

## TAXONOMIC REVISION OF ENDIANDRA (LAURACEAE) IN BORNEO

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### SUMMARY

The genus *Endiandra* R.Br. (Lauraceae) has not been revised since Meissner (1864). Flora treatments and local revisions for this genus of about 100 species have been produced for Peninsular Malaysia (Kochummen, 1989) and Australia (Hyland, 1989) with ten and thirty-eight species, respectively. A revision of *Endiandra* in Borneo contributes to the taxonomic understanding of the genus. Eight species, with a possible ninth imperfectly known species, are recognized on the island. Three species, *E. immersa*, *E. elongata*, and *E. rhizophoretum*, are described as new; the five other species are *E. clavigera* Kosterm., *E. ochracea* Kosterm., *E. kingiana* Gamble, *E. macrophylla* (Blume) Boerl., and *E. rubescens* (Blume) Miq.; *E. rigidior* Kosterm. is an imperfectly known species. A key to the eight species, and descriptions, illustrations, discussions, and distribution maps of each species are provided.

**Key words:** *Endiandra*, Lauraceae, Borneo, taxonomy.

### INTRODUCTION

*Endiandra* is a genus consisting of about 100 species distributed from southern China, Taiwan, Malesia, and Australia to Fiji. Its diversity is strongly centred in the south-eastern part of Malesia, and about half of the species are reported from New Guinea. Australia is the second centre of diversity, with 38 recognized species (Hyland, 1989).

The genus *Endiandra* was originally established by Robert Brown (1810) for a single species from Australia, *E. glauca*. Brown characterized the genus by its hermaphrodite flowers, with six equal tepals, three stamens with staminal glands, and bilocular anthers with extrorse anther cells. After that several species were described. Nees (1831) described *E. firma* and added *E. sieberi* in *Systema Laurinarum* (1836). Meissner (1864) recognized all three previously described species and described three new species, *E. pubens*, *E. virens*, and *E. muelleri*.

Since then *Endiandra* has only been treated in floras or local revisions. For example, Bentham (1870), while dealing with Australian Lauraceae, recognized seven species, of which one was described as new, *E. discolor*. Recent efforts were made by Kostermans who described many species of Lauraceae, including *Endiandra* species, in preparation for a revision, but he never finished a revision of the whole family or of *Endiandra* (for complete bibliography see Kruijer & Lut, 1995). More recently,

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Kochummen (1989) recognized ten species of *Endiandra* in Peninsular Malaysia (three of which were new), including some *Endiandra* species with commercial-sized trunks more than 50 cm in diameter, such as *E. kingiana* Gamble, *E. maingayi* Hook. f., and *E. praeclara* Gamble. Most recently, Hyland (1989) recognized 38 species in Australia, of which 14 were described as new.

The Bornean *Endiandra* species were selected for this revision as a precursor of an *Endiandra* treatment in Malesian regions. As Kochummen only treated *Endiandra* in Peninsular Malaysia, other regions in Malesia lack any treatment. The island of Borneo was chosen because of its high diversity of plants and endemism. It has been reported that Borneo has 1500 genera, of which 59 genera are endemic to Borneo (MacKinnon et al., 1997). High diversity and endemism in Borneo are caused not only by its geological history, soil, and geography of mountain and water barriers, but also by its climate. Thus, it is expected that there would be *Endiandra* species that are known only from Borneo.

The position of the genus in the family is best shown by the study of wood and bark anatomy and observation of inflorescence types (Van der Werff & Richter, 1996). *Endiandra* is a member of the tribe Cryptocaryae, together with *Beilschmiedia*, *Cryptocarya*, *Potameia*, and *Triadodaphne*. This tribe is characterized by paniculate to more or less cymose inflorescences with the ultimate divisions not strictly cymose and the lateral flowers of a cyme not quite opposite. In terms of wood anatomy, Cryptocaryae have marginal parenchyma, non-septate fibers with conspicuously bordered pits, and exclusively simple vessel perforations in the secondary xylem. In addition, the secondary phloem lacks fibers and has a characteristic sclereid formation (Richter, 1981).

#### MATERIAL AND METHODS

A revision of Bornean *Endiandra* was carried out by examining herbarium collections from the following institutions: BO, HUH, K, KEP, L, and MO. All dimensions given are for dried materials, including those for floral characters. The species distribution maps were prepared with the ArcView software program.

#### ENDIANDRA

*Endiandra* R.Br., Prodr. Fl. Nov. Holland. (1810) 402. — Type species: *Endiandra glauca* R.Br.  
*Dictyodaphne* Blume, Mus. Bot. Lugd.-Bat. 1 (1850) 270. — Type species: *Dictyodaphne rubescens*  
Blume = *Endiandra rubescens* (Blume) Miq.

*Brassiiodendron* C.K. Allen, J. Arnold Arbor. 23 (1942) 153. — Type species: *Brassiiodendron*  
*fragrans* C.K. Allen = *Endiandra fragrans* (C.K. Allen) Kosterm.

Medium- to large-sized trees. *Leaves* alternate, rarely subopposite, penninerved, rarely triplinerved, spirally arranged; chartaceous or coriaceous; petiolate. *Inflorescences* borne in the axils of foliage leaves or in the axils of bracts; paniculate, seldom racemose. *Flowers* bisexual; pedicellate; 3-merous, rarely 2-merous. Tepals 6, rarely 4, in 2 whorls of 3 or 2. Stamens 3, seldom 2 (*E. xanthocarpa* B. Hyland) or 6 (*E. globosa* Maiden & Betche and *E. montana* C.T. White), anthers bilocellate, rarely unilocellate (*E. monothyra* B. Hyland), extrorse, rarely introrse (*E. introrsa* C.T. White); staminal glands 6, in 3 pairs, sometimes fused to form a disc, or absent; staminodes 3 or absent.

Ovary superior, sessile, style short, stigma inconspicuous. *Fruits* berries, ellipsoid, cupule absent, tepals caducous, absent at the base of the fruits.

Distribution — From China, Malesia, and Australia to Fiji.

Notes — Blume (1850) erected a new genus, *Dictyodaphne* to accommodate his new species, *D. rubescens*. A year later, Blume (1851) described another species (*D. macrophylla*), but noted that *Dictyodaphne* might only be a subgenus of *Endiandra*. The reduction of *Dictyodaphne* to *Endiandra* was also suggested by other authors such as Miquel (1852) and Bentham (1880), who reduced it to a section and a subgenus of *Endiandra*, respectively. On the other hand, Meissner (1864) and Baillon (1870) treated it as a genus.

Allen (1942) described the genus *Brassiodendron*, differing from both *Endiandra* and *Beilschmiedia* in having 6 stamens. In the revision of Australian Lauraceae, Hyland (1989) found 6 species with the stamen characters of *Brassiodendron*, but concluded that they did not form a monophyletic group. Based on additional characters (anther cells introrse or extrorse; whorls 1 and 2 or 2 and 3 fertile) he placed these species in *Beilschmiedia* or *Endiandra*, respectively and did not recognize *Brassiodendron* as a distinct genus.

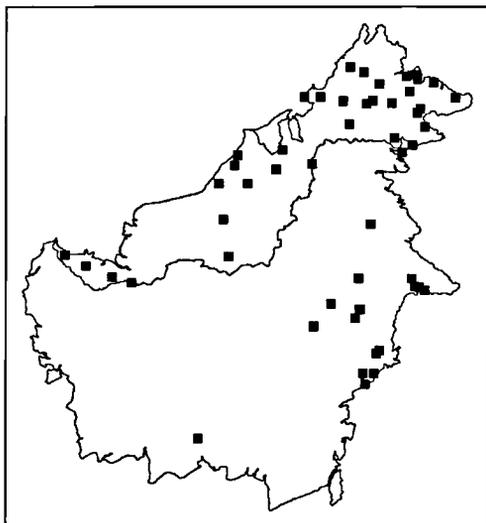
#### TAXONOMY OF BORNEAN ENDIANDRA

Eight species of *Endiandra* are recognized among the collections from Borneo. Of these, three are new species. *Endiandra immersa* Arifiani is described based on several collections, one of which was previously annotated by Kostermans as a type of *E. scrobiculata* Kosterm. This name was never validly published and was later used for a different species described by Kochummen (1991). *Endiandra elongata* Arifiani and *E. rhizophoretum* Kosterm. ex Arifiani are the other two new species.

Distribution — In Borneo, *Endiandra* species have been collected from all three countries, i.e., Malaysia, Brunei Darussalam, and Indonesia. They are distributed from Sabah, Belait, Sarawak, E Kalimantan, and S Kalimantan, to W Kalimantan. However, most collecting has been carried out in the northern part of Borneo, especially in Sabah and Sarawak, while in the southern part, Indonesia, only a few places have been explored (Map 1). All eight *Endiandra* species have been collected from N Borneo, and there are several species co-occurring in one place. In Semengoh Arboretum (in Kuching) alone, four species of *Endiandra* have been collected, i.e., *E. clavigera*, *E. immersa*, *E. kingiana*, and *E. rubescens*. This large number of species in one place, suggests that there could be additional new species in places not yet explored. To improve our knowledge of *Endiandra* in Borneo, more exploration needs to be done, especially in the Indonesian part of Borneo.

Habitat & Ecology — The species occur mainly in lowland forest and rarely in montane Oak forest. Most collections are from sandy loam (sometimes acidic) soils, clay or heavy loam soil containing limestone. Some species grow along streams or in wet areas. The Bornean *Endiandra* species occur at elevations ranging from sea level to 1400 m.

Phenology — The phenology of *Endiandra* species in Borneo does not have any pattern. Fertile specimens have been collected throughout the year. Flowering material



Map 1. Distribution of *Endiandra* R.Br. in Borneo.

has been collected most frequently from April to July and fruiting material from July to September and November.

Note — Morphologically, the Bornean species of *Endiandra* are more or less uniform in flower structure. The flowers have three triangular, sessile stamens (representing the third whorl), and bilocellate anthers with narrowly triangular connectives beyond the locelli. If *Endiandra* is divided into two subgenera, the Bornean species would be members of subgenus *Dictyodaphne*, in which staminal glands and staminodia are absent.

