

A SYNOPSIS OF THE GENUS *BERLINIA* (*LEGUMINOSAE* – *CAESALPINIOIDEAE*)

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Berlinia Sol. ex Hook.f. (*Leguminosae* – *Caesalpinioideae*) is under investigation with two main goals: (i) to delimit and describe the species, and (ii) to elucidate their relationships. Delimitation and description is now largely completed and is presented in this synopsis. The genus *Berlinia* is assessed as comprising 18 species. Keys to the species are presented and for each species a brief description, selected synonymy and specimen citations are given. A monograph of *Berlinia* including a full taxonomic treatment and the results of the phylogenetic investigation will be published later by the senior author.

Keywords. *Berlinia*, *Caesalpinioideae*, *Fabaceae*, *Leguminosae*, taxonomy, tropical Africa.

INTRODUCTION

Berlinia is confined to tropical Africa and was described in 1849 by J. D. Hooker who created the genus to accommodate a single species. Establishing authorship of the genus was not straightforward. In the Niger Flora, the entry for *Berlinia* simply reads *Berlinia* Soland. The manuscript name *Berlinia acuminata* is written on one of the three different collections (*Smeathmann* s.n.) on which the genus is based in what is thought to be Solander's handwriting (Keay, 1954). Although the Niger Flora was edited by W. J. Hooker, in the preface, he credits the majority of the work to his son J. D. Hooker. However, at the beginning of the account of the *Leguminosae*, a footnote says 'by J. D. Hooker and G. Bentham'. Nevertheless, throughout the *Leguminosae* account authorships of new genera are attributed to one or other author, e.g. Hook.f. to *Ostyrocarpus*, or Benth. to *Leucomphalus*. As the primary literature is somewhat ambiguous we have been obliged to assess evidence from secondary sources. In a later paper Bentham (1866) described two additional new species in the genus (*B. auriculata* Benth. and *B. bracteosa* Benth.), but took no credit for the authorship of *B. acuminata*, simply citing the species as *B. acuminata* Soland., in Hook.f. Subsequently, when Keay (1954) unravelled the taxonomic and concomitant nomenclatural complexities of *B. acuminata*, he stated that *Berlinia* was described by J. D. Hooker. We therefore believe that the genus was described by J. D. Hooker, using Solander's manuscript name so that the genus is correctly attributed to Sol. ex Hook.f.

By the early 1900s, 26 more species had been described and the generic limits of *Berlinia* s.l. had become unclear. During the first half of the 20th century, several authors (Harms, 1915; De Wildemann, 1925; Baker, 1930; Pellegrin, 1949;

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Duvigneaud, 1950; Troupin, 1950; Hauman, 1952a) proposed a variety of taxonomic systems, to accommodate the considerable morphological diversity of *Berlinia* s.l., sometimes referred to as the *Berlinia* complex. Eleven new segregate genera were described. Despite the wealth of literature, there was no consensus on the generic limits of *Berlinia* and in consequence taxonomic confusion surrounded *Berlinia* and its putatively allied generic segregates. In 1957, Léonard published a higher level tribal account in which he proposed a narrower circumscription for *Berlinia*. Léonard's delimitation was based on Harms' (1915) sections *Euberlinia* and *Macroberlinia* and gained wide acceptance by the authors of *Berlinia* accounts in the major African Floras, namely Torre & Hillcoat (1956) in *Conspectus Flora Angolensis*, Keay (1958) in *Flora of West Tropical Africa*, Brenan (1967) in *Flora of East Tropical Africa*, Aubréville (1968 and 1970, respectively) in *Flore du Gabon* and *Flore du Cameroun*. Hauman (1952b) raised section *Macroberlinia* to generic rank in *Flore du Congo Belge et du Ruanda-Urundi*. There is significant disagreement between some of these floristic accounts of the genus which we believe can be resolved by revising *Berlinia* over its entire distribution.

This paper presents the progress that has been made towards clarifying the species-level taxonomy of the genus. Eighteen species are recognized, including two species recently described (Mackinder, 2006), of which 16 are assigned to section *Berlinia*. Within this section, species are seldom distinguished by a unique character or characters but instead species delimitation frequently rests on unique combinations of characters. Our findings confirm Brenan's (1963) observation that the species of this section 'are all uncommonly closely related to one another'.

The primary aim of this synopsis is to provide a means to identification. A brief description of the genus, the characters differentiating the two sections (Table 1) and keys to the species based on herbarium material and pods are presented. To assist in the use of the former key, the comparative states of four characters have been illustrated (Fig. 1). Geography is included in the key where it can assist the user in choosing the correct option. Pending the results of a phylogenetic investigation, the species are treated in alphabetical order within the two sections. For each species the accepted name with a brief synonymy is given, followed by geographical distribution, citation of selected specimens and a short description of recorded habitats.

SYNOPSIS OF *BERLINIA* NOM. CONSERV.

Berlinia Sol. ex Hook.f. in Hook., Niger Flora: 326–328 (1849), *nom. conserv.* –

Type: *Berlinia grandiflora* (J.Vahl) Hutch. & Dalziel.

Westia J.Vahl, Skr. Naturhist.-Selsk. 6: 117 (1810). – Type: *Westia grandiflora* J.Vahl.

Small to large forest trees, rarely shrubs. *Leaves* compound in (1–)2–5(–6) pairs, lower pair often shorter and broader. *Inflorescence* axillary or terminal, a solitary robust (or rarely slender) erect raceme, a cluster of racemes or a few to

TABLE 1. Characters that distinguish *Berlinia* sections *Berlinia* and *Macroberlinia*

| <i>Berlinia</i> section <i>Berlinia</i> | <i>Berlinia</i> section <i>Macroberlinia</i> Harms |
|--|---|
| 1. Inflorescence commonly a few to many-branched panicle, sometimes a cluster of racemes or very rarely a slender, solitary raceme | Inflorescence a solitary robust erect raceme |
| 2. Bracts inconspicuous, early caducous, seldom seen | Bracts conspicuous, semi-persistent to persistent, often seen |
| 3. Petal development unequal; adaxial petal well developed, laterals and abaxials poorly developed | Petal development subequal |
| 4. Mature pods commonly densely golden puberulous, more rarely glabrous and drying dull or shiny | Mature pods glabrous, drying black and slightly shiny |

many-branched panicle. *Bracts* conspicuous and semi-persistent to persistent or inconspicuous, soon falling. *Bracteoles* large, fully enclosing the bud before anthesis. *Hypanthium* conspicuous, tubular, 9–22 mm long. *Sepals* 5, reflexed. *Petals* 5; petal development subequal, or adaxial petal well developed but laterals and abaxials poorly developed. *Stamens* 10, 9 fused at the base into a ring, 1 free. *Staminodes* absent. *Pods* up to 50 cm long, woody, laterally compressed, 2-valved, drying golden to dark brown or black, glabrous or hairy, explosively dehiscent, terminal suture broad, up to 18 mm wide. *Seeds* 2–7. *Seedling* germination epigeal.

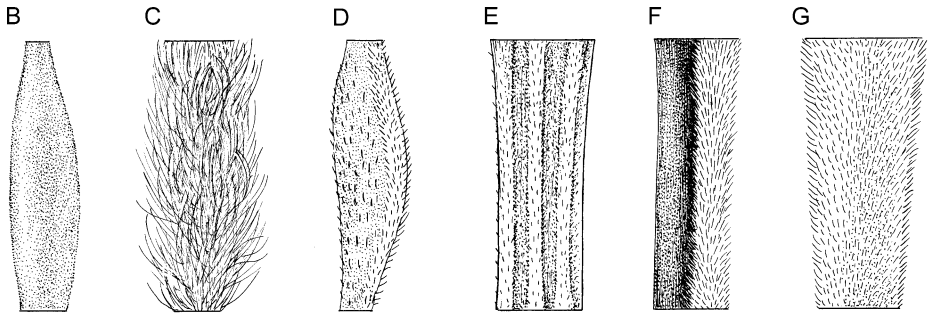
Of the 18 species, 17 are found in the Guineo-Congolian region, with a sole outlier in the coastal forests of southern Tanzania and northern Mozambique.

