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RESEARCH ARTICLE

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A revision of *Beilschmiedia* (*Lauraceae*) of Peninsular Malaysia

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Key words

Beilschmiedia
Lauraceae
Peninsular Malaysia
taxonomy

Abstract A revision of the Peninsular Malaysian species of *Beilschmiedia* (*Lauraceae*) is presented with a summary of the taxonomic history of the group, key, full descriptions, distribution maps, conservation assessments, ecological information, ethno-botanical notes and a discussion of morphology. In this treatment, 18 species are recognised; six names are lectotypified (*B. insignis*, *B. kunstleri*, *B. maingayi*, *B. membranacea*, *B. roxburghiana* and *B. scortechinii*) and five are placed into synonymy for the first time; one name is validly published for the first time (*B. atra*) and one species is recognised and described here as new to science (*B. kochummenii*). Most species are considered to be common (Least Concern), but *B. atra* must be considered to be extinct, two species are Critically Endangered (*B. kochummenii* and *B. membranacea*), four are Endangered (*B. lumutensis*, *B. penangiana*, *B. scortechinii*, *B. wallichiana*) and one is listed as Vulnerable (*B. insignis*).

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INTRODUCTION

The genus *Beilschmiedia* Nees was first described by Nees von Esenbeck in Wallich (1831) and is named after Karl Traugott Beilschmied, a chemist and botanist (1793–1848), who wrote mainly about plant geography. The genus is pantropical, with currently about 200–300 species being recognised.

The recognition of genera within the *Lauraceae* and the classification of the family have always been problematic. The general framework of characters which have been employed by most authors was first established by Nees von Esenbeck (1836). However, even within this framework, classifications can vary greatly, depending upon the weight given to any particular character. The placement of *Beilschmiedia*, together with *Cryptocarya* R.Br. and *Endiandra* R.Br. in one group was first proposed by Richter (1981) based on wood and bark anatomy. His findings were confirmed by later molecular studies (Rohwer et al. 2014), and *Beilschmiedia* is now placed in the *Cryptocarya* group as one of the early divergent clades within the family (Rohwer 2000, Rohwer et al. 2014). The genus has never been revised in full, but a number of important modern regional revisions exist, indicating a range in levels of local endemicity. In Madagascar, Van der Werff (2003) recognised nine species, all endemic; in Australia, 11 species occur, among which 10 (90 %) are endemic (Le Cusan & Hyland 2007); in China, Li et al. (2008a) recognised 39 species, of which 33 (c. 85 %) are endemic; and in Borneo, Nishida (2006) recognised 26 species, with 16 (61 %) of them endemic. An unpublished MSc thesis (Tetsana 2005) recognised 16 species in Thailand, of which two were new to science, eight were newly recorded for the country, and only four (25 %) were considered endemic; most of the non-endemics that occur in Thailand have distributions that extend to China, India and Myanmar rather than to Peninsular Malaysia. The most recent checklist for Peninsular Malaysia, by Turner (1995), recognised 18 species, the same number as in this present treatment. Among these 18 species, only seven are endemic (c. 38 %) though a further three (17 %) are restricted to Peninsular Thailand and Peninsular Malaysia together. The remaining species are more widespread and either also occur on the Sunda Plateau (Borneo, Java and Sumatra, extending to the Philippines in the case of *B. lucidula*), or, like most Thai species, they have distributions that extend into mainland Thailand, Indo-China, India or China. At present, no species from Peninsular Malaysia occurs east of the Wallace Line.

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MORPHOLOGY

Habit

Most species of *Beilschmiedia* are trees, usually up to 25–35 m tall, though a number of species do not get bigger than 15 m tall. Shrubs are rare in the genus.

Twigs and terminal leaf buds

The stoutness of the young twigs is a useful character for the recognition of some species (e.g., *B. kunstleri*). In this paper, I have measured the twig thickness on the first internode below the leaves.

The shape, length and hairiness of the terminal leaf buds are important in species recognition and in the definition of the various morphological groups. One of the most useful characters is their hairiness, as terminal leaf buds are either glabrous, sometimes with ciliate margins, or they are velutinous, and this character appears to be very stable within species. Nishida (2008) also used the type of hair (curly) on the leaf buds but I have only mentioned this character for one species in my key, as I find it difficult to circumscribe.

In some species the shape of the terminal leaf bud alone is enough for species recognition, as in the case of *B. lucidula*, in which they are round and swollen (see also Merrill 1914).

Leaves

Three different phyllotactic arrangements occur within this genus: opposite, alternate or rarely spiral. This last pattern is observed in the neotropical and the Bornean species, where it was used as one of the major characters in the classification of Nishida (1999, 2008). However, it is more difficult to use for the Peninsular Malaysian species because leaf arrangement is often very variable, and opposite, subopposite and alternate arrangements can sometimes be found on the same twig. In

addition, in Peninsular Malaysia, there are no truly opposite leaved species; all species which have opposite leaves also have some subopposite ones and occasionally some alternate ones as well.

One of the more difficult characters to use is the position of the secondary veins relative to the intervenium, which is important in a number of species groups. The main problem is that during drying, the intervenium can become warped around the secondary veins and may thus give the impression that the veins are raised. However, if the position of a vein is compared with the tissue immediately surrounding it, it is always clear whether the vein is sunken or raised. This problem usually manifests itself in species that have sunken veins, rather than in ones with raised veins.

Inflorescences

The inflorescences in this genus are always axillary, but because some are situated in the axils of leaves at the ends of the twigs, they can appear to be (sub)terminal.

Most species have type 3 inflorescences as defined by Van der Werff (2001), which are paniculate-cymose and repeatedly branched, with the lateral flowers of the ultimately cymes not strictly opposite. In the case of *B. roxburghiana*, the terminal cymes are strictly opposite, which might make this a type 2 inflorescence; however, the inflorescence of this species is small and compact and its appearance may be caused by a series of reductions (see discussion in Van der Werff 2001: 127). In *B. lumutensis*, the open, lax inflorescence clearly corresponds to type 2, making it the first unequivocal record of this inflorescence type for *Beilschmiedia* (see also discussion under *B. lumutensis*).

A number of species (*B. glabra*, *B. membranacea*, *B. penangiana*, *B. wallichiana*) have an inflorescence which is enclosed at the base by large orbicular bracts. This type of structure was also reported in the Bornean *B. gemmiflora* (Blume) Kosterm., and in the Thai endemics *B. argentata* Kosterm. and *B. velutinosa* Kosterm. (Tetsana 2005). Later in the development of the inflorescence into an infructescence these bracts often fall off, leaving behind a series of clear bract scars. Because only one species with this character occurs in Borneo, this character was not used in Nishida's (2008) division of the genus into subgenera. Given that there are now several species known with this character, I think it is sufficiently important to warrant placing these species in their own group.

Bracteoles

The morphology of these structures is important in species recognition in the closely related genus *Cryptocarya* (De Kok 2015, 2016), but the variation in *Beilschmiedia* is very limited and consequently this character is hardly used in this treatment.

Flowers

As in most genera of the *Lauraceae*, the structure of the flower is important in generic recognition, but within the genus it does not play a significant role in species delimitation. This is mainly due to the fact that there is very little variation within genera, and *Beilschmiedia* is no exception. The main variation is in the number of stamens, which can vary between and even within species. For instance, *B. roxburghiana* (Kostermans 1957b: 15) and *B. glauca* (Nishida 2008: 356) can have six or nine fertile stamens, while *B. dictyoneura* always has six.

Fruits

The size of the fruits is very variable, ranging from massive (50–88 mm long in *B. glabra*) to small (1.9–4.5 mm long in *B. glauca* and *B. scortechinii*), and fruit size is an important character in species identification. The same is true for the fruit stalk, which can swell up to 7.6–10 mm diam in *B. glabra*, but which does not swell at all in species like *B. palembanica*. In addition, some species have a small constriction at the apex of the fruit stalk (see Nishida 2005), a feature that is absent in *Cryptocarya* (De Kok 2015, 2016).

MATERIAL AND METHODS

This study is based mainly on observations of specimens from the following herbaria: BM, BO, ECON, IBK, K, KEP, L, MEL, P, PE and SING.

In the following descriptions:

i. all measurements and colour descriptions are from mature material unless stated otherwise;
ii. all measurements and all claims about the position of the veins relative to the remainder of the leaf are taken from dried material;
iii. all collections of *Beilschmiedia* from Peninsular Malaysia seen by the author are cited;
iv. selected specimens of Peninsular Malaysian *Beilschmiedia* species from outside Peninsular Malaysia are cited when this material was used in the descriptions;
v. all synonyms of *Beilschmiedia* taxa with types from Peninsular Malaysia are included. Synonyms based on types from outside the area are included only in those cases where type material has been seen by the author;
vi. Bornean distributions are taken from Nishida (2008), while the Thai distributions of some species are from Tetsana (2005);
vii. scans of type material were viewed on http://plants.jstor.org on 25 Nov. 2015;
viii. for the IUCN conservation assessments, all Areas of Occupancy (AOO) and Extents of Occurrence (EOO) were calculated using GeoCAT (Bachman et al. 2011, http://geocat.kew.org) on 27 July 2015.

TAXONOMIC TREATMENT

Beilschmiedia

Beilschmiedia Nees (1831) 61, 69; Gamble (1910) 142; Ridl. (1924) 82; Kosterm. (1957a) 229; Kochummen (1989) 117; Rohwer (1993) 385; Van der Werff (2001) 77; (2003) 134; Tetsana (2005) 1; Sach.Nishida (2008) 345. — Type species: *Beilschmiedia roxburghiana* Nees (1831) 69. — Lectotypified by Kostermans (1938) 839.

Hufelandia Nees (1833) 11, 21; Kosterm. (1957a) 229. — Type species: *Hufelandia thomaea* Nees & *Hufelandia pendula* (Sw.) Nees = *Beilschmiedia pendula* (Sw.) Hemsl.

Wimmeria Nees ex Meisn. (1864) 65, nom. in synon., nom. invalid (not *Wimmeria* Schltdl.); Kosterm. (1957a) 229.

Purkayasthaea C.S.Purkay. (1938) 278, pl. 25; Kosterm. (1957a) 229. — Type species: *Purkayasthaea pseudomicropora* C.S.Purkay. = *Beilschmiedia fagifolia* Nees = *Beilschmiedia roxburghiana* Nees.

Tylostemon Engl. (1898) 389; Kosterm. (1957a) 229. — Syntype species: *Tylostemon dinklagei* Engl. = *Beilschmiedia dinklagei* (Engl.) Robyns & R.Wilczek; *Tylostemon batangensis* Engl. = *Beilschmiedia batangensis* (Engl.) Robyns & R.Wilczek; *Tylostemon crassifolius* Engl. = *Beilschmiedia crassifolia* (Engl.) Robyns & R.Wilczek.

Lauromerrillia C.K.Allen (1942) 460; Kosterm. (1957a) 229; S.K.Lee et al. (1979) 65; X. Li et al. (2008b) 238. — Type species: *Lauromerrillia appendiculata* C.K.Allen = *Beilschmiedia appendiculata* (C.K.Allen) S.K.Lee & Y.T.Wei.

Shrubs to trees. Terminal leaf buds conspicuous. *Leaves* arranged spirally or alternate to opposite, pinninerved. *Inflorescences* axillary panicles, usually type 3 (Van der Werff 2001) (i.e. paniculate-cymose, repeatedly branched, with the lateral flowers of the ultimately cymes not strictly opposite), or rarely type 2 (with the lateral flowers of the ultimate cymes strictly

opposite); involucral bracts usually absent, rarely present. *Flowers* bisexual, perianth tube short or absent; perianth lobes 6, subequal, deciduous; stamens and staminodes together forming 4 whorls each of 3 stamens/staminodes: either 3 whorls of stamens (total of 9 stamens) plus 1 whorl of staminodes, or (rarely in Peninsular Malaysia) 2 whorls of stamens (total of 6 stamens) plus 2 whorls of staminodes; stamens with filaments hairy; anthers 2-celled, in the 1st and 2nd whorls introrse, in the 3rd whorl extrorse to almost introrse, with 2 glands on each filament; staminodes of the 4th whorl cordate or ovoid, shortly stalked or sessile; ovary sessile, narrowing into a style; stigma obtuse. *Fruit* oblong or ovoid; perianth deciduous leaving a narrow ring; fruit stalk often not or only slightly thickened, but sometimes much thickened; sometimes a small constriction at the apex of the fruit stalk is present.

Distribution — About 200–300 species throughout the tropics, but extending as far south as central Chile and New Zealand. Currently 18 species are recognised in the flora of Peninsular Malaysia.

Uses — Many of the taller trees of this genus are minor commercial timbers, usually traded under the name *Medang*, in common with most species of *Lauraceae* (Burkill 1966). *Medang* qualifies as a light- to medium-weight hardwood (Lemmens et al. 1995: 78). Other minor uses are mentioned under the individual species.

