Taxonomic Notes on Bornean *Litsea*, *Lindera*, *Neolitsea* and *Iteadaphne* (Lauraceae)

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Summary

Litsea Lam., *Lindera* Thunb., *Neolitsea* Merr. and *Iteadaphne* Blume share a combination of many features that distinguish them collectively as a well-defined natural group from the rest of the Lauraceae. However, within the group, the genera are defined on features that are unsatisfactory whether considered individually or in combination.

- The main line of division is anther locule number: four versus two. This feature separates the 4-locular genera *Litsea* and *Neolitsea* from the 2-locular genera *Lindera* and *Iteadaphne*. However, there are several species on one side of the division that are mirrored by species on the other side, differing only by the anther locule number. In this revision, four such sets of twins are united as four species with variable anther locule number. One of these species is *Litsea cubeba* (Lour.) Pers., in which 2-locular and 4-locular anthers can occur even within the same flower.
- Another line of division uses a combination of leaf venation and floral merism, by which triveined dimerous *Neolitsea* has been distinguished from penniveined trimerous *Litsea*. These two-feature states are not fixed, and some authors have defined *Neolitsea* on dimery with or without triveined leaves. However, dimery itself is a variable feature and the type species, *Neolitsea cassia*, has been found to have both dimerous and trimerous flowers.
- *Litsea* species can be distinguished from *Lindera* if the fruit has a prominent cupule, but there are a few *Litsea* species without cupule development (e.g. *Litsea elliptica* and all the species with variable anther locule number), and these have often been misidentified as *Lindera*.
- *Iteadaphne* is distinguished from *Lindera* in its umbellules reduced to a single floret. By default, *Lindera* consists of species with 2–20 florets per umbellule. However, the number of florets in the umbellules is actually variable. The type species of *Iteadaphne* has itself been found to be part of a variable species, *Litsea subumbelliflora* (Blume) Ng, with 2 or 4 anther locules and 1–6

florets per umbellule. Hence *Iteadaphne* is reduced to *Litsea*.
- *Litsea*, *Lindera* and *Neolitsea* should be united as a single natural genus, but their merger would result in a great nomenclatural upheaval. The alternative, adopted here, is to retain them as artificial genera, for nomenclatural stability.
- In writing the account for The Tree Flora of Sabah and Sarawak, 9 new taxa (species or varieties) are described, 47 species are reduced to synonymy and one species is excluded from Lauraceae.

Introduction

Litsea Lam., *Lindera* Thunb., *Neolitsea* Merr. and *Iteadaphne* Blume are collectively distinguished from the rest of Lauraceae by a suite of reproductive characters. The species are nearly always dioecious, rarely polygamous (*Litsea cubeba* (Lour.) Pers., *Litsea lancifolia* (Roxb. *ex* Wall.) Hook. *f.*) The inflorescence is an axillary raceme terminating in a dormant terminal bud. However, instead of flowers, the raceme bears 'involucral buds', each involucral bud consisting of a perianth-like involucre of 4 (sometimes 3 or 5) decussate bracts enclosing 1–20 florets in an umbellule. The stalk of the umbellule is here called a peduncle and the stalks of the florets are called pedicels. At anthesis, each involucral bud behaves like a unified flower, with all its florets opening together to expose a mass of protruding stamens, staminodes and stigmas on an open involucre imitating a perianth. In the female flower, the ovary sits within a hypanthium (perianth tube), with the perianth lobes (small and flimsy), staminodes, and glands arising from the mouth of the hypanthium. The hypanthium is enlarged in fruit to form a cup-like or dish-like cupule in most species of *Litsea* and to some extent in *Neolitsea*, but not in *Lindera*. The number of perianth lobes varies from 3 to 9, with 6 as the most common number, but aberrant specimens have 2 and even no perianth lobes. In the male flowers, the staminodes are replaced by functional stamens and the pistil by a pistillode. The stamens range in number from 3 to 12 and rarely 18, with 9 as the most common number. Glands are usually present, as swollen pads of tissue between the stamens and staminodes, sometimes free standing and sometimes attached to the sides of the filaments; they sometimes look like sessile anthers with bulging but non-functional anther locules.

I recently found a population of *Litsea cubeba* with hermaphrodite flowers in the Bario Highlands, Sarawak. About ten trees were all heavy with fruit, but some also bore flowers toward the twig tips. The flowers had functional stamens (with swollen anther locules opening by uplifted flaps to release pollen) and ovaries containing well-formed ovules. I then

re-examined my previous drawings of dissected flowers and confirmed that *Litsea cubeba* has three distinct kinds of flowers: male, female, and hermaphrodite, and that hermaphrodite trees are not only in Sarawak, but also in Ranau, Sabah (*SAN 114166*). I also found a hermaprodite flower in *Litsea lancifolia* var. *lancifolia* in a specimen from Ranau, Sabah (*Matamin Rumuto MR 27*), which I had previously taken to be male.

Within the group, there is abundant evidence that the genera are artificial. The major internal line of division is whether the anthers are 2- or 4-locular. *Lindera* and *Iteadaphne* are 2-locular whereas *Litsea* and *Neolitsea* are 4-locular. This dividing feature stands almost alone, partially supported by the development of cupules in most species of *Litsea* and *Neolitsea* and the non-development of cupules in *Lindera* and *Iteadaphne*. Division by anther locule number has resulted in species of *Litsea* having 'twin species' in *Lindera/Iteadaphne*, differing only in the number of anther locules. In such cases, only male specimens can be identified positively. Female and sterile specimens can only be placed by looking for exact matches in leaves or localities. Twin species could have arisen by parallel evolution in different genera but are more likely to be the result of an arbitrary line of division based on a character that is in fact variable. I have united these twins and placed them in *Litsea*:

1. *Litsea subumbelliflora* (Blume) Ng includes *Litsea lanceolata* (Blume) Kosterm. and *Lindera subumbelliflora* (Blume) Kosterm.
2. *Litsea cubeba* (Lour.) Pers. includes *Lindera pipericarpa sensu auct. non* (Miq.) Boerl., *Lindera oxyphylla* (Nees) Hook.*f.* and *Lindera reticulosa* Kosterm.
3. *Litsea lancifolia* (Roxb. *ex* Wall.) Hook.*f.* and *Litsea sessiliflora* Hook.*f.* have both been found to include male specimens with 2-locular anthers that technically would qualify these specimens to be new species of *Lindera* or *Iteadaphne,* but such 'species' would consist of male specimens only.

Further details are given in the respective species accounts below.

The well-developed cupule is associated with *Litsea* but a few species of *Litsea* (e.g. *Litsea elliptica* Blume, and all the species with variable anther locule number) have weakly developed or undeveloped cupules, and fruiting specimens of these species are often misidentified as *Lindera*.

Neolitsea was included in *Litsea*, until raised to generic level by Merrill (1906). Previously, it had been *Litsea* Lam. sect. *Neolitsea* Benth. The section *Neolitsea* was described by Bentham (in Bentham and Hooker, 1880) as follows: *Folia saepius triplinervia. Flores sepius 2-meri, perianthi segmentis 4, staminibus perfectis 6* (Leaves often triplinerved. Flowers often

2-merous, perianth segments 4, perfect stamens 6). By default, *Litsea* became a genus with penninerved leaves and trimerous flowers. However, dimery is not always associated with triveined leaves, and some authors, e.g. Kostermans (1957) have dropped the triveined character from the definition of *Neolitsea*, leaving dimery as the key character. There are indeed 4 perianth lobes in *N. amabilis* and *N. villosa* but I have found florets with 3, 4 and 6 perianth lobes in *N. cassia,* the type species of *Neolitsea.*

Lindera differs from *Litsea* and *Neolitsea* only by anther locule number, associated with lack of cupule development in fruit. *Lindera* parallels the situation in *Litsea* prior to Merrill in that it consists of two subgroups of species, one with triveined leaves and the other with penniveined leaves. *Lindera* also has dimerous as well as trimerous flowers.

Iteadaphne is distinguished from *Lindera* by its umbellules bearing a single floret. By default, *Lindera* consists of species with 2–20 florets per umbellule. The arbitrariness of this line of division is quite obvious. The number of florets in the umbellule is variable in most, perhaps all species.

Neolitsea amabilis Airy Shaw and *Lindera montanoides* Kosterm. have 1–3 florets per umbellule. Both species have triveined leaves but one is a *Neolitsea* because of 4-locular anthers and the other a *Lindera* because of 2-locular anthers. *Lindera bibracteata* (Nees) Boerl. is consistently uniflorous and could have been placed in *Iteadaphne* but was placed in *Lindera* instead; it has triveined leaves.

The type species of *Iteadaphne* is '*Iteadaphne confusa* Blume' (= *Lindera subumbelliflora* (Blume) Kosterm.), and this has been found to consist of local populations with uniflorous umbellules, mirrored by *Litsea lanceolata* (Blume) Kosterm. with 4 anther locules. The two combined make the widespread *Litsea subumbelliflora* (Blume) Ng that has 2 or 4 anther locules and 1–6 florets per umbellule. This merger has the effect of reducing *Iteadaphne* to *Litsea.* There are two other species of *Iteadaphne* to be accounted for: *Iteadaphne caudata* (Nees) H.W.Li and *Iteadaphne philippinensis* Elmer. These should be examined carefully to see whether they fit into *Lindera, Litsea* or *Neolitsea.* It is likely that they already have 'twin species' in those genera, with which they should be united. *Iteadaphne caudata* has triveined leaves, suggesting a relationship with *Lindera bibracteata.*

Litsea, *Lindera* and *Neolitsea* could be merged into a single genus, which would be a natural genus because it would share many traits all supporting each other. Such a genus could then be re-sorted into sections (I would expect five or more sections) that are better defined than the current three genera. However, merger would result in considerable nomenclatural upheaval because there are about 400 binomials in *Litsea,*

100 in *Lindera* and 100 in *Neolitsea*. *Lindera* is the oldest name. For the Tree Flora of Sabah and Sarawak, for which this research has been carried out, the preferred option is to maintain *Litsea*, *Lindera* and *Neolitsea* as separate artificial genera.

The following definitions appear to me to be the most practical for conserving existing species names.

Litsea: leaves penniveined; anther locules 4, but allowing for species with anther locules variably 2 or 4; fruits with or without prominent cupules.

Neolitsea: leaves triveined; anther locules 4; fruits with or without prominent cupules.

Lindera: leaves penniveined or triveined; and anther locules 2; fruits without prominent cupules.

New Taxa and Status Changes

Litsea Lam.