Key to the sections

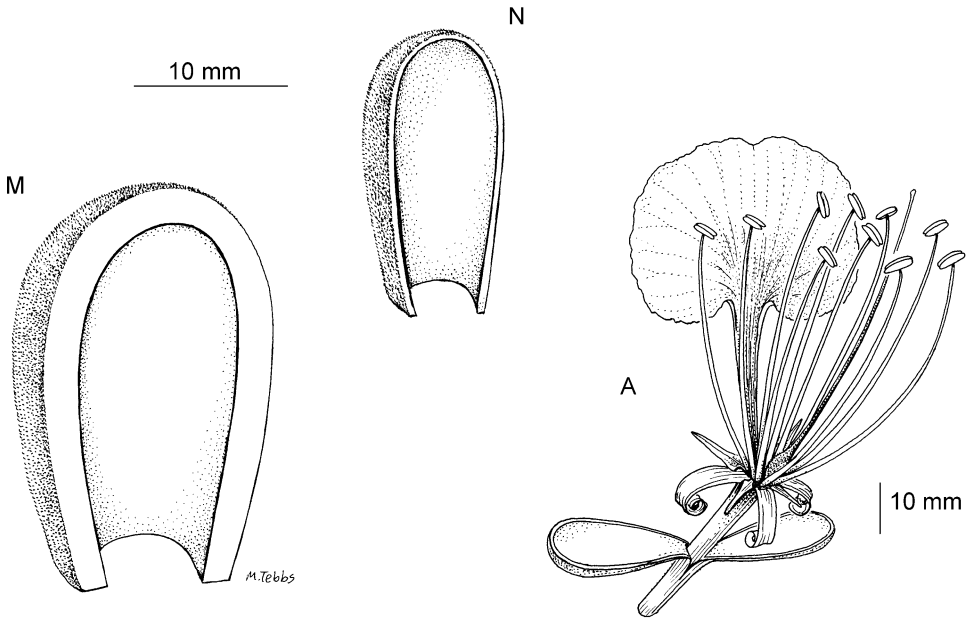
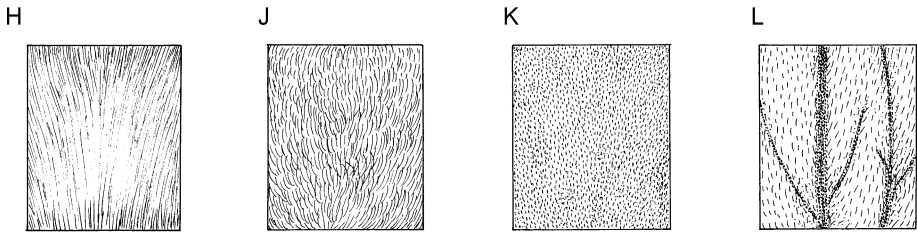
- 1a. Petals of similar length, the lamina of the adaxial petal broadest; bracts large, at least 22 mm long, conspicuous in the maturing inflorescence, sometimes persistent until the flowers have opened; immature and mature fruits glabrous, drying black and slightly shiny _____ section **Macroberlinia** (species 1 and 2)
- 1b. Petals very unequal in length, the adaxial petal broader and longer than the others, the lateral petals barely as long as the claw of the adaxial petal; bracts small, not exceeding 5 mm long, falling when the inflorescence is very immature; immature and mature fruits commonly densely golden puberulous, occasionally glabrous and then drying golden and shiny or dull black or brown _____ section **Berlinia** (species 3–18)

Key to the species of section Macroberlinia

- 1a. Bracts 45–105 mm long, enclosing and obscuring the unopened part of the inflorescence to give a crowded ‘head-like’ appearance, then falling when the



5 mm



M. Tebb

flowers open; bracteoles 52–75 mm long, glabrous or sparsely puberulous on the interior surface, the surface not concealed by the indumentum; width of the adaxial (widest) petal 55–92 mm; known from Nigeria, Cameroon, Equatorial Guinea, Gabon, Congo (Brazzaville), Congo (Kinshasa) and Angola _____

_____ **1. *B. bracteosa***

- 1b. Bracts 22–30 mm long, enclosing only very immature buds then falling, more mature buds clearly visible in the unopened part of the inflorescence; bracteoles 22–38 mm long, densely puberulous on the interior surface, the surface concealed by the indumentum; width of the adaxial (widest) petal 55–68 mm; known from Sierra Leone, Liberia, Ivory Coast and Ghana _____

_____ **2. *B. occidentalis***

Key to the species of section Berlinia

- 1a. Hypanthium glabrous, or sparsely and unevenly white pubescent, or the white pubescence present in one or more irregular narrow longitudinal bands, sometimes the band becoming broader and meeting towards the base of the hypanthium, most or all of the surface of the hypanthium not concealed by the indumentum, the indumentum not extending to the sepals _____ 2
- 1b. Hypanthium golden tomentose, either completely covered or the indumentum confined to one broad longitudinal band, the surface of the hypanthium concealed by the indumentum (where present), the indumentum sometimes extending to the sepals _____ 12
- 2a. Ovary moderately villous, the surface not concealed beneath; known only from Gabon _____ **15. *B. rabiensis***
- 2b. Ovary densely sericeous or densely puberulous, the surface concealed beneath; widespread _____ 3
- 3a. Ovary densely sericeous, the individual hairs clearly visible at $\times 10$ magnification _____ 4

FIG. 1. *Berlinia* section *Berlinia* floral ground plan with comparative states of four morphological characters in *Berlinia*. A, flower; B, ovary surface densely puberulous; C, ovary surface densely sericeous; D, ovary surface moderately villous; E, hypanthium surface with whitish pubescence in *irregular* narrow longitudinal bands; F, hypanthium surface partially concealed by a single broad golden tomentose band; G, hypanthium surface fully concealed by a golden tomentose indumentum; H, bracteole interior surface concealed by densely silky indumentum; J, bracteole interior surface concealed by densely villous indumentum; K, bracteole interior surface concealed by densely puberulous indumentum; L, bracteole interior surface only partially concealed by moderately puberulous indumentum; M, bracteole thick; N, bracteole thin. A from *Lisowski* 132, B from *Louis* 2322, C from *Latilo* FHI 34423, D from *Schoenmaker* 330, E from *Lisowski* 132, F from *Harley* 1494, G from *Preuss* 189, H from *Latilo* FHI 34423, J from *Gossweiler* 13745, K from *Louis* 2322, L from *Touissant* 2192, M from *Lisowski* 132, N from *Latilo* FHI 34423. Drawn by Margaret Tebbs.

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- 3b. Ovary densely puberulous, the individual hairs not visible at $\times 10$ magnification _____ 9
- 4a. Bracteole interior glabrous, sparsely to densely puberulous, the surface concealed or not by the indumentum _____ 5
- 4b. Bracteole interior densely villous or silky, the surface concealed by the indumentum _____ 11
- 5a. Bracteoles 11–19 \times 6–8 mm; pedicels 7–12 mm long; inflorescence axes glabrous to sparsely puberulous; known from Nigeria, Cameroon, Gabon and Congo (Brazzaville) _____ **3. B. auriculata**
- 5b. Bracteoles 22–51 \times 8–20 mm; pedicels 14–60 mm long; inflorescence axes moderately to densely puberulous _____ 6
- 6a. Hypanthium indumentum present, usually arranged in irregular longitudinal bands of pubescence, sometimes with a more complete covering but always some part of the surface clearly visible; bracteoles 45–51 \times 17–22 mm; pedicels 24–60 mm long, leaflets concolorous, the tertiary venation visible and raised; known from Gabon, Congo (Brazzaville), Congo (Kinshasa) and Angola (Cabinda) _____ **18. B. viridicans**
- 6b. Hypanthium glabrous or with scattered and sparse white pubescence; bracteoles 22–50 \times 8–15 mm; pedicels 14–36 mm long, leaflets concolorous or discolorous, the tertiary venation visible and raised or not _____ 7
- 7a. Tertiary leaflet venation on both surfaces visible and raised, leaflets (1)2–3 pairs, usually concolorous and drying green; known from Nigeria, Cameroon, Equatorial Guinea, Gabon, Congo (Brazzaville), Congo (Kinshasa) and Angola _____ **6. B. congolensis**
- 7b. Tertiary leaflet venation on both surfaces indistinct, leaflets (2)3–5 pairs, discolorous or concolorous, usually drying brown _____ 8
- 8a. Style not exceeding 30 mm long; underside of leaflets glabrous; adaxial petal 35–48 mm long, bracteoles 8–13 mm wide, the interior surface moderately to densely puberulous, the surface only partially concealed by the indumentum; tree of coastal forest on sandy soil; known from Tanzania and Mozambique _____ **13. B. orientalis**
- 8b. Style more than 40 mm long; underside of leaflets glabrous; adaxial petal 44–62 mm long, bracteoles 10–15 mm wide, the interior surface densely puberulous, the surface visible in places; tree of coastal forest, known from Sierra Leone, Ivory Coast, Ghana, Nigeria, Cameroon, Equatorial Guinea and Gabon _____ **5. B. confusa**
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- 9a. Bracteoles 2–4 mm thick (see Note 1); 15–32 mm wide _____ 10
- 9b. Bracteoles thinner, c.1 mm thick; 9–18 mm wide; known from Congo (Brazzaville) and Congo (Kinshasa) _____ **14. B. phenacoea**

