

Type: *Ahmad* SAN 50511, Borneo, Sabah, Tenom, Pangi, mile 79 (holotype SAN).

DISTRIBUTION. Endemic to Borneo and confined to Sabah.

HABITAT. Lowland mixed dipterocarp forest on ridges, at altitudes up to 305 m. On yellow sandstone soils.

SPECIMENS EXAMINED—BORNEO. SABAH: Tenom, Pangi, mile 79, *Ahmad* SAN 50511 (SAN); Beaufort, Landing area Rayoh, *Saikeh* SAN 72152 (K, SAN).

This species is endangered in conservation terms, known only from two collections from southwestern Sabah. The main threat to this species is logging. It resembles *A. myrioneura* and *A. borneensis* in having many lateral veins (20–26 pairs) but differs from both species by the glabrous young parts of branchlets and persistent bracteoles.

25. Adinandra plagiobasis Airy-Shaw, Kew Bull. Misc. Inform. (1939) 504; Masamune, *Enumeration Phanerogamarum Bornearum* (1942) 471; Kobuski, J. Arn. Arb. 28 (1947) 80; Whitmore *et al.*, Tree Flora of Indonesia Check List for Kalimantan 2, 1 (1990) 346.

Type: *Richards* 1191, Borneo, Sarawak, Mt. Dulit (Ulu Tinjar), near Long Kapa, on side of steep ridge in primary rainforest (holotype K; isotype A).

VERNACULAR NAME. *laban, pungo* (unknown dialect in Sarawak).

DISTRIBUTION. Endemic to Borneo and restricted to Sarawak. This species is rare, known only from the type collection from Mt. Dulit in Sarawak.

HABITAT. Hill mixed dipterocarp forest on side of steep ridges, at about 1500 m altitude. Soil type not known.

SPECIMENS EXAMINED—BORNEO. SARAWAK: Mt. Dulit (Ulu Tinjar), near Long Kapa, *Richard* 1191 (A, K).

This species is easily recognised by its narrowly oblong-elliptic to sublanceolate leaves with asymmetric cordate base.

26. Adinandra quinquepartita Kobuski, J. Arn. Arb. 28 (1947) 53: Corner in Wong & Phillipps (eds.), Kinabalu Summit of Borneo (1996) 132; Meijer, Bot. News Bull., Sabah Forest Record No. 9 (1967) 84; Cockburn, Trees of Sabah 2, (1980) 110; Whitmore *et al.*, Tree Flora of Indonesia Check List for Kalimantan 2, 1 (1990) 346.

Type: *Clemens* 50781, Borneo, Sabah, Mt. Kinabalu, Gurulau spur (holotype A; isotypes K, L).

Synonyms: *A. impressa sensu* Cockburn, Trees of Sabah 2 (1980) 110, *pro parte, non* Kobuski (1947); *A. sarosanthera sensu* Cockburn, Trees of Sabah 2 (1980) 110, *pro parte, non* Miq. (1859).

VERNACULAR NAME. Not known.

DISTRIBUTION. Endemic to Borneo, this species is rare, known only from the Kinabalu area in Sabah.

HABITAT. Submontane to montane forest, at altitudes up to 2300 m in open places. On ultramafic soils.

SPECIMENS EXAMINED—BORNEO. SABAH: Ranau, East Mesilau, north of Golf course, *Ansow & Yapuk* SNP 3811 (SAN, SNP); Mt. Kinabalu, Gurulau spur, *Clemens* 50781 (A, K, L); Mt. Kinabalu, southern slope, Sg. Mesilau, underneath the Mesilau cave, *Collenette* 23599 (A, BO, CANB, G, K, L, SAR); Mt. Kinabalu, southern slope, Sg. Mesilau, underneath the Mesilau cave, *Collenette* 21599 (A, BO, CANB, G, K, L, S, SAR, US); Mt. Kinabalu, southern slope, Sg. Mesilau, above Mesilau cave, *Fuch & Collenette* 38571 (SAN); Ranau, Kinabalu, Mesilau, *Kokawa & Hotta* 4061 (SAN).

Leaf lateral veins on the upper surface are impressed or sunken when dry. This species is close to *A. impressa* but differs by its typically larger leaves; creamy white petals, and sparsely hirsute anthers.

27. Adinandra rubiginosa Kobuski, J. Arn. Arb. 34 (1953) 130–131.

Type: *Endert* 3869, Borneo, Kalimantan, W. Koetai, near Kemoel (holotype A; isotypes BO, L).

VERNACULAR NAME. Not known.

DISTRIBUTION. Endemic to Borneo and restricted to Kalimantan. Only known from the type specimen from W. Koetai in Kalimantan.

HABITAT. Mixed dipterocarp forest on steep slopes, at about 1500 m altitude. Soil type not known.

SPECIMENS EXAMINED—BORNEO. KALIMANTAN: Subdivision W. Koetai, near Kemoel, *Endert* 3869 (A, BO, L).

This species is easily recognised by its chanelled or grooved midrib on the lower side and reddish brown hairs all over the young parts and under surface of the leaf. The type specimen has only very young flower buds.

28. Adinandra sadaui J.B. Sugau, *Sandakania* 16 (2005) 23.

Type: *Francis* SAN 49211, Borneo, Sabah, Ranau, Togudon Paginatan Road (holotype SAN; isotypes A, B, K, KEP, L, SAR).

DISTRIBUTION. Endemic to Borneo and only known from the type locality in Sabah.

HABITAT. Mixed dipterocarp forest, on hillsides at about 350 m altitude. On mudstone and alluvium soils.

SPECIMENS EXAMINED—BORNEO. SABAH: Ranau, Togudon-Paginatan road, *Francis* SAN 49211 (A, B, K, KEP, L, SAN, SAR).

This species is known from only one collection with flower buds and fruits. It is close to *A. colombonensis* in having obovate-elliptic leaves but differs by its more-or-less symmetric leaf base and larger seeds (6–7 mm across).

29. Adinandra sarosanthera Miq., Fl. Ned. Ind. 1 (2) (1859) 477; Szyszylowicz in *Nat. Planzenfam.* 3, 6 (1893) 189; Merrill, J. Str. Br. Roy. As. Soc. (1921) 391; Melchior in *Nat. flanzenfam.* ed. 2, 21 (1925) 144; Masamune, *Enumeration Phanerogamarum Bornearum* (1942) 471; Kobuski, J. Arn. Arb. 28 (1947) 62; Corner in Wong & Phillipps (eds.), Kinabalu Summit of Borneo (1996) 132; Meijer, Bot. News Bull., Sabah Forest Record No. 9 (1967) 84; Keng, Flora of Thailand 2, 2 (1972) 152, Tree Flora of Malaya 3 (1978) 280; Cockburn, Trees of Sabah 2 (1980) 108; Whitmore *et al.*, Tree Flora of Indonesia Check List for Kalimantan 2, 1 (1990) 346; Turner in Gardens' Bulletin Singapore 47, 2 (1995) 482; Argent *et al.*, Manual of the Larger and More Important Non Dipterocarp Trees of Central Kalimantan Indonesia 2 (1997) 626.

Type: *Korthals s.n.* (HLB No. 908. 246-444), Borneo, Kalimantan, near Doesson river and near Mt. Pamatton (holotype L; isotype G).

Synonyms: *Sarosanthera excelsa* Korth., *Verh. Nat. Gesh. Bot.* ed. Temminck (1840) 104. *A. lamponga* Miq., *Fl. Ned. Ind.* Suppl. 1 (1862) 479; Szyszylowicz in *Nat. Pflanzenfam.* 3, 6 (1893) 189 as "*lampango*"; Melchior in *Nat. Pflanzenfam.* ed. 2, 21 (1925) 144.

VERNACULAR NAME. Not known.

DISTRIBUTION. Thailand and Peninsular Malaysia (Keng, 1972), Sumatra and Java (Kobuski, 1947) and Borneo. In Borneo, known from Sabah and Kalimantan.

HABITAT. Hill mixed dipterocarp forest, on ridges of undulating lands at altitudes up to 800 m. On sandstone and alluvial soils.

SPECIMENS EXAMINED—BORNEO. SABAH: Tawau, Elphinstone Prov., *Elmer* 21629 (A). **KALIMANTAN:** Borneo, b.b. 2108 (L); Borneo, Kapuas, b.b. 9458 (SAN); North of Meratus Mountain, near G. Sarempaka, *de Vogel* 1925 (L); E. Borneo, Subdiv. W. Kutai, near Mt. Antjalong, *Endert* 2138 (L); Central E. Borneo, W. Koetai, near Lahoen, *Endert* 1835 (L); *Korthals s.n.* (HLB No. 3) (L); Borneo (exact locality lacking), *Korthals s.n.* (HLB No. 908.246-371) (L); HLB No. 908.246-434 (L); Kalimantan, near Doesson river and near Mt. Pamatton, *Korthals s.n.* (HLB No. 908. 246-444) (G, L); E. Borneo, E. Kutai, sangkulirang Subdiv., Along Menubar, *Kostermans* 5115 (L); E. Borneo, E. Kutai, Sangkulirang Subdiv., G. Tepian Logang on Menubar river, *Kostermans* 5306 (L); E. Borneo, Berouw, Mt. Ilias Bungaan, *Kostermens* 13877 (L).

This species is easily recognised by its evenly spaced leaf lateral veins and shiny leaf upper surface. The seeds are flattened-discoid and large.

Miquel (1859) reduced the genus *Sarosanthera* to *Adinandra* and renamed *S. excelsa* Korth. as *Adinandra sarosanthera* Miq. because the species epithet "*excelsa*" in the genus *Adinandra* was preoccupied by *Adinandra excelsa* Korth. (1840). Merrill (1921), Masamune (1942) and Anderson (1980) had wrongly spelt the species as *A. sarcosanthera* Miq. Anderson (1980) had also wrongly identified specimens collected from mixed dipterocarp forest and kerangas in West Sarawak as *A. sarcosanthera* Miq. The present study finds that none of the specimens from Sarawak belongs to *A. sarosanthera* Miq. This species is somewhat widespread in Borneo and in Indo-Malesian region. Keng (1972) stated that this species also occurred in Peninsular Malaysia and Thailand. The specimens from Peninsular Malaysia, Thailand, Sumatra and Java were, however, not examined, but Keng's and Kobuski's description on the species and its habitat, matched with that of *A. sarosanthera* Miq.

30. Adinandra subsessilis Airy-Shaw, Kew Bull. Misc. Inform. (1939) 505; Masamune, *Enumeration Phanerogamarum Bornearum* (1942) 471; Kobuski, J. Arn. Arb. 28 (1947) 66; Corner in Wong & Phillipps (eds.), Kinabalu Summit of Borneo (1996) 132; Meijer, Bot. News Bull., Sabah Forest Record No. 9 (1967) 83; Cockburn, Trees of Sabah 2 (1980) 107. Anderson, A Checklist of the Trees of Sarawak (1980) 330; Whitmore *et al.*, Tree Flora of Indonesia Check List for Kalimantan 2, 1 (1990) 346.

Type: *Native Collector* (*Richards* 1958) Borneo, Sarawak, Mt. Dulit (holotype K; isotype A).

VERNACULAR NAME. *parik, tavango* (Kayan).

DISTRIBUTION. Endemic to Borneo and confined to Sabah and Sarawak, widespread.

HABITAT. Mixed dipterocarp to montane forest, on slopes and ridges, at altitudes up to 2000 m. On sandstone soils.

SPECIMENS EXAMINED—BORNEO. SABAH: Tawau, Serudong, Ulu Sungai, *Aban* SAN 31203 (SAN); Keningau, Nabawan, Witti range Tiulon, plot 17, *Aban* et al., SAN 64820 (K, KEP, SAN); Sandakan, Telupid road, mile 83, 500' alt., *Ahmad & Termiji* SAN 62410 (SAN); Ranau, Nabutan, *Amin* et al., SAN 129330 (K, KEP, SAN); Keningau, Witti range area, Ulu Sg. Mantuluk, *Asik* SAN 113264 (SAN); Keningau, Logging area Lanas, *Asik* SAN 119637 (SAN); Tawau, Quoin hill, 200' alt., *Bakar* SAN 18527 (K, L, SAR); Tawau, Bombalai F.R., *Binson & Bongsu* SAN 62782 (SAN); Tenom, Kemabong-Katubu track, mile 4.5, *Cockburn & Saikeh* SAN 70042 (SAN); Lamag, Inarat, G. Lotung, 1250, *Cockburn* SAN 83078 (A, BO, K, KEP, OXF, SAN, SAR, SING); Sandakan, Telupid, mile 85, *Dewol* SAN 71491 (K, L, SAN, SAR, SING); Nabawan, Sepulut, Sg. Siburan, *Dewol & Lideh* SAN 114578 (K, KEP, L, SAN); Keningau, Ulu Sg. Tingalan, *Fedilis & Asik* SAN 113058 (K, KEP, L, SAN); Nabawan, Sg. Maadum, *Fidilis & Sumbing* SAN 118850 (SAN); Tenom, Mendalom F.R., *Fidilis* SAN 120339 (SAN); Keningau, Crocker range, mile 16, Kimanis road, *Fidilis* SAN 120579 (SAN); Keningau, Ulu Sg. Putih, *Fidilis* SAN 125427 (SAN); Ranau, Kinabalu, below Layang-Layang, *George Mikil* SAN 46582 (SAN); Tongod-Kinabatangan, Imbak camp, *Ignatius & Ramlan* SAN 138183 (SAN); Tambunan, Trusmadi tambahan dua, *Joseph & Donggop* SAN 130209 (E, K, KEP, L, PNH, SAN); Tawau, Sg. Pang Burung proposed F.R., 300' alt., *Madani & Saikeh* SAN 67661 (SAN); Mostyn, Sepang ayer, Sepit Batu, 200' alt. *Madani* SAN 53145 (SAN); Tawau, Quoin Hill, Agriculture station, 600' alt., *Meijer* SAN 29520 (SAN); Lahad Datu, 500' alt., *Tahir* SAN 29670 (BO, K, KEP, L, PNH, SAR, SING); Keningau, Sepulut F.R., Tekala area, Sigin & Fedilis SAN 69062 (K, SAN); Keningau, Tambulanon, *Sigin* SAN 68588 (SAN); Keningau, Sepulut F.R., *Sigin* SAN 69072 (A, OXF, SAN); Keningau, Pinangah F.R., *Sumbing* SAN 110107 (K, SAN); Nabawan, Sg. Milian, *Sumbing* SAN 118573 (SAN); Keningau, Nabawan, Tiulon, *Termiji & Dewol* SAN 83895 (K, L, SAN). **SARAWAK:** 4th Div.,

Bintulu, Tubau, Ulu Jelutong, B. Sehiwa, *Abang Mohtar* et al., S. 54213 (SAR); 5th Div., Limbang, G. Pagon, path to G. Pagon Periok, *Dayang Awa & B. Lee* S. 47602 (K, KEP, L, MO, SAN, SAR); Mt. Dulit, Native collector (*Richards* 1958) (A, K).

