Blumea 65, 2020: 167–175
www.ingentaconnect.com/content/nhn/blumea

RESEARCH ARTICLE

https://doi.org/10.3767/blumea.2020.65.02.08

Taxonomic revision of *Dehaasia* (*Lauraceae*) in Sumatra

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Key words

Dehaasia
Lauraceae
revision
Sumatra
taxonomy

Abstract A revision of *Dehaasia* (*Lauraceae*) in Sumatra is presented. Eight species are recognized, including two newly described species (*D. bandaharense* and *D. pilosa*). A key to the eight species, descriptions and distribution maps of each species and illustrations of newly described species are provided. A neotype for *D. incrassata* is designated.

Citation: Fijridiyanto IA, Smets E, Arifiani D. 2020. Taxonomic revision of Dehaasia (Lauraceae) in Sumatra. Blumea 65 (2): 167–175. https://doi.org/10.3767/blumea.2020.65.02.08.
Effectively published online: 28 October 2020.

INTRODUCTION

Dehaasia Blume belongs to the *Lauraceae* and consists of approximately 35 species distributed from South China to New Guinea, with a centre of diversity in Malesia (Rohwer 1993). *Haasia* Blume (Nees 1836) was published earlier than *Dehaasia* and comprised six species: *Haasia cuneata* Blume, *H. elongata* Blume, *H. incrassata* (Jack) Nees, *H. media* Blume, *H. microcarpa* Blume and *H. peduncularis* (Nees) Nees. Later, Blume (1837) published *Dehaasia* Blume with his four species: *Dehaasia cuneata* (Blume) Blume, *D. elongata* Blume, *D. media* Blume and *D. microcarpa* Blume. Both spellings, *Dehaasia* and *Haasia*, are named after Dirk de Haas (died in 1702), who became Governor of Ambon in 1687 (Balakrishnan & Chakrabarty 2011). Even though the spelling '*Haasia*' was found to be older, the name '*Dehaasia*' has always been more widely used; therefore, to avoid nomenclatural disruption and unnecessary practical problems the conservation of this spelling was proposed (Balakrishnan & Chakrabarty 2011). The proposal to conserve the spelling of *Dehaasia* has been recommended by the Nomenclature Committee for Vascular Plants (Applequist 2012) and approved as *Dehaasia* orth. cons. by the General Committee (Wilson 2016). The type species of this genus is *D. microcarpa*, a synonym of *D. incrassata* (Jack) Kosterm. (Kostermans 1952a).

Dehaasia is a member of the tribe *Perseeae*, which contains genera such as *Persea* Mill., *Phoebe* Nees, *Alseodaphne* Nees and *Nothaphoebe* Blume. *Dehaasia*, *Alseodaphne* and *Nothaphoebe* are morphologically closely similar (Julia et al. 2009). *Dehaasia* differs from *Alseodaphne* only by 2-thecate vs 4-thecate anthers, respectively (Rohwer 1993, Van der Werff 2001). Recently, molecular studies (Rohwer et al. 2009, Li et al. 2011) showed that the species of the genus *Dehaasia* are scattered throughout the *Alseodaphne-Dehaasia* clade. The genus *Nothaphoebe* is also nested in this clade. These molecular data supported *Dehaasia*, *Alseodaphne* and *Nothaphoebe* as closely related. Li et al. (2011) proposed to include *Dehaasia* in *Alseodaphne*. However, because of the limited taxon sampling in their study, they suggested that a major revision was needed for the delimitation of *Dehaasia*, *Alseodaphne* and *Nothaphoebe*. As a molecular phylogenetic analysis is not included in this study and as long as the genus circumscription is not resolved, we will continue to use *Dehaasia* in its present delimitation.

Local taxonomic studies of the genus have been made, for instance in Java (Backer & Bakhuizen van den Brink f. 1963), Peninsular Malaya (Kochummen 1989) and Borneo (Julia et al. 2009). Kochummen (1989) recognised nine species in Peninsular Malaysia, including the endemic species *D. lancifolia* Ridl. Backer & Bakhuizen van den Brink f. (1963) recognized five species in Java. Julia et al. (2009) reported 16 species in Sabah and Sarawak. The island of Sumatra was chosen for this study, because of its species richness in this genus and lack of a recent taxonomical treatment.

MATERIAL AND METHODS

A revision of Sumatran *Dehaasia* was carried out by examining herbarium collections from the herbaria BO, L and U (for abbreviations see Thiers, http://sweetgum.nybg.org/science/ih/). All dimensions given are of dried material except for the floral characters. Flowers were soaked in boiling water before observation and measurement. Synonyms of *Dehaasia* taxa from outside Sumatra are included when type material was seen by the first author. Scans of type material were accessed at the Global Plants website (http://plants.jstor.org) in March 2017, specimens seen only as image are denoted with an asterisk (*).

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MORPHOLOGY OF *DEHAASIA* IN SUMATRA

Habit

The *Dehaasia* species in Sumatra are small to moderately tall trees, 6 to 35 m tall.

Twigs and terminal leaf buds

In general, the growth is sympodial and the twigs are mostly slender with prominent lenticels and leaf scars. The terminal leaf buds are glabrous to densely pubescent.

Leaves

The simple leaves are spirally arranged, usually clustered near the tip of the branches. Leaf shapes range from elliptic to obovate. The biggest leaf size can be found in *D. incrassata*, up to 32 by 15 cm. The leaf surface is mostly glabrous, except for *D. cuneata* and *D. tomentosa* (Blume) Kosterm., which have hairs on the lower surface.

All species of *Dehaasia* in Sumatra have penninerved leaves. The midribs and secondary veins on the upper surface are usually flat or immersed or slightly raised, but raised on the lower surface in all species. The secondary veins are mostly curving and joining near the margin. The tertiary venation is reticulate or scalariform-reticulate, mostly inconspicuous on the upper surface and conspicuous on the lower surface. The characters of leaf venation are stable within a species and can be used to differentiate the species.

Most species have glabrous petioles, but they are hairy in *D. cuneata* and *D. tomentosa.* The length of the petiole varies within and among species; the longest petioles of up to 40 mm are found in *D. sumatrana* Kosterm. The adaxial side of the petiole is often channelled to the base but sometimes rounded or flat at the base. *Dehaasia teijsmannii* Kosterm. has petioles that are deeply channelled whereby both edges almost meet.

Inflorescences

Inflorescences of the *Dehaasia* species in Sumatra arise from the axils of bud scales, at the tip of branches or at the base of the new growth, and sometimes in the axils of the first leaves on the new growth, they appear to be axillary or subterminal. All species have type 2 inflorescences (Van der Werff 2001), which are paniculate-cymose and repeatedly branched, with the lateral flowers of the ultimate cymes strictly opposite; except for *D. sumatrana*, in which the cymes are modified to pseudo-umbels. This species also has the longest inflorescences, up to 22 cm long. The bracts are early caducous in all species.