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- 10a. Leaflet length 3 or more times the width, leaflets often slightly falcate, upper pair of leaflets opposite, lower pairs opposite or sub-opposite; hypanthium unevenly pubescent, the surface clearly visible between irregular longitudinal bands of hairs; pedicels 23–60 mm long; petiolules 5–18 mm wide; known from Cameroon, Equatorial Guinea, Central African Republic, Gabon, Congo (Brazzaville) and Congo (Kinshasa) _____ **4. *B. brunelii***
- 10b. Leaflet length not more than 2½ times the width, leaflets straight, all pairs of leaflets opposite, hypanthium glabrous, occasionally with patches of pubescence at apex or with sparse scattered pubescence; pedicels 18–25 mm long; petiolules 7–12 mm long; known from Nigeria and Cameroon _____ **7. *B. coriacea***
- 11a. Bracteole interior densely silky, indumentum pale, soft to the touch and often with a slight sheen; petiolules 5–9 mm; upper leaflets 7.0–22.0 × 3.2–11.5 cm; petiole 20–42(–65) mm; bracteole width 11–20 mm; known from Mali, Guinea (Conakry), Niger, Sierra Leone, Ivory Coast, Ghana, Togo, Benin, Nigeria, Equatorial Guinea, Cameroon, Central African Republic and Congo (Kinshasa) _____ **10. *B. grandiflora***
- 11b. Bracteole interior densely villous, indumentum mid brown, not soft to the touch, without a sheen; petiolules 3–4 mm; upper leaflets 7.5–9.0 × 2.4–4.0 cm; petiole 12–20 mm; bracteole width 7–13 mm, known only from Congo (Kinshasa) _____ **16. *B. sapinii***
- 12a. Adaxial petal length 31–40 mm, adaxial petal width 21–40 mm _____ 13
- 12b. Adaxial petal length 52–85 mm, adaxial petal width 46–94 mm _____ 14
- 13a. Pedicels 10–12 mm long; adaxial petal width 21–28 mm; underside of leaflets frequently appearing glabrous or occasionally sparsely puberulous at × 10 magnification, at higher magnifications appearing sparsely to moderately puberulous; tertiary venation indistinct or visible above and below; leaf apex acuminate, acumen 4–13 mm; bracteoles 18–28 × 8–14 mm, interior surface densely pale to golden puberulous, becoming patchy on older bracteoles; known from Sierra Leone, Liberia, Ivory Coast and Ghana _____ **17. *B. tomentella***
- 13b. Pedicels 30–36 mm long; adaxial petal width c.40 mm; underside of leaflets moderately pubescent on mid-vein, secondary veins and very lower part of leaf blade and at higher magnifications; tertiary venation visible and somewhat raised; leaf apex acute; bracteoles 24–40 × 12–20 mm, interior surface densely villous; known from Congo (Kinshasa) and Angola _____ **12. *B. lundensis***
- 14a. Bracteoles not exceeding 1 mm thick; narrowly oblong, 14–16 mm wide; known only from Nigeria _____ **11. *B. hollandii***
- 14b. Bracteoles 2–4 mm thick; obovate, 16–35 mm wide _____ 15
- 15a. Inflorescence a branched panicle; leaf apex acute or short (3 mm) acuminate; adaxial petal 50–75 × 43–72 mm wide; known from altitudes of (450–)900–1700 m; known from Congo (Kinshasa), Burundi, Angola and Zambia _____ **9. *B. giorgii***
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- 15b. Inflorescence a cluster of 2–4 racemes, rarely a solitary raceme; leaf apex short to long acuminate, acumen (5–)7–12 mm; adaxial petal 67–85 × 55–94 mm wide; known from altitudes of 1–400 m; known from Nigeria, Cameroon and Gabon _____ **8. *B. craibiana***

Key to mature Berlinia pods

The majority of *Berlinia* species cannot be distinguished in fruit alone. However, a third of the species, including some common ones, can be recognized from fallen valves and so a pod key is included here. The pods of *Berlinia hollandii* from Nigeria are unknown.

- 1a. Pods covered in a dense felt of pale gold, gold to reddish-gold indumentum
4. *B. bruneelii*; known from Cameroon, Equatorial Guinea, Central African Republic, Gabon, Congo (Brazzaville) and Congo (Kinshasa).
 6. *B. congolensis*; known from Nigeria, Cameroon, Equatorial Guinea, Gabon, Congo (Brazzaville), Congo (Kinshasa) and Angola.
 8. *B. craibiana*; known from Nigeria, Cameroon and Gabon.
 9. *B. giorgii*; known from Congo (Kinshasa), Burundi, Angola and Zambia.
 10. *B. grandiflora*; Mali, Guinea (Conakry), Niger, Sierra Leone, Ivory Coast, Ghana, Togo, Benin, Nigeria, Cameroon, Equatorial Guinea, Central African Republic and Congo (Kinshasa).
 12. *B. lundensis*; known from Congo (Kinshasa) and Angola.
 13. *B. orientalis*; known from Tanzania and Mozambique.
 14. *B. phenacoa*; known from Congo (Brazzaville) and Congo (Kinshasa).
 16. *B. sapinii*; known only from Congo (Kinshasa).
 17. *B. tomentella*; known from Sierra Leone, Liberia, Ivory Coast and Ghana.
 18. *B. viridicans*; known from Gabon, Congo (Brazzaville), Congo (Kinshasa) and Angola (Cabinda).
- 1b. Pods glabrous or appearing so to the naked eye and at × 10 magnification, the surfaces drying golden brown, mid-brown, dark brown or black _____ 2
- 2a. Pods drying dark brown to black _____ 3
- 2b. Pods drying golden brown or mid-brown _____ 5
- 3a. Pods glabrous at all magnifications, surface appearing dull or slightly shiny _____ 4
- 3b. Pod appearing glabrous at × 10 magnification but at higher magnification minutely reddish puberulous, surface is dull; known from Sierra Leone, Liberia, Ivory Coast, Ghana, Nigeria, Cameroon, Equatorial Guinea and Gabon _____ 5. *B. confusa*
- 4a. Pod surface glossy _____ 1. *B. bracteosa* or 2. *B. occidentalis* (see Note 2)
- 4b. Pod surface dull; known only from Gabon _____ 15. *B. rabiensis*

- 5a. Pod surface glossy with clearly visible transverse veins; known from Nigeria, Cameroon, Gabon and Congo (Brazzaville) _____ 3. *B. auriculata*
 5b. Pod surface dull and scurfy without clearly visible transverse veins; known from Nigeria and Cameroon _____ 7. *B. coriacea*

Section Macroberlinia

1. *Berlinia bracteosa* Benth., Trans. Linn. Soc. London 25: 309 (1866). – *Westia bracteosa* (Benth.) J.F. Macbr., Contrib. Gray Herb. n.s. 3, 59: 20 (1919). – *Macroberlinia bracteosa* (Benth.) Hauman, Bull. Séances Inst. Roy. Colon. Belge Bull. 23: 518 (1952). – Type: Equatorial Guinea, Bioco, Mann 1434 (holo K!; iso P!).

Shrub or tree (2–)8–35 m tall; diameter at breast height (dbh) 11–90 cm. *Leaflets* in (3–)4–5(–6) pairs; terminal pair (see Note 3) 11.8–44.0 × 4.2–12.6 cm, concolorous or almost so; underside appears glabrous at × 10 magnification but puberulous at higher magnifications; tertiary venation indistinct above, visible below; apex rounded to shortly acuminate. *Petioles* 18–64 mm long. *Petiolules* 8–13 mm long. *Inflorescence* a solitary robust raceme, axes densely golden brown puberulous. *Bracts* present, 45–105 mm long, persisting in the unopened part of the inflorescence. *Bracteoles* 52–75 × 15–20 mm, interior surface glabrous or sparsely puberulous. *Pedicels* 12–20 mm long. *Hypanthium* glabrous or sparsely and unevenly pubescent. *Petals* subequal in length; adaxial petal 52–78 × 55–92 mm, apex bilobed. *Ovary* densely sericeous, individual hairs visible at × 10 magnification. *Immature and mature pod* glabrous, drying black and slightly shiny.

Distribution and habitat. Nigeria, Cameroon, Equatorial Guinea, Gabon, Congo (Brazzaville), Congo (Kinshasa) and Angola. Lowland forest, forest edges and clearings, along rivers, streams and mangrove edge; 1–650 m.