This species is close to *A. nunkokensis* but differs by its narrowly ovate sepals with narrowly acute apex and with long erect hairs on the young parts of the branchlets.

31. Adinandra tomentosa J.B. Sugau, *Sandakania* 16 (2005) 25.

Type: *Martin* S. 37134, Borneo, Sarawak, 1st Div., G. Santubong (holotype SAN; isotypes A, K, KEP, L, SAR).

DISTRIBUTION. Endemic to Borneo and only known from the type locality G. Santubong in Sarawak.

HABITAT. Hill forest, at about 650 m. On sandstone-derived soils on slopes.

SPECIMENS EXAMINED—BORNEO. SARAWAK: 1st Div., G. Santubong, *Martin* S. 37134 (A, K, KEP, L, SAN, SAR).

It is readily recognized by its brownish appressed hairs all over the young parts of the tree. This species resembles *A. subsessilis* in having oblong-elliptic leaves and hairy young parts of branchlets, but differs by its brownish appressed hairs all over the young parts of the tree, and thicker petioles.

32. Adinandra verrucosa Stapf, Hooker's Icon. Pl. (23) (1893): t 2266; in Tran. Linn. Soc. Bot. 2, 4 (1894) 133 (Flora of Mt. Kinabalu); Merrill, J. Str. Br. Roy. As. Soc. (1921) 391; Masamune, *Enumeration Phanerogamarum Bornearum* (1942) 471; Kobuski, J. Arn. Arb. 28 (1947) 58–59; Keith, Preliminary List of North Borneo Plant Names. North Borneo Forest Record No. 2. Second ed. (1952) 278; Corner in Wong & Phillipps (eds.), Kinabalu Summit of Borneo (1996) 132; Meijer, Bot. News Bull., Sabah Forest Record No. 9 (1967) 83; Cockburn, Trees of Sabah 2 (1980) 107; Anderson, A Checklist of the Trees of Sarawak (1980) 330; Whitmore *et al.*, Tree Flora of Indonesia Check List for Kalimantan 2, 1 (1990) 346.

Type: *Haviland* 1101, Borneo, Sabah, Mt. Kinabalu (holotype K; isotype not certain, Haviland deposited his collections from Mt. Kinabalu at K).

VERNACULAR NAME. *boh telikan* (Dusun-Brunei), *legai* (Iban); *medang berunok* (Brunei-Tutong); *tagowon* (Dusun-Kiau).

DISTRIBUTION. Endemic to Borneo and restricted to Sabah, known only from high elevations on Mt. Kinabalu.

HABITAT. Montane forest, at about 2000 m altitude on Mt. Kinabalu. On ridges and slopes. On granite-derived soils.

SPECIMENS EXAMINED—BORNEO. SABAH: Kinabalu, Eastern shoulder, *Chew, Corner & Stainton* RSNB 904 (BO, SAN, SAR); Kinabalu, Eastern shoulder, *Chew, Corner & Stainton* RSNB 1100 (SAN); Mt. Kinabalu, Paka cave to Lobang, *Clemens* 10735 (A); Ranau, Kinabalu, below Layang-Layang camp, *George Mikil* SAN 46582 (SAN); Mt. Kinabalu, *Haviland* 1101 (K); Kinabalu, Carson camp, *Hotta* 3844 (SAN); Ranau, Kundasang, *Meijer* SAN 21984 (SAN); Mt. Kinabalu, near Kamburanga, *Smythies* S. 10631 (SAN); Kinabalu, Mentaki ridge, RSNB 7145 (SAN, SING).

This species is easily recognized by its sturdy branchlets and petiole; the leaves are thickly coriaceous with channeled or grooved midrib on the lower side of dried leaves.

Indeterminate specimens

The following specimens do not match any known species in the present paper. However, the material is inadequate or too incomplete for description as new species.

1. *Ilias Paie* S. 16366, Borneo, Sarawak, Serian, Gn. Penrissen (A, B, K, L, M, S, SAN, SAR). Close to *A. subsessilis* but differs by its appressed short hairs on the young part of branchlets.
2. *Meijer* SAN 19950, Borneo, Sabah, Jesselton, Bukit Padang (K, SAN). Close to *A. dumosa* but differs by its conspicuously lenticellate branchlets.
3. *Paul Chai* S. 39646, Borneo, Sarawak, 4th Div., Gn. Mulu National Park, Ulu Sg. Berar (A, K, KEP, L, MO, SAR). Close to *A. colombonensis* but differs by its more-or-less symmetric leaf base.
4. J. *& M.S. Clemens* 31014, Borneo, Sabah, Kota Belud, Mt. Kinabalu, Penibukan (BO). Close to *A. borneensis* but differs by its dense hairiness on the young parts of branchlets and very conspicuous tertiary venation.
5. *Chew, Corner & Stainton* RSNB 1610, Borneo, Sabah, Mt. Kinabalu, Ulu Langanan, Mamut river. Close to *A. colombonensis* but differs by its more-or-less symmetric leaf base, leaf lateral veins raised on both surfaces, and hairy pedicel (in bud).

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The edible Cucurbitaceae of Thailand and Malesia and the wild forms of the cultivated ones

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Summary. An enumeration of the 27 wild and cultivated edible species in Asia and Malesia, belonging to 15 genera of the family Cucurbitaceae is presented. Seven new forms are recognized including six for wild representatives: *Citrullus lanatus* (Thunb.) Matsum. & Nakai f. *amarus* (Schrad.) W.J. de Wilde & Duyfjes, *Cucumis melo* L. f. *agrestis* (Naudin) W.J. de Wilde & Duyfjes, *Cucumis sativus* L. f. *hardwickii* (Royle) W.J. de Wilde & Duyfjes, *Luffa acutangula* (L.) Roxb. f. *amara* (Roxb.) W.J. de Wilde & Duyfjes, *Luffa aegyptiaca* Mill. f. *sylvestris* (Miq.) W.J. de Wilde & Duyfjes, *Momordica charantia* L. f. *abbreviata* (Ser.) W.J. de Wilde & Duyfjes. Furthermore, all cultivars of the Wax Gourd appear to belong to the form *Benincasa pruriens* (Parkinson) W.J. de Wilde & Duyfjes f. *hispida* (Thunb.) W.J. de Wilde & Duyfjes.

Edible Cucurbits can be gathered from the wild, but they are mostly cultivated. Recognising their importance, Alefeld (1866) had enumerated the cultivated Cucurbits in Europe. The cultivated Cucurbits in SE Asia originated either from their own wild Asian stock, or had been introduced from other continents. In most cases, a wild progenitor of a cultivated Cucurbit is not directly evident, but wild forms or obviously most closely related wild species, can be indicated.

It remains unclear whether the wild forms of cultivated species are to be regarded as the truly wild botanical progenitors of the cultivated ones, or if they are to be regarded as feral forms that may have evolved later on by degeneration or retrogression from the original cultivated forms of unknown origin (Whitaker & Davis, 1962; Walters & Decker-Walters, 1988). As a matter of fact, a number of Cucurbit species were described for the first time

from plants found originally in cultivation, which implies that such names (and further subdivisions) may fall under the rules for cultivated plants, which are at present being developed as a system with a name code alongside the rules operative under the International Code of Botanical Nomenclature.

According to those concerned with cultivated plants, cultivated material belongs to a "culton" (or "cultigenous species" or "cultispecies") containing cultivars, not participating in evolution. "Culton" should then be opposed to the term "taxon" (composed of materials from the wild) which is an evolutionary entity. However, well-established correctly published names cannot be discarded without great nomenclatural disturbance.

During our taxonomic revision work on Cucurbitaceae, we have found it convenient to make distinction between the cultivated form which can be found as an escape in the wild, and the truly wild form. Generally these two categories are quite distinct, but on closer look, they intergrade morphologically. As such, we feel that within each species, the distinction of the cultivated plants from the wild ones only merit the rank of form (forma), i.e. a botanical wild form and a cultivated form. This view was already expressed by Meeuse (1962) in a note under *Citrullus lanatus*, the Watermelon. We do not follow authors like Grebenščikov (1986) for *Momordica charantia*, Kirkbride (1993) for *Cucumis melo*, or Merrick (1990) for *Cucurbita argentea*, who accept the rank of subspecies for the wild form, but we use consistently the rank of forma within all species known as cultivated.

For Thailand and Malesia, the 15 genera listed below, comprising 27 species, are relevant, but still more truly wild species may be found locally used for vegetables or drugs. The genus *Praecitrullus* with one species known only in cultivation in India, can be expected in our area in the future. Those genera introduced from outside Asia are marked with an asterisk.

In several cases, the formal status as forma for the wild plants is proposed here for the first time. For the genera *Gynostemma, Hodgsonia, Momordica, Siraitia* and *Trichosanthes* which have been recently treated taxonomically by the authors, full genus and species descriptions are left out; only the literature references are given.

1. *Benincasa* Savi
2. **Citrullus* Schrad.
3. *Coccinia* Wight & Arn.
4. *Cucumis* L.
5. **Cucurbita* L.
6. **Cyclanthera* Schrad.
7. *Gynostemma* Blume
8. *Hodgsonia* Hook. f. & Thomson
9. **Lagenaria* Ser.
10. *Luffa* Mill.

11. *Momordica* L.
12. *Praecitrullus* Pangalo
13. **Sechium* P. Browne
14. *Siraitia* Merr.
15. *Trichosanthes* L.

1. **Benincasa** Savi

Benincasa Savi (1818) 158. Type: *Benincasa cerifera* Savi.

Stout herbaceous annual climber; monoecious (sometimes flowers hermaphroditic); plant hairy. Probract present. Tendrils branched. Leaves simple. Flowers: solitary, long-pedicelled, large; petals free, yellow. *Male flowers*: receptacle-tube shallow; sepals entire or serrate, recurved; petals large, obovate, margin entire; stamens 3, inserted towards the base of the receptacle-tube; filaments free, short, anthers all 2-thecous, exserted, thecae flexuous, connective broad, thin, 3-lobed; disc absent or low. *Female flowers*: perianth as in male flowers; ovary ovoid or narrowly ellipsoid, densely hairy, style short, thick, inserted on disc, stigma robust; ovules numerous, horizontal; staminodes present, sometimes with reduced anthers. Fruit a pepo, large, indehiscent. Seeds: numerous, flat, margin only slightly thickened.

The genus *Benincasa* Savi is monotypic with the only species *B. pruriens* (Parkinson) W.J. de Wilde & Duyfjes, of Asian-Pacific origin. It is mainly known as widely cultivated, for its edible fruits in several forms or cultivars. Its precise area of origin is unknown, but it is speculated to be China, India, Indochina, or most probably, the Pacific. The fruits are usually large, (green or) white with a waxy skin, and greatly varying in shape and size: subglobose or broadly ellipsoid, 10 cm diameter or more, to elongate up to 120 cm long. Fruits much smaller than 10 cm diameter were mentioned only in more recent literature (Telford, 1982; Whistler, 1990; Rifai & Reyes, 1993; Marr *et al.*, 2007) and can be seen in several herbarium-collections from different localities. Telford (1982, f. 38A–E) described under the name *B. hispida* a wild population of NE Queensland originally published by Mueller (1868) as *Cucurbita vacua*. De Wilde & Duyfjes (2007b) recognized the small-fruited wild populations as the wild form, f. *pruriens*; all cultivated plants belong to f. *hispida*.

1. Benincasa pruriens (Parkinson) W.J. de Wilde & Duyfjes (2007b) 268.
Cucurbita pruriens Parkinson (1773) 44; Merr. (1954) 350.
Cucurbita pruriens Sol. in G. Forst., (1786) 92, *nom. nud.*
Benincasa hispida (Thunb.) Cogn. var. *pruriens* (Parkinson) Whistler (1990) 119, *nom. inval.* Type: *Banks & Solander s.n.* (holo BM, not seen).
Benincasa hispida (Thunb.) Cogn. (1881) 513; Gagnep. (1921) 1055; Cogn. & Harms (1924) 164; Craib (1931) 757; Merr. (1935) 379; Chakrav. (1959) 84; Backer (1964) 301; P.H. Hô (1991) 719, fig. 1995; Keraudren (1975) 45; Walters & Decker-Walters (1989):

274; Rifai & Reyes (1993) 95; C. Jeffrey (2001) 1530.
Cucurbita hispida Thunb. (1783) 38; in Murray (1784A) 868; (1784B) 322. Type: *Thunberg* 22775 (UPS), Japan.
Benincasa cerifera Savi (1818) 158; C.B. Clarke (1879) 616; S.K. Chen (1995) 334, pl. 87: 1–5. Type: unknown, described from a cultivated plant, possibly originating from eastern Asia.
Cucurbita villosa Blume (1826) 931. Type: *Blume* 1079 (holo L), Indonesia, Java.
Cucurbita farinosa Blume (1826) 931. Type: not found, Indonesia, Java.
Cucurbita littoralis Hassk. (1844) 190. Type: not found, Indonesia, Java.
Gymnopetalum septemlobum Miq. (1856) 679. Type: *Junghuhn s.n.* (holo L, barcode: L0587810), Indonesia, Weltevreden.