KEY TO THE BORNEAN SPECIES OF ENDIANDRA

- 1a. Lower leaf surface papillose ..... **6. *E. ochracea***
- b. Lower leaf surface pubescent or glabrous, not papillose ..... 2
- 2a. Lower leaf surface pubescent, sometimes only major veins pubescent ..... 3
- b. Lower leaf surface glabrous ..... 5
- 3a. Lower leaf surface or major veins with erect indument ..... 4
- b. Lower leaf surface or major veins with appressed indument ..... **7. *E. rhizophoretum***
- 4a. Indument on the entire lower leaf surface; connectives 0.3–0.4 mm long beyond the anther cells ..... **4. *E. kingiana***
- b. Indument mostly on the major veins, sparser and minute on the lower leaf surface; connectives 0.6–0.9 mm long beyond the anther cells ..... **2. *E. elongata***
- 5a. Tertiary veins immersed on the upper surface ..... 6
- b. Tertiary veins raised on the upper surface ..... 7
- 6a. Twig densely pubescent; anther cells slit-like ..... **7. *E. rhizophoretum***
- b. Twig glabrous or with a few appressed hairs; anther cells broadly elliptic ..... **3. *E. immersa***

- 7a. Tepals erect or nearly so at anthesis, inner surface of outer whorls with dense, erect indument; anthers pentagonal, coarsely papillose, anther cells roundish . . . . . **1. *E. clavigera***  
 b. Tepals half erect to spreading at anthesis, inner surface of outer whorls with basal triangular papillose patch, glabrous towards apex; anthers triangular, finely papillose, anther cells slit-like . . . . . 8  
 8a. Twig glabrous; lamina 16–30 cm long; secondary veins immersed or impressed above . . . . . **5. *E. macrophylla***  
 b. Twig pubescent; lamina 6.5–15 cm long; secondary veins raised above . . . . . **8. *E. rubescens***

**1. *Endiandra clavigera* Kosterm. — Fig. 1, Map 2**

*Endiandra clavigera* Kosterm., New and Crit. Mal. Pl. III (1955) 10. — Type: SF 35747 (*Daud & Tachun*) (holo SING; iso BO, KEP, SING), Malaysia, Sarawak, Sebutut River area, fr., 11 Aug. 1938.

Large trees, to 25 m tall. *Twigs* angular when young, becoming terete, smooth, glabrous. Terminal buds brownish, with a sparse, appressed indument. *Leaves* alternate, spirally arranged, firmly coriaceous; lamina elliptic, 11–25 by 4–11 cm, base cuneate, flat, rarely slightly curled at junction with petiole, apex acute or acuminate, both surfaces glabrous; midrib immersed or slightly raised above, raised below; secondary veins 4–8 pairs, close to each other towards the base of the leaf, more distant from each other towards the apex, immersed above, raised below, disappearing towards leaf margins; tertiary veins coarsely reticulate, raised on both surfaces; petiole terete, glabrous, 6–10 by 2–3.6 mm. *Inflorescences* in leaf axils, paniculate, 2.5–7 cm long; with a sparse to dense, short, erect indument; axis and branches angular, striate; pedicels 2–3.5 mm long; bracts of inflorescence narrowly ovate or elliptic, to 1 mm long, mostly caducous; bracteoles narrowly elliptic, 0.5 mm long, mostly persistent. *Flowers* green, 2–2.5 mm diam. at anthesis. *Hypanthium* shallowly cyathiform, both surfaces with a sparse, appressed indument. *Tepals* subequal, erect or nearly closed at anthesis, outer surface of the outer tepals with a sparse or dense, short, erect indument, rarely subglabrous, outer surface of the inner tepals glabrous except for the basal triangular pubescent patch, inner surface of the outer and inner tepals with a dense, erect indument; outer tepals elliptic or broadly elliptic, 1–1.5 by 1–1.2 mm, inner tepals narrowly elliptic, 0.7–1.1 by 0.5–0.7 mm. *Anthers* sessile, pentagonal or nearly so, densely, coarsely papillose, 0.6–0.9 by 0.5–0.8 mm, connective nearly flat or slightly obtuse beyond the anther cells, c. 0.1 mm long; anther cells roundish, extrorse, flaps rolled outwards; glands absent. *Pistil* 0.6–0.8 mm long, ovary globose, papillose, 0.5–0.7 by 0.5–0.7 mm, style absent, stigma minutely capitate, oriented to one side, papillose. *Fruits* green, ellipsoid, base tapered, 7–10 by 3.5–4 cm.

Field notes — Trees to 25 m, bark grey, brown, or black, and smooth. Inner bark reddish.

Distribution — Endemic to Borneo, known only from Sarawak.

Habitat & Ecology — Lowland Dipterocarp forest or ridge top mixed Dipterocarp forest on limestone and sandy soil. Altitude up to 540 m. Flowering: Apr., May, Sept.; fruiting: Aug. to Jan.

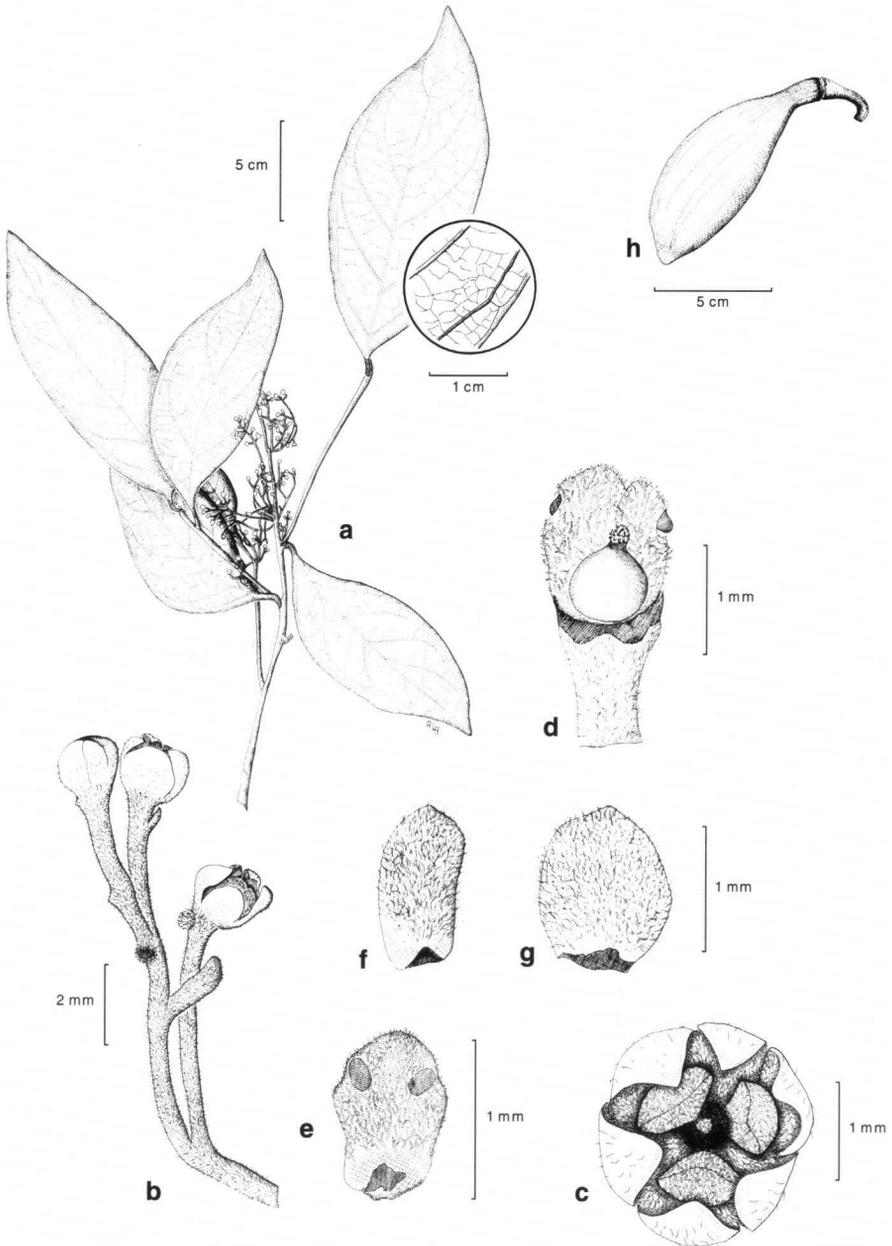
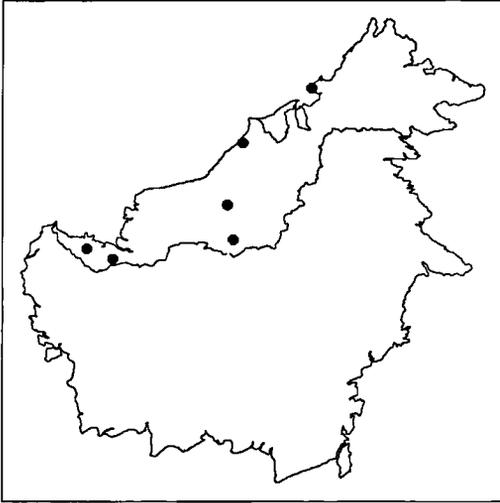


Fig. 1. *Endiandra clavigera* Kosterm. a. Habit; b. inflorescence; c. flower (top view); d. stamens and pistil; e. anther; f. & g. inner and outer tepals showing the inner surface; h. fruit [a–d, f, g: *S* 13653 (*Ghazali*), BO, K, L; e: *S* 15627 (*Galau*), L; h: *S* 15721 (*Galau*), BO, K, L].



Map 2. Distribution of *Endiandra clavigera* Kosterm. in Borneo.

Local names — Bejubai (Iban) and Medang (Malay).

Notes — *Endiandra clavigera* is best recognized by its small flowers and distinct anthers. At anthesis, the tepals remain erect or nearly closed and the flower opens only by a small pore, 2–2.5 mm diameter. The other *Endiandra* species from Borneo have half-erect to spreading tepals at anthesis. The small anthers (0.6–0.9 by 0.5–0.8 mm) with roundish cells, densely covered by erect hairs, and the nearly pentagonal connective also distinguish *E. clavigera*. Most other *Endiandra* species in Borneo have bigger (1–2.5 by 0.8–1.1 mm), densely papillose anthers with slit-like cells and a narrowly triangular connective beyond the anther cells.

Vegetatively, the best character to identify *E. clavigera* are the coriaceous leaves, which is unique among *Endiandra* species in Borneo. These leaves tend to stay green when dry, have a coarse tertiary reticulation, and the upper leaf surface is usually shiny with a smooth texture.

In Borneo, *E. clavigera* is quite similar to *E. macrophylla*. In both, the lower leaf surfaces are glabrous and the tertiary veins are raised on the upper surface. They differ in the floral characters such as size of outer and inner tepals (1–1.5 by 1–1.2 mm, 0.7–1 by 0.5–0.7 mm in *E. clavigera*, 4–6 by 2.5 mm, 3–3.5 by 1.5 mm in *E. macrophylla*), anthers (0.6–0.9 by 0.5–0.8 mm in *E. clavigera*, 1.5–2.5 by 1 mm in *E. macrophylla*), shape of anther cells (roundish in *E. clavigera*, slit-like in *E. macrophylla*) and the shape of the fruit base (tapered into the pedicel in *E. clavigera*, obtuse in *E. macrophylla*).

## 2. *Endiandra elongata* Arifiani, *spec. nov.* — Fig. 2, Map 3

*Endiandrae kingianae* Gamble similis sed connectivo ultra loculos 0.6–0.9 mm producto, pagina inferiore foliorum indumento sparso, pilis brevibus, erectis, praesertim secus nervos praedita, recedit. — Typus: *Kostermans 6754* (holo BO; iso BO, K, KEP, L), Indonesia, E Kalimantan, Loa Haur region, W of Samarinda, elev. 50 m, fl., fr., 6 May 1952.