1. **Litsea aban-gibotii** Ng, **sp. nov.**
(Named for Aban Gibot, b. 1944, plant collector in the Sabah Forest Department)

Folia infra nitida ob pilos tenues microscopicos (*manifesti magnificatione 15*x). *Fructus in cupulis profundis poculiformibus sedentes*. **Typus:** *Aban Gibot SAN 66744*, Sabah, Papar District (holo KEP; iso SAN).
Figure 1

Small to medium-sized trees. **Leaves** alternate, *undersurface with silky shee n due to closely-packed microscopic hairs* (visible at 15x magnification); blades elliptic or obovate, 9–13.5 x 4–4.8 cm, base cuneate to attenuate, apex acuminate; midrib shallowly impressed above; lateral veins 9–10 pairs; intercostal venation faint, closely scalariform (mostly closer than 0.2 cm); petiole 1.5–2 cm long, up to 0.2 cm thick. **Inflorescences** borne on twigs up to 1.2 cm diam.; raceme axis highly condensed, 0.2–0.4 cm long; **florets** 3 or more per umbellule; peduncles 0.3–0.7 cm long. **Fruits** ovoid, *c.* 1.4 x 1.4 cm; hypanthium at first globose, finally forming a deep cup-shaped cupule covering the basal half to two-thirds of the fruit; pedicel *c.* 0.4 cm long, gradually narrowed downwards from the cupule.

Distribution: Endemic in Borneo: Sabah, Papar District; Sarawak, Bintulu and Lundu Districts; Brunei, Belait District.

Specimens examined: Sabah, Papar (*SAN 66744*); Sarawak, Bintulu (*S 18697*) and Lundu (*S 76785*); Brunei, Belait (*Niga NN 242*, *Niga NN 244*).

Notes: The silky sheen on the leaf undersurface, due to microscopic appressed hairs, is highly characteristic of a small number of *Litsea* species, which includes *L. chewii* Kosterm., *L cuprea* Merr. and *L. staintonii* Kosterm. *L. aban-gibotii* differs from the others by its closely spaced (mostly closer than 2 mm) scalariform intercostal veins.

2. **Litsea accedens** (Blume) Boerl.
Handl. Fl. Ned. Ind. 1, 3 (1900) 145.
Basionym: *Tetranthera accedens* Blume, Mus. Bot. Lugd. Bat. 1 (1851) 383.
Type: *Korthals s.n.*, Borneo (holo not seen; iso U *Acc. No. 188204B*).

Notes: A highly variable species in which three varieties may be recognized:

i. var. *accedens*: intercostal venation reticulate; leaves variable in shape, from elliptic to oblong–elliptic, obovate and lanceolate. Widespread.
ii. var. *kinabaluensis* (Kosterm.) Ng: intercostal venation scalariform; leaves ovate or oblong-elliptic. Endemic to the Kinabalu region of Sabah.
iii. var. *oblanceolata* (Gamble) Ng: intercostal venation scalariform; leaves oblanceolate. Widespread.

i. Var. **accedens**
New synonyms:
Litsea costata (Blume) Boerl., Handl. Fl. Ned. Ind. 3 (1900) 144. **Basionym:** *Cylicodaphne costata* Blume, Mus. Bot. Lugd. Bat. 2 (1856) 13. **Type:** *Korthals s.n.*, Borneo (lectotype, here designated, L *Acc. No. 90523333*).
Litsea insignis (Blume) Boerl., Handl. Fl. Ned. Ind. 3 (1900) 142. **Basionym:** *Tetranthera insignis* Blume, Mus. Bot. Lugd. Bat. 1 (1851) 382. **Type:** *Korthals s.n.*, Sumatra (lectotype, here designated, *L Acc. No. 905233560*).
Litsea ochracea (Blume) Boerl., Handl. Fl. Ned. Ind. 3 (1900) 144. **Basionym:** *Cylicodaphne ochracea* Blume, Mus. Bot. Ludg. Bat. 2 (1856) 13. **Type:** *Korthals s.n.*, Sumatra (holo not seen; iso BO *Acc. No. 1278346*, U *Acc. No. 38210*).

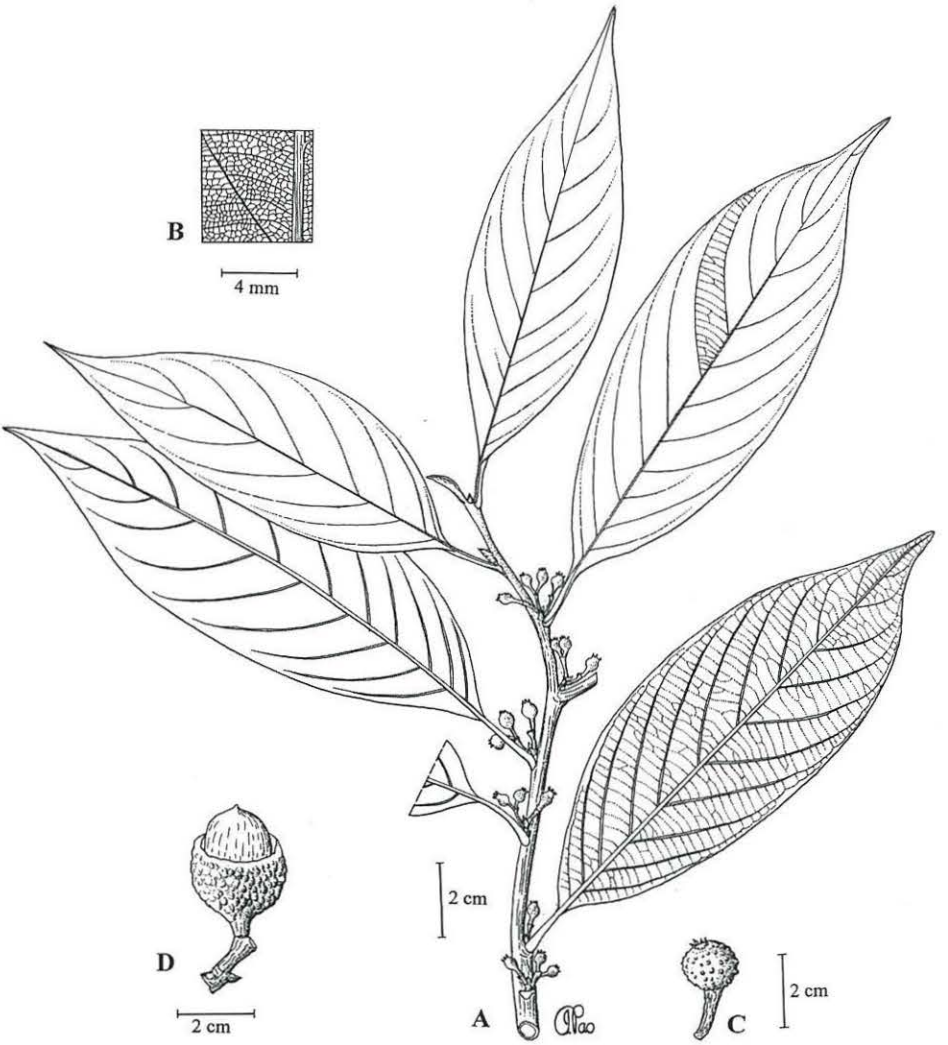

Figure 1. *Litsea aban-gibotii* Ng. A, fruiting (young) leafy twig; B, detail of venation on lower leaf surface; C, young fruit; D, older fruit. (A–B from *SAN 66744*, C from *S 76785*, D from *Niga NN 242.*)

Litsea ridleyi Gamble, Bull. Misc. Inform. Kew (1910) 317. **Type:** *Ridley 5101*, Singapore (lectotype, here designated, SING).
Litsea wrayi Gamble, Bull. Misc. Inform. Kew (1910) 319. **Type:** *Wray 4036*, Perak, Waterfall Hill (lectotype, here designated, SING).
Litsea pentagona Merr., Univ. California Publ. Bot. 15 (1929) 81. **Type:** *Elmer 20666*, Sabah, Tawau (holo not seen; iso BO, NY, SING).

ii. Var. **kinabaluensis** (Kosterm.) Ng, **stat. nov.**
Basionym: *Litsea kinabaluensis* Kosterm., Reinwardtia 7 (1969) 506. **Type:** *Clemens 33053*, Sabah, Gunung Kinabalu (holo BO).

iii.Var. **oblanceolata** (Gamble) Ng, **stat. nov.**
Basionym: *Litsea oblanceolata* Gamble, Bull. Misc. Inform. Kew (1910) 362. **Type:** *King's Collector 2020*, Perak, Larut (lectotype, here designated. K).
New synonyms:
Litsea ochracea (Blume) Boerl. var. *oblanceolata* (Gamble) Kochummen, Tree Flora Malaya 4 (1989) 163.
Litsea perakensis Gamble, Bull. Misc. Inform. Kew (1910) 359. **Type:** *King's Collector 5114*, Perak, Larut (lectotype, here designated, K).

3. **Litsea andreana** Ng, **sp. nov.**
(Named for Andrè Joseph Guillaume Henri Kostermans, 1907–1994, forest botanist in Bogor, Indonesia)

Folia magna obovata ad oblanceolata infra tomentosa 29–50 cm longa 17–19 cm lata basi subcordata. Racemi cauliflori 0.4–1.2 cm longi. **Typus:** *Ilias Paie S 39032*, Sarawak, Niah (holo SAR; iso KEP).
Figure 2

Small to medium-sized tree. **Leaves** *alternate, densely tomentose below*; *blades broadly obovate to oblanceolate, 29–50* x *17–19 cm, base subcordate*, apex rounded; midrib broad and raised to shallowly impressed above; lateral veins 15–24 pairs; intercostal venation scalariform, prominent below; petiole 1–1.5 cm long, 0.6–0.9 cm thick. **Inflorescences** *borne on the branches and trunk*; raceme axis 0.4–1.2 cm long, c. 0.5 cm thick; **florets** *c.* 7 per umbellule; anthers 4-locular (*S 39032*); peduncles *c.* 0.6 cm long. **Fruit** not seen.

Distribution: Endemic in Borneo: Sarawak, Semengoh FR; Kalimantan, Gunung Bentuang and Sampit.