Annual herb, shoots 2–7 m long, stem 3–5 mm diameter, sparsely or densely grey or rusty hairy, hairs 2–5 mm long. Probract narrow- or broad-elliptic, (0.5–)1–2 cm long, acute or blunt, ± hooded or concave. Tendrils 2- or 3-branched. Leaves 5–7-angular or shallowly (sometimes deeply) lobed, 7–20 cm diameter, base cordate, apex (of lobes) acute-acuminate, margin coarsely dentate, cystoliths not apparent; petiole 4–12(–20) cm long. *Male flowers*: pedicel 4–15 cm long, hairy; receptacle-tube broadly cup-shaped, 4–6 by 10–15 mm; sepals narrowly elliptic or linear, 10–20 mm long, acute, entire, or (deeply) 2–3-lobed or serrate; petals obovate to narrowly elliptic, 25–40(–70) mm long, subacute or obtuse, with minute mucro, hairy on veins outside; stamens inserted at *c.* ? from the base in the receptacle-tube, very densely pilose-hairy where the stamens are inserted, the hairs screening off a small basal glabrous chamber without or with an inconspicuous disc at the bottom (see note), filaments glabrous, erect, broad, 2–3 mm long; anthers somewhat connivent, 4–5 by 5–7(–10) mm, somewhat exserted, thecae sigmoid along a broad, flat 3-lobed connective. *Female flowers*: perianth similar as in male but somewhat smaller; pedicel 2–4 cm long; ovary densely hairy, (narrowly) ovoid or (narrowly) ellipsoid (cylindrical), 15–20(–40) by 5–10(–15) mm, style stout, 2–3 mm long, stigma stout, 5–10 mm diameter, undulating by 3 horseshoe-shaped lobes; disc a low ± undulating ring; staminodes inserted close to the disc, mostly inconspicuous, 1–2 mm long, flat. Fruit solitary, globose, ellipsoid or narrowly ellipsoid, 4–120 cm long, green or green with a white waxy layer, glabrescent; pericarp thin, leathery, when old woody, 1–1.5 mm thick; mesocarp ± absent or thick and fleshy; fruiting pedicel 3–5 cm long, usually curved, leaving a concave scar after breaking off. Seeds ovate-elliptic, 7–10 by 4–7 mm, pale, faces not ornamented, margin narrow, finely 2-grooved.

DISTRIBUTION. Widely cultivated in SE Asia (and elsewhere), the wild form mainly in C and E Malesia, Australia and in the Pacific; see further under the forms.

NOTES. Young developing leaves have small glands on the blade, and their lobe-apices develop precociously and are conspicuously darker on drying, as was also observed by Cogniaux & Harms, 1924: 167 (note by Harms). This phenomenon is also obvious in not closely related *Mukia*, *Cucumis sativus*, and some other genera.

A more conspicuous disc in the (male) flower can be found in cultivated varieties and in hermaphroditic flowers.

KEY TO THE FORMS

Fruit subglobose to oblong (10–)20–60(–120) by 10–25 cm. Seeds 8–10 mm long. Cultivated ..... **a.** f. ***hispida***
Fruit globose or ellipsoid, 4–8 cm long. Seeds 7–8 mm long. Wild ..... **b.** f. ***pruriens***

a. Benincasa pruriens (Parkinson) W.J. de Wilde & Duyfjes f. **hispida** (Thunb.) W.J. de Wilde & Duyfjes, *comb. & stat. nov.*
Cucurbita hispida Thunb. (1783) 38.

Stout plant with grey or rusty coloured hairs. Flowers large, in *male* 6–10 cm diameter. Fruit subglobose or (long-)ellipsoid, (10–)20–60(–120) cm long; pericarp hard-leathery, *c.* 0.5 mm thick; mesocarp fleshy, 2–10 cm thick. Seeds 8–10 mm long, embedded in rather firm pulp.

DISTRIBUTION. Widely cultivated for the fruit with thick fleshy mesocarp, cooked as a vegetable.

NOTE. The form *hispida* comprises all cultivated or escaped varieties or cultivars of the Wax Gourd.

b. Benincasa pruriens (Parkinson) W.J. de Wilde & Duyfjes. f. **pruriens**
Cucurbita vacua F. Muell. (1868) 186.
Benincasa vacua (F. Muell.) F. Muell. (1882) 76. Syntypes (Telford 1982): *Dallachy s.n.* 28 Sept. 1867 & 20 Nov. 1867 (MEL, not seen), Queensland, Rockingham Bay.
Benincasa hispida (Thunb.) Cogn., for the wild form: I. Telford (1982) 170; Peekel (1984) 547, fig. 874.

(Fig. 1)

Plants generally of a more delicate stature compared to cultivated form *hispida*; hairs grey(-brown) coloured. Flowers smaller, in male 5–7 cm diam. Fruit globose or ellipsoid (subacute at both ends), 4–8 cm long; pericarp woody, 1–1.5 mm thick; mesocarp ± absent. Seeds 7–8 mm long, embedded in rather juicy whitish pulp.

DISTRIBUTION. Thailand (possibly), Borneo, Java, Lesser Sunda Islands, Celebes, Papua New Guinea (New Ireland, fruit ellipsoid), Australia (Queensland), Solomon Isl., and islands in the Pacific.

Fig. 1. *Benincasa pruriens* f. *pruriens*. Sabah, Luasong. Photo: de Wilde.

HABITAT. Disturbed areas in lowland rainforest, forest edges, open forest, river banks, scrub-land and beach-vegetation; up to 700 m altitude.

NOTE. Forms similar to the truly wild form of *Benincasa pruriens* possibly developed from escaped populations of the cultivated form *hispida* in natural places. In China, the wild form apparently has never been found. As the oldest collections of the wild form, with very small fruits, come from E Malesia, Queensland, and The Pacific, this area could be the place of origin of *Benincasa.* According to De Wilde & Duyfjes (2007b), the Pacific is the most plausible place of origin.

2. citrullus Schrad.

Citrullus Schrad. (1836) 279, *nom. cons.*; Naudin (1859b) 99; Cogn. (1881) 507; Cogn. & Harms (1924) 102; Meeuse (1962) 54; I. Telford (1982) 173; Greb. (1986) 932; C. Jeffrey (2001) 1533. Type: *Citrullus vulgaris* Schrad.
Colocynthis Mill. (1754), without pagination, *nom. rejic.*; Chakrav. (1959) 112.

Herbs, annual or perennial with root-stock, trailing or climbing; monoecious; plant scabrous or soft-hairy. Probract present. Tendrils branched, unbranched or spinescent (not in Asia). Leaves simple, ± pinnatilobed. Flowers solitary, pedicelled, medium-sized, petals (nearly)

free, yellow. *Male flowers*: receptacle-tube short, broadly campanulate; sepals narrow; petals ovate-oblong, obtuse, margin entire; stamens 3, inserted near the base of the receptacle-tube, filaments free, short, anthers two 2-thecous, one 1-thecous, thecae sigmoid, connective broad, flat; disc inconspicuous. *Female flowers*: perianth as in male; ovary ovoid or subglobose, hairy, style short, stigma 3-lobed, ovules numerous, horizontal; disc not apparent; staminodes small. Fruit a pepo, (small or) large, firm-walled, indehiscent. Seeds numerous, compressed, ovate(-oblong) in outline, (nearly) smooth, margined or not.

DISTRIBUTION. A genus of 4 species in Africa, east to Pakistan; *Citrullus lanatus* widely cultivated.

1. Citrullus lanatus (Thunb.) Matsum. & Nakai (1916) 30 (not seen); Meeuse (1962) 57; Backer (1964) 300; C. Jeffrey (1967) 46, f. 5; (2001) 1533; H. Hara (1969) 346, f. 5; Keraudren (1975) 106; I. Telford (1982) 173; S.K. Chen (1995) 336, pl. 87: 6–9.
Momordica lanata Thunb. (1794) 13. Type: *Thunberg s.n.* (UPS, photo seen), Cape Prov., Republic of South Africa.
Cucurbita citrullus L. (1753) 1010.
Colocynthis citrullus (L.) Kuntze (1891) 256.
Cucumis citrullus (L.) Ser. (1828) 301. Type of *Cucurbita citrullus* not yet designated (see: Linnaean Typification Project).
Citrullus vulgaris Schrad. (1836) 279; Naudin (1859b) 100; Gagnep. (1921) 1056; Craib (1931) 760. Type: unknown.
Citrullus edulis Spach (1838) 214; Miq. (1856) 662. Type: unknown.

Annual herb; stems to 3 m long, 2–4 mm diameter, softly grey-hairy, hairs 2–3(–5) mm long. Protract oblong, (sub)obtuse, narrowed at base, 0.5–1.5(–2) cm long, glands not obvious. Tendrils 2- or 3-branched. Leaves ovate to oblong in outline, 5–20 by 3–15 cm, pinnately (deeply) 3–5-lobed, base shallowly cordate, apex and apices of lobes rounded, obtuse or acute, margin irregularly dentate, glabrescent above, scabrid below; cystoliths and glands not obvious; petiole 3–12 cm long, soft hairy. *Male flowers*: pedicel 1–8 cm long, hairy; receptacle tube 3–4 mm long, villous-hairy; sepals linear, 3–5 mm long; petals 5–15 mm long; filaments *c.* 2 mm long, glabrous, anthers connivent into a globose mass *c.* 3 mm diameter. *Female flowers*: pedicel 0.5–4 cm long; ovary 6–12 mm long, style 4–5 mm long. Fruit solitary, (sub)globose or ellipsoid, (3–)6–30(–60) cm long, (pale) green or greyish green without or with stripes or blotches, or yellow, glabrescent, smooth; pericarp hard but not woody; pulp (including mesocarp) white, yellow or pink(-red); fruiting pedicel 2–7 cm long. Seeds 6–12 mm long, smooth or ± rough, white, brown or nearly black, margin absent or present.

DISTRIBUTION. Indigenous to southern Africa, the original wild form was probably found chiefly in the Kalahari desert; there are cultivated forms with numerous variants in the warmer parts all over the world.

KEY TO THE FORMS

Fruit globose, (3–)6–20 cm diameter ..... **a.** f. ***amarus***
Fruit subglobose or ellipsoid, 20–60 cm long ..... **b.** f. ***lanatus***

a. Citrullus lanatus (Thunb.) Matsum. & Nakai f. **amarus** (Schrad.) W.J. de Wilde & Duyfjes, *stat. nov.*
Colocynthis amarissima Schrad. (1833) 2, nom. nud.
Citrullus amarus Schrad. (1836) 279; (1838) 413. Syntypes: *Ecklon & Zeyher*, Rietvalley and Zwartland, Cape, Jan., Febr. (not seen).

VERNACULAR NAMES. Bittermelon, Tsamma (S Africa).

NOTE. The wild form, our present form *amarus*, was treated by Meeuse (1962: 57); he also commented on the distinction between the wild and cultivated forms and the area of origin in southern Africa. Wild forms, similar to the wild form from southern Africa, are also known from the rest of Tropical Africa and Australia (Telford, 1982: 173) and they may be found in drier areas in India and Malesia as well.

Citrullus lanatus f. *amarus* much resembles *Citrullus colocynthis*, the Colocynth. The latter occurs in northern Africa, extending east to Pakistan and western India, and is also widely established in semi-dry areas elsewhere, especially in Australia.

b. Citrullus lanatus (Thunb.) Matsum. & Nakai f. **lanatus**

This is the commonly grown and frequently escaped water melon of all areas. There are many cultivars, which are all covered by the general description of the species.

VERNACULAR NAMES. Watermelon, Sandía, Semangka (Indonesia).

3. Coccinia Wight & Arn.

Coccinia Wight & Arn. (1834) 347; Endl. (1839) 938; Miq. (1856) 673; Cogn. (1881) 528; Pax (1889) 35; Gagnep. (1921) 1053; Chakrav. (1959) 116; C. Jeffrey (1967) 56; Keraudren (1975) 65; A.K. Singh (1990) 21. Type: *Coccinia indica* Wight & Arn., nom. illeg. (= *Bryonia grandis* L; *C. grandis* (L.) Voigt), from India.
Cephalandra Schrad. (1836) 280. Type: *Cephalandra quinqueloba* (Thunb.) Schrad. (*Bryonia quinqueloba* Thunb.).

Herbaceous or (sub)woody climbers; dioecious; early glabrescent. Probract: small, caducous. Tendrils simple or 2-branched. Leaves simple, variable of shape. *Male flowers*:

solitary (or 2 or 3), (yellowish, not in Asia) or white; receptacle-tube cup-shaped; sepals 5, small; corolla campanulate, 5-lobed, lobes fused for *c.* 2/3, margin entire; stamens 3; filaments fused or free but tightly appressed forming a column; anthers all 2-thecous, or two 2-thecous and one 1-thecous, free or coherent into a globular synandrium; thecae 3-plicate; connectives broad; base of receptacle with an inconspicuous nectariferous disc (all species?). *Female flowers*: mostly solitary; perianth as in male; ovary ovoid or oblong, smooth or faintly ribbed, glabrous; ovules many, horizontal. Fruit berry-like, globose or elongate, moderate of size; pericarp thin. Seeds numerous, (ovate-)elliptic in outline, compressed.

DISTRIBUTION. A genus of *c.* 30 species in Africa; one species, *Coccinia grandis*, is widely distributed also in tropical SE Asia and N Australia; introduced in America.

1. Coccinia grandis (L.) Voigt (1845) 59; Backer (1964) 305; Keraudren (1975) 66, pl. 11: 1–3; I. Telford (1982) 176; P.H. Hô (1991) 727, fig. 2018; S.K. Chen (1995) 383, pl. 101: 1–3, 6; C. Jeffrey (2001) 1529.
Bryonia grandis L. (1767) 126; Lour. (1790) 595; Ser. (1828) 305. Lectotype (Jeffrey, 1967): *LINN 1153/2*, India.
Bryonia alceifolia Willd. (1805) 624. Type: not found, India.
Momordica bicolor Blume (1826) 928, including var. a & var. b. Type: *Blume* 1012 (holo L), Indonesia, Java.
Coccinia indica Wight & Arn. (1834) 347, nom. illeg.: Craib (1931) 761.
Cephalandra indica (Wight & Arn.) Naudin (1866) 16, nom. illeg.; C.B. Clarke (1879) 621; Ridl. (1922) 849.
Coccinia wightiana M. Roem. (1846) 93.
Coccinia grandis (L.) Voigt var. *wightiana* (M. Roem.) Greb. (1986) 929. Type: *Wight* 1123 (not seen), but *Bryonia grandis* L. cited by Wight & Arnott (1834) in the synonymy.
Coccinia cordifolia auct. non (L.) Cogn.: Cogn. (1881) 529, pro parte (excl. syn. *Bryonia cordifolia* L. = *Mukia maderaspatana*); Gagnep. (1921) 1054; Merr. (1935) 381.