Selection of specimens examined. **Nigeria:** Calabar, Akampka at the reserve boundary near Awi, fl. 19 v 1965, *Daramola* FHI 55577 (FHI, K!). **Equatorial Guinea:** Luba – Malabo, km 2, fr. 24 iv 1987, *Carvalho* 2851 (BR!, K!). **Cameroon:** 16 km on the road from Ebolowa to Minkok, fl. 30 iv 1975, *J.J.F.E. de Wilde* 8216 (B, BR!, EA, HBG!, K!, LG, MA, MO, P!, PRE, SRGH, WAG!, YA). **Gabon:** 5–30 km NNW of Ndjolé, fl. 27 iv 1992, *Breteler* 11138 (G!, WAG!). **Congo (Brazzaville):** Kouilou, 2°47'S, 11°51'E, fr. undated, *Sargos* 181 (P!). **Congo (Kinshasa):** Luki. Percée de la Ntosi, fl. 21 v 1952, *Gutweiller* R.48 (ZT!). **Angola:** Cabinda, alto Maiombe, fl. 27 vi 1953, *Pinto* 355 (LISC!).

2. *Berlinia occidentalis* Keay, Kew Bull. 1954: 269 (1954). – Type: Liberia, *Baldwin* 11604 (holo K!).

Tree (3–)10–35 m tall; dbh 15–90 cm. *Leaflets* in 4–5 pairs; terminal pair 12.8–25.2 × 5.2–7.6 cm, concolorous; underside puberulous, hairs just visible at × 10 magnification; tertiary venation visible, sometimes raised above and below; apex acute to shortly acuminate. *Petioles* 15–51 mm long. *Petiolules* 8–14 mm long.

Inflorescence a solitary raceme, axes densely reddish brown puberulous. *Bracts* 22–30 mm long, present only in very immature inflorescences. *Bracteoles* 22–38 × 12–30 mm, interior surface densely puberulous. *Pedicels* 21–46 mm long. *Hypanthium* moderately pubescent. *Petals* subequal in length; adaxial petal 40–70 × 55–68 mm, apex bilobed. *Ovary* densely sericeous, individual hairs visible at × 10 magnification. *Immature and mature pod* glabrous, drying black and slightly shiny.

Distribution and habitat. Sierra Leone, Liberia, Ivory Coast and Ghana. Fringing forest, commonly along streams and rivers, sometimes in drier areas and on sandy soil; 1–200 m.

Selection of specimens examined. **Sierra Leone:** Gorahun, fl. & fr. 5 vi 1952, *Small* 725 (BR!, K!, P!). **Liberia:** Near Firestones Plantations along Dukwai R., fl. 1929, *Cooper* 217 (F!, NY!). **Ivory Coast:** Guiglo, Tai National Park, 2 km ENE of Tai Ecological Station, fr. 5 ix 2001, *Wieringa* 4322 (WAG!). **Ghana:** Western Region, close to Aiyinasi, fl. 27 ii 1995, *Jongkind* 2068 (MO, WAG!).

Section *Berlinia*

3. *Berlinia auriculata* Benth., *Trans. Linn. Soc. London* 25: 309 (1866). – Type: Cameroon, *Mann* 2195 (holo K!; iso BM!, GH!, NY!).

Shrub or tree 2–20(–30) m tall; dbh 5–77 cm. *Leaflets* in 2–3(–4) pairs; terminal pair 7.1–22.4 × 3.5–15.0 cm, discolorous; underside glabrous or occasionally sparsely scattered pubescent; tertiary venation visible, sometimes raised above, visible but not raised below; apex shortly acuminate. *Petioles* 10–48 mm long. *Petiohules* 7–10 mm long. *Inflorescence* commonly a cluster of racemes, rarely a solitary raceme; axes glabrous to sparsely yellowish grey puberulous. *Bracts* falling early, not seen. *Bracteoles* thin, 11–19 × 6–8 mm, interior surface glabrous to moderately puberulous, the surface not concealed by the indumentum. *Pedicels* 7–12 mm long. *Hypanthium* glabrous. *Petals* unequal in length; adaxial petal 32–44 × 15–24 mm, apex bilobed. *Ovary* densely sericeous, individual hairs visible at × 10 magnification. *Immature and mature pod* glabrous, drying golden or medium brown.

Distribution and habitat. Nigeria, Cameroon, Gabon and Congo (Brazzaville). Lowland forest, along rivers and on beaches; 1–500(–900) m.

Identification note. May be misidentified as *Berlinia congolensis* (Baker f.) Keay when sterile but note leaflets of *B. auriculata* are frequently discolorous (concolorous in *B. congolensis*).

Selection of specimens examined. **Nigeria:** Degema Distr., fl. ii 1957, *Chesters* 11 (K!). **Cameroon:** Secondary forest near Mundemba town, fl. 12 v 1986, *D. W. Thomas* 6126 (BR!, K!, MO, NY!, WAG!). **Gabon:** Réserve de la Lopé au sud d'Ayem, fl. 30 iii 1989, *McPherson* 13827 (F!, MO, NY!, P!). **Congo (Brazzaville):** Environs de Brazzaville, forêt de la Djoumouna, fl. 27 i 1967, *Sita* 1542 (P!, WAG!).

4. *Berlinia bruneelii* (De Wild.) Torre & Hillc., *Bol. Soc. Brot. ser. 2*, 29: 40 (1955). – *Berlinia acuminata* Sol. ex Hook.f. var. *bruneelii* De Wild., *Ann. Mus. Congo Belge*,

Bot. sér. 5, 2: 138 (1907). – *Berlinia grandiflora* var. *bruneelii* (De Wild.) Hauman, Fl. du Congo Belge et du Ruanda-Urundi 3: 393 (1952). – Type: Congo (Kinshasa), *Bruneel* 26 (holo BR!).

Tree 2–40 m tall; dbh 20–25 cm. *Leaflets* in 2–4 pairs; terminal pair 11–35 × 4.1–12 cm, commonly discolorous, rarely concolorous; underside appears glabrous at × 10 magnification but at higher magnifications occasionally a sparse pubescence is visible on the lower part of the mid- and secondary veins; tertiary venation commonly distinct and sometimes raised above and below; apex rounded, acute or shortly acuminate, acumen to 3 mm. *Petioles* 11–36 mm long. *Petiolules* 5–18 mm long. *Inflorescence* axillary, commonly a pair of racemes, rarely a solitary raceme, occasionally a few-branched panicle; axes densely puberulous. *Bracts* falling early, not seen. *Bracteoles* thick, 30–53 × 15–32 mm, interior surface densely pale puberulous. *Pedicels* 23–60 mm long. *Hypanthium* unevenly pubescent, the surface clearly visible between irregular longitudinal bands of hairs. *Petals* unequal in length; adaxial petal 48–88 × 40–83 mm. *Ovary* densely puberulous, individual hairs not visible at × 10 magnification. *Immature and mature pod* densely golden velutinous.

Distribution and habitat. Cameroon, Equatorial Guinea, Central African Republic, Gabon, Congo (Brazzaville), Congo (Kinshasa) and Angola (unconfirmed sterile specimens). Lowland forest, near streams and edge of marshes; 250–600 m.

Identification note. Has been misidentified as *Berlinia craibiana* Baker f. and occasionally as *B. giorgii* De Wild. and can be confused with *B. phenacoa* Mackinder when sterile (or occasionally when in flower). Differs vegetatively from *Berlinia craibiana* in having longer petioles, 11–36 mm long compared with (0–)2–10(–14) mm in *B. craibiana*, longer petiolules, 5–18 mm long compared with 4–8 mm in *B. craibiana*, and leaf apices rounded, acute or shortly acuminate with an acumen up to 3 mm long compared with short to long acuminate, acumen (5–)7–12 mm long in *B. craibiana*. Sterile herbarium specimens of *Berlinia bruneelii* may be confused with *B. giorgii* although the latter has comparatively short petiolules (3–7 mm long). Habitat notes can be a useful indicator in separating these two species as *Berlinia bruneelii* is a tree of lowland (250–600 m) gallery or swamp forest, often found near streams and at the edge of marshes, whereas *B. giorgii* is an upland tree (450–)950–1700 m preferring the drier habitats of wooded grassland, woodland or gallery forest. Sterile collections of *Berlinia bruneelii* are often indistinguishable from sterile specimens of *B. phenacoa* although specimens with petiolules exceeding 10 mm belong to *B. bruneelii*.

Selection of specimens examined. **Cameroon:** c.30 km S of M'Balmayo, fl. 13 ii 1964, *W.J.J.O. de Wilde* 1921 (B, BR!, K!, MO, P, PRE, WAG!, YA). **Equatorial Guinea:** Rio Muni, fl. 14 iv 1914, *Tessman* 950 (B, K!). **Gabon:** c.10 km route Moanda–Mbinda, fl. 15 ix 1970, *Breteler* 6474 (BR!, P!, WAG!). **Congo (Brazzaville):** Odzala Nat. Park, fl. 17 ii 1995, *Champluvier* 5417 (BR!). **Central African Republic:** Sangha Economique, Ndakan, gorilla study area, fl. 26 ii 1988, *Harris & Fay* 260 (MO!, WAG!). **Congo (Kinshasa):** Katanga R., Lupala Parc, fl. 13 ii 1957, *Robyns* 4318 (BR!, K!).