Flowers

The floral characters are important for species delimitation within *Dehaasia* in Sumatra. In most species the outer tepals are smaller than the inner tepals except for *D. caesia* Blume with equal tepals. The tepals are often hairy but glabrous in *D. sumatrana* and *D. pilosa* Fijrid. (sp. nov.). The number of stamens is 9, equally divided over three androecial whorls. The stamens are club-shaped and truncate, rounded or slightly emarginate at the apex, densely covered by 0.1–0.3 mm long hairs, especially on the filaments. The anthers are 2-thecate and open by valves, one per thecae. The anthers in the first and second whorl open introrse, while those in the third whorl open extrorse. In most species, the filaments are longer than the anthers, and those of the third whorls basally bear two sessile or subsessile glands. Most species have three staminodes in the fourth whorl, except for *D. incrassata*, where staminodes are absent. The staminodes are awl-shaped, ovoid, cordate or with two separate apical-lateral glands, completely covered with hairs or with a hairy basal part only. Awl-shaped staminodes are found in *D. caesia*, *D. pilosa* and *D. teijsmannii*, whereas ovoid staminodes occur in *D. cuneata*, *D. sumatrana* and *D. tomentosa*; staminodes with two separate apical-lateral glands are found in *D. bandaharense* Fijrid. (sp. nov.). The ovaries are mostly glabrous except in *D. pilosa*.

Fruits

The fruits are narrowly ellipsoid to ellipsoid, with a fleshy, coloured and warty pedicel. The largest fruit is found in *D. incrassata*, up to 3.5 cm long with a swollen stipe of up to 3 cm length.

TAXONOMIC TREATMENT

Dehaasia

Dehaasia Blume in Nees (1836) 372 (‘*Haasia*’), nom. & orth. cons.; Blume (1837) 161; (1851) 333; Miq. (1858) 928 (‘*Haasia*’); Lecomte (1914) 150 (‘*Haasia*’); Ridl. (1924) 87; Kosterm. (1952b) 120; Backer & Bakh.f. (1963) 130; Kosterm. (1957a) 36; (1957b) 228; (1964) 466; (1973) 427; Kochummen (1989) 138; Rohwer (1993) 381; van der Werff (2001) 136. — Type: *Dehaasia microcarpa* Blume (= *Dehaasia incrassata* (Jack) Kosterm.).

Cyanodaphne Blume (1851) 333; Kosterm. (1952b) 126. — Lectotype (designated by Kostermans 1952b): *Cyanodaphne cuneata* (Blume) Blume (= *Dehaasia cuneata* (Blume) Blume).

Shrubs to medium trees; bark usually thin, white, smooth and easy to peel off; wood yellow. *Twigs* mostly sympodial, whitish, slender with prominent lenticels and leaf scars, glabrous or minutely puberulous with appressed light brown hairs, terminal leaf buds glabrous to densely covered with silky brown hairs. *Leaves* spirally arranged at the end of twigs, simple, elliptic to obovate or oblanceolate; blade coriaceous or chartaceous, rarely membranous, penninerved; petioles mostly channelled on adaxial side, glabrous or hairy. *Inflorescences* axillary to cataphylls or occasionally to foliage leaves, paniculate-cymose, with the lateral flowers of the ultimate cymes strictly opposite, mostly minutely puberulous with appressed light brown hairs, bracteoles on the pedicel caducous. *Flowers* bisexual, perigynous, with a shallow or deep receptacle tube; tepals 6, arranged in two whorls, often unequal, then outer tepals smaller, glabrous to densely covered with appressed light brown hairs. *Stamens* 9, club-shaped, hairy, mostly filaments longer than anthers, arranged in three whorls, anthers of first and second whorls introrse, in third whorl extrorse and with two sessile or subsessile glands at each filament; anthers 2-thecate, truncate, rounded or slightly emarginate at the apex, opening with single valves. *Staminodes* 3 in the fourth whorl or absent. *Ovary* superior, ovoid, ellipsoid or globose, glabrous or hairy; style terete, shorter or longer than ovary, glabrous or hairy. *Fruits* ellipsoid or narrowly ellipsoid, rarely globose; exocarp glossy, mesocarp thin and fleshy; stalk distinctly swollen, fleshy, coloured and warty.

Distribution — About 35 species distributed from South China to New Guinea, and centred in Malesia with most species on the Malay Peninsula, Sumatra and Borneo. In this revision, eight species are recognized for Sumatra.

Uses — The wood of *Dehaasia* is rather soft to hard and moderately durable to extremely durable (e.g., *D. caesia*); it has many uses, such as construction material of houses (exterior and interior uses), furniture, pianos, tools, oars, boats, carvings and knife sheaths. It can also be used in the veneer and plywood industries (Kostermans 1973, Wiselius 1998).

KEY TO THE SPECIES

1. Terminal leaf buds glabrous to/or sparsely hairy 2
1. Terminal leaf buds densely hairy 6
2. Inflorescences paniculate-cymose 3
2. Inflorescences paniculate with the ultimate flowers of each branch pseudo-umbellate . . . . . 6. *D. sumatrana*

3. Tepals unequal, outer tepals 1.1–1.6 mm long, inner tepals 1.7–2.7 mm long; receptacle shallow 4
3. Tepals equal or nearly so, outer tepals 0.7–1.1 mm long, inner tepals 1–1.1 mm long; receptacle deeply tubular . . . . . 2. *D. caesia*
4. Tertiary veins on lower leaf surface reticulate. Staminodes present 5
4. Tertiary veins on lower leaf surface scalariform-reticulate. Staminodes absent . . . . . 4. *D. incrassata*
5. Rachis of inflorescences with sparsely to densely pubescent. Ovary glabrous. Leaves coriaceous, tertiary veins on upper leaf surface conspicuous . . . . . 1. *D. bandaharense*
5. Rachis of inflorescences glabrous. Ovary hairy. Leaves chartaceous, tertiary veins on upper leaf surface inconspicuous . . . . . 5. *D. pilosa*
6. Leaves coriaceous; petiole flat to/or channelled above. . 7
6. Leaves membranous; petiole deeply channelled above so that the edges almost meet . . . . . 7. *D. teijsmannii*
7. Outer tepals spreading, much shorter than inner tepals, outer tepals 0.5 mm long, inner tepals c. 1.3 mm long. Midrib on upper leaf surface glabrous; secondary veins on upper leaf surface slightly raised to flat . . . . . 3. *D. cuneata*
7. Outer tepals erect, slightly smaller than inner tepals, outer tepals 1.1–1.3 mm long, inner tepals 1.2–1.5 mm long. Midrib on upper leaf surface with sparse light brown hairs; secondary veins on upper leaf surface more or less impressed . . . . . 8. *D. tomentosa*

1. *Dehaasia bandaharense* Fijrid., *sp. nov.* — Fig. 1; Map 1

Dehaasia bandaharense differs from *D. corynantha* Kosterm. in smaller lamina (shorter than 12 cm vs up to 25 cm long) with a cuneate (vs acute) base. The inflorescence is longer (up to 10 cm vs up to 7 cm long). The staminodes are with two separate apical-lateral glands (vs awl-shaped with no glands). — Type: *W.J.J.O. de Wilde & B.E.E de Wilde-Duyfjes 15557* (holo L.1797857; iso MO [Van der Werff, pers.comm.]), [Indonesia], Sumatra, Aceh, Gunung Leuser Nature Reserve, Gunung Bandahara, 20 Mar. 1975. Paratype: *W.J.J.O. de Wilde & B.E.E de Wilde-Duyfjes 15572* (L), Indonesia, Sumatra, Aceh, Gunung Leuser Nature Reserve, Gunung Bandahara.