Perennial, herbaceous or soft-woody climbers to 8 m tall, with tuberous rootstock, sparsely puberulous, early glabrescent; older stem to 15 mm across, with grey bark. Probract carnose, elliptic to oblong, 2–3 mm long. Tendrils simple. Leaves slightly succulent, 3–10 cm across, entire, (3- or) 5-angular or -lobed or deeply 3–5(–7)-lobed, or dissected to 4/5 deep, the lobes short or long, triangular to oblong, with apex acute or rounded, base deeply cordate, margin minutely (blackish) dentate-sinuate; glands small, several, near insertion of petiole and along lateral nerves; cystoliths in older leaves present; petiole 1–2.5 cm long. *Male flowers*: solitary (or 2 or 3); pedicel 20–50 mm long; receptacle-tube cup-shaped, narrowed to the base, 6–8 mm long, *c.* 6 mm wide at throat, greenish white; sepals oblong-subulate, *c.* 3 mm long, ± up-curved, pale green; corolla white (pale green veined), broad-campanulate, (15–)25–30 mm long, the lower (1/2–)2/3 fused, free lobes ovate-oblong, acute(-acuminate), inside (sparsely) pubescent; stamens inserted *c.* 5 mm below the

receptacle-throat, filaments either connate or free but coherent, forming a seemingly solid but hollow column (4–)5–6 mm long (sometimes leaving 3 openings at base), anthers two 2-thecous, one 1-thecous, free, but mostly coherent into a subglobose whole, *c.* 5 mm diameter; the receptacle-tube below the insertion of the stamens densely white-hairy, hiding a basal hollow, *c.* 3 mm deep, containing a green-yellow cup-shaped disc adnate to the bottom of the tube. *Female flowers*: resembling male flowers, solitary; pedicel 1–3 cm long; ovary oblong, narrowed at both ends, 10(–13) by 2(–3) mm, style 3–5 mm long, at base surrounded by a cup-shaped disc, stigmas 3, broad, oblong, 5–7 mm long, papillose; staminodes minute. Fruit pendent, elliptic or oblong, 2.5–6 by 1.5–3 cm, apex subacute, green-white blotched or striped, ripening red (starting at the apex), pulp juicy, red; fruiting pedicel 1–4 cm long. Seeds 6–7 by 2.5–3 by *c.* 1.5 mm, ± smooth, whitish, margin narrow.

DISTRIBUTION. Widely distributed in the Old World, northern tropical Africa, east to Arabia through India (type) to China, Malesia and tropical North Australia.

ECOLOGY. Prefers a (strong to) light monsoon climate. Common in open forest, scrub, along waste land, and roadsides; 0–500 m altitude; flowering and fruiting throughout the year.

USES. Pickled young fruits and the young shoots are cooked and eaten as a vegetable, especially in India and Thailand.

NOTES. Fruits are (glaucous) green with contrasting white blotches in rows and turn into bright red when ripe, except for the very base. The pulp is frequently eaten by animals, mainly birds. Jeffrey (1980b: 803) comments on a personal communication to him by A.K. Singh, saying that in India there are two distinct variants: the wild variant with ellipsoid-oblong bitter fruits, and a cultivated variant with oblong, more obtusely rounded fruits with a sweet taste. The sweet-tasting fruits would belong to the type of *Coccinia grandis*, and the bitter or wild variant to *Coccinia 'wightiana'* or *Coccinia 'alceifolia'*. This division was formally published by Grebenščikov (1986: 929) as *Coccinia grandis* (L.) Voigt var. *wightiana* (M. Roem.) Greb. (see also Boonkerd *et al.*,1993: 151). However, the division of the available names for the two variants is highly speculative, and we maintain that all three names represent only leaf-variants of the wild plants, which can be found in any place in the vast area of the species. The cultivated variant with sweet fruits does as yet not occur in Thailand, and plants in Indochina and Malesia, also those providing a vegetable, all belong to the one botanical species *Coccinia grandis* (L.) Voigt. If the recognition of the sweet-fruited or other cultivated variant(s) appears desirable, these should be named and effected as cultivar(s) within an as-yet- undescribed forma alongside the wild form, forma *grandis*.

4. **Cucumis** L.

Cucumis L. (1753) 1011; (1754) 442; Lour. (1790) 591; Ser. (1828) 299; Roxb. (1832) 719; Wight & Arn. (1834) 351; Endl. (1839) 928; M. Roem. (1846) 15; Miq. (1856) 670; Hook.

f. (1867) 826; C.B. Clarke (1879) 619; Cogn. (1881) 479; Pax (1889) 27; Cogn. & Harms (1824) 116; Chakrav. (1959) 98; Meeuse (1962) 59; C. Jeffrey (1967) 94; Keraudren (1975) 69; J.H. Kirkbr. (1993) 1–159; Schaefer (2007); Renner et al. (2007, in press). Lectotype (Britton & Wilson, 1925): *Cucumis sativus* L.
Melo Mill. (1754) without pagination. Lectotype (Swart 1960, 1979): *Cucumis melo* L.

Small or medium annual or perennial climbers (rarely suberect); monoecious (rarely dioecious); plant scabrous or setose, stem 1–4 mm diameter. Probract absent. Tendrils simple. Leaves simple. Flowers solitary or few-fascicled; pedicels short; corolla composed of partly fused petals, small- or medium-sized, yellow. *Male flowers*: receptacle-tube campanulate or turbinate, small; sepals small, mostly linear; petals (corolla) with margin entire; stamens 3, free, inserted about halfway the receptacle-tube, filaments short, anthers two 2-thecous, one 1-thecous, thecae sinuate, 3-plicate or S-shaped, connective considerably produced apically; disc large, gland-like, free from the tube. *Female flowers*: usually solitary; ovary hairy, hairs sometimes apical on small protuberances, ovules numerous, horizontal; perianth as in male flowers but somewhat larger, stigma cupular, with finger-like projections; staminodes often present, small; disc surrounding base of style, free from the tube. Fruit a (large) pepo (fleshy berry), indehiscent, pubescent or glaubrous, or with fleshy spines or tubercles, green, yellow or orange, (rarely maturing underground in *C. humifructus*, southern Africa). Seeds numerous, flat, elliptic or oblong, pale, not sculptured, unmargined with acute edge, unwinged (or rarely winged).

DISTRIBUTION. About 30 species in the Old World, mostly Africa; 2 species widely cultivated.

NOTE. According to molecular research (Renner *et al.,* 2007, in press; Schaefer, 2007, and Ghebretinsae *et al.*, 2007) the genus *Cucumis* should include a number of smaller genera, including *Mukia*, but for the present purpose we treat *Cucumis* in the original sense.

KEY TO THE SPECIES

1. Fruits with long soft spines ..... ***C. anguria***
   Fruits smooth or shortly prickled 2

2. Leaf lobes rounded ..... ***C. melo***
   Leaf lobes acute-acuminate ..... ***C. sativus***

1. Cucumis anguria L. (1753) 1011; Meeuse (1962) 77 (including var. *longipes* (Hook. f.) A. Meeuse); J.H. Kirkbr. (1993) 37.

For the description see the cited literature.

NOTE. This African species has been introduced and cultivated in tropical America (originally in Jamaica and Trinidad) since a long time ago, and has become, in modern times, more and more cultivated elsewhere, e.g., in India. It can be expected in our area in the future. It has a wild variety in Africa, *C. anguria* L. var. *longaculeatus* J.H. Kirkbr. (1993: 39), which is also introduced in America.

Vernacular NAME. West Indian Gherkin.

2. Cucumis melo L. (1753) 1011; Lour. (1790) 591; C.B. Clarke (1879) 620; Cogn. (1881) 482; Gagnep. (1921) 1057; Cogn. & Harms (1924) 120; Craib (1931) 760; Merr. (1935) 378; Chakrav. (1959) 102; A. Meeuse (1962) 61; Backer (1964) 301; C. Jeffrey (1967) 106; Keraudren (1975) 70; I. Telford (1982) 189; J.H. Kirkbr. (1993) 79; S.K. Chen (1995) 338; C. Jeffrey (2001) 1512. Lectotype (Meeuse, 1962): *LINN 1152/8*, a plant cultivated at Uppsala, which is according to Kirkbride, *op. cit.*, a member of his subsp. *melo*; it belongs in the present article to our forma *melo*.
Cucumis melo L. var. *cultus* Kurz (1877) 46; C. Jeffrey (2001) 1512. Type: not indicated.
(Fig. 2)

Annual or subperennial trailer to 6 m long, plant (woolly) hairy, hirsute or hispid. Leaves ovate or subcircular in outline, 3–15 cm diameter, (deeply) lobed or unlobed, mostly hispid, lobes mostly rounded, margin shallowly sinuate-toothed; petiole 3–10 cm long. *Male*

Fig. 2. *Cucumis melo* f. *agrestis*. Indonesia, Lombok. Photo: de Wilde.

flowers: few-fascicled; pedicel 3–25 mm long, hairy; receptacle-tube 4–6 mm long; sepals 1–6 mm long; corolla united in lower third, lobes elliptic or oblong, 5–20 by 2.5–15 mm, apex obtuse or subacute, mostly finely hairy; filaments *c.* 0.5 mm long, anthers ± included, 1–2(–2.5) mm long, connective with (entire or) 2-lobed apical extension. *Female flowers*: solitary; pedicel 5–30(–50) mm long; ovary ellipsoid, 4–10(–14) mm long, densely fine-hairy, hairs spreading or appressed; sepals 1.5–3(–7) mm long; corolla 8–15(–25) mm long; style 1–2 mm long, stigma 1.5–2.5 mm diam., lobes lobulate. Fruit globose, (narrowly) ellipsoid or (ob)ovoid, 2–20(–100) by 2–5(–20) cm, smooth, variously coloured, green, yellow, white or brown, plain-coloured, striped or mottled, pericarp leathery, mesocarp juicy or carnose; fruiting pedicel 2–4 cm long. Seeds 4–15 mm long, 1–2 mm thick, usually unwinged.

DISTRIBUTION. All over southern Africa and (cultivated) in Madagascar; in Asia east to China and Japan, and through Malesia to Australia and the Pacific. Widely cultivated all over the world. Australia is a centre of complex variation, in fruit-size as well as in mode of dissection of the leaves (Telford, 1982: 189).

NOTES. The cultivated form and the wild form are segregated by Kirkbride (1993), as subspecies, distinguished by the hairs on the ovary: subsp. *melo* having the ovary with spreading pilose or lanose hairs; in subsp. *agrestis* the ovary is covered with retrorse or antrorse, appressed, sericeous hairs.

The wild form, with small fruits is widespread almost as the species and widely adventive as a weed. It was for the first time formally recognized and described as var. *agrestis* by Naudin (1859a: 73), later as a subspecies by Pangalo (1933). The wild form consists of truly wild plants (Africa) and those to be regarded as degenerated running wild feral forms originating from cultivated plants. The wild form morphologically varies continuously into cultivated varieties, and arbitrarily we distinguish the wild form as follows:

KEY TO THE FORMS

Plant more slender, leaf blades 2–5 cm diameter. Ovary with appressed hairs; corolla 5–8 mm long. Fruits 2–5 cm long. Seeds 4–8 mm long ..... **a**. f. ***agrestis***

Plant generally more robust, leaf blades 4–15 cm diameter. Ovary usually with ± spreading hairs; corolla 8–20 mm long. Fruits (5–)10–20(–100) cm long. Seeds 8–15 mm long .... **b**. f. ***melo***

a. Cucumis melo L. f. **agrestis** (Naudin) W.J. de Wilde & Duyfjes, *stat. nov.*

Cucumis melo L. var. *agrestis* Naudin (1859a) 73; S.K. Chen (1995) 339.

C. melo L. subsp. *agrestis* (Naudin) Pangalo (1933) 534; I. Telford (1982) 189; J.H. Kirkbr.

(1993) 81. Lectotype (Kirkbride, 1993): *Naudin s.n.* (P?), cultivated from seeds from India.
Bryonia callosa Rottl. (1803) 210.
Cucumis callosus (Rottl.) Cogn. & Harms (1924) 129; Chakrav. (1959) 100. Type: *Rottler s.n.* (K), Madras.
Cucumis trigonus Roxb. (1832) 722. Lectotype (J.H. Kirkbr. 1993): *Roxburgh s.n.* (K).
(Fig. 3)

Although truly wild-looking plants occur frequently in Africa, Asia, Malesia, Australia and the Pacific, its area of origin is considered by Meeuse, *op. cit.*, as Transvaal in southern Africa.

b. Cucumis melo L. f. **melo**

This form encompasses all possible cultivars of Melons. In previous literature frequently called 'culta' or 'cultus', see e.g. Kurz, 1877; Naudin, 1859: 34–83; Grebenščikov, 1986: 918; Paje & van der Vossen, 1993: 153; Jeffrey 2001.

The cultivar ('convar.') *conomon* (Thunb.) Greb. (Grebenščikov, 1986: 921) is used as a vegetable, especially in China, 'Pickling Melon'. This group is treated by Jeffrey (2001) under subsp. *agrestis.*

3. Cucumis sativus L. (1753) 1012; (1763) 1437; Lour. (1790) 591; C.B. Clarke (1879) 620; Cogn. (1881) 498; Gagnep. (1921) 1057; Cogn. & Harms (1924) 143; Merr. (1935) 378; Chakrav. (1959) 105; Backer (1964) 301; P.H. Hô (1991) 720, fig. 1997; Keraudren (1975) 71; I. Telford (1982) 189; Gildemacher & G.J. Jansen (1993) 157; J.H. Kirkbr. (1993) 84; S.K. Chen (1995) 339, pl. 88: 1–2; C. Jeffrey (2001) 1520. Lectotype (Ten Pas et al., 1985): *Burser vol. 17, no. 97* (UPS), from cultivation.