Specimens examined: Sarawak, Semengoh FR *S 39302*; Kalimantan, G. Bentuang, *Burley et al. 2858* and Sampit *Kostermans 8057.*

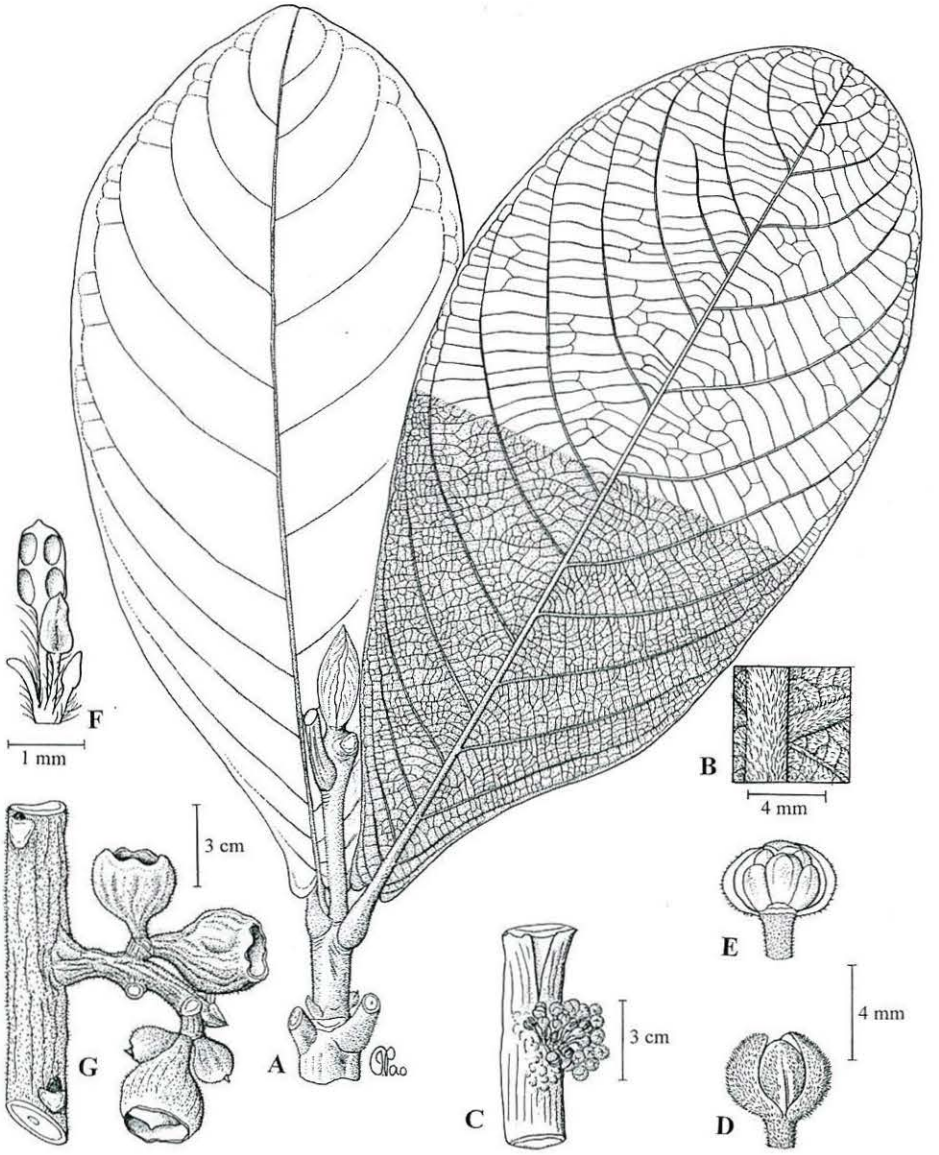

Figure 2. *Litsea andreana* Ng var. *andreana* (A–F): A, leafy twig; B, detail of venation and indumentum on lower leaf surface; C, cauliflorous inflorescence; D, involucral bud; E, umbellule of florets within an involucral bud; F, stamen, staminode and glands; var. *dewolii* Ng: G, young infructescence. (A–F from *S 39032*, G from *SAN 142976*.)

Var. **dewolii** Ng, **var. nov.**
(Named for Dewol Sundaling, b. 1950, plant collector in the Sabah Forest Department)

A varietate typica foliis multo maioribus ad 100 cm longis 35 cm latis, racemis longioribus c. 5.5 cm longis ramis majoribus insidentes differt. **Typus:** *Dewol SAN 142976*, Sabah, Danum Valley (holo SAN; iso KEP).

Leaves to *c.* 100 x 35 cm. **Inflorescences** *borne on large branches*; the *raceme axis c. 5.5 cm long* and *c.* 0.9 cm thick; umbellules and florets not seen. **Fruits** with the basal three quarters enclosed in a cup-like cupule when fresh, completely shrunken into the cupule when dried; cupule densely tomentose, *c.* 2.5 cm wide and *c.* 2 cm deep, non-pedicellate when fresh, basally narrowed into a 0.5 cm-long pedicel when dried.

Distribution: Endemic in Borneo: Sabah.

Notes: Known only from the type specimen.

4. **Litsea cordata** (Jack) Hook.*f.*
Fl. Brit. Ind. 5 (1886) 177. **Basionym:** *Tetranthera cordata* Jack, Malay. Misc. ii (1822) 34. **Type:** unknown (Jack's description).
New synonym: *Litsea elmeri* Merr., Univ. California Publ. Bot. 5 (1929) 82. **Type:** *Elmer 21221*, Sabah, near Tawau (holo not seen; iso SING).

Notes: This is a well-known species and Jack's name has been consistently applied even though the type cannot be located. On the Singapore sheet of *Elmer 21221,* (type of *Litsea elmeri* Merr.) there is a determination slip by Kostermans re-determining the specimen as *L. cordata*. I agree with Kostermans, but the reduction does not seem to have been published.

5. **Litsea costalis** (Nees) Kosterm.
Reinwardtia 7 (1969)501. **Basionym:** *Alseodapne costalis* Nees *in* Wallich, Pl. As. Rar. 2 (1831) 72. **Type:** *Wallich 2594B*, Singapore (holo K; iso BO)

Var. **nidularis** (Gamble) Ng, **stat. nov.**
Basionym: *L. nidularis* Gamble, Bull. Misc. Inform. Kew (1910) 365. **Type:** *King's Collector 6883*, Perak, Larut (lectotype, here designated, K).

Notes: Litsea costalis var. *nidularis* differs from the typical variety in having smaller, narrower leaves and less prominent venation, but there are intermediates, and at least one specimen from Brunei (*Dransfield JD 7249*)

bears leaves of both types.

6. **Litsea crassifolia** (Blume) Boerl.
Handl. Fl. Ned. Ind. 3 (1900) 143.
Basionym: *Tetranthera crassifolia* Blume, Mus. Bot. Lugd. Bat. 1 (1851) 386. **Type:** *sin. coll., s. n.*, Java (holo not seen, iso U *Acc. No. 261746B*).
New synonym: *Litsea lithocarpoides* Kosterm., Reinwardtia 7 (1968) 348. **Type:** *Clemens 33823,* Sabah, Gunung Kinabalu (holo L; iso BO, K).

Notes: The isotype of *Litsea crassifolia* (U, viewed on the L database website) consists of one detached leaf with no number and no locality. However, the name has been consistently applied in the region and there is no reason to dispute its application. *Litsea lithocarpoides* is merely a high elevation form of *L. crassifolia,* which is already known to occupy a broad elevational range, from sea level white sands and peat swamps to high mountains where soil conditions are similarly sandy or peaty.

7. **Litsea cubeba** (Lour.) Pers.
Syn. Pl. 2 (1807) 4. **Basionym:** *Laurus cubeba* Lour., Fl. Cochin. (1790) 252. **Type:** not seen.
Synonym: *Litsea citrata* Blume, Bijdr. Fl. Ned. Ind. 2e (1826) 565 (reduced by Kostermans in Reinwardtia 10 (1988) 465).
New synonyms:
Lindera pipericarpa auct non (Miq.) Boerl.: Gamble, J. As. Soc. Bengal 75, 2 (1912) 198; Ridley, Flora Malay Pen. 3 (1924) 135; Burkill, Dict. Econ. Prod. Malay Pen. 2 (1936) 1371; Kochummen, Tree Flora of Malaya 4 (1989) 147.
Lindera oxyphylla (Nees) Hook.f., Fl. Brit. Ind. (1886) 183. **Basionym:** *Daphniphyllum oxyphyllum* Nees in Wallich, Pl. As. Rar. 2 (1831) 63. **Type:** *Porter s.n., Penang* (Wallich Cat. 2547, not seen).
Lindera reticulosa Kosterm., Reinwardtia 9 (1974) 102. **Type:** *FRI 5016, Pahang,* Fraser's Hill (holo K; iso K, KEP).
Figure 3

Notes: Litsea cubeba is geographically a very widespread species, ranging from Nepal and Sikkim to Japan and Java.

While reviewing specimens from Borneo and the Malay Peninsula, it struck me that the Bornean specimens identified as *Litsea cubeba* by Kostermans resembled the Peninsular specimens named variously as *Lindera pipericarpa* (Miq.) Boerl, *Lindera oxyphylla* and *Lindera reticulosa.* Similarity in the leaves, fruits and female florets indicated that they are one species in spite of specimens having been placed in two different

genera due to difference in anther locule number.

The mystery deepened when I found that Kostermans (1970) had transferred *Lindera pipericarpa* to *Litsea pipericarpa* (Miq.) Kosterm. Kostermans suggested that the earlier authors had not examined the anthers. The lack of a cupule in the fruit would have suggested *Lindera*, but there is another possibility, that the flowers examined by the earlier authors did have two anther locules while those examined by Kostermans had four, making *Litsea pipericarpa* a species with variably 2 and 4 anther lobes.

I examined the type of *Lindera pipericarpa* (now *Litsea pipericarpa*, basionym *Polyadenia pipericarpa* Miq., Fl. Ind. Bat. 1, 1 (1858) 962) in Bogor: *Teysmann, HB 2214, Sumatra*; (=BO *Acc. No. 1277851*) which bears Kosterman's annotations and found that Gamble (1912), Ridley (1924), Burkill (1936) and Kochummen (1989) were all mistaken. *Lindera pipericarpa* has leaves resembling *Anisoptera* (Dipterocarpaceae) in the undersurface that is prominently reticulate-veined, finely tomentose and tinged yellow. It is confined to Sumatra. *Litsea cubeba*, in contrast, has leaves glabrous and glaucous below.

I have transferred all the Malay Peninsula specimens previously identified as *Lindera pipericarpa* to *Litsea cubeba* on the grounds that the anther locule number in *Litsea cubeba* is not a species-defining character, but a variable character expressed differently in different parts of the geographical range of the species. While the Peninsular plants all appear to be 2-locular, the Bornean specimens may be 2-locular (e.g. *SA 1284*, *S 55827*), 4-locular (e.g. *SAN 114245*) or have both conditions within the same floret (e.g. *SAN 114166* and *TK 1122*). In the population of *Litsea cubeba* in Bario, Sarawak, that has hermaphrodite flowers, I found stamens with 2 or 4 anther locules within the same flower, together with abnormal stamens with 1 or 3 locules.