KEY TO THE SPECIES

1. Inflorescence with round bracts at base; infructescence with bract scars at base 2
1. Inflorescence without bracts at base; infructescence without bract scars at base 5
2. Leaf under-surface and petioles glabrous or with only a few hairs present 3
2. Leaf under-surface and petioles sparsely hairy 4
3. Terminal leaf buds densely hairy to velutinous . . . . . 14. *B. penangiana*
3. Terminal leaf buds glabrous . . . . . 3. *B. glabra*
4. Tertiary veins reticulate; petiole > 10 mm long . . . . . 17. *B. wallichiana*
4. Tertiary veins scalariform to reticulate; petiole < 7.5 mm long . . . . . 12. *B. membranacea*
5. Terminal leaf buds glabrous to sparsely hairy; fruit stalks swollen 6
5. Terminal leaf buds velutinous; fruit stalks slender to swollen 12
6. Inflorescence with the lateral flowers of the ultimately cymes strictly opposite (inflorescence type 2, Van der Werff 2001) . . . . . 9. *B. lumutensis*
6. Inflorescence with the lateral flowers of the ultimate cymes are not strictly opposite (inflorescence type 3, Van der Werff 2001) 7
7. Terminal leaf buds linear, 1.2–1.8 mm long . . . . . 6. *B. kochummenii*
7. Terminal leaf buds ovoid to lanceolate, 5–15 mm long . 8
8. Inflorescence sparsely hairy 9
8. Inflorescence glabrous 10
9. Petiole 8.5–20 mm long; bracteoles 2.8–4 mm long; perianth lobes sparsely hairy outside; fruit ellipsoid, 15–88 by 8–39 mm . . . . . 3. *B. glabra*
9. Petiole 15–48 mm long; bracteoles 1–1.4 mm long; perianth lobes glabrous outside; fruit globose to ellipsoid, 25–55 by 20–40 mm . . . . . 5. *B. insignis*
10. Leaves (sub)opposite, sometimes one or two leaves alternate . . . . . 8. *B. lucidula*
10. Leaves all or mostly alternate 11
11. Twigs stout, 4.8–6.7 mm diam, sparsely hairy; petiole 15–48 mm long; fruit (dried) globose to ellipsoid, 25–55 by 20–40 mm . . . . . 5. *B. insignis*
11. Twigs slender, 1.5–3.8 mm diam, glabrous; petiole 12–27 mm long; fruit (dried) ellipsoid, 2.5–4.5 by 1.5–2.5 mm . . . . . 4. *B. glauca*
12. Mature leaves with lower surface glabrous or with only a few scattered hairs present (sometimes with hairs on the veins of young leaves) 13
12. Mature leaves with lower surface uniformly hairy 18
13. Young twigs glabrous to sparsely hairy 14
13. Young twigs velutinous to densely hairy 16
14. Twigs stout ((5.5–)15–20 mm diam); leaves spirally arranged and crowded at end of twigs, oblanceolate, 21–37 by 6–14 cm; terminal leaf bud 6.2–11.5 mm long . . . . . 7. *B. kunstleri*
14. Twigs slender (1.5–3 mm diam); leaves alternate to (sub)opposite, elliptic to lanceolate, (5–)8–16 by 2.4–4.6 cm; terminal leaf bud 1.8–3.8 mm long 15
15. Inflorescence without bracts at its base; bracteoles lanceolate, 1–1.8 mm long; fertile stamens 6; fruit warty when mature . . . . . 2. *B. dictyoneura*
15. Inflorescence with bracts at its base; bracteoles orbicular, 1–3 mm long; fertile stamens 9; fruit smooth when mature . . . . . 14. *B. penangiana*
16. Terminal leaf buds with erect, curly, dark red-brown hairs . . . . . 10. *B. madang*
16. Terminal leaf buds with straight appressed light to dark brown hairs 17
17. Terminal leaf buds 3.5–10 mm long . . . . 11. *B. maingayi*
17. Terminal leaf buds 1.4–3.5 mm long 15. *B. roxburghiana*
18. Inflorescence 6–20 mm long, enclosed at base by bracts or with bract scars; bracteoles orbicular or unknown . 19
18. Inflorescence 20–110 mm long, not enclosed at base by bracts and bract scars absent; bracteoles triangular to lanceolate or linear 20
19. Tertiary veins reticulate; petiole > 10 mm long; inflorescence velutinous . . . . . 17. *B. wallichiana*
19. Tertiary veins scalariform to reticulate; petiole 5–10 mm long; inflorescence sparsely hairy . 12. *B. membranacea*
20. Ovary hairy . . . . . 16. *B. scortechinii*
20. Ovary glabrous 21
21. Leaf blades < 5.5 cm wide; terminal leaf bud < 4 mm long; bracteoles 0.7–1.7 mm long . . . . . 1. *B. atra*
21. Leaf blades > 4.6 cm wide; terminal leaf buds > 3 mm long; bracteoles 0.5–7 mm long 22
22. Terminal leaf buds 5–9 mm long, hairs straight, appressed, light brown; bracteoles linear, 0.5–5 mm long; fruit (dried) subglobose, 7–21 by 4.7–20 mm . . . 13. *B. palembanica*
22. Terminal leaf buds 3–6.5 mm long, hairs erect, curly dark red-brown; bracteoles triangular to oblong, 0.6–7 mm long; fruit (dried) ellipsoid, 16–25 by 9–11 mm 10. *B. madang*

1. ***Beilschmiedia atra*** Kosterm. ex de Kok, *sp. nov.* — Fig. 1; Map 1

Beilschmiedia atra differs from *B. madang* in having smaller leaves (blades 8.5–10 by 3–5.5 cm vs 13–22 by 4.6–12 cm), with a cuneate vs usually rounded base. The petiole is generally shorter (9–15 mm vs 9.5–30 mm) and bracteoles are on averaged much shorter per specimen (0.7–1.7 mm long vs 0.6–7 mm long). — Type: *Corner SFN 29423* (holotype K [K001098083]; isotypes K [K001098082], SING 2 sheets), Peninsular Malaysia, Johor, Mawai-Jemaluang Road.

Trees. *Twigs* slender, 2.3–3 mm diam, round in cross-section, velutinous when young, some glabrescent, smooth; terminal

leaf buds lanceolate, 3–4 mm long, velutinous; hairs short, curly, erect to appressed, reddish brown. *Leaves* alternate, blades elliptic to lanceolate, 8.5–10 by 3–5.5 cm, leathery; apex acute to acuminate, often with a distinct tip; base cuneate, often asymmetric; margins recurved; secondary veins 6–7 pairs, tertiary veins reticulate; upper surface glabrous, drying dark brown, midrib sunken, glabrous, secondary veins sunken, tertiary veins inconspicuous; lower surface sparsely hairy, midrib raised, velutinous, secondary veins raised, tertiary veins distinct. *Petiole* 9–15 mm long, slender, half terete, velutinous when young, sometimes glabrescent. *Inflorescence* 23–50 mm long, densely hairy, not enclosed at base by bracts; bracteoles lanceolate, 0.7–1.7 mm long, apex acute, persistent. *Flowers*: perianth tube not distinct; perianth lobes elliptic to orbicular,

Fig. 1 *Beilschmiedia atra* Kosterm. ex de Kok. a. Habit; b. detail of midrib on upper surface of leaf at base; c. indumentum on lower leaf surface; d. terminal leaf bud; e. bracteoles on the inflorescence; f. detail of inflorescence; g. flower; h. stamen of the inner whorl; i. ovary (from *Corner SFN 29423*, a–d from isotype; e–i from holotype). — Scale bars: a, e = 3 cm; b–d, f = 5 mm; g–i = 1 mm. — Drawings by Juliet Beentje.

1.3–1.6 by 0.8–1.5 mm, sparsely to densely hairy, margin not ciliate, apices acute. *Stamens* 9, 1–1.2 mm long, filaments slightly longer than anthers, not exceeding the perianth lobes; anthers glabrous, obtuse at apex. *Ovary* c. 1.5 mm diam, glabrous; style c. 0.5 mm long. *Fruit* unknown.

Distribution — Endemic to Johor and Pahang (Peninsular Malaysia).

Ecology — Growing at low altitudes, sometimes in swamps.

IUCN Conservation Assessment — This species has been collected only four times, all between 1901 and 1936, at low altitude in Johor and Pahang States. An analysis of the EOO gives a conservation assessment of Vulnerable, but an analysis of the AOO gives the assessment of Endangered. Given the intensive logging and landscape modification that has occurred since 1936, the time that has elapsed since the last collection was made and the fact that it is only recorded from the lowlands, this species must be considered extinct.

Phenology — Flowering: March to May (October); fruiting: times unknown.

Notes — This species has not been described before nor its name validly published. Kostermans named specimens in various herbaria as *Beilschmiedia atra*, from at least 1962 onwards. However, I could find no publication where he officially described this species, illustrating a common phenomenon with this author. The name has also been used by some other botanists and occurs in various databases. I therefore validate this name here.

This species is morphologically similar to the Bornean endemic *B. murutensis* Kosterm., but the later has ovoid terminal leaf buds and shorter leaves. It also seems to be similar to *B. brachystachys* Kosterm., which differs in having terminal leaf buds which are narrowly ovoid with long erect hairs and leaves that are pubescent along the midrib on the upper surface (see Nishida 2008).

2. *Beilschmiedia dictyoneura* Kosterm. — Map 1

Beilschmiedia dictyoneura Kosterm. (1965) 24, f. 4; Kochummen (1989) 119; I.M.Turner (1995) 276; Sach.Nishida (2008) 354. — Type: *Kostermans 4464* (holotype BO [sheet number 0118371]; isotype K [K000768691]), Indonesia, north of Balikpapan, Sungai Wain region.

Trees 10–35 m tall, dbh 10–30 cm; bark grey, reddish or pale brown, smooth to finely fissured or pitted; inner bark reddish to dark brown, aromatic; sapwood white to yellowish. *Twigs* slender, 1.5–3 mm diam, round in cross-section, glabrous to sparsely hairy, more densely hairy at nodes; terminal leaf buds ovoid, 1.8–2.6 mm long, velutinous; hairs short, appressed, dark brown. *Leaves* (sub)opposite, blades lanceolate to elliptic, (5–)8–16 by 2.3–4.5 cm, thickly leathery; apex acute with a clear point; base cuneate; margins flat; secondary veins 6–10 pairs, curving and joining near margin; tertiary veins laxly reticulate; upper surface glabrous, slightly glossy, midrib sunken to flattened, secondary veins raised, tertiary veins distinct; lower surface glabrous, midrib raised, secondary veins raised, tertiary veins distinct. *Petiole* 14–22 mm long, glabrous, channelled. *Inflorescence* 14–70 mm long, sparsely hairy to velutinous, not enclosed at base by bracts; bracteoles lanceolate, 1–1.8 mm long, apex acute, persistent. *Flowers* greenish white to white; perianth tube absent; perianth lobes broadly ovate, almost equal or inner three lobes slightly smaller, 0.5–1 by 1–1.7 mm, sparsely hairy, apices broadly acute. *Stamens* 6, representing first and second whorls, c. 0.7 mm long, glabrous or pubescent only around base, filaments shorter than anthers; anthers glabrous, acute at apex. *Staminodes* 3–6 (3 in third whorl, 0–3 in fourth whorl). *Ovary* c. 0.6 mm long, glabrous; style c. 0.5 mm long. *Fruit* (dried) ellipsoid, 12–17 by 9.5–13.3 mm, apex rounded, base rounded, surface pitted when young to warty when mature. Stalk slightly swollen, 2–2.6 mm diam, 25 mm long, not constricted at apex.

Distribution — Peninsular Malaysia, Borneo and Sumatra.

Ecology — Lowland to mountain forest, sometimes on sandy, loamy soil, at 20–1100 m altitude.

IUCN Conservation Assessment — Least Concern.

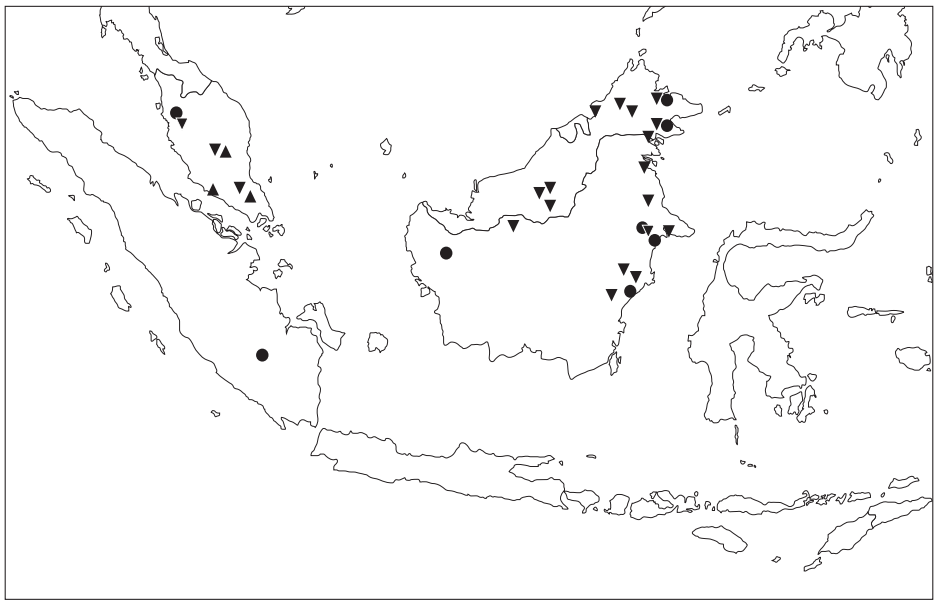
Phenology — Flowering and fruiting all year round.

