

A review of the genus *Curtisia* (Curtisiaceae)

E. YU. YEMBATUROVA*⁺, B-E. VAN WYK*[•] and P. M. TILNEY*

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ABSTRACT

A review of the monotypic southern African endemic genus *Curtisia* Aiton is presented. Detailed studies of the fruit and seed structure provided new evidence in support of a close relationship between the family Curtisiaceae and Cornaceae. Comparisons with several other members of the Cornales revealed carpological similarities to certain species of *Cornus* s.l., sometimes treated as segregate genera *Dendrobenthamia* Hutch. and *Benthamidia* Spach. We also provide information on the history of the assegai tree, *Curtisia dentata* (Burm.f.) C.A.Sm. and its uses, as well as a formal taxonomic revision, including nomenclature, typification, detailed description and geographical distribution.

INTRODUCTION

Curtisia Aiton is a monotypic genus traditionally placed in the family Cornaceae. It is of considerable interest because of the many uses of its timber and bark—but no recent reviews of the morphology, taxonomy or anatomy are available. Recent cladistic and molecular systematic studies have revealed new evidence of relationships at family level (Murrell 1993; Xiang *et al.* 1993; Noshiro & Baas 1998; Xiang & Soltis 1998; Xiang 1999), including support for a separate family, Curtisiaceae, or a close relationship with the family Grubbiaceae, even resulting in a proposal for extending it to also include *Grubbia* P.J.Bergius (Xiang *et al.* 2002). As no taxonomic revision of *Curtisia* has ever been published since its original description in 1789, we present here a formal taxonomic treatment of this interesting southern African endemic genus. A further aim was to investigate the structure of the fruit and seeds to allow comparisons with putative relatives.

MATERIALS AND METHODS

Young branches with leaves and fruits at different stages of maturation were fixed in FAA (for a minimum of 24 hrs). The voucher specimen is *Van Wyk & Yembaturova 4218* (JRAU), collected at Diepwalle Forest (3323CC), Knysna District, Western Cape, South Africa. Some *Curtisia* fruits and seeds were also obtained from the carpological collections of LE and STU (collection of Felix Hohmann). Suitable portions were treated according to the method of Feder & O'Brien (1968) for embedding in glycol methacrylate (GMA). Specimens from the following herbaria were examined: JRAU, NBG, PRE and STU. Herbarium acronyms are given after Holmgren *et al.* (1990).

A Porter-Blüm ultramicrotome was used to cut transverse sections of the fruits from 3 to 5 µm thick, and the periodic acid-Schiff/toluidine blue staining method

(Feder & O'Brien 1968) was applied. Suitable sections were photographed. Fruits obtained from carpological collections were rehydrated and then softened by means of prolonged heating in Strassburger mixture (water, glycerol and 96 % ethyl alcohol in equal proportions), in accordance with traditional anatomical procedures (Prozina 1960) and then sectioned either by hand or sledge microtome. Test-reactions to identify lignification (phloroglucine and concentrated HCl), cutin and fatty substances (Sudan III, IV), starch (I-KI) and protein (biuret test with 5 % copper sulphate and 50 % KOH) were applied to the sections. The terminology used is illustrated in the figures.

RESULTS AND DISCUSSION

Vegetative morphology

The plants are tall shrubs or medium-sized trees 8 to 13 m high (Figure 1A) although specimens of up to 20 m are not uncommon (Coates Palgrave 2002). Young twigs are densely tomentose; the hairs are rusty brown to dark brown but become sparser and greyish with age. The bark is initially brownish and smooth; in older trees it becomes darker, tinted with grey and rough with square fissures (Figure 1D, E). The leaves are opposite, simple, petiolate and lack stipules. They are elliptic to ovate-lanceolate, 130–150 × 50–70 mm, leathery, bright to dark green and glossy above (but sometimes sparsely pubescent, mostly along the midrib, with simple, straight, thin hairs) and markedly reddish tomentose below (tending to become somewhat glabrescent with age). The lamina is entire, dorsiventral, with its apex broadly tapering to rounded and abruptly pointed; the base is mostly broadly tapering, less often cuneate; the margins are usually slightly revolute and are markedly dentate to serrate or almost sinuate. The venation is pinnate and markedly raised on the abaxial surface (Figure 1C). Stomata are anomocytic. Petioles are up to 30 mm long and rusty tomentose when young but may become sparsely hairy with age. Bud scales are brown or rust-brown and very densely pubescent.

Reproductive morphology and anatomy

Floral morphology and vasculature was thoroughly investigated by Eyde (1967, 1988). The small flowers of *Curtisia* are arranged in terminal, rather large (up to 120

* Department of Botany and Plant Biotechnology, University of Johannesburg, P.O. Box 524, Auckland Park, 2006 Johannesburg.

+ Present address: Department of Botany, Russian State Agrarian University—K.A. Timiryazev MSKHA, ul. Timiryazevskaya, 49 Moscow 127550, Russian Federation.

• Corresponding author e-mail address: bevanwyk@uj.ac.za; telephone: 027 011 559 2412.

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mm long) panicles (Figure 1B). Sometimes second-order inflorescences are formed of flowers clustered together, giving a somewhat capitate appearance. The peduncles and pedicels are covered with dense yellowish hairs. The opposite primary branches of the panicles are subtended by pronounced, markedly pubescent bracts (Cannon 1978). As is common for Cornaceae, floral parts are in fours (visible in Figure 1B). The petals are twice as long as the calyx tube, oblong in shape; the stamens are equal to petals in length. A characteristic centrally located vascular bundle in the four-loculed inferior ovary was described by Eyde (1967) who suggested the removal of *Curtisia* from Cornaceae on the basis of this feature.