I thought that *Litsea cubeba* with 4-locular anthers might exist as a rare condition in the Peninsula because of two specimens, *Ridley 11390* (Taiping Hills, Perak), and *Ridley 13780* (Telom, Pahang), placed by Gamble (1912) in *Litsea citrata* Blume. These were reported to have 'quadrate anthers'. This reference was overlooked by Ridley (1924) but cited in synonymy by Burkill (1936) under *Lindera pipericarpa,* implying that Burkill disagreed with Gamble over the number of anther locules. Duplicates of the two specimens were located in SING and examined by Julia Sang, who found the anthers to be 2-locular. I nevertheless think that the specimens examined by Gamble were 4-locular, otherwise he would not have said so. In any case, *Litsea citrata* Blume has itself been reduced to *Litsea cubeba* by Kostermans (1988).

In summary, both *Litsea pipericarpa* and *Litsea cubeba* have synonyms in *Lindera* and the reason, I believe, is variation in the number

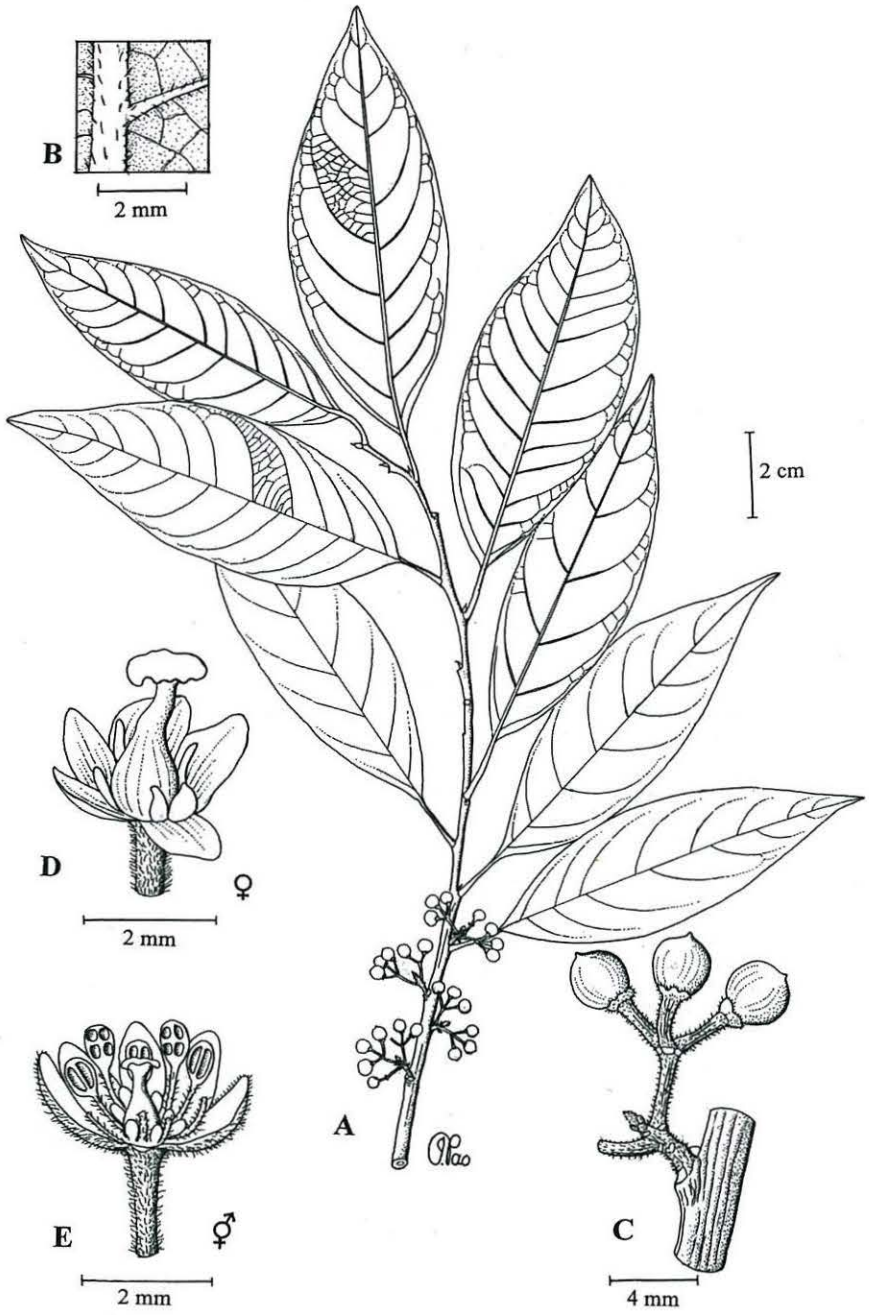

Figure 3. *Litsea cubeba* (Lour.) Pers. A, fruiting leafy twig; B, detail of venation and indumentum on lower leaf surface; C, infructescence; D, female flower; E, hermaprodite flower with stamens variably 2-locular and 4-locular. (A–C from *SAN 60328*, D from *SAN 24022*, E from *SAN 114166*.)

of anther locules, which the authors had not been prepared for.

8. *Litsea elliptica* Blume
Bijdr. Fl. Ned. Ind. 11e (1826) 563. **Type:** *s. coll., s. n.,* Java, Mt Salak (holo *L Acc. No. 905233282;* iso BO *Acc. No. 1274910*).
New synonym:
Litsea pruriens Kosterm., Reinwardtia 8 (1970) 105. **Type:** Kostermans 12675, Kalimantan, W. Kutei, Belajan River (holo BO; iso SING).

Notes:
I can find no consistent difference between *L. elliptica* and *L. pruriens. Litsea elliptica* has small or undeveloped cupules and fruiting specimens are often mistaken for *Lindera* but the males consistently have 4-locular anthers.

9. **Litsea firma** (Blume) Hook. *f.*
Fl. Brit. Ind. 5 (1886) 162. **Basionym:** *Tetranthera firma* Blume, Mus. Bot. Lugd. Bat. 1 (1851) 381. **Type:** *Korthals, s.n.*, Borneo (lectotype here designcted BO *Acc. No. 1245463*).
New synonyms:
Litsea cylindrocarpa Gamble, Bull. Misc. Inform. Kew (1910) 318. **Type:** *King's Collector 6673*, Perak, Larut (lectotype, here designated, SING).
Litsea turfosa Kosterm., Reinwardtia 7 (1968) 353. **Type:** *Lajanjah SAN 44550*, Sabah, Beaufort (holo K; iso SAN, SAR, SING).

Notes: Litsea turfosa and *L. cylindrocarpa* are linked by intermediates to *L. firma* (Blume) Hook. *f.*, forming a single widespread and common species.

10. **Litsea fulva** (Blume) F.Vill.
Nov. App. Fl. Filip. (1880) 181. **Basionym:** *Tetranthera fulva* Blume, Mus. Bot. Lugd. Bat. 1 (1851) 377. **Synt Types:** *s. coll., s. n.* Java and Sumatra (according to Blume), not seen.)

Notes: The typical variety of this species ranges from Sumatra to Java, Borneo and the Philippines, but the new variety described below is endemic to the Kinabalu massif in Sabah.

Var. **corneri** Ng, **var. nov.**
(Named for E.J.H. Corner, 1906–1996)

A varietate typica foliis ovatis vel ellipticis aut subobovatis (vs. obovatorum)

umbellulis fructibusque sessilibus (vs. pedunculatorum) differt. **Typus:** *Chew & Corner RSNB 4473*, Sabah, Kinabalu, Bembangan River at *c.* 1700 m (holo SING; iso SAN).

Leaves *ovate, elliptic or sub-obovate*; 3–11 x 1.5–4.4 cm, below *hairy all over or on the veins*, base cuneate to rounded, apex acuminate; midrib above sunken into a narrow groove; lateral veins 8–10 pairs; intercostal veins scalariform; petiole 0.4–0.5 cm long. Flowering on the twigs; raceme axis highly condensed 0.1–0.2 cm long; **florets** *c.* 3 per umbellule; peduncle *practically absent* (umbellules practically sessile). **Fruits** ellipsoid, *c.* 1 x 0.7 cm; cupule forming a cup *c.* 0.6 cm wide, *c.* 0.5 cm deep, *non-pedicellate.*

Distribution: Endemic in Borneo: Sabah, Gunung Kinabalu at 1500–2600 m.

Specimens examined: Sabah *Chew & Corner RSNB 151*, *Chew & Corner RSNB 4473*, *Clemens 29564*, *Clemens 31052*, *Clemens 32506*, *Clemens 33811*, *Clemens 35117*, *Sugau JBS 128* and *SAN 117234.*

11. **Litsea garciae** Vidal
Rev. Pl. Vasc. Filip. (1886) 228. **Type:** *Vidal 861*, Philippines (holo not seen; iso L).
New synonyms:
Litsea sebifera auct. non (Willd.) Pers. in Blume, Bijdr. Fl. Ned. Ind. (1825) 560; Gamble, J. As. Soc. Beng; 75 (1912) 176; Ridley, Fl. Malay Peninsula 3 (1924) 128.
Litsea glutinosa auct. non (Lour.) C.B.Rob.: Burkill, Economic Products Malay Peninsula 2 (1936) 1376.
Litsea aurea Kosterm., Reinwardtia 8 (1970) 86. **Type:** *bb 8697*, Sumatra, Palembang (holo BO).
Litsea robusta auct. non Blume: Kochummen, Tree Flora Malaya 4 (1989) 163, *pro parte.*

Notes: This species has had a very confused taxonomic history although it is clearly distinguished by its uniquely asymmetric leaf shape: oblong-ovate to lanceolate, expanded more on one side than the other in the lower half of the leaf. No other *Litsea* species has a leaf like this. Furthermore, the apical buds, when resting are covered by large overlapping silvery-silky reduced leaves. The fruits are among the largest in the genus, depressed globose, up to 4 cm diameter when fresh. An edible variety is grown in Sarawak (Bidayuh name engkalak), Brunei (Brunei Malay name pengalaban), and the Philippines and Java. In Sabah and Peninsular Malaysia, the species is represented by big forest trees (up to 50 m tall),

undoubtedly wild and indigenous, but the fruits are not eaten.

