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REVISION OF THE AFRICAN GENUS HECKELDORA (MELIACEAE)

J.J.F.E. DE WILDE

Nationaal Herbarium Nederland, Wageningen branch (Herbarium Vadense),
Biosystematics Group, Wageningen University,
Generaal Foulkesweg 37, 6703 BL Wageningen, The Netherlands

SUMMARY

The African genus *Heckeldora* (Meliaceae) is revised. Contrary to earlier views the widespread and variable *H. staudtii* is shown to consist of four distinct entities, each worthy of specific status. *Heckeldora zenkeri* is therefore re-instated and two other species, originally described in the much larger genus *Guarea,* and formerly also considered conspecific with *H. staudtii*, are resurrected and formally transferred to *Heckeldora*. In addition, two new species, *H. jongkindii* J.J. de Wilde from Liberia and *H. trifoliolata* J.J. de Wilde from Gabon are recognized and described. *Heckeldora mangenotiana* is transferred to *Guarea* and the new combination made. A key to the six *Heckeldora* species now recognized is provided and maps of their distribution are presented.

Key words: *Guarea, Heckeldora*, Meliaceae, Africa, revision, taxonomy.

INTRODUCTION

In their authoritative generic monograph of the Meliaceae Pennington & Styles (1975) recognize four subfamilies. Using morphological, anatomical and palynological characters these authors grouped the 35 genera admitted to Melioideae into seven tribes. Among these a new tribe Guareeae is presented, distinctive in particular by a cylindrical complete staminal tube with anthers inserted within the throat and capsular-, rarely berry-like fruits containing arrillodiate seeds or seeds with a sarcotesta. Within Guareeae a stipitate disk, unilocular ovary with parietal placentation and indehiscent berry-like fruits define the genus *Heckeldora*.

Interestingly, recent molecular phylogenetic studies of Meliaceae support the recognition of only two subfamilies viz. Melioideae and Swietenioideae which are found to present sister groups (Muellner et al., 2003). Furthermore, these studies show close affinities between species of tribes Aglaieae and Guareeae, making it likely that one of these taxa will not survive as a meaningful unit.

Heckeldora was described by Pierre (1897) who named it in honour of the French physician and Professor in Botany E.M. Heckel (1843–1916), Director of the colonial museum at Marseille. Pierre, giving details of the flower and the fruit, stipulates that in *Heckeldora* the ovary is uni-locular with parietal placentation, each of the 2 or 3 placentas bearing 2 collateral or sometimes slightly superposed ovules. He recognizes two species viz. *H. latifolia* Pierre and *H. angustifolia* Pierre, both growing in the vicinity of Libreville in Gabon.

Pellegrin (1911), referring to manuscript names by Pierre, adds two new species to the genus viz. *H. acuminata* and *H. klainei*. They are based on specimens collected by Klaine, again in the neighbourhood of Libreville. Much later, in a revision of the African representatives of the genus *Guarea* F. Allam. ex L., Pellegrin (1939) critically examined the generic differences between *Guarea* and *Heckeldora*. Considering in particular the characteristics of the ovary and fruit he concluded that *Heckeldora* should be sunk in *Guarea* in which, moreover, he also included the monotypic genus *Leplaea* Vermoesen (1921). In the introduction (p. 147) Pellegrin incidentally refers to *Guarea* sect. *Heckeldora*, comprising the two *Heckeldora* species described by Pierre. In my opinion this constitutes validation of a sectional rank, the new combination being *Guarea* sect. *Heckeldora* (Pierre) Pellegr. In all Pellegrin recognized 17 African *Guarea* species, not counting *G.? klainei* Pierre ex Pellegr., which he considered insufficiently known.

Harms (1940), ignoring Pellegrin (1939), recognizes *Guarea* sect. *Heckeldora* (Pierre) Harms. Among other characters he notes that the section is distinguished by rostrate, probably indehiscent fruits and that according to Pierre the ovary is 1-locular with 2 or 3 parietal placentas. He admits 9 species in the section. On account of the large berry-like fruits *Leplaea* is maintained as a separate genus.

Staner (1941), in a comprehensive treatment of the Meliaceae of Central Africa, refutes a sectional status of the species with indehiscent 1-locular fruits and parietal placentation within *Guarea*. He maintains *Heckeldora* as a genus, as also *Leplaea*.

Pennington & Styles (1975) maintain generic status for *Heckeldora*. They state that the condition of a unilocular ovary with parietal placentas is unique within the family. *Leplaea* is reduced to *Guarea*. These authors, following Keay's (1958) treatment in the Flora of West Tropical Africa, consider all material assigned to *Heckeldora* to present one very variable species, which should be named *H. staudtii* (Harms) Staner. *Heckeldora latifolia*, the name of the species designated by Pennington & Styles (1975) as the lectotype species of the genus, is a synonym.

Finally, Aké Assi & Lorougnon (1989) describe *H. mangenotiana*, a species endemic to Côte d'Ivoire. It should be transferred to *Guarea* as discussed under species excluded.

Recent work on the Meliaceae for a checklist of the flowering plants of Gabon (Sosef et al., 2006) leads to the view that the current concept of a monotypic genus *Heckeldora* is not satisfactory. This opinion was reinforced when newly collected material of *Heckeldora* from Liberia could not be accommodated into the already very wide concept of *H. staudtii*. The here presented revision is based on macromorphological characters of the available material. Six species are recognized of which two are described as new. *Heckeldora zenkeri* (Harms) Staner, formerly included in the widespread *H. staudtii* (Harms) Staner, is here reinstated as a distinct species. *Guarea ledermannii* Harms and *G. leptotricha* Harms are both transferred to *Heckeldora* and the new combinations made.

HECKELDORA

Heckeldora Pierre (1897) 1286; T.D. Penn. & Styles (1975) 491. — *Guarea* L. sect. *Heckeldora* (Pierre) Pellegr. (1939) 147. — *Guarea* L. sect. *Heckeldora* (Pierre) Harms (1940) 135. — Lectotype: *Heckeldora latifolia* Pierre (= *H. staudtii* (Harms) Staner).

Shrubs or treelets; dioecious; thinly stemmed, not or sparsely branched, the leaves congested terminally. *Indumentum* either of simple short hairs, sometimes with brownish resinous central canal, and/or of long, weak and sericeous hairs; dark brown, very short, glandular trichomes often present. *Leaves* imparipinnate, (1–)3–13(–15)-foliolate; petiole adaxially flattened or shallowly furrowed, minutely pubescent, rachis ditto; leaflets without pellucid lines or dots, distal leaflets largest, proximal leaflets smaller, often slightly unequal-sided at the base, upper surface glabrous but very often with a conspicuous erect, stiff indumentum on the shallowly impressed midrib; venation pinnate or secondary nerves comparatively few and characteristically loop-shaped. *Inflorescences* axillary or supra-axillary, single or a few clustered in a fascicle, racemiform to sparsely paniculately branched, often pendulous; staminate inflorescences long and usually much longer than the pistillate ones. *Flowers* borne on jointed pedicels, unisexual, male and female flowers very similar but with functional dimorphy, in staminate flowers the pistillode slender but distinct; in pistillate flowers the ovary thick and swollen, ellipsoid to ovoid. *Calyx* cup-shaped, not or shallowly 3–5-lobed or dentate. *Petals* (3 or) 4 (or 5), free, imbricate, reflexed or rolled backwards at anthesis. *Staminal tube* about as long as or somewhat shorter than the petals, funnel-shaped, margin crenate, anthers 7–10, inserted within and near the rim of the tube, sometimes slightly exserted, dorsifixed, attached near their base. *Gynoecium* stipitate, the stipe of discoid origin, expanded halfway or at the apex to form respectively a collar or an annular cushion beneath the narrowed base of the ovary. *Ovary* unilocular with 2 (or 3) parietal placentas near the base of the cavity, each placenta with 2 collateral or slightly superposed ovules; stylehead discoid. *Fruit* a stipitate, 1–5-seeded, ovoid to broadly obovoid berry, or one or more developing seeds becoming increasingly superposed and the fruit narrowly ovoid with conspicuous constrictions between the seeds and beaked at apex. *Seeds* completely enveloped by a vascularised sarcotesta, sometimes polyembryonic. *Embryo* with thick, plano-convex, collateral cotyledons and superior radicle.

Distribution — Six species in West and Central tropical Africa, most diverse in Cameroon (4 spp.) and Gabon (3 spp.).

KEY TO THE SPECIES

1a. Leaves 1- or 3-foliolate. — Gabon . . . . . **5. H. trifoliolata**
b. Leaves 2- or more jugate (rarely associated with 3-foliolate leaves) 2
2a. Proximal leaflets with marked looped main secondary nerves (curvinerved); petals 11–12 mm long; staminal tube 10–12 mm long. — Liberia . . . . **1. H. jongkindii**
b. Leaflets usually penninerved; petals less than 11 mm; staminal tube less than 10 mm long 3
3a. Leaflets thinly but distinctly sericeous on lower surface. — Cameroon . . . . . **3. H. leptotricha**
b. Leaflets glabrous or lower surface pubescent on nerves only 4
4a. Calyx 2–3.5 by 3–4 mm; petals 8 mm long or more; ovary hairy, not furrowed . . . . . **6. H. zenkeri**
b. Calyx 0.2–2 by 2–2.5(–3) mm; petals (5.5–)6–8(–9.5) mm long; ovary glabrous, rarely pubescent 5

5a. Calyx less than 1 mm long; young infructescences stout, patent, almost perpendicular to the stem, (2–)12–30(–66) cm long; fruits almost symmetric, apiculate, not beaked at apex; not moniliform, ribbed or mammillary. — SW Cameroon, in submontane forest . . . . . **2. H. ledermannii**

b. Calyx 1 mm or longer; infructescences slender, more or less drooping, less than 12 cm long; fruits asymmetric, often ribbed and moniliform, mammillary, beaked at the apex . . . . . **4. H. staudtii**

1. Heckeldora jongkindii J.J. de Wilde, *spec. nov.* – Fig. 1; Map 1

A speciebus *Heckeldorae* omnibus cognitis combinatione foliolorum nervis lateralibus principalibus valde curvatis cum petalis et tubis staminalibus 10–12 mm longis, fructu c. 2 × 3 cm insigniter 8-costato late obovoideo rostrato et distributione segregata in Liberia distinguenda. — Typus: *Jongkind & Blyden 5279* (holo WAG), Liberia, Sino, Sapo National Park, just east of Sinoe River, 22 November 2002.