Trees, 20–30 m tall, stem up to 40 cm diam, wood yellowish; twigs slender to thick, 2–7 mm diam, cracked and easily peeling off when dried; terminal buds glabrous, cataphylls ciliate. *Leaves* spirally arranged near the end of twigs; lamina coriaceous, elliptic to subobovate, 6–11 by 3–4.7 cm, apex short acuminate, base cuneate, glabrous on both sides, midrib flat above, raised below, secondary veins 8–10 pairs, raised to flat above, raised and joining near the margin below, tertiary veins reticulate, conspicuous above, prominent below. *Petioles* 8–16 mm long, 0.5–1 mm diam, glabrous, channelled above towards the base. *Inflorescences* subterminal and axillary, paniculate-cymose, up to10 cm long; rachis filiform, with sparse to dense minute appressed light brown hairs. *Flower* buds grey-green tepals unequal; outer tepals ovate, c. 1.6 by 1.2 mm, with minute light brown appressed hairs, margin ciliate; inner tepals broadly ovate, c. 2 by 1.8 mm, apices broadly acute, with minute light brown appressed hairs, margin ciliate; receptacle shallow, pedicel c. 3.7 mm long. *Stamens* 1.3–1.7 mm long, anthers rounded to truncate or slightly emarginate at apex; filaments longer than anthers, pubescent, filaments of the third whorl with two sessile glands each. *Staminodes* with two separate apical-lateral glands, filament c. 0.7 mm long, pubescent. *Pistil* c. 2 mm long; ovary ovoid, c. 1.2 by 0.7 mm, glabrous; style terete, c. 0.8 mm long, glabrous; stigma triangular. *Fruit* not seen.

Distribution — Aceh.

Habitat & Ecology — Mountain rainforest, at 800–1000 m altitude. Flowering in March.

Note — This species is similar to the Bornean species *D. corynantha* Kosterm.; which has bigger leaves (up to 25 cm long) with impressed secondary veins above and an ellipsoid ovary as long as the style.

2. *Dehaasia caesia* Blume — Map 1

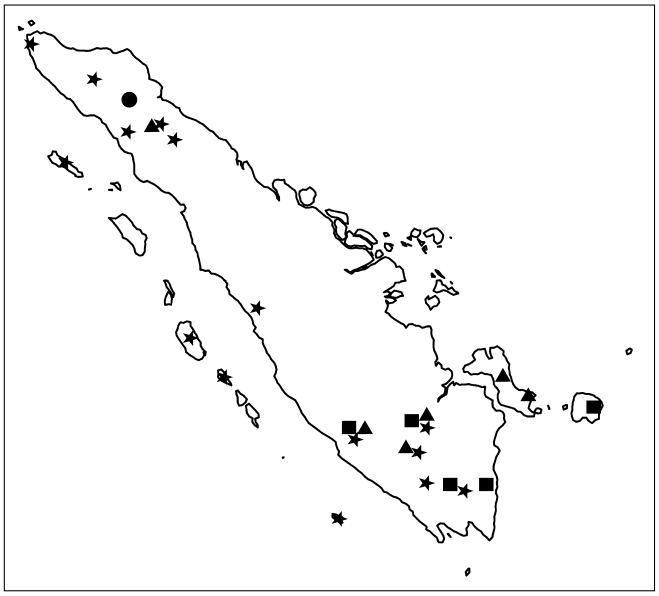
Dehaasia caesia Blume (1851) 333; Backer & Bakh.f. (1963) 131; Kosterm. (1964) 467; (1973) 429. — Lectotype (designated by Kostermans 1973): *Hasskarl 345* (lecto L.0036308), [Indonesia,] Java.

Trees, up to 25 m tall, stem up to 20 cm diam; twigs sympodial, terete, 4–7 mm diam, glabrous, lenticels inconspicuous, terminal bud with sparse minute appressed brown hairs. *Leaves* spirally arranged, clustered at the end of branches; lamina coriaceous, obovate to elliptic, 4.5–15 by 2–6 cm, apex acuminate, base cuneate (rarely obtuse), lamina glabrous on both sides, greyish below, midrib impressed to flat above, raised below, secondary veins 8–11 pairs, flat to raised above, raised below, curving and joining near leaf margin, tertiary veins reticulate, conspicuous above, inconspicuous below. *Petioles* 10–20 mm long, 1–2 mm diam, glabrous, channelled above. *Inflorescences* subterminal and axillary, paniculate-cymose, 4–12 cm long; rachis filiform, with sparse to dense minute appressed brown hairs. *Flowers*: tepals equal or nearly so, with minute brown appressed hairs; outer tepals ovate, 0.7–1.1 by 0.7–1.1 mm, apex broadly acute, margin ciliate; inner tepals ovate, 1–1.1 by 0.9–1.1 mm, apex broadly acute, margin ciliate; receptacle deeply tubular; pedicel 1.5–2.5 mm long. *Stamens* 0.6–0.8 mm long, anthers truncate at apex; filaments as long as or slightly longer than anthers, pubescent, filaments of the third whorl with two sessile glands each. *Staminodes* awl-shaped, 0.4–0.5 mm long, pubescent. *Pistil* 1–1.4 mm long; ovary globose, 0.5–0.7 mm diam, glabrous; style terete, 0.5–0.7 mm long, glabrous; stigma capitate. *Infructescences* 4–8.5 cm long, glabrescent. *Fruit* ellipsoid, 2–2.1 by 1.1–1.4 cm; stalk swollen, 0.6–1 cm long, fleshy and warty.

Distribution — Palembang, Bangka Island, Bengkulu and Lampung.

Habitat & Ecology — Growing at 5–900 m altitude. Flowering: February.

Vernacular Names — Medang batu, medang tanduk, medang tungkai.



Map 1 Distribution of *Dehaasia bandaharense* Fijrid. (●), *D. caesia* Blume (■), *D. cuneata* (Blume) Blume (▲) and *D. incrassata* (Jack) Kosterm. (★) in Sumatra.