Annual climber or trailer, with fibrous roots, shoots to 5 m long, plant scabrid by bristly hairs. Leaves broadly ovate in outline, 10–15(–20) cm diameter, (shallowly or) deeply 5-lobed, the middle lobe largest, lobes at apex acute-acuminate, margin finely dentate, both surfaces sparsely hairy; petiole 5–10 cm long. *Male flowers*: solitary or few-fascicled; pedicel 5–20 mm long, hairy; receptacle-tube 4–5(–10) mm long, hairy; sepals 4–5(–7) mm long; petals (corolla) (10–)20(–25) mm long, at base fused for 1/3; filaments short, anthers 2.5–3 mm long, included or hardly protruding, connective extension slender, entire or 2-lobed; disc 1–1.5 mm diameter. *Female flowers*: solitary (or few-fascicled); pedicel 2–20 mm long; ovary 10(–20 in certain cultivars) mm long, glabrous or densely hairy; perianth similar as in male flowers; style short, stigma 2–3 mm diam., lobes lobulate; staminodes small. Fruit ellipsoid to cylindrical, 5–20(–50) cm long, blunt at apex, smooth or lowly prickled, mono-coloured, whitish or green, or variously bi-coloured (striped), white, green or yellow(-brown); pericarp thin; mesocarp carnose or pulpy, whitish or yellowish; fruiting pedicel 1.5–4 cm long. Seeds elliptic, 7–12 mm long, unwinged.

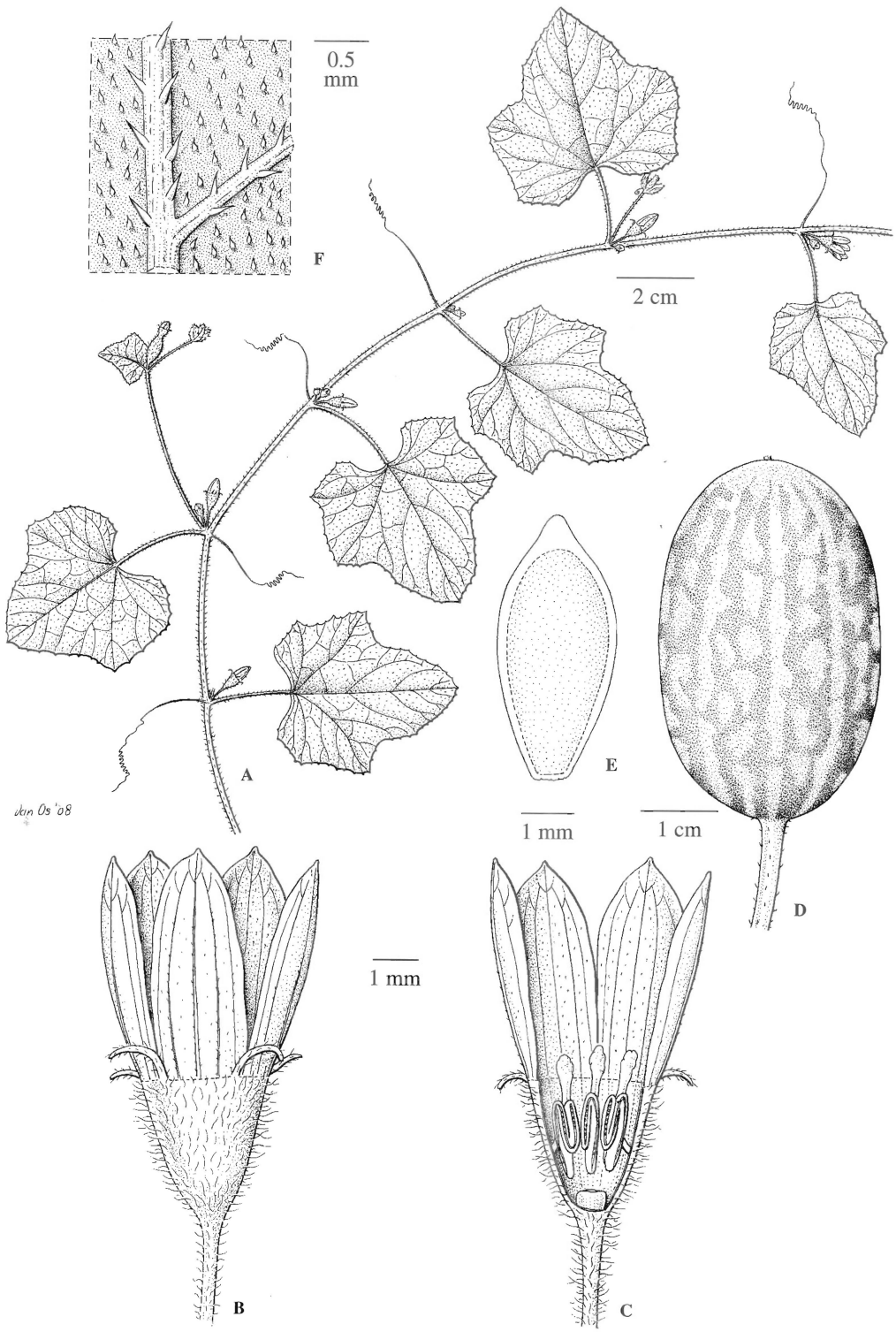

Fig. 3. *Cucumis melo* L. f. *agrestis* (Naudin) W.J. de Wilde & Duyfjes. **A.** Habit. **B–C:** Male flower, from outside and opened respectively. **D**. Fruit. **E**. Seed. **F**. Detail of lower surface of leaf blade (**A**: *Brass 24287*. **B–C, F**: *De Wilde & Duyfjes 21859*. **D–E**: *De Wilde & Duyfjes 21862*).

DISTRIBUTION. Originally occurring in SE Asia (northern India), at present cultivated world-wide.

NOTES. The variation in *Cucumis sativus*, in all parts, is considerable; there is also a broad range in sex-expression: unisexual flowers as well as hermaphroditic flowers exist.
All cultivars are in our present sense comprised in f. *sativus*.
The origin of *C. sativus* is thought to be in the southern Himalayas (Zeven & de Wet, 1982; Roy & Sunil Saran, 1990: 255).

The originally described wild botanical species *C. hardwickii* Royle, with bitter fruit, is from northern India and does also occur in northern Thailand but not in Malesia. Later additional collections have become known as the wild form of *C. sativus* (Duthie, 1903: 374). At present it is known as *C. sativus* L. var. *hardwickii* (Royle) Alef. We give it the status of forma.

Cucumis sativus L. f. **hardwickii** (Royle) W.J. de Wilde & Duyfjes, *stat. nov.*
C. hardwickii Royle (1839) 220, tab. 47: 3; Naudin (1859a) 30.
C. sativus L. var. *hardwickii* (Royle) Alef. (1866) 196; Gabaev (1932) 35. Type: *Royle s.n.* (LIV, not seen; iso K), India.

(Fig. 4)

5. Cucurbita L.

Cucurbita L. (1753) 1010; (1754) 441; Duchesne (1786) 148; Ser. (1828) 316; Naudin (1856) 5; Hook. (1867) 828; C.B. Clarke (1879) 621; Cogn. (1881) 542; Pax (1889) 33; Gagnep. (1921) 1064; Chakrav. (1959) 120; Backer (1964) 305; Keraudren (1975) 102; Widjaja & Sukprakarn (1993) 160; Stevels (1990) 137; C. Jeffrey (2001) 1541.
Pepo Mill. (1754) without pagination. Type: *Cucurbita pepo* L.

Medium-sized stout annual or perennial (not in our area) trailing or climbing herbs, stem 3–5(–10) mm diameter, plant hairy or scabrous; monoecious. Probract absent. Tendrils (2–)3–6-branched. Leaves simple, with long petiole; blade large, subentire or lobed, sometimes with whitish blotches, apex of lobes rounded or acute, margin finely or coarsely dentate. Flowers solitary (in male sometimes 2); receptacle-tube (shallowly) campanulate; sepals 5; corolla large, 6–10 cm long in cultivated species, petals fused for the lower half, orange(-yellow), lobes acute, ± out-curved at apex. *Male flowers*: pedicel long; sepals oblong or linear, or obovate and long-clawed; corolla-lobes ovate(-oblong), (sub)entire; stamens 3, filaments free, swollen at base (in cultivated Asian species), inserted towards the bottom of the receptacle-tube, anthers two 2-thecous, one 1-thecous, united (connivent) into an elongated whole, thecae plicate-sinuate, connective narrow, not apically produced, connate, hidden by the thecae; disc (pistillode) absent. *Female flowers*: pedicel shorter than in male flowers; ovary globose or ellipsoid, 1(–2) cm diameter, placentas 3(–5), ovules

Fig. 4. *Cucumis sativus* f. *hardwickii*. Thailand. Photo: P. Phonsena.

numerous, horizontal; perianth as in male flowers; style short, stout, stigma-lobes 3(–5), thickly carnose, each lobe shallowly lobed; disc absent or inconspicuous; staminodes short, at base of receptacle tube. Fruit a pepo, often with hard rind, very variable, small or (very) large, variable in shape and colour. Seeds numerous, medium or large, ellipsoid (-oblong) in outline, flat, little or not ornamented, margin narrow (rarely broad).

DISTRIBUTION. About 25 species. All *Cucurbita* species are originally indigenous in the New World; four species are cultivated all over the world, of which *C. pepo, C. maxima,* and *C. moschata* very extensively so in tropical as well as (in summer) in subtropical or extra tropical regions.

USES. Flowers, cooked or fried, are eaten. Fruits and (oily) seeds are widely used as food. Shoots are used as a vegetable. Also medicinal.

NOTE. Marked wild or feral forms do not occur in our area, and these have not been further accounted for. The three (four) cultivated species are each very variable and look-alike and can often only be recognized when completely known (habit, flowers and fruits); especially, well-developed fruit can be characteristic. Hybridization between the species seems difficult or absent. A brief description of each current species should suffice for distinction and naming a plant found in our area. The species of Thailand and Malesia are annual.

1. Cucurbita argyrosperma Huber (1867) 8; Mabb. (1985) 452; Merrick (1990) 77; C. Jeffrey (2001) 1541; L.H. Bailey (1948) 457. Type: from Mexico.
C. mixta Pangalo (1930) 258; Widjaja & Sukprakarn (1993) 163. Type: not seen.

NOTES. *C. argyrosperma* was formerly a part of *C. mixta* Pangalo. It has, for a long time, been included in *Cucumis moschata* and it seems genetically closest to *C. pepo*, but there are sterility barriers (Widjaja & Sukprakarn, 1993: 163). It is primarily cultivated for its nutritious seeds. It is infrequent in our area.

2. Cucurbita ficifolia Bouché (1837) 205; Andres (1990) 102; Roxas (1993) 165.

We have no knowledge of this species, but according to Roxas (1993) it is potentially a crop in our area, to be cultivated at higher altitudes.

3. Cucurbita maxima Duchesne (1786) 7; Lam. (1786) 151; Cogn. (1881) 544; C.B. Clarke (1879) 622; Chakrav. (1959) 123; (1990) 332; Keraudren (1975) 103; S.K. Chen (1995) 382; Paris (2000) 316; C. Jeffrey (2001) 1545. Type: *Lamarck s.n.* (P).

Plant, especially the leaves, rigid. Leaves lobed or not, ± reniform in outline. Flowers: pedicel terete; receptacle-tube campanulate; sepals linear in male and female flowers. Fruits (blue-)green or orange, smooth or warty; fruiting pedicel stout, ± terete, spongy, often with a ± fissured surface, not widened at the transition to the fruit. Seeds *c.* 20 mm long.

4. Cucurbita moschata Duchesne (1786) 7; Poiret (1818) 234; Backer (1964) 305; Paris (2000) 305–319.
C. pepo L. var. *moschata* (Duchesne) Lam. (1786) 152; Chakrav. (1959) 123; (1990) 332; Keraudren (1975) 104; S.K. Chen (1995) 379, pl. 100: 1–6; C. Jeffrey (2001) 1545. Type (Keraudren, 1975): original material unknown.
Gymnopetalum calyculatum Miq. (1861) 332. Type: *J. Amann* (= *S. Kurz*) *s.n.* (sphalm. *J. Amand*) (U), Indonesia, Bangka.

Plants including leaves pubescent, not scabrous. Leaves lobed, lobes acute or obtuse. *Male flowers*: pedicel subterete; receptacle-tube (shortly) campanulate; sepals linear. *Female flowers*: pedicel ± angular; receptacle-tube as in male; sepals ± linear or mostly *leaf-like broadened at apex* (long clawed). Fruit (depressed) globose, elongated or flask-shaped, often shallowly furrowed (sulcate) from apex to base of fruiting pedicel; fruiting pedicel angled, distinctly broadened at the transition to the fruit. Seeds variable in size, 10–15(–20) mm long.

NOTE. *Cucurbita moschata* is the most heat-tolerating species and found most frequently in the lowland tropics.

5. Cucurbita pepo L. (1753) 1010; Ser. (1828) 316; Naudin (1856) 29, tab. 2A; C.B. Clarke (1879) 622; Cogn. (1881) 545; Gagnep. (1921) 1065; Chakrav. (1959) 120; (1990) 332; Keraudren (1975) 105; P.H. Hô (1991) 721, fig. 2001; C. Jeffrey (2001) 1547. Lectotype (Keraudren, 1975): *LINN 1151.4*, but a *Burser* specimen is proposed as conserved type (Linnaean Typification Project).

Plant, including leaves, rigid or scabrous, (bushy, not trailing, in certain varieties). Leaves often deeply acutely lobed, lobes often lobulate. Flower pedicel subangular; receptacle-tube campanulate; sepals linear in male and female flowers. Fruits small, medium or very large, smooth, sometimes costate or verrucate; fruit pulp sometimes fibrous; fruiting pedicel rather slender, woody, angular (sulcate), not or only little thickened at the transition to the fruit. Seeds variable in size, 7–25 mm long.

NOTE. Here belongs the non-trailing sub-erect 'bushy' growing (Italian) 'Courgette' or 'Zucchini', nowadays a popular vegetable in Europe, and also the flat 'Scallop' or 'Patison'. See further Jeffrey (2001), and Goldman (2004).