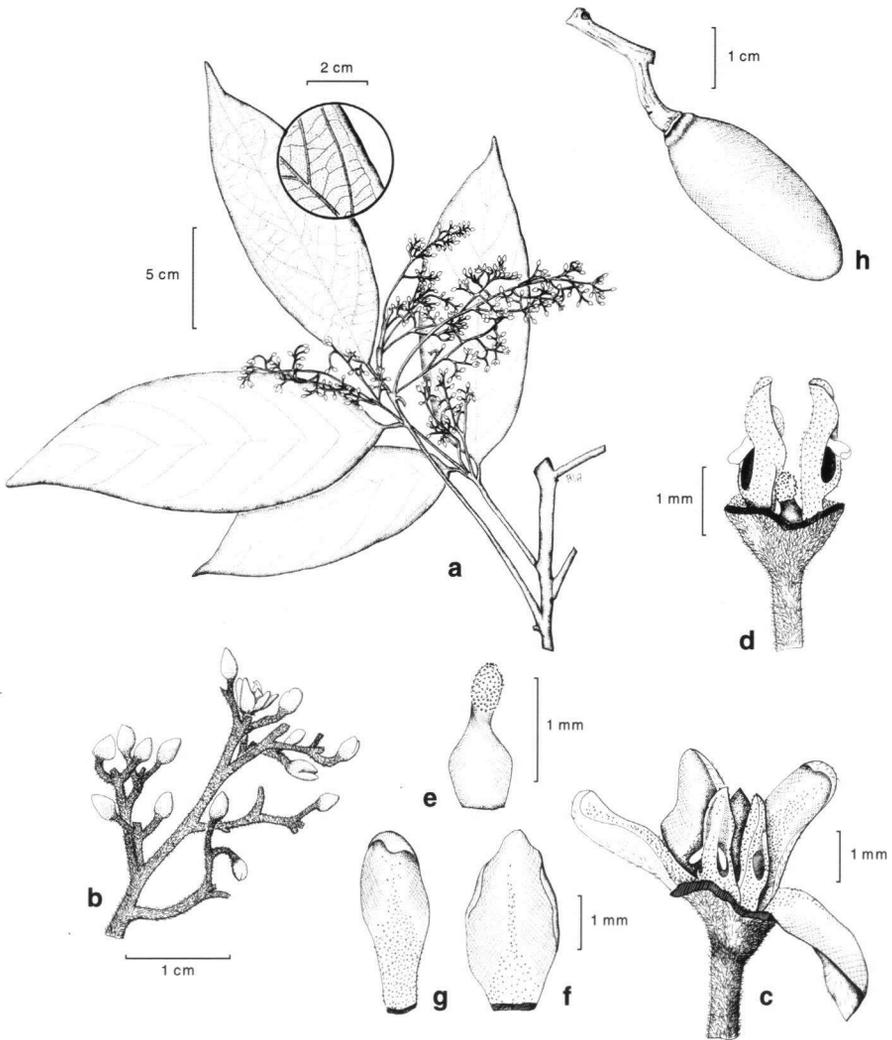


Fig. 2. *Endiandra elongata* Ariefiani. a. Habit; b. inflorescence; c. flower; d. open stamens on receptacle with ovary; e. pistil; f. & g. outer and inner tepals showing the inner surface; h. fruit (*Kostermans 6754*, BO, K, L).

Trees to 20 m tall. *Twigs* terete, with densely brown tomentellous indument, the surface completely covered when young, becoming glabrous. Terminal buds brown, with a dense, short, erect indument. *Leaves* alternate, rarely subopposite, spirally arranged, chartaceous; lamina elliptic, 11.5–25 by 5–10 cm, base acute to obtuse, rarely attenuate, flat at junction with petiole, apex acute or acuminate, upper surface glabrous, lower surface with a short, erect indument on the veins (otherwise with a scattered, sparse, minute indument or glabrous); midrib immersed above, raised below; secondary veins 5–8 pairs, close to each other towards the base of the leaf, more distant from each

other towards the apex, immersed to slightly impressed above, raised below, disappearing towards leaf margins; tertiary veins scalariform, finely reticulate, raised on both surfaces; petiole terete, with the same indument as twigs, 10–14 by 2–3 mm. *In-florescences* in axils of leaves or bracts, paniculate, to 10 cm long, with a dense, short, erect indument; axis and branches angular, striate; pedicels 1–3 mm long; bracts of inflorescence caducous; bracteoles narrowly elliptic, to 2 mm long, mostly caducous. *Flowers* white or yellow, 4–6 mm diam. at anthesis. *Hypanthium* shallowly cyathiform, both surfaces with a dense, erect indument. *Tepals* subequal, half-erect to spreading at anthesis, outer surface of the outer tepals with a sparse, short, erect or appressed indument, outer surface of the inner tepals glabrous except for the basal triangular pubescent patch, inner surface of the outer tepals glabrous except for the basal triangular papillose patch, inner surface of the inner tepals papillose, outer tepals elliptic, 3–3.5 by 1.5–2 mm, inner tepals elliptic or nearly so, 2.5–3.5 by 1–1.5 mm. *Anthers* sessile, narrowly triangular, papillose, 1.5–2 by 0.8–1.1 mm, connective narrowly triangular beyond the anther cells, 0.6–0.9 mm long; anther cells slit-like, extrorse, flaps rolled outwards; glands absent. *Pistil* c. 1.3 mm long, ovary ellipsoid, glabrous, c. 1 by 0.5–0.8 mm, style terete, glabrous, c. 0.2 mm long (almost sessile), stigma minutely capitate, oriented to one side, papillose. *Fruits* narrowly ellipsoid, base obtuse, 3.5–7 by 1.4–2.3 cm.

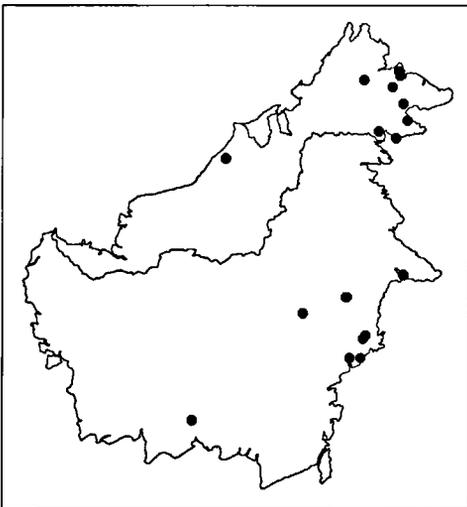
Field notes — Trees to 20 m, with smooth grey outer bark, inner bark reddish.

Distribution — Endemic in Borneo, mostly in NE Borneo (Sabah), more rarely in Sarawak and Kalimantan.

Habitat & Ecology — Primary or mixed Dipterocarp forest on sandy or heavy loam soil containing limestone. Altitude up to 305 m. Flowering: Feb., May to July, Oct. to Dec.; fruiting: Mar. to Dec.

Local names — Medang, Medang Tabak (Malay), Lampiuk, Marindau, Medang Teras, Resak Bunga, Lussutan (Dayak).

Note — *Endiandra elongata* is unique in having long anther connectives, about as long as the anther cells, 0.6–0.9 mm long. The species is similar to *E. kingiana* in the



Map 3. Distribution of *Endiandra elongata* Arifiani in Borneo.

alternate or subopposite leaf arrangement, dense, erect indument on both hypanthium surfaces, and scalariform tertiary venation. However, *E. elongata* differs from *E. kingiana* in having longer connectives (0.6–0.9 vs. 0.3–0.4 mm long) and sparser indument only on the major veins of the lower leaf surface (vs. dense indument on the entire lower leaf surface in *E. kingiana*).

### 3. *Endiandra immersa* Arifiani, *spec. nov.* — Fig. 3, Map 4

Ab congeneribus borneensibus venatione immersa, venis secundariis et tertiis vix visibilibus, floribus parvis differt. — Typus: *Kostermans 7701* (holo L; iso BO, K), Indonesia, E Kalimantan, Tandjong Bangko, near mouth of Mahakam River, elev. 20 m, fl., 1 Aug. 1952.

Large trees, to 30 m tall. *Twigs* angular, striate, glabrous or with a few appressed hairs when young, becoming terete. Terminal buds brown, with a dense, short, appressed indument. *Leaves* alternate, spirally arranged, chartaceous; lamina elliptic, 7.5–14 by 3.5–6 cm, base cuneate, flat, rarely slightly curled at junction with petiole, apex acute, both surfaces glabrous; midrib immersed above, raised below; secondary veins 4–6 pairs, close to each other towards the base of the leaf, more distant from each other towards the apex, sometimes irregularly, immersed above, slightly raised below, disappearing towards leaf margins, rarely weakly brochidodromous; tertiary veins finely reticulate, immersed above, immersed or weakly raised below; petiole slightly or deeply canaliculate, with a sparse, appressed indument, 9–17 by 1–2.5 mm. *Inflorescences* in leaf axils, paniculate, 1.5–7.5 cm long; with a dense, short, erect indument; axis and branches angular, striate; pedicels to 2.5 mm long; bracts of inflorescence caducous; bracteoles narrowly elliptic, to 2 mm long, mostly caducous. *Flowers* white to yellow, 2–5 mm diam. at anthesis. *Hypanthium* shallowly cyathiform, both surfaces with a sparse, appressed indument. *Tepals* subequal, half-erect to spreading at anthesis, outer surface of the outer tepals with a sparse, short, appressed indument or subglabrous, outer surface of the inner tepals glabrous except for the basal triangular pubescent patch, inner surface of the outer tepals glabrous except for the basal triangular papillose patch, inner surface of the inner tepals papillose, outer tepals elliptic or nearly so, 1.5–2.5 by 1–1.2 mm, inner tepals elliptic, 1.3–1.8 by 0.8–1 mm. *Anthers* sessile, triangular, papillose, 1–1.2 by 0.8–1 mm, connective broadly triangular beyond anther cells, c. 0.3 mm long; anther cells broadly elliptic, extrorse, flaps rolled outwards; glands absent. *Pistil* c. 1 mm long, ovary nearly globose, glabrous, c. 0.7 by 0.6 mm, style terete, glabrous, to 0.2 mm long (almost sessile), stigma minutely capitate, oriented to one side, papillose. *Fruits* green, ellipsoid, base obtuse, 3.5–5 by 1.5–2.5 cm.

Field notes — Trees to 30 m tall, to 40 cm dbh. Bark rather smooth, cracked, outer bark green or light brown, and inner one brownish. Wood red or brown.

Distribution — Endemic in Borneo, known from E Kalimantan and Sarawak.

Habitat & Ecology — Lowland Dipterocarp forest on wet sandy loam soil. Flowering: Apr., June, Aug.; fruiting: Apr., Sept.

Local names — Margaran and Medang (Iban).