Shrublet up to 1.5 m high. *Leaves* imparipinnate, 5–9-foliolate; petiole 5–16 cm long, terete, faintly flattened on the upper surface near the base; rachis 9–14 cm long; petiolules 0.1–0.3 cm long, that of the terminal leaflet 0.5 cm or longer; all these parts pubescent. Leaflets opposite, subopposite or more or less alternate, narrowly elliptic to elliptic, obovate or very broadly obovate, 4.5–16.5 by 2.2–12 cm, distal leaflets largest, proximal ones smaller; apex acuminate or sometimes rounded, rarely almost caudate; base cuneate or obtuse, in terminal leaflets often distinctly attenuate; upper surface glabrous but for a short dense indumentum from the furrow of the impressed midrib, secondary nerves 2–6(–8) on either side, rarely opposite, widely spaced, ascendant, characteristically loop-shaped, curving and anastomosing before reaching the margin, tertiary nerves indistinct; lower surface with scattered very minute dark brown trichomes (magnification!), the midrib and nerves prominent and with some indistinct indumentum near the base. *Inflorescences* few and spaced among the leafy upper part of the stem; male inflorescences paniculate (female ones unknown), pendulous, up to 35 cm long, raceme-like or with basal branches up to 10 cm long, the branches widely spaced and gradually becoming shorter towards the top, branches of the 2nd order up to 1 cm long; axes flattened, puberulous. Bracts narrowly ovate, c. 1.5 by 0.5 mm, acute at apex, puberulous. Flowers usually a few clustered at the top of the ultimate branches or otherwise widely spaced along the branches. *Male flowers* fragrant; pedicel slender, 2–3 mm long, articulate, the part below the articulation up to 1 mm long, with a minute up to 1 mm long bracteole; the part above the articulation receptacular, (staying with the flower when this drops) cylindrical, c. 2 mm long, dotted with very short dark brown glandular trichomes. Calyx cup-shaped, 2–3 by 3–3.5 mm, 4-dentate, puberulous on margin, dotted with minute brown trichomes similar to those on the receptacle (magnification!). Petals 4, free, imbricate in bud, reflexed during anthesis, narrowly obovate, 11–12 by 3.5–4.5 mm, glabrous but with a fringe of very short hairs on the margin, white. Staminal tube narrowly funnel-shaped, 10–12 mm long, glabrous, crenate at apex, apexes of anthers barely visible above the rim; anthers 8, oblong, c. 1.2–1.5 by 0.6–0.8 mm, opening laterally, lengthwise, producing well-grown pollen. Pistillode distinct, stipitate; stipe 2.5–3 mm long, glabrous, inflated in the upper part to form a cushion-shaped ring around the attenuate base of the ovary; ovary ellipsoid to obovoid, 2–3 by 1.8–2 mm, sericeous, 1-locular with 2 parietal placentas, each

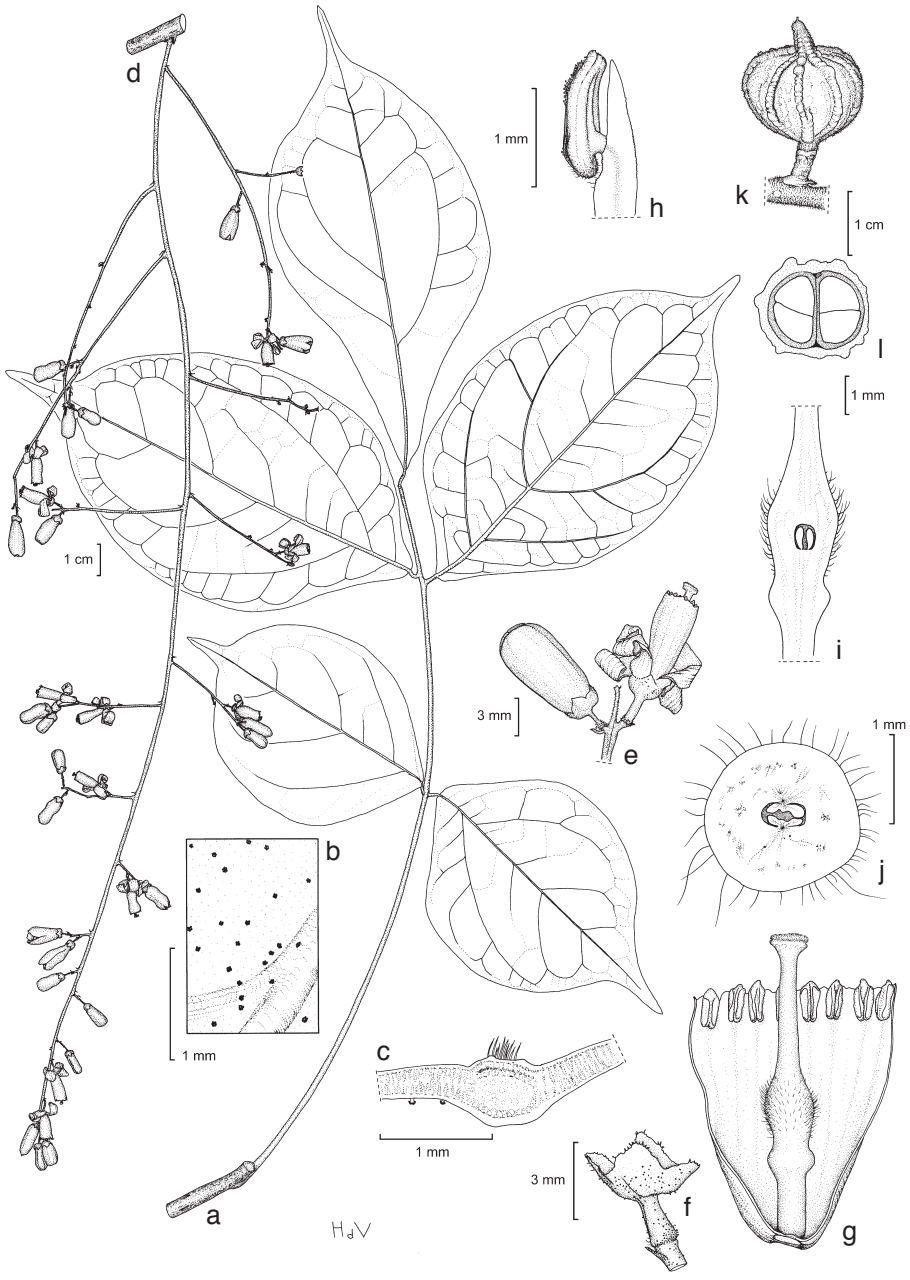
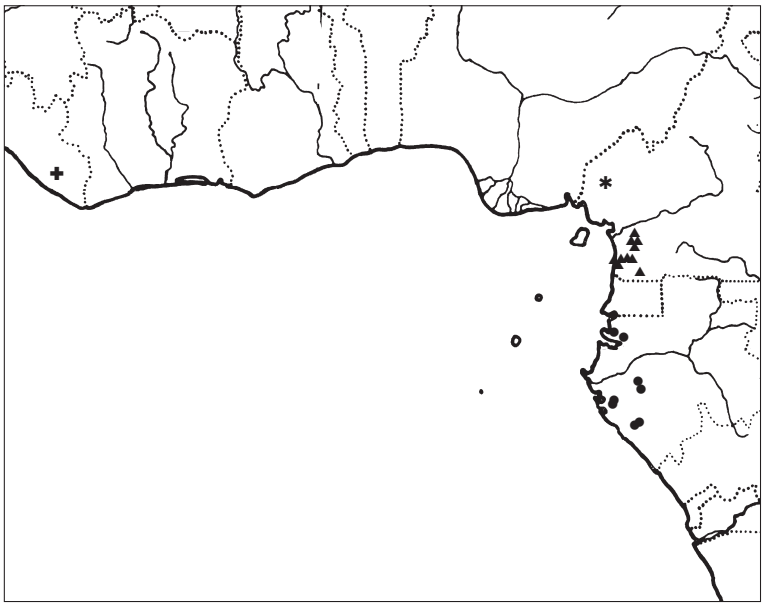


Fig. 1. *Heckeldora jongkindii* J.J. de Wilde. a. Part of stem with leaf; b. detail showing trichomes at lower surface of leaflet; c. transverse section of midrib of leaflet; d. inflorescence; e. detail of ultimate part of inflorescence; f. calyx with articulate pedicel and bracteole; g. opened staminal tube with pistillode; h. detail of insertion of anther; i. longitudinal section of pistillode; j. transverse section of pistillode; k. fruit; l. transverse section of fruit (a, b, d–g: *Jongkind & Blyden 5279*; c, h–j: *Parren 516*; k, l: *Jongkind et al. 5613*; all WAG).