Note — This is one of the few *Beilschmiedia* species that only has six stamens, a character that it shares with some collections of the Peninsular Malaysian species *B. glauca* and the two Borneo endemics *B. crassa* Sach.Nishida and *B. kinabaluensis* Kosterm. (Nishida 2008).

3. *Beilschmiedia glabra* Kosterm. — Fig. 2; Map 1

Beilschmiedia glabra Kosterm. (1965) 22; Kochummen (1989) 119; I.M. Turner (1995) 276. — Type: *Kostermans 7313* (holotype BO; isotypes A [A00415470], NY [NY00354905], P [P00745522]), [Indonesia], Borneo, Peak of Balikpapan, Beoul.

Endiandra sp. 2 Kochummen (1989) 144. Based on *Kochummen KEP 94834* (KEP) Peninsular Malaysia, Johor, Labis.



Map 1 Distribution of *Beilschmiedia atra* (●), *B. dictyoneura* (▲) and *B. glabra* (▼). Map based on a map provided by d-maps.com.

Trees 6–35 m tall, dbh 12–30 cm; bark grey to (dark or red) brown, smooth to finely cracked; inner bark creamy to brownish, smelling slightly sour or nasty; sapwood hard, fawn to white. *Twigs* slender, 2–3 mm diam, glabrous, smooth; terminal leaf buds ovoid to lanceolate, 5–15 mm long, glabrous. *Leaves* (sub)opposite, blades elliptic to obovate or lanceolate, 5.3–19 (–26) by 2.3–9.3 cm, leathery; apex acute with a distinct tip; base cuneate, slightly asymmetric; margins usually flat; secondary veins 6–10 pairs, tertiary veins reticulate; upper surface glabrous, drying light yellowish brown, midrib raised, glabrous, secondary veins raised, tertiary veins distinct; lower surface glabrous, midrib raised, secondary veins raised, tertiary veins distinct. *Petiole* 8.5–20 mm long, channelled, glabrous. *Inflorescence* 6–40 mm long, sparsely hairy, bracts at base

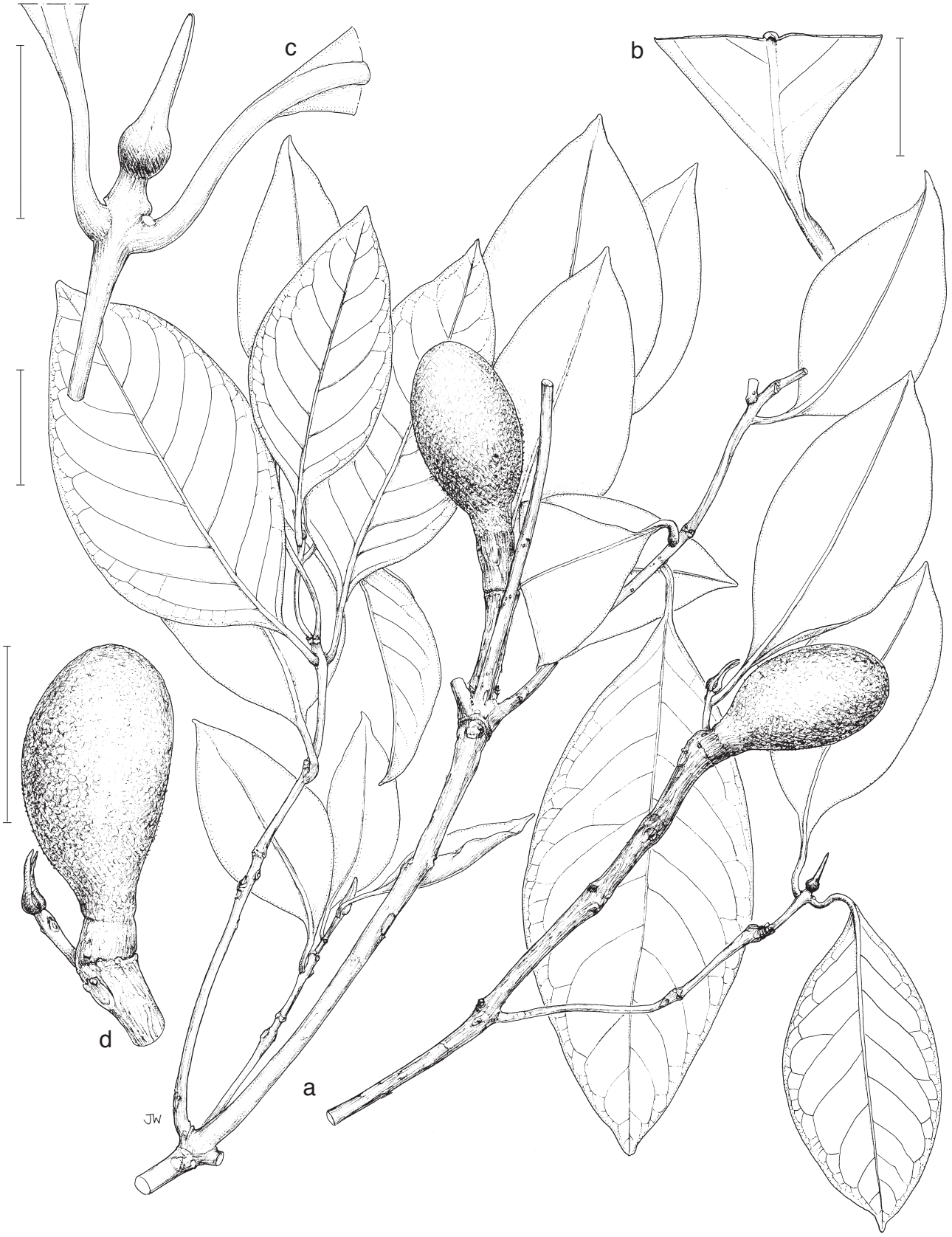


Fig. 2 *Beilschmiedia glabra* Kosterm. a. Habit; b. detail of midrib at base of leaf on upper surface; c. terminal leaf bud; d. fruit and fruit stalk (all from *Kiah SFN 32424*). — Scale bars: a, d = 3 cm; b, c = 1 cm. — Drawings by Juliet Beentje.

orbicular, 2.3–3.3 mm long, glabrous, with margins entire; bracteoles 2.8–4 mm long, caducous. *Flowers* yellowish or pale green; perianth tube absent; perianth lobes 6, 2.5–3.5 by 1.1–1.5 mm, inside pubescent, outside sparsely hairy, apices acute. *Stamens* 9, 2.3–3.7 mm long, pubescent, filaments longer than anthers; anthers truncate at apex, glabrous, dark yellow. *Ovary* c. 0.7 mm diam, glabrous; style c. 1.5 mm long. *Fruit* (dried) ellipsoid, 15–88 by 8–39 mm, apex rounded to beaked, base slightly narrowed, surface smooth to warty, pale brown or pinkish. Stalk when mature swollen to 10 mm diam, not constricted at the apex.

Distribution — Rare in Peninsular Malaysia, widespread in Borneo (Nishida 2008: 356).

Ecology — Lowland and hill forest, including swamps, sometimes over sandstone or limestone, at (300–)600–900(–1300) m altitude.

IUCN Conservation Assessment — Least Concern.

Phenology — Flowering: July to November; fruiting: March to November.

Notes — Since at least 1971, Kostermans named specimens of this species from Peninsular Malaysia housed in various herbaria as '*Beilschmiedia johorensis*'. However, I could find no publication where he officially described this species. Kochummen (1989: 144) placed one specimen of this taxon in *Endiandra*, as his undescribed species number 2.

This is one of the few species of *Beilschmiedia* that is relatively easy to recognise, by its combination of (sub)opposite, glabrous leaves that often dry yellowish brown, glabrous terminal leaf buds and round bracts at the base of the inflorescence.

4. *Beilschmiedia glauca* S.K.Lee & L.F.Lau — Map 2

Beilschmiedia glauca S.K.Lee & L.F.Lau in Lee (1963) 193; Hô (1991) 474; Kochummen (1989) 119; I.M.Turner (1995) 276; Tetsana (2005) 37; X. Li et al. (2008) 240; Sach.Nishida (2008) 356. — *Beilschmiedia glauca* S.K.Lee var. *glauca*. — Type: *Hainan Expedition 676* (holotype HSNU not seen; isotype PE [00188583]), China, Hainan, Peisha Hsien, Yingge.

Beilschmiedia endiandrifolia Kosterm. (1957b) 38 (nom. invalid.)); (1964) 125; J.A.R.Anderson (1980) 221; Sach.Nishida (2008) 357. Based on *Henderson 23561* (KEP, SING), Peninsular Malaysia, Pahang, Cameron Highlands.

Trees 6–23 m tall, dbh 15–30 cm; bark reddish to grey brown, smooth to shallowly fissured; inner bark dark red with orange flecks; sapwood white. *Twigs* slender, 1.5–3.8 mm diam, flattened in cross-section, glabrous; terminal leaf buds lanceolate, 7.6–12.6 mm long, glabrous. *Leaves* alternate to (sub)opposite, blades broadly elliptic to almost rounded, 6–15 by 2.8–9.6 cm, shiny, thick to thinly leathery; apex rounded to acute, often with a distinct short tip; base rounded or broadly cuneate, sometimes asymmetric; margins flat; secondary veins 4–8 pairs, tertiary veins areolate-reticulate to scalariform; upper surface glabrous, midrib raised to flattened, secondary veins raised, tertiary veins distinct; lower surface glabrous, glaucous to very grey, midrib raised, secondary veins raised, tertiary veins distinct. *Petiole* 12–27 mm long, channelled, glabrous. *Inflorescence* 50–120 mm long, glabrous, yellow green, not enclosed at base by bracts; bracteoles linear, c. 0.4 mm long, caducous. *Flowers* white to greenish yellow; perianth tube not distinct; perianth lobes orbicular to elliptic, 1.2–1.7 by 1.3–1.7 mm, glabrous outside, apices rounded to acute, margins not ciliate, lobes almost equal or inner three slightly smaller. *Stamens* (6–)9, 1–1.5 mm long, filaments almost as long as anthers, pubescent or rarely glabrous; anthers glabrous, obtuse at apex. *Staminodes* 3(–6). *Ovary* 0.8–2 mm diam, glabrous; style 0.8–1 mm long. *Fruit* (dried) ellipsoid, 2.5–4.5 by 1.5–2.5 mm, apex rounded, base tapered, surface smooth, brownish, smell resinous. Stalk swollen when mature to c. 3 mm diam, not constricted at apex.

Local name — Selepak (Sakai language).

Distribution — South China to Peninsular Malaysia and Borneo, also reported from North Sumatra (Nishida 2008: 357).

Ecology — Lowlands and montane forest, sometimes over sandstone, from 360–1375 m altitude.

IUCN Conservation Assessment — Least Concern.

Phenology — Flowering: March to September; fruiting: July to September.

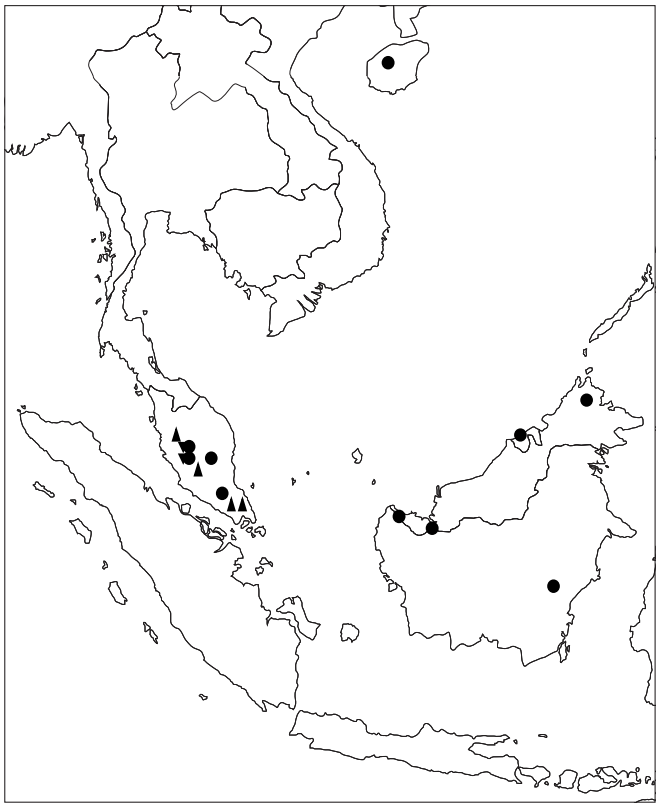
Notes — The name *Beilschmiedia endiandrifolia* was proposed by Kostermans (1957b) to reflect the fact that the venation pattern is very similar to that seen in the genus *Endiandra*, since both have areolate reticulations. However, Kostermans's name was never validly published although it does occur in the literature.

The Malaysian material of this species belongs to the type variety, *Beilschmiedia glauca* var. *glauca*, as the axillary inflorescence is glabrous (see Li et al. 2008a: 240).

5. *Beilschmiedia insignis* Gamble — Map 2

Beilschmiedia insignis Gamble (1910) 147; Ridl. (1924) 82; Kosterm. (1964) 131; Kochummen (1989) 119; I.M.Turner (1995) 276. — Type (selected here): *King's Collector 8479* (lectotype K [K000768664]), [Peninsular Malaysia], Perak, Taiping.