Notes — *Endiandra immersa* is best recognized by the immersed venation of its leaves, with secondary and tertiary venation often scarcely visible, and by its small flowers. The two L sheets of the type collection of *E. immersa* had been annotated

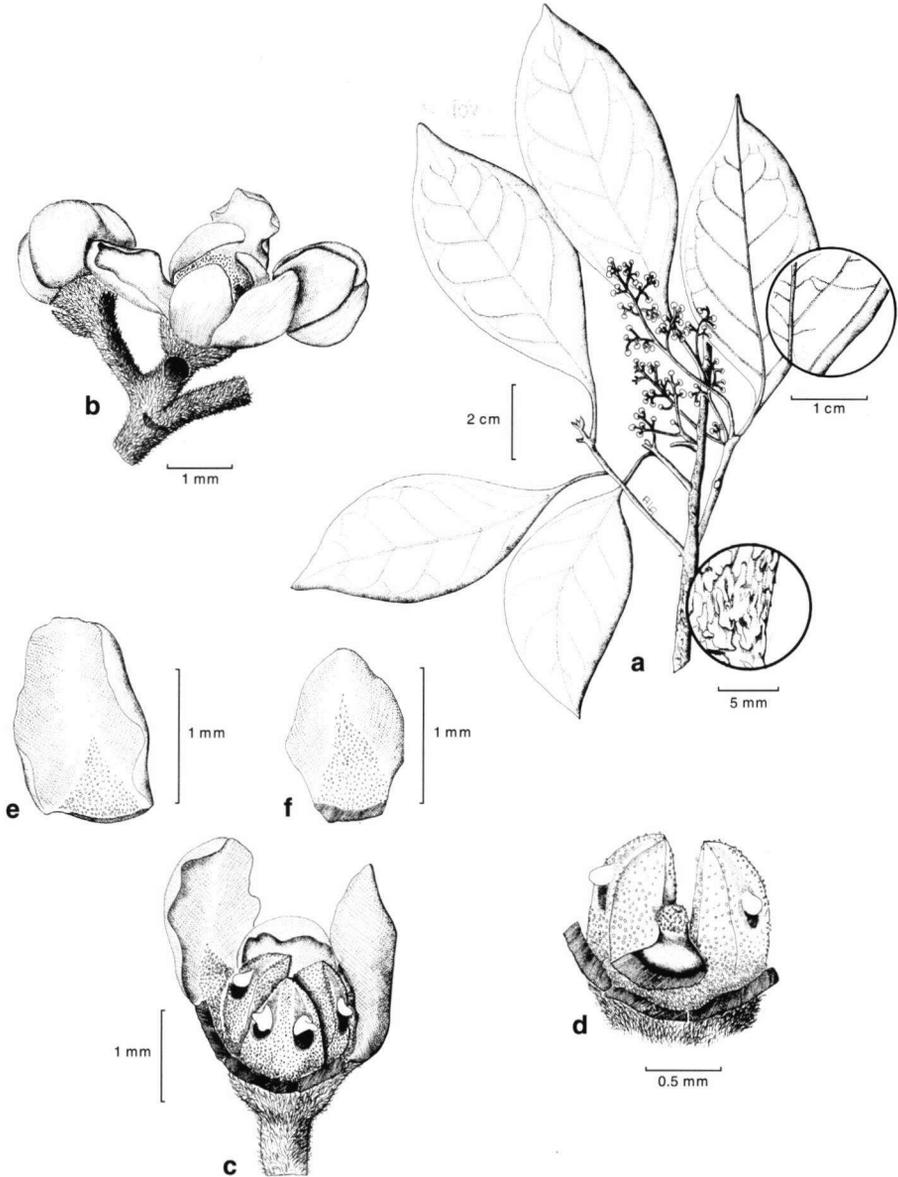
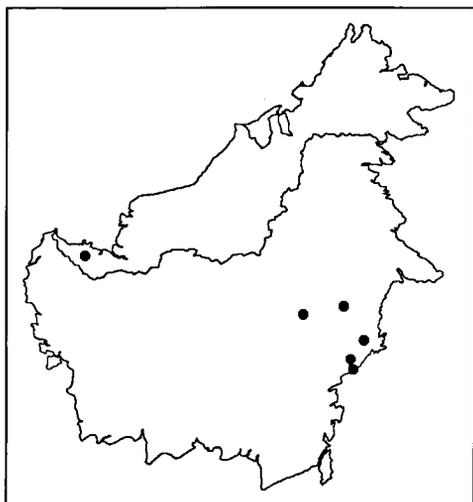


Fig. 3. *Endiandra immersa* Arifiani. a. Habit and twig; b. & c. flowers; d. open stamens and pistil e. & f. outer and inner tepals showing the inner surface (Kostermans 7701, BO, K, L).

by Kostermans as the type collection of *E. scrobiculata* Kosterm., a name which remained unpublished. Several other collections from Borneo in L were also annotated as *E. scrobiculata*. Later, Kochummen (1991) published *E. scrobiculata* Kosterm. ex Kochummen, based on two collections from mountain forests (1200 m altitude) at Fraser's Hill, Pahang. Flowers of this species are not known. I consider *E. immersa*



Map 4. Distribution of *Endiandra immersa* Arifiani in Borneo.

and *E. scrobiculata* Kosterm. ex Kochummen as distinct species based on the larger fruit size of the latter (to 5 vs. 7 cm long), the presence of the species in different habitats (1200 m altitude in Peninsular Malaysia vs. lowland forests of Borneo), and the fact that the type specimen of *E. scrobiculata* clearly shows secondary venation and traces of tertiary venation. In *E. immersa* secondary and tertiary venation are scarcely, if at all, visible.

At first glance, *E. immersa* can vegetatively be confused with *E. rhizophoretum*. Differences are discussed under the latter.

#### 4. *Endiandra kingiana* Gamble — Fig. 4, Map 5

*Endiandra kingiana* Gamble, Bull. Misc. Inform. Kew (1910) 151. — Type: *King's Coll. 6487* (holo K), Malaysia, Perak, Larut, elev. 150–250 m, fl., Aug. 1884.

Large trees, to 30 m tall. *Twigs* angular, striate, initially densely brown-tomentellous, becoming glabrous with age. Terminal buds reddish, with a dense, erect indument. *Leaves* alternate, infrequently subopposite, spirally arranged, chartaceous; lamina elliptic to broadly elliptic, 8–18 by 4–7 cm, base cuneate to obtuse, flat at junction with petiole, apex acute or acuminate, upper surface glabrous, lower surface with a dense, erect indument; midrib immersed or slightly impressed above, sometimes pubescent, raised below; secondary veins 5–9 pairs, close to each other towards the base of the leaf, more distant from each other towards the apex, impressed above, raised below, disappearing towards leaf margins; tertiary veins scalariform, coarsely reticulate, immersed or slightly raised above, raised below; petiole terete, with a dense, short, erect indument, 10–20 by 2–3 mm. *Inflorescences* in leaf axils, paniculate, short, condensed, 1–6 cm long, with a dense, short, erect, brown indument; axis and branches angular, striate; pedicels 2–3 mm long; bracts of inflorescence caducous; bracteoles narrowly elliptic, to 1 mm long, mostly caducous. *Flowers* white, 2.5–4 mm diam. at anthesis. *Hypanthium* shallowly cyathiform, both surfaces with a dense, erect indument. *Tepals*

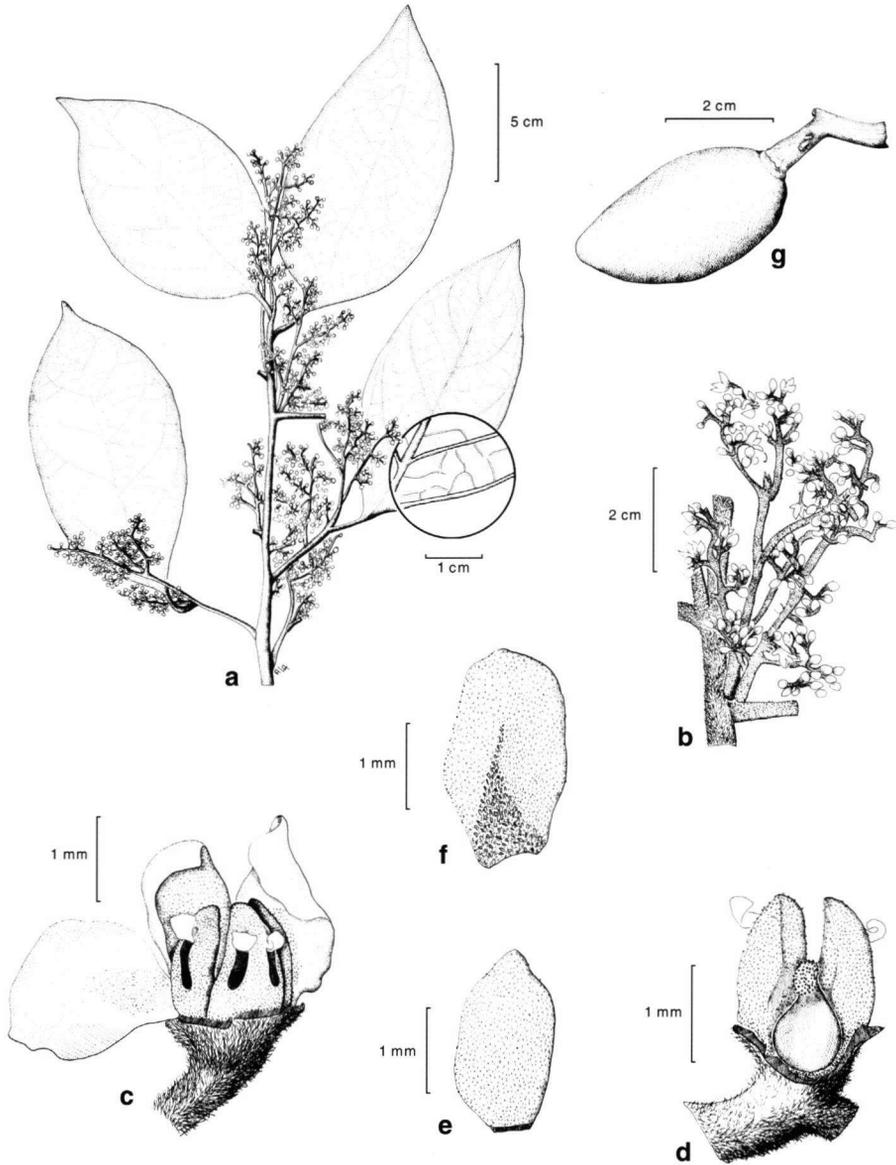


Fig. 4. *Endiandra kingiana* Gamble. a. Habit; b. inflorescence; c. open flower showing stamens; d. open stamens and pistil; e. & f. inner and outer tepals showing the inner surface; g. fruit (*King's Coll.* 6487, K).

subequal, half-erect to spreading at anthesis, outer surface of the outer tepals with a sparse, short, erect indument, outer surface of the inner tepals glabrous except for the basal triangular pubescent patch, inner surface of the outer tepals glabrous except for the basal triangular papillose patch, inner surface of the inner tepals papillose, outer

tepals elliptic or nearly so, 1.3–2.3 by 1.1–1.6 mm, inner tepals narrowly elliptic, 1.3–2 by 1–1.2 mm. *Anthers* sessile, narrowly triangular, papillose, 1–1.2 by 0.8–0.9 mm, connective narrowly triangular beyond the anther cells, 0.3–0.4 mm long; anther cells slit-like, extrorse, flaps rolled outwards; glands absent. *Pistil* c. 0.9 mm long, ovary globose, glabrous, c. 0.5 by 0.5 mm, style terete, glabrous, c. 0.3 mm long, stigma minutely capitate, oriented to one side, papillose. *Fruits* brown, ellipsoid, base obtuse, 2–8 by 1.3–3.2 cm.