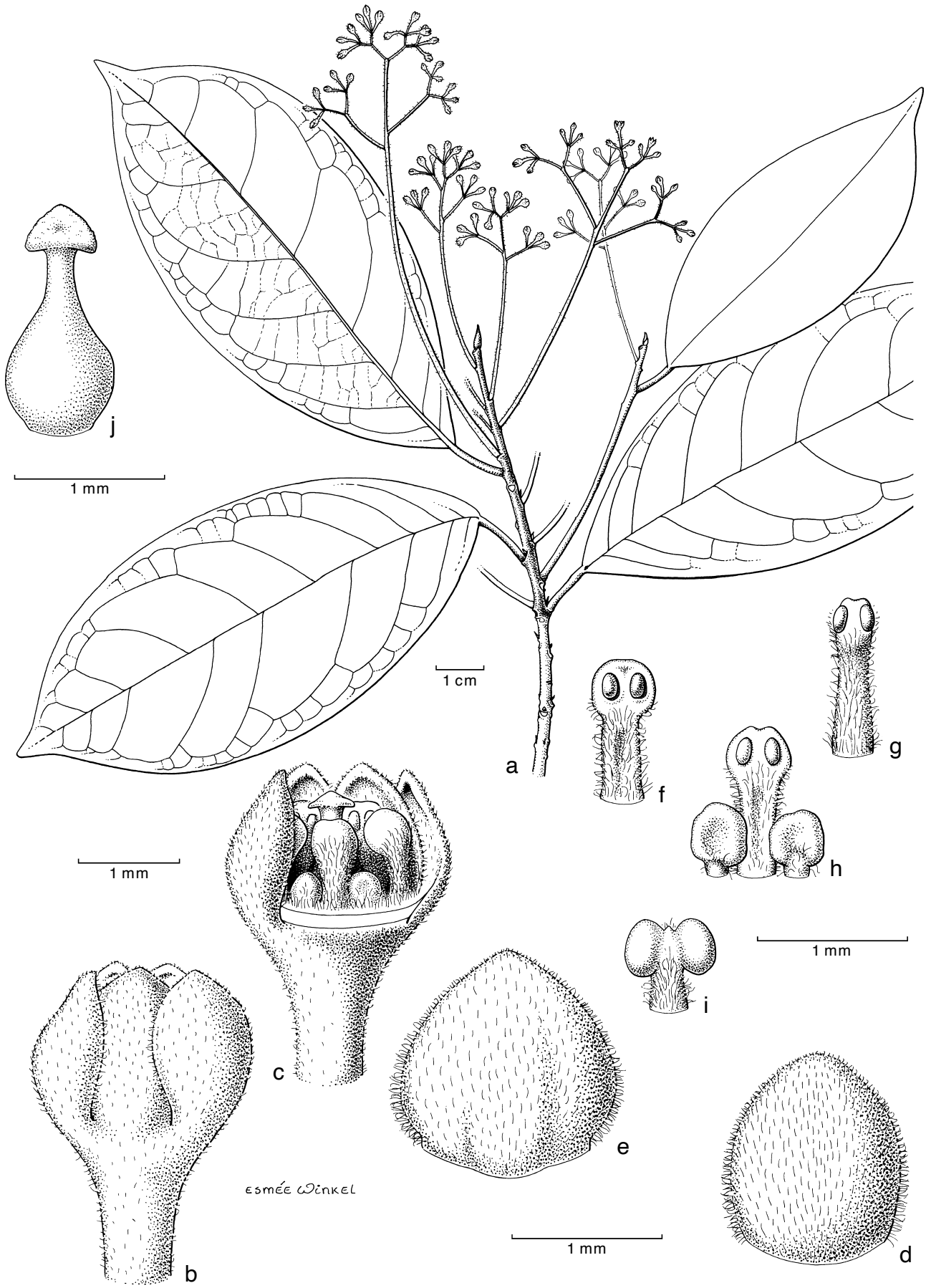


Fig. 1 *Dehaasia bandaharense* Fijrid. a. Flowering leafy twig; b, c. flower buds; d, e. outer and inner tepals; f. first whorl stamen; g. second whorl stamen; h. third whorl stamen with a pair of glands; i. staminode; j. ovary (all: *W.J.J.O. de Wilde & B.E.E. de Wilde-Duyfjes 15557*, L). — Drawing by Esmée Winkel.

Note — *Dehaasia caesia* differs from the other *Dehaasia* species of Sumatra by its subequal tepals and a capitate stigma.

3. *Dehaasia cuneata* (Blume) Blume — Map 1

Dehaasia cuneata (Blume) Blume (1837) 164; Koord. & Valeton (1904) 203; Ridl. (1924) 87; Backer & Bakh.f. (1963) 131; Kosterm. (1964) 467; (1973) 435; Kochummen (1989) 139. — *Cryptocarya cuneata* Blume (1825) 558. — *Haasia cuneata* (Blume) Blume in Nees (1836) 378, *nom. inval.*, genus name rejected. — *Cyanodaphne cuneata* (Blume) Blume (1851) 334. — Type: *Blume s.n.* (holo L.0036313; iso L.00336315), [Indonesia,] Java, Nusa Kambangan.

Trees, up to 35 m tall, stem up to 50 cm diam; bark yellowish; sapwood yellow, heartwood darker yellow; twigs whitish, with prominent lenticels and leaf scars, glabrous to sparsely covered with minute appressed light brown hairs, terminal leaf buds densely hairy. *Leaves* spirally arranged at end of twigs; lamina coriaceous, obovate (or elliptic), (3.5–)7–13(–16.5) by (2.5–)3–6(–7.5) cm, apex rounded or obtuse (rarely short acuminate), base cuneate or obtuse, (oblique), glabrous above, grey with sparse minute appressed light brown hairs below, midrib impressed to flat above, raised to flat below, secondary veins 6–9 pairs, curving and joining near margin, slightly raised to flat and glabrous above, raised to flat below, tertiary veins conspicuous, reticulate above, scalariform-reticulate below. *Petioles* (3–)8–20(–27) mm long, with sparse minute appressed light brown hairs to more densely hairy at the base, flat to channelled but almost terete at the base. *Inflorescences* subterminal and axillary, paniculate-cymose, up to 14 cm long, with minute appressed light brown hairs. *Flowers*: tepals unequal, with dense appressed light brown hairs, margin ciliate; outer tepals spreading, c. 0.5 by 0.6 mm; inner tepals broadly ovate, c. 1.3 by 1.4 mm, apex broadly acute; receptacle tubes deep; pedicel c. 2.7 mm long. *Stamens* 0.8–0.9 mm long, anthers truncate or slightly emarginate at apex; filaments longer than anthers, pubescent, filaments of the third whorl with two sessile glands each. *Staminodes* narrowly ovoid, thin, c. 0.6 by 0.3 mm, abaxially pubescent and adaxially glabrous. *Pistil* c. 1.4 mm long; ovary ovoid, glabrous, c. 0.7 by 0.5 mm; style terete, c. 0.7 mm long, glabrous, stigma triangular. *Infructescences* (2–)4.5–13.5 cm long. *Fruit* ellipsoid or oblongoid, 2.3–2.8 by 1.1–1.5 cm, with a sour taste and strong smell; stalk distinctly swollen, 1–1.7 cm long, fleshy, warty, red when fresh.

Distribution — Malay Peninsula, Sumatra (West coast, Bengkulu, Palembang and Bangka Island), Java, Borneo.

Habitat & Ecology — Rather common, scattered, on sandy soil, primary forest, at 5–700 m altitude. Flowering: February to June; fruiting: March to September.

Vernacular names — Medang puti, medang tanahan, medang tanduk.

Note — This species is quite similar to *D. tomentosa*. The latter has a shallow receptacle, subequal tepals, thick staminodes, midrib on the upper leaf surface with sparse light brown hairs.