Curtisia fruits (Figure 1C) are usually referred to as drupes (or 'drupaceous') (e.g. Dyer 1975; Leistner 2000) but this term is imprecise. True drupes are found only in the subfamily Prunoideae of the family Rosaceae where the fruit develops from a monocarpous gynoecium (Shibakina 1984; Levina 1987). In members of Cornales, as well as many other taxa, the fruits are syncarpous (with two or more fused carpels) and often pseudomonomerous (with only one of two or more locules and seeds reaching full development). Therefore, the term 'pyrenarium', proposed by Z. Artyushenko (Artyushenko & Fyodorov 1986) for such fruits as those of *Curtisia*, will be used. The term 'pyrene' applies to fruits

such as those of *Ilex* L. and some Araliaceae, where each seed is surrounded by a lignified endocarp (each called a pyrene). However, when the endocarp is fused into a single bony structure around the seeds, the term 'fused pyrenes' or 'pyrenarium' is preferable. The pyrenaria of *Curtisia* are small (10–15 mm in diameter), globose, subglobose or rarely ovoid, snow-white and sometimes with \pm persistent calyx teeth (Figure 1C). The outer pericarp tissues are fleshy (Figure 2A) and comprise both hypanthial exocarp and mesocarp, the latter developed from both hypanthial and carpellary tissues. The heavily lignified endocarp constitutes a four-loculed stone, usually with a fully developed seed in each. Only the very central area, where the vascular bundle is located, is not lignified (Figure 2F, arrow). The seeds are exotestal (see description of the seed coat later on), with copious endosperm and a well-developed, small, centrally located embryo.

The structure of the fruit wall and the seed was studied in detail. The exocarp is formed by a single layer of radially elongated cells with heavily thickened and cutinized walls (Figure 2B). The mesocarp is primarily parenchymatous. A hypoderm is clearly visible (Figure 2B, K) as the outermost zone of the mesocarp, with two to three layers of minute cells which are flattened in the tangential direction and sometimes have an almost

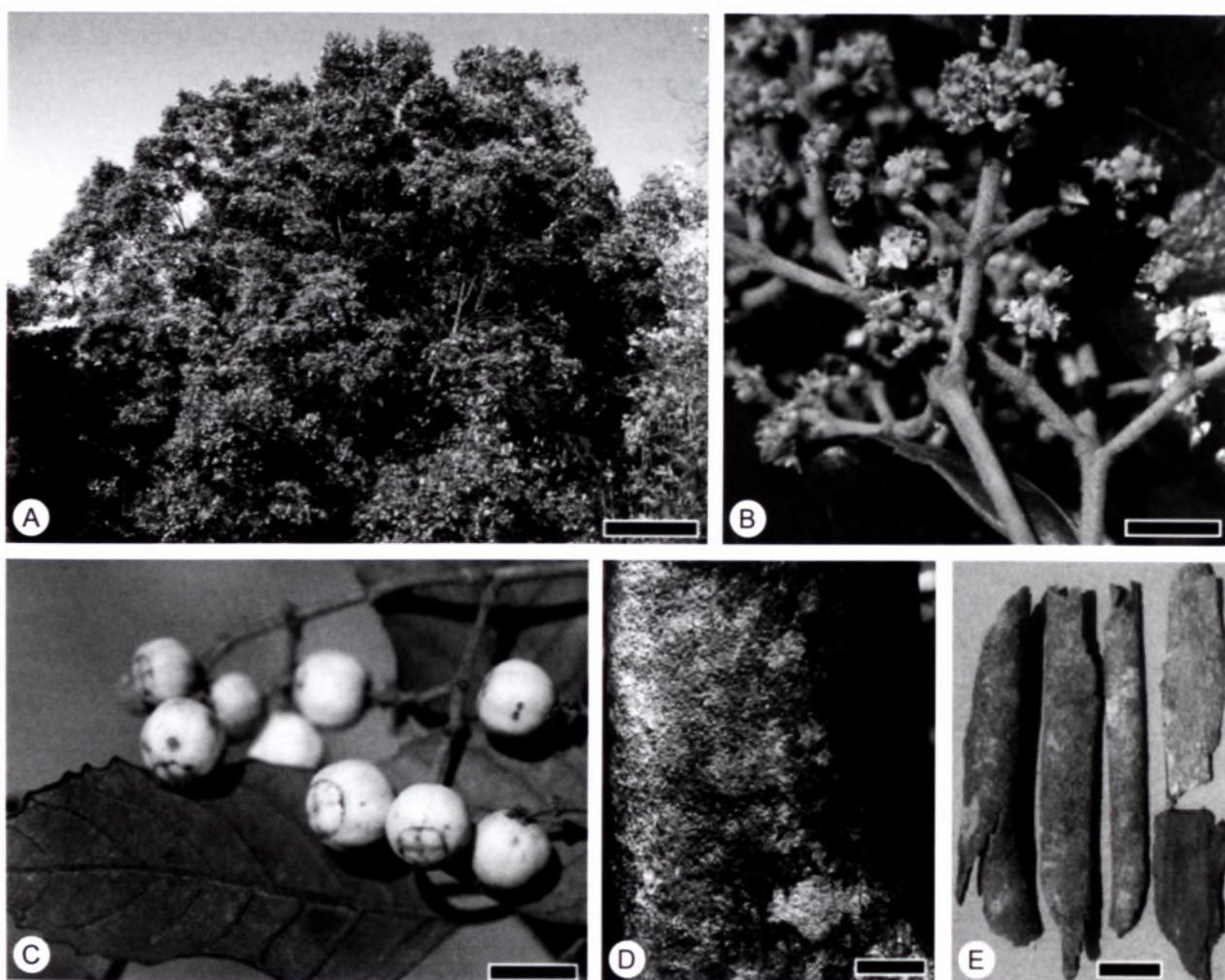


FIGURE 1.—Morphology of *Curtisia dentata*: A, growth form (cultivated tree at Kirstenbosch Botanical Garden); B, inflorescence with flowers (note densely tomentose vestiture); C, fruits (note white colour) and leaf surface; D, E, bark. Scale bars: A, 1 m; B, 6 mm; C, 10 mm; D, E, 40 mm. Photographs by B-E. van Wyk.