Trees (3–)10–34 m tall, dbh 5–23 cm; bark smooth to faintly fissured, grey to dark grey or dark brown; inner bark pale to dark brown or pinkish red; sapwood pale yellow to white, very fragrant. *Twigs* stout, 4.8–6.7 mm diam, slightly striated, with prominent leaf scars, sparsely hairy; terminal leaf buds lanceolate, glabrous, margins ciliate, 8–14 mm long. *Leaves* (sub)opposite to alternate, blades elliptic to lanceolate or oblong, 11–34(–60) by 5–11.6(–18) cm, leathery; apex rounded to acute; base cuneate; margins flat to recurved; secondary veins 7–12(–20) pairs, tertiary veins reticulate; upper surface glabrous, glossy, dark to bright green, sparsely hairy on midrib, midrib flattened to sunken, secondary veins slightly sunken to raised, tertiary veins faint; lower surface sparsely hairy, pale



Map 2 Distribution of *Beilschmiedia glauca* (●), *B. insignis* (▲) and *B. kochummenii* (▼). Map based on a map provided by d-maps.com.

green, midrib raised, secondary veins faintly raised, tertiary veins raised. *Petiole* 15–48 mm long, slender, channelled. *Inflorescence* 70–170 mm long, glabrous to sparsely hairy, not enclosed at base by bracts; bracteoles orbicular, 1–1.4 mm long, glabrous, margins ciliate. *Flowers* glabrous, pale green to white or orange yellow; perianth tube not distinct; perianth lobes ovate, 3–3.3 by 1–1.2 mm, apices acute, glabrous, margins ciliate. *Stamens* 9, 1.8–2 mm long. *Ovary* c. 1 mm diam, glabrous; style c. 1.2 mm long. *Fruit* (dried) globose to ellipsoid, 25–55 by 20–40 mm, apex rounded to short beak, base rounded, surface glabrous, smooth, reddish brown. Stalk when mature swollen to 4 mm diam, with a constricted apex.

Fig. 3 Plate of *Beilschmiedia kochummenii* de Kok. a. Habit; b. detail of midrib at base of leaf upper surface; c. detail of terminal leaf bud; d. fruit and fruit stalk (all from *Kochummen FRI 16580*). — Scale bars: a = 3 cm; b–d = 2 cm. — Drawings by Juliet Beentje.

Distribution — Endemic to Peninsular Malaysia.

Ecology — Primary and secondary forest from lowlands to mountains, at 30–350(–1860) m altitude.

IUCN Conservation Assessment — Endangered (EN B2ab (ii,iii)). This species is known from 12 collections which were made between 1886 and 2009, and is reported to be scattered through the forests of various states (Kochummen 1989: 119). An analysis of the EOO gives a conservation assessment of Near Threatened, but an analysis of the AOO gives the assessment of Endangered. Given the small AOO and the intensive logging and landscape modification that has occurred in the last 50 years, it must be considered to be Endangered.

Phenology — Flowering: February to April; fruiting: August and September.

Note — In the original description, two collections were mentioned: Perak, Sept. 1886, *King's Collector 6615* (BM, K, SING) and Perak, Taiping, Feb. 1886, *King's Collector 8479* (K 2 sheets). The first collection has mature fruits, while the later one has mature flowers. As bracteoles are important in this genus, and they are more likely to be present in flowering specimens than fruiting, the later collection is chosen here as the lectotype.

6. *Beilschmiedia kochummenii* de Kok, *sp. nov*. — Fig. 3; Map 2

Beilschmiedia kochummenii de Kok; Kochummen (1989) 122 & f. 3 (as *Beilschmiedia* sp. 'A'); I.M.Turner (1995) 277.

Beilschmiedia kochummenii differs from *B. lumutensis* in having terminal leaf buds that are 1.2–1.8 mm long (vs 2–7 mm long) and linear with a swelling near the base (vs linear to lanceolate with no swelling near the base), and a short (< 20 mm long) infructescence (vs 20–65 mm long). Furthermore, it differs from *B. glabra* by having an infructescence with multiple small fruits, each 20–37 by 10–23 mm, vs solitary larger fruits, each 50–88 by 24–39 mm in *B. glabra*, and the mature fruit stalk is 3–4.3 mm diam vs 8.3–15 mm diam in *B. glabra*. — Type: *Kochummen FRI 29384* (holotype KEP; isotypes K [K001098098], SING), Peninsular Malaysia, Cameron Highlands.

Small trees 12–15 m tall, dbh 15–45 cm; bark (grey-)brown, smooth to fissured; inner bark pink; sapwood whitish. *Twigs* slender, 0.2–0.9 mm diam, glabrous to sparsely hairy, slightly angled, pale brown; terminal leaf buds linear, 1.2–1.8 mm long, swollen at the base, glabrous to sparsely hairy; hairs short, curly, erect to appressed, dark brown. *Leaves* spirally arranged to rarely opposite, blades elliptic to narrowly obovate, 8–18.5 by 3–6.5 cm, sometimes thickly leathery; apex acute, often with a distinct point; base cuneate, often asymmetric; secondary veins 6–9 pairs, curving and joining near margins; tertiary veins reticulate; upper surface glabrous, midrib raised to sunken, secondary veins raised, tertiary veins prominent; lower surface glabrous, midrib raised, secondary veins raised, tertiary veins prominent. *Petiole* 11–25 mm long, channelled, glabrous. *Inflorescence* 100–200 mm long, glabrous to sparsely hairy, not enclosed at base by bracts; bracteoles unknown. *Flowers* unknown. *Fruit* (dried) obovoid, 20–37 by 10–23 mm, apex rounded, base rounded, surface glabrous, smooth, purplish to black when mature. Stalk when mature swollen to 4.3 mm diam, not constricted at apex.

Distribution — Endemic to Peninsular Malaysia.

Ecology — Growing scattered in montane forest and along road sides at 750–1500 m altitude.

IUCN Conservation Assessment — Critically Endangered (CR B2ab(ii,iii)). This species is only known from three collections that were made between late 1972 and 1982, from parts of Peninsular Malaysia that have seen many modifications of the landscape over the last 20 years. An analysis of the EOO and AOO both gives the assessment of Critically Endangered. Therefore it is listed as Critically Endangered here.

Phenology — Flowering time unknown; fruiting between August and January.

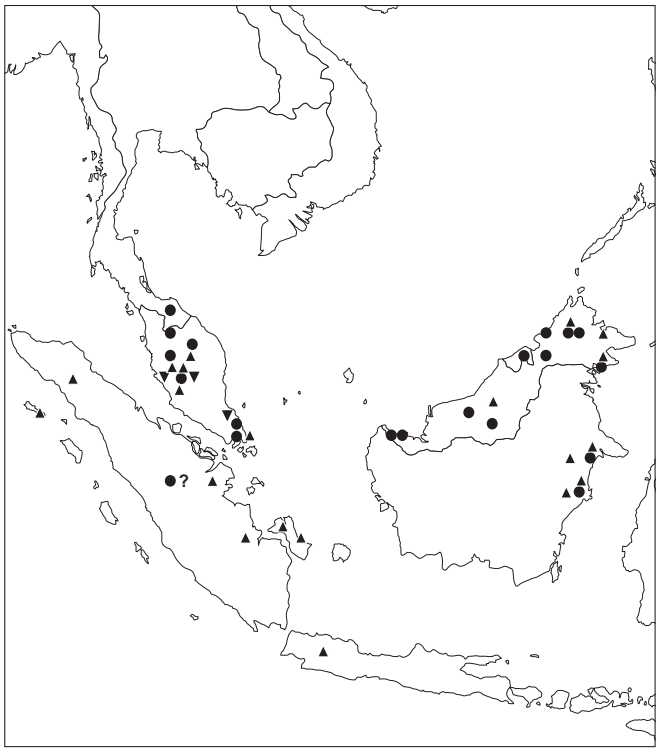
Notes — This species was first mentioned in print by Kochummen (1989: 123), as *Beilschmiedia* sp. 'A', based on the specimens: *FRI 16580*, *16612*, *16641* and *29384*. The specimen *FRI 16612* is placed in *B. roxburghiana* in this revision, as it differs from *B. kochummenii* in having velutinous terminal leaf buds without a swelling at their base.

In recognition of his discovery of this species and of his many other contributions to the Flora of Peninsular Malaysia, I name this species after K.M. Kochummen (1931–1999).

7. *Beilschmiedia kunstleri* Gamble — Map 3

Beilschmiedia kunstleri Gamble (1910) 147; Ridl. (1924) 83; Kosterm. (1964) 132; Kochummen (1989) 120; I.M.Turner (1995) 276; Sach.Nishida (2008) 362. — Type (selected here): *King's Collector 6854* (lectotype K [K000768665]), [Peninsular Malaysia], Perak, near Larut.

Trees or shrubs 5–35 m tall, dbh 15–30 cm; bark greyish or black to brownish, smooth to scaly, lenticellate; inner bark pinkish to yellow brown; sapwood whitish or pale yellow to creamy. *Twigs* stout, (5.5–)15–20 mm diam, sparsely hairy, with prominent lenticels and leaf scars; terminal leaf buds ovoid to lanceolate, 6.2–11.5 mm long, velutinous; hairs both short, erect and curly, and long and straight, dark brown. *Leaves* spirally arranged and crowded at the ends of twigs, blades oblanceolate, 21–37 by 6–14 cm, thickly leathery; apex blunt or acute; base cuneate; margins revolute; secondary veins 9–16 pairs, tertiary veins reticulate to scalariform; upper surface glabrous, glossy, light to dark green, midrib raised or flattened, secondary veins sunken to raised, tertiary veins distinct; lower surface glabrous, midrib raised and very sparsely hairy, secondary veins raised, tertiary veins distinct. *Petiole* 10–33 mm long, slightly swollen, sparsely hairy. *Inflorescence* 110–190 mm long, not enclosed at base by bracts, sparsely hairy to velutinous; bracteoles linear, 1.7–3 mm long, apex acute. *Flowers* sparsely hairy, white or yellow; perianth tube not distinct; perianth lobes sparsely hairy, 3.3–3.5 by 1.3–1.6 mm, apices rounded, margins not ciliate. *Stamens* 9, 2–3 mm long. *Ovary* c. 1 mm diam, glabrous; style c. 1.6 mm long. *Fruit* (dried) ovate to ellipsoid, 1.5–25 by 8–20



Map 3 Distribution of *Beilschmiedia kunstleri* (●), *B. lumutensis* (▼) and *B. madang* (▲). Map based on a map provided by d-maps.com.

mm, apex acute to blunt, base attenuate, surface smooth to ribbed, red to brown when mature, shiny. Stalk when mature (slightly) swollen to 5 mm diam, bright red, with a constriction at the apex.

Distribution — Peninsular Thailand to Borneo, and reported from Sumatra by Nishida (2008: 362).

Ecology — Growing in primary and secondary forests, sometimes in swamp-forest or along streams, from 10–800(–1300) m altitude.

IUCN Conservation Assessment — Least Concern.

Phenology — Flowering: February to August; fruiting: March to September.

Notes — The original description mentioned two collections: Perak, near Larut, 1884, *King's Collector 6854* (K) and Singapore, Bukit Timah, *Bayliss 5885*. As I could not find the second collection, I have chosen the first as the lectotype.

This species is usually easily recognisable due to its big, glabrous leaves and stout twigs. However, the variation in twig thickness can be considerable even within one collection, and some specimens have slender twigs which then resemble *B. maingayi*, from which *B. kunstleri* differs in having a different leaf shape, texture and apex.

8. *Beilschmiedia lucidula* (Miq.) Kosterm. — Map 4

Beilschmiedia lucidula (Miq.) Kosterm. (1970) 23; Kochummen (1989) 120; I.M.Turner (1995) 276; Sach.Nishida (2008) 363. — *Cryptocarya lucidula* Miq. (1858) 922; Kosterm. (1964) 413. — Type: *Horsfield s.n.* (holotype U [U0002629]; isotypes BM [BM000799340, BM000799343], K [K000575303, K000768701]), [Indonesia], Java, Banjoemas.

Endiandra sumatrana Miq. (1858) 919; Kosterm. (1964) 496. — Type: *Teijsman 1010* (holotype U [U0002628]), [Indonesia, West Sumatra], near Batang baroe.

Beilschmiedia gammieana King ex Hook.f. (1886) 124; Tetsana (2005) 33, f. 11, 12. — Syntypes: *Hooker & Thomson 241* (K 2 sheets [K000768653, K000768654]), East Nepal, north slope of Phulloot; *King 3063* (K [K000768652]), [India], Sikkim, Phămlĕt Pŏt, syn. nov.

Beilschmiedia praecox Koord. & Valeton (1904) 195; Kosterm. (1964) 145. — Type: *Herb. Koorders s.n.* (BO, L), [Indonesia], East Java.