Field notes — Trees to 30 m tall, to 50 cm dbh. Bark smooth, partly peeling off irregularly, outer bark grey, and inner bark white.

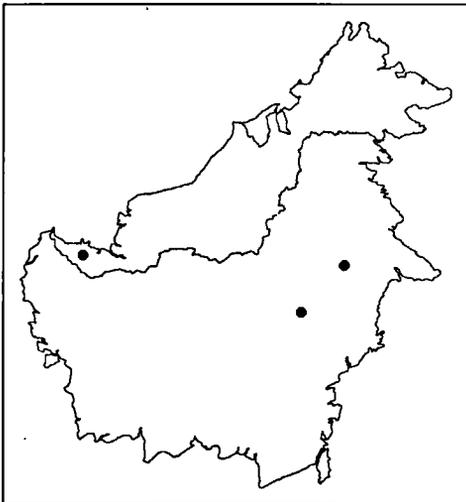
Distribution — In Borneo, the species is distributed in Belait (Brunei Darussalam), Sarawak (Malaysia), and E Kalimantan (Indonesia). The species has also been reported from Perak (Peninsular Malaysia) and Sulawesi (Indonesia).

Habitat & Ecology — Primary lowland forest or lowland mixed Dipterocarp forest on a sandy loam, acidic soil, or on lime soil. Altitude up to 100 m. Flowering: Apr., Aug.; fruiting: Sept., Nov.

Local name — Medang (Malay).

Notes — *Endiandra kingiana* was described by Gamble on a collection from Perak, Peninsular Malaysia. In 1971 Kostermans annotated a Bornean collection (*Kostermans 7703*) as the type of *E. pulcherrima*, a new species. This specimen was collected from E Kalimantan, Borneo, at altitudinal level of 20 m. However, the name was never published. I consider this specimen and other specimens annotated as *E. pulcherrima* as belonging to *E. kingiana*, they differ only in having a denser indument of the lower leaf surface.

Among Bornean *Endiandra*, *E. kingiana* is easy to recognize. *Endiandra kingiana* is the only *Endiandra* species in Borneo that bears a dense, erect indument on the lower leaf surface, including the veins. In other species in Borneo, the lower leaf surfaces bear either a sparse, appressed or erect indument or are glabrous. In addition, compared with *E. elongata*, *E. kingiana* has shorter connectives (about half the size of those of *E. elongata*).



Map 5. Distribution of *Endiandra kingiana* Gamble in Borneo.

Some fruiting collections from Semengoh Arboretum [S 37181 (*Othman et al.*), S 37687 (*Paul Chai et al.*), and S 33532 (*Ilias & P. Sie*)] are identified as *E. kingiana* with some doubt. These collections are similar in twigs and lower leaf surface indument to *E. kingiana*, but differ in having sparser, shorter indument on the terminal buds and lower leaf surface, a longer petiole, a bullate upper leaf surface and an almost rounded instead of an elliptic or broadly elliptic lamina. Flowering specimens are needed to determine if these collections represent an undescribed species.

### 5. *Endiandra macrophylla* (Blume) Boerl. — Fig. 5, Map 6

*Endiandra macrophylla* (Blume) Boerl., Handl. Fl. Ned. Ind. 3 (1900) 136. — *Dictyodaphne macrophylla* Blume, Mus. Bot. Lugd.-Bat. 1 (1851) 332. — Syntype: *Korthals s.n.* (L), Indonesia, Sumatra.

*Endiandra frondosa* Kosterm., Reinwardtia 7 (1965) 142. — *Endiandra macrophylla* Merr., Univ. Calif. Publ. Bot. 15 (1929) 90, nom. ill., non (Blume) Boerl. — Type: *Elmer 21457* (MO), Malaysia, Tawao.

Trees to 12 m tall. *Twigs* angular, striate, glabrous when young, becoming terete. Terminal buds silver or brown, with a sparse or dense, appressed indument. *Leaves* alternate, spirally arranged, chartaceous; lamina elliptic to slightly obovate, 16–30 by 5–13 cm, base cuneate, rarely slightly oblique, flat at junction with petiole, apex acuminate, both surfaces glabrous; midrib immersed or slightly raised above, raised below; secondary veins 8–13 pairs, close to each other towards the base of the leaf, more distant from each other towards the apex, immersed to slightly impressed above, raised below, disappearing towards leaf margins; tertiary veins finely reticulate, raised on both surfaces; petiole slightly to deeply canaliculate, glabrous, 12–25 by 2–5.5 mm. *Inflorescences* in leaf axils, paniculate, 6–15 cm long, with a sparse or dense, short, erect indument; axis and branches angular, striate, or terete; pedicels 1.5–3 mm long; bracts of inflorescence caducous; bracteoles narrowly elliptic, to 2 mm long, mostly caducous. *Flowers* cream or yellow, 6–9 mm diam. at anthesis. *Hypanthium* shallowly cyathiform, outer surface with a sparse, appressed indument, inner surface with a dense, erect indument. *Tepals* subequal, half-erect to spreading at anthesis, outer surface of the outer tepals with a dense, short, erect indument to glabrous, outer surface of the inner tepals glabrous except for the basal triangular pubescent patch, inner surface of the outer tepals glabrous except for the basal triangular papillose patch, inner surface of the inner tepals papillose, outer tepals elliptic to broadly elliptic, 4–6 by 2.5 mm, inner tepals narrowly elliptic, 3–3.5 by 1.5 mm. *Anthers* sessile, narrowly triangular, papillose, 1.5–2.5 by 1 mm, connective narrowly triangular beyond the anther cells, 0.2–0.5 mm long; anther cells slit-like, extrorse, flaps rolled outwards; glands absent. *Pistil* c. 1 mm long, ovary ellipsoid to globose, glabrous, 0.5–0.8 by 0.5 mm, style terete, glabrous, c. 0.2 mm long (almost sessile), stigma minutely capitate, oriented to one side, papillose. *Fruits* ellipsoid, base obtuse, 4–7.5 by 1.7–2.5 cm.

Field notes — Trees to 12 m tall. Bark smooth, outer bark green or grey, and inner bark brown to reddish.

Distribution — Mostly in Sabah, a few in Sarawak and E Kalimantan, and rarely in W Kalimantan. This species has also been reported from Sumatra, Peninsular Malaysia, and Irian Jaya.

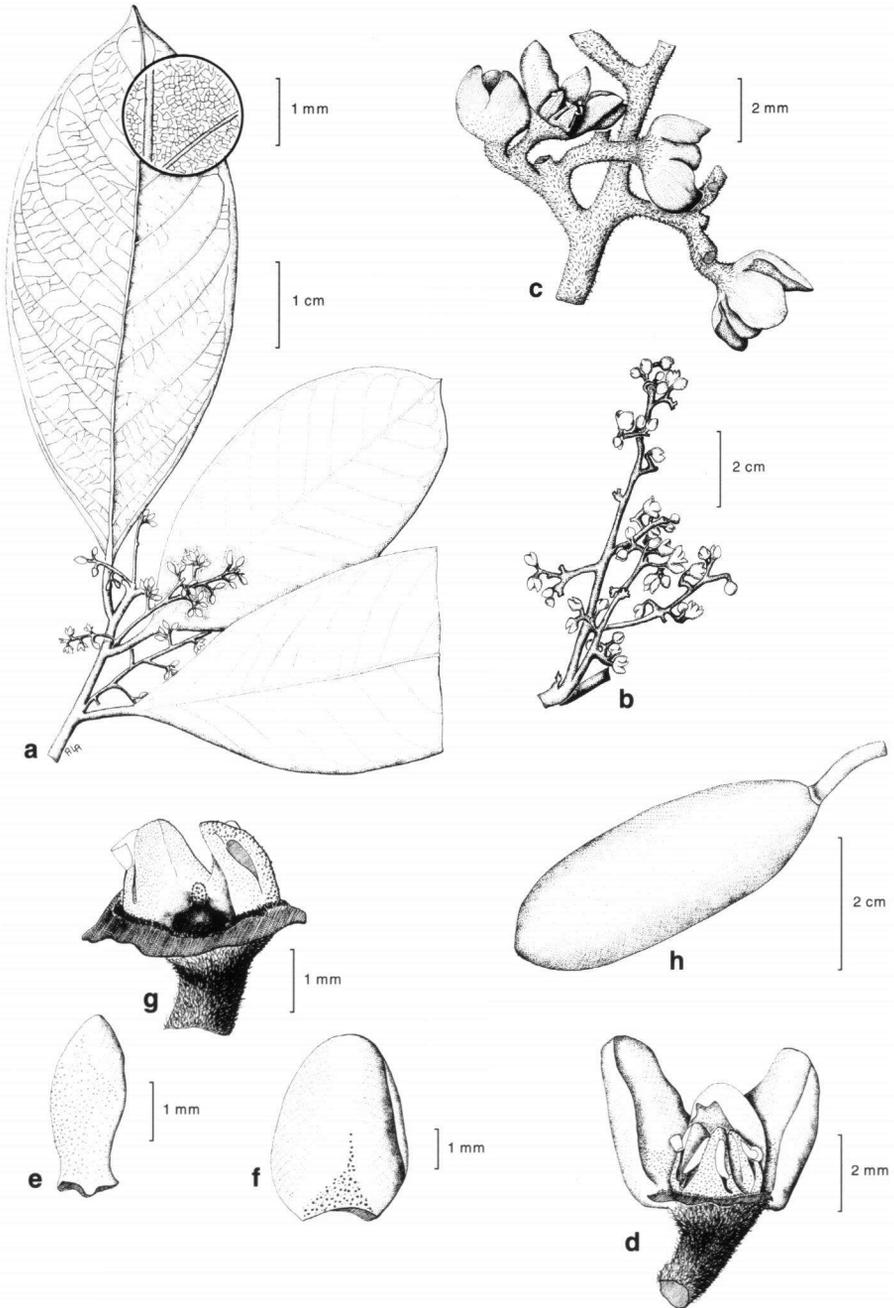
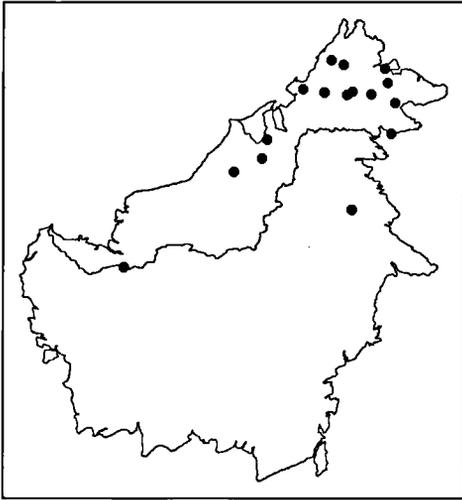


Fig. 5. *Endiandra macrophylla* (Blume) Boerl. a. Habit; b. & c. inflorescences; d. flower; e. & f. inner and outer tepals showing the inner surface; g. open stamens and pistil; h. fruit [a, f: S 27605 (Soepadmo & Smith), BO, L; b–e, g: SANA 4806 (Wood), L; h: SAN 89328 (Dewol & Kodoh), L].