5. *Berlinia confusa* Hoyle, Kew Bull. 1934: 184 (1934). – Type: Nigeria, *J. Smith* 54 (holo K!; iso FHI).

Tree (8–)15–30(–40) m tall; dbh 10–100 cm. *Leaflets* in 3–5 pairs; terminal pair 5.5–17 × 2.7–6.6(–9) cm, discolorous; underside frequently appearing glabrous or occasionally sparsely puberulous at × 10 magnification but at higher magnifications a sparsely to moderately puberulous indumentum is sometimes visible; tertiary venation indistinct above and below; apex acute or acuminate, acumen 5–7 mm long (when present). *Petioles* 14–35(–50) mm long. *Petiolules* 5–6 mm long. *Inflorescence* a one to few-branched panicle, axes densely reddish-brown puberulous. *Bracts* falling early, not seen. *Bracteoles* thin, (22–)27–34(–45) × (10–)13–15 mm, interior surface densely puberulous. *Pedicels* 15–31 mm long. *Hypanthium* commonly glabrous or with sparse scattered pubescence, rarely more densely hairy. *Petals* unequal; adaxial petal 44–62 × 35–55 (–62) mm; apex not appearing bilobed. *Ovary* densely sericeous, individual hairs visible at × 10 magnification. *Immature pod* appears glabrous at × 10 magnification, minutely reddish puberulous at higher magnifications; *mature pod* scurfy, drying dull black.

Distribution and habitat. Sierra Leone, Liberia, Ivory Coast, Ghana, Nigeria, Cameroon, Equatorial Guinea and Gabon. Lowland humid forest; 1–400 m.

Identification note. Has been misidentified as *Berlinia congolensis* when sterile but leaflets of *B. confusa* are discolorous and in 3–5 pairs (concolorous and in 2–3 pairs in *B. congolensis*). *Berlinia confusa* is a widespread taxon whose geographical range encompasses that of *B. tomentella* Keay from which (in some cases) it can be very difficult to distinguish when sterile. The latter is a small tree, 8–10 m tall, commonly found in swamps, along forest edges and in secondary forest whereas *Berlinia confusa* is a larger, (8–)15–30(–40) m tall, forest tree.

Selection of specimens examined. **Sierra Leone:** Gola Forest, fr. 31 v 1952, *Small* 711 (BR!, K!, P!). **Liberia:** Ganta, about 160 miles N of Monrovia, fl. 27 i 1969, *Jansen* 1356 (BR!, NY!, P!, WAG!). **Ivory Coast:** 56 km N of Sassandra, E of Beyo, fl. 28 i 1959, *Leeuwenberg* 2612 (BR!, E!, K!, L!, P!, UPS!, WAG!, Z!). **Ghana:** fl. v 1930, *Vigne* FHI 1676 (FHI, G!, K!). **Nigeria:** Idanre F.R., southern part of reserve near Lagos-Benin Rd., fl. 1 vi 1957, *Keay* FHI 37039 (FHI, K!). **Cameroon:** 1 km on a forestry road branching S, 33 km on road from Kribi to Bipindi, fl. 13 ii 1994, *Wieringa* 2194 (G!, WAG!). **Equatorial Guinea:** Bata-Utonde: Estrada kms 21–22, area da povoação de Ebeevang, fl. 13 vi 1991, *Carvalho* 4731 (BR!, NY!). **Gabon:** Near Sablière, 4 km N of Libreville, fl. 13 iii 1985, *Reitsma* 657 (NY!, WAG!).

6. *Berlinia congolensis* (Baker f.) Keay, Kew Bull. 1954: 271 (1954). – *Berlinia heudelotiana* Baill. var. *congolensis* Baker f., Leg. Trop. Afr. 3: 684 (1930). – Type: Angola, *Gosswailer* 9042 (holo BM!; iso K!, MO).

Berlinia grandiflora (J.Vahl) Hutch. & Dalziel var. *pseudoauriculata* Hauman, Bull. Séances Inst. Roy. Colon. Belge Bull. 23: 523 (1952). – Type: Congo (Kinshasa), *Dacremont* 268 (holo BR!; iso K!, NY!).

Tree 3–20 m tall; dbh 15–65(–120) cm. *Leaflets* in (1)2–3 pairs; terminal pair 9.4–16 × 6–8 cm, usually concolorous and drying green; underside glabrous; tertiary venation distinct and raised above and below; apex acute to acuminate, acumen

4–15 mm long. *Petioles* 10–31 mm long. *Petiolules* 6–9 mm long. *Inflorescence* a cluster of racemes or a slender panicle; axes densely puberulous. *Bracts* falling early, not seen. *Bracteoles* thin, 27–34 × 8–12 mm, interior surface sparsely to densely puberulous. *Pedicels* 18–36 mm long. *Hypanthium* glabrous, occasionally with patches of pubescence at apex. *Petals* unequal in length; adaxial petal 45–55 × 44–54 mm. *Ovary* densely sericeous, individual hairs visible at × 10 magnification. *Immature and mature pod* densely golden velutinous.

Distribution and habitat. Nigeria, Cameroon, Equatorial Guinea, Gabon, Congo (Brazzaville), Congo (Kinshasa) and Angola. Lowland humid forest, forest edges, border of swamps, along streams and gallery forest; 200–900 m.

Identification note. Has been misidentified as *Berlinia auriculata* and *B. confusa* when sterile. See identification notes under those species for differences.

Selection of specimens examined. **Nigeria:** Eket, fl. undated, *Talbot* 3110 (BM!, K!, Z!). **Cameroon:** Campo, road to Ile Dipikar, fl. 16 ii 1994, *Wieringa* 2244 (WAG!). **Equatorial Guinea:** Bata-Senge, estrada km 24, 1°51'N, 9°45'E, fl. 13 v 1997, *A.M. de Carvalho* 6317 (MA, MO!, WAG!). **Gabon:** Region du Nyanga, Tchibanga, fl. 14 iii 1914, *Le Testu* 1713 (BM!, BR!, G, NY!, P!). **Congo (Brazzaville):** Kouilou, *Sargos* 73 (P!). **Congo (Kinshasa):** Kimpangu R., Luidi, fl. 20 ii 1952, *Devred* 1103 (BR!). **Angola:** Lunda, R. Luachimo, Dundo, fl. 10 ix 1946, *Gossweiler* 13573 (BM!, K!).

7. *Berlinia coriacea* Keay, *Kew Bull.* 1954: 272 (1954). – Type: Nigeria, *Kennedy* 1694 (holo FHO!; iso K!).

Tree 6–25 m tall; dbh 25–30 cm. *Leaflets* in (1–)2–3 pairs; terminal pair 16.8–31.3 × 6.7–13.5 cm, discolorous; underside glabrous to sparsely pubescent, sometimes more densely so along the mid- and secondary veins, tertiary venation indistinct above, visible and somewhat raised below, apex commonly short acuminate, sometimes acute or rounded. *Petioles* 20–48 mm long. *Petiolules* 7–12 mm long. *Inflorescence* a few-branched panicle, rarely a cluster of racemes or a solitary raceme; axes moderately to densely puberulous. *Bracts* falling early, not seen. *Bracteoles* thick, 35–50 × 16–22 mm, interior surface moderately to densely puberulous. *Pedicels* 40–48 mm long. *Hypanthium* glabrous, occasionally with patches of pubescence at apex or with sparse scattered pubescence. *Petals* unequal in length; adaxial petal 62–80 × 50–70 mm. *Ovary* densely puberulous, individual hairs not visible at × 10 magnification. *Immature pod* densely golden puberulous (*Onochie* 31230); *mature pod* surface appearing glabrous, dull and scurfy at × 10 magnification.

Distribution and habitat. Nigeria and Cameroon (see identification note). Lowland forest, swampy areas and near water; 1–600 m.

Identification note. *W.J.J.O. de Wilde* 1927 from Cameroon compares well with typical *Berlinia coriacea* in most respects and hence is placed here although the hypanthium indumentum is atypical.

Selection of specimens examined. **Nigeria:** Sapoba, fl. undated, *Kennedy* 1656 (BR!, F!, GH!, NY!). Shashaka F.R., Ijebu Prov., fl. 8 iv 1935, *Richards* 3344 (BM!, BR!, G!). **Cameroon:**

Centre agronomique N'Kolbisson, 8 km W of Yaoundé, fl. 22 ii 1964, *W.J.J.O. de Wilde* 1927 (WAG!).