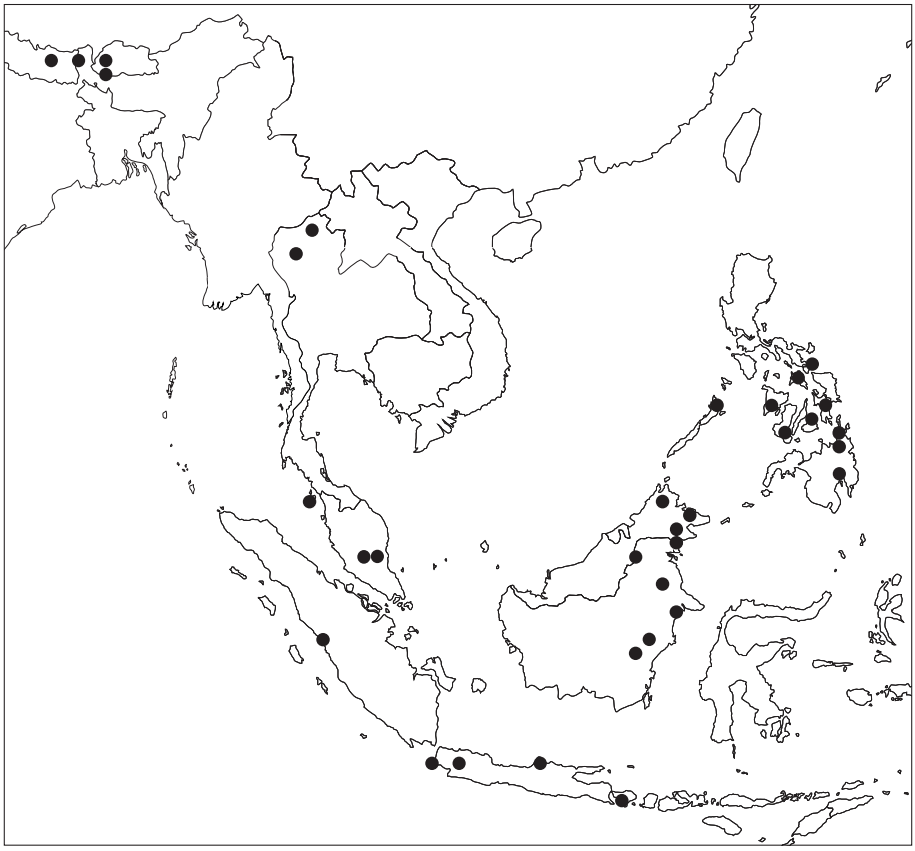
Linociera nervosa Elmer (1913) 1652. — *Beilschmiedia nervosa* (Elmer) Merr. (1915) 271; Kosterm. (1964) 140. — *Pygeum nervosum* Elmer ex Koehne (1915) 337, 345. — Type: *Elmer 11833* (holotype PNH not seen; isotypes A [A00052070], BM [BM000799341], E [E00393167], K [K000778441], US [US00047802]), [Philippines], Mindanao, District of Davao, Todaya, Mt Apo.

Beilschmiedia leytensis Merr. (1914) 357; (1915) 271; Kosterm. (1964) 134. — Syntypes: *Wenzel 501* (A [A00062473], BM [BM000799342], US [US00099405]), [Philippines], Leyte, Dagami; *Wenzel 183* [Philippines], Leyte, Dagami.

Trees 5–27 m tall, dbh 5–70 cm; bark greenish or grey to brown, smooth or scaly; inner bark pink to reddish; wood white, strongly aromatic. *Twigs* slender, 1.3–2 mm diam, round or slightly angled in cross-section, smooth, glabrous; terminal leaf buds ovoid to lanceolate, 5–10 mm long, glabrous. *Leaves* (sub)opposite, blades elliptic, oblong or oblong-lanceolate, 8–16 by 2.7–8 cm, thinly leathery, shiny; apex acute; base cuneate; margins straight; secondary veins 6–11 pairs, curving and joining near margins, tertiary veins reticulate; upper surface glabrous, midrib raised, secondary veins raised, tertiary veins distinct; lower surface glabrous, midrib raised, secondary veins raised, tertiary veins distinct. *Petiole* 8–30 mm long, channelled, glabrous. *Inflorescence* 25–80 mm long, not enclosed at base with bracts, glabrous; bracteoles linear, c. 1.4 mm long, caducous. *Flowers* white to pale green, glabrous on the outside; perianth tube c. 1 mm long; perianth lobes ovate-elliptic, 1.7–3.5 by 1–1.2 mm, apices rounded to acute. *Stamens* 9, 1.2–2 mm long. *Ovary* 0.6–2.3 mm diam, glabrous; style 0.7–2.3 mm long. *Fruit* (dried) globose to obovoid, 20–40 by 14–55 mm, apex rounded, base tapering, surface striate, glabrous, glaucous, purplish black when mature. Stalk when mature swollen to 3 mm diam, dark brown to reddish, constricted at apex.

Local names — Peninsular Malaysia: Lidak Sapi or Selabu.

Distribution — Nepal, Bhutan, India (Sikkim), Thailand, Malaysia, Indonesia (Kalimantan, Sumatra, Java, Bali) and the Philippines.



Map 4 Distribution of *Beilschmiedia lucidula*. Map based on maps provided by d-maps.com.

Ecology — Primary and secondary forests, often in seasonally wet areas, sometimes over sandstone, limestone or on poor sandy soils, from 0–1400(–2150) m altitude.

IUCN Conservation Assessment — Least Concern.

Phenology — Flowering: August to February; fruiting: March to October.

Note — Some specimens from lowland areas in parts of India, including West Bengal, Assam and Tamil Nadu, which used to be put under the name *Beilschmiedia gammieana*, belong, in my view, to a different species, as they have alternate leaves and a very different inflorescence.

9. *Beilschmiedia lumutensis* Gamble — Map 3

Beilschmiedia lumutensis Gamble (1910) 148; Ridl. (1924) 84; Kosterm. (1964) 135; Kochummen (1989) 120; I.M.Turner (1995) 276. — Type: *Ridley 10323* (holotype K [K000768671]; isotype SING [SING 0055157]), [Peninsular Malaysia], Perak, Lumut.

Trees or shrubs 3–15 m tall; bark light or greenish grey to yellow brown, smooth. *Twigs* slender, 2.5–3.7 mm diam, longitudinally ridged, dark brown when dried, glabrous; terminal leaf buds linear to lanceolate, 2–7 mm long, glabrous. *Leaves* (sub)opposite, blades elliptic to oblong, 8–16 by 1.8–8 cm, thinly leathery; apex rounded to acute; base broadly cuneate; margins flat; secondary veins 6–12 pairs, curving and joining near margins; tertiary veins reticulate; upper surface glabrous, shiny when dried, midrib slightly sunken in lower half, secondary veins raised, tertiary veins distinct; lower surface glabrous, shiny when dried, midrib raised, secondary veins raised, tertiary veins distinct. *Petiole* 8–23 mm long, channelled, glabrous. *Inflorescence* type 2 (Van der Werff 2001), 20–65 mm long, glabrous, not enclosed at base by bracts; bracteoles orbicular to linear, 0.6–0.7 mm long, glabrous, caducous. *Flowers* pale yellowish green, glabrous; perianth tube not distinct; perianth lobes elliptic to orbicular, 1.5–2 by 1.1–1.7 mm, apices rounded to acute, margins glabrous. *Stamens* 9, 1–1.5 mm long. *Ovary* c. 1 mm diam, glabrous; style c. 0.5 mm long. *Fruit* (dried) ellipsoid 18–30 by 8.5–15 mm, apex rounded, base cuneate, surface smooth, glabrous. Stalk when mature swollen to c. 3 mm, 7–15 mm long, not constricted at apex.

Distribution — Endemic to Peninsular Malaysia.

Ecology — Growing in lowland and hill forests, sometimes on sandstone or near streams, at 150–200 m altitude.

IUCN Conservation Assessment — Endangered (EN B2ab (ii,iii)). This species is recorded as uncommon (Kochummen 1989: 120) and is only known from six collections which were made between 1899 and 1967. The part of Peninsular Malaysia where this species occurs has seen many modifications of the landscape over the last 30 years. An analysis of the EOO and the AOO both gives the assessment of Endangered. Therefore, it is listed as Endangered here.

Phenology — Flowering: February to August; fruiting: February to July.

Notes — *Beilschmiedia lumutensis* appears to be closely related to the Bornean species *B. microcarpa* Sach.Nishida, *B. gynotrochioides* Kosterm. and *B. glauciphylla* Kosterm. It has in common with these species its opposite, elliptic leaves and its narrow, glabrous terminal leaf buds. The differences between these species are set out in Table 1. The Peninsular Malaysian species seems to be morphologically closest to *B. microcarpa* as it has flowers and fruits of similar size and shape. However, *B. microcarpa* is only found in the northern part of Sarawak, Sabah and the eastern part of Kalimantan, while *B. gynotrochioides* and *B. glauciphylla* are distributed in the central part of Sarawak (Nishida 2006: 92; 2008: 357, 367). So it seems that *B. lumutensis* is morphological closest to *B. microcarpa*, but it is geographically separated from it by *B. gynotrochioides* and *B. glauciphylla*. The morphological differences between *B. lumutensis* and *B. microcarpa* are small, the principal one being that the leaf is on average broader and its apex is acuminate in *B. microcarpa* vs narrower with a leaf apex which is rounded to acute in *B. lumutensis.*

Table 1 Morphological differences between *Beilschmiedia glauciphylla*, *B. gynotrochioides*, *B. lumutensis* and *B. microcarpa*. Data for the Bornean species taken from Nishida (2006: 92; 2008: 357, 367).

	Fruits	Flower	Leaves
B. glauciphylla	spindle-shaped, 65–80 mm long	c. 3–4 mm diam	10–20 by 4–10 cm
B. gynotrochioides	broadly ellipsoid, 65–80 mm long	c. 3–4 mm diam	10–16 by 4–6.5 cm
B. lumutensis	ellipsoid, 18–30 mm long	< 2 mm diam	8–16 by 1.8–8 cm
B. microcarpa	ellipsoid, up to c. 35 mm long	c. 2 mm diam	11–19 by 5–8 cm

Beilschmiedia lumutensis is unique among the Peninsular Malaysian species in having an inflorescence of type 2 (Van der Werff 2001), with the lateral flowers of the ultimately cymes strictly opposite, vs the more usual type 3, in which the lateral flowers of the ultimate cymes are not strictly opposite. However, apart from the structure of the inflorescence, this species falls well within the definition of *Beilschmiedia*. Although the inflorescence might perhaps suggest a relationship with *Dehaasia* Blume, other characters, such as the flowers and dark coloured twigs of *B. lumutensis* all point towards *Beilschmiedia*. In *Dehaasia* the tepals are unequal (the outer 3 much smaller than the inner 3) to almost equal and the twigs are often light in colour (Van der Werff 2001). I therefore agree with Kostermans (1973a) and Kochummen (1989) in keeping this species in *Beilschmiedia.*

10. *Beilschmiedia madang* (Blume) Blume — Map 3

Beilschmiedia madang (Blume) Blume (1851) 332; Kosterm. (1964) 136; Kochummen (1989) 120; I.M.Turner (1995) 276; Sach.Nishida (2008) 363. — *Laurus madang* Blume (1826) 555; Kosterm. (1964) 650. — *Polyadenia madang* (Blume) Nees (1836) 578; Kosterm. (1964) 1311. — Type: *Blume 776* (holotype L; isotype U 2 sheets [U0002637, U0002636]), [Indonesia], Java, in Silvis montosis.

Tetranthera bancana Miq. (1855) 950; Kosterm. (1962a) 159; (1964) 1379. — *Litsea bancana* (Miq.) Boerl. (1900) 143. — *Malapoenna bancana* (Miq.) Kuntze (1891) 572. — Type: *Horsfield s.n.* (holotype U [U0002632]; isotype K [K000768702]), [Indonesia, Sumatra, Bangka], Banca.

Beilschmiedia roxburghiana Nees var. *malaccensis* Meisn. (1864) 63; Kosterm. (1964) 147. — *Beilschmiedia malaccensis* Hook.f. (1886) 123; Ridl. (1924) 83; Kosterm. (1964) 137; Kochummen (1989) 120; I.M.Turner (1995) 276. — Type: *Griffith s.n.* (holotype K [K000768666]), [Peninsular Malaysia], Malacca.

Beilschmiedia curtisii Gamble (1910) 148; Ridl. (1924) 84; Kosterm. (1964) 123; Kochummen (1989) 120; I.M.Turner (1995) 276. — Syntypes: *Curtis 1015* (BM [BM000799352], ECON [ECON00241872], K 8x [K001083359, K001083360, K001083361, K001083362, K001083363, K000768668, K000768669, K000768670]), [Peninsular Malaysia], Pulau Penang, Government Hill; *Ridley 8075* (K [K001083364]), Singapore, Garden Jungle.

Beilschmiedia perakensis Gamble (1910) 149; Ridl. (1924) 85; Kosterm. (1964) 144; Kochummen (1989) 122; I.M.Turner (1995) 277; Sach.Nishida (2008) 348. — Syntypes: *Scortechini s.n.* (K 2 sheets [K000768676, K001098150]), [Peninsular Malaysia], Perak; *King's Collector 8489* (K [K000768678] and picture at KEP), Perak; *King's Collector 10026* (K 3 sheets [K000768677, K001098151, K001098153]), Perak; *King's Collector 10432* (K [K001098152] and picture at KEP), Perak, syn. nov.

Dehaasia olivaeformis Teijsm. & Binn. (1854) 77, 241; Kosterm. (1964) 470 [nom. in syn.].