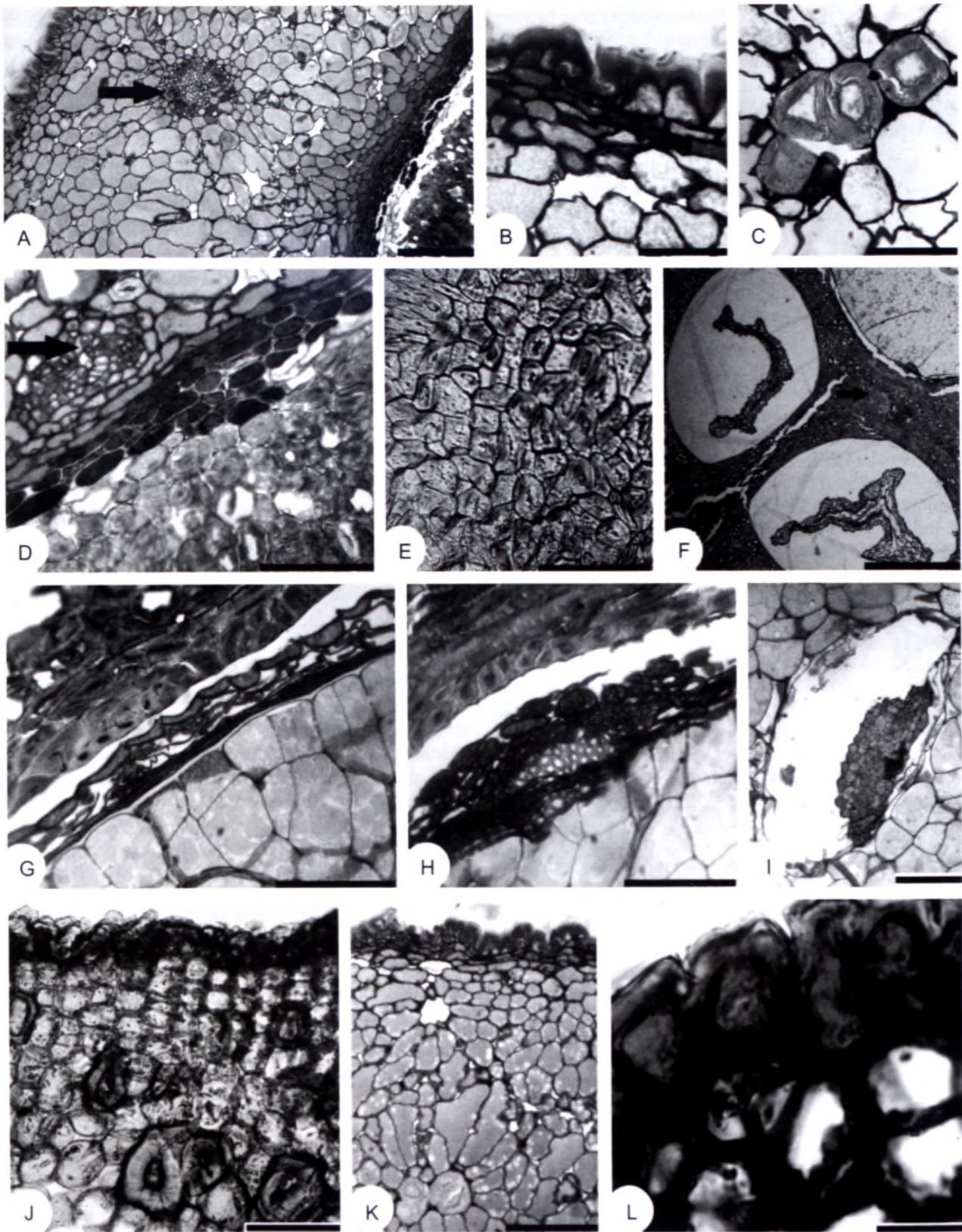


FIGURE 2.—Fruit and seed anatomy in c/s: A–I, *Curtisia dentata*; J, L, *Dendrobenthamia japonica* (Sieb. et Zucc.) Hutch. A, fleshy part of pericarp; B, exocarp (note cell wall cutinization) and hypoderm (outermost zone of mesocarp); C, mesocarp sclereids; D, derivatives of mesocarp vascular bundles and transitional zone between mesocarp and endocarp; E, endocarp sclereids; F, endocarp with seed-bearing locules and central vascular bundle (arrow); G, seed coat; H, seed coat vascular bundle; I, embryo and endosperm cells; J, K, exomesocarp with scattered sclereids (note similarity in structure); L, exocarp cells. Scale bars: A, J, K, 0.2 mm; B–E, G–I, L, 0.07 mm; F, 0.7 mm.

tabular arrangement. Most of the mesocarp consists of loosely arranged, large, thin-walled parenchymatous cells of varying shape. These cells form up to 16 layers. Small sclereids (Figure 2C) can be found scattered throughout the entire mesocarp (solitary or in clusters of two to

four). Also scattered in the mesocarp are the derivatives of vascular bundles (Figure 2A, D, arrow); they are fairly large but usually only slightly lignified. The inner zone of the mesocarp is composed of two or three layers of small, thin-walled cells which are elongated tangentially.

There is a very conspicuous intermediate zone between the mesocarp and endocarp, formed by five to seven (or up to nine) layers of small, tangentially elongated cells filled with brightly coloured tanniferous substances (dark zone in Figure 2A, D). These cells possess slightly thickened walls that are somewhat lignified.