This species was first described by Blume (1825) as '*Litsea sebifera* Pers.' and this name was taken up by Gamble (1912) and Ridley (1924). However, *Litsea sebifera* Pers. has turned out to be a different species. The oldest valid name for this species is *Litsea garciae* Vidal. Gamble's description: 'innovations silvery-silky' and leaves 'often unequal at base' undoubtedly fits *Litsea garciae*. Ridley's comment that trees are 'occasionally planted by the Javanese' also points to *Litsea garciae*, because no other *Litsea* species is cultivated in home gardens. Burkill (1936) redetermined this species as '*Litsea glutinosa*', but this was a mistake; the true *Litsea glutinosa* (Lour.) C.B.Rob. has different leaves and much smaller fruits. Kochummen (1989) did not recognise *Litsea garciae* in the Tree Flora of Malaya because he confused it with *Litsea robusta*, which is similar in inflorescence and fruit but different in leaf shape. On re-sorting Kochummen's specimens, about half were found to belong to *L. garciae* and half to *L. robusta*. The latter is rare in Borneo.

12. **Litsea globularia** Ng, **sp. nov.**
(Latin, *globularis*=globe, referring to the fruit)

Folia opposita infra tomentosa. Fructus globosi ad 2.4 cm diam. cupula patelliformi circulari ad 8 mm lata pedunculo 2–12 mm longo pedicello 2–5 mm longo articulato insidenti. **Typus:** *Primack S 42435*, Sarawak, Gunung Mulu (holo KEP; iso A, K, L, SAR).
Figure 4

Medium-sized tree. Leaves opposite, chartaceous, tomentose below especially on the midrib; blades obovate, 8–23 x (3–)5(–8) cm, base rounded, apex acuminate; midrib sunken above and the groove sometimes filled with hairs; lateral veins 9–14 pairs; intercostal venation laxly reticulate; petiole 0.5–1 cm long. **Inflorescences** borne on twigs; raceme axis highly condensed, *c.* 0.1 cm long; **florets** 5 per umbellule; peduncles 0.2–1.2 cm long. **Fruits** globose, to 2.4 cm diam.; cupule forming a circular plate up to 0.8 cm wide; pedicel thick, 0.2–0.5 cm long.

Distribution: Endemic in Borneo: Sabah, Sarawak, Brunei and Kalimantan.

Selected specimens examined: Sabah (*SAN 16397*, *SAN 28910*, *SAN 31923*, *SAN 42841*, *SAN 50511*, *SAN 65214*, *SAN 86964* and *SAN 128632*), Sarawak (*S 4025*, *S 15093*, *S 23019*, *S 33214*, *S 42435*, *S 50511* and *S 62309*); Brunei (*Kirkup DK 942*, *Coode MC 6340*); Kalimantan (*Kostermans 10439*).

13. **Litsea grandis** (Wall. *ex* Nees) Hook. *f.*
Fl. Brit. Ind. 5 (1886) 162. **Basionym:** *Tetranthera grandis* Wall. *ex* Nees *in* Wallich, Pl. As. Rar. 2 (1831) 162 **Type:** '*Wallich 2552*', Penang (holo K).

Notes: This species is now reorganized to have three varieties, linked by intermediates:

i. var. *paludosa*: leaves ovate or elliptic; glaucous below
ii. var. *grandis*: leaves oblong-elliptic, elliptic, or round; not glaucous below; indumentum on twigs and leaf undersurface mid-brown
iii. var. *rufo-fusca*: leaves ovate; not glaucous below; indumentum dark blackish red-brown

i. Var. **paludosa** (Kosterm.) Ng, **stat. nov.**
Basionym: *Litsea paludosa* Kosterm., Reinwardtia 8 (1970) 103. **Type:** *Anderson S 14520*, Sarawak, Simanggang (holo BO; iso SAR, SING).

Notes: This variety includes *Litsea grandis* in Anderson (1963).

ii. Var. **rufofusca** (Kosterm) Ng, **stat. nov.**
Basionym: *L. rufofusca* Kosterm., Reinwardtia 7 (1968) 352, *l.c.* 8 (1970) 109. **Type:** *bb. 33044*, Kalimantan, Sampit area (holo L; iso BO).

14. **Litsea jaswirii** Ng, **sp. nov.**
(Named for Jaswir Singh, b. 1938, plant collector of the Sabah Forest Department)

Folia elliptica basi attenuata apice acuminato. Fructus ovoidei ad obovoidei ad 2.3 cm longi 1 cm diam. plerumque solitarii cupula non profunda prominente stipitata stipite prominenti insidentes. **Typus:** *Jaswir Singh SAN 28253*, Sabah, Kundasang (holo KEP; iso SAN).
Figure 5

Small and medium-sized tree. **Leaves** alternate; blade elliptic 7–13.5 x 2–4.5 cm, glabrous, chartaceous, base attenuate, apex acuminate, the upper and lower halves almost mirror images of each other in size and shape; midrib above flat, striate or shallowly impressed; lateral veins 5–7 pairs; intercostal veins reticulate; petiole 0.8–1.5 cm long. Flowering on the twigs; raceme axis 0.4–1.5 cm; **florets** 3–5 per umbellule; peduncles 0.3–1 cm long. **Fruit** narrow, ovoid, ellipsoid or obovoid, to 2.3 x 1.0 cm; usually 1, rarely 2–3 developed per umbellule; cupule a shallow cup to 0.5 cm wide, pedicel 0.5–1.3 cm long.

Distribution: Endemic in Borneo: Sabah, Gunung Kinabalu.

Specimens examined: Sabah, Kinabalu (*Carr SFN 27216*, *Chew RSNB 525*, *Clemens 26367*, *SAN A 4532*, *SAN 15272*, *SAN 28253*, *SAN 28294*, *SAN 28917)*.

15. **Litsea lancifolia** (Roxb. *ex* Wall.) Hook. *f.*
Fl. Brit. Ind. 5 (1886) 159. **Basionym:** *Tetranthera lancifolia* Roxb. *ex* Wall. *ex* Nees *in* Wallich, Pl. As. Rar. 2 (1831) 65. **Type:** '*Wallich 2532'*, India, Silhet (holo K).

Notes: This is one of the four species in which the anther locules may be 4 or 2. The species varies greatly in leaf size, leaf shape, midrib prominence and peduncle length, and has a wide distribution from India to Yunnan, Sumatra, Peninsular Malaysia and Borneo. In this treatment, the Bornean population is divided into four varieties, all linked by intermediates. The species is characterised by *leaves opposite to sub-opposite*, intercostal venation reticulate to sub-scalariform, *fruits ellipsoid or ovoid*, *small* (*to 8* x *7 mm*), *with hypanthium undeveloped or forming a small cup or cone*, pedicellate or non-pedicellate.

The anthers are 4-locular except in var. *iliaspaiei* where the number is variable, 4 or (rarely) 2 locules.

The four varieties are distinguished as follows:

i. var. *iliaspaiei*: leaves broad, but small and shorter than 8 cm.
ii. var. *lancifolia*: leaves broad, longer than 8 cm, with midrib sunken above.
iii. var. *grandifolia*: leaves broad, longer than 8 cm, with midrib prominent above.
iv. var. *rheophytica*: leaves linear, willow-like.

i. Var**. iliaspaiei** Ng, **var. nov.**
(Named for Ilias Paie, 1936–1986, plant collector in the Sarawak Forest Department)

A varietate typica foliis obovatis ad ellipticis parvis 3.5–7(–8.5) cm longis 1.3–3.2 cm latis differt. **Typus:** *Ilias Paie S 40749*, Sarawak, Bukit Sempadai, (holo KEP; iso SAR).

Small trees to 10 m tall. **Leaves** opposite, glabrous to finely hairy below; blade obovate to elliptic, *small*, *3.5–7(–8.5)* x *1.3–3.2 cm*, base cuneate,

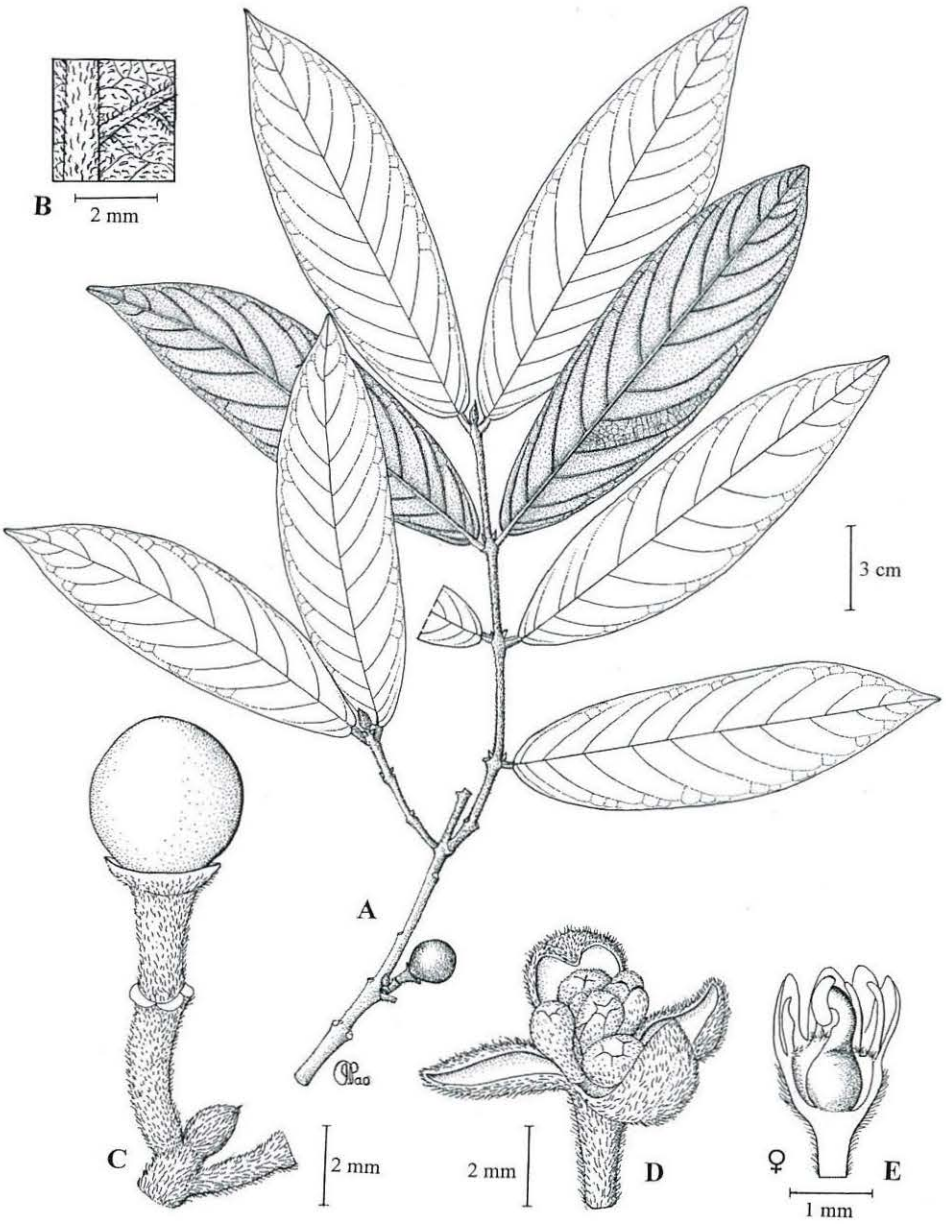

Figure 4. *Litsea globularia* Ng. A, fruiting (young) leafy twig; B, detail of venation and indumentum on lower leaf surface; C, young fruit; D, umbellule of florets; E, female flower. (A–B from *S 42435*, C from *S 39856*, D–E from *S 47538*.)

apex acuminate; midrib above sunken; lateral veins 5–10 pairs; intercostal veins reticulate; petioles 0.3–0.4 cm long. Flowering on the twigs, raceme axis highly condensed, 0.1–0.3 cm long; **florets** 1–6 per umbellule; peduncles 0.1–0.6 cm long. **Fruits** ovoid, *c.* 0.7 x 0.6 cm; cupule forming a shallow plate *c.* 0.3 cm wide, on a short *c.* 0.1 cm pedicel.