Trees 1.2–30 m tall, dbh 5–40 cm, with short buttresses up to 1.5 m; bark smooth, grey white to (greyish) brown to black; inner bark reddish brown to deep red; sapwood yellow to yellowish

brown or cream. *Twigs* slender to thick (2.5–7.5 mm diam), velutinous; hairs falling off in patches, reddish brown; terminal leaf buds lanceolate to ovate, 3–6.5 mm long, velutinous, hairs short, curly, erect, dark reddish brown. *Leaves* alternate to (sub) opposite, blades broadly elliptic to obovate, 8–25 by 3–12 cm, (thickly) leathery, light to dark green; apex rounded to acute, often with a clear point; base rounded to cuneate, sometimes unequal; margins flat to recurved; secondary veins 7–18 pairs, curving and joining near margins; tertiary veins reticulate to scalariform, upper surface glabrous to sparsely hairy at base, midrib sunken to raised, secondary veins sunken to raised, tertiary veins faint to distinct; lower surface glabrous to sparsely hairy, more densely so on veins, hairs reddish brown, midrib raised, secondary veins raised, tertiary veins distinct. *Petiole* 5–30 mm long, slender to slightly swollen, channelled to half terete, velutinous at base, becoming less hairy distally when older, hairs often reddish brown. *Inflorescence* 20–150 mm long, sparsely hairy to velutinous, becoming sparsely hairy more distally, not enclosed at base by bracts; bracteoles triangular to oblong, 0.6–7 mm long, persistent. *Flowers* pale yellow to pale yellowish brown, sparsely hairy to velutinous; perianth tube not distinct; perianth lobes elliptical, 1.2–3 by 1.2–1.5 mm, apices rounded to acute, margins not ciliate. *Stamens* 9, 1.1–2 mm long. *Ovary* 0.7–1 mm diam, glabrous; style 0.5–0.6 mm long. *Fruit* (dried) ellipsoid, 13–25 by 5–19 mm, apex rounded to pointed, base rounded to cuneate, surface smooth, glabrous to sparsely hairy (hairs long), shiny, turning dark blue or black when ripe. Stalk when mature, slender to slightly swollen to c. 1.8 mm diam, red when mature, sometimes constricted below apex.

Distribution — Malaysia (including Sabah and Sarawak) and Singapore, Indonesia (Kalimantan, Sumatra and Java).

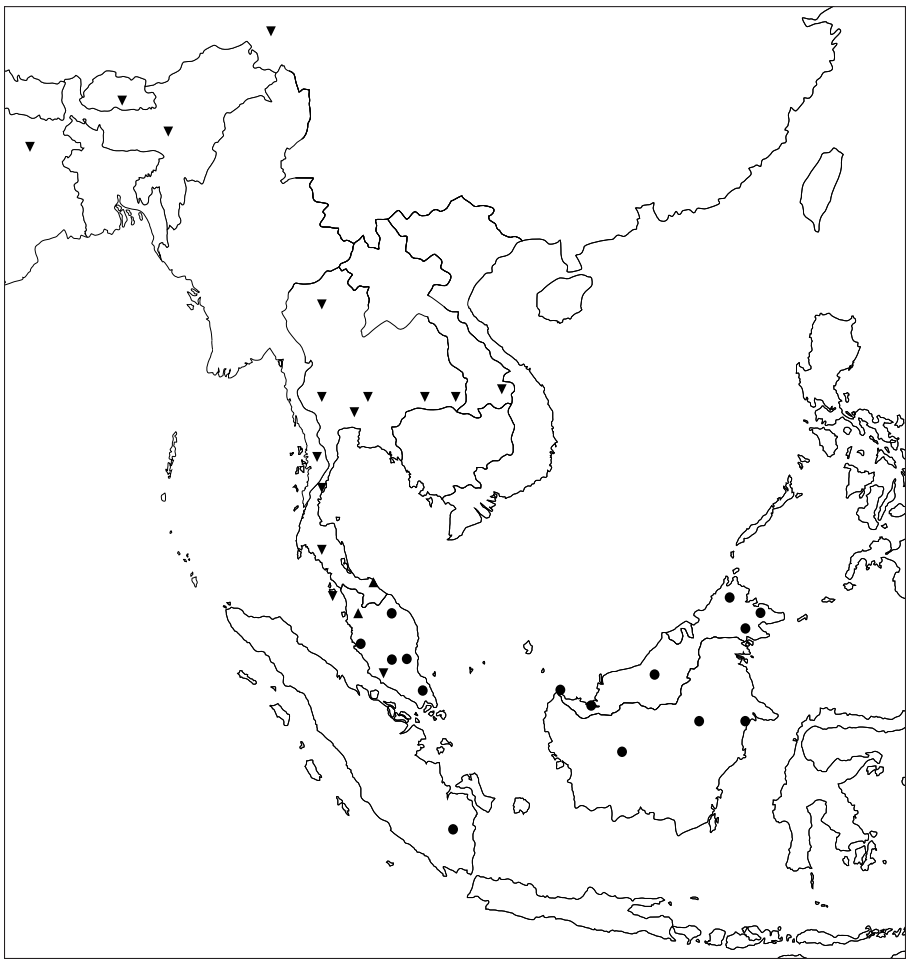
Phenology — Flowering and fruiting all year round.

Ecology — In primary and secondary lowlands, including swamps, to montane forests, sometimes on sandy or rocky soils, at 30–1000 m altitude.

IUCN Conservation Assessment — Least Concern.

Notes — In Nishida's (2008) revision of the Bornean species of *Beilschmiedia*, she mentioned that most specimens of *B. madang* from Borneo differ from the type from Java in having reddish hairs, coriaceous leaves with an inrolled margin, and coarser venation that is sunken in the upper leaf surface, whereas the type has ochre hairs, chartaceous leaves with a flat margin, and finer venation that is slightly raised on the upper leaf surface (Nishida 2008: 365). In this study, I have seen specimens from Borneo, Peninsular Malaysia, Sumatra and Java, and I can confirm this general observation. The Peninsular Malaysian specimens closely resemble those from Borneo. A part of the variation that Nishida (2008) described used to be recognised in Peninsular Malaysia as *B. perakensis* (leaf with inrolled margins and raised veins on the upper surface). However, there is much overlap between these and the other characters mentioned by Nishida (2008) and I agree with her in keeping this complex taxon as one species.

The Bornean species *B. reticulata* Kosterm. has been recorded as occurring in Peninsular Malaysia (Kostermans 1962a: 158). This rare species is in fact only known with certainty from two specimens with young fruits, both from Sabah, and Nishida (2008: 308) listed it in her revision of the Bornean species among her imperfectly known taxa. The only specimen Kostermans recorded from Peninsular Malaysia (*Ridley 15610*) can, in my view, be best seen as a less hairy form of *B. madang*.



Map 5 Distribution of *Beilschmiedia maingayi* (●), *B. membranacea* (▲) and *B. roxburghiana* (▼). Map based on maps provided by d-maps.com.

11. *Beilschmiedia maingayi* Hook.f. — Map 5

Beilschmiedia maingayi Hook.f. (1886) 123; Ridl. (1924) 84; Kosterm. (1964) 137; Kochummen (1989) 121; I.M.Turner (1995) 276; Sach.Nishida (2008) 365. — Type (selected here): *Maingay 2662 [Kew distribution nr. 1268]* (lectotype K [K000768674]; iso-lectotype K [K001098123]), [Peninsular Malaysia], Malacca.

Trees 5–20 m tall, dbh 10–30 cm; bark brown to (black) grey, smooth to (finely) cracking; inner bark red or pale brown, fragrant; wood white to yellow. *Twigs* slender, 3.4–7.5 mm diam, velutinous when young, glabrescent when older; terminal leaf buds triangular, 3.5–10 mm long, velutinous; hairs short, straight, appressed, light brown. *Leaves* alternate to rarely spiral, blades elliptic or oblong to oblanceolate, 12–38 by 3.5–12.5 cm, leathery to membranous, bright to dark green, drying reddish brown to dark brown; apex acute to acuminate; base attenuate; secondary veins 7–13 pairs, tertiary veins reticulate; upper surface glabrous, midrib sunken to flattened, secondary veins often sunken, tertiary veins distinct or sometimes not visible; lower surface glabrous, midrib raised, secondary veins raised, tertiary veins distinct, yellowish green. *Petiole* slender, 10–30 mm long, sparsely hairy. *Inflorescence* 5–36 mm long, not enclosed at base by bracts, velutinous; bracteoles lanceolate, 5–6 by 2.7–3 mm, apex acute. *Flowers* hairy outside, white or (greenish) yellow to dull yellow brown, fragrant, smelling faintly of aniseed; perianth tube absent; perianth lobes ovate, 2.8–4 by 2–2.6 mm, apices round. *Stamens* 9, 2–2.5 mm long, all filaments shorter than anthers; anthers glabrous, obtuse to truncate at apex, red. *Ovary* 0.9–1 by 0.9–1 mm, glabrous; style 1.3–1.5 mm long. *Fruit* (dried) ellipsoid, 35–45 by 17–25 mm, apex rounded to slightly pointed, base rounded to cuneate, surface smooth, tuning dark when ripe. Stalk when mature strongly swollen to 5.4 mm diam, brown, not constricted below apex.

Distribution — Malaysia (including Sabah and Sarawak), Indonesia (Kalimantan and Sumatra).

Ecology — Growing in lowland to montane forests, sometimes over granite or sandy loam, at 100–1200 m altitude.

IUCN Conservation Assessment — Least Concern.

Phenology — Flowering: June to November; fruiting: April to September.

Notes — The difference between this species and *B. wallichiana* has been discussed by various people. Kochummen (1989: 121) thought that the main difference was that *B. maingayi* is a big tree with glabrous leaves, while *B. wallichiana* is a small tree with hairy leaves. Nishida (2008: 365) stated that *B. maingayi* is distinguished from *B. wallichiana* by the former having appressed hairs on the terminal leaf buds and by having filaments shorter than the anthers, while the latter has erect to appressed hairs on the terminal leaf bud and filaments that are longer than the anthers. As defined in this present study, *B. maingayi* can vary from a small to a large tree but given the lack of specimens of *B. wallichiana* with good field notes, it is very difficult to say anything about its habit. The leaves of *B. maingayi* are clearly glabrous while those of *B. wallichiana* are sparsely hairy, in particular along the veins and the leaf margins. Both species can have appressed hairs on the terminal leaf buds. However, I found that main difference between these two species is that *B. wallichiana* has bracts at the base of the inflorescence whereas *B. maingayi* does not.

This species is morphological closely related to the Indian and northern Thai species *B. clarkei* Hook.f. They differ by the latter having raised secondary veins on the upper surface, and anthers which are shorter than the filaments.

There are two sheets of the type gathering at K. The specimen with the floral dissections in the envelope pinned to the sheet and with the detailed drawings on the sheet is chosen here as the lectotype.

12. *Beilschmiedia membranacea* Gamble — Map 5

Beilschmiedia membranacea Gamble (1910) 150; Ridl. (1924) 86; Kosterm. (1964) 138; Kochummen (1989) 121; I.M.Turner (1995) 276; Tetsana (2005) 44. — Type (selected here): *King's collector 10928* (lectotype K [K000734864]; isolectotype K [K000768681] and picture at KEP), Malay Peninsula, Perak.

Trees 4.5–6.5 m tall, dbh 7.5–10 cm. *Twigs* slender, 1.4–1.5 mm diam, flattened in cross-section, whitish, densely hairy; terminal leaf buds elliptic to lanceolate, 2.3–3 mm long, velutinous; hairs long, straight, appressed, light brown. *Leaves* alternate, blades elliptic or ovate, 8.5–20 by 5–8.5 cm, membranous, drying greenish, shiny; apex obtuse or acute to acuminate; base cuneate to rounded; secondary veins 8–11 pairs, tertiary veins scalariform to reticulate; upper surface glabrous, shiny, midrib sunken, densely hairy, secondary veins raised, tertiary veins distinct; lower surface sparsely hairy, midrib raised, secondary veins raised, tertiary veins distinct. *Petiole* 5–10 mm long, half terete, densely hairy. *Inflorescence* 6–14 mm long, sparsely hairy, enclosed at base by orbicular bracts; bracteoles unknown. *Flowers* unknown. *Fruit* (dried) oblong, 11–25 by 5.8–15 mm, apex rounded, base rounded to acuminate, surface smooth, glabrous, red when mature. Stalk when mature slightly swollen to 3.2 mm diam, 5–15 mm long, constricted below apex.

Local names — Peninsular Malaysia: Medang tandok or Medang tanah.

Distribution — Peninsular Thailand and Peninsular Malaysia.

Ecology — Growing in evergreen forest, at 100–900 m altitude.

IUCN Conservation Assessment — Critically Endangered (CR B2ab(ii,iii)). This species was collected three times between 1886 and 1929 in parts of Peninsular Thailand and Malaysia that have been much logging and modification of the landscape since that time. An analysis of the EOO and the AOO both gives the assessment of Critically Endangered. Therefore, it is listed as Critically Endangered here.

Phenology — Flowering unknown; fruiting: July to September.

Notes — There are two sheets of the type gathering of this species at K. The specimen with the fruit attached to the specimen is chosen here as the lectotype.

This species is morphological closely related to *B. glabra* and *B. wallichiana*. The difference between them are set out in Table 2.

Table 2 Morphological differences between *Beilschmiedia glabra*, *B. membranacea* and *B. wallichiana*.