The typically woody endocarp comprises 17 to 20 layers of fairly small sclereids (Figure 2E), mostly orientated parallel to the longitudinal fruit axis, except for the innermost layer(s), which can be variously orientated to form a 'lining' layer for each locule. Some of the sclereids appear to contain tannins.

The seed coat of *Curtisia* was previously incompletely described as 'thin and filmy, made of compressed and partially obliterated cells' (Trifonova 2000). However, our study revealed several interesting structural details. Firstly, the exotesta is composed of fairly large, tangentially elongated cells, which appear oval or almost crescent-shaped in cross section (due to concave outer tangential walls) (Figure 2G). These cells are filled with tanniferous substances and have walls consisting of cellulose. In certain parts of the seed coat, large sclerified vascular bundle derivatives are found (Figure 2H), surrounded by a few layers of very small, compressed parenchymatous cells. This type of seed coat can be classified as 'exotestal' because of the pronounced, thick-walled outer cells.

The meso- and endotestal components of the seed coat largely consist of compressed and deformed cells of irregular shape, sometimes only with their walls persisting. The part of the endotesta which lies against the endosperm is homogenous and the cell walls are indistinguishable and cutinized.

The seed has a massive copious endosperm, with protein as the main ergastic substance; the minute embryo is located centrally within the endosperm (Figure 2I).

Phylogenetic relationships

The relationships of *Curtisia* have not yet been clarified. Its position within the Cornaceae had been stable for a long time (Harms 1898; Wangerin 1910; Philipson 1967; Cronquist 1981; Thorne 1992) but its isolated position within the family was noted—hence the subfamily Curtisioidae of Harms (1898). Evidence had gradually accumulated (Adams 1949; Eyde 1967; Yeramyan 1971) for separating it as a monotypic family Curtisiaceae Takht. (validated by Takhtajan 1987) but still within Cornales. This followed an earlier trend of splitting the broad family concept of Harms (1898) by elevating most of the 15 genera to family status, e.g. *Davidia* Baill. to Davidiaceae (Li 1954), *Mastixia* Blume to Mastixiaceae (Calestani 1905—cited by Takhtajan 1987) and *Toricellia* DC. to Toricelliaceae (Hu 1934—cited by Takhtajan 1987).

Detailed molecular systematic studies by Xiang and co-authors (Xiang *et al.* 1993, 1998, 2002; Xiang & Soltis 1998; Xiang 1999; Fan & Xiang 2003) showed that *Curtisia* is sister to another southern African endemic genus *Grubbia*, and that the combined clade is again sister to the rest of the Cornales. A suggestion by Xiang *et al.* (2002) to expand the Grubbiaceae to include

Curtisia (citing similarities such as the geographical distribution, woody habit, leathery simple leaves with revolute margins, opposite phyllotaxy, lack of stipules, hermaphroditic flowers, inferior ovary and copious endosperm) was not followed in later treatments (e.g. Angiosperm Phylogeny Group II 2003; Heywood *et al.* 2007) where the two monotypic families were retained. According to Xiang *et al.* (2002), 'no apparent morphological synapomorphies can be found for the two genera at present' and there are indeed important differences between them. The distribution of *Curtisia* extends along the southern and eastern coast of South Africa northwards as far as Mozambique (coastal zone—Da Silva *et al.* 2004) and eastern Zimbabwe (Baker 1911–1912; Eyles 1917), whereas *Grubbia* is restricted to fynbos. The large, leathery leaves of *Curtisia* are coarsely dentate or sometimes sinuate and only slightly revolute, whereas the small, almost ericoid leaves of *Grubbia* species have entire margins which are distinctly revolute. There are also important morphological differences in reproductive structures—inflorescences, flowers and especially the fruits. Xiang *et al.* (2002) ascribed these differences to ancient divergence. It is possible that a more detailed investigation of the anatomy of *Grubbia* fruits and seeds could shed some light on the *Curtisia*–*Grubbia* relationship, but hitherto this appears to be based only on molecular evidence.

Carpological research of Cornales and allies by Yembaturova (2001, 2002), the comparative results of which are summarized in Table 1, showed a number of basic structural traits that appeared to be of diagnostic value. *Curtisia* resembles *Cornus* L. s.l., *Nyssa* L., *Alangium* Lam. and *Corokia* A.Cunn. most closely, and *Davidia* and *Mastixia* to a lesser extent. All of these taxa have epigynous flowers (however, this is still questionable for *Davidia*), typical pyrenaria, thick, succulent exomesocarps and well-developed woody endocarps. *Curtisia*, however, differs from all other taxa in having stones with all four locules similar in size and shape, each containing a fully developed seed. The other taxa usually have only a single fully developed locule and seed. There are also differences in some finer structural details. *Alangium* and *Mastixia*, for example, have conspicuous secretory structures in their fleshy mesocarp tissues which are absent in *Curtisia*. Species of *Nyssa* have either no sclereids or far more mesocarp sclereids than *Curtisia*. Furthermore, *Curtisia* is the only genus with a centrally located vascular bundle in the ovary; other putative Cornaceae relatives are reported to have transseptal bundles (Eyde 1967).

As is well known, the Cornaceae have a rich fossil record which includes wood, leaves and especially fruits (Miki 1956; Eyde & Barghoorn 1963; Eyde *et al.* 1969; Mai & Walther 1978; Arbuzova 1988; Eyde 1988; Eyde & Xiang 1990). Most of the fossil structures have been identified as belonging to the genera *Davidia*, *Mastixia*, *Diplopanax* Hand.-Mazz., *Nyssa*, *Alangium* and *Cornus*. Recently, a fossil species of the Eocene London Clay flora, originally referred to as *Leucopogon quadrilocularis* Reid & Chandler or *Cornus quadrilocularis* (Reid & Chandler) Chandler was shown to belong to *Curtisia* (Manchester *et al.* 2007) on the basis of the endocarp structure. The fossil endocarps of *Cornus quadrilocula-*

ris are composed of slightly elongated sclereids and possess four seed-bearing locules and a vascular bundle in the centre, as in extant *Curtisia*.