The anthers may be 4-locular (*S 40749*, *SAN 1769* and *SAN 88274*) or 2-locular (*S 52326*). In the case of the specimen with two anther locules, the number of florets was reduced to one, technically making this specimen an *Iteadaphne*, but in all other respects, it conforms to *L. lancifolia* var. *iliaspaiei*.

Distribution: Endemic in Borneo: Sabah and Sarawak. In hill and lower montane forests at 950–1600 m elevation.

Selected specimens examined: Sabah, *(SAN 31441*, *SAN 119768*, *SAN A 1769* and *Sugau JBS 10)*, Sarawak (*S 21788*, *S 33758*, *S 40749*, *S 47656* and *S 56855)*.

ii. Var. lancifolia

New synonyms:

Litsea varians (Blume) Boerl., *l.c.* (1900) 143. **Basionym:** *Tetranthera varians* Blume, Mus. Bot. Lugd. Bat. 1 (1851) 376. **Type:** *Korthals s. n.*, Borneo (holo not seen; iso BO *Acc. No. 1249188*).

iii. Var. **grandifolia** (Stapf) Ng, **stat. nov.**

Basionym: *Lindera grandifolia* Stapf, Trans. Linn. Soc. Bot. Ser. 2, 4 (1894) 220. **Type:** *Haviland 1334*. Sabah, Kinabalu (holo K; iso SAR).

New synonyms:

Litsea amaroideocarpa Kosterm., Reinwardtia 7 (1968) 345.

Litsea oppositifolia Gibbs, J. Linn. Soc. Bot. 42 (1914) 130. **Type:** *Gibbs 3136*, Sabah, Tenom (holo BM).

Notes: Stapf (1894) based *Lindera grandifolia* on a fruiting specimen. Kostermans transferred *Lindera grandifolia* to *Litsea* but had to give it the new epithet *amaroideocarpa*, because *Litsea grandifolia* had already been used for another species (*Litsea grandifolia* Lecomte in Nouv. Arch. Mus. 5e Ser 5 (1913) 87). However, under its new status as a variety of *L. lancifolia*, Stapf's original epithet is hereby restored.

iv. Var. **rheophytica** (Kosterm.) Ng, **stat. nov.**

Basionym: *Litsea rheophytica* Kosterm., Reinwardtia 7 (1968) 350. **Type:** *Chai P.P.K. S 18951*, Sarawak, Rejang River, Pelagus Falls (holo L; iso

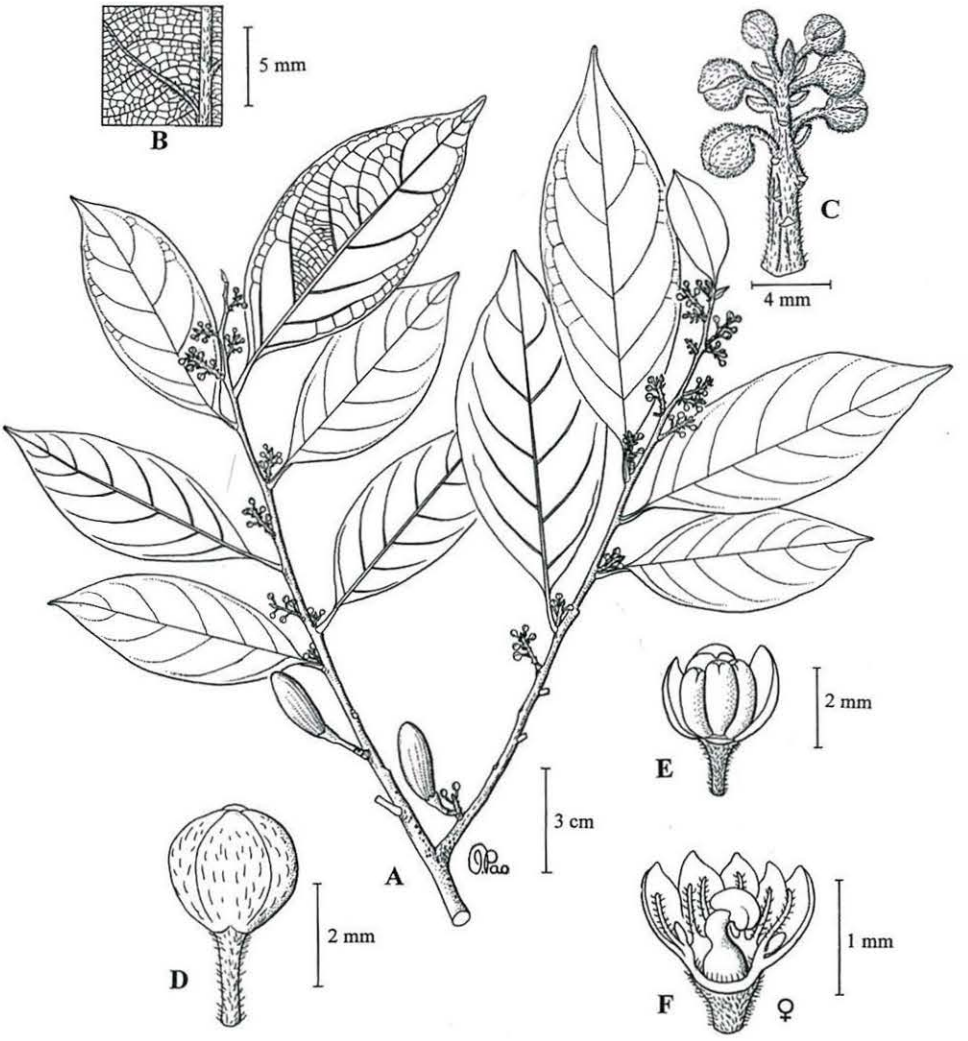

Figure 5. *Litsea jaswirii* Ng. A, flowering and fruiting leafy twig; B, detail of venation and indumentum on lower leaf surface; C, raceme of involucral buds; D, involucral bud; E, umbellule of florets within an involucral bud; F, female flower. (A–F from *SAN 28253.*)

BO, KEP, SAN, SAR).

16. **Litsea machilifolia** Gamble
Bull. Misc. Inform. Kew (1910) 320. **Type:** *Curtis 795*, Penang (lectotype, here designated, SING);
New synonyms:
Litsea teysmannii Gamble, Bull. Misc. Inform. Kew (1910) 319. **Type:** *Ridley 5845*, Malacca (lectotype, here designated, SING).
Litsea panamonja auct. non Hook. *f.*: Gamble, J. As. Soc. Beng. 75, 2 (1912) 172; Ridley, Flora Malay Pen. 3 (1924) 127; Kochummen, Tree Flora Malaya 4 (1989)162.
Litsea sp. '1' and *Litsea* sp. '2' in Kochummen, Tree Flora Malaya 4 (1989) 166.

Notes: This widespread and common species is easily distinguished by leaf morphology, relatively long racemes, and relatively large fruits. The cupule is a fleshy cup on a pedicel of variable length (0–3 cm long). This extreme variation in fruit pedicel length has been a source of great confusion. Gamble (1910) placed specimens with long pedicels in *L. machilifolia* and those without pedicels in *L. teysmannii*. Kochummen (1989) recognised *L. teysmannii* but associated it with swampy habitats. For the non-swamp specimens, he placed those with 2–3 cm-long pedicels in *L. machilifolia*; one specimen (*FRI 26004*) with a 0.7 cm-long pedicel into his *Litsea* sp. 2; and specimens without pedicels into *Litsea* sp. 1 (*FMS 6844*, *FRI 2045*, *FRI 3806*, *FRI 15688*, *FRI 19240*, *FRI 26003*, *KEP 110331* and *SFN 30880*). Non-fruiting specimens were placed arbitrarily. The impossibility of sorting out non-fruiting specimens indicates that the whole complex belongs to one species. In Borneo, the fruiting pedicel is similarly variable although not as extreme as in the Malay Peninsula.

Two Malayan specimens, from Perak (*Curtis 2694*) and Malacca (*Derry 2002*), had previously been determined by Gamble (1912) as *Litsea panamonja*, a species otherwise known only in India and Myanmar. I have redetermined these specimens as *Litsea machilifolia*, thereby excluding *Litsea panamonja* from the Malay Peninsula.

17. **Litsea magnifica** (Miq.) F.Villar
in Blanco, Fl. Filip. 3, Nov. App. (1880) 181. **Basionym**: *Lepidadenia magnifica* Miq. Fl. Ind. Bat. 1 (1858) 936. **Type:** *Teysmann HB 1011*, Sumatra, Batang Baroes (holo not seen; iso U *Acc. No. 38224*).
New synonym: *Litsea johorensis* Gamble, Bull. Misc. Inform. Kew (1910) 315. **Type:** *Ridley 13479*, Johore (lectotype, here designated, SING).

Notes: Litsea magnifica and *L. johorensis* are cauliflorous and similar in their large obovate leaves and small fruits, *c.* 1 x 0.7 cm. Kochummen (1989) separated them by the degree of swelling of the petiole base. There is also variation in the development of the cupule in fruit, but the number of herbarium collections is few and the evidence insufficient to support more than one species.