8. *Berlinia craibiana* Baker f., Cat. Talbot's Nigerian Pl.: 27 (1913). – Type: Nigeria, *Talbot* 1524 (holo BM!; iso K!, Z!).

Shrub or more commonly a tree 3–30 m tall; dbh 20–40 cm. *Leaflets* in (2–)3–5 pairs; terminal pair (8.2–)12.3–19.5 × 3.4–8.5 cm, concolorous or discolorous; underside pubescence visible on the mid-vein and basal half of secondary veins at × 10 magnification, but at higher magnifications pubescence also visible on leaf blade; tertiary venation distinct and raised above and below; apex short to long acuminate, acumen (5–)7–12 mm long. *Petioles* (0–)2–10(–14) mm long. *Petiohules* 4–8 mm long. *Inflorescence* commonly a cluster of 2–4 racemes, rarely a solitary raceme; axes moderately or (more commonly) densely golden puberulous. *Bracts* falling early, not seen. *Bracteoles* thick, (23–)35–54 × 17–34 mm, interior surface densely puberulous. *Pedicels* 28–72 mm long. *Hypanthium* densely tomentose, the surface concealed by the indumentum. *Petals* unequal in length; adaxial petal 67–85 × 55–94 mm, apex not clearly bilobed. *Ovary* densely sericeous, individual hairs visible at × 10 magnification. *Immature and mature pod* densely golden velutinous.

Distribution and habitat. Nigeria, Cameroon and Gabon. Lowland humid forest, forest edges, along streams and in secondary forest; 1–400 m.

Identification note. Has been confused with *Berlinia bruneelii* or *B. giorgii* when sterile. See identification notes under *Berlinia bruneelii*. Occasionally confused with *Berlinia viridicans* Baker f. when sterile but at × 10 magnification pubescence is visible on leaflet underside along mid-vein and basal half of secondary veins (underside of leaflets of *B. viridicans* appears glabrous at × 10 magnification) and leaf apex is short to long acuminate (acute in *B. viridicans*).

Selection of specimens examined. **Nigeria:** fl. 1928, *Kennedy* 167 (FHI, G!). **Cameroon:** Bipindi, fl. 1904, *Zenker* 2937 (BR!, E!, G!, HBG!, L!, P!, WAG!, Z!). **Gabon:** Rabi area, road from Kouna to Rabi, between Echira and Niunga junction, fr. 18 v 1992, *Breteler* 11526 (WAG!).

9. *Berlinia giorgii* De Wild., Pl. Bequaert. 3: 140 (1925). – Type: Congo (Kinshasa), *Giorgi* 195 (holo BR!).

Berlinia giorgii De Wild. var. *gossweileri* Baker f., J. Bot. 66, Suppl. 1: 141 (1928). – Type: Angola, *Gossweiler* 8828 (holo BM!; iso K!).

Berlinia giorgii De Wild. var. *gilletii* (De Wild.) Hauman, Fl. du Congo Belge et du Ruanda-Urundi 3: 395 (1952). – Type: Congo (Kinshasa), *Butaye* s.n. (holo BR!).

Berlinia giorgii De Wild. var. *vernica* Hauman, Inst. Roy. Colon. Belge Bull.: 23 (1952). – Type: Congo (Kinshasa), *Hardy* 38 (holo BR!).

Berlinia giorgii (De Wild.) var. *pubescens* Hauman, Fl. du Congo Belge et du Ruanda-Urundi 3: 395 (1952). – Type: Congo (Kinshasa), *Cabra-Michel* 1 (holo BR!).

Berlinia sp. 1. White, For. Fl. N. Rhod.: 100 (1962).

Shrub or tree 4–18 m tall; dbh 30–50 cm. *Leaflets* in (3–)4–5 pairs; terminal pair 10.5–19(–37) × 5.8–10.5(–17) cm, discolorous; underside with a sparse pubescence visible on the mid-vein (rarely a much denser covering is present; see Note 4) at × 10 magnification but at higher magnification a sparse pubescence also visible on basal part of the secondary veins, this occasionally extending to the base of the blade; tertiary venation visible, somewhat raised; apex acute or short acuminate, acumen to 3 mm long. *Petioles* 14–60(–81) mm long. *Petiolules* 3–7 mm long. *Inflorescence* a terminal or axillary branched panicle; axes densely golden or reddish golden puberulous. *Bracts* falling early, not seen. *Bracteoles* thick, 32–45 × 16–25 mm, interior surface densely pale puberulous. *Pedicels* 18–30 mm long. *Hypanthium* densely tomentose, the surface concealed by the indumentum. *Petals* unequal in length; adaxial petal 50–75 × 43–72 mm. *Ovary* densely puberulous, individual hairs not visible at × 10 magnification. *Immature and mature pod* densely golden velutinous.

Distribution and habitat. Angola, Congo (Kinshasa), Burundi and Zambia. Gallery forest, woodland and wooded grassland; (450–)950–1700 m.

Identification note. Has been confused with *Berlinia bruneelii* and *B. craibiana*. See identification note under *Berlinia bruneelii*.

Selection of specimens examined. **Angola:** Uige Distr., a cerca de 3 km a NW de Quimbele, fl. 29 viii 1971, *Ramundo* 872 (BR!, LISC!, LUA, WAG!). **Congo (Kinshasa):** Katanga R., Lupala Parc, fl. 5 viii 1953, *Robyns* 3873 (BR!, K!, WAG!). **Burundi:** Burunuripo et Mumonge, fr. vi 1967, *De Clerck* 18 (BR!). **Zambia:** Abercorn, fl. 7 v 1936, *Burt* 5909 (BM!, BR!).

10. *Berlinia grandiflora* (J.Vahl) Hutch. & Dalziel, Kew Bull. 1928: 398 (1928) (see Note 5). – *Westia grandiflora* J.Vahl, Skr. Naturhist.-Selsk. 6: 118 (1810). – Type: Benin, *Isert* s.n. (holo C).

Berlinia acuminata Sol. ex Hook.f. in Hook., Niger Flora: 326 (1849) excl. spec. Smeathman, excl. spec. Ansell. – Type: Guinea, *Heudelot* 886 (lecto K! [see Note 6]; iso BR!, GH!, HBG!, P, WAG!).

Berlinia heudelotiana Baill., *Adansonia* 6: 185 (1865). – Type: Guinea, *Heudelot* 886 (holo P; iso BR!, GH!, K!).

Tree 2–20(–30) m tall; dbh 10–70 cm. *Leaflets* in (2–)3–4(–5) pairs; terminal pair 7–22 × 3.2–11.5 cm, concolorous or almost so; underside glabrous, sparsely or moderately pubescent, pubescence sometimes confined to leaflet margins and venation; tertiary venation indistinct above, visible below; apex rounded to acuminate. *Petioles* 20–42(–65) mm long. *Petiolules* 5–9 mm long. *Inflorescence* a much-branched panicle; axes densely reddish-brown puberulous. *Bracts* falling early, not seen. *Bracteoles* thin, 23–32(–46) × 11–20 mm, interior surface densely villous. *Hypanthium* glabrous, occasionally with patches of pubescence at apex. *Petals* unequal in length; adaxial petal 36–66 × 32–52(–74) mm, apex not appearing bilobed. *Ovary* densely sericeous, individual hairs visible at × 10 magnification. *Immature and mature pod* densely golden velutinous.

Distribution and habitat. Mali, Guinea (Conakry), Niger, Sierra Leone, Ivory Coast, Ghana, Togo, Benin, Nigeria, Equatorial Guinea, Cameroon, Central African Republic and Congo (Kinshasa). Fringing forest, along stream and rivers; 1–700 m.

Selection of specimens examined. **Mali:** Koumana, fl. 22 iii 1899, *Chevalier* 612 (BR!, G!, L!, P!, Z!). **Guinea (Conakry):** Kouroussa, fl., *Pobéguin* 861 (K!, P). **Niger:** Brousse à Karités, 60 km S d'Ossou, 13°03'N, 3°12'E, fl. 5 i 1943, *Marchal* 6303 (P!). **Sierra Leone:** Central Province, Njala, fl. 4 iv 1928, *Deighton* 1119 (BM!, K!). **Ivory Coast:** Bouna, fl. 23 vi 1989, *Poilecot* 1969 (G!). **Ghana:** Bole, fl. v 1935, *Vigne* 3834 (BM!, K!, NY!). **Togo:** Between Sokoda and Tchamba, gallery forest along the R. Koloware, fl. 19 vii 1984, *Ake Assi* 16688 (G!). **Benin:** Mt Dahomey, Cercle de Djougou, fl. 30 v 1910, *Chevalier* 23829 (P!, WAG!). **Nigeria:** Western State, 1.7 km S of Itori, fl. 17 xii 1973, *R.C. Brown* 913 (K!, LUH, NY!). **Equatorial Guinea:** Bioco, Territorium Haute Volta, fl. v 1968, *Moreau* 82 (K!, WAG!). **Cameroon:** Bange, Bezirk Moloundou, fl. 17 ii 1911, *Mildbraed* 4496 (HBG!). **Central African Republic:** 45 km S of Lidjumbo, fl. 12 ii 1989, *D.J. Harris* 1834 (MO, P!, WAG!). **Congo (Kinshasa):** Barumbu, near Basoko, fl. v 1921, *Goosens* 1693 (BR!).