Map 6. Distribution of *Endiandra macrophylla* (Blume) Boerl. in Borneo.

**Habitat & Ecology** — Primary rain forest, disturbed Dipterocarp, or peat swamp forest on clay loam soil or sandy soil. Mostly in wet areas along brooks or riverbanks, flatland, hillsides, to mountain areas. Flowering: Jan., Mar. to Oct.; fruiting: Jan., May to July, Sept., Nov.

**Local names** — Bilyangas (Kinabatangan), Kayu Malam.

**Notes** — *Endiandra macrophylla* is characterized by its large, glabrous lamina (16–30 by 5–13 cm) with fine reticulation, glabrous twigs and large flowers (6–9 mm diam. at anthesis). *Endiandra macrophylla* can be confused with *E. rubescens*. Both species have a fine reticulation and slit-like anther cells. However, *E. rubescens* has a sparse, appressed indument on the twigs (glabrous twigs in *E. macrophylla*), smaller lamina (6.5–15 by 2–7 cm) and smaller flowers (3–5 mm diam. at anthesis) than *E. macrophylla*. This species grows at a wide range of elevation from sea level to 740 m. The collections from higher elevations [*S* 30351 (*Paul Chai*), *SAN* 77167 (*G. Shea & Aban*), *SAN* 83187 (*Saikeh Lantoh*)] do not differ from those of lower elevations.

*Endiandra macrophylla* was originally described as *Dictyodaphne macrophylla* by Blume (1851) based on specimens from Java and Sumatra. In 1929, Merrill described another *E. macrophylla* based on specimens from Borneo. Realizing that *E. macrophylla* Merr. is an illegitimate name, Kostermans (1965) erected the name *E. frondosa* Kosterm. to replace *E. macrophylla* Merr. After comparing the types of *E. frondosa* (*Elmer* 21457) and *E. macrophylla* specimens, I decided to place *E. frondosa* in synonymy of *E. macrophylla* because they do not differ sufficiently from each other to warrant specific recognition.

## 6. *Endiandra ochracea* Kosterm. — Fig. 6, Map 7

*Endiandra ochracea* Kosterm., *Reinwardtia* 7 (1965) 29. — Type: *Kostermans* 9572 (holo BO; iso A, BO, K, KEP, L, LAE, P, PNH, SING), Indonesia, E Kalimantan, W Kutei, Kelindjau River, Segoi, elev. 20 m, fr., 6 Dec. 1954.

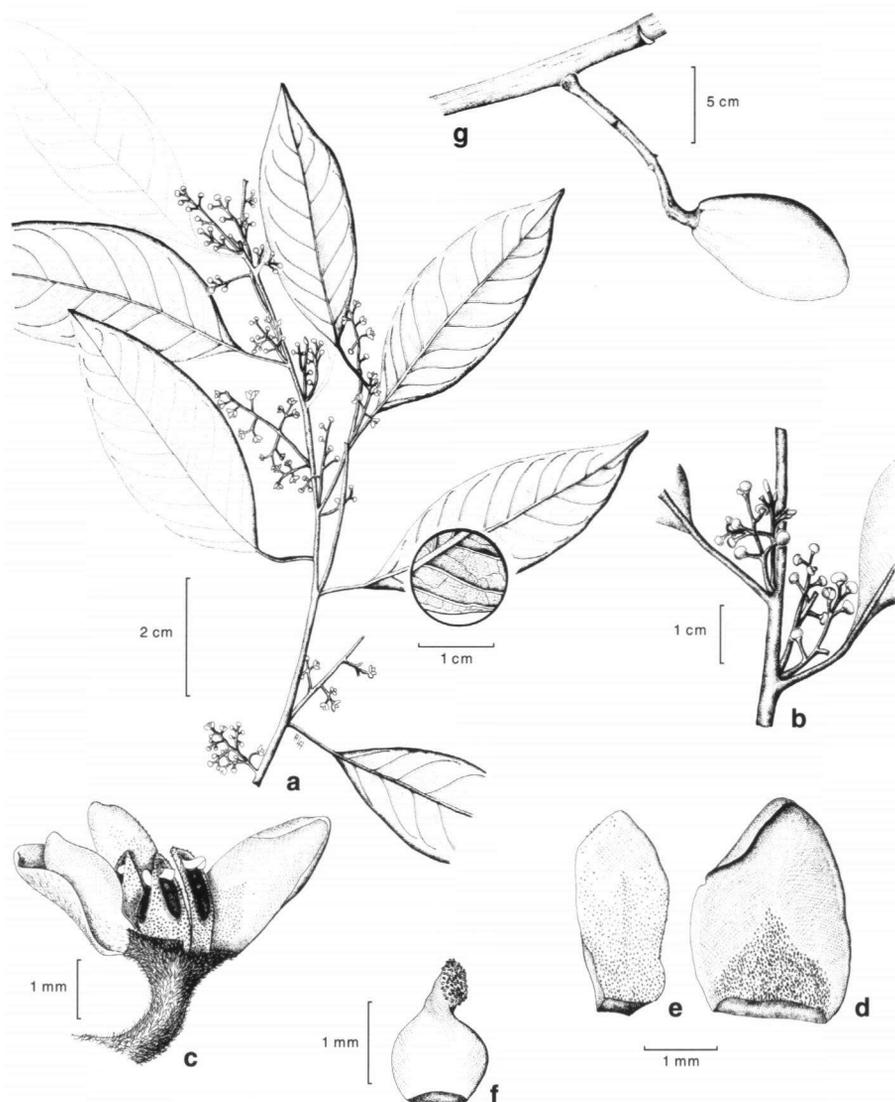


Fig. 6. *Endiandra ochracea* Kosterm. a. Habit and papillose lower leaf surface; b. inflorescence; c. flower; d. & e. outer and inner tepals showing the inner surface; f. pistil; g. fruit (a–f: *Ambriansyah & Arifin* AA 363, MO; g: *Kostermans* 9572, BO, KEP, L).

Trees to 25 m tall. *Twigs* angular, striate, with a sparse, appressed indument when young, becoming terete and glabrous. Terminal buds silver, with a dense, appressed indument. *Leaves* alternate, spirally arranged, chartaceous; lamina elliptic, 7–16 by 3–5.5 cm, base cuneate to attenuate, flat at junction with petiole, apex acuminate, upper surface glabrous, lower surface papillose; midrib immersed above, raised below; secondary veins 6–9 pairs, close to each other towards the base of the leaf, more distant from each other towards the apex, raised on both surfaces, disappearing towards

leaf margins; tertiary veins finely reticulate, raised on both surfaces; petiole slightly to deeply canaliculate, glabrous, 10–15 by 1–1.7 mm. *Inflorescences* in leaf axils, paniculate, rarely racemose, 3–5 cm long, with a dense, short, erect or appressed indument; axis and branches angular, striate; pedicels 1–3 mm long; bracts of inflorescence narrowly elliptic, to 1.5 mm long, mostly caducous; bracteoles narrowly elliptic, to 1 mm long, mostly caducous. *Flowers* cream to yellowish green, 3–5 mm diam. at anthesis. *Hypanthium* shallowly cyathiform, outer surface with a sparse, erect indument, inner surface with a dense, erect indument. *Tepals* subequal, half-erect to spreading at anthesis, outer surface of the outer tepals with a sparse, short, erect indument, outer surface of the inner tepals glabrous except for the basal triangular pubescent patch, inner surface of the outer tepals glabrous except for the basal triangular papillose patch, inner surface of the inner tepals papillose, outer tepals elliptic, 3–4 by 1.5–2 mm, inner tepals narrowly elliptic, 2–2.5 by 1–1.4 mm. *Anthers* sessile, narrowly triangular, weakly papillose, 1–2 by 0.8 mm, connective narrowly triangular beyond the anther cells, c. 0.3 mm long, anther cells slit-like, extrorse, flaps rolled outwards; glands absent. *Pistil* 1.5–1.7 mm long, ovary ellipsoid to globose, glabrous, c. 1 by 0.7–1 mm, style terete, glabrous, c. 0.5 mm long, stigma minutely capitate, oriented to one side, papillose. *Fruits* ellipsoid, base obtuse, 2.5–4 by 1.2–2.2 cm.

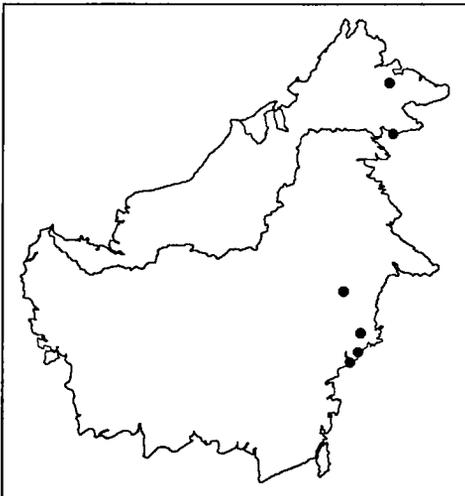
Field notes — Trees to 25 m tall, to 75 cm dbh. Bark yellowish to grey, smooth, without smell. Wood soft, white, and without smell. Fruit glossy green.

Distribution — Endemic in Borneo and distributed from the eastern part of N Borneo (Sabah) to E Borneo (E Kalimantan).

Habitat & Ecology — Primary forest on sandy loam soil, along streams. Altitude up to 140 m. Flowering: Jan., May, July; fruiting: Apr. to June, Aug., Sept.

Local names — Medang, Medang Alus (Malay).

Note — *Endiandra ochracea* was named after the ochraceous or yellowish color on the lower surface of the dry leaves which is caused by the papillae. Among the species from Borneo, *E. ochracea* is the only one with papillae. Kostermans considered *E. ochracea* close to *E. rubescens* from which it differs in its unbranched short infructes-



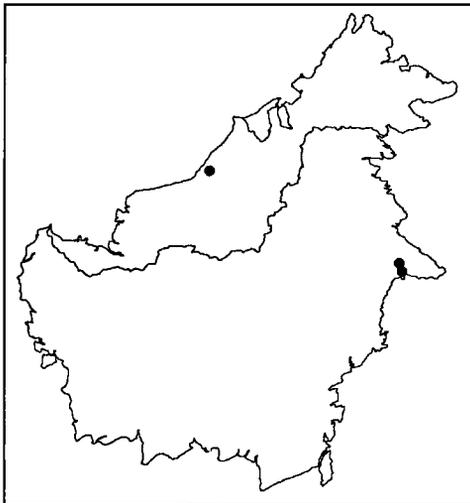
Map 7. Distribution of *Endiandra ochracea* Kosterm. in Borneo.

cence and the papillose lower leaf surface. His argument for an unbranched infructescence is not strong because there are a few branched infructescences and some scars on the infructescence main stalk that imply that the branches fell off because the main stalk could not hold fruit-bearing branches.