18. **Litsea sessiliflora** Hook.*f.*
Fl. Brit. Ind. 5 (1886) 160. **Type:** *Maingay, KD 1511*, Penang (holo K).
This is one of the four species in which the number of anther locules may be 4 or 2. The variation is found within the new variety, var. *othmanii.*

i. Var. **sessiliflora**
New synonym: *Litsea sandakanensis* Merr., J. Str. Br. Roy. As. Soc. 85 (1922) 194. **Type:** *Ramos 1507.* Sabah (holo not seen; iso L *Acc. No. 923246540*).

Var. **othmanii** Ng, **var. nov.**
(Named for Haji Othman Ismawi, b. 1940, plant collector in the Sarawak Forest Department)

A varietate typica foliis glabris vel infra minute adpresse pubescentibus (vs. tomentosorum) 1.5–3(–4.5) cm latis (vs. 3–9.5 cm) differt. **Typus:** *Othman S 57189*, Sarawak, Lundu, Gunung Putin (holo KEP; iso SAN, SAR).

Small tree. **Leaves** *opposite*, glabrous to finely appressed hairy below; blade *mostly narrow-elliptic* (rarely narrow-ovate or narrow-obovate), (6–)7–14.5 x 1.5–3 cm, *base cuneate*, apex acuminate; midrib sunken above; lateral veins 6–10 pairs; intercostal veins reticulate; petiole 0.3–0.8 cm long. Flowering on the twigs, raceme axis 0.1–0.5 cm long; **florets** 1–3 per umbellule; anther locules 2 (*Wong WKM 1252*) or 4 (*S 2992, S 44528*); peduncles 0.1–0.2 cm long. **Fruits** ellipsoid, *c.* 0.8 x 0.6 cm; cupule a small cup 0.3–0.4 cm wide, *c.* 0.2 cm deep, non-pedicellate.

Distribution: Endemic in Borneo: Sabah, Sarawak, Brunei and Kalimantan. Lowland to lower montane forests at 1500 m elevation.

Selected specimens examined: Sabah (*Chew RSNB 506, SAN 1156, SAN 29331, SAN 32930, SAN 46653, SAN 54383, SAN 78015, SAN 84387, SAN 91434* and *SAN 120142)*; Sarawak (*S 1145, S 13271, S 21517*, S 29992, *S 35172, S 41851*, S 44528, *S 51475 S 83468)*; Brunei (*BRUN 432, BRUN 1143, BRUN 15636, Wong WKM 785* and *WKM 1252*, Kalimantan *(Church*

582 and *Kostermans 21440)*.

Notes: The narrow, elliptic leaves resemble *Litsea subumbelliflora* (Blume) Ng which, however, has an attenuate leaf base. Also, the fruits of *L. subumbelliflora* have distinct peduncles (0.2–0.6 cm long) and pedicels (0.1–0.5 cm long).

When I first examined the specimen *Wong WKM 1252* and found uniflorous umbellules with 2-locular anthers, I thought I had a new species of *Iteadaphne* and a new generic record for Borneo. However, a single male specimen does not make a species. I eventually found the females in *Litsea* filed together with male specimens having 4-locular anthers and 2–3 florets per umbellule!

19. **Litsea subopppositifolia** Ng, **sp. nov.**
(Named for the subopposite leaves)

Folia subopposita coriacea ovata ad elliptico-oblonga plerumque plus quam 4 cm lata. **Typus:** *Sugau JBS 116*, Sabah, Tambunan (holo KEP; iso SAN). **Figure 6**

Small tree. **Leaves** subopposite, coriaceous, glabrous, slightly glaucous below; blade ovate to oblong-elliptic, 8.5–20 x 3.5–8 cm, but mostly broader than 4 cm, base cuneate, apex acute to acuminate; midrib broad and flat, impressed, or prominent above; lateral veins 6–12 pairs; intercostal veins reticulate to vaguely scalariform; petiole 1–2.5 cm long, 0.2–0.4 cm thick (relatively thick and stout). **Inflorescences** borne on the twigs; raceme axis 0.5–2.5 cm long; **florets** *c.* 3 per umbellule; peduncles 0.3–0.8 cm long. **Fruits** ellipsoid, to 2 x 1.5 cm; cupule forming a cup to 1.5 cm wide and 0.5–0.8 cm deep; pedicel short and fleshy, 0.2–0.3 cm long.

Distribution: Endemic in Borneo: Sabah and Sarawak. Lower and upper montane forest at 1100–3000 m elevation.

Selected specimens examined: Sabah (*SAN 29195*, *SAN 38327*, *SAN 38349*, *SAN 46569*, *SAN 95242*, *SAN 123342*, *SAN 123387*, *SAN 123532*, *Sugau JBS 116)*; Sarawak (*S 38135* and *S 50427)*.

20. **Litsea subumbelliflora** (Blume) Ng, **comb. nov.**
Basionym: *Laurus subumbelliflora* Blume, Bijdr. Fl. Ned. Ind. 11e (1826) 554. **Type:** *Blume s.n.*, Java (lectotype, here designated, L *Acc. No. 951212095*)

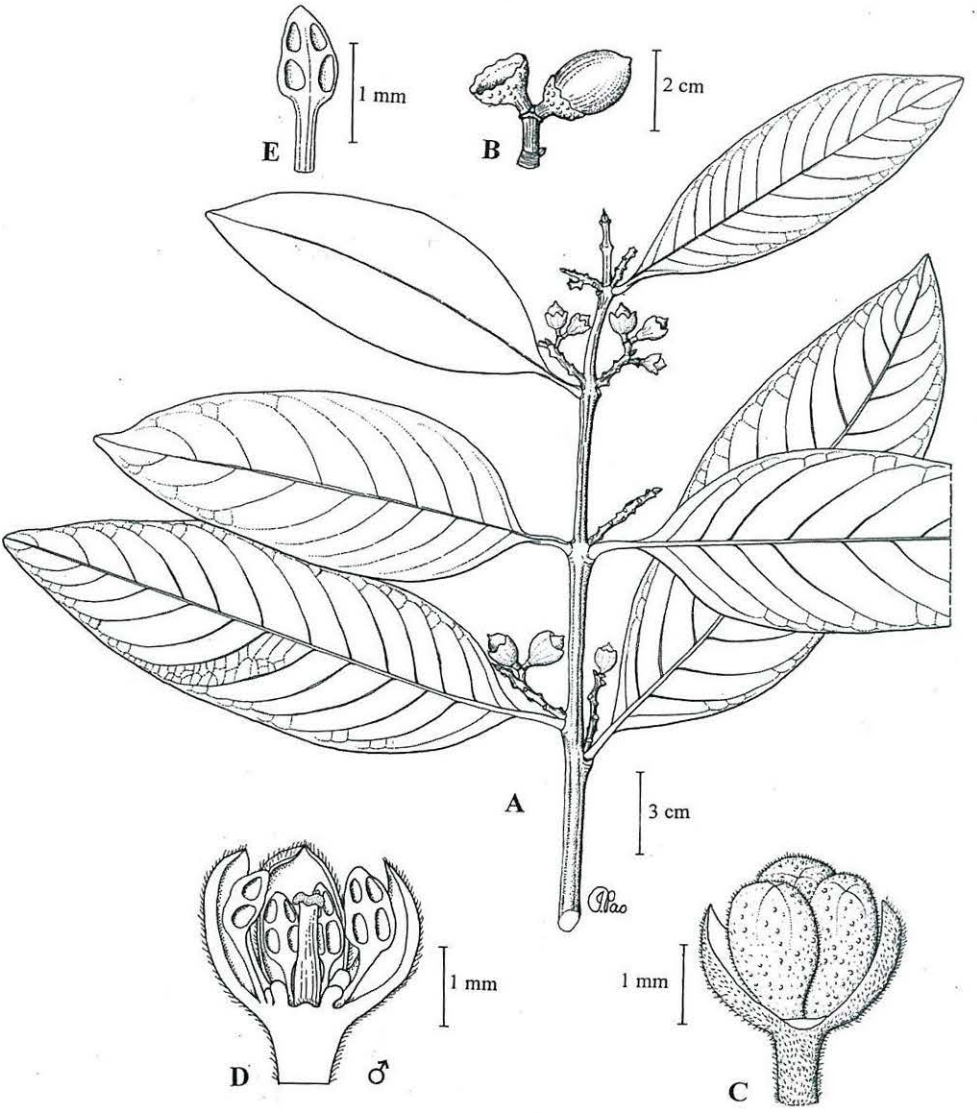

Figure 6. *Litsea subopositifolia Ng*. A, fruiting (young) leafy twig; B, part of infructescence with an older fruit; C, umbellule of 3 fiorets (flowers) within an involucral bud; D, longitudinal section of flower; E, a stamen with 4-locular anther. (A from J.B. *Sugau JBS 116* from *Carr SFN 27101*, C–E from *Carr SFN 27724)*.

New synonyms:

Laurus pauciflora Blume, Fl. Ned. Ind. 11e (1826) 555. **Type:** *Blume s.n.*, Java (holo L *Acc. No. 905230213*).

Iteadaphne confusa Blume, Mus. Bot. Lugd. Bat. 1 (1851) 365, *nomen illeg.*

Lindera subumbelliflora (Blume) Kosterm., J. Sci. Res. Indon. 1 (1952) 127.

Litsea lanceolata (Blume) Kosterm., Reinwardtia 7 (1968) 348. **Basionym:** *Aperula lanceolata* Blume *l.c.* (1851) 367. **Type:** *Blume s.n.*, Java (holo not seen; iso U *Acc. No. 190430B*).

Notes: This is one of the four species in which male specimens with two anther locules were placed in *Lindera* or *Iteadaphne* and those with 4 anther locules in *Litsea.* In Borneo, both conditions occur, but in the Malay Peninsula only the 2-locular condition is found. The species includes *Laurus subumbelliflora* Blume and *Laurus pauciflora* Blume that Blume (1851) combined and renamed *Iteadaphne confusa* Blume when he created the genus *Iteadaphne*. This procedure is incorrect. The situation was rectified with the choice of the epithet *subumbelliflora* by Kostermans (1952) when he reduced *Iteadaphne confusa* Blume to *Lindera subumbelliflora* (Blume) Kosterm. With the merger of *Lindera subumbelliflora* with *Litsea lanceolata*, the species becomes *Litsea subumbelliflora.*

21. **Litsea umbellata** (Lour.) Merr.

Philip. J. Sc. Bot. 14 (1919) 242. **Basionym:** *Hexanthus umbellatus* Lour., Fl. Cochinch. (1790) 195. **Type:** not seen.