Map 1. Distribution of *Heckeldora jongkindii* J.J. de Wilde (✚), *H. ledermannii* (Harms) J.J. de Wilde (✱), *H. leptotricha* (Harms) J.J. de Wilde (▲) and *H. trifoliolata* J.J. de Wilde (●).

placenta near the base of the ovarian cavity with 2 collateral, erect, vestigial ovules; style 4–4.5 mm long, glabrous; stigma disciform. *Female flowers* not known. *Fruit* on up to 6 mm long stalk, very broadly obovoid, c. 2 cm long and 3 cm diam., distinctly 8-ridged and somewhat verrucose, conspicuously beaked by a straight c. 8 mm long rostrum, pale yellow, very shortly and densely pubescent; 1-locular, 2-seeded (only one fruit analyzed!). *Seeds* completely enveloped by an up to 1 mm thick sarcotesta.

Distribution — Only known from Liberia.

Habitat & Ecology — The type was collected in disturbed forest at c. 115 m altitude. Additional collections mention secondary forest. Flowering in March; fruiting in December.

Etymology — The specific epithet is honouring Dr Carel C.H. Jongkind, distinguished botanist and connoisseur of African plants, who twice collected this new endemic Liberian *Heckeldora* species.

Additional collections examined:

LIBERIA. *Baldwin 11468* (K), Sinoe Co., Jaurazon; *Jongkind et al. 5613* (WAG), Sino, Sapo National Park, buffer zone close to Sinoe R.; *Parren 516* (WAG), Sino, between Jalays Town and the Sapo National Park entrance.

2. Heckeldora ledermannii (Harms) J.J. de Wilde, *comb. nov.* — Fig. 2; Map 1

Guarea ledermannii Harms (1911) 160; Pellegr. (1939) 151; Harms (1940) 135, in *Guarea* L. sect. *Heckeldora* (Pierre) Harms. — Type: *Ledermann 1516* (holo B, delet.), Cameroon, Mbo, Kongoa Mts. — Neotype (designated here): *Leeuwenberg 8813* (WAG; iso BR), Cameroon, west-side of Mt Koupé, near Mbule.

Shrub or small tree up to 5 m high; stem up to 1.5 cm diam., near the top sometimes with a few conspicuous large cicatrices, sparsely branched, the branches shortly pubescent, glabrescent with age. *Leaves* imparipinnate, 5–11(–13)-foliolate; petiole 4.5–13(–15) cm long, terete but somewhat flattened or shallowly furrowed on the upper surface, swollen at base; rachis (4–)16–29 cm long; petiole and rachis both minutely pubescent; petiolules 0.1–0.5 cm long, puberulous, petiolule of terminal leaflet up to 1.5 cm long. Leaflets opposite, subopposite or alternate, elliptic, oblong or obovate, usually narrowly so, (5–)10–20(–24) by 2–7(–9) cm, distal leaflets largest, proximal ones smaller; apex acuminate or in proximal leaflets acute; base obtuse to cuneate and in terminal leaflets often attenuate, sometimes slightly oblique; upper surface glabrous except for a short, dense, stiff indumentum on the midrib, main secondary nerves indistinct, 6–17 on either side, usually alternate, straight or slightly arched but curving and anastomosing well before reaching the margin, tertiary nerves indistinct; lower surface glabrous with prominent midrib and lateral nerves and rather distinct tertiary nervation. *Inflorescences* axillary or supra-axillary, single or up to 3 in a fascicle, raceme-like, not or sparsely paniculately branched. Male inflorescences slender, up to 33 cm long, the axis thin, less than 1 mm diam., in sicco flattened, grooved, puberulous; the secondary branches very short, 0.5–1 mm long, widely spaced, few- or single-flowered. Female inflorescences not known but young infructescences robust, perpendicular to the stem, up to 67 cm long, main axis 2–3 mm diam., in sicco furrowed, puberulous; secondary branches usually short and less than 1.5 cm long, rarely up to 10.5 cm long. *Male flowers* subtended by a minute narrowly triangular puberulous bracteole; pedicel slender, c. 1.5 mm long, minutely puberulous, dark glandular trichomes absent. Calyx saucer-shaped, 3- or 4-toothed, less than 1 by 2 mm, puberulous. Petals 3 or 4, free, narrowly ovate, 6–7 by 2–2.5 mm, minutely puberulous on the margin. Staminal tube 5–6 mm long, glabrous, shallowly crenate at apex; anthers 7 or 8, slightly protruding from the tube, c. 0.7 by 0.5 mm. Pistillode distinct, stipitate, 5 mm long; stipe 1.5 mm long, swollen at the top to form a cushion-shaped ring around the retracted base of the ovary, glabrous; ovary broadly ovoid, c. 1 mm diam., glabrous or sparingly pubescent,

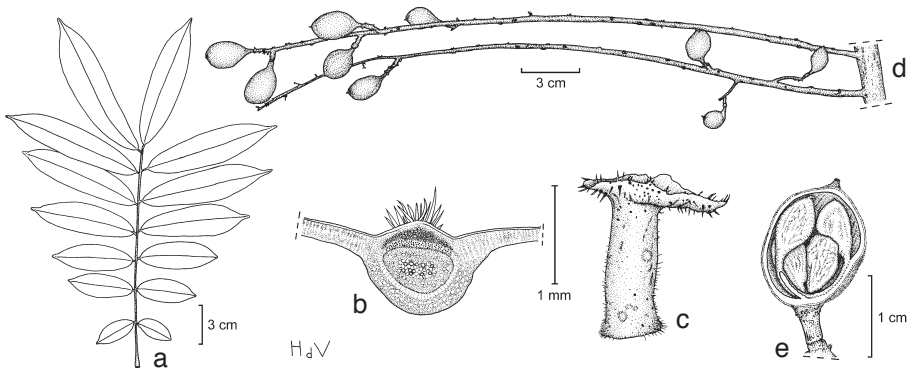


Fig. 2. *Heckeldora ledermannii* (Harms) J.J. de Wilde. a. Leaf; b. transverse section of midrib of leaflet; c. calyx with pedicel; d. part of stem with infructescences; e. longitudinal section of young fruit (a, e: *Leeuwenberg 9281*; b, c: *Leeuwenberg 8813*; d: *Groves et al. 82*; all WAG).

not furrowed; style 2.5 mm long, glabrous; stigma disciform. *Female flowers* not known. *Infructescences* sparsely fruited, usually only up to 5 fruits developing into maturity. *Immature fruit* obovoid, c. 2–3 by 1–2 cm, dull grey-green, puberulous, at the base contracted into an up to 5 mm long longitudinally wrinkled stipe, apex obtuse, still crowned by the persistent remains of style and stigma, unilocular with almost basal placentation, the two pairs of young developing seeds arising from near the base of the ovarian cavity, one seed of each pair becoming superposed and its funicle lengthening and partly adnate to the ovary wall. Mature fruit not known.

Distribution — Endemic to Cameroon, South-West Province.

Habitat & Ecology — The species seems confined to fertile volcanic soils at altitudes of 900–1500 m in the transition zone of evergreen tropical rain forest of low and medium altitudes towards submontane forest.

Notes — 1. Harms (1911), in the diagnosis of *Guarea ledermannii*, mentions the affinity of the new species with *Guarea staudtii*, described earlier by him in 1896. This already signals the probability that also *G. ledermannii* ought to be placed in *Heckeldora*. Moreover, Harms' description of *G. ledermannii* contains the statement that the leaflets are glabrous or almost glabrous but show the midrib puberulous on the upper surface. This is a strong indication that a *Heckeldora* is at hand as none of the African *Guarea* species presently known shows a distinct indumentum on the midrib of the leaflets. It is assumed, therefore, that *G. ledermannii* belongs in *Heckeldora*. Unfortunately, the holotype of *G. ledermannii*, viz. *Ledermann 1516*, was destroyed in Berlin and no other original material has been located.

2. Meliaceous material collected from the type region of *G. ledermannii* is identified to belong in *Heckeldora* as shown by unilocular ovaries and parietal (basal) placentation. A number of characters of this material, particularly the dimensions of the calyx and the features of the infructescence and fruits do not fit in *H. staudtii*. Among this material *Leeuwenberg 8813*, a male flowering collection, matches well the diagnosis of *G. ledermannii*. It is designated here as the neotype of the basionym *G. ledermannii* and hence of the new combination *H. ledermannii* (Harms) J.J. de Wilde.

3. Heckeldora leptotricha (Harms) J.J. de Wilde, *comb. nov.* — Fig 3; Map 1

Guarea leptotricha Harms (1897) 265; Pellegr. (1939) 150; Harms (1940) 135; Keay (1958) 707, in syn. of *H. staudtii*. — Lectotype (designated here): *Zenker 1028* (K; iso E), Cameroon, Bipindi.