11. *Berlinia hollandii* Hutch. & Dalziel, Kew Bull. 1928: 398 (1928). – Type: Nigeria, *Holland* 10 (holo K!).

Tree 7–10 m tall; dbh not recorded. *Leaflets* in 3–4 pairs; largest pair assumed as terminal pair but not attached to rachis, 15.5–18.4 × 5.3–6.0 cm, concolorous; underside pubescence visible on the mid- and secondary veins at × 10 magnification, but at higher magnifications sparse pubescence also visible on leaf blade; tertiary venation visible and slightly raised above and below; apex long acuminate, acumen 12–16 mm long. *Petioles* 19–32 mm long. *Petiolules* 8–10 mm long. *Inflorescence* a lax panicle, axes densely golden puberulous. *Bracts* soon falling, not seen. *Bracteoles* thin, 44–60 × 14–16 mm, interior surface densely puberulous. Pedicels 14–42 mm long. *Hypanthium* densely tomentose, the surface concealed by the indumentum. *Petals* unequal in length; adaxial petal 60–72 × 60–66 mm, apex not clearly bilobed. *Ovary* densely sericeous, individual hairs visible at × 10 magnification. *Immature and mature pod* unknown. Only known from two collections.

Distribution and habitat. Nigeria. Forest; c.100 m.

Selection of specimens examined. **Nigeria:** Old Calabar, fl. 19 iii 1897, *Holland* 10 (K!); Itu, Cross River, fl. undated, *Holland* 30 (K!).

12. *Berlinia lundensis* Torre & Hillc., Bol. Soc. Brot. ser. 2, 29: 41 (1955). – Type: Angola, *Gosswailer* 13745 (holo K!; iso LISC, P!).

Tree c.8 m tall; dbh not recorded. *Leaflets* in 3 pairs; terminal pair 10.7–15.2 × 4.4–7.5 cm, discolorous; moderately pubescent on mid-vein, secondary veins and very basal part of leaf blade; tertiary venation distinct and somewhat raised above and below; apex acute. *Petioles* 18–23 mm long. *Petiolules* 4–6 mm long. *Inflorescence* axillary, a branched panicle or cluster of racemes; axes densely reddish puberulous. *Bracts* falling early, not seen. *Bracteoles* thin, 24–40 × 12–20 mm, interior surface densely villous. Pedicels 25–45 mm long. *Hypanthium* densely tomentose, indumentum extending to the sepals, the surface concealed by the indumentum. *Petals* unequal in

length; adaxial petal c.38 × 40 mm. *Ovary* densely sericeous, individual hairs visible at × 10 magnification. *Immature and mature pod* densely golden velutinous.

Distribution and habitat. Angola and Congo (Kinshasa). Forest, river edge; 700 m.

Selection of specimens examined. **Congo (Kinshasa):** Kwango, fl. & fr. 1928, *Vanderyst* 16691 (BR!). **Angola:** Lunda, Dundo, Rio Luachimo, fl. 28 x 1946, *Gosswiler* 13745 (K!, LISC!, P!). Only known from these two gatherings.

13. *Berlinia orientalis* Brenan, Kew Bull. 18: 211 (1963). – Type: Mozambique, *Allen* 35 (holo K!).

Tree 6–25 m tall. *Leaflets* in 2–4 pairs; terminal pair 8–11.5 × 3.1–4.8 cm, concolorous or discolorous; underside glabrous; tertiary venation indistinct above, visible but not distinct below; apex acute. *Petioles* 16–42 mm long. *Petiolules* 5–7 mm long. *Inflorescence* a few-branched panicle; axes moderately to densely golden puberulous. *Bracts* falling early, not seen. *Bracteoles* thin, (13–, *Barbosa* 2087)22–30 × 8–13 mm, interior surface moderately to densely puberulous, the surface only partially concealed by the indumentum. *Pedicels* 12–20 mm long. *Hypanthium* glabrous or sparsely and unevenly (scattered) pubescent. *Petals* unequal in length; adaxial petal 42–48 × 33–50 mm, apex not always appearing bifid when pressed but two lobes are apparent after boiling of dried specimens. *Ovary* densely sericeous, individual hairs visible at × 10 magnification. *Immature and mature pod* densely golden velutinous.

Distribution and habitat. Tanzania and Mozambique. Coastal forest, sandy soils, locally abundant; 1–250 m.

Selection of specimens examined. **Tanzania:** Lindi, Lutamba-See, 40 km W of Lindi, fl. 7 ix 1934, *Schlieben* 5264 (BM!, BR!, G!, HBG!, P!, Z!). **Mozambique:** Cabo Delgado, entre Nangade & Palma, fl. 20 x 1942, *Mendonça* 1005 (BM!, K!, LISC!).

14. *Berlinia phenacoa* Mackinder, Kew Bull. 61(2): 161 (2006). – Type: Congo (Kinshasa), *Louis* 860 (holo BR!; iso K!, NY!).

Berlinia grandiflora sensu Hauman non (J.Vahl) Hutch. & Dalziel var. *grandiflora* in Fl. du Congo Belge et du Ruanda-Urundi 3: 389 (1952).

Tree (2–)5–20(–24) m tall; dbh 20–35 cm. *Leaflets* in 3–4 pairs; terminal pair 11–24.2 × 3–9 cm, commonly discolorous, very rarely concolorous or nearly so; underside glabrous; tertiary venation distinct and raised above, distinct and somewhat raised below; apex rounded, acute or short acuminate. *Petioles* 15–38 mm long. *Petiolules* 5–10 mm long. *Inflorescence* commonly a panicle, sometimes a cluster of 3–4 racemes; axes moderately puberulous. *Bracts* falling early, not seen. *Bracteoles* thin or leathery, 16–41 × 9–18 mm, interior surface densely golden puberulous. *Pedicels* 10–22 mm long. *Hypanthium* glabrous or sparsely to moderately unevenly (scattered) pubescent, the indumentum sometimes arranged in irregular narrow or broad bands. *Petals* unequal in length; adaxial petal 40–67 × 30–54 mm. *Ovary* densely puberulous, individual hairs not visible at × 10 magnification. *Immature and mature pod* densely golden velutinous.

Distribution and habitat. Congo (Brazzaville) and Congo (Kinshasa). Gallery forest; 350–750 m.

Identification note. Sterile collections are commonly indistinguishable from sterile collections of *Berlinia bruneelii*.

Selection of specimens examined. **Congo (Brazzaville):** Plateau des Cataractes, Lousseké a 4 kms de Kibossi près de la R. Gapiema, fl. 17 xii 1962, *Descoings* 9740 (P!, WAG!). **Congo (Kinshasa):** Yangambi, au 6 km NW de Poste, fl. 19 v 1936, *Louis* 3910 (BM!, BR!, K!, P!).

15. *Berlinia rabiensis* Mackinder, *Kew Bull.* 61(2): 162 (2006). – Type: Gabon, Schoenmaker 330 (holo WAG!).

Tree 25–40 m tall; dbh 75–110 cm. *Leaflets* in 3–5 pairs; terminal pair 16.2–21.5 × 6.3–9.1 cm, somewhat discoloured; underside frequently appearing glabrous or occasionally sparsely puberulous at × 10 magnification but at higher magnifications sparse to moderate appressed pubescence visible on some or all of blade; tertiary venation distinct and somewhat raised above and below; apex rounded. *Petioles* 36–64 mm long. *Petiolules* 7–12 mm long. *Inflorescence* a much-branched robust panicle; indumentum of axes dense pale to golden appressed puberulous. *Bracts* falling early, not seen. *Bracteoles* thin, 22–30 × 9–15 mm, interior surface densely pale or golden puberulous, the surface concealed by the indumentum. *Pedicels* 5–17 mm long. *Hypanthium* glabrous or sparsely and unevenly pubescent with a single longitudinal band of hairs. *Petals* unequal in length; adaxial petal 40–45 × 40–42 mm, apex not appearing bilobed when pressed. *Ovary* moderately villous, individual hairs visible at × 10 magnification, the surface not completely concealed by the indumentum. *Immature and mature pod* glabrous.