**7. *Endiandra rhizophoretum* Kosterm. ex Arifiani, *spec. nov.* — Fig. 7, Map 8**

*Endiandrae immersae* similis, sed ramulis pubescentibus, foliis majoribus, venatione secundaria et tertiaria subtus elevata recedit. — Typus: *S 18137* (*Ashton*) (holo L; iso BO), Malaysia, Bintulu, Labang River area, fl., 4 Jan. 1963.

Medium-sized trees, to 18 m tall. *Twigs* terete with a dense, appressed indument, glabrous with age. Terminal buds brown with a dense, short, appressed indument. *Leaves* alternate, spirally arranged, chartaceous; lamina elliptic, 14.5–29 by 5.5–11 cm, base cuneate, flat at junction with petiole, apex acuminate, upper surface glabrous, lower surface with a sparse, appressed indument or glabrous; midrib slightly raised, sometimes slightly impressed above, raised below; secondary veins 6–9 pairs, close to each other towards the base of the leaf, more distant from each other towards the apex, immersed, rarely weakly raised above, raised below, disappearing towards leaf margins; tertiary veins finely reticulate, immersed above, weakly raised below; petiole flat above, with a sparse, appressed indument, 10–25 by 2.5–4.2 mm. *Inflorescences* in leaf axils, paniculate, 6.1–14 cm long, with a dense, short, erect indument; axis and branches angular, striate; pedicels 3–4 mm long; bracts of inflorescence caducous; bracteoles narrowly elliptic, to 0.7 mm long, mostly caducous. *Flowers* cream to yellow, 4–5 mm diam. at anthesis. *Hyanthium* shallowly cyathiform, both surfaces with a dense, erect, indument. *Tepals* subequal, half-erect to spreading at anthesis, outer surface of the outer tepals with a sparse, short, appressed indument, outer surface of the inner tepals glabrous except for the basal triangular pubescent patch, inner surface of the outer tepals glabrous except for the basal triangular papillose patch, inner surface of the inner tepals densely papillose, outer tepals broadly ovate, 3–4 by 2.5–2.7 mm, inner tepals elliptic, 2.5–3 by 1–1.4 mm. *Anthers* narrowly triangular, papillose,



Map 8. Distribution of *Endiandra rhizophoretum* Kosterm. ex Arifiani in Borneo.

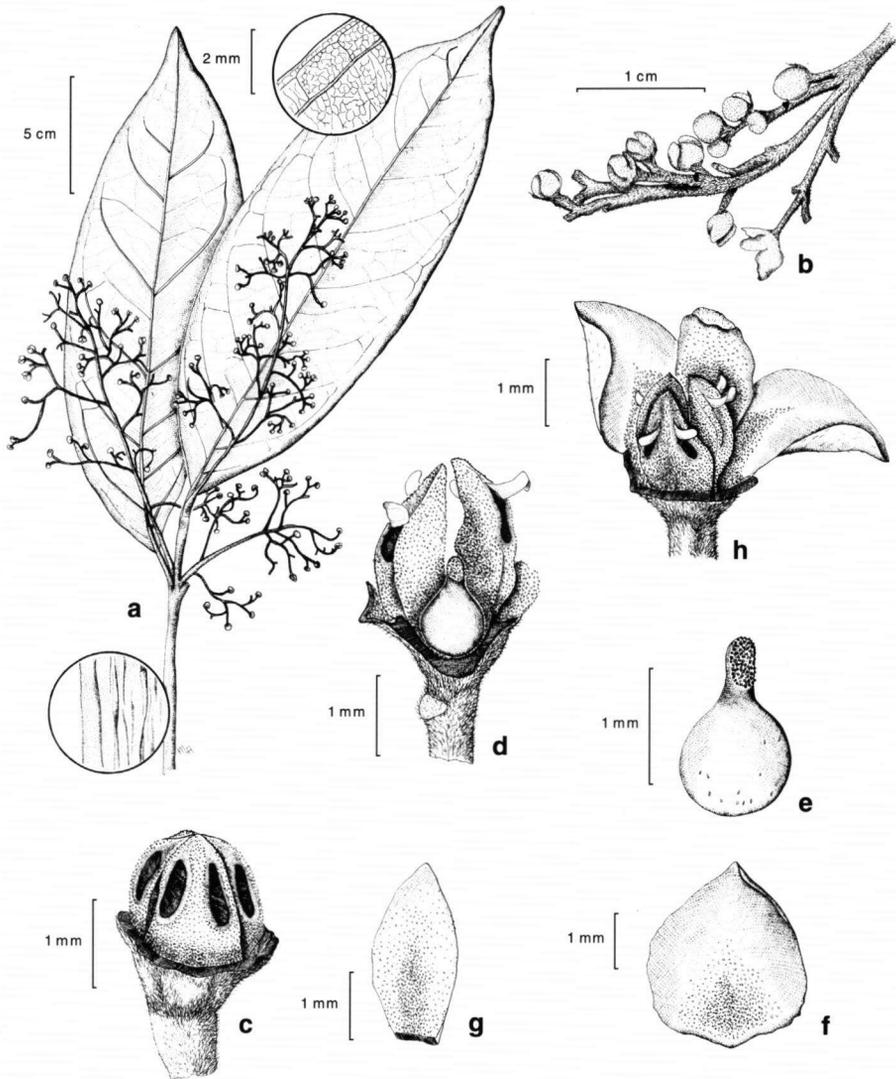


Fig. 7. *Endiandra rhizophoretum* Kosterm. ex Arifiani. a. Habit and appressed pubescent twig; b. inflorescence; c. unopened stamens; d. open stamens and pistil; e. pistil; f. & g. outer and inner tepals showing the inner surface; h. flower (a–f: *S 18137* (Ashton), BO, L; g & h: *Aet 421*, BO, L).

1–1.5 by 0.9–1.2 mm, connective narrowly triangular beyond the anther cells, c. 0.2 mm long; anther cells slit-like, extrorse, flaps rolled outwards; glands absent. *Pistil* 1–1.5 mm long, ovary nearly globose, glabrous, 0.5–0.7 by 0.6–0.9 mm, style terete, glabrous, c. 0.2 mm long, stigma minutely capitate, oriented to one side, papillose. *Fruit* unknown.

*Distribution* — Sarawak and E Kalimantan.

*Habitat & Ecology* — Riverbank areas. Alt. up to 100 m. Flowering: Apr., May.

Local name — Marawakan.

Note — *Endiandra rhizophoretum* is most readily recognized by its immersed leaf venation and the dense indument on its young twigs. It is similar to *E. immersa*, but differs from the latter in the following characters: dense indument on young twigs (glabrous or nearly so in *E. immersa*); leaf size 14.5–29 cm long (7–14 cm long in *E. immersa*); flat to terete petiole (canaliculate in *E. immersa*); and secondary veins raised on lower leaf surface (immersed in *E. immersa*). *Endiandra rhizophoretum* can have some appressed hairs on the lower leaf surface, but they are inconspicuous when present.

### 8. *Endiandra rubescens* (Blume) Miq. — Fig. 8, Map 9

*Endiandra rubescens* (Blume) Miq., Pl. Jungh. 1 (1852) 176. — *Dictyodaphne rubescens* Blume, Mus. Bot. Lugd.-Bat. 1 (1850) 270. — Type: *Praetorius s.n.* (holo L, iso L), Indonesia, Sumatra.

Large trees, to 35 m tall. *Twigs* brownish or whitish, terete or angular, striate with a sparse to moderately dense, appressed indument. Terminal buds light brown, with a sparse to dense, appressed indument. *Leaves* alternate, spirally arranged, chartaceous; lamina elliptic, 6.5–15 by 2–7 cm, base cuneate to attenuate, flat at junction with petiole, apex acute or acuminate, both surfaces glabrous; midrib immersed or slightly raised above, raised below; secondary veins 7–11 pairs, close to each other towards the base of the leaf, more distant from each other towards the apex, raised on both surfaces, disappearing towards leaf margins, rarely brochidodromous; tertiary veins finely reticulate, immersed or raised above, raised below; petiole slightly or deeply canaliculate, with a sparse indument or nearly glabrous, 8–15 by 1–2.5 mm. *Inflorences* in leaf axils, paniculate, 4–13 cm long; with a sparse or dense, short, erect indument; axis and branches angular, striate; pedicels 1.5–3 mm long; bracts of inflorescence narrowly ovate or elliptic, to 1 mm long, mostly caducous; bracteoles caducous. *Flowers* white or yellow, 3–5 mm diam. at anthesis. *Hypanthium* shallowly cyathiform, outer surface with a sparse, erect indument, inner surface with a dense, appressed indument. *Tepals* subequal, half-erect or spreading at anthesis, outer surface of the outer tepals with a sparse, erect indument, outer surface of the inner tepals glabrous except for the basal triangular pubescent patch, inner surface of the outer tepals glabrous except for the basal triangular papillose patch, inner surface of the inner tepals dense papillose, outer tepals elliptic, 2.4–2.7 by 1.1–1.5 mm, inner tepals narrowly elliptic, 1.8–2.1 by 0.8–1 mm. *Anthers* sessile, slightly triangular, finely papillose, 1–1.3 by 0.9–1 mm, connective narrowly triangular beyond the anther cells, 0.2–0.5 mm long; anther cells slit-like, extrorse, flaps rolled outwards; glands absent. *Pistil* c. 0.8 mm long, ovary ellipsoid to globose, 0.5–0.7 by 0.5 mm, style absent, stigma minutely capitate, oriented to one side, papillose. *Fruits* green, ellipsoid, base obtuse, 2–5 by 1.3–2.5 cm.

Field notes — Trees up to 35 m. Bark whitish, brownish or grey, smooth, inner bark reddish.

Distribution — It has been reported from Sarawak, Belait, to Sabah (in the north), and from E Kalimantan to S Kalimantan (in the east). This species is also reported from Java, Sumatra, and Peninsular Malaysia.