Species	Tree height (m)	Fruit size (mm)	Fruit stalk diam (mm)	Fruit stalk length (mm)
B. membranacea	< 6.5	11–25 by 5.8–15	1.9–3.2	5–15
B. wallichiana	< 3.3	16.5–17.2 by 11–15	2.8–2.9	35–37
B. glabra	6–35	3–9.5 by 2.5–26	1.5–1.8	3–15

13. *Beilschmiedia palembanica* (Miq.) Kosterm. — Map 6

Beilschmiedia palembanica (Miq.) Kosterm. (1955) 31; (1964) 143; Kochummen (1989) 121; I.M.Turner (1995) 276; Tetsana (2005) 47. — *Cryptocarya palembanica* Miq. (1861) 359; Kosterm. (1964) 426. — Type: *Teijsmann s.n.* (holotype U [U0002630]; isotype L [L0035613]), [Indonesia], Prov. Palembang, in Ogan-ulu.

Beilschmiedia longipes Hook.f. (1886) 123; Ridl. (1924) 85; Kosterm. (1955) 31; (1964) 135; Kochummen (1989) 121; I.M.Turner (1995) 276. — Type: *Maingay 2997* (holotype K [K000768675] and picture at KEP), [Peninsular Malaysia], Malacca.

Beilschmiedia sumatrensis Ridl. (1923) 89; Kosterm. (1955) 31; (1964) 150. — Type (selected by Turner 2012: 227): *Ridley s.n.* (lectotype K [K000778438]), [Indonesia], Sumatra, Berastagi woods.

Trees 10–30 m tall, dbh 5–30 cm; bark grey to brown or red-brown, smooth or flaking into irregular small flakes; inner bark red to yellow brown; sapwood (pale) yellow or cream. *Twigs* slender, 2.2–3 mm diam, brownish, velutinous; terminal leaf buds lanceolate, 5–9 mm long, velutinous; hairs short, straight, appressed, light brown. *Leaves* alternate to subopposite, blades elliptic to lanceolate, (6.5–)9–31 by (2–)3–13 cm, leathery, bright to dark green; apex blunt or acuminate; base cuneate; margins flat to recurved; secondary veins 9–13 pairs, curving and join near margins; tertiary veins reticulate to scalariform; upper surface glabrous, shiny, (dark) green when fresh, midrib sunken and velutinous, secondary veins sunken, tertiary veins distinct; lower surface sparsely to slightly hairy, pale green when fresh, drying brownish, midrib raised, densely hairy, secondary veins raised, tertiary veins distinct. *Petiole* 9–25 mm long, channelled to half terete, slender to swollen, sparsely hairy to velutinous. *Inflorescence* 35–160 mm long, not enclosed at base by bracts, velutinous, red; bracteoles linear, 0.5–5 mm long. *Flowers* hairy, green, cream or white to deep yellow; perianth tube c. 1 mm long, densely hairy; perianth lobes elliptic, 1.5–2 by 0.9–1.3 mm, apices rounded to acute, densely hairy. *Stamens* 9, 0.7–1.7 mm long, anthers about as long as filaments, yellow. *Ovary* c. 1 mm diam, glabrous; style c. 1 mm long. *Fruit* (dried) (sub)globose, 7–21 by 4.7–20 mm, apex rounded to pointed, base rounded, surface smooth, glabrous, brownish red to red, maturing black. Stalk when mature slightly swollen to 2.5 mm, 3–5.4 mm long, not constricted below apex.

Local names — Kayu Mengkuching (Tesuan language).

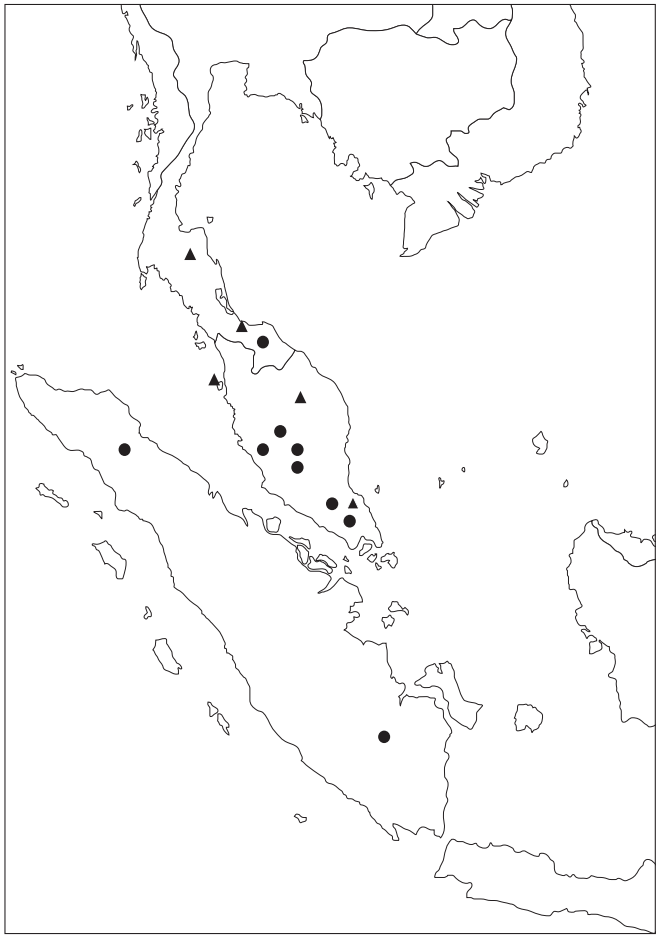
Distribution — Peninsular Thailand and Peninsular Malaysia, Indonesia: Sumatra.

Ecology — Primary and secondary lowland to montane forest, often near streams or in peat swamps, often on clay soils, at 0–1400 m altitude.

IUCN Conservation Assessment — Least Concern.

Phenology — Flowering: (September) December to July; fruiting: November to April.

Note — This species is morphologically very similar to *Beilschmiedia atra*, *B. madang* and *B. scortechinii*. The differences between them are given in Table 3.



Map 6 Distribution of *Beilschmiedia palembanica* (●) and *B. penangiana* (▲). Map based on a map provided by d-maps.com.

14. *Beilschmiedia penangiana* Gamble — Map 6

Beilschmiedia penangiana Gamble (1910) 149; Ridl. (1924) 85; Kosterm. (1964) 143; Kochummen (1989) 122; I.M.Turner (1995) 276. — Type: *Curtis 1098* (holotype K [K000768679]; isotype SING 2 sheets), [Peninsular Malaysia], Penang, Penara Bukit.

Beilschmiedia brevipes Ridl. (1924) 86; Kosterm. (1964) 120; Kochummen (1989) 118; I.M.Turner (1995) 276; Tetsana (2005) 24. — Type: *Foxworthy FMS 3181* (holotype K [K000768680]; isotypes SING [SING0055162, SING0055163]), Peninsular Malaysia Pahang, Ulu Rompin, syn. nov.

Trees or shrubs 3–22 m tall, dbh up to 30 cm; bark pale grey, (powdery) scaly, lenticellate; inner bark pale orange to dark brown, wood cream. *Twigs* slender, 2.2–2.6 mm diam, smooth or longitudinally ridged, sparsely hairy when young, glabrous when mature, whitish; terminal leaf buds linear, 1.5–3.8 mm long, densely hairy to velutinous; hairs long, straight, appressed, light brown. *Leaves* alternate to (sub)opposite, blades elliptic to elliptic-lanceolate, 5.5–11 by 2–4.6 cm, thinly leathery, drying blackish; apex acute, often with a distinct long tip; base cuneate; margins flat to recurved; secondary veins 8–15 pairs, looping near margins, tertiary veins reticulate; upper surface glabrous, midrib sunken, secondary veins (slightly) raised, tertiary veins distinct; lower surface glabrous or with a few hairs present, midrib raised, secondary veins raised, tertiary veins distinct. *Petiole* 6–17 mm long, slender, half terete, channelled, glabrous to sparsely hairy. *Inflorescence* 27–120 mm long, enclosed at base by orbicular bracts 1–3.3 by 0.8–3.3 mm with entire margins, sparsely hairy to velutinous; bracteoles lanceolate, c. 1 mm long, caducous. *Flowers* with no distinct perianth tube; perianth lobes elliptic, 1.1–1.6 by 0.8–1.3 mm, outer lobes wider than inner ones, apices rounded, glabrous, margins hairy. *Stamens* 9, 0.9–1.2 mm long, glabrous. *Ovary* c. 0.6 mm diam, glabrous; style c. 0.5 mm long. *Fruit* (dried) ellipsoid, 8–20 by 6–9 mm, apex rounded, base cuneate, surface smooth, glabrous, colour unknown. Stalk when mature slightly swollen to 1.6 mm, 4–5 mm long, red, constricted at apex.

Table 3 Morphological differences between *Beilschmiedia atra*, *B. madang*, *B. palembanica* and *B. scortechinii*.

Species	Leaves (cm)	Terminal leaf bud length (mm)	Bracteoles (mm)	Ovary	Fruit	Fruit colour when ripe
B. atra	8.5–10 by 3–5.5	3–4	lanceolate, 0.7–1.7 long	glabrous	unknown	unknown
B. madang	13–22 by 4.6–12	3–6.5	triangular to oblong, 0.6–7 long	glabrous	ellipsoid	dark blue or black
B. palembanica	(6.5–)9–31 by (2–)3–13	5–9	linear, 0.5–5 long	glabrous	(sub)globose	black
B. scortechinii	6–18 by 2.3–6.2	4.1–6.2	lanceolate to orbicular, 1.4–1.5	hairy	unknown	unknown

Local names — Peninsular Malaysia: Mědang ayer or Metiup.

Distribution — Peninsular Thailand and Peninsular Malaysia.

Ecology — Growing in lowland or hill forests, often near streams or along forest edges, sometimes over sandstone, at 100–700 m altitude.

IUCN Conservation Assessment — Endangered (EN B2ab (ii,iii)). In Peninsular Malaysia, this species is only known from eight specimens, all collected between 1886 and 1971, though in Peninsular Thailand it has been collected more recently (five specimens between 1984 and 2005). The areas in Peninsular Malaysia have gone through a major period of logging since the collections were made there. An analysis of the EOO gives a conservation assessment of Least Concern, but an analysis of the AOO gives the assessment of Endangered. Given the amount of landscape modification in the region, it is listed here as Endangered.

Phenology — Flowering: October to May; fruiting: January to July.

Notes — The bracts at the base of the inflorescence are rather peculiar within the genus and are known only from a few other species (see also discussion under *B. membranacea*). When he first described this taxon, Ridley (1924: 86) thought that it might be closely related to *B. tonkinensis* (Lecomte) Ridl. (= *Beilschmiedia roxburghiana*), but see Table 1 for differences.

According to Tetsana (2005: 73), *B. penangiana* differs from *B. brevipes* by the latter having glabrous, papery bracteoles. However, after studying the type material of *B. brevipes* at Kew, it was clear that the abundance of hairs on the bracteoles is more variable then she thought.

This species is morphologically very similar to *B. gemmiflora* from Borneo, Sumatra and New Guinea. However, it differs from the latter by having terminal leaf buds which are ovoid in shape, leaves that are generally broader (3.5–8 cm wide), and mature fruit that are much bigger (c. 30 by 17 mm) (see Nishida 2008: 355).

Kochummen (1989: 122) thought that the white twigs and blackish leaves when dried of this species were an indication that it might be better placed in *Dehaasia* than in *Beilschmiedia*. However, no known species of *Dehaasia* resembles this plant and in particular the inflorescence structure is very different from that of any known *Dehaasia.* I therefore agree with Kostermans (1973a) in retaining this species in *Beilschmiedia.*

15. *Beilschmiedia roxburghiana* Nees — Map 5

Beilschmiedia roxburghiana Nees (1831) 69; Kosterm. (1964) 146; Tetsana (2005) 50; X. Li (2008b) 237. — *Laurus bilocularis* Roxb. (1814) 30; (1832) 311, nom. nud.; Kosterm. (1964) 574; Tetsana (2005) 50. — Type (selected here): *Wallich [Cat. Num.] 2605* (lectotype K-W [K001116547]; isolecto BM [BM000880626], G [G00368746], K [K000768626], P [P00745639]), [India], HBC [Botanical Garden Calcutta].

Beilschmiedia fagifolia Nees (1831) 69; Kosterm. (1964) 126; Tetsana (2005) 50. — *Tetranthera fagifolia* Wall. (1830) 2539, nom. nud. — *Beilschmiedia roxburghiana* var. *fagifolia* (Nees) Kosterm. (1964) 147. — Type: *Wallich [Cat. Num.] 2539* (holotype K-W [K001116381]; isotypes BM [BM000950890], E 2 sheets [E00386410, E00393178], K 2 sheets [K000768628, K000768627], P [P00745629]), [India], Sillet.

Beilschmiedia undulata Miq. (1855) 920. — *Haasia undulata* Teijsm. & Binn. ex Miq. (1855) 920 [nom in syn.]; Kosterm. (1973a) 478.

Beilschmiedia pahangensis Gamble (1910) 150; Ridl. (1924) 86; Kosterm. (1964) 142; Kochummen (1989) 121; I.M.Turner (1995) 276. — Type: *Ridley 2273* (holotype K [K000768682]; isotype SING 2 sheets [SING0055160, SING0055161]), [Peninsular Malaysia], Pahang, Kuala Teriang, syn. nov.