4. *Dehaasia incrassata* (Jack) Kosterm. — Map 1

Dehaasia incrassata (Jack) Kosterm. (1952a) 91; Merr. (1952) 230; Backer & Bakh.f. (1963) 131; Kosterm. (1964) 468; (1973) 441; Kochummen (1989) 139. — *Laurus incrassata* Jack (1822) 33; Kosterm. (1964) 637. — *Machilus incrassatus* (Jack) Nees (1831) 70; Kosterm. (1964) 910. — *Haasia incrassata* (Jack) Nees (1836) 376, *nom. inval.*, genus name rejected. — *Persea incrassata* (Jack) Nees (1836) 127, 376; Kosterm. (1964) 1230. — Type: *Jack s.n.* † (see note), [Indonesia], Sumatra, Natal; neotype (selected here): *Teysmann s.n.* (neo L.0036318), [Indonesia], Sumatra.

Haasia microcarpa Blume in Nees (1836) 373. — *Dehaasia microcarpa* (Blume) Blume (1837) 162; Kosterm. (1964) 469. — Lectotype (selected here): *Hasskarl s.n.* (lecto L.0036319; isolecto U.0002728), [Indonesia,] Java, Bantam [Banten].

Dehaasia squarrosa Zoll. & Moritzi in Zoll. (1854) 115; Hassk. (1855) 8, as *nom. nov.* — *Haasia squarrosa* (Zoll. & Moritzi) Miq. (1858) 929; Kosterm. (1964) 537. — Type: *Zollinger 1376* (holo BO not found; iso P.01753085*, U0002732), [Indonesia,] Java.

Dehaasia media Blume (1837) 163; Kosterm. (1964) 469. — Lectotype (selected here): *sine coll.* (lecto L.0036322; isolecto L.0036323, L.0036324), [Indonesia], Ambonia (Ambon).

Beilschmiedia purpurea Elmer (1910) 703; Kosterm. (1964) 145. — Syntypes: *Elmer 11288* A.00041494*, BM.000950898*, E.00386537*, HBG.509735*, G.00368769*, L.0036325, LE.00012682*, MO247193*, NY.00022716*, US.00099411*), [Philippines,] Island of Mindanao, District of Davao, Todaya, Mt Apo.

Trees, up to 20 m tall, stem up to 40 cm diam; bark smooth; twigs sympodial, slightly striate, slender to thick, 3–7 mm diam, glabrous; terminal leaf buds glabrous to glabrescent, cataphylls ciliate. *Leaves* spirally arranged at the end of twigs; lamina chartaceous to subcoriaceous, elliptic to broadly elliptic or subobovate, (6.5–)12–26(–32) by (2.5–)3.5–12(–15) cm, glabrous on both sides, apex acute to acuminate, base cuneate, midrib flat to slightly raised above, midrib raised below, secondary veins (6–)8–10(–13) pairs, flat to raised above, raised and joining near margin below, tertiary veins scalariform-reticulate, conspicuous above, prominent below. *Petioles* 7–25 mm long, 1–4 mm diam, glabrous, flat to channelled above. *Inflorescences* terminal and axillary, paniculate-cymose, (4–)10–13(–18) cm long; rachis pale green to red when fresh, filiform, with minute light brown appressed hairs. *Flowers* greenish white; tepals unequal, ovate, outer tepals 1.1–1.3 by 1.5–2.5 mm, glabrous or with sparse minute light brown appressed hairs, margin ciliate; inner tepals broadly ovate, 2.5–2.7 by 2–2.7 mm, apex broadly acute, glabrous or with sparse minute light brown appressed hairs, margin ciliate; receptacle shallow; pedicel c. 6.7 mm long. *Stamens* 1.5–2 mm long, anthers rounded to truncate or slightly emarginate at apex; filaments longer than anthers, pubescent, filaments of third whorl with two sessile glands each. *Staminodes* absent. *Pistil* c. 2.5 mm long; ovary subgloboid to ovoid, c. 1 by 1.3 mm, glabrous; style terete, glabrous, slender, longer than ovary, c. 1.5 by 0.1 mm; stigma triangular. *Infructescences* 2–8.5 cm long, glabrous. *Fruit* ellipsoid, 2–3.5 by 1–2.5 cm, shiny black when fresh; stalk distinctly swollen, 2.5–3 cm long, fleshy and warty, bright red when fresh.

Distribution — Thailand, Malay Peninsula, Sumatra (Aceh, North Sumatra, South Sumatra, West Sumatra, Bengkulu, Lampung, Simalur (Simeulue) Island, Sipora Island, Siberut Island and Enggano Island), Java, Borneo, Sulawesi, Maluku and New Guinea.

Habitat & Ecology — Primary and secondary forests, at 50–1200 m altitude. Flowering: February to December; fruiting: February to December.

Vernacular names — Kayu madang kuning, kayu si marhaluwang, masasen kuning, medang kayu mesang, medang keladi, medang kuning.

Note — The type specimen of Jack's collection from Sumatra was destroyed in 1824 (Merrill 1952, Balakrishnan & Chakrabarty 2011). Therefore a neotype is designated here using Teijsmann's collection, also collected from Sumatra. This specimen is a paratype of *Dehaasia squarrosa*, a synonym of *D. incrasssata.*

5. *Dehaasia pilosa* Fijrid., *sp. nov.* — Fig. 2; Map 2

Dehaasia pilosa differs from *D. brachybotrys* (Merr.) Kosterm. in smaller lamina (shorter than 23 cm vs up to 40 cm long) with the base cuneate to obtuse (vs acute); the secondary veins on lower leaf surface not all distinctly joining near the margin (vs distinctly joining near margin); the inflorescence generally longer (up to 10 cm vs up to 6 cm long); the ovary hairy (vs glabrous). — Type: *Boschproefstation E.1063* (holo L.1797809), [Indonesia,] Sumatra, Bengkulu, Redjang.