Shrub or treelet up to 2 m high, usually unbranched. *Leaves* congested terminally, imparipinnate, (3–)5–11-foliolate; petiole 4–22 cm long, terete, somewhat flattened above near the base; rachis 8–17 cm long; petiole and rachis pubescent, tomentose or more rarely glabrescent; petiolules 0.1–0.3 cm long, pubescent, that of the terminal leaflet 0.5 cm or more long. Leaflets opposite, subopposite or more or less alternate, elliptic to narrowly elliptic or obovate, 3–23 by 1.5–9.5 cm, distal leaflets largest, proximal ones smaller; apex usually acuminate or almost caudate, rarely acute; base attenuate, cuneate or obtuse and often slightly unequal-sided; upper surface glabrous but with a short indumentum on the shallowly impressed midrib, secondary nerves 6–18 on either side, opposite or not, straight or slightly arched but curving and anastomosing before reaching the margin, tertiary nerves indistinct; lower surface strewn with weak sericeous

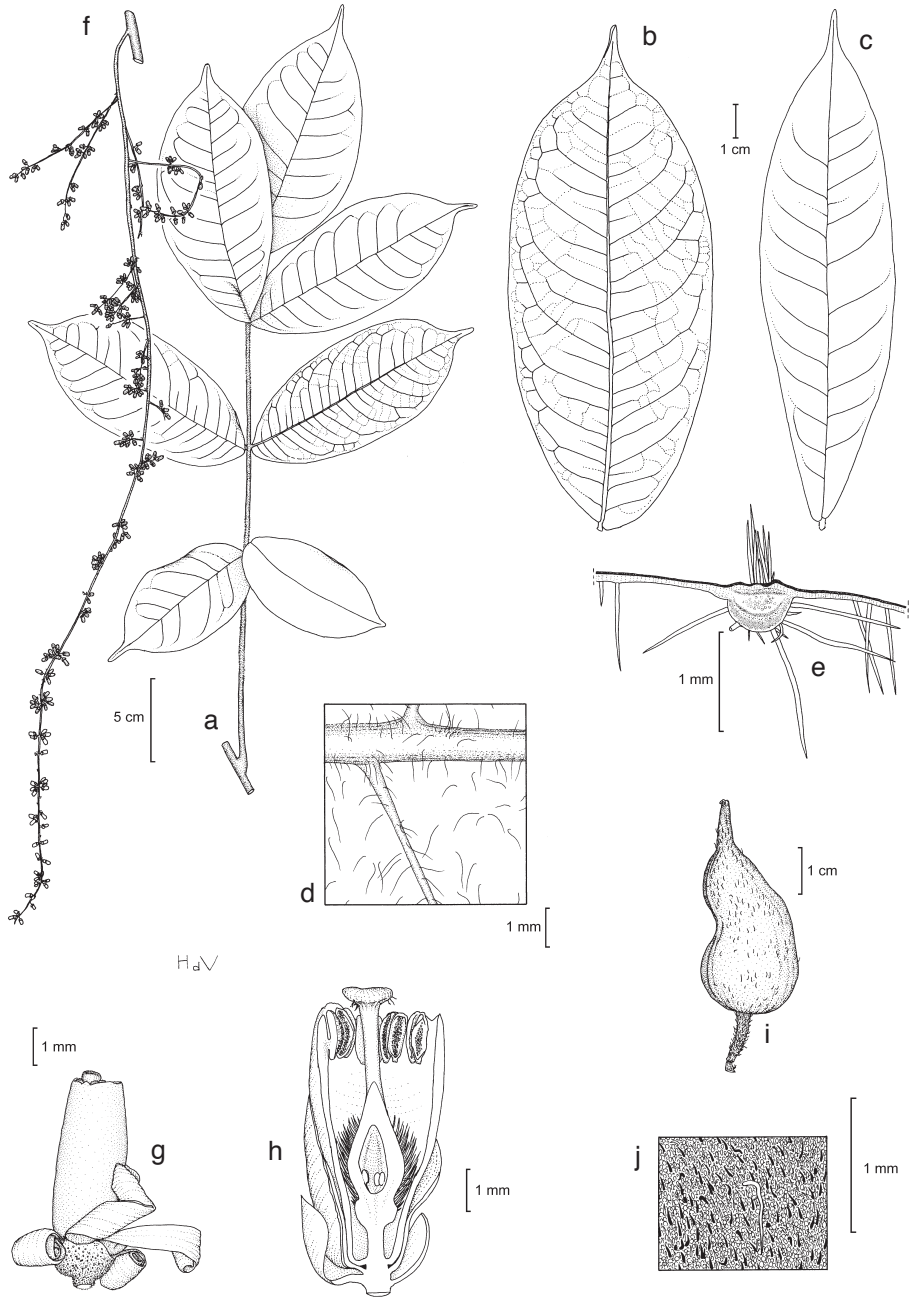


Fig. 3. *Heckeldora leptotricha* (Harms) J.J. de Wilde. a. Part of stem with leaf; b. leaflet, lower surface; c. leaflet, upper surface; d. detail of trichomes at lower surface of leaflet; e. transverse section of midrib of leaflet; f. inflorescence; g. flower; h. longitudinal section of staminate flower; i. fruit; j. detail indumentum of fruit (a, b, h: *Bos 6686*; c, e: *W.J. de Wilde & De Wilde-Duyfjes 1543*; d: *Bos 4060*; f: *Leeuwenberg 5100*; g: *Bos 7077*; i, j: *Bos 3393A*; all WAG).

hairs, especially on the prominent midrib and nerves (see also note). *Inflorescences* born on the stem among the leaves, usually few in a fascicle or even singly, occasionally up to 15 together, in vivo dull dark purplish red; female inflorescence 1–10 cm long; male inflorescence often pendulous, up to 55 cm long, not or sparsely branched and then loosely paniculate with the basal branches up to 10 cm long, the higher branches rather widely spaced and progressively becoming shorter; axes flattened, puberulous. Bracts early caducous, narrowly ovate, c. 1.5 by 0.5 mm, acute at apex, puberulous. Flowers often 2 or 3 together, sometimes single, the clusters widely spaced along the axes. *Male flowers* shortly pedicellate or almost sessile; bracteoles minute, early caducous. Upper receptacular part of pedicel cylindrical, slightly tapering to the base, c. 0.5 mm long, dotted with very short dark brown glandular trichomes. Calyx cup-shaped, 2–3 by 2.5–3.5 mm, 3–5-lobed or dentate, puberulous to pubescent and often with a few large bright brown glands (magnification!). Petals 4 or 5, free, narrowly oblong to obovate, 6–7 by 2–3 mm, glabrous. Staminal tube c. 6.5 mm long, almost glabrous, crenate at apex; anthers 7–9(–12), implanted within the tube near the rim and barely visible from the outside, c. 0.8–1.2 by 0.6–0.8 mm, dorsifixed, attached near the base. Pistillode distinct, slender, stipitate; stipe c. 1 mm long, glabrous, inflated in the upper part to form an annular, faintly 4-lobed cushion around the attenuate base of the ovary; ovary ellipsoid, 1.5–3 by 1–1.5 mm, sericeous; style 2.5–3 mm long, glabrous; stigma disciform. *Female flowers* similar to male ones but anthers not producing mature pollen. Ovary well developed, stout, narrowly ellipsoid, c. 6 by 2 mm, sericeous, unilocular with 2 (or 3) parietal placentas, each placenta bearing 2 more or less collateral ovules near the base of the ovarian cavity, one ovule of each pair developing above the other and the ovules finally superposed; style somewhat shorter than in male flower, glabrous. *Fruit* on an up to 1 cm long stipe, indehiscent, berry-like, ovoid or cylindrical but usually irregularly shaped and knobbed, not ribbed, 2–5-seeded, with conspicuous constrictions between the seeds, up to 3.5 by 2.2 cm, usually but not always extended by an often curved up to 1.5 cm long rostrum, brownish orange or reddish at maturity, minutely puberulous to very shortly pubescent, felty and, moreover, with sparse white silky hairs. *Seeds* completely enveloped by a sarcotesta.

Distribution — Cameroon, coastal zone of South Province.

Habitat & Ecology — In shrub layer of evergreen high forest, often in deep shade; also in riparian habitats. Altitude up to 400 m. Flowering: November to April and in July; fruiting: September to April.

Note — The seemingly weak and often curved or wavy hairs in dried herbarium specimens become erect and rigid upon boiling in water.

4. Heckeldora staudtii (Harms) Staner — Fig. 4a–d; Map 2

Heckeldora staudtii (Harms) Staner (1941) 207; Keay (1958) 707, p.p.; Staner & G. Gilbert (1958) 207; T.D. Penn. & Styles (1975) 491, p.p. — *Guarea staudtii* Harms (Aug. 1896) 180; Pellegr. (1939) 150; Harms (1940) 135. — Lectotype (designated here): *Staudt 534* (holo B, delet.; lecto G; iso-lecto COI, P), Cameroon, Johann Albrecht's Höhe.

Heckeldora latifolia Pierre (1897) 1287; Pellegr. (1939) 150. — Lectotype (designated here): *Klaine 432* (P, n.v., see note 2), Gabon, near Libreville.

Heckeldora angustifolia Pierre (1897) 1287; Staner (1941) 207. — *Guarea angustifolia* (Pierre) Pellegr. (1939) 151, non C.DC. (1903) 408. — *Guarea pierreana* Harms (1940) 135. — Lectotype (designated here): *Klaine 431* (P), Gabon, Mt Bouet near Libreville.

Heckeldora acuminata Pierre ex Pellegr. (1911) 65. — Lectotype (designated here): *Klaine 2490 B* (P), Gabon, near Libreville.

Heckeldora klainei Pierre ex Pellegr. (1911) 65. — Lectotype (designated here): *Klaine 701* (P), Gabon, near Libreville, syn. nov.

Guarea parviflora Baker f. (1913) 17; Pellegr. (1939) 150; Harms (1940) 135; Keay (1958) 707. — Type: *Talbot 1281* (holo BM; iso K), Nigeria, Oban.