The greatest degree of resemblance to *Curtisia* in pericarp structure (Figure 2J, L, with a portion of *Curtisia* pericarp given in Figure 2K for comparison) is shown by two representatives of the genus *Cornus* s.l., currently segregated into the genera *Dendrobenthamia* (Asian dogwoods with compound fruits) and *Benthamidia* (American dogwoods with fruits clustered together without fusing). These three taxa all have radially elongated exocarp cells with heavily cutinized walls, solitary or clustered sclereids scattered throughout the parenchymatous mesocarp and a homogeneous woody endocarp. It is noteworthy that scattered sclereids were previously treated as an adaptation to synzoochorous dispersal in the relatively large, compound fruits of *Dendrobenthamia*, believed to be dispersed by monkeys (Eyde 1985). *Curtisia* fruits, despite their bitter taste, are also dispersed by animals such as birds (loeries, rameron pigeons), wild pigs, monkeys and less often baboons (Watt & Breyer-Brandwijk 1962). It seems likely that *Curtisia* fruits may be oil-yielding, as many white-fruited dogwoods from *Cornus* s.l. [e.g. *Swida alba* (L.) Opiz, *S. sericea* (L.) Holub and other shrubby species] have fruits rich in oil (Sozonova 1992). These fruits look white because of the oil droplets that reflect light. Thus, fruit anatomy has hereby provided evidence of a possible *Curtisia*–*Cornus* affinity and therefore supports Takhtajan’s (1987) treatment of *Curtisia* as a monotypic family Curtisiaceae within the order Cornales, close to the core family Cornaceae. The latter is currently treated as consisting only of *Cornus* s.l. but it has often been divided into several segregates (Takhtajan 1987, 1997).

TAXONOMY

Curtisia Aiton, Hortus kewensis 1: 162 (Aug.–Oct. 1789) nom. cons.; Thunb.: 100 (1792); Thunb.: 28 (1794); Thunb.: 141 (1823); Willd.: 687 (1797); Roem. & Schult.: 294 (1818); Spreng.: 442 (1825); DC.: 12 (1825); Harv.: 143 (1838); Endl.: 799 (1839); Lindl.: 783 (1847); Harv.: 579 (1862); Hook.f.: 949 (1867); Baill.: 3: 334 (1863), 163 (1879a), 253 (1879b); Harms: 262 (1898); Wangerin: 29 (1910). Type: *C. faginea* Aiton [now *C. dentata* (Burm.f.) C.A.Sm.].

Note: the generic name *Curtisia* Aiton was conserved against the earlier homonym *Curtisia* Schreber, Apr. 1789 (family Rutaceae) and is listed in the International Code of Botanical Nomenclature (McNeill *et al.* 2006). Both these generic names were given in honour of William Curtis, the founder and for a long time the proprietor of the famous *Curtis’s Botanical Magazine*, published since 1786 and known as *Botanical Magazine* (Burt Davy 1932; Marais 1985).

Trees, medium-sized to large, up to 20 m high, or tall shrubs. Bark brown and smooth when young, dark brown and square-fissured with age. *Young branchlets* with reddish or rust-brown hairs. *Leaves* simple, opposite; petiole up to 20(–30) mm long, pubescent; lamina oblong-elliptic to ovoid, 25–10 × 25–75 mm, penninerved, leathery, margins dentate, revolute to sinuate, glabrous on upper surface and rust-brown pubescent beneath. *Inflorescences* terminal, paniculate, loose or compact, inflorescence branches tomentose; bracts conspicuous, linear-lanceolate, rust-brown tomentose, subtending opposite primary inflorescence branches. *Flowers* minute, sessile or shortly pedicellate, scentless, hermaphrodite, epigynous, tomentose. *Calyx* tube 4-lobed, adnate to ovary. *Petals* 4, cream-coloured or white with a tint of purple, valvate. *Androecium* didymous; stamens 4, alternating with petals; filaments subulate; anthers short. *Gynoecium* syncarpous; ovary 4-locular (occasionally 3-locular); ovules pendulous, one per locule. *Fruit* globose, snow-white, drupaceous (pyrenarium), stone

TABLE 1.—Comparative carpological traits in genera of Cornaceae sensu Harms (1898) [From Yembaturova (2001), translated from Russian]

Taxa	Ovary	Mature pericarp consistency	No. well-developed seeds per fruit	Endocarp type and no. cell layers	No. locules or pyrenes	No. and type of sterile locules	No. meso-carp cell layers
1. <i>Cornus</i> L.	Inferior	Fleshy	1 or 2	Woody (> 20)	1 or 2 (3 or 4) locules	1(2), compressed	> 20
2. <i>Nyssa</i> L.	Inferior	Fleshy	1 or 2	Woody (> 20)	1 or 2 locules	1, compressed	> 20
3. <i>Alangium</i> Lam.	Inferior	Fleshy	1 or 2	Woody (> 20)	1 or 2 locules	1, compressed	> 20
4. <i>Mastixia</i> Blume	Inferior	Fleshy	1	Woody (16–20) (transition to cartilaginous)	1 (incomplete septa)	None	> 20
5. <i>Corokia</i> A.Cunn.	Inferior	Fleshy	1 or 2	Woody (> 20)	1 or 2 locules	None	> 20
6. <i>Davidia</i> Baill.	Inferior (?)	Fleshy	1	Very woody (> 20)	7–9 locules	6–8 compressed	> 20
7. <i>Curtisia</i> Ait.	Inferior	Fleshy	4	Woody (> 20)	4 locules	None	> 20
8. <i>Camptotheca</i> Decne	Inferior	Dry at maturity	1	Weakly lignified, reduced (7–8)	1	None	> 20
9. <i>Griselinia</i> Forst.f.	Inferior	Fleshy	1	Weakly lignified or non-lignified (3–7)	1	None	17–20
10. <i>Aucuba</i> Thunb.	Inferior	Fleshy	1	Non-lignified (3–5)	1	None	15–18
11. <i>Toricellia</i> DC.	Inferior	Fleshy	1	Cartilaginous (12–14)	3 or 4 locules	2 or 3, keep their shape and size	6–9
12. <i>Melanophylla</i> Baker	Inferior	Dry at maturity	1	Woody	3 locules	2, keep their shape and size	few
13. <i>Kaliphora</i> Hook.f.	Semi-inferior	Fleshy	2	Cartilaginous (7–8)	2 pyrenes	None	> 20
14. <i>Helwingia</i> Willd.	Inferior	Fleshy	2–4	Cartilaginous (6–10)	2–4 pyrenes	None (rarely 1)	20
15. <i>Garrya</i> Dougl. ex Lindl.	Superior	Dry at maturity	1 or 2	Non-lignified (2–7)	1	None	10–13