6. Cyclanthera Schrad.

Cyclanthera Schrad. (1831) 2; Cogn. (1881) 822; Naudin (1859b) 156; Chakrav. (1959) 178; Backer (1964) 306; Keraudren (1967) 19. Type: *Cyclanthera pedata* Schrad., Mexico.

Annual or perennial herbaceous climbers, (sub)glabrous, monoecious. Probract absent. Tendrils simple or 2- or more-branched. Leaves simple, lobed or unlobed, or pedately

foliolate. Flowers small, pale greenish yellow; male inflorescences racemose or paniculate. *Male flowers*: receptacle-tube small, shallow; sepals small, subulate or linear; petals (free or) hardly connate at base, ovate-oblong, obtuse or acute; stamens united into a short central column, anthers connate into a head or into a horizontal (peltate) ring, opening with conduplicate slits or with a simple horizontal slit; disc (pistillode) absent. *Female flowers*: solitary or one co-axillary with male inflorescence; perianth as in male flowers; ovary narrowly ovoid or ellipsoid, somewhat oblique, rostrate, (1 or) 3 (or many)-loculed, style short, stigma hemi-spherical, large, ovules 1 to many per locule; staminodes absent. Fruit oblique, ovoid(-oblong), various of shape, not juicy, glabrous or mostly with soft spines, 1- or more-locular, 5- to many-seeded, when ripe elastically opening and jetting the seeds away, leaving central column and placenta. Seeds flattened, angular, often toothed at the end(s), faces smooth or rough.

DISTRIBUTION. An American genus with some 30 species, of which 2 species have been introduced as vegetable to other continents, including SE Asia.

KEY TO THE SPECIES

Leaves shallowly lobed. Flowers *c.* 3 mm diameter. Fruit soft-spiny, 2–3 cm long ..... **1. *C. brachystachya***

Leaves deeply lobed. Flowers *c.* 6 mm diam. Fruit smooth or sparsely soft-spiny, 5–7 cm long ..... **2. *C. pedata***

1. Cyclanthera brachystachya (Ser.) Cogn. (1881) 842; Keraudren (1967) 20, Pl. 5, 4–9; C. Jeffrey (2001) 1555.

Elaterium brachystachium Ser. (1828) 310; Cogn. (1881) 842. Type: based on an unpublished figure in Moçino & Sessé, tab. 38, fig. F, Mexico.

Cyclanthera explodens Naudin (1859b) 160; Backer (1964) 306. Type: plant cultivated at P, originating from New Grenade, Mexico.

Vigorous but slender climber to 5 m long, lanate or (finely) hairy on the nodes, later scabrous or glabrescent. Tendrils (1 or) 2-branched. Leaves triangular or ovate in outline, 6–9 cm long, 3- or 5-lobed up to halfway deep, lobes triangular, acute, margin finely dentate; petiole 1–5 cm long. *Male flowers*: in condensed 10–20-flowered racemes or few-branched panicles, 1–2.5 cm long, shorter than the leaves; pedicel 1–3 mm long; receptacle-tube *c.* 1.5 mm diameter; sepals less than 1 mm long, or ± absent; petals green-yellow, triangular, *c.* 1 by 1 mm, finely papillate; anther circular, horizontal, *c.* 0.5 mm diameter, opening with a circular slit. *Female flowers*: shortly pedicelled; ovary obliquely ovoid, style short, stigma broadly rounded. Fruit 2–3 cm long, ovoid-reniform, green, with soft spines; fruiting pedicel 1–3 cm long. Seeds *c.* 8 per fruit, 9–14 by 6–8 mm, ± 5-angled, 3-(or 5)-toothed at base, 3-toothed at apex, blackish brown.

DISTRIBUTION. Introduced from tropical America; in Java locally cultivated for the young shoots used as a vegetable.

2. Cyclanthera pedata Schrad. (1831) 2; Naudin (1859b) 159; Cogn. (1881) 825 (including var. *edulis*); Pax (1889) 38, f. 22; Chakrav. (1959) 178; S.K. Chen (1995) 396, pl. 101: 7–12; C. Jeffrey (2001) 1555. Type (Cogn., 1881): *Herb. Schrader*, cultivated, originating from Mexico.

Stout (sub)perennial herb, to 5 m long, glabrous; stem 2–5 mm diameter. Tendrils 2-branched. Leaves subcircular in outline, 5–20(–25) cm diameter, deeply 5–7(–9)-lobed, lobes oblong-lanceolate, acute, margin serrate-dentate; petiole stout, 5–15 cm long. *Male flowers*: in narrow, raceme-like panicles, 10–15(–20) cm long (peduncle 4–10 cm long), flowers many, ± tiered, and ± crowded in short-stalked fascicles along the rachis; pedicel 4–10 mm long; receptacle-tube 3–4 mm diameter; sepals less than 1 mm long; petals ovate-triangular, 1.5–2 mm long, acute, sparsely very short glandular-pubescent or papillose; anther circular, horizontal, 1–1.5 mm diameter, opening with a circular slit. *Female flowers*: solitary (or 2), co-axillary with male inflorescence; pedicel *c.* 3 mm long; ovary obliquely oblong, apex attenuate, style short, thick, stigma *c.* 2 mm diameter, shallowly lobulate. Fruit oblong, 5–7 by 2–3 cm, ± inflated, base attenuate, apex ± rostrate and hooked, 2-locular with 8–10 seeds, green (-yellow) or whitish, smooth or sparsely soft-spiny; fruiting pedicel 0.5–1 cm long. Seeds *c.* 10 per fruit, 10–12 by 7–8 by *c.* 2 mm, more or less 4-angular, apex appendiculate, base truncate, margin muricate, brown, faces faintly sculptured.

DISTRIBUTION. Widely distributed in Central and S America (Peru); introduced and locally commonly cultivated in mountainous areas in the southern Himalayas of India and in China. Not yet seen in Thailand or Malesia, but can be expected in the future as cultivated for the young shoots and fruits, used (cooked) as vegetable.

7. Gynostemma Blume

Gynostemma Blume (1825) 23; W.J. de Wilde & Duyfjes (2007a) 264. Type: *Gynostemma pedatum* Blume.

1. Gynostemma pentaphyllum (Thunb.) Makino (1902) 179; Backer (1964) 306; Keraudren (1975) 25, pl. 5: 1–7; C. Jeffrey (1980a) 10; (2001) 1511; S.K. Chen (1995) 387.
Vitis pentaphylla Thunb. (1784B) 105. Type: *Thunberg* 5858 (UPS, photograph seen), Japan.
Gynostemma pedatum Blume (1825) 23; C.B. Clarke (1879) 633 ('*pedata*'); Cogn. (1881) 913; Gagnep. (1921) 1080; Ridl. (1922) 851; Craib (1931) 766; Chakrav. (1959) 188.
Pestalozzia pedata Zoll. & Moritzi in Moritzi (1846) 31.

Zanonia pedata (Blume) Miq. (1856) 683. Lectotype (de Wilde & Duyfjes, 2007a): *Blume* 1429 (holo L, *barcode L 0588327*; iso L (6 sheets)), Java, Tjanjor & Krawang.

For the description see de Wilde & Duyfjes (2007a).

NOTE. This widespread Asian species has medicinal properties and is locally cultivated in Korea and China and recently also in northern Thailand. It is used as herbal tea.

Fig. 5. *Hodgsonia macrocarpa*. Sabah, Maliau Basin, Belian Camp. Photo: de Wilde.

8. Hodgsonia Hook. f. & Thomson

Hodgsonia Hook. f. & Thomson ('1853' 1854) 257; W.J. de Wilde & Duyfjes (2001) 169; C. Jeffrey (2001) 1525. Type: *Hodgsonia heteroclita* (Roxb.) Hook. f. & Thomson (*Trichosanthes heteroclita* Roxb.).

This Asian genus contains two species: *H. heteroclita* (Roxb.) Hook. f. & Thomson in India, China, Myanmar, Indochina and northern Thailand and *H. macrocarpa* (Blume) Cogn. (Fig. 5) in Peninsular Thailand and (West) Malesia. Both species have large seeds, rich in oil. In northern Thailand and China *H. heteroclita* is cultivated for their oily seeds. For taxonomy and descriptions see De Wilde & Duyfjes (2001).

Vernacular name. Kadam.

9. LAGENARIA Ser.

Lagenaria Ser. (1825) 25, tab. 2; C. Jeffrey (2001) 1531. Type: *Lagenaria vulgaris* Ser. (= *L. siceraria* (Molina) Standl.).
Adenopus Benth. (1849) 372. Lectotype (here chosen): *Adenopus longiflorus* Benth., West Africa.
Sphaerosicyos Hook. f. (1867) 824. Type: *Sphaerosicyos meyeri* Hook. f., nom. illeg. (= *Luffa sphaerica* Sonder; *Lagenaria sphaerica* (Sonder) Naudin, S. Africa).

Robust annual (or perennial) climbing herbs; monoecious (or dioecious); stem 2–5 mm thick; plant finely hairy. Probract absent (or present, not in Asia). Tendrils simple or 2-branched. Leaves simple, entire or lobed; petiole long, usually with a pair of glands at apex. Flowers solitary (or male flowers in raceme, not in Asia), pedicelled, large, opening at night, petals white. *Male flowers*: pedicel long; receptacle-tube (broadly) campanulate or cylindrical; sepals narrow; petals free, obovate, margin entire or ± crisped; stamens 3, short, filaments free, inserted on the tube towards the base, anthers coherent but free, two 2-thecous, one 1-thecous, thecae triplicate and often also much contorted, connective broad; disc present. *Female flowers*: pedicel shorter than in male; ovary hairy, ovules numerous, horizontal; perianth as in male, but receptacle-tube short; style short, stigma consisting of 3 subsessile parts, each 2-lobed; disc absent; staminodes small. Fruit large, hard-shelled, inside fleshy, indehiscent, green or yellowish. Seeds numerous, compressed, margin ± distinct.

DISTRIBUTION. About 6 species in Africa, one also in S America; one species, *Lagenaria siceraria,* widely cultivated.

1. Lagenaria siceraria (Molina) Standl. (1930) 435; A. Meeuse (1962) 83; Backer (1964) 302; C. Jeffrey (1967) 51; (2001) 1531; Keraudren (1975) 93; Widjaja & Reyes (1993) 190 with figure; S.K. Chen (1995) 348, pl. 91: 1–6; A.C. Clarke *et al.* (2006) 893.
Cucurbita siceraria Molina (1782) 133. Type: *Molina,* South America, Chile (not seen).
Cucurbita lagenaria L. (1753) 1010. Lectotype (C. Jeffrey, 1967): *LINN 1151/1* (LINN), a cultivated plant at Uppsala.
Lagenaria vulgaris Ser. (1825) 25, tab. 2; Naudin (1859b) 91; Cogn. (1881) 417. Type: not indicated.
Cucurbita lagenaria var. *oblonga* Blanco (1837) 772; Merr. (1918) 373. Type: not indicated, Philippines.
Cucurbita lagenaria var. *villosa* Blanco (1837) 772; Merr. (1918) 373. Type: not indicated, Philippines.
Cucurbita idolatrica Willd. (1805) 607; Blume (1826) 930. Type not indicated, 'Habitat in Guinea'.

Robust climber or trailer to 5 m long; stem ridged, 2–5 mm diameter, glabrescent. Probract absent. Tendrils 2-branched. Leaves reniform suborbicular or ovate in outline, entire or obscurely 3–9-lobed, 5–30 cm diameter, base cordate, apex obtuse or acute, margin (sparsely) finely dentate, pubescent, cystoliths not obvious; petiole 4–20 cm long, laterally at apex with 2 small (raised) glands. *Male flowers*: pedicel 4–30 cm long; perianth 40–60(–120) mm diameter; receptacle-tube (long-)campanulate, slightly bulbous at base, 10–15 mm long, pubescent; sepals spaced, narrowly triangular or linear, *c.* 5 mm long; petals broadly obovate, 20–40(–50) by (10–)15–35 mm, pubescent, margin (sub)entire; stamens inserted below halfway in the receptacle-tube, anthers forming a ± elongate whole, filaments free, 2–3 mm long, glabrous; disc gland-like, at base of tube. *Female flowers*:

pedicel 5–7 mm long; ovary cylindrical, reversed flask-shaped or obovoid, 1–2 cm long, villose; receptacle-tube 2–3 mm long; sepals and petals as in male flowers but somewhat smaller. Fruit solitary, ellipsoid or variously flask-shaped, often with a long 'neck', (6–)10–80 cm long, up to 20 cm wide, glabrescent; fruiting pedicel 5–10 cm long. Seeds numerous, subtruncate at both ends, (17–)10–20(–25) mm long, pale brown, ± 2-horned on the broader end, faces shallowly sculptured with two submarginal ridges, margin narrow but distinct.

DISTRIBUTION. Africa; world-wide cultivated.

NOTES. *Lagenaria siceraria*, very variable in fruit- and seed-size and shape, was already known in pre-Columbian times in S America, but it possibly originates from Africa. Small-fruited forms, not necessarily wild forms, are known from e.g., the Moluccas (Rumphius, 1747, 5: tab. 144), or from Africa (Naudin, 1855: 65, with coloured figure, the fruit being about 6 cm long and provisionally named *L. microcarpa*, nom. inval., from Gabon). In absence of a clear indication of a wild form we refrain from designating a formal wild form. Small immature fruits are frequently offered as a vegetable on markets, e.g. in Thailand.

Heiser (1973) distinguished two difficult to separate subspecies, based primarily on leaf blade and seed characters. The subsp. *asiatica* (Kobyakova) Heiser occurs in Asia. Heiser postulated that the Asian subspecies migrated long time ago from Africa, and since developed a considerable local variation including feral forms.

10. LUFFA Mill.

Luffa Mill. (1754) without pagination; Cogn (1881) 455; C. Jeffrey (1967) 75; (2001) 1539; Keraudren (1975) 46; I. Telford (1982) 179; Greb. (1986) 937; Heiser & E.E. Schill. (1988) 185; (1990) 120; G.J. Jansen et al. (1993) 194. Type: *Luffa aegyptiaca* Mill. (= *L. cylindrica* L.).