Shrub or treelet up to 2.5(–3) m high, thinly stemmed; stem up to 0.8 cm diam., sparsely branched, with dark greenish brown or blackish bark. *Leaves* confined to the upper part of the stem and branches, imparipinnate, (3–)5–11(–15)-foliolate; petiole 2.5–13.5(–16) cm long, slender, terete but flattened or shallowly furrowed above; rachis (3–)5–20(–33) cm long; both petiole and rachis minutely pubescent; petiolules 0.1–0.6 cm long, puberulous, petiolule of terminal leaflet up to 0.8 cm long. Leaflets opposite, subopposite or more or less alternate, elliptic, obovate or ovate, usually narrowly so, 4–20(–22) by (1–)2–7.5(–8.5) cm, distal leaflets largest, proximal leaflets smaller; apex acuminate to almost caudate, drip-tipped, or acute, or rarely obtuse; base cuneate to obtuse and in terminal leaflets often attenuate, frequently somewhat unequal-sided; upper surface glabrous but usually with a rather dense, stiff, short to sometimes comparatively long indumentum in the furrow of the shallowly impressed midrib, main secondary nerves indistinct, 5–11 on either side, opposite or not, straight or slightly arched but curving and anastomosing before reaching the margin, tertiary nerves indistinct; lower surface glabrous or thinly puberulous on the prominent midrib and distinct nerves. *Inflorescences* axillary or supra-axillary, underneath or in between the leaves near the apex of the stem, single or up to 5 clustered in a fascicle, raceme-like or sparsely paniculately branched, up to 40 cm long; the branches, if present, rather widely spaced, near the base of the inflorescence, up to 14 cm long and progressively shorter higher up, finally the flowers almost sessile, often a few together and the inflorescence becoming raceme-like; the axes slender, somewhat flattened and furrowed, puberulous or shortly pubescent; bracts subtending the ramifications narrowly oblong or ovate, c. 0.8–1 by 0.2–0.3 mm, acute at apex, puberulous. Female inflorescences comparatively short, up to 15 cm long. *Male flowers* often sweetly fragrant; pedicel slender, 1–3 mm long, usually articulate, minutely puberulous and often strewn with conspicuous minute dark brown glandular trichomes (magnification!); bracteole narrowly oblong or triangular, c. 0.2–0.4 by 0.1–0.2 mm, puberulous. Calyx cup-shaped, shallowly (3- or) 4- or 5-lobate or bluntly dentate, 1–2(–2.5) by 2–3 mm, puberulous or almost glabrous, and sometimes strewn with conspicuous minute blackish trichomes. Petals (3 or) 4 or 5, free, narrowly oblong to obovate, 6–8(–9.5) by 2–2.5(–3) mm, bluntly acute at apex, puberulous on the margin, otherwise usually glabrous, greenish to white or pale pink. Staminal tube 5–7(–7.5) mm long, glabrous, shallowly crenate at apex; anthers (6–)8–10(–12), implanted inside near the rim and completely hidden in the tube or slightly exserted, c. 0.8–1 by 0.3–0.6 mm. Pistillode distinct, slender, stipitate, 6–7(–8) mm long; stipe 1–2.5 mm long, inflated in the upper half to form an annular structure around the base of the ovary, glabrous; ovary obovoid to spindle-shaped, 1–2 mm diam., variously glabrous, hirsute or sericeous, longitudinally usually distinctly 8- (or 9-)furrowed or ridged; style 1.5–3(–4) mm long, glabrous; stigma disciform. *Female flowers* similar to male flowers but anthers not producing full-grown pollen; the stipe expanded in the upper part to form a cushion underneath the ovary;

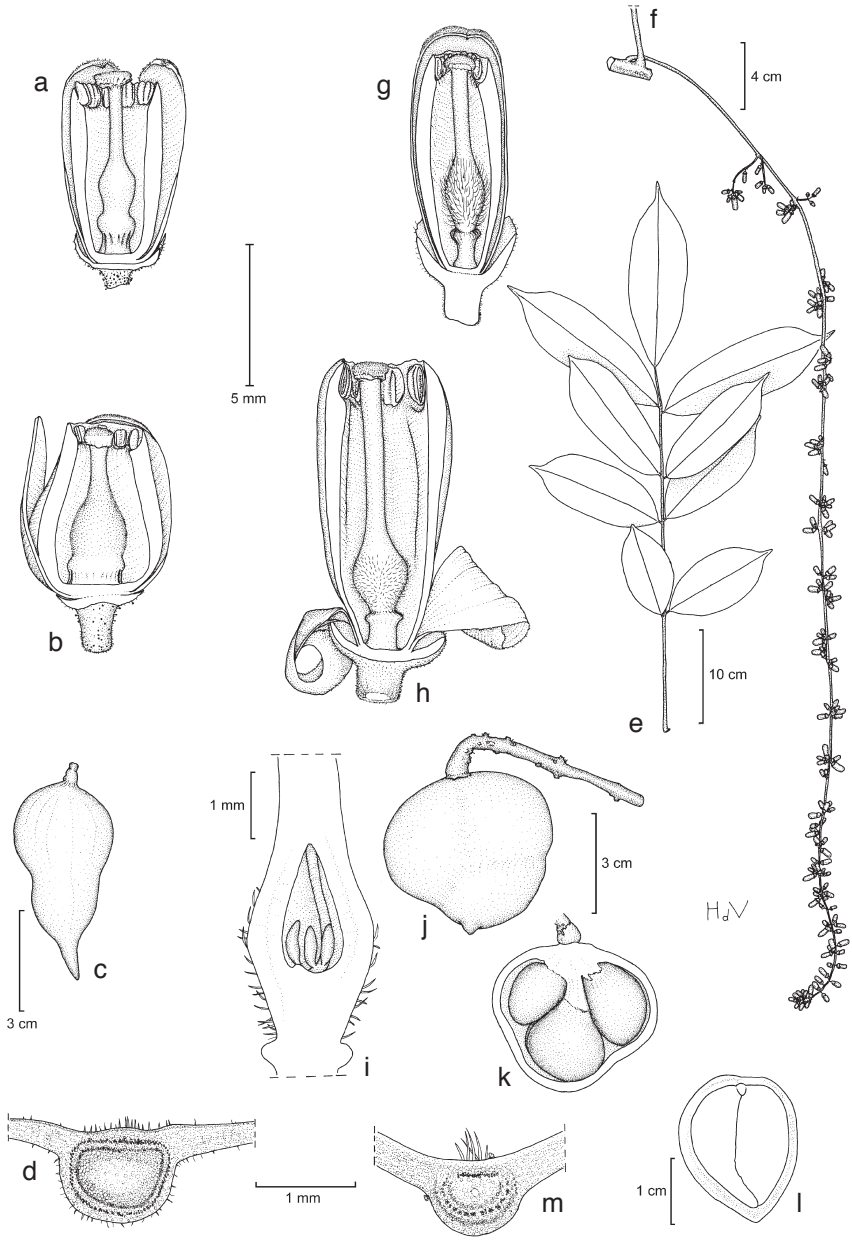


Fig. 4. a–d: *Heckeldora staudtii* (Harms) Staner. a. Section of staminate flower; b. section of pistillate flower; c. fruit; d. transverse section of midrib of leaflet. — e–m: *Heckeldora zenkeri* (Harms) Staner. e. Leaf; f. staminate inflorescence; g. section of staminate flower; h. section of pistillate flower; i. longitudinal section of ovary; j. fruit; k. fruit, opened; l. longitudinal section of seed; m. transverse section of midrib of leaflet (a, d: *Leeuwenberg 9132*; b; *Wieringa 921*; c: *Breteler 6583*; e–g: *WJ. de Wilde & De Wilde-Duyfjes 1932*; h, i: *Breteler & JJ. de Wilde 375*; j, k: *JJ. de Wilde 7875A*; l: *JJ. de Wilde et al. (WALK-B) 290*; m: *Breteler 1603*; all WAG).

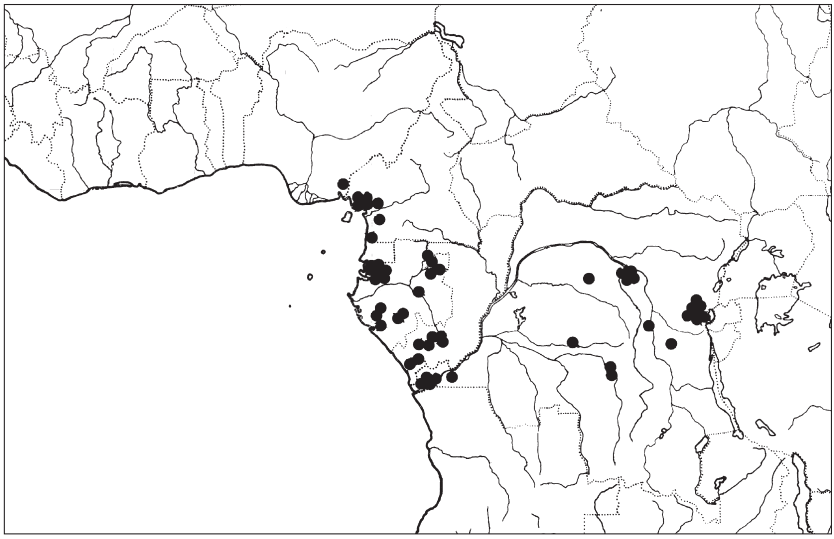
ovary well developed, ellipsoid, c. 3 by 2 mm, variously glabrous or pubescent; both the ovary as well as the inflated part of the stipe longitudinally 8- (or 9-) furrowed; unilocular with 2 (or 3) pairs of collateral upright ovules with parietal placentation from near the base of the ovarian cavity. *Infructescence* scantily fructiferous, usually only 2 or 3 drooping fruits developing into maturity, rarely many more. *Fruit* on a conspicuous, up to 15 mm long, 7–9-ribbed stipe, indehiscent, basically ovoid to cylindrical, c. 2.5–6 by 1.5–3 cm, however usually irregularly shaped and asymmetric, knobbed by the outlines of the 2–4(–5) large seeds and with constrictions between the seeds, often markedly 7–9-ridged, more rarely the fruits 1-seeded and almost globose, 1.5–2 cm diam. or elongated spindle-shaped, up to 3 by 1 cm, extended by an often curved, up to 20 mm long rostrum; pinkish brown or orange-yellow at maturity, minutely puberulous or covered with a dense velvety indumentum.

Distribution — S Nigeria, Cameroon, Equatorial Guinea, Gabon, Congo (Brazzaville), Democratic Republic of Congo.

Habitat & Ecology — In shrub layer of mature evergreen and semi-deciduous lowland forest, also in old secondary forest; on dry land and on alluvial soil along watercourses. Altitude up to 1000 m. Flowering and fruiting: Nigeria & Cameroon: October to March (fl.), May to December (fr.); Gabon to Democratic Republic of Congo: March to November (fl.), September to June (fr.).