(3)4-locular, (3)4-seeded, with a central vascular bundle. *Seeds* exotestal. *Endosperm* copious. *Embryo* minute, centrally located. *Flowering time*: late October to March. *Fruiting time* May to October. *Chromosome number* $n = 13$ (Goldblatt 1978). *Conservation status*: Low Risk. Figure 1.

The species of *Curtisia*

There is only one extant species in the genus (see generic description given above).

***Curtisia dentata* (Burm.f.) C.A.Sm.**, in Journal of South African Forestry Association 20: 50, t. 170 (1951); Cannon: 635 (1978). Type: South Africa, *Sideroxylum dentatum* J.Burm., Rariorum Africanarum plantarum 235, t. 82 (1738), iconotype (Figure 3).

Sideroxylon dentatum Burm.f.: 6 (1768).

Curtisia faginea Aiton: 162 (1789); Willd.: 687 (1797); Roem. & Schult.: 294 (1818); Thunb.: 141 (1823); Spreng.: 442 (1825); DC.: 12 (1825); Pappe: 17 (1854); Harv.: 570 (1862); Wangerin: 30 (1910); Baker f.: 76 (1911–1912); Eyles: 435 (1917); Burt Davy: 512 (1932); Steedman: 60 (1933). Type: South Africa, introduced by Francis Masson in 1775 (Banks Herbarium, sheet BM000794113, BM!).

Illustrations: Burm.: t. 82 (1738); Lam.: t. 71 (1823); Sim: t. 77 (1907); Wangerin: 30 (1910); Burt Davy: 513 (1932); Cannon: t. 170 (1978). There is a beautiful unpublished painting of *Curtisia dentata* by Clemenz Heinrich Wehde mann (1762–1835) in the repository of Natural History Museum (BM). This original watercolour forms part of the Wehde mann collection entitled 'Sketches of plants growing about Plettenburg Bay on the coast of Africa'.

History and uses

The most well-known name for *Curtisia* is assegai, assegai-tree (Afrikaans: *assegaaiboom*) or assegai-wood (*assegaaihout*). The records for this name date back to the earliest colonial days, recorded, according to Smith (1966), by Hermann in 1672 and Burmann in 1692. These plant names apparently were the first cases of modern spelling of the name. Early writers used such versions as *hazegaiejn boomen hout*, *assgaaij*, *assegaie* and *hassagay-hout*. As far as the origin of the name *assegai/assagay* is concerned, several versions exist. One of them is that the name is derived through Portuguese from the Latin word *hasta*, meaning a spear (Palmer & Pitman 1972). Another idea is that it refers to the Arabic word *Azzaghayah*, adopted by the Portuguese with various spelling modifications and taken over by early Dutch writers (Smith 1966), evolving to its present-day form with time but always referring to weapons (spears and bows) used by the native African people. The ethnobotanical importance of the tree is reflected in the large number of vernacular names recorded in southern Africa. In Table 2, all these are listed exactly as they were published.

The wood of *Curtisia* is iron-hard but elastic, strong and very durable—traditional javelins and spears, with 1.8 m-long tapering shafts, were made from this timber. Thunberg, in his descriptions of his travels in the Cape of Good Hope between 1772 and 1775 (Forbes 1986), repeatedly mentioned *Curtisia* (as 'assagay wood') and its practical use for 'assagays' (javelins that Khoikhoi people carried with them on their journeys, with which they 'defended themselves against their enemies and wild beasts, and were able to kill them, buffaloes and other animals'). Later on, many other uses were found. The fact that assegai wood shrinks less than most

other woods, made it very useful for the early settlers. It was the preferred timber for the axles and poles for wagons as well as the spokes, naves and felloes of the wheels. The highly decorative qualities of *Curtisia* timber—resembling mahogany due to developing a reddish brown, cinnamon tint with age—were appreciated by craftsmen producing tool handles (hammer handles in particular), implements of husbandry, furniture and floor covering (Watt & Breyer-Brandwijk 1962; Smith 1966; Palmer & Pitman 1972; Van Wyk *et al.* 2000). The bark was used for tanning, yielding 2.98 to 14.05 % of tannin; up to 4 % of tannin was yielded by the leaves and twigs of the plant (Watt & Breyer-Brandwijk 1962; Van Wyk *et al.* 1997). *Curtisia* is also an attractive ornamental tree, especially for moist gardens.