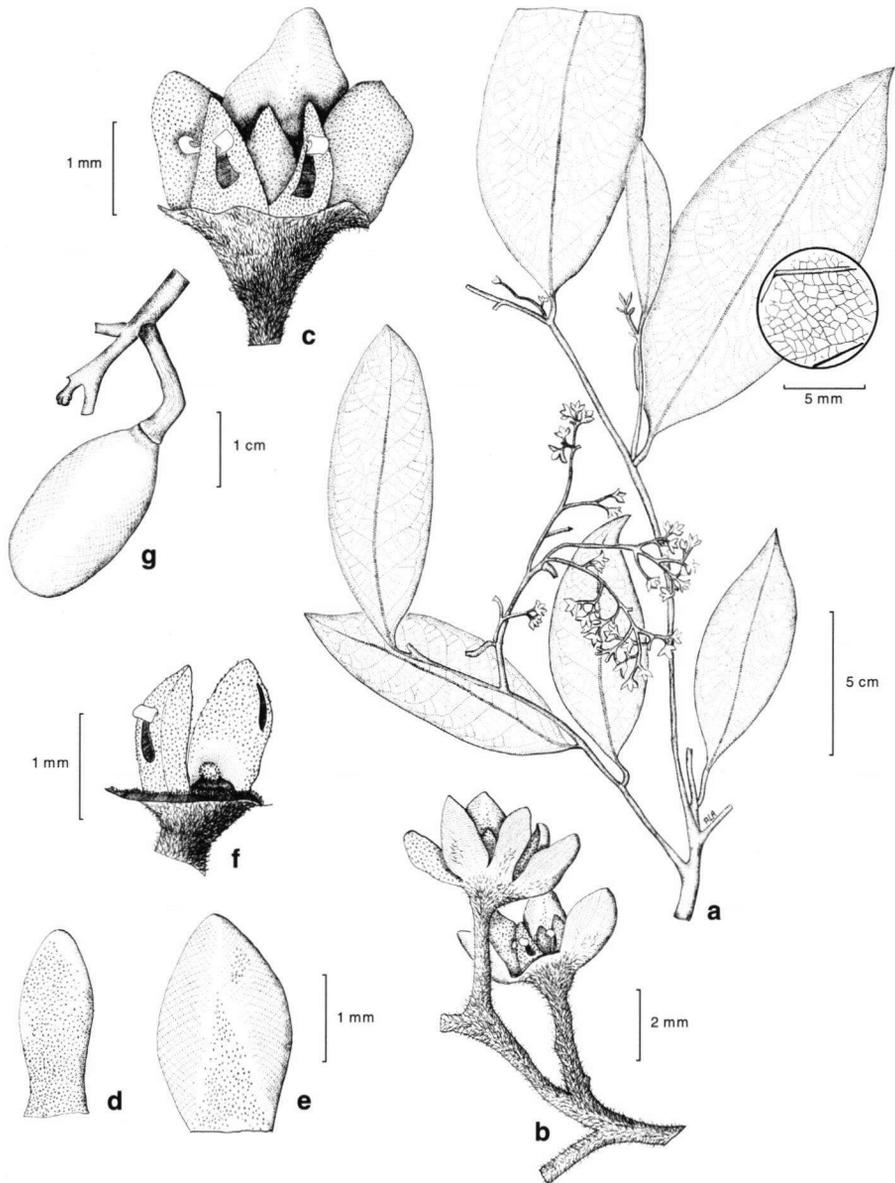
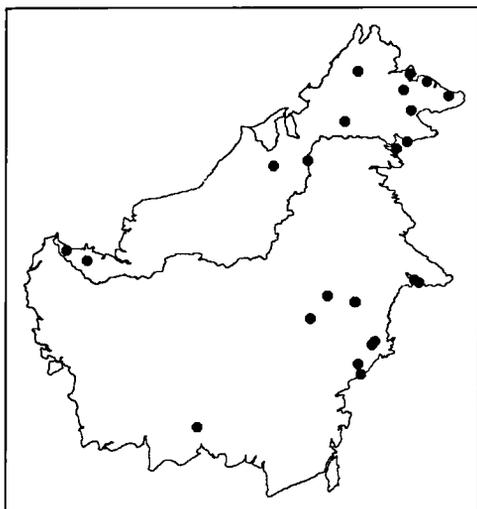


Fig. 8. *Endiandra rubescens* (Blume) Miq. a. Habit and twig; b. inflorescence; c. flower; d. & e. inner and outer tepals showing the inner surface; f. open stamens and pistil; g. fruit [a: *SANA1762* (Sario), K, KEP, L; b–f: *Kostermans 7235*, L; h: *Kostermans 4399A*, L].

**Habitat & Ecology** — Primary rain, Dipterocarp, peat swamp, and montane oak forests, on sandy loam or acid soils along streams. Altitude up to 1400 m. Flowering: Mar. to Aug., Nov., Dec.; fruiting: Jan., Feb., June to Nov.

**Local names** — Bejubui (Melanau), Medang lilin, Medang, Lingkasig (Sungei).



Map 9. Distribution of *Endiandra rubescens* (Blume) Miq. in Borneo.

Notes — Some collections placed in this species had been annotated by Kostermans as *E. falcata*, an unpublished name. I consider that these collections do not differ from *E. rubescens*. *Endiandra rubescens* is similar to *E. ochracea* that has similar secondary and tertiary venation but differs from that species in lacking a papillose lower leaf surface. From *E. macrophylla* it differs in having a smaller lamina, raised secondary veins on the upper surface (immersed to slightly impressed in *E. macrophylla*), and pubescent twigs. These differences are discussed further under *E. macrophylla*.

Provisionally included in *E. rubescens* are two groups of specimens that may represent additional species. More collections are needed to determine their status. The first group consists of three collections [*Ambriansyah & Arifin* W 689 (K), W 826 (BO), and W 944 (K)] and differs from *E. rubescens* in having paler leaves and twigs, stiffer leaves and paler flowers. The second group consists of four collections [*S* 2633, *S* 2701, *S* 3252 (*J.A.R. Anderson*) (KEP), and *Sanusi bin Tahir* 9221 (BO, K, KEP, L)] and differs from typical *E. rubescens* in having paler twigs, broadly elliptic to slightly obovate lamina and stiffer leaves. Some duplicates of *Sanusi bin Tahir* 9221 were annotated as *E. elliptica* Kosterm., an unpublished name.

#### IMPERFECTLY KNOWN SPECIES

##### 1. *Endiandra rigidior* Kosterm.

*Endiandra rigidior* Kosterm., *Rheedea* 4 (1994) 15. — Type: *Muas* 1287 (holo SAR, not seen), Malaysia, Sarawak, Semengoh Forest Reserve, elev. 40 m, fr., Dec.

The status of *Endiandra rigidior* described by Kostermans (1994) as a new species from Borneo (Sarawak) could not be confirmed. This species was described by Kostermans based on fruiting specimens. According to the description, plants are glabrous, except for the inflorescence and the terminal buds which are sparsely covered by

minute, appressed hairs. Twigs are glossy, slightly angular; the leaves are rigidly coriaceous, glossy, elliptic, obscurely acuminate, base cuneate, to 12–20 by 4–10 cm, prominently reticulate, midrib hardly raised above, but prominent below; lateral nerves 5 or 6 pairs, arcuate, erect-patent; petiole is stout, 1–2 cm long, flattened above and thickened near the base. The fruits are ellipsoid, smooth, 8 by 5.5 cm.

No other collections from Borneo match Kostermans' description perfectly. However, there are some collections [SAN 105334 (*Fidilis & Sumbing*), S 45397 (*Bernard Lee*), *Kostermans 8124*] that might belong to *E. rigidior* because they have stout petioles that are flattened above and thickened near the base. However, they differ from *E. rigidior* in having a larger lamina and less prominent reticulation. Compared with *E. macrophylla*, they differ in lacking the canaliculate petiole and prominent reticulation. Matching these specimens with the type specimen will not determine their status because the type specimen is only a fruiting specimen, and fruiting specimens cannot be identified to genus with certainty. The plant could be *Endiandra*, *Beilschmiedia*, or another genus. Flowering specimens are needed for genus determination.

#### ACKNOWLEDGEMENTS

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## IDENTIFICATION LIST

The numbers behind the collector numbers refer to the following *Endiandra* species:

1 = <i>clavigera</i>	5 = <i>macrophylla</i>
2 = <i>elongata</i>	6 = <i>ochracea</i>
3 = <i>immersa</i>	7 = <i>rhizophoretum</i>
4 = <i>kingiana</i>	8 = <i>rubescens</i>

- Aet 421: 7; 480: 7 — Ambriansyah & Arifin AA 363: 6; AA 607: 8; W 763: 2 — Ampuria 35328: 2 — Asah 12718: 3 — Awing 34798: 5.
- bb series 16810: 3; 16936: 8; 19072: 3; 28130: 3; 29227: 2 — Burley & Tukirin 791: 5 — Burley & Tukirin et al. 436: 5.
- Chew Wee-Lek CWL 478: 5.
- Elmer 21457: 5 — Endert 1425: 8; 2070: 8.
- Gibot 37120: 5.
- Haviland & Hose 3653E: 8 — Hose 471: 8.
- Kato et al. B 10123: 8 — King's Collector 6487: 4 — Kostermans 4005: 8; 4016: 8; 4031: 6; 4111: 4; 4305: 8; 4326: 3; 4399A: 8; 4479: 6; 4548: 8; 4995: 8; 5608: 8; 5661: 8; 5762: 2; 5796: 8; 5798: 8; 6410: 3; 6416: 3; 6594A: 6; 6597: 8; 6605: 8; 6754: 2; 7080: 4; 7235: 8; 7701: 3; 7703: 4; 7710: 8; 7944: 2; 8024: 8; 8039: 8; 9080: 8; 9556: 8; 9572: 6; 9703: 2; 9704: 2; 9797: 8; 9805: 3; 9820: 2; 9867: 2; 9873: 8; 9955: 3; 10103: 8; 10360: 3; 10654: 8; 10758: 2; 10765: 8; 10844: 2.
- Lantoh 73177: 8.
- Mendoza 4268: 8; 38645: 8.
- Nangkat 270: 8 — Nooteboom & Chai 2325: 8.
- S series 204: 1; 13653: 1; 15627: 1; 15721: 1; 16469: 5; 18137: 7; 24120: 1; 27289: 2; 27605: 5; 29495: 1; 30351: 5; 32492: 1; 34385: 1; 34423: 8; 34647: 8; 36825: 1; 37181: 4; 44088: 4 — SAN series A 1762: 8; 2980: 2; A 3462: 6; A 4772: 2; A 4806: 5; 17184: 8; 17692: 8; 18609: 2; 18725: 2; 23004: 8; 26979: 2; 27241: 2; 29345: 2; 30071: 2; 30587: 6; 31605: 2; 34205: 5; 36368: 5; 39867: 5; 49285: 1; 55972: 2; 59838: 2; A 62448: 2; 67366: 8; 73798: 2; 76672: 5; 77167: 5; 77799: 5; 81592: 8; 83187: 5; 88686: 6; 89328: 5; 90637: 5; 95804: 5; 97387: 5; 100277: 5; 107237: 5; 110565: 8; 112918: 5; 118746: 5; 119595: 5 — SF series 35747: 1.
- Winkler 2353: 8; 2417: 7 — Wiriadinata 3434: 5 — Wood & Wyatt-Smith A4289: 8.