Vernacular names — Democratic Republic of Congo: Lifundji, ikokakoka (dial. Turumbu); kamantimbia, kulumanya (dial. Kitembo).

Notes — 1. The concept of *H. staudtii*, here presented, largely follows the notion of this species used by Staner & Gilbert (1958). An analysis of material originating from the whole area at first made me recognize two groups. One group, characterized by numerous conspicuous short brown glandular trichomes on the calyx and a distinctly articulated pedicel was presumed to be confined to Lower Guinea, including Congo



Map 2. Distribution of *Heckeldora staudtii* (Harms) Staner.

(Brazzaville). The material that came from the Congolian region generally lacked these characteristic trichomes and showed a less constant articulation of the pedicel. More or less intermediate, doubtful specimens, however, were found. Moreover, no reliable correlation could be established with one or more of the other, often highly variable characters. I, therefore, refrained from awarding the two groups taxonomic distinction, not even at a subspecific level.

2. When Pierre (1897) published the new genus *Heckeldora* he founded it on two simultaneously described new species, viz. *H. latifolia* and *H. angustifolia*. In the description of *H. latifolia* he cites two specimens namely *Klaine 432* and *Autran* in *Heckel 14*. According to a note in Pierre's handwriting added to *Klaine 431* (a syntype of *H. angustifolia*) *Heckel 14* consists of fruits in spirit. I have not seen the latter material and in doubt of its condition I chose to designate *Klaine 432* as the lectotype of the name *H. latifolia*. Unfortunately, I failed to recover the authentic material from the Paris herbarium. However, Dr F.J. Breteler (pers. comm., at WAG) informs me that he examined *Klaine 432* in Paris in December 1992. He then copied the line drawing of this specimen, most probably prepared by Delpy. The drawing is marked: "Heckeldora latifolia Pierre, ad Libreville, Gabon. Coll. R.P. Klaine No. 432 – 4/96", and with the scribbled observation: "Fleurs desirées". It represents a twig with a leaf and an infructescence, details of the fruit and seed, and a fragment of a leaflet. The drawing concurs with the information given in the original description. I trust *Klaine 432* will be recovered and marked as the lectotype of *H. latifolia*. Meanwhile it is surprising that the characters of the inflorescence and flowers, mentioned also in the description, apparently are not taken from the two syntypes cited, as these show only fruits. This inconsistency probably becomes comprehensible upon examination of *Klaine 701* (2 sheets in P). This specimen comprises leaves and an inflorescence with flowers at anthesis. Added to this collection and in the handwriting of Pierre is a description in Latin of the plant with an analysis of its flowers and a sketch of a longitudinal section of a flower, dated 12 Sept. 1896. The details, and in particular those of the flowers, mentioned in this description perfectly match the data of *H. latifolia* given in the protologue. Moreover, above the handwritten description, and always in Pierre's hand, it is written "R.P. Klaine n. 701 = 432". Evidently, at the time this description was prepared Pierre held the opinion that *Klaine 701* and *Klaine 432* represented the same species. Also accompanying *Klaine 701* is a reproduction of a drawing of this collection by E. Delpy, dated February 1897. It represents a small part of an inflorescence and all parts of a dissected flower. In the caption of Delpy's drawing, interestingly, the specific epithet in *H. latifolia* is crossed out later and replaced by "*Klainii*". Apparently Pierre, following a meeting of the Linnean Society of Paris on 15 January 1897, where he presented the new genus and its two species, changed his mind and concluded that *Klaine 701* represented still another species. This may have led Pierre to exclude *Klaine 701* from the material on which he based *H. latifolia* just before this name became validated by its publication in April 1897.

Pellegrin (1939) was first to conclude that the name *H. latifolia* was a slightly junior synonym of the basionym of *H. staudtii* (*Guarea staudtii*). This has been followed by all subsequent authors and is accepted here.

3. From Pierre's (1897) description of *H. angustifolia* it is clear that length and width of the leaflets as well as their ratio present the main characteristic to discriminate between

this species and *H. latifolia*. Leaflets of *H. angustifolia* are indicated to measure between 1 and 2 cm in width. However, *Klaine 431* (the lectotype) also shows leaflets that measure 2.5 cm in width and thus are at the lower limit of the dimensions indicated for *H. latifolia* viz. 2.5–7 cm. In *Sita 4579* (WAG) from Congo (Brazzaville) the leaflets measure 5.5–12 by 1.3–2.7 cm, and they are narrowly shaped. All details of the inflorescences and of the flowers of this collection, however, perfectly fall within the variation indicated for *H. staudtii*. This and more data from recent collections support the conclusion that the material with narrow leaflets on which *H. angustifolia* is based falls within the variation of the taxon described by Pierre as *H. latifolia*. Consequently, Keay (1958) is followed who considered *H. angustifolia* and *H. latifolia* identical and placed both names into the synonymy of *H. staudtii*.

4. *Heckeldora klainei* was validly published by Pellegrin (1911). This author cited three collections and from among these syntypes I selected *Klaine 701* as the lectotype. Details of *Klaine 701* are given above with note 2. The material fits well into our concept of *H. staudtii* and accordingly the name *H. klainei* is considered a later synonym.

5. *Heckeldora acuminata*, a manuscript name of Pierre validated by Pellegrin (1911), is based on three syntypes. *Klaine 2490 B* is chosen here as the lectotype. The material, two sheets conserved in P, consists of leaves and flowers. All details of these fall well within the variation ascribed by the present author to *H. staudtii*.

6. *Guarea parviflora* was validly published by Baker (1913). The characteristics of the type, *Talbot 1281* (BM, K), as well as the details given in the protologue and in particular the length of the calyx and the petals all point to *H. staudtii*. Keay (1958) was first to place *G. parviflora* in the synonymy of *H. staudtii*, which is followed here.

5. Heckeldora trifoliolata J.J. de Wilde, *spec. nov.* — Fig. 5; Map 1

> Species endemica in Gabonica combinatione foliorum (1–)3-foliolatorum nervis lateralibus principalibus valde curvatis cum fructu rostrato non costato notabilis. — Typus: *J.J. de Wilde, Van der Maesen & Moussavou 11594*, unicate (holo WAG), Gabon, Ngounié Prov., Koumounabwali massif, c. 1° 16' S, 10° 28' E, 14 December 1995.

Shrublet up to 150 cm high. *Leaves* imparipinnate, 3-foliolate; petiole 5.5–13.5 cm long, slender, terete, towards the base faintly flattened above; rachis 3–7.5 cm long; petiolules 0.2–0.5 cm long, puberulous, the petiolule of the terminal leaflet in the same range. Leaflets opposite, subopposite or alternate, elliptic, ovate or obovate, 9–20 by 5–10 cm, terminal leaflet largest; apex acuminate, sometimes acute or rounded; base cuneate or rounded, the lower half of the leaflet sometimes attenuate; upper surface glabrous but for a dense, very short, stiff indumentum in the shallow furrow of the impressed midrib and principal nerves, main secondary nerves 3–5 on either side, rarely opposite, widely spaced, ascendant, characteristically loop-shaped, curving and anastomosing before reaching the margin, tertiary nerves indistinct above, rather distinct below; lower surface with a few loosely scattered very minute dark brown glandular (?) trichomes (strong magnification!) and somewhat puberulous on the prominent midrib and lateral nerves. *Inflorescences* few, axillary or spaced among the leaves in the upper part of the stem; male inflorescence a raceme-like narrow panicle, pendulous, up to 33 cm long, the basal branches if present sparse, up to 1 cm long, bearing up to 5 flowers, otherwise the branches barely developed and the flowers seemingly sessile, rather widely

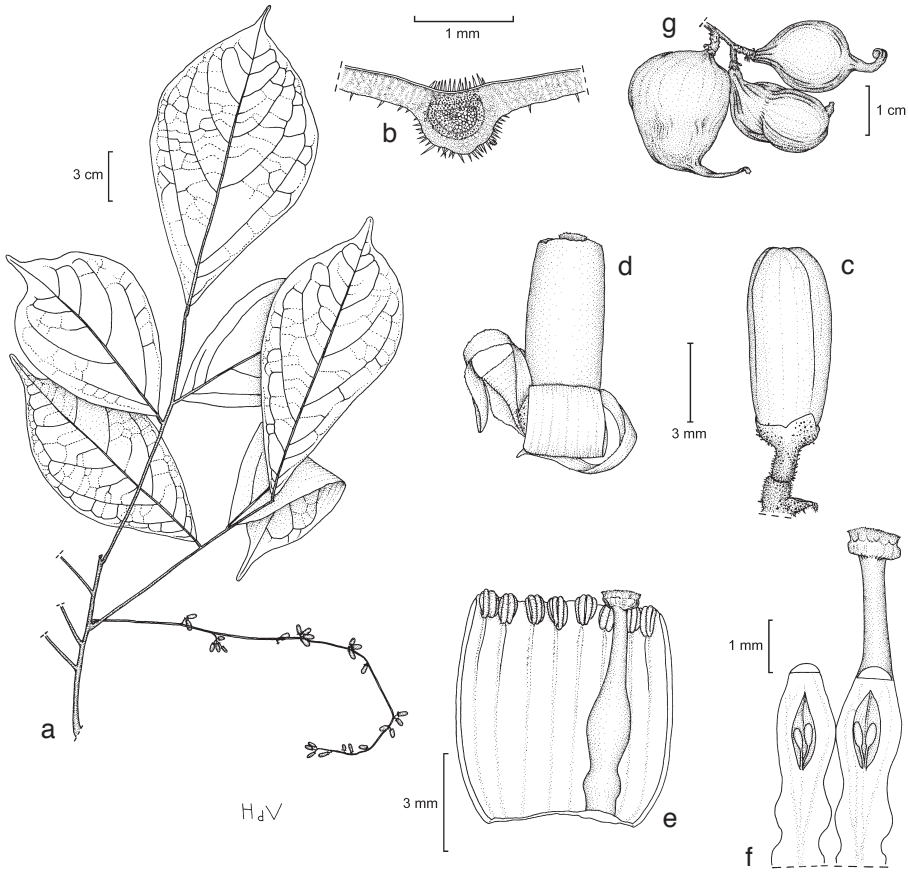


Fig. 5. *Heckeldora trifoliolata* J.J. de Wilde. a. Habit of staminate plant; b. transverse section of midrib of leaflet; c. flower bud; d. flower at anthesis; e. opened staminal tube with pistillode; f. longitudinal section of ovary and stipe of pistillode; g. fruits (a, c–f: *J.J. de Wilde, Van der Maesen & Moussavou 11594*; b, g: *Van Valkenburg et al. 2715*; all WAG).