Curtisia dentata is important in traditional medicine (Arnold *et al.* 2002). Zulu people use the bark to treat diarrhoea and stomach ailments. It serves as an aphrodisiac (a 'love charm' to make a man attractive) and as a 'blood purifier' or 'strengtheners' (Cunningham 1988; Hutchings *et al.* 1996; Van Wyk *et al.* 1997; Ngwenya *et al.* 2003). Since the tannin-rich bark is used for medicinal purposes, the debarking and ringbarking of trees caused significant damage in some localities. The bark (Figure 1E) used to be sold by traditional Zulu herb gatherers for R30 per 50 kg bag but after becoming scarce due to overexploitation, it is only included in special bark mixtures, such as 'Special Khubalo' (Cunningham 1988). Rapid coppicing and the apparent capability of the bark to regrow, played a very important role in the survival of this forest tree. Despite a broad phytochemical survey of the Cornaceae by Bate-Smith *et al.* (1975), the chemical rationale for the traditional uses is still poorly understood. It may be assumed, however, that the high tannin content contributes to the efficacy in treating diarrhoea and stomach ailments.

Geographic distribution

Curtisia dentata is restricted to southern Africa, primarily along the southern and the eastern coasts of South Africa and extends into Swaziland, Mozambique and eastern Zimbabwe (Figure 4). The genus is confined to montane forests (mainly found on southern and south-western slopes), at altitudes from sea level to 2 300 m.

SPECIMENS EXAMINED

Anon. 9701 (PRE). A.M.W. 1005 (NBG). Acocks 8992 (PRE). Airy Shaw 3614, 3736 (PRE).

Bakker 281 (PRE). Balkwill 1474 (PRE). Balsinhas 02576 (PRE). Bayliss 127, 6169 (PRE, 2 sheets); 466, 1328, 1490 (PRE). Bazer 809 (PRE). Bird 1042, 1213, 1241, 1396, 1412 (PRE). Bos 965 (NBG, PRE); 1314 (NBG). Botha 0007 (PRE). Botha & Cilliers 3636 (PRE). Boucher G19, 322, 2078 (PRE). Bredenkamp 1511 (PRE). Britten 1333 (PRE). Burgers 1111 (PRE). Burgoyne 1726 (PRE); 6206 (NBG, PRE). Burt Davy 1262, 2439, 2442 (PRE).

Cheadle 737 (PRE). Codd 3050 (PRE). Codd & Dyer 9117 (PRE). Comins 933 (PRE). Compton 28675, 32241 (PRE); 29500 (NBG, PRE). Curson & Irvine 86 (PRE, 2 sheets).

Dahlstrand 2661 (PRE). Davis 56 (PRE). De Winter 8266A (PRE). Dlamini s.n. (PRE). Dohse 140 (PRE). Duthie 632 (NBG). Dyer 4850 (PRE).

Eastwood 2430 (PRE). Ecklon & Zeyher 558 (NBG, 2 sheets); 596 (NBG); s.n. (PRE). Edwards 1450, 3311 (PRE).



FIGURE 3.—Iconotype of *Curtisia dentata* [Burmamn: plate 82 (1738)].

Fisher 1105 (PRE). Flanagan 143 (PRE). Forest Dept. s.n. sub STEU18857 (PRE).

Galpin 4229, 11612, 13676 (PRE). Gertzner 4387, 4488, 4499 (PRE). Giffen G849 (PRE). Gillet 72, 1311 (NBG). Glen 2413 (PRE). Goodier & Phipps 157 (PRE). Grant 3263 (PRE). Guillardmod 9314 (PRE).

Hemm 40, 522 (PRE). Henkel 2545 (PRE). Herman & Prior 322 (PRE). Hoffmann 171 (PRE). Humbert 9675 (PRE).

Jacobsen 1812, 4679 (PRE). Jones & Leach 2531 (PRE).

Kemp 1200 (PRE). Kerfoot 6122 (PRE, 2 sheets; STU). Kerfoot, Forrester & Gooyer 131 (PRE). Killick 866, 1900 (PRE); s.n. (PRE, photo!). Kluge 1358 (PRE).

Legat 2442 (PRE). Liebenberg 7955A (PRE).

MacOwan 731 (PRE). Maguire 1438 (NBG). Marloth 524 (PRE); 5246 (NBG). Meyer 1927, 2610 (PRE). Miller S/26 (PRE). Muir 117 (PRE). Mogg 17209, 34609 (PRE). Mohle 416 (PRE). Moll 1789 (PRE). Morze 2010 (PRE). Mullin 16/52 (PRE). Mullins s.n. (PRE, 2 sheets). Müller 487 (PRE). Müller & Scheepers 118 (PRE).

Nicholson 658 (PRE). Nienaber EN162 (PRE).

Obermeyer 890, 1179 (PRE); 2008 (NBG, PRE). Osborne 30 (PRE).

Paterson 2109 (PRE). Pegler 1332, 4606 (PRE); s.n. (NBG). Phillips s.n. (PRE). Pillans 3664 (PRE). Plantk. Hons. 477 (JRAU). Pole Evans 3619, 15490, s.n. (PRE). Prosser s.n. (PRE).

Raal 226 (PRE). Ranger 290 (PRE). Reid 4063 (PRE). Reyneke 189 (PRE). Rodin 3147, 4104 (PRE). Rogers 23038 (PRE). Rudatis 1776 (PRE).

Scharf 1784 (PRE). Scheepers 832 (PRE). Schutte 29 (JRAU). Sebothoma 334, 346 (PRE). Sim 2020 (PRE). Smith 40 (PRE). Smuts 11, 98 (PRE); 1094 (PRE, 2 sheets); s.n. (NBG). Smuts & Gillet 2262 (NBG, PRE); 3600 (PRE). Stalmans 335, 1164 (PRE). Stokoe s.n. (NBG). Stork 61580 (PRE). Story 1665 (PRE). Strey 9424, 10738 (PRE). Symons 504, 15736 (PRE).