Beilschmiedia glomerata Merr. var. *tonkinensis* Lecomte (1914) 149. — *Beilschmiedia tonkinensis* (Lecomte) Ridl. (1920) 190; (1924) 85; Kosterm. (1964) 152; Kochummen (1989) 122; I.M.Turner (1995) 277; (2012) 227. — Syntypes: *Harmand s.n.* (P, K), Laos, Bassin d'Attopeu; *Bon s.n.* (P not seen), [Vietnam], Tonkin meridional, syn. nov.

Trees 3–25 m tall, dbh 40–60 cm; bark scaly to smooth, greenish to greyish black or light orange-brown; wood white to yellow. *Twigs* slender, 1.5–3.2 mm diam, slightly flattened in cross-section, velutinous when young, soon glabrescent, often remaining velutinous at nodes, whitish; terminal leaf buds ovate, 1.4–3.5 mm long, velutinous; hairs long, straight, appressed, light to dark brown. *Leaves* alternate or opposite, blades oblong to (elliptic-)lanceolate, 5–22 by 1.5–8.4 cm, (thickly) leathery, aromatic when crushed; apex round, acute to shortly acuminate; base cuneate to rounded, often asymmetric; margins recurved; secondary veins 5–12 pairs, tertiary veins reticulate; upper surface glabrous, some hairs on veins of young leaves and midrib, midrib sunken at base, secondary veins (slightly) raised, tertiary veins faint to distinct; lower surface glabrous, some hairs on veins of young leaves, midrib raised, secondary veins raised, tertiary veins distinct. *Petiole* 8–25 mm long, slender, channelled, velutinous when young, internodes soon glabrescent, nodes often remaining velutinous. *Inflorescence* 14–40 mm long, not enclosed at base by bracts, velutinous when young, soon becoming sparsely hairy; bracteoles orbicular, 2.5–3 mm long, caducous. *Flowers* pale yellowish green; perianth tube not distinct; perianth lobes linear to oblong-acute, 2.5–4 by 1–1.2 mm, apices acute, pubescent on both surfaces. *Stamens* 9, 1–2.5 mm long, hairy; anthers ovoid, with obtuse apex. *Ovary* globose, c. 1 cm diam, glabrous; style sparsely hairy, 2–2.5 mm long. *Fruits* (mature?) ellipsoid to oblong, 12–44 by 7.8–18 mm, apex rounded, base rounded, surface smooth, glabrous, turning purplish black and glaucous when mature. Stalk when mature slender to slightly swollen to 3.5 mm, 3.5–35 mm long, red, constricted at apex.

Local names — Medang salah, Medang tandok, Penapoh, Medang punggok, Tampu rengat or Medang teraelak.

Distribution — India (Assam and Andaman Islands), Bhutan, Myanmar, Thailand, Laos, South China and Peninsular Malaysia.

Ecology — Growing in dry evergreen, mixed deciduous and dry dipterocarp forests, often along rivers, sometimes over limestone, at 50–975 m altitude.

IUCN Conservation Assessment — Least Concern.

Phenology — Flowering: January to June; fruiting: February to November.

Uses — The bark of this species is boiled, sometimes together with the bark of *Vitex pubescens* L. (= *Vitex pinnata* L.) or species of *Mangifera* or the leaves of a species of *Justicia* and a *Zingerberaceae*, and the decoction is drunk for curing stomach-ache or other digestive disorders and after childbirth. In Thailand, the bark is used in a remedy for tuberculosis (Tetsana 2005: 50).

The leaves and roots are pounded together and applied over the stomach to cure what is called 'bisa hati', a general digestive complaint in the region of the heart (Burkill 1966).

Notes — The name *Beilschmiedia roxburghiana* was based on the collection *Wallich 2605* of which several specimens are available for lectotypification. The specimen *Wallich 2605* at K-W is selected here as the lectotype.

16. *Beilschmiedia scortechinii* Gamble — Map 7

Beilschmiedia scortechinii Gamble (1910) 148; Ridl. (1924) 84; Kosterm. (1964) 148; Kochummen (1989) 120; I.M.Turner (1995) 276. — Type (selected here): *Scortechini 483* (lectotype K [K000768672] and picture at KEP; iso-lectotypes BM [BM000799355], K [K000768673], P 2 sheets [P00745516, P00745517]), [Peninsular Malaysia], Perak, at Caulfield's Hill.

Trees up to 10 m tall. *Twigs* slender, 3–4 mm diam, round to flattened in cross-section, velutinous, (light) brown; terminal leaf buds lanceolate, 4.1–6.2 mm long, velutinous; hairs short, straight to curly, erect to appressed, (reddish) brown. *Leaves* alternate,

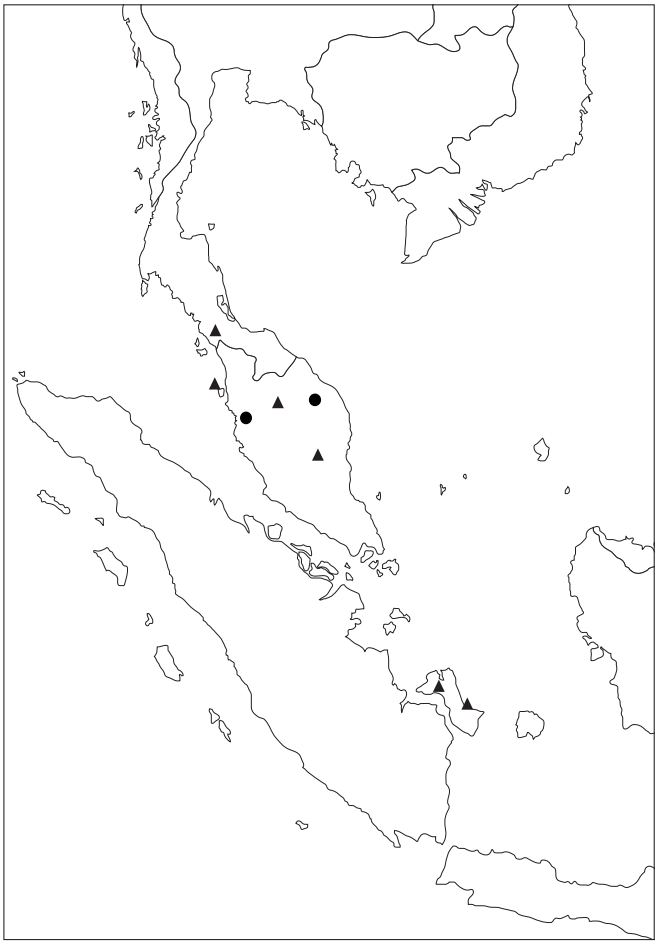
blades elliptic to lanceolate or obovate, 6–18 by 2.3–6.2 cm, leathery; apex acute, sometimes with a distinct point; base cuneate, sometimes unequal; margins flat to recurved; secondary veins 4–13 pairs, tertiary veins scalariform; upper surface velutinous when young, glabrescent, midrib sunken, velutinous when young, later glabrescent, secondary veins raised or inconspicuous, tertiary veins not distinct; lower surface sparsely hairy to velutinous, midrib raised, secondary veins raised, tertiary veins distinct. *Petiole* 9–24 mm long, slender to slightly swollen, half terete, velutinous. *Inflorescence* 24–110 mm long, not enclosed at base by bracts, velutinous to densely hairy; bracteoles lanceolate to orbicular, 1.4–1.5 by 1.4 mm, caducous. *Flowers* yellow, velutinous in bud, later almost glabrescent; perianth tube c. 1 mm long; perianth lobes elliptic to oblong, 1.9–2.5 by 1–1.3 mm, apices acute to rounded. *Stamens* 9, 1–1.8 mm long. *Ovary* c. 1 mm diam, sparsely hairy; style c. 0.8 mm long. *Fruit* unknown.

Distribution — Endemic to Peninsular Malaysia: Perak and Terengganu.

Ecology — Growing in hill and montane forest, at 1200–1375 m altitude.

IUCN Conservation Assessment — Endangered (EN B2ab (ii,iii)). This species is endemic to the northern part of Peninsular Malaysia and is known from only three collections, two from the1880s from Perak and one relatively recent one (1968) from Terengganu. Both areas have gone through a major period of logging and general modification of the landscape since these collections were made. An analysis of the EOO and the AOO both gives an assessment of Endangered. Therefore, it is proposed as Endangered here.

Phenology — Flowering: April; fruiting time unknown.



Map 7 Distribution of *Beilschmiedia scortechinii* (●) and *B. wallichiana* (▲). Map based on a map provided by d-maps.com.

Notes — This species was recognised as distinct by Ridley (1924) and Kostermans (1964), but was placed into the synonymy of *B. madang* by Kochummen (1989: 120). It is superficially similar to *B. madang*, but differs by having narrower leaves (3–12 cm wide in *B. madang* vs 2.3–6.2 cm wide in *B. scortechinii*) and among the Peninsular Malaysian *Beilschmiedia* species it has the unique character of a hairy ovary.

In the original description, two different Scortechini gatherings were mentioned: *Scortechini 483* & *493*, both from Perak, at Caulfield's Hill (Gamble 1910: 148). I could not find any specimens of the later gathering, whereas there are two sheets of the first gathering at K, one at BM and two at P. One of these two K specimens is accompanied by a card with a number of dissected flowers glued to it and with some notes and drawings and a signature by Gamble. This specimen is selected here as the lectotype.

17. *Beilschmiedia wallichiana* (G.Don) Kosterm. — Map 7

Beilschmiedia wallichiana (G.Don) Kosterm. (1960) 391, f. 6; (1964) 154; Kochummen (1989) 122; I.M.Turner (1995) 277; Tetsana (2005) 60; Sach. Nishida (2008) 365. — *Sideroxylon wallichiana* G.Don (1838) 28; Kurz (1872) 172; Hook.f. (1886) 180; Kosterm. (1964) 1351. — *Sideroxylon rugosum* Wall. (Nees (1831) 4158, nom. inval.). — *Litsea rugosa* (Wall.) Kurz (1872) 172; Hook.f. (1886) 180. — *Malapoenna rugosa* (Wall.) Kuntze (1891) 573. — Type: *Porter* [*Wallich*] *4158* (holotype K-W [K001038280]), Malay Peninsula, Penang.

Trees 1.5–15 m tall, dbh up to 40 cm diam; bark grey. *Twigs* slender, 3.7–7 mm diam, velutinous when young, soon becoming glabrous; terminal leaf buds lanceolate, 5.3–6.5 mm long, velutinous; hairs long, straight, erect to appressed, light brown. *Leaves* alternate or arranged spirally, or rarely opposite, blades elliptic to obovate, 13–30 by 4.3–10 cm, leathery; apex acute to acuminate; base cuneate, sometimes asymmetric; secondary veins 7–12 pairs, tertiary veins reticulate; upper surface glabrous, midrib flattened to raised, secondary veins raised, tertiary veins reticulate and distinct; lower surface sparsely hairy on and adjacent to midrib and along the margins, midrib raised, secondary veins raised, tertiary veins distinct. *Petiole* 10–15 mm long, half terete, velutinous to sparsely hairy. *Inflorescence* 10–20 mm long, velutinous, enclosed at base by orbicular bracts 2.5–2.8 mm long, hairy, margin entire; bracteoles orbicular, 1–2 mm long, persistent. *Flowers* white; perianth tube 0.8–0.9 mm long; perianth lobes lanceolate-oblong, 3–4 mm long, apices acute, sparsely hairy. *Stamens* 9, 1–2.5 mm long, filaments longer than the anthers. *Ovary* c. 2 mm long, glabrous; style c. 2 mm long. *Fruit* (dried) ellipsoid, 16.5–17.2 by 11–15 mm, apex round, base attenuate, surface smooth, shiny. Stalk when mature slightly swollen to 2.9 mm diam, 35–37 mm long, not constricted at apex.

Distribution — Peninsular Thailand and Peninsular Malaysia.

Ecology — Growing in forests, sometimes among rocks or over shale, at 20–910 m altitude.

IUCN Conservation Assessment — Endangered (EN B2ab (ii,iii)). This species is endemic to Peninsular Thailand and Peninsular Malaysia and is known from only five collections, all made between the 1820s and 1971. The areas where this species was collected have gone through a major period of logging and general modification of the landscape since that time. An analysis of the EOO gives a conservation assessment of Near Threatened, but an analysis of the AOO gives the assessment of Endangered. Given the amount of landscape modification in the region, I consider it here to be Endangered.

Phenology — Flowering: January and February; fruiting in September.

Note — For a discussion of the differences between this species and *B. maingayi*, see under that species.

EXCLUDED NAMES

Beilschmiedia foxiana Gamble (1910) 150; Ridl. (1924) 86; Kosterm. (1964) 128. — Type: *Fox 10705* (holotype SING; isotype BO), [Peninsular Malaysia], Penang, at Birch's Hill = **Alseodaphne foxiana** (Gamble) Kosterm. (1973b) 107; Kochummen (1989) 112.

Beilschmiedia longipedicellata Ridl. (1926) 475; Kosterm. (1964) 135. — Type: *Hume 8432* (holotype SING), Peninsular Malaysia, Selangor. = **Dehaasia longipedicellata** (Ridl.) Kosterm. (1955) 37.

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4 = *glauca*
5 = *insignis*
6 = *kochummenii*
7 = *kunstleri*
8 = *lucidula*
9 = *lumutensis*
10 = *madang*
11 = *maingayi*
12 = *membranacea*
13 = *palembanica*
14 = *penangiana*
15 = *roxburghiana*
16 = *scortechinii*
17 = *wallichiana*

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