spaced along the angular puberulous axis. Bracts ovate, c. 1 by 0.5 mm, puberulous. *Male flowers* on up to 4 mm long pedicels, sometimes almost sessile; bracteoles ovate, minute, 0.4–0.5 by 0.2–0.3 mm, pubescent, receptacular part of the pedicel (the part that stays with the flower when it drops from the inflorescence) cylindrical, 1–3 mm long, puberulous, dotted with contrasting dark brown very short glandular trichomes, jointed to the less than 1 mm long basal part of the pedicel. Calyx cup-shaped, c. 1–1.5 by 2–3 mm, shallowly 4-dentate, puberulous, dotted with conspicuous minute dark brown trichomes similar to those on the receptacle (magnification!). Petals 4, free, narrowly oblong to narrowly obovate, 7.5–8.5 by 2.5 mm, glabrous. Staminal tube 7–7.5 mm long, up to 3 mm wide, glabrous, very shallowly crenate at apex, anthers not visible above the rim; anthers 8, c. 1 by 0.5 mm, producing well-developed pollen. Pistillode distinct, stipitate; stipe 1–2.5 mm long, glabrous, more or less inflated halfway; ovary ellipsoid or ovate, 1.5–2.5 by 1–1.5 mm, glabrous, 1-locular with parietal placentation,

each of the two placentas with 2 vestigial collateral ovules implanted near the base of the locule; style 2–3 mm long, glabrous; stigma discoid. *Female flowers* not known. *Infructescences* sparse, probably only one per plant, short, 1–4 cm long, 1- or 2-, rarely more fruited. *Fruit* on a 5–10 mm long stipe, indehiscent, obovoid or cylindrical but often irregularly shaped, not ribbed, up to 3.5 by 2.5 cm and extended by a curved, up to 1.5 cm long rostrum, yellowish at maturity, densely very shortly pubescent.

Distribution — Gabon, confined to the coastal provinces.

Habitat & Ecology — In shrub layer of both mature and secondary forest; on sand and rocky outcrops in the sedimentary basin. Altitude up to 350 m. Flowering: August to December and April; fruiting: December to February.

Note — The five flowering collections I examined all represent male individuals. Female flowers are wanted.

Additional specimens examined:

GABON. *Haegens & V.d. Burgt 108* (WAG), Ogooué-Maritime, Rabi-Kounga, road to Divangui, 1° 54' S, 9° 55' E; *Le Testu 5118* (P), Echiras forest, between Moutéti and Malongo Mabey; *A.M. Louis, Breteler & De Bruijn 187* (WAG), Estuaire, near Libreville, along road to Cap Estérias, 0° 29' N, 9° 30' E; *Nguema Miyono 2017* (LBV, WAG), Estuaire, Crystal Mts, 0° 26' N, 10° 08' E; *Reitsma c.s. 3227* (LBV), Nyanga, c. 50 km SSW of Doussala, 2° 36' S, 10° 35' E; *Schoenmaker 270* (WAG), Ogooué-Maritime, Rabi-Kounga, c. 1° 58' S, 9° 54' E; *Van Valkenburg et al. 2715* (LBV), Nyanga, Moukalaba-Doudou National Park, 2° 39' S, 10° 30' E.

6. **Heckeldora zenkeri** (Harms) Staner — Fig. 4e–m; Map 3

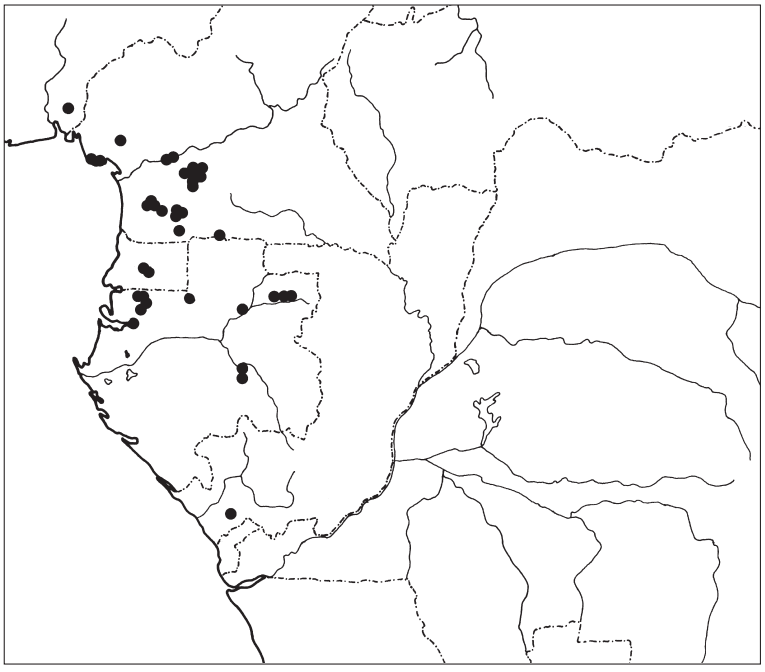
Heckeldora zenkeri (Harms) Staner (1941) 207; Keay (1958) 707. — *Guarea zenkeri* Harms (Nov. 1896) 158; Pellegr. (1939) 151; Harms (1940) 135. — Lectotype (designated here): *Zenker 379* (holo B†; lecto K; iso-lecto COI), Cameroon, Yaoundé-Station.

Guarea bipindeana C.DC. (1907) 149; Pellegr. (1939) 151; Staner (1941) 202. — Type: *Zenker 2921* (holo G; iso B, BR, COI, E, L, WAG, Z), Cameroon, Bipindi.

Guarea nigerica Baker f. (1913) 18; Pellegr. (1939) 150; Harms (1940) 135; Staner (1941) 210; Keay (1958) 707. — Type: *Talbot 1350* (holo BM; iso K), Nigeria, Oban.

Shrub or treelet up to 4 m high, sparsely branched. *Leaves* congested terminally, imparipinnate, (3–)7–11(–13)-foliolate; petiole 3.5–12(–19) cm long, slender, terete, near the base slightly flattened and higher up shallowly and often inconspicuously furrowed above; rachis 13.5–25(–36) cm long; petiole and rachis almost glabrous or at best puberulous, however, always with a dense very short stiff indumentum in the furrow above; petiolules 0.1–0.5 cm long, puberulous. Leaflets opposite, subopposite or alternate, narrowly elliptic to elliptic or (narrowly) obovate 4–21 by 2.5–7 cm; distal leaflets largest, proximal leaflets considerably smaller; apex acuminate or rarely almost acute; base cuneate or obtuse; upper surface glabrous but for a short stiff dense indumentum in the furrow of the impressed midrib, exceptionally the midrib glabrous; secondary nerves 5–13 on either side, not very distinct, opposite or not, straight or somewhat arched but always curving and anastomosing before reaching the margin, tertiary nerves indistinct; lower surface glabrous or sparsely puberulous on the prominent midrib, secondary nerves distinct. *Inflorescences* axillary or in between the leaves near the leafy apex of the stem, usually few or even single; female inflorescences comparatively short, sometimes reaching 28 cm long, male inflorescences up to 60(–80) cm long, almost not or sparsely branched and then loosely paniculate with the basal

branches up to 15(–17) cm long, the branches progressively becoming shorter and more widely spaced towards the distal part, finally the flowers almost sessile, a few clustered together and the inflorescence raceme-like; axes flattened, puberulous; bracts narrowly ovate, c. 1.5 by 0.5 mm, acute at apex, pubescent. *Male flowers* shortly pedicellate, sweetly fragrant; upper receptacular part of pedicel cylindrical, slightly tapering to the base, 0.5–1.5 mm long, puberulous and with a few large, flat, roundish, yellowish brown trichomes and rarely in addition with a number of dark brown, short, glandular trichomes, jointed to the very short bracteolate lower part of the pedicel; bracteoles narrowly ovate to triangular, minute, c. 1 by 0.2–0.4 mm, pubescent. Calyx cup-shaped, 2–3.5 by 3–4 mm, not or shallowly (3- or) 4-lobed to dentate, puberulous and with a few large brownish glands (magnification!). Petals (3 or) 4, free, narrowly obovate or oblong, 8–11 by 2.5–4 mm, obtuse to acute at apex, greenish white to pink, glabrous or minutely puberulous particularly on edge. Staminal tube 8–10 mm long, glabrous, crenate at apex; anthers 8 or 9, implanted near the rim inside and not or very slightly extending beyond the tube, c. 1 by 0.6 mm. Pistillode distinct, slender, stipitate; stipe 0.5–2.5 mm long, glabrous, somewhat inflated in the middle or higher up; ovary with vestigial ovules, ellipsoid, c. 1–2 by 1–1.5 mm, sericeous or sparsely hirsute; style 3–4 mm long, glabrous; stigma disciform. *Female flowers* similar to male flowers but anthers not producing mature pollen; the stipe swollen to form a narrow annulus beneath the ovary; ovary well developed, ellipsoid to ovoid, c. 1.5–3 by 1.5–2 mm, sericeous, 1-locular with 2 pairs of erect ovules implanted parietal near the base of the ovarian cavity. *Fruit* ovoid to obovoid but irregularly shaped and knobbed, not ribbed,



Map 3. Distribution of *Heckeldora zenkeri* (Harms) Staner.

bluntly pointed at the apex, 3–7 by 2–5 cm, yellowish at maturity, very shortly pubescent, velvety, in dried material the basal part often contracted into a stipe up to 0.5 cm long, the apical part also constricted and over c. 1 cm more or less gradually tapering into the apex. *Seeds* completely enveloped by a sarcotesta to 3 mm thick, sometimes polyembryonous.