Annual or subperennial, climbing herbs to 10 m long; monoecious (one species dioecious, not in our area); puberulous, later glabrescent, scabrid. Probract fleshy, less than 5 mm long, with glands. Tendrils branched. Leaves simple, mostly lobed. Flowers medium or large, yellow; male flowers bracteate, in peduncled racemes; female flowers solitary, often co-axillary with male inflorescence. *Male flowers*: pedicelled; receptacle-tube small, shallow; sepals enclosing petals in bud; petals free, entire, folded in bud; stamens 3 or 5: two in pairs and one single, the paired ones free or variously united, then appearing as 3 stamens, of which two 2-thecous, one 1-thecous, filaments free, inserted at base of the receptacle-tube, anthers free or free but connivent into a subglobose synandrium, connective mostly broad, thecae marginal, convoluted; disc not apparent. *Female flowers*: receptacle-tube and perianth as in male flowers; ovary elongated or ovoid, smooth or spiny (not so in Thailand

and Malesia), ovules numerous, horizontal; style short, stigma 3-parted, each part 2-lobed; staminodes small; disc absent. Fruit subglobose to (long-)cylindrical, smooth, ribbed or with short spines, when ripe dry and fibrous within, dehiscing by an apical operculum. Seeds numerous, medium-sized, compressed, elliptic-oblong in outline, blackish.

DISTRIBITION. About 7 species, of which 4 in the Old World (mainly Africa) and 3 in America; 2 species in Thailand and Malesia and these widely cultivated, also elsewhere in warm regions.

KEY TO THE SPECIES

Plant flowering during the night, flowers pale yellow. Fruit 10-ribbed. Leaves rather pale green, angular or lobed up to 1/3 deep ..... **1. *Luffa acutangula***

Plant flowering during daytime, flowers bright yellow. Fruit not ribbed. Leaves dark green, variable of shape, lobed up to 4/5 deep ..... **2. *Luffa aegyptiaca***

1. Luffa acutangula (L.) Roxb. (1814) 70; (1832) 713; Backer (1964) 300; Keraudren (1975) 49; S.K. Chen (1995) 333, pl. 86: 7–9; C. Jeffrey (2001) 1540; K.L. Marr *et al.* (2005b) 154–165, f. 2.

Cucumis acutangulus L. (1753) 1011.

Cucurbita acutangula (L.) Blume (1826) 932. Type: not yet designated (Linnaean Typification Project).

Luffa foetida Cav. (1791) 7, tab. 9. Type: not known.

Luffa forskalii Harms (1924) 232.

L. acutangula (L.) Roxb. var. *forskalii* (Harms) Heiser & E.E. Schill. (1990) 123. Type: *Schweinfurth 545* (not seen), Yemen.

Medium-sized climber to 5 m long, stem 2–4 mm diameter, glabrous or subscabrous. Probract with 2–5 glands. Tendrils 3–5-branched. Leaves pale green; blade subcircular in outline, 5–20 cm diameter, unlobed or shallowly 5–7-lobed; petiole 5–12 cm long. Flowers opening at night; pale yellow; male and female perianth similar; male flowers in a raceme; female solitary or usually co-axillary with male raceme. *Male flowers*: pedicel 1–4 cm long; receptacle-tube shallowly campanulate; sepals oblong-lanceolate; petals obovate, *c.* 2 cm long, apex rounded or emarginate; stamens 3, filaments 3–4 mm long. *Female flowers*: pedicel 5–10 cm long; ovary obovate-ellipsoid, 10-ridged. Fruit long-ellipsoid, 10-ridged, 10–30 by 4–10 cm, apex obtuse or acute, green, glabrous; pulp fibrous, operculum small. Seeds numerous, ovate-elliptic in outline, 10–12 by 6–8 mm, smooth or rugose, grey-black, not winged, margin narrow, ± square.

DISTRIBUTION. Originally in S Asia (India); at present widely cultivated.

KEY TO THE FORMS

Plant stout. Fruit 10–30 cm long. Cultivated, widespread in tropical areas ..... **a.** f. ***acutangula***
Plant delicate. Fruit 5–8 cm long. India ..... **b.** f. ***amara***

a. Luffa acutangula (L.) Roxb. f. **acutangula**

This form contains all cultivated or running wild cultivars, including feral forms that have reverted to wild, bitter forms, but excluding forma *amara*.

b. Luffa acutangula (L.) Roxb. f. **amara** (Roxb.) W.J. de Wilde & Duyfjes, *stat. nov. Luffa amara* Roxb. (1814) 70; (1832) 715; (1978) pl. 11; Wight & Arn. (1834) 343; Naudin (1859b) 123; C. Jeffrey (2001) 1540.
Luffa acutangula (L.) var. *amara* (Roxb.) C.B. Clarke (1879) 615; Cogn. (1881) 461; Cogn. & Harms (1924) 69; Chakrav. (1959) 81. Lectotype (Jeffrey 1980b: 792): *Roxb. Ic. No. 460* (K, not seen), India. (Note: Chakravarty, 1959, indicated as lectotype a collection of *Rottler* (K, not seen)).

This is the wild form of *Luffa acutangula*, confined to India. Cogniaux (1881) included here also *L. sylvestris* Miq., but we agree with Harms (in Cogniaux & Harms, 1924) who already remarked that this latter belongs to *L. cylindrica*.
We have not seen the original drawing of Roxburgh, Icones no. 460, but have seen the reproduction of 1978.

2. Luffa aegyptiaca Mill. (1768) without pagination, based on *Momordica luffa* L. (1753) 1009; Backer (1964) 300; Marr et al. (2005a) 137–153, f. 3. Type: a cultivated plant, no specimen located.
Luffa petola Ser. (1828) 303; Miq. (1856) 667. Type: *Petola* (Rumphius (1747) Herb. Amb. 5: 405, tab. 147).
Luffa pentandra Roxb. (1832) 712; Miq. (1856) 667. Type: not indicated.
Momordica cylindrica L. (1753) 1009.
Luffa cylindrica (L.) M. Roem. (1846) 63; C. Jeffrey (1967) 76; (1980a) 54; Keraudren (1975) 47; Greb. (1986) 957; I. Telford (1982) 179; S.K. Chen (1995) 331, pl. 86: 1–6. Lectotype (Wunderlin, 1978): *Herb. Linn. No. 1150.9* (LINN, Linnaean Typification Poject).
Luffa leucosperma M. Roem. (1846) 63; Miq. (1856) 666. Type: not known (China & Cochinchina).
Luffa subangulata Miq. (1856) 667.
Luffa acutangula (L.) Roxb. var. *subangulata* (Miq.) Cogn. (1881) 461. Type: *Horsfield s.n.* (U; iso BM).

(Fig. 6)

Fig. 6. *Luffa aegyptiaca* f. *aegyptiaca*. Thailand. Photo: de Wilde.

Climbers 5–15 m long, stem 2–5 mm diameter, glabrescent, scabrous. Probract 3–5 mm long, acute, with (1–)4–8 glands. Tendrils 2–6-branched. Leaves dark green; blade suborbicular in outline, 5–15 cm diameter, palmately 3–5(–7)-lobed, *c.* 1/4 deep or much deeper, lobes various, blade base cordate, apex acute, margin variously lobed-dentate, glands small; petiole 2–15 cm long. Flowers opening at day-time; bright yellow. *Male flowers*: in peduncled raceme, 5–35 cm long, peduncle 5–12 cm long; bracts ovate-oblong, *c.* 5 mm long, glandular; pedicel 2–10 mm long; receptacle-tube *c.* 5 mm across, mostly hairy inside; sepals triangular, acute(-acuminate), 5–10 mm long, with few glands; petals broadly rounded, 20–45 by 15–30 mm; stamens 3 or 5, exserting from the receptacle-tube, anthers 3–5 mm diameter. *Female flowers*: pedicel 10–30 mm long, ovary ellipsoid or cylindrical, 15–30 mm long, finely hairy, smooth or obscurely ribbed. Fruit globose, or short- to long-ellipsoid or cylindrical, 3–20(–50) cm long, not ribbed, (light and dark) green, glabrous; pulp fibrous, operculum small, beaked; fruiting pedicel 1–6 cm long. Seeds numerous, elliptic in outline, 7–12 by 4–8 mm, dull, blackish, with narrow membranous wing-like border.

DISTRIBUTION. Old World, Australia, naturalized in tropical America.

VERNACULAR NAMES. Vegetable sponge, Loofah.

KEY TO THE FORMS

Plant robust. Fruit ellipsoid to cylindrical, 10–20(–60) cm long ..... **a.** f. ***aegyptiaca***
Plant less robust in all parts. Fruit globose or (broadly) ellipsoid, 3–8(–10) cm long .....
..... **b.** f. ***sylvestris***

a. Luffa aegyptiaca Mill. f. **aegyptiaca**

This is the cultivated form, very variable in fruit-size; often escaped into wild (secondary) vegetations, and at present occurring in all tropical areas.

b. Luffa aegyptiaca Mill. f. **sylvestris** (Miq.) W.J. de Wilde & Duyfjes, *comb. & stat. nov.*
Luffa sylvestris Miq. (1856) 666. Type: *Petola silvestris* Rumph. (1747) Herb. Amb. 5: 409, tab. 150.
Luffa aegyptica Miller var. *peramara* F.M. Bailey (1890) 29. Type: not indicated, Australia, Mulgrave River.
Luffa insularum A. Gray (1854) 644.
Luffa cylindrica (L.) M. Roem. var. *insularum* (A. Gray) Cogn. (1881) 459. Lectotype not indicated, Samoan Islands, Friendly Islands, Fiji. (not seen).
Luffa cylindrica (L.) M. Roem. var. *minima* Naudin (1862) 165. Type: not indicated (cultivated in Paris from seed from New Caledonia).
Luffa cylindrica (L.) M. Roem. var. *leiocarpa* Naudin (1859b) 121; I. Telford (1982) 180.
Luffa leiocarpa F. Muell. (1863) 107.

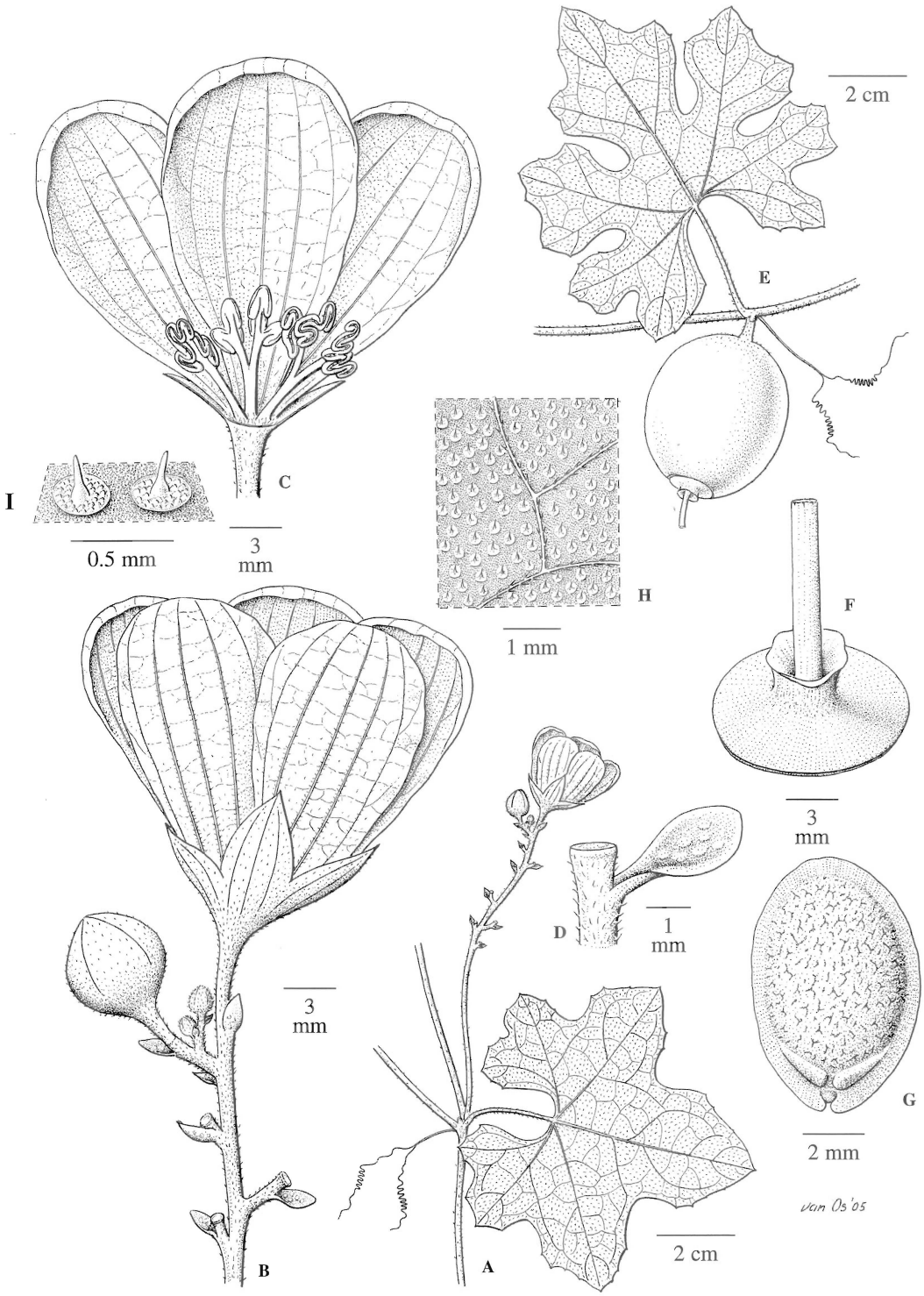

Fig. 7. *Luffa aegyptiaca* Mill. f. *sylvestris* (Miq.) W.J. de Wilde & Duyfjes. **A**. Node with male inflorescence. **B**. Apex of male inflorescence. **C**. Male flower, opened. **D**. Detail of male pedicel with bract, shifted up along pedicel. **E**. Node with fruit. **F**. Lid of fruit. **G**. Seed, same shape as in cultivated form, but smaller. **H**, **I**. Detail of upper surface of leaf blade with coarse hairs inserted on cistolyths (all: *De Wilde & Duyfjes 21861*).