Distribution and habitat. Gabon. Lowland forest; c.1–100 m.

Selection of specimens examined. **Gabon:** Near Rabi, fl. 22 i 1994, *Haegens* 255 (WAG!); Rabi, 3 km on rd to Divangui, fl. 24 i 2005, *Mackinder* 542 (K!, LBV!, WAG!).

16. *Berlinia sapinii* De Wild., *Compagnie du Kasai*: 301 (1910). – Type: Congo (Kinshasa), *Sapin* s.n. (holo BR!).

Small tree, height and dbh not recorded. *Leaflets* in 3–4 pairs; terminal pair 7.5–9.0 × 2.4–4.0 cm, concolorous; underside sparsely to moderately pubescent on mid-vein and secondary veins, sparse pubescence sometimes also visible on basal part of leaf blade; tertiary venation visible, raised or not above and below; apex acute. *Petioles* 12–20 mm long. *Petiolules* 3–4 mm long. *Inflorescence* axillary, a panicle or cluster of 2 or more racemes; axes densely golden puberulous. *Bracts* falling early, not seen. *Bracteoles* thin, 20–31 × 7–13 mm, interior surface densely villous. *Pedicels* 16–40 mm long. *Hypanthium* glabrous or sparsely and unevenly pubescent, the surface clearly visible between irregular longitudinal bands of hairs. *Petals* unequal in length; adaxial petal c.45 × 36 mm. *Ovary* densely sericeous, individual hairs visible at × 10 magnification. *Immature pod* unknown, mature pod densely golden velutinous.

Distribution and habitat. Congo (Kinshasa). Along rivers and stream banks in woodland and wooded grassland; 600–1000 m.

Selection of specimens examined. **Congo (Kinshasa):** Bas-Katanga, la route de Kinda, bords de la Lovoie, fl. ii 1937, *Herman* 2196 (BR!); R. Musonoi, route Kolwezi-Luena, fl. 20 i 1987, *Malaisse* 14144 (BR!).

17. *Berlinia tomentella* Keay, *Kew Bull.* 1954: 273 (1954). – Type: Ghana, *Vigne* 116 (holo K!).

Tree 3–10(–20) m tall; dbh 30–80 cm. *Leaflets* in (2–)3–5 pairs; terminal pair 10.8–18.5 × 3.8–7.4 cm, commonly discolorous, occasionally concolorous; underside frequently appearing glabrous or occasionally sparsely puberulous at × 10 magnification, at higher magnifications sparsely to moderately puberulous; tertiary venation indistinct or visible but seldom raised above and below; apex acuminate, acumen 4–13 mm. *Petioles* 6–29 mm long. *Petiolules* 4–8 mm long. *Inflorescence* a cluster of racemes or a panicle; axes densely pale to golden puberulous. *Bracts* falling early, not seen. *Bracteoles* thin, 18–28 × 8–14 mm, interior surface densely pale puberulous, indumentum becoming ‘patchy’ on older bracteoles. *Pedicels* 10–24 mm long. *Hypanthium* (at least in part) moderately to densely tomentose. *Petals* unequal; adaxial petal 31–40 × 21–28 mm, apex appearing bilobed to 6 mm. *Ovary* densely sericeous, individual hairs visible at × 10 magnification. *Immature and mature pod* densely golden velutinous.

Distribution and habitat. Sierra Leone, Liberia, Ivory Coast and Ghana. Swamp, forest edge, secondary forest; 1–400 m.

Identification note. Can be difficult to distinguish from *Berlinia confusa* when sterile. See identification notes under *Berlinia confusa*.

Selection of specimens examined. **Sierra Leone:** Southern Prov., Pujehun, fl. 26 iv 1914, *Aylmer* 61 (K!). **Liberia:** Bomi Hills, just N of mining area, fl. 29 iv 1966, *Bos* 1942 (BR!, K!, P!, WAG!). **Ivory Coast:** Boubéle, prés de Tabou, fl. 2 iii 1965, *Ake Assi* 7851 (G!). **Ghana:** Western Region, Ankasa near R. Suhien, fl. 15 iv 1978, *Hall* 46681 (GC, K!, WAG!).

18. *Berlinia viridicans* Baker f., *J. Bot.* 66, Suppl. 1: 141 (1928). – Type: Angola, *Gossweiler* 7797 (holo BM!; iso BR!, COI, K!, LISC!).

Tree 5–10 m tall; dbh not recorded. *Leaflets* in 3–5 pairs; terminal pair 12.8–21 × 5–7 cm, concolorous; appearing glabrous at × 10 magnification but at higher magnifications a sparse pubescence visible on basal mid- and secondary veins; tertiary venation visible and raised above and below; apex acute. *Petioles* 5–6 (–24) mm long. *Petiolules* 4–5 mm long. *Inflorescence* a panicle; axes moderately puberulous. *Bracts* falling early, not seen. *Bracteoles* thin, 45–51 × 17–22 mm, interior surface moderately to densely golden puberulous. *Pedicels* 24–60 mm long. *Hypanthium* unevenly pubescent, the hairs usually arranged in irregular longitudinal bands, sometimes with a more complete covering but always some part of the surface clearly visible. *Petals* unequal in length; adaxial petal 50–85 × 42–60 mm. *Ovary*

densely sericeous, individual hairs visible at $\times 10$ magnification. *Immature pod* unknown; *mature pod* densely golden velutinous.

Distribution and habitat. Gabon, Congo (Brazzaville), Congo (Kinshasa) and Angola (Cabinda). Forest, along rivers and streams; 1–100 m.

Selection of specimens examined. **Gabon:** Gamba, fl. & fr. 25 vii 1998, *Breteler* 14485 (LBV, WAG!). **Congo (Brazzaville):** Kouilou, Les Sara, fl. 4 vii 1989, *Dechamps* 13258 (BR!, MO!, WAG!). **Congo (Kinshasa):** Mayumbe, Ganda Sundi, Kangu, fl. & fr. 14 x 1911, *de Briey* 2 (BR!). **Angola:** Cabinda-Buco Zau, na Res. Da Chiaca, fl. 18 iii 1959, *Murta* 48 (LISC!).

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NOTES

- 1 Thickness as measured on a herbarium collection, not *in vivo*.
- 2 The pods of these two species are indistinguishable but their geographical ranges do not overlap and so can be used to infer identification. *Berlinia bracteosa* is known from Nigeria, Equatorial Guinea, Cameroon, Central African Republic, Gabon, Congo (Brazzaville), Congo (Kinshasa) and Angola. *Berlinia occidentalis* is known from Sierra Leone, Liberia, Ivory Coast and Ghana.
- 3 Leaflets were measured to the nearest mm. In slightly falcate leaflets, length was assessed as the shortest distance from base to apex. Width measurements were taken at the widest point of the leaflet blade.
- 4 A dense tomentum on the underside of the leaflets was seen on *Cabra-Michel* 1 and *Becquet* 2171, two of four collections cited by Hauman (1952b) under *B. giorgii* De Wild. var. *pubescens* (De Wild.) Hauman. Two other collections cited by Hauman (*Michel & Reed* 1104, and *Delevoy* 483) were less densely hairy below. One other collection, *Compere* 1237 (not cited by Hauman), also had a dense tomentum. As none of these specimens differ in other respects from typical *B. giorgii*, we have not maintained variety *pubescens*.
- 5 The name *Berlinia grandiflora* was misapplied by Hauman (1952b) in the *Flore du Congo Belge et du Ruanda-Urundi*. In his account, Hauman delimited a species (with four varieties) to which he incorrectly applied the name *Berlinia grandiflora* (J.Vahl) Hutch. & Dalziel, noting it was a very widely distributed species and that in certain details was very variable. Soon after, two of Hauman's varieties were given specific

rank by other authors. Keay (1954) recognized *Berlinia grandiflora* sensu Hauman var. *pseudoauriculata* Hauman as *B. congolensis* (Baker f.) Keay. Torre & Hillcoat (1955) raised *Berlinia grandiflora* sensu Hauman var. *bruneelii* (De Wild.) Hauman to species level as *B. bruneelii* (De Wild.) Torre & Hillc. Hauman considered a third variety, 'var. *smeathmanii*', as *mal délimitée* (poorly delimited) and of the three collections cited, one he noted as doubtful (*Hulstaert* 842), the second (*Duvigneaud* 960) is sterile and the third (*Gillardin* 393) is indistinguishable from *B. confusa* Hoyle. The typical variety of Hauman's *Berlinia grandiflora* is given specific status as *B. phenacoa* Mackinder (this paper).

6 A full justification of the lectotypification of *Berlinia acuminata* can be found in Keay (1954).