Thode A273 (PRE); A844 (NBG, PRE); A845 (PRE, 2 sheets). Thorncroft 1005 (PRE). Topper 97 (NBG). Torre & Pereira 12.738 (PRE).

Uys s.n. (PRE).

TABLE 2.—Vernacular names for *Curtisia dentata*. All names given in exactly same form as originally published

Vernacular name	Language group	Reference
Assegaaboom; assegaaihout; (Assegaai wood)	Afrikaans	Hutchings <i>et al.</i> 1996; Smith 1966; Von Breitenbach <i>et al.</i> 2001
Assegaai-hout	Afrikaans	Burt Davy 1932
Assegaai	Afrikaans	Coates Palgrave 2002; Hutchings <i>et al.</i> 1996; Van Wyk <i>et al.</i> 1997, 2000; Von Breitenbach <i>et al.</i> 2001
Asgaai	Afrikaans	Von Breitenbach <i>et al.</i> 2001
Asgaai hout	Afrikaans	Burt Davy 1932; Watt & Breyer-Brandwijk 1962
Assegai	English	Coates Palgrave 2002; Van Wyk <i>et al.</i> 1997, 2000; Von Breitenbach <i>et al.</i> 2001
Assegai wood	English	Watt & Breyer-Brandwijk 1962
Assegai-tree	English	Coates Palgrave 2002
Cape assegai wood	English	Steedman 1933; Watt & Breyer-Brandwijk 1962
Lance wood	English	Steedman 1933; Watt & Breyer-Brandwijk 1962
muchekamani	Ndau	Watt & Breyer-Brandwijk 1962
Muchekamani	Ndau	Steedman 1933
umquixina	Nguni	Watt & Breyer-Brandwijk 1962
modula-tšhwene	Northern Sotho	Palmer & Pitman 1972
Modulatšhwene	Northern Sotho	Von Breitenbach <i>et al.</i> 2001
Molowla-tchayne	Ses.	Burt Davy 1932
Mubotjo; mupunguti	Shona	Watt & Breyer-Brandwijk 1962
iliNcayi; isiNwati	Swazi	Palmer & Pitman 1972
ili-ncayi; isi-nwati	Swati	Watt & Breyer-Brandwijk 1962
um-poyi	Swati	Watt & Breyer-Brandwijk 1962
musangwe; mufhefhera	Venda	Palmer & Pitman 1972
umGzina	Xhosa	Palmer & Pitman 1972
umgxina	Xhosa	Von Breitenbach <i>et al.</i> 2001
umhlebe	Xhosa	Von Breitenbach <i>et al.</i> 2001; Watt & Breyer-Brandwijk 1962
omhlebe	Xhosa	Watt & Breyer-Brandwijk 1962
isibande; usirayi	Xhosa	Von Breitenbach <i>et al.</i> 2001
umlahleni	Xhosa	Van Wyk <i>et al.</i> 1997
umhlibe	Zulu	Hutchings <i>et al.</i> 1996
umagunda	Zulu	Von Breitenbach <i>et al.</i> 2001
uMagunda; uMaginda	Zulu	Palmer & Pitman 1972
umlahleni	Zulu	Cunningham 1988; Hutchings <i>et al.</i> 1996; Van Wyk <i>et al.</i> 1997; Von Breitenbach <i>et al.</i> 2001
umlahlenisefile; igejalibomvu; ijundumhlahleni	Zulu	Cunningham 1988; Hutchings <i>et al.</i> 1996
ugejelibomvu	Zulu	Ngwenya <i>et al.</i> 2003
Umgxcina	Zulu	Cunningham 1988
Umqxina	Zulu	Steedman 1933
inkunzitwalitshe; inphephelangeni	Zulu	Hutchings <i>et al.</i> 1996
inPhephelelangeni	Zulu	Cunningham 1988
umPhephelangeni; umBese	Zulu	Palmer & Pitman 1972
om-Hlibe; um-Gxina; um-Guna; Moodalagweene	-	Burt Davy 1932

Van der Merwe 1309 (PRE). Van der Schijff 4642, 4675, 5121 (PRE). Van Son s.n. (PRE). Van Warmelo s.n. (PRE). Van Wyk 4110, 7005, 7528 (PRE). Van Wyk & Theron 4564 (PRE). B-E. & C.M. van Wyk 28 (JRAU). Van Wyk & Yembaturova 4218 (JRAU). Von Ludwig s.n. (STU)

Wager 23012 (PRE). Ward 3422 (PRE). Wells 2996 (PRE). West 3012, 3814 (PRE). Williams 2418 (NBG, PRE).

Zeyher 558, 7699 (PRE).

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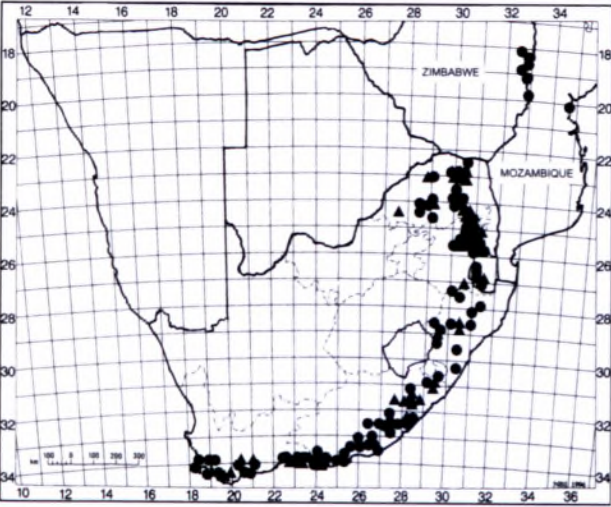


FIGURE 4.—Known distribution of *Curtisia dentata*, ●, in South Africa, Swaziland, Mozambique and Zimbabwe. Additional localities given by Von Breitenbach (1995), ▲.

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