Distribution — Nigeria, Cameroon, Equatorial Guinea, Gabon, Congo (Brazzaville).

Habitat & Ecology — In shrub layer of old growth evergreen and semi-deciduous forest, also in old secondary forest. Altitude up to 800 m. Flowering: October to March; fruiting: November to May.

Notes — 1. Harms (Nov. 1896) stated in the protologue that the ovary is 4-locular with 1 ovule in each locule. Certainly this is due to an observation error. Staner (1941) correctly concluded that the ovary is 1-locular, that the taxon belongs in *Heckeldora*, and accordingly effected its transfer. This is corroborated by examination of an isotype in COI.

2. *Guarea bipindeana* was validly published by De Candolle (1907). In the protologue the ovary of flowers of *Zenker 2921*, the type, is described as 4-locular, each locule containing 1 ovule. Already Pellegrin (1939) noticed that contrary to the statement in the protologue the ovaries in *Zenker 2921* are 1-locular with 4 ovules. This is supported by personal observation. Following Pellegrin (1939), who considered the name a later synonym of *G. zenkeri*, it is here placed in the synonymy of *H. zenkeri*.

3. *Guarea nigerica* was described by Baker (1913). Its protologue fits in every detail our concept of *H. zenkeri*. Baker explicitly follows Harms in considering the genus *Heckeldora* congeneric with *Guarea*.

4. Full-grown seeds in *J.J. de Wilde et al. (WALK-B) 290* were found sometimes to contain two well-developed embryos. Polyembryony reportedly is also found in other Meliaceous taxa. Fisch et al. (1995) for instance studied it in *Carapa procera* DC. and suggested that it may be an evolutionary strategy to survive partial damage by herbivores at the seedling stage.

EXCLUDED SPECIES

Heckeldora mangenotiana Aké Assi & Lorougnon (1989) 165. — Type: *Aké Assi 13291* (holo P, n.v.) = **Guarea mangenotiana** (Aké Assi & Lorougnon) J.J. de Wilde, *comb. nov.*

Note — The diagnosis states that the ovary is 1-locular with parietal placentation. This, however, is not shown in fig. 1 accompanying the description. In this the longitudinal section of a flower shows the ovary sessile and 2-locular, character states not found in *Heckeldora*. Unfortunately, it is not indicated on which material the drawing is based and I was unable to see the type. Interestingly, material of a 2 m high flowering shrub recently collected by *Jongkind c.s. 4479* (WAG) near Tabou in Côte d'Ivoire, the type area of *H. mangenotiana*, perfectly matches the description of this taxon, except that it shows a distinctly 2-locular ovary with in each locule a single axillary ovule. The combined information convinced me that a new *Guarea* is at hand. The three other *Guarea* species present in the area are well known and do not accommodate the material of the shrub or treelet described by Aké Assi & Lorougnon. Accordingly the new combination is here presented.

ACKNOWLEDGEMENTS

The curators of B, BM, BR, COI, E, FHO, G, K, L, P and Z are acknowledged for kindly putting herbarium collections on loan. In particular I am indebted to Gideon Shu Neba from Cameroon. At the time a fellow of the MOABI Foundation working in Wageningen, he studied the African representatives of the genus *Guarea* and meanwhile he paved the way for the present treatise on *Heckeldora*. The translations of the diagnoses into Latin were kindly provided by Dr Roel Lemmens. The accurate and artistic drawings were made by Hans de Vries. Dr Jan Wieringa prepared Map 1. I am grateful to a referee and to Prof. Marc Sosef for help and constructive comments on the manuscript that was prepared for publication by Ro de Wilde-Bakhuizen.

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IDENTIFICATION LIST

The number indicated behind each collection refers to the name of the species as follows:

1 = *H. jongkindii* J.J. de Wilde
2 = *H. ledermannii* (Harms) J.J. de Wilde
3 = *H. leptotricha* (Harms) J.J. de Wilde
4 = *H. staudtii* (Harms) Staner
5 = *H. trifoliolata* J.J. de Wilde
6 = *H. zenkeri* (Harms) Staner

Attims 245: 4.

Baldwin 11468: 1 — Bolema 1084: 4 — Bos 3393: 3; 3393A: 3; 3911: 3; 4060: 3; 5058: 3; 5328: 3; 5505: 3; 5658: 3; 6471: 3; 6686: 3; 6687: 3; 6781: 3; 6993: 3; 7077: 3; 7168: 3 — Bouquet 733: 4; 744: 4; 746: 4; 1001: 4; 2402: 4 — Breteler 1603: 6; 6583: 4; 8536: 4; 15727: 6 — Breteler & J.J. de Wilde 317: 6; 375: 6 — Breyne 3579: 4.

Cable 1429: 4 — Casier 289: 4 — Christiaensen 972: 4; 2075: 4 — Claessens 586: 4 — Compère 41: 4; 80: 4; 1741: 4 — Courtet in herb. d'Alleizette 1178: 4 — Cusset 1220: 6.

J.J. de Wilde 7875A: 6; 7885A: 6 — J.J. de Wilde, Arends & De Bruijn 8888: 6; 9130: 4 — J.J. de Wilde & De Wilde-Bakhuizen 11732: 4 — J.J. de Wilde & Sosef 10470: 4 — J.J. de Wilde, Van der Maesen & Moussavou 11594 (type): 5 — J.J. de Wilde, Van Gemerden & Shu Neba 12197: 3 — J.J. de Wilde et al. (WALK-B) 290: 6; 490:4 — W.J. de Wilde & De Wilde-Duyfjes 1180: 6; 1180C: 6; 1269: 3; 1397: 6; 1513: 3; 1543: 3; 1617: 6; 1932: 6; 1979B: 6; 2266: 6; 2824: 3; 3817: 3; 3855: 3 — De Wit 7633 sub 53: 6; 7855 sub 66: 6 — Devred 4179: 4 — Donis 1912: 4; 1964: 4; 3782: 4.

Elad 390: 6; 452: 4 — Eneme Efua 280: 4 — Etuge & Thomas 227: 4; 245: aff. 6 — Evrard 5204: 4.

Gilbert 10072: 4 — Groves et al. 82: 2 — Gutzwiller 2133: 4; 2437: 4.

Haegens & Van der Burgt 108: 5 — Hallé 735: 4; 752: 4; 1292: 6; 3435: 6 — Hallé & Villiers 5313: 4.

Jaques-Félix 5016: 6 — Jeffrey 323: 6 — Jongkind & Blyden 5279 (type): 1 — Jongkind et al. 5613: 1.

Khayoto 457: 6 — Klaine 431: 4; 431-bis: 4; 701: 4; 2163: 4; 2408: 4; 2490B: 4; 2604: 4; 3265: 4.

Lane et al. 477: 2 — Le Testu 5118: 5; 7746: 6; 9545: 6 — Lebrun 5253: 4; 5865: 4; 6409: 4 — Leeuwenberg 5100: 3; 6837: 4; 8813 (type): 2; 9132: 4; 9281: 2; 10561: 4; 10562: 4 — Lejoly 93/393: 6 — A. Léonard 1898: 4 — Letouzey 10212: 6; 14340: 4 — A. Louis 100: 4; 2830: 4 — A. Louis, Breteler & De Bruijn 187: 5 — J. Louis 248: 4; 291: 4; 910: 4; 1573: 4; 1791: 4; 2229: 4; 2372: 4; 2674: 4; 2801: 4; 2894: 4; 2992: 4; 3469: 4; 3657: 4; 3716: 4; 3956: 4; 4268: 4; 5949: 4; 8466: 4; 9022: 4; 10366: 4; 10871: 4.

Maudoux 319: 4 — Meijer 15328: 6 — Mildbraed 7689: 6.

Ngok Banak 1034: 4 — Ngok Banak, Moungazi & Mbazza 1755: 6; 1844: 6 — Nguema Miyono 2017: 5.

Parren 516: 1 — Pierlot 2814: 4; 2934: 4.

Reitsma & Wilks 3227: 5.

Schoenmaker 270: 5 — Shu Neba & Ndoum X1080: 6 — Sita 3192: 4; 4579: 4 — Staudt 534 (type): 4.

Talbot 1281: 4; 1350: 6 — Tchouto & Elad BIBOX-55: 6; EBIAX-15: 3; EBIAX-25: 3; EGONX-33: 6 — Thomas 2515: 4 — Thomas & Mcleod 5103: 2 — Thomas & Nemba 5411: 4 — Troupin 2493: 4; 3147: 4; 3696: 4; 6289: 4; 7790: 4; 10137: 4; 10261: 4; 10822: 4.

Van Andel 3676: 4; 4273: 3 — Van der Maesen, Louis & De Bruijn 5411: 4; 5563: 6; 5631: 6 — Van Valkenburg et al. 2715: 5; 3068: 4 — Vos 149: 4.

Wagemans 1724: 4; 2170: aff. 4 — Wieringa 371: 4; 840: 4; 921: 4; 1944: 6; 2005: 4; 3892: 6; 3984: 6.

Yafunga 134: 4.

Zenker 379 (type): 6; 468: 6; 1028 (type): 3; 2402: 6; 2921: 6; 3731: 6; 3974: 6.