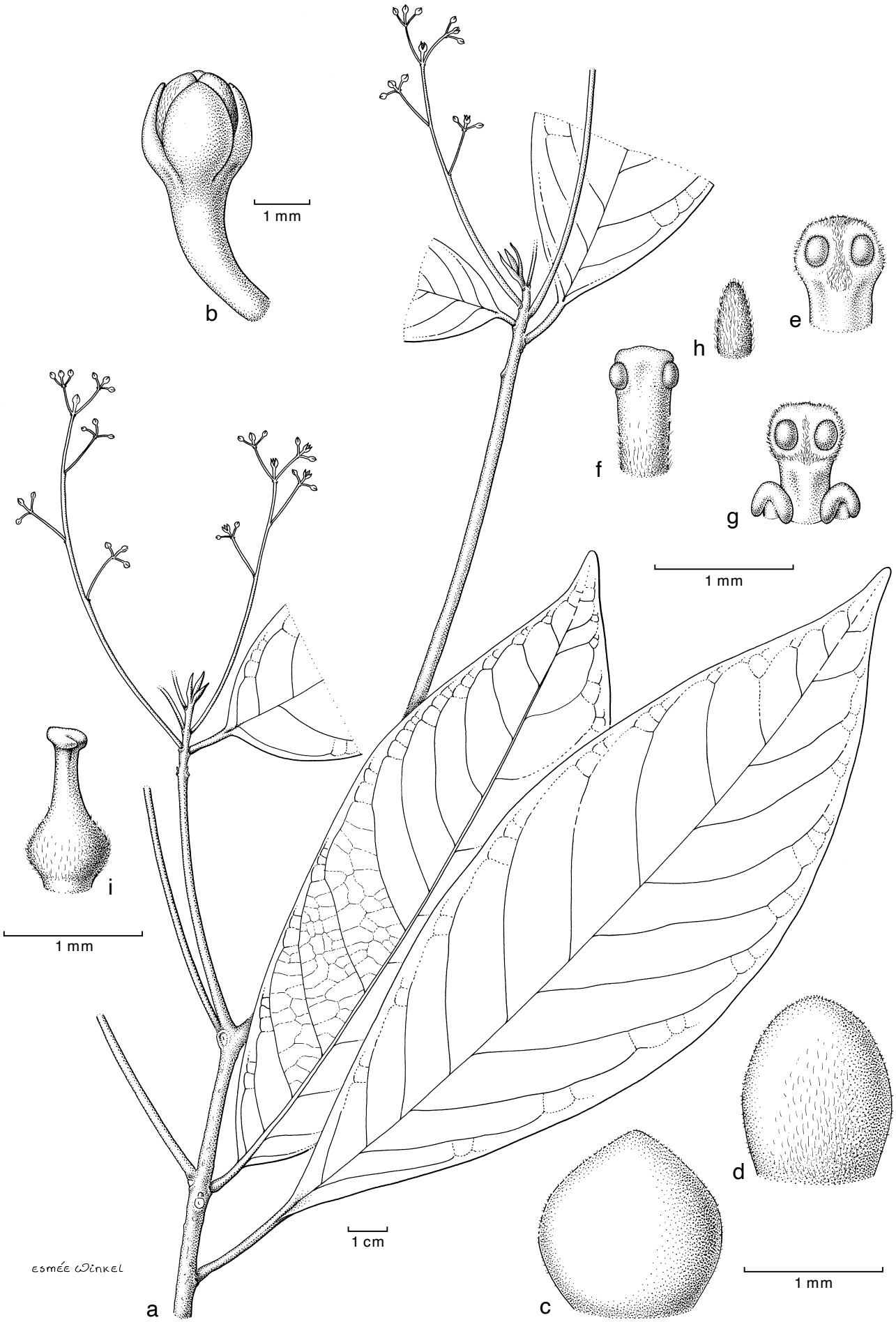


Fig. 2 *Dehaasia pilosa* Fijrid. a. Flowering leafy twig; b. flower buds; c, d. inner and outer tepals; e. first whorl stamen; f. second whorl stamen; g. third whorl stamen with a pair of glands; h. staminode; i. ovary (all: *Boschproefstation E1063*, L). — Drawing by Esmée Winkel.

Trees, twigs slender, 2–4 mm diam, greyish, slightly grooved, with inconspicuous lenticels; terminal buds glabrous to glabrescent, cataphylls ciliate. *Leaves* spirally arranged at end of twigs; lamina chartaceous, elliptic to obovate, 6–22 by 3.5–7 cm, glabrous on both sides, apex subacute to acuminate, base cuneate to obtuse, midrib impressed to flat above, raised below, secondary veins 10–13 pairs, impressed to flat above, raised and not all distinctly joining near margin below, tertiary veins reticulate, inconspicuous above, conspicuous below. *Petioles* 7–30 mm long, 0.7–1.5 mm diam, glabrous, channelled towards the base. *Inflorescences* subterminal, paniculate-cymose, up to10 cm long; rachis filiform, glabrous. *Flowers*: tepals unequal, outer tepals broadly ovate to rounded, 1.1–1.3 by 1.5–1.8 mm, glabrous to glabrescent, margin ciliate; inner tepals broadly ovate, 1.7–2 by 1.7–1.8 mm, apices broadly acute to obtuse, glabrescent, margin ciliate; receptacle shallow, pedicel c. 3.2 mm long. *Stamens* 1.3–1.7 mm long; anthers rounded to truncate at apex, slightly wider than filaments; filaments longer than anthers, with short appressed hairs, filaments of the third whorl with two subsessile glands each. *Staminodes* awl-shaped, c. 0.5 mm long, with short appressed hairs. *Pistil* c. 2 mm long; ovary ovoid, c. 0.9 by 0.7 mm, hairy; style terete, c. 1.1 mm long, sparsely hairy at base; stigma triangular. *Fruit* not seen.

Distribution — Bengkulu. This species is only known from the type specimen.

Habitat & Ecology — Growing at c. 1100 m altitude. Flowering: June.

Vernacular name — Medang tanduk.

Note — This species is morphologically almost similar to *D. brachybotrys*; the latter has bigger leaves, glabrous ovaries, shorter and hairy inflorescences.

6. *Dehaasia sumatrana* Kosterm. — Map 2

Dehaasia sumatrana Kosterm. (1973) 470. — Type: *Boschproefstation E.1077* (holo BO.1273069; iso L.1797944), [Indonesia,] Sumatra, Bengkoelen, Redjang, Tjoeroep.

Trees, 6–22 m tall, stem 12–34 cm diam; bark thin, peeling, with lenticels, inner bark brown; sapwood yellow; twigs sympodial, thick, glabrous, rough, with protruding lenticels and leaf scars; terminal leaf buds glabrescent; cataphylls broadly ovate, apices cuspidate to caudate, inner side glabrous, margin ciliate. *Leaves* spirally arranged at the end of twigs; lamina stiffly chartaceous, obovate to elliptic, 10–30 by 3.7–10 cm, apex obtuse to acuminate, base cuneate, glabrous on both surfaces, rather glossy above, rough and glaucous below, midrib impressed to flat above, raised below, secondary veins 8–11(–14) pairs, curving and joining near the margin, impressed to flat above, raised below, tertiary veins reticulate, inconspicuous above, prominent below. *Petioles* 25–40 mm long, 2–3 mm diam, glabrous, adaxial side flat, thicker and rough in the proximal half of the base because of protruding lenticels. *Inflorescences* subterminal, paniculate with the ultimate flowers of each branch pseudo-umbellate, 8–22 cm long; rachis slender, glabrous, purplish pink. *Flowers*: tepals subequal, glabrous except for the ciliate margin; outer tepals broadly ovate, 1.2–1.5 by c. 1.1 mm, apex acute to broadly acute; inner tepals broadly ovate, c. 1.5 by 1.5 mm, apices broadly acute; receptacle tubes deep; pedicel filiform, 0.4–2 cm long, greenish white. *Stamens* 0.8–1.2 mm long, anthers rounded to truncate or slightly emarginate at the apex with minute unicellular hairs; filaments as long as anthers or slightly shorter, pubescent, filaments of the third whorl with two sessile glands each. *Staminodes* ovoid to broadly ovoid, 0.4–0.6 by 0.2–0.5 mm, inner face glabrous, outer face villose along the central part. *Pistil* c. 1.4 mm long; ovary globose, c. 0.6 by 0.8 mm, glabrous; style terete, glabrous, c. 0.8 by 0.1 mm; stigma triangular. *Infructescences* c. 14 cm long. *Fruit* subglobose, 3–4 cm wide, glossy (purple-)black; stalk swollen, c. 3 cm long, fleshy, warty, bright red when fresh.

Distribution — Payakumbuh, Aceh, Bengkulu. This species is endemic to Sumatra.

Ecology — Primary, secondary and disturbed forest, at 10–1100 m altitude. Flowering: January to June; fruiting: August.