New synonym: *Litsea gracilis* Gamble, Bull. Misc. Inform. Kew. (1910) 317. **Type:** *Ridley 14603*, Perak, Temango (holo not seen; iso SING).

Notes: In his account in the Tree Flora of Malaya, Kochummen (1989) noted that he had not seen the rare species, *Litsea gracilis*, known only from the type. However, the isotype in SING bears a note by him reducing it to *Litsea umbellata*. I agree with this reduction.

22. **Litsea unita** (Blume) Boerl.

Handl. Fl. Ned. Ind. 3 (1900) 145. **Basionym:** *Cylicodaphne unita* Blume, Mus. Bot. Lugd. Bat. 1 (1851) 387. **Type:** *s. coll., s. n.*, Indonesia (holo L *Acc. No. 90523382*).

New synonyms:

Litsea pallidifolia Merr., Univ. California Publ. Bot. 5 (1929) 81. **Type:** *Elmer 20808*, Sabah, near Tawau (holo not seen; iso SING).

Litsea montis-dulit Airy Shaw, Bull. Misc. Inform. Kew (1939) 536. **Type:** *Synge 1649*, Sarawak, Dulit Ridge (holo K; iso BO, SING).

Notes: This species has pale-coloured leaves with few, widely spaced lateral veins. The isotype of *Litsea montis-dulit* in SING bears a note by Kostermans reducing it to *Litsea unita* but which reduction he did not publish.

Lindera Thunb.

23. **Lindera bibracteata** (Blume) Boerl.
Handl. Fl. Ned. Ind. 3 (1900) 146. **Basionym:** *Laurus bibracteata* Blume, Bijdr. Fl. Ned. Ind. (1825) 553. **Type:** *Blume s.n.*, Java, Mt Salak (holo L *Acc. No. 905230346*).
New synonyms:
Lindera rufa (Stapf) Gamble, J. As. Soc. Beng. 75, 2 (1912) 199. **Basionym:** *Lindera caesia* (Reinwardt *ex* Blume) VillarBoerl. var. *rufa* Stapf, Trans. Linn. Soc. Bot. 4 (1894) 220. **Type:** *Haviland 1106*, Borneo, Sabah (holo not seen; iso SING, SAR).
Lindera turfosa Kosterm., Reinwardtia 7 (1969) 497. **Type:** *Kostermans 8136*, Borneo, Kalimantan, Sampit district (holo BO; iso L).

Notes: This is a distinctive and common species with triveined, ovate leaves with a long-acuminate apex. There is variation in the degree of hairiness in the twigs and underside of the leaves, but the variation is continuous.

24. **Lindera lucida** (Blume) Boerl.
Handl. Fl. Ned. Ind. 3 (1900) 147. **Basionym:** *Litsea lucida* Blume, Bijdr. Fl. Ned. Ind. (1825) 562. **Type:** *Blume s.n.*, Java (holo L *Acc. No. 905230435*).
New synonym: *Lindera pedicellata* Kosterm., Reinwardtia 8 (1970) 83. **Type:** *Clemens 28522*, Borneo, Sabah, Gunung Kinabalu (holo BM)

Neolitsea Merr.

25 ***Neolitsea cassia*** (L.) Kosterm.
J. Sci. Res. Indon. 1 (1952) 152; Comm. For. Res. Inst. 57 (1957) 49 and 54. **Basionym**: *Laurus cassia* L., Sp. Pl. (1753) 369. **Type**: 'Fl. Zeylanica No 146' (BM)
Synonym: *Neolitzea zeylanica* (Nees) Merr., Philip. J. Sc. 1, Suppl. (1906) 57. **Basionym:** *Litsea zeylanica* Nees, Amoen. Bot. Bonn. 1 (1823) 58, *t.* 5. **Type:** Hermann's Herb: *Laurus zeylanica* in BM, not seen
New synonyms:
Neolitsea latifolia (Blume) S.Moore, J. Bot. 43, Suppl (1925) 89. **Basionym:** *Litsea latifolia* Blume, Mus. Bot. Lugd. Bat. 24 (1851) 394. **Type**: *s. coll., s.n.* Sumatra (not seen).

Neolitsea coccinea B.C.Stone, Malaysian Forester 43 (1980) 245. **Type:** *Kiew RK 732*, Gunung Ulu Kali (holo KEP).
Neolitsea sp. 1 in Kochummen, Tree Flora Malaya 4 (1989) 169.

Notes: Nees (1823), in publishing *Litsea zeylanica* Nees, listed *Litsea cassia* L. as a synonym. When Merrill (1906) established the genus *Neolitsea*, he transferred *Litsea zeylanica* (Nees) to *Neolitsea zeylanica* (Nees) Merr., and made it the type species of the new genus. Kostermans (1952) briefly discussed the history of *Neolitsea* and made the following comment about its type species: 'As *Neolitsea zeylanica* (Nees) Merr. is identical with *Laurus cassia* L. (p.p.), the type species was renamed in this paper: *Neolitsea cassia* (L.) Kosterm.'

Kostermans (1957) later restated the change in a more formal manner, but an explanation was only provided at the end of this paper, under the heading 'Additions to: A historical survey of Lauraceae'. The addendum says '*Laurus cassia* L. is based on no. 146 in his Flora zeylanica, which in turn is based on Hermann's specimens. In Hermann's Herbarium (British Museum) these represent a mixture of *Litsea zeylanica* Nees and the wild *Cinnamomum zeylanicum* (Trimen in J. Linn. Soc. Bot. 24: 140. 1887).'

Litsea latifolia Blume was described in 1851 with three varieties, var. *areolata*, var. *caesia* and var. *punctata* in addition to the typical variety. The species was reduced by Hooker *f.* (1886) to *Litsea zeylanica* Nees. I have seen a specimen labelled as *Litsea latifolia* Blume (BO *Acc. No.* 1278323), possibly the type of *L. latifolia* var. *caesia* Blume, and an image of another, *NY 355281*, possibly the type of *L. latifolia* var. *punctata* Blume (Herb. Meisner), from the NY website. Both specimens conform to *Litsea zeylanica*, now *Neolitsea cassia*, hence I concur with Hooker *f.*

Moore (1925) transferred *Litsea latifolia* Blume to *Neolitsea latifolia* (Blume) S.Moore apparently without realizing that Hooker *f.* had already reduced *Litsea latifolia* Blume to *Litsea zeylanica.*

Neolitsea zeylanica, now *Neolitsea cassia,* is variable in fruit shape (globose or ellipsoid), fruit size (0.5–1.5 cm diam.) leaf texture (chartaceous to coriaceous), and cupule development (distinct or indistinct). It covers a vast geographic range, from the Himalayas to Australia, and from sea coasts to high mountains. In the Malay Peninsula on Gunong Ulu Kali, there is a population with coriaceous leaves and small ellipsoid fruits that was described as *Neolitsea coccinea* B.C.Stone and which is identical to montane specimens of *N. cassia* in Borneo. Then there are montane specimens in the Malay Peninsula with ellipsoid fruits but leaves chartaceous to coriaceous, which Kochummen (1989) called *Neolitsea* sp 1, and which are also part of the *N. cassia* complex.

26. **Neolitsea villosa** (Blume) Merr.
Philip. J. Sc. Bot. 4 (1909) 261. **Basionym:** *Litsea villosa* Blume, Mus. Bot. Lugd. Bat. 1 (1851) 349. **Type:** *Zippelius s.n.*, Moluccas, Ambon (holo not seen; iso L *Acc. No. 905234108*).
New synonyms: *N. mollissima* (Gamble) Gamble, Bull. Misc. Inform. Kew (1911) 172. **Basionym:** *Tetradenia mollissima* Gamble, Bull. Misc.Inform. Kew (1910) 366. **Type:** *Wray 931*, Perak, Gunung Batu Putih (holo K).

Notes: This species differs from the more widespread *Neolitsea cassia* (L.) Kosterm. by its densely hairy twigs. I cannot see any difference between *N. mollissima* and *N. villosa*. Also, *N. kedahense* Gamble, existing as a single population on Gunong Jerai, Kedah, is probably no more than a local variant of *N. villosa*.

Excluded Species

Litsea casearioides Kosterm., Reinwardtia 7 (1968) 346. **Type**: *James Ah Wing SAN 19047* (holo L; iso SAN, SING, KEP).

This species has to be excluded from Lauraceae (J. Sugau and W.J.J.O. de Wilde, *pers. comm.*). Its status will be clarified in a paper being prepared by de Wilde.

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References

Anderson, J.A.R. 1963. The flora of the peat swamp forest of Sarawak and Brunei, including a catalogue of all recorded species of flowering plants, ferns and fern allies. *Gardens' Bulletin Singapore*. **20**: 131–228.

Bentham, G. and J.D. Hooker. 1880. Laurineae. *Genera Plantarum* **3:** 146–165.

Burkill, I.H. 1936. Litsea. *Dictionary of the Economic Products of the Malay Peninsula.* **2**: 1375–1379 (pagination according to ed 2, 1966).

Gamble, J. S. 1910. XLVII. New Lauraceae from the Malayan region III. *Bulletin of Miscellaneous Information from Kew.* pp. 312–321.

Gamble, J. S. 1912,. Lauraceae. *Journal of the Asiatic Society of Bengal.* **75**: 35–202.

Hooker, J.D.*f.* 1886. Laurineae. *Flora of British India.* **5**: 116–188.

Kochummen, K.M. 1989. Lauraceae. *Tree Flora of Malaya.* **4**: 98–178.

Kostermans, A.J.G.H. 1952. A historical survey of Lauraceae. Part III. *Journal for Scientific Research in Indonesia.* **1**: 141–159. 1

Kostermans, A.J.G.H. 1957. Lauraceae. *Communications of Forest Research Institute (Indonesia).* **57**: 1–64.

Kostermans, A.J.G.H. 1970. Materials for a revision of Lauraceae III. *Reinwardtia.* **8**: 21–196.

Kostermans, A.J.G.H. 1988. Materials for a revision of Lauraceae V. *Reinwardtia.* **10**: 439–469.

Merrill, E.D. 1906. The flora of Lamao forest reserve. *Philippine Journal of Science* **1,** suppl: 1–143.

Moore S. 1925. Dr H. O. Forbe's Malayan plants. *Journal of Botany.* **43**, Suppl: 1–136.

Ridley H.N. (1924). Laurineae.,*Flora of the Malay Peninsula.* **3**: 75–137.

Stapf, O. 1894. On the flora of Mount Kinabalu, in North Borneo. *Transactions of the Linnean Society, Botany.* **4**: 69–263.