Luffa aegyptiaca Mill. var. *leiocarpa* (Naudin) Heiser & E.E. Schill. (1990) 123. Type: *Mueller* (K, not seen) Australia.

(Fig.7)

Tendrils (simple or) 2- or 3-branched. Fruit globose, 3–5 cm diameter, or ellipsoid, 5–8(–10) cm long; fruiting pedicel 1–3 cm long. Seeds brown-black, *c.* 7 by 4 mm.

DISTRIBUTION. Common in eastern Malesia (often coastal), Australia and the Pacific; similar plants also known from Jemen, India, and elsewhere.

11. Momordica L.

Momordica L. (1753) 1009; (1754) 440; Cogn. (1881) 427; Cogn. & Harms (1924) 8; Chakrav. (1959) 86; C. Jeffrey (1967) 17; Keraudren (1975) 36; I. Telford (1982) 166; S.K. Chen (1995) 326; C. Jeffrey (2001) 1521; W.J. de Wilde & Duyfjes (2002) 133. Type: *Momordica balsamina* L.

Distribution. About 40 species in the Old World, most species in Africa; 8 species in Asia.

KEY TO THE SPECIES

1. Plant monoecious. Male bract halfway the pedicel. Fruit fusiform or elongate, 2–11(–40) cm long, knobbly irregularly ridged ..... ***M. charantia***
   Plant dioecious. Male bract subapical. Fruit spiny or ridged 2

2. Male petals 40–60 mm long. Petals cream. Fruit broad-ellipsoid, 10—15(–20) cm long, densely soft spiny or sharply tuberulate ..... ***M. cochinchinensis***
   Male petals 20(–30) mm long. Petals yellow. Fruit ellipsoid, 3–5 cm long, with 8–10 irregular lengthwise ridges ..... ***M. subangulata***

1. Momordica charantia L. (1753) 1009; Willd. (1805) 602; Blume (1826) 927; Naudin (1859b) 131; Miq. (1856) 663; Cogn. (1881) 436; Cogn. & Harms (1924) 24; Chakrav. (1959) 88; (1982) 89, f. 8–10; Backer (1964) 299; C. Jeffrey (1967) 31; Keraudren (1975) 42; I. Telford (1982) 167; S.K. Chen (1995) 327; Reyes et al. (1993) 206; Walters & Decker-Walters (1988) 286; W.J. de Wilde & Duyfjes (2002) 135. Lectotype (C. Jeffrey, 1967): *Herb. Clifford 451, momordica 2* (BM-000647445, Linnaean Typification Poject), cultivated at Hartekamp, The Netherlands.
Momordica muricata Willd. (1805) 602; Lubbock (1892) 601, f. 384.
M. charantia var. *muricata* (Willd.) Chakrav. (1982) 92, f. 1–7. Type: (Chakravarty, 1982): Rheede Hort. Mal. 8 (1688) plate 10.

Momordica balsamina auct. non L.: Blanco (1837) 768; Merr. 1918: 370 (*Species Blancoanae 481*).
Momordica cylindrica ('*cilindrica*') auct. non L.: Blanco (1837) 769, Merr. 1918: 370.

For the description see de Wilde & Duyfjes (2002).

DISTRIBUTION. Tropical and subtropical Africa and S, E, and SE Asia, Malesia, Australia and the Pacific; also common in America, where introduced. Cultivated mostly as larger-fruited cultivars. Immature fruit and young shoots are used as a vegetable; the fruit is medicinal.

HABITAT. Scrub and secondary places, forest edges; at low and medium altitudes.

VERNACULAR NAME: Balsam Pear, Bitter Melon, Bitter Gourd.

KEY TO THE FORMS

Plant more delicate. Fruit ± fusiform, 2–5 cm long, with *c.* 6 rows of few, low, broad-based soft prickles with acute apex. Growing wild ..... **a.** f. ***abbreviata***
Plant generally stouter. Fruit (narrowly) elliptic to oblong, 6–40 cm long, surface with bluntish soft thorn-like protuberances and/or rounded warts in more or less longitudinal rows. Cultivated or escaped near villages ..... **b.** f. ***charantia***

a. Momordica charantia L. f. **abbreviata** (Ser.) W.J. de Wilde & Duyfjes, *stat. nov.*
Momordica charantia L. var. *abbreviata* Ser. (1828) 311; Cogn. (1881) 437, p.p., excl. *M. muricata* Willd.
Momordica charantia L. subsp. *abbreviata* (Ser.) Greb. (1986) 926. Type: not seen (G).
(Fig. 8)

This is the wild form, widespread in the Old World and already long-time naturalized in tropical America. It is generally more delicate than the cultivated varieties under forma *charantia*, the latter including, however, frequently cultivated plants with small fruits of only *c.* 5 cm long or more.

The distinction between forma *abbreviata* and forma *charantia* seems rather sharp on the characters given in the key, but vegetatively and in the flowers, both forms are similar, though forma *abbreviata* is more delicate in all parts.

b. Momordica charantia L. f. **charantia**

The forma *charantia* comprises all cultivated varieties, including plants with small as well as with larger fruits. It should be noted that taxa with small densely muricate-tubercled

Fig. 8. *Momordica charantia* f. *abbreviata*. Thailand. Photo: P. Phonsena.

Fig. 9. *Momordica charantia* f. *charantia*. Thailand, market. Photo: de Wilde.

fruits and named *Momordica muricata* (Willd., 1805; based on Rheede 1688: 19, tab. 10) also belong under forma *charantia*. Most likely the cultivated form originated from the wild form in India (Williams & Ng, 1976).

(Fig. 9)

2. Momordica cochinchinensis (Lour.) Spreng. (1826) 14; Ridl. (1922) 848; Reyes et al. (1993) 206; S.K. Chen (1995) 329, pl. 85: 5–10; C. Jeffrey (2001) 1521; W.J. de Wilde & Duyfjes (2002) 137. Type: *Loureiro s.n.* (BM), from Cochinchina (Vietnam).

For the description see de Wilde & Duyfjes (2002).

This is a very variable botanical species, found wild as well as cultivated, of which in Thailand and Malesia only incidentally the immature fruit is eaten as a vegetable.
A separate wild form, to be distinguished from cultivated forms, does not exist.

VERNACULAR NAME. Sweet Gourd.

USES. Bitter Gourd (*Momordica charantia*) and Sweet Gourd both have numerous medicinal uses, the latter especially in China.

3. Momordica subangulata Blume (1826) 928 is a wild, botanical species of which the shoots are occasionally used as a vegetable. Its subsp. *renigera* (G. Don) W.J. de Wilde (2002: 147) has a comparatively stout habit and a tuberous rootstock. It is occasionally locally cultivated by indigenous tribes as a vegetable in the north of Thailand (W.J. de Wilde & Duyfjes, 2002: 147–148).

For the description see de Wilde & Duyfjes (2002).

The species **Momordica balsamica** L., Balsam Apple (Africa and drier areas of NW India and introduced in Australia) and **Momordica dioica** Willd. (India) are occasionally used medicinal or, the latter, as a vegetable. Their use is not recorded from our area. See also Reyes *et al.*, 1993: 209.

12. Praecitrullus Pangalo

Praecitrullus Pangalo (1944) 203. Type and only species: *Praecitrullus fistulosus* (Stocks) Pangalo = *Citrullus fistulosus* Stocks.

1. Praecitrullus fistulosus (Stocks) Pangalo (1944) 203; Chakrav. (1990) 331; A.K. Singh (1990) 16; Whitaker (1990) 320; C. Jeffrey (2001) 1537.
Citrullus fistulosus Stocks (1851) 74, tab. 3.
Citrullus vulgaris Schrad. var. *fistulosis* (Stocks) Duthie & Fuller (1882/93) 46, t. 47.
Colocynthis citrullus var. *fistulosis* Chakrav. (1959) 116. Type: unknown.

This species is locally cultivated in mountainous northern India as a vegetable. It is unknown in our area, but it can be expected there in the future.

13. Sechium P. Browne

Sechium P. Browne (1756) 355, *nom. cons.*; Ser. (1828) 313; Cogn. (1881) 900; Backer (1964) 306; C. Jeffrey (2001) 1555. Type: *Sechium edule* (Jacq.) Sw.

Medium or stout climbers, perennial, monoecious; plants (almost) glabrous. Probract absent. Tendrils 2–5-branched. Leaves simple, angular, subentire or shallowly lobed, base cordate. Flowers rather small, short-pedicelled; male flowers in racemes, female flowers solitary, 2 or 3, often co-axillary with male inflorescence; perianth dirty whitish or pale yellowish. *Male flowers*: receptacle-tube shallow; sepals linear; petals free, elliptic-oblong,

(sub)acute, margin entire; stamens 3, filaments united into a column, inserted at base of receptacle-tube, ± free at apex, anthers two 2-thecous, one 1-thecous, thecae sigmoid; disc (pistillode) absent. *Female flowers*: short- or long-pedicelled; perianth as in male flowers; ovary ovoid(-oblong), smooth or with few (coarse) hairs, unilocular with apically one pendulous ovule, style slender, short, stigma capitate, 2-lobed, lobes entire or lobulate, recurved; staminodes absent, but base of receptacle-tube sometimes with 10 shallow pouches. Fruits carnose (or fibrous, not in Asia), ± obovoid, smooth or sulcate, glabrous, setose or with soft spines. Seed one, large, ovoid, sometimes ± compressed, testa woody, glabrous, with sharp edges.

DISTRIBUTION. About 5 species in 2 sections in tropical America. One species, *Sechium edule*, widely cultivated.

1. Sechium edule (Jacq.) Sw. (1800) 1150; Ser. (1828) 313; Cogn. (1881) 901; Chakrav. (1959) 204, (1990) 333; Backer (1964) 306; Newstrom (1990) 141–149; Engels & C. Jeffrey (1993) 246; S.K. Chen (1995) 394, pl. 105: 1–5.
Sicyos edulis Jacq. (1760) 32.
Chayota edulis (Jacq.) Jacq. (1780) 245. Neotype (C. Jeffrey, 1980a: 59): *Jacquin* (BM?, not seen), Cuba.

(Fig. 10)

Fig. 10. *Sechium edule*, left hand female flower; right hand male flower. Thailand. Photo: de Wilde.

Stout perennial herb, 5–10(–15) m long, stem 2–10 mm diameter, with tuber-like rootstock; almost glabrous. Tendrils 2–5-branched. Leaves subcircular in outline, 10–20 cm diameter, usually 5-angular or shallowly lobed, lobes acute, margin finely sparsely dentate, finely scabrous especially on upper surface, distinctly reticulately nerved; petiole 5–15 cm long. *Male racemes*: 8–30 cm long, 10–30-flowered, with flowers 2(–6) subfasciculate. *Male flowers*: pedicel 1–6 mm long; receptacle-tube *c.* 5 mm wide; sepals oblong-linear, 5–7 mm long; petals subglabrous, 10–17 mm long; staminal column 1–2 mm long, spreading free parts *c.* 1 mm long, anthers *c.* 2 mm diam. *Female flowers*: ovary *c.* 5 mm long, glabrous or ± hairy, style 3–4 mm long, stigma *c.* 3 mm diameter, papillose. Fruit indehiscent, 7–15(–20) cm long, often with irregular surface, low-warted or irregularly sulcate, smooth or (soft) spiny, green or whitish; later on the embryo germinating in the seed and emerging at apex of fruit; fruiting pedicel 2–3 cm long. Seed 5–10 cm long.

DISTRIBUTION. Originally cultivated in Central America, now widely cultivated (usually over trellis) in the tropics all over the world.

VERNACULAR NAME. Chayote.

USES. The shoots and fruits are commonly used as vegetable. The nectariferous male flowers attract bees.

Sechium edule was already known in pre-Columbian times and is now known from numerous cultivars or land-races all over the world in the tropics and subtropics. Feral forms are known in Central America. A very much related wild species in America is *S. compositum* (Donn. Sm.) C. Jeffrey, with bitter fruits. (See Jeffrey, 1978; Newstrom, 1990).

14. Siraitia Merr.

Siraitia Merr. (1934) 200; W.J. de Wilde & Duyfjes (2006) 499. Type: *Siraitia silomaradjae* Merr., Sumatra.

An Asian genus with 2 or 3 species.

1. Siraitia grosvenorii (Swingle) A.M. Lu & Zhi Y. Zhang (1984) 29, f. 1: 1–7; (1986) 162, pl. 43: 1–7; W.J. de Wilde & Duyfjes (2006) 499.
Momordica grosvenorii Swingle (1941) 198.
Thladiantha grosvenorii (Swingle) C. Jeffrey (1979) 393. Type: *Taam* 1 (holo NA, not seen), Guangxi, China.

This is a botanical species from southern China where it is locally cultivated for the sweet and medicinal fruit (fruit-pulp). The fruits can be found, imported from China, in markets in Thailand, or in Chinese or exotic shops elsewhere all over the world.

15. Trichosanthes L. (1753) 1008; (1754) 439; Chakrav. (1990) 327; Rugaya (1999) 61; Gildemacher et al. (1993) 271; C. Jeffrey (2001) 526; W.J. de Wilde & Duyfjes (2004) 17; Duyfjes & Pruesapan (2004) 82. Lectotype (Hitchcock & Green, 1929): *Trichosanthes anguina* L.

Trichosanthes is the largest genus of Asian Cucurbitaceae, with about 100 species. Several wild species are popular and cultivated in China for medicinal purposes.

Two species are relevant in our area: **T. cucumerina** L. var. **anguina** (L.) Haines (1925, 388), an only cultivated variety, possibly originating from India. The wild **T. edulis** Rugaya var. **sativa** Rugaya (in Rugayah & de Wilde, 1999: 256) is endemic in New Guinea, where the roasted or cooked immature fruits are eaten.

Trichosanthes dioica Roxb. (1832, 701; Chakrav. 1959, 54) is a dioecious climber with a perennial rootstock, extensively cultivated in India, where the green fruits and leaves are used as vegetable. It is also collected in the wild, but there are some cultivated agricultural forms (Chakravarty, 1990: 327). The species is not yet seen cultivated in Thailand or in the Malesian area.

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