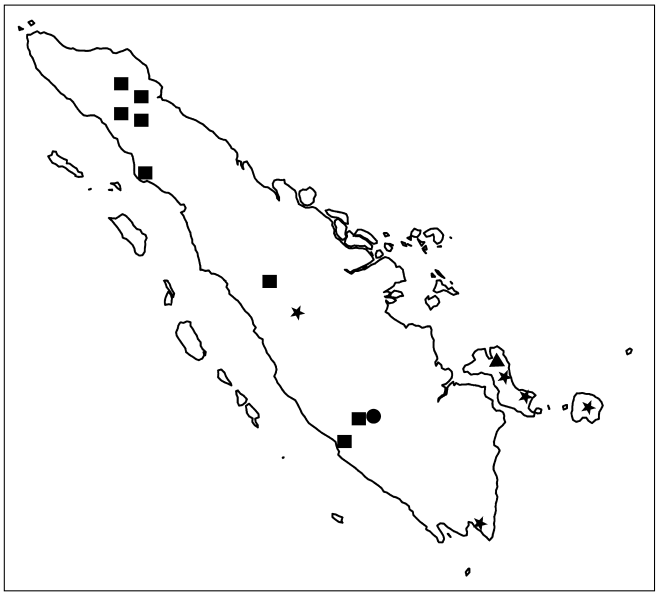
Vernacular names — Medang jambu, medang kuning, medang sangka.

Note — This species is easily recognized among the other *Dehaasia* species of Sumatra by its long filiform pedicels, petioles rough and thick in the basal half, and the prominently reticulate lower leaf surface.

7. *Dehaasia teijsmannii* Kosterm. — Map 2

Dehaasia teijsmannii Kosterm. (1973) 471. — Type: *Teijsmann s.n.* (holo BO1273060; iso BO1273064, L0036337), [Indonesia,] Sumatra, Bangka, Sungai Liat.

Trees, twigs terete but angular near the tip, slender, smooth, lenticels conspicuous near the tip, 3–5 mm diam, glabrous but with sparse minute appressed hairs near the tip, terminal leaf buds densely covered with silky hairs. *Leaves* spirally arranged; lamina membranous, elliptic to sub-obovate, 8–16 by 4–8.5 cm, glabrous on both surfaces, apex obtuse to acuminate, base cuneate, midrib flat to sunken near the base above, raised below, secondary veins 10–12 pairs, curving and joining near margin, sunken to flat above, raised below, tertiary veins reticulate, inconspicuous above, slightly prominent below. *Petioles* 6–13 mm long, 1–1.5 mm diam, deeply channelled so that the edges almost meet, glabrous or with sparse minute appressed hairs. *Inflorescences* paniculate-cymose, axillary, 2–4 cm long, few-flowered, rachis with sparse minute appressed light brown hairs. *Flowers*: tepals unequal, outer tepals ovate, c. 0.7 by 0.8 mm, glabrous but with ciliate margin; inner tepals broadly ovate, 1.3–1.5 by 1.4–1.5 mm, glabrescent, margin ciliate, apex broadly acute; receptacle tubes deep; pedicel slender, c. 7.7 mm long. *Stamens* 0.8–1.4 mm long; anthers glabrous, truncate at apex; filaments longer than anthers, with dense, 0.1–0.2 mm long brown hairs, filaments of third whorl with two sessile glands each. *Staminodes* 1(–3?), shortly awl-shaped, c. 0.6 mm long, with dense 0.1–0.2 mm long brown hairs on both sides. *Pistil* c. 1.7 mm long; ovary ellipsoid, c. 1 by 0.7 mm,



Map 2 Distribution of *D. pilosa* Fijrid. (●), *D. sumatrana* Kosterm. (■), *D. teijsmannii* Kosterm. (▲) and *D. tomentosa* (Blume) Kosterm. (★) in Sumatra.

glabrous; style terete, glabrous, shorter than ovary, c. 0.7 mm long; stigma inconspicuous. *Fruit* not seen.

Distribution — Bangka Island. This species is only known from the type specimen.

Vernacular name — Medang candik.

Note — This species has similar membranous leaves as *D. membranacea* Kosterm., which differs in having longer inflorescences and pedicels, heart-shaped and glabrous staminodes, and a caudate leaf apex.

8. *Dehaasia tomentosa* (Blume) Kosterm. – Map 2

Dehaasia tomentosa (Blume) Kosterm. (1973) 473; Kochummen (1989) 141. — *Cyanodaphne tomentosa* Blume (1851) 334. — Lectotype (first selection by Kostermans 1973, final selection made here): *Muller s.n.* (lecto L.0036341; isolecto BO not found, L.0036340), Borneo (see note 1).

Trees, 8–14 m tall, stem 10–18 cm diam; bark grey, smooth; sapwood yellow or light brown, rather soft, with a smell like cedar-wood; twigs sympodial, terete, whitish, glabrous to sparsely hairy, densely hairy at the tip, with prominent lenticels and leaf scars; terminal leaf buds densely hairy. *Leaves* spirally arranged at the end of twigs; lamina coriaceous, elliptic or obovate to broadly obovate (narrowly obovate), 4–22.5 by 2–13 cm, glabrous above, with sparse minute appressed light brown hairs below, apex rounded or acuminate (shortly acuminate), base cuneate, midrib impressed with sparse light brown hairs above, raised below, secondary veins 8–10(–12) pairs, curving and joining near margin, more or less impressed above, raised below, tertiary veins scalariform-reticulate, inconspicuous above, conspicuous below. *Petioles* 3–15 mm long, 1–3 mm diam, sparsely to densely minute light brown hairy, channelled but rounded at the base. *Inflorescences* subterminal and axillary, paniculate-cymose, up to 12 cm long, tomentose; bracteoles caducous. *Flowers* pale green or white, fragrant; tepals subequal, tomentose, margin ciliate; outer tepals erect, ovate to broadly ovate, 1.1–1.3 by 0.8–1.4 mm, apex broadly acute; inner tepals broadly ovate, 1.2–1.5 by 1.2–1.7 mm, apex broadly acute; receptacle shallow; pedicel stout, c. 1.2 mm long. *Stamens* 0.6–0.8 mm long; anthers rounded to truncate (or slightly emarginate) at apex; filaments slightly longer than anthers, densely curly brown hairy; filaments of the third whorl with two sessile glands each. *Staminodes* broadly ovoid, thick, 0.6–0.7 by 0.4–0.5 mm, half of outer side curly brown hairy, inner side glabrous. *Pistil* 1.2–1.4 mm long; ovary globose, 0.6–0.8 by 0.7–0.9 mm, glabrous; style terete, glabrous, 0.4–0.7 by c. 0.1 mm; stigma bilobed. *Infructescences* 9–13.5 cm long, sparsely tomentose. *Fruit* oblong, 1.8–2.3 by 0.9–1 cm; stalk distinctly swollen, 1.3–2.3 cm long, fleshy and warty, red when fresh.

Distribution — Malay Peninsula, Sumatra (West coast Lampung, Bangka Island and Belitung Island), Borneo.

Habitat & Ecology — Common, on sandy soil, at 20–1000 m altitude. Flowering: September to January.

Vernacular names — Medang kumbang, medang putih, medang sang, medang talur.

Notes — 1. In the protologue, no type specimen of this species was mentioned by Blume (1851). Later, when Kostermans (1973) treated this species as a new combination, he wrote: “Typus: Mueller s.n, Borneo, ster, (BO, L)”, but he did not select the specimens, nor did he indicate which specimen was the lectotype or isolectotype.

2. This species is similar to *Dehaasia cuneata*. The latter has minute outer tepals and deeper receptacle tubes. One specimen of *D. tomentosa* from relatively high altitude (1000 m) at West Coast of Sumatra has narrowly obovate leaves.

DUBIOUS NAMES

Dehaasia palembanica Kosterm. (1973) 463. — Type: *bb 9611* (holo BO), [Indonesia,] Sumatra, Bengkulu, Muko-Muko.

Note — The type specimen of this species is very similar to *Dehaasia cuneata*. Kostermans (1973) distinguished *D. palembanica* from *D. cuneata* by its larger outer tepals, and by leaves that are not grey below and have a different size. These are not strong characters to distinguish them. Kostermans (1973) also cited *bb 9611* as *Dehaasia cuneata*. Moreover, all sheets of *bb 9611* were labelled with different names by Kostermans. Of the two sheets in BO Kostermans labelled: BO.1240752 as *D. microsepala* Kosterm.: a name which was never published, whereas BO.1273090 was labelled as *D. caesia.* The other sheet of *bb 9611* in L (L.1796990) was labelled by Kostermans as *D. cuneata*. The paratypes cited by Kostermans (1973) are vegetatively different from the type specimens. Because these specimens are sterile, it was difficult to determine to which species they belong. Therefore, it seems best to place this species as an imperfectly known species until more fertile specimens become available.

Dehaasia subcaesia (Miq.) Kosterm. (1964) 472. — *Haasia subcaesia* Miq. (1860) 361. — Type: *Teijsmann H.B. 4386* (holo U; iso BO, L), [Indonesia,] Sumatra, Lampung, near Marassa.

Note — The types are sterile. According to Kostermans (1973), they represent young shoots. This species is related to *D. caesia*, but differs (among other characters) by flowers with unequal and glabrous tepals. We could not see these characters on the cited specimens, because they were mostly sterile or fruiting. Kostermans cited only a single flowering specimen (*T.B. 1119*) as preserved in BO and L, but we could not find this specimen in either the two herbaria. Two other flowering specimens labelled by Kostermans in 1970 as *D. subcaesia*, *Boschproefstation E.772* and *Endert 99E.IP.764*, have equal and hairy tepals as in *D. caesia.*

EXCLUDED NAMES FOR SUMATRA

Dehaasia pauciflora Blume (1851) 333; Kosterm. (1973) 466; Kochummen (1989) 140. — Type: *Sine coll., sine num., sine loc.* (holo BO; iso L.0036333).

Note — This species has been reported as distributed in Sumatra (Kostermans 1973, Kochummen 1989). However, we have not seen any material from Sumatra to support this claim.

Alseodaphne polyneura Miq. (1858) 916. — *Dehaasia polyneura* (Miq.) Kosterm. (1973) 466. — Syntypes: *Teijsmann s.n.* (BO, U not found), [Indonesia, Sumatra,] Padang, Poeloe Pisang. = *Alseodaphne polyneura* Miq.

Note — This species was formerly named *Alseodaphne polyneura* Miq. (Miquel 1858), and the type specimen in BO is a sterile young shoot (Kostermans 1973). The sheets of *Soepadmo 159* ([Indonesia,] Sumatra, upper Riauw, Pakanbaru Tenajan) and *bb 23556* ([Indonesia,] Sumatra, Bengkoelen, Moeko, Lalang Loeas) housed at Leiden were labelled by Kostermans as *Dehaasia polyneura* (Miq.) Kosterm. in 1971 and published in Kostermans (1973) as a new combination. After observing *Soepadmo 159*, it was apparent that the flowers have 4-thecate anthers and the filaments of the third whorl have two distinctly stalked glands. These are genus characters for *Alseodaphne* with *Alseodaphne polyneura* Miq. as the valid name.

Acknowledgements We would like to thank the curators of the BO and L herbaria for access to or loan of specimens used in the present study. We thank Esmée Winkel for making the drawings of *D. bandaharense* and *D. pilosa*. We are grateful to Brigitta de Wilde-Duyfjes for helpful suggestions and to Dr. Henk van der Werff for valuable discussions during the preparation of the manuscript. We want to thank Prof. Dr. J.G. Rohwer (Hamburg University) for many useful comments on earlier drafts of the manuscript. The first author received support from The IDB Merit Scholarship Programme for High Technology by Islamic Development Bank.

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IDENTIFICATION LIST

1 = *Dehaasia bandaharense* Fijrid.
2 = *Dehaasia caesia* Blume
3 = *Dehaasia cuneata* (Blume) Blume
4 = *Dehaasia incrassata* (Jack) Kosterm.
5 = *Dehaasia pilosa* Fijrid.
6 = *Dehaasia sumatrana* Kosterm.
7 = *Dehaasia teijsmannii* Kosterm.
8 = *Dehaasia tomentosa* (Blume) Kosterm.

Achmad 217: 4; 229: 4; 935: 4; 1187: 4; 1455: 4 – Arbain DA-464: 4.
bb series 6092: 8; 6242: 4; 6571: 4; 8423: 4; 8449: 6; 8657: 6; 8818: 2; 9721: 6; 15947: 3; 16593: 3; 29734: 8; 30068: 3; 32205: 3; 34066: 3; 35173: 3 – Boschproefstation E.772: 2; E.967: 3; E.1063: 5; E.1077: 6; T.335: 3; T.372: 2; T.912: 3; T.936: 3.
De Voogd 590: 6 – De Wilde & De Wilde-Duyfjes 14373: 6; 14420: 4; 14455: 4; 14607: 6; 15557: 1; 15572: 1; 19563: 4 – Dorst 99 E.IP.764: 2.
Elmer 11288: 4 – Endert 99 E.IP.764: 2; 99 E.IP.772: 2; 203 E.3 P967: 3.
Forbes 1613: 4.
Gussdorf 209: 2; 245: 4.
Hasskarl 345: 2.
Iboet 137: 4; 540: 4.
Jacobs 355: 4; 4655: 4.
Lambach 1343: 4 – Lörzing 5240: 4; 12719: 4 – Lütjeharms 4265: 4.
Koorders 10439: 4; 10617: 4; 28577: 2 – Kostermans 49: 3, 12039: 3; S.27: 4; S.104: 3 – Kostermans & Anta 395: 3; 398: 3; 798: 8; 807: 3; 900: 8; 1010: 8; 1176: 8; 1209: 8.
Maradjo 15: 6; 22: 4 – Mochtar 26A: 2.
Rahmat Si Toroes 4967: 4; 5315: 4; 5375: 4; 5582: 4 – Reksodihardjo 627: 4 – Rochadi 666: 6.
Thorenaar 99.E.IP.1016: 2.
Van Rossum 23: 8; 23A: 8; 45: 8 – Van Steenis 9792: 6.
Yates 1396: 4.
Zollinger 1376: 4.